U22A-06 1145h

Evidence for Microbial Activity in 3.5 Ga Pillow Basalts From the Barberton Greenstone Belt, South Africa

Karlis Muehlenbachs[1] (780-492-2827; karlis.muehlenbachs@ualberta.ca)

Neil R. Banerjee[2] (neil.banerjee@geo.uib.no)

Harald Furnes[2] (harald.furnes@geo.uib.no)

Hubert Staudigel[3] (hstaudigel@ucsd.edu)

Maarten de Wit[4] (maarten@cigces.uct.ac.za)

[1]Department of Earth and Atmospheric Sciences, University of Alberta, Edmonton, AB T6G 2E3, Canada

[2]Department of Earth Science, University of Bergen, Bergen 5007, Norway

[3]Scripps Institution of Oceanography, University of California, La Jolla, CA 92093-0225, United States

[4]CIGCES, Geological Sciences, University of Cape Town, Rondebosch 7701, South Africa

We have discovered biosignatures in the formerly glassy rims of pillow lavas from the Mesoarchean Barberton Greenstone Belt (BGB) in South Africa. Over the last decade, bioalteration of basaltic glass in pillow lavas and volcaniclastic rocks has been well documented from in-situ oceanic crust and well-preserved Phanerozoic ophiolites. Much of the debate regarding the biogenicity of purported microfossils of early life centers on the interpretation of the host rocks' protoliths. To date, most protoliths have been interpreted to be of sedimentary origin. Some workers have proposed alternate origins for these substrates, including hydrothermal and even volcanic derivation, to cast doubt on their putative biogenicity. Hence studies documenting evidence for early life have proven to be controversial. Here we document evidence for microbial activity in 3.5 Ga subaqueous volcanic rocks that represent a new, unambiguous geological setting in the search for early life on Earth. The BGB magmatic sequence is dominated by mafic to ultramafic pillow lavas, sheet flows, and intrusions interpreted to represent 3480- to 3220-million-year-old oceanic crust and island arc assemblages. The BGB pillow lavas are exceptionally well-preserved and represent unequivocal evidence that these rocks were erupted in a subaqueous environment. The formerly glassy rims of the BGB pillow lavas contain micron-sized, microbially generated, tubular structures consisting of titanite. These structures are interpreted to have formed during microbial etching of the originally glassy pillow rims and were subsequently mineralized by titanite during greenschist facies seafloor hydrothermal alteration. Overlapping metamorphic and magmatic dates from the pillow lavas suggest this process occurred soon after eruption of the pillow lavas on the seafloor. X-ray mapping has revealed the presence of carbon along the margins of the tubular structures. Disseminated carbonates within the microbially altered BGB pillow rims have C-isotope values depleted by as much as -16 per mil, which is consistent with microbial oxidation of organic matter. In contrast, the crystalline pillow interiors exhibit C-isotope values bracketed between Archean marine carbonate (0 per mil) and mantle CO2 (-5 to -7 per mil). On the basis of the observed textural and geochemical signatures we propose that the glassy rims of the BGB pillow lavas hosted microbial life almost 3.5 billion years ago. Remnants of Archean oceanic crust may therefore be one of the most promising places to search for vestiges of early life on Earth.

U23A CC: 517 A Tuesday 1330h

The International Polar Year 2007-2008 I

Presiding: **M Albert,** Cold Regions Research and Engineering Laboratory**; P Johnson,** University of Ottawa

U23A-01 1330h

A New Phase of Exploration and Understanding: Planning for The International Polar Year - 2007/2008

Chris Rapley[1] (c.rapley@bas.ac.uk); Robin Bell[2] (robinb@ldeo.columbia.edu); Ian Allison (ian_@aad.gov.au); Robert Bindschadler (Robert.A.Bindschadler@nasa.gov); Gino Casassa (gcasassa@cecs.cl); Steve Chown (slchown@sun.ac.za); Gerard Duhaime (gerard.duhaime@fss.ulaval.ca); Vladimir Kotlyakov (igras@igras.geonet.ru); Michael Kuhn (Michael.Kuhn@uibk.ac.at); Olav Orheim (orheim@npolar.no); Prem Pandey (info@ncaor.org); Hanne Petersen (hkp@dpc.dk); Vladimir Ryabinin (celfring@nas.edu); Henk Schalke (henkscha@worldonline.nl); Zhanghai Zhan (zhangzhanhai@263.net.cn)

[1]British Antarctic Survey, High Cross Madingley Rd.

[2]Lamont Doherty Earth Observatory of Columbia University, 61 Rte. 9W

Planning is underway for an International Polar Year in 2007-2008. (IPY 2007/8) which will be a significant research opportunity to further our understanding of polar regions and polar processes. The International Polar Year has the potential to capture the public's imagination and convey the crucial role that the polar regions play in global systems. IPY 2007/8 will be an international programme of coordinated, interdisciplinary, scientific research in the Earth's polar regions to explore new frontiers, to increase our ability to detect changes at the Earth's poles and to deepen our understanding of polar processes and their global linkages. A crucial component of the IPY 2007/8 will be to attract and develop the next generation of polar scientists, engineers and leaders and to capture the interest of the public and decision-makers. The vision is for many nations to work together to gain holistic insights into planetary processes, targeted at exploring and increasing our understanding of the poles and their role in the global system. The concept of an International Polar Year 2007/8 has been endorsed and advanced by a broad range of global and polar research groups both internationally and nationally. To date 18 nations have formed national committees who are coordinating IPY activities nationally. The International Council for Science (ICSU) formed an International Polar Year Planning Group (IPY-PG) to stimulate, encourage and organize a debate on the International Polar Year 2007/8, formulate a set of objectives and develop a high level Science Plan. The Planning Group has sought input from the international science community and to date has received 138 ideas from over 22 nations. This input from the international community covers both poles, global processes and a diverse spectrum of disciplines. To date the input from the science community has identified key questions and proposed projects within the three major themes proposed by the ICSU IPY Planning Group: Exploration of New Frontiers, Understanding Change at the Poles and Decoding Polar Processes. Within the "Exploration" theme, three major concepts advanced by the community are genomic studies of the polar ecosystems, probing the polar deeps and sub-ice environments and studying the influence of the Earth's interior on polar processes. Within the theme of "Change at the Poles" the three major concepts advanced include climate connections and instabilities, solar forcing of the polar atmospheres and polar ecosystems response to change. Within the theme of "Decoding Polar Processes" three major concepts advanced include global forces on Peoples of the North, polar influences on people of the globe and contaminants at the poles. These ideas have been integrated into an outline of the proposed science questions and projects for the International Polar Year to be presented to the science community between April and September of 2004 for debate, discussion and review.

U23A-02 1430h

Dawn of a New Era of Polar Science: Efforts of the U.S. National Committee for the International Polar Year

Mary R Albert (603-646-4422; malbert2vt@hotmail.com)

Chair U.S. National Commmittee for the IPY, CRREL 72 Lyme Road, Hanover, NH 03755, United States

The polar regions, fascinating regions that capture the imaginations of people everywhere, hold the keys to our changing world. Plans are underway toward International Polar Year (IPY) 2007-2008. The vision for IPY 2007-2008 is that it will be the dawn of a new era in polar science, kicked off with an intense, internationally coordinated campaign of activities. IPY 2007-2008 will address research in both polar regions that involve the strong linkages to the rest of the globe. It will be multi- and interdisciplinary in scope and truly international in participation. It will educate and excite the public, and help produce the next generation of engineers, scientists, and leaders. Formed in the summer of 2003, the U.S. National Committee for the IPY has initiated conversations at meetings large and small, held internet discussions, and has listened to ideas voiced by the research community. Suggestions brought forward from individuals and communities to the U.S. National Committee were insightful and wide-ranging, and they all fit under broad umbrellas of understanding change in the polar regions, and exploring new frontiers. Change has occurred in the past and is occurring now, including changing environment, changing modes of communication, and changing human-environment dynamics. Intellectual curiosity drives the ideas voiced for exploration, ranging from investigation of life forms and their adaptability, facilitated by new genomics techniques, to geophysical investigations using new autonomous tools. The U.S. National Committee has worked to serve as a facilitator between the scientific community and our national agencies, helping to nurture ideas and partnerships that can lead to new international endeavors that will make the International Polar Year 2007-2008 the dawn of a new era of polar science.

URL: http://www.us-ipy.org

U23A-03 1445h

The electronic Geophysical Year (eGY) 2007-2008

C. Barton[1] (charles.barton@anu.edu.au); D. N. Baker[2] (daniel.baker@lasp.colorado.edu); B. Fraser[3] (phgjf@cc.newcastle.edu.au); V. Papitashvili[4] (papita@umich.edu); A. Rodger[5] (asro@bas.ac.uk); B. Thompson[6] (thompson@eitv3.nasacom.nasa.gov); J. H. Allen[7] (Joe.H.Allen@noaa.gov); B. Arora[8] (bra@iig.iigm.res.in); D. Kerridge[9] (djk@bgs.ac.uk); Y. Kamide[10] (kamide@stelab.nagoya-u.ac.jp)

[1]Res. School of Earth Sciences, Australian National University, Canberra ACT 0200, Australia

[2]LASP/Univ. of Colorado, 1234 Innovation Drive, Boulder, CO 80303-7814, United States

[3]Space Physics Group, Univ. of Newcastle, Callaghan, NSW 2308, Australia

[4]SPRL, University of Michigan, 2455 Hayward St., Ann Arbot, MI 48109, United States

[5]British Antarctic Survey, Cambridge, Cambridge CB3 0ET, United Kingdom

[6]Code 682, NASA/GSFC, Greenbelt, MD 20771, United States

[7]NOAA/NGDC, 325 Broadway, Boulder, CO 80301, United States

[8]Indian Inst. of Geomagnetism, Colaba, Bombay 400005, India

[9]British Geological Survey, Murchison House West Mains Road, Edinburgh EH9 3LA, United Kingdom

[10]Nagoya University, Toyokawa,, Aichi 422, Japan

An Electronic Geophysical Year (eGY) is planned for 2007/08 as a 50-year sequel to the highly successful International Geophysical Year. The central objective is to bring the management of geoscientific information worldwide into the 21st century through an e-Science approach and the development of virtual observatories. The challenge in 1957-58 was to acquire and make available to the world community the observational data required to build a comprehensive understanding of the Earth and its processes. That challenge remains and is yet more pressing because of the growing demands we place on our natural resources and environment. Our observational data gathering capabilities have expanded enormously during the past 50 years, particularly through space-based observations. For example, the US National Virtual Observatory will be adding 500 TB of astronomical data per year from 2004. This proliferation of data requires a modern, distributed approach to data management and dissemination. To meet this challenge, we have at our disposal the power of the Internet and grid computing infrastructures for data sharing, processing, and visualization. The eGY concept arose within the International Union of Geodesy and Geophysics, with support from the Scientific Committee on Solar-Terrestrial Physics, the International Union of Geological Sciences, and the Society of Exploration Geophysicists, as a means of providing an international focus for e-Science and

U

virtual observatory development across all the geosciences. It provides a common thread among other global geoscientific initiatives - the *4th International Polar Year*, the *International Year of Planet Earth*, the *International Heliospheric Year*, and *Climate and Weather of the Sun-Earth System*. Virtual observatories provide exciting prospects in the geosciences, and are under varying stages of development, for example the Virtual Seismic Network (http://equinfo.ucsd.edu/vsn/), the Virtual Solar Observatory (http://vso.nso.edu/), and the Virtual Geomagnetic Observatory (http://maggy.emgin.umich.edu/mist/). It is only a matter of time before virtual observatories are a standard feature across all the discipline areas within the geosciences, and add a new dimension to the role of the World Data Centers.

U24A CC: 517 A Tuesday 1530h

The International Polar Year 2007-2008 II

Presiding: **M Albert,** Cold Regions Research and Engineering Laboratory**; P Harrison,** National Research Council of Canada

U24A-01 1530h

OASIS: Ocean-Atmosphere-Sea-Ice-Snowpack Interactions in Polar Regions

Jan W Bottenheim[1] (416 739 4838; Jan.Bottenheim@ec.gc.ca); Jonathan Abbatt[2]; Harold Beine[3]; Torunn Berg[4]; Keith Bigg[5]; Florent Domine[6]; Caroline Leck[7]; Steve Lindberg[8]; Patricia Matrai[9]; Robie MacDonald[10]; John McConnell[11]; Ulrich Platt[12]; Oleg Raspopov[13]; Paul Shepson[14]; Oleg Shumilov[15]; Jochen Stutz[16]; Eirc Wolff[17]

[1]Meteorological Service of Canada, 4905 Dufferin Street, Toronto, ON M3H 5T4, Canada

[2]U Toronto, Toronto, ON, Canada

[3]CNR, Rome, Italy

[4]NILU, Kjeller, Norway

[5]Antarctic Society of Australia, Sidney, Australia

[6]CNRS, Grenoble, France

[7]U Stockholm, Stockholm, Sweden

[8]ORNL, Oak Ridge, TN, United States

[9]Bigelow Laboratory for Ocean Science, W. Boothbay Harbor, ME, United States

[10]Institute for Ocean Science, Sidney, BC, Canada

[11]York U, Toronto, ON, Canada

[12]U Heidelberg, Heidelberg, Germany

[13]SPbF IZMIRAN, St Petersburg, Russian Federation

[14]Purdue U, W Lafayette, IN, United States

[15]Polar Geophysical Institute of the RAS, Murmansk Region, Russian Federation

[16]UCLA, Los Angeles, CA, United States

[17]British Antarctic Survey, Cambridge, United Kingdom

While Polar regions encompass a large part of the globe, little attention has been paid to the interactions between the atmosphere and its extensive snow-covered surfaces. Recent discoveries in the Arctic and Antarctic show that the top ten centimeters of snow is not simply a white blanket but in fact is a surprisingly reactive medium for chemical reactions in the troposphere. It has been concluded that interlinked physical, chemical, and biological mechanisms, fueled by the sun and occurring in the snow, are responsible for depletion of tropospheric ozone and gaseous mercury. At the same time production of highly reactive compounds (e.g. formaldehyde, nitrogen dioxide) has been observed at the snow surface. Air-snow interactions also have an impact on the chemical composition of the snow and hence the nature and amounts of material released in terrestrial/marine ecosystems during the melting of seasonal snow-packs. Many details of these possibly naturally occurring processes are yet to be discovered. For decades humans have added waste products including acidic particles (sulphates) and toxic contaminants such as gaseous mercury and POPs (persistent organic pollutants) to the otherwise pristine snow surface. Virtually nothing is known about transformations of these contaminants in the snowpack, making it impossible to assess the risk to the polar environment, including humans. This is especially disconcerting when considering that climate change will undoubtedly alter the nature of these transformations involving snow, ice, atmosphere, ocean, and, ultimately, biota. To address these topics an interdisciplinary group of scientists from North America, Europe and Japan is developing a set of coordinated research activities under the banner of the IGBP programs IGAC and SOLAS. The program of Ocean-Atmosphere-Sea Ice-Snowpack (OASIS) interactions has been established with a mission statement aimed at determining the impact of OASIS chemical exchange on tropospheric chemistry and climate, as well as on the surface/biosphere and their feedbacks in the Polar regions of the globe. It is proposed that this program will culminate in a concerted field project during the IPY. In this contribution we will present the details of the emerging OASIS science plan and progress towards its implementation.

U24A-02 1545h

The IPY: an Opportunity to Establish a Legacy of Polar Climate Observations

Arnold L. Gordon[1] (845 365-8325; agordon@ldeo.columbia.edu); Alex Hall[2] ((310) 206-5253; alexhall@atmos.ucla.edu); Sarah Gille[4] (858-822-4425; sgille@ucsd.edu); Christopher L. Sabine[5] ((206) 526-4809; Chris.sabine@noaa.gov); William M. Smethie[1] (845-365-8566; bsmeth@ldeo.columbia.edu); Kevin G. Speer[3] ((850)- 645-4846; kspeer@ocean.fsu.edu); Achim Stoessel[6] (979-862-4170; astoessel@ocean.tamu.edu); Stephen G. Warren[7] (206-543-7230; sgw@atmos.washington.edu)

[1]Lamont-Doherty Earth Observatory, 61 Route 9W, Palisades, NY 10964, United States

[2]University of California, Los Angeles, Dep't of Atmospheric Sciences 405 Hilgard Ave. Box 951565, Los Angeles, CA 90095, United States

[3]Florida State University, 900 Call St, Tallahassee, FL 32306, United States

[4]University of California, San Diego, 9500 Gilman Dr., MC 0230, La Jolla, CA 92093-0230, United States

[5]NOAA Pacific Marine Environmental Laboratory, 7600 Sand Point Way NE, Seattle, WA 98115, United States

[6]Texas AM University, Department of Oceanography 3146 Texas A&M University, College Station, TX 77843-3146, United States

[7]University of Washington, Department of Atmospheric Sciences University of Washington, Box 351640, Seattle, WA 98195, United States

Each polar region has similarities but for the most part they are very different from each other. The differences are mainly a consequence of land/ocean configuration and contrasting hydrological states. While the Arctic seems to be warming, Antarctica, with the important exception of the Antarctic Peninsula, is cooling. The engagement of the two Polar Regions in the present climate system and their response and feedback to changes of the global climate and global carbon cycle is of fundamental scientific concern and high societal importance. Climate models indicate that the polar regions will bear the brunt of enhanced greenhouse global warming, and that the influence of polar climate change will spread to lower latitudes through its effect on sea level, Earth's albedo, and the ocean circulation. Recent observations lend support to some of these model-simulated trends. However, climate models do not include many of the physical or biogeochemical processes likely to be important for high latitude climate, nor do they resolve the small spatial scales characteristic of these processes. Our first priority should be to improve the observational grid required for to improve the models. The IPY offers the possibility of an international coordinated multidisciplinary effort, with consistent standards of measurements and observational design spanning both Polar Regions. We suggest the deployment of an array of sensors, much of which, due to the challenging environment conditions, will involve innovative technological systems. All climate elements will have to be covered in a unified program, including atmosphere, ocean, ice and land. For example, one can envision a series, perhaps of order ten per polar region, of heavily instrumented transects radiating from the both poles, spanning the continents, their margins and oceanic realm, to perhaps 60° latitude. Data will be gathered from the heights of the atmosphere to the depths of the ocean, with particular focus on the surface interface. Embedded in these spokes may be more focused objectives, perhaps targeting interaction between climate system elements. As with the IGY, a legacy will be established, a path will be created building the temporal dimension of research, with at least parts of the IPY observational grid extending into the future.

U24A-03 1600h

Earth Science Research as IPY Priority

Vladimir Kotlyakov[1] (7-095-959-00-32; geography@glas.arc.org); Yury Leonov[2]; Bernard Coakley[3] (1-907-474-5385; Bernard.Coakley@gi.alaska.edu); Garrik Grikurov[4] (7-812-114-31-13; grikurov@mail.lanck.net); Leonard Johnson[3] (1-907-474-5385; len.johnsoniii@verizon.net); Vladimir Kaminsky[4] (7-812-113-83-79); Yngve Kristoffersen[5] (47-55-58-34-07; Yngve.Kristoffersen@geo.uib.no); German Leitchenkov[4] (7-812-312-35-51; $german_l@mail.ru$); $VladimirPavlenko$[6]

[1]Scientific Council for Arctic and Antarctic Research of RAS;National delegate to SCAR, 29, Staromonetny St., Moscow 109017, Russian Federation

[2]Geological Institute of RAS, Pizhevsky St., Moscow 109017, Russian Federation

[3]University of Alaska Fairbanks, 900 Yukon Drive, Fairbanks, AK 755780, United States

[4]VNIIOkeangeologia, 1, Angliysky Ave., Saint-Petersburg 190121, Russian Federation

[5]University of Bergen, Allegaten 41, Bergen 5007, Norway

[6]Arctic Research Centre of RAS; National delegate to IASC, 35, Staromonetny St., Moscow 109017, Russian Federation

The preparations for IPY 2007/2008 are evolving from conceptual to implementation planning. Many earth scientists are concerned that the emerging plans for IPY are too narrowly focused on environmental processes and therefore appear discriminatory with respect to other fundamental sciences. National/international efforts such as USGCRP (U.S. Global Change Research program) and IPCC (Intergovernmental Panel on Climate Change) are also involved in the multitude of climate change issues, and just how the proposed IPY program could augment and complement these ongoing activities without reproducing them requires careful analysis and coordination. In particular, the polar research is unthinkable without study of the geological history of the Arctic and the Southern Oceans as a clue to tectonic evolution of the entire planet and test of the current geodynamic paradigm. In addition to these fundamental objectives, the circum-polar continental margins of the Arctic and Antarctica are likely to become the scenes of geopolitical intrigue provoked by implementation of the provisions of the Law of the Sea that require acquisition of specific earth science knowledge at internationally recognized levels of credibility. Interdisciplinary international programs (e. g. JEODI), based on geophysical data acquisition and analysis that would lead, where appropriate, to scientific drilling, had independently been proposed for studying the coupled tectonic and oceanographic history of the polar regions. Admitting the importance of identifying fundamental constraints for paleooceanography and climatic history of the high latitudes, and acknowledging the progress achieved so far in promoting IPY activities, the international earth science community has suggested developing the proposed approach into a major IPY endeavor - to examine the Polar Ocean Gateway Evolution (POGE). Such study would enable linking the geological history of the Polar Regions during the last 100 Ma and related fundamental changes that occurred in the face of the Earth with modern consequences of these processes and their impact on contemporary world. In good agreement with this project idea, although on a shorter time scale, is another initiative SALE (Subglacial Antarctic Lake Exploration) that has also been submitted for consideration in IPY context. It is hoped that IASC, SCAR and IUGS will take an active stand in endorsing earth science component of IPY, and that other bodies responsible for formulating IPY agenda will eventually recognize the fundamental importance of learning the past in order to understand the present and predict the future.