The International Biogeoscience Conference 2013 Nagoya, Japan

Revealing the biotic diversity of the early earth and the evolution of cyanobacteria and eukaryotes
November 1st-4th, at Nagoya University, Japan

CONTACT: Kenichiro Sugitani; sugi@info.human.nagoya-u.ac.jp
Message from the Organizing Committee

Dear participants
The organizing committee is pleased to welcome all the participants to “The International Biogeoscience Conference Nagoya 2013, Japan – Revealing the biotic diversity of the early earth and the evolution of cyanobacteria and eukaryotes”. This conference provides the participants of various disciplines with opportunities to engage in frank exchanges of views about the history of the Earth and life.

We discuss significant contemporary issues relating to our understanding of the early evolution of life and its interaction with Earth’s surface environments. In the past 10 years, evidence has been accumulating for the early evolution of complex ecosystems and biotic diversity during the Archean. Biosignatures including cellular fossils, carbon isotopic values of kerogen, molecular biomarkers such as lipids and hopanes, and microbialites such as stromatolites and microbially induced sedimentary structures in siliciclastic settings, have been reported from number of sedimentary successions deposited in environments ranging from deep-sea hydrothermal vent systems to coastal sandy intertidal flats, and even from volcanic rocks. It is believed that by 3.0 Ga microorganisms were flourishing in multiple environments. However, these early ecosystems and the biological affinities of reported fossils are poorly understood. Although the signatures of photosynthetic microorganisms can possibly be traced back to 3.49 Ga, the timing of the origin of oxygenic photosynthesis is still unclear. Also problematic are the recently reported spheroidal and lenticular cellular microfossils larger than 20 µm (up to 200 µm) in diameter. They are reported from 3.0, 3.2 and 3.4 Ga sedimentary successions including chemically precipitated cherts and siliciclastic sediments in South Africa and Western Australia. Large size, organic-walled preservation and morphologies imply that they are eukaryotic, although their exact biological affinities and implications for the early evolution of life are poorly understood. In order to answer these unresolved problems, multidisciplinary approaches are indispensable and collaborations of researchers of various disciplines are essential, including further understanding of extant microbes and their interaction with environments.

Thus, this conference aims to bring together geologists, paleontologists, geochemists, and biologists to discuss contemporary issues relating to the early evolution of life and its interaction with Earth’s surface environments. Hopefully, this conference will provide all participants with opportunities for new discoveries and collaborations.
Organizing Committee

Chair:
Kenichiro SUGITANI, Graduate School of Environmental Studies, Nagoya University

Members:
Koichi MIMURA, Graduate School of Environmental Studies, Nagoya University
Makoto TAKEUCHI, Graduate School of Environmental Studies, Nagoya University
Malcolm R. WALTER, Australian Centre for Astrobiology, University of New South Wales
Martin J. VAN KRANENDONK, Australian Centre for Astrobiology, University of New South Wales
David FLANNERY, Australian Centre for Astrobiology, University of New South Wales
Takuya SAITO, Graduate School of Science and Engineering, Tokyo Institute of Technology
Mamoru ADACHI, Center for Leading Graduate Schools Program, Nagoya University

Co-host organizations
Graduate School of Environmental Studies, Nagoya University
School of Informatics and Sciences, Nagoya University
Department of Earth and Planetary Sciences, Nagoya University
Nagoya University Museum, Nagoya University
Australian Centre for Astrobiology, University of New South Wales
Japan Astrobiology Network Association

Acknowledgement
We deeply appreciate financial support from the Graduate School of Environmental Studies and Department of Earth and Planetary Sciences, Nagoya University, Kato Memorial Bioscience Foundation, and Japan Society for the Promotion of Science (No. 24654162 for K.S.). Ms. Takako Hirota, of the accounting division of the Graduate School of Environmental Studies, Nagoya University, Ms. Asa Ito, GT-center, and Mr. Katsuyuki Aoyagi, Japan Travel Bureau are deeply acknowledged for their assistance.
General Information

**Date:** November 1\(^{st}\) (Friday) – 4\(^{th}\) (Monday: National Holiday)

**Official Language:** English. No translation facilities are available in the conference and the field trip, but a voluntary interpreter will accompany in the post-conference optional tour.

**Venue:** Sakata-Hirata Hall, Higashiymama Campus, Nagoya University. 3 minutes walk from exit 2 of the subway station “Nagoya University” (D2 in the campus map below) (the simplest route).
Access to Nagoya University: From downtown (Nagoya, Fushimi, Sakae and Shin-Sakae), you take the Subway Higashiyama Line bound for Fujigaoka and transfer at Motoyama St. to the Subway Meijo Line (clockwise). Nagoya University St. is the next stop. You may walk from Motoyama St. to the university. From Chubu International Airport (Centrair) to Nagoya, take the Meitetsu Line (30min. by an expressway).

To Chubu International Airport (Centrair): Although you may take several ways to the airport (Centrair), we suggest here the simplest way. You take the Subway Higashiyama Line bound for Takabata and transfer at Nagoya St. to the Meitetsu Line. You will find several services of expressway to the Chubu International Airport.
Information about Nagoya City:
Nagoya Convention & Visitors Bureau ➔ http://www.ncvb.or.jp/en/contents/

Registration Fees: The registration fee includes three free events (a pre-conference one-day field trip to the geological sites and an icebreaker) and refreshments, but NOT lunch or the official dinner.

Late and on-site registration

Note: Payment only by Japanese Yen (JPY)
Professionals: JPY20,000
Students: JPY7,000
Accompanying persons: JPY5,000

One day pass

Note: payment only by Japanese Yen (JPY)
Professionals: JPY7,000
Students: JPY3,000
Accompanying persons: JPY2,000

Official dinner (on November 2nd at Nagoya University)

On-site registration is also available: payment only by Japanese Yen (JPY)
All: JPY3,000

Hands-on Microfossil and Rock Observation: We have a plan of hands-on microfossil and rock observation (all specimens were collected by K. Sugitani). To date this event is planned to be held within the poster room in the afternoon on November 2nd and all the day on November 3rd. K.S. interprets the specimens by request, during e.g. core times for poster session and after the session on November 3rd (approximately 1 hour).

Post-conference Optional Tour: A post-conference optional bus tour (from the conference site) will be held in the afternoon of November 4th. We will visit first a museum exhibiting Japanese traditional art during the Tokugawa era and then go to Nagoya Castle. After these activities, we will enjoy Japanese cuisine at a restaurant downtown. The tour fee including dinner is JPY11,000 (without drinks). If you do not have dinner, the cost is JPY7,000. Please book this tour from the online registration site ➔ https://amarys-jtb.jp/biogeoscience/

Tokugawa Art Museum ➔ http://www.tokugawa-art-museum.jp/
Guide to Participants

Permission requirement for recording presentations: Please DO NOT take photos of presentations or record talks without permission of the presenters. Please ensure that your mobile phones are turned off during the sessions in the conference room.

Oral presentation: 20 minutes including discussions is provided for each general speaker. Please PREVIOUSLY install your PPT files into the computer (Windows) connected to the projector during refreshments and lunches, or in the morning (the reception will open 8:00 on November 2\textsuperscript{nd} and 8:15 on November 3\textsuperscript{rd} and 4\textsuperscript{th}), and check if the presentation works correctly. The presenters may also connect their own computers directly to the projector; for Mac users, please bring your DVI adapter.

Poster Presentation: 1) The conference HP says that the poster board is 152cm in height and 115cm in width. However, as the board has very short legs, I recommend that you prepare posters with a printed area less than 120 cm in height. 2) You may post your presentations from 8:00 on November 2\textsuperscript{nd}. Please remove them before 13:00 on November 4\textsuperscript{th}. If posters are left after 13:00 on November 4\textsuperscript{th}, they may be discarded. The poster room is in front of the conference room. You will be able to find it easily. Pins will be available. 3) We have two core times, which are from 15:45 to 16:45 on November 2\textsuperscript{nd} and from 15:25 to 16:25 on November 3\textsuperscript{rd}. Poster presentations will be divided into two groups by their poster numbers (odd or even). Poster presentations with odd numbers will have core time on November 2\textsuperscript{nd} and those with even numbers on November 3\textsuperscript{rd}.

Internet access: Internet access is available in and around the conference room. Details will be indicated at the venue.

Lunch and refreshment: Lunch will be available at a café near the conference room and some restaurants including Italian, Korean, Chinese, and Japanese around Nagoya University (5 minutes walk), during the conference. Some restaurants in the university are also available on November 2\textsuperscript{nd}. Refreshment will be served in the morning and the afternoon.

Help desk: If you have any questions, please feel free to ask the staff at reception. Also please mail to pilbarasurftrip@yahoo.co.jp (preferred), pilbarasurftrip@docomo.ne.jp, or phone to +81-(0)90-1623-3117 (K.Sugitani; Please note that during the session, this phone will be turned off and therefore the reply may be delayed).

Emergency: Emergency calls in Japan; 110 for police (no area code) and 119 (no area code) for ambulance and fire.

Cloak: Cloak service is available from 8:15 to 18:30 on November 2\textsuperscript{nd} (Saturday) and November 3\textsuperscript{rd} (Sunday), and from 8:15 to 13:00 on November 4\textsuperscript{th} (Monday). Please keep valuables with yourself. DO NOT leave them in your bags being stored in the cloakroom.
Session Program

Oral Session
November 2nd (Saturday)

09:00-09:10
Welcoming address
Satoru Kuno¹, Kenichiro Sugitani²
¹Dean, Graduate School of Environmental Studies, Nagoya University, Japan
²Graduate School of Environmental Studies, Nagoya University, Japan

1) 9:10-10:05 (Keynote Talk)
Geological evidence of oxygenic photosynthesis and the biotic response to the 2.4-2.2 Ga “Great Oxidation Event”
J. William Schopf¹
¹University of California, Los Angeles, USA

2) 10:05-10:25
Cyanobacterial evolution and development: What living species tell us about history and background of their morphological diversity?
Akiko Tomitani¹
¹Japan Agency for Marine-Earth Science and Technology, Japan

3) 10:25-10:45
A public goods approach to major evolutionary transitions
Douglas H. Erwin¹
¹National Museum of Natural History, USA

10:45-11:00
Refreshments served

4) 11:00-11:20
Oceanic sedimentary sequences in Mesoarchean Dixon Island-Cleaverville Formation, Pilbara, Australia: Result of DXCL drilling project
Shoichi Kiyokawa¹, Takashi Ito², Minoru Ikehara³, Kosei E. Yamaguchi⁴, Hiroshi Naraoka¹, Tetsuji Onoue⁵, Kenji Horie⁶, Ryo Sakamoto¹, Yuhei Aihara⁷, and Tsubasa Miki¹
¹Kyushu University, Japan; ²Ibaraki University, Japan; ³Kochi University, Japan; ⁴Toho University, Japan; ⁵NASA Astrobiology Institute, USA; ⁶Kumamoto University, Japan; ⁷National Institute of Polar Research, Japan

5) 11:20-11:40
Geochemical evidence for redox stratification of the ocean 2.7 billion years ago
Kosei E. Yamaguchi¹,² and Akane Abe¹
¹Toho University, Japan; ²NASA Astrobiology Institute, USA

6) 11:40-12:00
Early Archaean carbonates on early Earth - microbial mediated mineralisation versus hydrothermal origin
Joachim Reitner¹, Jan-Peter Duda¹, Franziska Wilsky¹, Bent T. Hansen¹, Nadien Schäfer¹, and Martin J. Van Kranendonk²
¹Georg-August-University of Goettingen, Germany; ²ACA, University of New South Wales, Australia
7) 12:00-12:20
Assessing the biogenicity of geochemical signatures in Palaeoarchaean rocks from the Pilbara Craton (Western Australia)
Jan-Peter Duda¹, Joachim Reitner¹, Martin Blumenberg¹, Danny Ionescu², Nadine Schäfer¹, and Martin J. Van Kranendonk³
¹Georg-August-University of Goettingen, Germany; ²Max-Planck-Institute for Marine Microbiology, Germany; ³ACA, University of New South Wales, Australia

12:20-13:40
Lunch

8) 13:40-14:25 (Keynote Talk)
Insights from the molecular biological information into the early evolution of life
Akihiko Yamagishi¹, Satoshi Akanuma¹, and Shin-ichi Yokobori¹
¹Tokyo University of Pharmacy and Life Science, Japan

9) 14:25-14:45
Enigmatic origin and evolution of cyanobacterial photosynthesis: lipids vs photosystems and pigments
Naoki Sato¹,²
¹The University of Tokyo, Japan; ²JST, CREST, Japan

10) 14:45-15:05
Possible involvement of polyunsaturated lipids in the evolutionary adaptation of anaerobic bacteria against oxidative stress
Akio Ueno¹, Satoru Shimizu¹, Kiyohito Yoshida², and Hitotoshi Okuyama²
¹Horonobe Research Institute for the Subsurface Environment, Japan; ²Hokkaido University, Japan

11) 15:05-15:25
Abiotic sulfurisation of a modern ecosystem and the preservation of early life
Anais Pagès¹, Kliti. Grice¹, Ricardo J. Jahnert¹, Michael Vacher², Roger E. Summons³, Peter R. Teasdale³, David T. Welsh³, Martin J. Van Kranendonk⁵, and Paul Greenwood¹²
¹Curtin University, Australia; ²The University of Western Australia, Australia; ³Massachusetts Institute of Technology, USA; ⁴Griffith University, Australia; ⁵University of New South Wales

12) 15:25-15:45
Comparison between the biomarker geochemistry of the 1.4 Ga Velkerri Formation (northern Australia) and the Hongshuzhuang Formation (northern China)
Simon C. George¹, Emma N. Flannery¹,², Qingyong Luo¹,³ and Ningning Zhong³
¹Macquarie University, Australia; ²Geoscience Australia, Australia; ³China University of Petroleum, China

13) 15:45-16:45
Refreshments & poster session (core time for odd numbers)

14) 16:45-17:05
Non invasive dating and detection of nuclear biosignatures in Archean cherts by Electron Paramagnetic Resonance
Didier Gourier¹, Hervé Vezin², and Laurent Binet¹
¹Chimie-ParisTech, France; ²Université de Lille 1, France

17:05-17:25
The evolutionary origin of multicellularity in cyanobacteria and The Great Oxidation Event
Bettina E. Schirrmeister¹, Jurrian M. De Vos², Alexandre Antonelli³, and Homayoun C. Bagheri⁴
¹University of Bristol, UK; ²Brown University, USA; ³University of Gothenburg, Sweden; ⁴University of Zurich, Switzerland
15) 17:25-17:45
Substantial environmental oxygen gradients before the evolution of cyanobacteria: Implications from the revised phylogeny of magnetotactic bacteria
Hang Yu¹ and Joseph L. Kirschvink¹,²
¹California Institute of Technology, USA; ²ELSI, Tokyo Institute of Technology, Japan

16) 17:45-18:05
The origin of life on Earth: Some geological constraints
Malcolm R. Walter¹
¹ACA, University of New South Wales, Australia

18:05-18:25
Discussion led by Malcolm R. Walter

18:40-20:40
Official Dinner

November 3rd (Sunday)

17) 9:00-9:45 (Keynote Talk)
Algae as driving force of the diversification of eukaryotes and expansion of Earth’s ecosystem
Isao Inouye¹
¹University of Tsukuba, Japan

18) 9:45-10:05
Diachronous diversification of ichnofossil producers and increase in the biological activities in the Cambrian Explosion
Tatsuo Oji¹, Takafumi Mochizuki¹, Yuanlong Zhao², Jin Peng², Xinglian Yang², and Sersmaa Gonchigdorj³
¹Nagoya University, Japan; ²Guizhou University, China; ³Mongolian University of Science and Technology, Mongolia

19) 10:05-10:25
Neoproterozoic thrombolite and spherical structures from Brazil: An image of the oldest multicellular animal
Akihiro Kano, Tomoyo Okumura¹, Fumito Shiraishi², Chizuru Takashima³, and Nilo Matsuda⁴
¹Kyushu University, Japan; ²Hiroshima University, Japan; ³Saga University, Japan; ⁴Petrobras Co., Brazil

10:25-10:40
Refreshments served

20) 10:40-11:00
Experimental geobiology of microbial sediments
Tanja Bosak¹, Giulio Mariotti¹, J. Taylor Perron¹, Sara B. Pruss², Francis A. Macdonald³, and Vanja Klepac-Ceraj⁴
¹Massachusetts Institute of Technology, USA; ²Smith College, USA; ³Harvard University, USA; ⁴Wellesley College, USA

21) 11:00-11:20
Tidalites, evaporites, and anoxygenic photosynthetic microbial mats and associated heterotrophic organisms in the ~3.3 Ga-old Josefsdal Chert, Barberton
Frances Westall¹, Jean-Gabriel Bréhéret², Axelle Hubert¹, Barbara Cavalazzi¹,³, and Claire Rollion-Bard⁴
¹CNRS, France; ²University of Tours, France; ³University of Bologna, Italy; ⁴University of Nancy, France

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22) 11:20-11:40
Investigating the syngeneity and the palaeobiology of hydrocarbons in stromatolites from the Fortescue group in the Pilbara region, Western Australia (2.7-2.8 Ga)
Yosuke Hoshino1,3, David T. Flannery2,3, Malcolm R. Walter2,3, and Simon C. George1,3
1Macquarie University, Australia; 2University of New South Wales, Australia; 3ACA, University of New South Wales, Australia

23) 11:40-12:00
Coevolution of ocean chemistry and early animals following the global glaciation
Kunio Kaiho1, Masahiro Oba1, Atena Shizuya1, Kenji Yamada1, Minori Kikuchi1, Naoto Senba1, Zhong-Qiang Chen2, Paul Gorjan3, Jinnan Tong2, Satoshi Takahashi4, and Li Tian2
1Tohoku University, Japan; 2China University of Geosciences, China; 3Washington University, USA; 4The University of Tokyo

12:00-13:20
Lunch

24) 13:20-14:05 (Keynote Talk)
The Agouron Institute Drilling Project: Initial results of the biomarker analyses
Katherine L. French1, Christian Hallmann2, Janet M. Hope3, Roger Buick4, Jochen J. Brocks3, and Roger E. Summons1
1Massachusetts Institute of Technology, USA; 2Max-Planck-Institute, Germany; 3Australian National University, Australia; 4University of Washington, USA

25) 14:05-14:25
Identification of microbial fossils from metabasalts based on petrographical and geochemical studies
Hisanari Sugawara1, Masayuki Sakakibara2, and Minoru Ikehara3
1Gunma Museum of Natural History, Japan; 2Ehime University, Japan; 3Kochi University, Japan

26) 14:25-14:45
Limu o Pelé, mineralic artefacts or microfossils from the Neoarchean stromatolites of the Tumbiana Formation, Fortescue Group, Pilbara Craton?
Wladyslaw Altermann1, Martin J. van Kranendonk2, Anatoliy B. Kudryavtsev3, David T. Flannery2, J. William Schopf4, and Malcolm R. Walter2
1University of Pretoria, South Africa; 2ACA, University of New South Wales, Australia; 3University of California, Los Angeles, USA

27) 14:45-15:05
Eukaryote-like microfossils from the Neoarchean (~2.7 Ga) Sodium Group (Ventsdorp Supergroup) of South Africa
Józef Kazmierczak1, Barbara Kremer2, Władysław Altermann2, and Ian Franchi3
1Polish Academy of Sciences, Poland; 2University of Pretoria, South Africa; 3The Open University, UK

28) 15:05-15:25
Domain-level identification of Proterozoic microfossils and extant prokaryotes by FTIR microspectroscopy
Motoko Igisu1, Yuichiro Ueno1,2,3, and Ken Takai1,3,4
1Precambrian Ecosystem Lab., JAMSTEC, Japan; 2Tokyo Institute of Technology, Japan; 3ELSI, Tokyo Institute of Technology, Japan; 4Subsurface Geobiology Advanced Research Project, JAMSTEC, Japan

15:25-16:25
Refreshments & poster session (core time for even numbers)
29) 16:25-16:45
In situ, spatially resolved biosignature detection at the microbial scale
Kenneth H. Williford\textsuperscript{1,2}, Jennifer L. Eigenbrode\textsuperscript{3}, Christian Hallmann\textsuperscript{4,5}, Kouki Kitajima\textsuperscript{2}, Reinhard Kozdon\textsuperscript{2}, Anatoliy Kudryavstev\textsuperscript{6}, Kevin Lepot\textsuperscript{2,7}, J. William Schopf\textsuperscript{8}, Michael J. Spicuzza\textsuperscript{2}, Kenichiro Sugitani\textsuperscript{2}, Roger E. Summons\textsuperscript{2}, Takayuki Ushikubo\textsuperscript{2,9}, Martin J. Van Kranendonk\textsuperscript{10}, and John W. Valley\textsuperscript{2}
\textsuperscript{1}Jet Propulsion Laboratory, California Institute of Technology, USA; \textsuperscript{2}University of Wisconsin, USA; \textsuperscript{3}NASA GSFC, USA; \textsuperscript{4}Max-Planck-Institute for Biogeochemistry, Germany; \textsuperscript{5}Massachusetts Institute of Technology, USA; \textsuperscript{6}University of California, Los Angeles, USA; \textsuperscript{7}Université Lille 1, France; \textsuperscript{8}Nagoya University, Japan; \textsuperscript{9}JAMSTEC, Kochi Institute for Core Sample Research, Japan; \textsuperscript{10}ACA, University of New South Wales, Australia

30) 16:45-17:05
Isotopic and nanoscale textural evidence for the biogenicity of 3.4 billion years old cell-like structures
Kevin Lepot\textsuperscript{1,2,3}, Kenneth H. Williford\textsuperscript{1,4}, Emmanuelle J. Javaux\textsuperscript{2}, Takayuki Ushikubo\textsuperscript{1,5}, Kenichiro Sugitani\textsuperscript{2}, Koichi Mimura\textsuperscript{6}, Michael J. Spicuzza\textsuperscript{2}, and John W. Valley\textsuperscript{1}
\textsuperscript{1}NAI, University of Wisconsin, USA; \textsuperscript{2}Université de Liège, Belgium; \textsuperscript{3}Université Lille 1, France; \textsuperscript{4}Jet Propulsion Laboratory, NASA, USA; \textsuperscript{5}JAMSTEC, Kochi Institute for Core Sample Research, Japan; \textsuperscript{6}Nagoya University, Japan

31) 17:05-17:25
Ultrastructural evidence for biogenicity of Archean organic-walled microfossils
Emmanuelle J. Javaux\textsuperscript{1}, Kevin Lepot\textsuperscript{2}, and Kenichiro Sugitani\textsuperscript{3}
\textsuperscript{1}Université de Liège, Belgium; \textsuperscript{2}Université Lille 1, France; \textsuperscript{3}Nagoya University, Japan

32) 17:25-17:45
The oldest accretionary complex and the beginning of the Pacific-type orogeny based on geology of the 3.96 Ga Nulliak supracrustal rocks in Labrador
Tsuyoshi Komiya\textsuperscript{1}, Shinji Yamamoto\textsuperscript{1}, Masanori Shimojo\textsuperscript{1}, and Shogo Aoki\textsuperscript{1}
\textsuperscript{1}The University of Tokyo, Japan

33) 17:45-18:05
A planetary driver of atmospheric and biological change through the Precambrian
Martin J. Van Kranendonk\textsuperscript{1}
\textsuperscript{1}ACA, University of New South Wales, Australia

18:05-18:20
Discussion led by Martin J. Van Kranendonk

18:20-19:30
Hands-on microfossil observation

November 4\textsuperscript{th} (Monday)

34) 9:00-9:20
Palynology of lenticular microfossils from the 3.4 Ga Strelley Pool Formation, Western Australia: Do they represent early eukaryotic lineage?
Kenichiro Sugitani\textsuperscript{1}, Koichi Mimura\textsuperscript{1}, Makoto Takeuchi\textsuperscript{1}, Kevin Lepot\textsuperscript{2}, and Emmanuelle J. Javaux\textsuperscript{3}
\textsuperscript{1}Nagoya University, Japan; \textsuperscript{2}Université Lille 1, France; \textsuperscript{3}Université de Liège, Belgium

35) 9:20-9:40
Paleoproterozoic prokaryotic palynomorphs
Paul Strother\textsuperscript{1}
\textsuperscript{1}Boston College, USA
Evidence of interactions between Thermotogales and Thermococcales that are stronger than fermenter-methanogen syntrophy
Tomohiko Kuwabara$^1$, Zhao Di$^1$, and Kensuke Igarashi$^1$

$^1$University of Tsukuba, Japan

Physiological and isotopic characteristics of nitrogen fixation by hyperthermophilic and thermophilic methanogens: Insight into nitrogen anabolism of the subseafloor microbial communities in the early Earth
Manabu Nishizawa$^1$, Junichi Miyazaki$^{1,2}$, and Ken Takai$^{1,2}$

$^1$Precambrian Ecosystem Laboratory, JAMSTEC, Japan; $^2$Subsurface Geobiology Advanced Research Program, JAMSTEC, Japan

Physiological and isotopic characteristics of nitrogen fixation by hyperthermophilic and thermophilic methanogens: Insight into nitrogen anabolism of the subseafloor microbial communities in the early Earth
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$^1$Precambrian Ecosystem Laboratory, JAMSTEC, Japan; $^2$Subsurface Geobiology Advanced Research Program, JAMSTEC, Japan

10:20-10:35
Refreshments served

Stromatolites from the Archaean Dharwar craton, India: Raman spectroscopic, and carbon, strontium and multiple sulfur isotopic characterization
M. Satish-Kumar$^1$, Yoshihiro Nakamura$^1$, Hikaru Murakami$^1$, Kazuki Okochi$^2$, Rie Yamazaki$^2$, Kaoru Mishima$^3$, Yuichiro Ueno$^3$, and Tomokazu Hokada$^4$

$^1$Niigata University, Japan; $^2$Shizuoka University, Japan; $^3$Tokyo Institute of Technology, Japan; $^4$National Institute of Polar Research, Japan

10:35-10:55

Geomicrobiological processes forming daily lamination in travertines
Tomoyo Okumura$^1$, Chizuru Takashima$^2$, and Akihiro Kano$^1$

$^1$Kyushu University, Japan; $^2$Saga University, Japan

10:55-11:05

Evidence for biogenic graphite in early Archaean Isua metasedimentary rocks
Yoko Ohtomo$^1$, Takeshi Kakegawa$^2$, Akizumi Ishida$^3$, and Minik T. Rosing$^4$

$^1$Kochi Institute for Core Sample Research, JAMSTEC, Japan; $^2$Tohoku University, Japan; $^3$The University of Tokyo, Japan; $^4$University of Copenhagen, Denmark

11:05-11:25

Origin of organic matter in the Archean seafloor hydrothermal deposits: biological and abiological processes in the early Earth
Yuichiro Ueno$^{1,2,3}$

$^1$Tokyo Institute of Technology, Japan; $^2$ELSI, Tokyo Institute of Technology, Japan; $^3$Precambrian Ecosystem Laboratory, JAMSTEC, Japan

11:25-11:45

Origin of organic matter in the Archean seafloor hydrothermal deposits: biological and abiological processes in the early Earth
Yuichiro Ueno$^{1,2,3}$

$^1$Tokyo Institute of Technology, Japan; $^2$ELSI, Tokyo Institute of Technology, Japan; $^3$Precambrian Ecosystem Laboratory, JAMSTEC, Japan

11:45-12:00
Discussion led by David T. Flannery

12:00-12:15
Closing talk by Malcolm R. Walter

13:30 Departure for optional tour, after lunch
**Poster Session**
*(November 2nd to 4th)*

**P1:** Biological entities in the stratosphere (22-27km) – Evidence for life in Space and its continual input to Earth
Milton Wainwright\(^1,2\), Christopher E. Rose\(^1\), Alexander J. Baker\(^1\), and N. Chandra Wickramasinghe\(^2\)
\(^1\)University of Sheffield, UK; \(^2\)Center for Astrobiology, University of Buckingham, UK

**P2:** Lu-Hf isotope analysis of Archean Barberton basalts to understand mantle early evolution
Takao Yamagichi\(^1\), Tsuyoshi Iizuka\(^1\), Shun’ichi Nakai\(^1\), and Maarten J. de Wit\(^2\)
\(^1\)The University of Tokyo, Japan; \(^2\)Nelson Mandela Metropolitan University, South Africa

**P3:** Amino acid oligomerization driven by comet impacts as a possible mechanism in prebiotic chemistry
Haruna Sugahara\(^1\) and Koichi Mimura\(^1\)
\(^1\)Nagoya University, Japan

**P4:** Chemical structure and isotopic distribution of insoluble organic matter from the Murchison meteorite revealed by stepwise pyrolysis
Koichi Mimura\(^1\) and Fumiaki Okumura\(^2\)
\(^1\)Nagoya University, Japan; \(^2\)Japan Petroleum Exploration Co. Ltd, Japan

**P5:** Formation of amino acids from carboxylic acid and ammonia by shock wave: implication to chemical evolution in primitive oceans
Yoshihiro Furukawa\(^1\), Chizuka Suzuki\(^1\), Takamichi Kobayashi\(^2\), Toshimori Sekine\(^3\), Hiromoto Nakazawa\(^1\), and Takeshi Kakegawa\(^1\)
\(^1\)Tohoku University, Japan; \(^2\)National Institute for Materials Science, Japan; \(^3\)Hiroshima University, Japan

**P6:** Greigite formation from hematite by sulfur respiration of *Methanocaldococcus jannaschii*
Kensuke Igarashi\(^1\), Takuya Adachi\(^1\), Yasuhisa Yamamura\(^1\), and Tomohiko Kuwabara\(^1\)
\(^1\)University of Tsukuba, Japan

**P7:** Significance of long-chain polyunsaturated fatty acids as a possible biomarker of photosynthetic dinoflagellate symbiosis in marine invertebrates
Takahiro Wakahara\(^1\), Kiyohito Yoshida\(^1\), Aitor Laza-Martinez\(^2\), Masanobu Kawachi\(^3\), and Hidetoshi Okuyama\(^1\)
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**P8:** Field occurrence and lithology of Archean hydrothermal systems in the 3.2Ga Dixon Island Formation, Western Australia
Yuhei Aihara\(^1\), Shoichi Kiyokawa\(^1\), Takashi Ito\(^2\), Minoru Ikehara\(^3\), Kosei E Yamaguchi\(^4\), Kenji Horie\(^5\), Ryo Sakamoto\(^1\), and Tsubasa Miki\(^1\)
\(^1\)Kyushu University, Japan; \(^2\)Ibaraki University, Japan; \(^3\)Kochi University, Kochi, Japan; \(^4\)Toho University, Japan; \(^5\)National Institute of Polar Research, Japan
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Hiroaki Minami1, Akane Abe1, Hiroshi Naraoka2, and Kosei E. Yamaguchi1,3
1Toho University, Japan; 2Kyushu University, Japan; 3NASA Astrobiology Institute, USA

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Tomohiro Nakamura1, Kosei E. Yamaguchi1,2, Minoru Ikehara3, Shoichi Kiyokawa4, and Takashi Ito5
1Toho University, Japan; 2NASA Astrobiology Institute, USA; 3Kochi University; 4Kyushu University, Japan; 5baraki University, Japan

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Tsubasa Miki1, Shoichi Kiyokawa1, Naoto Takahata2, Akizumi Ishida2, Takashi Ito3, Minoru Ikehara4, Kosei E. Yamaguchi5,6, Ryo Sakamoto1, and Yuji Sano2
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1Toho University, Japan; 2NASA Astrobiology Institute, USA; 3Kyushu University, Japan; 4Kochi University, Japan; 5Ibaraki University, Japan

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1Ehime University, Japan; 2Kochi University, Japan

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1Osaka University, Japan; 2Kochi University, Japan; 3University of Manitoba, Canada

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1The University of Tokyo, Japan; 2Tokyo Institute of Technology, Japan
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