

Subglacial Antarctic Lake Environment Exploration and Study in the IPY 2007-2009

Subglacial Antarctic lake environments are emerging as one of the new frontiers targeted for exploration during the IPY 2007-2009. Several campaigns by various nations are in the early stages of planning and implementation with timelines that will coincide with the IPY. The ambitious interdisciplinary objectives can best be realized by multiple exploration programs investigating diverse subglacial environments continent-wide over the next decade or more. A concerted, multi-target approach is needed to advance our understanding of the range of possible lake evolutionary histories; the character of the physical, chemical, and biological niches; the interconnectivity of subglacial lake environments; the coupling of the ice sheet, climate and the evolution of life under the ice; the tectonic settings; and the interplay of biogeochemical cycles. Research and exploration programs spanning the continent will investigate subglacial lake environments of differing ages, evolutionary histories, and biogeochemical settings. The combined efforts will provide a holistic view of these environments over millions of years and under changing climatic conditions. The IPY will provide an opportunity for an intense period of initial exploration that will advance scientific discoveries in glaciology, biogeochemistry, paleoclimate, biology, geology and tectonics, and ecology. While early discoveries and exciting findings are expected during the IPY 2007-2009, a long term sustained program of research and exploration will continue far beyond the IPY.

Therefore the question is: how does subglacial environment exploration and study benefit from designation as an IPY program? What short term accomplishments can be expected by 2009 or 2010 as the IPY concludes? Within the five year period that spans the IPY, specific accomplishments will be targeted, accelerating the research agenda and setting a solid framework for follow-on studies. Four phases of exploration and discovery are envisioned.

PHASE I, 2004-2006: In the lead up to the IPY intensive planning efforts will be conducted to develop a detailed science implementation plan and a technology development strategy. Details of these workshops are already being planned with an international science implementation workshop to be held in the fall of 2004. The science requirements based on this first workshop will form the basis for international consideration of technological alternatives, a new technology needs analysis, and development of a plan of action in the spring of 2005. It is also expected that an independent, third party objective panel of experts can be convened to develop standard environmental performance and "cleanliness" standards with a report issued by the end of 2005. This panel may also be charged with issuing an opinion on which proposed activities require Initial Environmental Evaluations (IEEs) or Comprehensive Environmental Evaluations (CEEs) based on the requirements of the Antarctic Treaty and its Environmental Protocols. Remote geophysical surveys will continue to expand the inventory of possible study sites, more fully characterize high priority targets for exploration and refine study plans based on new information. Develop a timeline for environmental review at the national and international level and make first assessments of which activities will require IEEs or CEEs.

PHASE II 2006-2007: In this phase, proof of concept, methodologies and technologies will proceed in analogous environments such as sub-aerial frozen lakes, ice shelves, and ice fields in the northern and southern hemispheres. Technologies,

sampling devices and sensor packages will be tested and improved. Increasingly more rigorous settings will be chosen for testing and exploration. Environmental requirements will be refined and technologies appropriately refined. Remote geophysical surveys will continue to expand the inventory of possible study sites and more fully characterize high priority targets for exploration. Study plans will be refined based on new information. Provide draft environmental impact assessments for “packages” of activities for national and international review and comment. Develop draft Comprehensive IEEs and CEEs for those activities judged to have more than minor or transitory impacts.

PHASE III 2007-2008 – Small subglacial features (Lake Ellsworth – West Antarctica) will be targeted for final field testing and method check-outs close to existing infrastructure. Initial deployments of sensor packages will be conducted. In medium size lakes, instrument sensor strings (i.e., observatories) can be deployed to provide the first *in situ* data from a subglacial lake in addition to essential baseline information to refine models and inform technology development efforts. Lake water sample return missions may also be feasible in this time frame. High density target driven geophysical surveys will continue to characterize possible study sites and sampling plans will continue to be refined based on the new information. These efforts will be coordinated with the traverses so that subglacial targets can be accessed enhancing the programs of these other IPY efforts. Provide detailed plans for the next few years including IEEs and CEEs when appropriate.

PHASE IV 2008-2009- Larger subglacial (Lake Concordia – East Antarctica) features are targeted for sensor package deployment and possible sample retrieval. Targets in East Antarctica will be chosen to represent the diverse population of subglacial features. Lake water return missions will be conducted and sediment sample return missions may be possible. These efforts will be coordinated with the traverses so that subglacial activities can be used to enhance these other IPY programs.

Subglacial environments have already generated great public interest. Through out the period of planning, field testing, and ultimate mission implementation it is expected that public interest will be high. The intention is to capitalize on this interest by actively engaging the public on a journey of exploration and discovery. If properly presented and framed, this program provides an opportunity for the public to see how science is practiced, including failures as well as successes. While field efforts will probably be most intense in 2008 and 2009, the lead-up can be capitalized on to generate great public interest.