

INTERNATIONAL CONTINENTAL SCIENTIFIC DRILLING PROGRAM



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June 22, 2011

07-2011 Revised Workshop Proposal

Oman Ophiolite Drilling Project, Workshop Proposal

Peter Kelemen (USA), Ali Al-Rajhi (Oman), Shoji Arai (Japan), Donna Blackman (USA), Georges Ceuleneer (France), Laurence Coogan (Canada), Margot Godard (France), Steve Goldstein (USA), Philippe Gouze (France), Greg Hirth (USA), Al Hofmann (Germany), Bjorn Jamtveit (Norway), Jürgen Koepke (Germany), Charles Langmuir (USA), Craig Manning (USA), Jürg Matter (USA), Katsu Michibayashi (USA), Barbara Sherwood Lollar (Canada), Everett Shock (USA), Eric Sonnenthal (USA), Damon Teagle (UK), Wenlu Zhu (USA)

Dear Dr. Kelemen,

Thank you very much for submitting a Workshop Proposal on the “**Oman Ophiolite Drilling Project**”, which you prepared together with an impressive number of Co-Principal Investigators.

Your proposal was reviewed by the ICDP Science Advisory Group (SAG) and meanwhile decided on by the Executive Committee (EC) at their recent meeting in Rome. Please find enclosed the assessment of the SAG for your information and consideration.

The EC agrees with the SAG that your proposal addresses fundamental scientific issues of global significance and in addition has a high societal relevance. Both panels are impressed by the quality and expertise of the PIs and the broad range of highly qualified scientists shown on the invitation list. Therefore, it is my great pleasure to inform you that the EC unanimously agreed to provide funding for the planned workshop with up to 50.000 US Dollars. This workshop, however, should be held in Oman as this would allow visitation of potential drill sites and examination of surface exposures. Furthermore, we consider a meeting in Oman much more useful in terms of outreach and capacity building as this would allow involvement of additional Omanis, especially students.

I would like to ask you to carefully consider the points of improvement identified by the SAG in their proposal assessment. A question that needs to be addressed very carefully at the workshop and in any subsequent proposal to ICDP is the “need-for-drilling criterion”. The ICDP will only co-finance projects where it can clearly be demonstrated that the necessary information is not otherwise obtainable than by drilling.

With respect to the workshops I would like to give you the following general instructions:

- The workshop has to be announced by ICDP as a „Call for Participation“ in EOS. You will be asked to provide a text for publication and to propose a workshop date in agreement with the EC chairman.
- ICDP workshop funds will be made available to your institution as soon as you have submitted a budget plan and a list of potential invitees.
- You will be in charge for inviting individuals to the workshop in accordance with ICDP policies and the workshop budget.
- The key deliverable must be a workshop report for Scientific Drilling and, if possible for EOS.

Please contact Dr. Ulrich Harms (ulrich@gfz-potsdam.de) for discussing funding and workshop details such as the contact to the Tibetan Ophiolite Drilling scientists, and for OSG support measures.

I wish you successful meetings and fruitful discussions.

Best regards,



ICDP Science Advisory Group, Assessment 2011

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ICDP Funds Requested (US\$): 50,000

PROPOSAL OVERVIEW

This workshop proposal aims to develop a full proposal for drilling in the Oman ophiolite. In concert with surface-based studies and through comparison with studies of the ocean crust at sea, drilling would provide key data on the processes of melt extraction from the mantle, igneous accretion of oceanic crust, and hydrothermal modification of that crust prior to ophiolite emplacement.

Drilling would also investigate present-day alteration processes, their relationship to the deep biosphere, and their potential for facilitating carbon capture and sequestration via in-situ mineral carbonation. Drilling is being considered in a series of 500- to 600-m-deep holes (the practical limit of drilling equipment currently available in Oman). This drilling would be carried out in two phases, with Phase 1 designed to sample ongoing alteration reactions as well as the dike/gabbro and crust/mantle transitions, and Phase 2 comprised of a series of holes constituting a complete crustal section of the Oman ophiolite.

This workshop proposal is a considerably expanded version of a workshop proposal that was submitted to the ICDP in 2001, which was subsequently approved for funding. However, for a variety of reasons (discussed in the present proposal), this workshop was not conducted and ICDP funding was eventually withdrawn.

COMMENTS – STRENGTHS AND WEAKNESSES

The Oman ophiolite is composed of igneous crust and upper mantle formed at a submarine spreading center, and is one of the key ophiolite exposures world-wide. As described in this proposal, increased understanding of the Oman ophiolite through drilling has the potential to lead to major advances in general theories of partial melting, melt transport, heat transfer from the mantle to the hydrosphere, crustal genesis, mineral hydration and carbonation, geochemical cycles, the deep biosphere, chemosynthetic pathways, and abiotic hydrocarbon synthesis. In the 21st century, it will become essential to understand many of these processes better, in order to learn how to counteract negative, global-scale human impacts on the Earth. Based on previous surface geological data, up to 15 drill holes are being considered in this project.

The proposed workshop would focus on fundamental scientific issues of global significance, and is international in scope. The drilling target is one of the best areas worldwide to address these scientific issues. The proposed drilling is necessary to achieve the staged scientific objectives, which require acquisition of fresh, unweathered samples from a variety of crustal levels and geochemical/thermal environments. The PIs have the experience and productivity necessary to carry out this project. The estimated total budget for the workshop is 188,000 US\$, with a requested ICDP support of 50,000 US\$.

The budget for this workshop seems reasonable given the number of people (70) and the transportation distances involved. Although this project has the potential for leading to exciting and important science, there are several weaknesses with the proposed activities that need to be addressed at the workshop and in any subsequent drilling proposal. These are:

- 1) The geological and geophysical setting of the Oman ophiolite is not described in sufficient detail and the geophysical data needed for drill site selection and interpretation and extrapolation of drilling results were not presented in this proposal. Thus, the potential drill sites are speculative and the rationale behind drill site placement is not clear. These issues need to be discussed in detail at the workshop, with the relevant data (including the seismic and gravity studies alluded to on p. 11) and drill siting strategy presented in any subsequent drilling proposal. This includes discussion of whether or not the ~600 m maximum depth of the drill holes planned is sufficient to get below near-surface weathering effects (as needed to significantly improve upon readily available surface outcrop data) and adequately sample rocks involved in ongoing hydrothermal/carbonation reactions within the ophiolite. Decisions about depths needed for drilling may be better informed by along-strike seismic refraction profiles.
- 2) A stronger case needs to be made that drilling of the Oman ophiolite will lead to fundamental advances in our understanding of the formation and early alteration of oceanic crust, including integration with results from ODP/IODP investigations of the current oceanic crust as well as studies of other on-land ophiolite exposures. To facilitate these comparisons will require, among other things, seismic refraction surveys to clearly delineate the velocity structure of the Oman ophiolite for comparison with results from marine seismic investigations.
- 3) Much of the proposal focuses on hydrothermal/carbonation issues, which are of high scientific importance and societal relevance. In any subsequent drilling proposal, the PIs will need to justify why drilling the Oman ophiolite is necessary to make fundamental advances in our understanding of these processes, which cannot be attained at other locations or in other projects.
- 4) Although there is a strong scientific team already associated with this project, additional younger scientists should be included in the workshop. This can be facilitated by open advertisement of the workshop, as required by ICDP.

SUMMARY RECOMMENDATIONS

The internationally recognized team of experts organizing this effort eventually plan to drill a sequence of 500 to 600 m deep holes to create a complete transect of geophysical and physical properties through the Oman ophiolite. This proposal has important scientific and societal significance and focuses on ICDP's main themes. SAG is generally positive about this proposal, and would like to see the workshop funded by ICDP. However, there are a number of issues as described above that should be addressed at the workshop and in any subsequent drilling proposal.

Although the PIs plan to hold this workshop in New York, they note that it could also be held in Oman at comparable cost but decide against this option because a workshop on carbon capture and sequestration was recently held in Oman that many of the PIs attended. SAG recommends holding the workshop in Oman, as this would allow visitation of potential drill sites and examination of comparable surface exposures, especially by scientists who may not have already been involved in this project. Holding the workshop in Oman would facilitate involvement by additional Omanis, especially students, and is seen by

SAG as important in local capacity building. The workshop could be either immediately before or after the upcoming international conference on the geology of Oman, to be held in January 2012.

There is no management plan presented for this project, and roles and responsibilities for key operational and scientific aspects of this project will need to be clearly delineated in any eventual drilling proposal.

In addition, SAG suggests that scientific and technical experts who are operating the Tibetan Ophiolite Drilling Project (PI Jingsui Yang, yangjingsui@yahoo.com.cn.) take part in the workshop.