U.S. Continental Scientific Drilling Community Looks to the Future

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Continental scientific drilling in the U.S.A. may be poised to take a significant step forward as a result of two recent workshops that laid out the possibilities for the future. The meetings, in June 2009 in Denver, Colorado and in June 2010 in Arlington, Virginia, brought together about 100 members of the community. The first meeting stressed the themes and topics of important science for which drilling is a necessary means of collecting samples and data. The second workshop developed recommendations for implementation of a strong U.S. program including its position as a necessary component of the International Continental Scientific Drilling Program (ICDP).

The June 2009 workshop reviewed the range of scientific interests that continental drilling alone enables and specified possible interactions between continental and ocean drilling. Four overarching themes emerged: (i) global environmental and ecological change (emphasizing Earth history), (ii) geodynamics (broadly defined), (iii) the geobiosphere, and (iv) natural resources and environmental concerns (Table 1). Within each theme are a number of topics. Each topic has enough intellectual coherence for a consensus to be developed that reviews the field, identifies subjects for future growth, and suggests the means to reach goals. Most of these topics are familiar ones that have been expounded previously. Progress constantly brings new topics to the drilling community; for example, it has recently emerged that lake sediments preserve records of rates, processes, and triggers of evolutionary events, so that a whole community of evolutionary biologists will have interests in drilling projects.

The two main problems identified were (i) the thematic breadth of scientific drilling allowing no single focus and (ii) the path to funding being hindered by obstacles and delays (Fig. 1). To strengthen the U.S. community an enlarged Science Planning Committee of DOSECC has been charged with overseeing overall and topical scientific planning, considering advances in equipment or facilities that are necessary for the drilling community, and communicating internally, to the broader scientific community as well as to key funding agencies and to the ICDP.

Both workshops concluded that scientific planning should be a bottom-up effort, with communities gathering to reflect, assess, propose, consider, and develop consensus. Three special considerations emerged. First, planning efforts should be inclusive and international, including participants who address the same questions through different means. Where appropriate, they should include ocean drillers. Second, these efforts should be broadly announced and their results communicated so that members of other communities who might profitably participate in projects are fully informed of the opportunities. For example, study of the deep biosphere can be a part of many investigations. Third, any plan should be a guide, not a limit. The seemingly infinite creativity of investigators should not be discounted simply because their proposal is not in line with a pre-existing document.

Currently, the DOSECC office acts to bind the U.S. community together and inform the broader Earth science profession through annual workshops, newsletters, and booths at large professional meetings. It also has a very successful but poorly known program of internships for students and schoolteachers. Workshop participants recommended that these efforts should be expanded and supplemented by the wealth of modern communication modes.

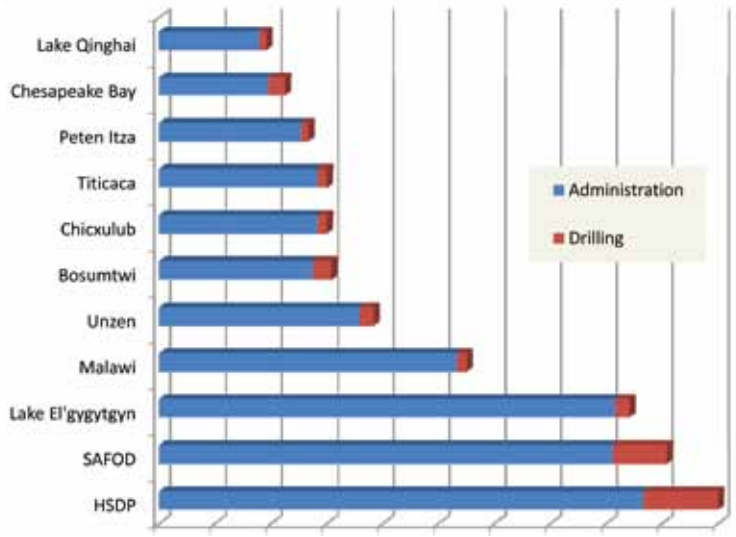

Figure 1. Comparison of drilling time to preparation time for representative projects. Administrative time includes the time from first workshop or first contact with DOSECC office until drilling actually begins. Projects undergo a year or more of planning and refinement before that occurs. The spectacle of 4–10 years of delay before operations begin effectively precludes young U.S. investigators from undertaking continental scientific drilling efforts (courtesy of Dennis Nielson).

Broadening the community is an important goal. An open planning process will do much to involve more investigators in drilling activities. The internship program should inform younger professionals of the potential rewards of drilling to gather necessary samples for their investigations and should enlist new members of the community. An important task will be to explore other ways to encourage investigators to undertake projects where drilling promises substantial rewards, despite the costs in money and time. Furthermore, the community will be looking at ways to mentor neophyte drilling scientists and to provide timely guidance to strengthen their proposals and projects.

Table 1. Themes and topics in continental scientific drilling.

Themes	Topics	
Global environmental and ecological change	High-resolution time-series records	Plio-Pleistocene climate records Evolution in isolated lake systems Climate and evolution of hominins and associated faunas (History of the magnetosphere)
	Deep-time records	Climate history Sea-level history Paleoceanography Atmospheric history and early life Cryospheric history from near-field sub-ice records (Stratigraphic architecture and crustal deformation) Evoluton and extinction Dynamics of the solar system (History of the magnetosphere) Antarctic deep-time records
Geodynamics	Crustal evolution (Stratigraphic architecture and crustal deformation) Hotspots, mantle plumes, and large igneous provinces Processes and hazards at volcanoes Fault mechanics (History of the magnetosphere) Ice-sheet history and dynamics	
Geobiosphere	Microbiology, including ichnofossils Biogeochemistry	
Natural resource systems and related environmental concerns	Hydrothermal resources and core deposits Groundwater Hydrocarbons CO_2 sequestration	

For international projects, the ICDP remains a key source of funding. Currently the principal source of funds in the U.S.A. is the National Science Foundation (NSF). However drilling activities are supported by other federal agencies and private sources. The 2010 workshop recommended several steps to deal with funding issues.

1. The 2010 workshop encouraged the NSF to identify a central internal point of contact and to secure funding arrangements for the costs of continental drilling, much as it supports telescopes for astronomers and ships for oceanographers. Ideally the central point of contact would be a formal program at NSF with a director and budget. NSF should also coordinate with scientific drilling efforts in other agencies.
2. Workshop participants strongly favored maintaining an appropriately funded facility, the current DOSECC office or a similar agency, to serve the community and provide drilling services coupled with a formal program at NSF with a director and budget.
3. The workshop recommended that the allocation of funding for drilling operations be based upon a set amount each year or a set number of drilling days, with some flexibility to deal with significant opportunities in a timely fashion. Funds from other agencies would extend the level of activity. This arrangement would remove the severe obstacle of including drilling costs in proposals.
4. One of the most pressing perceived obstacles to developing drilling projects is the need for funds to do preliminary site and feasibility studies. Consequently, the workshops recommended development of a system of funding necessary preliminary studies.

To implement the recommendations of the workshops, the continental scientific drilling community must work together, justify its science, plan its future, and work with funding agencies to develop mutually satisfactory arrangements. An enhanced continental scientific drilling effort in the U.S. A. requires an active community, thoughtful planning, and a clear pattern of funding to synergistically interact with related organizations and overlapping communities, and it will strengthen the international drilling communities and the Earth science effort as a whole.

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