



BOREHOLE TESTING
HYDROFRACTURING
STRESS MEASUREMENTS
System Design · Planning
Lab + Field Measurements

CBM - Project Sigillaria License Area

**OPEN - HOLE PERMEABILITY AND
HYDROFRAC STRESS MEASUREMENTS
IN BOREHOLE RIETH-1**

Operation Report

Client: CONOCO Mineralöl GmbH, Essen

Contract: Ref. - No. GCBM-04 dated 28.03.1995

MeSy-Quotation: 113.06.94 dated 14.06.1994
120.07.94 dated 20.07.1994

MeSy-Reporter: Dipl.-Geophys. G.Klee

Date: 15.05.1995

Project: CBM project Sigillaria License Area
Location: about 4 km SW of Drensteinfurt, Germany
Borehole: Rieth-1
Purpose: open-hole permeability and hydrofrac stress measurements
Test-Period: 10.-11.05.1995
Participants: Mr. K. Thomas (Conoco Essen)
 Mr. P. Wilson (Conoco Houston)
 Dipl. Ing. P.Hegemann (MeSy, partly)
 Dipl. Geophys. G. Klee (MeSy)
 Dipl. Geophys. T. Przybilla (MeSy)
 Prof. Dr. F.Rummel (MeSy, partly)
 Dipl. Ing. H.Vogt (MeSy)
 Dipl. Geophys. U.Weber (MeSy)

TIME TABLE OF TESTING

date	time	event
May 95		preparation of equipment
09.05.95		arrival of winch system MKW-5000 at Rieth drill-site
10.05.95	13.30-16.00	log-analysis for test-interval selection at MeSy-office (K.Thomas, P.Wilson, G.Klee)
	15.00	departure of MeSy engineers T.Przybilla and H.Vogt from Bochum
	16.30	arrival at drill-site
	16.45	departure of MeSy engineers P.Hegemann, G.Klee and U.Weber from Bochum
	17.45/18.00	arrival at drill-site
	16.45-21.50	set - up of winch, double-packer tool (2 m interval-length) and surface equipment
	20.15	problems with the power-supply, MeSy UPS damaged
	21.50	tool at zero-mark (middle of test-interval), venting of the hydraulic system
	22.12	start tripping into hole
	22.23-22.35	test of tool in the casing at 15 m depth
	23.30	departure of P.Hegemann
11.05.95	02.10	tool at 1710.0 m, cable load: 1.16 tons

date	time	event
11.05.95	02.10-02.17	upward movement, cable load: 1.67 tons
	02.17	tool at 1694.0 m
	02.20-03.48	test 1 at 1694.0 ¹ <i>pressure pulse tests and three refrac-cycles with 1.0, 3.5 and 5.0 l/min conducted</i>
	04.15	end of packer deflation, tool stuck at 1692.51 m, 2.0 tons
	04.15-07.00	several un-successful attempts to get the tool free (inflation of packer elements, circulation through pressure-release-valve, circulation through test-interval) - tool stuck not caused by hydraulic problems
	07.00	downward movement to at 1704 m, tool free (load: 1.2 tons), upward movement only to 1700 m possible with 3.0 tons
	08.30	situation information to Prof. Rummel
	09.30	decision by Conoco: attempt to move the tool stepwise deeper in order to carry out a possible break of the weak-point in the cable-head at the bottom of the well
	09.35	downward movement to 1706.0 m, 1.1 tons, upward movement to 1701.9 m possible with 3.0 tons
	09.48	downward movement to 1710.0 m, 0.8 tons (tool not free), upward movement to 1702.13 m possible with 3.0 tons
	10.00	downward movement to 1709.24 m, 0.88 tons, upward movement to 1702.09 m possible with 3.0 tons
	10.04	downward movement to 1709.24 m, 0.84 tons, upward movement to 1702.63 m possible with 3.0 tons
	10.08	downward movement to 1709.01 m, 1.0 tons, upward movement to 1702.67 m possible with 3.0 tons
	10.12	downward movement to 1709.0 m, 0.9 tons, upward movement to 1702.56 m possible with 3.0 tons
	10.16	downward movement to 1710.0 m, 0.85 tons

¹ all depth marks were measured from rig floor (3.2 m above ground level) and corresponds to the middle of the test-interval

date	time	event
11.05.95	10.19-10.28	circulation of 50 l through test-interval
	10.30	upward movement to 1702.97 m, 3.0 tons
	10.31-11.16	short down- and upward movements, tool can be moved up to 1699.23 m with 3.0 tons
	11.20	downward movement to 1702.44 m, load increase from 1.1 to 1.4 tons
	11.21-12.21	short down- and upward movements, tool can be moved up to 1698.36 m with 3.0 tons
	12.26	downward movement to 1713 m, tool not free
	12.30	arrival of Prof. Rummel
	12.35	upward movement to 1702.70 m possible with 3.0 tons
	12.38	load increase to 3.2 tons
	13.53	upward movement to 1697.94 m possible
	13.58	load increase to 3.3 tons
	14.08	upward movement to 1697.62 m possible
	14.55	load increase to 3.4 tons
	15.00	upward movement to 1697.47 m possible
	15.10	downward movement to 1709.0 m, 0.52 tons
	15.15-15.30	circulation of 100 l through test-interval
	15.43	upward movement to 1701.98 m with 3.5 tons possible
	16.00-17.15	discussion about further procedure, decision: - circulation of 25 l through the test-interval - conduction of a test at present depth - break of weak-point within the cable-head
	17.00	arrival of MeSy-engineer P.Hegemann
	17.20-17.35	change of MeSy flowmeter
	17.40-17.45	circulation of 25 l through test-interval
	17.48	tool at 1705.0 m, 2.5 tons (overload to guarantee injection into the packer-elements)
	17.49-18.52	test 2 at 1705.0 <i>pressure pulse test and three refrac-cycles with 0.9, 3.0 and 5.5 l/min conducted</i>
	18.55-19.06	safety meeting
	19.10-19.17	lowering of the upper turn-over wheel to about 2 m above rig-floor
	19.20-19.28	break of weak-point within the cable-head with 3.7 tons cable-load (top fish at about 1702 m)
	19.30	start tripping out of hole

date	time	event
11.05.95	20.48	complete wireline, coil-tubing and all cable-clamps out of hole
	20.48-21.30	rig-down of the equipment
	21.45	departure from drill-site
	23.00	arrival in Bochum
12.05.95	07.00-13.30	participation of MeSy-engineer G.Klee on the first recovery of the fishing-tool
		preparation of a back-up PERFRAC VIII hydrofrac-tool at MeSy
13.05.95	11.30-14.30	participation of Prof. Rummel on the fishing-operation
15.05.95	13.00-15.45	maintenance of the hydrofrac-equipment at drill-site

Field Data Records

Overview - Plots
of Downhole Injection - and Packer Pressure
and Surface Injection - Flow - Rate Records
of Conducted Tests

upper window:

x - axis: time, minutes
y - axis: injection pressure (lower curve), MPa
packer pressure (upper curve), MPa
+: indicates maximum injection pressure

lower window:

x - axis: time, minutes
y - axis: injection flow-rate, l/min
+: indicates flow-rate at maximum injection pressure

Flow: surface injection flow-rate, l/min
 $P_{i, \text{down.}}$: downhole injection pressure, MPa
 $P_{p, \text{down.}}$: downhole packer pressure, MPa
 P_{uphole} : uphole pressure, MPa
 P_{annulus} : annulus pressure, MPa
 $T_{\text{emp.}}$: downhole temperature, °C
data corresponds to + - position (maximum injection pressure)

