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This informal newsletter is intended to keep IUGG Member National Committees informed about the activities of the IUGG Associations, and actions of the IUGG Secretariat. Past issues are posted on the IUGG Web site (http://www.iugg.org/publications/ejournals/). Please forward this message to those who will benefit from the information. Your comments are welcome.

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1. Deep Drilling by Russian Scientists Reaches Subglacial Lake Vostok (*Feature article*)

On 5 February 2012, deep drilling through the East Antarctic Ice Sheet to reach Lake Vostok was successfully completed. This momentous occasion was recorded by three independent sensors that indicated the drilling tool reached lake water 3769.3 m beneath the ice surface. Shortly after these recordings were made, the drill tip was quickly lifted up to about 50 m above the lake surface. This was in preparation for the drillers to reduce the column of fluid in the hole slightly to allow the lake waters to rise up about 40 m and freeze for later sampling.

The discovery of subglacial Lake Vostok is one of the great geographical achievements of the 20th Century, and of global importance. The possible existence of subglacial lakes had been postulated as early as the 1960s, when Soviet scientist Dr. I. Zotikov proved theoretically that pressure melting resulting from the great thickness of ice in Central Antarctica could lead to the presence of liquid water at the interface between the bedrock and overlying ice sheet. In 1970s, when performing the first airborne radar sounding of the ice sheet, British scientists led by Dr. G. Robin, discovered unusual reflections at the ice sheet base. They suggested that these reflections resulted from liquid water. The term "*subglacial lake*" was then introduced. In recent years, many other liquid water bodies have been found at the base of the ice sheet, but Lake Vostok remains the largest. In 1980s, Soviet scientists mapped the boundaries of the lake by means of ground-based radio echo sounding, and first recognized its huge size (see Table 1). They also found the ice was floating on the lake.

Table 1. Lake Vostok statistics

Area	10,000 square km
Length	230 km
Width	50 km
Ice thickness	3700-4200 m
Melting temperature at base	-2.4 to -3.15ºC
Water depth	Up to 600 m
Sediment thickness	100-200 m

In the 1990s, images obtained from the satellite ERS-1 verified the early mapping of the ice boundaries, clearly illustrating its enormous size (Figure 1).

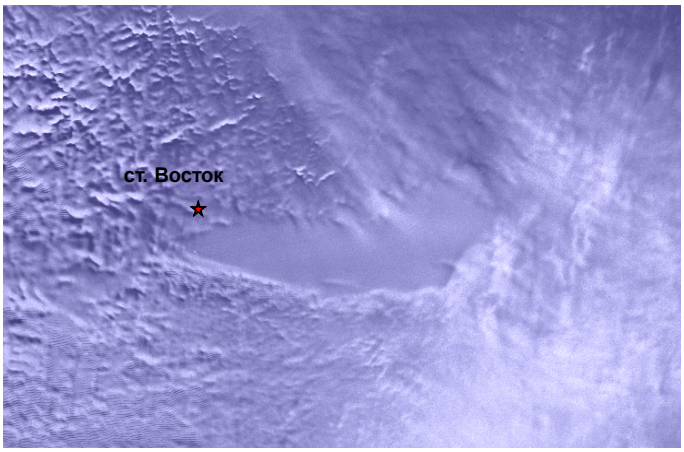


Figure 1. Vostok Lake is visible as an elongate, flat feature on the image from the ERS-1 satellite. The red star marks the site of the Russian Vostok research station. For scale, the lake is about 230 km long.

Ice core drilling at Vostok station began in the early 1970s, with the aim of recovering a long geochemical and isotopic palaeoclimate archive. In the 1980s, I reached an agreement with leading French glaciologist Claude Lorius that we would join forces to investigate the ice cores from the Vostok borehole. Since that time, we successfully developed our Soviet-French collaboration, and many interesting results ensued. Several years later, American scientists also joined our team. Results of their core investigations are published in many papers in leading journals and are widely known by scientists and broader society. For example, our paper “Climate and atmospheric history of the past 420,000 years from the Vostok ice core, Antarctica” (published in *Nature* in 1999) has received more than 3000 citations.

The complete dataset from the Vostok ice cores demonstrated that during the last 420,000 years the climate underwent huge cyclic fluctuations, helping us define the natural baseline of glacial-interglacial climate variability on Earth. Interestingly, greenhouse gas concentrations and the global temperature change at the same time throughout the record. Ice-core records show a drastic increase in greenhouse gasses during the last 100 years, but the corresponding temperature change has not yet exceeded the baseline of natural variability. Finally, the ice cores show that the Holocene epoch has lasted for about 11,000 years, much longer than the three previous interglacial periods. While the precise timing of the next ice age is uncertain, the anthropogenic influence on Earth's radiative budget now means that it will occur later than it would naturally. It is important also to note that the Holocene climatic optimum was 1.5ºC cooler than the maximum temperature experienced during the previous interglacial. Clearly, no anthropogenic impact took place on the Earth at that time.

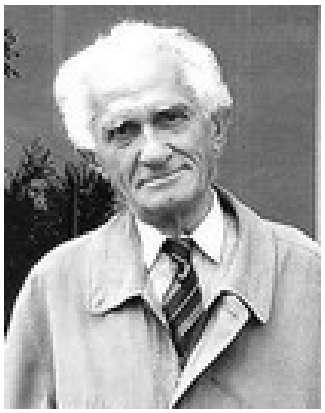
In 1994, the borehole depth had reached 3623 m, and at this level, it was found that the ice was formed from the freezing of lake water. At this time, Scientific Committee on Antarctic Research (SCAR) members adopted a recommendation to stop the drilling and to modify the equipment so that it could guarantee that the drilling fluid would not pollute the lake water. It took eight years to modify the drilling equipment and to follow the internationally agreed procedures of the Antarctic Treaty System (circulation, review and acceptance of a Comprehensive Environmental Impact assessment), before continuing drilling down to the lake water, with successful penetration of the lake and a carefully controlled rise in the lake water achieved on 5 February 2012. Sampling of the frozen lake water using a sterile ice drill is planned for next year.

Lake Vostok has probably been isolated from the outside world for tens of millions of years. Calculations indicate that thermal conditions are not identical in different parts of the lake, and this causes internal currents and active energy exchange. Ice melts from the 'roof' of the lake in some regions and refreezes in others, such as at the borehole site. Air in snow-covered surface of the ice sheet is captured as bubbles and transported downwards by ice flow entering the lake when the basal ice melts into the lake, and this process has been going on for millions of years. The lake waters may include microorganisms, and these will be of great scientific interest. It is evident that the lake is supersaturated with oxygen due to an abundant supply from ice melt above. But the ice that refreezes from the lake water does so very slowly, does not contain any gas, and therefore the oxygen accumulates in the lake. As calculations show, up to 0.7-1.3 grams of oxygen might be dissolved in a liter of the lake water. No known bacteria can exist under such conditions. Additionally, the pressure in the lake can reach 400 atmospheres, similar to the deep ocean floor. No light can penetrate the ice sheet. Hence there can be no photosynthesis, and organisms can exist here only due to chemosynthesis. But hot springs might exist at the lake floor, creating a habitat for organic life. Thus, the sampling of water from Lake Vostok opens new opportunities for scientists. In the future, we will discover whether life exists in this environment; to date, life has been found on Earth. Finding in this most extreme environment will be of global importance.

The Russian Antarctic Expedition plans to continue investigations of Lake Vostok. The intention for the forthcoming 2012/2013 season is to recover the 40 meters of frozen lake water, and to deploy specially designed instruments for taking water samples and performing biophysical studies. Scientists from the Saint-Petersburg Institute of Nuclear Physics are planning to calculate the number of cells in the lake water, isolate the DNA by means of polymer chain reaction, and to search for genes typical for the lake microorganisms. The isotopic and geochemical studies of lake water together with other analyses of water and ice will be carried out in a new laboratory recently opened at the Arctic and Antarctic Research Institute in St.-Petersburg. Discovery of oxygenophiles (organisms that exist in very high oxygen environments) would be a very important finding for the field of astrobiology. At the present time, many scientists postulate that an ocean might exist under a thick layer of ice on Europa, a Jovian satellite, and that this might be suitable for life. It is not inconceivable that finding organic life in Lake Vostok will be helpful in identifying locations for possible life on other planets in the Solar system.

Acknowledgments. I thank Ian Allison (Australia), Peter Barrett and Andrew Mackintosh (both New Zealand) for their thorough review and valuable comments.

Vladimir M. Kotlyakov



Academician Vladimir M. Kotlyakov, Director of the Institute of Geography, Russian Academy of Sciences, Moscow, is a Vice-President of the Russian National Committee for Geodesy and Geophysics. He has a particular interest in glaciology and physical geography in polar and mountain regions. Dr. Kotlyakov directed the twenty-year project which resulted in the World Atlas of Snow and Ice Resources (1997). He participated in many expeditions, worked and wintered in the Arctic, Antarctic, on the slopes of Europe's highest summit, Mt Elbrus, and headed the high mountain glaciological expeditions to the Pamirs. Dr. Kotlyakov was President of the International Commission of Snow and Ice (ICSI), Vice-President of the International Association of Hydrological Sciences (IAHS), Vice-President of the International Geographical Union (IGU), Member of the ICSU International Geosphere-Biosphere Program (IGBP) and the ICSU Scientific Committee on Antarctic Research (SCAR).

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2. IUGG Annual Report for 2011

The IUGG Annual Report provides a summary of the activities of the Union and the IUGG Associations as well as of the Union and Inter-Unions Commissions. Thanks to the input from the Union Associations, the Union Commissions, and the International Lithosphere Program. The 2011 IUGG Annual Report is now completed and posted on the web page: http://www.iugg.org/publications/reports/report2011.pdf. We invite you to download this impressive summary of last year's activities. The report will be printed together with the 2012 IUGG Yearbook and will be mailed to the Adhering Organizations, National Committees, International partners, and major libraries in May 2012.

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3. Next Bureau Meeting

The IUGG President Harsh Gupta announced the date of the next IUGG Bureau Meeting. The Bureau comprised of the President, Vice-President, Secretary General, Treasurer and 3 Members at large will meet in Freudenstadt, Germany, 29 September - 2 October 2012. The Bureau will analyze the activity of the Union since the last Bureau Meeting and will discuss major issues of the Union's activity for the next year; among them, how to improve links between IUGG and the Union Associations with the National Committees for Geodesy and Geophysics, the preparation of the 2013 Executive Committee Meeting in Prague in 2013, on the visibility of the Union and its links to other international programs and activities, and some other topics.

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4. IUGG and IUGS review the International Lithosphere Program

The International Union of Geological Sciences (IUGS) and IUGG co-sponsor the joint International Lithosphere Program (ILP). Both organizations agreed to conduct a joint review of the ILP activities for the last quadrennium in 2011. The IUGS review was made through an interview with the ILP President Sierd Cloetingh and the ILP Secretary General Roland Oberhänsli. The IUGS review panel was comprised of the following experts: Jacques Charvet (France), William Cavazza (Italy); Laurent Jolivet (France); Jaume Vergés (Spain). To conduct an IUGG review of the ILP scientific, administrative and financial activities, IUGG President Harsh Gupta appointed

the following experts to serve on the ad-hoc review committee: Chen Yun-tai (China), Alik Ismail-Zadeh (Germany/Russia), and Kalachand Sain (India). Bob Engdahl (USA) and Søren Gregersen (Denmark) were asked to comment on a draft report. The IUGG review was based on the ILP reports (2007-2010) submitted by the ILP Secretary General to IUGG, and on the ILP Terms of Reference.

For the past four years the International Lithosphere Program (ILP) has been very active and successful in accomplishing its tasks following the guideline assigned by IUGG and IUGS. ILP has contributed immensely to unravel the scientific curiosity of what happened in the past and what is expected in future. The program has provided important information on the lithosphere from its shallow parts to the deep interior through multidisciplinary research projects. Although ILP has been keeping a fine balance between "addressing societal needs" and "satisfying scientific curiosity", the review had several recommendations as to how the program could widen its impact and strengthen its activities, and also improve its administration. The joint review report can be downloaded from the IUGG web-page: http://www.iugg.org/programmes/ILP%20IUGS-IUGG%20ARC%20Review.pdf.

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5. Report on the Closing Ceremony of the International Year of Chemistry

The Closing Ceremony of the 2011 International Year of Chemistry (IYC2011) was held in Brussels, Belgium, on 1 December 2011. The Participants of the Ceremony were welcomed by HRH Prince Philippe of Belgium; by M. Geoghegan-Quinn, EU Commissioner for Research, Innovation and Science; and by N. Moreau, President of the International Union of Pure and Applied Chemistry (IUPAC). All speakers highlighted the importance of chemistry in our society and reviewed some of the accomplishments of IYC2011, mainly in the area of education and public outreach. A group of young chemists in research and industry put forward their vision of the future by telling the stories of three accomplished chemical scientists in 2050. In doing so, they highlighted the potential role of chemistry in addressing the society's biggest challenges: to guarantee pure water, food, energy, and healthcare for all. They advocated concerted efforts involving industry, academia, government, and the general public. The program continued with lectures on antibiotics by A. Yovath (Nobel Prize in Chemistry, 2009) and on organic light emitting diodes and photovoltaics by J.L. Brédas (Francqui Prize, 1997). There was an interesting panel discussion with scientists and industry leaders on various aspects of the future of chemistry, research, public-private partnership, the role of women in chemistry, and education. The IYC2011 was formally closed by M. Nalecz, Director, Division of Basic and Engineering Sciences at UNESCO, under whose auspices this International Year was organized.

The geophysics community might be interested in two particular achievements of IYC2011:

- A set of 9 lessons has been created for communicating climate change science, targeted at age 16-19 (http://www.explainingclimatechange.com/).
- A worldwide chemistry experiment "Water: A Chemical Solution" has been conducted during IYC2011. It actually consisted of running a set of four adaptable experiments focusing on water, aimed at a range of ages from primary school to high school. The experiments include determining the pH and the salinity of water, which are parameters of geophysical relevance. The results are reported on the experiment's website (http://water.chemistry2011.org/).

This IYC2011 event was quite illuminating for a geophysicist, as it leads one to realize that there are very close ties between chemistry and geophysics. Some of the big challenges that were identified relate directly to geophysical problems. Hydrology plays a major role in addressing the challenge for access to pure water, for instance. The quest for sustainable energy sources involves studies of solar irradiance, greenhouse gas emissions and atmospheric chemistry, carbon capture and sequestration and geologic storage.

On behalf of IUGG President H. Gupta, the President of the Belgian National Committee for Geodesy and Geophysics J. De Keyser attended the IYC2011 Closing Ceremony. More information on the IYC can be found at: http://www.chemistry2011.org/

Received from J. De Keyser

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6. Awards & Honors

Priscilla Grew, former Chair of the U.S. National Committee for Geodesy and Geophysics, was elected as a Lifetime National Associate of the National Research Council of the National Academies.

Vincent Courtillot, former Member of the French National Committee for Geodesy and Geophysics, was awarded the 2012 Arthur Holmes Medal and Honorary membership of the European Geosciences Union (EGU) for his seminal contributions to geomagnetism and the geodynamics of mantle hotspots. The award is one of the three equally-ranked most prestigious annual awards made by EGU and reserved for scientists who have achieved exceptional international standing in Solid Earth Geosciences, defined in their widest senses, for their merit and their scientific achievements.

Peter Fox, Chair of the IUGG Union Commission for Data and Information (UCDI), was awarded the 2012 Ian McHarg Medal of the EGU Earth and Space Science Informatics Division for his contribution to recognizing the fundamental importance of establishing informatics as a genuine discipline within the Earth Sciences.

Congratulations to Priscilla, Peter and Vincent!

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7. IUGG-related meetings occurring during April – June

A calendar of meetings of interest to IUGG disciplines (especially those organized by IUGG Associations) is posted on the IUGG web site (http://www.IUGG.org/calendar). Specific information about these meetings can be found there. Individual Associations also list more meetings on their web sites according to their disciplines.

April

- 22-27, EGU, Vienna, Austria, EGU General Assembly
- 22-27, SCAR, Montreal, Canada. IPY 2012 - From Knowledge to Action

May

- 16-19, IUGG, EGU, Bacau, Romania, First International Conference on Moldavian Risks - from Global to Local Scales

- 20-25, JpGU, Chiba-city, Japan, Japan Geoscience Union Meeting
- 21-24, IAHS, Prague, Czech Republic, GwFR2012 - International Conference on Groundwater in Fractured Rocks
- 21-25, IAVCEI, Olot, Spain, 1st International Congress on management and awareness in protected volcanic landscapes

June

- 4-14, IAGA, San Fernando, Cadiz, Spain, XVth IAGA Workshop on Geomagnetic Observatory Instruments, Data Acquisition and Processing
- 10-20, IACS, IUGG, McCarthy, Alaska, USA. International summer school/workshop in glaciology
- 18-22, IUGG, Edinburgh, United Kingdom, XXIXth Conference on Mathematical Geophysics
- 25-28, IAMAS, IUGG, Boulder, Colorado, USA, Comparative Climatology of Terrestrial Planets

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End of IUGG Electronic Journal Volume 12 Number 4 (1 April 2012)

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