GEO-Meß-Systeme GmbH

MESY GmbH · Meesmannstraße 49 · D-44807 Bochum · FRG

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

CBM - Project Sigillaria License Area

CASED - HOLE PERMEABILITY AND STRESS MEASUREMENTS IN BOREHOLE RIETH-1

Phase II

Operation Report

Client:	CONOCO Mineralöl GmbH, Essen
Contract:	GCBM-04-95, Variation Order No. 001 dated 09.05.1995
MeSy-Quotation:	113.05.95 dated 04.05.1995
MeSy-Reporter:	Dipl.-Geophys. T. Przybilla
Date:	19.06.1995

Amtsgericht Bochum 14 HRB 2572
Geschäftsführer: Prof. Dr. F. Rummel

Telefon 02 34 / 5 45 31
Telefax 02 34 / 5 45 33

Sparkasse Bochum
(BLZ 430 500 01) 43 308 618

Project:	CBM project Sigillaria License Area
Location:	about 4 km SW of Drensteinfurt, NRW, Germany
Borehole:	Rieth-1
Purpose:	cased-hole permeability and stress measurements
Test-Period:	12.06. - 16.06.1995
Participants:	Mr. K. Thomas (Conoco Essen) Mr. S. Strauss (Conoco Houston) Dipl. Ing. P. Hegemann (MeSy) cand. geophys. T. Hettkamp (MeSy) Dipl. Geophys. G. Klee (MeSy) Dipl. Geophys. J. Kramer (MeSy) Dipl. Geophys. T. Przybilla (MeSy) Dipl. Ing. H. Vogt (MeSy) Dipl. Geophys. U. Weber (MeSy)

TIME TABLE OF TESTING

date	time	event
12.06.95	17.00	arrival of G. Klee, T. Przybilla, H. Vogt and U. Weber at RIETH-1 wellsite
	17.30	S. Strauss decided to start testing at June 13th 1995
	18.00	departure of MeSy engineers from wellsite
13.06.95	05.50	arrival of G. Klee, T. Przybilla, H. Vogt and U. Weber at RIETH-1 wellsite
	06.00-12.55	set-up of surface and downhole equipment, MeSy-GO-cablehead with Western-Atlas-cable (Rochester-cable $^{15}/_{32}$") connected.
	12.55	tool at wellhead, set zero-mark at middle of injection interval
	13.00-13.30	venting of the hydraulic system
	13.30	start tripping into hole
	13.35-13.55	test at 20 m[1], *file: 0020CH01.UMD*

[1] all depth marks were measured from rig-floor and corresponds to the middle of the 8.7 m long test-intervall

date	time	event
13.06.95	17.10	tool at 1591.5 m
		P_{hydr}=16.40 MPa (ρ=1.05 g/cm^3)
	17.17	**START OF CASED - HOLE TEST 6 AT 1591.5 m**
	17.17	**start frac-test**
		start data recording, *file: 1591.UMD*
	17.23	restart of data recording, *file: 1591.UMD*
		set packers to 9 MPa surface pressure, fast decrease of packer pressure
	17.44	deflation of packer elements
	17.47	set packers to 9 MPa surface pressure, still fast decrease of packer pressure, pressure pulse test with leaking packer elements, conduction of frac-cycles with 1.7, 3, 5 and 6 l/min. shut-in pressure: 23.7 MPa
	18.47	**end of frac-test**
	18.47	**END OF CASED - HOLE TEST 6**
	18.48-19.00	deflation of packer elements
	19.15	tool stucks (400 LBS overload)
	22.00	reset of packers and slow deflation of packer elements without any result
	22.45	depth: 1590.5 m, tool moves upward
	22.50-23.13	moving tool up and down at 1587.7 m
	23.13	tool stucks at 1588.3m
	23.45	injection of 50 l into interval
14.06.95	00.00	tool free
	00.00-04.00	tripping out of hole
	04.00	tool out of hole, cable and both tubings up to 2 m above the cablehead damaged
	04.00-08.15	rig-down of downhole equipment, MeSy-GO-cablehead with Western-Atlas cable reconnected, repair of tubings
	08.15-08.30	rig-up of downhole equipment
	08.30	tool at wellhead, set zero-mark at middle of injection interval, venting of the hydraulic system
	09.00	start tripping into hole

date	time	event
14.06.95	09.05-09.25	test at 20 m, *file: 0020CH02.UMD*
		tool leaking
	09.40	tool out of hole
	09.45-09.52	test of tubing and packers, pressurization of tubing, *file: TUBING.UMD*
	10.00-11.45	replacement of both packers, change of o-ring seal at packer expansion piston
	11.45-12.03	venting of the hydraulic system
	12.08	tool at wellhead, set zero-mark at middle of injection interval, start tripping into hole
	12.18-12.30	test at 20 m, *file: 0020CH03.UMD*
	15.30	arrival of T. Hettkamp and J. Kramer at wellsite
	16.42	tool at 1275.0 m, P_{hydr}=13.07 MPa (ρ=1.044 g/cm^3)
	16.48	**START OF CASED - HOLE TEST 7 AT 1275.0 m**
	16.48	**start of frac-test**
		start data recording, *file 1275.UMD*
		set packers to 9 MPa surface pressure, packer elements slightly leaking, conduction of pressure-pulse test and frac-cycles with 1.5, 3 and 5 l/min, shut-in pressure: 19.0 MPa -19.5 MPa.
	17.15	departure of T. Przybilla and H. Vogt from wellsite
	17.54	**end of frac-test**
	17.54	**END OF CASED - HOLE TEST 7**
	17.55-18.10	deflation of packer elements
	18.25	tool at 1248.4 m, P_{hydr}=12.79 MPa (ρ=1.044 g/cm^3)
	18.33	**START OF CASED - HOLE TEST 8 AT 1248.4 m**
	18.33	**start frac-test**
		start data recording, *file: 1248.UMD*
		set packers to 9 MPa surface pressure, conduction of pressure-pulse-test, frac-cycles with 1.5, 3, 4.4, 5 and 6 l/min, shut-in pressure: 17.8 MPa
	20.02	**end of frac-test**
		interval bleed off, end of data recording
	20.02-20.07	preparation for injection-/fall-off-test
	20.07	reset packers to 9.5 MPa surface pressure

date	time	event
14.06.95	**20.28**	**start main injection-test**
		start of data recording, *file: 1248CH01.UMD,* reset packers to 10 MPa surface pressure
	20.30	start injection
	20.35	departure of U. Weber from wellsite
	20.47	reset packers from 3.8 MPa to 9.0 MPa surface pressure
	20.58	reset packers from 4.5 MPa to 9.0 MPa surface pressure
	21.10	reset packers from 5.0 MPa to 10 MPa surface pressure
	21.22	reset packers from 4.7 MPa to 9.0 MPa surface pressure
	21.33	reset packers from 5.0 MPa to 9.0 MPa surface pressure
	21.46	reset packers from 5.0 MPa to 8.6 MPa surface pressure
	21.57	reset packers from 5.1 MPa to 9.2 MPa surface pressure
	22.10	reset packers from 5.1 MPa to 9.1 MPa surface pressure
	22.21	reset packers from 5.2 MPa to 9.3 MPa surface pressure
	22.30	end of data recording
	22.31	start of data recording, *file 1248CH02.UMD*
	22.32	reset packers from 6.1 MPa to 10.0 MPa surface pressure
	22.33	**end of main injection**
		total injected volume: 21.5 l
		injection duration: 123 min
		mean injection-rate: 0.175 l/min
	22.33	**start main fall-off-test**
	23.00	reset of packers from 3.0 MPa to 9.0 MPa surface pressure
	23.21	reset of packers from 3.0 MPa to 9.8 MPa surface pressure

date	time	event
14.06.95	23.44	reset of packers from 2.9 MPa to 8.5 MPa surface pressure
15.06.95	00.06	reset of packers from 3.1 MPa to 8.7 MPa surface pressure
	00.27	reset of packers from 3.0 MPa to 9.1 MPa surface pressure
	00.50	reset of packers from 3.0 MPa to 8.8 MPa surface pressure
	01.15	reset of packers from 3.0 MPa to 8.7 MPa
	01.30	**end of main fall-off-test**
		end of data recording
	01.30	**END OF CASED - HOLE TEST 8**
	01.33-02.00	deflation of packer elements
	05.25	tool at 1560.0 m, P_{hydr}=16.05 MPa (ρ=1.049 g/cm^3)
	05.39	**START OF CASED - HOLE TEST 9 AT 1560.0 m**
	05.39	**start frac-test**
		start data recording, *file: 1560.UMD*, set packers to 9.5 MPa surface pressure, conduction of frac-cycles with 1.5, 3.0, 4.0 and 6.0 l/min, shut-in pressure: 23.0 MPa - 23.5 MPa
	06.52	**end of frac-test**
		end of data recording
	06.52	**END OF CASED - HOLE TEST 9**
	06.54-07.23	deflation of packer elements
	07.23	start tripping out of hole
	08.15	arrival of T. Przybilla, H. Vogt and U. Weber at wellsite
	10.00	departure of T. Hettkamp, G. Klee, J. Kramer
	11.45	tool out of hole
	11.45-15.30	rig-down of downhole equipment, testing of packer elements
	12.00-15.30	perforation work at 1083.7 m by Western Atlas
	12.45	arrival of P. Hegemann at wellsite
	15.30-16.00	rig-up of downhole equipment and MeSy winch system MKW-1500

date	time	event
15.06.95	16.00	tool at wellhead, set zero-mark at middle of injection interval, venting of the hydraulic system
	16.10	start tripping into hole
	16.38-17.06	test of tool at 20 m
		start of data recording, *file: 0020CH04.UMD,* packer pressure decreases
	17.20	stop and restart of data recording: *file 0020CH05.UMD,* pumping into interval, deflation of packer elements, reinflation of packer elements, fluid-losses from packer elements into interval
	18.13	tool out of hole
		leakage at the bottom of the top-packer repaired, change of o-ring seal at bottom-packer
	20.00	tool at wellhead, set zero-mark at middle of injection interval, venting of the hydraulic system
		start tripping into the hole
	20.25	test of tool at 20 m
	22.03	departure of P. Hegemann from wellsite
16.06.95	00.07	tool at 1083.7 m, P_{hydr}=11.10 MPa (ρ=1.044 g/cm^3)
	00.18	**START OF CASED - HOLE TEST 10 AT 1083.7 m**
	00.18	**start of frac-test**
		start of data recording, *file: 1083.UMD,* set packers to 10.1 MPa surface pressure, conduction of pressure-pulse-test and frac-cycles with 1.5, 3.4 and 5 l/min, shut-in pressure: 16.8 MPa
	04.45	preparation for injection test
	04.51	**end of frac-test**
		end of data recording
	05.38	**start main injection-test**
		start data recording, *file: 1083CH01.UMD*
	08.25	**end of main injection**
		total injected volume: 28.37 l
		injection duration: 167 min
		mean injection rate: 0.170 l/min
	08.25	**start main fall-off test**
	12.00	interval bleed off

date	time	event
16.06.95	**12.08**	**end of main fall-off test**
		end of data recording
	12.08	**END OF CASED - HOLE TEST 10**
	12.20-12.40	deflation of packer elements
	12.40	start tripping out of the hole
	16.00	tool out of hole, rig-down of downhole and surface equipment, dismantling of the equipment
	17.39	departure of T. Przybilla, H. Vogt and U. Weber from wellsite
19.06.95		maintenance of the equipment

APPENDIX A

Overview - Plots of

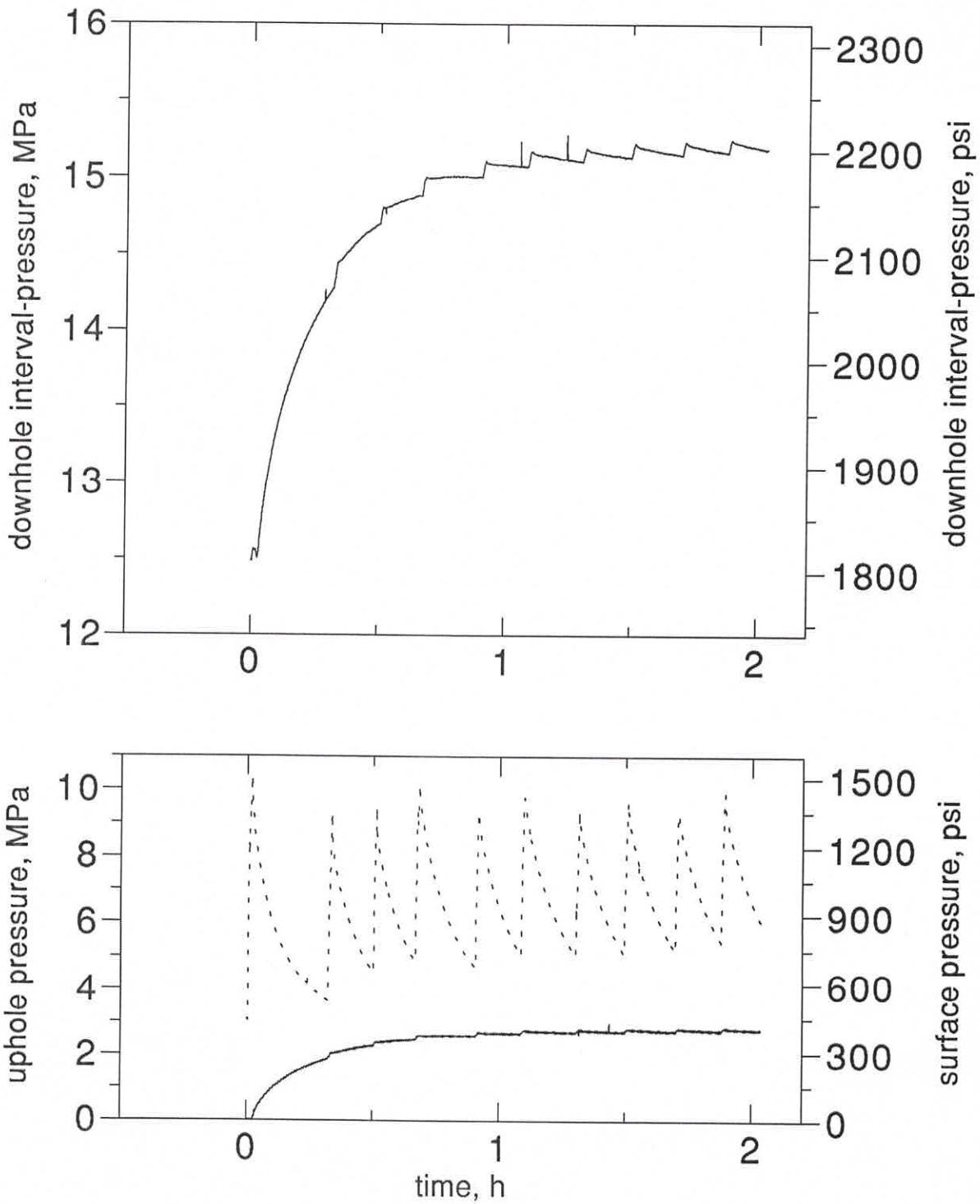
Injection - and Fall - Off - Tests

remarks: data were not corrected with respect to power supply induced noise

uphole pressure curves:
solid line: interval pressure
broken line: packer pressure

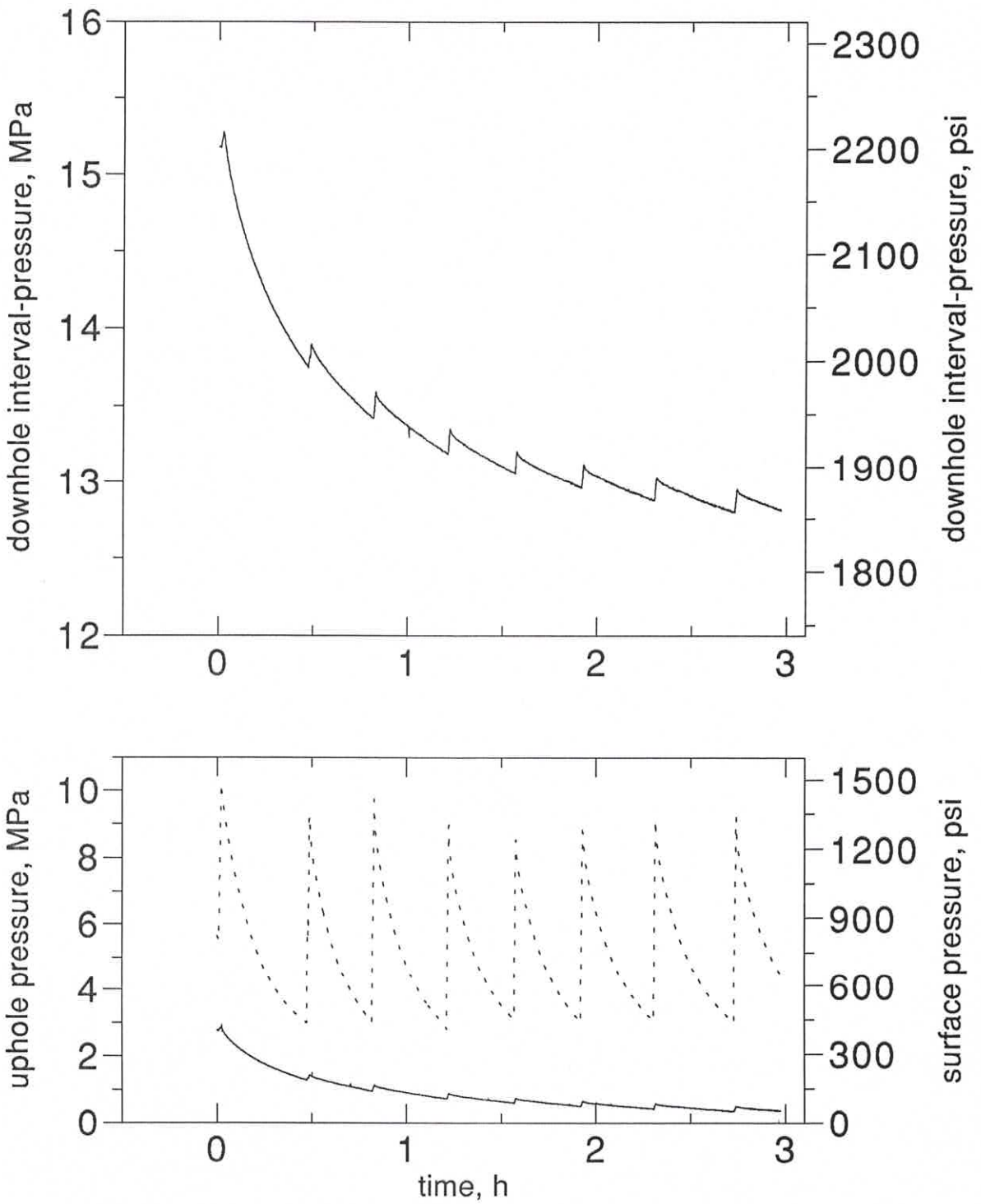
GEO-Meß-Systeme GmbH

CASED - HOLE TEST 8 AT 1248.4 m
main injection test
file: 1248CH01.DAT
start: 14.06.1995, 20.28 end: 14.06.1995, 22.33



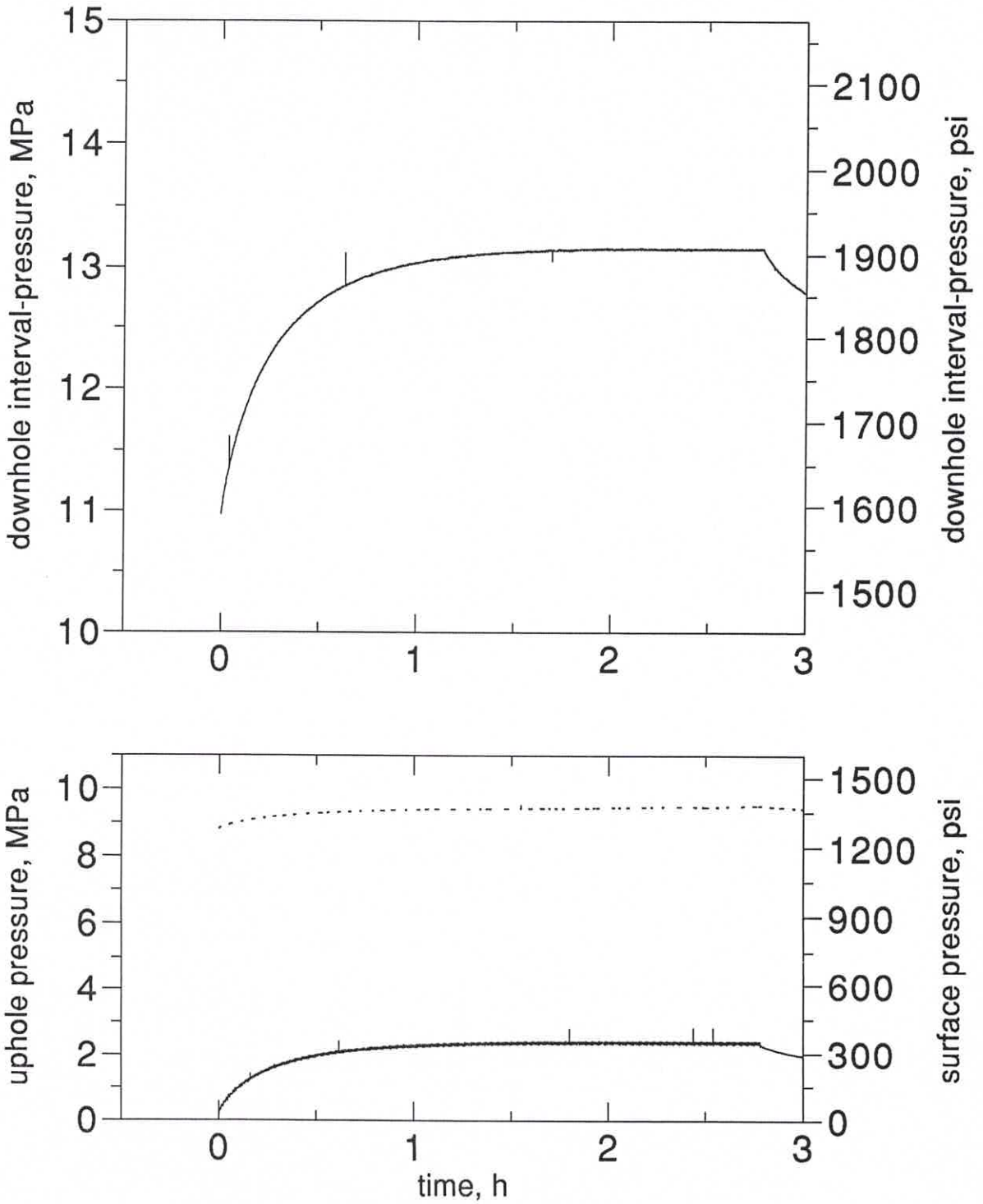
GEO-Meß-Systeme GmbH

CASED - HOLE TEST 8 AT 1248.4 m
main fall-off test
file: 1248CH02.DAT
start: 14.06.1995, 22.33 end: 15.06.1995, 01.30



GEO-Meß-Systeme GmbH

CASED - HOLE TEST 10 AT 1083.7 m
main injection test
file: 1083CH01.DAT
start: 16.06.1995, 05.38 end: 16.06.1995, 08.25



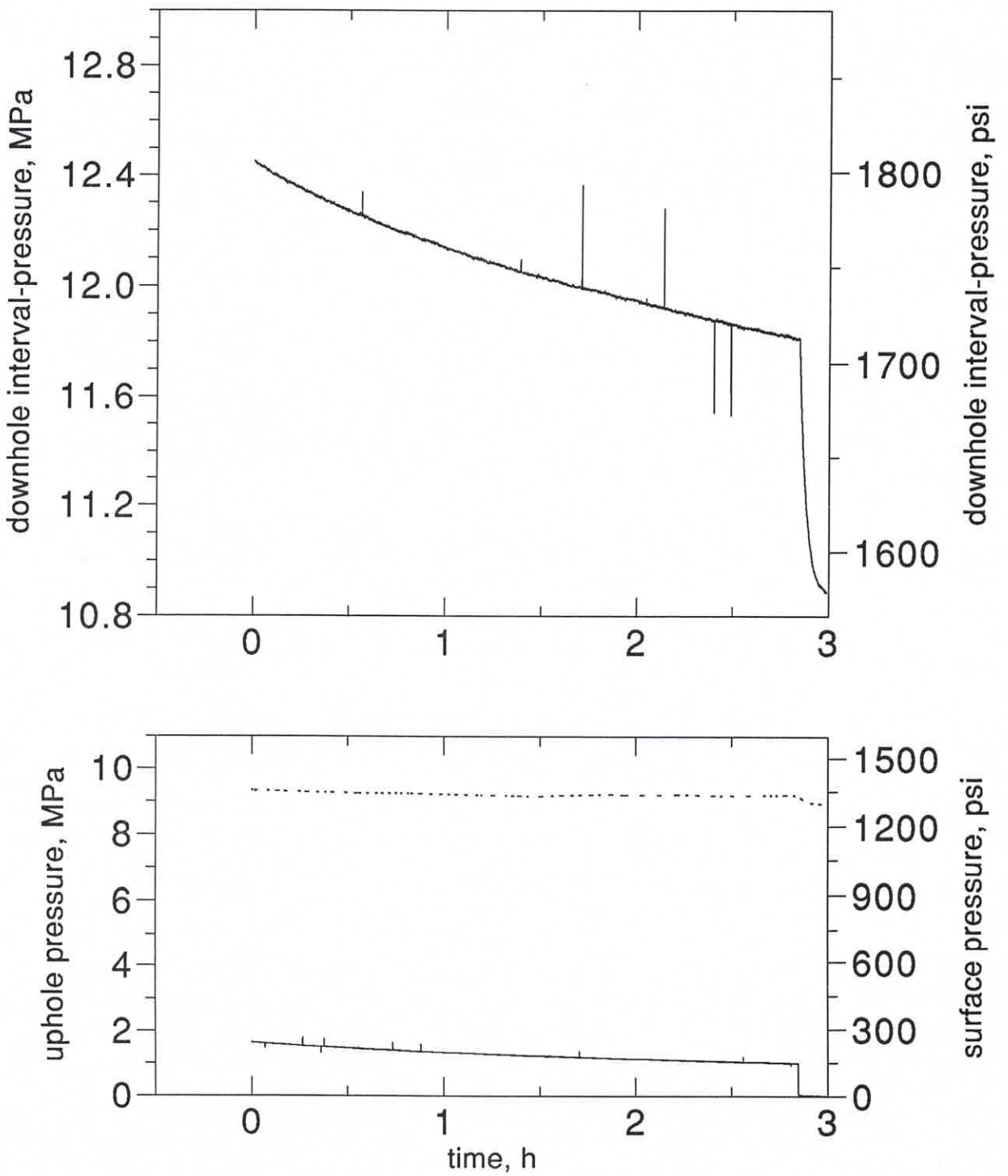
GEO-Meß-Systeme GmbH

CASED - HOLE TEST 10 AT 1083.7 m

main fall-off test

file: 1083CH02.DAT

start: 16.06.1995, 08.25 end: 16.06.1995, 12.08



APPENDIX B

Overview - Plots of

Frac / Step - Rate - Tests

remarks: data were not corrected with respect to power supply induced noise

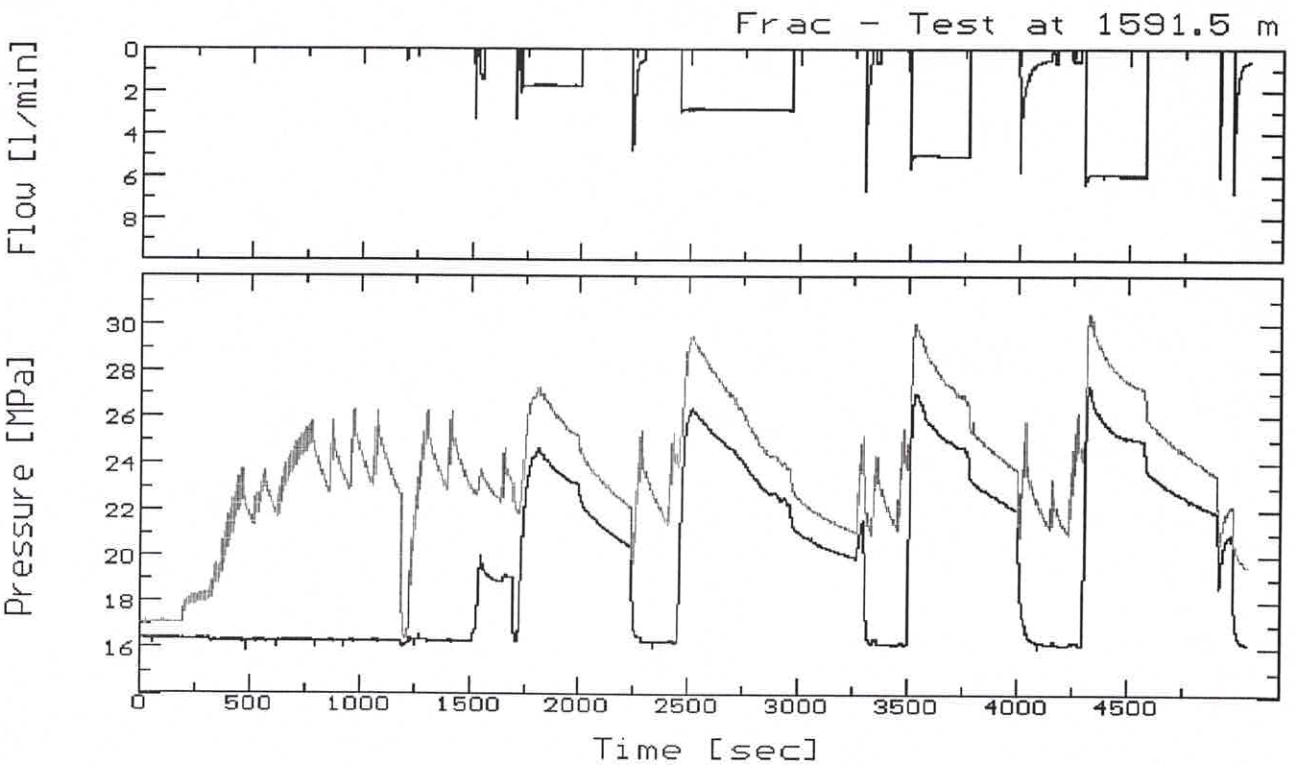
downhole pressure curves:
lower curve: interval pressure
upper curve: packer pressure

GEO-Meß-Systeme GmbH

CASED - HOLE TEST 6 AT 1591.5 m

Frac Test

file: 1591.DAT

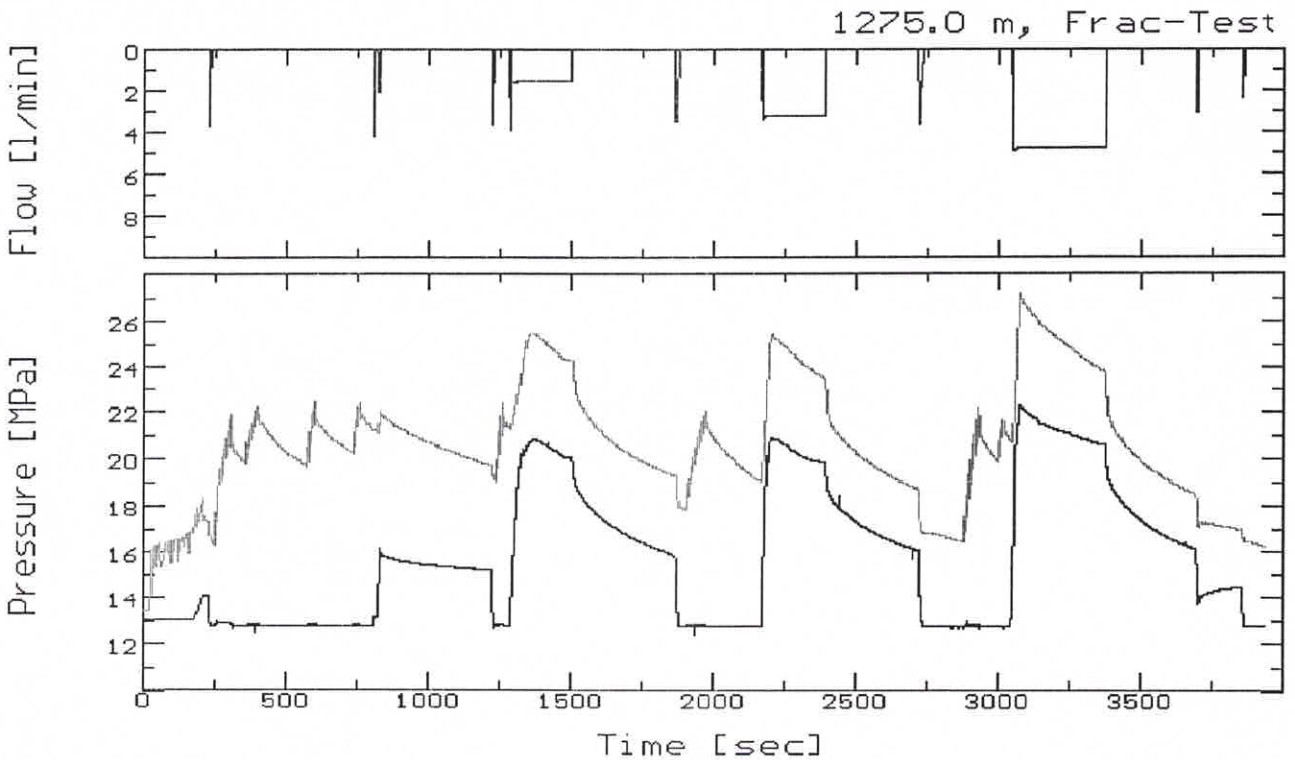


GEO-Meß-Systeme GmbH

CASED - HOLE TEST 7 AT 1275.0 m

Frac Test

file: 1275.DAT

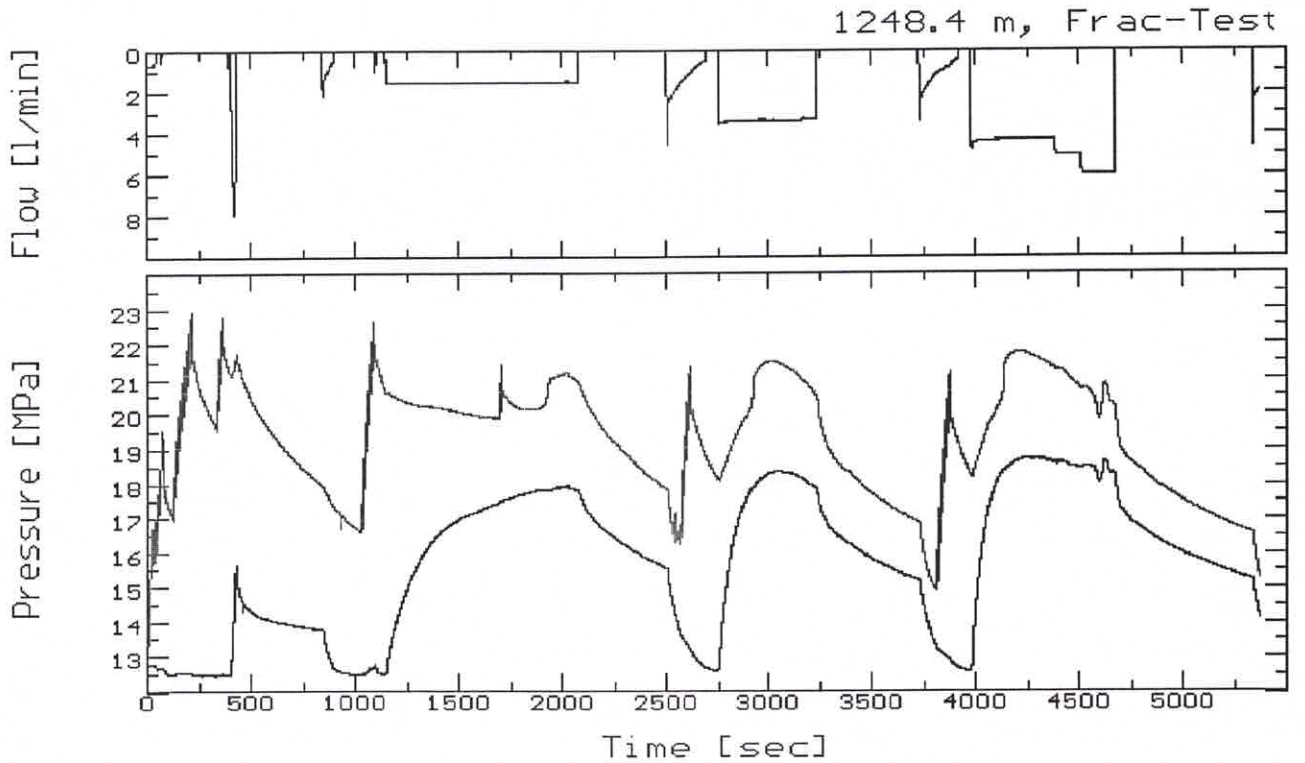


GEO-Meß-Systeme GmbH

CASED - HOLE TEST 8 AT 1248.4 m

Frac Test

file: 1248.DAT

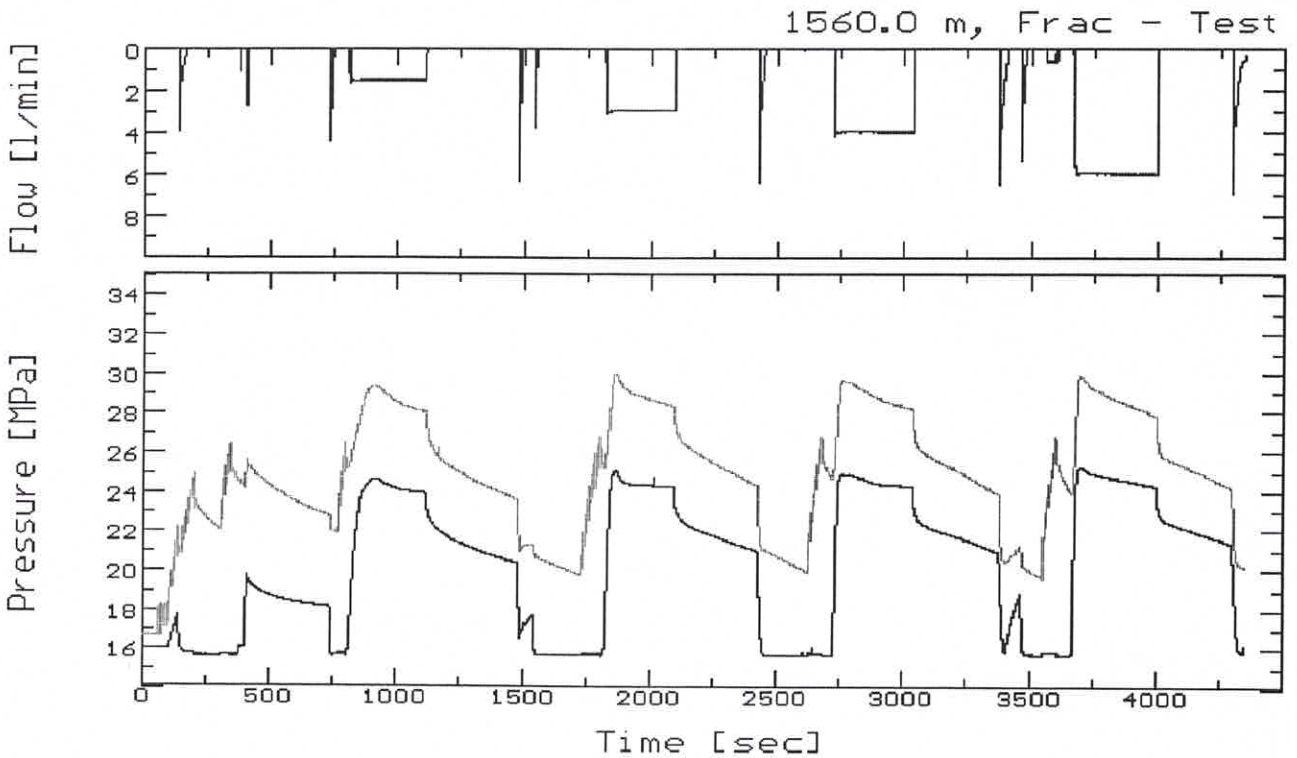


GEO-Meß-Systeme GmbH

CASED - HOLE TEST 9 AT 1560.0 m

Frac Test

file: 1560.DAT



GEO-Meß-Systeme GmbH

CASED - HOLE TEST 10 AT 1083.7 m

Frac Test

file: 1083.DAT