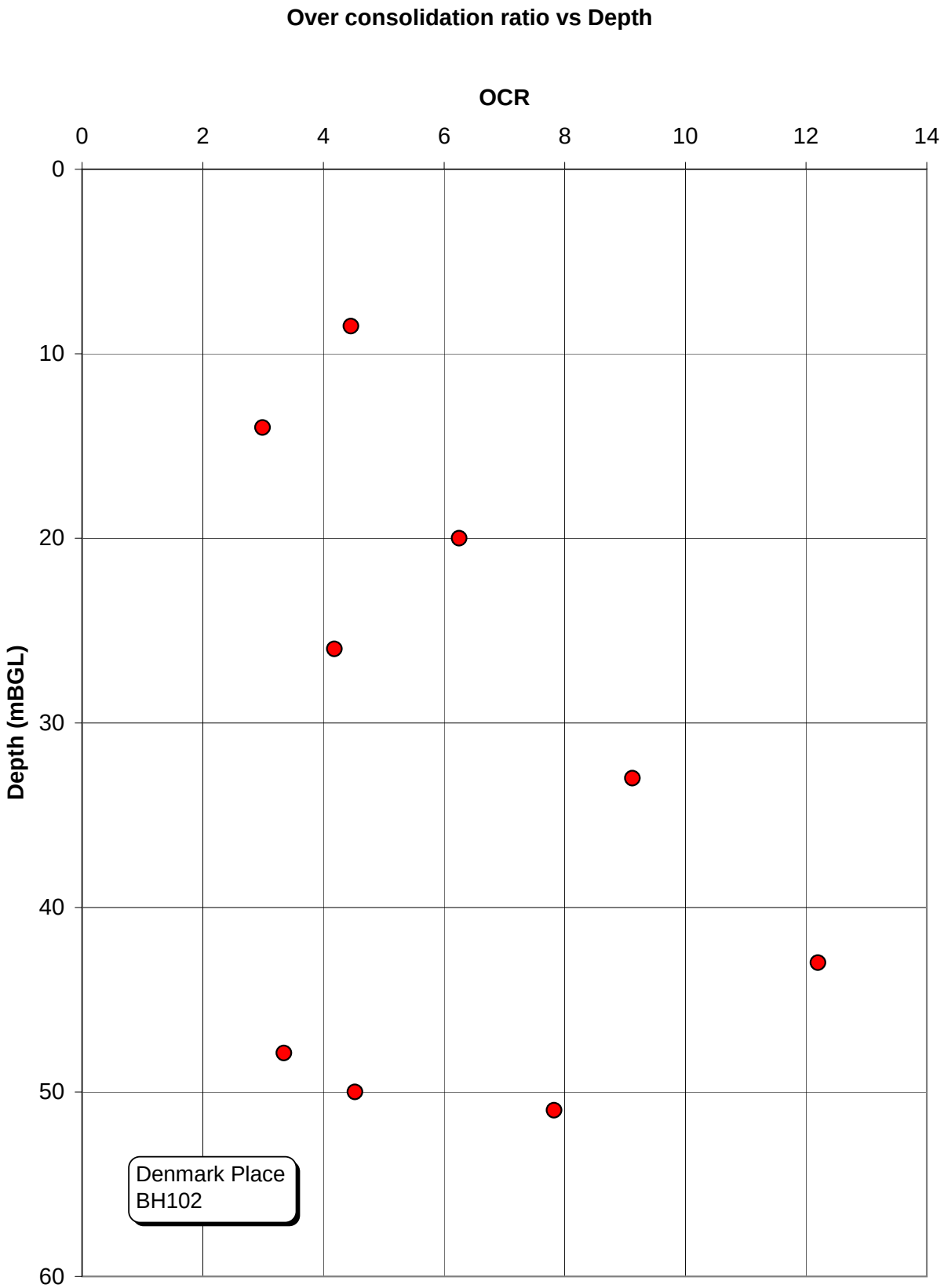
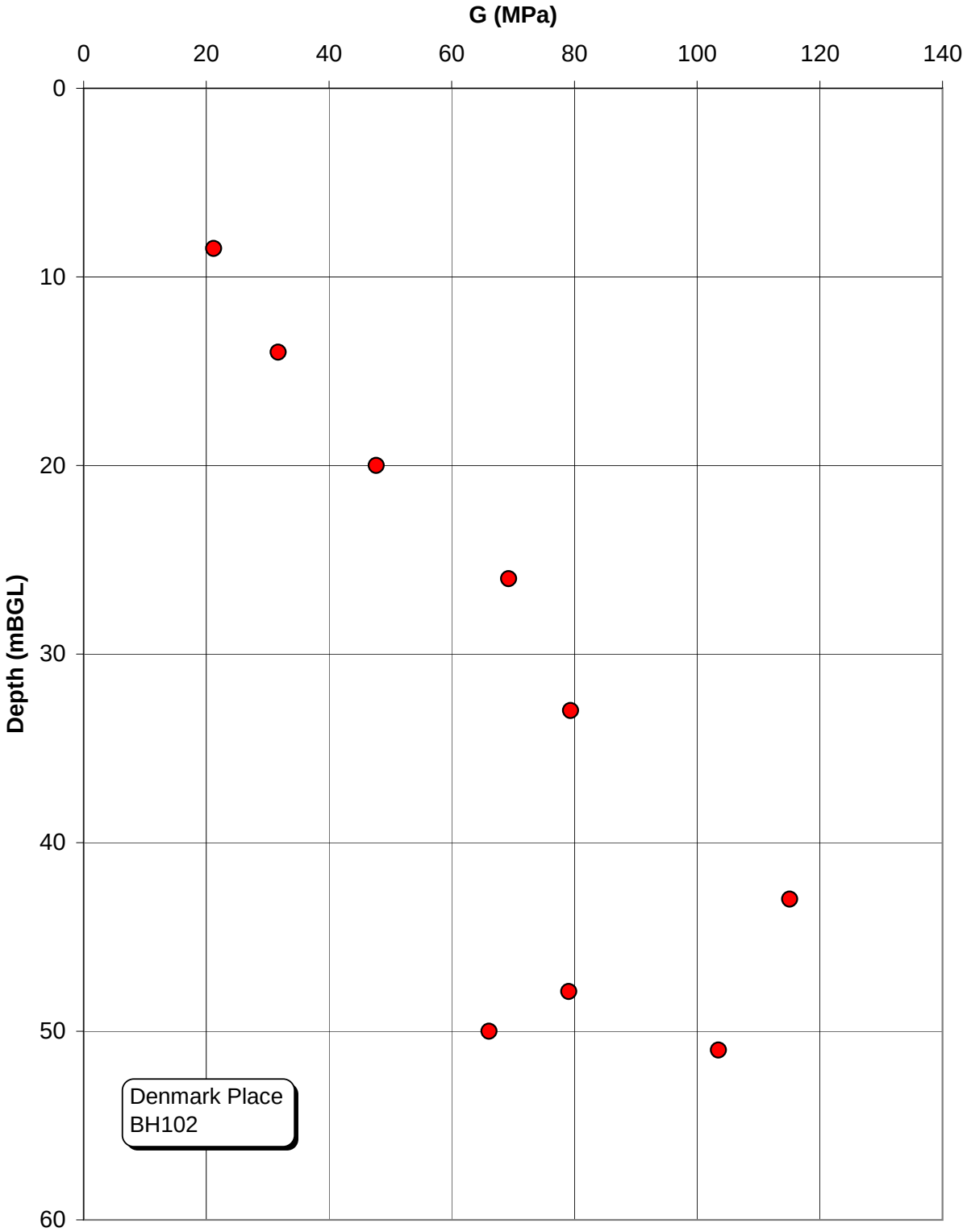
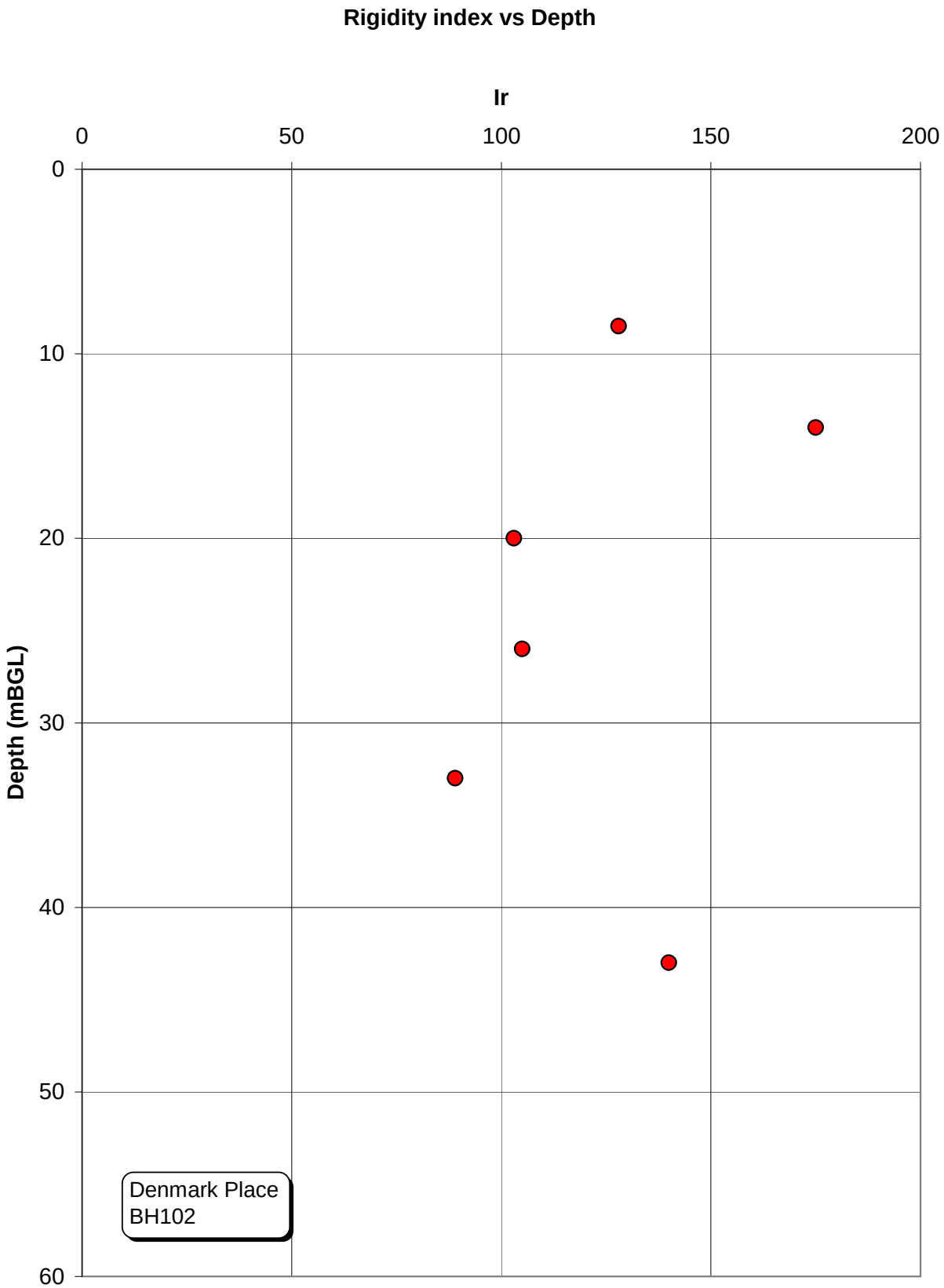
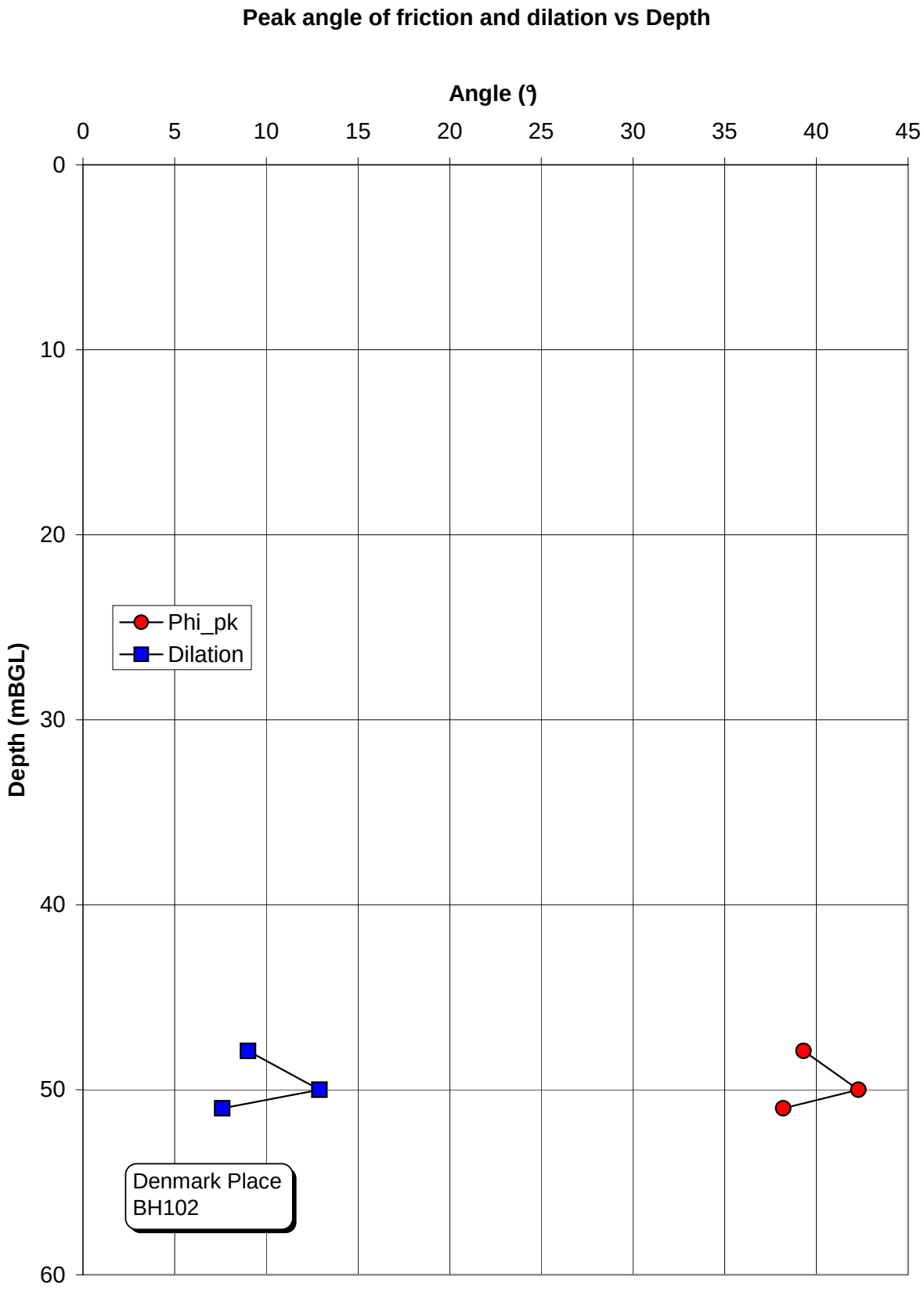

Over consolidation ratio vs Depth
OCR
0
2
4
6
8
10
12
14
Depth (mBGL)
0
10
20
30
40
50
60
Denmark Place
BH102

Initial shear modulus vs Depth



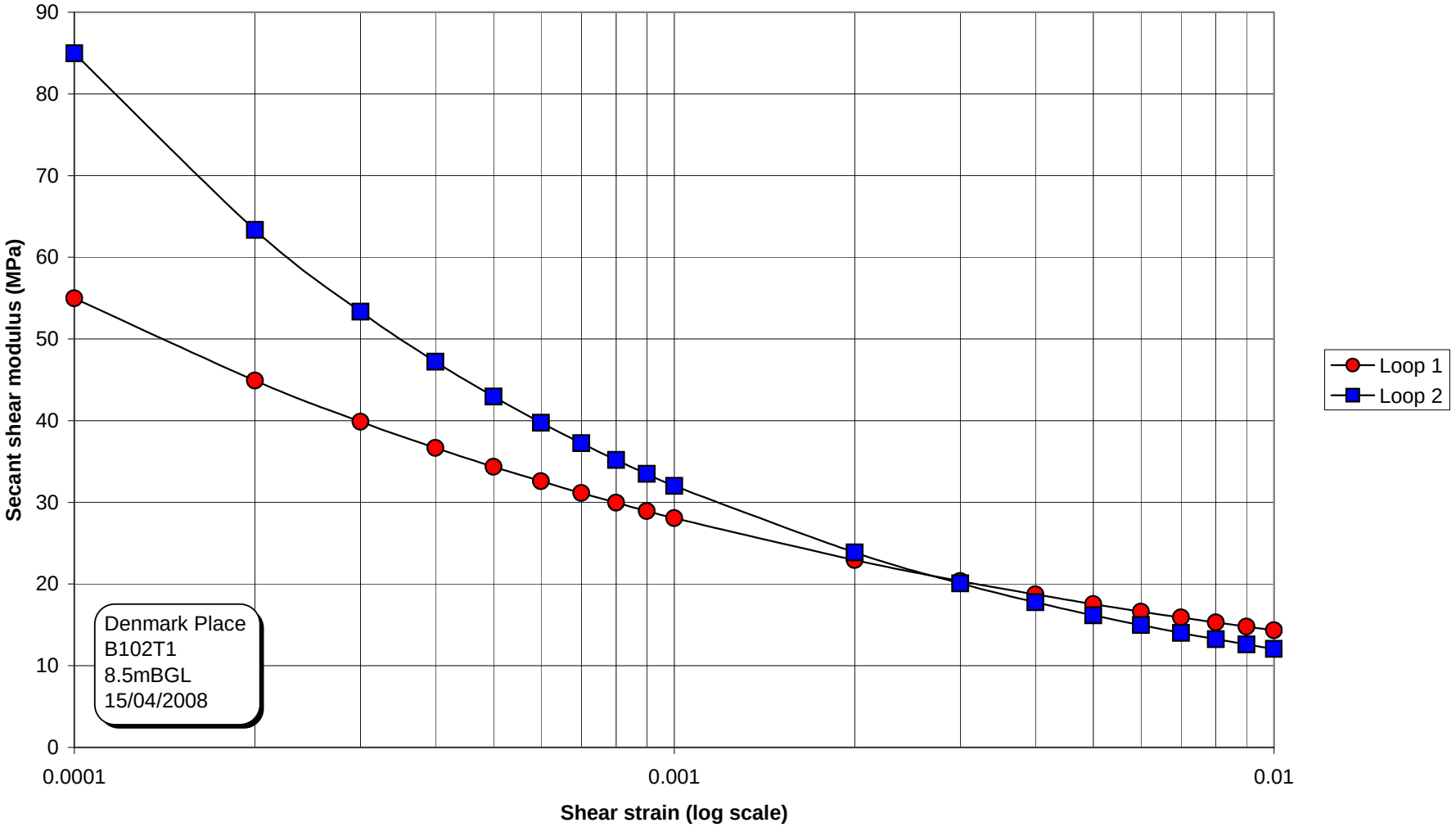

Rigidity index vs Depth
Ir
0
50
100
150
200
Depth (mBGL)
0
10
20
30
40
50
60
Denmark Place
BH102


Peak angle of friction and dilation vs Depth
Angle (°)
0
5
10
15
20
25
30
35
40
45
Depth (mBGL)
0
10
20
30
40
50
60
Phi_pk
Dilation
Denmark Place
BH102

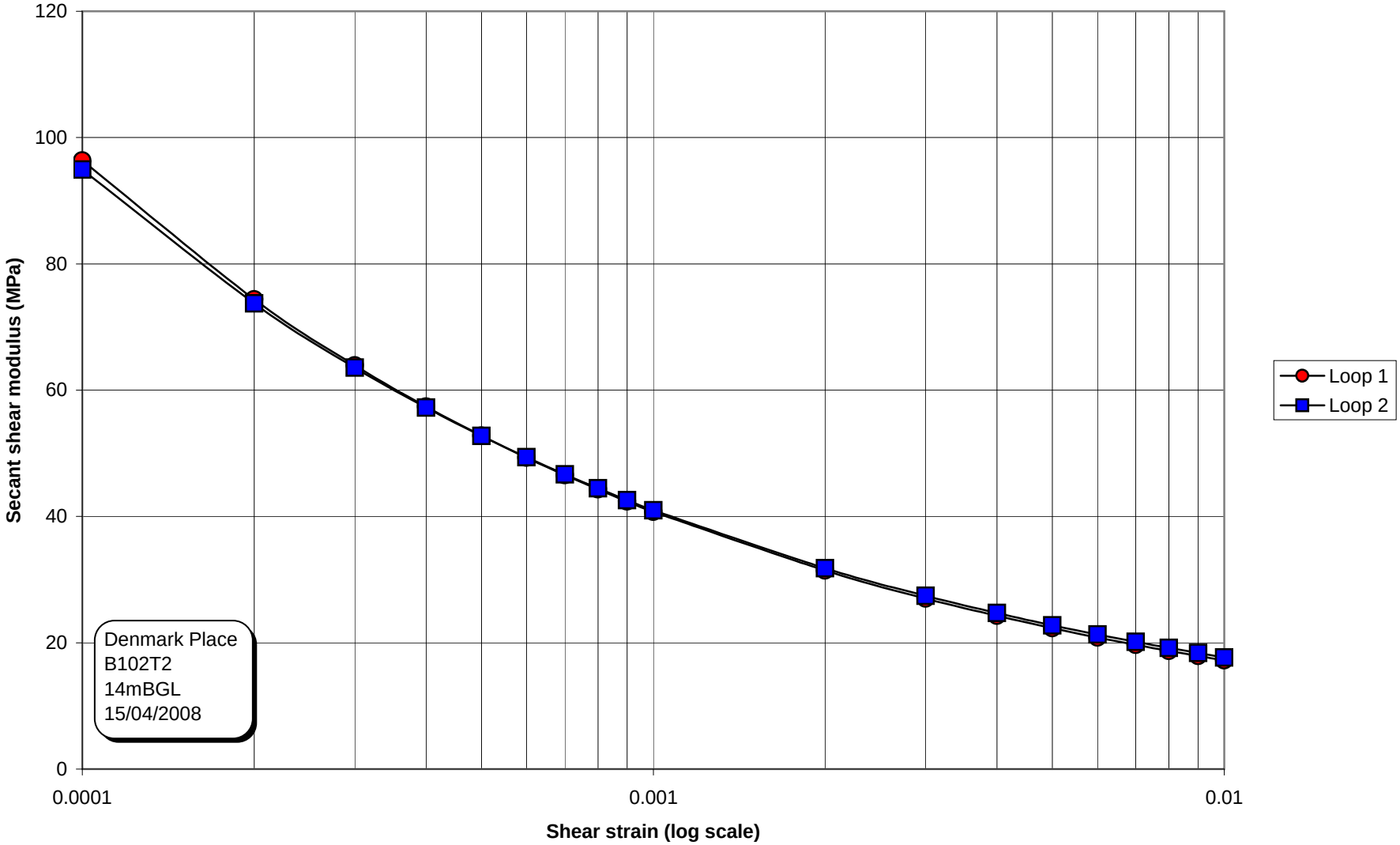
BOREHOLE B102

SHEAR MODULUS DATA FROM THE ANALYSIS OF UNLOAD/RELOAD CYCLES

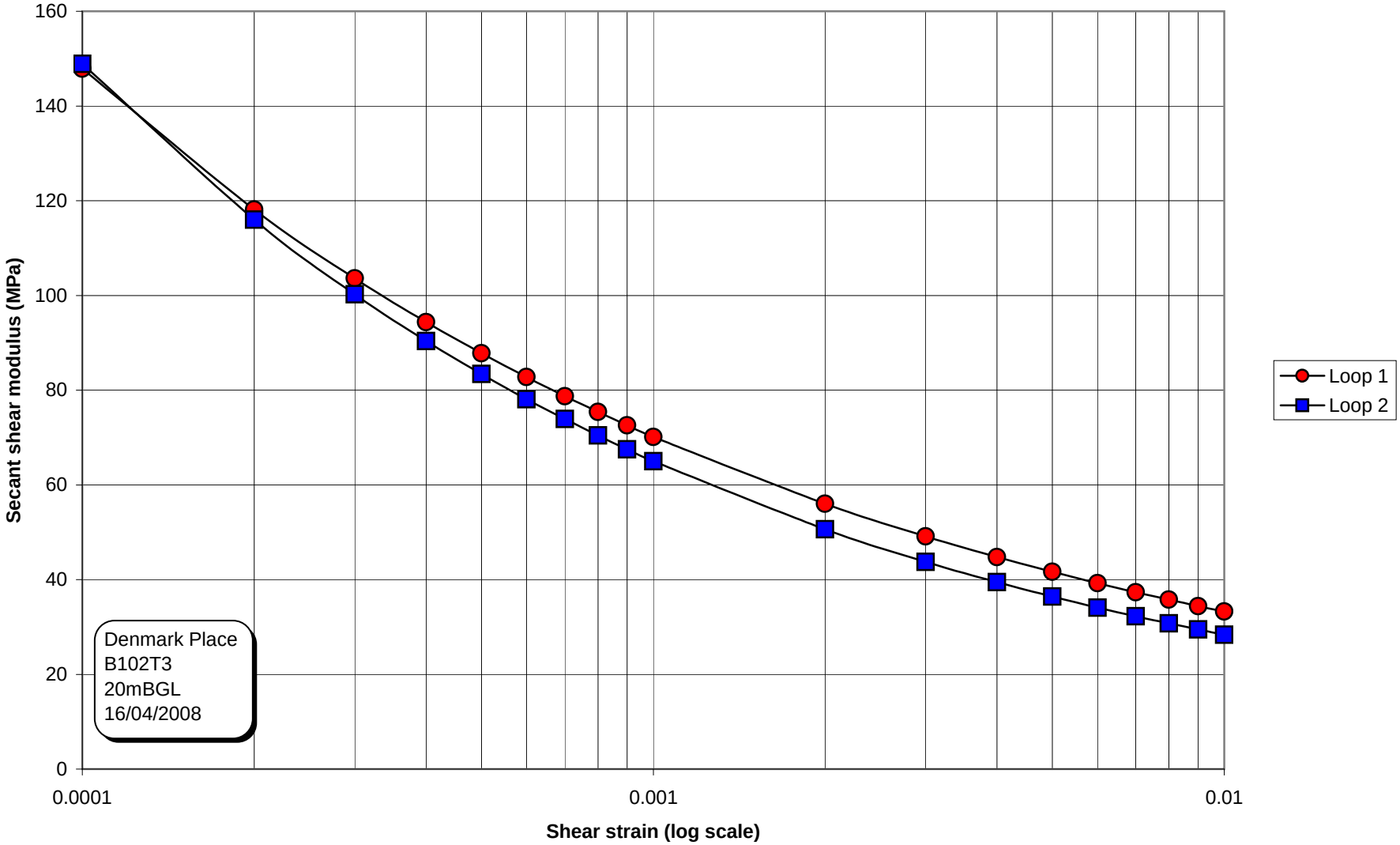
The variation of secant shear modulus with shear strain



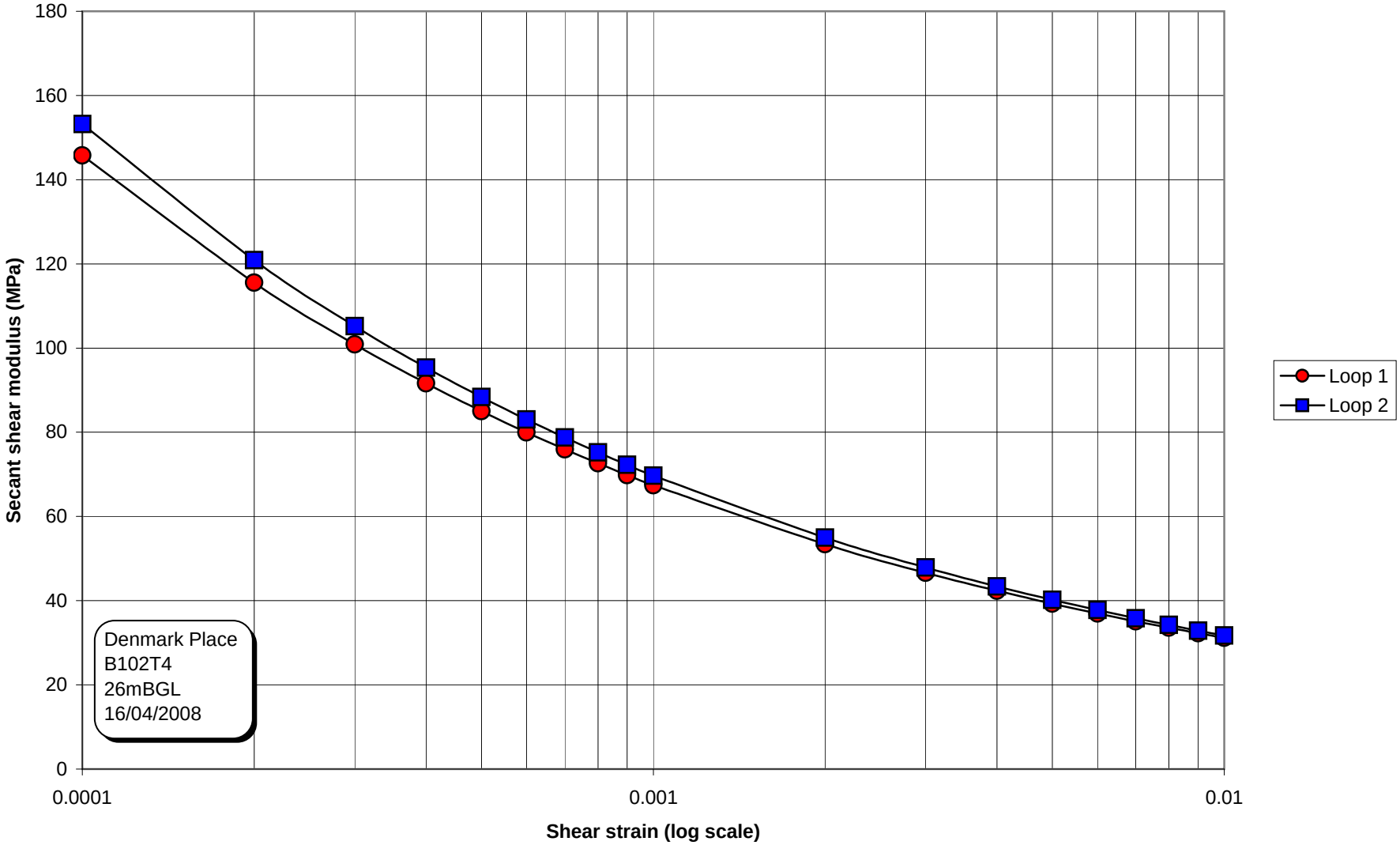
The variation of secant shear modulus with shear strain



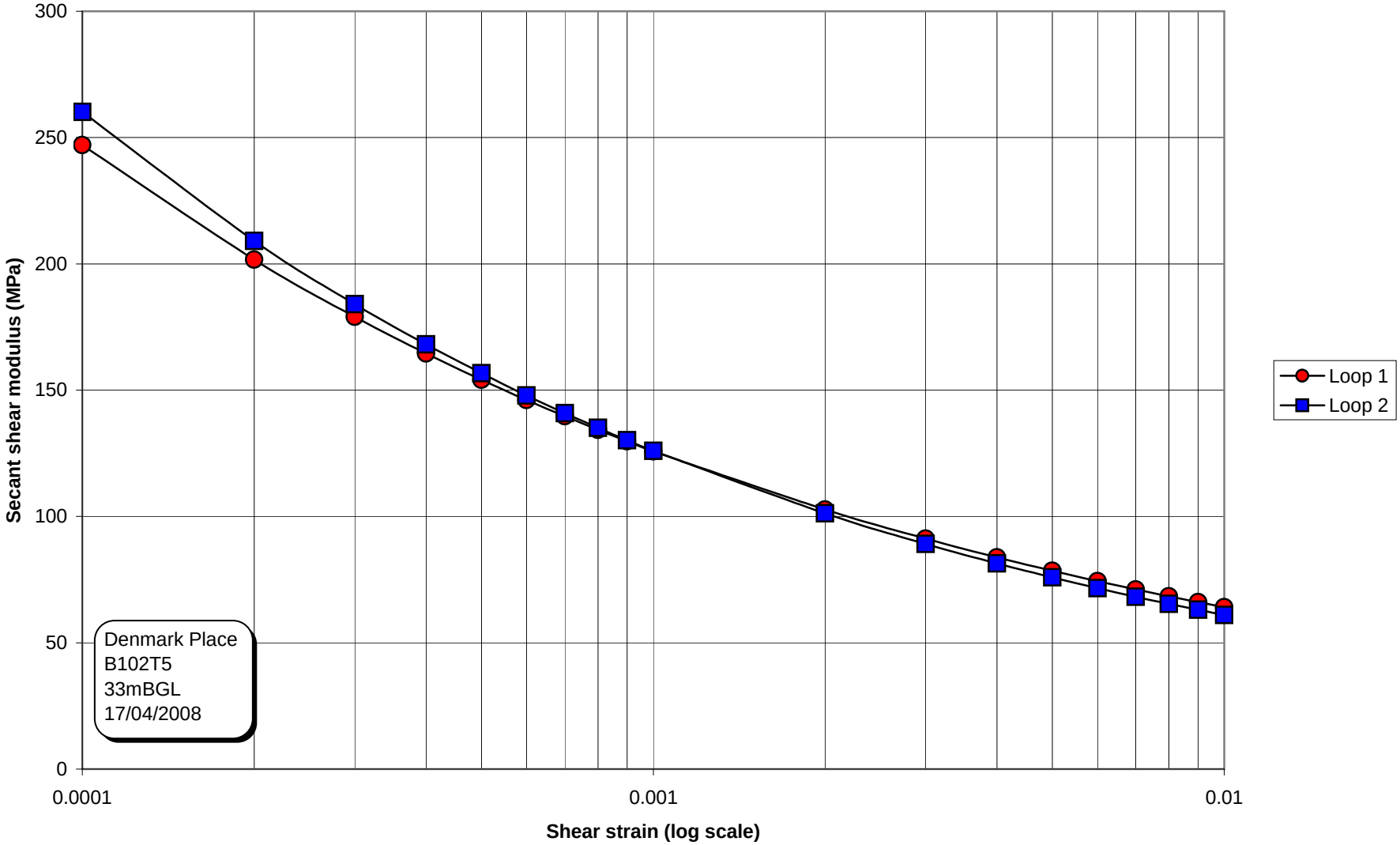
The variation of secant shear modulus with shear strain



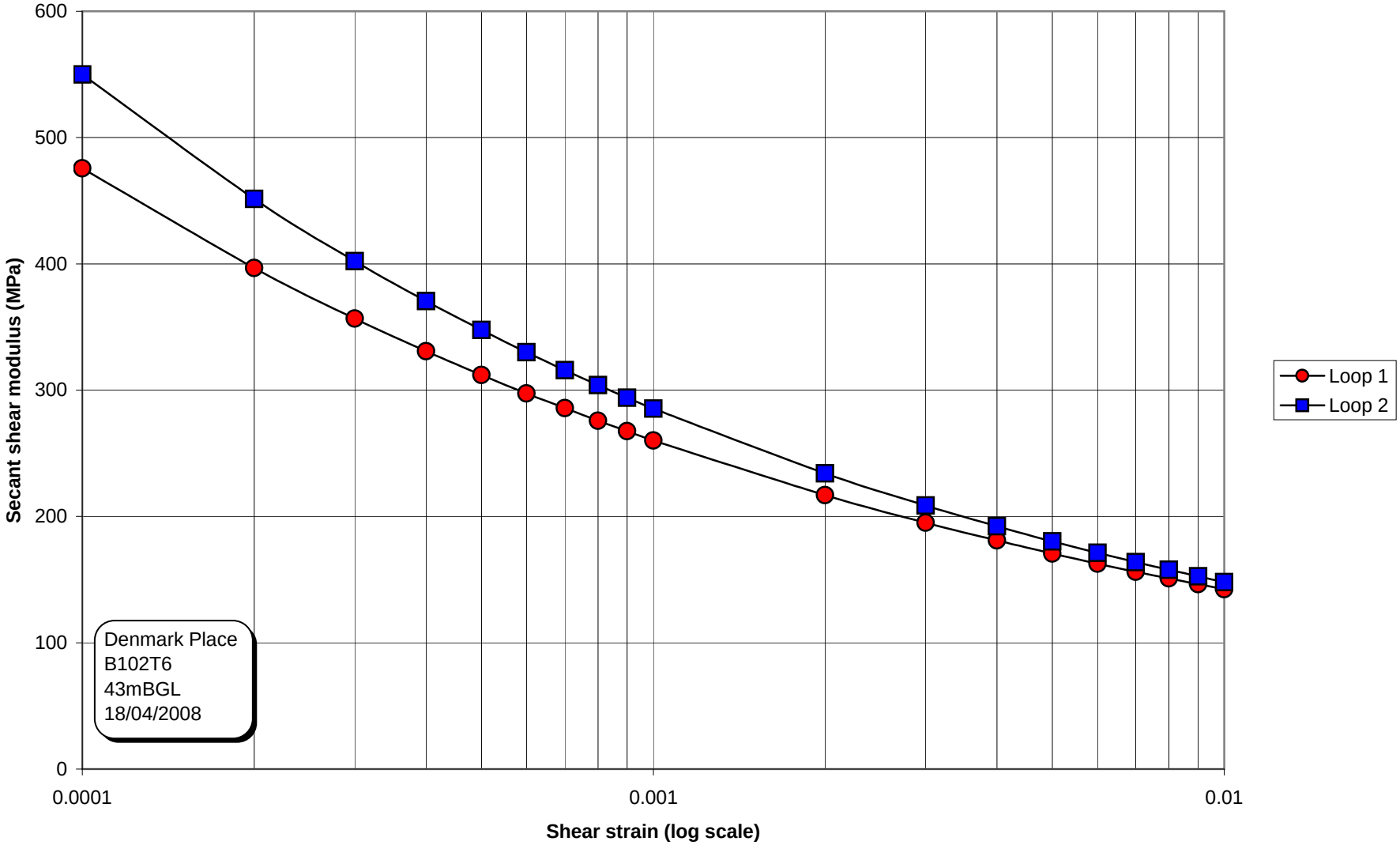
The variation of secant shear modulus with shear strain



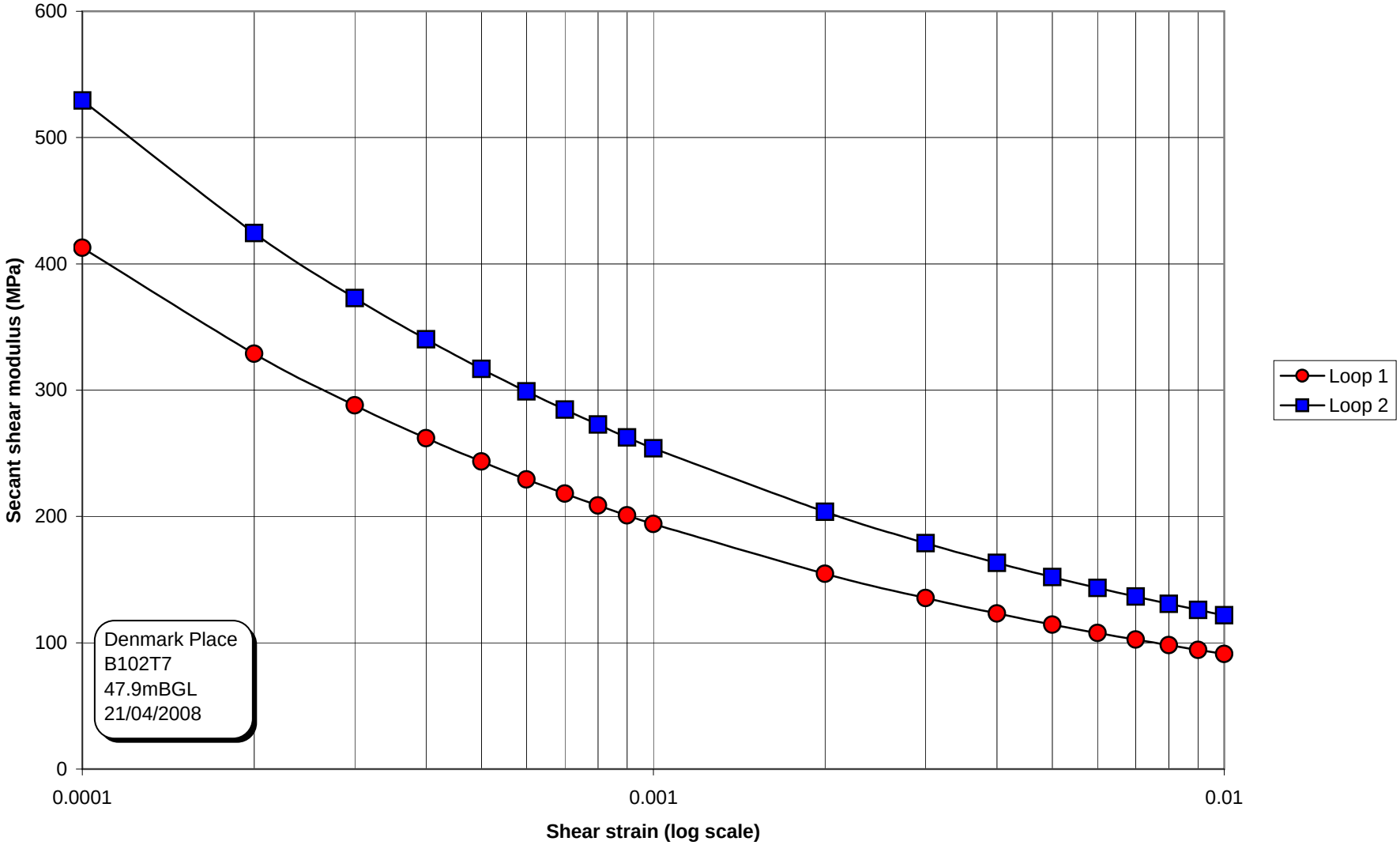
The variation of secant shear modulus with shear strain



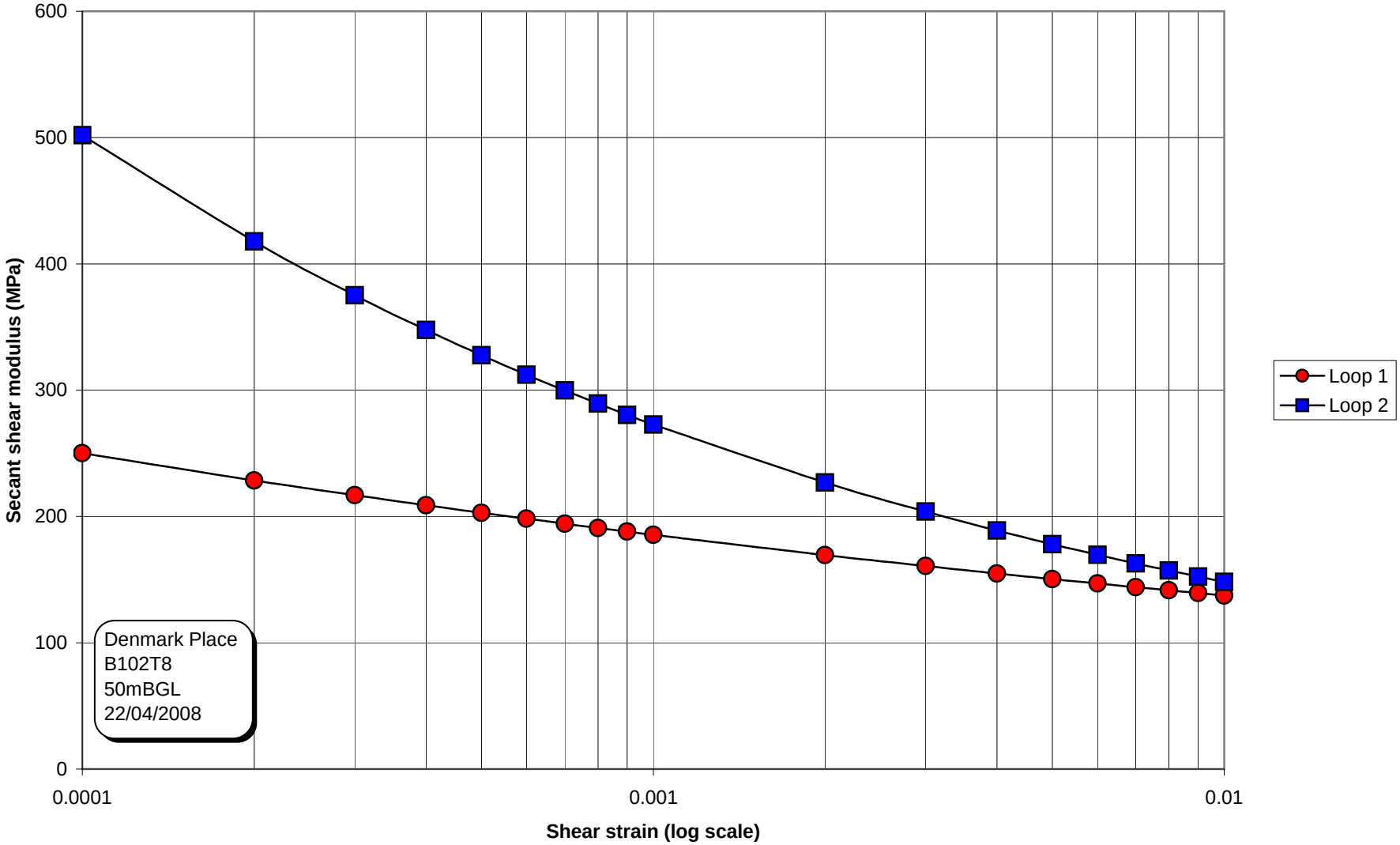
The variation of secant shear modulus with shear strain



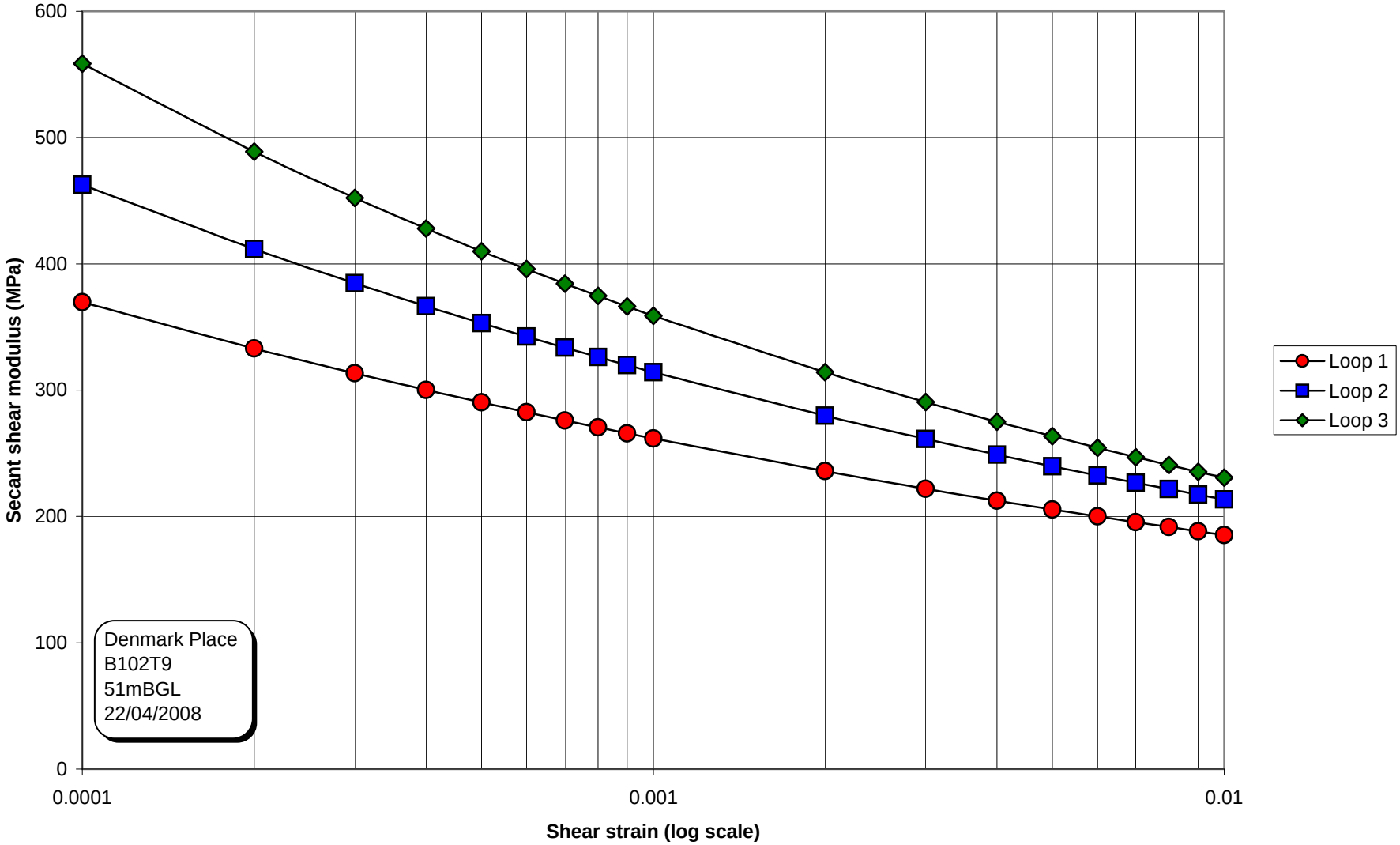
The variation of secant shear modulus with shear strain



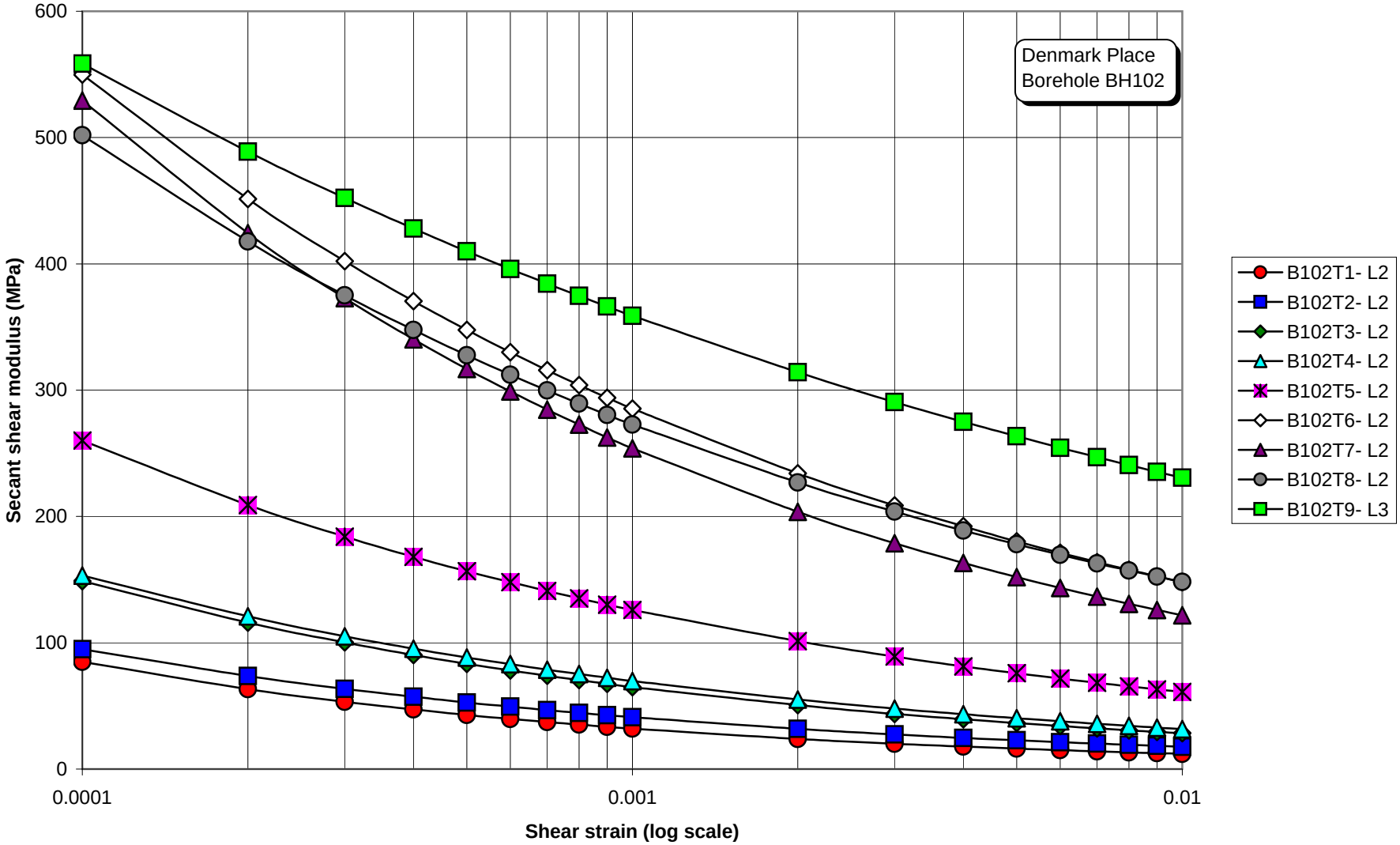
The variation of secant shear modulus with shear strain



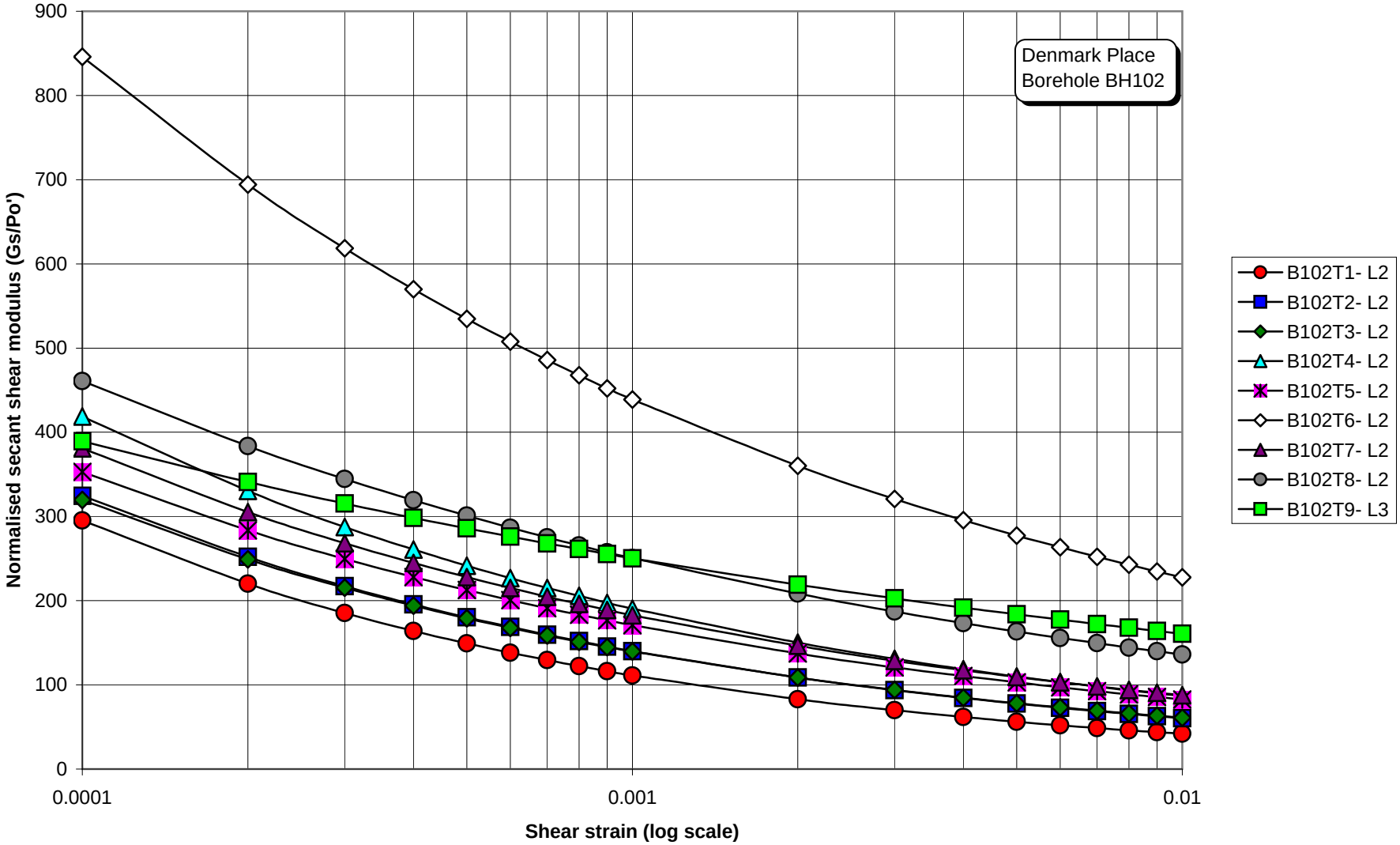
The variation of secant shear modulus with shear strain



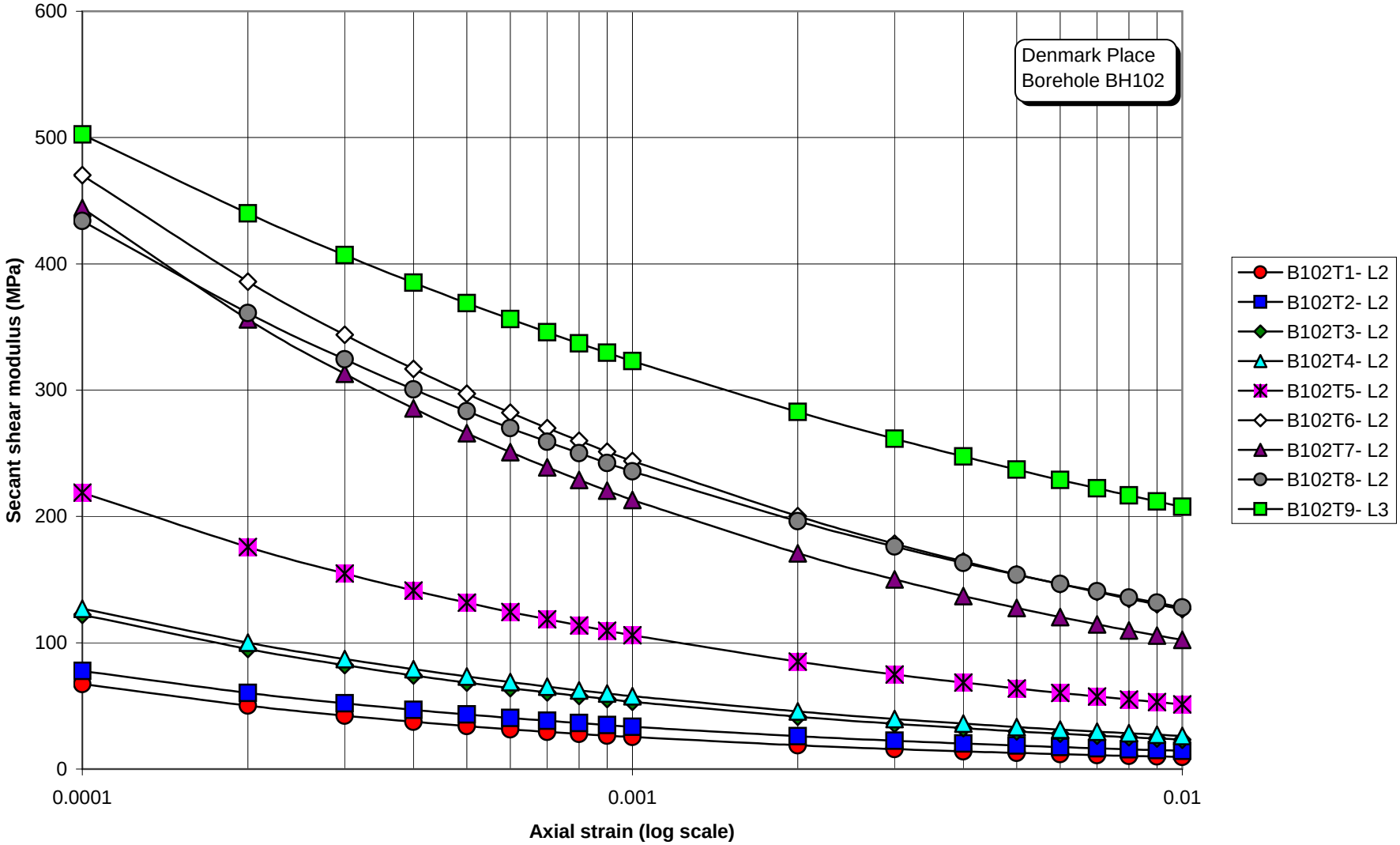
Secant shear modulus versus shear strain, all tests



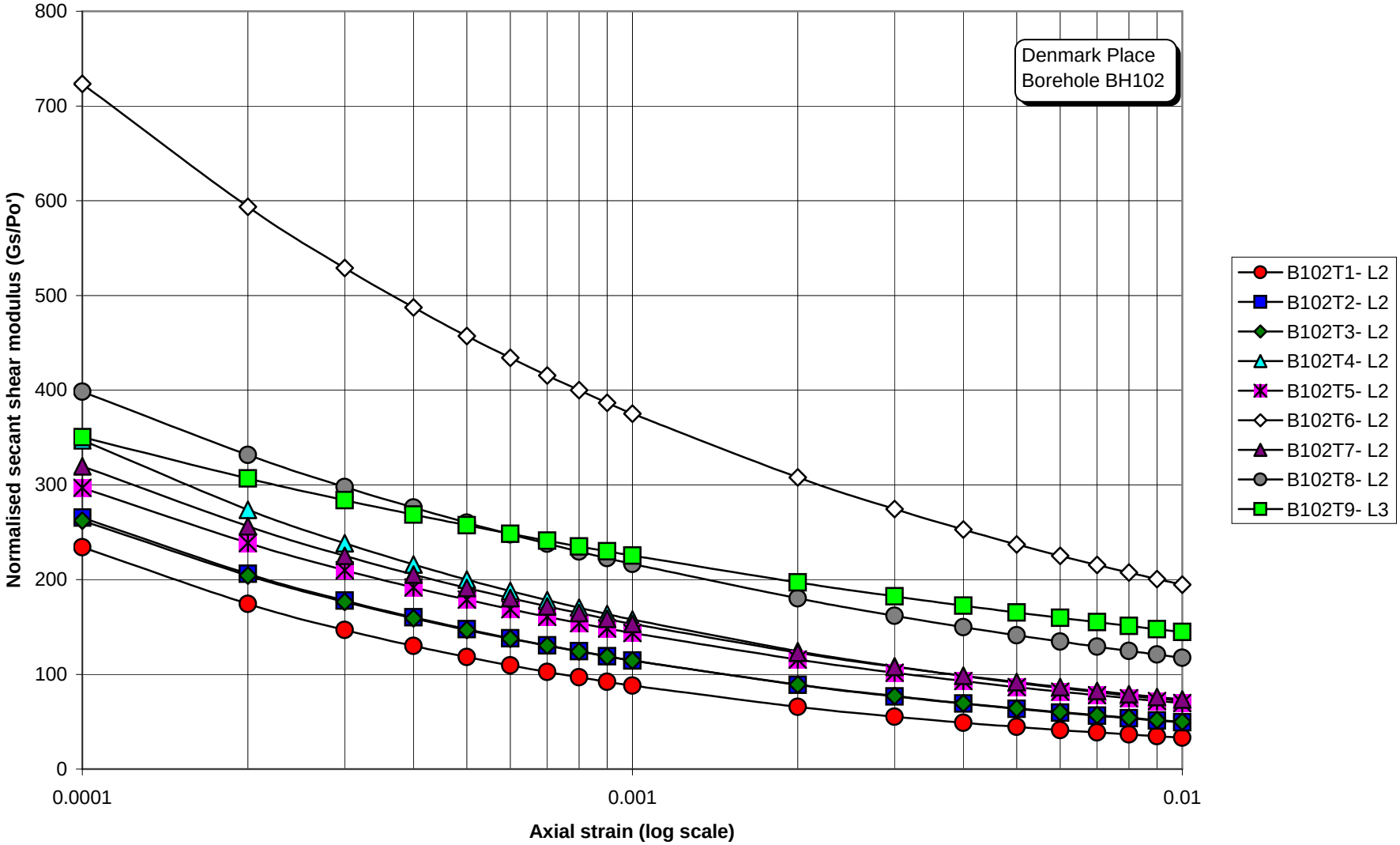
Normalised secant shear modulus versus shear strain, all tests



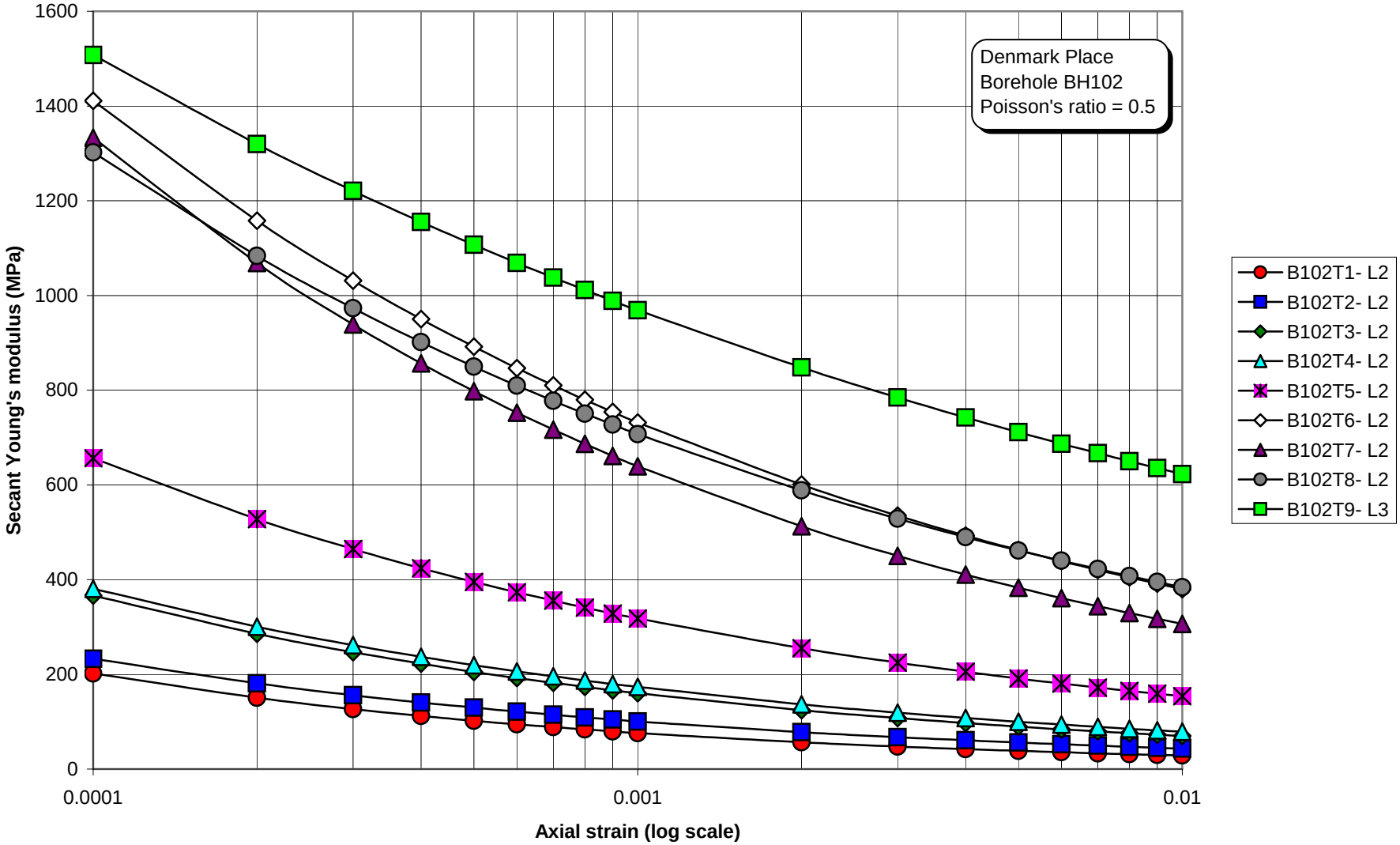
Secant shear modulus versus axial strain, all tests



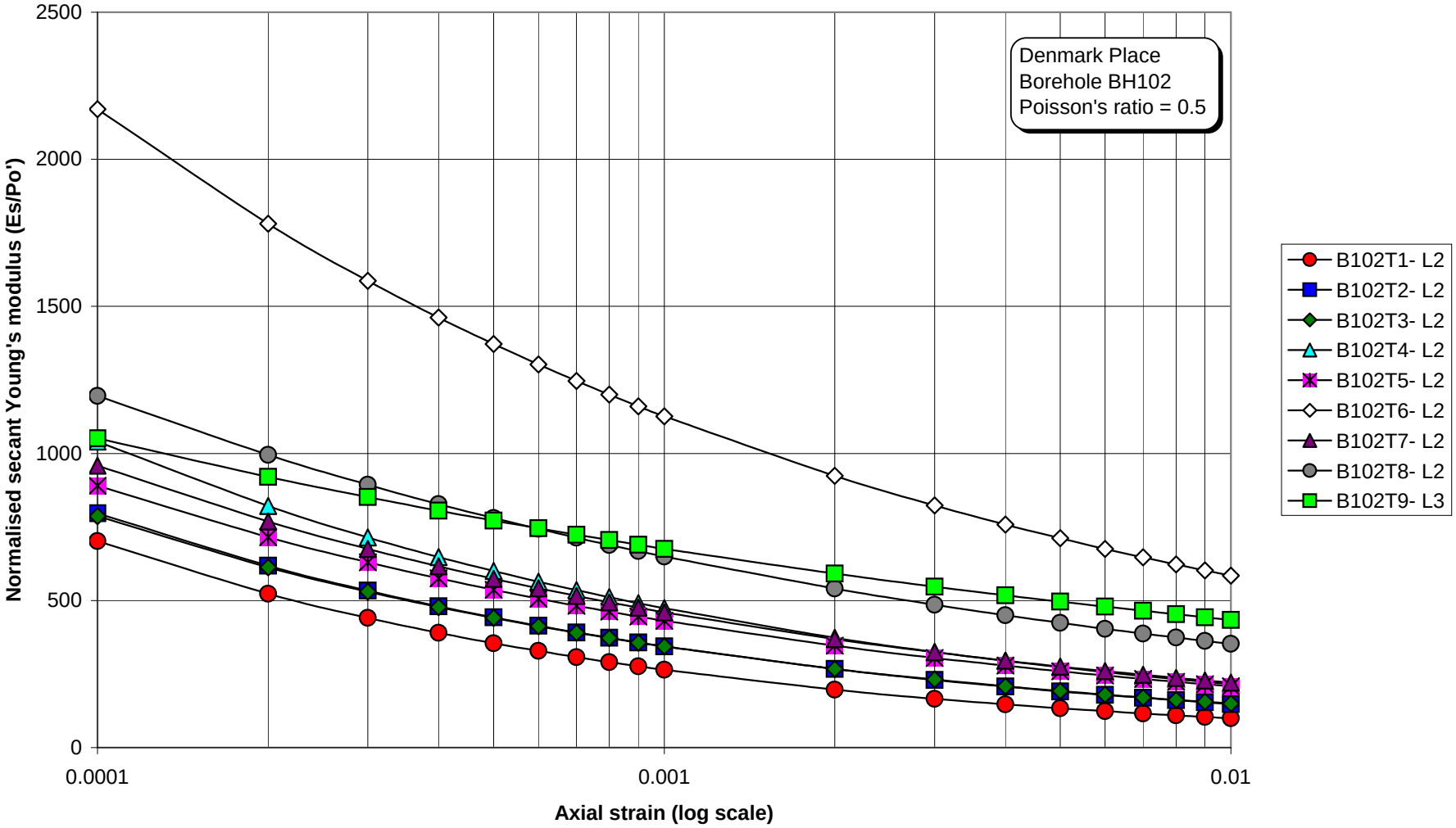
Normalised secant shear modulus versus axial strain, all tests



Secant Young's modulus versus axial strain, all tests



Normalised secant Young's modulus versus axial strain, all tests



BOREHOLE B102

TEST DATA FOR INDIVIDUAL TESTS

(TAKEN FROM WINSITU, EXCEL AND WINLOG FILES)

B102T1 - SUMMARY OF RESULTS
[File made with WinSitu Version 1.20.1.1]

[DETAILS OF TEST]
Project : 36237
Site : Denmark Place
Borehole : BH102
Test name : B102T1
Test date : 15 Apr 08
Test depth : 8.50 Metres
Water table : 5.6 Metres
Ambient PWP : 28.4 kPa
Material : London Clay
Probe : Digital 6 arm weak rock self boring pressuremeter
Diameter : 88.1 mm
Data analysed using average arm displacement curve
A non-linear analysis of the rebound cycles has been carried out
The file includes results from a curve fitting analysis

Analysed by RWW on 15 Apr 08

Remarks: Problems with power supply - affected SCU so first loop spoiled.

[RESULTS FOR CAVITY REFERENCE PRESSURE]
Strain Origin (mm) : "Arm ave=-0.050"
Po from Marsland & Randolph (kPa) : "Arm ave=398.0"
Po from Lift off (kPa) : "Arm ave=336.3"
PWP versus Total Stress (kPa) : "PPC Ave=202.0"
Best estimate of Po (kPa) : "Arm ave=316.0"

[UNDRAINED STRENGTH PARAMETERS]
Gibson & Anderson 1961 - Cu (kPa) : "Arm ave=132.1"
Limit pressure (kPa) : "Arm ave=1187"
Jefferies 1988 - Cu (kPa) : "Arm ave=134.4"
Undrained yield stress (kPa) : "Arm ave=541.0"

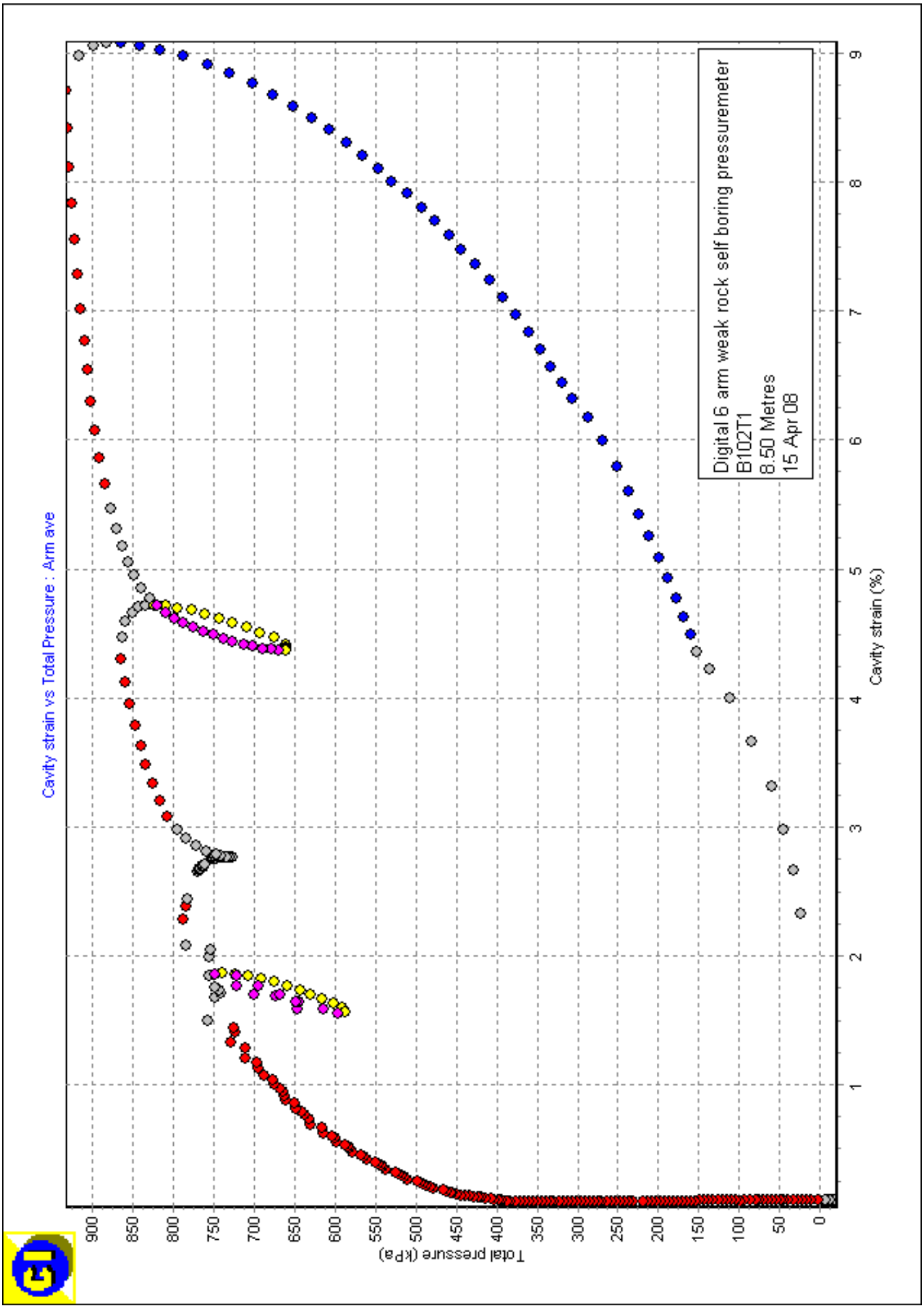
[LINEAR INTERPRETATION OF SHEAR MODULUS G]
Initial slope shear modulus (MPa) :"Arm ave=21.2"

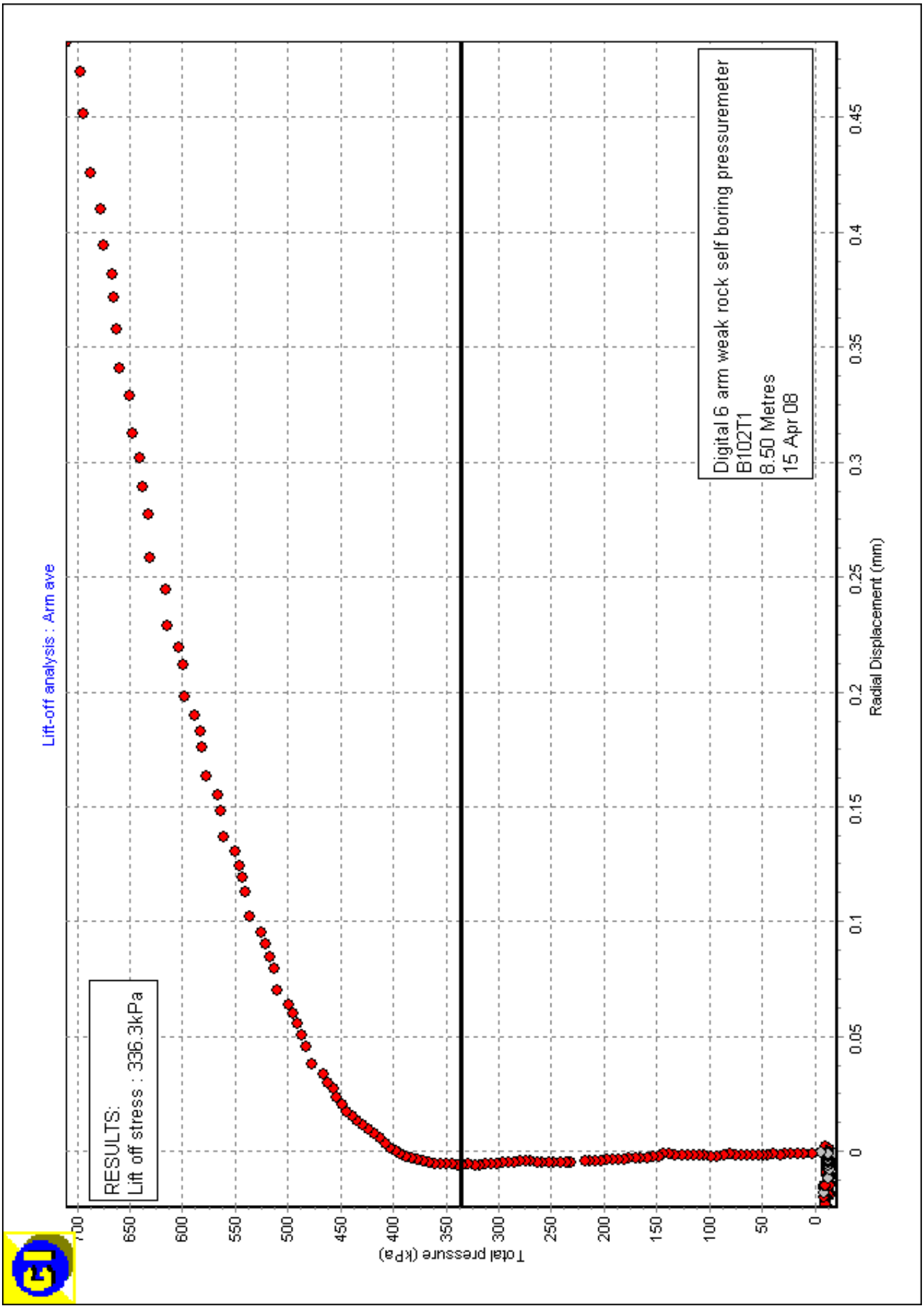
Axis	Loop No	Value (MPa)	Mean Strain (%)	Mean Pc (kPa)	dE (%)	dPc (kPa)
Arm ave	1	25.0	1.723	661	0.591	148
Arm ave	2	24.2	4.554	740	0.675	164

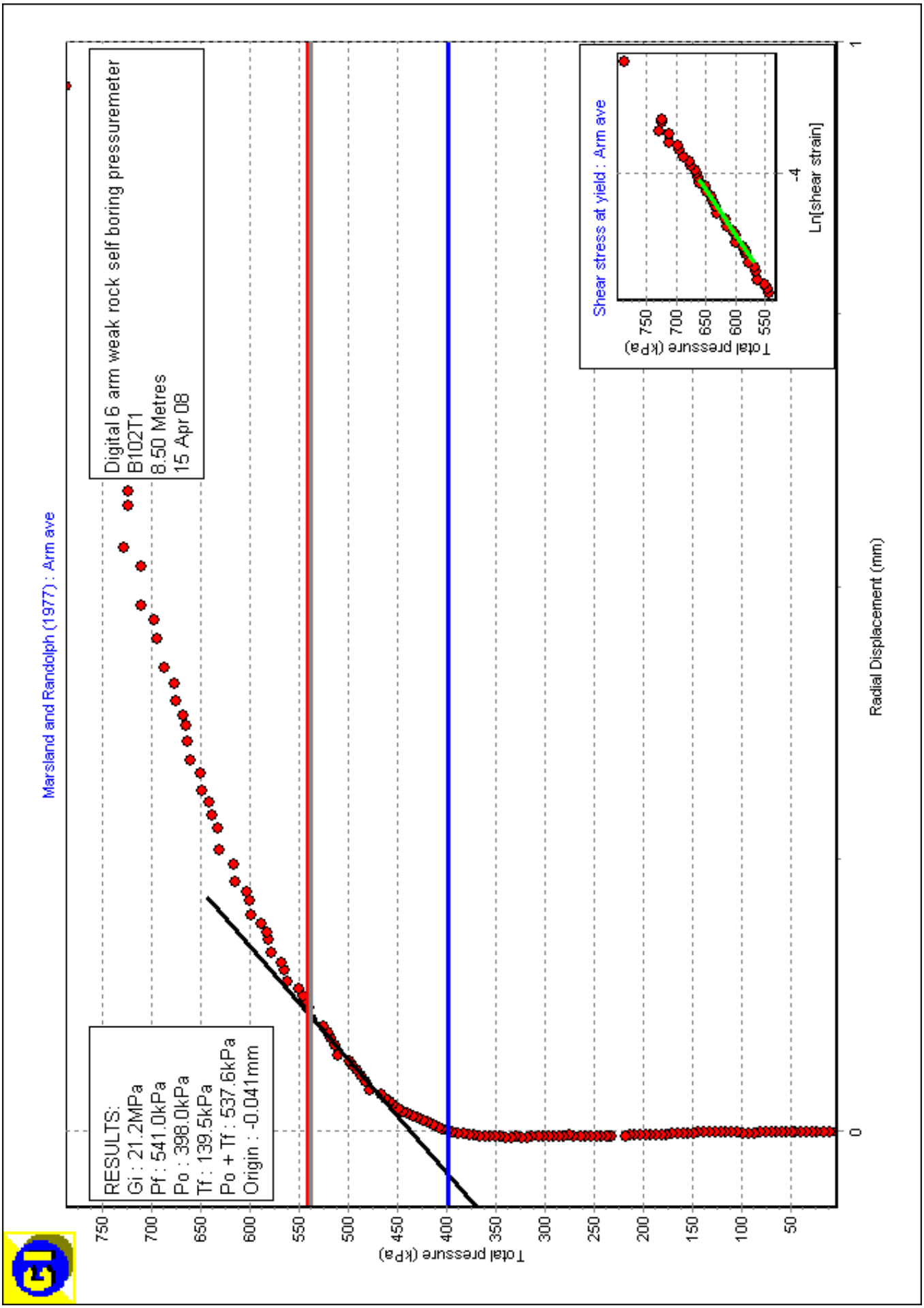
[NON LINEAR INTERPRETATION OF SECANT SHEAR MODULUS]

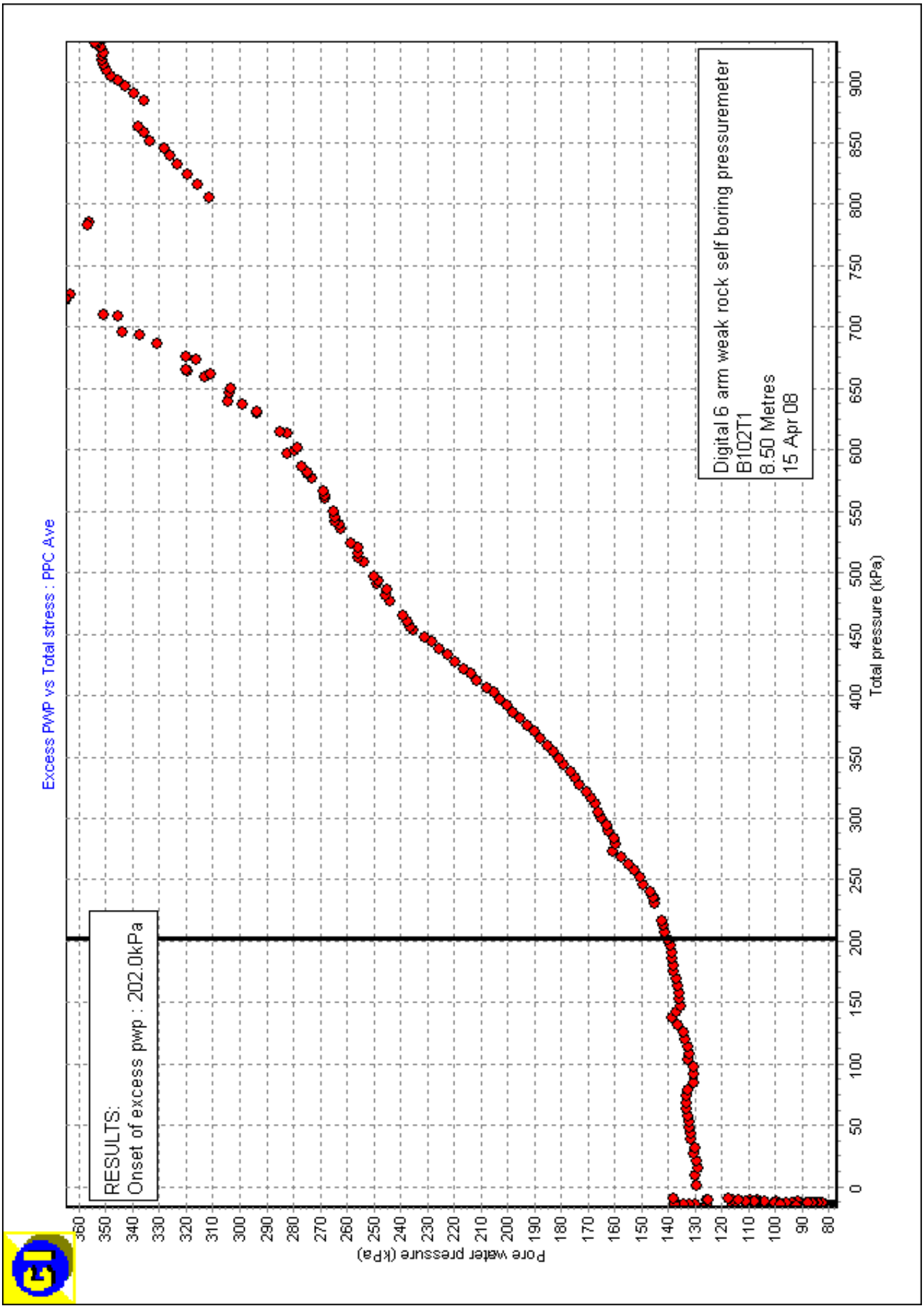
Axis	Loop No	Intercept (MPa)	Alpha (MPa)	Gradient
Arm ave	1	5.269	3.733	0.708
Arm ave	2	2.972	1.711	0.576

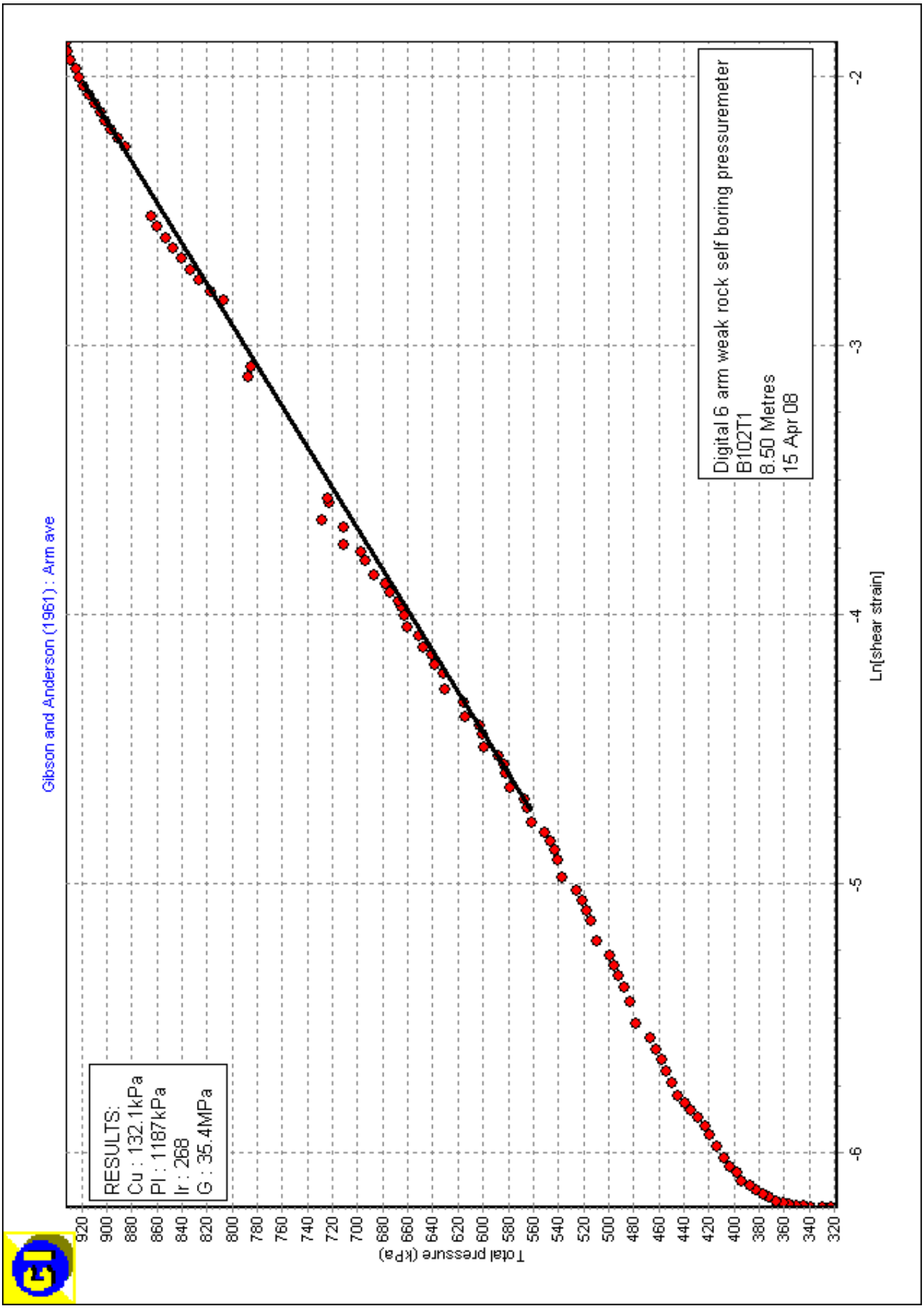
[PARAMETERS USED FOR UNDRAINED CURVE MODELLING]
Axis is Arm ave
Strain Origin (mm) : -0.05
Po (kPa) : 316
Cu (kPa) : 132.1
Limit pressure (kPa) : 1187
Non-linear exponent : 0.576
Calculated alpha (MPa) : 2.157
G at yield (MPa) : 16.9

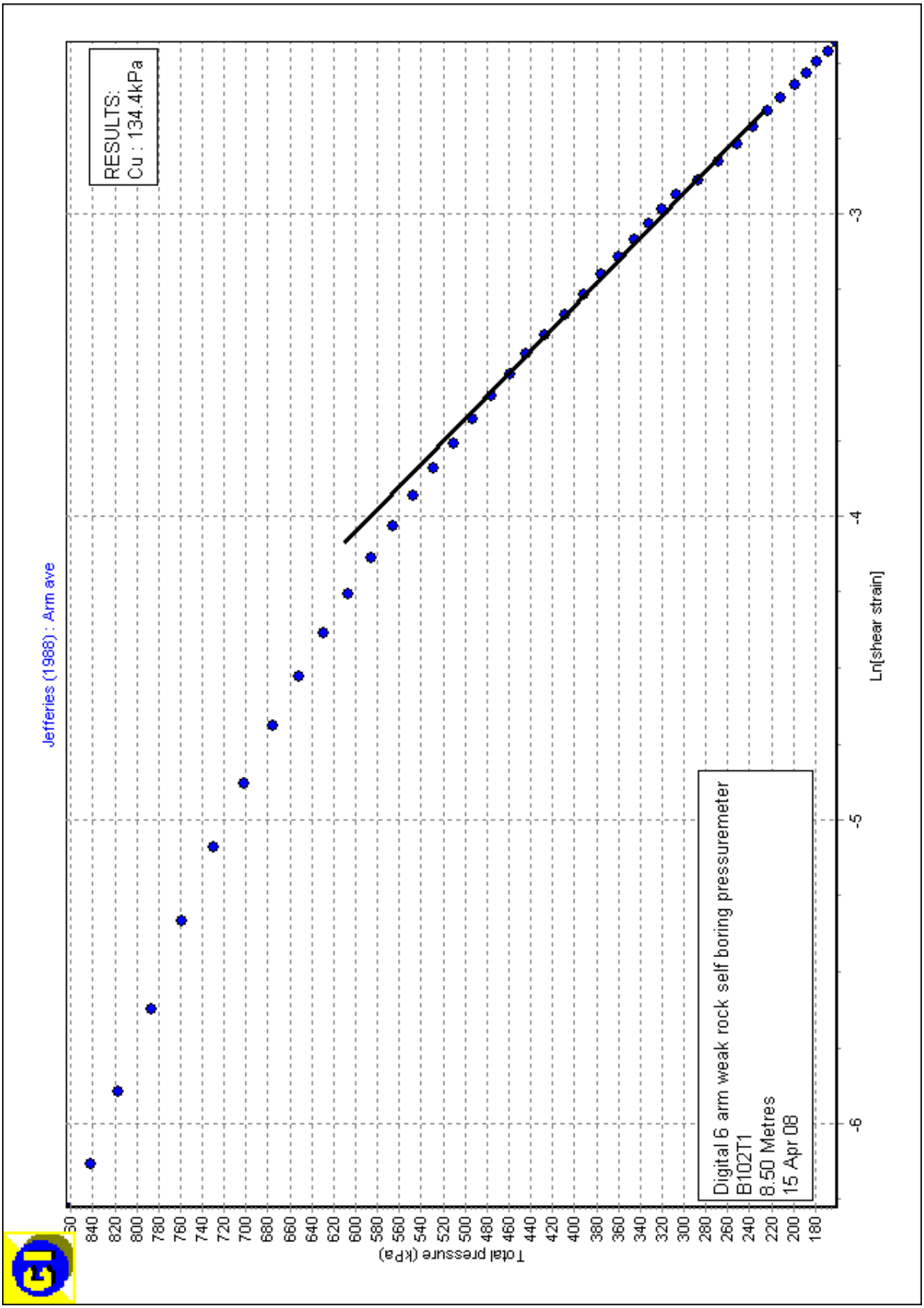

Cavity strain vs Total Pressure : Arm ave
Digital 6 arm weak rock self boring pressuremeter
B102T1
8.50 Metres
15 Apr 08
Total pressure (kPa)
Cavity strain (%)
0
50
100
150
200
250
300
350
400
450
500
550
600
650
700
750
800
850
900
1
2
3
4
5
6
7
8
9

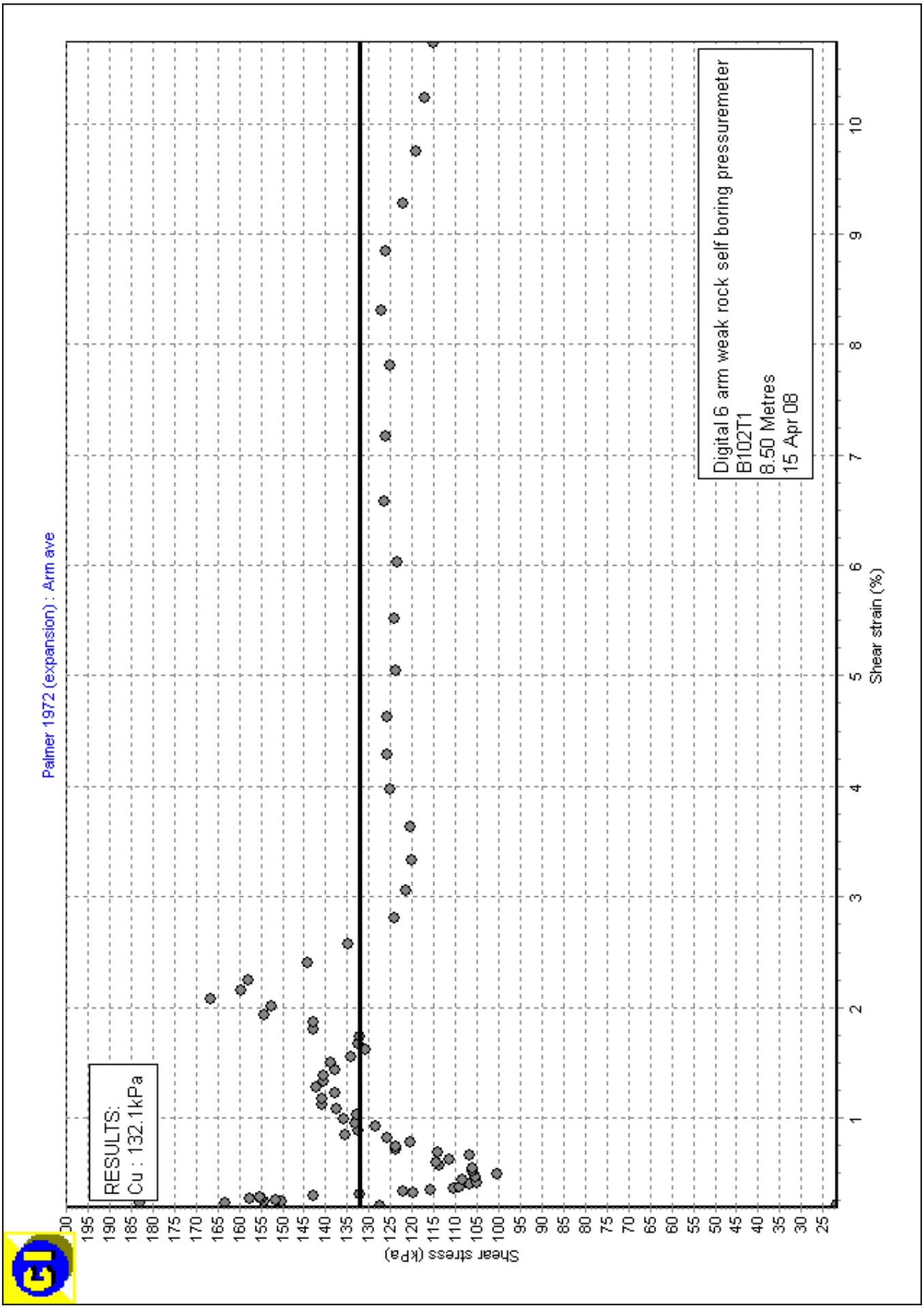

Lift-off analysis : Arm ave
RESULTS:
Lift off stress : 336.3kPa
Digital 6 arm weak rock self boring pressuremeter
B102T1
8.50 Metres
15 Apr 08
Total pressure (kPa)
Radial Displacement (mm)
0
50
100
150
200
250
300
350
400
450
500
550
600
650
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
0.45

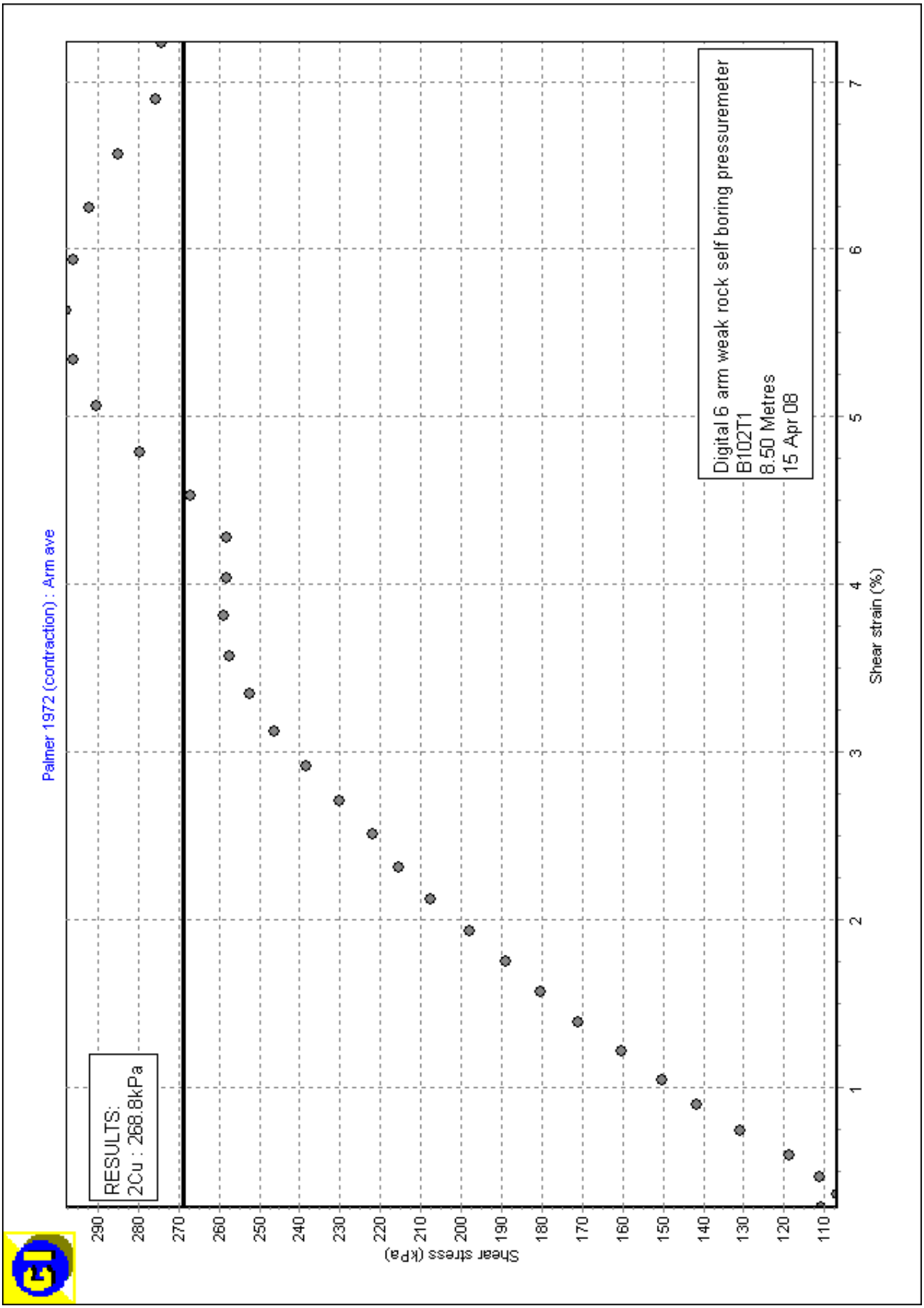

Digital 6 arm weak rock self boring pressuremeter
B102T1
8.50 Metres
15 Apr 08
RESULTS:
Gi : 21.2MPa
Pf : 541.0kPa
Po : 398.0kPa
Tf : 139.5kPa
Po + Tf : 537.6kPa
Origin : -0.041mm
Marsland and Randolph (1977) : Arm ave
Total pressure (kPa)
Radial Displacement (mm)
Shear stress at yield : Arm ave
Total pressure (kPa)
Ln[shear strain]

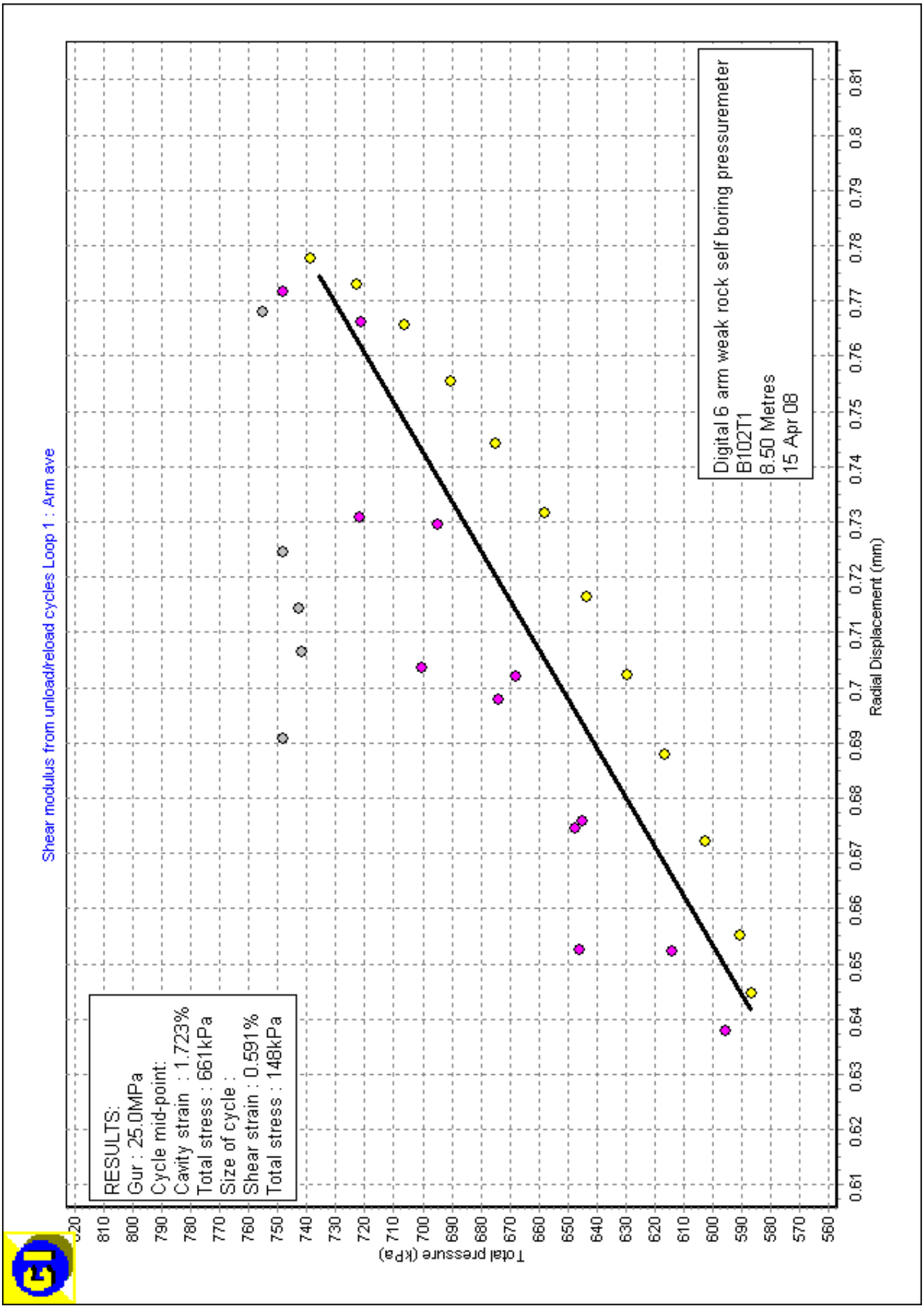

Excess PWP vs Total stress : PPC Ave
Digital 6 arm weak rock self boring pressuremeter
B102T1
8.50 Metres
15 Apr 08
RESULTS:
Onset of excess pwp : 202.0kPa
Pore water pressure (kPa)
Total pressure (kPa)

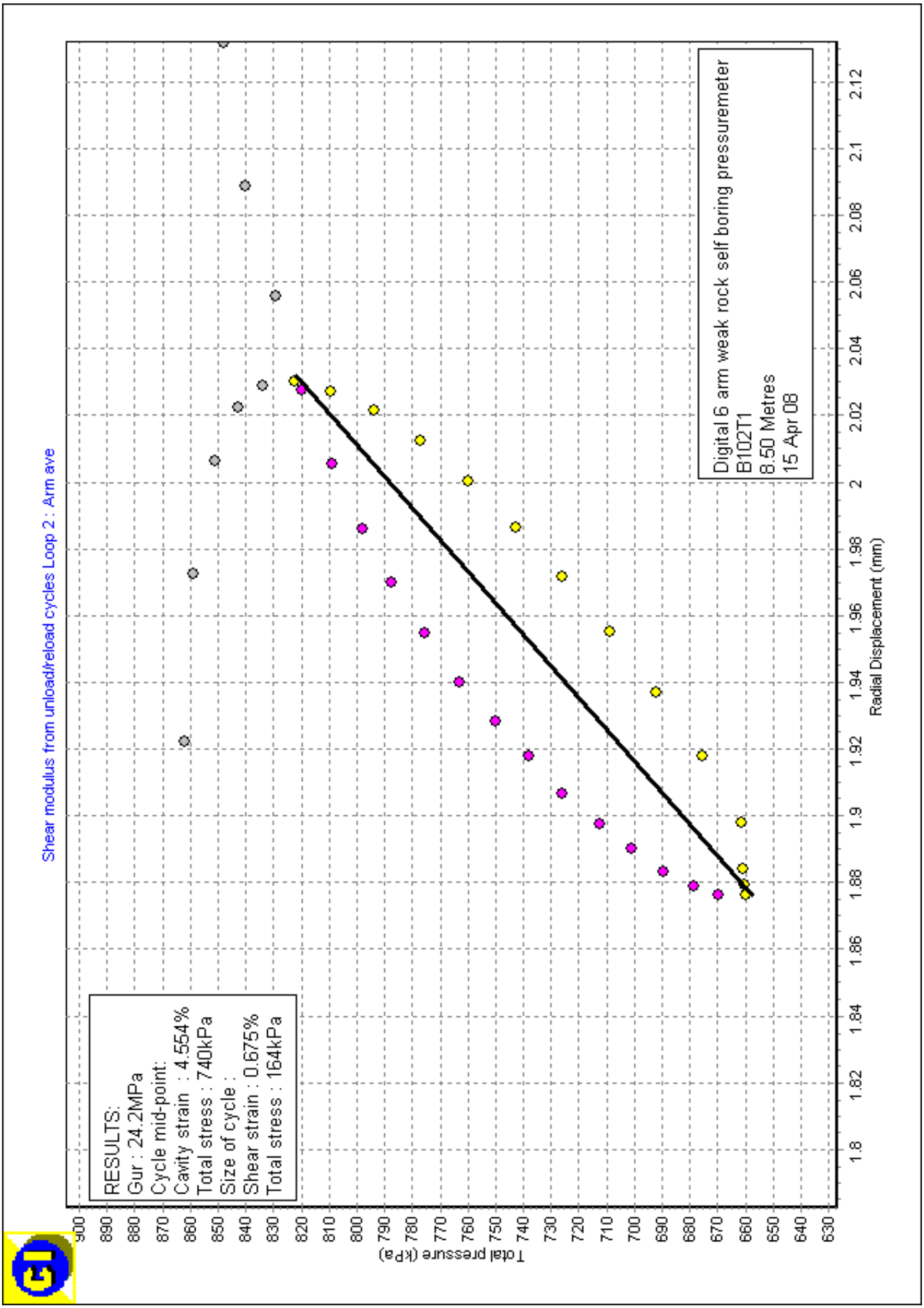

Gibson and Anderson (1961) : Arm ave
RESULTS:
Cu : 132.1kPa
Pl : 1187kPa
Ir : 268
G : 35.4MPa
Digital 6 arm weak rock self boring pressuremeter
B102T1
8.50 Metres
15 Apr 08
Total pressure (kPa)
Ln[shear strain]

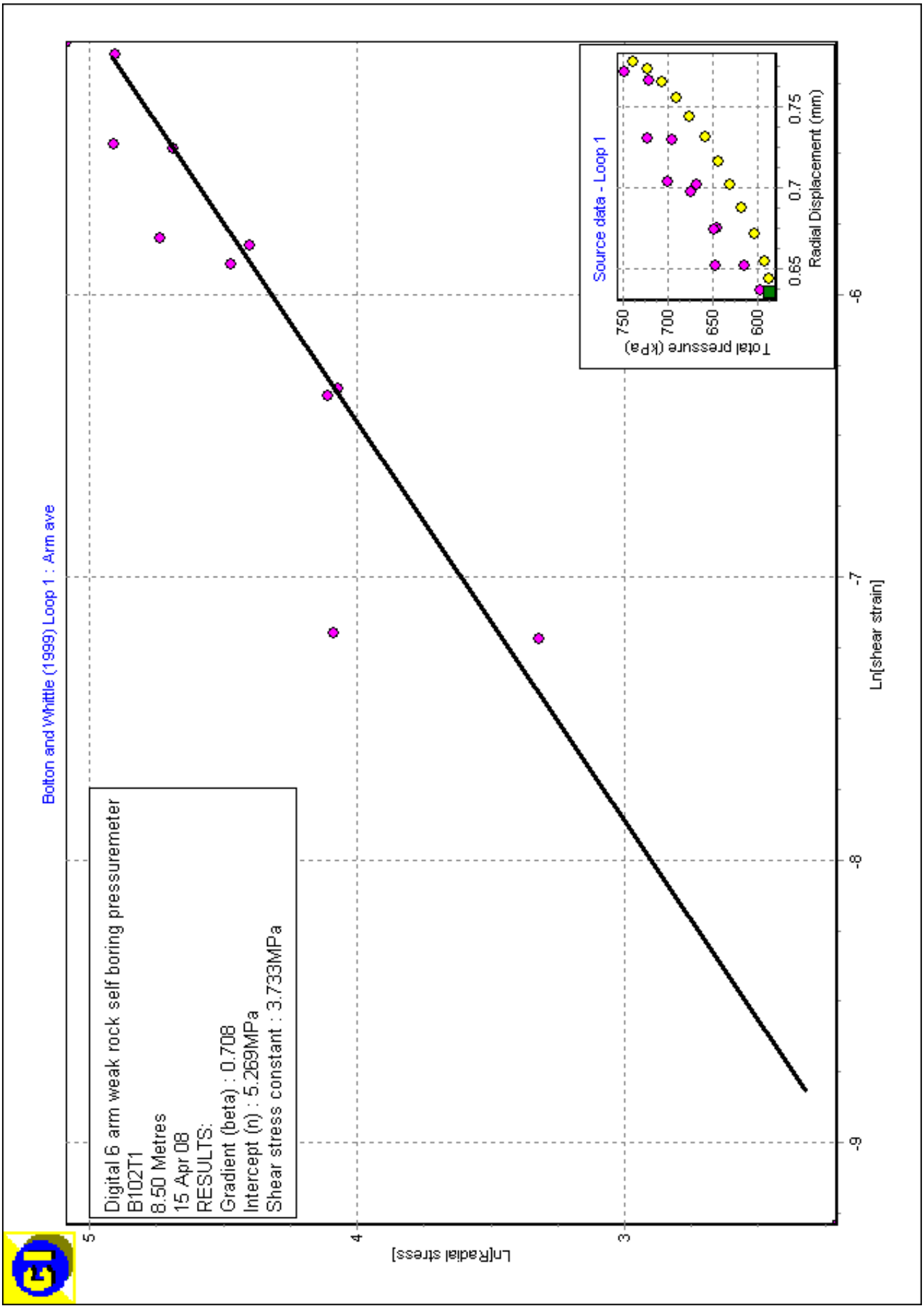

RESULTS:
Cu : 134.4kPa
Jefferies (1988) : Arm ave
Digital 6 arm weak rock self boring pressuremeter
B102T1
8.50 Metres
15 Apr 08
Total pressure (kPa)
Ln[shear strain]

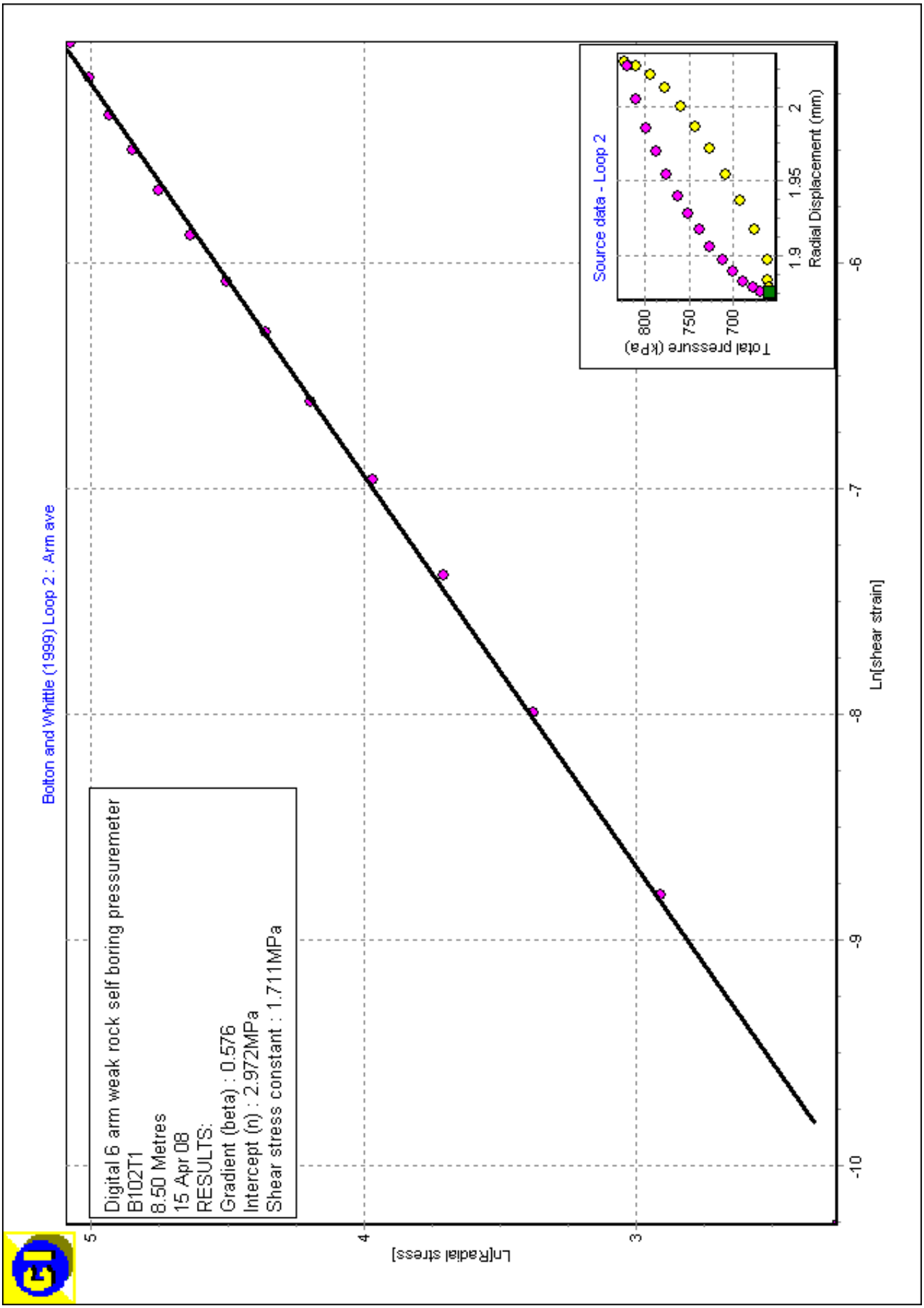

Palmer 1972 (expansion) : Arm ave
RESULTS:
Cu : 132.1kPa
Digital 6 arm weak rock self boring pressuremeter
B102T1
8.50 Metres
15 Apr 08
Shear stress (kPa)
Shear strain (%)

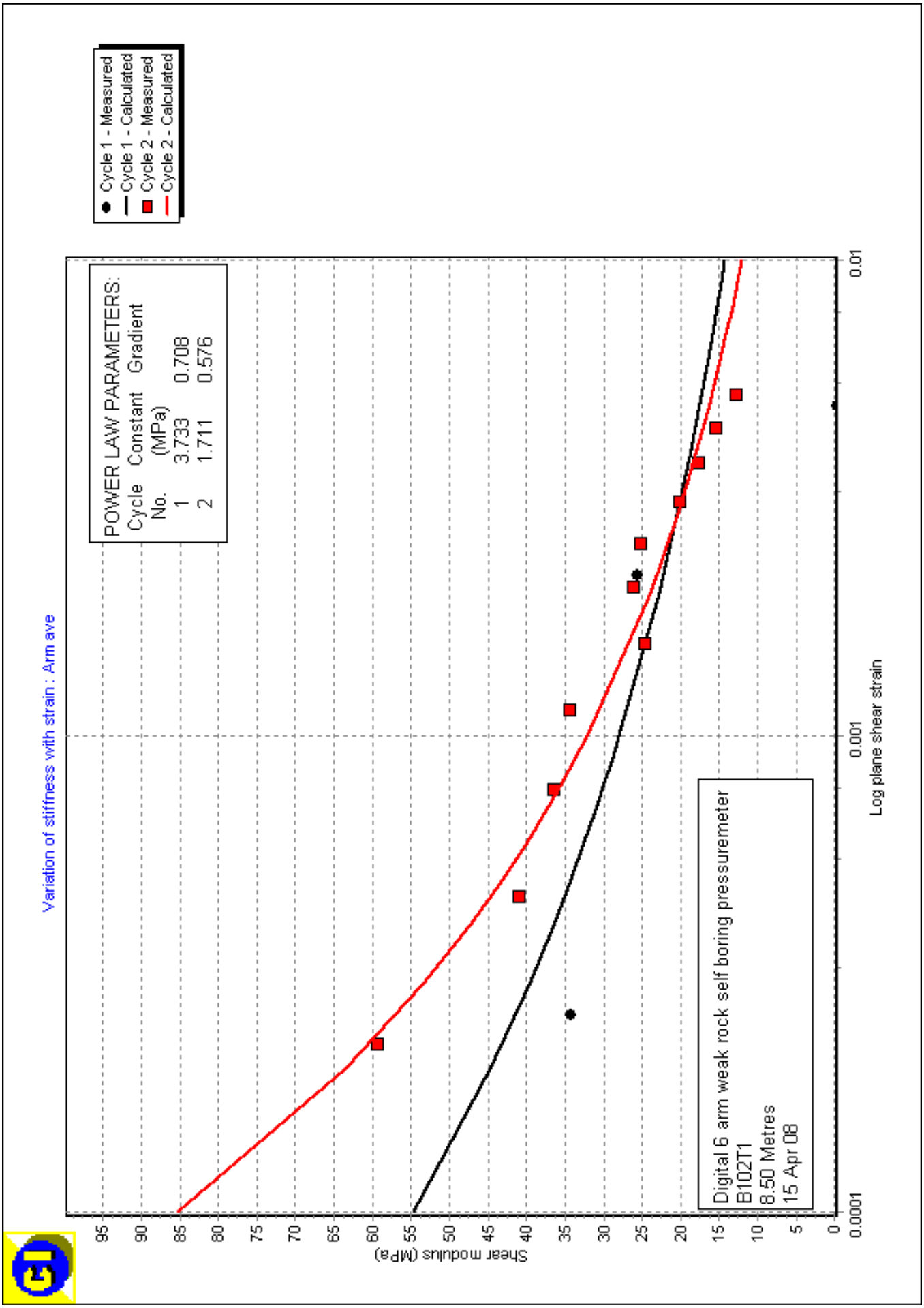

Palmer 1972 (contraction) : Arm ave
RESULTS:
2Cu : 268.8kPa
Digital 6 arm weak rock self boring pressuremeter
B102T1
8.50 Metres
15 Apr 08
Shear stress (kPa)
Shear strain (%)

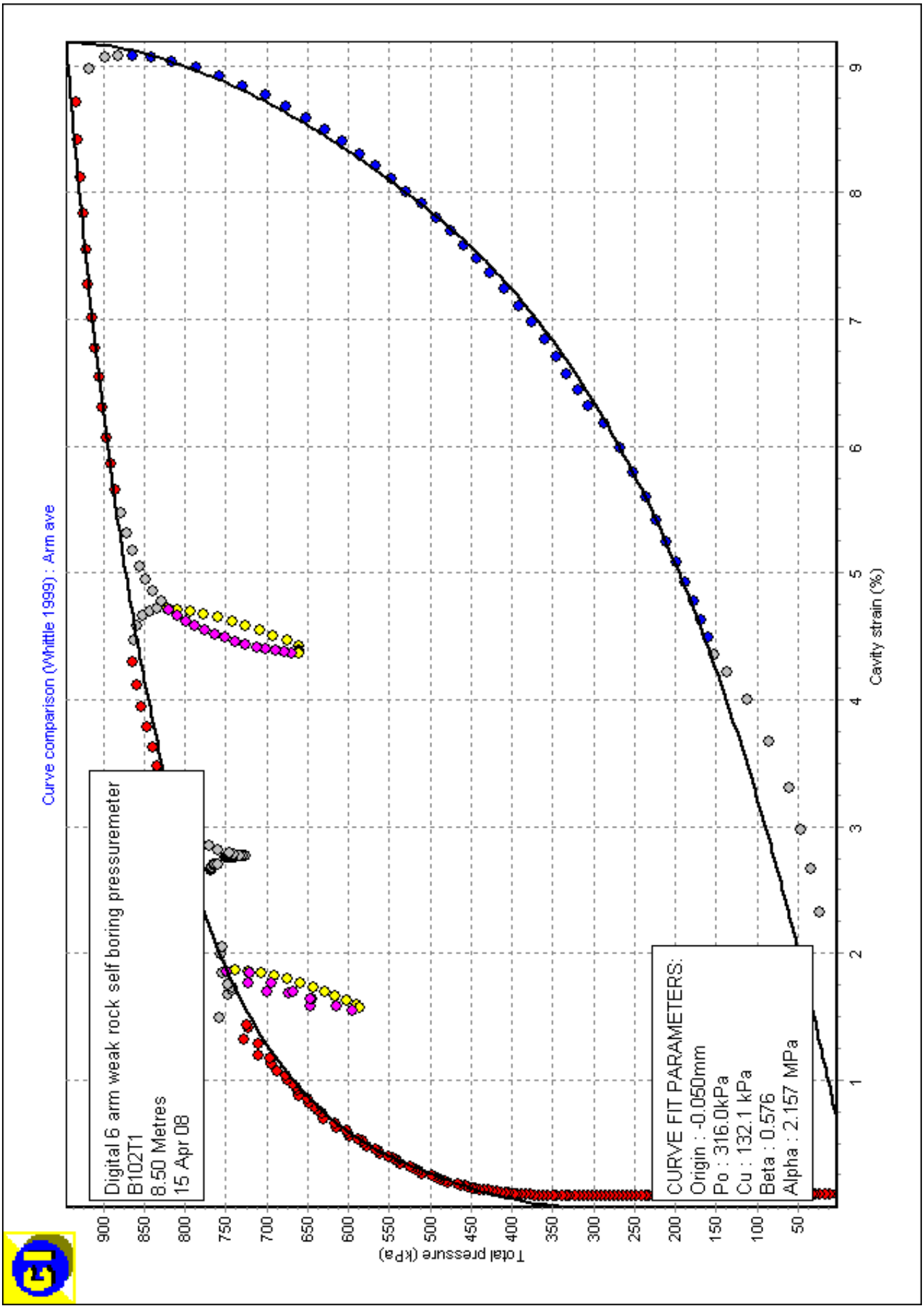

Shear modulus from unload/reload cycles Loop 1 : Arm ave
RESULTS:
Gur : 25.0MPa
Cycle mid-point:
Cavity strain : 1.723%
Total stress : 661kPa
Size of cycle :
Shear strain : 0.591%
Total stress : 148kPa
Digital 6 arm weak rock self boring pressuremeter
B102T1
8.50 Metres
15 Apr 08
Total pressure (kPa)
Radial Displacement (mm)


Shear modulus from unload/reload cycles Loop 2 : Arm ave
RESULTS:
Gur : 24.2MPa
Cycle mid-point:
Cavity strain : 4.554%
Total stress : 740kPa
Size of cycle :
Shear strain : 0.675%
Total stress : 164kPa
Digital 6 arm weak rock self boring pressuremeter
B102T1
8.50 Metres
15 Apr 08
Total pressure (kPa)
Radial Displacement (mm)


Bolton and Whittle (1999) Loop 1 : Arm ave
Digital 6 arm weak rock self boring pressuremeter
B102T1
8.50 Metres
15 Apr 08
RESULTS:
Gradient (beta) : 0.708
Intercept (n) : 5.269MPa
Shear stress constant : 3.733MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 1
Total pressure (kPa)
Radial Displacement (mm)


Bolton and Whittle (1999) Loop 2 : Arm ave
Digital 6 arm weak rock self boring pressuremeter
B102T1
8.50 Metres
15 Apr 08
RESULTS:
Gradient (beta) : 0.576
Intercept (n) : 2.972MPa
Shear stress constant : 1.711MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 2
Total pressure (kPa)
Radial Displacement (mm)


Cycle 1 - Measured
Cycle 1 - Calculated
Cycle 2 - Measured
Cycle 2 - Calculated
POWER LAW PARAMETERS:
Cycle No. Constant (MPa) Gradient
1 3.733 0.708
2 1.711 0.576
Variation of stiffness with strain : Arm ave
Shear modulus (MPa)
Log plane shear strain
0.0001
0.001
0.01
Digital 6 arm weak rock self boring pressuremeter
B102T1
8.50 Metres
15 Apr 08


Curve comparison (Whittle 1999) : Arm ave
Digital 6 arm weak rock self boring pressuremeter
B102T1
8.50 Metres
15 Apr 08
CURVE FIT PARAMETERS:
Origin : -0.050mm
Po : 316.0kPa
Cu : 132.1 kPa
Beta : 0.576
Alpha : 2.157 MPa
Total pressure (kPa)
Cavity strain (%)

6 ARM SELF BORING PRESSUREMETER **TEST RECORD SHEET**

Site	Date	Day	Borehole	Test	Depth to Test Centre (below ground level)
DENMARK PLACE	15/4/08	TUES	102	1	8.5

Weather:- F, NS Material:- LONDON CLAY

Water table	Drilling Start	Drilling End	Distance	Drill Rate	Ram Pressure
	10:45	11.12	8.0 – 9.0	1m / 20 min	70BARS.

Ground level :- Orientation:-

Water Press.	Inst.OD	Shoe OD	Cutter Type	Cutter position	Probe Reference
200Ri	85.1	89.1	73 R-R	5mm BACK	'MOLLY'

Drilling Remarks:- EASY

Strain Rate	Press. Rate	Cycle Time	Gas Bottle	Battery	PPC Type	Max Pressure Cap.
16/min	2 (m)	6 SEC	3000Ri	11.8	TRIG	10mPa.

Arm 1	Arm 2	Arm 3	Arm 4	Arm 5	Arm 6	PPC A	PPC B	TPC	Date:-
-115	91	-13	81	-92	123	-1024	-923	-2453	Ground Level Zeros
									Pre-drilling Zeros
-128	109	-44	2.8	-100	107	-1024	-905	-2462	Post-drilling Zeros
									Pre-test Zeros
									Ground Level Zeros

Test starts:- 11:16.

Line	Notes
352	LOOP 1 NO Herts — SCU NOT WORKING WELL, SWITCHED TO MANUAL
436	LOOP 2 – VERY NICE.
486	UNLOAD

Test ends:- 11:55 Max Press:- 932

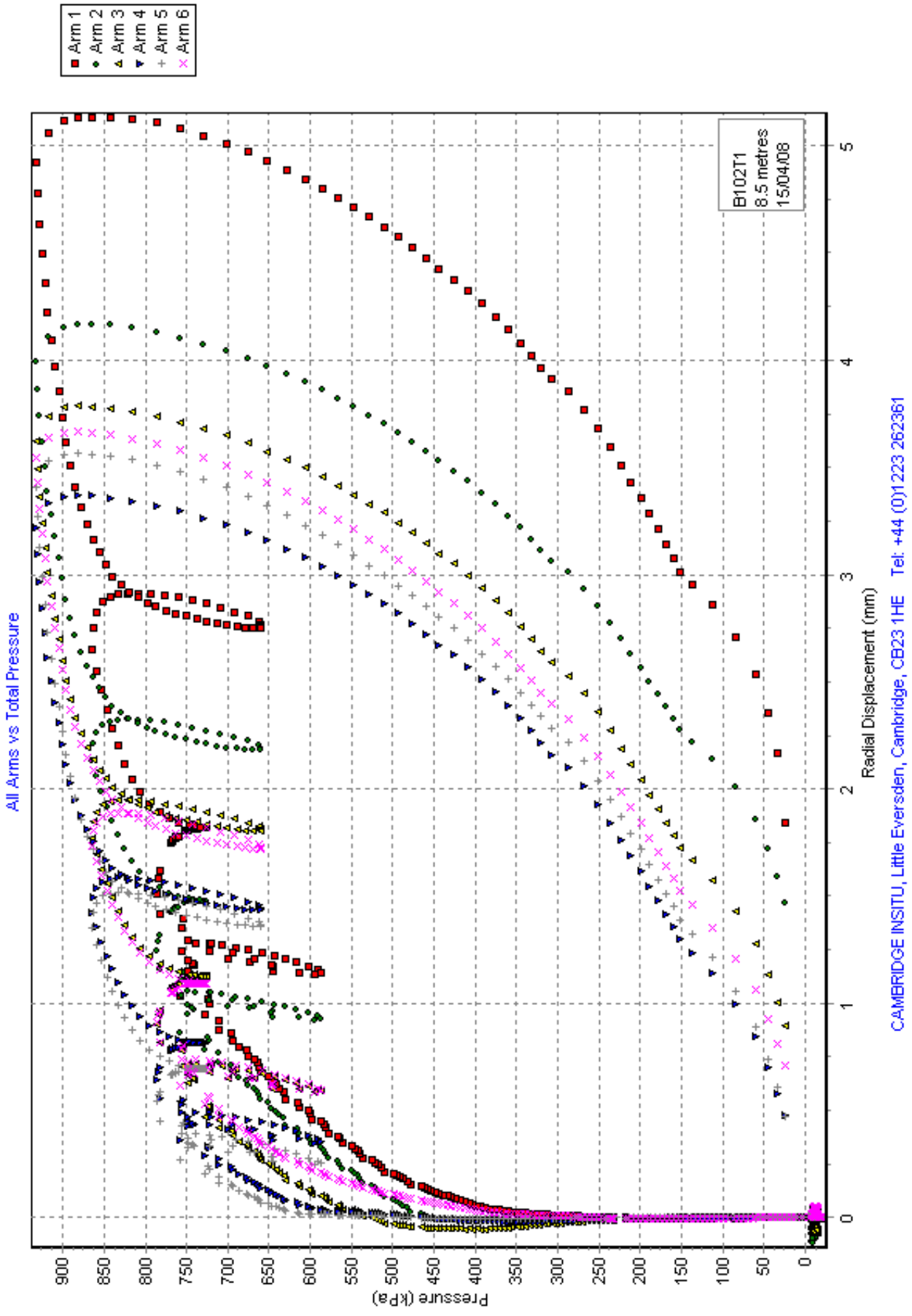
Calibrated Data details:

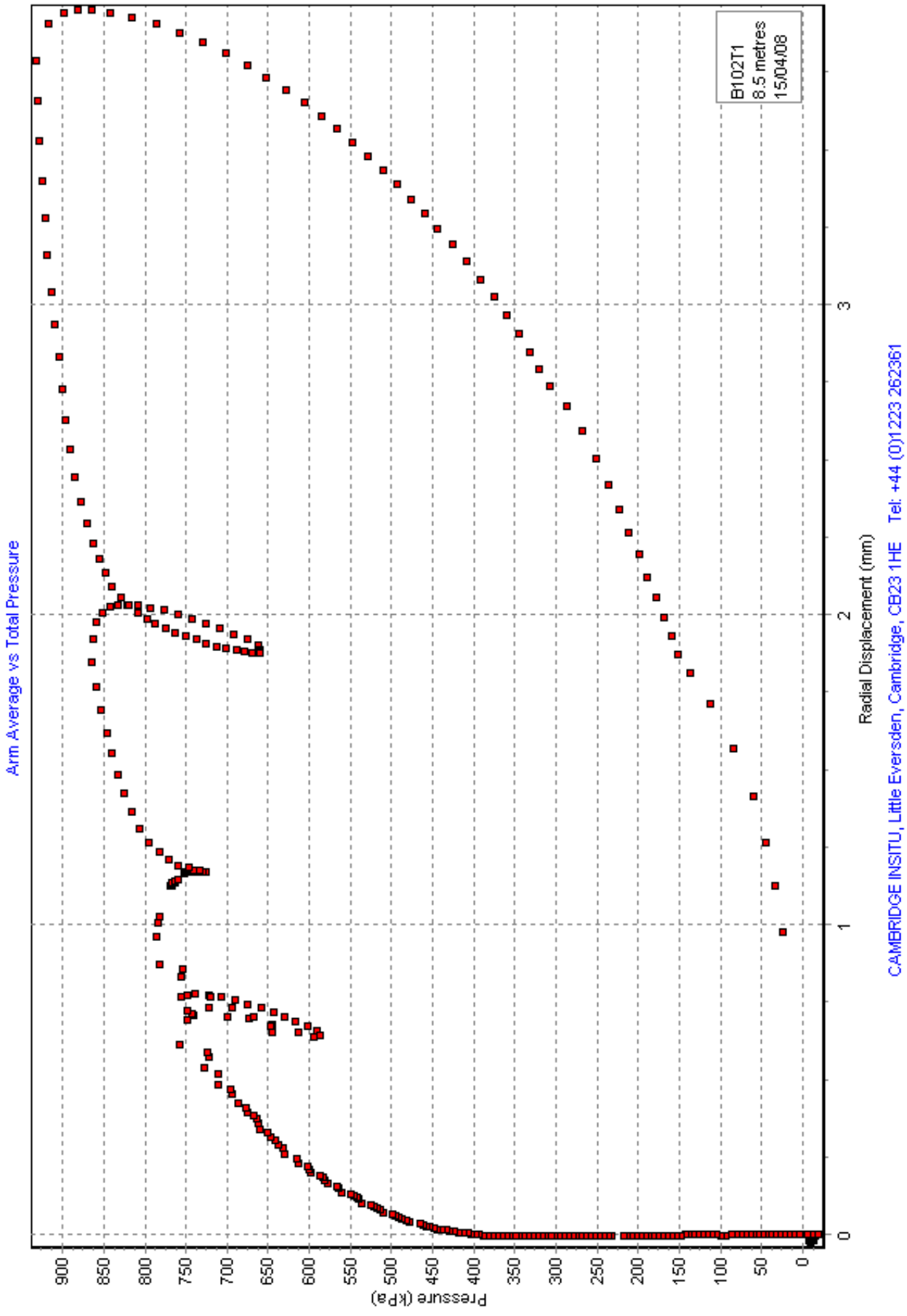
Mem. Correction.	Mem. Compression.	Strain Cals.	Pressure Cals.
W0130T1	W0130T2.	10/4/08	11/4/08.

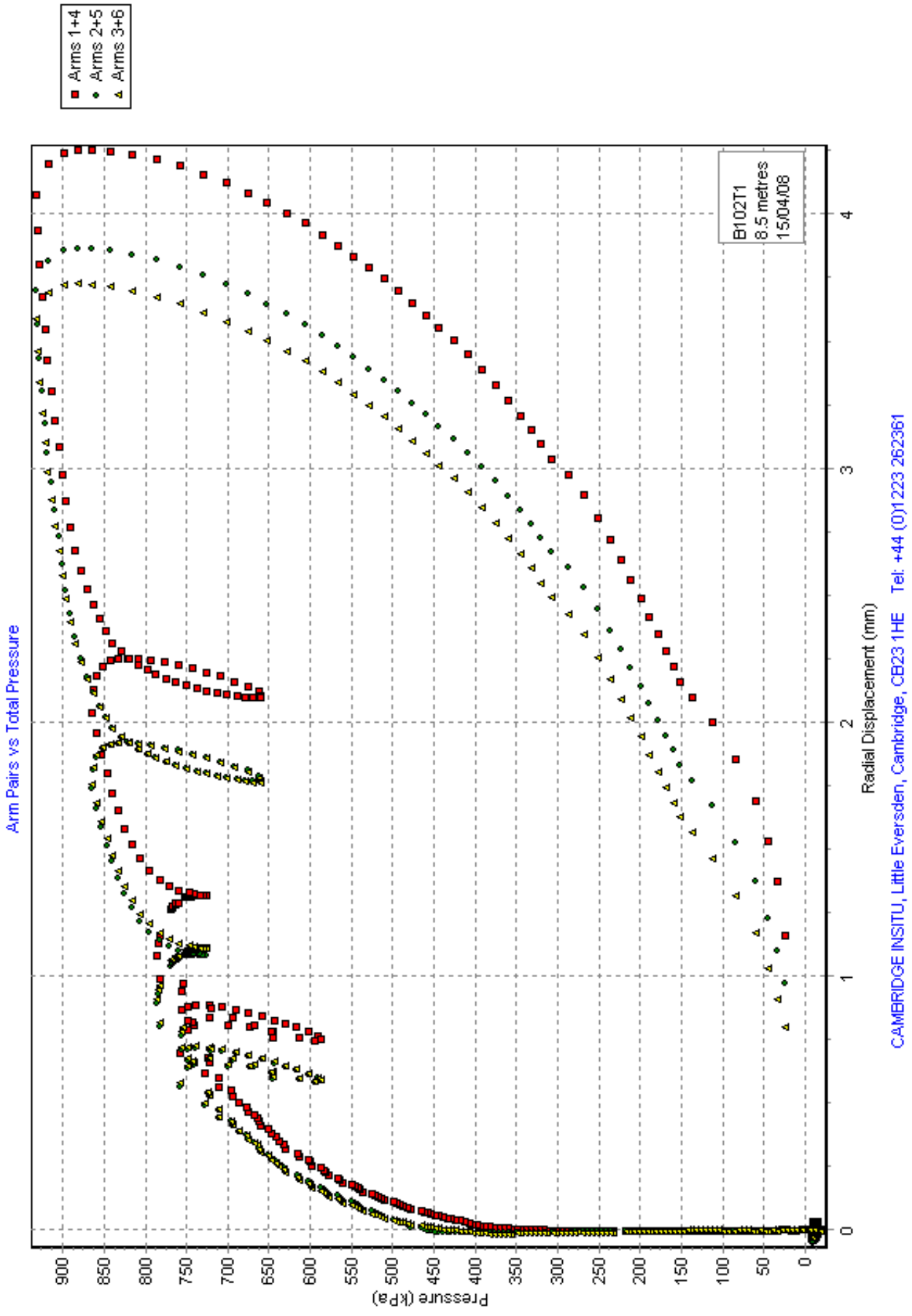
TEST REMARKS: Pushed things a bit because of battery problems. Between the PPC zeros is Az -1070 Bz = -920.

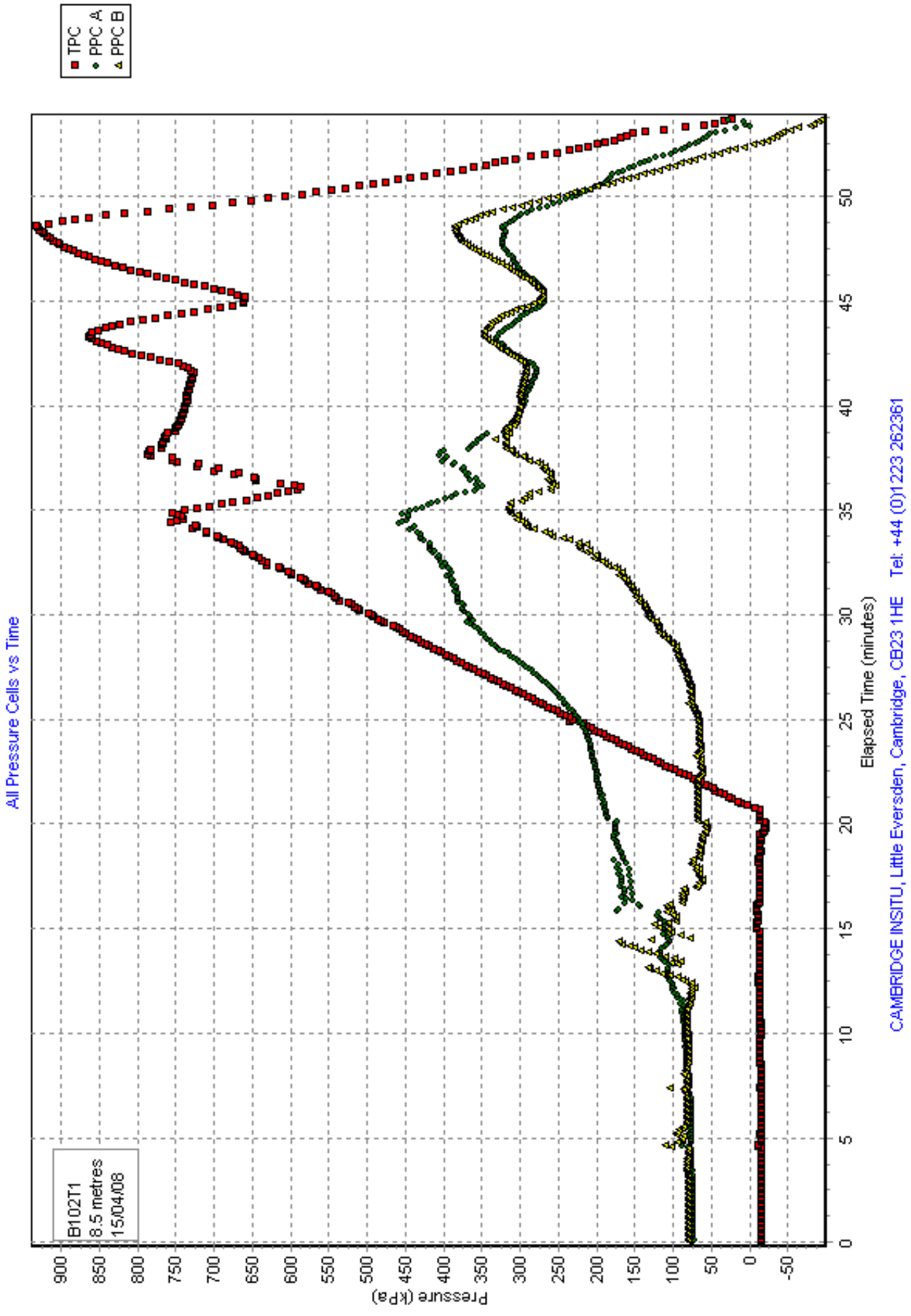
Driller: SAMM

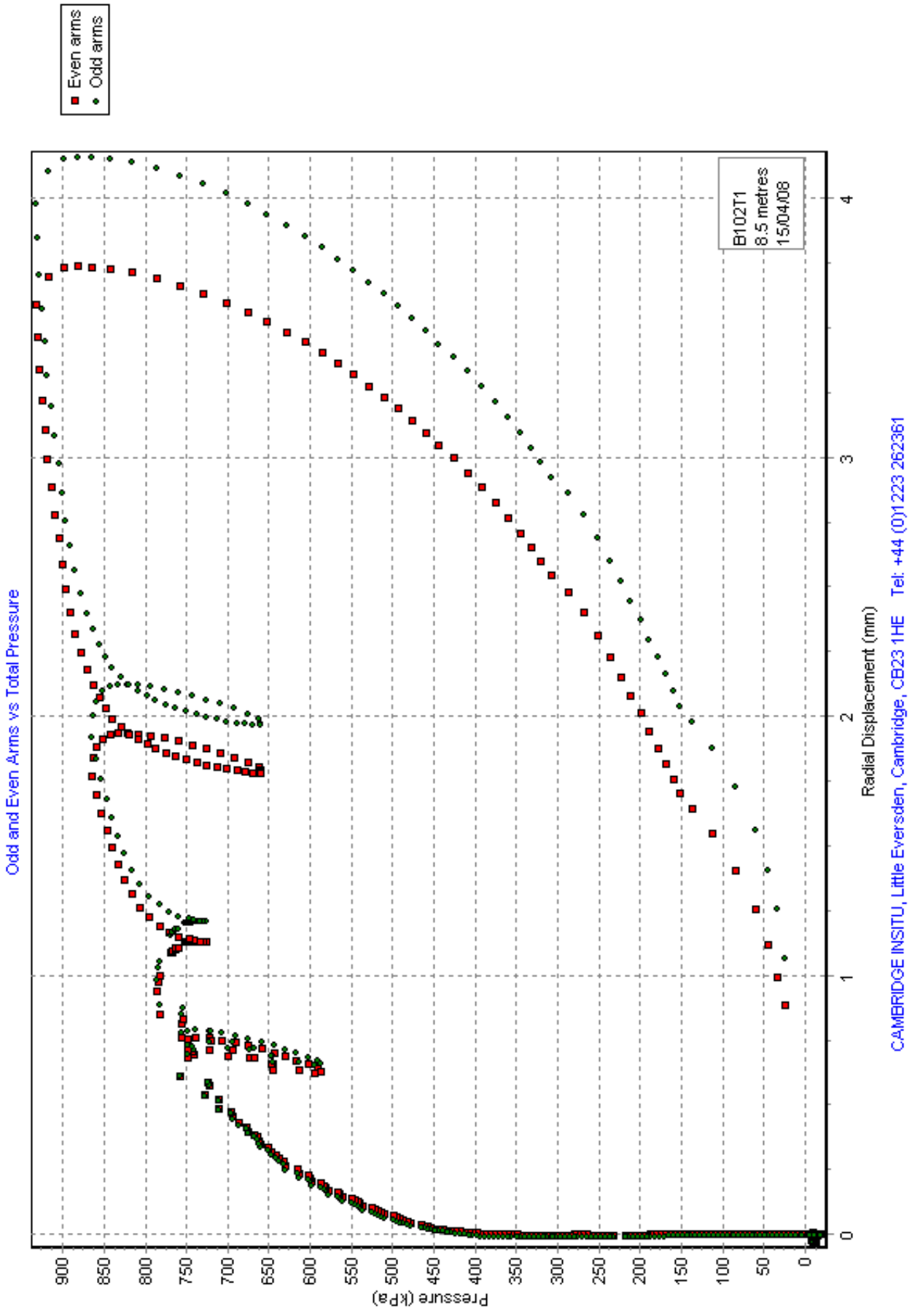
Tester: RW.


Arm 1
Arm 2
Arm 3
Arm 4
Arm 5
Arm 6
B102T1
8.5 metres
15/04/08
All Arms vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
CAMBRIDGE INSITU, Little Eversden, Cambridge, CB23 1HE Tel: +44 (0)1223 262361


Arm Average vs Total Pressure
B102T1
8.5 metres
15/04/08
Pressure (kPa)
Radial Displacement (mm)
CAMBRIDGE INSITU, Little Eversden, Cambridge, CB23 1HE Tel: +44 (0)1223 262361


Arms 1+4
Arms 2+5
Arms 3+6
B102T1
8.5 metres
15/04/08
Arm Pairs vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
CAMBRIDGE INSITU, Little Eversden, Cambridge, CB23 1HE Tel: +44 (0)1223 262361


TPC
PPC A
PPC B
All Pressure Cells vs Time
B102T1
8.5 metres
15/04/08
Pressure (kPa)
Elapsed Time (minutes)
CAMBRIDGE INSITU, Little Eversden, Cambridge, CB23 1HE Tel: +44 (0)1223 262361


Even arms
Odd arms
Odd and Even Arms vs Total Pressure
B102T1
8.5 metres
15/04/08
Pressure (kPa)
Radial Displacement (mm)
CAMBRIDGE INSITU, Little Eversden, Cambridge, CB23 1HE Tel: +44 (0)1223 262361

B102T2 - SUMMARY OF RESULTS
[File made with WinSitu Version 1.20.1.1]

[DETAILS OF TEST]

Project	:	36237
Site	:	Denmark Place
Borehole	:	BH102
Test name	:	B102T2
Test date	:	15 Apr 08
Test depth	:	14.00 Metres
Water table	:	5.6 Metres
Ambient PWP	:	82.4 kPa
Material	:	London Clay
Probe	:	Digital 6 arm weak rock self boring pressuremeter
Diameter	:	88.1 mm

Data analysed using average arm displacement curve
A non-linear analysis of the rebound cycles has been carried out
The file includes results from a curve fitting analysis

Analysed by RWW on 16 Apr 08

Remarks: Start drilling 14:24

[RESULTS FOR CAVITY REFERENCE PRESSURE]

Strain Origin (mm)	:	"Arm ave=0.050"
Po from Marsland & Randolph (kPa)	:	"Arm ave=360.6"
Po from Lift off (kPa)	:	"Arm ave=324.3"
PWP versus Total Stress (kPa)	:	"PPC Ave=405.6"
Best estimate of Po (kPa)	:	"Arm ave=375.0"

[UNDRAINED STRENGTH PARAMETERS]

Gibson & Anderson 1961 - Cu (kPa)	:	"Arm ave=133.4"
Limit pressure (kPa)	:	"Arm ave=1273"
Jefferies 1988 - Cu (kPa)	:	"Arm ave=136.3"
Undrained yield stress (kPa)	:	"Arm ave=494.1"

[LINEAR INTERPRETATION OF SHEAR MODULUS G]
Initial slope shear modulus (MPa) :"Arm ave=31.7"

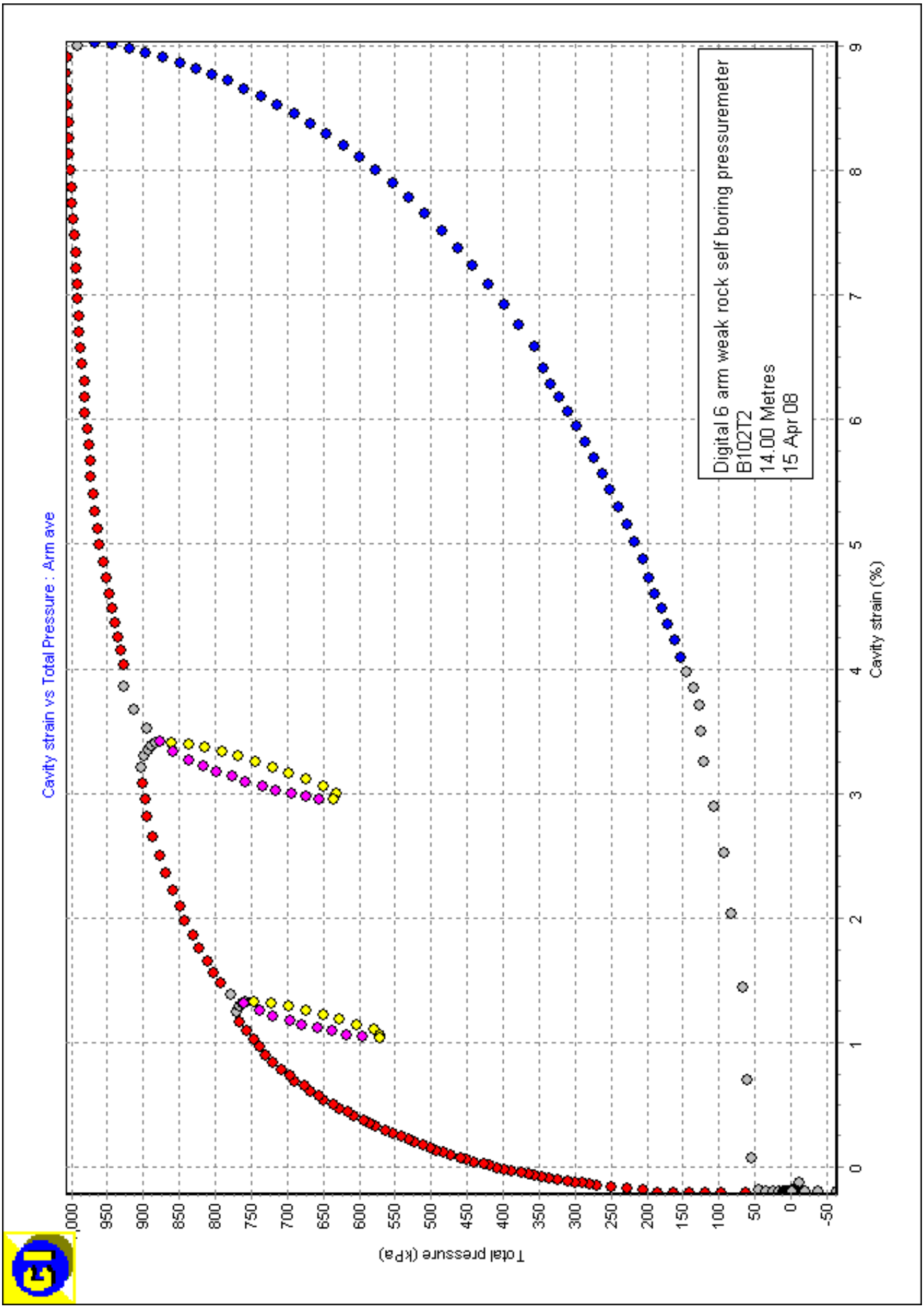
Axis	Loop No	Value (MPa)	Mean Strain (%)	Mean Pc (kPa)	dE (%)	dPc (kPa)
Arm ave	1	34.2	1.191	661	0.570	195
Arm ave	2	27.4	3.200	756	0.867	238

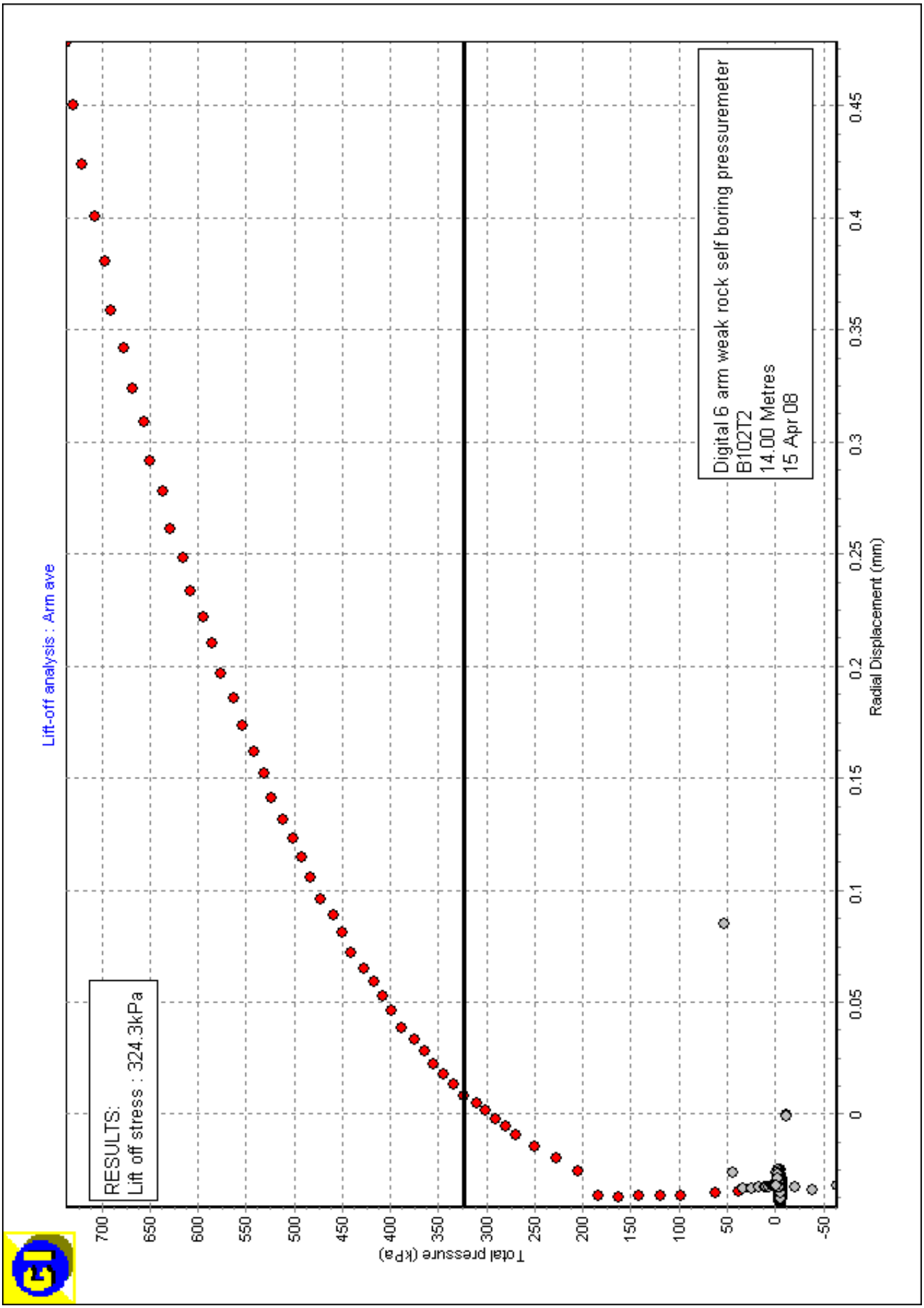
[NON LINEAR INTERPRETATION OF SECANT SHEAR MODULUS]

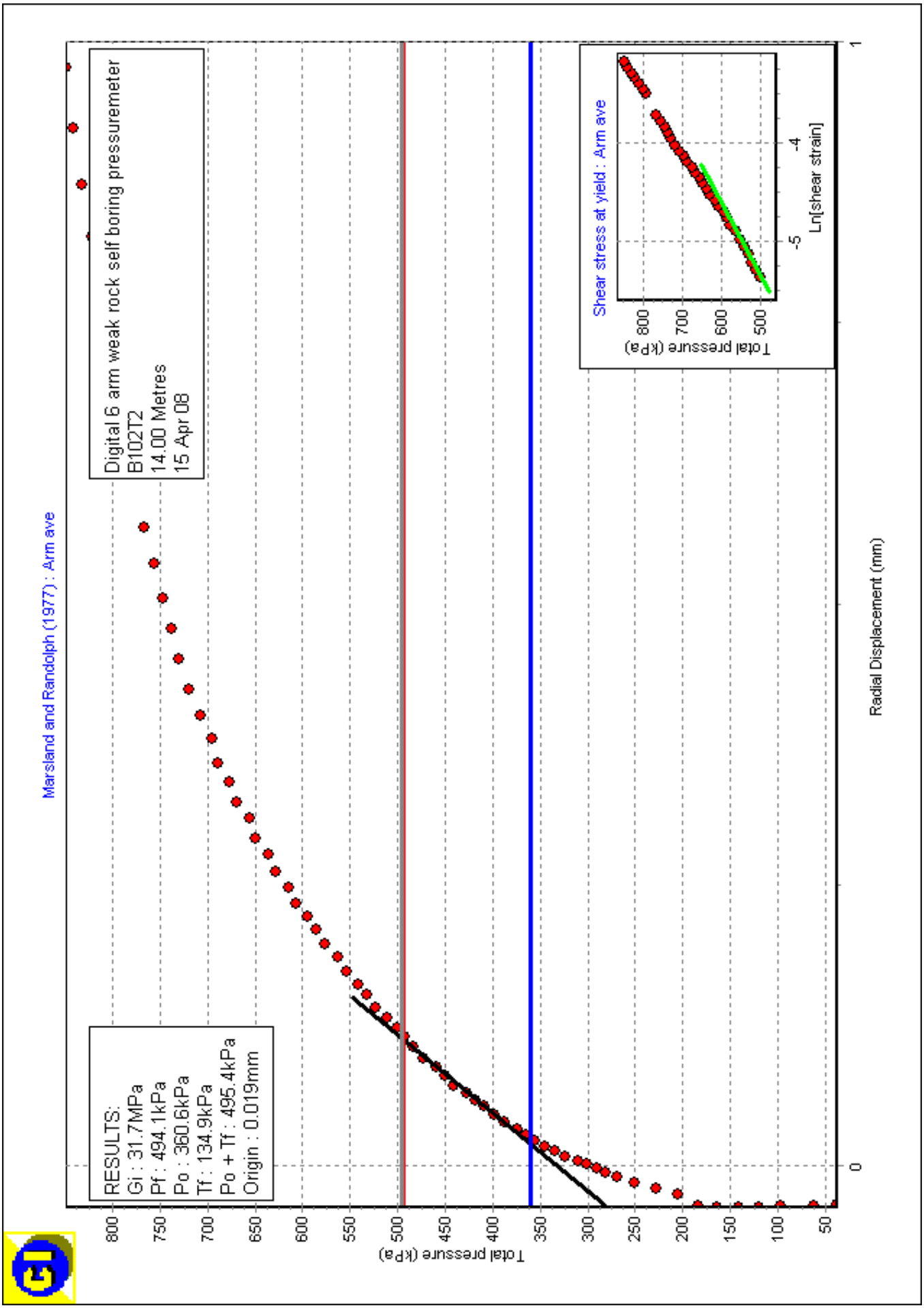
Axis	Loop No	Intercept (MPa)	Alpha (MPa)	Gradient
Arm ave	1	4.911	3.076	0.626
Arm ave	2	5.182	3.292	0.635

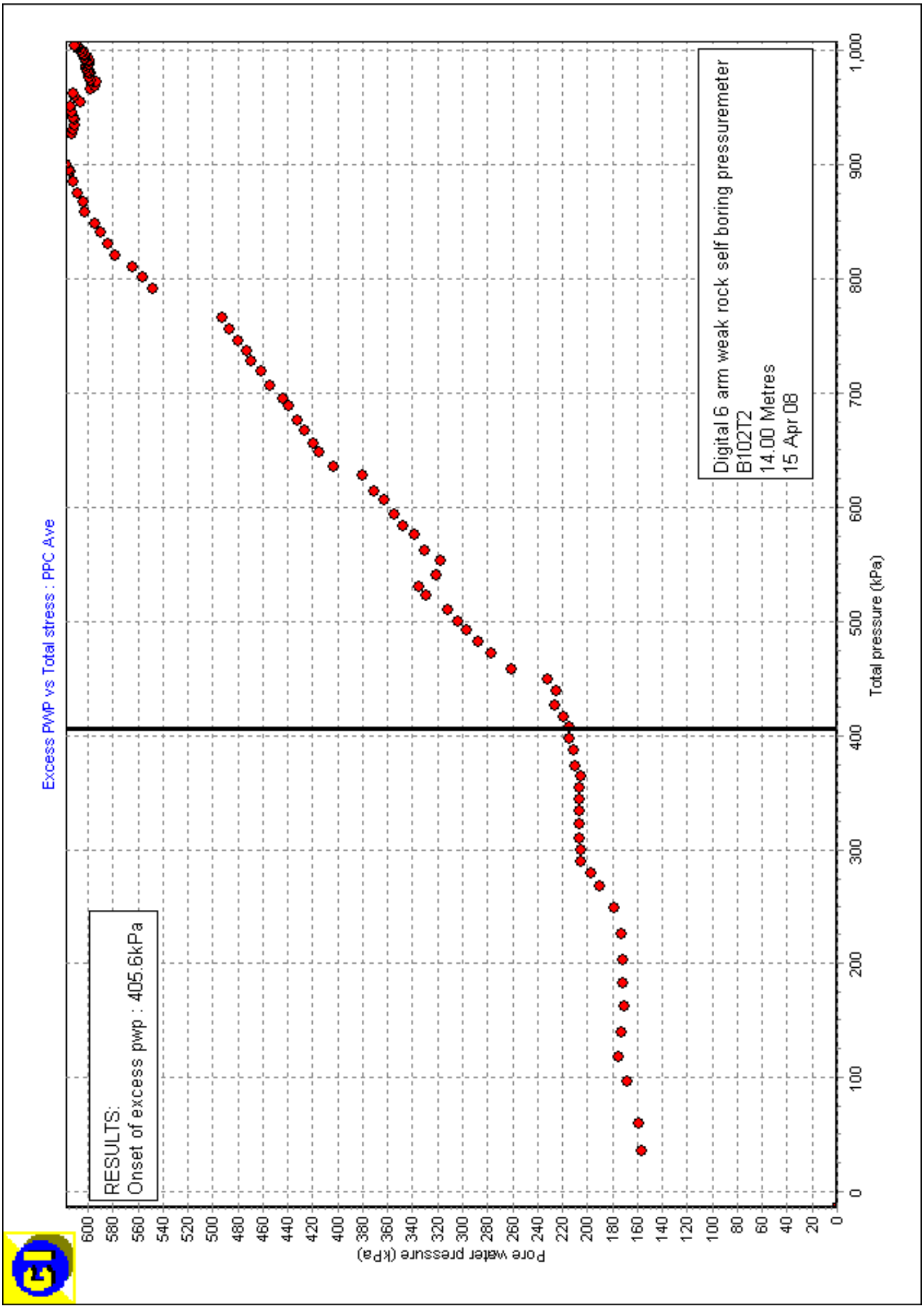
[PARAMETERS USED FOR UNDRAINED CURVE MODELLING]
Axis is Arm ave

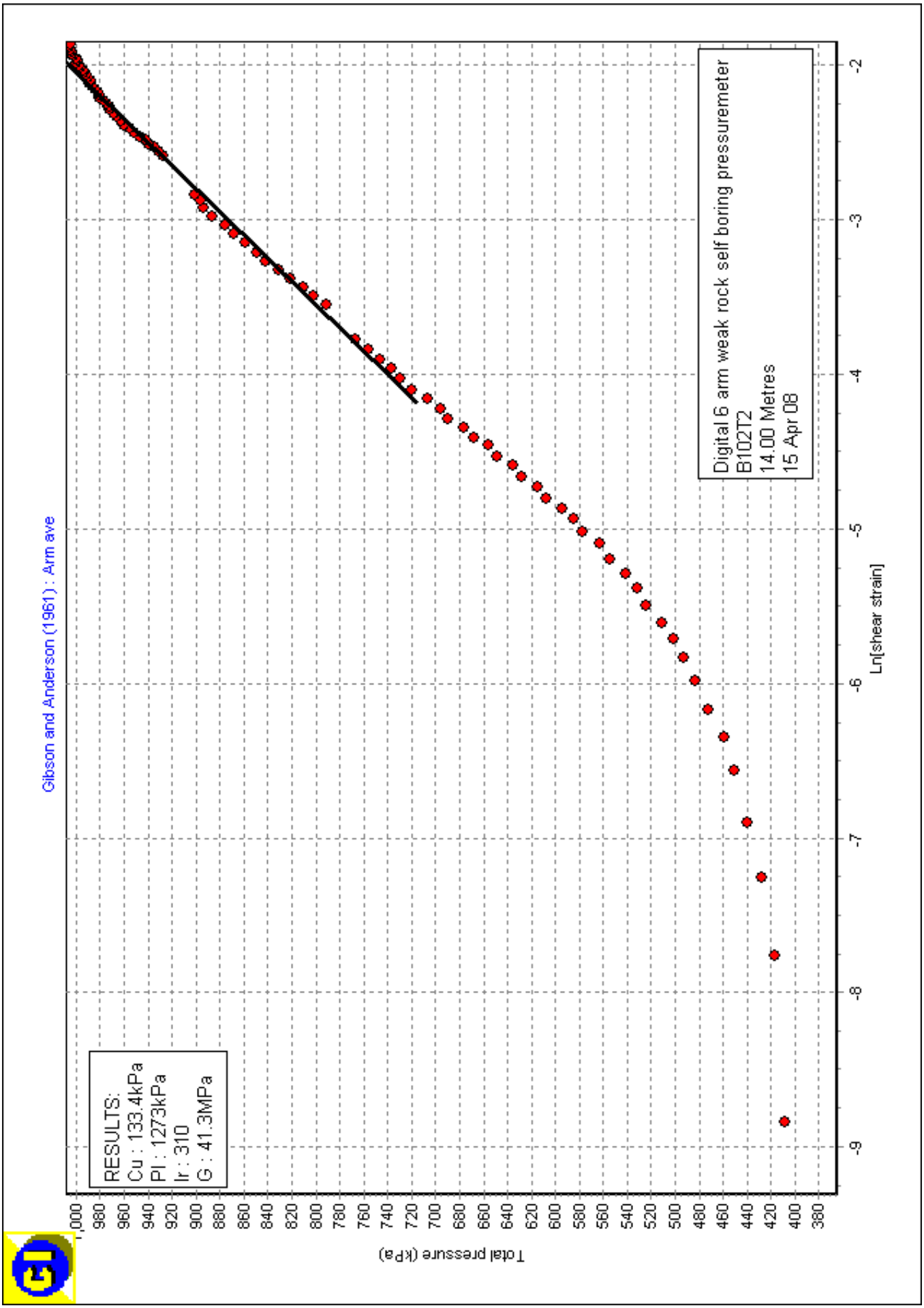
Strain Origin (mm)	:	0.05
Po (kPa)	:	375
Cu (kPa)	:	133.4
Limit pressure (kPa)	:	1273
Non-linear exponent	:	0.635
Calculated alpha (MPa)	:	3.539
G at yield (MPa)	:	23.3

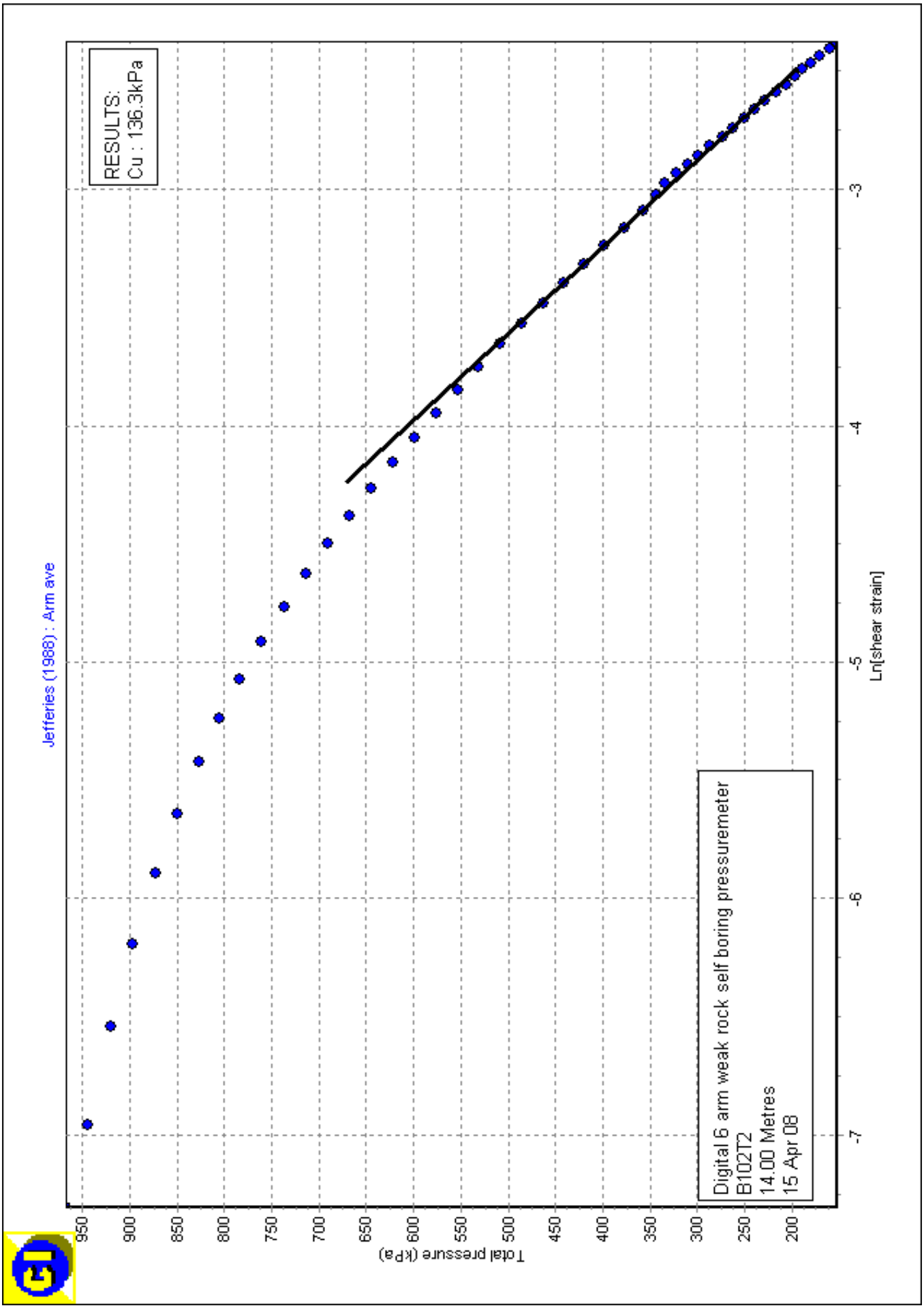

Cavity strain vs Total Pressure : Arm ave
Digital 6 arm weak rock self boring pressuremeter
B102T2
14.00 Metres
15 Apr 08
Total pressure (kPa)
Cavity strain (%)
-50
0
50
100
150
200
250
300
350
400
450
500
550
600
650
700
750
800
850
900
950
1000
0
1
2
3
4
5
6
7
8
9

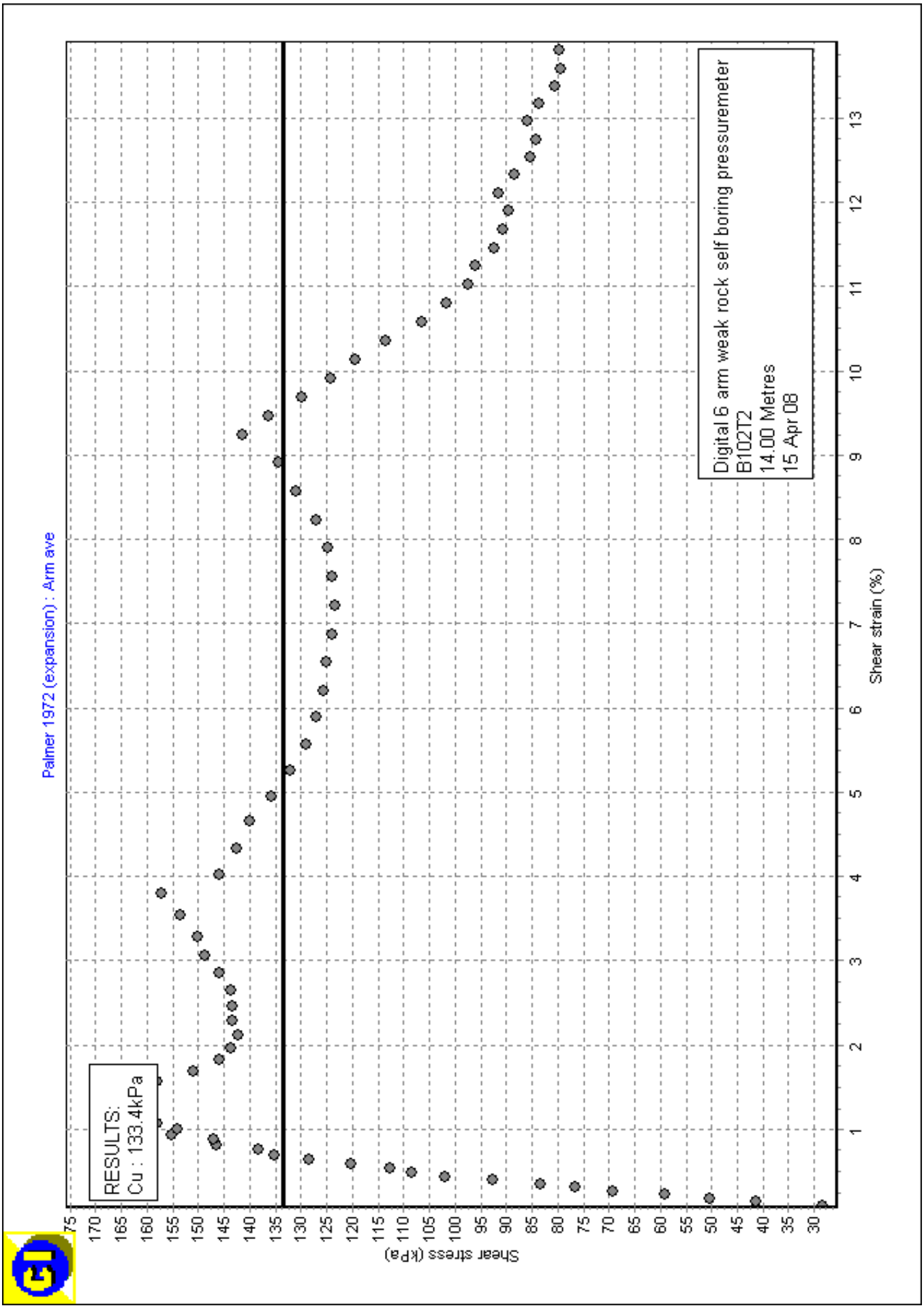

Lift-off analysis : Arm ave
RESULTS:
Lift off stress : 324.3kPa
Digital 6 arm weak rock self boring pressuremeter
B102T2
14.00 Metres
15 Apr 08
Total pressure (kPa)
Radial Displacement (mm)
700
650
600
550
500
450
400
350
300
250
200
150
100
50
0
-50
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
0.45


Digital 6 arm weak rock self boring pressuremeter
B102T2
14.00 Metres
15 Apr 08
RESULTS:
Gi : 31.7MPa
Pf : 494.1kPa
Po : 360.6kPa
Tf : 134.9kPa
Po + Tf : 495.4kPa
Origin : 0.019mm
Marsland and Randolph (1977) : Arm ave
Total pressure (kPa)
Radial Displacement (mm)
Shear stress at yield : Arm ave
Total pressure (kPa)
Ln[shear strain]


Excess PWP vs Total stress : PPC Ave
RESULTS:
Onset of excess pwp : 405.6kPa
Digital 6 arm weak rock self boring pressuremeter
B102T2
14.00 Metres
15 Apr 08
Pore water pressure (kPa)
Total pressure (kPa)


Gibson and Anderson (1961) : Arm ave
RESULTS:
Cu : 133.4kPa
PI : 1273kPa
Ir : 310
G : 41.3MPa
Digital 6 arm weak rock self boring pressuremeter
B102T2
14.00 Metres
15 Apr 08
Total pressure (kPa)
Ln[shear strain]


RESULTS:
Cu : 136.3kPa
Jefferies (1988) : Arm ave
Digital 6 arm weak rock self boring pressuremeter
B102T2
14.00 Metres
15 Apr 08
Total pressure (kPa)
Ln[shear strain]
950
900
850
800
750
700
650
600
550
500
450
400
350
300
250
200
-3
-4
-5
-6
-7


Palmer 1972 (expansion) : Arm ave
RESULTS:
Cu : 133.4kPa
Digital 6 arm weak rock self boring pressuremeter
B102T2
14.00 Metres
15 Apr 08
Shear stress (kPa)
Shear strain (%)