MEETING OF JOIDES DOWNHOLE MEASUREMENTS PANEL

KTB Drillsite Laboratory
Windischeschenbach
Federal Republic of Germany

11-12 September 1989

EXECUTIVE SUMMARY

1. A major component of this meeting was the joint session with LITHP on the afternoon of 11 September.

2. "The long-term sealing of re-entry drillholes is essential for fluid sampling and temperature measurements. Hole-sealing technology should be developed to realise COSOD II objectives."

[DMP Recommendation 89/14]

3. The Wireline Packer is due for delivery before the end of 1989, about one year behind schedule, with no overspend. First deployment is the Nankai Leg (131).

4. The Geoprops Probe was contracted to Tam Inc. in June 1989. Official delivery time is 9 months ± 2 months from that date. Unofficial expectations are for delivery in November 1989.

5. "A TAM representative should be invited to the next meeting of DMP to report directly on the status of the wireline packer and the geoprops probe."

[DMP Recommendation 89/15]

6. A Job Description has been formulated for the JOIDES Logging Scientist.

[DMP Recommendation 89/16]

Panel view was that this should be published in the JOIDES Journal.

7. High temperature logging remains the biggest challenge facing the Panel.

"A high-temperature logging tool combination rated to at least 350°C be developed by the logging contractor to address as many as possible of the following scientific needs identified by LITHP and listed below in decreasing order of priority.

1. Temperature
2. Borehole Fluid Resistivity
3. Formation Resistivity
4. Natural Gamma
5. Sonic
6. Caliper
7. Flowmeter
8. Borehole Fluid Pressure

These objectives are to be achieved by repackaging existing tools, not by the development of new tools."

[DMP Recommendation 89/17]

8. "Funds for the development of the high-temperature tool combination, currently allocated as $300,000 for tool hire during FY91 and FY92, should be made available as soon as possible to allow the redirected initiative to be brought to fruition before the estimated tool deployment date of mid-1991."

[DMP Recommendation 89/18]

9. "A JOI-supported inter-programme workshop on high-temperature logging should be planned, and scheduled to take place before mid-1990, in order to develop the necessary engineering science for the longer term."

[DMP Recommendation 89/19]

10, DMP support the following recommendations of the Sedimented Ridge DPG.

(i) The Barnes-Uyeda tool be modified for higher temperatures (up to 200°C) and be made stronger.

(ii) A slimline self-contained probe be developed or acquired to measure temperatures up to 350°C.

Further, DMP support the development of a high-temperature fluid-sampling capability.

11. The deployment of the Formation Microscanner (FMS) is a major success.

"LDGO and TAMU should give high priority to ensuring that full shipboard image processing facilities are available for FMS data. Consideration should be given to incorporating the FMS-dedicated microvax within the TAMU vax cluster."

[DMP Recommendation 89/20]

12. Panel considered that the spinner flowmeter plus injection method constitutes a potentially viable approach to downhole permeability determination subject to solving the problems of heave compensation and packer deployment. The proponent (R Morin) was encouraged to liaise with TAMU to obtain advice on how these problems might be solved.

13. A search committee (Worthington, Sondergeld, Hutchinson) has been formed to nominate replacement candidates for Eddie Howell. A replacement from industry is to be sought, preferably with a tool development background.

14. The next DMP meeting is scheduled for 23-24 January 1990 in College Station, Texas. This is one week later than originally planned to allow Andy Fisher to host. It is hoped to arrange sessions with TAMU engineers and computer specialists during the meeting.

PAUL F WORTHINGTON
25 September 1989

MEETING OF JOIDES DOWNHOLE MEASUREMENTS PANEL

KTB Drillsite Laboratory
Windischeschenbach
Federal Republic of Germany

11-12 September 1989

MINUTES

Present

Chairman:	P F Worthington (UK)
Members:	B Carson (USA)
	J Gieskes (USA)
	E Howell (USA)
	M Hutchinson (USA)
	D Karig (USA)
	R Morin (USA)
	C Sondergeld (USA)
	R Wilkens (USA)
	H Crocker (Canada/Australia)
	J P Foucher (France)
	H Kinoshita (Japan)
	H Villinger (FRG)
Liaisons:	R N Anderson (LDGO)
	K Becker (LITHP)*
	D Cowan (PCOM)
	A Fisher (TAMU)
	X Golovchenko (LDGO)
	J Mienert (SGPP)
Guests:	S Bell (Canadian Geol. Surv.)
	E Huenges (KTB)
	K Moran (SMP)
	M Zoback (Stanford Univ.)
Apologies:	P Lysne (USA)
Absent:	O Stephansson (ESF)

* The entire JOIDES Lithosphere Panel was in attendance for agenda item 8 which was conducted as a joint session.

1. Welcome and Introductory Remarks

The meeting was called to order at 9.00 am on Monday, 11 September 1989. The Chairman welcomed DMP Members, Liaisons and Guests to the first DMP meeting to be held outside the USA for about three years. Kate Moran was attending to provide an update on the Lateral Stress Tool (LAST) and Mark Zoback had been asked to provide an account of the chronology and status of the Wireline Packer from his sub-contractor standpoint. A key aspect of this DMP meeting was the joint session with the JOIDES Lithosphere Panel, scheduled for the afternoon of Day 1, at which the focus was to be on high-temperature slimhole logging. The Panel meeting was to be followed by a logging workshop with the German Continental Deep Drilling Project (KTB) at which it was proposed to share experiences and to explore possibilities for collaboration.

The Chairman noted that this was the second consecutive meeting at which the ESF Representative had been absent (without apology). Chairman to contact Dr Stephansson to see if there are any communication problems.

[ACTION: WORTHINGTON]

Review of Agenda and Revisions

The pre-circulated agenda was modified as follows.

(a) Item 4(i) - Wireline Packer
[ZOBACK]

(b) New Item 4(vi) - Formation Evaluation Tool
[CROCKER]

(c) New Item 10(iv) - BHTV Software
[ZOBACK]

(d) New Item 14 - Spinner Flowmeter
[MORIN]

(e) New Item 15 - Panel Membership
[WORTHINGTON]

(f) New Item 16 - Measurement while Drilling
[WORTHINGTON]

(g) New Item 17 - Interwell Studies
[WORTHINGTON]

(h) Renumbered Item 18 - Other Business
[PANEL]

(i) Renumbered Item 19 - Dates and Formats of Next DMP Meetings
[WORTHINGTON]

With these modifications the pre-circulated agenda was adopted as a working document for the meeting.

2. Minutes of Previous DMP Meeting, La Jolla, California, 23-24 May 1989

The minutes were adopted with the following modifications.

Page 4, para 4, sentence 2:

replace with

"The tool is approximately 9 cm in diameter."

Page 13, para 5:

line 4; ERI for ORI

line 5; should read

"Oblique seismic/electric experiment - ERI ..."

line 6; ORI for ERI

The Chairman signed the master copy for ODP records.

Matters Arising

(a) French High-Resolution Magnetometer

Foucher reported that the tool is unlikely to be ready for Leg 129. Total CFP are positive about its future availability to ODP. Tests are scheduled for the North Sea in the near future. A constraint is the need for a sea-bottom observatory while the tool is in the hole. Vertical resolution is about 50 cm.

(b) Sealing of Drillholes

Fisher reported that during the previous DMP meeting there was a general discussion of plans for FY 91 to drill (1) on and near the crest of the EPR, (2) on and near the ridge crest of the Chile triple junction, and (3) on and near the sedimented Juan de Fuca and Gorda Ridges. Several DMP members expressed interest in developing the necessary technology to plug a re-entry drill hole in these settings, so that the fluids in the hole would have a chance to equilibrate (both geochemically and thermally) with the surrounding rock. Mike Storms at TAMU has indicated that the following techniques might be available to the ODP, given sufficient lead time for development and testing.

1) 'Packing' the top of a re-entry cone

It is a standard oil-field technique to place a packer near the top of a well and seal it in place with cement. This method has the advantage that it may be possible to purchase "off-the-shelf" components to complete this procedure. In addition, the composition of fluids and rock in the hole would be little altered during emplacement of the seal. Upon return, the drill ship would simply locate the cone, run pipe to the sea floor, and drill through the cement and packer. This technique has the added advantage that it would require little additional lead time.

2) Sealing several levels within a single hole

This is also a fairly standard procedure. The hole is filled to some level of interest with heavy mud, and the drill bit is pulled to the top of this section. A slug of cement is 'floated' on the top of the mud where it solidifies. This process can be repeated several times at different levels in the same hole. Cement is easily drilled out upon re-entry of the hole. The mud will help to reduce free convection and mixing in the sealed hole, and so will speed thermal equilibration, but will also contaminate fluid samples. This procedure could probably be accomplished with little lead time and with off-the-shelf materials. It may also be possible to place several packer-cement plugs (as described above) in a borehole, although this would be time consuming and considerably more expensive.

3) Resealable plugs

It should be possible to place a removable lid in a re-entry cone so that the hole can be re-opened by a drill ship, a submersible, or a conventional ship with wireline re-entry capabilities. This possibility requires the most lead time (certainly at least 1 year for development and testing) and would probably also be the most expensive and time consuming to deploy.

In order to undertake any of the above options to develop a method for plugging a borehole, it will be necessary to direct appropriate engineering effort. As the ODP/TAMU engineering group is currently occupied with numerous other projects (DCS, Navidrill, PCB, packers, etc.) development of technology to plug a borehole for later re-entry might cause other projects to be delayed, postponed or dropped. The engineering group needs to be given specific priorities for projects of this kind, including a clear description of the scientific objectives to be addressed.

DMP Recommendation 89/14

"The long-term sealing of re-entry drillholes is essential for fluid sampling and temperature measurements. Hole-sealing technology should be developed to realise COSOD II objectives."

(c) DMP-SMP Collaboration

The Chairman reported that he would be attending the next SMP meeting on 2-3 October 1989. Issues to be raised are:

- DMP view on physical properties
- DMP policy on VSP
- Joint SMP/DMP meeting
- Long-term collaboration, especially as regards the integration of core and log data

The Chairman reiterated the appropriateness of the attendance of SMP Chairman, Kate Moran, at the current DMP meeting.

3. PCOM Report

Cowan reported on the PCOM meeting held in Seattle during the period 22-24 August 1989. PCOM responses to DMP Recommendations 89/9 - 89/13 were as follows.

Rec. No.	Description	PCOM Response
89/9	Logging programme, Leg 129	Supported
89/10	Logging programme, Leg 130 : test Geoprops Probe	Proposal no longer feasible because Geoprops will not now be ready
89/11	Staggering of hostile-environment drilling programmes	Supported, but there are other influencing factors eg. ship scheduling
89/12	Navidrill testing on Leg 130	Navidrill is in a phase of redevelopment: may not yet be able to take core. Too early to test on Leg 130
89/13	Six-month appointment of engineering scientist for high-temperature slimhole logging appraisal	Support; leave to LDGO and TAMU

Other key points:

- geochemical reference leg has not been reinstated in 1990.
- Diamond Coring System (DCS) vs Logging was reviewed. PCOM appreciated that sophisticated logging could not take place with 4-inch DCS holes. PCOM directed TAMU to develop the capability to run ODP logging tools at sites drilled with the DCS. One possibility is a larger-diameter hole dedicated to logging at DCS sites.

- a PCOM liaison to be present at pre-cruise meetings to ensure compliance with approved scientific objectives.

4. Monitor Reports

(i) Wireline Packer

Zoback reported that LDGO had originally become aware of the existence of an Amoco wireline packer which would be relevant to the needs of ODP. Amoco could not develop the tool for ODP, but wished to collaborate on development. Amoco tool would not fit through the ODP bottom-hole assembly (BHA) and therefore modification was needed. Since LDGO are not permitted to develop tools, a contract was sublet to Stanford University to oversee the development. TAM, Inc., had previously built the Amoco packers and they were given the contract to build two tools with the same capability as the Amoco tool, but matched to ODP needs. There was no other packer supplier and the tools were offered by TAM as "catalogue items". TAM ran into two problems, motors and pumps. These problems seem to have been solved. There has been no overspend.

Zoback described the current status of the tool. Overall length is about 13 m. Downhole tests at the Nevada Test Site are scheduled for September/October 1989. Calibration problems in the test chamber are inevitable but solvable. Deployment target is the Nankai Leg.

Anderson furnished the following points of embellishment. The Wireline Packer had failed to deflate on its first field test. The sensors functioned for 24 continuous hours before failing. The samplers worked. A new slimhole motor has arrived and a new pump is being machined. Delivery is "guaranteed" for the end of 1989.

Noting that the tool was about one year behind schedule, the Chairman asked for the date when the contract was signed by TAM, Inc.

LDGO liaison to provide a chronology of key dates in the development history of the Wireline Packer.

[ACTION: LDGO LIAISON]

(ii) Geoprops Probe

Karig reported that TAM, Inc., had increased their estimated costs to c. $176,000 prior to signing the contract. There is also a need for land testing. The land test could be undertaken by TAMU in their test hole for circa $16,000. An extra $40,000 was therefore needed. JOI is funding the land test directly : NSF is covering the overspend.

TAM are just completing the construction drawings. There is some commonality with the wireline packer.

The contract was officially signed in June 1989 with delivery scheduled for 9 months ± 2 months thereafter. Unofficially the tool is expected to be ready by November 1989. There was no alternative supplier.

The tool is scheduled for deployment during the Nankai Leg. Deadline for completion is therefore the second week in February.

DMP Recommendation 89/15

"A TAM representative should be invited to the next meeting of DMP to report directly on the status of the wireline packer and the geoprops probe."

Fisher to arrange.

[ACTION: FISHER]

(iii) Lateral Stress Tool

Moran reviewed the phase 1 LAST tool. LAST tools are designed for soft sediments and therefore for use in the APC zone. Tool is self contained and is attached to the APC. Measurements are pore fluid pressure, lateral stress, and possibly temperature. Tool OD is just under 3 inches.

The LAST 1 chronology/schedule is:

Conceptual design	- Sept 1986
Design	- Feb 1987
First tool completed	- Jan 1988
Bench testing	- Feb - Aug 1988
Offshore field test	- Oct 1988
Redesign	- Nov 1988 - May 1989
Onshore field calibration	- Sept - Oct 1989
Offshore field test	- Nov 1989
ODP Leg 131	- April - May 1990

The tool is on schedule for Leg 131 (Nankai).

A phase 2 LAST tool is under development. This measures the strength of a material and the shear modulus. Provisional schedule for the second LAST tool is:

Conceptual design	- Sept 1986
Design	- April 1989
Tool completion	- Sept 1989
Onshore field test	- Nov 1989

The phase 2 tool is unlikely to be fully field tested prior to the Nankai Leg.

The Chairman complimented Moran on her comprehensive and informative report on a tool which is being developed according to schedule.

(iv) VSP/WST

Wilkens recapped on earlier concern as to what VSP tool was to be used in the Nankai Trough. Schlumberger's seismic acquisition tool (SAT) is too large for deployment. The Woods Hole three-component tool remains a possibility : alternative is the Schlumberger WST. Wilkens will continue to monitor.

[ACTION: WILKENS]

(v) Long-term Temperature Tool

Kinoshita reported on progress towards the Nankai Downhole Observatory. The measuring system is an 800 m thermistor cable within an 1100 m hole (NKT 2). This cable incorporates 19 thermistors and two pressure and temperature crystal gauges at the top and bottom. The entire section will be cased with perforations about every 50 cm. There is a downhole data logger with acoustic data transmission. It is hoped for a five-year durability. One data reading from thermistors and gauges will be taken each day.

Satisfactory data will be contingent upon closing the hole to prevent fluid venting. Strategy is for a plastic round plate covered by gravel and then cemented. The new Japanese submersible (6500 m depth capability) will be used.

Expectation is for subsequent tool recovery with some milling, and further experimentation, eg. flowmeter studies and seismic observations.

(vi) Formation Evaluation Tool

Crocker reported on an improved wireline formation tester which he is developing for the oil industry. The aims are a true sample of formation fluid, better pressure measurement, steady state drawdowns for improved permeability determination, and in-situ analysis of any recovered hydrocarbons.

The tool has many similarities to the wireline packer. OD is 5.5 inches, length is 5.5 metres. The sensors monitor produced fluids until constancy is established. The sensors are temperature, pressure, density and resistivity: it is intended to add viscosity and dielectric constant. The flow rate is being designed to maximise the chances of constancy being achieved within 30 minutes. There are ten 40 cc sample chambers. A sample may or may not be taken as desired, according to the nature of the fluid. The flow rates can be varied for multi-rate permeability evaluation corrected for formation damage.

The tool has been tested and is being redesigned. A second prototype is scheduled for testing early next year. A commercial tool should be available in about 12 months' time. In principle, such a tool could be made available to ODP, but it would require appropriate modifications.

An extension would be to use with self-locking packers to investigate inflow, eg. through perforations.

In thanking Crocker for making the Panel aware of these interesting developments, the Chairman noted that the tool affords a potential "quantum leap" in downhole hydrogeology in that its multi-rate testing facility might overcome departures due to well inefficiency.

The tool has interesting refinements which could benefit future generations of the ODP wireline packer. Contact with TAM, Inc., should be encouraged. Fisher to arrange.

[ACTION: FISHER]

Crocker confirmed that he would be pleased to collaborate with TAM. If, however, his tool did come to fruition in the future, and ODP expressed an interest in it, he would not consider it appropriate to participate in related discussions since he would hope to have a commerical interest. The Chairman acknowledged the integrity of Crocker's position and stated that the benefit to the Panel in being informed of this future technology far outweighed any other considerations at this stage.

5. <u>JOIDES Logging Scientist - Job Description</u>

Golovchenko and Wilkens presented a draft Job Description for the JOIDES Logging Scientist. This was reviewed, edited and adopted.

<u>DMP Recommendation 89/16</u>

"The following be adopted as the Job Description for the position of JOIDES Logging Scientist.

The JOIDES Logging Scientist is an integral member of the scientific party of an ODP cruise. The position is open to scientists of any discipline (eg. seismology, rock physics, stratigraphy, geochemistry), with or without previous logging experience, who have an interest in using continuously recorded borehole data to add to the scientific success of the expedition. The JOIDES Logging Scientist will receive pre-cruise training in ODP log operations and interpretation from the Borehole Research Group of the Lamont-Doherty Geological Observatory (LDGO).

During the cruise the JOIDES Logging Scientist will assist in the routine processing of all borehole logging data. During logging runs he/she will assist the Lamont Logging Scientist in monitoring operations and will have the primary responsibility for the rapid distribution and explanation of the logging data to the scientific party immediately after the data have been collected. The second major responsibility of the JOIDES Logging Scientist is to be a primary author of the non-operational sections of the borehole logging site reports. A brief operational report will be required at the end of the leg.

Routine post-cruise processing of logging data will be done by the Borehole Research Group at LDGO. Advanced processing and speciality log interpretation (eg. quantitative mineralogy, sonic waveform analysis) may be undertaken by the JOIDES Logging Scientist (at LDGO if desired), by prior arrangement."

Panel expressed the view that this Job Description ought to be published in the JOIDES Journal.

6. Thematic or Synthesis Publications

The Chairman called for proposals in response to a PCOM request which had been highlighted at the previous DMP meeting. The following suggestions were considered worthy of pursuit.

(i) A thematic issue on technical aspects of new downhole instrumentation, eg. wireline packer, geoprops probe, lateral stress tool, Barnes/Uyeda, drillstring packer.

To be pursued in mid-1990 after the tools have been tested. Target journal is Scientific Drilling.

[ACTION: ANDERSON]

(ii) An overview of geochemical logging, possibly using the material of the logging session at the January 1990 geochemical workshop (see item 13). Target journal is AAPG Bulletin. Editor to be contacted to secure approval in principle.

[ACTION: BELL]

(iii) A contemporary paper on the use of logs to recognise Milankovitch cyclicity. Target at general audience, eg. Nature or Geology. Suggested author is R Jarrard. Golovchenko to pursue.

[ACTION: GOLOVCHENKO]

7. ODP Accomplishments and Benefits

DMP have been asked to identify those aspect of downhole measurements that have advanced science. To allow more efficient use of time, Panel were asked to submit their contributions to the Chairman who would then consolidate these into a list for PCOM information. The following is a synthesis of Panel opinion based on the written submissions.

The key contribution of downhole measurements is the physico-chemical characterisation of oceanic lithosphere through continuous measurements at in-situ conditions and at a scale which is intermediate between core data and surface geophysics. Thus borehole logs permit the extrapolation of rock properties away from cored zones. Specific examples follow.

(i) Structure

Sonic logs and vertical seismic profiles have allowed surface seismic sections to be interpreted in terms of lithology in Crustal Layer II where core recovery has usually been poor. This is leading to an improved definition of seismic structure.

(ii) Composition

Geochemical logs have resulted in an improved documentation of geochemical profiles encompassing both the sediments of Layer I (enhanced by logging through pipe) and the basalts of Layer II. This, in turn, is leading to a better evaluation of chemical flux and thereby of the geochemical budget.

(iii) Hydrothermal Processes

Studies of thermal and fluid-flow regimes through heat-flow measurements, packer experiments, and fluid sampling are providing a new basis for evaluating circulation within, and exchanges between, Layers I and II.

Specific inputs are the characterisation of Layer II permeabilities (at site 504B) and identifying the pulsing fluid activity associated with dewatering of sediments in the Barbados accretionary complex.

(iv) Stress

Borehole televiewer logs are identifying principal directions of stress through breakout delineation both within plates and at plate boundaries such as ridge crests. These data are providing a better insight into spreading mechanisms.

(v) Sediment Stratigraphy

The multi-log recognition of Milankovitch cyclicity in ocean sediments has opened the door to a cyclostratigraphy based on truly continuous measurements. A bonus is that the different resolutions of the various logging tools guide the assignment of Milankovitch periodicities to observed cyclic phenomena. This is but one input to an emerging global event stratigraphy with projected log inputs on the seismic, chemo-, cyclo-, magneto-, and litho-stratigraphic fronts.

(vi) Long-term Observations

Recent downhole measurements effected by wireline re-entry of DSDP/ODP holes have confirmed the feasibility of long-term experimentation to monitor earth processes, eg. seismic, thermal. These holes will also be available for future logging surveys as technology advances.

8. High Temperature Slimhole Logging

This item of the DMP agenda was addressed through a joint session with the JOIDES Lithosphere Panel (LITHP). The purpose of the meeting was to exchange cultures in the context of LITHP's projected requirements for downhole measurements in hostile environments. The meeting was co-chaired by the DMP Chairman and the LITHP Chairman, R Batiza. The following are joint minutes.

(i) Proposed Workshop on High-Temperature Slimhole Tools

DMP Chairman reported that ODP needs a strategy for the phased development of logging tools for deployment in high-temperature, and possibly slimhole, environments. Development costs are likely to be extremely high : it is unlikely that ODP would be able to fund these in isolation. There is therefore a need to involve other scientific programmes that face similar problems. As a first step, an interprogramme workshop had been proposed. The aim is to bring together all those scientific programmes with a need for high-temperature (slimhole) logging tools, to identify the existing technology for various temperature and hole diameter scenarios, to agree shortfalls that impact on all programmes, and to set in motion initiatives designed to remedy the identified shortcomings. In this way, it might be possible to share development costs that would otherwise be prohibitive. However, the involvement of other scientific programmes makes the concept more complicated. A pre-workshop planning meeting might be needed to agree an agenda and structure the required inputs. No date has been fixed for either the pre-workshop meeting or the workshop itself. Possible targets are November 1989 and April 1990, respectively. Before then, we need to identify ODP's scientific requirements and what tools are needed to meet them.

(ii) Perceived Scientific Requirements for Downhole Measurements

Davis (CEPDPG, SRDPG) introduced the scientific goals in the context of the East Pacific Rise (EPR) and Sedimented Ridge Crests (SR).

The EPR plan is to drill to about 1.5 km depth bsf as close as possible to the axial magma chamber. The Diamond Coring System (DCS) will be used almost exclusively. Temperatures are not known, but are estimated at about 350°C over much of the depth.

The SR aim is to drill through the sediment pile (200-1000 m thick) and to penetrate as far as possible into basaltic basement. Both the DCS and the Rotary Core Barrel (RCB) will be used. Expected temperature range in the sediment section is 200-400°C. In the basement, temperatures are typically expected to be up to 350°C.

Becker (LITHP) described the required downhole measurements in terms of scientific themes, hydrothermal (at SR and EPR) and magmatic processes (at EPR only).

Hydrothermal	Magmatic
Temperature	Natural Gamma
Pressure	Density
Permeability	Porosity
Discrete Fluid Samples	Stress
Borehole Fluid Logs of pH and Resistivity	Sonic & Seismic Velocities (P and S)

A borehole seal is essential for hydrothermal studies.

(iii) Identification of Technical Shortfalls

Howell reported on the status of off-the-shelf high-temperature logging tools. In general, high-temperature tools require more preventive maintenance. Calibration problems can be expected, especially with slimhole tools and those from different contractors, and therefore calibration blocks are needed on board ship. Laboratory experiments may be needed to verify tool responses at high temperatures. Off-the-shelf high temperature tools do not afford the same reliability as conventional tools and it is usual to ask for three high-temperature tools of each type at the logging site rather than two.

Various (slimhole) service-company tools are available up to 260°C. These provide for all the hydrothermal and magmatic requirements up to this temperature except for:

permeability
pH
stress

Permeability is impeded by the difficulties of packer design and deployment; the strategy would be to use the packer in the cool part of a hole and measure only interval permeabilities. pH is not measured routinely even at low temperatures. Stress measurement using the BHTV is seriously affected by temperature degradation of the cable. Further, a dewared BHTV requires a large-diameter hole; the other measurements (density, sonic, etc.) do not.

Extending the operating temperature range of tools requires additional thermal insulation or hole cooling. Off-the-shelf 260°C logging tools can be double-dewared to reach 300°C at which temperature they would have a typical operational period of 6-8 hours. Double-dewared tools require a large-diameter hole. They cannot be deployed in DCS holes although with (repackaging) modifications to the dewar design they could be slimholed. Difficulties are anticipated with the very high temperature operation of nuclear and sonic tools due to the functioning of crystals and transducers, respectively. Also a teflon cable is needed for operations up to 300°C. For 350°C operation, it would be necessary to cool the 300°C tools.

Hole cooling is very difficult in DCS holes because of the restricted annulus around the tool which impedes circulation. Large diameter holes can be cooled during logging, eg. by using a "toolpusher" system with circulation, in which the SES is deployed with a wet connect and with the (dewared) tool attached to the base of the drillstring. Such a strategy might also require in-hole data recording.

The two possible approaches are:

(a) at DCS sites drill a large-diameter hole, specifically for logging, or

(b) drill each hole with DCS and ream to a larger diameter.

In either case, dewared tools should be used in conjunction with a toolpusher and circulation.

In summary, off-the-shelf temperature and pressure (slimhole) tools exist with ratings up to 350°C, and existing gamma, density, porosity, resistivity and sonic/seismic tools might be dewared in a large-diameter mode to the same temperature rating, especially if deployed in conjunction with cooling.

Anderson proposed the development of a single combination slimhole, 350°C tool string for use as a stand-alone high temperature logging tool either with a logging cable or with downhole recording. Temperature, pressure and fluid and rock resistivity would be logged with this combination. The feasibility of this development will depend on further investigations. Operating a fluid sampler at high temperature and pressure is beyond the capability of the LDGO Borehole Research Group. The development of high-temperature permeability and pore pressure tools is more within the brief of TAMU.

(iv) Future Strategy

A short-term strategy was required to address as far as possible the immediate needs of LITHP, the Central and Eastern Pacific DPG, and the Sedimented Ridge DPG. A longer term strategy should be developed to address those issues that could not be resolved in the short term.

Becker reported that for the short term, the following were the LITHP priorities for downhole measurement at high temperatures to be addressed by the ODP logging contractor.

1. Temperature (all hydrothermal objectives fail without this)
2. Downhole Fluid Resistivity (in borehole)
3. Formation Resistivity (for porosity)
4. Natural Gamma
5. Sonic (preferred over density tool)
6. Caliper
7. Flowmeter
8. Borehole Fluid Pressure

LITHP view was that 1-5 must be measured, 6-8 were of lower priority.

Other LITHP needs are high-temperature permeability and pore pressure determinations and pore fluid sampling.

In the longer term, provision must be made for developments that are too complex or costly to be met before mid-1991. The concept of an inter-programme workshop on downhole measurements at high-temperature should be strongly supported.

After the joint meeting with LITHP, DMP formulated the following.

DMP Recommendation 89/17

"A high-temperature logging tool combination rated to at least 350°C be developed by the logging contractor to address as many as possible of the following scientific needs identified by LITHP and listed below in decreasing order of priority.

1. **Temperature**
2. **Borehole Fluid Resistivity**
3. **Formation Resistivity**
4. **Natural Gamma**
5. **Sonic**
6. **Caliper**
7. **Flowmeter**
8. **Borehole Fluid Pressure**

These objectives are to be achieved by repackaging existing tools, not by the development of new tools."

DMP Recommendation 89/18

"Funds for the development of the high-temperature tool combination, currently allocated as $300,000 for tool hire during FY91 and FY92, should be made available as soon as possible to allow the redirected initiative to be brought to fruition before the estimated tool deployment date of mid-1991."

DMP Recommendation 89/19

"A JOI-supported inter-programme workshop on high-temperature logging should be planned, and scheduled to take place before mid-1990, in order to develop the necessary engineering science for the longer term."

DMP Consensus

DMP support the following recommendations of the Sedimented Ridge DPG.

(i) The Barnes-Uyeda tool be modified for higher temperatures (up to 200°C) and be made stronger.

(ii) A slimline self-contained probe be developed or acquired to measure temperatures up to 350°C.

Further, DMP support the development of a high-temperature fluid-sampling capability.

9. Logging Contractor's Report

Anderson reported that the logging footage per leg continues to climb with logging now being successfully carried out in over 90% of designated holes. In particular, geochemical logs have been run in 41 wells : the tool now contains a boron sleeve.

The bridging problem is technically under control through the use of the side-entry-sub (SES) and salt muds. However, recently the SES has not been fully deployed because a number of BHAs have been lost and replacement stocks had run low. Since the SES increases the risk of loss, its deployment had been restricted. Consequently, the bridging problem has recently become more serious. A new stronger SES is being developed with TAMU help and this is expected to be available in March 1990.

Funding is available for the lease of one digital borehole televiewer (BHTV) from WBK Bochum. This includes training of LDGO staff, six months operation and analysis of the results. An FRG proposal (Fuchs, Karlsruhe Univ.) incorporates some support for the lease of a second tool. Digital BHTV deployment is scheduled for early in FY90.

Anderson presented a synopsis of logging results from legs 125 and 126. The new temperature tool is operational and was upgraded from 55°C to 85°C for Leg 126.

A key success is the new formation microscanner (FMS). This has also been used to identify breakouts for inferring stress directions.

A major problem concerns the FMS-dedicated microvax workstation. This is proving too complex to operate on a leg by leg basis due to a combination of start-up problems and the fact that the software is not easy to manipulate. Consequently there is, as yet, no real-time processing capability on board ship. This means that shipboard scientists do not have access to FMS images and therefore the benefits of core orientation are being lost. There are two possible courses of remedial action, either remove the microvax workstation from the ship to overcome the start-up problems or incorporate the microvax within the TAMU vax cluster.

The Panel expressed grave concern that much of the scientific value of the FMS will be lost if full image processing is not available on board ship.

DMP Recommendation 89/20

"LDGO and TAMU should give high priority to ensuring that full shipboard image processing facilities are available for FMS data. Consideration should be given to incorporating the FMS-dedicated microvax within the TAMU vax cluster."

Kinoshita informed the Panel of progress on Leg 128. The downhole seismometer system, which was delivered late without an explanatory manual, is not functioning well. There appears to be a fault with one of the horizontal sensors. Further information is awaited.

10. Software

(i) Terralog

Foucher reported that IFREMER were interested in obtaining the basic Terralog package for log reading and processing. No other expressions of interest were received.

(ii) Alternatives to Basic Terralog

Hutchinson reported on other options for reading LIS tapes. The National Geophysical Data Centre (NGDC) has placed all DSDP logging data on optical disc. There are plans to extend this archive to ODP data. A new version of Terralog is being conceived to read this information and this might encompass the LIS option. Other alternatives are pc based. The situation is complicated by the fact that Schlumberger is introducing a new LIS format as a standard.

(iii) Future Strategy

The aim of the survey was to facilitate logs getting out into the community. A list of reading options could usefully be included with LDGO log mailouts. The NGDC option still requires a means of access through personal computer. The NGDC compilation of ODP logging data should be effected, in ASCII format, in batches of, say, ten legs. Input should be sought from the JOIDES Information Handling Panel.

Two actions were identified.

The survey information (Item 10(ii)) should be developed into a releasable form.

[ACTION: ANDERSON/HUTCHINSON]

The Information Handling Panel should be asked for their input to a future strategy for ODP log data archiving and access.

[ACTION: WORTHINGTON]

(iv) BHTV Software

Zoback described MAC interactive processing of BHTV data. The ultimate goal is to have BHTV and FMS data side by side. Stanford are developing general log interpretation software for the MAC. This also allows selected targets to be studied. Shipboard users would have to bring their own MAC. The question of shipboard deployment of MAC software should not be considered until the more pressing problem of shipboard FMS real-time processing has been resolved.

11. WPAC Planning

Fisher and Golovchenko reviewed the current status.

(i) Nankai Trough

Programme similar to that outlined at the previous DMP meeting. Plan is to deploy the wireline packer initially in casing.

(ii) Legs 133-135

No further developments. Detailed planning not yet completed.

12. CEPAC Planning

Fisher and Golovchenko reviewed the current status.

(i) Leg 129: Old Pacific Crust

The following departures were noted from DMP Recommendation 89/9.

PIG 1 is now the deep hole and has the same logging programme previously recommended for the original PIG 4 except for the Dual Laterolog. PIG 1 will not be drilled last.

PIG 3-4 are now shallower holes and have the same logging programme as previously recommended for these except that the FMS is to be run in both holes.

The Barnes/Uyeda tool (WSTP) is to be deployed in two holes, as yet unspecified.

All locations are tentative, pending site-survey reports.

(ii) Leg 130: Ontong-Java Plateau

The following departures were noted from DMP Recommendation 89/10.

The re-entry site (now OJP-5) will have standard logs (including FMS) plus BHTV. Shallow sites, now OJP-1, OJP-2, OJP-4, were recommended for FMS logging in addition to the other standard log combinations: the FMS appears to have been omitted from the current schedule. Fisher to check.

[ACTION: FISHER]

The Geoprops Probe will not be ready for testing during this leg.

(iii) CEPAC Themes

No further developments.

13. Proposed Geochemistry Workshop

The Chairman reported that this had now been scheduled for 9-12 January 1990 at the UCLA Conference Center, Lake Arrowhead, California. It is being organised by G W Brass and M Kastner. Kastner had requested input on Geochemical Logging but no further details had been forthcoming. The Chairman hoped that the earlier concept of a geochemical logging session would be developed. Chairman undertook to contact the conveners to progress the initiative.

[ACTION: WORTHINGTON]

14. Spinner Flowmeter

Morin outlined the principles of a flowmeter plus injection programme for determining the vertical distribution of permeability around a borehole. The technique is used in hydrology where it is becoming a standard method. The end result is effectively a series of straddle packer tests but with no packer. The flowmeter can be used in stationary mode or as a continuous log. Where frictional head losses are suspected, a pressure log is needed because the head at the surface can no longer be assumed constant. The measurable range of permeability depends on the attainable head and fluid flow. Examples were shown of permeability determinations from 1 mD upwards over several orders of magnitude. The limit of resolution is governed by the resolution of the flowmeter. The lower limit might be extended by emplacing a packer-type oriface within the borehole. Fortunately, many holes are underpressured and suck fluid naturally.

The question was raised of deploying the technique at hole 504B for which there are published data that lie within the measurable range of permeability. The permeable zone of 504B is of greatest interest and it is here that the prospects for a permeability "log" are best. The operational procedure would be to lower the flowmeter through the pipe, set a packer in the casing, and obtain detailed permeability measurements approximately every 20 m.

DMP Consensus

The spinner flowmeter plus injection method constitutes a potentially viable approach to downhole permeability determination subject to solving the problems of heave compensation and packer deployment. Morin is encouraged to liaise with TAMU to obtain advice on how these problems might be solved.

15. Panel Membership

The Chairman noted that Eddie Howell was attending his last DMP meeting and thanked him on behalf of ODP for his input over the past years. In order to maintain the technical balance on the Panel, a replacement from industry should be sought, preferably with a tool development background. A search committee was appointed to nominate replacement candidates for consideration at the November 1989 meeting of PCOM.

[ACTION: WORTHINGTON, SONDERGELD, HUTCHINSON]

16. Measurement while Drilling

The Chairman noted that DMP have been asked to consider this technology in the past and that, while it would be premature to recommend its deployment in ODP, Panel ought to take a preliminary position on its potential usefulness. This position will be taken at the next DMP meeting.

[ACTION: PANEL]

17. Interwell Studies

The Chairman commented on the scientific desirability of performing a detailed characterisation of oceanic lithosphere in places where it was believed to be markedly heterogeneous. Such a study, necessarily carried out at a multi-well site, might involve interwell (tomographic) measurements of velocity and resistivity, as well as interwell comparisons of permeability obtained throughout multipacker deployments (drillstring, wireline, flowmeter/injection, etc.). Panel are asked to consider possible target areas, the key regional scientific issues, the form that the study might take, and the scientific benefits if successful.

[ACTION: PANEL]

18. Other Business

No new business.

19. Dates and Formats of Next DMP Meetings

The next meeting of the JOIDES Downhole Measurements Panel will take place at ODP/TAMU, College Station, Texas on 23-24 January 1990. It is hoped to arrange sessions with TAMU engineers and computer specialists during the afternoon of 23 January. Fisher to host.

Subsequent DMP meetings in 1990 should be scheduled to permit:

(i) a visit to the drillship
(ii) a joint meeting with SMP

Possible target dates (venues) are June 1990 (Seattle) and October 1990 (Brisbane).

The Chairman apologised to Panel members for such a long meeting, albeit extended by the four-hour joint meeting with LITHP. DMP was barely able to cope with its workload over three meetings per year. Yet, no one wished to meet four times per year on a regular basis. A possibility might be to delegate a portion of the workload to an ad hoc subcommittee. An obvious remit for a subcommittee would be the DMP scientific initiative of Item 17. The subcommittee option will be pursued if the DMP business workload warrants it after the next meeting in January 1990.

Close of Meeting

The Chairman thanked Members, Liaisons and Guests for their contribution to the meeting, the KTB of FRG for their kind hospitality, and Dr H Villinger for his gracious hosting. The meeting closed at 7.24 pm on Tuesday, 12 September 1989.

PAUL F WORTHINGTON
19 September 1989