MEETING OF JOIDES DOWNHOLE MEASUREMENTS PANEL

KTB Visitor Centre
Windischeschenbach
Germany

2-4 June 1992

RECEIVED
JUL 0 6 1992
Ans'd............

EXECUTIVE SUMMARY

1. Key thrusts of the meeting were technology exchange with KTB, in situ pore fluid sampling, high-temperature logging technology, and public information aspects of downhole measurements.

2. Panel recommended that the revised version of the ODP guidelines for the development and deployment of third party tools should be adopted and promulgated. The guidelines should applied to two of the tools that are currently under development, the BGR Borehole Magnetometer and the CSM/LDGO High-Temperature Resistivity Tool. On the basis of this experience, consideration should be given to issuing a further version of the guidelines if necessary.

   [DMP Recommendation 92/4: to ODP-LDGO, Tool P.I.s]

3. Panel endorsed the Request for Proposals for a Feasibility Study for In Situ Sampling of Pore Fluids. Pore fluid sampling is to be the highest priority with the determination or monitoring of pore fluid pressure and permeability as secondary priorities. Panel reiterates its strong support for the development of an in situ pore fluid sampler.

   [DMP Recommendation 92/5: to PCOM, JOI]

4. Panel expects that the issue of the above RFP will be in accordance with the timetable specified by the Steering Group for In Situ Pore Fluid Sampling.

5. Panel concurred that Leg 148, the return to Hole 504B, should be dedicated to drilling. coring and logging as the top priorities. Other experiments, such as offset VSP, should be deferred until the hole has reached its target depth and possibly until a later visit. Before further drilling, the (LDGO-Gable) temperature tool should be run and borehole fluid sampling undertaken. After drilling, the standard logging suite and high-temperature BHTV should be run, packer-flowmeter experiments undertaken, and the German high-temperature magnetometer deployed over target intervals. Schlumberger hostile environment logging (HEL) tools should be on standby on board ship during this leg.

   [DMP Recommendation 92/6: to PCOM, ODP-LDGO]

6. Panel considered that the Principal Investigators associated with the return to Hole 504B should investigate oil-industry thermistor/pressure observatories in order to establish what is available as off-the-shelf technology.

   [DMP Recommendation 92/7: to ODP-LDGO, 504B P.I.s]

7. The public information booklet on ODP downhole measurements is scheduled for publication in late July / early August. The purpose is to inform the scientific community about the proven benefits of ODP's downhole measurements programme and to highlight the scientific opportunities created by the availability of this technology.

8. Excellent progress continues to be made in the development of high-temperature logging technology. The three priorities are temperature and resistivity measurement, and borehole fluid sampling.

9. Panel considered that each technology that is developed and declared operational by ODP should be described in an appropriate industry publication with the object of informing industry of these achievements.

[DMP Recommendation 92/8: to ODP-LDGO, ODP-TAMU]

10. The joint technology session with KTB emphasised once again the benefits that can be derived from inter-programme collaboration. This was the second such meeting: it is hoped to hold others in the future.

11. DMP Chairman is to step down at year end, although he is prepared to remain on the Panel for one further year in the interests of corporate memory, as is the DMP tradition. Nominations are being sought for a successor.

12. The next DMP meeting will take place in downtown Victoria, B.C., Canada, during the period 23-25 September 1992. The meeting will encompass a half-day joint session with SMP, a meeting of the JOIDES Steering Group for In Situ Pore Fluid Sampling, and a visit to the JOIDES Resolution.

PAUL F WORTHINGTON

23 June 1992

MEETING OF JOIDES DOWNHOLE MEASUREMENTS PANEL

KTB Visitor Centre
Windischeschenbach
Germany

2 - 4 June 1992

MINUTES

Present

Chairman:	P F Worthington	(UK)
Members:	R Desbrandes	(USA)
	J Gieskes	(USA)
	S Hickman	(USA)
	P Lysne	(USA)
	R Morin	(USA)
	M Williams	(USA)
	H Crocker	(Canada/Australia)
	H Draxler	(FRG)
	J-P Foucher	(France)
	L Petersen	(ESF)
	M Yamano	(Japan)
Liaisons:	J Bahr	(SGPP)
	K Becker	(PCOM)
	P Demenocal	(ODP-LDGO)
	A Fisher	(ODP-TAMU)
	C Moore	(TECP)
Guests:	H Beiersdorf	(FRG)
	J Erzinger	(Giessen Univ) **
	A Green	(CSM)
	M Manning	(CSM)
	T Nagao	(Japan)
	H Villinger	(FRG)

Apologies

M Hutchinson	(USA)
O Kuznetzov	(Russia)
J McClain	(LITHP)

** Present for agenda items 12 - 14 only

1. Welcome and Introductions

The meeting was called to order at 0830 hours on Tuesday 2 June 1992. This was the second DMP meeting of the year. A special welcome was extended to those attending for the first time and to returning guests: Laust Petersen (new ESF representative), Jean Bahr (SGPP Liaison), Peter Demenocal (LDGO Liaison), Casey Moore (TECP Liaison), and guests Helmut Beiersdorf (FRG), Heiner Villinger (FRG), Toshi Nagao (Japan), Andy Green (CSM) and Mike Manning (CSM). Another guest, Jorg Erzinger (University of Giessen), would be attending for part of the meeting.

Key thrusts of the meeting were the technology exchange with KTB, in situ pore-fluid sampling, high-temperature logging technology and public information aspects of downhole measurements.

Review of Agenda

Four modifications were proposed:

(i) TEDCOM Liaison report [Item 4(v)];
(ii) Recent results from pore fluid sampling in oil wells [Item 7(ii)];
(iii) Agenda Item 12(i) to include future logging programme for Leg 148;
(iv) Agenda Item 22 to address recent changes in Australian ODP Secretariat.

With these modifications the precirculated agenda was adopted as a working document for the meeting.

2. Minutes of Previous DMP Meeting, Kailua Kona, Hawaii, 28-30 January 1992

The following modification was proposed: Page 18, Para 15(i), Line 2; delete "MgO insulated".

With this modification the minutes were adopted as a fair record.

Matter Arising

Panel wished to express their appreciation to Schlumberger for expediting the delivery of spare parts for the FMS prior to Leg 141. Chairman undertook to write a letter of thanks to Claude Boyeldieu of Schlumberger, Paris.

[ACTION: WORTHINGTON]

3. PCOM Report

Becker reported on the PCOM meeting held in Corvallis, Oregon, during the period 21-23 April 1992. PCOM responses to specific DMP recommendations were as follows:

Rec. No.	Description	PCOM Response
92/01	Guidelines for enforcement of third-party tool development	Accepted with Page 4, Para (iii) changed to read: "If DMP proposes and PCOM endorses the Mature Tool Proposal, the Science Operator or Logging Contractor will progress the acquisition of the tool for ODP provided funds are available".

92/02	Logging priorities for Leg 142	Unclear. The Logging Contractor acknowledged that the JOIDES Logging Scientist should have been informed.
92/03	Dissemination of log data	Deferred pending upgrade of computer system and progress on the ODP Datanet proposal.

Other highlights were:

(i) The general ship direction through to 1996 will be; Atlantic Ocean, adjacent seas, and eastern Pacific.

(ii) TAMU is to prepare a detailed report on DCS status and forward plans for the August 1992 meeting of PCOM. The Chairman pointed out that a functioning DCS or an equivalent facility was essential if the goals of the ODP Long Range Plan were to be achieved.

(iii) The DCS will not be ready for further testing during Leg 148, which has been redefined as a return to 504B.

(iv) The August 1992 PCOM meeting will also make decisions concerning the shipboard computer upgrade and the RFP for deep drilling.

4. Liaison Reports

(i) Shipboard Measurements Panel

The Chairman reported on the SMP meeting held in Honolulu, Hawaii, during the period 20-22 March 1992. Core-log integration was a major agenda item. SMP recommended that CORPAC should be acquired as the shipboard core-log data correlation tool. CORPAC is a software package for correlating any digital data series, e.g. MST natural gamma vs. log gamma. CORPAC would be especially effective if used in conjunction with the Sonic Core Monitor. SMP generally endorsed the report of the JOIDES Data Handling Working Group. The ODP Datanet concept was well received. Other featured topics included laboratory resistivity equipment, the accuracy of GRAPE density measurements, and the calibration of shipboard XRF equipment, which will be vital for validating the interpretation of the new generation of geochemical logging tools. There is strong support in SMP for continuing the close ties with DMP, especially while the issue of core-log integration continues to evolve rapidly.

(ii) Lithosphere Panel

The Chairman read a report received from McClain on the LITHP meeting held in Davis, California, during the period 18-20 March 1992. Key points were: LITHP supports the continued development of the DCS but suggested easier test sites; LITHP strongly endorses PCOM's plan to return to Hole 504B during Leg 148; LITHP is supportive of the Lithosphere Characterization concept and is prepared to issue a joint RFP (with DMP) at the appropriate time; highest ranked drilling proposals are return to 504B and Hess Deep; McClain will attend only one more meeting as LITHP Liaison to DMP.

(iii) Sedimentary and Geochemical Processes Panel

Bahr reported on the SGPP meeting held in Miami, Florida, during the period 6-8 March 1992. SGPP's highest drilling priorities are a generic gas hydrates leg and a return to the Barbados accretionary prism. SGPP is strongly supportive of the in situ pore fluid sampling initiative and the moves by the Steering Group towards an RFP. SGPP favours a packer device for multiple sampling and for measurements of pore fluid pressure and permeability. SGPP sees the Pressure Core Barrel as a high priority for engineering development because of its potential application in gas hydrates.

(iv) Tectonics Panel

Moore gave the inaugural TECP Liaison report to the Panel. TECP needs information on fluid and hydrological properties, such as fluid pressure, permeability and specific storage, and on the distribution and orientation of structural fabrics. There are also requirements for the (workstation) integration of seismic, core and log data (note the planned introduction of a workstation with Landmark software on Leg 146), for the long-term monitoring of earth processes, e.g. borehole seals, and for stress measurements, e.g. using the LAST tool. TECP endorses the DMP drive towards in situ pore fluid sampling but supports the SGPP view that such a facility should also allow measurements of permeability and pore pressure. In addition to the fluid-sampling and data-integration needs, TECP has an urgent need for a means of locating core in the hole and for hardrock sidewall cores, especially where core recovery is poor. Another key issue is the relationship between seismic data and physical properties; for example, what is the effect of pressure?

In thanking Moore for his historic address the Chairman noted that the current drive to integrate core and log data was a subset of a much bigger problem, that of integrating all physical data from the pore to the surface geophysical scales. An important contributor will be the recently developed Sonic Core Monitor. Sondergeld offered a presentation for the next DMP meeting on the measurement and interpretation of physical properties of core plugs under simulated overburden conditions, illustrated by examples of real data. The Chairman welcomed and accepted this offer, and pointed out that the subject matter would also be of interest to SMP.

(v) Technology and Engineering Development Committee

Becker reported on the TEDCOM meeting held in College Station, Texas, during the period 7-8 May 1992. The principal agenda item was the DCS. It was still not clear why the DCS had failed to perform on Leg 142. Possible causes were software inadequacies, feedback sensor problems in the secondary heave compensator system, and errors in the models of drillpipe dynamics. TEDCOM's position is that to abandon the DCS now would be premature. TEDCOM made specific recommendations for resolving the problem. It was proposed that TAMU should engage a consultant as a matter of urgency. A key task is to carry out a detailed computer simulation of the secondary heave compensator system. It was also suggested that more land testing could be done. The DCS could be ready for further testing at sea by Leg 153. As regards other engineering tools, the Pressure Core Sampler, Motor-driven Core Barrel and Borehole Seal have been declared operational and their use should be encouraged.

5. Tool Monitor Reports

(i) Geoprops Probe

Fisher reported that the Geoprops Probe, a geomechanical tool for measuring temperature, pressure and permeability and for collecting water samples, should be ready for shipboard tests on Leg 146. Geoprops requires the Motor-driven Core Barrel, operational as of Leg 141 and possibly to be deployed on Leg 144. The feasibility study for the completion of Geoprops, undertaken by Scott McGrath of ODP-TAMU, has formed the basis for a contract let to Aumann Engineering in mid-

March. The contract is funded through the additional finance secured by Bobb Carson. The programme of work provides for modified sequencing valves, protective rubber "boots" over wiring, basic drawings, shock absorber, bench testing, calibration, readjustment of temperature circuit, spares, and an operating/maintenance manual. The work should be completed by mid-July, at which time Geoprops should be at the stage of an ODP Development Tool (ref. Item 6).

(ii) LAST

Crocker tabled a brief report from Moran. LAST-1 will be available for Leg 146. Moran will transfer the two LAST-1 tools to the ship at the Victoria port call. LAST-2 will have its final field test in Houston during the week of 15 June 1992. Moran will also receive technical training in the detailed operation of the tool during that week. If the field test is satisfactory, the tool will be transferred to ODP-TAMU for shipping to the Leg 146 port call.

(iii) BGR Borehole Magnetometer

Draxler reported that after modification, the tool is being deployed in the KTB hole (at 6000 m). BGR considers the tool to be operational. The tool is available to ODP and would be ideal for use at Hole 504B during Leg 148. Running the tool requires a dedicated scientist and possibly a technician. The Principal Investigator (Bosum) is submitting a formal proposal for the tool to become an ODP Certified Tool (ref. Item 6).

(iv) French Sediment Magnetometer

Foucher reported that the tool is likely to be deployed on Leg 145. A French scientist will be on board and the tool will be operated by the Schlumberger engineer who will be trained in its use later in June. The susceptibility tool will be run with the magnetometer as before.

(v) Japanese Borehole Magnetometer

Yamano reported that the tool was deployed during Leg 143 where it was run in three holes. The tool had not been subjected to a full land test. It is a 67-mm diameter memory tool but was run on the logging cable for depth counting. Very noisy results were obtained (e.g. at Site 869). Data degradation was attributed to tool rotation during sequential digitisation of the sensor data. Other Panel members ascribed the noisy data to internal tool problems. The tool should not be deployed at sea again until these difficulties have been resolved and the tool has performed satisfactorily during land tests. It was noted that the tool would not have satisfied the ODP guidelines for Third Party Tools (ref. Item 6).

(vi) Packer-Flowmeter

Morin reported that the tool was used successfully on Leg 139 after debugging on Leg 137. It is planned to deploy it again during Legs 146-148. The Packer-Flowmeter is an ODP Development Tool and is a candidate to become an ODP Certified Tool (ref. Item 6).

6. Third Party Tools

The Chairman introduced this item by recalling that DMP had been asked to strengthen the guidelines for the development and deployment of third party tools with a view to their enforcement. The previous DMP meeting had placed an action on the Chairman to prepare a revised set of guidelines in accordance with the stated views of the Panel. These guidelines had been prepared and circulated to Panel members for comment. No changes were notified by the deadline and the guidelines duly passed to PCOM for their consideration. As noted under Item 3, PCOM had adopted the new guidelines with one minor modification. PCOM had directed that these guidelines be published in the JOIDES Journal.

Panel observed that the development of guidelines such as these was an evolutionary process. To date, comparatively few tools have passed through the system but many proposals for tool development are now being received by ODP. The guidelines therefore need to be available to the community now, even though they might be modified in the future. Some of the tools that are currently under development should become test cases for the guidelines. In the light of that experience the guidelines could be revised as appropriate. The Chairman reminded the Panel that it was proposed to issue the guidelines in brochure form just as soon as the current efforts on the ODP Downhole Measurements booklet (ref. Item 14) had come to fruition. This would secure a wider circulation to prospective proponents than could be achieved through the JOIDES Journal alone.

DMP Recommendation 92/4

"The revised version of the ODP guidelines for the development and deployment of third party tools should be adopted and promulgated. The guidelines should be applied to two of the tools that are currently under development, the BGR Borehole Magnetometer and the CSM/LDGO High-Temperature Resistivity Tool. On the basis of this experience, consideration should be given to issuing a further version of the guidelines if necessary."

Green and Draxler agreed to apply the guidelines to these tools and to report back to the Panel with recommendations for improvement. At the same time ODP-LDGO will apply the guidelines from the ODP side and report on their experience.

[ACTION: DEMENOCAL, DRAXLER, GREEN]

Panel noted that an enforceable set of guidelines would allow proponents to demonstrate to their funding agencies that their tools had been accepted. The guidelines would therefore serve as an auditable measure of performance.

7. In Situ Pore Fluid Sampling

(i) JOIDES Steering Group for In Situ Pore Fluid Sampling

Gieskes had chaired the inaugural meeting of this group in the unavoidable absence of the Chairman. He reported that the group had met in College Station on 2 April 1992. The required technology encompassed the sampling of pore fluids in sediments and in basement, compatibility with ODP operations, and a capability for some in situ monitoring (of the sample and, for example, of formation temperature, pressure and permeability). The group had prepared a request for proposals for a feasibility study for in situ sampling of pore fluids. The tasks of the appointed contractor would include: consultation with ODP, evaluation of hydrogeological settings, evaluation of sampling technologies, selection of best sampling technologies, and report to DMP. The envisaged schedule is:

15 May 1992	Forward RFP to JOI, Inc	(done)
15 June 1992	Issue of RFP	
15 August	Deadline for responses	
22 September 1992	Evaluation of proposals	(by Steering Group)
30 September 1992	Selection of contractor	
15 October 1992	Issue of contract	
January 1993	Oral report to DMP	(College Station)
March 1993	Deadline for final report	

The technology contact for this initiative is Dave Huey (ODP-TAMU) and the science contacts are Joris Gieskes (DMP) and Peter Swart (SGPP).

After broad discussion, during which the SGPP and TECP Liaisons strongly supported the secondary goals of pore pressure and permeability determination, Panel formulated the following recommendation.

DMP Recommendation 92/5

"DMP endorses the Request for Proposals for a Feasibility Study for In Situ Sampling of Pore Fluids. Pore fluid sampling is to be the highest priority with the determination or monitoring of pore fluid pressure and permeability as secondary priorities. Panel reiterates its strong support for the development of an in situ pore fluid sampler."

The Chairman thanked Gieskes and other members of the Steering Group for an outstanding contribution to ODP. He expressed the wish that bureaucracy would not detract from their technical achievements to date. Panel looked forward to reviewing progress at the next DMP meeting.

(ii) Recent Results from Pore Fluid Sampling in Oil Wells

Crocker reported on pore-fluid sampling experiences offshore Australia. The objective had been to obtain pristine pore fluid samples using downhole monitoring of sample resistivity for quality control. The time required to attain a constant fluid resistivity was six hours. This demonstrates that it is possible to obtain pristine fluid samples but that a substantial investment of time might be needed. If time limitations are severe, a dilution curve could be established through multiple sampling at one station. Short tests for a single sample cannot be expected to provide meaningful data.

8. JOIDES Data Handling Working Group

The Chairman reported on the meeting held in Toronto, Canada, on 5-6 March 1992. The group concurred that changes are urgently needed to the shipboard computer system because the work of the shipboard scientist is being hampered by the difficulty of retrieving current data and by a lack of sophisticated computing resources to manipulate those data. More specifically, the integration of the increasing amount of logging data with core data was perceived as essentially impossible within the confines of the present shipboard computing environment. The working group outlined a package of recommendations for a major overhaul of the shipboard computer system. The recommendations included the installation of a new shipboard relational database to accommodate all the digital and text data sets currently acquired during a leg. Further, new software is needed to support the collection of data from, inter alia, the following tools: multi-sensor track, magnetometer, WSTP, slimhole temperature tool, and core natural gamma. The existing computer hardware environment should be supplemented by dedicated workstations for core-log data correlation, downhole measurements laboratory, underway geophysics laboratory, and physical properties laboratory. The implementation of the recommendations should be monitored by a Data-Handling Steering Group. The group's recommendations have subsequently been endorsed by PCOM.

9. Operations Report

As reported under Item 4(v), the DCS was unsuccessful in cutting core during Leg 142. The new Hard-Rock Guidebase and Drill-In BHA worked well. Logging proved to be especially important on Leg 143 due to the very low (< 5%) core recovery over extensive intervals (> 100 m). The logging programme was comprehensive. This leg featured the deepest hole (866A: 1743.6 mbsf) to be drilled during a single ODP leg: here the overall core recovery was around 15%. Logging plans for the current leg (144) include geophysical, geochemical and FMS logs at all sites, and the BHTV at basement sites. Logging Hole 801C is an alternative during Leg 144.

10. Logging Contractor's Report

Demenocal reported that the LDGO temperature tool was now MAC-friendly: a third tool was being built. Other developments include a new depth counter and platform for third party tools. Discussions are proceeding with the French concerning the magnetometer/susceptibility tool. This tool is to be deployed on Leg 145. Draxler reported that the (alternative) University of Munich tool failed in the KTB hole at 120°C and will not be upgraded until year-end. On the computing side, Sun-3 systems are to be phased in over the next two years to replace the Masscomps. LDGO BRG is to be a test centre for the new Schlumberger data analysis package, CHARISMA,which is UNIX based and includes log evaluation and seismic packages. Roger Anderson has resigned as BRG Director. David Goldberg is Interim Director through to FY93. Two scientific positions are currently open.

11. Science Operator's Report

Fisher reported that the two big initiatives are the DCS and shipboard computing. The Sonic Core Monitor had several good runs on Leg 143 but there were some electronic/battery problems and one of the two units had now been brought back to shore. Graphic interactive software for analysing WSTP temperature data was introduced on Leg 144. For the FY93 budget the three highest priorities are the real-time navigation system, the computer system upgrade for the chemistry laboratory, and the core-log integration workstation(s). The Pressure Core Sampler (now declared operational), the Vibra-Percussive Core Barrel (for unconsolidated sand recovery), and two Cork systems (with thermistor chains, pressure sensors and sampling straw) are scheduled for deployment on Leg 146.

12. Future Logging Programme

(i) Legs 145 - 148

Leg 145: North Pacific Neogene Transect

Fisher reported that the standard suite (geophysical, geochemical and FMS) is planned for four sites (NW-1A, DSM-1, DSM-4, PM-1A) and that the (French) magnetometer/susceptibility tools are proposed for DSM-1 (800 m sediment, 50 m basement). Secondary plans are to run the standard suite at six other sites, the BHTV at two others, and the magnetometer/susceptibility tools at all sites.

Leg 146: Cascadia Accretionary Margin

The pre-cruise meeting was held in April. Logging plans as per previous DMP Minutes.

Leg 147: Hess Deep

Logging plans as per previous DMP Minutes.

Leg 148: 504B

Becker outlined the plans for a return to Hole 504B. The aims are to deepen the hole by 300 - 500 m and to recover gabbro from seismic Layer 3. The logging programme need not be as extensive as on previous legs at 504B. After much discussion, Panel formulated the following recommendation.

DMP Recommendation 92/6

"Leg 148, the return to ODP Hole 504B, should be dedicated to drilling, coring and logging as the top priorities. Other experiments, such as offset VSP, should be deferred until the hole has reached its target depth and possibly until a later visit. Before further drilling, the (LDGO-Gable) temperature tool should be run and borehole fluid sampling undertaken. After drilling, the standard logging suite and high-temperature BHTV should be run, packer-flowmeter experiments undertaken, and the German high-temperature magnetometer deployed over target intervals. Schlumberger hostile environment logging (HEL) tools should be on standby on board ship during this leg."

Panel considered that the hole should not be sealed with a thermistor string in place because there is no proven string available and the hole would be put at risk. It was noted that long-term temperature measurements are made in drill-holes in the oil industry. It is possible that established technology is already available off-the-shelf.

DMP Recommendation 92/7

"The Principal Investigators associated with the return to Hole 504B should investigate oil-industry thermistor/pressure observatories in order to establish what is available as off-the-shelf technology."

Becker will report back to DMP.

[ACTION: BECKER]

Crocker will try to solicit an industry speaker on downhole monitoring for the next DMP meeting.
[ACTION: CROCKER]

(ii) North Atlantic

Fisher reported that there had been no developments as regards logging plans for Legs 149 - 152, which remain as outlined in the previous DMP Minutes. However, there had been a planning change for Leg 149 (North Atlantic Non-volcanic Rifted Margins, Iberian Abyssal Plain). PCOM had recommended drilling a single deep hole (IAP-1; over 2800 m sediment with 5200 m water depth - the operating limit of the JOIDES Resolution) instead of the four shallower holes originally proposed. This matter is still being debated.

13. Non-Engineering Wish List

The Chairman reviewed for Panel's information the priorities for non-engineering development proposed by the JOIDES advisory structure. These were as follows.

(i) Core-log integration

(1)	Workstation and software	(FY92)
(2)	Natural gamma and MST upgrade	(FY92)
(3)	Downhole magnetic susceptibility	(FY93)
(4)	Discrete core resistivity	(FY92)

(ii) Capital Replacement Equipment

(1)	Computers & software for data handling	(FY92/93)
(2)	Seismic data acquisition/synthetic workstation	(FY93)
(3)	Auto titration	(FY93)

(iii) New/Improved Equipment

(1)	Fluid sampling and permeability	(FY92)
(2)	Sidewall coring tool	(FY92)
(3)	Sediment colour scanner	(FY92)
(4)	Core barrel magnetometer	(FY92)

Becker noted that this list will be considered at the August meeting of PCOM. The Chairman reiterated the importance and visibility of the core-log integration initiative.

14. Public Information Booklet

The Chairman informed Panel of progress on the production of a technical information booklet on ODP downhole measurements. The purpose is to inform the scientific community about the proven benefits of ODP's downhole measurements programme and to highlight the scientific opportunities created through the availability of this technology. The initiative is being driven through a subcommittee comprising the Chairman, Golovchenko (ODP-LDGO), Fisher and Riedel (ODP-TAMU). The subject matter has been reviewed by referees from DMP and elsewhere in ODP. The final versions of text and artwork have been agreed and the booklet is currently at the graphics design stage. Page proofs will be available around the end of June 1992. Publication date is estimated as late July / early August. The booklet will be distributed to Panel members before the next meeting of DMP.

15. High-Temperature Logging Technology

(i) Temperature Tool & Cable

Demenocal reported that the tool and cablehead are robust and deliberately overdesigned: therefore the cable is the primary test target. Money is available for one test only. LDGO have not been able to identify a suitable site. Lysne offered to investigate other opportunities for test sites, noting that the cost of testing can be similar to the cost of manufacture. Draxler reported that KTB had reviewed possible high-temperature test sites. The Russians have a 300°C autoclave in Perm and Schlumberger (Paris) will have a facility for tests at equivalent temperatures under simulated operating conditions. The hottest place in Europe is in northern Italy and it might be worth approaching the Italian geothermal agency to see if a hole is available: in the past the Kuster sampler has been run there.

(ii) Resistivity

Manning reported on progress in building two tools on behalf of LDGO and the UK Dept of Energy who will receive one tool which would be available for loan to ODP. Temperature specification is 350°C for four hours and pressure rating is 100 MPa. Minimum weight is 50 kg. All electronics are rated to 200°C. Tool diameter is 48 mm. It comprises 3 x 3 m sections housing probes, dewared electronics and an extension piece. The tool comprises short and long normal configurations and a short focussed electrode configuration. Focussing technology is being input by consultants (UK BGS). There is also a capability for measuring borehole fluid resistivity. Resistivity ranges are 0.02 - 0.2 Ωm (borehole fluid) and 0.1 - 1000 Ω m (formation). Draxler commented that the latter range is sufficient for fracture detection but it may not be sufficient for lithology identification in crystalline rocks. Development began on 1 January 1992 and the tool is scheduled for completion by 1 September 1992. By that date testing will have been confined to a 250°C autoclave. Environmental testing will be completed in the USA, possibly at Los Alamos or the Salton Sea.

(iii) Fluid Sampling

Lysne reported that DoE had approved the proposal to build a high-temperature borehole fluid sampler. Funds will be available from 1 October 1992. Sample requirements had been specified by a committee chaired by John Edmond (MIT). The tool will be rated to 400°C for a few hours. Tool diameter will be 50 mm. The Chairman proposed inviting John Edmond to the next DMP meeting to brief Panel on the output from his committee.

[ACTION: WORTHINGTON]

(iv) Gamma Spectral Tool

Lysne also reported on progress towards developing a high-temperature natural gamma spectral tool. This was on the original list of priorities of DMP and LITHP but was not one of the top three. Geophysical Research Corporation in Tulsa are building the tool on behalf of Sandia Labs. Delivery is expected in September 1992, after which the tool will be tested and calibrated in DoE test pits near Albuquerque, N.M. Lysne concluded by emphasising the further need to understand what these (high-temperature) data mean. This is a prerequisite for meaningful interpretation.

16. Technology Review - Oilfield Petrophysics

The Chairman briefly reviewed the current status of petrophysics in the oil industry. There were two key issues. First, with the progressive integration of traditionally separate geoscience subdisciplines, the petrophysical subject area was being redefined to include not just core analysis and well logging but also aspects of borehole geophysics and engineering applications. Second, recent advances in data acquisition technology had placed our ability to measure ahead of our ability to understand the data and how they might best be used. Therefore the present thrust was one of developing new interpretation methods which made use of the available technology in a way that is not confined by classical subject boundaries. This is an important message for ODP because the need for sophisticated downhole technology for fluid sampling, high-temperature logging, etc., is not going to be met by current drives in industry, whose present focus is elsewhere. The Chairman requested that this message be borne to mind in the future, when identifying ODP technology needs and how these might be met.

17. ODP Downhole Measurements - Publicity Opportunities

The Chairman reminded Panel members that the last DMP meeting had been attended by the ODP Public Information Coordinator, Karen Riedel. Since the Panel had been debating for some time how to expand its promotion of downhole measurements to the scientific community, the Chairman had asked the Public Information Coordinator to use the opportunity to evaluate the Panel's culture and to suggest ways in which the Panel might best achieve its public information goals. The fruits of her deliberations were contained in a briefing note circulated to the Panel. The Chairman summarised its contents.

Essentially three major thrusts were proposed: print media (e.g. the booklet that is currently in preparation, targeted news releases, and trade journals), electronic media (e.g. video releases, CNN news snippets), and exhibits (e.g. permanent museum feature, travelling poster display). Much spirited discussion followed. Draxler showed Panel a KTB video that had been prepared for public dissemination. The Panel concurred with the Public Information Coordinator that industry was often unaware of the technology achievements of ODP in the logging area. This was seen as a major problem. Several suggestions were made for taking the initiative further. The following recommendation was formulated.

DMP Recommendation 92/8

"Each technology that is developed and declared operational by ODP should be described in an appropriate industry publication with the object of informing industry of these achievements."

The Chairman asked Panel Members to study the briefing note carefully and then to formulate suggestions for addressing the issues raised. These would be considered at the next DMP meeting when a plan of action would be drawn up.

[ACTION: PANEL]

Crocker observed that Ms Riedel had put in a good deal of effort on the Panel's behalf over the past few months. He proposed a vote of thanks. The Chairman noted that Ms Riedel's contribution was much appreciated by the Panel. He undertook to convey this message on Panel's behalf.

[ACTION: WORTHINGTON]

18. Shipboard Integration of Core and Log Data

Fisher reported that Science Operations, ODP-TAMU, is purchasing several copies of software for the development of custom data-merging tools. A request has been submitted to JOI for RISC-based workstations. Efforts are being made to obtain a Sun SPARC station for Leg 145: this would use similar correlation software to that used on Leg 138. Janecek and possibly Coyne are to sail on Leg 138, which should see the next major shipboard thrust towards core-log integration. The MST upgrade, including the addition of the natural spectral gamma system, is targeted for Leg 149. The downhole tools laboratory has been added to the shipboard ethernet. ODP-TAMU is preparing a four-year computer plan for consideration at the August PCOM. Overall the initiative is contingent upon money and the availability of people.

The Chairman reiterated that the core-log integration initiative is fundamental to data acquisition and handling in ODP. It was gratifying to see that there was now widespread support within the programme. The importance of continued dialogue with SMP could not be overstated.

19. Panel Membership

The Chairman announced that he would be stepping down at year end, after the 1992 annual meeting of PCOM with panel chairs. In 1990 the Chairman had been asked to extend his tenure until ODP renewal. It seemed that renewal issues would be clarified by the end of 1992, and that would be the most logical time for a change. The Chairman invited Panel members to consider whether they would be prepared to serve as Panel chair and, if so, to inform him within the next few weeks. He would pass these names on to the PCOM Chairman who would take the matter further.

No further nominations had been received to replace Roy Wilkens and therefore the Chairman proposed to forward to PCOM the single name that Panel had identified at the previous DMP meeting. In accordance with PCOM directives this name is not being minuted, although PCOM minutes do not reflect the same adherence to this protocol.

Sondergeld announced that he would be rotating off the Panel after the next DMP meeting. The Chairman commented that Panel would have to seek a replacement from industry if the technical balance is to be maintained: that might not be easy at the present time.

20. Next DMP Meetings

The Chairman stated that there were emerging difficulties associated with holding the next DMP meeting in Sante Fe, New Mexico, as originally planned. There were clashes with the Victoria port call, with the Leg 139 post-cruise meeting (also on Vancouver Island), and with the SMP meeting (also scheduled for Vancouver Island during the port-call week). A head count showed that up to seven panel members and liaisons would have conflicts during that week if DMP met anywhere other than Victoria. Lysne confirmed that the Sante Fe meeting could not be shifted by a week because of hotel-room shortages due to tourist events: DMP was already in a very tight accommodation window. Lysne noted that if it was decided to change venue, the prebooked accommodation in Sante Fe could be cancelled without difficulty. The Chairman added that a major additional concern was the need to secure a quorum for the In Situ Pore Fluid Sampling Steering Group which would meet as an extension of the next DMP meeting. A quorum would not be reached with the present arrangements. All in all, it seemed that there was little choice but to relocate the next DMP meeting to Victoria, B.C. Such a move would also allow a joint session with SMP, to continue the dialogue on core-log integration. Further, several Panel members had not yet seen the JOIDES Resolution. A Victoria meeting would encompass a ship tour.

After further discussion it was decided to hold the next DMP meeting in downtown Victoria, B.C., during the period 23-25 September 1992. The In Situ Pore Fluid Sampling Steering Group would meet at 1700 hours on Tuesday 22 September 1992. A joint session with SMP would be targeted for the afternoon of Wednesday 23 September. The ship tour would be arranged for Thursday 24 September. Fisher agreed to make the necessary arrangements for the ship tour.

[ACTION: FISHER]

The Chairman said that Kate Moran had offered to be a host for the meeting but she would no doubt be supported by someone from her own organisation based in the area. The Chairman apologised to Lysne for this late change in the arrangements, which had been brought about by circumstances beyond Panel's control.

The subsequent DMP meeting would be the first under the new Chair. However, it was important to make arrangements now. It is quite some time since Panel has met at ODP-TAMU and therefore the January 1993 meeting of DMP would take place in College Station, Texas. The Chairman will investigate suitable dates and report back to Panel.

[ACTION: WORTHINGTON]

21. Joint Technology Session with KTB

This aspect of the meeting had been co-chaired by Peter Lysne on behalf of DMP. The aim was to air technology and exchange views in areas of mutual interest. The session also included a review of German ODP activity and a KTB status report. Results from the KTB main hole were featured. Scheduled reports on tool development and performance included borehole magnetometry, VSP surveys, Sonic Core Monitor, Packer-Flowmeter, high-temperature tools (resistivity, fluid samplers, magnetometer), cross-hole seismic experiments, and data handling (ODP Datanet, KTB Databank). The session concluded with visits to the KTB drilling rig and field laboratory. It was hoped that this type of joint meeting would become a regular occurrence, perhaps at 2-3 year intervals.

22. Other Business

Crocker informed Panel of changes to the Australian ODP Secretariat. These are not as projected at the previous DMP meeting. The Secretariat moved on 1 April 1992 to the Geology and Geophysics Department, University of New England, Armidale, New South Wales. The new director is Richard Arculus. The functions of the Secretariat are essentially unchanged.

23. Close of Meeting

The Chairman thanked Panel Members, Liaisons and Guests for their contribution to the meeting, KTB for their kind hospitality, and Hans Draxler for his gracious hosting. The meeting closed at 1505 hours on Thursday 4 June 1992.

PAUL F WORTHINGTON

23 June 1992

RECEIVED
JUL 20 1992
Ans'd...........

Joint Meeting DMP/KTB

KTB Information Center
Windischeschenbach, June 2nd 1992

Protocol:

The Downhole Measurements Panel (DMP) of the Ocean Drilling Programme (ODP) met for the second meeting of the year 1992 at the KTB drilling site in Windischeschenbach, Germany.

To foster cooperation between the DMP and KTB a one day joint meeting was organized on June 2nd 1992. The goal was to convey results from the KTB operation, discuss common problems on formation evaluation techniques, downhole sampling, logging operations and high temperature tool development.

The meeting was chaired by K. Bram of KTB and co-chaired by P. Lysne, DMP and J. Draxler, DMP/KTB. The Agenda of the meeting is enclosed (Ref. 1).

Participants:

Downhole Measurements Panel:
Members:

H. Crocker	Canada/Australia
R. Desbrandes	USA
J. Draxler	Germany (KTB)
J. Gieskes	USA
S. Hickman	USA
P. Lysne	USA
R. Morin	USA
L. Petersen	Scandinavia
C. Sondergeld	USA
M. Williams	USA
M. Yamano	Japan

Liasons:

K. Becker	(PCOM) USA
A. Fischer	(ODP-TAMU) USA
P. De Menocal	(LDGO-BRG) USA
J. Bahr	(SGGP) USA
C. Moore	(TECP) USA

Guests:

A. Green	(CSM) UK
M. Manning	(CSM) UK

H. Beiersdorf	(BGR) Germany
H. Villinger	(Uni.-Bremen) Germany
W. Bosum	(BGR) Germany
H. Gatto	(Cons. KTB) Germany
F. Fieberg	(Uni.-Braunschweig) Germany

KTB-Projet Management (KTB-PL) and Fieldlaboratory (KTB-FL):

K. Bram	KTB-PL
C. Bücker	KTB-FL
C. Chur	KTB-PL *)
H.-G. Dietrich	KTB-FL
W. Dorn	KTB-PL *)
M. Heinisch	KTB-FL *)
P. Kehrer	KTB-PL *)
W. Kessels	KTB-PL
J. Kück	KTB-PL
S. Lich	KTB-FL
S. Rust	KTB-FL
G. Zoth	KTB-PL

*) Could not attend full day.

1. Welcome and Introduction

K. Bram opened the joint meeting at 8.30 and gave a special welcome to the members, liaisons of the DMP, the guests of DMP/KTB and the participants from KTB.

After a short briefing of the Agenda, the Agenda was accepted as a schedule for the meeting.

2. Review of German ODP Activity

Helmut Beiersdorf, the coordinator of the German activities in ODP, welcomed the participants of the Joint Meeting on behalf of Dr. Maronde of Deutsche Forschungsgemeinschaft (Bonn), which is the main sponsor of the German ODP participation. Deutsche Forschungsgemeinschaft, it is the equivalent to the U.S. National Science Foundation, made some funds available to the meeting and the field trip.

H.B. mentioned that the negotiations on the continuation of Germany's ODP participation beyond 1993, came to a successful end despite of serious financial constraints. The Bundesministerium für Forschung und Technologie (Federal Ministry of Research and Technology) has sent a letter to Deutsche Forschungsgemeinschaft in which its intent was expressend to continue financial support in form of the other half of the initial contribution of which the first half comes from Deutsche Forschungsgemeinschaft. The only obstacle before the signing of the ODP Memorandum of Understanding (MOU) is the "Intellectual Properties" clause of the MOU. But it is hoped that this can be removed soon.

The German ODP community is far from being tired of ODP, and has recently, at the German Annual ODP Colloquium, again expressed its great interest in the continuation of the program.

H.B. also pointed out that he sees with great sympathy the close cooperation between ODP and KTB in the field of engineering including downhole measurements, and wished the meeting good success.

3. Status Report KTB-Oberpfalz HB

Peter Kehrer welcomed the participants on behalf of the KTB Project Management. He gave a brief summary of the status of the project. Current depth of the KTB superdeep well is 6200,7 m with a deviation of only 0,2° and is drilling ahead. 8000 m should be reached at the end of 1992 and the target depth of 10 00 m and a range of 300 °C is planned for February 1994. Deepening of the well below 10 000 m is under discussion. The projekt has undergone an intensive planning period during the last months concerning budget, time schedule and evaluation of scientific results.

The excellent cooperation between ODP and KTB in logging and drilling technologies was emphasized. This is also expressed by the fact that this is already the second DMP-Meeting at the drillsite in Windischeschenbach. There is much discussion in the International Geoscientific Community about the forming of an "International Continental Deep Drilling Programme". Meetings toward this goal were held at an International Symposium in Paris in April 1992, discussions will be continued at the International Geological Congress in Kyoto in August/September 1992. A special International Conference for this subject will be held in Germany in spring of next year which will be organized by the "Geoforschungszentrum Postsdam" a new geoscientific research institute.

4. Results: KTB-Oberpfalz HB, 0 - 6000 m
a) Drilling Operation (Chur)

A specific drilling strategy with new technology was developed to drill the KTB ultra deep borehole.

In particular for

- vertical drilling
- casing program
- coring.

Engineering calculations as well as drilling experiences from the KTB pilot hole, the Russian Kola well and other drilling operations worldwide have shown the need for a straigth borehole to reduce torque and drag between the drill string and the borehole wall to a minimum.

The vertical borehole is also necessary for running the special clearance 16" and 13 3/8" casing strings.

To achieve that, Vertical Drilling Systems (VDS) were developed. The latest design VDS-5 has an external steering system where hydraulicaly actuated pistons push expanding stabilizer ribs against the borehole wall. The borehole inclination is continuously measured by two inclination sensors. If the inclination deviates from verticality, the pressure in the respective hydraulic cylinder is released and the bit corrects the deviation.

Using the vertical drilling systems, it was possible to maintain an average borehole inclination less than 0.5°. The horizontal displacement at 6000 m is only 8.5 m (Ref. 2).

The verticality of the borehole is also a major requirement for the casing programme with extrem narrow clearances. The well was drilled down to 3003 m with 17 1/2" bit size. After the 16" casing was run to 3000.5 m and cemented, the well was drilled with 14 3/4" bit size to 6018 m. After a three weeks logging programme a combined 13 3/8" and 13 5/8" casing string was run to 6013,5 m and cemented. Both casing strings required special couplings to realize a maximum clearance to the nominal borehole diameter of only 15 mm.

The well now will be drilled with 12 1/4" bit size to 10 km.

For coring new technology was also developed. Whereas the coring in the 14 3/4" drilling phase was done with roller cone core bits and a 8" x 4" core barrel, the majority of the core drilling in the 12 1/4" drilling phase will be done with a Large Diameter Coring System (LDCS). This system drills with a 12 1/4" thin kerf diamond core bit a 334,6 mm core. The LDCS drills not only in one single core run a rock volume five times more than the standard coring system, but also increases the core recovery from slightly over 40 % up to 90 %.

b) Logging Operations and Evaluations
- Highlights: New Logging Tools (Draxler)

After reaching the depth of 6020,0 m on March 13th 1992 an extensive logging programm was run after the borehole had been cooled by additional circulation for 48 hrs. The programme was split in two segments: the first included temperature sensitive tools (like Magnetometer - Uni. Braunschweig, GLT) and the tools requiring the MAXIS 500 (FMI, DSI and the prototype ALAT). In addition 6 temperature surveys were run to record the temperature increase with time. In 188 hrs the increase was 48 °C. The maximum recorded reached 162 °C.

After reconditioning the borehole the second segment of services was run under reduced hydrostatic pressure (51 bar), due to a lowering of the mud level by 500 m. The goal was to locate producing zones by provoking inflow.

New tools run:
Formation Micro Imager (FMI) was used in the KTB-HB since the depth of 720 m with good results. In 17 1/2" borehole the tool covers 36 % of the circumference and in 14 3/4" hole 43 % (see Ref. 3 in appendix). The Dipole Sonic Imager (DSI) was run as of 3000 m depth. The detection of the shear velocity is improved due to direct shear wave propagation. The recorded Stoneley-wave showed clear enhancement with strong chevron signatures at fractured zones (see Ref. 4 in appendix).

Schlumberger offered a new prototype tool the Azimuthal Laterolog. We recorded the interval from 6000 - 3000 m with this tool. It provides the standard Dual Laterolog plus 12 additional Laterolog curves from an array of electrodes arranged on the circumference of the sonde in sectors of 30 degrees. As the tool is run in combination with an orientation and deviation tool (GPIT), the Array Laterolog resistivities can be oriented in space.

As the Laterolog system provides "deep" investigation resistivities, confirmation of "open" fractures or fracture systems can be detected. In addition, this tool might bring information about anisotropy.

Tool specification and one log example are given as Ref. 5 and 6 in the appendix.

- Correlation of GLT with XRF/XRD (Gatto)

As in the KTB-pilot hole the GLT was run in the KTB-deep hole from 6000 - 3000 m. The large borehole diameter of 14 3/4" required a recalibration of the results. The elements evaluated from the GLT have been crosscorrelated with the X-ray fluorescence analysis made on rock samples in the KTB-field laboratory. The samples are collected at 2 m depth intervals.

A comparison of the two methods in a paragneiss and amphibolite section shows good agreement (Ref. 7 and 8). Due to the denser sampling rate of 0,1524 m, the log shows more details.

A quantitative analysis was performed using the ELAN programme. Each of the two predominant rock types found in the KTB-pilot hole and as well in the KTB-deep hole, gneisses and amphibolites are composed of at least 10 minerals. The availability of a continuous X-ray diffraction analysis (XRD) done in the KTB field laboratory made it possible to select a suitable compromise model for the evaluation. Comparing ELAN results to XRD, good agreement was observed in gneisses (Ref. 9) and to a lesser degree in amphibolites (Ref. 10).

- Borehole Stability - Break-outs (Kück)

Especially in the lower portion of the borehole between 5500 and 6000 m a rather fast development of breakouts has been observed, shortly after drilling ovalisation of the borehole is measured. Repeated caliper logs show this increase in diameter immediately after drilling with a complete stabilisation later on.

The minimum diameter remains at bit size (see Ref. 11). Further confirmation of the fast-development of break-outs is the increase of borehole deviation even with the Vertical Drilling System (VDS4) in the borehole (5800 - 5843 m). If the rock remains stable while being drilled, the deviation is corrected and remains around zero degree (5843 - 5890 m).

The break-out orientation between 3400 - 6000 m is between 80 - 90 degrees, corresponding to the interval from 5900 - 6023 m shown on Ref. 12.

- Geothermic: Temperature Evaluation (Zoth)

To a depth of about 4000 m the temperature is rather well defined as temperature measurements have been made in the KTB pilot well one year after drilling has stopped.

The temperature estimation for the KTB-deep borehole is still problematic due to the disturbance caused by the drilling operation.

During the last logging series at 6000 m, six temperature logs have been recorded over a period of 188 hrs. With these data an estimation of the bottom hole temperature was made using different algorithms. The calculated average temperature gradient is 27.3 K/km. Down to a depth of 6000 m no change in this gradient has been observed. If there is no change the limit of 300 °C will be reached at 10.700 m depth (see Ref. 13).

- Geohydraulic: Testing and Sampling, Hydrofrac Experiment (Kessels)

Hydraulic experiments in the KTB boreholes followed the intention to determine the hydraulic parameters of the fractured zones and to recover formation fluids as uncontaminated as possible. The selection of the fractured zones for testing was done by an intensive log interpretation. A drawdown and injection test, six packer tests and a pump test were carried out in the 4000 m deep pilot hole. Prominent inflows were found between 480 m and 800 m and in the deepest part of the hole. In the upper part low salinity fluid with a negligible gas content was produced. From the deepest part highly saline fluids with a high gas content of 0,8 $m^3/1\ m^3$ were recovered. The 30 % CH_4 fraction in the gas was also remarkable.

In the main hole between 3000 m and 6000 m four fractured zones were investigated during a test. The mud level in the borehole was lowered by 500 m and inflow was observed. The intervalls detected by temperature and mud resistivity (salinity) logging were tested by taking fluid samples (Ref. 14). The analysis confirmed high salinity and gas content.

Two additional interesting observations have been made. During the inflow test (drawdown test) in the deep hole the fluid level in the pilot hole decreased and when the casing was cemented the level increased. This clearly shows that hydraulic communication exists between the KTB pilot hole and deep hole at 200 meters distance. A permeable fracture system exists in the deeper crystalline rock (Ref. 15).

- **Magnetic: Report on Tool Performance and Evaluation (Bosum/Fieberg)**

The Bundesanstalt für Geowissenschaften und Rohstoffe (BGR) in Hannover/Germany has developed a high resolution/high temperature 3-axis borehole magnetometer. The system consists of 3 ringcore fluxgates, perpendicular to each other, installed in a Dewar-housing with heat shield and heat-sinks, for temperature regulation, which is put in a titanium-housing for high pressure protection.

After a temperature test (Ref. 16) the borehole magnetometer has successfully been applied in the KTB borehole during the last logging phase till 6000 m depth, corresponding, to an environmental temperature of 170 °C (Ref. 17). The accurary of the tool in the stationary mode proved to 0,1 nT, in the (running) logging mode to 1 nT, for further specifications see Ref. 17. - Ref. 18 shows a field plot of the Magnetic-Log (vertical component) between 3350 m and 3700 m, in correlation with the lithology and the GAMMA-Log. The borehole magnetometer is constructed for temperatures up to 300 °C. Presently a gyro-system, giving reference for the magnetic field vector, is being integrated.

Due to the still missing heat protection system for the magnetometer sonde of the University of Braunschweig, the tool could only be run in the borehole when it was cooled. The interval between 6000 and 3000 m was logged successfully. The tool responded according to expectations. Due to the excellent calibration facilities available at Braunschweig the tool reaches a very high accuracy. A small temperatur effect was recognized and corrected for.

- Seismic: VSP and ISO 89-3D Survey (Bram)

In close co-operation between DEKORP and KTB a comprehensiv seismic survey was conducted in 1989 with the KTB drilling site in the centre.

Routine processing of the 3D-reflection seismic survey, the first ever carried out over crystalline rocks, failed due to the very complex reflectivity pattern, due to strong velocity anisotropy (up to 15 %) and the complex geology.

Performing a envelope-stacking technique the summed up energy of reflecting elements a first idea on the structural situation appeared governed by stepply dipping reflectors (50° and more!). The most prominent one, the so-called SE1 will be intersected at a depth of about 7000 m (after migration).

A recently shot VSP in the KTB-main hole from 6000 m to 3000 m confirms a lot of the observed reflectors, their interpretation despite having some of them already drilled through, remains however uncertain (Ref. 19).

The final results from this VSP are not available yet.

5. Sampling/Coring Innovations

- Sonic Core Monitor (Fisher)
Status of ODP Hard Rock Orientation (HRO) System

The ODP Hard Rock Orientation (HRO) System consists of the following components: core sciber, sonic core monitor, electronic multishot, bit-depth indicator. Each of these components is operational, but some individual software and hardware bugs remain. The full system is presently compatible with RCB operations only, although individual components are compatible with APC and XCB operations as well.

The core sciber marks the orientation of each piece of core relative to the core barrel, as the material enters through the core-catcher. The sciber does not impede the movement of the core into the barrel, but rotation of the barrel relative to the formation (due to torquing between the barrel and the BHA) can cause the core pieces to become 'lathed' by the sciber. The barrel latch system is now being redesigned to eliminate core barrel rotation. The sonic core monitor worked well during Leg 143, accurately recording the progress of cored materials as it filled the barrel. There were some minor electronic and power-supply problems, which have been fixed. Data from the monitor are presently dumped to a PC for analysis.

The electronic multishot replaces the photographic instrument used both for HRO applications and paleomagnetic investigations. The multishot must be run inside a non-magnetic drill collar, meaning that its use must be planned well in advance. The tool is operated like conventional survey instruments; data are downloaded to a PC. The final component of the HRO System is a means of recording the relative progress of the bit as it penetrates the formation. This is presently done manually with the assistance of the driller; automated recording of bit-depth information should be available soon.

Although each of the four HRO System components is operational, a great challenge remains in providing a software/hardware system for combining data from these different sources so that complete interpretations can be made. This development is difficult because the data presently come in very different forms. Two data sets are digital (sonic core monitor and electronic multishot) while two are analog (core scriber and bit-depth indicator). Core-Sciber data will probably remain analog for some time, as these data require the most basic interpretation; each piece of core must be examined by hand.

- Automatic Sampling System (Heinisch)

The representative routine sampling procedure in intervals of 1 m in connection with gaining of additional solid and fluid samples allows the realization of an extensive geoscientific program. To ensure reproducible analysis data, constant sampling quality is of great importance. Therefore suitable systems for represantative sampling of solids, mud and gases extracted from the mud are integrated into the circulation system of the drilling rig:

- An automatic sampling system (Ref. 20) located in a partial mud stream, which is controlled by rate of penetration and pump rate, collects constant amounts of cuttings, centrifuge material and mud over the full length of a sample interval.

- An additional partial stream of mud uncontaminated by air, is continuously degassed (Ref. 21), so that fluid inflows of gasrich fluids from the formation into the drilling mud can be detected, depth correlated and quantified.

A visit to the automatic sampling system is planned.

- Sedimentation Sub-Evaluation (Lich/Rust)

The sedimentation sub (also 'junk basket') is a tool that is normally used to bring lost pieces of tools from the borehole bottom to the surface (fishing operations).

In the KTB pilot-hole a junk basket was used a few times to get bigger rock samples than the usual cuttings. This tool was quite difficult to handle and was an instability within the drilling string. Therefore a new junk basket, (called 'cutting-sampler' (CS)), has been constructed for the KTB main hole by modifying a normal drill-collar. The new CS with 3 pockets is generally positioned a few meters above the bit and collects material from the borehole bottom (coming up with the mudflow) as well as breakout material from cavings.

Material from the CS enables investigations that require large sample sizes:

- fabric-oriented thinsections
- analysis of microfabrics or structures larger than a few mm
- rock-mechanical analysis.

When we started to analyse the cutting-sampler material, the central question was, wether it would be possible to distinguish samples coming from the bit (from borehole bottom) or from breakouts higher up the borehole.

Criteria for a discrimination of caving material against the 'fresh/just drilled' material are:

- Lithology (relative amount of components, degree of alteration, cataclasis - in comparison to the routine-cuttings lithoprofile)
- Size of the samples
- Shape of samples (grade of roundness/flatness, bit-influences).

In general caving-material can be identified:

- by mixtures of different lithologies or high amounts of lithologies that have not been drilled during the current run
- by their bigger size
- by their rather flat form
- and by concave surfaces with bit traces (directly representing the borehole wall).

Based on these data we correlate the CS samples with the existing cutting-profile, also considering borehole measurements (e.g. gamma-rey, caliper, Formation Micro Imager and BoreHole TeleViewer). Dip of foliation or faults can be measured directly on pieces from the borehole wall. Comparing these measurements with FMI-BHTV data, it is possible to get confirmation about the origin of this caving material (within a range of only few meters).

The correlation yields detailled information about:

GEOLOGY

- petrology (fabric, ...)
- structures (foliation, folds, fractures ...)
- small intercalations of different lithologies (eg. in the KTB instrusive dikes, meta-ultramafitites) which are hardly detected in the usual cuttings
- open fissures, joints and pores.

DRILLING

- developement of breakout areas eg. with respect to
- recent stress field configuration (rock mechanics) and
- microcracking.

The experiences with the CS have shown that the tool is completely filled after the first 5-10 meters of drilling, respectively reaming or short time of circulation. First data have shown, that the correlation of CS samples with borehole areas works quite well.

- Gamma Spectroscopy on Cores and Cuttings (Bücker)

A comparison of the borehole and the laboratory measurements of natural gamma ray activity showed a very good agreement between both for the depth section down to 6000 m of the KTB-HB. The laboratory measurements have been realized using cuttings and germanium detector. Cores are measured in a special apparatus with three independent NaJ scintillation counters positioned at 90° to each other which measure K, Th, U spectra separately.

Furthermore the RYBACH-relation between the gamma ray (GR) and the heat production (A, from NGS) has been tested and confirmed. It could be shown, that the correlation between A and GR depends an the Th/U-ratio and the K/U-ratio respectively. With increasing Th/U- and K/U-ratio the slope of the GR-A correlation increases. For a given Th/U- and K/U-ratio, the GR-A correlation holds for all borehole measurements if the GR is given in absolute API-units. That means that a meaningful information of the heat production can be derived only using the normal GR.

Integrating the heat production over depth yields a heat flow due to the radionuclides of about 6 mW/2 down to 6000 m. The contribution of the heat production to the total heat flow at the earth's surface is about 10 %.

6. HT-Tool Development and Tool Performance:

- Packer Flowmeter (Morin)

The tool was used on Leg 139 and logs were recorded successfully. The problems encountered on Leg 137 were solved.

The tool uncludes a flowmeter and a pressure transducer allowing an evaluation of the hydraulic conductivity and distribution in the borehole.

Permeability estimation, detection of fracture zones and calculation of the specific storage coefficient is possible.

The logs from leg 139 showed underpressured zones in well 857D.

- HT-Resistivity Tool Development CSM (Manning)

The Camborne School of Mines is building two HT resistivity tools, one for ODP and one for the UK Department of Energy. The tool should operate up to 350 °C for 4 hrs and measure the resistivity range between 0.1 and 1000 Ohm m.

The resistivity systems consist of: 16" and 64" Normal and Short Lateral.

The outside diameter of the tool must be samll enough to be used in boreholes drilled by the DCS (tool OD = 40 mm).

Technical details: electronic circuitry temperature rating 200 °C, Dewar-system internal temperature limit 170 °C. Thermo-syphons and heat pipes will help to distribute the heat evenly and avoid hot spots. The tool will have a Gearhart head cormection.

The first autoclave test will be made at Bochum (MESY) up to 250 °C in September, followed by field tests in Los Alamos or at Salton Sea.

- HT-Fluid Sampler/-Sensors SANDIA (Lysne)
Downhole Memory-Logging Tools

Logging technologies developed for hydrocarbon resource evaluation have not migrated into geothermal applications even though data so obtained would strengthen reservoir characterization efforts. Two causative issues have impeded progress: (i) there is a general lack of vetted, high-temperature instrumentation, and (ii) the interpretation of log data generated in a geothermal formation is in its infancy. Memory-logging tools provide a path around the first obstacle by providing quality data at a low cost. There tools feature on-board computers that process and store data, and newer systems may be programmed to make "decisions". Since memory tools are completely self-contained, they are readily deployed using the slick line found on most drilling locations. They have proven to be rugged, and a minimum training program is required for operator personnel. Present tools measure properties such as temperature and pressure, and the development of noise, deviation, and fluid conductivity logs based on existing hardware is relatively easy. A more complex geochemical tool aimed at a quantitative analysis of potassium, uranium and thorium will be available in about one year, and it is expandable into all nuclear measurements common in the hydrocarbon industry. A second tool designed to sample fluids at conditions exceeding 400 °C (752° F) is in the proposal stage. Partnerships are being formed between the geothermal industry, scientific drilling programs, and the national laboratories to define and develop inversion algorithms relating raw tool data to more pertinent information.

- HT-Magnetometer BGR (Bosum)
  See above under Magnetic.

- HT-Tool Status KTB (Bram)
  Ref. 22 gives a complete list of the tools presently under development for HT-environment. The BGT-upgrade will be done by KTB, while the other tools will be done by Schlumberger or different institutes. At the moment no test has been performed for 300 °C.

- Deep Hole Operation: Capstan, Cable (Zoth)

Due to the very high day rate for the drilling rig an installation for the logging system was designed to cut out rig-up and rig-down time completely. The logging cable is guided through a subsurface tunnel from the unit to the derrick and run over two sheave wheels in to the rig. It remains in the rig permanetely. Logging tools are prepared and calibrated while the drill pipes are still pulled. After the last pipe is out - the top sheave is placed over the borehole by a moveable arm and logging operation starts without delay (Ref. 23).

End of May 1992 the Capstan Unit - needed for operations in deeper holes - was installed. It is a new design including a compensating device. The Capstan will take the pull on line via two friction wheels with 5 wraps of cable each. The wheels are driven by hydraulic motors and have a diameter of 1.15 m.

Synchroneous motion of winch and capstan is reached by close control from the hydraulic system (Ref. 24).

The logging operations in the pilot well and down to 6000 m in the deep hole were performed using a VECTOR 7-46 V cable. A total of 1940 km of cable movement has been recorded without problems. With the installation of the capstan a longer cable with larger outer diameter (5000 m 7-52 V with 4100 m of 7-52 NA) was mounted on the larger drum of the winch. With this cable operations down to 8500 m will be handled. For the interval from 8500 - 10.000 m a piece of 2000 m length of smaller cable (7-39 TFE) will be spliced by a quick joint to the 7-52 VNA cable. This smaller cable will be run from a separate winch.

If the 7-39 TFE cable will cause problems due to temperature an alternative would be the mineral-isolated cable from BICC. A cable head for this type of cable is under development.

7. Crosshole Experiments:

- Interwell Seismic CSM (Green)

Surface and single hole seismic surveys have provided a wealth of information for the earth scientist including the following:

- Imaging boundaries.
- Physical rock properties.
- Calibration of surface seismics.
- Wave propagation studies.

Cross-hole seismic surveys provide all this information but fill a gap in the seismic spectrum. Surface reflection and refraction surveys operate at frequencies of up to 100 Hz and are limited by surface operation. Higher resolution single hole methods such as sonic and BHTV logs operate at more than 1 kHz but suffer lack of penetration and the effects of the borehole itself. Cross-hole seismics provides high resolution information between 0.1-1 kHz in the undisturbed region between boreholes.

Cross-hole surveys are now routine in some areas such as engineering and geothermal investigations. There are a variety of source and receivers existing that enable surveys to take place at depth of up to 3 km with interwell distances of 500 metres with the main choice being between clamped and unclamped tools. The tools used, however, must be determinded by the end use. Wave propagation studies would require a clamped 3 component receiver but velocity attenuation tomography is porbably more cost effectively carried out using hydrophones.

It is recommended that consideration of cross-well surveys by ODP should go through the following definition studies:

Phase 1:	Define objectives	(physical properties, boundary imaging etc).
Phase 2:	Define constraints	(borehole diameter, temperature etc).
Phase 3:	Define hardware	(clamped/unclamped etc.

8. ODP-Data Net Vision (De Menocal)

The Borehole Research Group (Lamont) is planning to implement a new program, called DataNet, which will significantly broaden the ODP logging operations and provide an internationally-available database resource. The DataNet concept is a management structure as well as a product. The essence of DataNet is that it provides the means to address three growing concerns within ODP: 1) increased international participation, 2) rapid, global accessibility of ODP log and core data, and 3) integration of log and core data. Lamont will remain the managerial hub of logging operations, but an intrinsic part of DataNet is to gradually distribute some of the logging contractor's responsibilities over to other DataNet-affiliated institutions. Thus, DataNet will enhance international cooperation, and produce a larger resource base since the affiliate institutions bring with them added expertise and experience. We plan to retain a single JOI contract for logging operations and DataNet; subcontracts to DataNet affiliates will be managed from Lamont.

Implementation of the DataNet structure will proceed in four phases. The first phase is business-as-usual until the end of FY92, with the renewal phase planning for the implementation of a full-scale DataNet proposal to JOI as a target goal. Phase II (FY93) marks the beginning of any real changes; we plan to develop and pilot-test essential software components of the DataNet database, and shipboard technical support and core-log data integration centers will be phased-in at IMT (Marseille) and URI (Rhode Island). Some of the critical routines required for the DataNet database have been developed at Lamont already (GeoBase, Sybase, GMT, and CORPAC programs) on-line. During Phase III (FY94) we plan to expand database development and testing and have a core-log data integration center in-place at Lamont

The beginning of Phase IV (FY95) marks the full implemantation of DataNet management and products. We plan to have the DataNet software package on-line and available for global access through internet by the beginning of FY95. Shipboard logging operations will be managed by IMT (Marseille) through an annual subcontract from Lamont. Core-log integration workstations will be installed at Lamont, URI (University of Rhode Island), TAMU (Texas A & M University), UNB (University of New Brunswick), and the ship; log analysis centers will be installed at Lamont, IMT, Leicester, and Karlsruhe. Phase IV marks the official end of business-as-usual operations and marks the beginning of a new international logging resource base whereby ODP core and log data are rapidly accessible through internet, and powerful computational tools are available to analyze, integrate, and extract these data.

The DataNet plan is our response to the evolving needs of the ODP community. We also hope to include the KTB program and its data within the DataNet environment. Merely repackaging the standard BRG logging service in this renewal phase is neither an efficient nor effective way to promote growth for the ODP program as a whole. DataNet is a forward-looking project, and we would like to include these features in the renewal proposal.

- SEL Software (Draxler for Sturmeit)

KTB has developed over the last four years a comprehensive software package for handling and manipulating data from different sources like drilling, logging, core analysis. The data can be in digital or analog from, numerical or continuous, fixed or variable sampling rate. In addition graphic display possibilities have been created to produce any kind of plot and combine data from these different sources. The package is called SEL from "SELECT".

For the data processing at the logging center additional software from CSN (Compagnie de Services Numériques, Paris) and Schlumberger (Formation Evaluation Package) is evailable.

These software packages run on the Micro VAX III installed at the logging center and is linked to the main frame VAX at the field laboratory. A data link to Hannover exists (9600 bauds). The evaluation of the Formation Micro Imager is done on a MAC II with software from Stanford University, modified and upgraded by Karlsruhe University.

Via the link to the field laboratory logging data (for ex. the reference Gamma Ray Log) is transfered to and constantly updated at the KTBase the KTB operational data base.

To support operational decisions fast "Quick Look" data outputs can be produced - like horizontal or vertical projections of the borehole trajectory. At the same time, formation evaluation studies are made exploiting data from logs, drilling and sample analysis.

The SEL package is the easy and fast manipulation device of the systam (Ref. 25 and 26).

9. Visits

After the meeting visits were made to the field laboratory, the drilling rig the automatic sampling system and the logging center.

The processing of sample material (cores, cuttings, drilling, powder, mud, gases) was explained by H.-G. Dietrich while visiting the individual sectors of the field laboratory.

The drilling rig and the associated installations were explaned by Tran Viet (KTB drilling engineer) and J. Draxler. The operation of the pipe handling equipment could be seen during a round trip operation.

Heinisch explained the automatic sampling system, but could not demonstrate it, as installation is not complete yet.

The tour through the logging center was guided by J. Draxler. The operation of the capstan and the logging system installation was explained. A visit to the data processing center closed the tour of the KTB drilling site.

10. Remarks

This protocol was compiled from abstracts of the presentations provided by the participants. If abstracts had not arrived in time, a short summary was written from notes taken during the meeting.

The KTB Projekt Management likes to thank the participants for their valued contributions to this second joint meeting.

J. Draxler

J. Draxler Hannover, July 9th 1992

Appendix: Ref. 1 - 24

Joint Meeting DMP/KTB
Windischeschenbach, June 2nd 1992
KTB Oberpfalz HB
Agenda

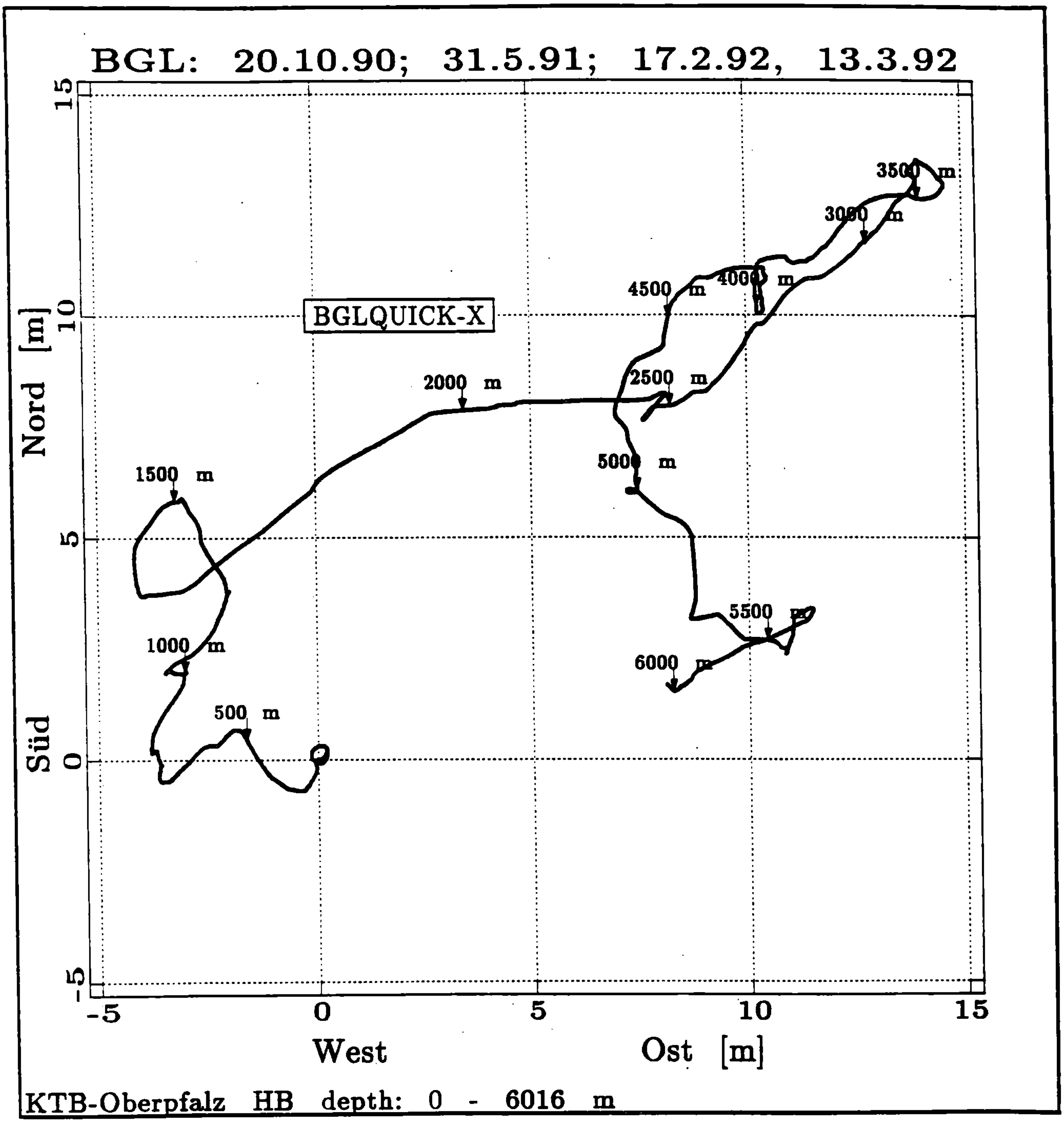
8.30	Welcome and Introductions, Discussion / Adoption of Agenda	(Bram)
8.45	Review of German ODP Activity	(Beiersdorf)
9.00	Status Report KTB-Oberpfalz HB	(Kehrer)
9.15	Results: KTB-Oberpfalz HB, 0 - 6000 m	
	Drilling Operation:	(Chur)
	Vertical Drilling Technology	
	Large Diameter Coring	
	Casing Scheme and Application	
	Cementation 16" and 13 3/8" Strings	
	Logging Operations and Evaluations	(Draxler)
	Highlights New Logging Tools (FMI, DSI, ALAT, GLT)	
	Correlation GLT with XRF/XRD	(Gatto)
	Borehole Stability (Break-outs)	(Kück)
	Geothermic: Temperature Evaluation	(Zoth)
	Geohydraulic: Testing and Sampling	(Kessels)
	Hydrofrac Experiment	
10.30 Break		
10.45	Magnetic: Report on Tool Performance and Evaluation	(Bosum/ Fieberg)
	Seismic: VSP and ISO 89 (3-D Survey)	(Bram)
11.15	Sampling / Coring Innovations:	
	Sonic Core Monitor	(Fisher)
	Automatic Sampling System	(Heinisch)
	Sedimentation Sub - Evaluation	(Lich/Rust)
	Gamma Spectroscopy on Cores and Cuttings	(Bücker)
12.00	HT-Tool Development and Tool Performance:	
	New Tool Performance Report LDGO	(DeMenocal)
	Packer Flowmeter	(Morin)
12.30 Lunch		
14.00	HT-Resistivity Tool Development CSM	(Manning)
	HT-Fluid Sampler / -Sensors SANDIA	(Lysne)
	HT-Magnetometer BGR	(Bosum)
	HT-Tool Status KTB	(Bram)
	Deep Hole Operation: Capstan, Cable	(Zoth)

15.15	Crosshole Experiments: Interwell Seismic CSM	(Green)
15.45	ODP Data-Net Vision SEL Software	(DeMenocal) (Sturmeit)
16.30	Visits: KTB Logging Centre Drilling Rig Field Laboratory	(Bram/Draxler) (Chur/Tran Viet) (Dietrich).

J.Draxler
Hannover, May 29th 1992

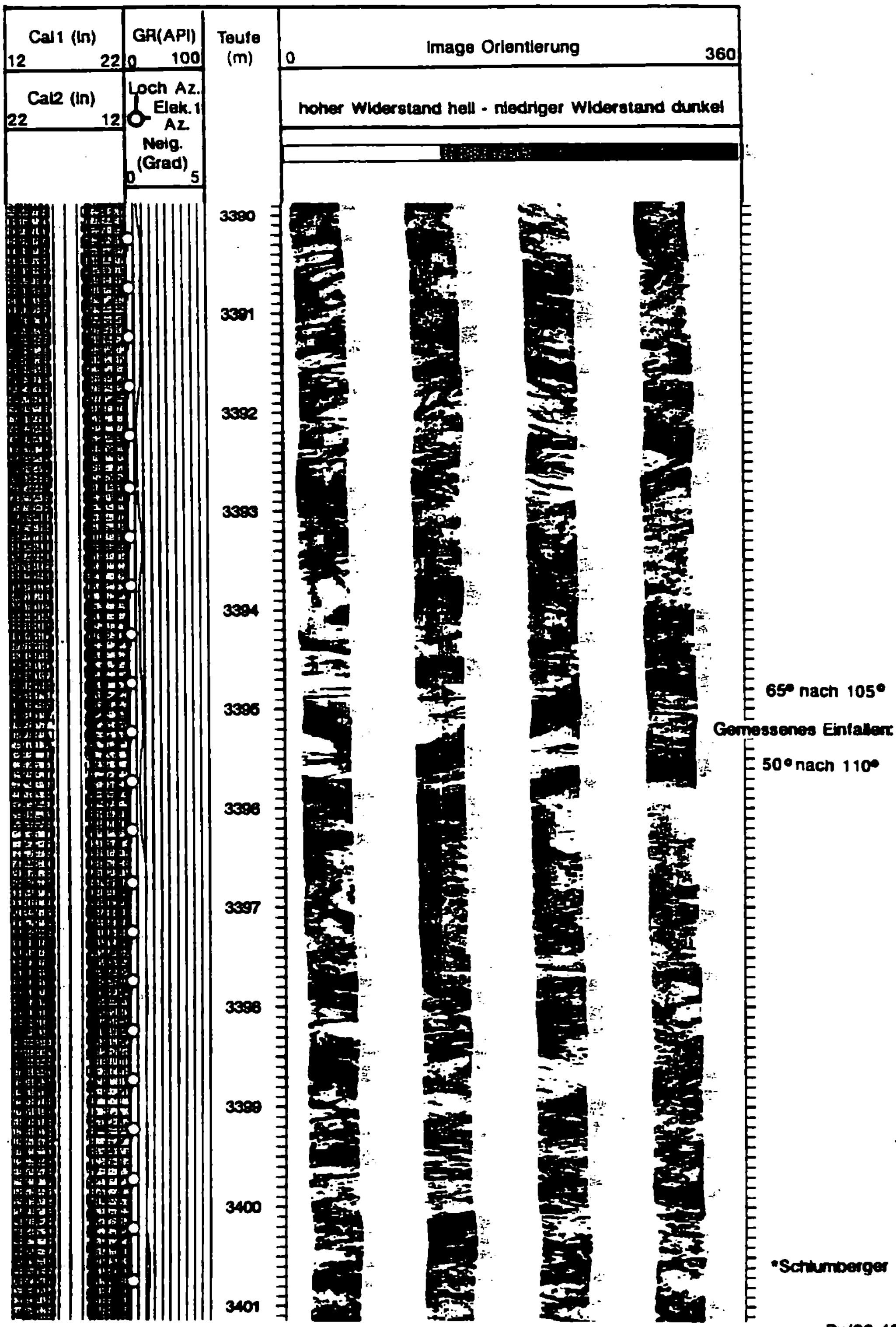
Ref.2

KTB-Oberpfalz HB
Horizontal Projection



Ref.3

FORMATION MICROIMAGER (FMI)*
Fracture Detection

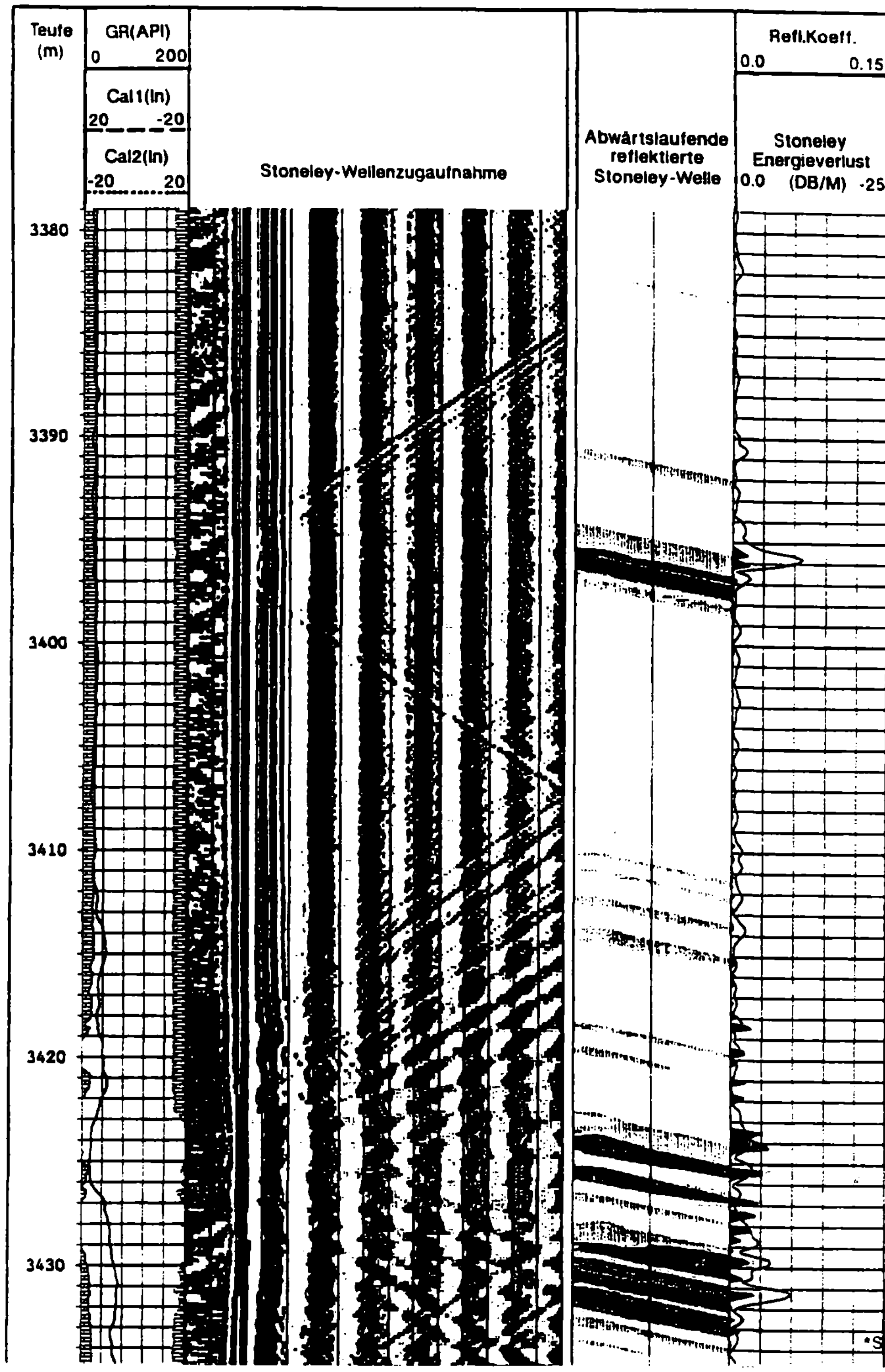


*Schlumberger

Dx/92-13

Ref.4

DIPOLE SONIC IMAGER (DSI)*
Fracture Detection



*Schlumberger

Dx/92-12

AZIMUTHAL ARRAY IMAGER (ALAT)

PRELIMINARY SPECIFICATIONS

Tool Diameter	(small sub)	3 5/8" (4 7/8" with stand-offs)
	(medium sub)	6" (7 1/4" with stand-offs)
	(large sub)	9" (10 1/4" with stand-offs)
Make-up Length		33.75 ft (11.02 m)
Tool Weight		556 lbs (252 kg)
Telemetry Type		DTS (with DTB through-wiring)
Combinability		Anywhere in the DTS string
		GPIT needed for oriented images
		With FBST, (FBCC housing is A 2)
Logging Speed	(high.azim.res.)	1800 ft/h 0.5" sampling
		3600 ft/h 1.0" effective sampling
	(DLL only)	7200 ft/h
Azimuthal Resolution		60 deg. fractures (1" stand-off)
Instrumental Accuracy		5% (1 < Ra < 2000)
		10% (2000 < Ra < 5000)
Maximum Temperature		350 ^{0}F (175 ^{0}C)
Maximum Pressure		20,000 psi (140 MPa)
Maximum Borehole Diameter		21"
Minimum Borehole Diameter		4 1/2"

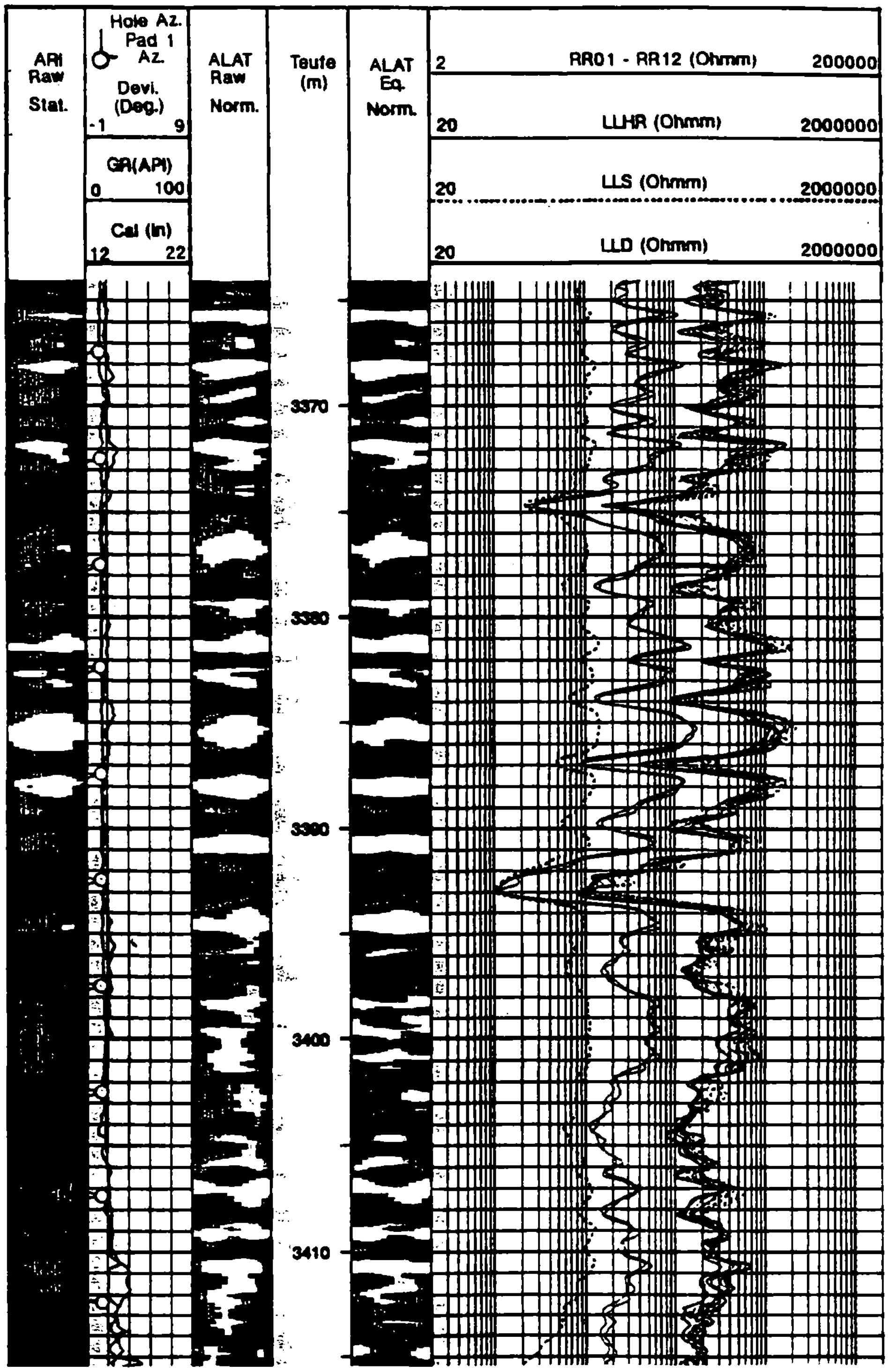
Resistivity Range (Azimuthal Mode);

Formation Resistivity: 0.2 - 40,000 Ohmm

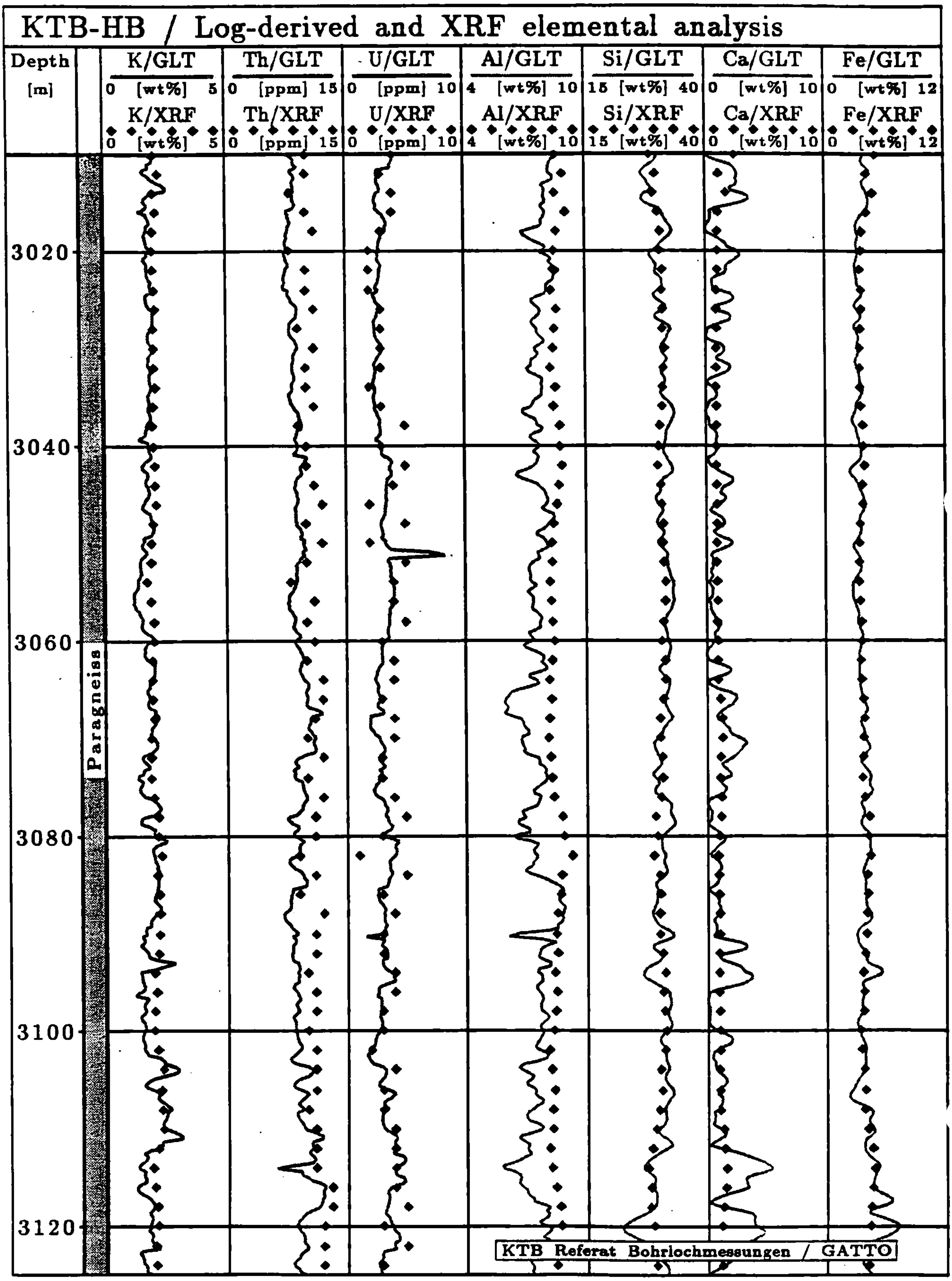
Mud Resistivity (conduct. muds only) up to 2 Ohmm

AZIMUTHAL ARRAY IMAGER (ALAT)*

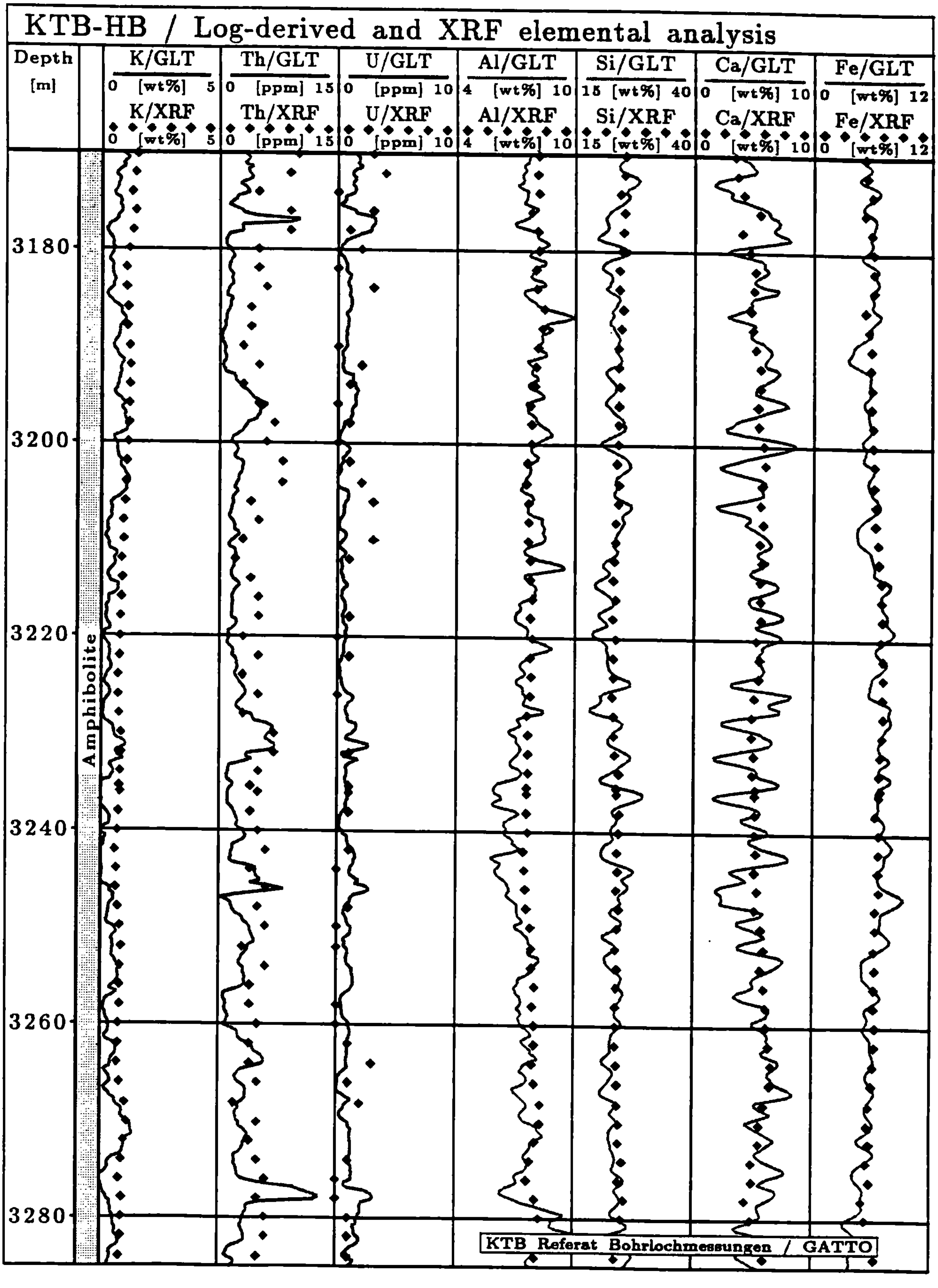
(Prototyp)



Ref.7

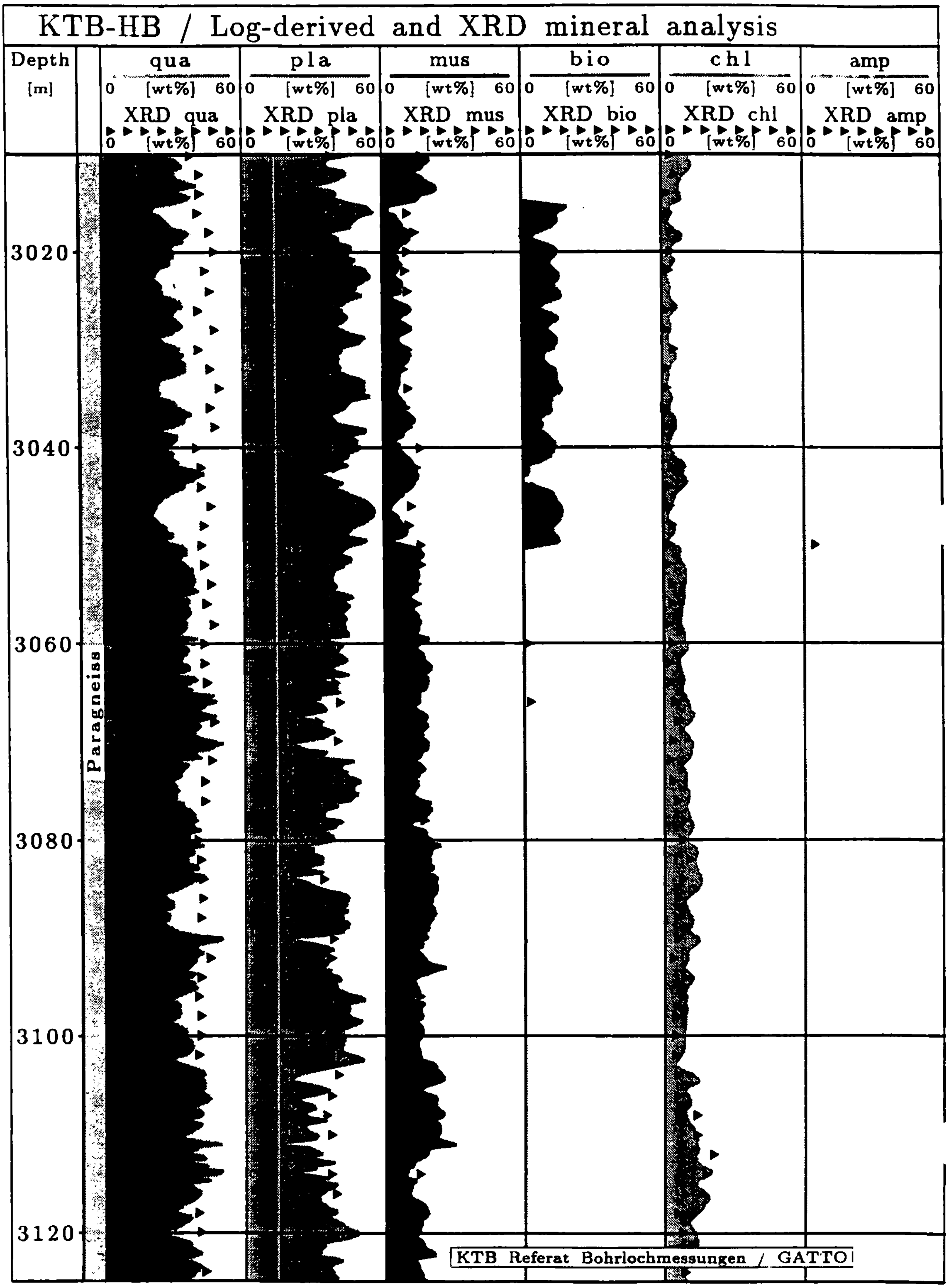


KTB-HB / Log-derived and XRF elemental analysis
Depth [m]
K/GLT 0 [wt%] 5
K/XRF 0 [wt%] 5
Th/GLT 0 [ppm] 15
Th/XRF 0 [ppm] 15
U/GLT 0 [ppm] 10
U/XRF 0 [ppm] 10
Al/GLT 4 [wt%] 10
Al/XRF 4 [wt%] 10
Si/GLT 15 [wt%] 40
Si/XRF 15 [wt%] 40
Ca/GLT 0 [wt%] 10
Ca/XRF 0 [wt%] 10
Fe/GLT 0 [wt%] 12
Fe/XRF 0 [wt%] 12
3020
3040
3060
3080
3100
3120
Paragneiss
KTB Referat Bohrlochmessungen / GATTO



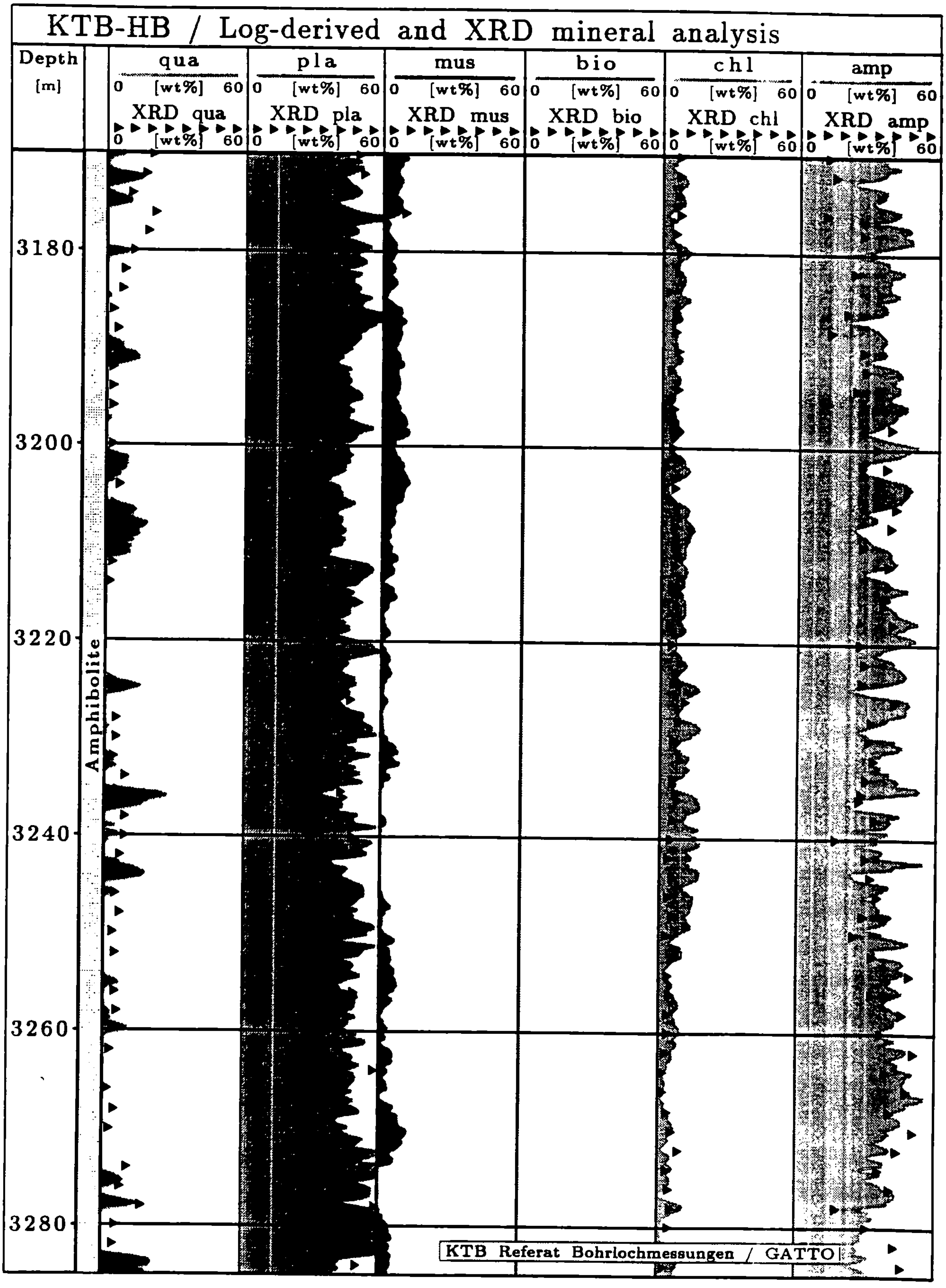
KTB-HB / Log-derived and XRF elemental analysis
Depth [m]
K/GLT 0 [wt%] 5
K/XRF 0 [wt%] 5
Th/GLT 0 [ppm] 15
Th/XRF 0 [ppm] 15
U/GLT 0 [ppm] 10
U/XRF 0 [ppm] 10
Al/GLT 4 [wt%] 10
Al/XRF 4 [wt%] 10
Si/GLT 15 [wt%] 40
Si/XRF 15 [wt%] 40
Ca/GLT 0 [wt%] 10
Ca/XRF 0 [wt%] 10
Fe/GLT 0 [wt%] 12
Fe/XRF 0 [wt%] 12
3180
3200
3220
3240
3260
3280
Amphibolite
KTB Referat Bohrlochmessungen / GATTO

Ref.9

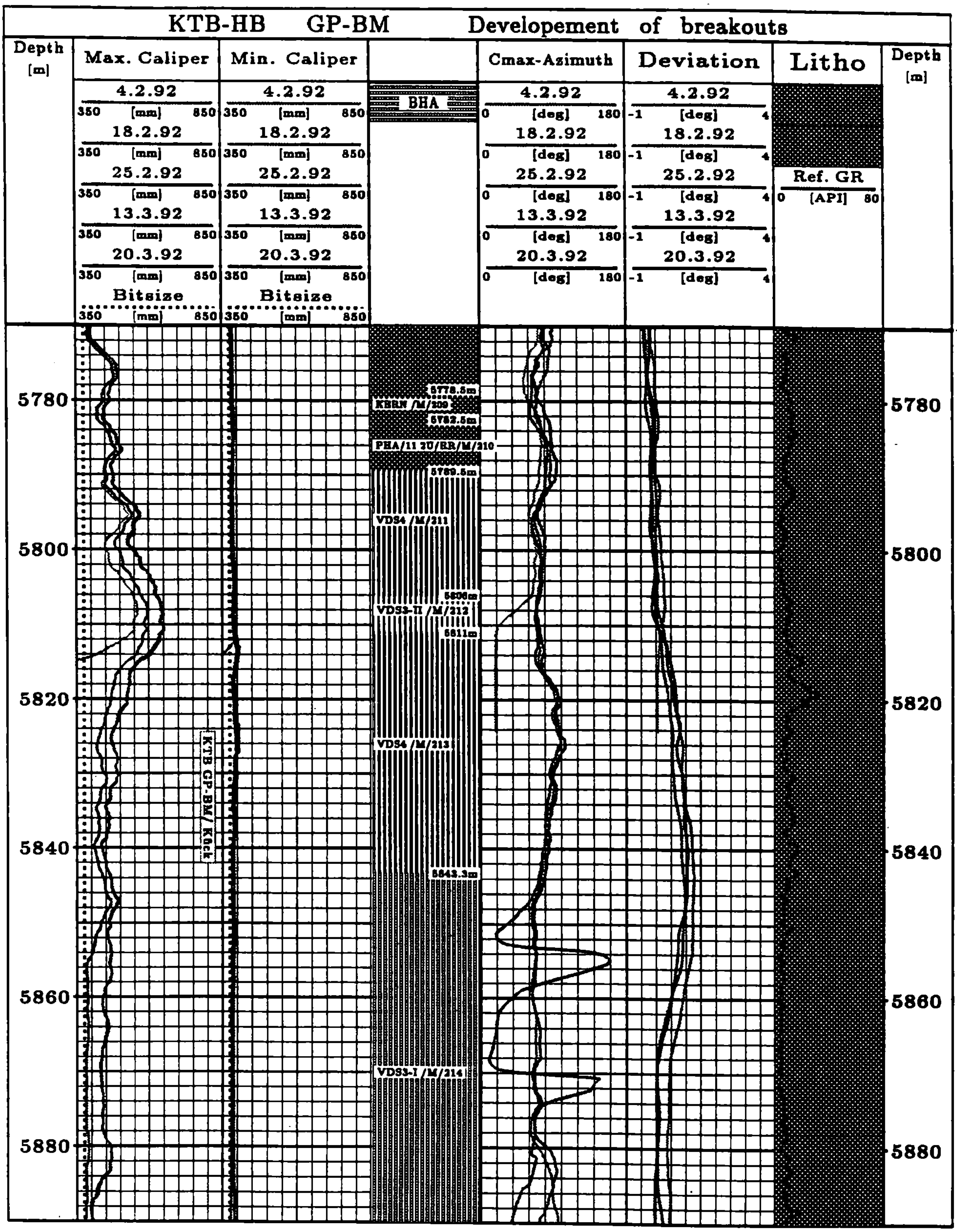


KTB-HB / Log-derived and XRD mineral analysis
Depth [m]
qua 0 [wt%] 60
XRD qua 0 [wt%] 60
pla 0 [wt%] 60
XRD pla 0 [wt%] 60
mus 0 [wt%] 60
XRD mus 0 [wt%] 60
bio 0 [wt%] 60
XRD bio 0 [wt%] 60
chl 0 [wt%] 60
XRD chl 0 [wt%] 60
amp 0 [wt%] 60
XRD amp 0 [wt%] 60
3020
3040
3060
3080
3100
3120
Paragneiss
KTB Referat Bohrlochmessungen / GATTO

Ref.10

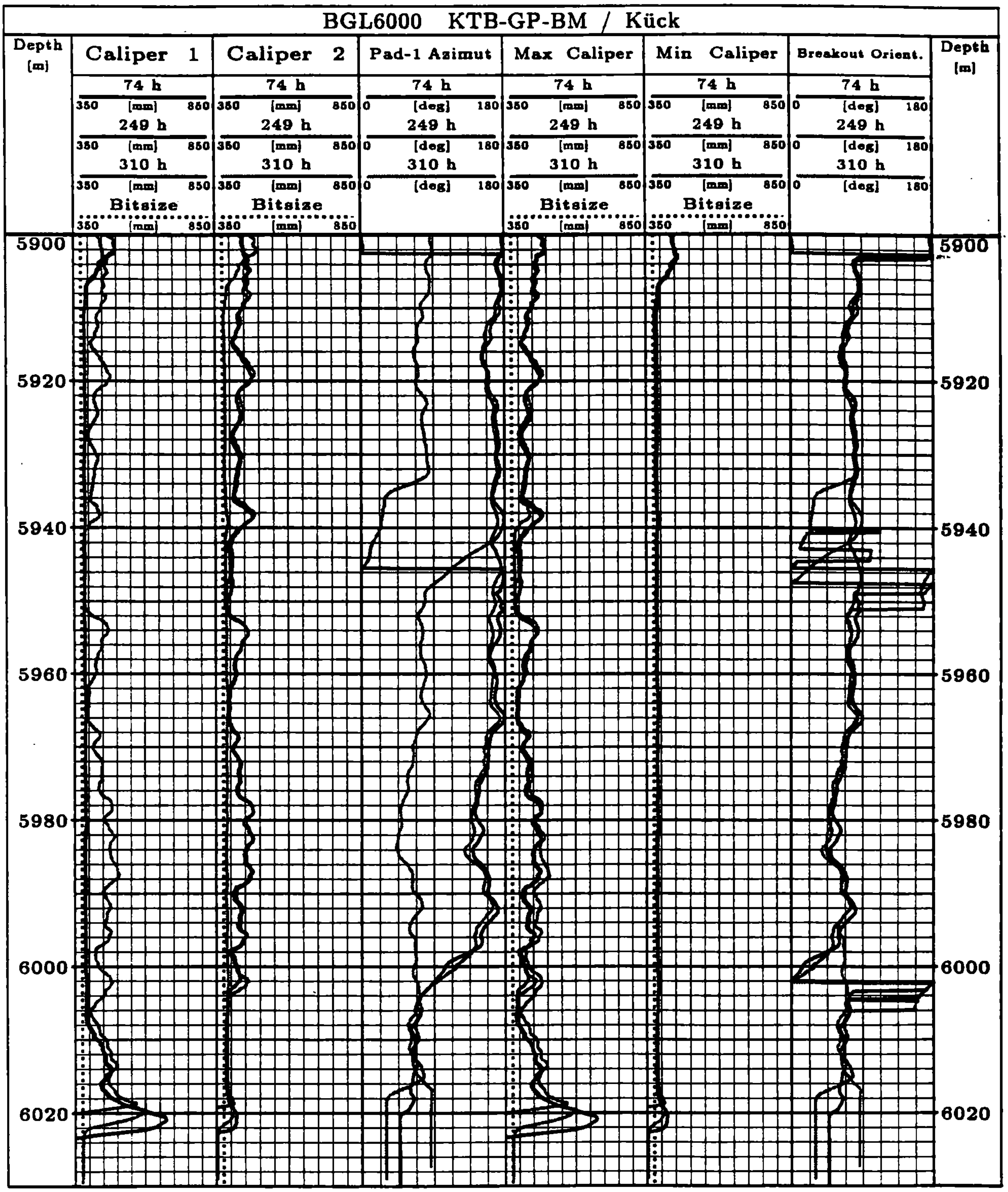

KTB-HB / Log-derived and XRD mineral analysis
Depth [m]
qua 0 [wt%] 60
XRD qua 0 [wt%] 60
pla 0 [wt%] 60
XRD pla 0 [wt%] 60
mus 0 [wt%] 60
XRD mus 0 [wt%] 60
bio 0 [wt%] 60
XRD bio 0 [wt%] 60
chl 0 [wt%] 60
XRD chl 0 [wt%] 60
amp 0 [wt%] 60
XRD amp 0 [wt%] 60
3180
3200
3220
3240
3260
3280
Amphibolite
KTB Referat Bohrlochmessungen / GATTO

Ref.11

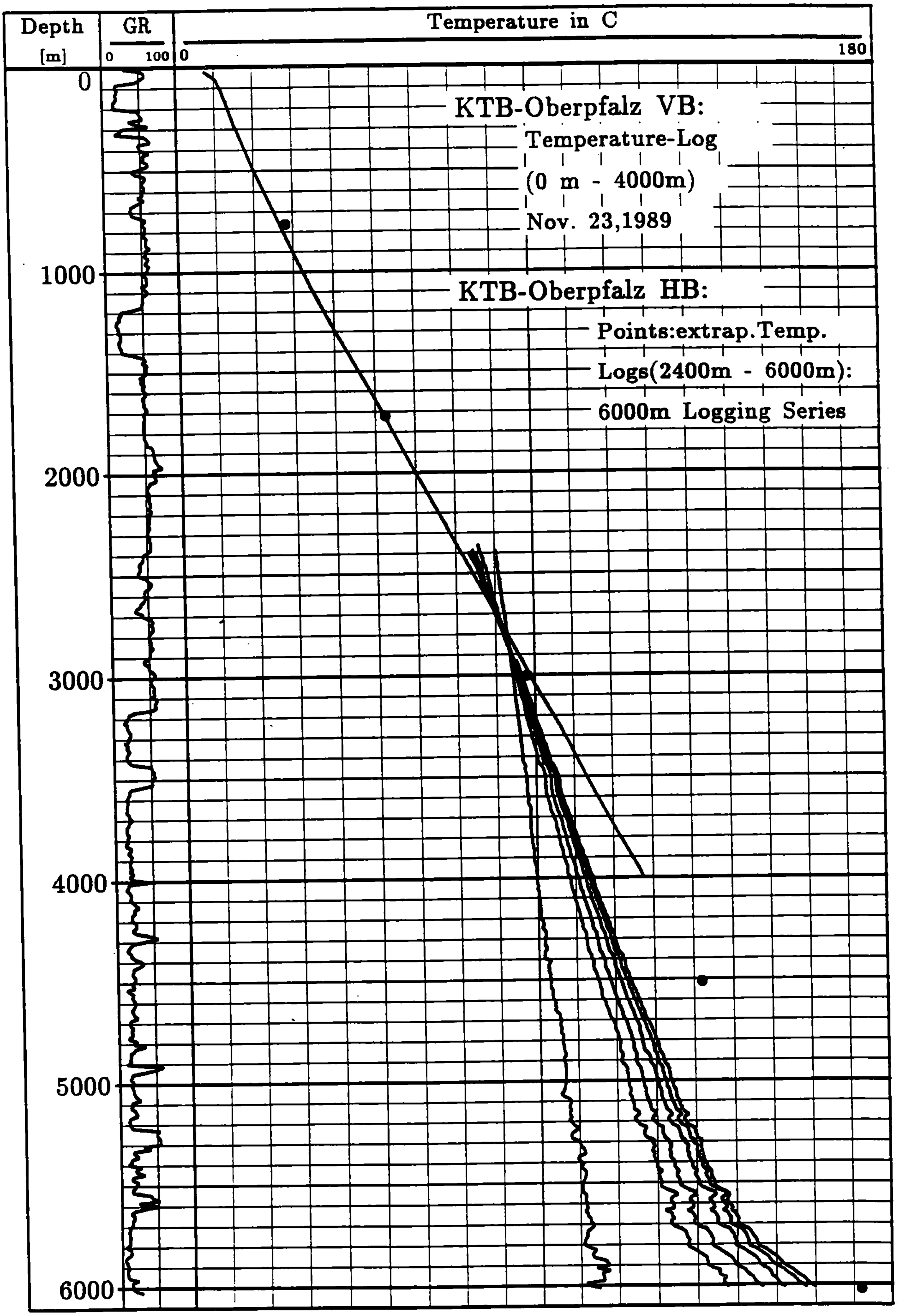


3-JUN-1992 11:37 / KTB-HB Referat Bohrlochmessungen / Kück

Ref.12

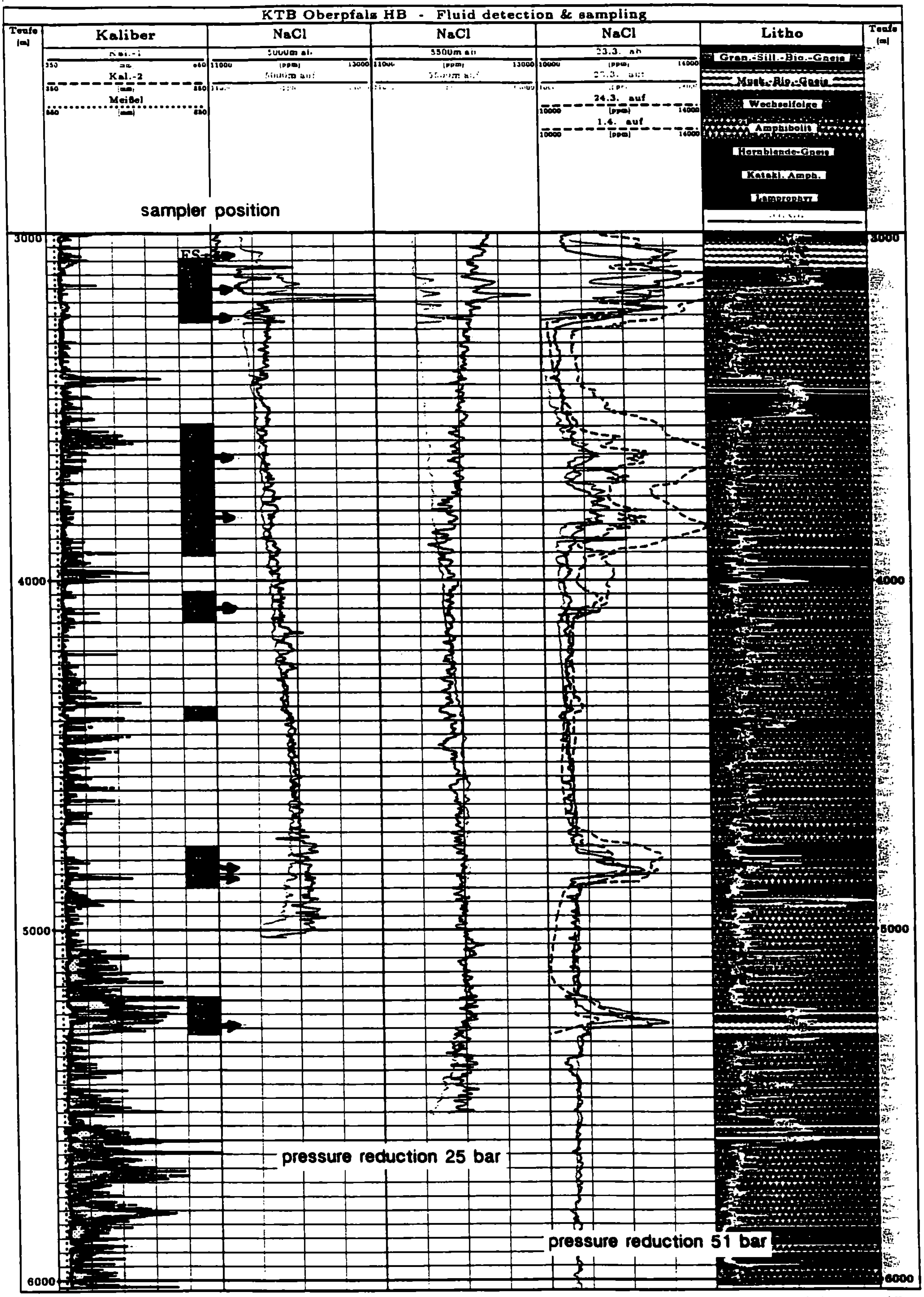


3-JUN-1992 10:37 / KUECK

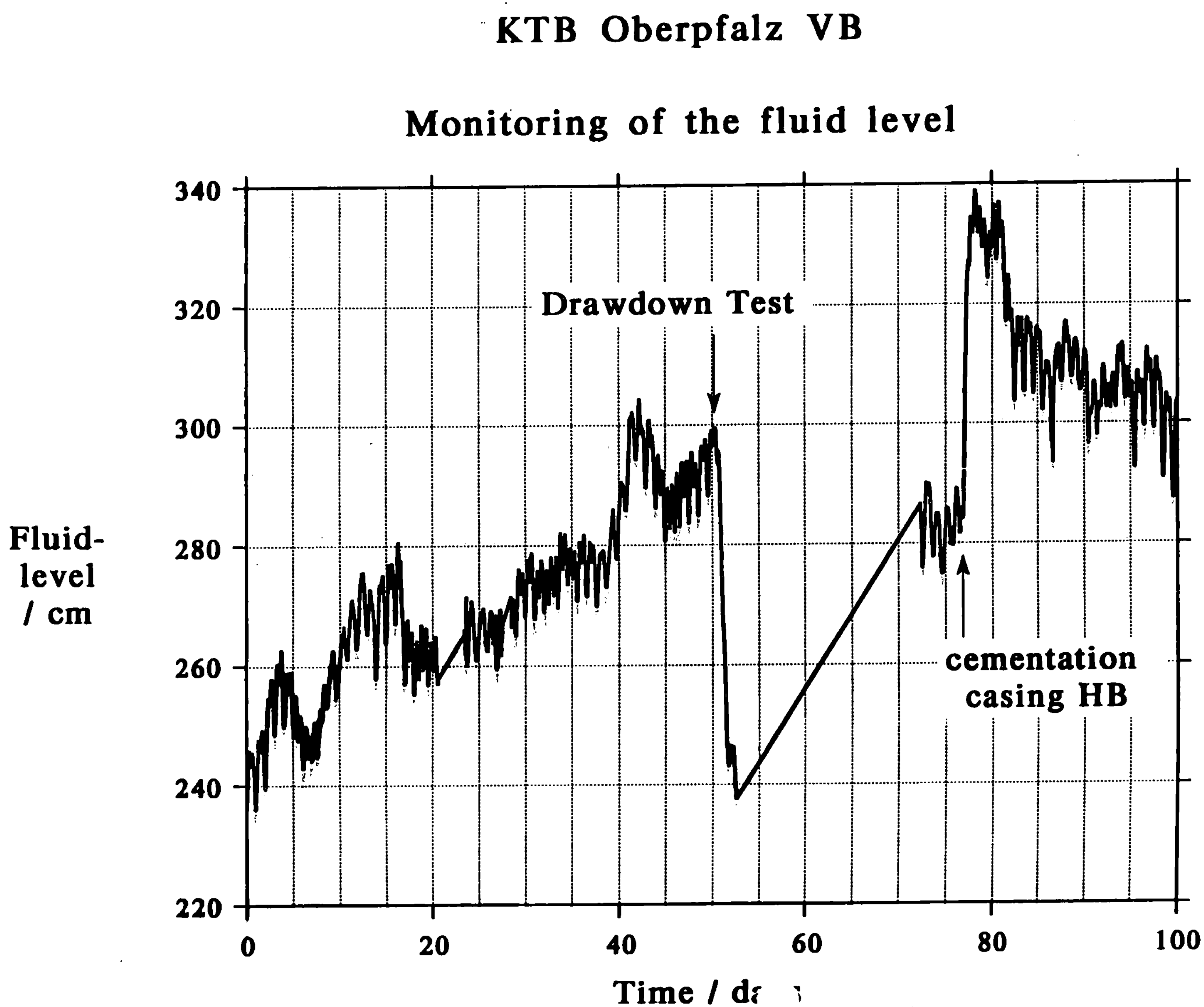


8-JUL-1992 08:33 / ZOTH

Ref.14



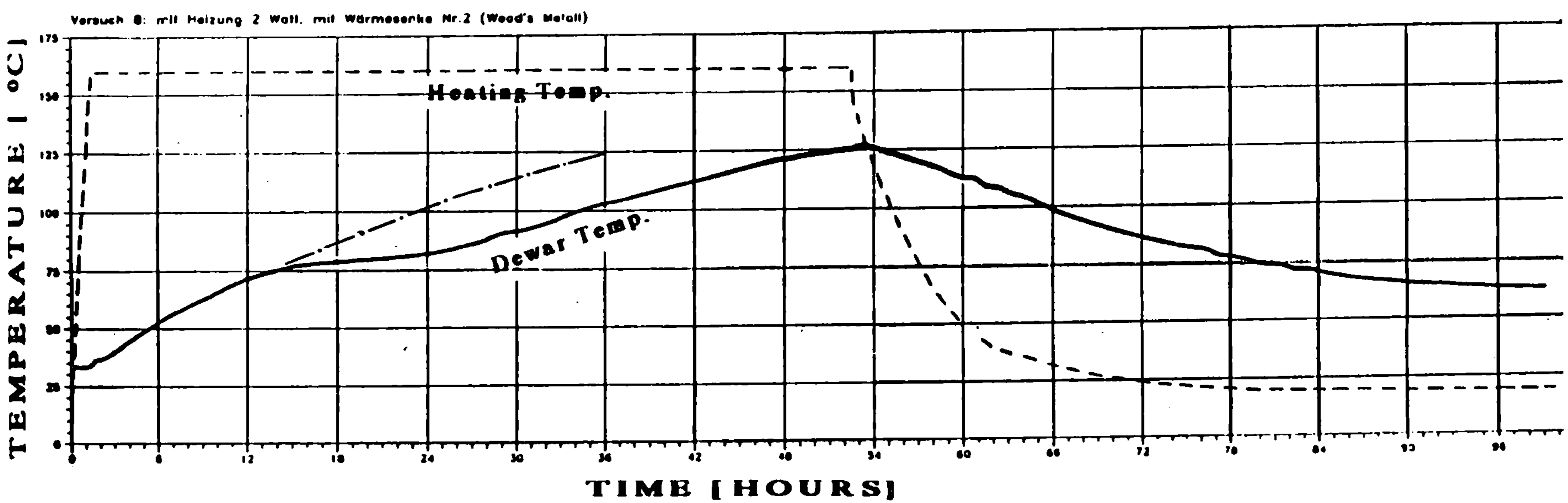
26-MAY-1992 12:55 / KTB-HB Referat Bohrlochmessungen / Kück


KTB Oberpfalz VB
Monitoring of the fluid level
Drawdown Test
cementation
casing HB
Fluid-
level
/ cm
340
320
300
280
260
240
220
0
20
40
60
80
100
Time / da

Ref.15

BGR

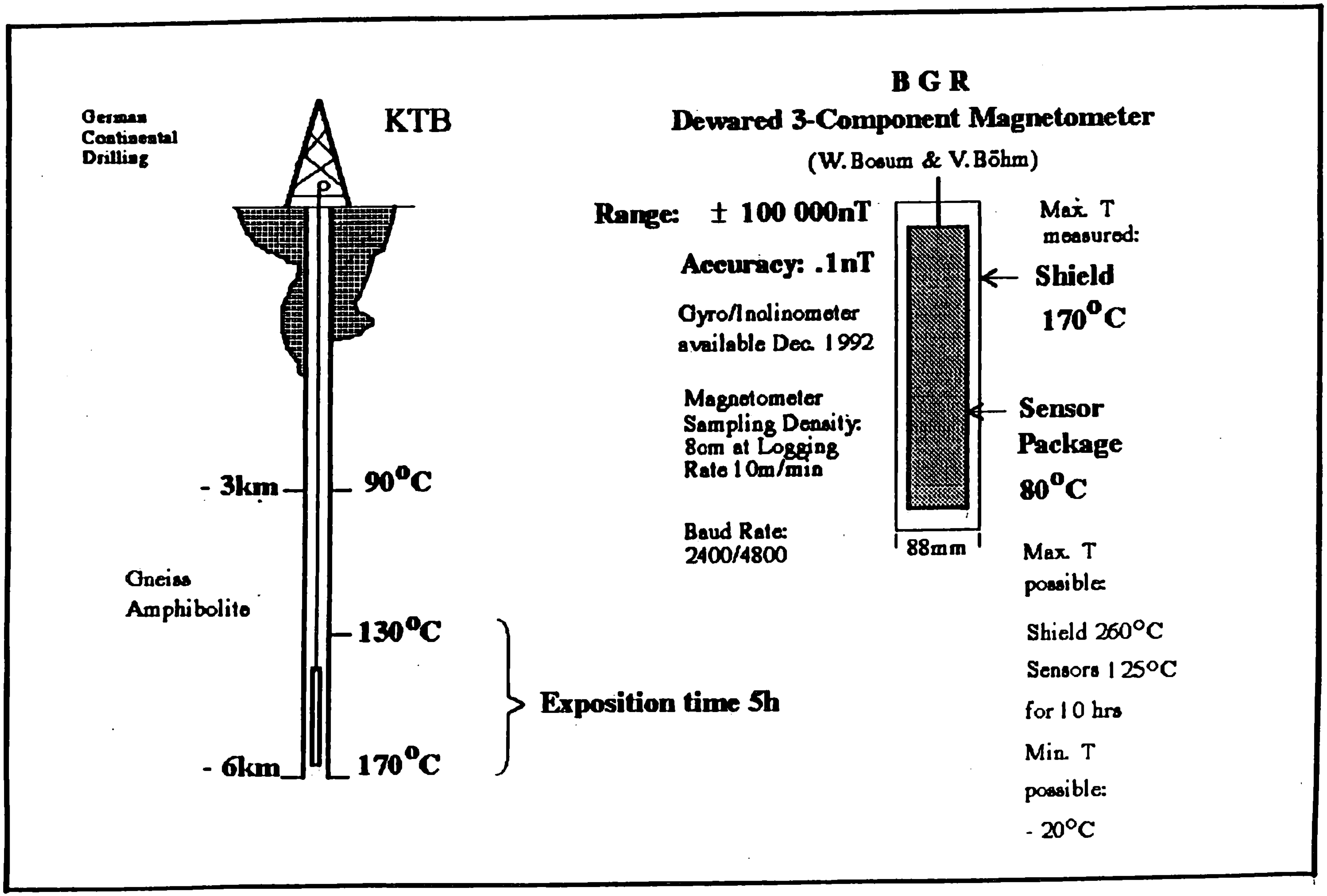
3-Component Borehole Magnetometer



Laboratory Test of Heat Protection System

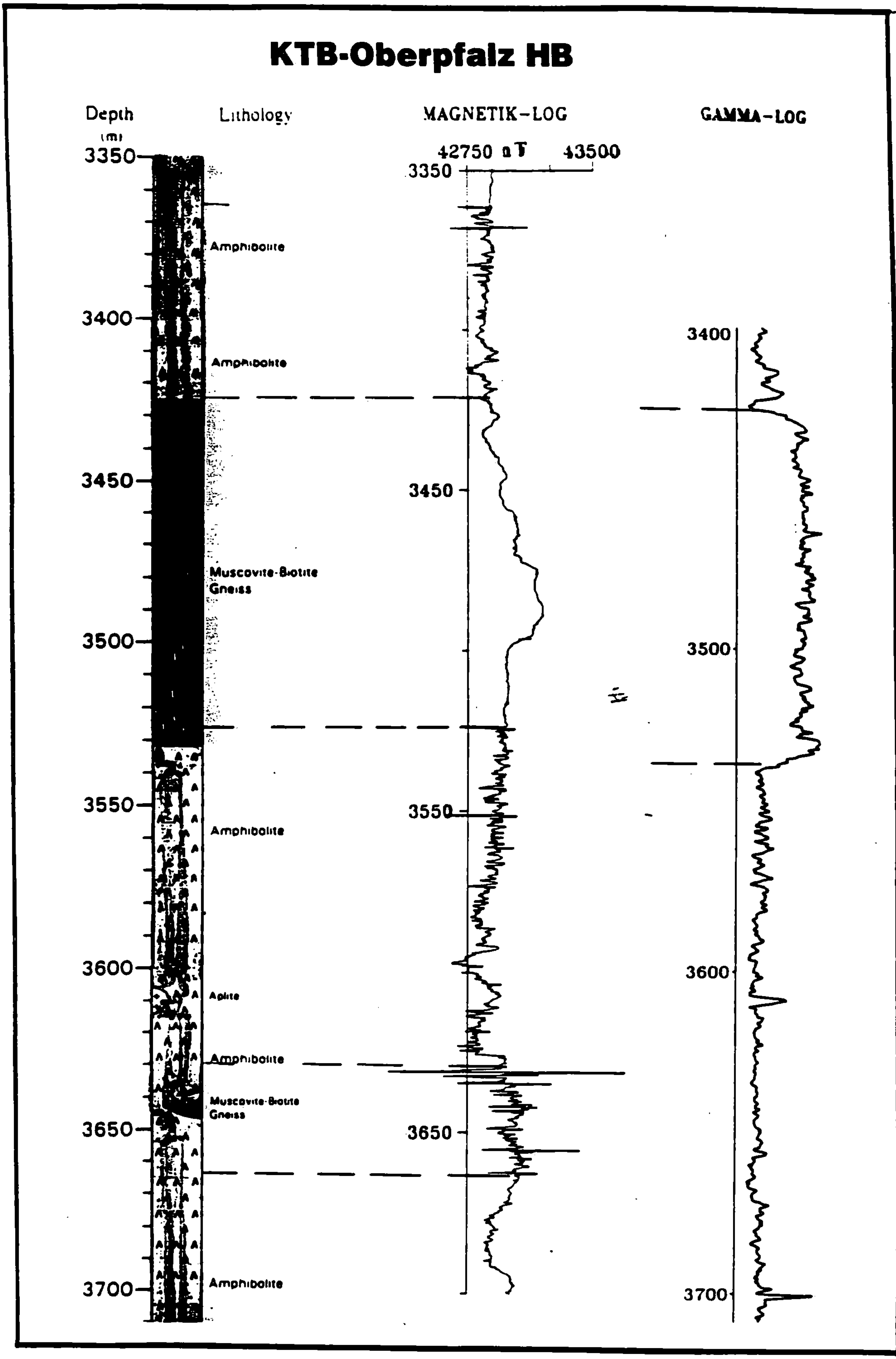
(December 1991)

Ref.16


German
Continental
Drilling
KTB
- 3km
90°C
Gneiss
Amphibolite
130°C
Exposition time 5h
- 6km
170°C
B G R
Dewared 3-Component Magnetometer
(W. Bosum & V. Böhm)
Range: ± 100 000nT
Accuracy: .1nT
Gyro/Inclinometer
available Dec. 1992
Magnetometer
Sampling Density:
8cm at Logging
Rate 10m/min
Baud Rate:
2400/4800
88mm
Max. T
measured:
Shield
170°C
Sensor
Package
80°C
Max. T
possible:
Shield 260°C
Sensors 125°C
for 10 hrs
Min. T
possible:
- 20°C

Ref.17

Ref.18


KTB-Oberpfalz HB
Depth (m)
Lithology
MAGNETIK-LOG
GAMMA-LOG
42750 nT
43500
3350
3400
3450
3500
3550
3600
3650
3700
Amphibolite
Amphibolite
Muscovite-Biotite Gneiss
Amphibolite
Aplite
Amphibolite
Muscovite-Biotite Gneiss
Amphibolite

Ref.19

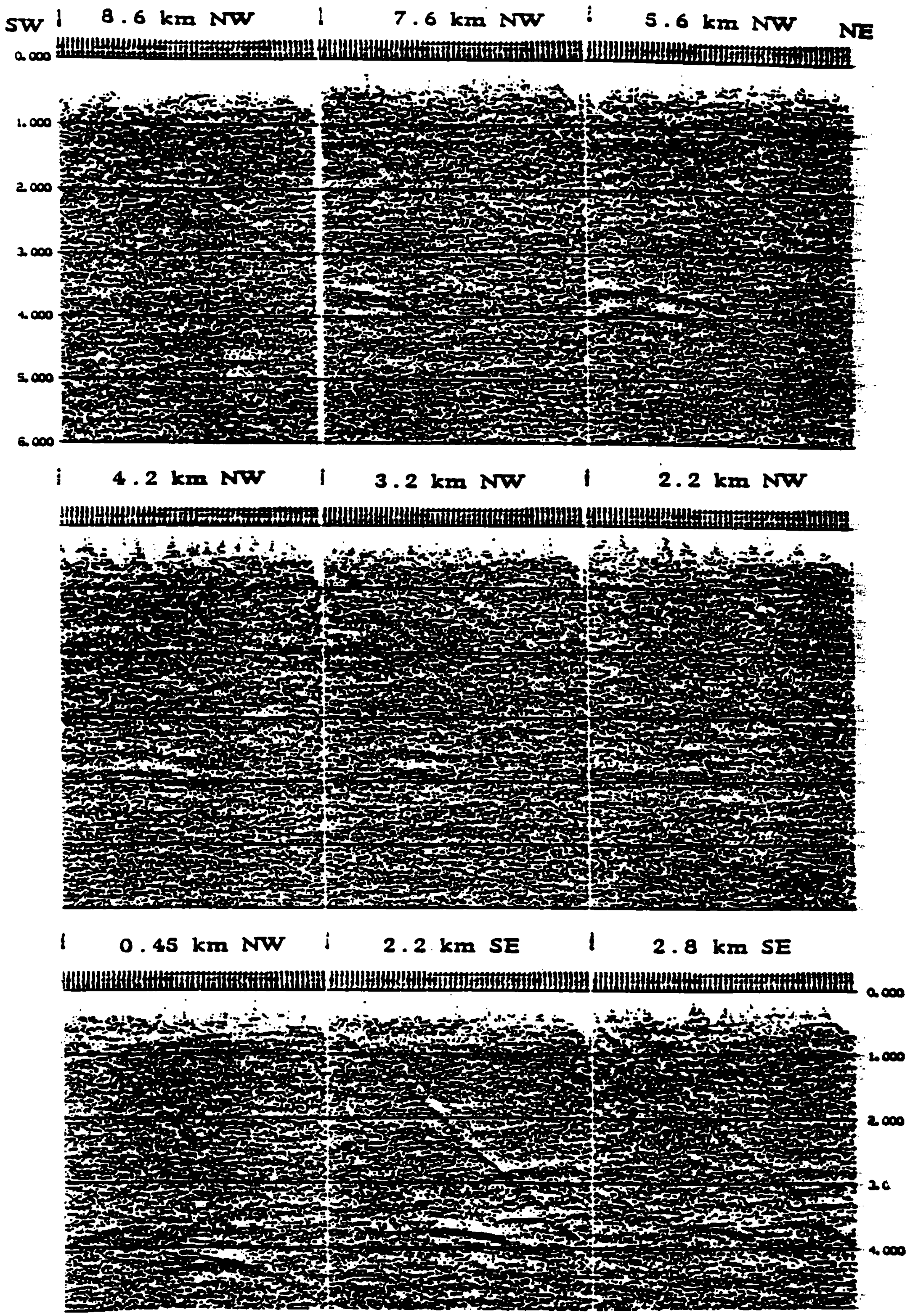
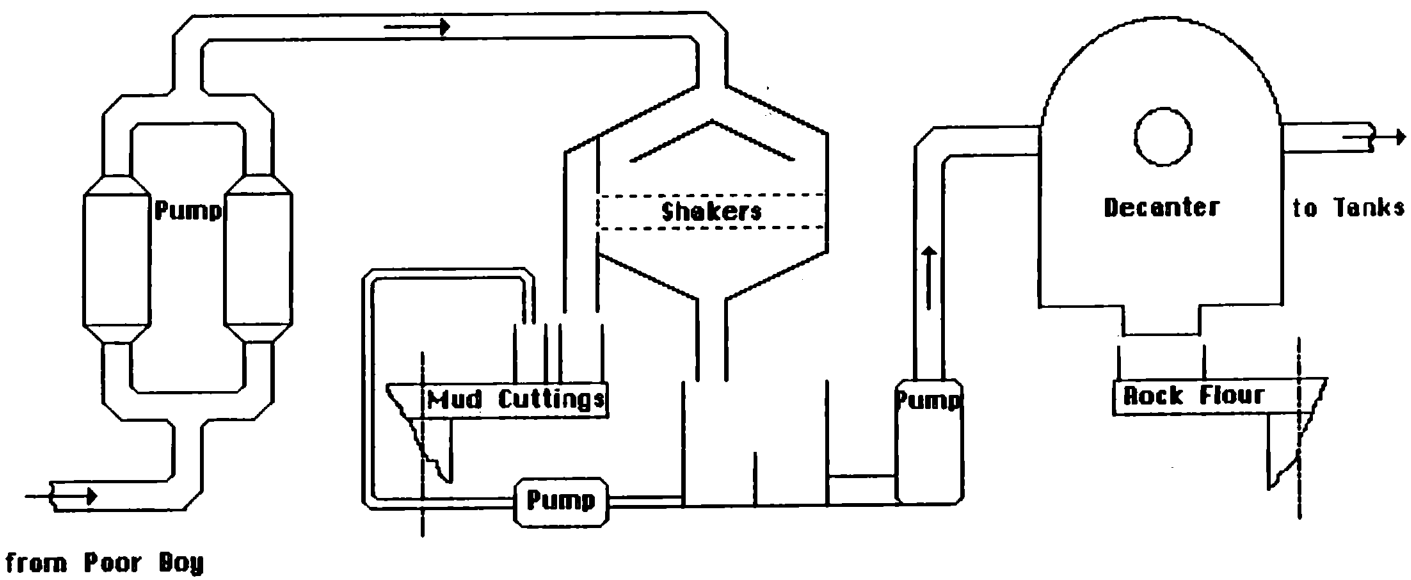


Abb. 3a: Inline-Ausspielungen. Entfernungsangaben über jedem Schnitt geben die Lage zur KTB an (ohne Interpretation).

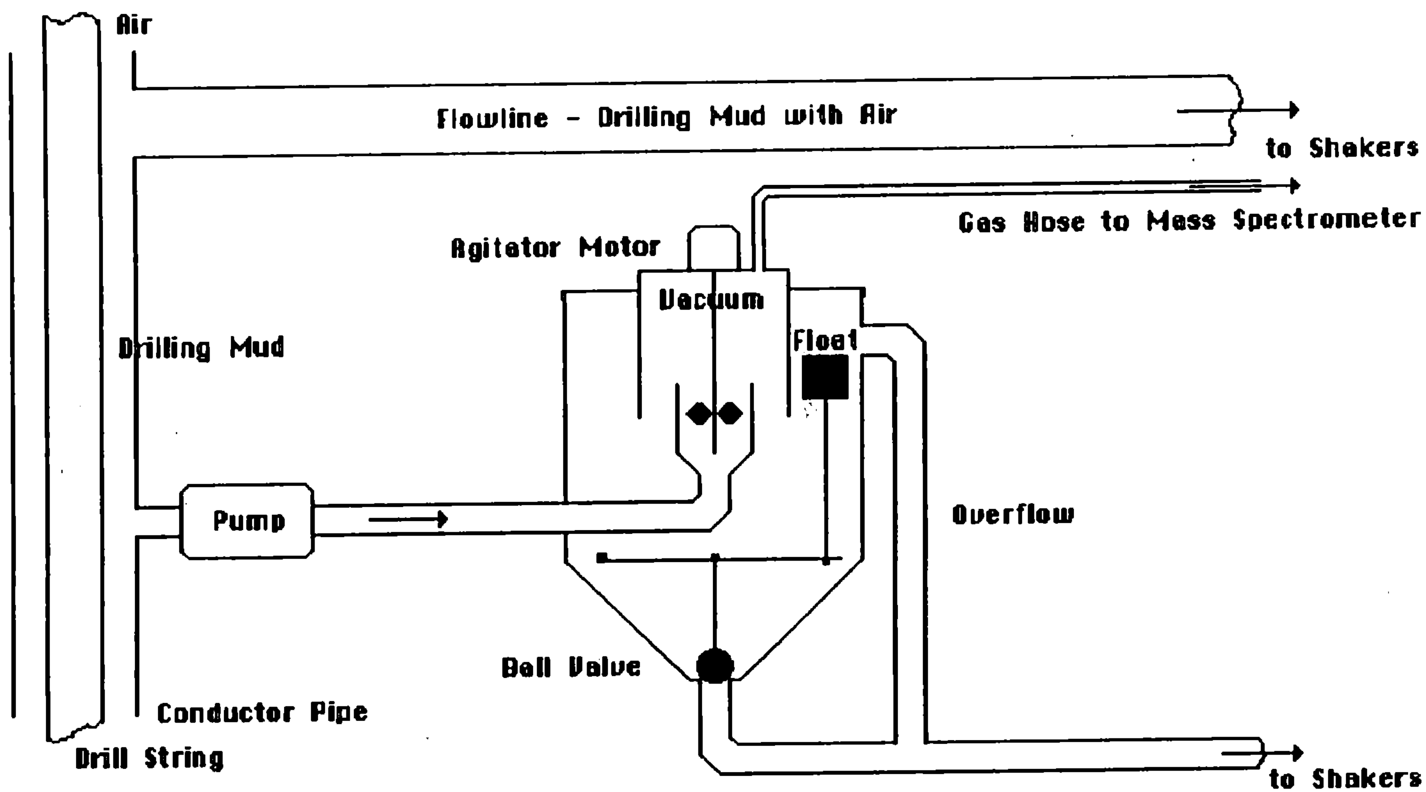


Automatic Sampling System for Cuttings, Mud and Rock Flour

KTB

Ref.20

Niedersächsisches Landesamt für Bodenforschung



Degassing System for Air-uncontaminated Drilling Mud

KTB

Ref.21

Niedersächsisches Landesamt für Bodenforschı

Tools	Company	Remarks
Cable head	Thetys/KTB	300 °C for mineral insulated cable
BGT	NLFB-KTB	200 °C, improvement to 225 °C in progress
AMS	Schlumberger	260 / 300 °C under development
BGT/GPIT	Schlumberger	260 / 300 °C under development
FMST	Schlumberger	260 °C under development
SIT	Schlumberger	260 °C under development
FS	Leutert	evaluation above 175 °C underway
SP-Redox	Univ. F	evaluation above 175 °C underway
Magnetometer	Univ. BS	125 °C, waiting for appropriate dewar flask
Magnetometer	BGR	175 °C succesfully tested
Magnetic Susc.	Univ. M	125 °C, waiting for appropriate dewar flask
BHTV	DMT	235 °C succesfully tested

K T B - HEL/VHEL Logging Tool Status

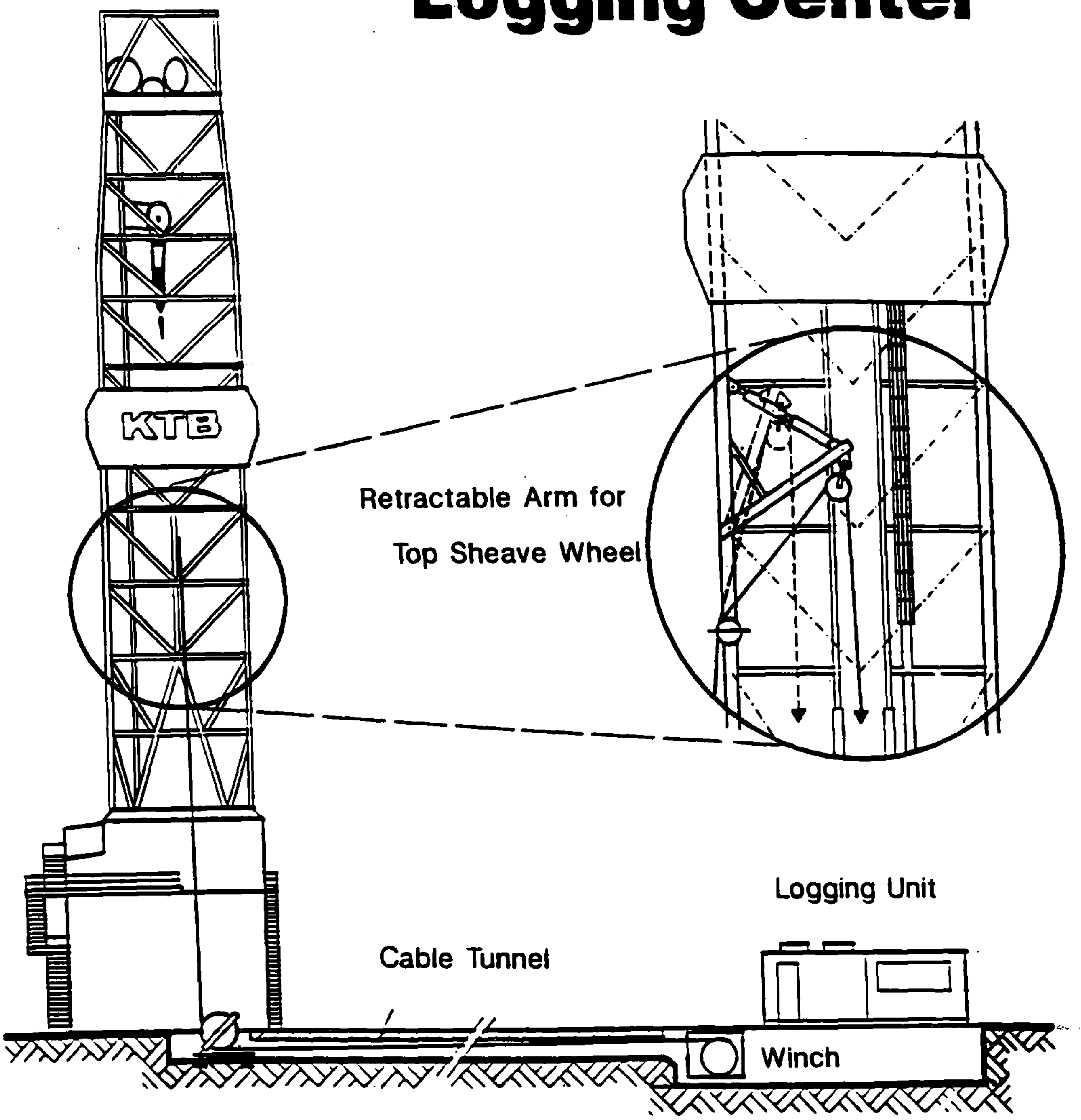
Joint meeting DMP/KTB, June 2nd, 1992

KTB

Ref.22

Niedersächsisches Landesamt für Bodenforschung

Logging Center

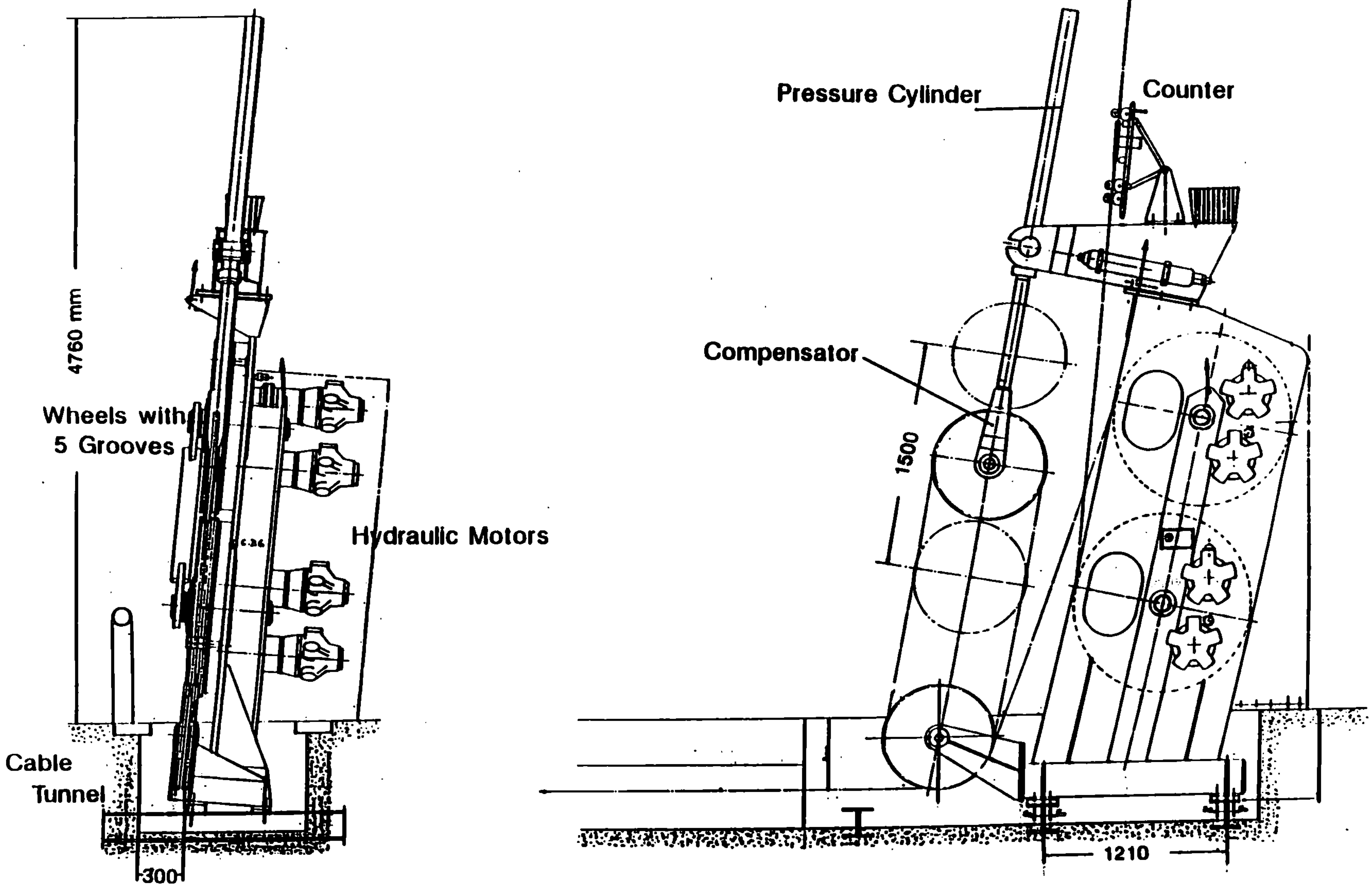


KTB - Logging System

Installation for Cable Guidance

Capstan Unit

(KTB - Logging System)



Ref.24

Graphic Output:

Logs (BHTV, Sonic, ...)
CROSS-Plots
Histogramms
XY-Plots

SEL

Input:

LIS-Data
ASCII-Data (freeformat)
GEOCOM-Data
MUDLOG-Data
KTBase
...

SEL–Datenbank
(Binary–Data)

Numeric Output:

Statistic-Data
LIS-Data
ASCII-Data

SEL Overview

KTB

Niedersächsisches Landesamt für Bodenforschung

Ref.25

Sub–Programms (selection)

ASCII (Ascii Output)
CLUSTER - Analysis
COMPUTE (arith./logical operations)
CONSTANT
CROSS (Cross plot)
DEFINE (Tables)
DEPTH - Matching
EDIT (Data edit)
FILL (Fill Gaps)
FILTER
GET (read Data from Disk)
PLOT
PUT (write Data to Disk)
SET (set Parameter)
SHOW (show Parameter)

SEL:

Commandlanguage (VAX/VMS)
Datahandler (Curves called by name)
Memoryhandler (50 Mbyte)
GKS–Plotsoftware

SEL Functions

KTB

Ref.26

Niedersächsisches Landesamt für Bodenforschung