

Frozen Ground

THE NEWS BULLETIN OF THE INTERNATIONAL PERMAFROST ASSOCIATION
WWW.PERMAFROST.ORG

Message from the President



Writing this column for Frozen Ground provides an opportunity to reflect on the activities of the IPA during 2014, many of which are described elsewhere in this issue. The last twelve months were certainly busy ones

for the IPA Executive with a total of nine meetings, four of which were held fully or partially face-to-face, while the remainder were held on-line. The timing of on-line meetings is itself a challenge since members live in time zones from GMT+8 to GMT-9, but participation is important because strategic tasks have been divided up among the members who report on progress at each meeting. In this way, all members of the executive actively contribute to the success of the organization.

The highlight of 2014 was undoubtedly the 4th European Permafrost Conference, held from June 18-21 in Évora, Portugal. The meeting was a great success, with a historic venue, an excellent technical program and enjoyable social activities for the several hundred delegates who attended. One of the highlights was the awarding of the IPA's lifetime achievement award to Academician Cheng Guodong. For further details visit the IPA



Cheng Guodong receiving the IPA Lifetime Achievement Award 2014 from IPA President Antoni Lewkowicz during EUCOP4 opening ceremony

website: <http://ipa.arcticportal.org/news/56-ipa-news/727-ipa-lifetime-achievement-award-goes-to-cheng-guodong.html>.

As a Regional Permafrost Conference, an IPA Council meeting was held, during which the members representing the organization's adhering bodies were updated on the organization's progress. The IPA's finances were reported as being in excellent shape, in part because of the support for the IPA Executive Director position from the Alfred Wegener Institute in Potsdam, Germany, and also because of the move to produce Frozen Ground as an on-line publication.

Several Action Groups have been funded since 2012 and for the first time, some

reported to Council. Action Groups are proving to be highly successful for focusing on targeted goals and more were approved during the spring and the fall of 2014. Currently, Action Groups are working on the last permafrost maximum and minimum in Eurasia, permafrost and culture, the characteristics and distribution of yedoma deposits, and permafrost research priorities (see below). Further details on the funded Action Groups can be found at <http://ipa.arcticportal.org/activities/action-groups/>.

In addition to Action Groups, the IPA has a number of core products which continually occupy members of the executive and individual IPA members. Chief among these is the Global Terrestrial Network on Permafrost (GTN-P) which has been redeveloped in terms of database management with funding from the PAGE21 project. Thanks to the efforts of the GTN-P Executive, national correspondents and the individual researchers, the GTN-P is about to publish its first paper derived from the new database. This is a big step forward for permafrost science and helps fulfill the IPA's role as a supplier of information to the global community of modellers and decision-makers concerned with permafrost.

A second core product is the "Multi-Lingual Glossary of Permafrost and Related Ground-Ice Terms". This started out as a set of terms and their definitions in English and



Group photo of EUCOP4 participants in Évora, Portugal. This figure is available in colour online at www.interscience.wiley.com/journal/ppp

(continued from page 1)

French developed by the Associate Committee on Geotechnical Research of the National Research Council of Canada, chaired by Hugh French. These terms were translated in 1998 with the help of IPA members from around the world under the direction of Robert van Everdingen and several editions of the Glossary were produced, the latest in 2005. Given this history, the IPA Executive felt that it was time to re-evaluate the list of terms, adding new ones and revisiting existing definitions to determine if they are still current. This process will be under the guidance of former IPA President Hugh French, and will involve consultation and input from the international community.

The Third International Conference on Arctic Research Planning (ICARP III) has also involved the entire network of permafrost researchers. The IPA is working with the Climate and Cryosphere project (CliC) to produce a set of priorities based on a community-wide consultation, termed a horizon scan.

I encourage all those associated with permafrost science and engineering to become individual members of the IPA!

A.G. LEWKOWICZ

This project has the status of an IPA Action Group. More than 600 research questions were submitted by individuals during the first stage of the process, and these will be grouped and then made available for community prioritization. The result is expected to be a road-map for research for the next decade.

The IPA continues to support its future members through the Permafrost Young Researchers Network (PYRN). The IPA provided financial support for several PYRN activities in 2014, but as in the past, on an ad-hoc basis. After discussions with the PYRN executive, the IPA is planning to start providing a consistent level of annual funding which will help PYRN better plan its future activities.

The IPA web-site is in the process of a major upgrade and revision. Karina Schollaen, the IPA's Executive Director, is working with Arctic Portal personnel to create a more attractive and more functional site. Among other refinements, the new site will work much better with mobile devices and social media. The new site is expected to launch in spring 2015.

The IPA lost one of its greatest scientific leaders when Professor J.R. Mackay passed away in October. Ross Mackay not only published seminal papers on ground ice, pingos, slope movements and other subjects, but he was also the first Secretary-General of the IPA and the first recipient of the IPA's Lifetime Achievement Award. He will be greatly missed.

In 2015, the IPA will continue to work on its core products, developing its collaborative relationships with its partner organizations, and preparing for the next ICOP in Potsdam in 2016 (www.icop2016.org). I encourage all those associated with permafrost science and engineering to become individual members of the IPA and wish you success in your research and other activities in 2015.

Antoni G. Lewkowicz
on behalf of the Executive Committee of the IPA

EUCOP4 Wrap-Up

by Karina Schollaen

More than 400 participants attended the 4th European Conference on Permafrost in Évora, Portugal

The Fourth European Conference on Permafrost (EUCOP4) was held in Évora, Portugal in June, 18-21. Over 400 participants from 28 different countries attended the meeting to present their newest studies in permafrost research, exchange experiences and their knowledge, discussed future collaborations and projects and enjoy the fabulous weather and extraordinary hospitality of the local people!

All abstracts from the conference are collected in an electronic Book of Abstracts, which contains 425 abstracts, including those

from the 3 plenary lectures, 1 from The Wiley - Blackwell Permafrost and Periglacial Processes Public Lecture and 23 session keynote lectures. One day before the official conferences started, the 24th IPA Council Meeting took place where 24 of the 26 IPA country members voted for the location for the next Regional Conference on Permafrost (RCOP). The RCOP 2018 will be organised by the French IPA National Committee in Charmonix, June 04-08, 2018. Furthermore, the

**IPA REPORT ABOUT
EUCOP4**
Permafrost and Periglac.
Processes 25: 344-348
(2014)

IPA President, Antoni Lewkowicz, announced that Hanne Christiansen had been unanimously selected by the Executive Committee as the Senior Vice-President, and she will become IPA President in June 2016.



Hanne Christiansen, the new IPA Senior Vice-President.

A detailed IPA report from the EUCOP4 is published in the journal *Permafrost and Periglacial Processes*, entitled "Report from the International Permafrost Association: Fourth European Conference on Permafrost (EUCOP4)". The article is free to access under "Special Features": http://onlinelibrary.wiley.com/journal/10.1002/28ISSN%291099-1530/homepage/ipa_reports.htm.

IPA Action Group Reports

by Action Group Leaders



Permafrost extension during the Last Glacial Maximum in the Northern Hemisphere

A permafrost map during the Last Glacial Maximum is almost as important as a map of present-day permafrost distribution. Understanding the sensitivity of permafrost extent to climate changes is crucial to unraveling the dynamics of climate feedbacks in the near future. Before estimations of permafrost evolution may be made by climate and permafrost modeling, evidence of permafrost occurrence and climatic conditions during the Last Glacial Maximum (LGM) will be helpful to document the wide range of responses of permafrost to climate changes. The general aim of the project was to map different kinds of permafrost all over the northern hemisphere. After common agreement of the evidence to be used for the recognition of former permafrost, the mapping was realized in separate regions coordinated by respective experts: North America (French), west and central Europe (Vandenberghe), southern Europe (Russia: Velichko), western Asia (Velichko), central Asia (Kazakhstan and neighbouring countries: Gorbunov, Marchenko), eastern Asia (Jin, Cui, Vandenberghe). The results in terms of former permafrost extension in the northern hemisphere may be expected to contribute substantially to a better understanding of the dynamics of changes of permafrost extent as a response to climate change. We expect that the maps produced will be of considerable help in modeling the future evolution of permafrost under warmer conditions.

Being aware of the problem of exact dating of former permafrost, we chose not to refer to LGM (Last Glacial Maximum), but to consider the last important phase of permafrost establishment as the LPM (Last Permafrost Maximum). This period largely corresponds to the LGM, but the LPM relates to the last cold maximum instead of depending on glacial margins or arbitrarily defined chronological boundaries.

The project ran for 2 years, starting with an initial meeting in Lanzhou in September 2011, followed by a progress-meeting in Salekhard in summer 2012. The final results were presented at EUCOP4 in Évora in summer 2014. The data on which the map is based consists of field evidence published in regular papers and in 'grey' literature, and new field research in specific regions. The final result is thus a permafrost extension map of the northern hemisphere at time of the LPM. Where possible a distinction has been made between continuous and discontinuous/sporadic permafrost. Besides equilibrium permafrost at LPM, regions underlain by relict permafrost and regions of now submerged permafrost are shown. The map was produced at a scale of 1:20 000 000 with the same projection as was used for the IPA Circum-Arctic Map of Permafrost and Ground Ice (Brown et al., 1998) and is published in a special issue of *Boreas*, together with an accompanying paper explaining the approach, limitations and main results. The map will be

digitally available at NSIDC, Boulder Colorado. In addition, in the same issue of *Boreas* a compilation of papers on specific regions with LPM permafrost is published (co-edited by J. Vandenberghe and H.M. French).

A map is always a state-of-the-art snapshot. This means that new data may appear that cause boundaries to be redrawn. In addition, some problems could not be solved in the short framework of this project: e.g. the categorization of permafrost in mountain regions and the low frequency of proxy-indicators for permafrost in some regions. It is hoped that these challenges will be met by a successor AG (co-ordinated by H. Jin).

Besides, the main moral and financial help of IPA, we acknowledge support from CAREERI (Lanzhou), NSIDC (Boulder) and *Boreas* (chief-ed. J. Piotrowski).

Reference:

Vandenberghe, J., French, H.M., Gorbunov, A., Velichko, A.A., Jin H., Cui Z., Zhang, T. & Wan, X. 2014 The Last Permafrost Maximum (LPM) map of the northern hemisphere: permafrost extent and mean annual air temperatures, 25-17 ka BP. *Boreas* 43, 652-666. IN: Vandenberghe, J. and French, H.M. (guest editors) 2014 Permafrost extension during the Last Permafrost Maximum (LPM) in the northern hemisphere. *Boreas* 43-3, 652-758.

by Jef Vandenberghe

Submarine Permafrost Mapping Action Group (SuPerMAG)

The Submarine Permafrost mapping Action Group of the IPA started a number of activities in 2014, including a 1-day workshop at EUCOP4 in Évora, Portugal in June. It is additionally supported by the CAGE, UIT and the Alfred Wegener Institute Helmholtz Center for Polar and Marine Research (AWI) in Potsdam, Germany. Travel support for the participation of some early career young scientists was provided by CliC/WMO and by the association of Polar Early Career Scientists (APECS). Participants included members of the scientific community,

national agencies, oil industry representatives and students.

The workshop brought together modelers and regional experts, to review current observational data, our understanding of processes determining submarine permafrost distribution, numerical modelling of relevant processes, techniques for model validation, and to discuss options for the cartographic representation of submarine permafrost. The workshop discussion and synthesis focused on multiple options for moving forward. The

necessity of bringing many of the discussions elements into the citable literature led to the suggestion that a publication be prepared that synthesizes existing knowledge and outlines the needs associated with a mapping effort for submarine permafrost. A document outline was created and work is underway. An interdisciplinary modelling effort has also begun, that integrates the state of the art on input parameterization with a circumpolar-scale approach.

by Paul Overduin

IPA Action Group Reports

by Action Group Leaders

Permafrost and Culture (PaC): Integrating environmental, geo-, and social sciences to assess permafrost dynamics and indigenous land use

This IPA Action Group, established in July 2014, was initiated by participants of the workshop on “Permafrost Dynamics and Indigenous Land Use” held in connection with the Arctic Science Summit Week (ASSW) 2014 in Helsinki. The aim is to integrate different fields of knowledge that have thus

far existed separately. Social anthropologists have documented indigenous land use in many permafrost regions all across northern Eurasia, but these insights have not yet been sufficiently aligned with research on geocryological, hydrological, climatic and ecological conditions. The mutual influence of indigenous land use and permafrost dynamics is not yet sufficiently understood.

Thermokarst regions in the Yakutian lowlands, for example, play a key role in Sakha cattle and horse breeding. The PaC Action Group started its activity with a specific focus on these unique Alas ecosystems in Central Yakutia. Currently, the PaC Action Group is preparing a scientific publication on this topic, which reviews the current

understanding of natural and social scientific research on the interaction of indigenous land use and permafrost dynamics in the Alas landscapes of Central Yakutia and also aims to highlight open research questions and the need for interdisciplinary permafrost research. Manuscript submission is planned for December 2014.

The Action Group plans, however, to go beyond this example and investigate indigenous culture and resource use in other permafrost regions. Thus, the agenda for work up to mid-2016 comprises additional case studies from the Barents Region, to be presented at ASSW 2015; a workshop and joint field work in Yakutsk in summer 2015 to include, in particular, Sakha natural and social scientists in the PaC Action Group's activity; and the formulation of a science plan to be presented at the ICOP2016.

by Mathias Ulrich and J. Otto Habeck



Large parts of the Central Yakutian lowlands are speckled with thermokarst basins, known as alas (alaa) and used by the local population for grazing cattle, making hay, and other forms of agriculture (Photo: M. Ullrich, July 2014).

Permafrost Research Priorities: A Roadmap for the Future

The aim of the PRP process, which follows the Sutherland method as did the SCAR Horizon Scan and other efforts, is to establish a concise set of ~15 - 20 key research priorities for the next ten years, as agreed upon by permafrost researchers, and with input from researchers in cognate scientific disciplines. The target audience of the exercise is three-fold: 1. The research community; 2. Funding agencies and 3. Policy-makers.

The PRP products will include a high level, but short benchmark publication that lists and puts into context research priorities for 2015 to 2025.

The Permafrost Research Priorities survey for submitting future research questions closed in September 2014. Almost 650 questions were received from more than 300 participants. The IPA and the Climate and Cryosphere Project (CliC) thank the community for this great response to the project. A list of all the submitted questions and preliminary figures depicting demographic data can be found on

the IPA website (http://ipa.arcticportal.org/images/stories/news/Results_PRP-survey.pdf).

Preliminary statistics from part two (demographics) of the survey show that:

- The respondents come from 37 countries
- A majority of the respondents (69 %) are men working within academia (68 %)
- 79 % of the respondents have a PhD as their highest academic degree
- The respondents have a wide range of areas of primary expertise, the most common being geomorphology (13 % of respondents), ecology, engineering and infrastructure, and climate change (each 8 % of respondents)
- Age distribution and years of experience working with permafrost related issues for respondents cover the full spectrum.

The PRP core group looks forward to getting your input again in the voting process, scheduled for spring 2015.

by Hugues Lantuit

New IPA Action Groups

by Karina Schollaen

The IPA funds 4 new international Action Groups in 2014 with up to 2500 Euros per year for 2 years

1. Permafrost and Culture (PaC): Integrating environmental, geo-, and social sciences to assess; Contact: Mathias Ulrich and Otto Habeck
2. Permafrost Research Priorities: A Roadmap for the Future; Contact: Hugues Lantuit
3. Last Permafrost Maximum and Minimum (LPMM) in Eurasia; Contact: Huijun Jin
4. The Yedoma Region: A Synthesis of Circum-Arctic Distribution and Thickness Contact: Jens Strauss

NEXT DEADLINE FOR ACTION GROUPS PROPOSALS:
October 2015

Obituary J. Ross Mackay

by Antoni G. Lewkowicz and Chris Burn

Ross Mackay published a total of 201 papers and two memoirs, covering all aspects of geocryology, including the active layer, the formation of ground ice, slope movements, pingos, thermal contraction cracking, ice wedges, and frost heave.

Professor Emeritus J. Ross Mackay (University of British Columbia, Canada) passed away peacefully on October 28, 2014, just short of the start of his 100th year. He was a seminal figure in geocryology and his publications will undoubtedly remain critical to permafrost science for many decades to come. He was among the most prominent and one of the last living representatives of the early international researchers in the field, such as Roger Brown, Arturo Corte, Alfred Jahn, Pavel Melnikov, Siemon Muller, Troy Péwé, Link Washburn, and Shi Yafeng.



Ross Mackay's findings, published in a total of 201 papers and two memoirs, covering all aspects of geocryology, including the active layer, the formation of ground ice, slope movements, pingos, thermal contraction cracking, ice wedges, and frost heave. They impacted the entire international community of researchers. His favoured methodology, based on carefully considered hypotheses, meticulous field observations year-round, and

fully supported answers, is a model for all earth and environmental scientists. His long-term studies of conditions in the western Canadian Arctic, particularly the Mackenzie Delta area, represent a baseline against which environmental changes have been evaluated and will continue to be measured. His contribution to founding the International Permafrost Association, and his service as Secretary-General of the IPA for 13 years helped bring the organization to where it is today and remains as a further legacy.

He was a Fellow of the Royal Society of Canada (the pre-eminent academic body in Canada) and received numerous other awards, including the Order of Canada, the Massey, Miller, Vega, and Logan medals, five honorary doctorates, including from the University of Helsinki, and election to the Russian Academy of Natural Sciences. He was the inaugural recipient of the IPA's Lifetime Achievement Award at the Third European Permafrost Conference on Svalbard in 2010 to which he sent greetings by video.

The Canadian permafrost community was fortunate to have had Professor Mackay in its midst for so many years. The Canadian

Geomorphological Research Group's young researcher award is entitled the J. Ross Mackay Award in his honour. All those receiving it know that they are following in the footsteps of a scientific giant.

Ross Mackay's 90th birthday celebration in 2006 brought together permafrost researchers from across Canada and internationally, including some of his former PhD students, to the University of British Columbia in Vancouver, his academic home for more than 50 years. A special issue of *Permafrost and Periglacial Processes* (volume 18(1)) was subsequently published in his honour.

Professor Mackay continued to travel to his field sites, with the assistance of his long-term collaborator, Chris Burn, until 2011. His remarkable longevity and activity is shown by two co-authored papers that are planned for posthumous submission. A special symposium in his memory is being organized at the Seventh Canadian Permafrost Conference in September 2015.

J. Ross Mackay was a brilliant scholar, a real gentleman, and a role model for generations of geocryologists. We are truly fortunate to have had him as a leader in our field of earth sciences.

XII. Congress of the International Association of Engineering Geologists (IAEG)

by Julia Stanilovskaya and Dmitry Sergeev

A poster about the 50th Anniversary of the First International Conference on Permafrost was presented

Jerry Brown and Julia Stanilovskaya, attended the XII Congress of the International Association of Engineering Geologists (IAEG) held at the University of Turin, September 15-19, 2014. They presented a poster about "The 50th Anniversary of the First International Conference on Permafrost" where they showed that the International Conferences on Permafrost (ICOP's) are the main platforms for continued and productive collaboration between the IPA and the IAEG. A brief review of the previous 10 ICOP's is

presented in their paper 'The 50th Anniversary of the First International Conference on Permafrost in the proceedings of the XII IAEG Congress published by Springer.

The eight volumes of XII IAEG Congress proceedings contain more than 4000 pages with reports on state-of-the-art engineering geology. A special volume was devoted to climate change specific problems. Approximately 25 % of the volumes reports were linked with permafrost topics. Different

processes such rock glaciers, erosion, floods, disturbances of hydropower and transport structures were the subject of investigation in all continents excluding Antarctica.

Reference:
Brown, J. and J. Stanilovskaya (2014). The 50th Anniversary of the First International Conference on Permafrost. *Engineering Geology for Society and Territory - Volume 7*. G. Lollino, M. Arattano, M. Giardino, R. Oliveira and S. Peppoloni, Springer International Publishing: 247-250.

The Global Terrestrial Network for Permafrost: News about the GTN-P Database

by Boris Biskaborn

The GTN-P website (<http://gtnp.arcticportal.org/>) received a facelift and a database website (<http://gtnpdatabase.org/>) has been installed

The data management group's goal is to provide a web-based resource for borehole temperature and thaw depth data assembled in the Global Terrestrial Network on Permafrost. The overall aims of this effort are 1) to enable the assessment of the links between ground temperature, gas fluxes and the Earth's climate system and 2) to establish a global monitoring database serving as an "early warning system" for the negative consequences of recent and future climate change on permafrost regions.

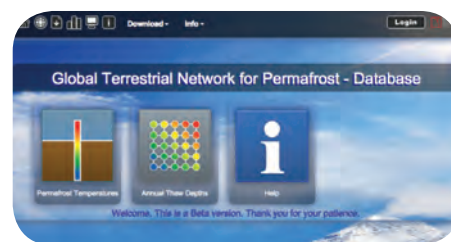
A new GTN-P website will be launched soon. It was designed by the Arctic Portal in collaboration with the GTN-P team, the IPA and within the framework of the Changing Permafrost in the

Arctic and its Global Effect on 21st Century (Page21) European 7th Framework project. This will go together with a new website for the GTN-P database. The GTN-P Database is currently funded by the PAGE21 project within the EU 7th framework program.

The database comprises Thermal State of Permafrost (TSP) and Circumpolar Active Layer Monitoring (CALM) data, as well as air

and surface temperature and moisture data (DUE Permafrost, MODIS) from terrestrial Arctic, Antarctic and mountain areas. The main advantage of the database is that these Essential Climate Variables will be harmonised for the first time in a central data management system following international ISO-standards for geospatial metadata. To obtain the highest possible integration within the international permafrost community, an online interface was developed by consulting the PAGE21 peer group. Concept and design of the system includes full documentation on the related GTN-P website (ISSN 2410-2385). Following the GTN-P Strategy and Implementation Plan 2012-2016, the data input is coordinated, reviewed and quality checked by National Correspondents. The output is provided in common formats including CSV, XML, KML, and shapefiles for GIS. Inconsistency within time series datasets, in regards to completeness, frequency and geometry did not allow their direct use within climate models. Therefore, NetCDF files for borehole temperatures and active layer thaw depth grids were developed in model-ready formats to facilitate direct application of the GTN-P database in permafrost and climate modelling.

We performed spatial statistics on the GTN-P metadata and assessed the database quality and its functionality as a permafrost monitoring platform. Inhomogeneous sample distribution was



detected and compared with environmental parameters, such as the spatial distribution of organic carbon contents and projected temperature differences at the end of the 21st century. The PAGE21/GTN-P data management group has submitted a paper to the Earth System Science Data journal (ESSD) that highlights the most important spatial permafrost research gaps on a numerical basis. One of the main conclusions in this paper is that there is still a need to develop a systematic approach to assess the permafrost monitoring quality. Due to the variety of individual borehole measurement setups and differential development of borehole properties in relation to local permafrost dynamics, the GTN-P database is afflicted with data inconsistencies. To establish a transparent and sustainable system the next efforts have to focus on GTN-P data quality control and assurance of permafrost variables. This will be one of the main topics during the upcoming 2nd GTN-P meeting in September 2015 associated with the GEOQuébec 2015 conference in Canada.

Workshop Report: Impacts of permafrost thaw in mountainous areas of Canada and beyond.

by Stephan Gruber, Lukas Arenson and Marten Geertsema

A number of phenomena related to permafrost are most prominently or exclusively observed in mountainous areas.

From 22–25 October 2014, 30 senior experts from academia, industry and government met near Whistler, BC, Canada, to develop priorities for research and knowledge transfer related to permafrost thaw in Canadian and other mountain environments. The workshop, organized by Stephan Gruber,

Marten Geertsema, and Lukas Arenson, received support from the Natural Sciences and Engineering Research Council of Canada (NSERC), BGC Engineering Inc., the British Columbia Ministry of Forests, Lands and Natural Resource Operations, and Carleton University.

Discussions addressed four key questions and the results are similarly grouped around these themes: (1) What is noteworthy about permafrost in mountains? (2) What is the relevance of permafrost in mountains? (3) What research and development needs exist? (4) What is a good way forward?

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1. What is noteworthy about permafrost in mountain regions?

About one third of the global permafrost region is situated in mountainous terrain. Despite extensive knowledge gaps about permafrost in the Canadian mountains, it is evident, that much of it is sensitive to degradation. Although permafrost (being a thermal condition) cannot be directly observed, drastic reduction in mountain glacier and snow cover is a clear indicator of environmental change that, inevitably, will also result in widespread thaw of permafrost with time. Permafrost in mountainous areas is governed by the same basic processes as permafrost in other environments. Even though, mountain topography and terrain-related mass movements yield a much greater diversity of materials and temperatures per unit area, than is encountered in cold lowlands, the governing principles are the same. Permafrost in mountainous regions therefore enriches the variety of phenomena encountered beyond what is found in lowland areas. A combined view on permafrost in differing environments is useful for informing research and practitioners. The expression “permafrost in mountainous regions” is preferred over “mountain permafrost” as it avoids implying separate entities. A number of phenomena related to permafrost are most prominently or exclusively

observed in mountainous areas: thermal effects of air advection in slopes composed of coarse materials, compaction of avalanche snow and debris into ice-rich permafrost, slow, gravity-driven mass movements of ice-rich sediments, intense sediment dynamics including rock fall and debris flows, as well as strong groundwater flow and extensive unsaturated zones.

2. What is the relevance of permafrost in mountain regions?

Permafrost thaw in the mountains will increase the probability of geohazards such as debris flows, rock falls, rock avalanches, and displacement waves. Due to the high potential energy and possible process transformations, these phenomena can have a reach that extends in lower-lying areas without permafrost. Best management practices for hazard mapping for linear infrastructure in mountain valleys are not well established from a permafrost perspective. As a result, geohazard potential is often under-appreciated. In addition, a number of geohazards without historic precedence have been observed originating from the periglacial belt, hence the permafrost in mountains adds an additional element of uncertainty to the identification and quantification of geohazards.

Permafrost thaw can strongly affect the timing, geochemistry, and sediment concentration of runoff and thus affects aquatic

ecosystems, growing conditions for vegetation, and drinking water safety. Increased sediment input by rock fall and debris flows can have long-lasting effects on the bed load and channel geometry of rivers in mountainous terrain.

Permafrost and glaciers often coexist in mountains. Glaciers respond to climate change at time scales that differ from those for permafrost. Many mountain landscapes will likely be devoid of glaciers while permafrost lingers and its geomorphic effects become predominant.

3. What research and development needs exist?

It was recognized that an improved understanding of processes and phenomena is required, but also that many mountain regions in South America and in Asia have extensive permafrost areas of which we know little. Crucial knowledge gaps were identified relating to (a) how runoff and water quality are affected by changes in permafrost; (b) how ground thermal regime and ground ice contents vary spatially and in the future beneath mountain slopes; (c) how much carbon is incorporated into frozen deposits; (d) how vegetation and permafrost interact in mountains; and (e) how rock slopes and their stability respond to permafrost degradation.



Participants of the 2014 workshop *Impacts of permafrost thaw in mountainous areas of Canada and beyond*:

Participants: Alexandre Bevington, Antoni Lewkowicz, Bernard Hallet, Bronwyn Benkert, Calvin Van Buskirk, Chris Burn, Christopher Stevens, Daniel Moore, Dorothea Stumm, Fabrice Calmels, Jennifer Baltzer, Jon Leighton, Lukas Arenson, Mark Williams, Marlow Pellatt, Marten Geertsema, Masaki Hayashi, Michele Koppes, Panya Lipovsky, Paolo Pogliotti, Philip Bonnaventure, Renoj Thayyen, Sarah Laxton, Sharon Smith, Stephan Gruber, Stephen Evans, Stuart Harris, Wei Shan, Wilfried Haerberli, Ying Guo

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The needs include new methods and technology for simulation studies and site investigations that allow an efficient and reliable identification of susceptible areas. Long-term monitoring of permafrost and related phenomena in mountains is required for informing research, industry and governments, for understanding environmental changes, and for developing and testing computer models and other new technical developments. Finally, there is a lack of baseline data suitable for supporting permafrost research in mountains. This includes high-elevation meteorological stations, snow observations, stream flow and water quality measurements, and meteorological models and re-analyses.

4. What is a good way forward?

As data in mountains is sparse, coordinated and co-located research activities as well as data exchange between all disciplines and industries is indispensable. The establishment of focus areas for long-term measurements is crucial for the execution of long-term research programs, monitoring of environmental change, and for testing computer models or other innovations. Such research initiatives have to be accompanied by the dissemination of information about permafrost in mountains and its relevance to stakeholders in government agencies, industry, and professional associations in order for them to make informed decisions. Finally, representations in national and international organizations will further the awareness of challenges related to

permafrost in the mountains, and establish a network of contacts.

First steps taken

A core group of professionals concerned with permafrost in mountainous areas in Canada and beyond has been established through this workshop, forming an initial nucleus for collaborative research projects. This group is open to additional participation and will disseminate information via the Internet (www.carleton.ca/permafrost/mountains). A GoogleEarth inventory of permafrost-related work in Canadian mountains is under development. Once published it will help in the selection of research locations and partners with most synergies and benefits.

Education & Outreach Standing Committee Report

by Hanne Christiansen and Kenji Yoshikawa

E&O Activities 2014

We have been responsible for leadership and co-ordination of the education and outreach activities of the IPA since 2010. Many of the objectives are ongoing.

We organized an education and outreach session during EUCOP4 Évora, Portugal. Our committee members Anna Klene and Julia Stanilovskaya chaired this session with 15-20 audience members, including Gerlis Fugmann (APECS Director), Ylva Sjöberg, Koichiro Harada, Inga Beck (May), and Kenji Yoshikawa. Gerlis Fugmann explained APECS activities and especially the ClC - APECS project "FrostBytes" which have been popular and that we are considering how to help promote further. Inga May presented a detailed plan for proposed Education and Outreach activities at ICOP2016. A committee meeting was held during EUCOP4 with Leena-Kaisa Viitanen, Karina Schollän, Irina Streletskaya, Ylva Sjöberg, Julia Stanilovskaya, Anna Klene, Koichiro Harada, Hanne Christiansen, Hugues Lantuit, Halldór Jóhannsson, Gleb Kraev and Kenji Yoshikawa in attendance. The major themes of this meeting included:

1. University of the Arctic Thematic Network on Permafrost (TNP) report and future direction.

2. Replacement members and chair: We will keep our current membership until at least 2016, but, we can also invite several new members to fill gaps (regional and/or generation etc.) such as someone new from PYRN, etc.

3. Relationship with APECS: we should check "Frostbytes" sites and continue to develop ideas for further promotion.

4. Tasks (priorities) for next 2 years: UArctic summer school, preparation of ICOP, and the IUCP inventory.

5. E&O committee ICOP2016 involvement: We are committed to support ICOP local organizers and help provide information. We need to ensure a close connection with ICOP E&O local organizers.



Students from the AG-218/219 International Bachelor Summer Fieldschool on their way to drill boreholes into permafrost in Adventdalen, Svalbard June 2014 (Photo: Hanne Christiansen).

Several ongoing and future initiatives

1. International Bachelor Summer Fieldschool, Summer 2014

We applied during spring 2013 for funding to develop one of the parts of the UArctic Thematic Network on Permafrost (TNP) activities in Norway to develop and host a Bachelor-level Permafrost Summer Fieldschool. Hanne H. Christiansen (UNIS) and Kenji Yoshikawa (UAF) first suggested the concept and met in Oslo during December 2013 to finalize the plans, including contacting potential colleagues who would be involved in presenting their fields of permafrost research in the course. The goal is that students learn about core permafrost research topics during the course and thus obtain an overview of how diverse permafrost studies are in modern Earth System Science, from potential carbon release due to increased permafrost thawing to infrastructure design on permafrost. This meant that the group of lecturers must cover biology, geography, geology, engineering, remote sensing, and geophysics. A permit to run the course through UNIS in summer 2014 was given to us in February 2014. At that time we advertised the course widely via UArctic, PYRN, APECS lists, IUCP lectures, etc. We received 47 applications of which 42 were deemed to qualify for the course. 25 of these were accepted as students, and all attended. They came from Norway (5), Denmark (8), Germany (4), Austria (1), Canada (1), Switzerland (1), US (1), Russia (2) Japan (2). The course was offered both as a 5 ECTS

version, which was the 3 week course including an evaluation of the final group presentations based upon fieldwork and excursions, and a 10 ECTS version which included an additional essay on a self-selected topic for which the student undertook a literature review and wrote the paper. We held the 2014 Bachelor-level Permafrost Summer Field School during the period 19 June to 11 July at UNIS in Longyearbyen, Svalbard. We are planning to offer this course again in 2015. A short video is available via YouTube: <https://www.youtube.com/watch?v=dkiflCkRAcM>.

2. Publication of the handbook for researchers and students:

D. Trombotto Liaudat et al. published a terminological guide of the South American geocryology: Trombotto Liaudat, D., P. Wainstein y L. U. Arenson. 2014. "Guía Terminológica de la Geocriología Sudamericana" / "Terminological Guide of the South American Geocryology". Vázquez Mazzini Editores, 127 pp, Buenos Aires.

3. Publishing the popular-press Permafrost book "Permafrost in Our Time".

Our community-based permafrost/active layer network involved installing permafrost temperature monitoring systems at over 450 public schools across Alaska (USA), Canada, Russia, Norway, Greenland, Mongolia, China, and Japan. Each installation consists of a small borehole drilled near the school lined with plastic pipe, and thermistor temperature sensors. Both local teachers and students participated in the drilling and instrument installation process, and we visited

classrooms to discuss permafrost science and engineering at each site. The teachers and students make periodic measurements of snow thickness above the measurement site and help with downloading the data. We use the data in subsequent classroom activities and in public/local government activities in indigenous communities. The resulting permafrost temperature data will make important contributions to studies of long-term permafrost conditions in various areas. The first edition (focused mainly on results from North America) of this book was published for a general audience and was delivered to all of the Alaskan and Yukon schools. This book also serves as a data archive as data are presented for each site. A digital version of this book is available from <http://issuu.com/permafrostbook/docs/piots>

Additionally, we continue working on bridging the gap between researchers and public/students/teachers in permafrost communities including:

1. Annual update of International University Courses on Permafrost (IUCP) <http://ipa.arcticportal.org/resources/courses-iucp.html>
2. Internships, summer schools, workshops for students and researchers at IPA's partner organizations and universities.
3. Supporting curriculum development and development of new joint permafrost courses.
4. Establishing a model curriculum for international Master/PhD programs on Permafrost.

We welcome any comments and requests which can be sent to our Education and Outreach Standing Committee members (<http://ipa.arcticportal.org/activities/standing-committees.html>).

PYRN Report

by George Tanski, Michael Fritz, Elin Högström, Alexandre Nieuwendam and Josefine Lenz, on behalf of the PYRN Executive Committee & ExOfficios

PYRN Activities 2014

The Permafrost Young Researchers Network (PYRN) is an international network fostering innovative collaboration, seeking to recruit, retain, and promote future generations of permafrost researchers. Established in 2005, in the framework of the 2nd International Conference on Arctic Research Planning (ICARP II), PYRN is evolving and expanding its network, bringing together young and

enthusiastic permafrost scientists from all around the world. We strongly benefit from our cooperation with the Association of Polar Early Career Scientists (APECS) and our overarching organization, the International Permafrost Association (IPA), as well as from partnerships with Climate and Cryosphere Project (CliC) and Polar Educators International (PEI). Currently, more than 1,200 members are involved in

PYRN, including from natural and social science, engineering and humanities.

In 2015, PYRN is celebrating its 10th birthday. Looking back at 2014, we are proud to report about workshop exchanges that brought together enthusiastic and motivated permafrost young scientists.



PYRN Executive Committee

George Tanski President	Alexandre Bevington Vice-President	Elin Högström Secretary	Josefine Lenz Treasurer	Denis Frolov Webmaster	Silvie Harder Andrea Schneider ICOP Jens Strauss Outreach/Newsletter	Alexey Maslakov APECS Elena Kuznetsova William Longo Cayetana Recio Blitz
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PYRN Council

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Julia Stanilovskaya PEI	Anne Morgenstern ExOfficios	Samuel Stettner	



PYRN National Representatives

Germany, Austria, Switzerland (Pyrn DACH)	U.S.A.	Norway	Spain	Canada	Russia
Cecile Pellet (CH) Ingo Hartmeyer (A)	Boris Radosavljević, George Tanski, Josefine Lenz (D)	Jennifer Frederick, William Longo	Andrea Schneider, Cayetana Recio Blitz	Alexandre Bevington, Silvie Harder	Denis Frolov, Alexey Maslakov

<http://pyrn.arcticportal.org>

Organizational chart of the Permafrost Young Researchers Network (PYRN). Members come from countries shown in orange.

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Workshop at the EGU 2014, Vienna, Austria

During the European Geosciences Union General Assembly 2014 (EGU) PYRN organized a workshop entitled “Methods and techniques to study permafrost in a climate change scenario”. Around 60 people participated. The Program included the following talks:

- 1- “Arctic and Antarctic thermal state of Permafrost”- Alexandre Nieuwendam, PYRN president 2012-2014. Center of Geographical Studies-IGOT, University of Lisbon.
- 2- “How to look at coastal permafrost? Examples from the Canadian and Russian Arctic” - Hugues Lantuit, Alfred Wegener Institute, Helmholtz Centre for Polar and Marine Research in Potsdam, Germany.
- 3- “Geophysics in alpine and arctic permafrost: useful methods, discernable targets, quantifiable parameters and reliability assessment” – Michael Krautblatter, Technical University of Munich, Germany.

4- “Paleoenvironmental studies in permafrost environments” – Marc Oliva, Center of Geographical Studies-IGOT, University of Lisbon.

Furthermore, PYRN hosted a joint workshop together with the Association of Polar Early Career Scientists (APECS): “Successful fieldwork - An APECS and PYRN panel discussion”. Four invited speakers (Andreas Richter, John Connelly, Marc Oliva and Bryn Hubbard) gave a short presentation full of tips, anecdotes and inspiration for a 20 people audience. More information is available on <http://apecs.is/en/news-feeds/apecs-news/6564-egu2014>.

Parallel to the EGU, APECS Austria held a kickoff meeting in the Department of Social and Cultural Anthropology in Vienna, in the form of a photo and poster exhibition entitled “Fieldwork in the Arctic and Subarctic”. Among the invited speakers at the opening of this event were PYRN members, including ExOfficios Hugues Lantuit and Alexandre Nieuwendam. They gave inspiration and shared experiences from PYRN with these newly founded national organization members.

PYRN is already preparing another permafrost workshop for EGU 2015.

Permafrost Young Researchers Workshop at 4th European Conference on Permafrost (EUCOP4), June 2014, Évora/Portugal

In June 2014, the Permafrost Young Researchers Workshop 2014 (www.eucop4.org/permafrost-young-researchers-workshop.html), jointly organized by PYRN, PAGE21, ADAPT and APECS, was held in conjunction with the Fourth European Conference on Permafrost 2014 in Évora, Portugal (<http://www.eucop4.org/>). This workshop involved about 100 early career permafrost scientists and engineers. The major focus of the workshop was to determine future avenues of permafrost research from a young researcher’s perspective. This activity was mentored by the International Arctic Science Committee (IASC), which is leading the process towards ICARP III (3rd International Conference on Arctic Research Planning), and the International Permafrost Association (IPA) together with the Climate and the Cryosphere Project (CliC), both coordinating permafrost activities within ICARP III.

The Permafrost Priority Sheets will summarize the discussions from the forum. This Priority Sheet will be a short document, which contributes to an assessment of research priorities from an early career researcher perspective piloted by the Association of Polar Early Career Scientists (APECS). It will feed into the final ICARP III meeting in Toyama, Japan in April 2015, together with contributions from other initiatives (e.g. Arctic in Rapid Transition). IPA, IASC, CliC and the Bolin Centre for Climate Research provided financial support which made the participation of 90 young researchers possible. A requirement from the participants was to create a FrostByte - a short video to present their research (<http://www.climate-cryosphere.org/categories/138-frostbytes>). Further information is available in our workshop report on <http://pyrn.arcticportal.org/index.php/en/workshoppublications>.

During the 4th European Conference on Permafrost a new PYRN Executive Committee of 12 international, young permafrost researchers was elected for the period of 2014-2016. Information on all new



PYRN Executive Committee at the 4th European Conference on Permafrost (EUCOP4) in June 2014 in Évora/Portugal elected for 2014-2016. From left to right: Alexandre Bevington (CA), George Tanski (GER), Elin Högström (CH), Silvie Harder (CA), Josefine Lenz (GER), Elena Kuznetsova (NOR), Alexey Maslakov (RU), Denis Frolov (RU), Jens Strauss (GER). Not in the picture: Andrea Schneider (GER), Cayetana Recio Blitz (ESP), William Longo (US) (Photo: Michael Fritz).

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ExCom members is provided at <http://pyrn.arcticportal.org/index.php/en/executive-committee-about/pyrn-excom-2014-2016>.

PYRN-Russia Meeting, September 2014, Moscow/Russia

The annual PYRN Russia meeting was held on the 25th of September in Moscow. The meeting was dedicated to field expeditions and fieldwork of permafrost researchers - young as well as senior - in 2014. The participants reported about expeditions to Yamal, Chokurdakh, Eastern and Western Siberia and the Himalayas. Furthermore, monthly PYRN Russia meetings are carried out to provide the permafrost community with news from Russia.

PYRN-DACH Meeting and workshop, October 2014, Wartaweil, Lake Ammer/Germany

A PYRN - DACH general assembly and workshop was organized during the 7th annual meeting of the working group permafrost (AK Permafrost) of the German Society of Polar Research, which was hosted by



Group picture of PYRN-DACH at the 7th AK Permafrost meeting, Wartaweil, Lake Ammer/Germany, hosted by the Technical University Munich (Photo: Kerry Leigh).

Prof. Michael Krautblatter and the Landslide Research Group at the Technical University Munich at Lake Ammer in Bavaria/Germany. PYRN has united the German speaking members since 2013 under the international roof of PYRN-DACH (Deutschland/Germany, Austria and Confederation Helvetica/Switzerland).

More than 25 young researchers attended the workshop “10 steps to write and publish a paper” held by the professional company Tress&Tress (<http://www.tress-tress.com/support/news-archive/2014-001.html>) which was fully funded by the IPA. Participants evaluated the course as “very encouraging”, “inspirational” and even felt “like start writing a paper right away”. An impression can be seen at <http://pyrn.arcticportal.org/index.php/en/pyrnmeetingsactivities/pyrn-dach-meeting-at-ak-permafrost-2014>.

The following two days of presentations and posters on lowland and mountain permafrost were dominated by motivated and dynamic young researchers.

The current representative for PYRN-DACH is Boris Radosavljevic with national speakers of Austria (Ingo Hartmeyer), Switzerland (Cecile Pellet) and Germany (Josefine Lenz).

PYRN Meeting and get-together at Arctic Change conference, December 2014, Ottawa/Canada

During the Arctic Change Conference, PYRN organized an icebreaker for its members attending the conference and arranged a general assembly of young researchers based in Canada. Additionally, PYRN co-organized a joint APECS/PYRN/ADAPT/AECRA/ASA social event with over 300 participants with games and prizes, which was kindly co-sponsored by the IPA. The social event provided a great opportunity to sustain the relationship with PYRN partners and to advertise the network in Canada.

What is PYRN planning next?

During the current mandate of the executive 2014-2016, PYRN is facing new exciting challenges. PYRN has started to organize itself in action groups working on the following tasks:

After the transfer of the PYRN website to the Arctic Portal we will continue working on restructuring the homepage and providing content; we also want to increase visibility of PYRN on facebook. PYRN’s 10th birthday will be celebrated continuously during 2015 – worldwide in the web as well as face to face e.g. at the Regional Geographic Conference (IGU2015) in Moscow/Russia in August. Together with the Polar Educators International (PEI), PYRN is working on the Development of a Permafrost Expedition Map (PEM) – an online tool for public, teachers and students. Besides PYRN events and workshops planned at conferences like EGU and AGU, we have started planning various young researchers’ activities during the Eleventh Conference on Permafrost (ICOP2016) to be held in summer 2016 in Potsdam/Germany (<http://icop2016.org/>): Two days of workshops of interest for young scientists, many opportunities for exchange during social and touristy events and be prepared to bring your sport shoes!

If you want to join a working group, become a PYRN member or are looking for more information, visit us at <http://pyrn.arcticportal.org>.

UPCOMING EVENTS

2015

EGU 2015

April 12-17, 2015
Vienna, Austria

Arctic Science Summit Week 2015

April 23-30, 2015
Toyama, Japan

26th IUGG General Assembly 2015

June 22-July 2, 2015
Prague, Czech Republic

Fourth Forum for Young Permafrost Scientists

25 June – July 10, 2015
Yakutsk, Russia

12th International Symposium on Antarctic Earth Sciences

July 13-17, 2015
Goa, India

Polar Climate and Environmental Change in the Last Millennium

August 24-26, 2015
Toruń, Poland

GEOQuébec - 7th Canadian Permafrost Conference

September 20-23, 2015
Québec, Canada

Permafrost in XXI century: basic and applied researches

September 27 - Oct. 01, 2015
Pushchino, Russia

2016

11th International Conference on Permafrost

June 20 - 24, 2016
Potsdam, Germany

INTERNATIONAL PERMAFROST ASSOCIATION

The mission of the International Permafrost Association is to promote research in permafrost and permafrost-related fields within the global scientific and engineering communities, to support the activities of researchers in these disciplines, and to disseminate findings concerning permafrost to the decision-makers, the general public and educators.

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