PROCEEDINGS OF SPIE

SPIDigitalLibrary.org/conference-proceedings-of-spie

Front Matter: Volume 8521

, "Front Matter: Volume 8521," Proc. SPIE 8521, Instruments, Methods, and Missions for Astrobiology XV, 852101 (13 November 2012); doi: 10.1117/12.2011937

SPIE.

Event: SPIE Optical Engineering + Applications, 2012, San Diego, California, United States

PROCEEDINGS OF SPIE

Instruments, Methods, and Missions for Astrobiology XV

Richard B. Hoover
Gilbert V. Levin
Alexei Y. Rozanov
Editors

14–15 August 2012
San Diego, California, United States

Sponsored and Published by
SPIE

Volume 8521

Proceedings of SPIE 0277-786X, V.8521

SPIE is an international society advancing an interdisciplinary approach to the science and application of light.

Instruments, Methods, and Missions for Astrobiology XV, edited by Richard B. Hoover, Gilbert V. Levin, Alexei Yu. Rozanov,
Proc. of SPIE Vol. 8521, 852101 · © 2012 SPIE · CCC code: 0277-7866/12/\$18 · doi: 10.1117/12.2011937

Proc. of SPIE Vol. 8521 852101-1

The papers included in this volume were part of the technical conference cited on the cover and title page. Papers were selected and subject to review by the editors and conference program committee. Some conference presentations may not be available for publication. The papers published in these proceedings reflect the work and thoughts of the authors and are published herein as submitted. The publisher is not responsible for the validity of the information or for any outcomes resulting from reliance thereon.

Please use the following format to cite material from this book:

Author(s), "Title of Paper," in *Instruments, Methods, and Missions for Astrobiology XV*, edited by Richard B. Hoover, Gilbert V. Levin, Alexei Y. Rozanov, Proceedings of SPIE Vol. 8521 (SPIE, Bellingham, WA, 2012) Article CID Number.

ISSN: 0277-786X

ISBN: 9780819492388

Published by

SPIE

P.O. Box 10, Bellingham, Washington 98227-0010 USA

Telephone +1 360 676 3290 (Pacific Time) · Fax +1 360 647 1445

SPIE.org

Copyright © 2012, Society of Photo-Optical Instrumentation Engineers.

Copying of material in this book for internal or personal use, or for the internal or personal use of specific clients, beyond the fair use provisions granted by the U.S. Copyright Law is authorized by SPIE subject to payment of copying fees. The Transactional Reporting Service base fee for this volume is \$18.00 per article (or portion thereof), which should be paid directly to the Copyright Clearance Center (CCC), 222 Rosewood Drive, Danvers, MA 01923. Payment may also be made electronically through CCC Online at copyright.com. Other copying for republication, resale, advertising or promotion, or any form of systematic or multiple reproduction of any material in this book is prohibited except with permission in writing from the publisher. The CCC fee code is 0277-786X/12/\$18.00.

Printed in the United States of America.

Publication of record for individual papers is online in the SPIE Digital Library.

SPIDigitalLibrary.org

Paper Numbering: Proceedings of SPIE follow an e-First publication model, with papers published first online and then in print and on CD-ROM. Papers are published as they are submitted and meet publication criteria. A unique, consistent, permanent citation identifier (CID) number is assigned to each article at the time of the first publication. Utilization of CIDs allows articles to be fully citable as soon as they are published online, and connects the same identifier to all online, print, and electronic versions of the publication. SPIE uses a six-digit CID article numbering system in which:

- The first four digits correspond to the SPIE volume number.
- The last two digits indicate publication order within the volume using a Base 36 numbering system employing both numerals and letters. These two-number sets start with 00, 01, 02, 03, 04, 05, 06, 07, 08, 09, 0A, 0B ... 0Z, followed by 10-1Z, 20-2Z, etc.

The CID Number appears on each page of the manuscript. The complete citation is used on the first page, and an abbreviated version on subsequent pages. Numbers in the index correspond to the last two digits of the six-digit CID Number.

Contents

vii *Conference Committee*

SESSION 1 ASTROBIOLOGY OF MARS

- 8521 02 **Stealth life detection instruments aboard Curiosity (Invited Paper)** [8521-1]
G. V. Levin, Arizona State Univ. (United States) and Univ. of Buckingham (United Kingdom)
- 8521 03 **Evidence of oil and gas hydrates within planet Mars: early biogenic or thermogenic sources from the Martian soils and deeper sediments near the deltas (Invited Paper)** [8521-2]
P. K. Mukhopadhyay, Global Geoenergy Research Ltd. (Canada)

SESSION 2 BIOMOLECULES, MICROFOSSILS, AND MICROORGANISMS IN CARBONACEOUS METEORITES

- 8521 04 **Origins of the L-amino acid excess in carbonaceous meteorites (Invited Paper)** [8521-3]
M. H. Engel, The Univ. of Oklahoma (United States)
- 8521 05 **Microbiological study of the Murchison CM2 meteorite** [8521-4]
E. V. Pikuta, Athens State Univ. (United States); R. B. Hoover, The Univ. of Buckingham (United Kingdom) and Athens State Univ. (United States)
- 8521 06 **Microfossils, biomolecules and biominerals in carbonaceous meteorites: implications to the origin of life (Invited Paper)** [8521-5]
R. B. Hoover, Athens State Univ. (United States) and Univ. of Buckingham (United Kingdom)

SESSION 3 MICROFOSSILS AND MICROORGANISMS IN ANCIENT ROCKS

- 8521 08 **Microscopic and microbiological investigations of Mississippian sylvite** [8521-7]
R. B. Hoover, Athens State Univ. (United States) and Univ. of Buckingham (United Kingdom);
E. V. Pikuta, Athens State Univ. (United States)

SESSION 4 PREBIOTIC CHEMISTRY AND THE ORIGIN OF LIFE I

- 8521 09 **On the laws for the emergence of life from the abiotic matter (Invited Paper)** [8521-8]
V. M. Kolb, Univ. of Wisconsin-Parkside (United States)
- 8521 0A **Big bang or continuous creation: does life have multiple origins?** [8521-9]
G. A. Konesky, K-Plasma Ltd. (United States)
- 8521 0B **Fluid mechanics leads to life in the universe** [8521-10]
C. H. Gibson, Univ. of California, San Diego (United States)

- 8521 0C **GTOs and HGT: genes are older than expected and can be installed by horizontal gene transfer, especially with help from viruses** [8521-11]
B. Klyce, Astrobiology Research Trust (United States)

SESSION 5 PREBIOTIC CHEMISTRY AND THE ORIGIN OF LIFE II

- 8521 0D **Application of the organic on water reactions to prebiotic chemistry (Invited Paper)** [8521-12]
V. M. Kolb, Univ. of Wisconsin-Parkside (United States)
- 8521 0E **Coacervates as prebiotic chemical reactors** [8521-13]
V. M. Kolb, M. Swanson, Univ. of Wisconsin-Parkside (United States); F. M. Menger, Emory Univ. (United States)

SESSION 6 EXOPLANETS AND ASTROBIOLOGY

- 8521 0F **Improved atmospheric 3D BSDF model in earthlike exoplanet using ray-tracing based method (Invited Paper)** [8521-14]
D. Ryu, S.-W. Kim, S. Seong, Yonsei Univ. (Korea, Republic of)
- 8521 0G **When did Earth appear habitable? (Invited Paper)** [8521-15]
G. A. Konesky, K-Plasma Ltd. (United States)

SESSION 7 MICROBIAL EXTREMOPHILES

- 8521 0H **Evolution of Archaea in 3D modeling (Invited Paper)** [8521-16]
E. V. Pikuta, Athens State Univ. (United States); D. Tankosic, NASA Marshall Space Flight Ctr. (United States); R. Sheldon, National Space Science and Technology Ctr. (United States)
- 8521 0I **Cryoprotection from lipoteichoic acid (Invited Paper)** [8521-17]
C. V. Rice, A. Middaugh, J. R. Wickham, A. Friedline, K. J. Thomas III, K. Johnson, M. Zachariah, R. Garimella, The Univ. of Oklahoma (United States)
- 8521 0J **Nucleotide fluctuation in extremophilic cold-adapted sequences and their degradation codes (Invited Paper)** [8521-18]
G. Tremberger Jr., S. Dehipawala, E. Cheung, J. Prayor, R. Duran, P. Schneider, D. Lieberman, T. Holden, T. Cheung, Queensborough Community College, CUNY (United States)
- 8521 0K **Long-term exposure of bacterial cells to simulated microgravity (Invited Paper)** [8521-23]
F. Karouia, NASA Ames Research Ctr. (United States) and Univ. of California, San Francisco (United States); M. R. Tirumalai, Univ. of Houston (United States); M. A. Nelman-Gonzalez, Wyle International Science and Engineering (United States); C. F. Sams, M. C. Ott, NASA Johnson Space Ctr. (United States); R. C. Willson, Univ. of Houston (United States); D. L. Pierson, NASA Johnson Space Ctr. (United States); G. E. Fox, Univ. of Houston (United States)

SESSION 8 COMETS, MOONS, PRIMORDIAL PLANETS, AND ASTROBIOLOGY

- 8521 OM **Extraterrestrial life contradicts dark energy** [8521-20]
C. H. Gibson, Univ. of California, San Diego (United States)
- 8521 ON **Carbonaceous chondrites as bioengineered comets** [8521-21]
R. B. Sheldon, Grassmere Dynamics LLC (United States); R. Hoover, NASA Marshall Space Flight Ctr. (United States)
- 8521 OQ **Comets as parent bodies of C11 carbonaceous meteorites and possible habitats of ice-microbes** [8521-25]
N. Wickramasinghe, J. T. Wickramasinghe, J. Wallis, Univ. of Buckingham (United Kingdom); R. B. Hoover, Athens State Univ. (United States) and Univ. of Buckingham (United Kingdom); A. Y. Rozanov, Paleontological Institute (Russian Federation)
- 8521 OR **Possible biological structures in the Tissint Mars Meteorite** [8521-103]
J. Wallis, Cardiff Univ. (United Kingdom); N. C. Wickramasinghe, D. H. Wallis, N. Miyake, M. Wallis, B. Di Gregorio, Univ. of Buckingham (United Kingdom); R. Hoover, Univ. of Buckingham (United Kingdom) and Athens State Univ. (United States)

Author Index

Conference Committee

Conference Chairs

Richard B. Hoover, NASA Marshall Space Flight Center (United States)
Gilbert V. Levin, Arizona State University (United States)
Alexei Yu. Rozanov, Paleontological Institute (Russian Federation)

Conference Program Committee

Marina M. Astafieva, Paleontological Institute (Russian Federation)
Michael H. Engel, The University of Oklahoma (United States)
George E. Fox, University of Houston (United States)
Todd Holden, Queensborough Community College (United States)
Vera M. Kolb, University of Wisconsin-Parkside (United States)
David S. McKay, NASA Johnson Space Center (United States)
Joseph D. Miller, The University of Southern California (United States)
Prasanta K. Mukhopadhyay, Global Geoenergy Research Ltd.
(Canada)
Elena V. Pikuta, National Space Science and Technology Center
(United States)
Nilton O. Rennó, University of Michigan (United States)
Charles V. Rice, The University of Oklahoma (United States)
Dongok Ryu, Yonsei University (Korea, Republic of)
Birgit I. Sattler, Leopold-Franzens-Universität Innsbruck (Austria)
Robert B. Sheldon, NASA Marshall Space Flight Center (United States)
Michael C. Storrie-Lombardi, Kinohi Institute (United States)
George Tremberger Jr., Queensborough Community College (United States)
N. Chandra Wickramasinghe, Cardiff University (United Kingdom)

Session Chairs

- 1 Astrobiology of Mars
Michael H. Engel, The University of Oklahoma (United States)
- 2 Biomolecules, Microfossils, and Microorganisms in Carbonaceous Meteorites
Gilbert V. Levin, Arizona State University (United States)
- 3 Microfossils and Microorganisms in Ancient Rocks
N. Chandra Wickramasinghe, Cardiff University (United Kingdom)

- 4 Prebiotic Chemistry and the Origin of Life I
Marina M. Astafieva, Paleontological Institute (Russian Federation)
Robert B. Sheldon, NASA Marshall Space Flight Center (United States)
- 5 Prebiotic Chemistry and the Origin of Life II
Elena V. Pikuta, National Space Science and Technology Center
(United States)
- 6 Exoplanets and Astrobiology
George E. Fox, University of Houston (United States)
- 7 Microbial Extremophiles
Prasanta K. Mukhopadhyay, Global Geoenergy Research Ltd.
(Canada)
Carl H. Gibson, University of California, San Diego (United States)
- 8 Comets, Moons, Primordial Planets, and Astrobiology
Todd Holden, Queensborough Community College (United States)
Charles V. Rice, The University of Oklahoma (United States)