Meeting of the Sedimentary and Geochemical Processes Panel GEOMAR-Kiel, Federal Republic of Germany 19-20 September 1989

Executive summary

The meeting was devoted to (1) review of drilling proposals, (2) revision of SGPP white paper, (3) preparation for CEPAC/DPG and (4) discussion of technology issues.

(1) Review of drilling proposals

SGPP has in hand 48 (!!) proposals for post-1991 drilling; of these the following ones will be in the **ranking which should be completed during the spring meeting**:

330/A Mediterranean Ridge
335/A Drowned atolls
338/D Marion Plateau
342/A Barbados accretion
348/A US middle Atlantic margin
59/A Madeira turbidites
341/A St.Lawrence late Wisconsian
332/A Florida Escarpment
337/D Test sea level curve
340/B North Australian foreland
345/A West Florida sea level
349/A Gran Canaria clastic apron
351/C Bransfield Strait

Several other proposals will be re-considered:

329/A Cretaceous Atlantic
339/A Benguela Current
336/A Arctic drilling
350/E Gorda deformation

A few proposals have not been reviewed because they were received late:

352/E Mathematicians Ridge
354/A Namibia upwelling
353/C Antarctic-Pacific margin
355/A Peru gas hydrates

(2) White paper

Evident was the discrepancy between the panel mandate as handed down by PCOM and the few themes to which SGPP has devoted its energies. A new introduction will explain this selection as well as the chapter sequence and linkage between themes. An executive summary of the white paper should **highlight technology** issues. Further needs to incorporate are: more explicit statement about instrumented holes; section on ice margin processes; greatly expanded section on sediment fluxes (including carbon budget as it pertains to paleocean chemistry); divide evaporate discussion between metallogenesis and paleocean chemistry. No outside comments were received.

(3) Preparation for CEPAC/DPG

Martin Goldhaber to present SGPP's justification for highest ranking of (1) hydrothermal processes at sedimented ridges and (2) the Cascadia accretionary margin. Document -drawn from the SGPP minutes, Fluid Working Group and Sedimented Ridge Crest Working Group reports- should reiterate: ***that drilling of sedimented ridge crests to occur only at an hydrothermally active segment and that SGPP's conception of the Cascadia drilling means the Oregon margin because fluids, sediments and hydrology are a documented and integral part of the drilling proposals.***

(4) Technology issues

Sand drilling was discussed based on the TAMU document (88-0300; see Appendix to panel minutes) rather than took the direct exchange with a TAMU engineer as hoped for. Because of the concern for improved recovery, specifically in the thematic areas achievable through drilling of:

-shallow water sands to secure one end-member for determining magnitude of sea level changes;
-volcanoclastics in accretionary margins;
-contourites for deep water history;
-carbonate sands in atoll drilling;

-sulfide sand & gravel in ridge valleys and sedimented ridge crests;
-unconsolidated mounds at mid-ocean ridges,
SGPP feels that the issue is ***not resolved with the receipt of this document (88-0300).***

The panel wishes to learn if there are **really new technologies** being considered to overcome the old problems or if these advances are not pursued at an innovative level because of lack of funds ? SGPP to prepare a short summary document to highlight the issue and ***send a one-time liaison to the annual TEDCOM meeting.***

Fluid sampling; this document will deal with:

1. *Extraction of pore fluids* - modification of present pore water protocol. All objectives cannot be accomplished with a single procedure but there is need for a variety; i.e. inert atmosphere, *in situ* temperature of squeezing, metal-free squeezers. What is minimum standard program needed ? What is the permissible flexibility for high density/volume sampling?
2. *Pressurized Core Barrel (PCB)* - flexibility to meet many scientific objectives. Sampling methane/hydrocarbon clatherates in order to measure their physical properties, imaging of internal structures, extraction of helium or other noble gases, CO_2, N_2, microbiological rate experiments injecting labeled tracers, mineral phase transition studies, and calibration of logging tools. PCB to be used at both high and low temperatures making temperature and in chemically-corrosive environments.
3. *High-temperature sampling* - upper limit for SGPP scientific targets is more likely 350-400°C and not 1200°C; feasibility of *in situ* extraction of fluids at these temperatures versus chemical logging using a dewared down-hole recording instrument will be considered.
4. *Instrumented holes* - monitoring should be done on either sealed or open holes at sedimented ridges, accretionary margins, marginal seeps and bare rock ridges for a duration of 2-4 months. Properties monitored should include temperature, flow rates, gases (e. g. CH_4), pore pressure, and specific ions.

Meeting of the Sedimentary and Geochemical Processes Panel
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Minutes

SGPP members in attendance:

Erwin Suess (chairman)
Nicholas Christie-Blick
Henry Elderfield
Martin Goldhaber
Judith McKenzie
William Normark
Dorrik Stow
Jacques Boulegue
Shirley Dreiss
Philip Froelich
Makato Ito
Juergen Mienert
Frederick Prahl
Chris van der Borch (for Steve Macko)

Liaisons in attendance:

Lawrence M. Cathles (19 Sept) (LITHP)
Graham Westbrook (20 Sept.) (TECP)
Andre Droxler (OHP)
Ulrich von Rad (PCOM)

19. September 1989

Welcoming

The panel was welcomed to GEOMAR by host and chairman **Erwin Suess**. The minutes of the previous meeting were approved and the agenda was discussed.

Reports

Downhole Measurement Panel

Jürgen Mienert reported on the DMP meeting held in Sept., 1989, in Windischeschenbach, West Germany. He presented an update on the following developments:

1. *Wireline packer* - the tool is operational but not tested; at sea testing will be done in November,1989.
2. *Geoprops* - development of the tool requires 9 more months; i. e. it will be ready for testing in March, 1990. It is unlikely that the tool will be ready for the Nankai Leg 131 (4/1-6/2/90). Panel questions whether this will jeopardize the proposed original scientific objectives.
3. *Lateral stress tool* - this tool is to be tested in November, 1989 and is scheduled for use on Leg 131.
4. *Long-term temperature tool* - this tool, developed by the Japanese for a sealed bore hole, is ready for use.
5. *High-temperature logging* of hydrothermal drill sites (such as, Site 504, sedimented ridges, EPR) - most logging tools are good only to 100-250°C; none are available for higher temperatures and probably will not be available in the near future. Therefore, in order to log hydrothermal holes, they must be cooled, but this presents a problem as cooling causes more fracturing. ARCO has logging tools available which can measure temperature, pressure, density and porosity up to 260°C. No high-temperature geochemical tools are available. Calibration is also a problem. It was concluded that it will be very difficult to get the critical measurements from high-temperature drill sites with the currently available logging tools.

Planning Committee Summer Meeting

Ulrich von Rad reported on the **PCOM** summer meeting in Seattle on 22-24 August 1989 in Seattle, Washington. The following items from the meeting were discussed:

1. Bruce Malfait from **NSF** presented the time frame for ODP renewal and reported that there is a heavy concentration on the long-range planning. The main science document is the Long-Range Science Plan, which is now being modified by JOI. A new COSOD should occur in 1993. New members for ODP are needed. To date there are no new developments. There is still hope that the Sowjet Union, which are eager to join, will be invited. An invitation from the USA is required.

2. *ODP Operations Schedule*

Leg 127, Japan Sea I has been completed. Three bottom hole assemblies (BHA) were lost. A new drill string is required as the present one is 5 years old.

Leg 128; Japan Sea II is underway and has received as 10 day extension to prepare the reentry hole which was not successfully completed by Leg 127.

Leg 129, Old Pacific Crust, co-chiefs Y. Lancelot & R. Larson - site surveys are not in, but still optimistic that a Jurassic window can be drilled.

Leg 130, Ontong Java, co-chiefs, W. H. Berger and L. Kroenke, has received two extra days of ship time. Co-chief Kroenke proposed changing the order of drilling with crustal objectives drilled prior to Neogene objectives. PCOM restated that the Neogene was the first objective of the Leg. It was suggested that to avoid future misunderstandings, the pre-cruise meeting should be attended by a PCOM member, who will ensure that the approved objectives be incorporated into the scientific prospectus.

Leg 131, Nankai, co-chief A. Tairo reported that the final plans for the leg are in and scientific staffing is almost complete.

Leg 132, Engineering II, co-chiefs Harding and J. Natland will be testing developments which improve drilling technology and improve recovery. Three areas have been select for test drilling, which will also produce scientific results; shallow water carbonates on MIT Guyot, young brittle crust in the Mariana or Bonin back-arc areas, and chert-chalk sequences on Shatski Rise.

Leg 133, 134, and 135 - co chiefs (see Appendix A) have been chosen and selection of scientific parties is underway.

Leg 136, Engineering III - will set the guide base on EPR. Successful bare-rock drilling is a high priority for the Memorandum of Understanding to be signed in 1992.

3. The Geochemical Reference Leg incident was discussed at length (1/2 day). A motion to reinsert the Geo. Ref. Leg into the present schedule was defeated (for 7, against 7, abstain 2), while one to replace Leg 129, Old Pacific Crust with Geo. Ref. Leg was also defeated (for 1, against 12, abstain 3). It appears that the Geo. Ref. Leg is out for the present period but resubmittal was encouraged for the 1991-1992 program. The Geo. Ref. Leg must be competitive with other proposed legs. The confusion surrounding the insertion and subsequent removal of the Geo. Ref. Leg in the FY 90 program was apparently caused by a misunderstanding about the original LITHP ranking of the Leg. In order to avoid misunderstandings with future rankings, PCOM proposed that panels submit more detailed documentation for their rankings. Letter from R. Moberly, PCOM chairman, to SGPP discussed below.

4. *FY 91 Drilling Program* in Central East Pacific includes:

Cascadia Margin - surveys of slope, margin and accretionary prism as well as Middle Valley are underway,

Chile Triple Junction - currently a single leg proposal,
East Equatorial Pacific - site surveys underway,
East Pacific Rise - no new developments, proposals must be combined,
Lower crust Site 504B - massaging of VSP data suggest that the transition could be 350 m closer than previously estimated. There are some interesting dipping reflectors. Concern was expressed about sampling the fluids prior to any Engineering operations.
Hydrothermal Processes at Sedimented Ridges - new prospectus is ready, 2 legs have been proposed that may be planned about 1 year apart.
Comments on *other CEPAC drilling* proposals:
Atolls & Guyots - 2 new proposals from Schlanger and Winterer are in, which are good, but no time is available in 1991 program,
Bering Sea - nothing new to report,
North Pacific Neogene - nothing reported,
Shatsky Rise - program requires good recovery, which will be evaluated during Leg 132 Engineering II. Drilling during this leg may accomplish many of the scientific objectives making a full follow-up leg unnecessary.
Young Hot Spot (*Loihi Seamount)* - no changes to report. Drilling would probably encounter high temperatures, requiring high temperature logging tools.
Hawaiian Flexure - low priority as dating resolution problem has not been resolved.

5. *Engineering and technical developments* were discussed, in particular the problem involving the logging of the 4 inch-hole cut by the diamond coring system (DCS). Optimism remains high for success with DCS but the problem remains, how to log with the current larger diameter logging tools? Three options were presented: (1) drill 4 in. hole and ream it to 5 to 6 in., (2) drill 4 in. hole and a second 6 in. hole nearby without coring but solely for logging, and (3) drill 4 in. hole and use and/or slim down existing tools. PCOM favors first option, which will be tested on next engineering leg, followed by second option. To slim down existing tools would be too expensive, so option 3 is not a viable one.

6. *Detailed planning groups (DPG)* - thematic panels need to give greater input to the DPG's but the two must maintain separate identities, i. e. planning and advising have separate functions.

7. *Global science programs other than JOIDES* - coordination has been proposed with other earth science programs, such as IRIS, POSEIDON, RIDGE, BRIDGE, FRIDGE, Global Sediment. Geol. Project (IUGS), Continental Drilling, WCRP-WOCE, JGOFS, Arctic Ocean Drilling and Global Seismic Networks. Tom Pyle of JOI suggested a possible model for the JOIDES structure with liaisons to other global geoscience initiatives.

Comment: S. Dreiss suggested that SGPP have a greater input into testing of tools on engineering legs as development goals appear to fall behind scientific needs.

Directive from Planning Committee chairman

Erwin Suess reported on the contents of a letter from **R. Moberly** concerning panel's ranking of proposed legs. The main points in the letter are: (1) panels should write-up a justification for their priority of specific legs. This should be done for the April, 1990 PCOM meeting. Is more Pacific or Atlantic drilling necessary? (2) Justification should include latest material and information available, such as on-going site surveys, (3) panels should send a delegated liaison to 16-17 November, CEPAC/DPG meeting to represent the respective panels viewpoint, and (4) thematic panels can and should write proposals and combine proposals.

Lithosphere Panel

Larry Cathles reported on LITHP meeting September, 1989 in West Germany. LITHP has defined four thematic entitles: (1) ocean crust, (2) ocean ridges & hydrothermal activity, (3) case studies, such as intraplate volcanism etc., and (4) sea floor observations (seismic, ocean ridges). The LITHP ranking for 1991 drilling is as follows:

1. 504B-crust
2. Sedimented ridges
3. EPR
4. Geochemical Reference Holes
5. Cascadia Accretionary
6. Chile Triple Junction
7. Eastern Equatorial Pacific.

LITHP voted on its thematic priorities. The main interests deal with crustal and sedimented ridge objectives. The top 8 drilling priorities from a list of 20 are:

1. Layer 2-3
2. Layer 3/mantle transition
3. Sedimented ridges
4. Fast spreading ridges
5. Slow spreading ridges
6. Geochemical drilling
7. Deep mantle drilling
8. Deep layer 3.

Targets of opportunity while the JOIDES Resolution is still in the Pacific were discussed:

- Hawaiian bulge in conjunction with work at near-by on-shore laboratory
- Hole 333 A in Cayman Trough, an uplifted Cretaceous window with potential drilling access to basement.

Down-hole instrument needs were listed for following joint meeting with DMP and potential high temperature tool with double Dewar packaging was discussed. LITHP has decided to put together a strong sedimented ridge program. The goal is to study one area very well to define hydrology, inflow and outflow, and to have sealed-off holes to study pressure, permeability, chemistry etc. Middle Valley looks like a good candidate. The LITHP and SGPP have common goals and need new technology to meet high-temperature objectives. Suggestions should be passed on to engineers.

- Coffee Break -

SGPP White Paper

The chairman opened a general discussion of the current draft of the White Paper Document. It was stated that in general the Document must be a balance between the broad mandate given to panel by PCOM and what the panel has decided are the important priorities for ocean drilling. An around-the-table discussion included the following items, in order discussed:

- *Introduction* - must be rewritten with due reference to the PCOM mandate
- *Technology* - as currently written, technology is scattered throughout the Document under various sections. It should be collated into a separate section entitled Technology and also should be highlighted in the Executive Summary.
- *Sediment fluxes* - Carbon budgets (item 4, p.2 of current draft) actually should be discussed under two sections of the Document; i. e. under mass transport the suspended load and under paleocean chemistry - the dissolved load Discussion of the latter should be expanded. What drilling approach would be required to obtain the needed information? **Action:** F. Prahl will supply the write-up for the dissolved carbon load.
- *Marine evaporites and early rifting systems* - M. Goldhaber expressed second thoughts about where these items should be located in the Document as they are concerned with the dissolved load. He suggested that they should be included partially under metallogenesis and partially under paleocean chemistry?
- *Sedimentary geometry* - M. Ito suggested that this items missing and should be added to the mandate.

- *PCOM mandate* - should be placed at the back of the Document
- *Themes* - the chapter sequence will be as follows:
    Sediment fluxes
    Sea level
    Fluids
    Metallogenesis
    Paleocean chemistry
    Technology

  A ranking is not implicit in order of the chapter listing. This should be explained in the summary along with an explanation of the link between the themes
- *Executive summary* - very important section of Document!
- *Petroleum generation* - U. von Rad pointed out that this subject was not dealt with specifically in the Document. As it will be a strong selling point for future ODP programs, a statement in the text relating fluid flow and hydrocarbon movement would be appropriate.
- *Chairman's summation of discussion* - The White Paper will contain the following changes or additions:
    1. present introduction will be eliminated,
    2. new introduction will discuss the selected items chosen by the panel from PCOM mandate, as well as present an explanation of the chapter sequence and linkage between the themes,
    3. executive summary, highlighting technology, will be added,
    4. PCOM mandate will be moved to appendix,
    5. a more explicit statement about instrumented holes will be added,
    6. section on ice margin processes will be expanded,
    7. sediment flux chapter will be expanded using W. Hay's work and will include a discussion of carbon budget issue,
    8. evaporate discussion will be divided between metallogenesis and paleocean chemistry,
    9. editorial revision to remove inconsistencies and smooth style will be made,
    10. small number of key citations will be added.

- Lunch Break -

During 1-3 pm the panel devoted this time to work on their respective White Paper revisions. The Chairman will collect these revisions and integrate the above 10 points into the White Paper.

Technology Issues

Sand Drilling

During the July, 1989 SGPP meeting at Lamont, the panel requested that an ODP representative be present at the following meeting to discuss the problem of good recovery of unconsolidated sediments. A representative did not appear but a document entitled *Unconsolidated Formation Recovery* (Summary Statement 88-0300) was sent (See Appendix B). A cover letter from M. Storms, Supervisor of Development Engineering, to E. Suess discussed in further detail issues of interest. In particular, the Christensen rubber sleeve core barrel is thought to be not suitable for use offshore on a floating drilling platform. W. Normark pointed out that there seems to be some discrepancies between the offshore use of the rubber sleeve technique by industry and the ODP decision not to pursue it. He further suggests that other techniques, such as vibrocoring, should be considered. The letter also states that advance piston corer should resolve the problem of recovery, "once a reliable breakaway piston head is developed". Because of our concern for good recovery of unconsolidated sediments in many target areas, the panel ***feels the issue is not resolved with the receipt***

of this document. We are concerned that required technology is not being developed for lack of sufficient funding. To strengthen communication, a SGPP delegate should meet with the engineers at TAMU. The panel recognized that recovery of unconsolidated sediments of all types and hole stability will present problems in the following, not all inclusive, thematic areas:

1. Continental margins - shallow water sand drilling to secure one end-member for determining magnitude of sea level changes;
2. Active margins and accretionary prisms - volcanoclastics,
3. Contourites - deep water history
4. Atoll drilling - carbonate sands
5. Sedimented ridges - sulfide sand & gravels in ridge valleys,
6. Mid-ocean ridge drilling - unconsolidated mounds.

Action: 1. Make strong statement in minutes about SGPP's concern that not enough is being done to make technologic advances to overcome problems related to recovery of unconsolidated sediments and hole stability in areas of key scientific targets.

2. Send a short document extracted from the minutes to PCOM, TEDCOM and TAMU which reflects the concern of SGPP and states the required technologic needs. **Action:** Sand Working Group- E. Suess, D. Stow, W. Normark, J. McKenzie.

3. Send one time liaisons to annual TEDCOM meeting. **Action:** delegated liaisons are D. Stow and N. Normark.

- Coffee Break -

Fluid Sampling

1st Outline: *Document on Fluid Sampling and Shipboard Protocol* prepared by H. Elderfield, which identifies deficiencies and requirements in current fluid sampling program.

1. Improvements in shipboard extraction of pore fluids - the need for a versatile system or systems that deal effectively with the various the problems of artifacts;
2. The pressurized core barrel - the need to carry through with the development of the complete system to the stage of sample extraction and processing;
3. In situ sampling - the need to redesign the current system,
4. The packer - the need for improvements,
5. The sampling policy - the need, when required, for more frequent sampling and larger samples of particular importance in larger numbers,
6. Implementation - the need for funds and action.

Comment: P. Froelich posed the questions; What is it that we would like to have measured and do we want to consider the instrumenting of holes?

2nd Outline: Discussion of ***Document on Fluid Sampling and Shipboard Protocol*** - identified key sampling & measurements topics.

1. *Extraction of pore fluids* - modification of present pore water protocol. Should the present program be abandoned or continued? Stainless squeezers should be retained, but a system should be added which would be compatible for trace element studies, e. g. titanium, Teflon squeezers. The need to work in an inert atmosphere cannot be resolved with present system. The temperature artifact remains a problem. It is possible to centrifuge in an inert atmosphere. All objectives cannot be accomplished with a single procedure but there is a need for a variety of procedures to accomplish the objectives. What is minimum standard program needed? What is the permissible flexibility for high density/volume sampling?

2. *Pressurized Core Barrel (PCB)* - The system should be designed to be flexible to meet many scientific objectives, e. g. sampling methane or hydrocarbon clatherates in order to measure their physical properties, imaging of internal structures, extraction of other gases (helium or other noble gases, CO_2, N_2), microbiological rate experiments injecting labeled tracers, mineral phase transition studies (sulfides and magnetic properties), and calibration of logging tools. Sub-sampling should be possible via compartments. The PCB will be used at both high and low temperatures making temperature insulation important. As corrosive chemicals, such as sulfides, may be present, the PCB should be made of stainless steel.
3. *High-temperature sampling* - the actual maximum temperature is not 1200°C but more likely 350-400°C, the upper limit for SGPP scientific targets. The feasibility of *in situ* extraction of fluids at these temperatures versus chemical logging using a dewared shown-hole recording instrument should be considered. To test the packer at high temperatures, experimental measurements of pressure, fluid flow, and permeability should be conducted.
4. *Instrumented holes* - monitoring should be done on either sealed or open holes at sedimented ridges, accretionary margins, marginal seeps and bare rock ridges for a duration of 2-4 months. Properties monitored should include temperature, flow rates, gases (e. g. CH_4), pore pressure, and specific ions. Monitoring can provide more information than single "snapshot" measurements, e. g. detect changes in flux rates.

Action: This outline will evolve into a Document of Fluid Sampling to be presented to Shipboard Measurements Panel (SMP) and TAMU. SGPP recognizes that the document will meet with some resistance to change current shipboard pore sampling procedures but feels strongly that the science requires these suggested changes. The document should be ready for JOI/USSAC sponsored workshop on ODP Geochemistry: Progress and Opportunities to be held 9-12 January, 1990, which is prior to the next SGPP meeting.

Action: Fluid Sampling Working Group - H. Elderfield, P. Froelich, F. Prahl; Suess to gather and edit.

20. September 1989

INTERNAL REVIEW OF PROPOSALS

SGPP has in hand a total of 48 proposals; 11 were reviewed in Denver, 9 were reviewed at Lamont, 28 are to be reviewed in Kiel or will be reviewed in Santa Cruz. After an initial ranking of the new proposals, those receiving a 3 or 4 were discussed at greater length under thematic groupings. Proposals receiving a 1 or 2 were deemed not appropriate or of lower priority for this panel. Ranks1 to 4 reflect the categories on the ODP review form

1. = Not within SGPP mandate
2. = Does not address high-priority thematic objectives of SGPP
2a. = Does, however, have secondary interest to SGPP
3. = Addresses SGPP objectives, but with deficiencies
4. = Addresses high-priority SGPP objectives)

NOTE: Prior to reviewing Proposal 342/A, a discussion on whether proponents of a proposal, who are members of SGPP, should stay in the room or leave while the proposal was under panel review. The consensus was that panel needed as much information as possible. Therefore, the proponent should remain in the room during the discussion but should leave the room when a vote on the proposal was taken.

The following proposals considered at the Kiel meeting are listed in numerical order with their watch dogs and Kiel rankings and are not necessarily in the order discussed:

329/A - Cretaceous Atlantic
S. Macko, M. Ito, W. Normark - 2a - needs a second review.

330/A - Mediterranean Ridge: An Accretionary Prism in a Collisional Contest
P. Froelich, M. Goldhaber, S. Dreiss - 3.

The proposal is to drill on mud diapirs on the Ridge. Piston core data from Prometheus med dome demonstrates that Aptian material is moving upward. Proposal would be potentially more interesting if it proposed to also study fluid circulation in the sediments. Boulegue suggested that there are published French data (Villefranche) as well as data from recent surveys (LePichon) which could be integrated into the proposal. Proponents need to include more information on existing brine data and geophysical measurements from the area.

331/A - Aegir Ridge
H. Elderfield, J. Boulegue, E. Suess - 2- proposal is not going anywhere and was also ranked low by LITHP.

332/A - Florida Escarpment Drilling Transect
J. Boulegue, S. Dreiss, H. Elderfield - 3.

The proposal is to designed to study the hydrology and fluid patterns along a well-studied area of the Florida Escarpment, where know seeps occur. Three holes are proposed; 1. on the more seaward plain, 2. above the seep colonies to obtain fluids and 3. more landward on the slope to capture the entire stratigraphic column of the carbonate platform with hopes of securing dense brines. The proposed area has been studied by Paull using the Alvin. Methane of a definite biogenic origin has been identified in the area of seeps. Open questions are: Do the organism surrounding the seeps utilize this methane? What is the relationship of the seeps to large-scale erosional patterns along the escarpment, dissolution of carbonate by H_2S? Thus, diagenesis of carbonates is an important aspect of the proposal. There are no allusions in the proposal to the available (?) petroleum-industry well data. Boulegue questions what can ODP bring to such an area as much of this work can be done from land based drilling and some of the objectives could be achieved by sea-floor instrumentation. Although the proposal is very interesting, is deep-sea drilling the correct approach?

333/A - Cayman Trough
Not within SGPP mandate - 1.

334/A - Galicia margin
Not within SGPP mandate - 1.

335/E - Drowned Atolls of the Marshall Islands: Paleocean.Lithosph.Tect. Implications
D. Stow, J. Mienert, S. Macko -4.

A number of Pacific atolls have been targeted with the following objectives:

1. to obtain atoll sea-level record and tie to other eustatic records,
2. to understand why some atolls drown and some do not,
3. to study mid-plate volcanism & sea level,
4. to evaluate the relation of diagenesis and depositional horizons to acoustic characteristics
5. to study horizontal and vertical tectonics in Pacific.

Drill sites on atoll tops will provide low-stand exposure records, while sites on the flanks will give a more continuous record with better dating potential. Turbidites may represent a low stand record, but this is controversial; does high or low stand shedding occur from carbonate platforms? It was questioned how tectonic movements versus

simple subsidence would not affect the eustatic record and how this might be resolved. It may be possible to drill atolls in other areas to distinguish between the two mechanisms.

336/A - Arctic drilling
M. Ito, J. McKenzie, F. Prahl - 2a - needs a second review.

337/D - Ocean Drilling Program Tests of the Sedimentary Architecture of the Exxon Sea-Level Curve
N. Christie-Blick, D. Stow - 4.

A total of 12 holes are proposed primarily to calibrate sequence boundaries and secondarily to investigate the paleoceanographic significance of the mid-Oliogocene event in the southwest Pacific, i.e. a global sea-level fall vs. a high stand in New Zealand. The proposal has good potential with the strong point being that there are good controls on subsidence rates in the area and good ties to land sections. (See hand-out from N. Christie-Blick).

338/D - Absolute Amplitude of Neogene Sea-level Fluctuations from Carbonate Platforms of the Marion Plateau, Northeast Australia
W. Normark, N. Christie-Blick, J. Mienert - 3.

The proposal is very immature and does not consider the results that will derive from the upcoming ODP Leg 133. It is a single objective proposal, which is overly simplified. The proponents do not state how they will determine sea-level falls. (See hand-outs from W. Normark & N. Christie-Blick). Discussion was as follows:
Elderfield - questioned if it were possible to discard a proposal which has serious deficiencies but is within the SGPP mandate.
Suess - Such proposals cannot be discarded it in this preliminary round but can be compared and ranked with other proposals within themes.
Normark - Feed-back from OHP is necessary to determine whether the stated biostratigraphic precision of depth is actually feasible.

339/A - Benguela upwelling
F. Prahl, J. McKenzie, J. Boulegue - 2a - needs a second review, mostly OHP
340/B - Evolution of Foreland Basins - A Record of Tectonic, Climatic and Oceanographic Change from the Northern Australian Margin
S. Dreiss, M. Goldhaber, P. Froelich - 3.

Focus of the drilling is the development of the foreland basin in the Banda Arc, which will serve as a modern analog for the development of ancient foreland basins because all stages of development can be documented. There are two subproposals along the W.E. transect: a. five drill holes to investigate the early tectonic and stratigraphic evolution of the foreland basins and b. five drill holes to study Cenozoic global climate evolution including one deep hole to obtain a reference section for East Indian Ocean, Paleogene-Cretaceous paleoceanography. The theme of fluid flow was only mention not fully developed. Drill holes were not sites to focus diagenesis. Discussion was as follows:
Suess - In this area, deep-sea tube worms at vents were fist described in 1904. The proposal is immature but has promise for interesting fluid objectives and should be redevoloped.

341/A - Global Climatic Change as Measured through a Continuous Late Wisconsin an Quaternary Record with Special Emphasis on the Holocene
J.McKenzie, H. Elderfield, F. Prahl - 3 - low level of development. The theme of the proposal is not of high interest to SGPP. To be more interesting the drilling should be sited more off-shore where it would be possible to secure a real marine record. Ice margin sediments do not have a high priority for SGPP..

342/A - Growth Mechanics and Fluids Evolution of the Barbados Accretionary Prism, M. Goldhaber, P. Froelich, D. Stow - 3 to 4.

Results from ODP 110 showed that methane from deep in the sediment pile is moving along the decollement. Fluid flow is apparently fault controlled. The new drilling proposes to drill along the accretionary prism to investigate changes in sediment patterns and fluid flow along strike. The proposal represents a large drilling effort with 20 some sites and 10 km of drilling. It takes a broader view of the prism environment than does the Cascadia drilling proposal, which is hydrologically driven. The objectives are primarily tectonic including the structural development of the prism. It proposes to study the timing of events. For SGPP, the themes of fluid circulation and sources are too broadly stated and need to be developed further. The diagenesis objective was left out in the submitted copy of the proposal. Discussion was as follows:

Goldhaber - proposal is a good integrated approach to study a prism which has varying thickness and sediment type, i.e. mud vs. sand.

Stow- proposal could pinpoint sedimentary geometry tying it to seismics and the thinning of sedimentary blanket.

Goldhaber - proposal is immature in that objectives are written in very broad generalities and the available data are mentioned but not given.

Westbrook - proposal is a product of R. Speed's attempt to meet 1 August deadline. There will be a supplementary proposal coming. Westbrook, a co-proponent of the proposal, wanted to show overheads supporting the proposal but was refused.

343/A - Cretaceous Carribean volcanics
J. Mienert, M. Ito, N. Christie-Blick, - 1 to 2.

344/A - Atlantic Magentic Quiet Zone
Not within SGPP mandate - 1.

345/A - The West Florida Continental Margin, Gulf of Mexico: Sea Level and Paleoclimatic History
N. Christie-Blick, D. Stow, S. Macko - 3.

The proposal is to evaluate the timing and amplitude of eustacy with mainly Neogene targets. The approach may be too simplistic. Six sites and 40 days of drilling are proposed. In addition, drilling should obtain data on the formation of tertiary phosphorites, history of the Loop Current and fluctuations of melt (fresh) water inflow into the Gulf. It is not entirely certain what effect the Loop Current would have on the sedimentary record of eustatic change due to its erosion potential. Another problem may be that the subsidence history is not as simple as the proponents suggest. (See hand-out from N. Christie-Blick).

346/A - Equatorial Atlantic transform margin
Not within SGPP mandate. - 1.

347/A - S Equatorial Atlantic
J. McKenzie, J. Boulegue - 1 -100% paleoceanography (OHP)

348/A - Upper Paleocene to Neogene Sequence Stratigraphy: The Ice House World and the U. S. Middle Atlantic Margin
J. Mienert, D. Stow - 4.

The proponents want to drill a transect across the N. Atlantic passive continental margin to calibrate deep to shallow water sedimentary sequences with the seismic record and tie these to the oxygen-isotope record for Miocene-Oliogocene ice volume changes. This is generally a very mature proposal which could feasibly provide constraints on the timing of sea-level events and the actual magnitude (amplitude) of change. A new seismic survey will be made in 1990 with 15 m resolution.

349/A - Drilling into the Clastic Apron of Gran Canaria: Evolution of a Linked System Volcanic Ocean Island - Sedimentary Basis
H. Elderfield, J. Boulegue - 3.

The proposal should really have a ranking closer to a 2a than a 3. It is a case study of interplate volcanism and is basically a LITHP proposal. A good land-based study is available, which the proponents would like to tie to sediments in the off-shore, submarine areas. The sedimentary aspect of the proposal could be related to both global mass balance as well as volcanoclastic sediments. Potential geochemical aspects of the proposal have not been developed. The framework of the proposal has potential for SGPP if it were developed. Nevertheless, the proposal looks very interesting. Normark expressed concern that what is identified as a debris flow could be a volcanic failure resulting in loss of stratigraphic control. A new site survey will be made in June 1991, so action is not pressing.

59/A Rev. - Continental Margin Sediment Instability Investigation by Drilling Adjacent Turbidite Sequences
D. Stow, M. Ito - 4.

The upper 20 m in the target area, the smallest deepest abyssal plain in Madeira basin, has been extensively studied as a radioactive waste deposition site. The proponents would like to:

1. date large turbidites and correlate them with sea-level changes,
2. test model for periods of erosion and growth of N. W. African margin, and
3. correlate distant turbidite layers.

With drilling it could be possible to make a sediment budget for the whole abyssal plain and reconstruct the timing of events. Other objectives include dating basement, physical properties of sediments, and diagenesis with respect to the organic carbon budget & redox diagenesis. The latter is related to the so-called "burn-down effect", whereby fresh organic matter is carried to the oxic environment of the abyssal plain with turbidites. The proposal addresses high SGPP priorities, i. e. sediment fluxes and related topics but it is immature and needs to be strengthen, particularly in geochemistry. P. Froelich pointed out that, although "burn-down" diagenesis in piston cores can be significant, it is questionable what can be learned from the study of this process in a deeper hole. This idea needs to be further developed. J. Mienert suggested that the ability to make a sediment budget in the target area is very difficult because of stratigraphic problems. Correlation among piston cores was questionable and will become even worse in older sediments. The proposal would promote technology.

350/E - Gorda deformation zone
M. Goldhaber, S. Dreiss - 2a - needs a second review, has secondary implications for sedimentary processes.

351/C - ODP Proposal for Bransfield Strait, B. C. Storey et al.
E. Suess, J. Boulegue - 3.
This proposal, which is to drill a young back-arc basin in the Antarctic Straits, has mainly lithosphere objectives related to petrogenic processes. The lithosphere and petrology goals are well-documented. There are, however, two other objectives which may be of interest to SGPP: 1.) a climatic theme (OHP) together with ice margin sedimentation and 2.) a geochemical, hydrothermal theme, i. e. the study of hydrothermal alteration of siliceous-rich, carbonate-poor sediments in a back-arc rifting zone. Although the global climatic objectives are well-documented, the scientific objectives for studying the hydrothermal system are very poor developed. Much more could be done with this latter theme, which could document a case for an integrated study. Although the proposal would be carried by another panel, SGPP could have an input, particularly, concerning the hydrothermal aspect. A fourth tectonic objective concerns Indean-type orogeny in an extension of a South American oil basin. The proposal should be rated 3 if the hydrothermal aspect is strengthened, but only 2a, if not.

The following proposals arrived late and will be held over for internal review during the Santa Cruz Meeting, 14-16 January, 1990:

352/E - Mathematician Ridge
H. Elderfield, J. Boulegue - .

353/C Rev. - Pacific margin of the Antarctic Peninsula
N. Christie-Blick, M. Ito - .

354/A - Angola/Namibian upwelling
J. Mienert, P. Froelich - 2a - has diagenesis and phosphorite objectives.

355/A - Peru gas hydrates
M. Goldhaber, F. Prahl -3.5.

Miscellaneous

Open Discussion on Proposals for Sea-level Theme

It was noted that there are currently 6 proposals with SGPP which related to the sea-level theme, i.e. 203/E (Cretaceous guyots in the Northwest Pacific, E. L. Winterer et al.) discussed in Lamont and 335/E, 337/D, 338/D, 345/A, & 348/A discussed in Kiel. It was recognized that there are two basic approaches to obtain the record of sea-level change, i. e. drilling on atolls and on passive continental margins. The two atoll proposals (203/E & 335/E) may have to be combined into a single proposal. The feasibility for using bio-, chemo-, and magneto-stratigraphies to date atoll and guyot sediments must be evaluated; a task for OHP. Also, two of the proposals (335/A & 348/A) have strong implications for OHP. The success of drilling in these targeted areas will be directly linked to technologic developments(i.e. sand drilling), which will enable good recovery.

At the Lamont meeting SGPP was asked to rank proposals for the FY 91 schedule and highest priority was given to hydrothermal processes at sedimented ridges and the Cascadia accretionary margin. **At that time the atoll and guyot proposals were not included in the list that SGPP was asked to rank. As the sea-level theme does have a high SGPP priority, some open concern about this omission was expressed. If a slot in the FY91/92 schedule should appear, SGPP would like to unofficially request that PCOM consider inserting a mature atoll/guyot proposal into the Pacific drilling program.**

Sea level will be a prime item for discussion on the agenda for the January meeting and will revolve around the sea-level related contents of the White Paper and USACC Workshop Report.

Preparation for 16-17 November CEPAC/DPG Meeting

Martin Goldhaber agreed to serve as the SGPP liaison to the **CEPAC/DGP meeting** to present the panel's justification for highest ranking of (1) hydrothermal processes at sedimented ridges and (2) the Cascadia accretionary margin for the FY91 schedule. A document drawn from the SGPP minutes and other sources should be written to justify SGPP's highest rankings. SGPP's conception of the Cascadia drilling means the Oregon margin because fluids, sediments and hydrology are a documented and integral part of the drilling proposals. Sedimented ridges justification is from the previous meetings discussions and is in the minutes. It should also be noted in the

document that, although SGPP ranked drilling EPR with a much priority than the higher two, the panel feels strongly that drilling should occur only on an hydrothermally active segment of the EPR.

This justification will be a direct input to CEPAC from SGPP and should assist with the planning, as requested in the written directive from R. Moberly.

Update on Central Oregon Accretionary Complex

Fred Prahl presented with documentation new SeaMark data acquired during recent site surveys for the proposed FY91 drilling on the central Oregon accretionary complex. In addition multi-channel seismic profiling for more than 700 nautical miles will be available by the end of October. Areas showing strong back-scattering with the SeaMark survey are of special interest and have been partially investigated during submersible dives. They were found to be sites of active venting. Apparently, precipitation of carbonates around vent sites causes high back reflection. The alignment of high back scatter areas, their elongated, oval shape parallel to ridge crests, and their size (several tens of meters) were particularly striking. These observations will be useful for locating future vents.

Ten drill sites with 500-700 m penetration are proposed. Geochemical reference sites on the abyssal plain and holes on the accretionary complex towards landward verging phenomena are planned. One reference site will be primarily a fluid site, which should provide information about fluid movements associated with dewatering or deformation and will, thus, be located near the deformation front.

New Proposals from Australia

Chris van der Borch reported on themes of prospective Australian drilling
- the Australian Southern Oceans margin, an E-W spreading ridge moving northward
- the northern Australian margin, a continental-arc collision zone. There will be 3 main themes:
- lithospheric extension between Antarctica & Australia
- magmatism during opening of Southern Ocean
- sea-level and paleoclimatic record.

A number of proposals are currently in various stages of development.

New SGPP Members

The panel is most pleased do learn that Bill W. Hay has accepted the invitation to join SGPP and will attend the January meeting. A second new member with an expertise in seismic stratigraphy has been requested, but it has been suggested that this individual be W. Normark's replacement, after he leaves the panel in January, 1990. Roger Flood has been suggested. An ocean crust petrologist is still badly needed. **Action**. W. Normark will forward Flood's c.v. to E. Suess to present at November PCOM meeting.

NEXT MEETING SCHEDULES

14-16 January 1990 - Santa Cruz, CA - The meeting, hosted by S. Dreiss, will run for 3 days with a possible half-day field trip lead by Dr. R. Garrison to see outcrops of the Monterey Formation. It is best to fly into San Jose airport and take the van to Santa Cruz; reservations are necessary. Plan to arrive Saturday evening and leave Wednesday morning. Let S. Dreiss know arrival times well in advance.

24-25 September - Paris, France - The meeting will be hosted by J. Boulegue and a one day excursion to the Diois area to see uplifted sea-floor containing Jurassic black smokers and black muds is tentatively planned.

Summary

Required from SGPP for November PCOM Meeting

* **White Paper** -executive summary + technology
  -input from other panel members
* **Fluid sampling document** -reduced version containing two topics
  - pressurized core barrel
  - shipboard sampling protocol
* **Justification of 1991 drilling priorities**
  -to be included in minutes from Kiel (still to come)
* **First ranking of 1992 drilling priorities** (48+ proposals)
  -with final priority list provided for April PCOM meeting

E.Suess
GEOMAR
Kiel, 23 October 1989

APPENDIX: SGPP MEETING 19. - 20.09.1989, KIEL

OCEAN DRILLING PROGRAM

SUMMARY STATEMENT SS-0300

UNCONSOLIDATED FORMATION RECOVERY

Introduction

Coring in unconsolidated formations is commonplace in ODP operations. Ordinary pelagic oozes, unconsolidated muds and semi-consolidated clays are cored with normally very good results using the Advanced Piston Corer (APC). More indurated mudstones, claystones, conglomerates and clay/sand mixtures are cored using the Extended Core Barrel (XCB) with results varying from poor to very good depending on the sometimes subtle differences in formation physical properties. Fully competent, lithified rock is normally cored using the Rotary Core Barrel (RCB).

Another category of sediments which cause more difficult coring problems are uncemented sands, turbidites, and loose or friable sediments which tend to be structurally destroyed during the coring process prior to becoming entrapped safely in the core barrel. Recovery in such formations has historically been difficult and sometimes impossible for DSDP/ODP. In the past, loose sands have been designated as scientific targets in a number of settings (e.g. submarine fans) or have been encountered by chance in holes aimed at other objectives. In many cases they have been cored with little or no satisfactory undisturbed recovery.

This Summary Statement outlines ODP's recognition of the unconsolidated formation recovery problem and attempts to detail the current technology available to cope with this problem both inside ODP and in the Oceanographic and Oilfield sectors. It also explains the developments now underway by ODP Engineering to improve upon the current state of the art for future ODP operations.

Oceanographic Tools and Techniques

In the course of core sampling the sea and ocean floor in support of oceanographic survey work a range of core sampling tools and techniques have been developed. Selection of the appropriate tool and technique tends to depend on several factors but will ultimately be controlled by formation.

Push coring, limited to upper layer sediments, relies on a reaction force to overcome the resistance of the formation to the entry of the core barrel. A seabed frame or template is generally deployed and a hydraulic jack is utilized to push the core barrel (or insitu test probe) into the unconsolidated material.

Gravity coring, used in limited water depth applications, utilizes a high velocity penetration of unconsolidated formations under the influence of a falling weight to achieve core recovery. Core catcher and internal valve arrangements are employed to protect core during withdrawal from the seabed and recovery through the water column. The technique is dependent on knowledge of the relationship of the corer to the seabed through metering and acoustic measurement to ensure best possible control of the tool during coring.

Piston coring, in effect an extension of gravity coring, allows deployment in ocean depths where gravity core control would be difficult, if not impossible, to achieve. System design and a preset free fall distance determine core barrel energy and velocity of approach to the formation. A piston positioned within the core barrel immediately above the core cutter and core catcher, helps to minimize core disturbance and displaces water from the core barrel during penetration minimizing resistance to entry of core material into the barrel. Bypass valves and shear pin techniques are used to minimize core extrusion and flow-in on withdrawal of the coring tool from the seabed particularly in the event of only partial penetration.

Vibro-coring tends to be used where formation resistance is greater than can be overcome by gravity and piston techniques. Generally this type of coring is electrically or electro-hydraulically achieved and therefore has depth limitations less than that which is possible by the other techniques. It is, however, a more effective method for achieving core recovery in many compacted and sandy formations. The introduction of impaction or percussion may also enhance the ability to core in more compacted materials.

With the exception of vibration coring, the foregoing techniques are in effect available through the ODP drillstring with the tools and techniques now in use by ODP.

Oilfield Tools and Techniques

Mud Control / Hole Stability A significant amount of research has been conducted in the oil industry in the past decade concerning core recovery in unconsolidated sands. Several important hydrocarbon reservoirs have been discovered where loose sand formations constitute the zones of interest, notably the Faja Petrolifera del Orinoco oil sands in Venezuela and the sands of the Green Canyon Area in the Gulf of Mexico. Both field

experimentation and laboratory model testing has been conducted on coring tools and techniques to optimize undisturbed core recovery in those formations.[5,6] Unfortunately for ODP the best results in such uncemented sands have been obtained by application of over pressure in the wellbore achieved by careful control of the mud system used. This approach to sand stabilization and enhanced core recovery is not available to ODP because mud return circulation via a riser would be required. Many oilfield successes are reported in the literature and by word of mouth about core recovery in sand formations which are determined through further investigation to be zones that are naturally stable enough to withstand the mechanical and pressure disturbances of the coring process. In similar formations, current ODP techniques (APC and XCB) achieve good results also.

Because the oil industry is obliged to drill and core with full time mud recirculation they have another set of advantages unavailable to ODP. In any given formation the mud system is selected to produce a stable mud cake on the wall of the hole which promotes hole stability while drilling. This leads to less fill in the hole between core runs. It also promises less troublesome (or catastrophic) hole problems (e.g. total collapse of the hole) which allows the drillers to continue deeper in the formation before abandoning (or casing) the hole. Generally lower circulation rates can be used while coring (as compared to ODP practices) since the mud system is much more efficient at cuttings removal than seawater as used by ODP. These lower flow rates help to reduce detrimental core washing effects. Oilfield practice also commonly calls for several selected casing strings to isolate unstable intervals so that drilling and coring can continue safely at greater depths. All of these factors make the probability of success for the oilfield coring contractors higher than for ODP.

Rubber Sleeve Core Barrels In any discussion of oilfield coring attempts in unstable sands rubber sleeve core barrels (RSCB's) are inevitably mentioned. The literature reports that RSCB's have sometimes been successful and sometimes not, and certainly do not represent any panacea for sand coring problems.[3,4,5,6]

Although RSCB's have been produced in several forms in the past the only current supplier of the service and equipment is Eastman Christensen. They make one size (6-7/8" O.D., 3" x 20' core) which is not wireline deployable. The concept of encasing the incoming core in a tight rubber sleeve is excellent. The mechanism which accomplishes this is ingenious. It uses a telescoping section with a 2-foot stroke similar to DSDP/ODP bumper subs to decouple the core bit from the drillstring. As the drillstring is rotated from the rig floor it is held motionless in the vertical direction while the RSCB advances to cut the core and wrap it in the rubber sleeve. Since it is mandatory that the drillstring be vertically motionless this design makes it completely impractical for use from a floating

vessel even if the best possible passive heave compensation is employed.[3,4] Thus the RSCB is not useful for ODP operations even if a pipe round trip for each core was considered acceptable.

If a different style of RSCB, suitable for ODP operations, was developed it is doubtful that recovery in loose sands would be greatly improved. The RSCB only improves upon more routine coring techniques in terms of: (1) core protection after the core has entered the barrel, (2) improvement in the efficiency of core catchers attempting to retain loose materials, and (3) helping to support the weight of core already in the barrel to prevent jamming of core attempting to enter. If the primary problem is inability to get the core to remain stable enough to get it in the core barrel in the first place, only item (3) above would offer any improvement. It is doubtful that detail alone would have a dramatic impact on sand coring success.

Full Closure Core Catchers The issue of adequate and appropriate core catchers for service in unconsolidated sediments is fundamental. The oilfield literature extensively analyzes this question and points to the necessity for core catchers which open fully with no restrictions to incoming core then close totally to prevent any core loss by fluidic leakage.[1,2] Christensen has a special core barrel which is offered to solve this problem specifically. Examination of this technology has led ODP Engineering to conclude that our standard flapper core catcher is as good or better than any similar device used in the oil or oceanographic industries. In DSDP/ODP operations when virtually unrecoverable loose sands have been encountered in XCB or RCB holes experience has shown that alterations in core catcher types almost never net any improvement in recovery. This strongly suggests that the recurring problem is one of getting the core material into the core barrel rather than one of retaining the material after it has been captured.

ODP Tools and Techniques - Existing and Developmental

Advanced Piston Corer The most notable successes in DSDP and ODP operations in coring loose sands have come when using piston coring techniques. Legs 96, 113, 116, and 117 all cored submarine fans using the APC with some success. On Leg 126 considerable success was experienced with the APC in uncemented vitric volcanic materials including sands and pebbles.

The APC system has the advantage of eliminating the problem of stability of the formation at the core cutting interface. If the core barrel will penetrate the formation it is assured to form a core inside the core barrel. Problems and shortcomings of the APC system in unconsolidated formations focus around: (1) inability to penetrate the full 9.5m of the APC stroke due to material incompressibility, (2) flow-in disturbance and false core after incomplete strokes, (3) core disturbance caused by other factors (e.g. weather/ship's heave, friction, drag and

corehead pressure effects), and (4) getting the APC permanently stuck because overpull to extract it tends to exceed the tensile strength of the piston rods (most common in formations containing at least some clay).

Looking at the above items in more detail, incomplete penetration of the APC in loose sands is only a problem in terms of time spent in coring to any given target depth. If the scientific objective has a high enough priority to justify slow progress (e.g. as little as 1-2 meters per core) the APC approach is viable. Flow-in disturbance after incomplete cores results when the core barrel is retracted from the formation after the initial stroke. The piston head is pulled to the top of the core receptacle and the flow-in material is sucked into the core barrel like a blood sample into a hypodermic syringe. In the past this has been a significant problem. Not only is the flowed-in portion of the recovered core generally worthless (and sometimes difficult to identify on the description table) it also camouflages the actual length of "true" core taken after a partial stroke. The driller then has no means to determine how much to drill down for the start of the next core and must play it safe and drill at least a depth equivalent to the measured core as it appears on deck. A prototype breakaway piston head for the APC was deployed on Leg 96 in an attempt to eliminate that problem. It worked on the test bench but not downhole. An improved version is now under development by ODP which, if successful, will virtually eliminate flow-in core. It will allow the piston head seals to be completely bypassed when retrieval begins thus obviating the reverse hypodermic affect. This, in turn, will allow the driller to advance the core bit only the distance of the recovered core which will normally be accurate as first measured (APC Advance-by-recovery method).

When the APC becomes stuck after shooting into the formation it is common to have to exert 20,000 to 130,000 pounds of overpull to extract it. If the core barrel does not come free at 130,000 lbs it generally is pulled apart at the piston rod weak link. This then junks the hole forcing a redrill operation in an adjacent hole if deeper penetration is desired. Normally the coring system is changed to the XCB at that time as well. Desire to avoid losing the APC hole (and the APC itself) due to excessive overpull commonly leads to a conservative approach where APC "refusal" is defined somewhat early. An upgraded version of the APC has recently been developed and will be available starting with Leg 129. The APC-129 version will improve on the present situation in two ways. It will feature piston rods capable of sustaining over 200,000 lbs of overpull for extraction. It will also provide a bearing-landing-shoulder feature which will allow a stuck APC barrel to be successfully drilled over by advancing the core bit until the material holding the core barrel has been drilled away. These two enhancements will enable the operators to safely continue APC operations much deeper into hostile formations.

Extended Core Barrel The XCB system has enjoyed some successes in sandy formations in the past. If any binding material is available the XCB has a chance of getting acceptable core recovery for many scientific objectives. Recent improvements to the XCB system include significant strengthening of the core barrel connections where torsion failures have occurred in the past, and inclusion of a flapper-type, full closure core catcher for XCB use. Both of these improvements should enhance XCB recovery possibilities and penetration depth potential in unconsolidated formations.

Vibracorer Extensive work carried out in several parts of the world in areas of vibration or vibro-impact coring have demonstrated the potential of this form of coring for application to ODP operations. The techniques, although not the answer to coring in all unconsolidated formations, have been tried and tested and do enhance core recovery where push coring and piston coring fail. Applied in areas of offshore mineral resource evaluation (e.g. European offshore sand and gravel surveys, Southeast Asia heavy mineral exploration) and in offshore site investigation for geotechnical requirements (e.g. coastal developments, seafloor emplacements, pipeline and cable routes) vibration and impact coring has become accepted by both industry and research study groups.

Due mainly to lack of commercial application, limited work has been undertaken to develop downhole, wireline retrievable vibration or percussion coring equipment. However, research and design work, motivated by achieving higher drilling rates, has been undertaken to develop downhole hammers. These units, when mounted in the drillstring and activated by mud flow and pressure, will induce a reciprocating force behind the drill bit introducing vibra-percussive drilling to hard rock formations.

It is a development of this work which is being considered for transfer into the design and manufacture of a prototype vibration or percussive coring tool for ODP. It is accepted that some disturbance of core will occur. With existing vibrocoring and vibro-impact systems, however, core disturbance, although to a degree formation dependent, tends to be concentrated in a zone adjacent to the core barrel liner. For the ODP tool an attempt will be made to provide for variation of vibration amplitude and frequency, by mechanical presetting prior to deployment and subsequent control of driving fluid flow. This facility will be used to maximize core recovery and with experience potentially minimize core disturbance.

Bailer Tool As a low cost alternative in those cases where recovery of loose materials proves to be simply impossible, ODP intends to deploy an off-the-shelf oilfield tool called a bailer. It is an in-the-pipe grab sampler and will be deployed when routine coring attempts fail to recover any core at all over an interval of several successive cores. The bailer will offer no more than the possibility of a cupful of material which will

certainly be disturbed. However, it will fill a gap that currently exists in certain ODP operations and enable identification of intervals of zero recovery with some form of minimal sample.

Hole Stability in ODP Operations Unlike the oil industry, ODP success at recovering cores in unconsolidated formations, especially loose sands, cannot be divorced from the ability to stabilize the hole above the zone at which the coring is taking place. ODP is not able to take advantage of a recirculating mud system to apply hydrostatic over pressure and produce a mud cake. Also, a planned multiple casing system and the time necessary for installation is not generally a part of ODP holes. Without either of these formation stabilization techniques coring operations are often dominated by hole cleaning requirements rather than coring hardware or technology. In formations that lack the property of self-stabilization it is necessary to remove fill and sloughed materials as fast as they accumulate. The pumped flow rates that may be required for such hole cleaning are often counter-productive to coring and commonly lead to increased hole erosion.

The alternative approach in highly unstable formations is to wall off the loose material to prevent ingress into the wellbore. In almost all cases, setting casing strings is possible in ODP holes only if a reentry cone is first emplaced on the seafloor to act as a casing hanger. The exception to this rule is a Drill-in Casing system (DIC) developed by DSDP. It was deployed once during DSDP but without full success. It has been revamped for use by ODP but never deployed. At best it offers the possibility of casing off a single, unstable zone without requiring a reentry cone. The geometry of the DIC components would limit the hole to a single bit, 9-7/8 inch diameter with no reentry possibilities. Thus, it would be a poor choice for coring loose materials if the standard RCB roller cone bit and coring system was used. A special 9-7/8 inch PDC core bit for use with the APC and/or XCB coring systems would be an option. This approach has never been tried, however, and success would depend partially on whether or not PDC cutters could withstand the duress of drilling-in the casing string prior to beginning the loose formation coring operations.

ODP also has a Triple Casing String system inherited from DSDP which is available but has never been deployed. It allows up to three casing strings to be hung from a reentry cone to wall off successively deeper zones of unstable formations. The innermost string would be 11-3/4 inch and would prohibit the use of a standard 11-7/16 inch APC/XCB roller cone core bit. Therefore, a specialized core bit would be required for APC or XCB coring with the same potential problems and restrictions mentioned in the case of the DIC. Additionally, if a PDC core bit was chosen it would be vulnerable to severe cutting structure damage due to impact with the reentry cone.

In summary, conventional hole stabilization techniques using sophisticated mud systems are not currently applicable to ODP operations. The setting of re-entry cones and multiple casing strings and/or use of drill-in-casing systems may help but are unlikely to be off benefit in most unconsolidated coring situations. Although ODP continues to pursue new or applicable technology to aid in solving hole instability problems, major break throughs in this area are not anticipated. Careful site selection will therefore most likely be the most important ingredient in achieving scientific depth objectives.

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9-11-89

Mike Storms

Dave Huey

September 11, 1989
MAS/M09/009

Dr. Erwin Suess
GEOMAR, Research Center for Marine Geoscience
Wischhofstrasse 1-3, D-23 Kiel 14
Federal Republic of Germany

Dear Erwin,

Enclosed you will find the most recent ODP "Summary Statement" (SS-0300) entitled "Unconsolidated Formation Recovery". The preparation of summary statements was initiated several months ago in an attempt to dispel misconceptions which arose concerning the applicability of state-of-the-art industry technology to ODP operations. Earlier SS issues dealt with Hard Rock Orientation and Free Fall Funnel Reentry Capabilities. In addition to clarifying misconceptions, the statements attempt to define the scientific problem statement (as understood by ODP engineering) and explain the current status of the required development within ODP. We feel that the JOIDES panel structure will benefit from this information and that this mechanism will help foster better communications and understanding between the scientific community and ODP development engineering.

Unfortunately the current engineering workload dictates that we not send an engineer to your September 1989 SGPP meeting in Kiel. However, we do appreciate your concerns and hope that you will consider holding a meeting of your sand coring sub-committee here in College Station so that several members of our engineering and drilling operations staff will be able to participate. I certainly agree with you on the importance of getting scientists and engineers together for constructive interactive dialogue. In the interim, I hope that the enclosed document will (1) provide you and your committee members with some valuable information, (2) clear up some misconceptions, and (3) serve as a starting point for discussions aimed at ensuring that the appropriate technology is ready when required.

In general, I would like to reiterate a few points made in the summary statement. First, the idea that industry rubber sleeve core barrel technology is readily applicable for ODP use is not true at all. The Christensen rubber sleeve core barrel requires a round trip of the drill string for each core. However, further investigation has determined that the tool is designed for use on land and the concept, in its present form, is not adaptable to offshore operations.

Ocean Drilling Program
Development Engineering
Drilling Operations
&M University Research Park
1000 Discovery Drive
College Station, Texas 77840 USA
(409) 845-8481
Telex Number: 792779 ODP TAMU
or Easylink Number: 62760290

In talking with the users of the Christensen rubber sleeve system we have determined that while it may preserve the quality of sand cores slightly better than other coring systems it does little to improve actual recovery over that achieved with other coring systems. In our opinion, if you are willing to consider a drill string round trip for each core, then a more efficient, and potentially better, solution would be to use the Advanced Piston Corer ([redacted]) (recognizing that you will get some 'limited' recovery but probably not achieve full stroke). We believe that this technique will become an option once a reliable breakaway piston head is developed. At this time we are just completing the design refinements to a breakaway piston head concept that has great potential. If this tool works as well as we anticipate then it should all but eliminate flow-in disturbance due to mechanical pullout of the APC after incomplete stroke. This means deploying the APC in an "advance by recovery" mode will become a more viable alternative and therefore should allow the APC to be successfully used in a sand coring mode, achieving high percentage, mostly undisturbed recovery.

Where appropriate, it is our feeling that the use of PDC core bits in conjunction with the newly strengthened Extended Core Barrel (XCB) or Rotary Core Barrel (RCB) may satisfy some requirements. In any case our ability to recover sand or sandy material should definitely be better than it has been in the past.

In addition to the modification of existing coring systems, ODP engineering is pursuing the application of oceanographic vibracoring techniques. We feel that vibracoring technology when merged with our standard APC or XCB coring systems, will significantly improve our ability to recover unconsolidated formations - particularly sand. Funding cuts experienced over the past two years have put this development program behind where we hoped to be at this time, however we are hopeful that progress will continue, additional funding will become available, and that this new technology will be developed and operational within the required time frame. Meeting your desired schedule will depend heavily on PCOM priority assignments.

Another important question to be answered is whether hole stability in unconsolidated formations can be maintained long enough to achieve the required scientific depth objective. This portends to be a much more serious problem than that of recovering the core samples. ODP drilling operations personnel are investigating alternative techniques for maintaining hole stability. Operationally, the importance of careful site selection cannot be over emphasized. Particular attention will have to be given to determining sites where science objectives can be achieved while minimizing the potential of unstable hole conditions as much as possible. These two objectives appear to be in complete contradiction with each other. Therefore this particular topic is one in which a round table discussion here at ODP with scientists, engineers and operations personnel all in attendance, would be particularly beneficial and of major importance to the success of any future unconsolidated coring attempts.

If you need any further assistance or information please do not hesitate to call. I look forward to hearing from you concerning the possible scheduling of a joint SGPP sub-committee/ODP meeting.

Best regards,

Michael A. Storms
Supervisor of Development Engineering

MAS:lf

enclosures: SS-0300 "Unconsolidated Formation Recovery"

cc: L. Garrison
B. Harding
R. Grout
A. Meyer
R. Moberly
J. McKenzie
W. Normark