Code of Conduct for the Exploration and Research of Subglacial Aquatic Environments

1. Background

This Code of Conduct (CoC) is to help guide the science community in the exploration and research of Antarctic subglacial aquatic environments (SAE). It has been prepared by an Action Group of the Scientific Committee on Antarctic Research (SCAR) in consultation with SAE specialists from a wide range of disciplines including the Committee of Managers of National Antarctic Programmes (COMNAP). SCAR has a long history of leadership in SAE research and development including the Subglacial Antarctic Lake Group of Specialists (SALEGoS 2000-2004) and the Scientific Research Programme Subglacial Antarctic Lake Environments (SALE 2004 onwards). The present document results from a recommendation approved by the Delegates at XXX SCAR that in recognition of "the value of these environments and the need to exercise wise environmental stewardship" a SCAR Action Group should be formed to devise a code of conduct that would provide "guiding principles for SAE exploration and research". The preparation of this CoC by the Action Group has drawn upon all relevant literature, with special attention to SALE reports and the US National Academies report on environmental stewardship of SAE. It will be modified and refined as new scientific results and environmental impact reports become available from planned SAE exploration campaigns.

2. Introduction

Antarctic ice is now widely recognised as a key constituent of the Earth System, driving ocean currents and global climate as well as strongly affecting world sea level. Early models for ice flow from the interior of the continent to the ocean assumed considerable friction between the bottom of the ice sheet and the underlying rock. The discovery of Lake Vostok and the subsequent detection of more than 380 other lake-like features beneath the ice changed our view of the subglacial environment. Drilling through ice to bedrock revealed the presence of water at the rock/ice interface whilst remotely sensed height changes in the ice surface over lakes suggested a discharge mechanism beneath the ice. From these and related observations, we must assume that the ice/rock interface may normally have free water present, that this water film may collect in lakes within watersheds, and that scientific activities that inadvertently contaminate one area may result in widespread contamination of this subglacial environment by down-slope flow. Much scientific attention is also focused on the possibility that this liquid water contains microbial communities that survive or grow in the extreme subglacial environment. To safeguard these unique lakes, and the subglacial aquatic environment as a whole, an internationally agreed upon Code of Conduct is essential. In developing this Code, SCAR is building on international discussions at SALE and on the US National Academies recommendations on environmental protection.

3. Guiding principles

3.1 Responsible stewardship during the exploration of subglacial aquatic environments should proceed in a manner that is consistent with the Protocol on Environmental Protection to the Antarctic Treaty, that minimizes their possible damage and contamination, and that protects their value for future generations, not only in terms of their scientific value but also in terms of conserving and protecting these pristine environments.

3.2 In accordance with the Protocol on Environmental Protection to the Antarctic Treaty, all proposed activities must undergo environmental impact assessment prior to an activity commencing. Projects aiming to penetrate into subglacial aquatic environments are certain to require an Initial Environmental Evaluation (IEE), and a subsequent Comprehensive Environmental Evaluation (CEE) may be the appropriate level of assessment given the potential impacts expected from such an

activity. The CEE will ensure that all relevant information is available internationally, that proposals are exposed to a wide range of expert comment and that the scientific community uses best-available practices.

3.3 In accordance with the principle of scientific cooperation found in the Antarctic Treaty, multinational participation in SAE exploration is encouraged.

3.4 Exploration should take a conservative, stepwise approach in which the data and lessons learned at each step are archived and used to guide future environmental stewardship, scientific investigations and technology development. This information should be freely disseminated in the public domain, and firstly via national operators to the Committee on Environmental Protection.

3.5 It is recommended that each potential exploration site is evaluated within the context of geophysical datasets that identify lakes and other regions where there is basal melting. This would assist in typifying the unique character of each site and selecting drilling locations. Additional considerations related to location include accessibility, logistic constraints, cost and potential environmental impacts of the surface camp.

3.6 Accurate records should be collected, maintained and made freely available for all subglacial sampling efforts.

3.7 Annex V of the Protocol allows areas to be designated as Antarctic Specially Protected Areas (ASPA), either to manage areas for research purposes or to conserve them as pristine exemplars for future generations. Subglacial lakes used as research sites should therefore be demarcated ASPAs to protect their long term scientific value, to regulate activities at these sites, and to formalize the requirements for full documentation and information exchange. In this way, each lake researched will have a known history of usage that later researchers can take into account. Once more direct information is available about the characteristics of subglacial lakes, attention should also be given to selecting and designating exemplar subglacial aquatic environments as ASPAs for long term conservation, in accordance with Article 3 of Annex V of the Protocol.

4. Drilling and SAE-entry

4.1 Unless there is site-specific evidence to the contrary, drilling to the base of Antarctic ice sheets should assume that the basal ice is underlain by liquid water, and that this water forms part of a subglacial drainage network requiring a high level of environmental protection. In general, downstream sites, particularly those closest to the sea, can be viewed to have lower environmental risk than upstream sites.

4.2 Exploration protocols should also assume that the subglacial aquatic environments contain living organisms, and precautions should be adopted to prevent any permanent alteration of the biology (including introduction of alien species) or habitat properties of these environments.

4.3 Drilling fluids and equipment that will enter the subglacial aquatic environment should be cleaned to the extent practicable, and records should be maintained of sterility tests (e.g., bacterial counts by fluorescence microscopy at the drilling site). As a provisional guideline for general cleanliness, these objects should not contain more microbes than are present in an equivalent volume of the ice that is being drilled through to reach the subglacial environment. This standard should be re-evaluated when new data on subglacial aquatic microbial populations become available.

4.4 The concentrations of chemical contaminants introduced by drill fluids and sampling equipment should be documented, and clean drilling technologies (e.g., hot-water) should be used to the full extent practicable.

4.5 The total amount of any contaminant added to these aquatic environments should not be expected to change the measurable chemical properties of the environment.

4.6 Water pressures and partial pressures of gases in lakes should be estimated prior to drilling in order to avoid downflow contamination or destabilisation of gas hydrates respectively. Preparatory steps should also be taken for potential blow-out situations.

5. Sampling and instrument deployment

5.1 Sampling plans and protocols should be optimized to ensure that one type of investigation does not accidentally impact other investigations adversely, that sampling regimes plan for the maximum interdisciplinary use of samples, and that all information is shared to promote greater understanding.

5.2 Protocols should be designed to minimize disrupting the chemical and physical structure and properties of subglacial aquatic environments during the exploration and sampling of water and sediments.

5.3 Sampling systems and other instruments lowered into subglacial aquatic environments should be meticulously cleaned to ensure minimal chemical and microbiological contamination, following recommendations under point 4.3.

5.4 Certain objects and materials may need to be placed into subglacial aquatic environments for monitoring purposes. This may be to measure the long term impacts of human activities on the subglacial environment and would be defined in the project's environmental impact assessment, or it may be for scientific purposes; e.g., long term monitoring of geophysical or biogeochemical processes. These additions should follow the microbiological constraints in 4.3, and for scientific uses should include an analysis of environmental risks (e.g., likelihood and implications of lack of retrieval) versus scientific benefits in the environmental assessment documents.

Members of the SCAR Action Group:

Irina Alekhina (Russia)
Peter Doran (USA)
Takeshi Naganuma (Japan)
Guido di Prisco (Italy)
Bryan Storey (New Zealand)
Warwick Vincent (Canada), chair
Jemma Wadham (United Kingdom)
David Walton (United Kingdom)