

Community Perspectives

'ICDP in the Second Quarter of its First Century'

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25+
YEARS OF
SCIENTIFIC DRILLING

Conference on
**International Continental
Scientific Drilling 2023**

This report summarizes the outcomes of the IV. International Conference of Continental Scientific Drilling 'ICDP in the Second Quarter of its First Century' convened at the German Research Center for Geosciences in Potsdam, Germany on July 21-23, 2023. The meeting was attended by 139 scientists from 23 countries representing various Earth science disciplines and career stages, including leading scientists of ICDP drilling projects, members of ICDP panels, representatives from partner organizations and funding agencies, as well as early-career researchers.

The conference aimed to highlight achievements of the past years, to conceptualize a scientific outlook and to inquire the organization of ICDP. Accordingly, the conference program was divided into

scientific sessions addressing the key research themes **Geodynamics, Geohazards, Georesources, Environmental Change** as defined in the ICDP Science Plan and so-called cross-topic sessions. In addition, sessions on the topics **Co-mingled Funding, Operational Support, Land-to-Sea initiative, Outreach and Early Career Researcher Support** were held. Each session began with an overview talk by the convener(s) followed by a series of lightning talks and ample time for lively discussions.

Here, we summarize the key outcome of the conference as well as suggestions and questions posted on interactive idea boards onsite at the conference and afterwards at the ICDP webpage, touching a variety of ICDP-related topics.



Science Topics

Geohazards

While fault zones, volcanoes and impact structures are long-standing main targets in ICDP, also topics such as induced seismicity, landslides, marine slope failures as well as astrobiology were highlighted as emerging or future topics. It was noted that geoscientists, engineers, and social scientists need to better communicate the results of fault drilling to society in general and to disaster management agencies in particular. Applicable science objectives of ICDP-funded fault-zone drilling projects could help to bridge the gap between the often more fundamental scientific goals of a drilling project and the needs of disaster management agencies.

Georesources

Collaboration with industry through in-kind contributions has proven successful, e.g. for the Bushveld Project/South Africa and should, if applicable, be considered for other projects in the future. In this context, the new 'world-class opportunity' approach as relevant criterion, outlined in the recently launched ICDP geothermal funding strategy, was positively mentioned. Research on extraction of solutes (lithium, dissolved minerals) from geothermal brines, in addition to heat, may open a new scientific pathway. Data management, especially for big data, including long-term data archiving and data accessibility, are key for the future. It is also critical to engage with the public and policymakers to generate acceptance for scientific drilling.

Cross-Topic Sessions

Co-mingled Funding

Summary: The principle of commingled funding in ICDP projects, where ICDP provides seed money for project proposals to support implementation of projects and to generate

Geodynamics

Drilling is a key instrument to shed light on mountain building processes and mantle-crust interaction and evolution. Similar to the other scientific sessions, the discussion focused on the aspects of funding, cooperation with industry, and education and outreach. To secure acceptance and funding, it is needed to emphasize the societal relevance of ICDP projects. The potential of scientific drilling for educational purposes and capacity building should be better exploited in the future. Similarly, outreach to public and young people should be improved. In this context, the 'Geobus' was briefly introduced as a successful outreach tool in the UK that could be considered for ICDP projects in the future.

Environmental Change

ICDP attracts a large community of scientists who address paleoclimate and paleoenvironmental change through investigations of core samples from sedimentary successions. Although scientific drilling projects have pivotally influenced young researchers' careers, the potential of scientific drilling for educational purposes and ECRs needs to be better exploited. Data discovery and integration will become increasingly important in the future. Access to drilling data, existing cores, and core storage in general as an alternative to costly drilling of new cores should be increasingly considered. Should modeling and downhole instrumentation become mandatory in ICDP projects?

matching funds from other scientific funding agencies, has proven to be very successful in the past. However, a minority of projects had to descope their operational objectives or to split their project in multiple phases because of insufficient matching funds.

Challenges and Tasks: While several national funding agencies support drilling-related science, often they do neither provide funding for drilling nor do they want to take the risk of being dependent on other funding agencies' commitment. Success rates do increase if Principal Investigators lobby early at many funding agencies, talk to program managers and find out what funding agencies essentially fund, and if they start very early to apply. They should also work on public-private partnerships for acquiring industry or donor grants. In addition, ICDP should advocate at national science funding agencies and supra-national organizations such as the EU to make supporting scientific drilling projects more attractive. The coordination of teams, timelines and grant conditions remains a challenge deserving ICDPs attention.

Operational Support

Summary: The ICDP Operational Support Group (OSG) as the operational backbone of the ICDP received positive feedback for its support in proposal preparation, project planning, drilling and logging operations, data and sample management, and scientific assistance. Cooperation with national organizations providing drilling-related support and infrastructure, such as e.g., the CSD Facilities in Minneapolis (US) was very well received and regarded as implemental. The planned assessment of ICDPs carbon release was acknowledged as first step towards a CO₂ mitigation strategy.

Challenges and Tasks: The visibility and accessibility of data, samples and publications generated in ICDP projects should be improved. For this purpose, a generally more consistent sample and data handling policy, resembling those in ocean drilling science is suggested amplified by an ICDP sample repository. Virtual workshops and training courses could reduce long-distance travel and thus help reducing the CO₂ footprint of ICDP.

Land-to-Sea Drilling Projects

Summary: There was general consensus that the Land2Sea (L2S) initiative, jointly launched by IODP and ICDP, has high potential to advance relevant scientific questions outlined in either science plan of ICDP and IODP, and that the expected outcome of L2S projects can be more than the sum of its marine and land parts.

Challenges and Tasks: The different program structures and funding approaches of IODP and ICDP require new coordination efforts when it comes to L2S project implementation and execution. The challenges identified during the currently developing ICDP IMMAGE project and the marine counterpart IODP Mediterranean-Atlantic Gateway Exchange Expedition 401 serve as a blueprint for implementing future L2S projects. Workshops designed for proposal development and kick-off workshops to bring together scientists from terrestrial and marine communities should be jointly organized and funded. Truly integrated campaigns will drive mutually beneficial developments in several aspects. In order to boost such development, the opening of 'priority lanes' in handling proposals and projects has been discussed. It was also suggested to open the discussion on a closer integration of the two global drilling programs e.g., utilizing joint/integrated data and sample repositories and common outreach actions, primarily in L2S projects.

Outreach and Early Career Support

Summary: ICDPs program and project outreach efforts targeting the scientific community are established and well received by the community. In contrast, broader impacts on stakeholders, decision makers, the general public and the private sector and industry and other target communities relevant for acceptance, funding and the overall successful execution of drilling efforts should be augmented. Early career researchers request to boost opportunities by or through ICDP for career development.

Challenges and Tasks: In order to improve ICDPs outreach to new target communities, the financial and human resources need to be expanded. ICDP should also enhance networking with other organizations to boost outreach efforts. On another note, it was made clear that the ICDP proposal guidelines should include a more specific focus on what outreach measures are expected in ICDP projects. An Early-Career Researcher (ECR) mentoring program would help to better integrate ECRs in

ICDP and path the way towards leading roles in future projects (PIs, co-PIs). ECR may also have a voice in ICDP panels. A funded ECR network in ICDP could help to increase the overall visibility of ICDP for ECRs. ICDPs website could have specific sections making it more appealing for ECRs. Finally, ICDP may consider grants for ECRs for small research programs, e.g. on legacy cores or for small drilling projects for ECRs.



Interactive Idea Boards

Additional key topics based on the roundtable discussions could be further discussed on interactive idea boards during and after the conference. The community's input, including questions, suggestions, ideas, and points of critique, will be considered in future committee meetings and strategic processes to enhance the future development of ICDP. Key aspects of each topic are summarized and commented by the OSG in the following paragraphs.

Proposal & Review

Summary: The community considers the current proposal evaluation process as very efficient, with three independent panels assessing each project for its scientific value (SAG), strategic feasibility (EC), and financial aspects (AOG). Omission of evaluation steps is subject to specific conditions and should be discussed with the OSG well in advance of the proposal deadline in any case. New scientific targets not yet considered in the Science Plan

are always welcome and can be explained in Pre-proposals, which will subsequently be discussed in the panels. Further raised issues regarding more fundamental support of ECRs (e.g. a mentor-mentee program and funding options) or better coordination with ECORD regarding L2S projects (e.g. through specific workshops for L2S proposal development) will find resonance and be discussed in the upcoming panel meetings.

Funding & Grants

Summary: ICDP primarily provides funding for operational scientific drilling activities, while PIs are responsible for seeking third-party funds for further project goals as requirements can vary significantly across countries. PIs can request support from their respective EC or AOG representative for insights into country-specific funding opportunities. Collaboration with industry is also encouraged by ICDP, provided that PIs ensure alignment with scientific goals and avoid inadvertently

supporting greenwashing. ICDP remains committed to supporting project partners through management training courses and will update Chapter 2.4 “Third-party funding acquisition” in the upcoming ICDP-Primer. Apart from this, ICDP is proactively taking steps to reduce its carbon footprint. Consequently, the carbon footprint of ongoing projects will be analyzed and assessed to serve as a blueprint for future ICDP initiatives. Resulting potential impacts on project financial feasibility will be topic in upcoming panel meetings.

ICDP Visibility

Summary: The new ICDP website has received positive feedback. The OSG is dedicated to maintain and improve it, along with maintaining social media accounts to boost ICDP’s visibility. ICDP offers personalized training courses based on community requests (e.g., data logging, management, etc.), which could be expanded with additional online offerings in the future. However, ICDP sees particular value in in-person training courses, as they allow for hands-on learning and foster better interactions between ERCs and senior scientists, aiding integration into projects. PIs are encouraged to announce these courses at their universities and institutes. Available materials, including the introductory presentation on ICDP, can be requested from the OSG or downloaded from the ICDP website (<https://nextcloud.gfz-potsdam.de/s/ndd3jHswgN6FcNH>). The OSG welcomes further suggestions at any time.

Logging & Drilling

Summary: The OSG provides drilling and logging support services, including training courses on software usage, data analysis, and interpretation of logging data. While the OSG endeavors to make self-recorded logging data accessible through the ICDP archive, it has no control over data archiving when logging is conducted elsewhere. In such cases, availability and storage are determined by PIs

or the respective institute. If there is interest in missing data in the ICDP archive, the OSG can assist in locating the relevant contact. The industry offers various probes for different environments. If these prove insufficient for extreme conditions (e.g., very high temperatures $> T_{\max} = 205^{\circ}\text{C}$), developments in probes and equipment can be proposed in ICDP proposals, exemplified by the ICDP project KMT. The OSG is available for assistance on this matter anytime.

Data & Samples

The demand for standards for cores, data, and reports within the community is high. However, setting standards is challenging due to the diversity of individual projects. The OSG offers equipment and support for specific activities, which can be requested and rented through project proposals. For cores, at least a description of the core catcher is currently required. ICDP also requests accessible sample storage for at least 10 years (as agreed on in the contract with ICDP) and data availability following FAIR standards. Basic data is often accessible through the ICDP website, while additional data repositories can be found with the assistance of the OSG. In any case, publications should always be identifiable with ICDP. Each project is advised to have a sample and data manager available for inquiries also after the project concludes. Due to high demand, ICDP will develop a mandatory data management plan template for future full-proposals. Continuing the quest for enhancements, ICDP encourages additional suggestions and values constructive feedback from the community.

Grand Initiatives

Major research efforts in Earth sciences provide important future opportunities for ICDP. Among the initiatives discussed was China’s upcoming SinoProbe-II program that offers unique and multifaceted cooperation

options. Likewise, the international infrastructure for earthquake sciences calls to set-up a couple of natural laboratories on geo-hazard hot-spots. At the same time seismogenic zone sampling and monitoring made great progress but requires new efforts to understand e.g., stress changes. An important field for ICDP will be to develop novel ideas in microbiology and to share them through new platforms and training programs. Finally, it became clear that astrochronology

and cyclostratigraphy are outstanding tools to understand Earth system response to astronomical forcing, among others.

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