6. Intermediate Logs

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6. Intermediate Logs: Interval 4512.0 - 6018.0 m

Time: 18.10.1991 - 13.03.1992

During this period 15 wireline operations were run either with KTB-logging tools or with tools from the service industry:

BGL/GR/AMS/TEMP/SP	: 8 logs
FMI/GR/AMS	: 2 logs
FS/GR	: 2 runs
BHTV-Facsimile	: 2 logs (1 test)
CERT/AMS/GR	: 1 run

The caliper logs (BGL/GR/AMS/TEMP/SP) were run mainly on request of the drilling department. The run with the electro-magnet (CERT/AMS/GR) was required to fish for junk in the borehole.

The other logs (FMI/GR and BHTV) were run to obtain geoscientific information. Two runs with the fluid sampler (FS/GR) recovered samples from zones of inflow.

The drilling department is interested in close control of the deviation and orientation of the borehole and about the break-out situation. The "Quick-Look"-presentations, developed by the Logging Center provide fast answers (see section 8).

These plots are available within hours after completion of the logging operations. Logging, drilling and lithology data are integrated.

Newly logged intervals are merged to provide a continuous profile of the borehole. Overlapping logs are plotted together to record - for example - hole diameter enlargements with time (break-out development).

The information obtained with the scientific logs was required by the field laboratory for the analysis of the lithology, structure, texture and tectonic features of the newly drilled interval. Fracture detection is another key issue, where these logs give an answer for.

As all these logs are run with the Auxiliary Measurement Sonde (AMS), the mud resistivity is measured in situ. Any change in resistivity indicate zones of inflow. Fluid samples were taken from these intervals confirming inflow of saline formation waters.

The information gained by runnig these intermediate logs was essential for planning the logging series at casing depth 6000 m. Examples of intermediate logs are presented in Fig. 6.1 - 6.4.

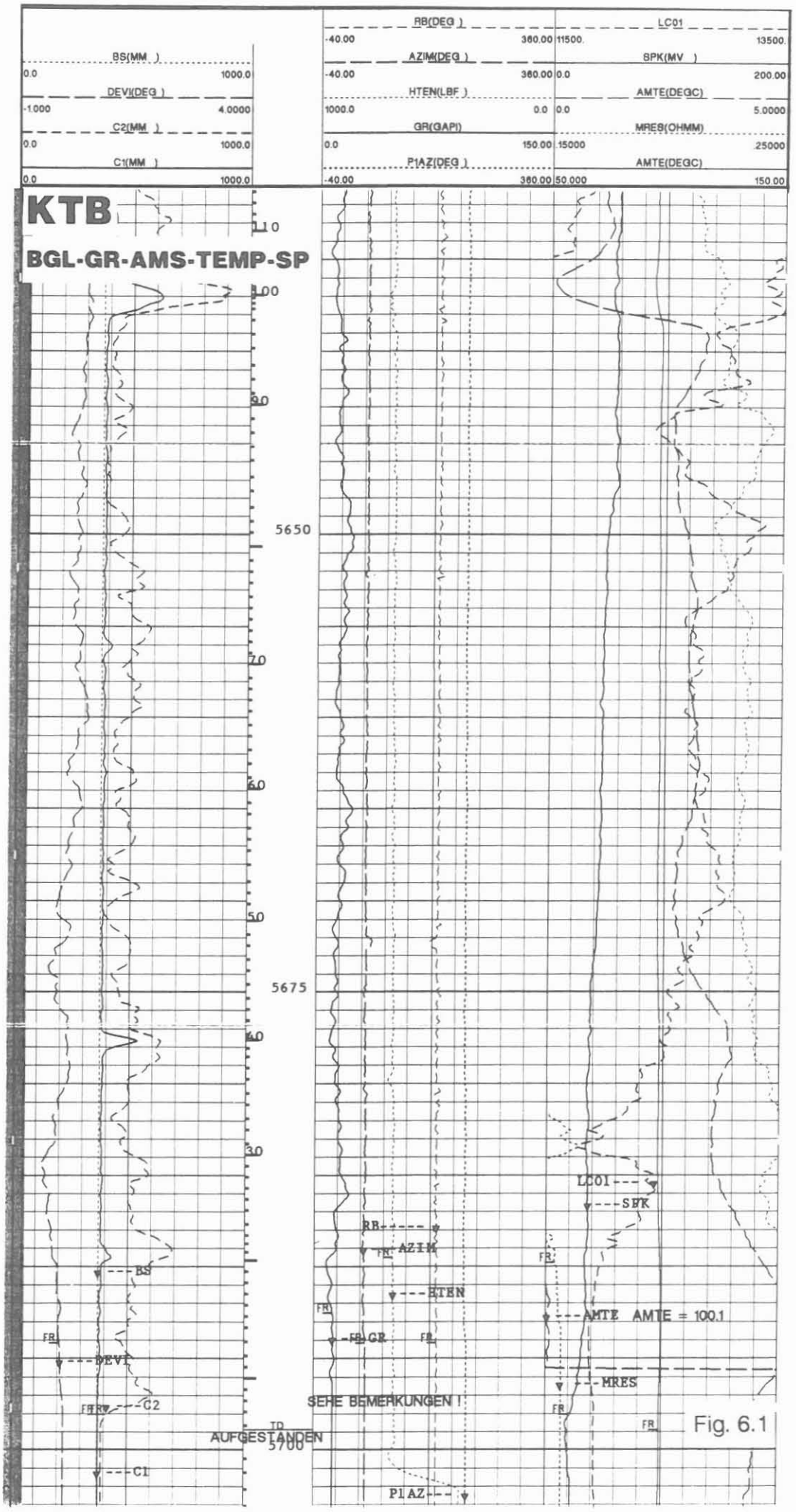
BS(MM)
0.0
1000.0
DEVI(DEG)
-1.000
4.0000
C2(MM)
0.0
1000.0
C1(MM)
0.0
1000.0
RB(DEG)
-40.00
360.00
AZIM(DEG)
-40.00
360.00
HTEN(LBF)
1000.0
0.0
GR(GAPI)
0.0
150.00
P1AZ(DEG)
-40.00
360.00
LC01
11500.
13500.
SPK(MV)
0.0
200.00
AMTE(DEGC)
0.0
5.0000
MRES(OHMM)
.15000
.25000
AMTE(DEGC)
50.000
150.00
KTB
BGL-GR-AMS-TEMP-SP
5650
5675
TD
AUFGESTANDEN
5700
BS
DEVI
C2
C1
RB
AZIM
HTEN
GR
P1AZ
LC01
SPK
AMTE
AMTE = 100.1
MRES
SEHE BEMERKUNGEN !
FR

Fig. 6.1

FMI/GR (Formation MicroImager/Gamma Ray)

Operator: Schlumberger Diepholz/KTB

Job No.	Date	Interval
HB-0001-0076	KTB-Report 91-2	0.0 - 1720.0 m
HB-0077-0127	KTB-Report 92-1	1720.0 - 4512.0 m
HB-0132	03.01.1992	3000.0 - 5505.0 m

Example:
Sections of logs: Resistivity Curves Control Plot: 4975.0 - 5039.0 m, **Fig. 6.2**

Images Field Plot: 5018.0 - 5075.0 m, **Fig. 6.3**

Caliper, Deviation and Orientation Plot: 5100.0 - 5168.0 m, **Fig. 6.4**

Purpose of log:
To obtain information about structure, texture, foliation and tectonic features, like slickensides, shear planes, folds and for the detection of fractures and fracture systems.

Operation:
This new logging tool requires as surface instrumentation the MAXIS 500 logging unit. Making a temporary connection from this mobile unit to the stationary logging unit on location, the logs are recorded. In 14 3/4" borehole the measurement covers 43 % of the circumference of the borehole.

As real-time record the Resistivity Curve Control Plot Fig. 6.2 ist registered. This plot gives information about the tool performance quality. Via play-back the other plots are made on location, like Image Field Plot Fig. 6.3 and Caliper, Deviation and Orientation Plot Fig. 6.4.

Depth scales: 1/200, 1/40 (in the field); logging speed: 6 m/min.

Technical information:
This new logging tool from Schlumberger makes a resistivity scan of sections of the borehole circumference by applying electrode arrays, mounted on four caliper arms, against the wall. Every caliper arm carries a pad and flap with 24 electrodes each. Magnetometer and inclinometer measurements record not only the trajectory of the borehole but allow in combination with the resistivity records the evaluation of dip and strike direction of the formation.

The data rate from the 192 resistivity electrodes is enormous and requires the computer system of the MAXIS 500. From these "fast channels" a complete set of data are recorded at increments of 0.1" (2,5 mm). The "slow channels" (accelerometer, inclinometer, magnetometer data) are recorded at the standard rate of 6".

Mnemonics and Units:

Mnemonic	Description	Unit
BS	Bit Size	(MM)
C1	Caliper 1 - 3	(MM)
C2	Caliper 2 - 4	(MM)
DEVI	Deviation	(DEG)
EI	Emex Intensity	(AMPS)
EV	Emex Voltage	(V)
FBCR	FMI Correlation Resistance	(KOHMS)
GR	Gamma Ray	(GAPI)
HAZI	Hole Azimuth	(DEG)
P1AZ	Pad 1 Azimuth	(DEG)
TENS	Tension	(LBF)

Description of Plots:

Resistivity Curves Control Plot (Fig. 6.2): This real-time plot serves as quality control during the logging operation. The response of 16 resistivity electrodes, the four-arm caliper, the deviation and orientation, pad 1 azimuth, EMEX current and voltage, gamma ray, bit size, tension and a correlation resistance are recorded. During the logging operation it is possible to step-through the arrays of resistivity electrodes to control the response.

Images Field Plot (Fig. 6.3): Fast optical presentation of resistivity images are given by this plot. This plot is made from uncorrected raw data and is unscaled horizontally. Detailed feature detection (fractures, foliation etc.) is therefore limited, but a first approximation is possible (quality control).

Caliper, Deviation and Orientation Plot (Fig. 6.4): This plot gives the borehole trajectory and caliper data presented in profile simulating the short and long axis of an ovalized borehole. The gamma ray is plotted as depth correlation log.

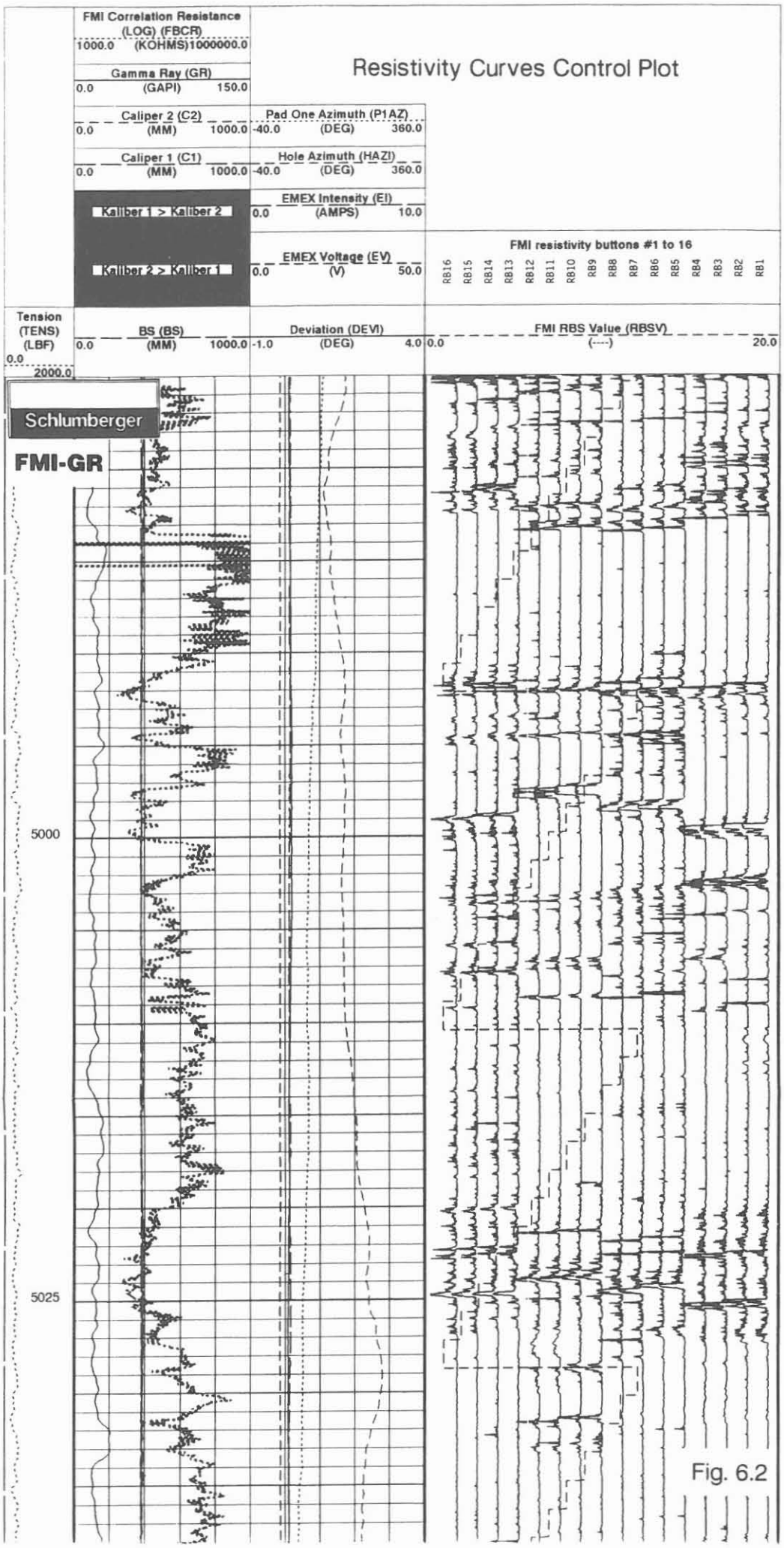
Resistivity Curves Control Plot
FMI Correlation Resistance (LOG) (FBCR)
1000.0 (KOHMS) 1000000.0
Gamma Ray (GR)
0.0 (GAPI) 150.0
Caliper 2 (C2)
0.0 (MM) 1000.0
Caliper 1 (C1)
0.0 (MM) 1000.0
Kaliber 1 > Kaliber 2
Kaliber 2 > Kaliber 1
Pad One Azimuth (P1AZ)
-40.0 (DEG) 360.0
Hole Azimuth (HAZI)
-40.0 (DEG) 360.0
EMEX Intensity (EI)
0.0 (AMPS) 10.0
EMEX Voltage (EV)
0.0 (V) 50.0
FMI resistivity buttons #1 to 16
RB16 RB15 RB14 RB13 RB12 RB11 RB10 RB9 RB8 RB7 RB6 RB5 RB4 RB3 RB2 RB1
Tension (TENS) (LBF)
0.0
2000.0
BS (BS)
0.0 (MM) 1000.0
Deviation (DEVI)
-1.0 (DEG) 4.0
FMI RBS Value (RBSV)
0.0 (----) 20.0
Schlumberger
FMI-GR
5000
5025

Fig. 6.2

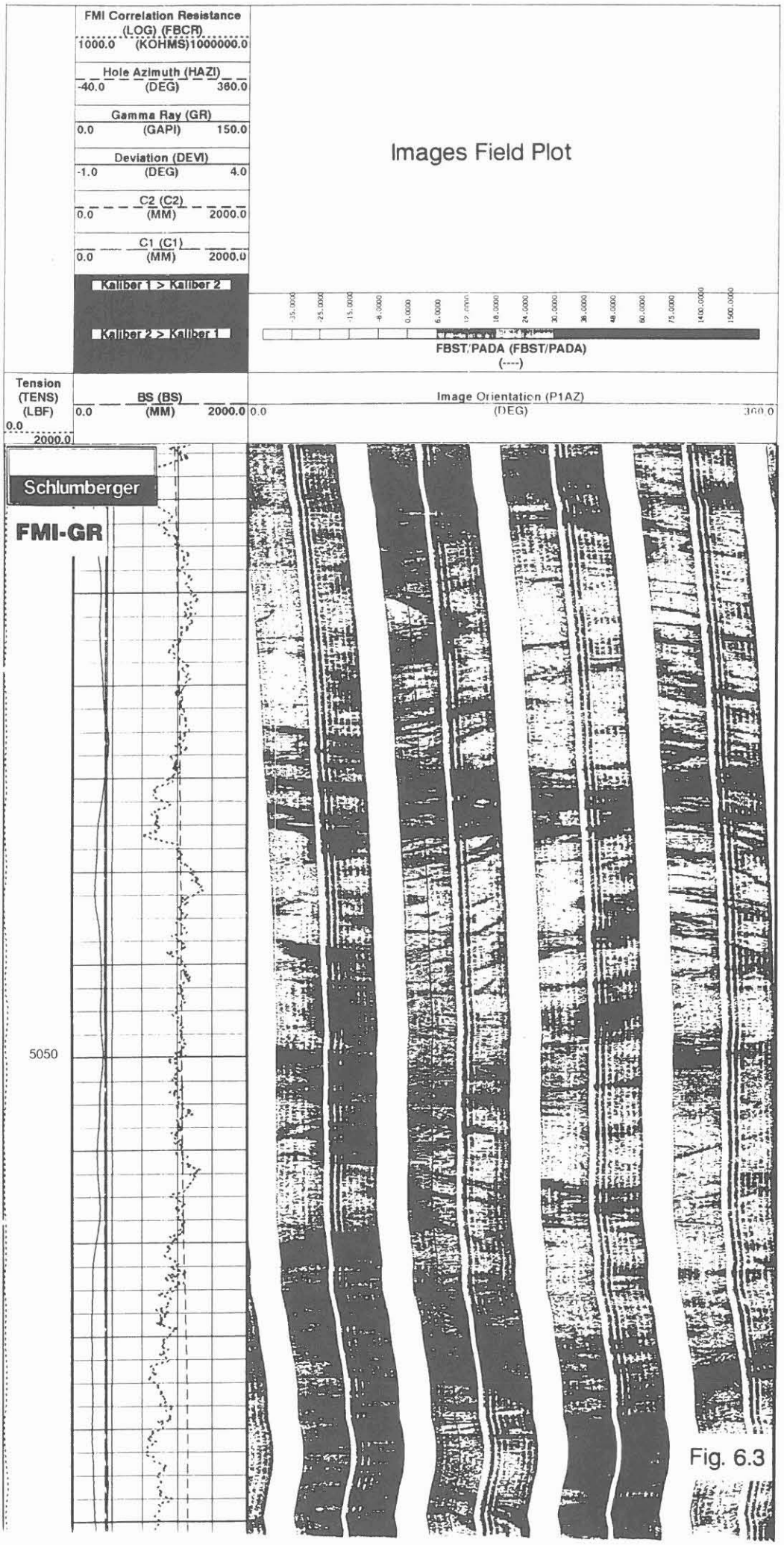
FMI Correlation Resistance (LOG) (FBCR)
1000.0 (KOHMS) 1000000.0
Hole Azimuth (HAZI)
-40.0 (DEG) 360.0
Gamma Ray (GR)
0.0 (GAPI) 150.0
Deviation (DEVI)
-1.0 (DEG) 4.0
C2 (C2)
0.0 (MM) 2000.0
C1 (C1)
0.0 (MM) 2000.0
Kaliber 1 > Kaliber 2
Kaliber 2 > Kaliber 1
Images Field Plot
FBST/PADA (FBST/PADA)
(----)
Tension (TENS) (LBF)
0.0
2000.0
BS (BS)
0.0 (MM) 2000.0
Image Orientation (P1AZ)
0.0 (DEG) 360.0
Schlumberger
FMI-GR
5050

Fig. 6.3

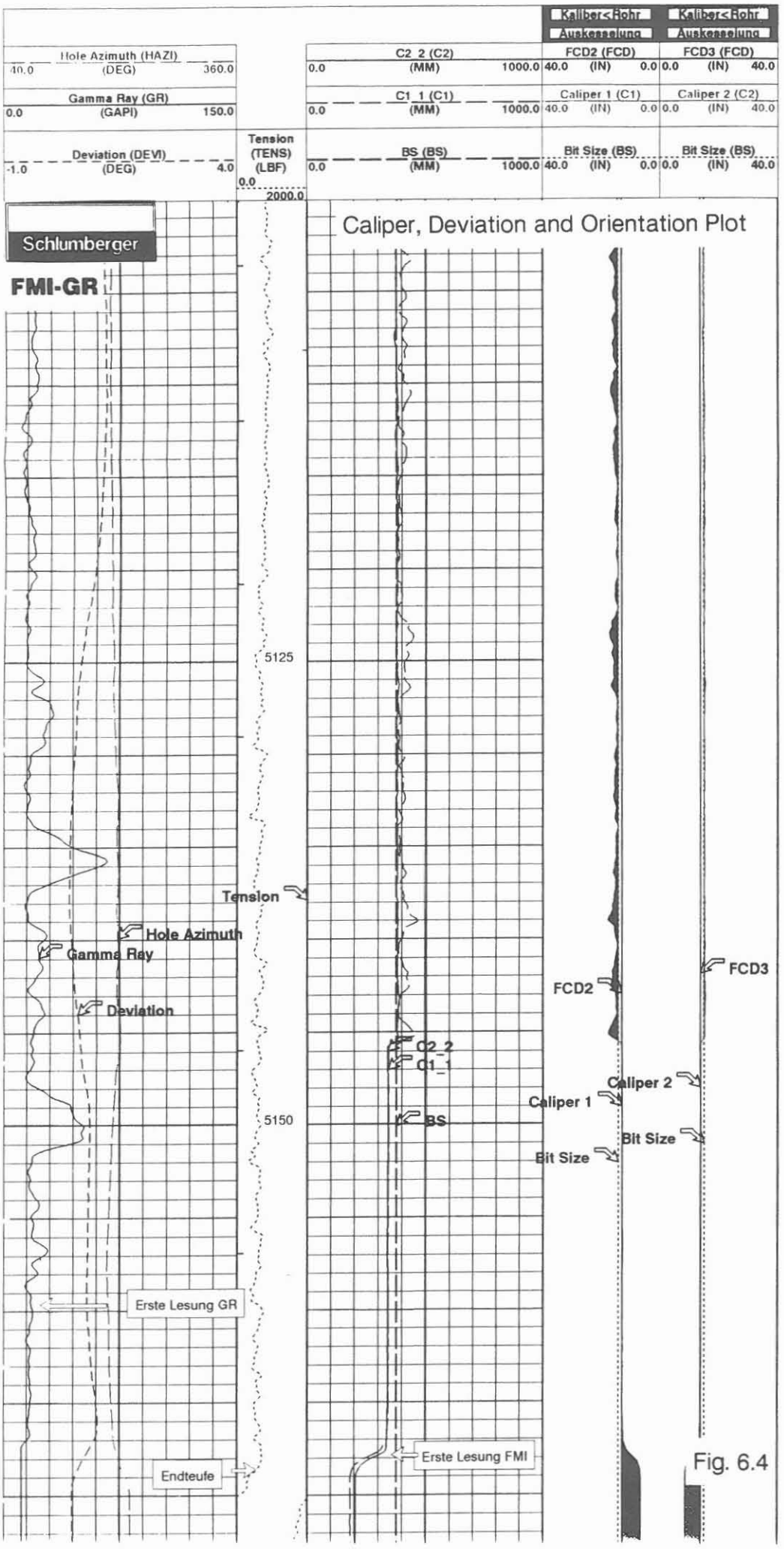
Kaliber<Rohr
Auskesselung
Kaliber<Rohr
Auskesselung
Hole Azimuth (HAZI)
40.0 (DEG) 360.0
Gamma Ray (GR)
0.0 (GAPI) 150.0
Deviation (DEVI)
-1.0 (DEG) 4.0
Tension (TENS) (LBF)
0.0
2000.0
C2_2 (C2)
0.0 (MM) 1000.0
C1_1 (C1)
0.0 (MM) 1000.0
BS (BS)
0.0 (MM) 1000.0
FCD2 (FCD)
40.0 (IN) 0.0
Caliper 1 (C1)
40.0 (IN) 0.0
Bit Size (BS)
40.0 (IN) 0.0
FCD3 (FCD)
0.0 (IN) 40.0
Caliper 2 (C2)
0.0 (IN) 40.0
Bit Size (BS)
0.0 (IN) 40.0
Caliper, Deviation and Orientation Plot
Schlumberger
FMI-GR
5125
5150
Tension
Hole Azimuth
Gamma Ray
Deviation
C2_2
C1_1
BS
FCD2
FCD3
Caliper 2
Caliper 1
Bit Size
Bit Size
Erste Lesung GR
Erste Lesung FMI
Endteufe

Fig. 6.4