



# ICDP Status and Future



**CURRENT STATUS as of January 2022**

## **ICDP Project Schedule 2021/2022**

### **ICDP Project with drilling operations in 2021**

- Drilling Overdeepened Alpine Valleys (DOVE)
- A Strainmeter Array Along the Alto Tiberina Fault System, Central Italy (STAR)
- Barberton Archean Surface Environments, Moodies Group (BASE)
- Drilling the Eger Rift (EGER)

### **Upcoming ICDP Projects**

- Bushveld Drilling Project (BVDP)
- Geological Research through Integrated Neoproterozoic Drilling (GRIND)
- Drilling the Ivrea-Verbano Zone (DIVE)
- Trans-Amazon Drilling Project (TransAmazon)
- Volcanic Forcing and Paleogene Climate Change (PVOLC)
- Sensitivity of the West Antarctic Ice Sheet to 2 Degrees Celsius (SWAIS 2C)

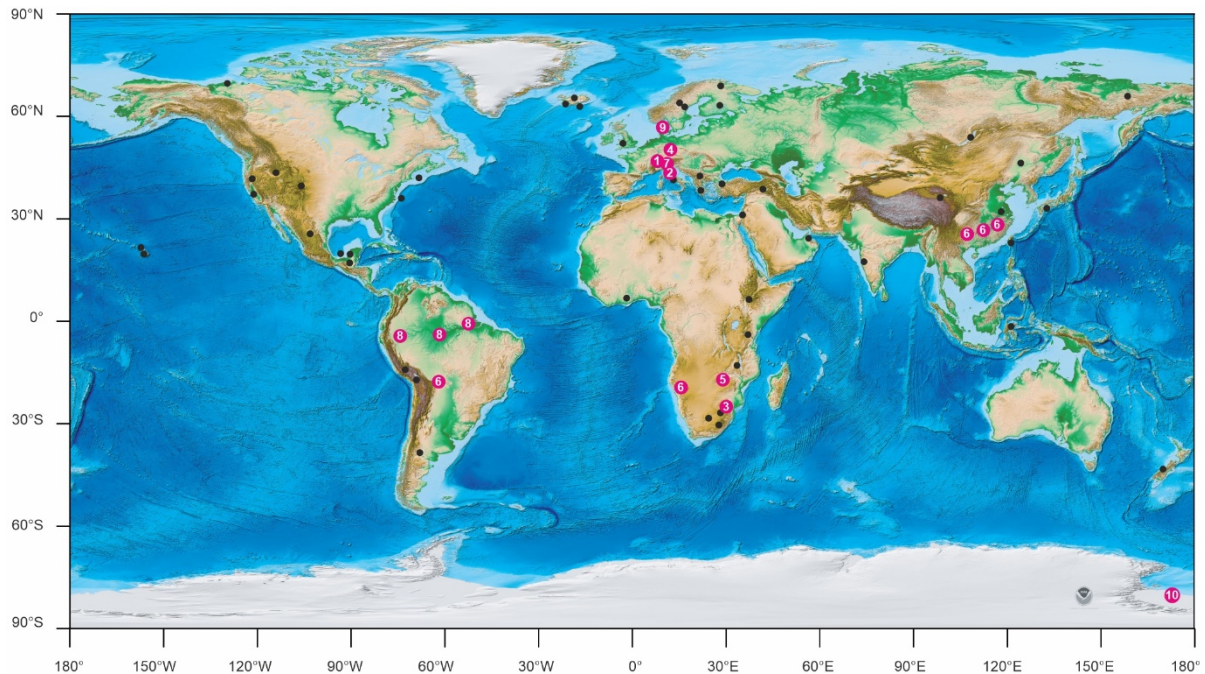
### **ICDP Workshops**

### **Proposal Submissions 2021**

### **ICDP Operational Support Group**

### **ICDP Profile**

## ICDP Project Schedule 2021/2022



### ICDP Projects with drilling operations in 2021

1 DOVE	May – November 2021	Switzerland & Germany
2 STAR	September 2021 (ongoing)	Central Italy
3 BASE	November 2021 (ongoing)	South Africa
4 EGER	November 2021 (ongoing)	Czech Republic

### ICDP Projects scheduled for 2022

5 Bushveld	Spring 2022	South Africa
6 GRIND	Spring-Summer 2022	Namibia, China, Brazil
7 DIVE	Spring 2022	North Italy
8 TransAmazon	Summer 2022	Brazil
9 PVOLC	Summer 2022	Denmark
10 SWAIS	Winter 2022/23	Antarctica

## ICDP Projects with drilling operations in 2021

### DOVE **Drilling Overdeepened Alpine Valleys (DOVE)**

The sedimentary infills of glacially overdeepened valleys are, together with glacial geomorphology, the best-preserved direct archives of extents and ages of past glaciations in and around mountain ranges. The multi-well ICDP project DOVE intends to recover a number of sediment cores from glacially overdeepened structures at several complementing locations within the Alps and their foreland. The cores will be investigated with regard to several aspects of environmental dynamics during the Quaternary, with focus on the glaciation, vegetation, and landscape history. The geometry of overdeepened structures will be investigated using different geophysical approaches and will help to better understand the process of overdeepening. Sedimentological analyses in combination with downhole logging, investigation of biological remains, thermochronometry and using state-of-the-art geochronological methods will allow to reconstruct the filling and erosion history of the troughs. Besides these fundamental scientific goals, DOVE also addresses a number of applied objectives such as groundwater resources, geothermal energy production, and seismic hazard assessment.

Two sites cored in 2021 recovered a succession of glacio- to lacustrine-sediments in Basadingen (N Switzerland) and S Rhine Glacier deposits of S Germany comprising little to strongly compacted tillites at the Tannwald site nearby Winterstettenstadt. Core drilling at the Basadingen site reached the bottom of the overdeepened basin at a depth of 143 meters. Drilling near Winterstettenstadt comprised three approx. 160 m deep boreholes, two of which were designed especially for geophysical investigations with no core recovery. All three holes reached the base of the basin with excellent core recovery at both sites.



*Drilling tillites deposited in overdeepened valley at the Tannwald site nearby Winterstettenstadt.*



## A Strainmeter Array Along the Alto Tiberina Fault System, Central Italy (STAR)

STAR aims to monitor slow (aseismic) deformation by strainmeter arrays in shallow boreholes to address questions about the relationship between creep, slow slip, dynamic earthquake rupture and tectonic faulting at the low-angle normal Alto Tiberina fault (ATF) in the Northern Apennines nearby Gubbio, where layers of carbonate rocks are only slightly inclined on top of each other. Thus, scientists preferentially expected creeping behavior and low earthquake activity of the ATF. Nevertheless, the opposite is observed at times: this portion of the ATF exhibits repeating earthquakes at shallow depth (~4 km), also described as low-angle normal fault paradoxon. Understanding the physics controlling both -seismic and aseismic- slip on a single fault patch, has implications for seismic hazard and risk assessment globally.

Within the framework of the STAR project, three out of six 80 -160 m deep boreholes were drilled in September and October 2021 and were equipped with borehole strainmeters, seismometers and fiber-optic cables to monitor slow (aseismic) and seismic deformation on the ATF. Drilling three more boreholes for the same purpose will resume in early 2022. Each of the then six sites will be equipped with surface GPS and a meteorological instrument kit allowing correlation between seismicity, degassing ( $\text{CO}_2$ ,  $\text{Rn}$ ) measurements and subsurface strain. STAR will provide the international community with an opportunity to study creep at local scale and over periods of minutes to months poorly constrained by other geophysical instruments.



*STAR drilling at Gubbio (Italy, Northern Apennines).*



### Barberton Archean Surface Environments, Moodies Group (BASE)

With an age of about 3.22 Ga, the Moodies Group represents the oldest well-preserved sediments from shallow water layers in the world. Moodies sedimentary successions reaches almost 4 km in stratigraphic thickness, is lithologically variable and was deposited within approx. 1 to 14 Ma. The metamorphic grade is lower greenschist-facies; widespread early-diagenetic silicification preserved micro- and macrotextures virtually without strain. Through extensive biomats along the paleo-shorelines Moodies sediments show that microbial life was already well established in the early oceans and pose questions on the development of oxygenic photosynthesis in early Earth which resulted in the evolution and rise of eukaryotic and complex multicellular life.

The BASE project started drilling Precambrian sedimentary strata in the Barberton Greenstone Belt, South Africa in November 2021. Drilling of two of a total of eight holes (3-1 and 4-1) is currently underway to recover up to 500 m of core from each hole. A remarkable outreach initiative includes a visitor center in Barberton Town that informs the local population, external visitors and scientists about the Archean geology, the Barberton Greenstone Belt, and the project through posters, samples, and guided tours. The visitor center also serves as a curational facility and for core description purposes.



*Drill Hole 4-1 and core samples taken from it in the BASE drilling campaign.*



### Drilling the Eger Rift (EGER)

The Eger Rift in Central Europe (Czech Republic & Germany) offers a worldwide unique location for studying intra-continental earthquake swarm (ES) activity which appears related to fluid-flow in the crust between 5 and 10 km depth, in combination with deep crust and mantle degassing as well as their interaction with the deep biosphere. Four boreholes were

already drilled in 2019/2020 and were instrumented with high-frequency 3D seismic arrays and continuous real-time fluid monitoring tools within the framework of the ICDP project 'Drilling the Eger Rift' to study seismicity, microbial life and origin, heat and fluid flow, fluid pathways, and composition. A 109 m deep pilot hole was drilled in early 2016 to study the impact of CO<sub>2</sub>-rich mantle-derived fluids on the geo-bio interaction. In October 2018, the HQ-size borehole Studenec cored mainly phyllites to 400 m depth. Drilling resumed in May-July 2019 with coring a 402 m deep borehole at Landwüst, Germany, and the Hartoušov mofette field in August-September 2019.

An additional borehole was drilled in November 2021 at the Bazina Liba site in the Czech Republic (well S4) and reached target depth of 400 m after only 10 days of wireline coring operations to complement the seismic borehole network. After recovering core of high quality and excellent recovery rate, the well was investigated by geophysical logging and will be equipped with devices for long-term seismic measurements.



*Close-up of the drill rig at S4 Bazina Liba site.*

## **ICDP Projects scheduled for 2022**



### **Bushveld Drilling Project (BVDP)**

With on the order of 1 million km<sup>3</sup> of igneous rocks, the Bushveld Complex in South Africa by itself constitutes a Large Igneous Province that poses first-order questions about how such vast volumes of magma can be generated from the mantle. However, apart from its size, the Bushveld has several other features that make it remarkable. The Bushveld Complex is bimodal in composition, with subequal proportions of mafic and felsic igneous rocks, providing an opportunity to study relationships between mantle and crustal sources of magmatism in

detail. The complex also holds an enormous wealth of mineral resources including strategic ores and metals.

Most of the 8 km-thick layered sequence of the Bushveld Complex is below the surface. Mining operations or fortuitous outcrop reveals only parts of the sequence in detail, and without vertical continuity. However, understanding how the Bushveld magmas accumulated and crystallized into layers and how ores formed within them, requires studying a continuous vertical sequence including the roof and floor zones. Furthermore, some of the most interesting science topics require techniques or conditions such as oriented core, or fluid and biological sampling, which will be provided by dedicated new scientific drilling boreholes.

The first phase of the Bushveld Complex Drilling Project was launched at the University of the Free State in Bloemfontein in April 2021 with logging and description of a pre-existing 6-km-long drillcore section, donated by Impala Platinum Ltd. This core section covers the upper two-thirds of the 9 km-thick Bushveld layered intrusion. BVDP plans drilling approximately 3 km through the lower section of the intrusion and through the base of the intrusion in early 2022.



*Marking and logging drill cores from the Bushveld Complex Main Zone. Photo: J. Magson, University of the Free State, South Africa.*



### **Geological Research through Integrated Neoproterozoic Drilling: The Ediacaran-Cambrian Transition (GRIND-ETC)**

The Neoproterozoic Era (1000 - 541 Ma) is one of the most dramatic in Earth history: metazoans evolved, the supercontinent Rodinia formed and broke apart, the global carbon cycle underwent high-amplitude fluctuations, oxygen concentrations rose and climate experienced at least two episodes of worldwide glaciation. The multi-stage three-nation GRIND project will obtain cores through archetype successions that record the environmental and biogeochemical context during which life on Earth exploded. The specific targets of the first GRIND phase are the Ediacaran-Cambrian transition strata (560-530 Ma) of west Brazil, south China and south Namibia. The objective is to create a core network of correlative ECT strata that will enable constructing a highly resolved, temporally constrained geobiological, stratigraphic and geochemical database, as well as to provide a legacy archive for future research. The goal is to understand the drivers of the Neoproterozoic Earth system revolution: it began with simple eukaryotes that populated Earth during the preceding billion years of the



Mesoproterozoic, underwent multiple Snowball Earth events, and emerged with the oxygenated, diverse ecosystems of the Cambrian.

The first phase of drilling in Namibia between September and November 2019 at Tierkloof in the southern Namibian desert retrieved 1,862 m drill core from 7 sites. GRIND will finalize operations in Namibia with a final core hole in the South in April/May 2022. In addition, drilling in Brazil and China is planned to commence in 2022. All cores will be split and either archived in repositories within each of the target nations or used for research purposes by GRIND-ECT scientists and for education and training for national capacity building and outreach activities. The working half of all cores will be permanently stored in the German Federal Institute for Geosciences and Natural Resources (BGR) in Berlin-Spandau, Germany.



*GRIND drilling and core description in Namibia in fall 2019.*



### **Drilling the Ivrea Verbano Zone (DIVE)**

The Ivrea Verbano Zone in the Southern Alps (Italy) probably represents the most complete pre-Permian lower crust–upper mantle transition in the world. However, several aspects of its formation and evolution remain enigmatic and are debated vigorously. "Drilling the Ivrea Verbano Zone (DIVE)" proposes to approach and study the Ivrea Verbano Zone by two ~1000-m deep boreholes in a pilot phase. Scientific drilling includes sampling petrological sections of the lower continental crust and its transition to the upper mantle, geophysical characterization of the crust–mantle transition zone, to study the rheology of continental roots through the distribution of brittle and ductile deformation, and to shed light on the role of the lower crust as a dynamic environment for fluid flow, fluid-rock reactions, volatile cycles, and extreme niches for hosting microbial activities.

The two drill sites located 8 km apart in the villages of Megolo and Ornavasso within the Valle Ossola were identified to achieve initial scientific goals and provide baseline data for later deep drilling. Continuous wireline-coring at the two sites will provide uncompromised, complete sections of deep ancient continental crust. Drill site DT-1a (Megolo) is expected to drill into pre-Permian mafic lower continental crust to investigate peridotite/pyroxenite-

gabbro metasedimentary interfaces. DT-1b, located in the municipality of Ornavasso in Val d'Ossola, will penetrate into pre-Permian heterogeneous intermediate to lower crust, including the potential to investigate the transition into denser lithology, such as pyroxenites, or restitic garnet-rich gneisses. Drilling is foreseen for spring-summer 2022.



The Trans-Amazon Drilling Project will address fundamental questions about the geologic and biotic evolution of the Amazon, focusing on (1) how Cenozoic climate and geologic history, including uplift of the Andes and development of the Amazon fluvial system, influenced the origins of the Amazon rainforest and its incomparable biodiversity; and (2) the origin of the Amazonian “Pentecaua” diabase sills, one of Earth’s largest intrusive complexes, and the impacts of this intrusion on the atmospheric gas composition and mass extinction at the Triassic/Jurassic boundary. It is planned to drill the entire Cenozoic sequence (and for two sites also the underlying diabase sequence) in five continental sites in four different ancient sedimentary basins that are aligned along the modern Amazon River and that transect the entire near-equatorial Amazon region of Brazil, from the Andean foreland to the Atlantic Ocean. This transect, coupled with proposed IODP sites on the Amazon continental margin, will encircling nearly 10% of Earth’s equatorial circumference. Spud in of the first well is currently planned for summer 2022.



*The Amazon region is target of upcoming ICDP drilling activities.  
Photo: Paul Baker.*

icdp |  **Volcanic Forcing and Paleogene Climate Change (PVOLC)**

The Paleocene-Eocene Thermal Maximum (PETM) is recognized as one of the potential analogues in the geological record for present-day global warming. The mechanisms that trigger such climatic events are highly debated, but one possibility for the PETM could be the large-scale emplacement of igneous rock at the North Atlantic. The PVOLC drilling targets in

NW Denmark a near-complete Paleocene-Eocene marine succession that contains hundreds of volcanic ash layers as well as sedimentary units assigned to the PETM. Surface outcrops, although well-studied, are deformed and discontinuous, but previous drilling has demonstrated a complete succession in the subsurface. The plan is to drill and core two ~500 m deep holes in this area in order to recover the Paleocene-Eocene strata. The core material will be analyzed to understand stratigraphy and geochronology, volcanic proxies, tephrostratigraphy, paleoclimate and paleobiology, and weathering. The overarching research goal is to causally link the emplacement of igneous rock at the North Atlantic to the tectonic, climatic and biotic changes occurring at this time. In order to achieve these goals the complementary offshore expedition of IODP '396 Mid-Norwegian Continental Margin Magmatism' was conducted in 2021.

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### **Sensitivity of the West Antarctic Ice Sheet to 2 degrees Celsius (SWAIS)**

Response of the West Antarctic Ice Sheet to expected future warming remains a significant uncertainty in sea level rise projections. SWAIS will focus on understanding past and current drivers, mechanisms and feedbacks that influence retreat of ice sheets to reduce uncertainty in numerical model projections of future environmental changes. SWAIS will recover and study sedimentary records of past environmental change and ice sheet dynamics in the interior Ross Sea Embayment of West Antarctica to pose the overarching question: How will marine-based ice sheets respond to a 2°C increase in global temperature and what are the local, regional, and global environmental consequences of this response if temperatures ultimately exceed this 2°C increase? In combination with detailed studies of glacial and oceanographic processes within the Ross Ice Shelf cavity and at the grounding zone near Kamb Ice Stream and new knowledge regarding ice flow dynamics, grounding line interactions and the influence of oceanic and atmospheric warming, this integrated 3-fold approach will improve projections of Antarctic ice sheet contribution to global sea level. SWAIS will utilize new drilling technology including 200-m-thick sea-ice melting to obtain a sedimentary history of past ice sheet dynamics at two locations (Kamb Ice Stream and Crary Ice Rise) along the Siple Coast in the West Antarctic interior. Drilling in Antarctica is planned for the 2022/2023 winter period.

### **ICDP Workshops**

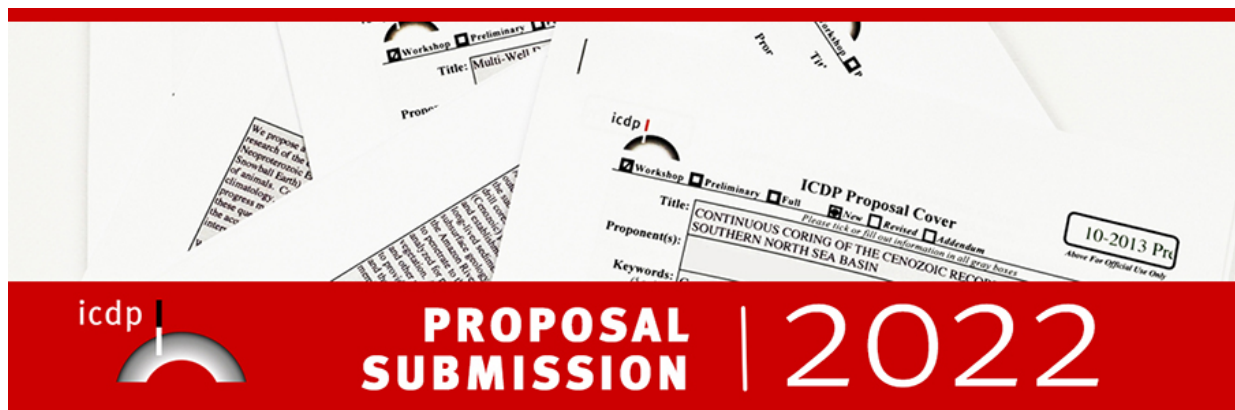
ICDP funds workshops to support groups of international scientists with an outstanding scientific theme of socio-economic relevance that requires drilling. The workshops serve to form a broad and competent Science Team and to develop full drilling proposals to ICDP and other co-funding agencies or industry. ICDP also supports post-drilling workshops after completion of the operative work and basic core and sample description for e.g. discussing of initial results and organizing individual sampling. Over the past years, ICDP supported the conduction of workshops with a broad topical spectrum addressing various future drilling projects.

Workshops 2021	Date and Venue	Participants	Countries
Danakil Depression in Ethiopia (ADD-ON) Part I	June 2021 (fully virtual)	70	13
Pliocene Lakes in western North America (PlioWest)	September 2021 (fully virtual)	52	11
Workshops 2022	Date and Venue		
Deep Drilling Turkana Basin (DDTB)	18-20 July 2022 Nairobi, Kenya		
Lake Victoria Drilling Project (LVDP)	25-27 July 2022 Dar es Salaam, Tanzania		
Lake Izabal Basin Research Endeavor (LIBRE)	August 2022 Guatemala City		
US Margin PETM	tbd		
Danakil Depression in Ethiopia (ADD-ON) Part II	tbd		

Operations and workshops scheduled for 2022 remain dependent on pandemic-induced restrictions and may be forced to delay starting dates. The experiences gained in ongoing operations in 2021 however have provided pathways how to cope with COVID-19 issue in the upcoming year 2022.

### ICDP proposal submission 2021

Eight Full Proposals, four Workshop Proposals and five Pre-Proposals were submitted by January 15, 2021. Despite the Corona pandemic and the resulting limited ability to conduct relevant studies in the field, the number of proposals remained at a high level. The increase in the number of pre-proposals compared to previous years reflects the desire of ICDP committees to emphasize the relevance and importance of pre-proposals.

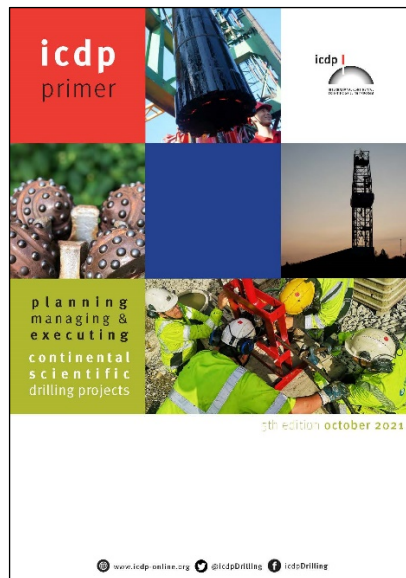


## Activities of the ICDP Operational Support Group

### Publications: New volume of SCIENTIFIC DRILLING & 5th Edition of the ICDP Best Practice Brochure “Primer”

Vol. 29 of the ICDP-IODP program journal SCIENTIFIC DRILLING was published in May 2021 on behalf of ICDP by Copernicus Publications, including one ‘Science Report’, one ‘Progress Report’, three ‘Reports on Technical Developments’, and one ‘Workshop Reports’. The number of manuscripts submitted to SCIENTIFIC DRILLING remained high in 2021 and confirmed the uniqueness of this journal in the geoscientific community.

The completely revised and now fifth edition of the ICDP Best Practice brochure "Planning, Managing and Execution of Continental Scientific Drilling Projects", the so-called “ICDP Primer”, was published in late 2021. This brochure is designed for scientists and engineers of upcoming drilling projects and explains the key steps and important challenges in planning and executing continental scientific drilling.



### ICDP at conferences

Due to the pandemic situation, the usual international conferences with ICDP presence were either switched to a hybrid format (AGU Fall Meeting) or held purely online (EGU General Assembly). On the EGU 2021 General Assembly, the virtual joint IODP-ICDP-SSP2.9 session "Achievements and perspectives in scientific ocean and continental drilling" was very well attended (over 80 participants), as was the ICDP-IODP Town Hall Meeting that followed. Five webinars jointly organized by IODP/ECORD and ICDP were also well received, with 25-40 participants attending each.

During the 2021 AGU Fall Meeting, on December 13, ICDP held a joint virtual Town Hall meeting together with Continental Scientific Drilling Facility (CSD) where Marco Bohnhoff (ICDP Executive Director) and Anders Noren (Director CSD) shared news and recent developments of ICDP and CSD. The presentations were followed by brief reports on current drilling projects in Italy (STAR), Switzerland, Germany (DOVE) and South Africa (BASE) and the opportunity to meet for specific discussion.



## Data and Sample Management and the mobile Drilling Information System

The mobile Drilling Information System (mDIS) is the platform-independent ICDP data portal for field, lab and sampling data to facilitate data management of drilling projects which was implemented in 2020. All ICDP projects with drilling activities in 2021 utilized mDIS in the field to capture critical datasets of the recovered rock samples, on-site sample requests, and drilling engineering data, together with a unique International Geo Sample Number (IGSN) to ensure a high-quality reference data set available for all science team members of a drilling project. The on-site data administrators of the respective projects (DOVE, STAR, BASE, EGER) were instructed in the use of mDIS in advance by the ICDP data administration team during virtual workshops lasting several days each. In addition, several ICDP projects with completed drilling activities as well as several core repositories have adopted the mDIS for curating samples and data. The mDIS package has been published as open source software under GPL 2.0 licence with the intention to allow broad access to and support by the science community at large.

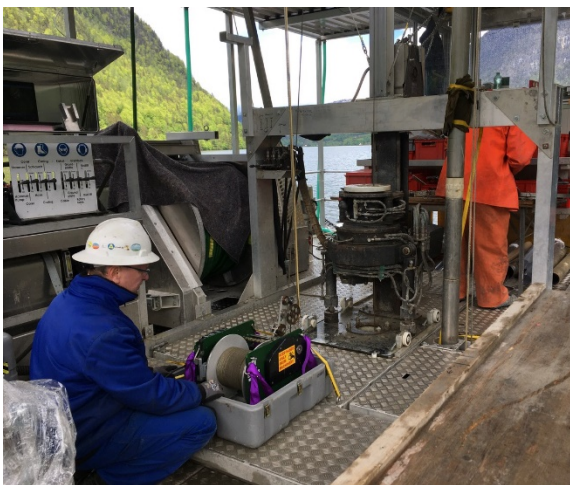


## Borehole Measurements 2021

The OSG downhole logging group performed downhole measurement campaigns in Austria on Lake Hallstatt and at the COSC-2 borehole in Sweden. In May 2021 the OSG logging team successfully deployed the 'ICDP memory logging system', iMLS in one of the boreholes of the H3 Hipercorig Hallstatt History project in Lake Hallstatt, Austria. Due to the unconventional operating principle of the new Hipercorig coring platform, the logging was anything but standard wireline logging: the sonde had to be inserted into the drill pipe at the lake floor through a guiding mechanism and was run up synchronously while slowly pulling out the casing string, a method requiring precise fine-tuning of both logging and casing retrieval

operations. It ultimately worked out very well, delivering the very first downhole measurements with the new Hipercorig system.

In September and October 2021, OSG provided downhole operations of the GFZ-owned borehole geophone chain during a three-week long seismic campaign at the COSC-2 borehole in Sweden. The campaign consisted of an extended walkaway Vertical Seismic Profile (VSP) survey around the drill site and a high-resolution zero-offset VSP survey in the borehole to generate a high-resolution 3D image of the subsurface in the direct vicinity of the borehole and to improve the geological interpretation by determining the origin of the basement reflections, the nature of the main décollement, and the degree of basement thrusting. The obtained data set exhibits an exceptionally good quality and shows many pronounced and clear reflections.



*OSG downhole logging at Lake Hallstatt, Austria.*

## ICDP Profile

Scientific Drilling is an indispensable tool of modern Earth Science research, because it provides the only means of obtaining direct information about on-going processes below the surface of the Earth and at depth. Drilling allows determining *in-situ* properties of solid materials and fluids, and permits testing of hypotheses and models derived from surface and remote sensing observations. Drill holes may be used as a natural laboratory for experiments and observatories for long-term monitoring of ongoing active geological, microbiological processes. Earth drilling, therefore, plays a critical role in scientific research directed towards improving our 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 by ICDP since 1996. The concept for this program was developed in response to the geosciences community's need for scientific drilling as an essential tool to achieve 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, comprises an independent science review board and executive and oversight committees. Administrative assistance and substantial operational support are provided by the GFZ German Research Centre for Geosciences in Potsdam. Funding is provided by a growing number of member countries, usually through corresponding national funding agencies.

ICDP fosters proposals through international workshops that assist researchers in the development of a drilling proposal. To date, more than 90 ICDP workshops have been funded and have resulted in more than 50 ICDP-supported and successfully executed drilling projects. Thematically the activities have focused 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 scientists in engineering, on-site science and data management technologies is also an important component of ICDP's strategy to foster the success of ICDP-related drilling proposals. The journal "Scientific Drilling" (jointly issued with the International Ocean Discovery 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 (as per December 31<sup>st</sup>, 2021) 22 members including 21 countries (Austria, Belgium, China, Czech Republic, Finland, France, Germany, Iceland, India, Israel, Italy, Japan, the Netherlands, New Zealand, Norway, South Africa, Spain, Sweden, Switzerland, the United Kingdom and the USA), and, in addition, UNESCO as member organization. The GFZ German Research Centre for Geosciences in Potsdam 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 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 are negotiated between new members and ICDP and vary, based on a number of criteria that include economic factors, scientific impact, manpower and population of the respective country. Low-income developing countries can become ICDP member under the UNESCO membership umbrella.

The ICDP funds are, for the most part, used for co-funding of approved ICDP projects and for executing ICDP workshops and training courses. In addition, funds cover expenditures for the maintenance of the ICDP Equipment Pool which includes the ICDP Drilling Information System (DIS). The annual membership income to support ICDP activities is approximately \$3.5M.

The philosophy of ICDP support for projects is based on the 'comingled funding' principle. This means that the ICDP –after an in-depth scientific and strategic evaluation- provides partial



funding of a project that then typically serves as a door opener for acquiring matching funds. The financial contribution by ICDP to directly support a drilling project varies between about 5% to about 70% (in rare cases) of the total operational costs.

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 to attract new Earth science communities through opportunities to get workshop and project proposals funded. ICDP's organization, its financing through commingled funding, and the bottom-up project policy, which relies on unsolicited proposals and thus drives the program at large, serves 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 commingled ICDP funding for each individual drilling project. In addition, the AOG decides on the annual program plan, associated budget and discusses the long-range plans of the ICDP as they are prepared and proposed by the EC.

**The Executive Committee (EC)** is responsible for the scientific orientation and objectives 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 and multi-year program plan. The EC is made up of one appointee from each ICDP member country and nominated by the respective funding partners of the program. EC members are typically science managers with expertise in drilling and/or coordination of major research projects.

**The Executive Director (ED)** represents the ICDP internationally and has the executive responsibility for carrying out the program. She or he plays a key role as the international spokesperson and ambassador for the ICDP and oversees the OSG during the planning, implementation and termination of ICDP-supported scientific drilling projects. Another key duty is to translate the program plan into annual and long-range program and budget plans.

**The Science Advisory Group (SAG)** is an independent body of internationally renowned experts in the research fields covered by the program. Its task is to carry out thorough scientific evaluations of all pre-proposals, full proposals and workshop proposals as they are submitted to the ICDP. The SAG also assigns priority to each proposal based on expected scientific impact, 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 GFZ German Research Centre for Geosciences in Potsdam handles the administration of the program, including financial accounting and contractual support. Currently the GFZ finances a group of six scientists, engineers and technicians from its own budget who compose the core of the ICDP Operational Support Group and are based at the GFZ. The OSG serves to support the following functions:

- Providing technical and scientific liaison to SAG and EC
- Developing Joint Research Ventures for each project authorized by the EC
- Managing and supporting the Secretariats for AOG and EC
- Assisting in contracting and permitting
- Supporting scientific and engineering drill-site operations
- Supporting field facility for core and sample description and management
- Providing all data collected during each project through a readily accessible data management system for ICDP projects, the Drilling Information System (DIS)
- Preparing – through ICDP's DIS - Initial Reports that describe drilling, engineering, sample and core description, and also procedures for each project
- Providing training courses in scientific drilling prior to and during drilling projects
- Organizing outreach activities on major international geoconferences (AGU, EGU, IGC)
- Editing the IODP-ICDP journal 'Scientific Drilling'
- Developing, purchasing and maintaining an ICDP Equipment Pool comprising scientific-technical instruments and tools for on-site use during ICDP projects
- Providing management support for individual ICDP projects
- Providing and operating ICDP equipment

Management of ICDP activities at the GFZ is conducted by the following personnel:

- Prof. Dr. Marco Bohnhoff (Executive Director)
- Dr. Ulrich Harms (Executive Secretary and Head of the ICDP Operational Support Group).

*Credits: Topographic/Bathymetric world map (Page 2) with courtesy from NOAA. All photos by ICDP, if not mentioned otherwise.*