

# International Continental Scientific Drilling Program ICDP

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## Annual Report 2011: Program Status and Future Directions

### Summary

Scientific drilling is an indispensable tool of modern Earth Science research, because it provides the only means of obtaining direct information on processes operating at depth. Drilling allows for determination of *in-situ* properties of solid materials and fluids and permits testing of hypotheses and models derived from surface observations. Drill holes may be used as a natural laboratory for experiments and as observatories for long-term monitoring of ongoing active processes. Earth drilling, therefore, plays a critical role in scientific research directed towards improved understanding of the workings of our planet and has a key role in solving urgent societal problems.

Multinational efforts in continental scientific drilling have been coordinated since 1996 within the ICDP. The concept for this program was developed in response to geosciences community's need for scientific drilling as an essential tool to enable a better understanding of fundamental Earth processes and structure. The program is based on comingled funding and international cost sharing, joint efforts of international science teams, as well as technology and knowledge sharing. The program concentrates on topics of high international priority, and drilling projects are conducted at locations of global geological significance. The organization is simple and flexible comprising an independent science review board, as well as an executive and an oversight committee. Administration assistance and substantial operational support are provided voluntarily by the German Research Centre for Geosciences – GFZ. Funding is provided by a growing number of member countries, usually through national funding agencies.

ICDP fosters proposals through international workshops that assist researchers in the development of a drilling proposal. To date, 55 of these workshops have been funded and have resulted in a total of 28 ICDP supported, successfully executed, drilling projects. Thematically the activities have centered on paleoclimate investigations, earthquake and volcano research, impact events, geodynamics, and potential energy resources (see below for current and future themes). Many scientific results from these drilling and Earth observation projects have been published in high-ranking scientific journals. Training of on-site scientists, engineering, on-site science and data management technologies are also important components of ICDP. The journal *Scientific Drilling*, jointly issued with the Integrated Ocean Drilling Program IODP, serves to communicate developments from current projects as well as workshop reports and announcements for future scientific-drilling related activities.

## Global Partners

ICDP currently has 25 members including 23 countries (Germany, USA, Japan, China, Canada, Austria, Norway, Mexico, Poland, Czech Republic, Iceland, Finland, South Africa, Italy, South Korea, Spain, Sweden, Switzerland, New Zealand, France, Israel, India and the Netherlands) and two member organizations (UNESCO and Schlumberger Services Inc. as a corporate affiliate). Expressions of interest in membership and/or negotiations are currently underway with Russia, Turkey, Great Britain, Portugal, Denmark, Belgium, among others. The German Research Centre for Geosciences - GFZ is the Executive Agency of the ICDP and acts on behalf of the ICDP members.

## Support Level

Drilling projects are an integral component of major geoscience research programs, including comprehensive pre-site investigations, accompanying laboratory studies, drilling (directly supported by ICDP), and measurements and tests in the drill hole. Drilling programs are costly and only realizable to a limited extent by any one entity acting alone. International cost sharing, optimal utilization of all available resources, incorporation of international leading experts, and application of the existing knowledge combined with selection of optimal drilling locations (“World Geological Sites”), are all essential elements of the international continental scientific drilling program ICDP.

ICDP is financed through the annual contributions of its members. The membership fees vary and are based on a number of criteria that include economic factors, the scientific manpower and size of the respective country. The full or Category A members USA, Germany, and Japan provide \$700,000 and have the right to chair panels while China, Canada, France and India contribute \$200,000. The smaller European countries contribute according to their ESF share between amounts of \$20,000 and \$70,000 annually. The German membership fee is provided in equal shares by the Deutsche Forschungsgemeinschaft, DFG and the German Research Centre for Geosciences - GFZ.

The ICDP funds are used, for the most part, for co-funding of the approved ICDP projects and for the execution of ICDP workshops and training courses. In addition, funds cover expenditures for the maintenance of the ICDP Equipment Pool and the ICDP Drilling Information System (DIS). The annual membership income to support ICDP activities is approximately \$3.2M.

The philosophy of ICDP support for projects is based on the “comingled funding” principle. This means that the ICDP is usually one of several funding partners in a joint drilling project. The financial contribution by ICDP to directly support an ICDP drilling project varies between about 5% to about 70% (in rare cases) of the total operational costs. The remainder of the funding for the drilling project is provided by national funding agencies or other sources of support for scientific drilling. Since the inception of the ICDP in 1996, 28 major drilling projects have been supported.

The program is based on a reliable budget with regular financial contributions by the member institutions, strict expense policies including moderate project funding with no long-term financial commitments and very low program administration costs. This allows for attracting new Earth science communities through opportunities to get workshop and project proposals funded. ICDP’s organization, financing through comingled funding, and the bottom-up project policy relying on unsolicited proposals driving the program at large is serving as a model for other programs.

## ICDP Organizational Structure and Management

**The Assembly of Governors (AOG)** provides financial and scientific oversight of the ICDP. It determines the program policies, decides on EC-recommended full proposals and allocates the amount of comingled ICDP funding for each individual drilling project. In addition, the AOG decides on the annual program plan and the associated budget, and it discusses the long-range plans of the ICDP as prepared and proposed by the EC.

**The Executive Committee (EC)** is responsible for the operation and management of the program. It decides on workshop and technical proposals, reviews the operational, technical, managerial and financial feasibility of full proposals, recommends funding of full proposals to the AOG, assembles the scientifically prioritized projects into an annual program plan with an associated annual budget and prepares the long-range program plan that constitutes the ICDP program. The EC is made up of one appointee from each ICDP member nominated by the respective funding partners of the program. EC members typically are science managers with expertise in drilling and/or coordination of major research projects. The chair of the EC (executive chair) represents the ICDP internationally and has the executive responsibility for carrying out the program. The executive chair plays a key role as the international spokesperson and ambassador for the ICDP. Tireless efforts to attract membership of an increasing number of countries have resulted in a strong growth of the scientific community for drilling.

**The Science Advisory Group (SAG)** is an independent body of internationally renowned experts in the research fields covered by the program. It has the task of carrying out thorough scientific evaluations of all pre-proposals, full proposals and workshop proposals submitted to the ICDP and to assign priority based on their expected scientific impact and their outreach and educational potential. The SAG recommendations are the primary input to the EC as it develops projects for both annual and long-range programs. The SAG has developed the following set of evaluation criteria:

- Quality of Science
- Need for Drilling
- Qualifications of Proponent
- Societal Relevance
- Budget
- Responsiveness to previous recommendations
- Technical Feasibility
- Adequacy of Site Characterization
- Cost Effectiveness
- Project Organization

**The Operational Support Group (OSG)** plays a major role in supporting the management of the program and in providing expertise and stability to planning and operation of the overall program. The German Research Centre for Geosciences (GFZ) handles the administration of the program, including financial accounting and contractual support. Currently the GFZ finances from its own budget a group of six scientists, engineers and technicians who compose the core of the ICDP Operational Support Group and who are based at the GFZ. The OSG serves to support the following functions:

- Provide technical and scientific liaison to SAG and EC
- Develop Joint Research Ventures for each project authorized by EC
- Management and support of Secretariats for AOG and EC

- Assistance in contracting and permitting
- Support for scientific and engineering drill-site operations
- Support for field facility for core and sample description and management
- Provide all data collected during each project through a readily accessible data management system for ICDP projects, the Drilling Information System (DIS)
- Prepare - through this Drilling Information System - Initial Reports that describe drilling, engineering and sample and core description and procedures for each project
- Provide training courses in scientific drilling prior to and during drilling projects
- Organize outreach activities on major international geoconferences (AGU, EGU, IGC)
- Edit the IODP-ICDP journal 'Scientific Drilling'
- Develop, purchase, and maintain an ICDP Equipment Pool comprising scientific-technical instruments and tools for on-site use in ICDP projects
- Provide management support for individual ICDP projects
- Provide and operate ICDP equipment

Management of ICDP activities at the GFZ takes place by the following personnel:

- Prof. Dr. Rolf Emmermann (Chair of the Executive Committee (EC) until 30.09.2011)
- Prof. Dr. Brian Horsfield (Chair of the EC beginning with 01.10.2011)
- Dr. Ulrich Harms (Executive Secretary and Head of the ICDP Operational Support Group).

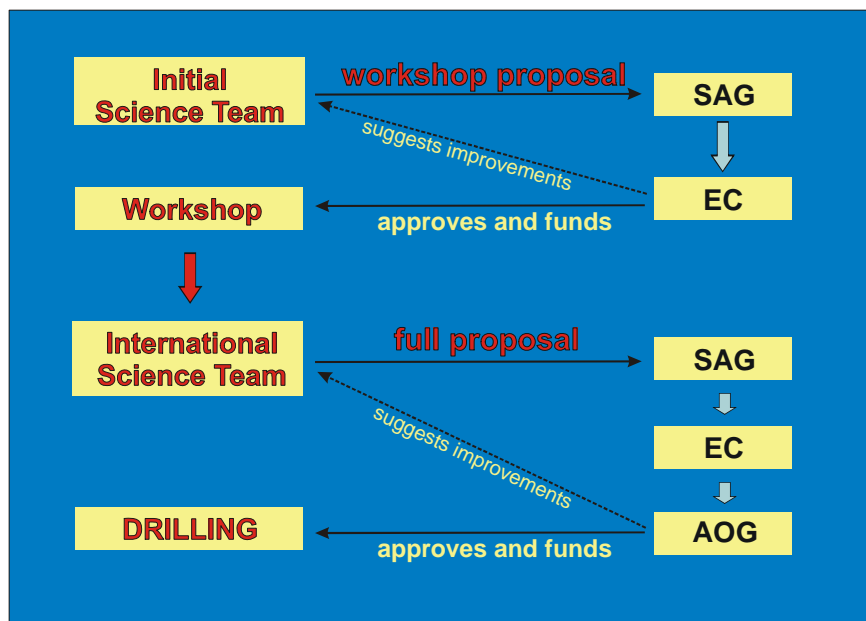


Figure 1: ICDP proposal handling workflow

#### Current ICDP Themes and Projects

From March 30 to April 1, 2005, the 2<sup>nd</sup> Potsdam Conference on Continental Drilling was held at the GFZ in Potsdam, with the title "ICDP – A Decade of Progress and Challenges for the Future". At this international conference 210 invited experts from 24 countries were brought together to identify and elaborate the main themes and key questions for future drilling activities on land including:

- Climate Dynamics and Global Environments

- Active Faulting and Earthquake Processes
- Volcanic Systems and Thermal Regimes
- Impact Structures and Impact Processes
- Geobiosphere and Early Life
- Convergent Plate Boundaries and Collision Zones
- Mantle Plumes and Large Igneous Provinces
- Natural Resources and Industry Coupled Scientific Drilling.

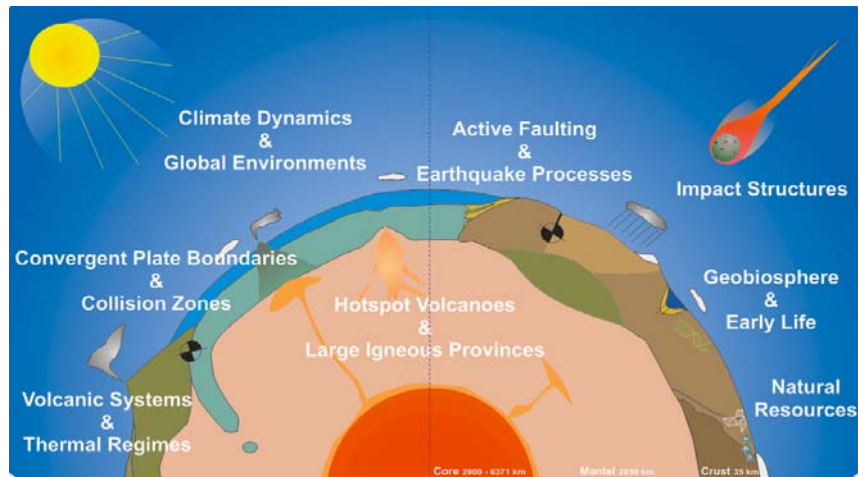


Figure 2: Scientific themes of the ICDP

The last years of unsolicited, proposal-driven program development in ICDP depict a focus on three out of the eight key themes in ICDP on i) *Climate Dynamics and Global Environments*, ii) *Volcanic Systems and Thermal regimes*, as well as iii) *Active Faulting and Earthquake Processes*.

Despite this process of focusing on key topics, there is nevertheless clear development towards new upcoming topics at the same time. An ICDP workshop was e.g. held in Vietnam to examine the options of drilling into arsenic-contaminated recent delta sediment deposits critical to groundwater utilization.

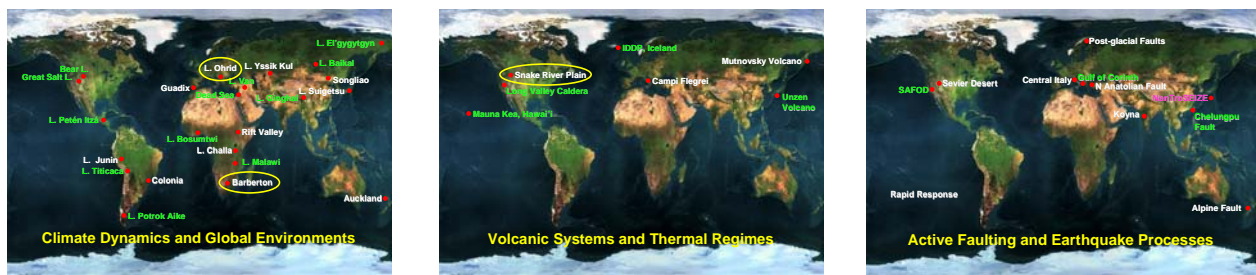


Figure 3: Current focus themes of ICDP with drill sites, completed drilling (green) and planned drilling (white). Drilling is currently ongoing at the Barberton Greenstone Belt, at Lake Ohrid and the Snake River Plain.

ICDP workshops are funded upon pre- and workshop proposals to support a group of international scientists with an outstanding scientific theme of socio-economic relevance that requires drilling. The workshops serve to form a broad and competent Science Team and to develop full drilling proposals to ICDP and other co-funding agencies or industry. Over the past years, ICDP supported the conduction of workshops with a broad topical spectrum addressing either future drilling projects or thematic issues.

Workshop Title	Date and Venue	Participation	Countries
Scientific Deep Drilling to Study Reservoir Triggered Earthquakes at Koyna, India	March 21-25, 2011 Hyderabad/Koyna, India	49 participants	11
Recovering uncompromised samples of aquifer sands with in-situ groundwater from up to 300-m depth in South and Southeast Asia (IDRAS)	April 25-28, 2011 Hanoi, Vietnam	40 participants	15
Climate evolution in Central Asia during the past few million years: A case study from Lake Issyk-Kul	June 12-17, 2011 Baet, Kyrgystan	46 participants	12
Drilling of Lake Junin, Peru: Potential for Development of a Continuous Tropical Climate Record Spanning more than 200 ka.	June 15-17, 2011 Tarma, Peru	27 participants	6
<i>Forthcoming Workshops with fixed dates</i>			
Scientific Drilling of the Lake Chalco, Basin of Mexico	March 4 to 9, 2012 Mexico City, Mexico		
Drilling of Lake Towuti, Indonesia: International collaboration on the climatic, environmental, and geological evolution of a tropical Pacific lake.	March 26-29, 2012 Bandung, Indonesia		

Table 1: Summary of ICDP workshops conducted and planned recently

## ICDP Projects with drilling accomplished in 2010/2011

### Lake Van Drilling (Paleovan)

The Paleovan project, supported by ICDP, the German Research Foundation, the Swiss National Science Foundation, and Turkey's Tübitak was successful in recovery and analysis of a long continental paleoclimate record in a sensitive, semiarid region to explore the dynamics of lake-level fluctuations and hydrogeological development. Further scientific goals are the temporal, spatial, and compositional evolution of explosive volcanism as reflected in the succession of tephra deposits, as well as the



Figure 4: Lake Van Drilling in operation in July 2011

reconstruction of earthquake activities. In addition, the sediments host key pathways for migration of continental and mantle-derived noble gases to be analyzed in pore waters. On the basis of a seismic site survey, several potential sites were selected from which two were finally drilled in July and August 2010. The "Ahlat Ridge" site (AR) was drilled on a low ridge in the deep basin to recover a complete sedimentary section. The "Northern Basin" site (NB) is located close to the northern shore of Lake Van.

Drilling was carried out at water depths of up to 360 meters and cores from 140 meters (NB) and 220 meters (AR) below the lake bed depth were retrieved. To obtain a complete sedimentary section, the two sites were cored multiple times (average recovery, 91% and 71% at AR and NB sites, respectively). Total length of all parallel cores recovered at the two sites is over 800 meters, allowing a consistent look back in time at the scale of several glacial-interglacial cycles. One hole at each site was wireline-logged using petrophysical and geo-chemical sensors lowered through the hole to complete sections with low recovery. Samples have been taken to analyze a variety of characteristics, including paleomagnetism, sedimentology, inorganic geochemistry, black carbon concentrations, pollen species and abundances, isotopes and biomarkers, general composition, and tephra layers, the latter of which can be dated using single-crystal analysis based on the argon isotope fractions present.

#### The Dead Sea Drilling Project (DSDP)

An ICDP deep drilling project was performed in the Dead Sea between November 2010 and March 2011. Researchers from six countries (Israel, USA, Germany, Swiss, Japan and Norway) drilled at two sites in the deep northern basin of the Dead Sea offshore Ein Gedi. One site was in the deepest basin in the center of the Dead Sea, at a water depth of 297 meters, and recovered cores down to about 460 meters below the sediment surface. The second site, in several meters of water, recovered cores down to roughly 350 meters below the sediment surface. The main purpose of the project was to recover a



continuous sequence of drill core to provide a high resolution record of the paleoclimate, paleoenvironment, paleoseismicity, and paleo-magnetism of the Dead Sea Basin. The findings from the Dead Sea Drilling Project will help to reconstruct the paleoenvironmental evolution and the seismic and tectonic history of the East Mediterranean, conditions that may have significantly driven human evolution due to the regions role as major route of early human migration and development. Along with the ICDP, funds for the Dead Sea drilling project were provided by the Israel Science Foundation; Dead Sea Works; the Israel ministries of Sciences and of National Infrastructures; U.S. National Science Foundation; Swiss National Science Foundation; GFZ Potsdam; the University of Bergen in Norway; and the Swiss Federal Institute of Technology (ETH Zürich).

*Figure 5: Dead Sea Drilling close to Ein Gedi*

#### Ongoing projects

##### The Snake River Plain Scientific Drilling (Project Hotspot)

The fundamental scientific objective of this project is to understand the interaction of deep mantle plumes and continental lithosphere and their evolution in time and space. Plume-related volcanism has distinct chemical and isotopic characteristics that are well constrained by studies of ocean island basalts. Continental lithosphere has distinct isotopic signatures, which vary with age and location that can be used to distinguish different lithospheric and crustal domains, and can be compared to oceanic reservoirs to determine the extent of source interactions. The Snake River Plain represents a world-class

example of active mantle plume volcanism in an intra-continental setting. Because it is young and tectonically undisturbed, the complete record of volcanic activity can be sampled only by drilling. The Snake River Plain furthermore represents an area with high heat flow and thermal anomalies which root deep into the mantle, making evaluation of the geothermal potential another important target of the



Figure 6: Pipe Tripping at the Kimberley site

Hotspot project. So far, Snake River Plane drilling has successfully completed two deep holes at Kimama and Kimberley with a third one at the Mountain Home Air Force Base in progress. The drilling has produced over 4600m of core, including more than 2300m of basalt, 1665m of rhyolite and more than 600m of sediments. The Kimama and the Kimberley drill holes have been geophysically logged with a full suite of logging tools. Vertical seismic profiles (zero-offset and walk-away VSP) have been conducted to identify and characterize seismic sources and determine in situ seismic velocities. Geophysical and seismic studies at the Mountain Home AFB drill site are scheduled for early 2012. Funding for this project is provided by ICDP, the US Department of Energy (DOE), the United States Air Force, and participating institutes from the US, Canada, Germany, UK and France.

#### Peering into the cradle of life: the Barberton drilling project

The Barberton Greenstone Belt in South Africa is one of the best-preserved successions of mid-Archean supracrustal rocks in the world, and, as such, it is a remarkable natural laboratory where conditions and processes at the surface of the Archean Earth can be studied in detail. Despite generally good outcrop, nowhere in the Barberton belt are complete field sections preserved, and crucial features such as the contacts of lava flows and continuous successions of critical sedimentary rock sequences are not exposed. Two of seven drill holes at five sites have already been completed after core drilling started in July 2011 where particular consideration is given to core orientation. The hole BARB1 reached a target



Figure 7: Barberton drilling activities in July 2011

depth of 120m, while 431m depth were achieved by BARB2. The hole BARB3 is currently at slightly over 600m depth and expected to reach target depth by the end of January 2012. Diamond drilling obtains continuous sections and relatively unaltered samples through the volcano-sedimentary successions. The drilling is conducted using a standard rig and conventional technology under the supervision of experienced geologists from South African universities and mineral exploration companies.



The distribution of samples and post-drilling research will be coordinated by a steering committee comprising representatives from all major participating countries. The project is supported by scientists from 13 countries in five continents and by the mineral exploration industry.

### **Upcoming projects**

Projects planned for 2012 comprise drilling into the Campi Flegrei caldera, the Songliao Basin, and Lake Ohrid.

- Campi Flegrei drilling was scheduled for 2011 but became postponed due to permission issues. Drilling is now expected to begin in early 2012 with a 500m deep pilot hole to infer mechanical properties and temperatures of the Campi Flegrei caldera host rocks and to characterize different fluid regimes at depth in order to plan the deep drilling and deviation in detail. The pilot hole is also aimed to study the volcanic stratigraphy of the eastern caldera border and to host innovative borehole sensors for volcano monitoring and risk mitigation.
- The principle target of drilling in the Chinese Songliao Basin is the recovery of a nearly complete Cretaceous terrestrial sedimentary record from a 5 km deep corehole in order to determine the basin-filling history and understand the response of terrestrial environment to geological events related to the carbon cycle and greenhouse climate change. Start of drilling is anticipated for spring 2012.
- Lake Ohrid, situated at the border between Albania and Macedonia, is considered to be the oldest continuously existing lake in Europe with an age of likely three to five million years and is worldwide unique for its more than 210 described endemic species. Lake drilling will shed new lights into the evolution of this aquatic ecosystem. Some shallow holes have been drilled in summer 2011, deep drilling is scheduled for spring 2012.

### **International Cooperation**

Through thematically oriented research projects and the requirement of establishing international science teams for each drilling project, ICDP has furthered the formation of new networks of scientific collaboration. One of the outstanding examples is the close cooperation between ICDP and the Past Global Changes Program (PAGES) in the field of paleoclimate and paleoenvironment. The availability of the GLAD800 (Global Lake Drilling Facility – a barge mounted drill rig capable of retrieving lacustrine sediment cores in most of the world's lakes from up to 800m depth) has stimulated a PAGES group to develop a long-term scientific concept for paleoclimatic and paleoenvironmental studies in continental lakes worldwide. Subprograms of PAGES, such as the International Decade of East African Lakes (IDEAL), actually structured their drilling proposals around ICDP planning and integrated their mainly limnology and biology oriented program into the ICDP research themes involving Earth history and climate.

From the first Potsdam Conference in 1993 it was evident that any program of Continental Scientific Drilling should try to develop close scientific and technological ties to the Ocean Drilling Program (then ODP, now IODP). This is most obvious in the area of research related to studying continental margins because they are situated in a gap between those areas normally considered in ocean drilling and in continental drilling. A good example of ICDP – IODP cooperation in this area is the study of global sea level change (eustasy) preserved in sediments obtained through drilling on land on the New Jersey

coastal plain and offshore on the continental shelf obtained by the Mission Specific Platform part of the IODP. Examples of ICDP – IODP cooperation are:

- Liaison memberships of ICDP and IODP representatives in panel and board meetings
- Homogenization of proposal forms allowing for submission of the almost identical proposals to both programs
- Joint ICDP-IODP project proposals, such as the Chixulub drilling proposal
- Annual joint IODP/ICDP DFG colloquia in Germany
- Jointly conducted international workshops on themes relevant to both programs

The latest development is a Joint Program Planning Group on Climate and Human Evolution with IODP, coordinated by the National Research Council, Board on Earth Sciences and Resources, as ICDP is planning to support a major project initiative for drilling of dry lake deposits in the vicinity of key fossil findings in the East African Rift system spanning the last 4 Million years of Earth history.

### **Education and Outreach Activities**

Joint Town Hall meetings at the AGU (ICDP-DOSECC) and the EGU (ICDP-IODP) were very well received events with about 200 attendees in average who met to hear about the news of the respective scientific drilling programs and initiatives. The 2010 EGU joint IODP-ICDP exhibition booth was an active focal point for the scientific drilling community and also for scientists from related fields of research from ICDP member and non member countries. Lively core scanner demonstrations with real cores were organized by ICDP. As a result we collected a total of 150 new subscribers to the IODP-ICDP *Scientific Drilling* journal.

Six oral and 25 poster presentations from the IODP-ICDP EuroFORUM 2010 summarized and reviewed major scientific achievements in ocean and continental drilling with special emphasis on the European contributions to IODP and ICDP. Furthermore, perspectives and visions for drilling projects using a multi-platform approach were tackled.

*Scientific Drilling* is a journal, jointly published by IODP and ICDP. The journal provides reports on deep Earth sampling and monitoring from ocean drilling and continental drilling scientific research projects. *Scientific Drilling* is designed to enhance communication between and among IODP and ICDP, and other national and international scientific drilling communities. Contributions are welcome on any aspect of scientific drilling, including borehole instruments, observatories, and monitoring experiments.

The annual 2011 ICDP Training Course was carried out at the KTB with 30 participants from 17 countries. Ten international experts held lectures on drilling engineering, downhole logging basics, application of downhole logging data, seismic monitoring, drill core and cuttings sampling and analysis, core logging, fluid and gas sampling and monitoring, deep biosphere studies, data management, application strategies, project planning and management. A field trip to two current geothermal drillings in Taufkirchen and Kirchweidach delivered valuable insights into state-of- the-art drilling equipments and techniques.

Activity	Date and Venue	Participation
ICDP-DOSSEC Town Hall Meeting	2010 AGU Fall Meeting December 13-17, San Francisco, USA	approx. 150 participants
Joint IODP-ICDP booth	2011 EGU General Assembly April 4-8, Vienna, Austria	150 new subscribers for 'Scientific Drilling'
ICDP-IODP Town Hall Meeting	2011 EGU General Assembly April 5, Vienna, Austria	approx. 250 participants
IODP ICDP EuroFORUM 2010: Achievements and perspectives in scientific ocean and continental drilling (joint IODP ICDP session)	2011 EGU General Assembly April 5, Vienna, Austria	approx. 80 participants
ICDP Workshop on Gas Monitoring	April 19-21, INGV Rome, Italy May 23-27, GFZ Potsdam	8 participants from forthcoming projects
Annual ICDP Training	October 10-14, GeoZentrum at the KTB, Windischeschenbach, Germany	30 participants from 17 countries

Table 2: ICDP Education and Outreach activities

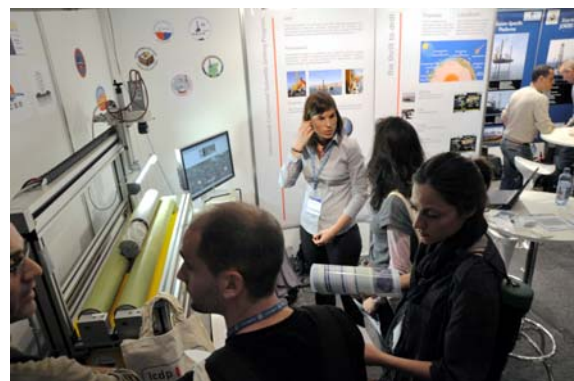


Figure 8: Group photo from the 2011 ICDP Training Course (right), core scanning demonstrations at IODP-ICDP booth during the 2011 EGU General Assembly in Vienna (left).

## Developments

Scientific and operational challenges addressed by scientific drilling projects have resulted in several developments inspired and supported by the ICDP:

- CULTS (Consortium of Underground Labs and Test Sites)
- GESEP core repository

1) ICDP projects often use specific or novel downhole techniques and procedures, which are required to be tested at specifically known borehole conditions. Tests in commercially available autoclaves can only prove instrument reliability at controlled pressure & temperature conditions while in-situ tests include e.g. true response from rock at real downhole conditions such as electrical variations due to the

spooling logging cable, rough sonde motion in a borehole, sonde rotation, fluid flow, casing effects, etc. Industry boreholes do not provide alternatives because of commercial usage.

For this purpose, a meeting was held by scientists responsible for or having access to test boreholes and underground test sites during the 2010 EGU Annual Meeting in Vienna to found the Consortium of Underground Labs and Test Sites. The aim is to coordinate and jointly utilize existing European sites for tests of borehole instruments and methods. Further goals comprise to enhance the visibility and to promote joint outreach.

2) Retrieving drill cores, drilling cuttings, and formation fluids and gases are one main goal in scientific drilling. These materials should be available for scientific investigations even long time after sample retrieving, which is only feasible if samples were safely stored and well recorded, but not all ICDP project partners have access to facilities for proper storage of sample material, i.e. national core repositories. Driven by the need to tackle these questions, concepts were developed

For an accurate core curation of continental drill cores e.g. from ICDP projects, the German Scientific Earth Probing Consortium GESEP has established a modern core repository in February 2011. This repository consists of two facilities. One is situated in Berlin-Spandau at a branch office of the Federal Institute for Geosciences and Natural Resources (BGR) with capacities for up to 41 km of core, mainly for crystalline rock samples without cooling. The second facility is integrated into the Bremen Core Repository at MARUM which is designed for soft sediment core curation and storage at +4°C. Originally constructed for the Integrated Ocean Drilling Program and similar programs for curation of up to 270 km, it is now also open for lacustrine cores of the ICDP. Both facilities provide state-of-the-art equipment for core opening, description, sampling parties and analyzes.



*Fig. 9: The IODP core repository at MARUM, Bremen is now accessible for ICDP drill core samples. Photo courtesy MARUM.*

## **Challenges**

One of the major challenges faced by PIs of ICDP drilling projects is coordination of funding sources. Since ICDP rarely pays the majority of costs for a project (average = 19%), the PI must secure additional funding, usually from his/her national funding agency/agencies. As a result, timing becomes a critical issue. If ICDP funding is secured, this is usually a positive in the PI's application for local funding, but this is not always the case. Some projects have been delayed or postponed due to the lack of "synchronicity" in funding sources.

Another challenge faced by the program as a whole is that member countries financial contributions have remained constant since their joining the program. In the case of Germany, Japan and the USA, this amount has remained constant (\$700K/yr) for 15 years. The only way the pool of comingled funds to support drilling projects has grown is by the addition of member countries. Fortunately the membership has grown steadily and now stands at 23 member countries. However, this kind of growth cannot be sustained indefinitely.

Drilling is expensive and the costs are steadily rising. As the scientific community becomes increasingly aware of the necessity and value of drilling to address some of society's most important problems, proposal pressure on the program is increasing. This has led, in some cases, to substantial reductions in funds allocated to individual projects.

### **ICDP International Review 2011**

On behalf of the Assembly of Governors, AOG and at the request of the main funding partners of the program, the International Continental Scientific Drilling Program has been evaluated in May 2011 by an international review committee of independent experts with key expertise in major programs in the geosciences and funding organizations.

The committee concluded that ICDP is a highly successful program, achieving with very modest investments world-class science of global impact. The program has been highly effective in community-building and is driving integration in modern Earth system science. It has demonstrated strong scientific leadership and effective allocation of its limited financial resources. The program holds great promise to further attract new member states, organizations and industrial partners.

One important outcome of the assessment is to start developing a new ICDP Science Plan. The AOG has therefore initiated the planning for an International Symposium on Continental Scientific Drilling in 2013.

### **Change in the ICDP Executive Committee**

After many successful years as Chairman of the ICDP Executive Committee, Prof. Dr. Dr. h.c. Rolf Emmermann handing over his position to Prof. Dr. Brian Horsfield with effect from October 1<sup>st</sup>, 2011.

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