STONE & WEBSTER ENGINEERING CORPORATION

CALCULATION TITLE PAGE

*SEE INSTRUCTIONS ON REVERSE SIDE

▲ 5010 64 (FRONT)

CLIENT & PROJECT	PAGE 1 OF 39 + ATT A (1 p) & ATT B (43 pp)
PRIVATE FUEL STORAGE, LLC - PRIVATE FUEL STORAGE FACILITY	

CALCULATION TITLE (Indicative of the Objective):	QA CATEGORY (✓)
ESTIMATE STATIC SETTLEMENT OF STORAGE PADS	☑ I - NUCLEAR SAFETY RELATED ☐ II ☐ III ☐ _____ OTHER

CALCULATION IDENTIFICATION NUMBER				
J.O. OR W.O. NO.	DIVISION & GROUP	CURRENT CALC. NO.	OPTIONAL TASK CODE	OPTIONAL WORK PACKAGE NO.
05996.01	G(B)	03		

* APPROVALS - SIGNATURE & DATE			REV. NO. OR NEW CALC NO.	SUPERSEDES * CALC. NO. OR REV. NO.	CONFIRMATION * REQUIRED (✓)	
PREPARER(S)/DATE(S)	REVIEWER(S)/DATE(S)	INDEPENDENT REVIEWER(S)/DATE(S)			YES	NO
PAUL J. TRUDEAU 2/12/97 Paul J. Trudeau	NURI T. GEORGES 2/14/97 Nuri T. Georges	Nuri T. Georges 2/14/97 Nuri T. Georges	0		✓	
PAUL J. TRUDEAU 5/12/97 Paul J. Trudeau	Alan F Brown 5/13/97 Alan F B	Alan F Brown 5/13/97 Alan F B	1	0		✓

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	COPY R4.2	✓			
	FIRE FILE	✓			

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REASONS FOR REV 1:

Adjust the estimated settlements of the storage pads to account for the increased weight of the casks from a maximum of 285K (used in Calc 05996.01-G(B)-03-0) to 354K recommended on p C3 of Calc 05996.01-G(B)-05-0 and to use G/G_{max} as a function of shear strain recommended by Geomatrix Consultants in Calc 05996.01-G(PO5)-1-0. Section 1.3, p 12/29.

Remove "Confirmation Required", since the original basis for the "Requires Confirmation" on p 21 of the original issue of this calculation was because some of the data were based on the original issue of Calc 05996-G(B)-01, which required confirmation. Calc 05996-G(B)-01, Rev 1, was finalized and no longer requires confirmation; therefore, this calculation no longer requires confirmation as well.

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OBJECTIVE:

ESTIMATE THE STATIC SETTLEMENT OF THE STORAGE PADS DUE TO THE LOAD IMPOSED BY THE STORAGE PAD SLAB AND THE STORAGE CASKS OVER THE 40-YR LIFE OF THE FACILITY.

ASSUMPTIONS / DATA

SWEC DRWG 0599601-EY-2-E: SITE PLAN GENERAL ARRANGEMENT INDICATES STORAGE PADS ARE 30' x 64' x 3' AND THEY WILL BE CONSTRUCTED IN A GRID PATTERN, WITH 5 FT SPACE BETWEEN SLABS IN THE LONG DIMENSION & 30 FT SPACE BETWEEN THEM IN THE SHORT DIMENSION.

FIG 1 SHOWS THE PLAN VIEW OF A TYPICAL STORAGE PAD (TAKEN FROM SWEC DRWG 0599601-EY-2).

BASED ON pC3 OF CALC 05996.01-G(B)-05, EACH FULLY LOADED CASK WEIGHS 310K (SNC) OR 354K (HOLTEC). BASE SETTLEMENT CALC ON WT = 354K.

FIG 2 PRESENTS THE GENERALIZED SUBSURFACE PROFILE, WHICH WAS DEVELOPED BASED ON BORINGS A-1 TO A-4, B-1 TO B-4, C-1 TO C-4, AND D-1 TO D-4

FIG 3 PRESENTS THE FOUNDATION PROFILE, SHOWING THE STORAGE PADS & THE PROFILE USED IN CALCULATING SETTLEMENTS

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ASSUMPTIONS / DATA (CONT'D)

CALC 05996.01-G(B)-01-1 PROVIDES BASES FOR DYNAMIC SOIL PROPERTIES, INCLUDING LOW-STRAIN ELASTIC MODULI VALUES SHOWN IN FIG 3.

SKETCH 05996.01-GSK-B-01A-0 "BORING LOCATION PLAN - SHEET 1 OF 2"

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METHOD:

TOTAL STATIC SETTLEMENT = ELASTIC SETTLEMENT
+ PRIMARY CONSOLIDATION "
+ SECONDARY SETTLEMENT

DIVIDE THE PROFILE INTO LAYERS.

ESTIMATE THE CHANGE IN VERTICAL STRESS AT THE CENTER OF EACH LAYER DUE TO THE STORAGE PAD LOADING, DISTRIBUTING THESE WITH RESPECT TO DEPTH ON A SLOPE OF 2V : 1H (SEE FIG 3)

ESTIMATE $\Delta\varepsilon_v$ DUE TO $\Delta\bar{\sigma}_v$

CALCULATE $\Delta\rho_i = \Delta\varepsilon_{v_i} H_i$

" $\rho_{TOTAL} = \Sigma \Delta\rho_i$

ELASTIC SETTLEMENT

$$\rho_{ELAS} = \Sigma \varepsilon_{v_i} H_i$$

WHERE ε_{v_i} = STRAIN IN LAYER i = $\dfrac{\Delta\bar{\sigma}_{v_i}}{E_i}$

H_i = THICKNESS OF " i

$\Delta\bar{\sigma}_{v_i}$ = CHANGE IN VERTICAL STRESS AT CENTER OF LAYER i DUE TO LOADING

E_i = MODULUS OF ELASTICITY FOR LAYER i, (ADJUSTED FOR STRAIN LEVEL)

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METHOD (CONT'D)

PRIMARY CONSOLIDATION SETTLEMENT

CONSOLIDATION TESTS PERFORMED ON SAMPLES OF CLAYEY SILT OBTAINED AT DEPTHS OF ~ 11 FT (IN LAYER 1 IN FIGURE 3) INDICATE THE MAXIMUM PAST PRESSURE, $\bar{\sigma}_{MPP}$, IS ~ 3 TSF. THE FINAL STRESS AT THE BOTTOM OF LAYER 1 (CALC'D ON p 17) IS 1.64 TSF;

∴ THE PRIMARY CONSOLIDATION IS CALCULATED BASED ON RECOMPRESSING THIS SOIL.

$$\rho_{PRI} = H \times \varepsilon_v = H \times RR \log \frac{\bar{\sigma}_{v_f}}{\bar{\sigma}_{v_0}}$$

WHERE: H = THICKNESS OF LAYER

ε_v = VERTICAL STRAIN DUE TO IMPOSED LOADING

RR = RECOMPRESSION RATIO (FROM CONSOLIDATION TESTS)

$\bar{\sigma}_{v_f}$ = FINAL EFFECTIVE VERTICAL STRESS AT CENTER OF LAYER

$\bar{\sigma}_{v_0}$ = INITIAL EFFECTIVE VERTICAL STRESS AT CENTER OF LAYER.

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METHOD (CONT'D)

SECONDARY SETTLEMENT

$$\rho_{SEC} = H \times \varepsilon_v = H \times C_\alpha \Delta \log t$$

WHERE: H = THICKNESS OF LAYER

ε_v = VERTICAL STRAIN DUE TO IMPOSED LOADING

C_α = COEFFICIENT OF SECONDARY COMPRESSION. (FROM CONSOLIDATION TESTS ε_v VS LOG t PLOTS. $C_\alpha = \Delta\varepsilon_v$ / LOG CYCLE OF TIME).

t = TIME CORRESPONDING TO LIFE OF THE FACILITY – ASSUME t_f = 40 YRS FOR CALCULATING ρ_{SEC}.

NOTE: USE C_α DETERMINED BASED ON RELOADING FOLLOWING AN UNLOADING CYCLE TO CORRECT FOR SAMPLE DISTURBANCE.

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DISCUSSION:

ELASTIC SETTLEMENTS

TABLE 1 PRESENTS THE CALCULATION OF ELASTIC SETTLEMENTS OF LAYER 1 TO 3 SHOWN IN FIGURE 3, USING LOW-STRAIN ELASTIC MODULI. IN REALITY, THE ELASTIC MODULI SHOULD BE REDUCED TO CORRESPOND TO THE LEVEL OF STRAIN EXPERIENCED DUE TO STATIC SETTLEMENTS (THIS IS DONE ON p 10), BUT THESE DATA DEMONSTRATE THAT THE CONTRIBUTION TO THE TOTAL ELASTIC SETTLEMENT OF A SINGLE, ISOLATED STORAGE PAD OF LAYERS 2 & 3 IS ~ 10%. THE ACTUAL STRAINS DUE TO CONSTRUCTION & LOADING OF THE STORAGE PADS WILL BE MUCH GREATER IN LAYER 1 THAN IN THE UNDERLYING LAYERS; ∴ THE REDUCTION IN MODULI FOR STRAIN WILL BE GREATER FOR LAYER 1. THIS MEANS THAT LAYERS 2 & 3 WILL CONTRIBUTE MUCH LESS THAN THE 10% OF THE TOTAL ELASTIC SETTLEMENT SHOWN IN TABLE 1. THE FOLLOWING PAGE INDICATES THE ELASTIC MODULUS OF LAYER 4 ($z \geq 120' \pm$) IS EVEN GREATER THAN THAT OF LAYERS 2 & 3; ∴ IT'S CONTRIBUTION TO THE SETTLEMENT OF AN ISOLATED PAD IS NEGLIGIBLE.

ESTIMATE MODULUS OF ELASTICITY OF LAYER 4 ($z > 120' \pm$)

$V_p = 5525$ FT/SEC

ASSUME $\gamma_m = 125$ PCF $\quad \mu = 0.5$

$$D = \rho V_p^2 = \frac{0.125 \frac{K}{FT^3}}{32.2 \frac{FT}{SEC^2}} \left(5525 \frac{FT}{SEC}\right)^2 = 118,500 \text{ KSF}$$

$$D = \frac{E(1-\mu)}{(1+\mu)(1-2\mu)}$$ EQ 12.8 LAMBE & WHITMAN (1969)

IF $\mu = 0.5$, DENOMINATOR = 0.

ASSUMING $\mu = 0.4$

$$E = 118,500 \frac{K}{FT^2} \times \frac{(1+0.4)(1-2\times0.4)}{(1-0.4)} = 55,300 \text{ KSF}$$

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ELASTIC SETTLEMENT OF ISOLATED PAD

$$\text{STRAIN IN LAYER 1} = \frac{\Delta\rho}{\Delta z} = \frac{0.107 \text{ IN.}}{(30-3)\text{FT} \times 12 \frac{\text{IN.}}{\text{FT}}} = 3.3 \times 10^{-4} \text{ IN./IN.}$$

(0.107 IN. FROM TABLE 1)

OR 3.3×10^{-2} %

THE E VALUE USED TO CALCULATE THIS SETTLEMENT WAS BASED ON E_{MAX}, WHICH IS APPLICABLE FOR VERY LOW SHEAR STRAINS, $\sim \gamma = 10^{-4}$ %.

ASSUME $\gamma = 10^{-1}$ %* $\quad E/E_{MAX} \simeq 0.43$ (FROM FIG 4)

RECALCULATE $\Delta\rho_{LAYER\ 1}$

$$\Delta\rho_1 = \frac{\Delta\bar{\sigma}_1}{E_1} \times \Delta z_1 = \frac{1.25 \text{ K/FT}^2}{0.43 \times 3780 \text{ K/FT}^2} \times 27 \times 12" = 0.25"$$

$$\varepsilon_v = \frac{0.25"}{27' \times 12"} = 7.7 \times 10^{-4} \text{ IN/IN.} \simeq 0.08\%$$

RECALCULATE $\Delta\rho_{LAYER\ 1}$ ASSUMING $\varepsilon_v \sim 0.06$ %, $\frac{E}{E_{MAX}} \simeq 0.55$

$$\varepsilon_v = \frac{1.25 \text{ KSF}}{0.55 \times 3780 \text{ KSF}} = 6 \times 10^{-4} \frac{\text{IN.}}{\text{IN.}}$$ ← CLOSE ENOUGH TO ASSUMED STRAIN

$$\Delta\rho = \varepsilon_v \times H = 6 \times 10^{-4} \frac{\text{IN.}}{\text{IN.}} \times 27' \times 12" = \underline{0.19"}$$

* BOWLES (1987) INDICATES "STATIC STRAINS ARE ON THE ORDER OF 10^{-1} %."

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ELASTIC SETTLEMENTS

EFFECT OF ADJACENT STORAGE PADS ON ELASTIC SETTLEMENT.

FIGURE 3 ILLUSTRATES THAT THE STRESS BULBS DUE TO ADJACENT STORAGE PADS (APPROXIMATED BY THE DASHED LINES AT 2V:1H) DO NOT OVERLAP IN LAYER 1;

∴ THE LOADINGS DUE TO ADJACENT STORAGE PADS DO NOT AFFECT THE SETTLEMENT OF LAYER 1.

∴ CALCULATE SETTLEMENTS IN LAYER 1 BASED ON $\Delta\sigma_v$ FOR A SINGLE ISOLATED STORAGE PAD.

THIS IS NOT THE CASE FOR THE UNDERLYING LAYERS. AT THE CENTER OF LAYER 2, THE STRESS BULBS OVERLAP ~ 1/3 (2 SIDES × 12.5'/SIDE ÷ 73' ≈ 34%) AND THEY OVERLAP THE CENTER OF THE PAD WIDTH AT THE BOTTOM OF LAYER 3.

∴ THE LOADINGS OF ADJACENT STORAGE PADS WILL CAUSE AN INCREASE IN STRESSES IN THE LAYERS BELOW LAYER 1.

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ESTIMATE ELASTIC SETTLEMENT OF LAYERS 2 - 4 ASSUMING ALL SLABS ARE CONSTRUCTED & FULLY LOADED.

THESE MATERIALS ARE VERY DENSE ($N > 100$ BL/FT & $N > 100$ BL / 6" ARE COMMON) ∴ STRAINS ARE EXPECTED TO BE LOW. ASSUME $\varepsilon_v \sim 5\text{-}10 \times 10^{-3}\%$ FIG 4 INDICATES $G/G_{MAX} \sim 0.9$.

ASSUME $\Delta\rho$ DUE TO RELOADING UP TO INITIAL IN SITU STRESSES = 0;

∴ USE $\frac{q}{D} = 1.47 \text{ KSF} + 3 \text{ FT}\,(0.15 - 0.08)\,\text{KCF} = 1.68 \text{ KSF}$

& DO NOT REDUCE WITH RESPECT TO DEPTH BECAUSE OF WIDE EXPANSE OF LOADED AREA.

$\varepsilon_v = \frac{1.68 \text{ KSF}}{E}$

LAYER	E_{MAX} KSF	E KSF	Δz FT	ε_v $\times 10^{-3}\%$	$\Delta\rho = \varepsilon_v \Delta z' \times 12"$ IN.
2 & 3	44,940	40,446	90'	4.2	0.045
4	55,300	49,770	(600-90)*	3.4	0.21
					0.25"

NOTE: CALC'D ε_v IS SLIGHTLY < ASSUMED VALUE ($5 \times 10^{-3}\%$); ∴ $E/E_{MAX} = 0.9$ IS REASONABLE FOR THESE LAYERS.

REF * ROCK ESTIMATED TO BE 520' TO 880' BELOW GRADE BASED ON SEISMIC REFLECTION SURVEY, (GEOSPHERE MIDWEST, 1997) LINE 2

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PRIMARY CONSOLIDATION SETTLEMENT

ESTIMATE SETTLEMENT OF LAYER 1 BASED ON RESULTS OF CONSOLIDATION TESTS.

NOTE: CONSOLIDATION TEST DATA PLOTTED AS ε_v VS $\log \sigma_v$ WHERE σ_v IN TSF.

AT CENTER OF LAYER 1, z BELOW SLAB = $\frac{30-3}{2} = 13.5'$ BELOW PAD, WHICH IS 3' DEEP.

$$\sigma_{v_o} = 16.5' \times 0.080 \text{ KCF} = 1.32 \text{ KSF} = \underline{0.66 \text{ TSF}}$$

$$\Delta\sigma_v = \frac{(1.47 \text{ KSF}_{\text{CASKS}} + 3' \times 0.15 \text{ KCF}_{\text{CONC}}) \times 30'}{30' + 16.5'} = 1.24 \text{ KSF} = 0.62 \text{ TSF}$$

$B + z_c$

$$\therefore \sigma_{v_f} = \sigma_{v_o} + \Delta\sigma_v = 0.66 + 0.62 = \underline{1.28 \text{ TSF}}$$

BORING	SAMPLE	RR	SR	$\bar{\sigma}_{mpp}$ TSF	LL %
C-1	U-3B	0.011	0.010	3.6	33.0
C-1	U-3C	0.008	0.014	2.8	47.8
C-1	U-3D	0.017	0.017	3.0	61.1
C-2	U-2C	0.010	0.015	3.0	34.6
	AVG	0.014	0.014		

$\sigma_{vf} < \sigma_{mpp}$ $\therefore \Delta\rho_{cf} = \Sigma H \cdot RR \cdot \log \frac{\sigma_{vf}}{\sigma_{v_o}}$

$$\Delta\rho_{cf_{AVG}} = 27 \text{ FT} \times 12 \text{"/FT} \times 0.014 \log \frac{1.28}{0.66} = \underline{1.31 \text{ IN.}}$$

CONSOLIDATION SETTLEMENT OF LAYERS 2-4 ASSUMED TO BE NEGLIGIBLE BECAUSE LAYER 2 IS VERY DENSE FINE SAND & UNDERLYING LAYERS ARE VERY DENSE SILT ($N >> 100$ BL/FT)

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SECONDARY SETTLEMENT

ESTIMATE SECONDARY SETTLEMENT OF LAYER 1 BASED ON RESULTS OF CONSOLIDATION TESTS. USE UNLOAD-RELOAD DATA TO CORRECT FOR EFFECTS OF SAMPLE DISTURBANCE.

THE RESULTS OF THE CONSOLIDATION TESTS THAT HAD UNLOAD-RELOAD CYCLES, C1-U3C, C1-U3D, & C2-U2C, ARE INCLUDED IN ATTACHMENT B.

TABLES 2A-2C PRESENT THE COEFFICIENTS OF SECONDARY COMPRESSION, C_α, FOR THESE CONSOLIDATION TESTS.

FIGURES 5 & 6A THROUGH 6C PLOT C_α AS A FUNCTION OF STRESS RATIO, $\bar{\sigma}_c/\bar{\sigma}_{MPP}$.

FIG 4-2 OF LADD (1971) PRESENTS A TYPICAL PLOT OF C_α VS STRESS RATIO FOR A VARIETY OF SOILS. THIS FIGURE ILLUSTRATES THAT C_α IS LOW (0.2 - 0.4% PER Δ LOG TIME) FOR OVERCONSOLIDATED SOILS, AND IT RISES RAPIDLY FOR VIRGIN COMPRESSION ($\bar{\sigma}_c/\bar{\sigma}_{MPP} \geq 1$).

FIG 5 PLOTS C_α VS $\bar{\sigma}_c/\bar{\sigma}_{MPP}$ FOR CONSOLIDATION TEST C1-U3D. THE SHAPE OF THE CURVE IS SIMILAR TO WHAT LADD (1971) PRESENTS, BUT C_α FOR THE INITIAL LOADING, RISES AT A STRESS RATIO ~ 0.5, RATHER THAN 1, AS EXPECTED. THIS DIFFERENCE IS ATTRIBUTED TO THE EFFECTS OF SAMPLE DISTURBANCE. NOTE, C_α REMAINS LOW FOR THE RELOAD CYCLE DATA PRESENTED IN FIG 5. ∴ USE THE RELOAD CYCLE C_α VALUES FOR ESTIMATING SECONDARY SETTLEMENT.

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SECONDARY SETTLEMENT

THE NEXT 3 PAGES CALCULATE THE STRESS RATIOS APPLICABLE FOR THE DEPTHS OF THE CONSOLIDATION TEST SAMPLES, AS WELL AS THOSE FOR THE BOTTOM OF LAYER 1, BEFORE & AFTER CONSTRUCTING & LOADING THE STORAGE PADS. THESE CALC'S INDICATE THAT THE STRESS RATIOS OF INTEREST ARE IN THE RANGE OF 0.2 TO 0.5; ∴ C_α VS $\bar{\sigma}_c / \bar{\sigma}_{MAP}$ ARE PLOTTED IN FIG'S 6A TO 6C WITH AN EXPANDED C_α SCALE.

THESE FIG'S INDICATE THAT:

C_α	TEST	LOADING IN TSF LOADED TO	UNLOADED TO	RELOADED TO
0.05	C1-U3C	2.0	0.5	8.
0.05	C1-U3D	8.0	0.5	8.
0.025	C2-U2C	2.0	0.5	8.

NOTE: TEST C1-U3D WAS LOADED TO A HIGHER LOAD BEFORE UNLOAD-RELOAD CYCLE THAN THE OTHER TWO TESTS; ∴ THESE RESULTS SHOULD BE GIVEN MORE WEIGHT THAN THE OTHERS, AS THE HIGHER PRECONSOLIDATION PRESSURE IS EXPECTED TO HAVE "CORRECTED" THE EFFECTS OF SAMPLE DISTURBANCE.

∴ C_α = 0.05 % / Δ LOG TIME

SHOULD BE USED TO ESTIMATE SECONDARY SETTLEMENTS OF LAYER 1.

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SECONDARY SETTLEMENT

CALCULATE $\frac{\bar{\sigma}_{v_f}}{\bar{\sigma}_{MPP}}$ AT DEPTH OF CONSOLIDATION TEST C1-U3C

NOTE: DEPTH OF SAMPLE TESTED = 11.2 FT $\quad \bar{\sigma}_{MPP} \geq 2.8$ TSF

$\bar{\sigma}_{v_o} \simeq 11.2\,\text{FT} \times 0.080\,\text{KCF} = 0.90\,\text{KSF} = 0.45\,\text{TSF} \quad \frac{\bar{\sigma}_{v_o}}{\bar{\sigma}_{MPP}} \leq \frac{0.45}{2.8} = \underline{0.16}$

$$\Delta\bar{\sigma}_v = \frac{[\underset{q_t}{1.47\,\text{KSF}} + \underset{\text{CONC}}{3'}\,(\underset{\text{EXCAVD SOIL}}{0.15} - 0.08)\,\text{KCF}] \times 30'}{\underset{B}{30'} + \underset{z_{SAMPLE}}{11.2'} - \underset{z_{FTG}}{3'}} = 1.32\,\text{KSF} = 0.66\,\text{TSF}$$

$\therefore \bar{\sigma}_{v_f} = 0.45 + 0.66 = 1.11$ TSF $\quad \& \quad \frac{\bar{\sigma}_{v_f}}{\bar{\sigma}_{MPP}} \leq \frac{1.11\,\text{TSF}}{2.8\,\text{TSF}} = \underline{0.36}$

SECONDARY SETTLEMENT

NOTE: DEPTH OF C1-U3D = 11.4 FT

$$\bar{\sigma}_{v_o} \simeq 11.4 \text{ FT} \times 0.080 \frac{K}{FT^3} = 0.91 \text{ KSF} = 0.46 \text{ TSF}$$

$$\bar{\sigma}_{MPP} \simeq 3 \text{ TSF}$$

$$\Delta\bar{\sigma}_v = \frac{\left[1.47 \text{ KSF} + 3'(0.15 - 0.08)\text{KCF}\right] \times 30 \text{ FT}}{30' + 11.4' - 3'} \quad (1.68 \text{ KSF}) = 1.32 \text{ KSF}$$

$$= 0.66 \text{ TSF}$$

At $z = 11.4'$ $\bar{\sigma}_{v_f} = \bar{\sigma}_{v_o} + \Delta\bar{\sigma}_v = 0.46 + 0.66 = 1.12$ TSF

$$\Rightarrow \frac{\bar{\sigma}_{v_o}}{\bar{\sigma}_{MPP}} = \frac{0.46 \text{ TSF}}{3.0 \text{ TSF}} = 0.15$$

$$\frac{\bar{\sigma}_{v_f}}{\bar{\sigma}_{MPP}} = \frac{1.12 \text{ TSF}}{3.0 \text{ TSF}} = 0.37.$$

At Bottom of Layer 1 ($z \simeq 30'$)

$$\bar{\sigma}_{v_o} = 30' \times 0.080 \text{ KCF} = 2.4 \text{ KSF} = 1.2 \text{ TSF}$$

$$\Delta\bar{\sigma}_v = \frac{1.68 \text{ KSF} \times 30'}{30' + 30' - 3} = 0.88 \text{ KSF} = 0.44 \text{ TSF}$$

$$\Rightarrow \frac{\bar{\sigma}_{v_o}}{\bar{\sigma}_{MPP}} = \frac{1.2 \text{ TSF}}{3.0 \text{ TSF}} = 0.40 \Rightarrow \frac{\bar{\sigma}_{v_f}}{\bar{\sigma}_{MPP}} = \frac{1.2 + 0.44 \text{ TSF}}{3.0 \text{ TSF}} \quad (1.64 \text{ TSF}) = 0.55$$

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SECONDARY SETTLEMENT

CALCULATE $\frac{\bar{\sigma}_{v_f}}{\bar{\sigma}_{MPP}}$ AT DEPTH OF CONSOLIDATION TEST C2-U2C

NOTE: DEPTH OF SAMPLE TESTED = 10.9 FT $\bar{\sigma}_{MPP} \geq 3$ TSF

$$\bar{\sigma}_{v_o} \simeq 10.9 \text{ FT} \times 0.080 \text{ KCF} = 0.87 \text{ KSF} = 0.44 \text{ TSF} \quad \therefore \frac{\bar{\sigma}_{v_o}}{\bar{\sigma}_{MPP}} \leq \frac{0.44}{3} = 0.15$$

$$\Delta\bar{\sigma}_v \simeq \frac{[1.47 \text{ KSF} + 3' (0.15_{\text{CONC}} - 0.08_{\text{EXCAV'D SOIL}}) \text{ KCF}] \times 30'_{B}}{30'_{B} + (10.9' - 3')_{z - z_{FTG}}} = 1.33 \text{ KSF} = 0.66 \text{ TSF}$$

$$\therefore \bar{\sigma}_{v_f} \simeq 0.44 + 0.66 = 1.10 \text{ TSF} \quad \therefore \frac{\bar{\sigma}_{v_f}}{\bar{\sigma}_{MPP}} \leq \frac{1.10}{3} = 0.37$$

SECONDARY SETTLEMENT

ASSUMING SECONDARY SETTLEMENT OCCURS AT RATE OF 0.05% / LOG CYCLE TIME (MIN) FOR RANGE OF LOAD INCREMENT APPLICABLE TO STORAGE PAD & THICKNESS OF LAYER 1 IS 30' - 3' (3' PAD)

TIME	TIME MIN	# LOG CYCLES TIME (MIN)	$\varepsilon_{v_{SEC}}$ %	ρ_{SEC} IN.
1 DAY	1440	3.16	0.16	0.52
1 WK	10,080	4.00	0.20	0.65
1 MONTH	43,830	4.64	0.23	0.74
1 YR	525,960	5.72	0.29	0.94
10 YR	5.26×10^6	6.72	0.34	1.10
20 YR	10.52×10^6	7.02	0.35	1.13
40 YR†	21.04×10^6	7.32	0.37	1.19

$$\varepsilon_{v_{SEC}} = 0.05\% \ \text{Log}_{10}(\text{ELAPSED TIME (MIN)})$$

$$\rho_{SEC} = (30' - 3')\,12''/' \times \varepsilon_{v_{SEC}}\% \times \frac{1\ \text{IN./IN.}}{100\%} = 3.24\,\varepsilon_v$$

† 40 YRS IS ESTIMATED LIFE OF FACILITY

SUMMARY - ENTIRE PROFILE WITHOUT SUBDIVIDING LAYER 1

THE ESTIMATED TOTAL STATIC SETTLEMENT OF A TYPICAL STORAGE PAD INCLUDES:

0.19" OF ELASTIC SETTLEMENT OF LAYER 1 (ISOLATED PAD)

+ 0.25" OF ELASTIC SETTLEMENT OF LAYERS 2-4 (ALL PADS LOADED)

+ 1.31" OF PRIMARY CONSOLIDATION OF LAYER 1

+ ~0" OF " " OF LAYERS 2-4

+ 1.19" OF SECONDARY SETTLEMENT OVER 40 YRS WITH ~ 0.6" OCCURRING WITHIN 1 WEEK OF LOADING, AN ADDITIONAL 0.3" WITHIN THE FIRST YEAR, & ~0.3" OCCURRING BETWEEN THE END OF YEAR 1 & YEAR 40.

Σ = 2.94" = TOTAL STATIC SETTLEMENT

NOTE: LAYERS 2-4 CONTRIBUTE < 10% OF THE TOTAL SETTLEMENT, BASED ON VERY CONSERVATIVE ASSUMPTIONS. IN ADDITION, THIS PORTION OF THE SETTLEMENT WOULD AFFECT THE ENTIRE SITE, AND THUS, WOULD NOT CONTRIBUTE TO DIFFERENTIAL SETTLEMENTS.

DISCUSSION (cont'd)

In the foregoing analyses >90% of the settlement is due settlement in Layer 1. In these analyses, Layer 1 was not subdivided into smaller layers and the stresses with depth were determined using an approximate method (distributing them with depth based on a slope of 2V:1H). The settlement of the storage pads due to Layer 1 was reevaluated, dividing Layer 1 into four sublayers as shown in Figure 7 and using Boussinesq's equation to distribute the loading with respect to depth, essentially as a strip load, since the pads are only 5 ft apart in the direction of their 64 ft lengths.

Table 3 presents these analyses, which are based on the same procedures described above, except Boussinesq's equation is used to distribute the loading with respect to depth, essentially as a strip load, and the rate of secondary compression is determined based on the dashed curve shown in Figure 8.

CONCLUSIONS:

Table 3 presents a summary of the estimated settlements in Layer 1. As discussed above, Layers 2 through 4 are expected to contribute less than "0.25" to the total settlement of the storage pads; therefore, the total estimated settlement of the storage pads is:

0.25 inches of immediate settlement in Layer 1
0.25 inches of immediate settlement in Layers 2-4
1.67 inches of primary consolidation settlement in Layer 1
1.16 inches of secondary compression in Layer 1 over 40 years

3.33 inches total settlement after 40 years

CALCULATION OF SETTLEMENTS BENEATH CENTER OF STORAGE PAD

ρ_{total} = **3.09 "**

q =	1.93 ksf	γ_t =	80.00 pcf	GWT > 100 ft below grade	
B =	30.00 ft	L =	640.00 ft (L = 64 ft, but use 640 ft to emulate strip footing)		
D_f =	3.00 ft	E_{max} =	3780 ksf (From Table 1 of Calc 05996.01-G(B)-01-1)		

CONCLUSIONS:

Portion of Load due to: Weight of Storage Pad = $\frac{0.45 \text{ ksf}}{1.93 \text{ ksf}}$ = 0.23

Portion of Settlement due to Weight of Storage Pad:

0.23	*	1.93	=	0.45 inches of immediate settlement due to Weight of Pad
0.23	*	**2.66**	=	**0.62 inches after 1 month due to Weight of Pad**
0.23	*	3.04	=	0.71 inches after 20 years
0.23	*	3.09	=	0.72 inches after 40 years

Portion of Settlement due to Placement of Casks:

2.66 inches after 1 month due to Weight of Pad + Casks
-0.62 inches after 1 month due to Weight of Pad

2.04 inches after 1 month due to Placement of Casks

Portion of Settlement from end of 1st month after Placement of Casks to 40 Years:

3.09 inches after 40 years
-0.62 inches after 1 month due to Weight of Pad
-2.04 inches after 1 month due to Placement of Casks

0.43 inches from 1 month to 40 years

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TABLE 1

CALCULATION OF ELASTIC SETTLEMENTS OF LAYERS 1 TO 3 USING LOW-STRAIN MODULI

LAYER	z FT	z_c FT	$\Delta\bar{\sigma}_v$ KSF	E^*_{MAX} KSF	$\Delta\rho_{MIN}$ IN.
	3				
1		16.5	1.25	3780	$(30'-3')\frac{\Delta\bar{\sigma}_v}{E_{MAX}} = 0.107"$ ← ~90% OF TOTAL FOR LAYERS 1 TO 3
	30				
2		42	0.80	44,936	$(60'-30')$ " $= 0.096"$
	60				
3		87	0.49	44,936	$(120'-60')$ " $= 0.008"$
	120				$I = 0.12"$

↑ BELOW BOTTOM OF PAD

$\Delta\bar{\sigma}_v$ = INCREASE IN STRESS AT CENTER OF LAYER ASSUMING q AT BASE OF STORAGE PAD = 1.47 KSF + 3' × 0.15 KCF = 1.93 KSF DISTRIBUTED 2V:1H WITH RESPECT TO DEPTH

$$\therefore \quad \Delta\bar{\sigma}_v = \frac{1.93\ \frac{K}{FT^2} \times 30\ FT}{30 + z}$$

← NOTE: THIS IGNORES EFFECT OF ADJACENT PAD LOADING. & WT OF SOIL REMOVED TO CONSTRUCT PAD (3 × 0.080 KCF = 0.24 KSF).

$$E = \frac{\Delta\bar{\sigma}_v}{\varepsilon_v} \quad \therefore \quad \varepsilon_v = \frac{\Delta\bar{\sigma}_v}{E}$$

$$\Delta\rho = \Delta z\, \varepsilon_v = (z_{BOTTOM} - z_{TOP})\ FT \times 12\ \frac{IN.}{FT} \times \frac{\Delta\bar{\sigma}_v\ KSF}{E\ KSF}$$

* E_{MAX} VALUES FROM TABLE 1 OF CALC 05996.01-G(B)-01-1

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Table 2A
Determination of Coefficients of Secondary Compression

Test ID	Load tsf	Increment tsf	t_{MAX} minutes	Remarks	Over 1 Log Cycle Strain (%) Start	Over 1 Log Cycle Strain (%) End	Strain(%)/ Log Cycle Time(min)	Max Past Pressure	Stress Ratio
C1-U3C	0.00	0.10	15	RELOAD	0.140	0.156	-0.016	2.8	0.04
C1-U3C	0.10	0.25	1500	RELOAD	0.557	0.641	-0.084	2.8	0.09
C1-U3C	0.25	0.50	1380	RELOAD	1.080	1.170	-0.090	2.8	0.18
C1-U3C	0.50	1.00	2580	RELOAD	1.900	2.010	-0.110	2.8	0.36
C1-U3C	1.00	2.00	12780	RELOAD	4.120	5.060	-0.940	2.8	0.71
C1-U3C	2.00	0.50	240	UNLOAD	4.660	4.620	0.040	2.8	0.18
C1-U3C	0.50	1.00	960	RELOAD	4.780	4.830	-0.050	2.8	0.36
C1-U3C	1.00	2.00	180	RELOAD	5.160	5.200	-0.040	2.8	0.71
C1-U3C	2.00	4.00	4320	VIRGIN	10.400	11.800	-1.400	2.8	1.43
C1-U3C	4.00	8.00	1080	VIRGIN	20.120	21.440	-1.320	2.8	2.86
C1-U3C	8.00	2.00	60	UNLOAD	20.820	20.720	0.100	8	0.25
C1-U3C	2.00	0.50	120	UNLOAD	19.790	19.640	0.150	8	0.06
C1-U3C	0.50	0.10	240	UNLOAD	18.590	18.390	0.200	8	0.01

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Table 2B
Determination of Coefficients of Secondary Compression

Test ID	Load tsf	Increment tsf	t_{MAX} minutes	Remarks	Over 1 Log Cycle Strain (%) Start	Over 1 Log Cycle Strain (%) End	Strain(%)/ Log Cycle Time(min)	Max Past Pressure	Stress Ratio
C1-U3D	0.00	0.10	8	RELOAD	0.120	-0.011	0.131	3	0.03
C1-U3D	0.10	0.25	36	RELOAD	0.238	0.267	-0.029	3	0.08
C1-U3D	0.25	0.50	60	RELOAD	0.700	0.742	-0.042	3	0.17
C1-U3D	0.50	1.00	78	RELOAD	1.450	1.570	-0.120	3	0.33
C1-U3D	1.00	2.00	15540	RELOAD	3.000	4.100	-1.100	3	0.67
C1-U3D	2.00	4.00	10500	VIRGIN	11.412	13.029	-1.617	3	1.33
C1-U3D	4.00	8.00	2640	VIRGIN	20.353	21.824	-1.471	3	2.67
C1-U3D	8.00	2.00	300	UNLOAD	21.570	21.520	0.050	8	0.25
C1-U3D	2.00	0.50	960	UNLOAD	20.300	20.100	0.200	8	0.06
C1-U3D	0.50	1.00	180	RELOAD	20.342	20.370	-0.028	8	0.13
C1-U3D	1.00	2.00	4080	RELOAD	20.980	21.010	-0.030	8	0.25
C1-U3D	2.00	4.00	180	RELOAD	21.670	21.740	-0.070	8	0.50
C1-U3D	4.00	8.00	240	RELOAD	22.840	23.130	-0.290	8	1.00
C1-U3D	8.00	2.00	900	UNLOAD	22.388	22.365	0.023	8	0.25
C1-U3D	2.00	0.50	60	UNLOAD	21.290	21.180	0.110	8	0.06
C1-U3D	0.50	0.10	180	UNLOAD	19.660	19.420	0.240	8	0.01

Table 2C
Determination of Coefficients of Secondary Compression

Test ID	Load tsf	Increment tsf	t_{MAX} minutes	Remarks	Over 1 Log Cycle Strain (%) Start	End	Strain(%)/ Log Cycle Time(min)	Max Past Pressure	Stress Ratio
C2-U2C	0.00	0.10	22	RELOAD	0.086	0.104	-0.018	3	0.03
C2-U2C	0.10	0.25	1380	RELOAD	0.284	0.341	-0.056	3	0.08
C2-U2C	0.25	0.50	2990	RELOAD	0.649	0.694	-0.045	3	0.17
C2-U2C	0.50	1.00	1500	RELOAD	1.084	1.192	-0.108	3	0.33
C2-U2C	1.00	2.00	16800	RELOAD	2.400	2.912	-0.512	3	0.67
C2-U2C	2.00	0.50	300	UNLOAD				3	0.17
C2-U2C	0.50	1.00	960	RELOAD	2.735	2.759	-0.024	3	0.33
C2-U2C	1.00	2.00	180	RELOAD	3.012	3.036	-0.025	3	0.67
C2-U2C	2.00	4.00	4320	VIRGIN	7.431	8.627	-1.196	3	1.33
C2-U2C	4.00	8.00	1080	VIRGIN	16.118	17.412	-1.294	3	2.67
C2-U2C	8.00	2.00	60	UNLOAD					
C2-U2C	2.00	0.50	174	UNLOAD					
C2-U2C	0.50	0.10	240	UNLOAD					

TABLE 3

CALCULATION OF SETTLEMENTS BENEATH CENTER OF STORAGE PAD

ρ_{total} = 3.09 "

q =	1.93 ksf	γ_t =	80.00 pcf	GWT > 100 ft below grade
B =	30.00 ft	L =	640.00 ft	(L = 64 ft, but use 640 ft to emulate strip footing)
D_f =	3.00 ft	E_{max} =	3780 ksf	(From Table 1 of Calc 05996.01-G(B)-01-1)

STRESSES BENEATH FOOTING:

LAYER	ΔH	z_{grade}	σ_{vo}	z_{ftg}	m	n	I_{corner}	I_{center}	$\Delta\sigma_v$	σ_{vf}
	ft	ft	ksf	ft					ksf	ksf
1A	5.00	5.50	0.44	2.50	6.00	128.00	0.250	1.00	1.69	2.13
1B	5.00	10.50	0.84	7.50	2.00	42.67	0.240	0.96	1.62	2.46
1C	7.00	16.50	1.32	13.50	1.11	23.70	0.213	0.85	1.44	2.76
1D	10.00	25.00	2.00	22.00	0.68	14.55	0.169	0.68	1.14	3.14

Note: $\sigma_{vo} = z_{grade} \times \gamma_t$ $\Delta\sigma_v = (q - \gamma_t D_f) \times I_{center}$ $I_{center} = 4 \times I_{corner}$ $\sigma_{vf} = \sigma_{vo} + \Delta\sigma_v$

I_{corner} = f(m & n) based on Fig 3.40 in Das(1995), where: m=b/z_{ftg}, b=B/2 n = l/z_{ftg}, where l=L/2

ELASTIC SETTLEMENTS:

LAYER	ΔH	$\Delta\sigma_v$	$\varepsilon_{assumed}$	E / E_{max}	E	ε_{actual}	$\Delta\rho_{elastic}$	= ΔH x 12 in./ft x ε_{actual}
	ft	ksf	%		ksf	%	inches	
1A	5.00	1.69	0.11	0.41	1564	0.11	0.06	
1B	5.00	1.62	0.10	0.43	1637	0.10	0.06	
1C	7.00	1.44	0.078	0.49	1850	0.078	0.07	
1D	10.00	1.14	0.052	0.58	2197	0.052	0.06	
						Total =	0.25	inches

Note: ε_{actual} = $\Delta\sigma_v$ / E

Assume: E / E_{max} Based on G/G_{max} from Geomatrix Calc 05996.01-G(P05)-1, Rev 0, p12/29 of Section 1.3

NOTE: E is directly related to G; i.e., E = 2 x (1+μ) G

PRIMARY CONSOLIDATION SETTLEMENTS:

LAYER	ΔH	σ_{vo}	σ_{vf}	$\Delta\rho_{primary}$	= ΔH x 12 in./ft x RR x Log (σ_{vf}/σ_{vo})
	ft	ksf	ksf	inches	
1A	5.00	0.44	2.13	0.57	
1B	5.00	0.84	2.46	0.39	
1C	7.00	1.32	2.76	0.38	
1D	10.00	2.00	3.14	0.33	
			Total =	1.67	inches

Note: 6.00 ksf =Maximum past pressure from consolidation tests - See p 7 Calc 05996.01-G(B)-01

0.014 = RR, See p 13 Calc 05996.01-G(B)-03

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TABLE 3 (CONT'D)

CALCULATION OF SETTLEMENTS BENEATH CENTER OF STORAGE PAD

ρ_{total} = 3.09 "

q =	1.93 ksf	γ_t =	80.00 pcf	GWT > 100 ft below grade	
B =	30.00 ft	L =	640.00 ft (L = 64 ft, but use 640 ft to emulate strip footing)		
D_f =	3.00 ft	E_{max} =	3780 ksf (From Table 1 of Calc 05996.01-G(B)-01-1)		

SECONDARY SETTLEMENTS:

Δ Secondary Settlement = 12 in./ft x C_α x Log_{10}(Δt in min)

= Log_{10}(40 yrs x 525,960 min/yr)

LAYER	ΔH	σ_{vf}	σ_{vf}/σ_{mpp}	C_α	4.64	7.02	7.32	
	ft	ksf		%/Log Cycle Time (min)	Log Cycles in 1 month Inches	Log Cycles in 20 Yrs Inches	Log Cycles in 40 Yrs Inches	
1A	5.00	2.13	0.35	0.035	0.10	0.15	0.16	
1B	5.00	2.46	0.41	0.042	0.12	0.18	0.18	
1C	7.00	2.76	0.46	0.049	0.19	0.29	0.30	
1D	10.00	3.14	0.52	0.060	0.33	0.50	0.53	
				Total =	0.74	1.12	1.16	inches

Note: C_α = rate of secondary compression & is $f(\sigma_{vf}/\sigma_{mpp})$ - From Figure 2 in Calc 05996.01-G(B)-05

525,960 min = 1 yr = 365.25 days x 24 hr/day x 60 min/hr

43,830 min/month = 525,960 min/yr / 12 months/yr

SUMMARY OF SETTLEMENTS:

LAYER	ΔH	z_{grade}	z_{ftg}	$\Delta\rho_{elastic}$	$\Delta\rho_{primary}$	Δ Secondary Settlement 1 month	20 yrs	40 yrs	
	ft	ft	ft	inches	inches	inches	inches	inches	
1A	5.00	5.50	2.50	0.06	0.57	0.10	0.15	0.16	
1B	5.00	10.50	7.50	0.06	0.39	0.12	0.18	0.18	
1C	7.00	16.50	13.50	0.07	0.38	0.19	0.29	0.30	
1D	10.00	25.00	22.00	0.06	0.33	0.33	0.50	0.53	
			Total =	0.25	1.67	0.74	1.12	1.16	inches

Total =

1.93 inches of immediate settlement

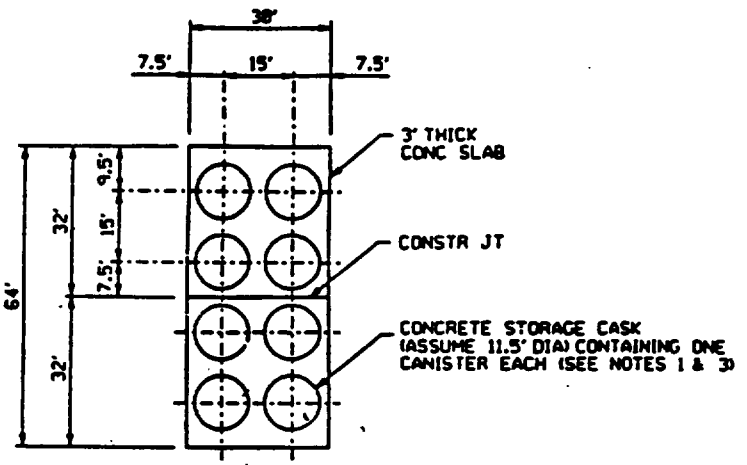
2.66 inches after 1 month

3.04 inches after 20 years

3.09 inches after 40 years

FIGURE 1

PLAN VIEW - TYPICAL STORAGE PAD



TYP STORAGE PAD
(500 REQD)
SCALE: 1" = 20'-0"

SWEC DRWG 0599601-EY-2-B
NOTE: DIM'S SAME ON " " 2-E

CASK WT = 354 K (P C3 CALC 05996.01-G(B)-05

$$\therefore \quad p = \frac{8 \text{ CASKS} \times 354^{K}/_{\text{CASK}}}{30' \times 64'}$$

$p = 1.475 \text{ KSF}$

$+ 0.45 \text{ KSF}$ (3' CONC PAD × 0.15 KCF)

1.93 KSF AT BOTTOM OF PAD

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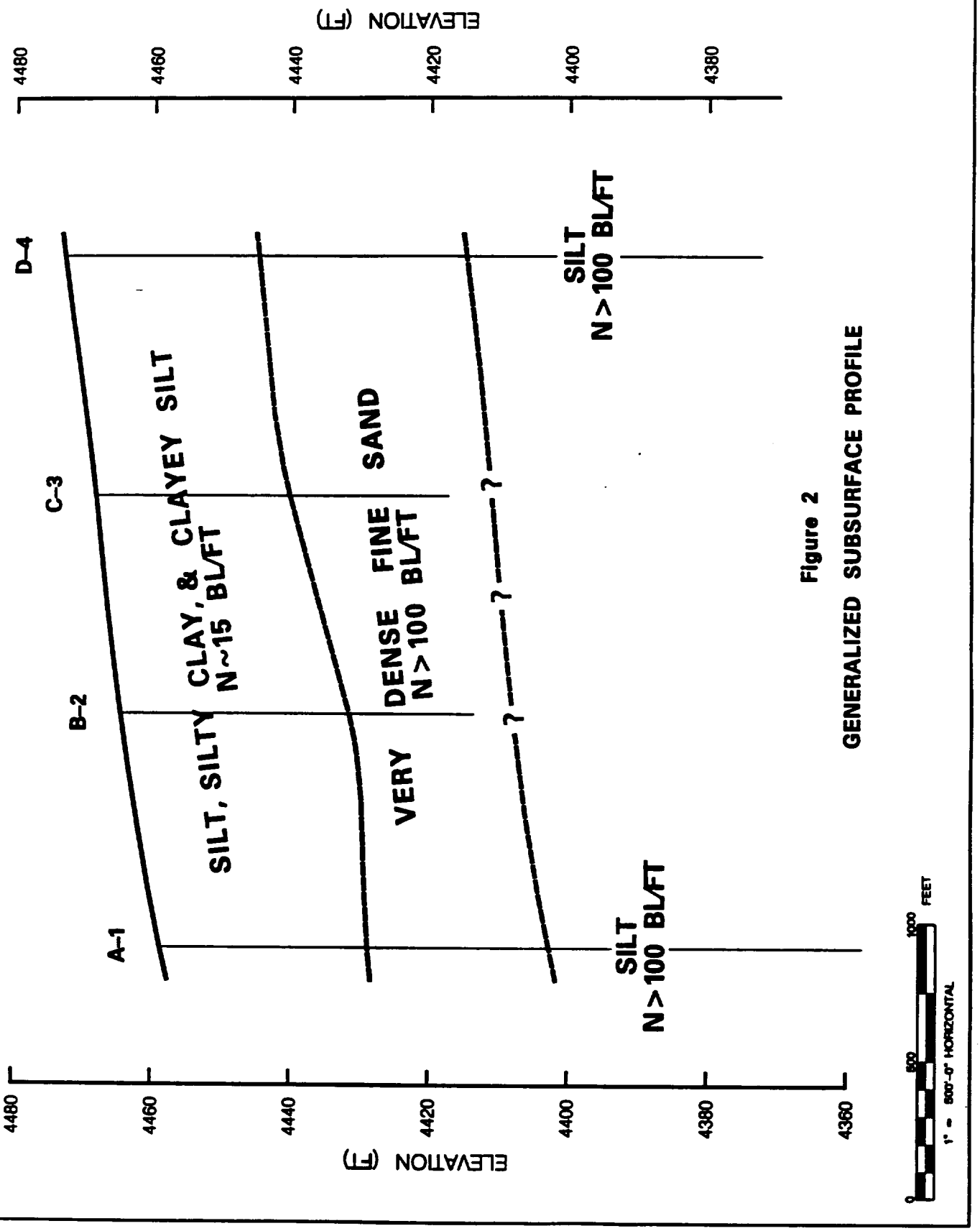

Figure 2

GENERALIZED SUBSURFACE PROFILE

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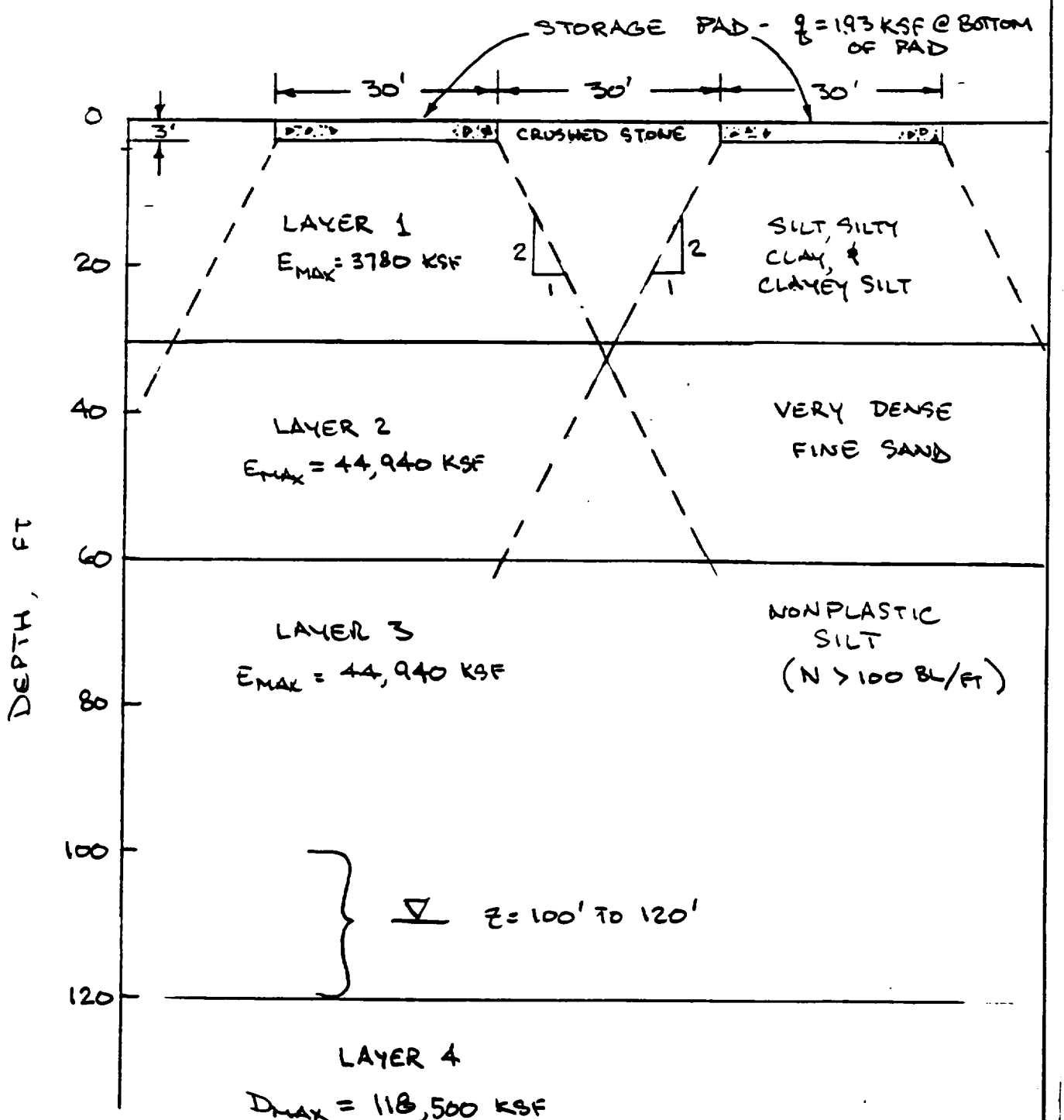
FIGURE 3

FOUNDATION PROFILE - STORAGE PADS



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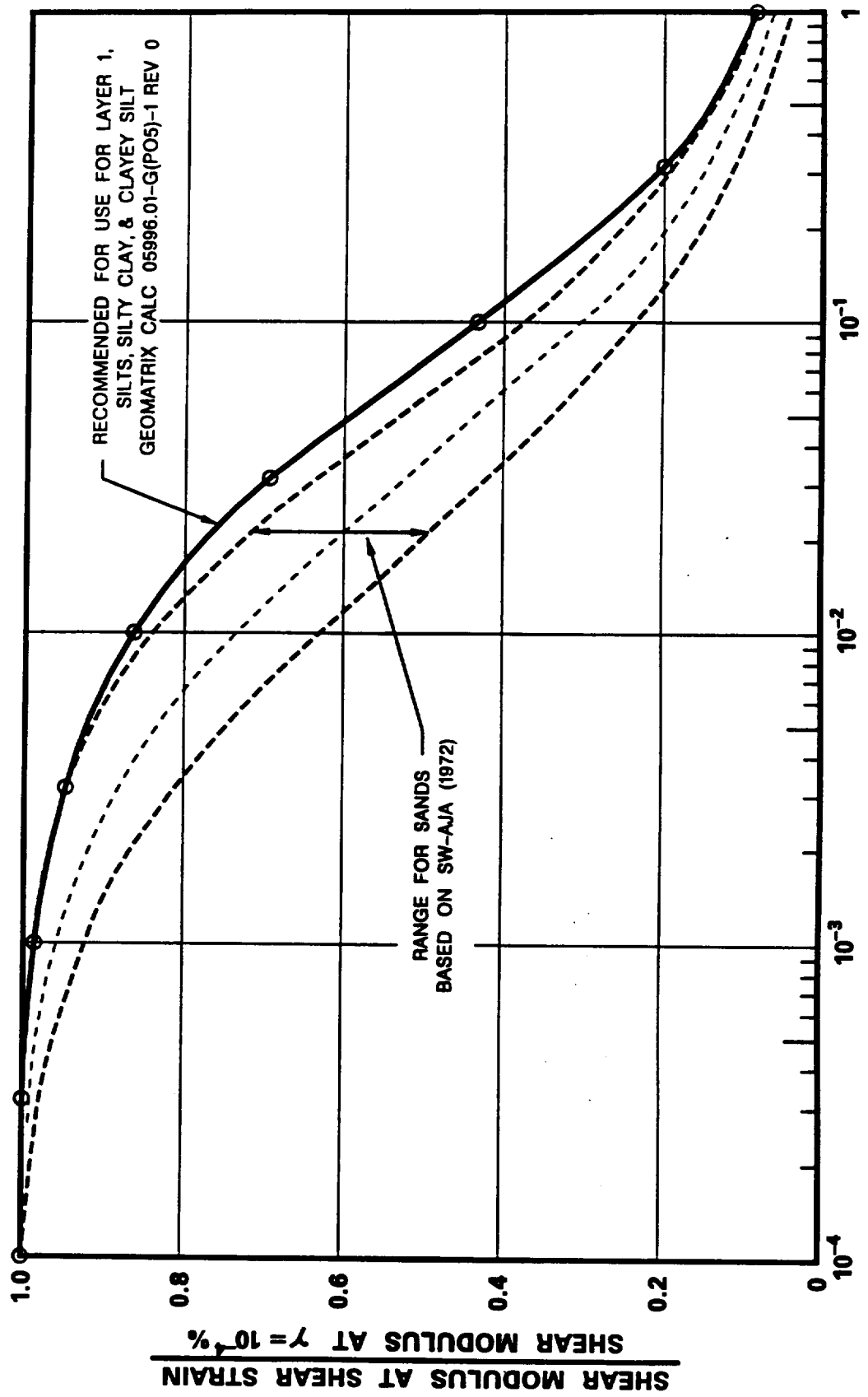

Figure 4

VARIATION OF SHEAR MODULUS WITH SHEAR STRAIN

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FIGURE 5
COEFFICIENT OF SECONDARY COMPRESSION VS STRESS RATIO
CONSOLIDATION TEST C1-U3D

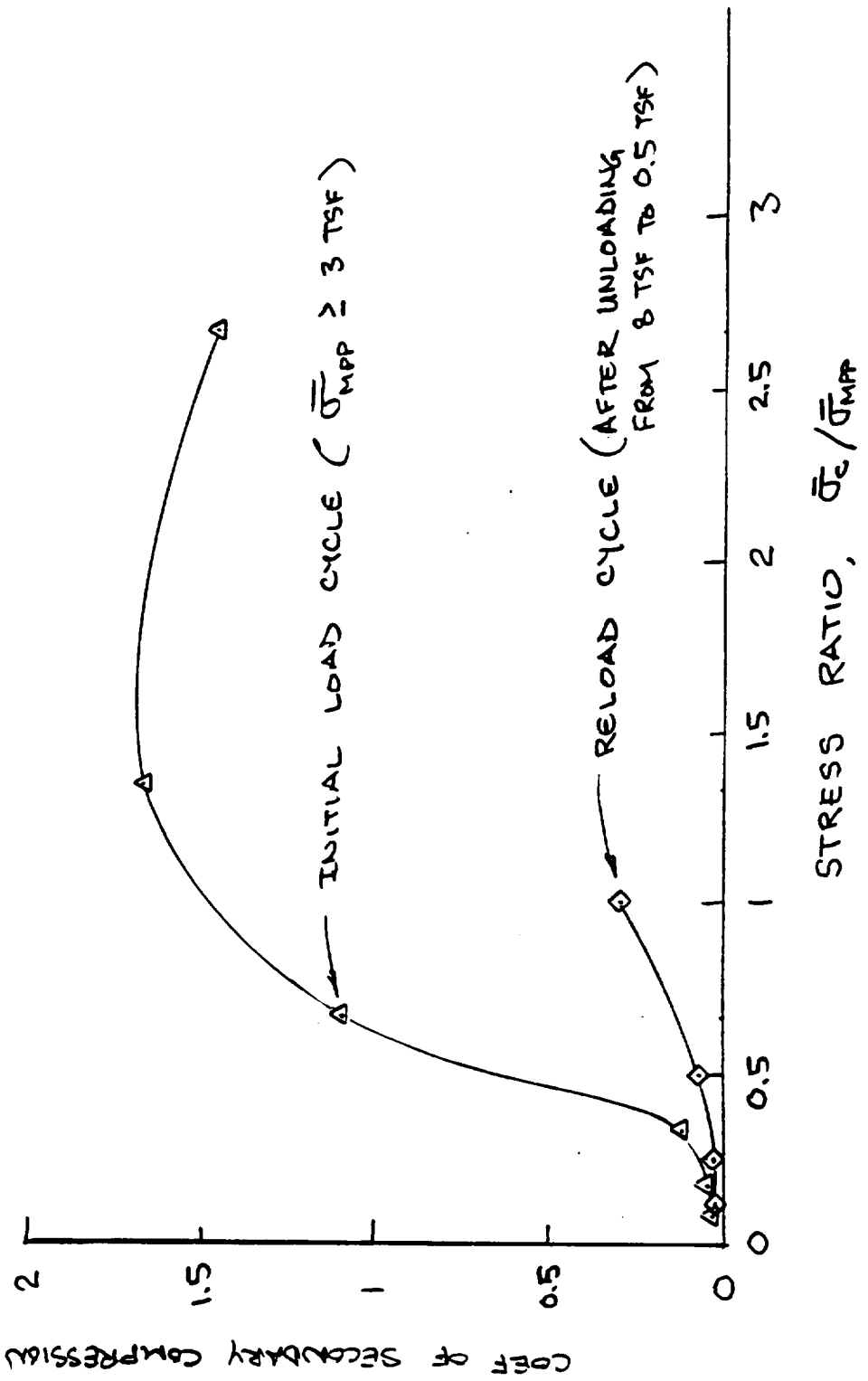

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FIGURE 6A

COEFFICIENT OF SECONDARY COMPRESSION VS STRESS RATIO

CONSOLIDATION TEST C1-U3C
(SAMPLE WAS NOT INUNDATED- Z = 11.2')

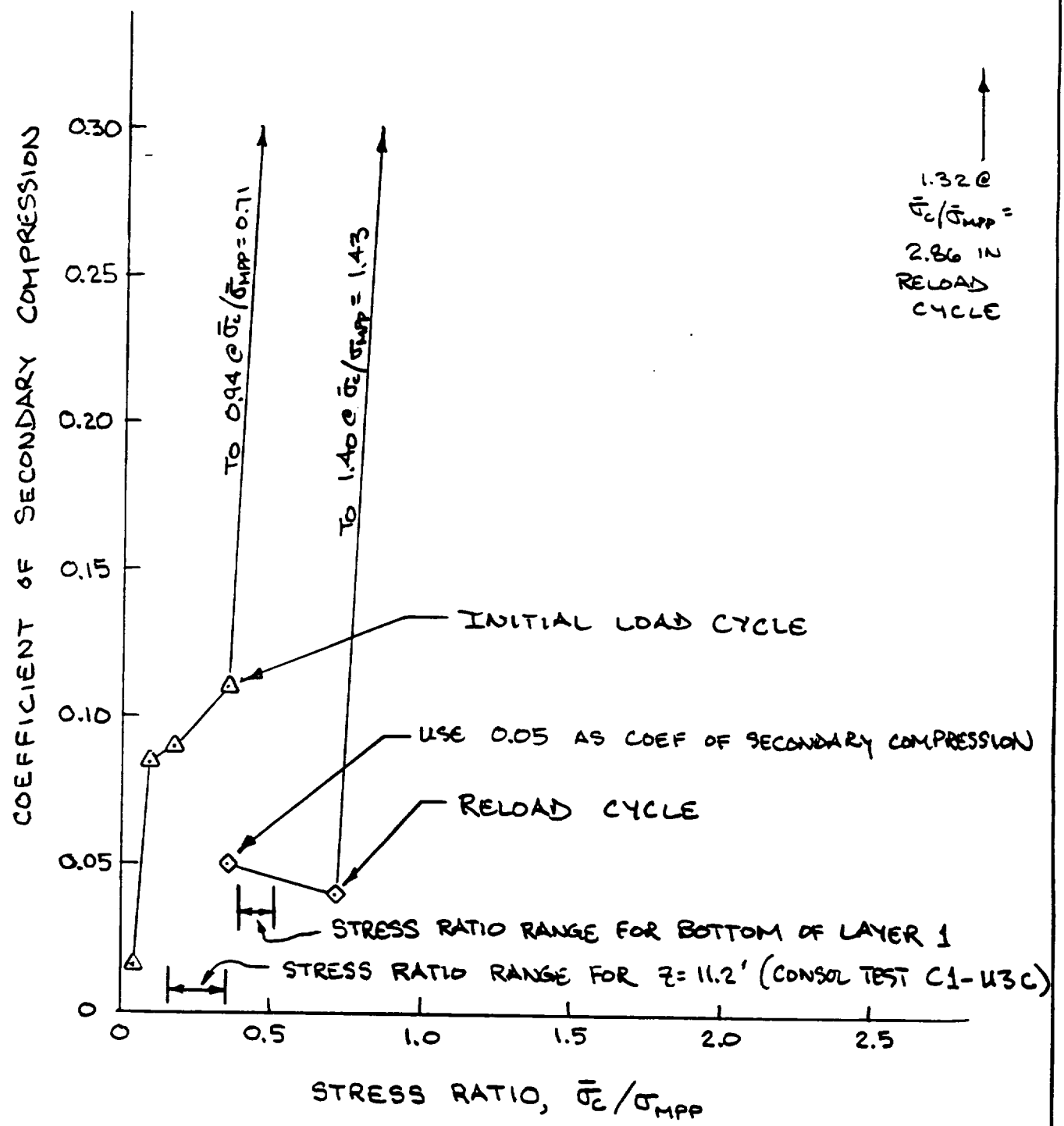
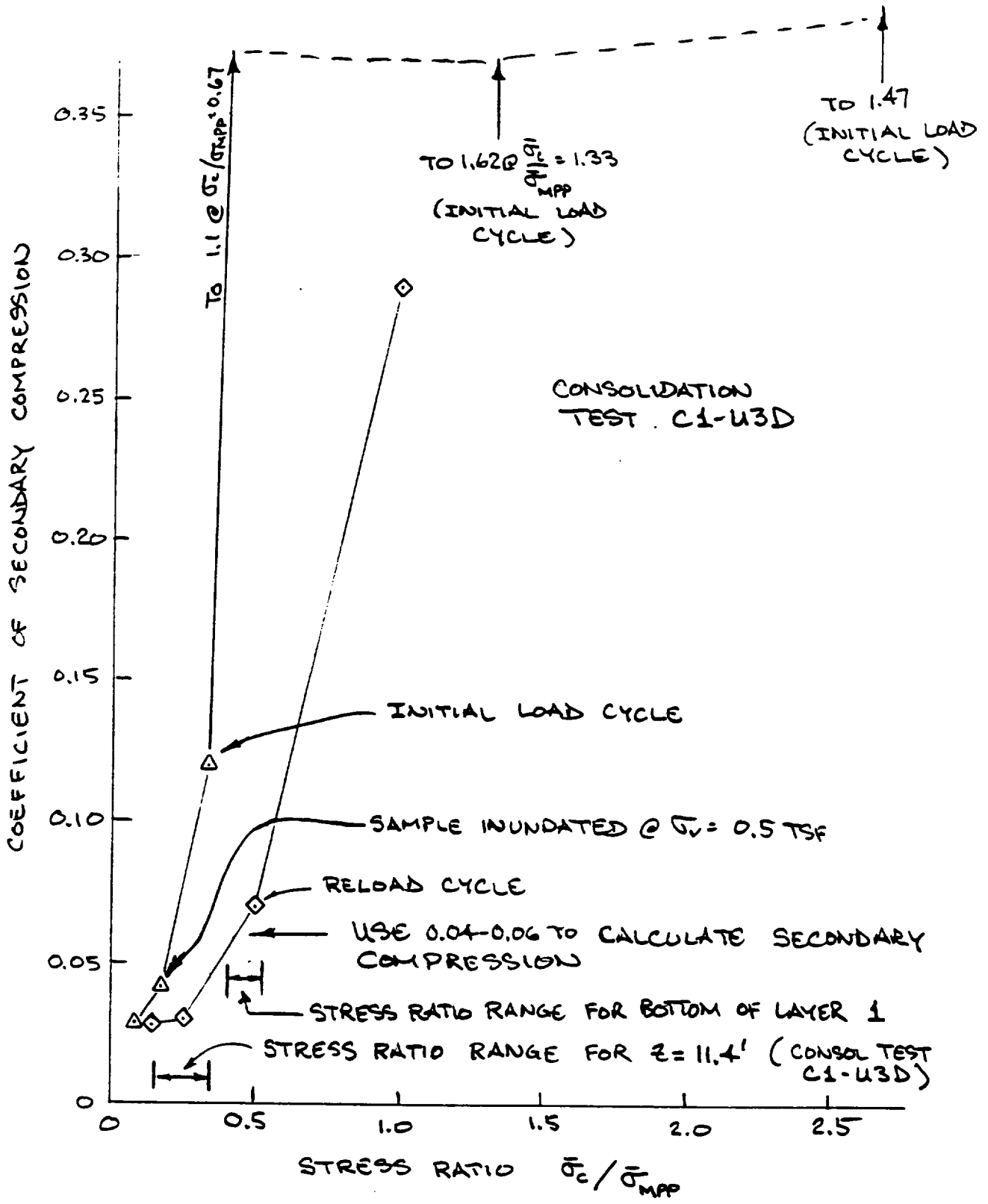


FIGURE 6B

COEFFICIENT OF SECONDARY COMPRESSION VS STRESS RATIO



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CALCULATION SHEET

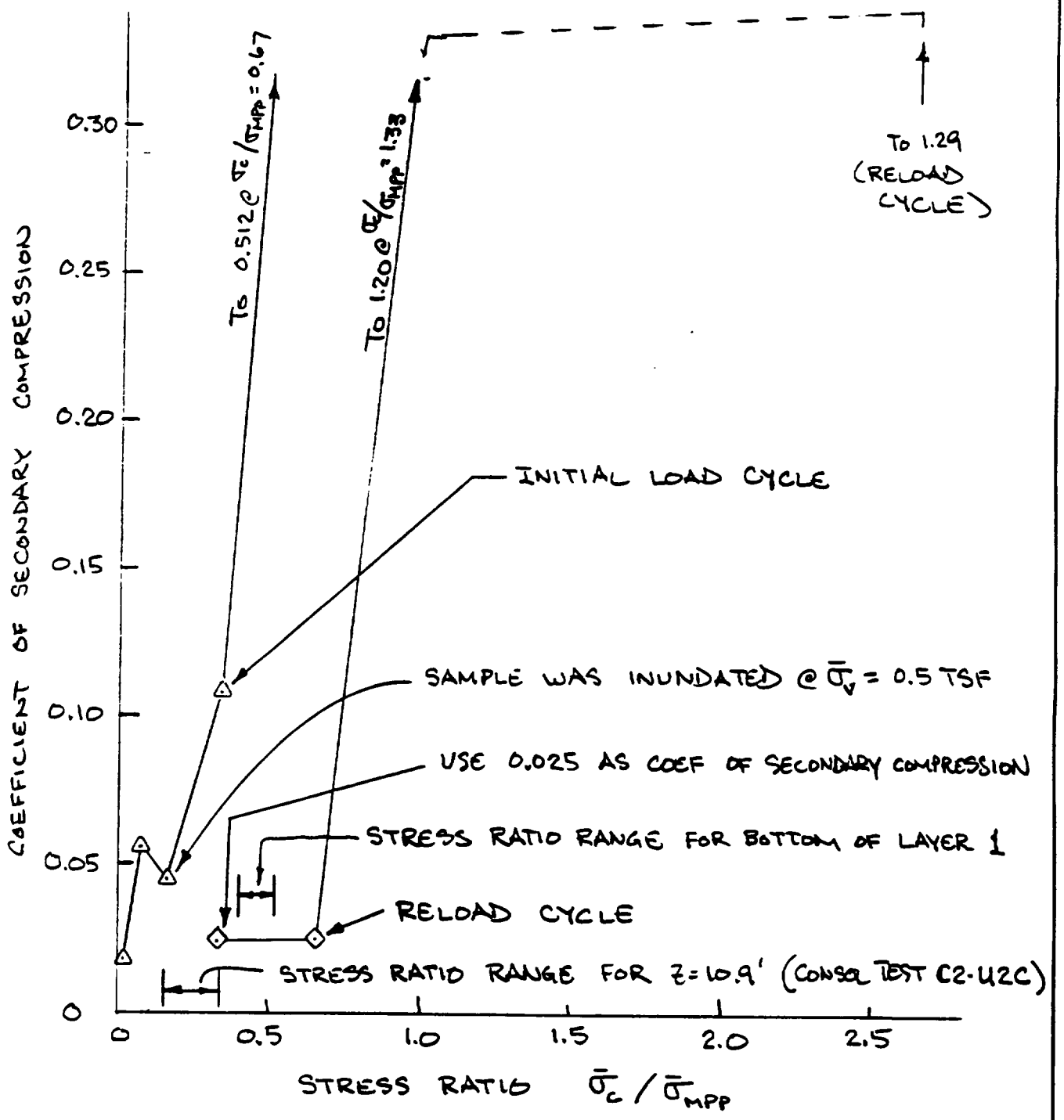
▲ 5010.65

CALCULATION IDENTIFICATION NUMBER				
J.O. OR W.O. NO.	DIVISION & GROUP	CALCULATION NO.	OPTIONAL TASK CODE	PAGE 37
05996.01	G(B)	03 - 1		

FIGURE 6C

COEFFICIENT OF SECONDARY COMPRESSION VS STRESS RATIO

CONSOLIDATION TEST C2-U2C



13 CALCULATION IDENTIFICATION NUMBER				
J.O. OR W.O. NO. 05996.01	DIVISION & GROUP G(B)	CALCULATION NO. 03 - 1	OPTIONAL TASK CODE	PAGE 38

STORAGE PAD 354 K

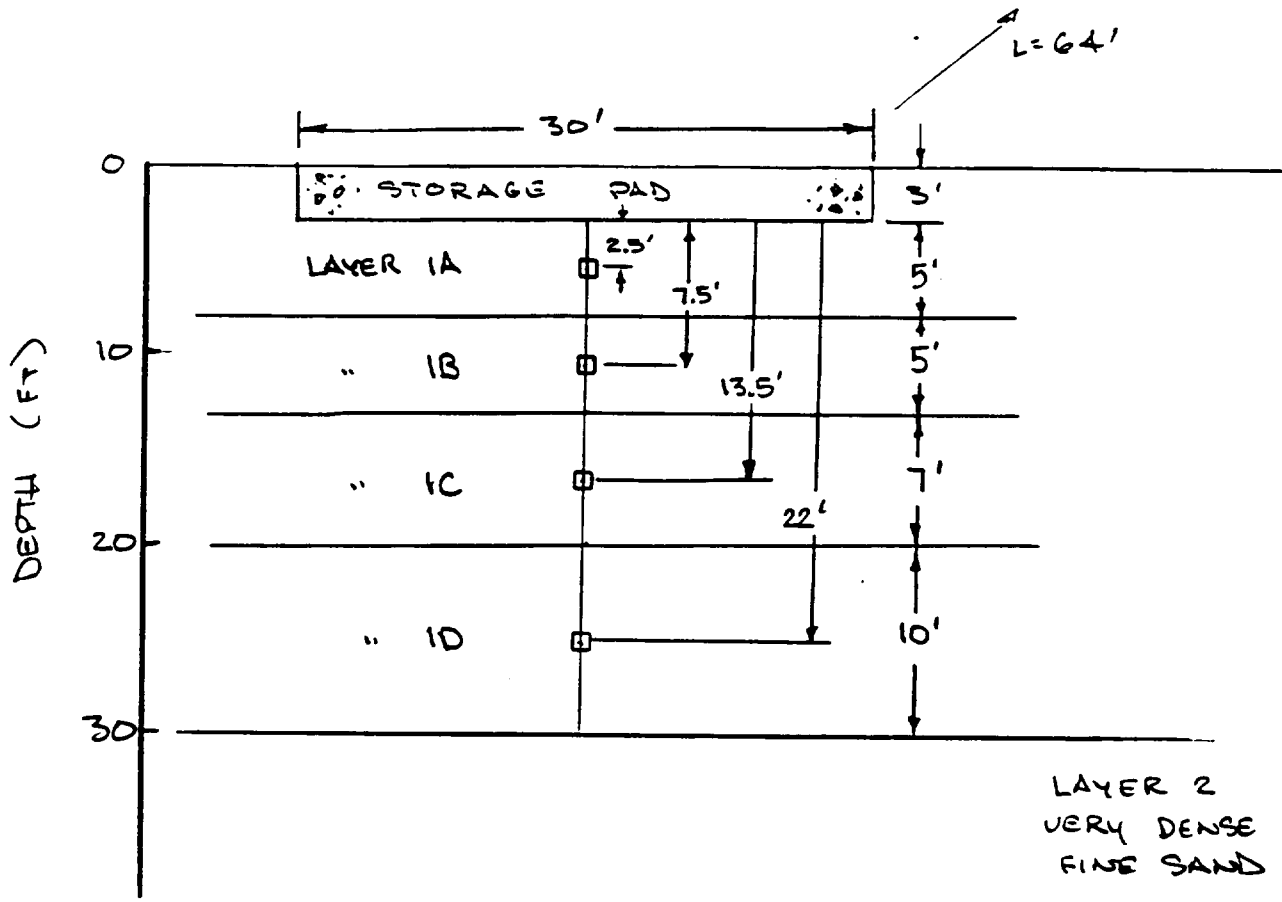


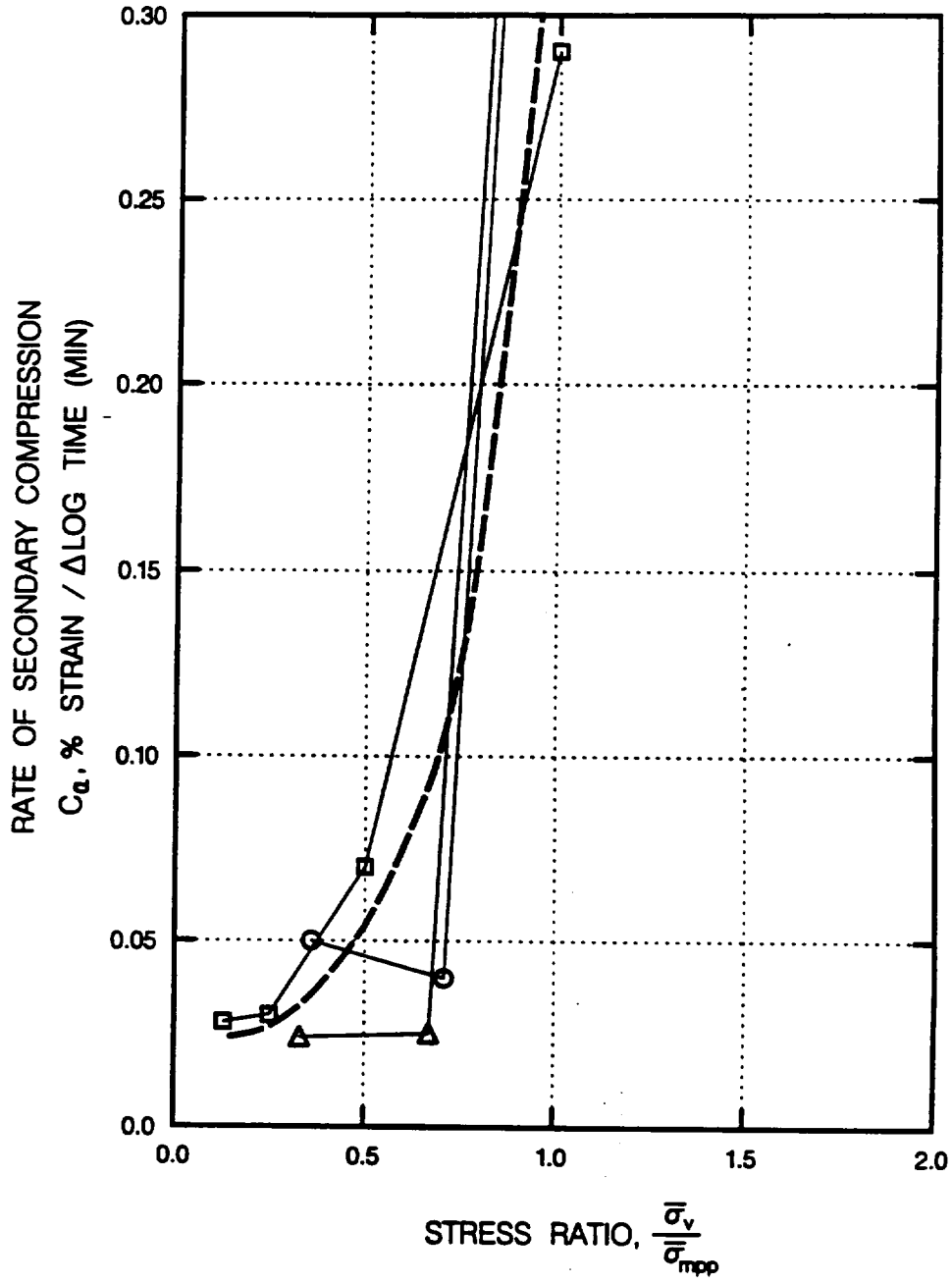
FIGURE 7

STORAGE PAD FOUNDATION PROFILE SHOWING SUBLAYERS USED TO ESTIMATE SETTLEMENTS OF LAYER 1

STONE & WEBSTER ENGINEERING CORPORATION

CALCULATION SHEET

CALCULATION IDENTIFICATION NUMBER				PAGE 39
J.O. OR W.O. NO.	DIVISION & GROUP	CALCULATION NO.	OPTIONAL TASK CODE	
05996.01	G(B)	03 - 1		



KEY

SYMBOL	TEST ID
O	C1-U3C
□	C1-U3D
Δ	C2-U2C

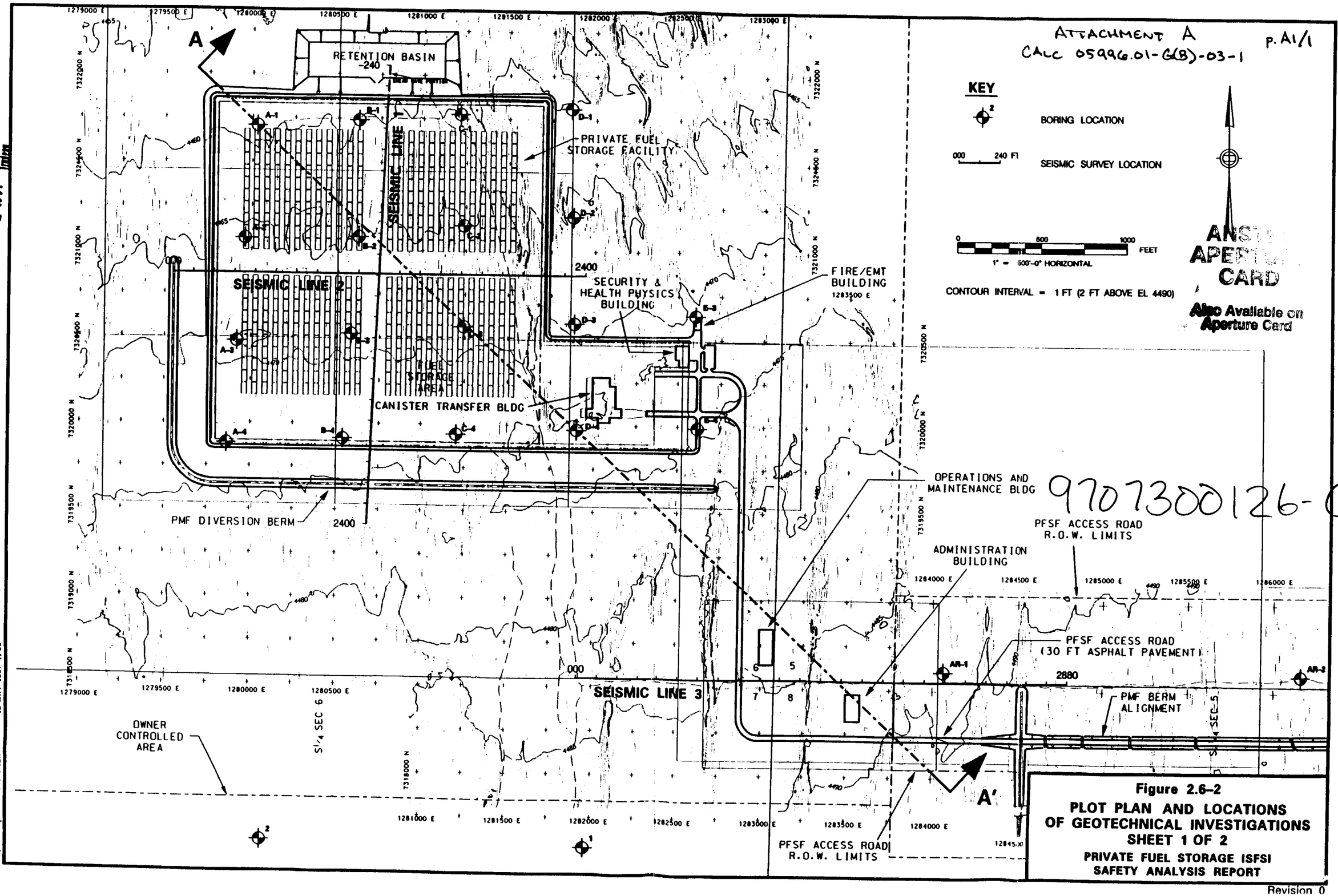
Figure 8

RATE OF SECONDARY COMPRESSION VS STRESS RATIO

BASED ON RELOADING PORTIONS OF CONSOLIDATION TESTS

ATTACHMENT A
CALC 05996.01-G(B)-03-1
P. A1/1

NOTED MAY 12 1997 P.I. initials



9707300126-01

Figure 2.6-2
PLOT PLAN AND LOCATIONS OF GEOTECHNICAL INVESTIGATIONS SHEET 1 OF 2
PRIVATE FUEL STORAGE ISFSI SAFETY ANALYSIS REPORT

G:\05996\gsk\b-03-a-0.dgn 12-MAY-1997 11:00

STONE & WEBSTER ENGINEERING CORPORATION

NOTED FEB 1 2 1997 P. I. Trudeau ▲5010.65

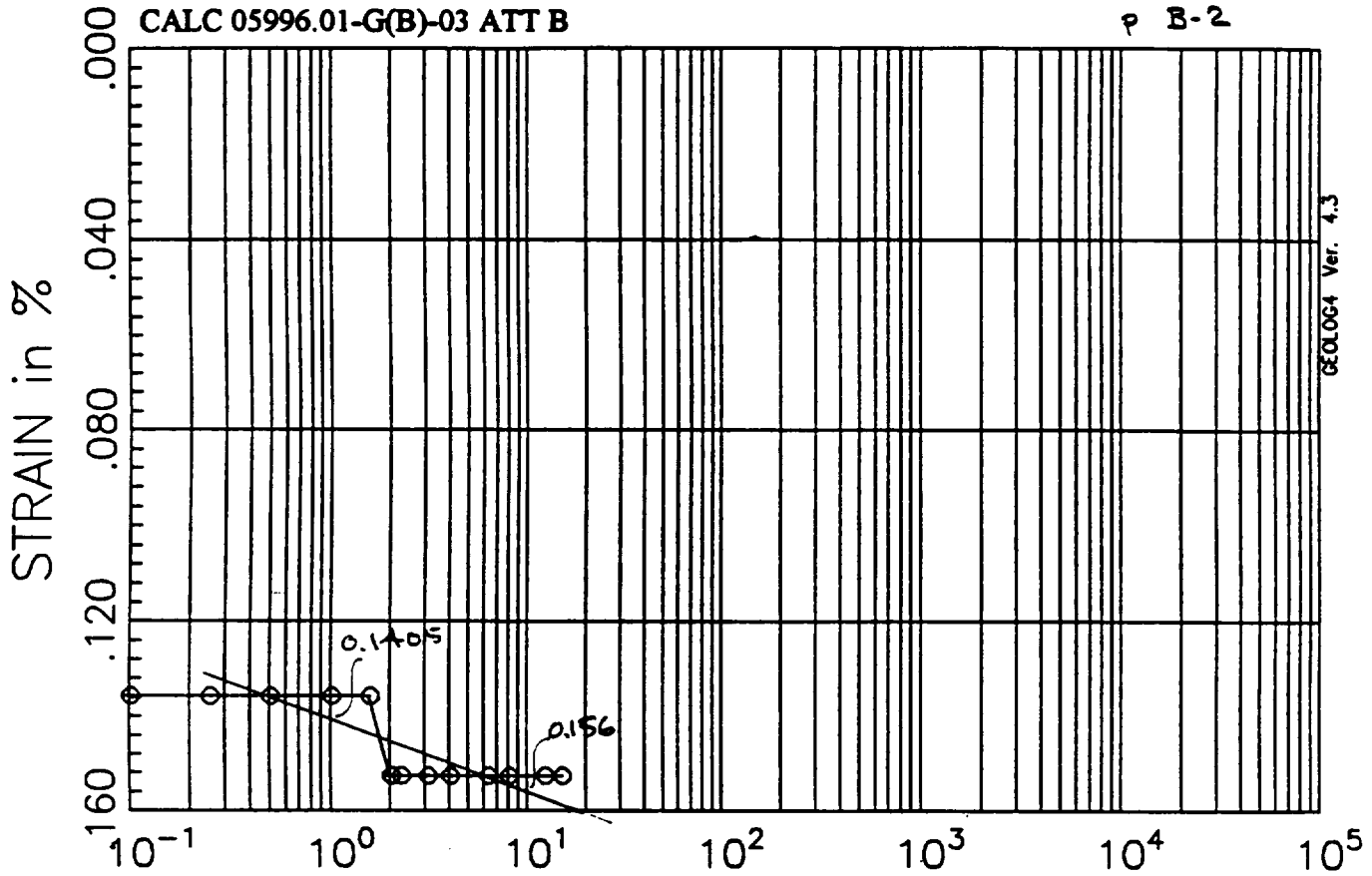
CALCULATION SHEET

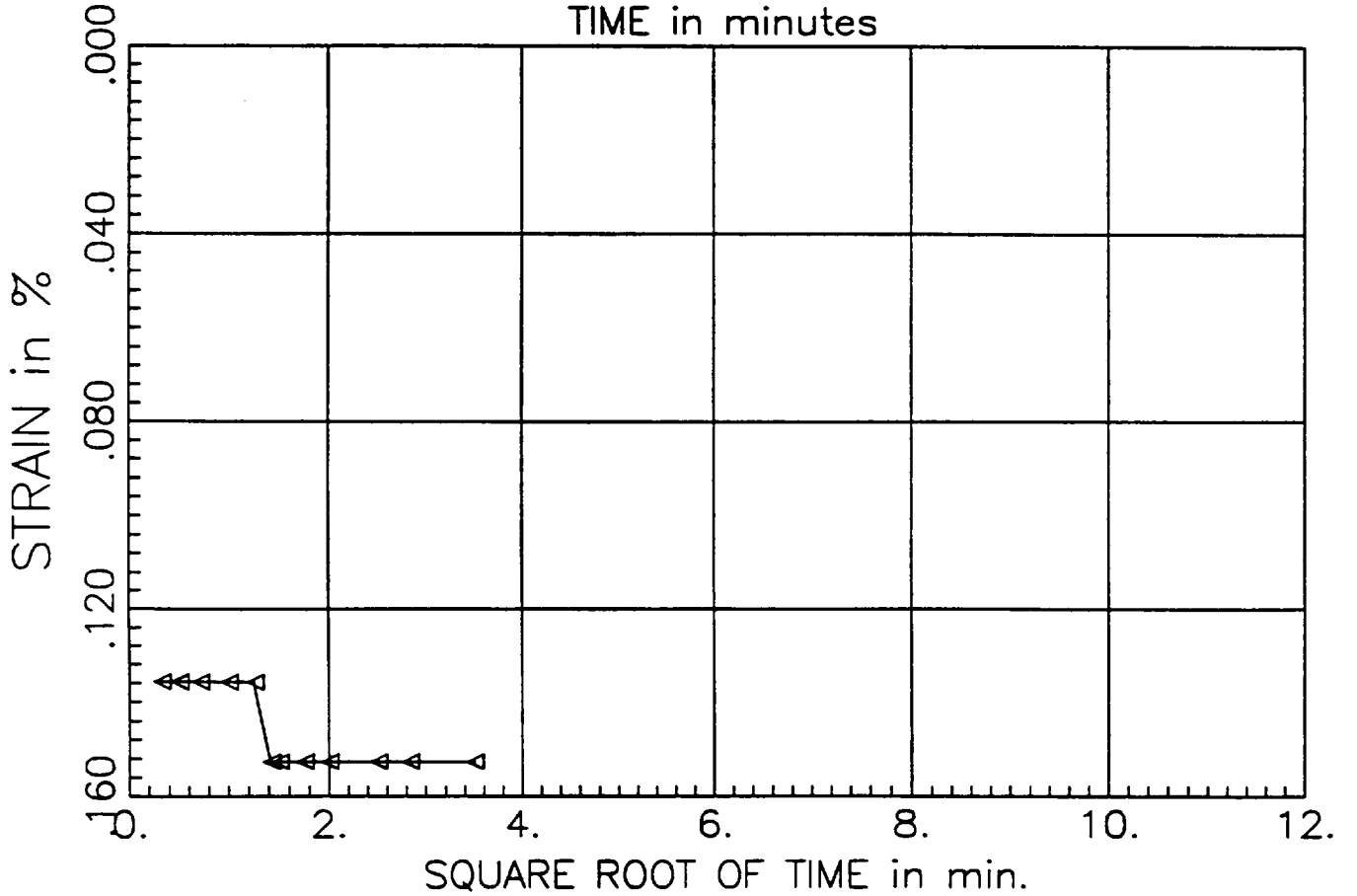
CALCULATION IDENTIFICATION NUMBER				PAGE B-1
J.O. OR W.O. NO.	DIVISION & GROUP	CALCULATION NO.	OPTIONAL TASK CODE	
05996.01	G(B)	03 - 1		

ATTACHMENT B

STRAIN vs TIME PLOTS FOR CONSOLIDATION

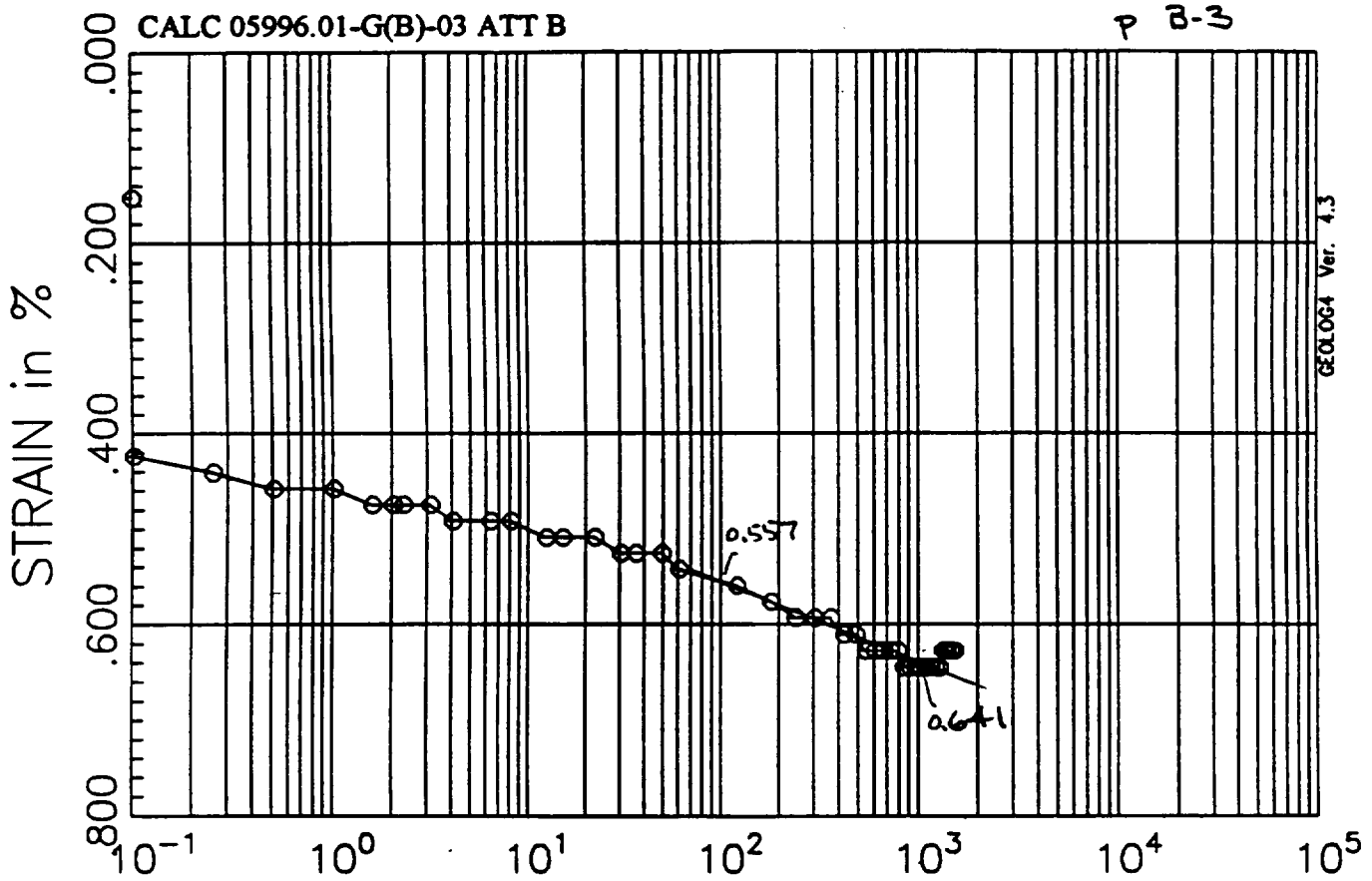
NOTE: NO CHANGES WERE MADE TO THE FOLLOWING PAGES IN REV 1 (PP B-2 TO B-43)

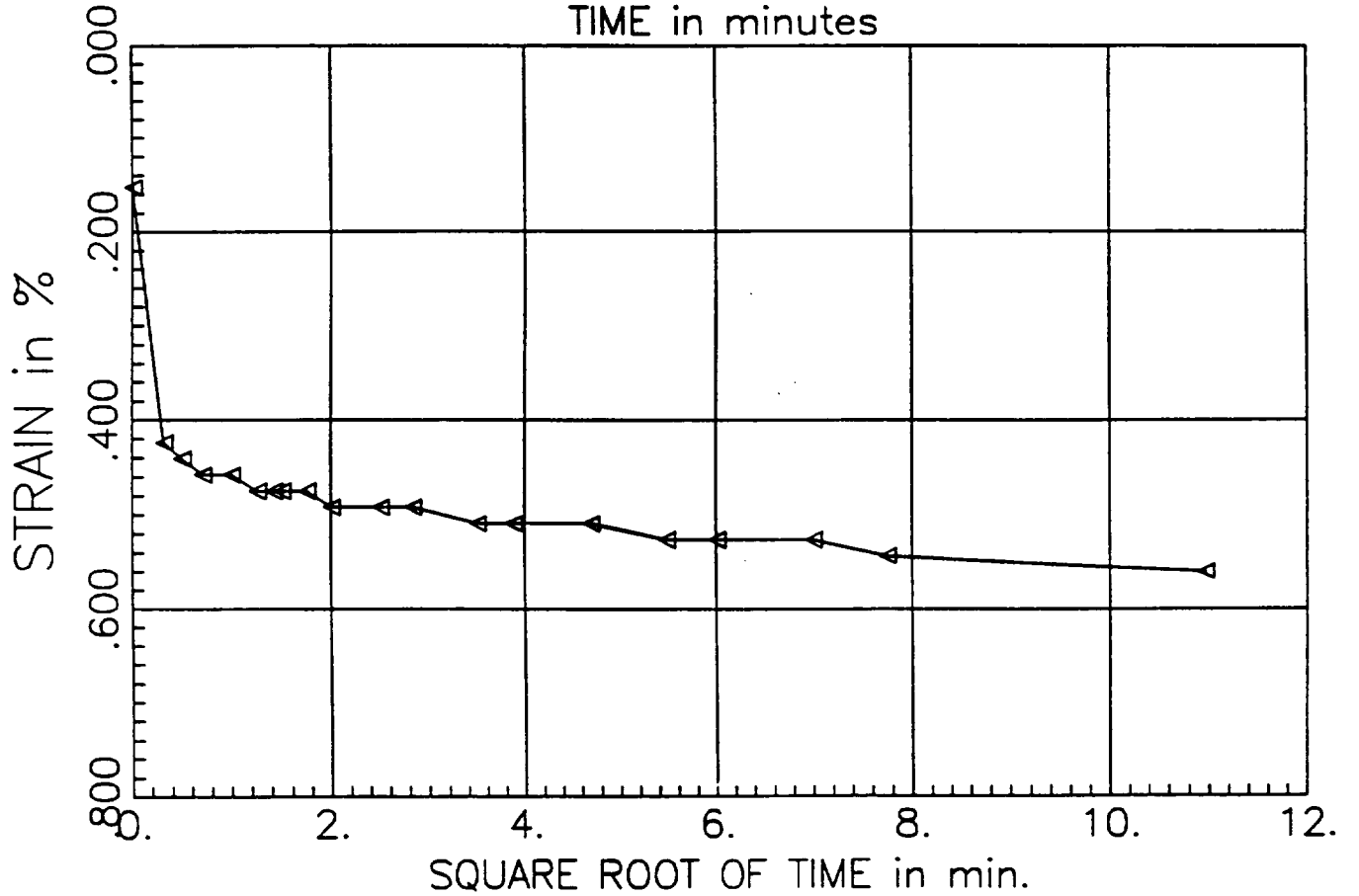




PRESSURE INCREMENT
from 0.00 tsf to 0.10 tsf

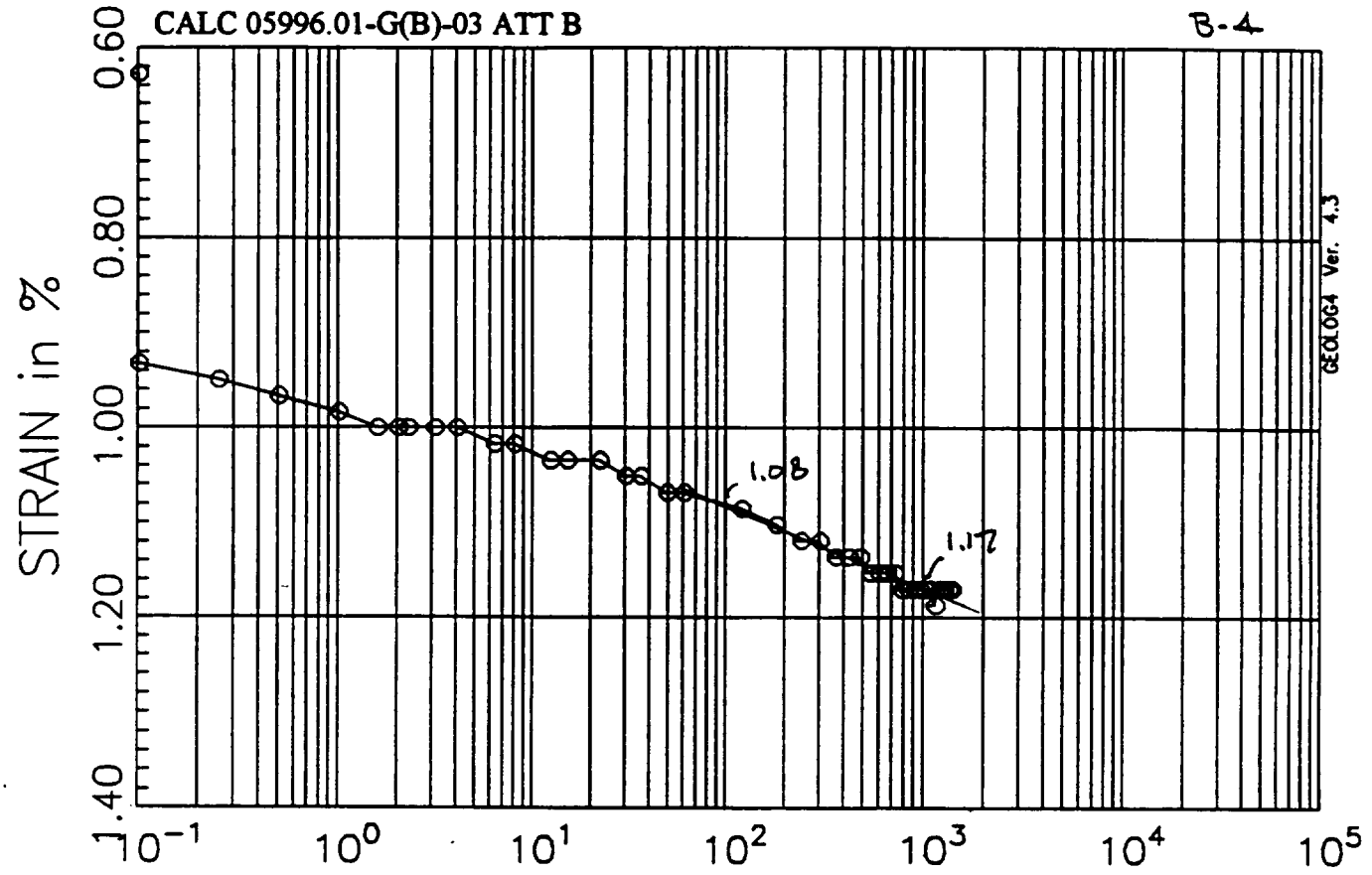
Test No: 4
Testname: C1-U3C

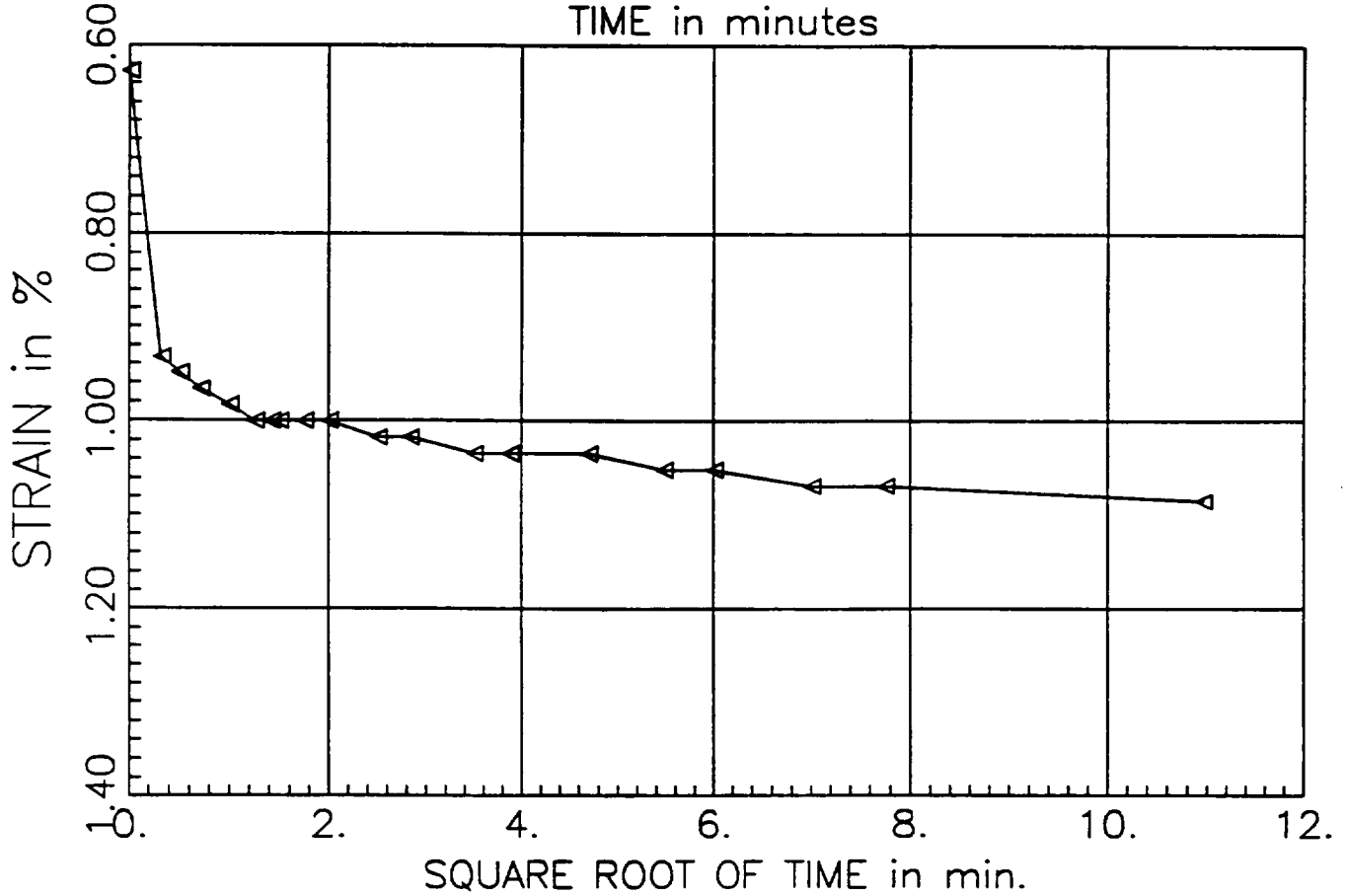




PRESSURE INCREMENT
from 0.10 tsf to 0.25 tsf

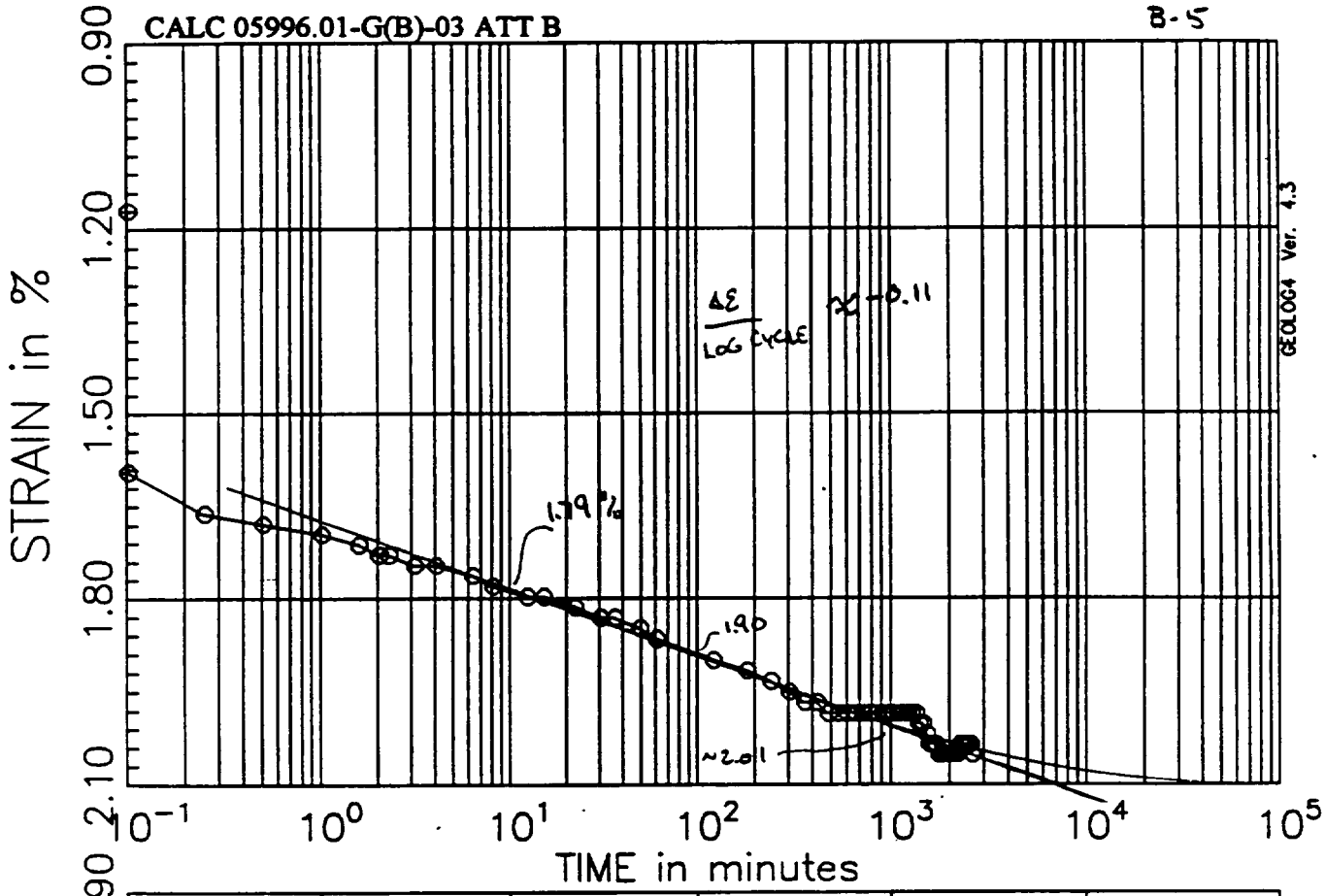
Test No: 4
Testname: C1-U3C

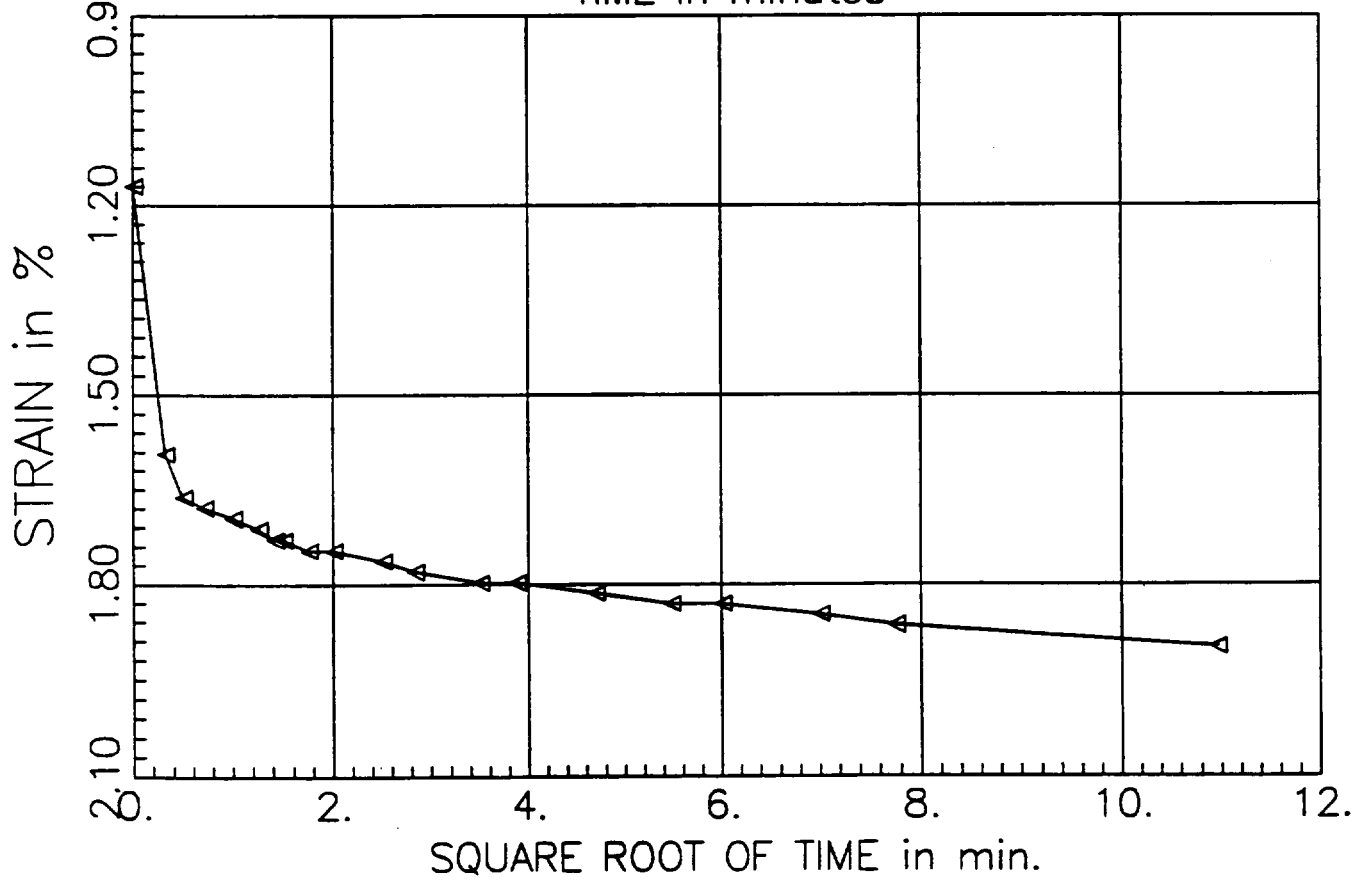




PRESSURE INCREMENT
from 0.25 tsf to 0.50 tsf

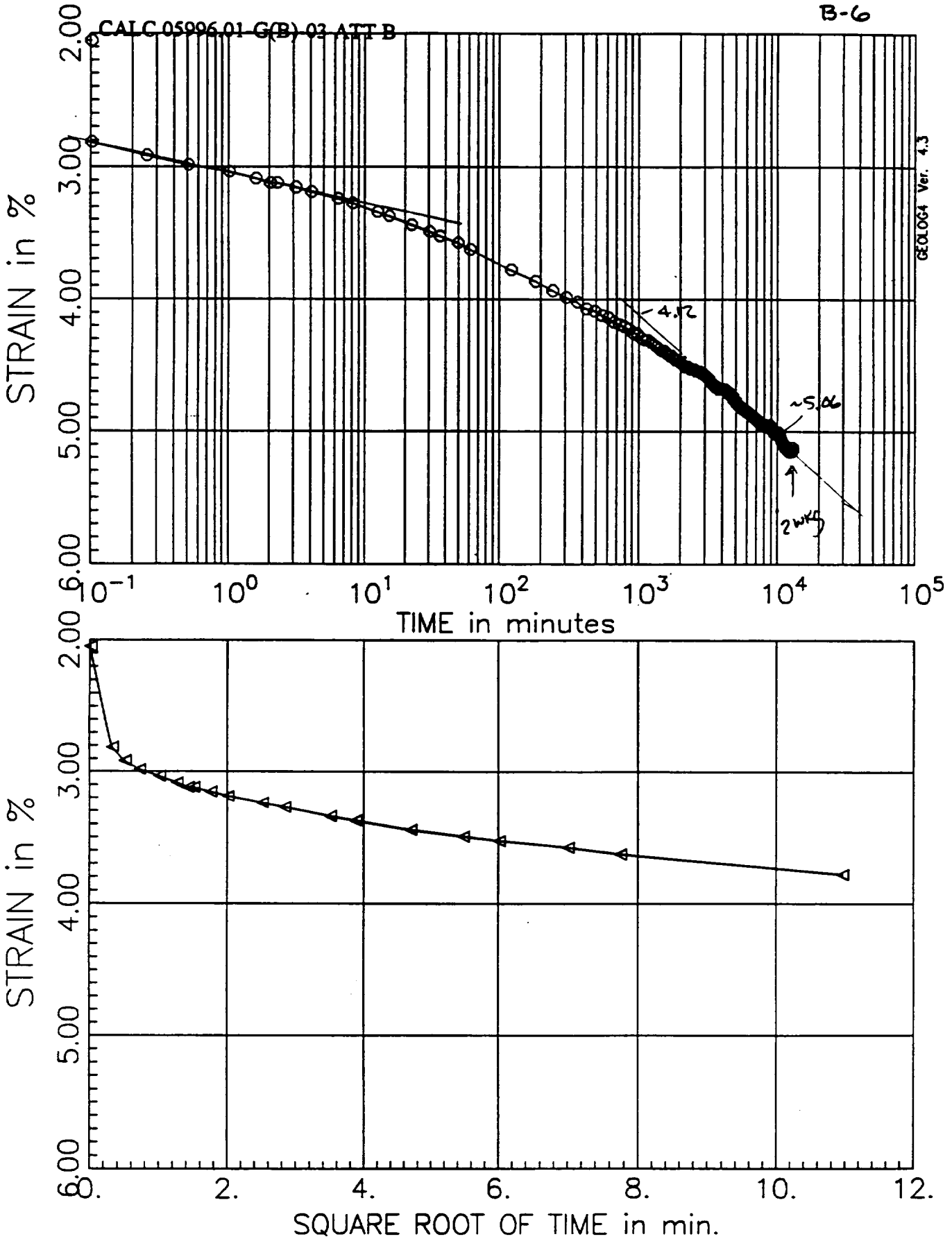
Test No: 4
Testname: C1-U3C





PRESSURE INCREMENT
from 0.50 tsf to 1.00 tsf

Test No: 4
Testname: C1-U3C



PRESSURE INCREMENT
from 1.00 tsf to 2.00 tsf

Test No: 4
Testname: C1-U3C

B-7

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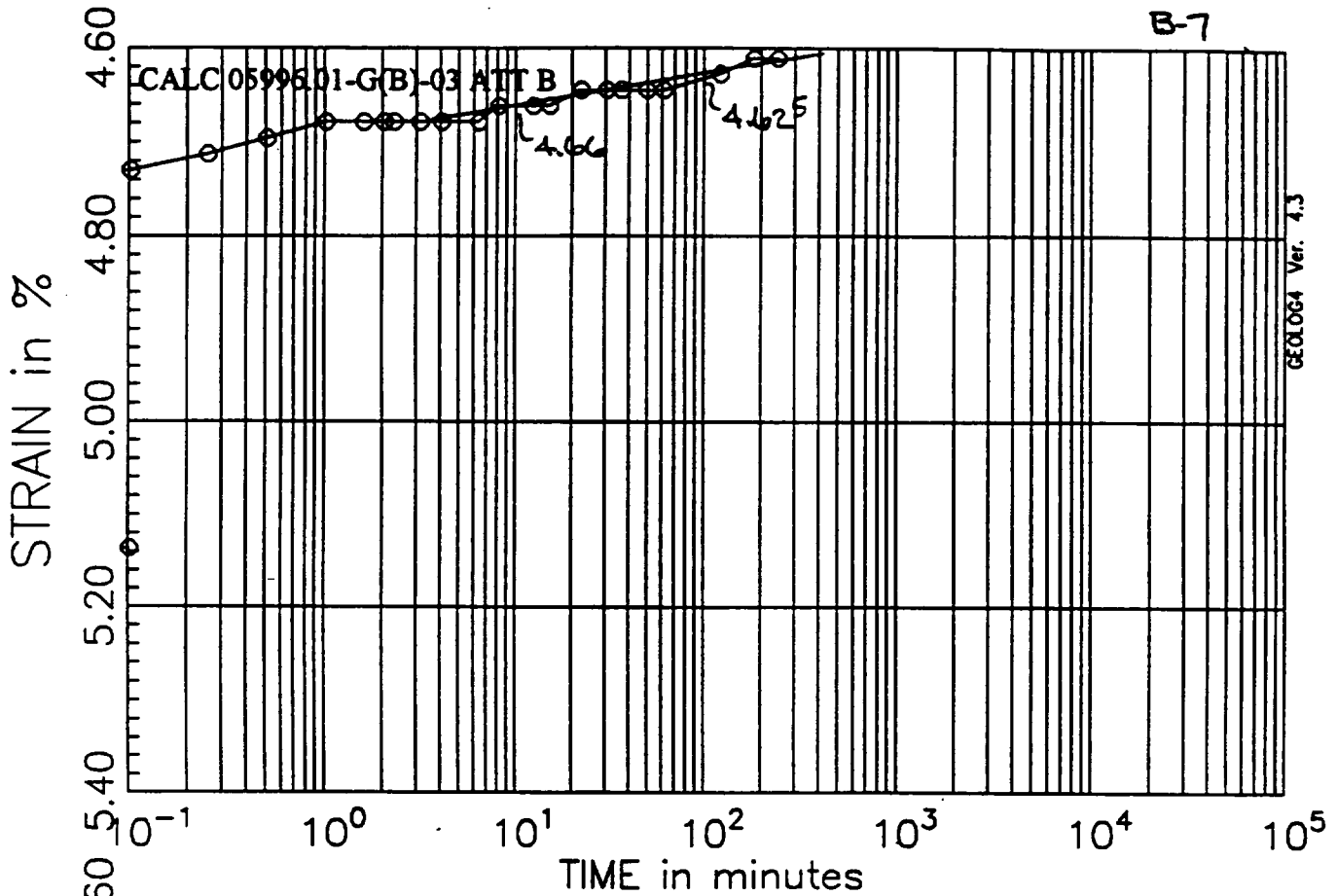
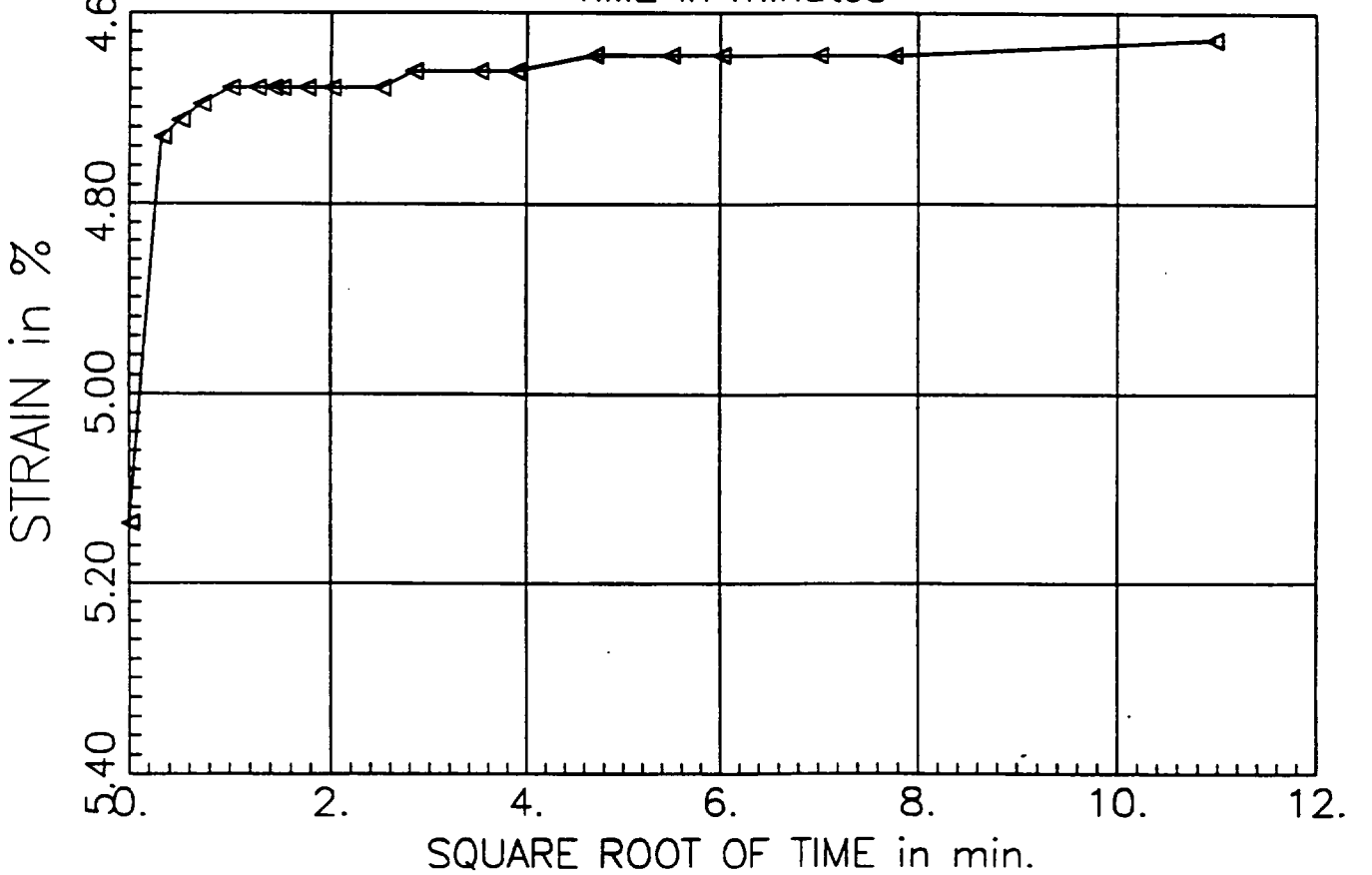
4.625

4.66

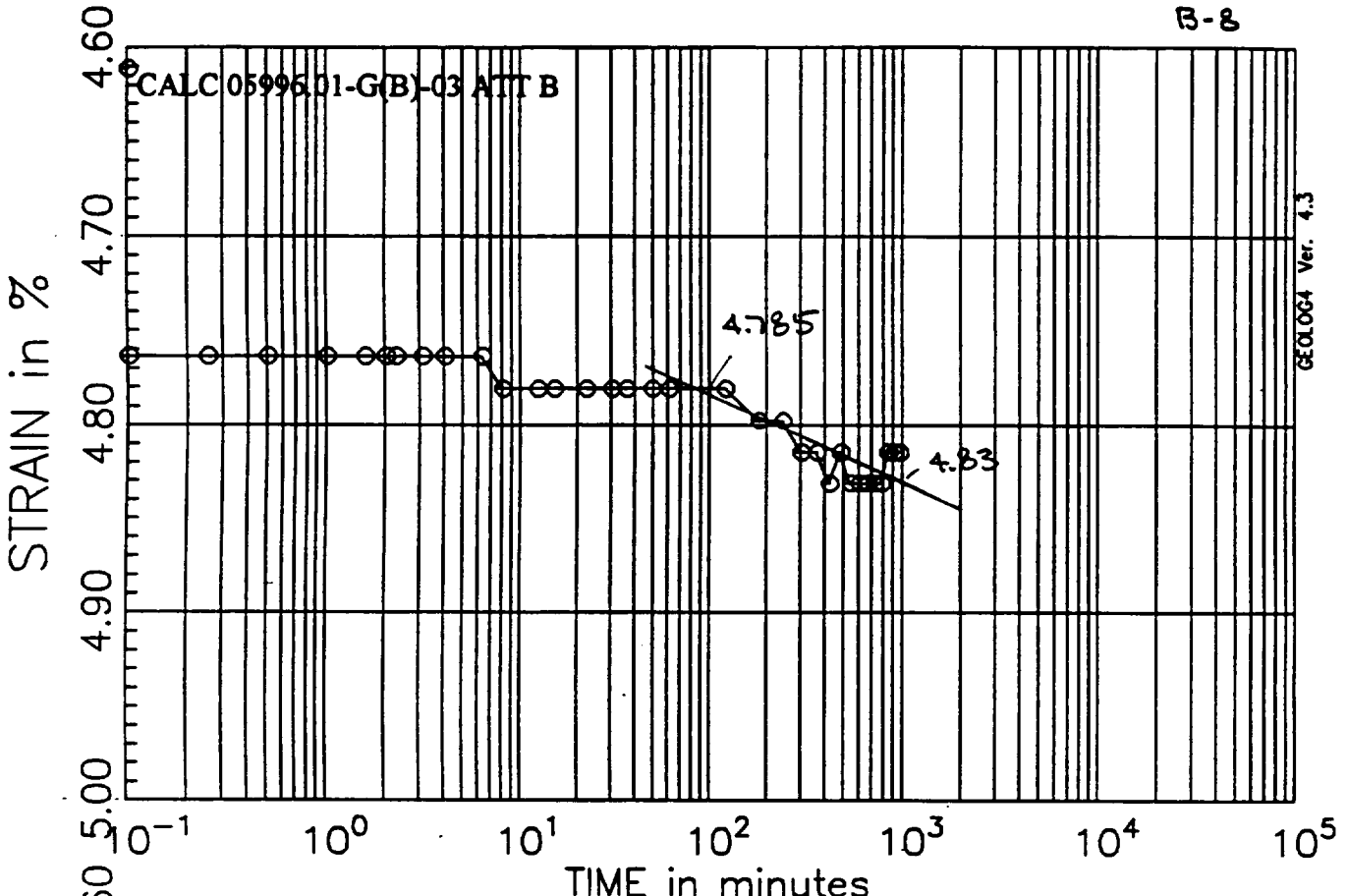


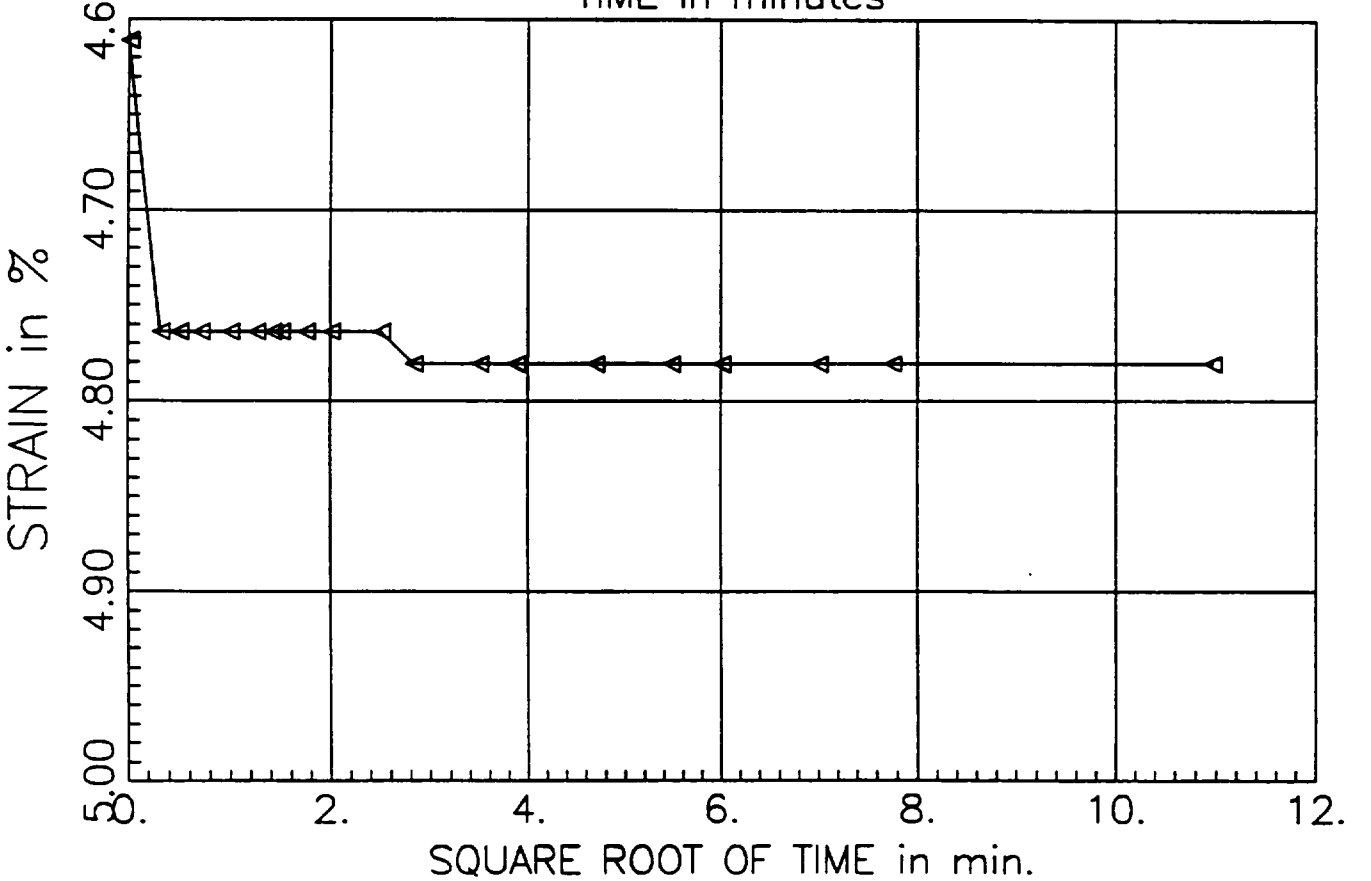


PRESSURE INCREMENT
from 2.00 tsf to 0.50 tsf

Test No: 4
Testname: C1-U3C

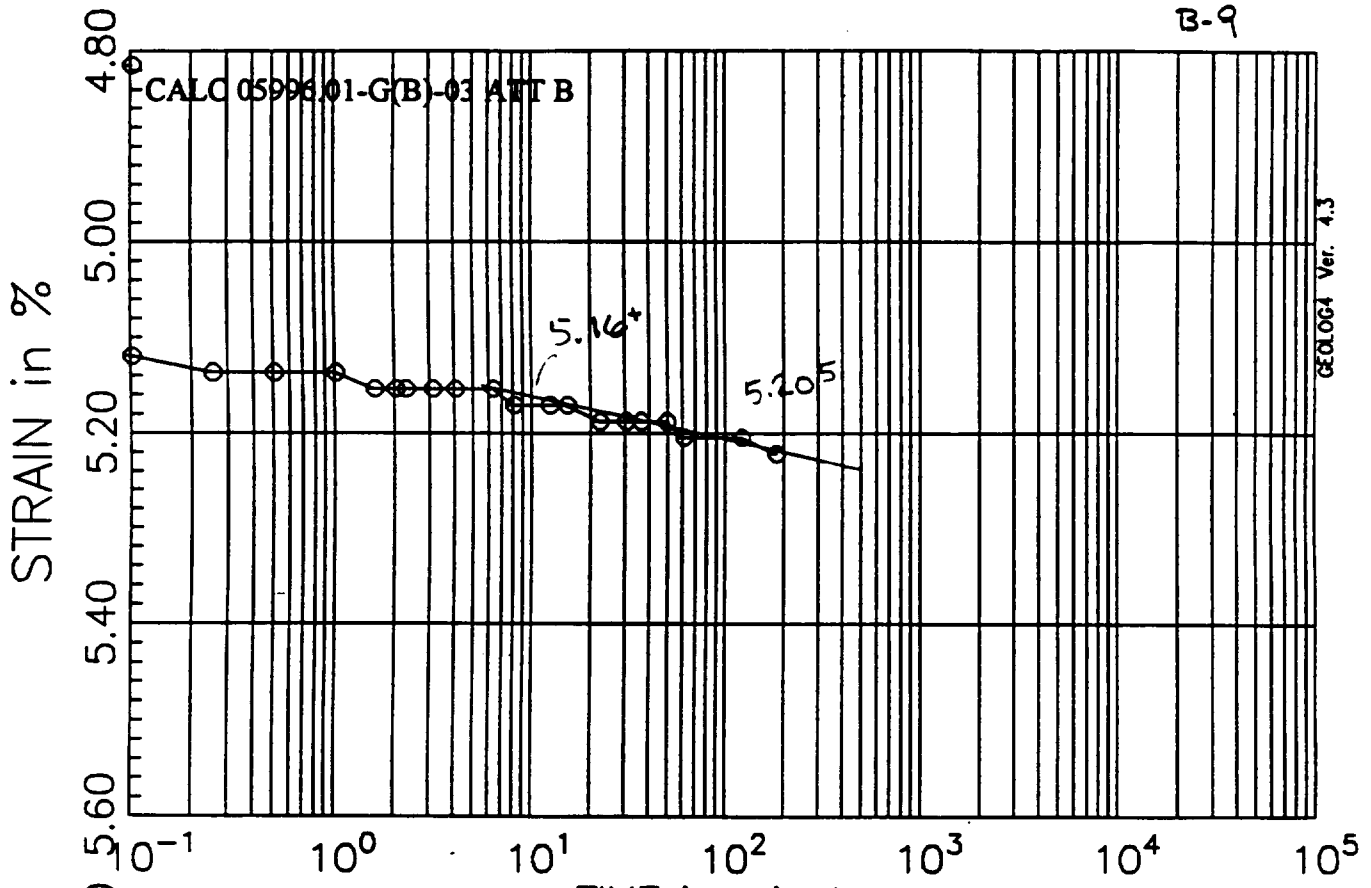
CALC 05996.01-G(B)-03 ATT B

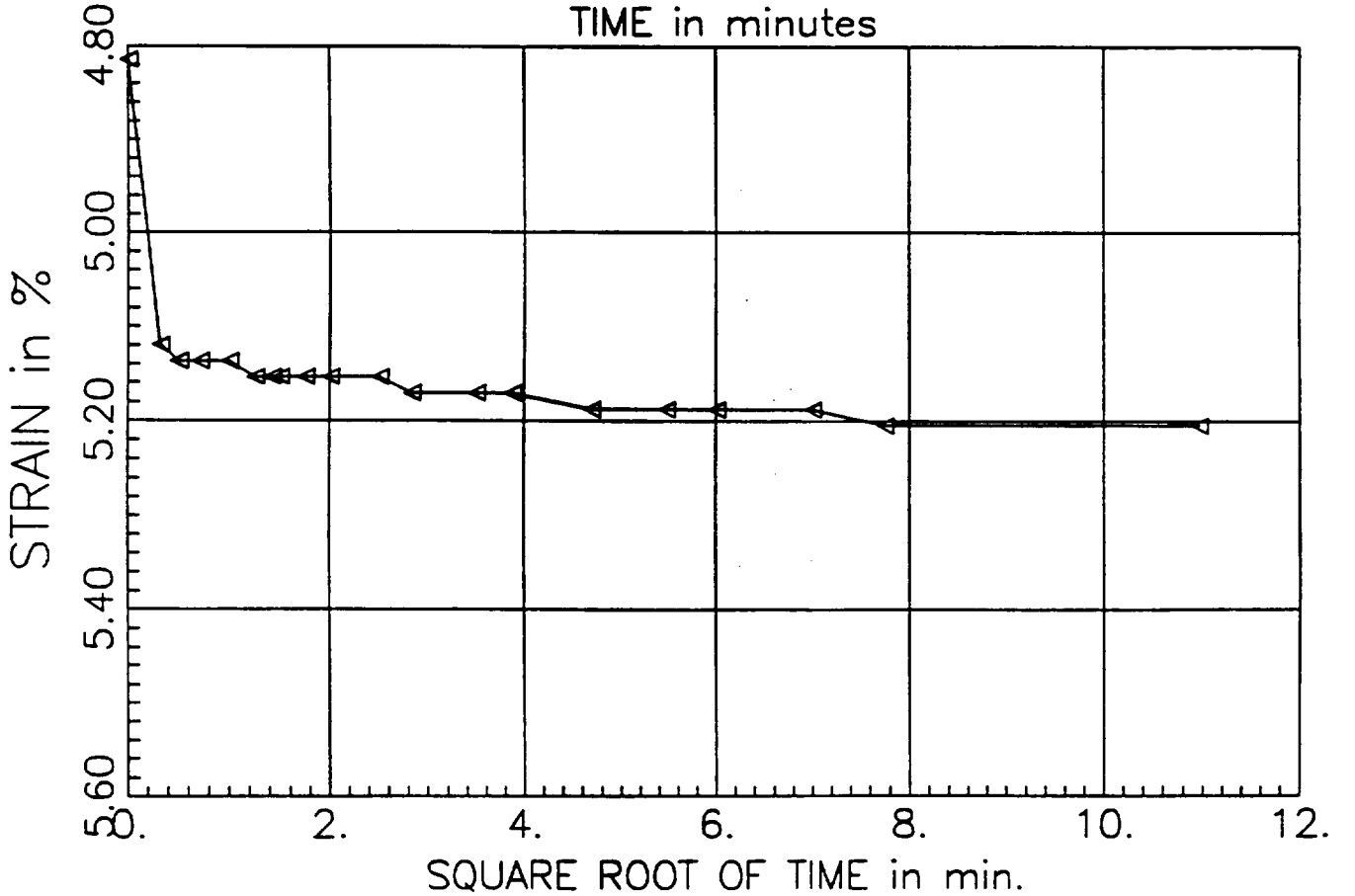




PRESSURE INCREMENT
from 0.50 tsf to 1.00 tsf

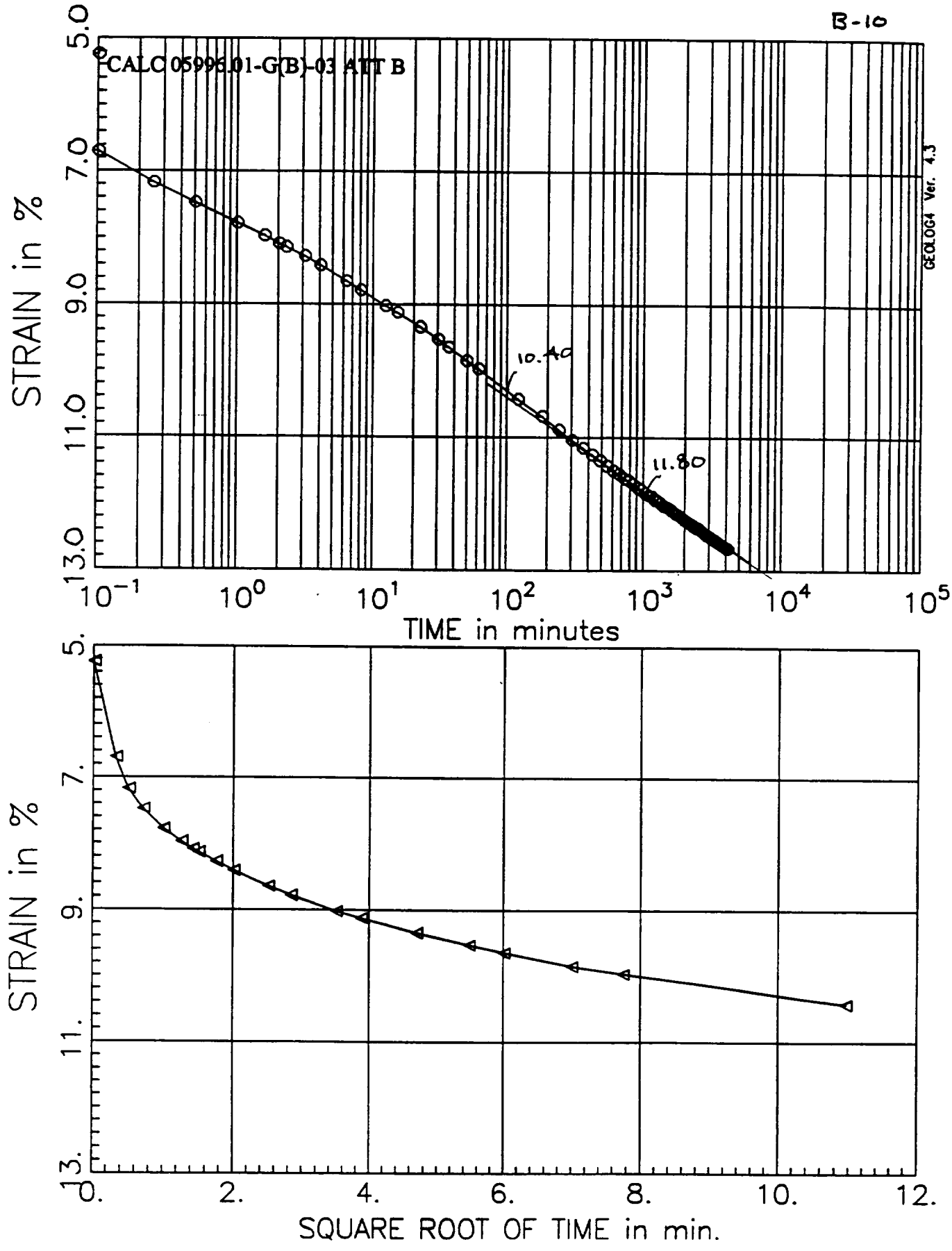
Test No: 4
Testname: C1-U3C





PRESSURE INCREMENT
from 1.00 tsf to 2.00 tsf

Test No: 4
Testname: C1-U3C



PRESSURE INCREMENT
from 2.00 tsf to 4.00 tsf

Test No: 4
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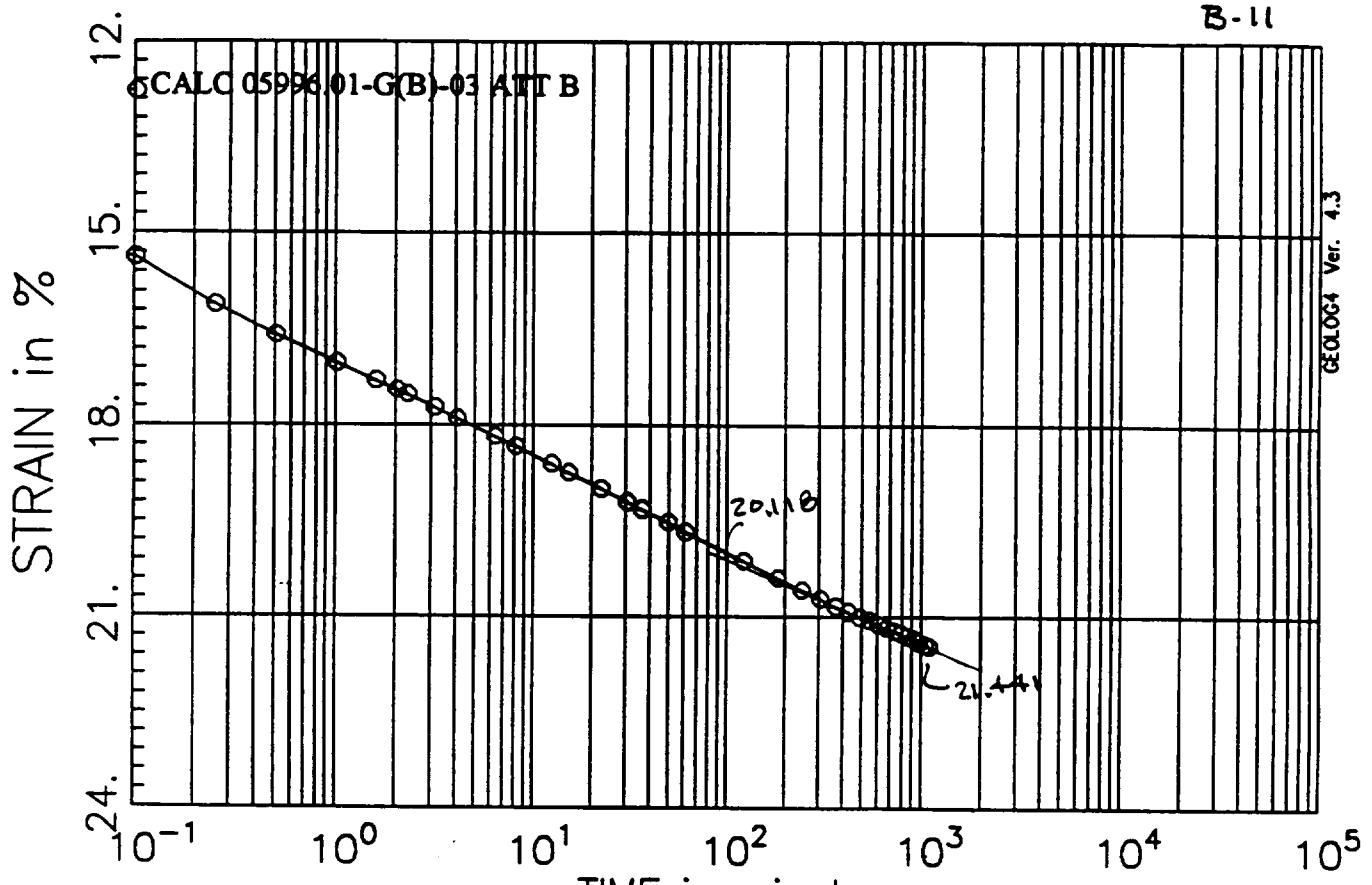
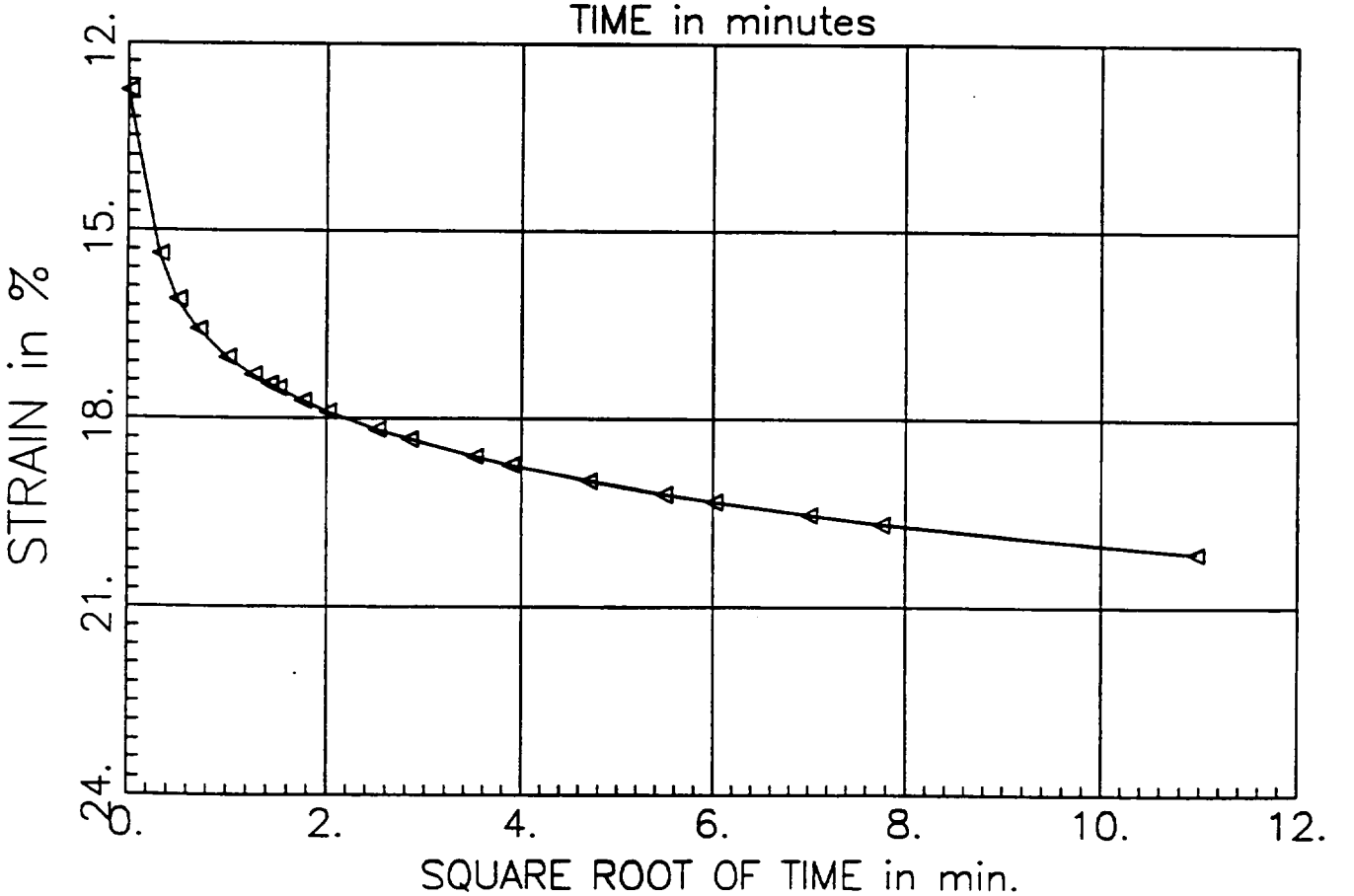
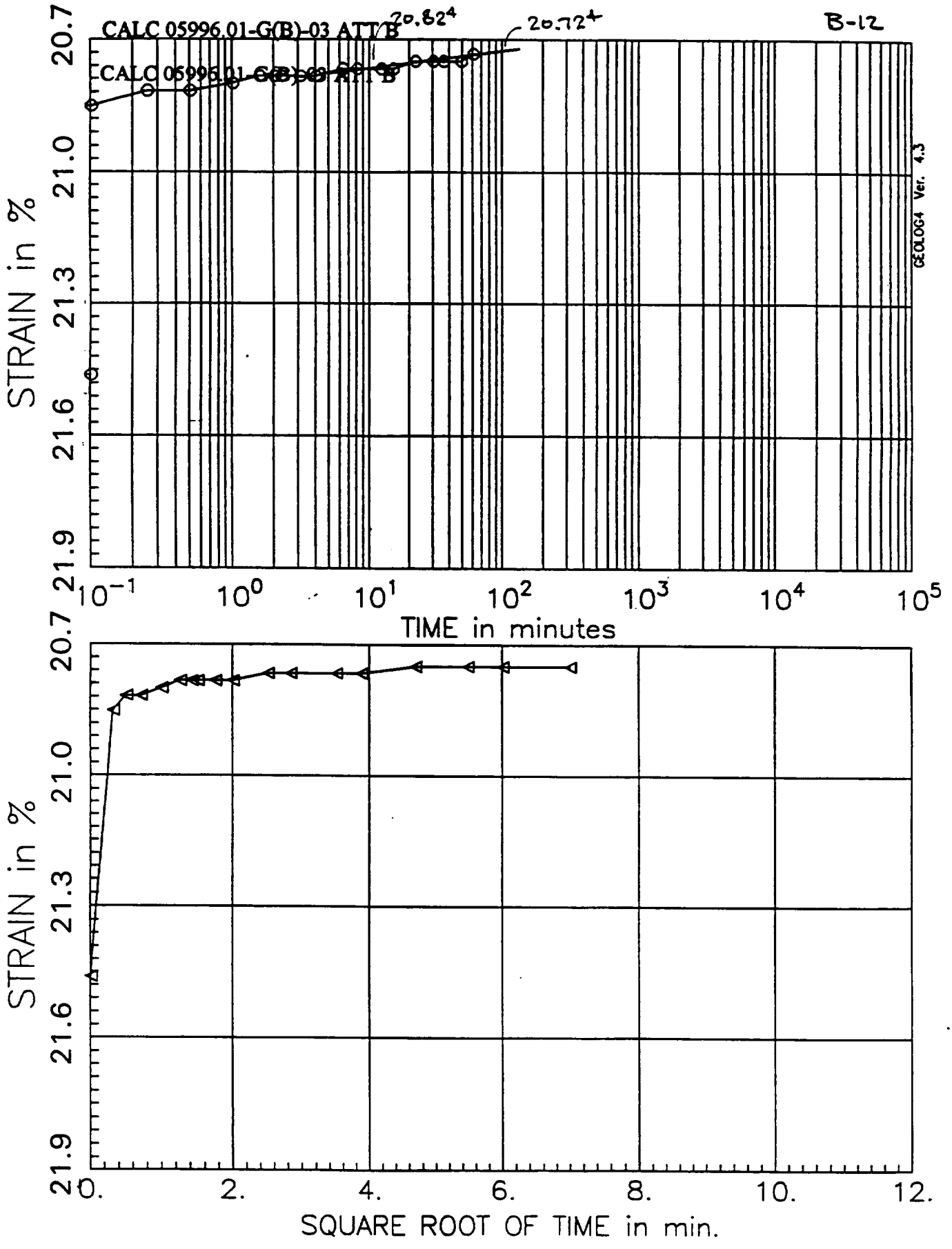




PRESSURE INCREMENT
from 4.00 tsf to 8.00 tsf

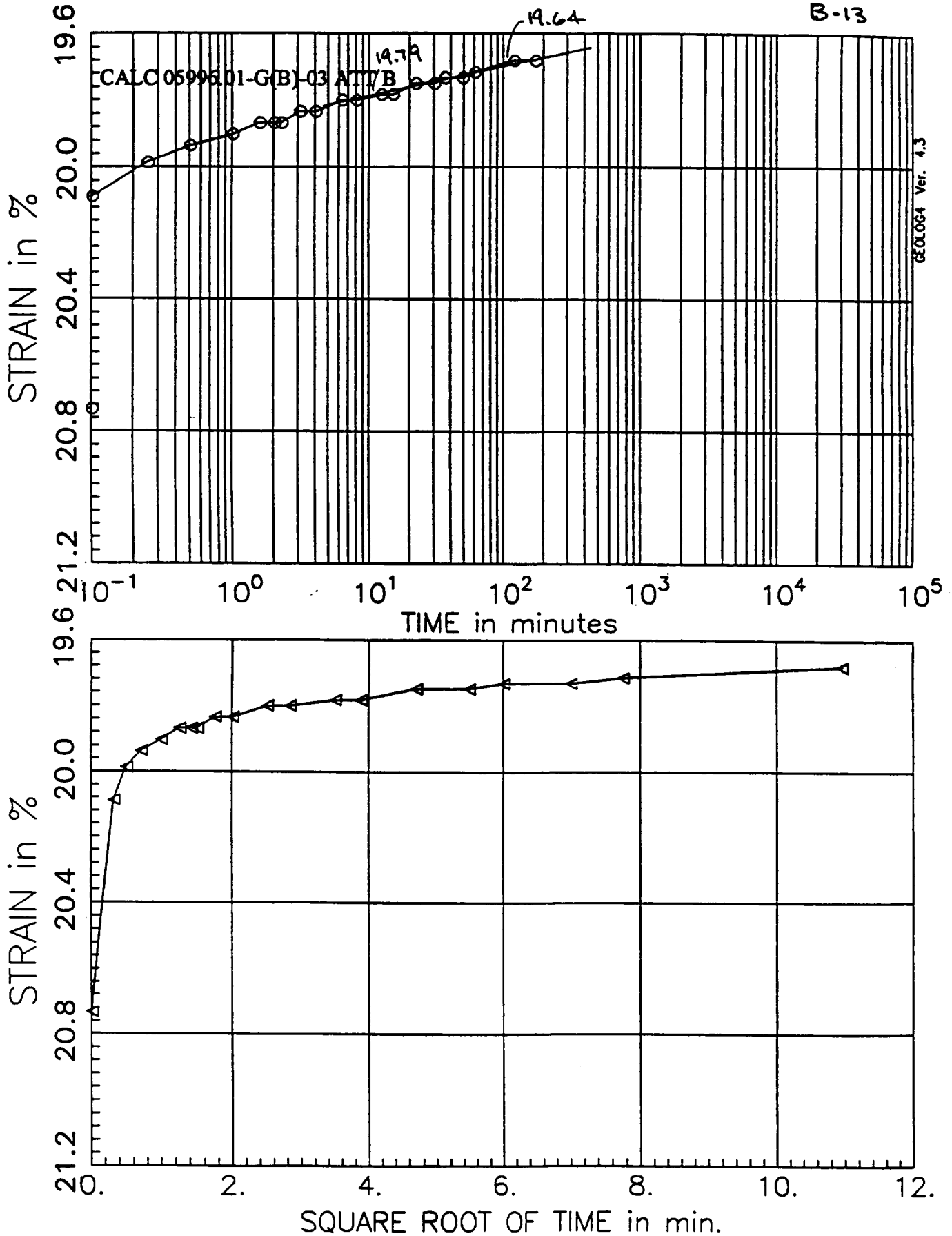
Test No: 4
Testname: C1-U3C



PRESSURE INCREMENT
from 8.00 tsf to 2.00 tsf

Test No: 4
Testname: C1-U3C

B-13



PRESSURE INCREMENT
from 2.00 tsf to 0.50 tsf

Test No: 4
Testname: C1-U3C

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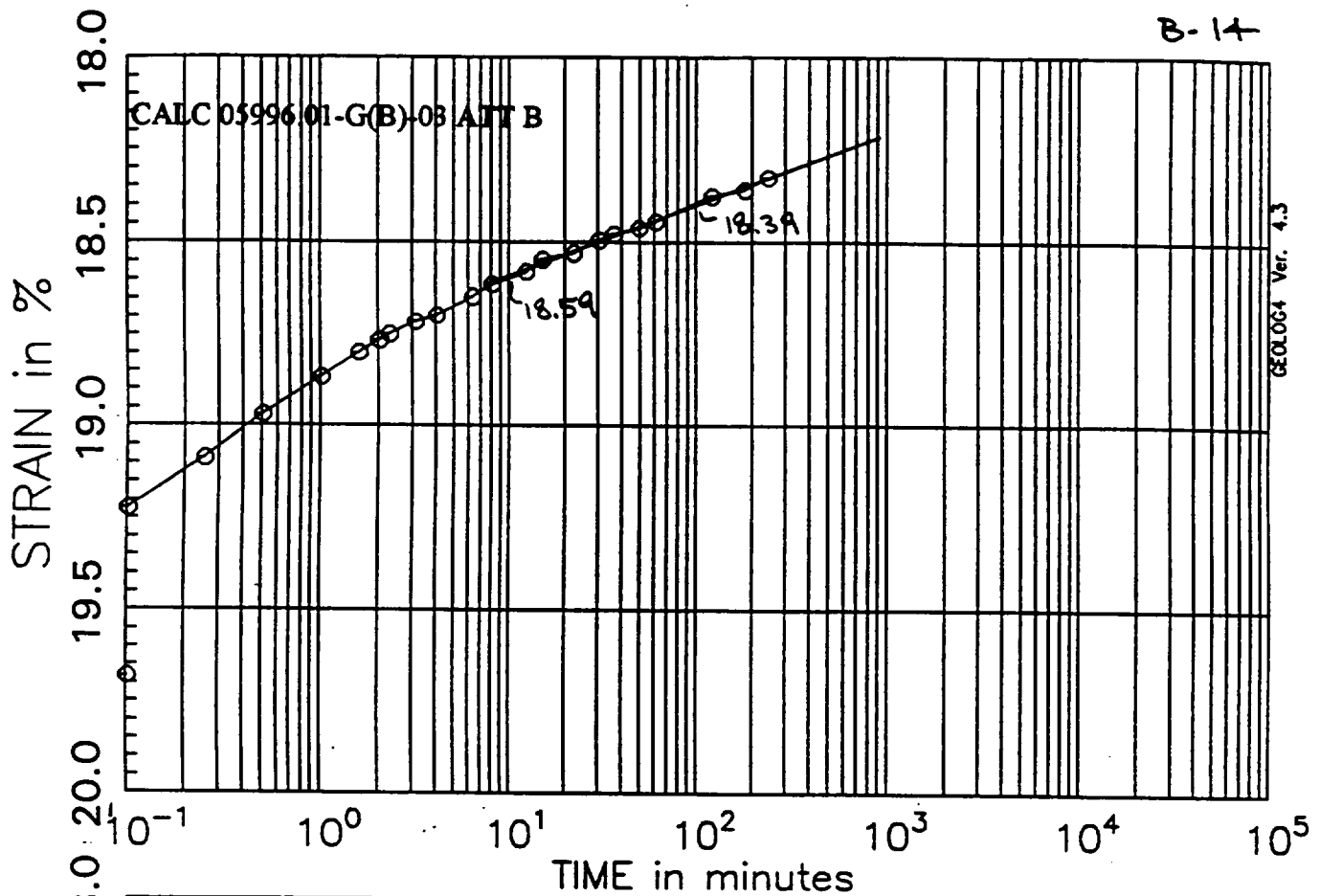
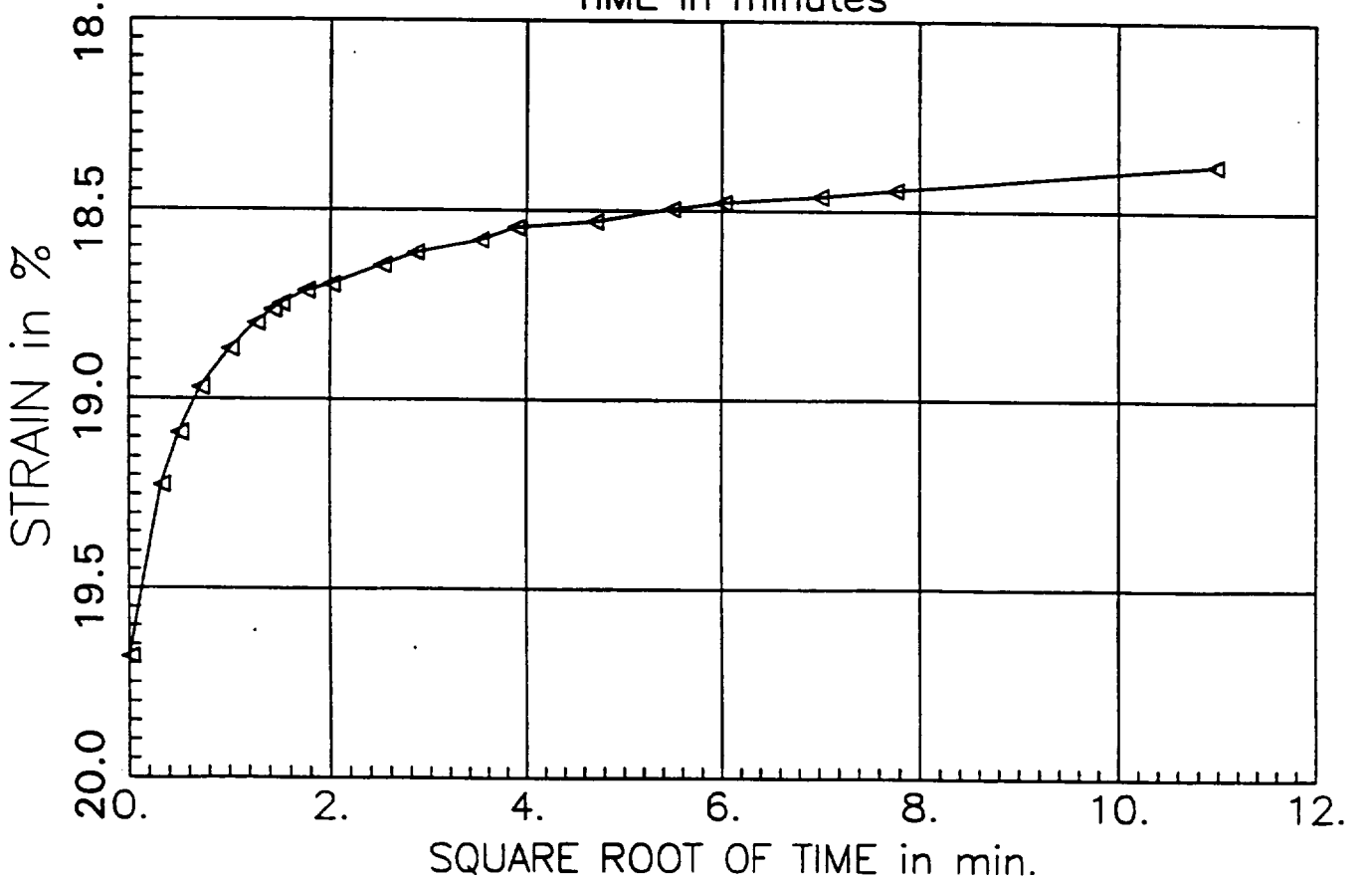
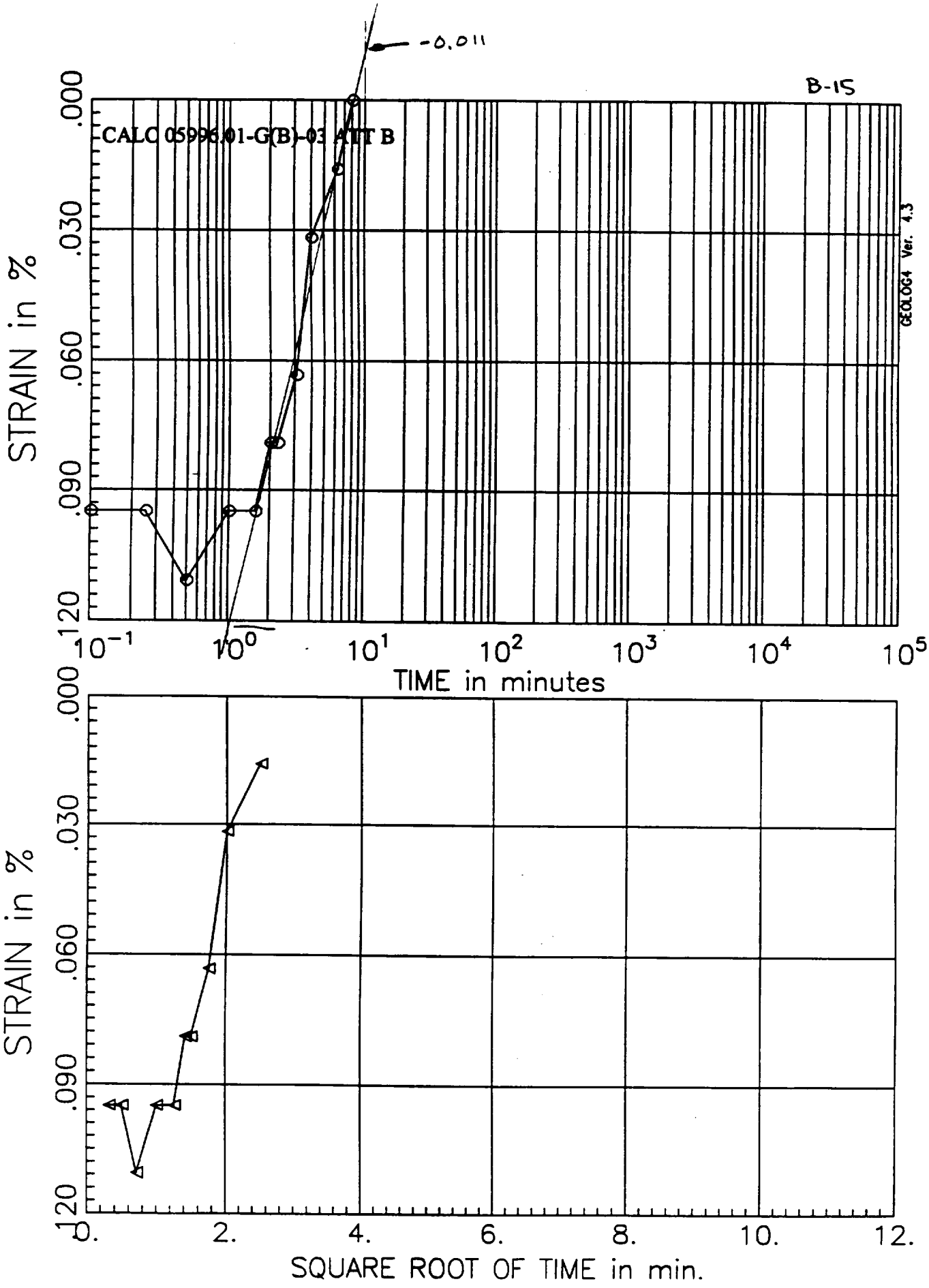




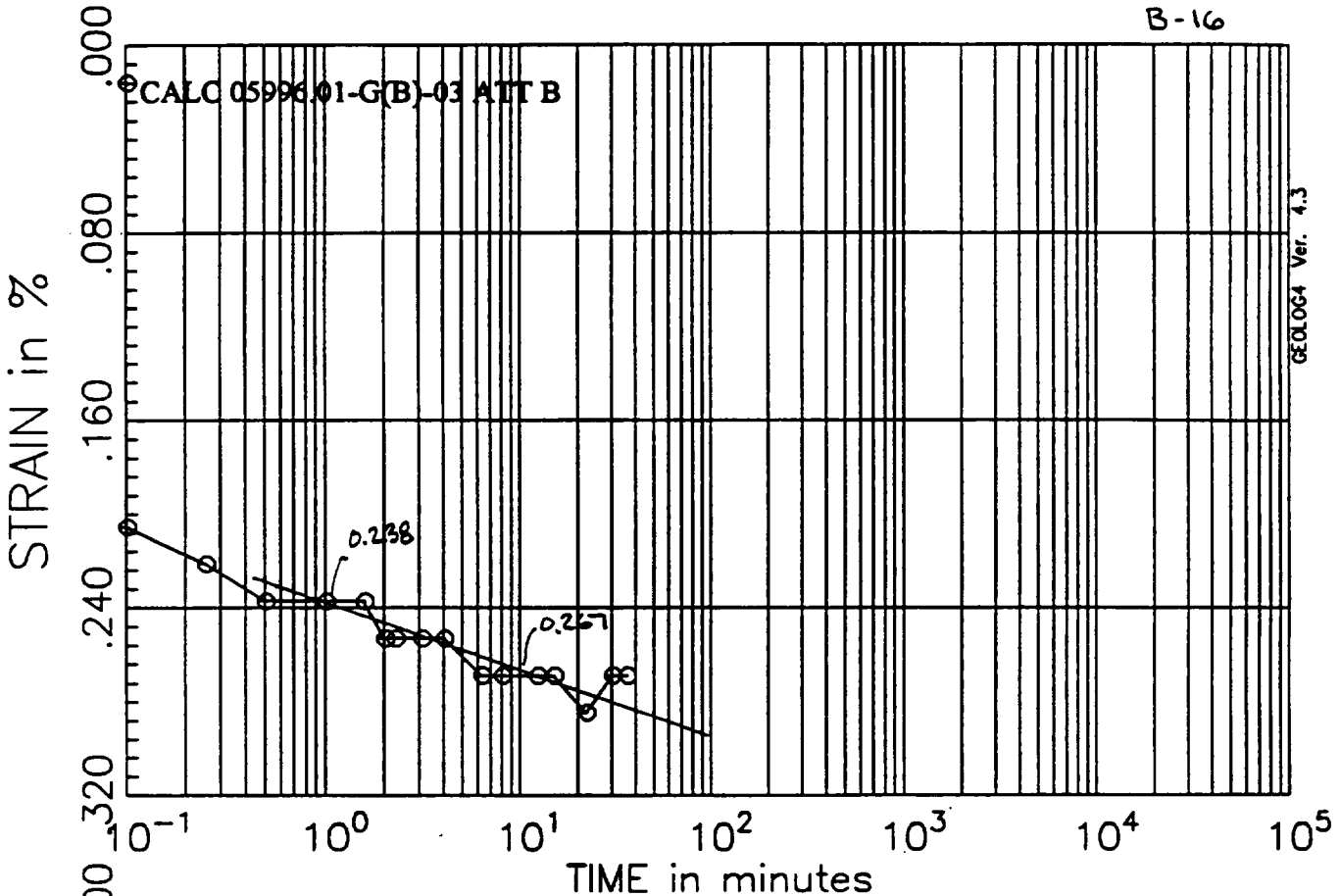
PRESSURE INCREMENT
from 0.50 tsf to 0.10 tsf

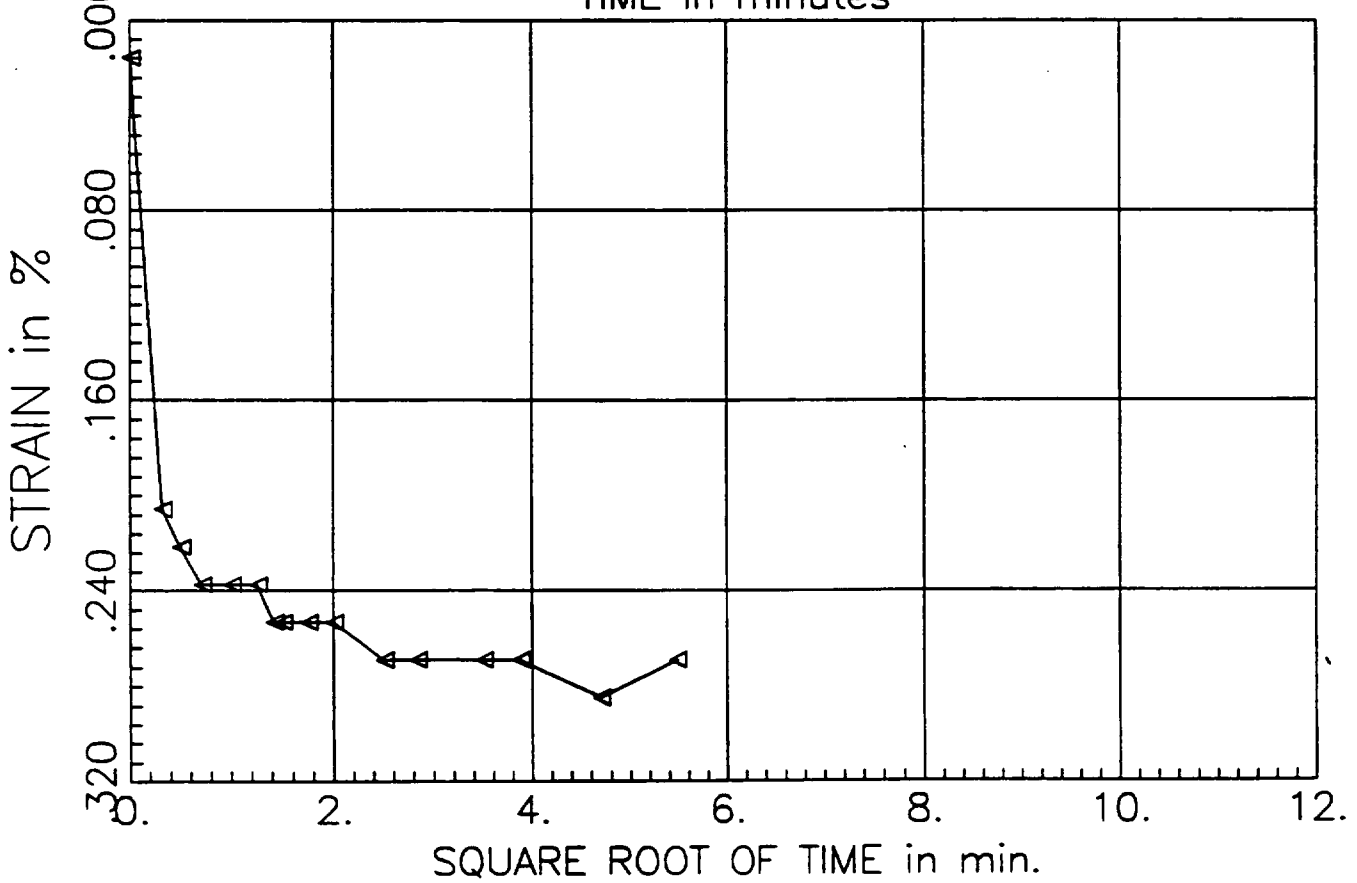
Test No: 4
Testname: C1-U3C



PRESSURE INCREMENT
from 0.00 tsf to 0.10 tsf

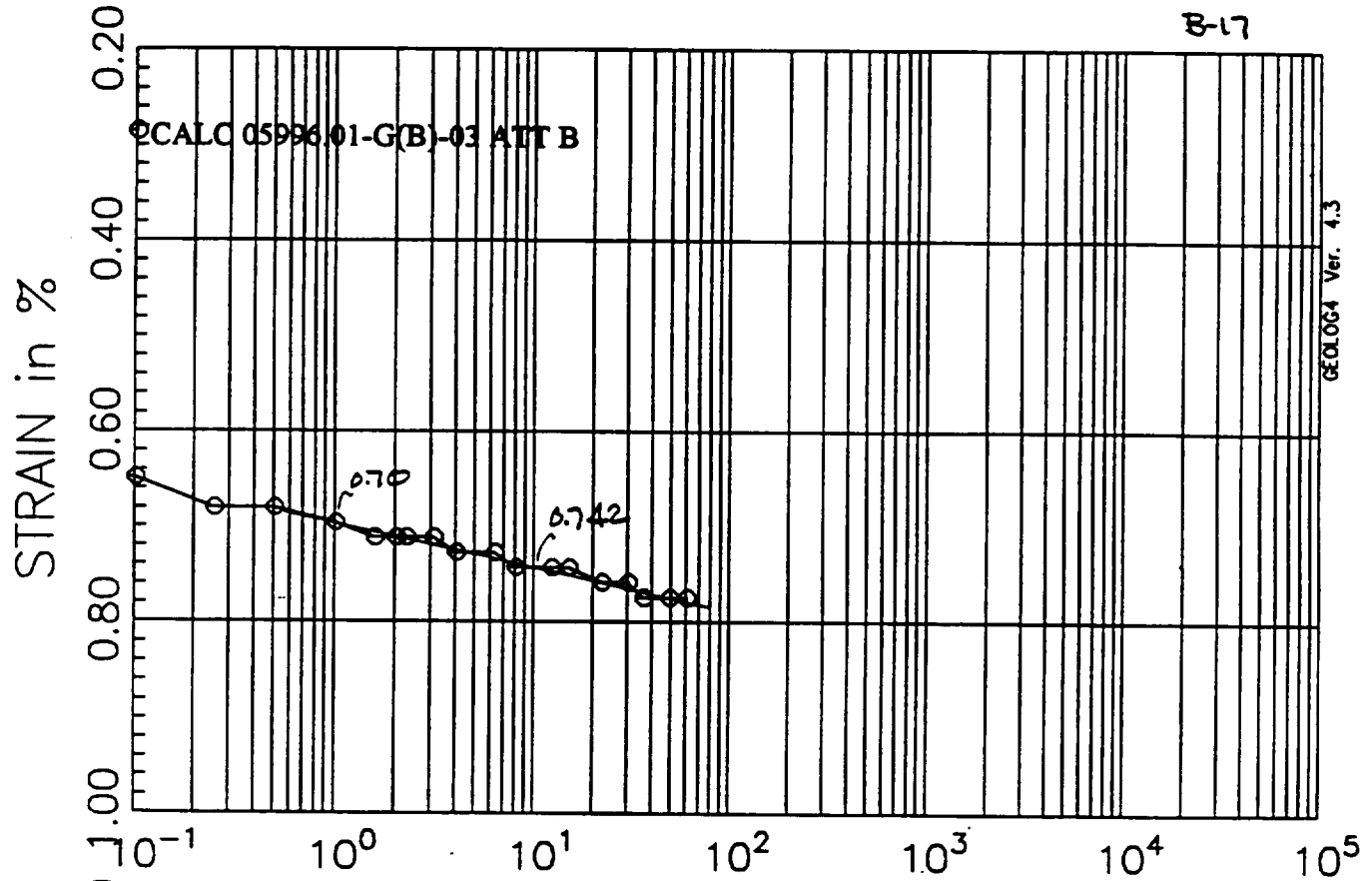
Test No: 2
Testname: C1-U3D

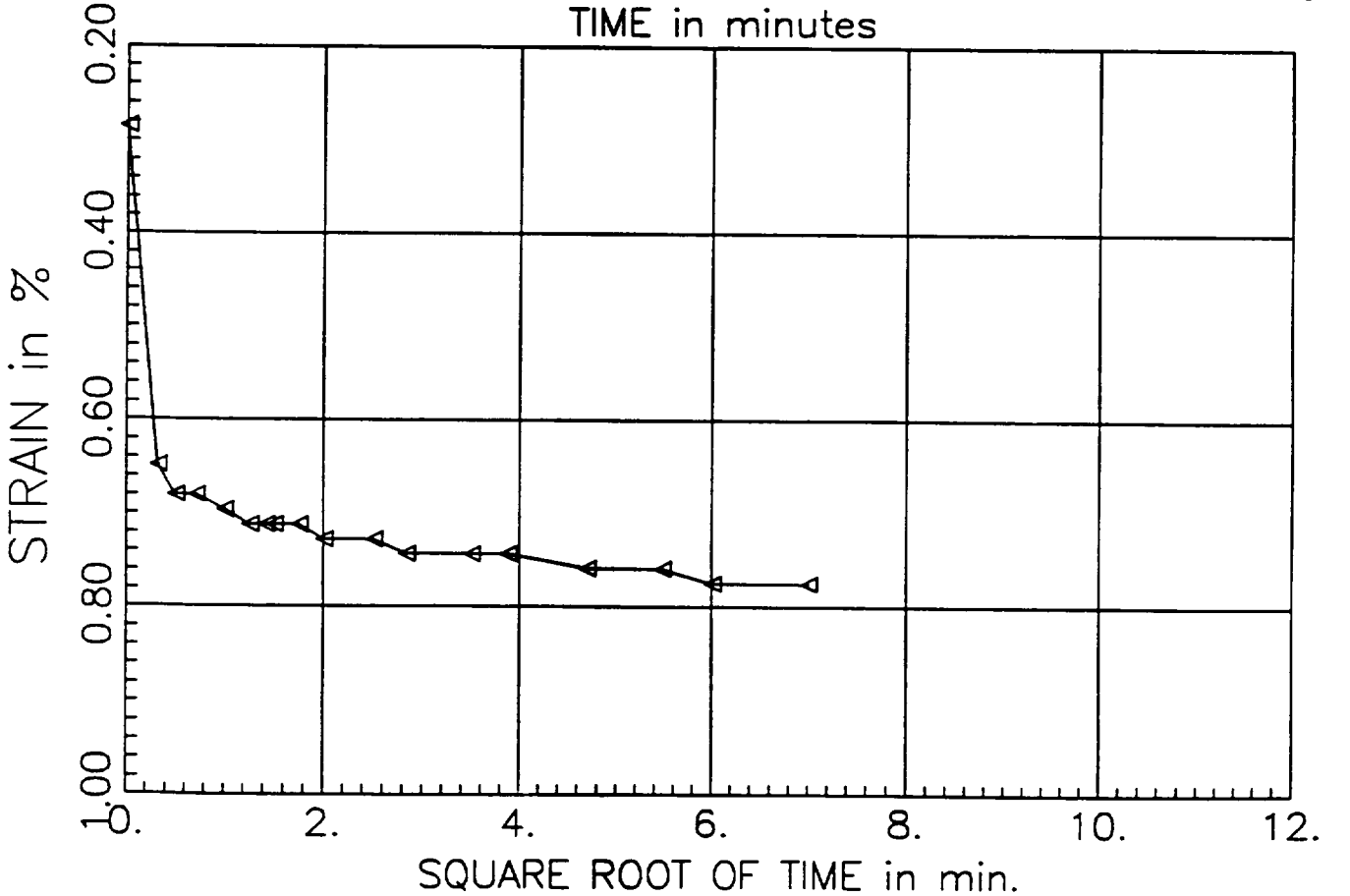




PRESSURE INCREMENT
from 0.10 tsf to 0.25 tsf

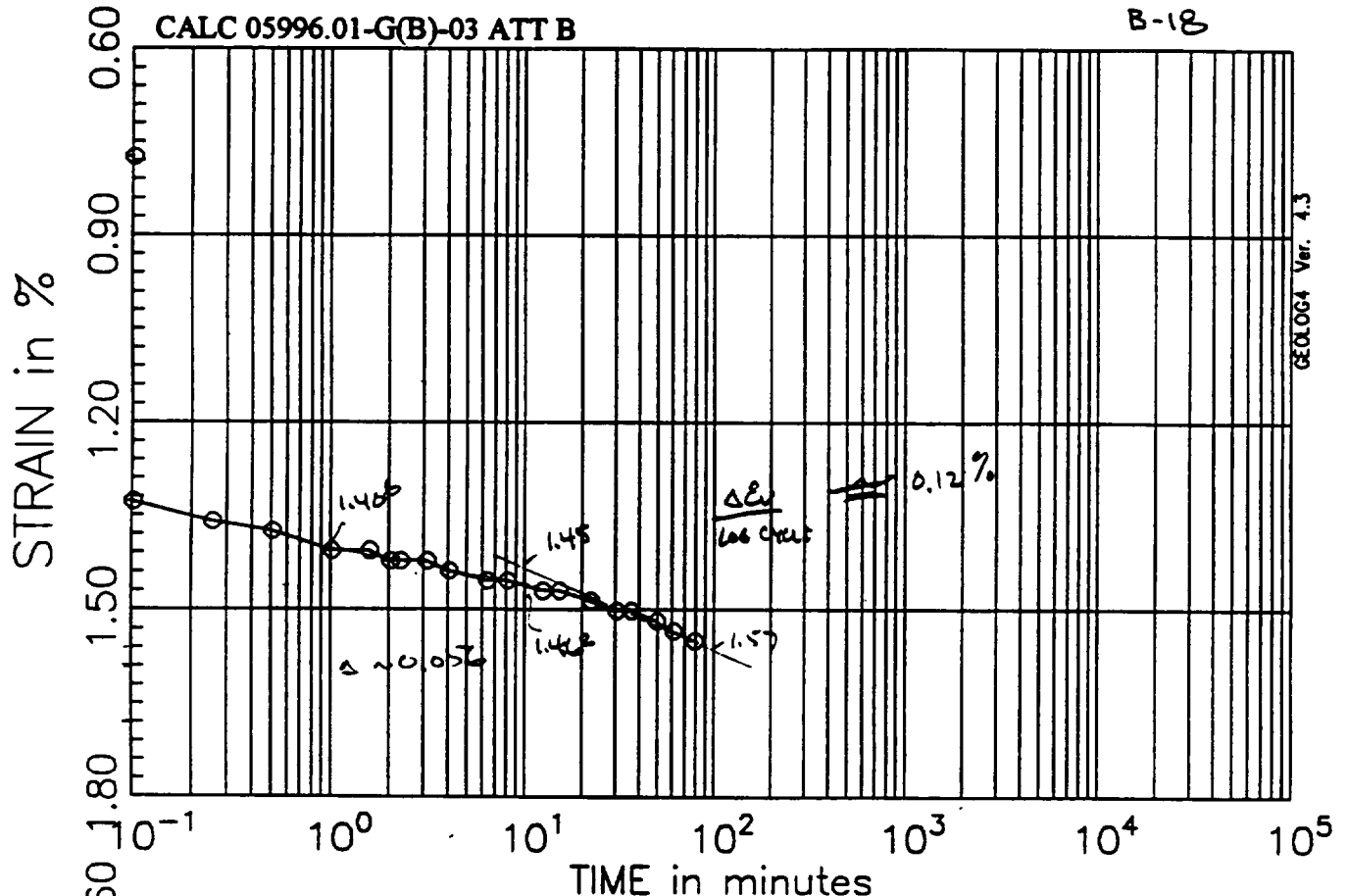
Test No: 2
Testname: C1-U3D

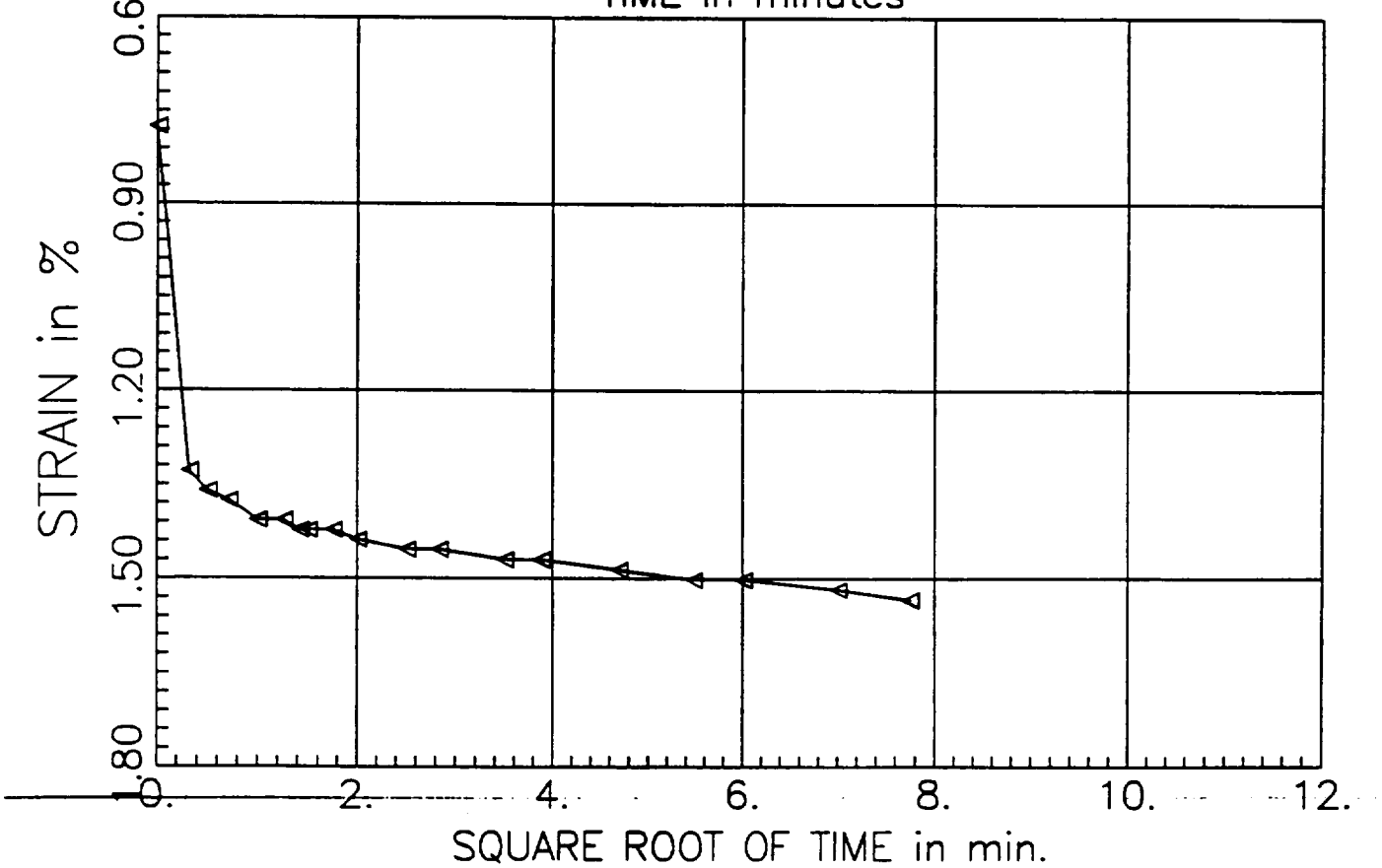




PRESSURE INCREMENT
from 0.25 tsf to 0.50 tsf

Test No: 2
Testname: C1-U3D



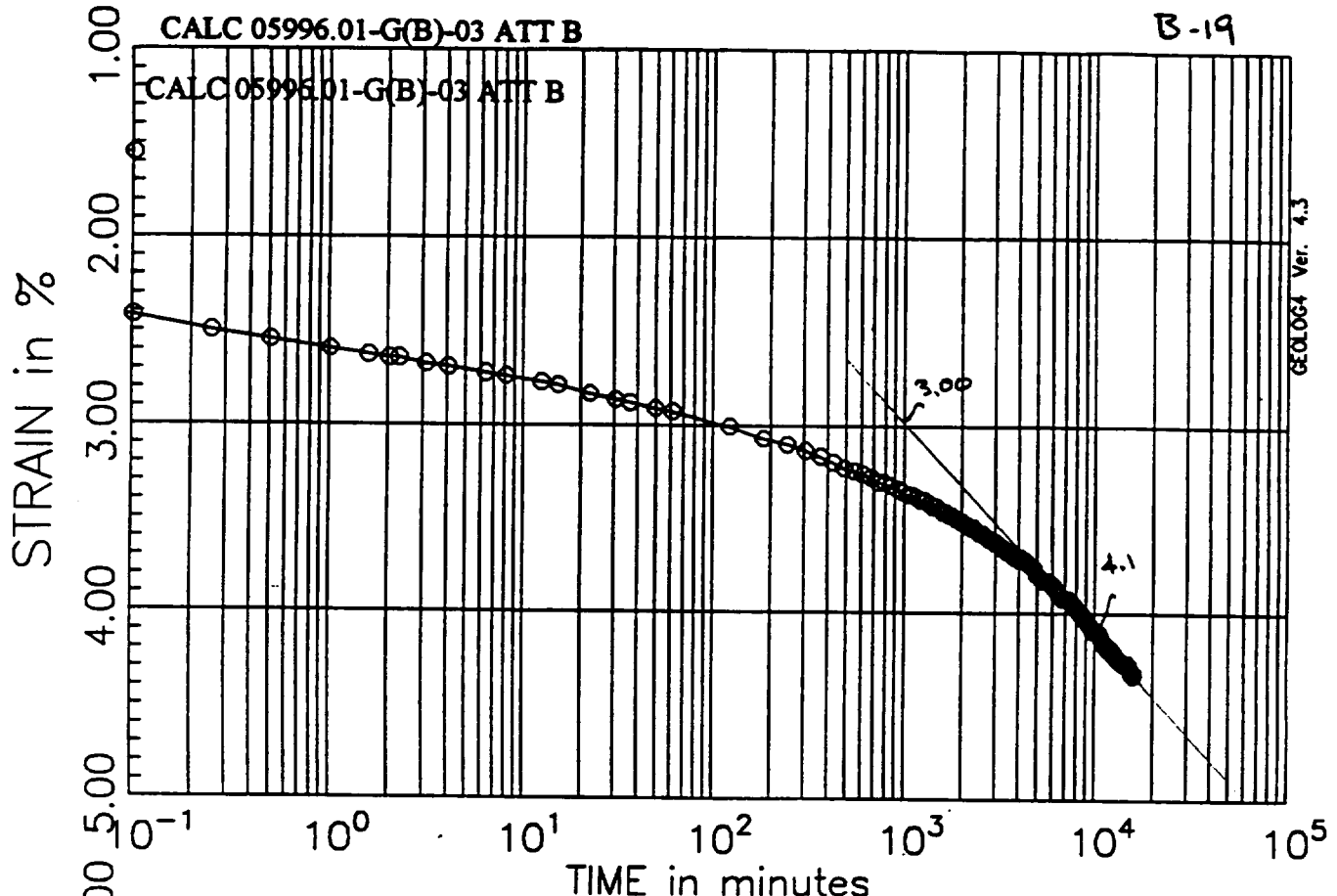


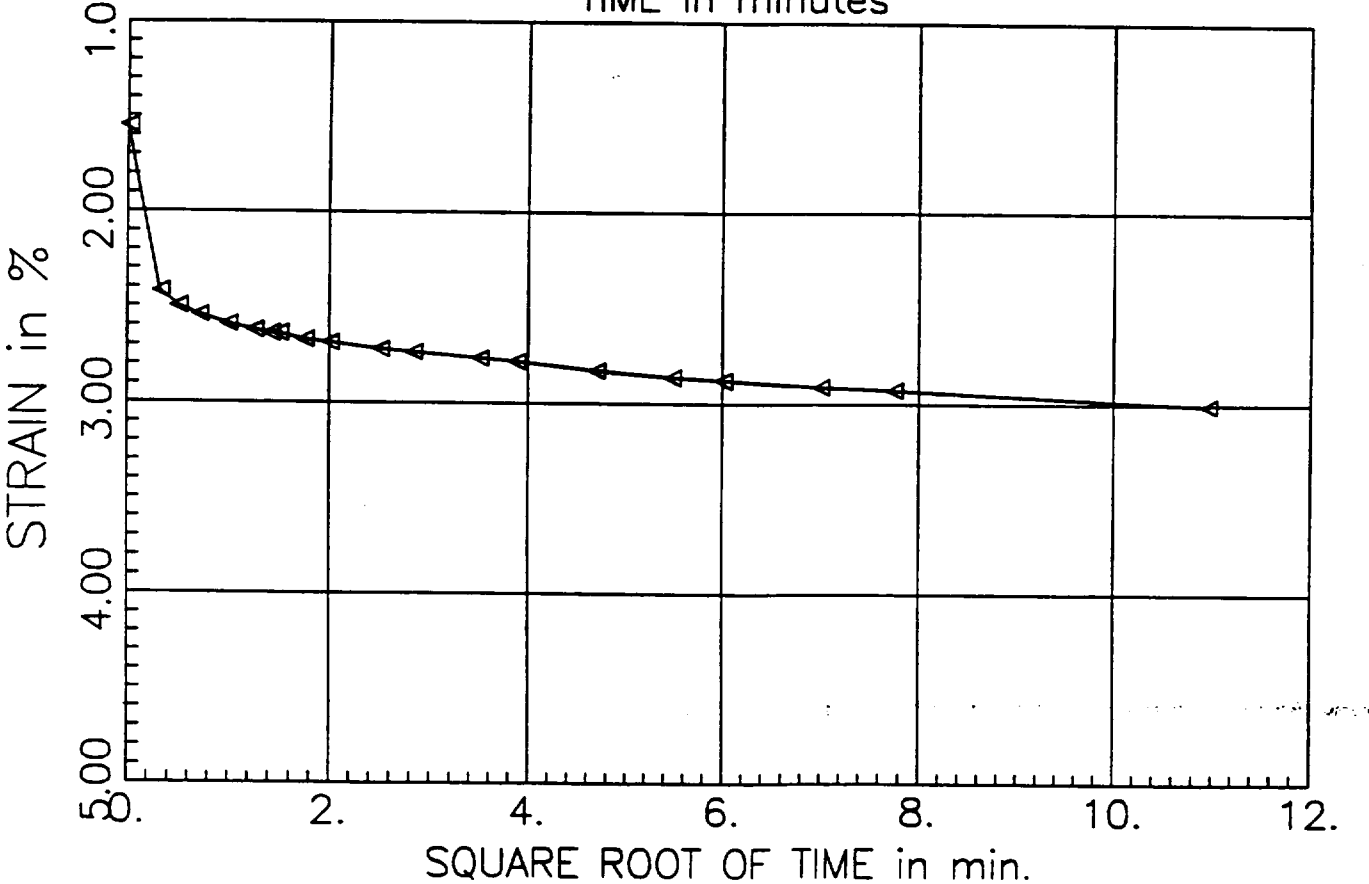
PRESSURE INCREMENT
from 0.50 tsf to 1.00 tsf

Test No: 2
Testname: C1-U3D

CALC 05996.01-G(B)-03 ATT B

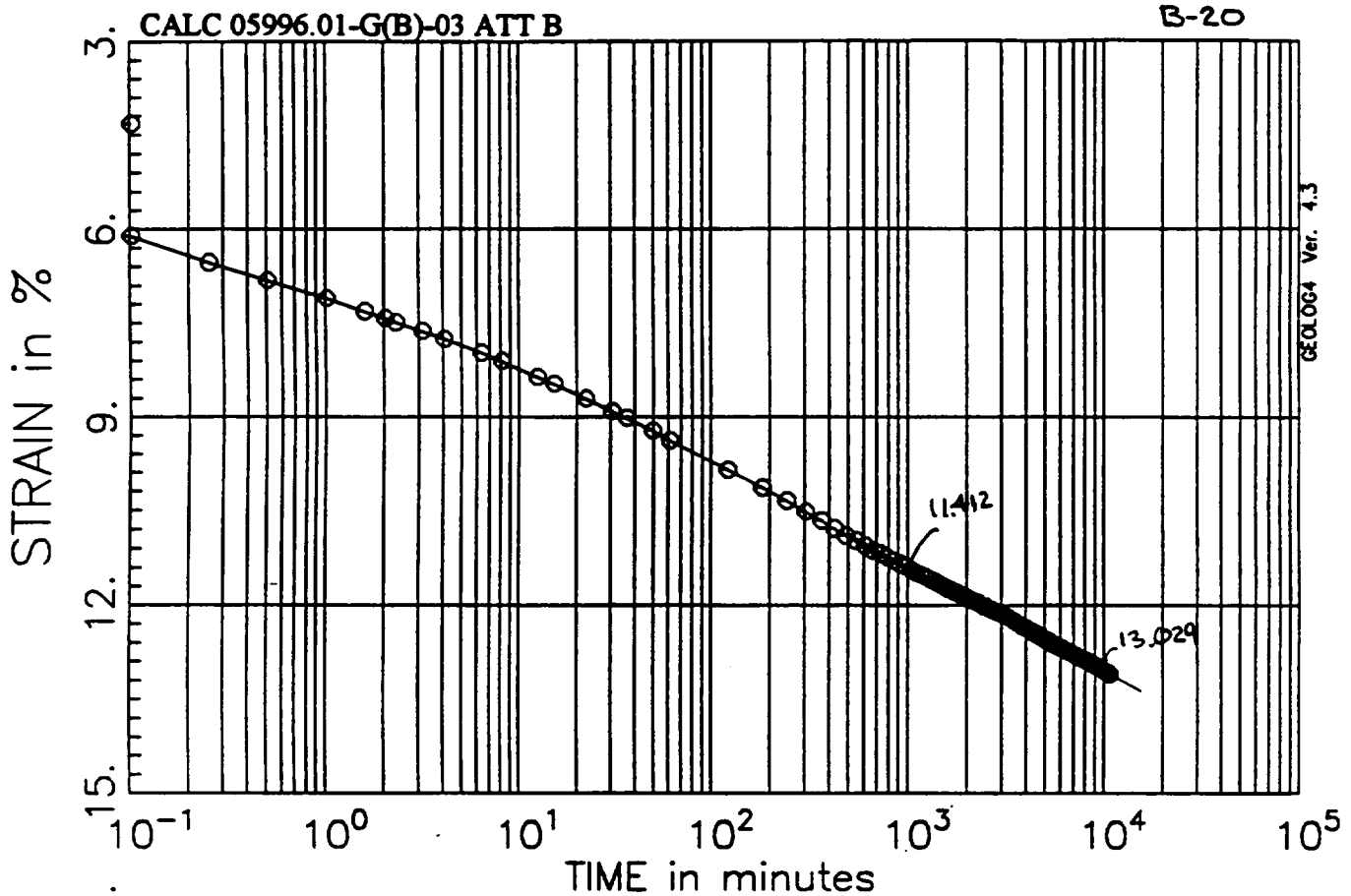
CALC 05996.01-G(B)-03 ATT B

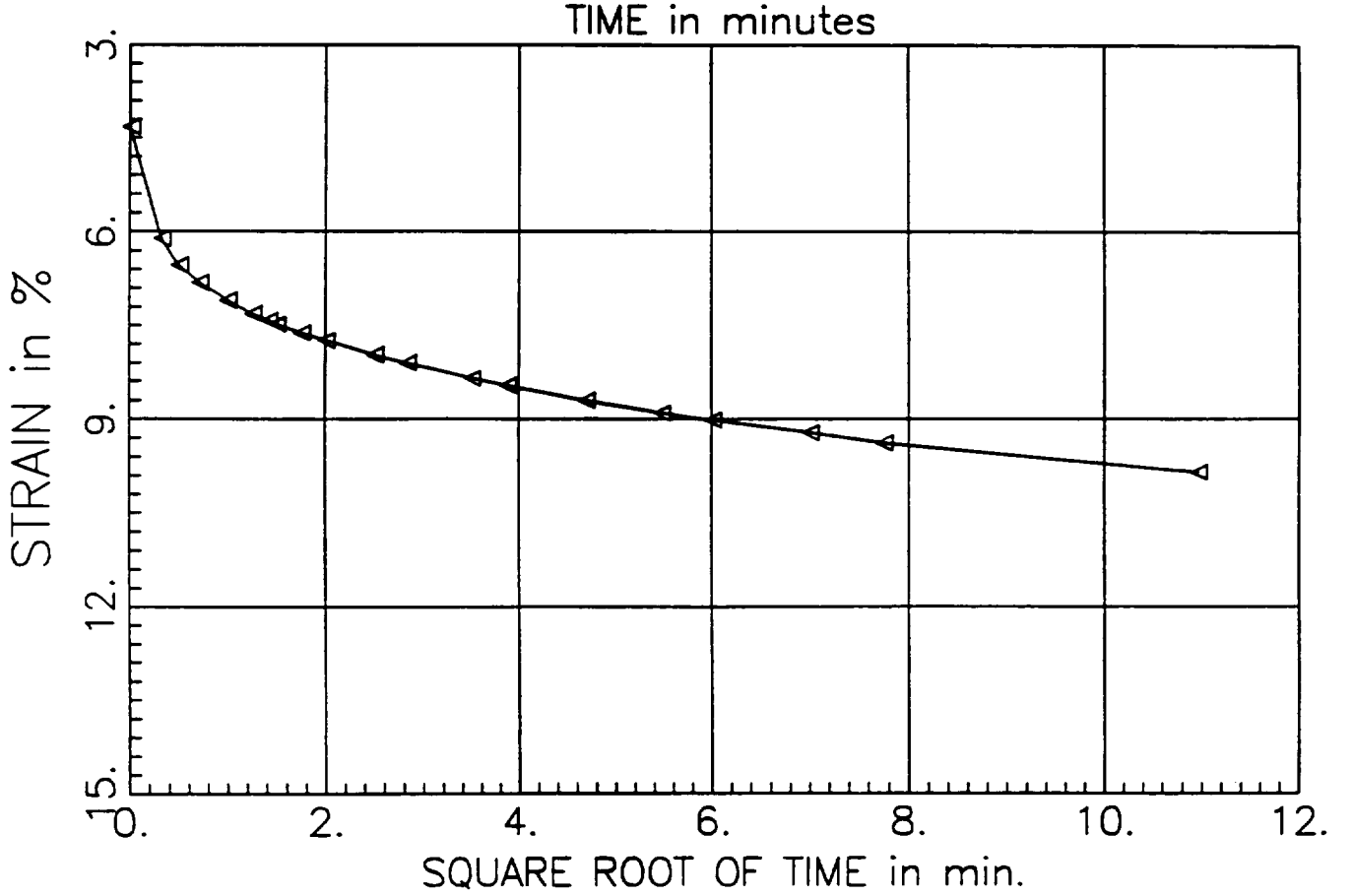




PRESSURE INCREMENT
from 1.00 tsf to 2.00 tsf

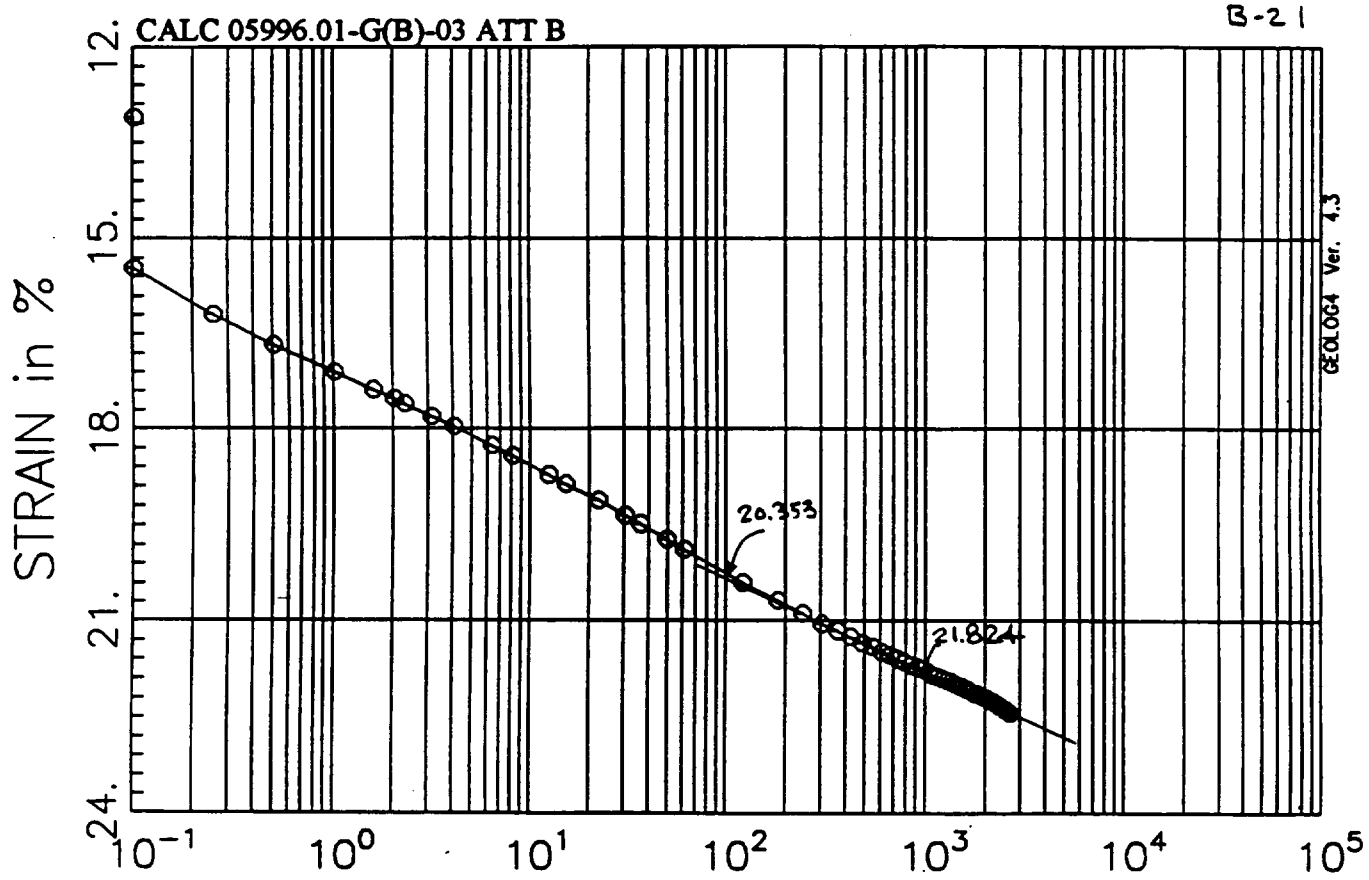
Test No: 2
Testname: C1-U3D

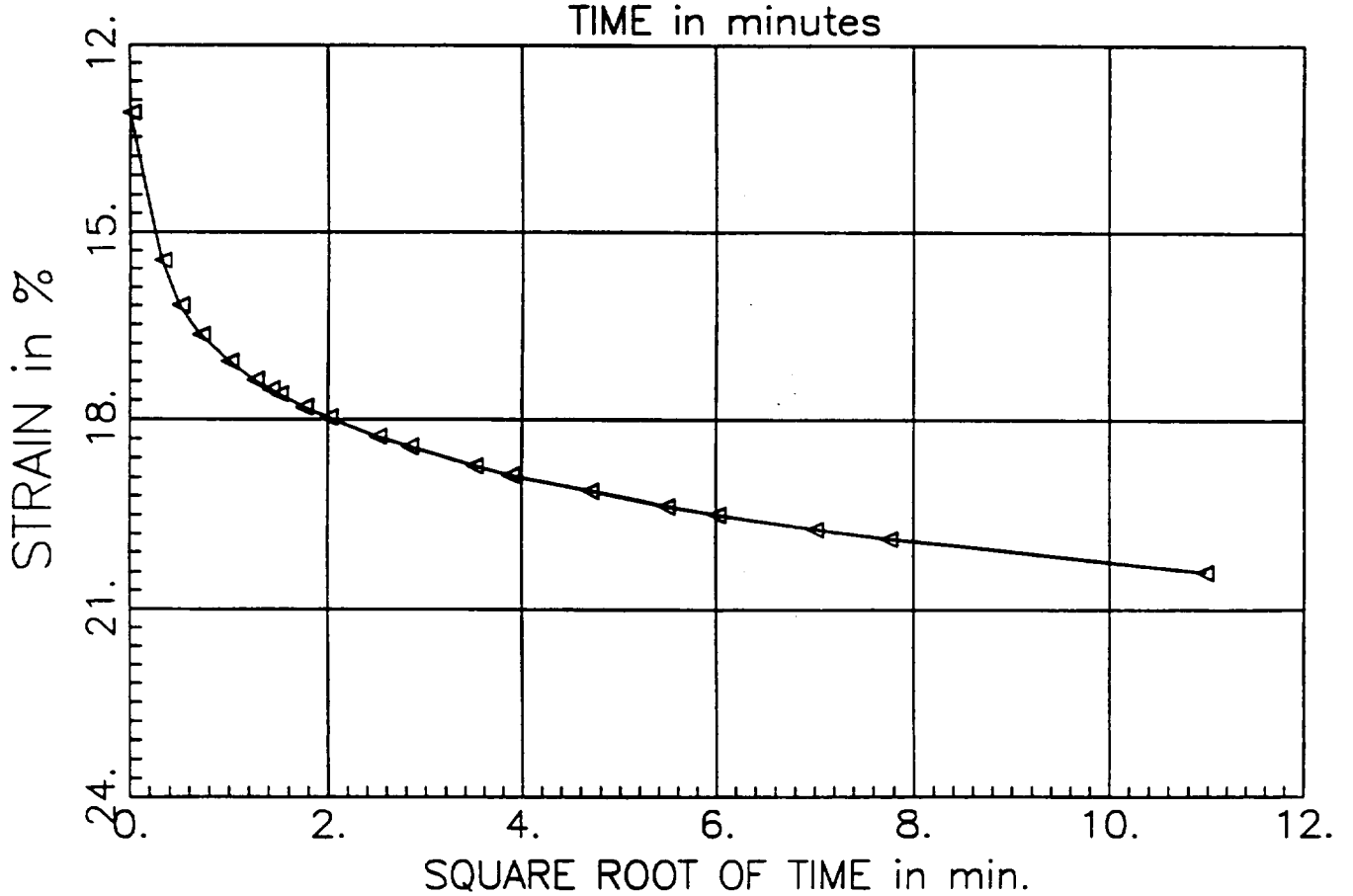




PRESSURE INCREMENT
from 2.00 tsf to 4.00 tsf

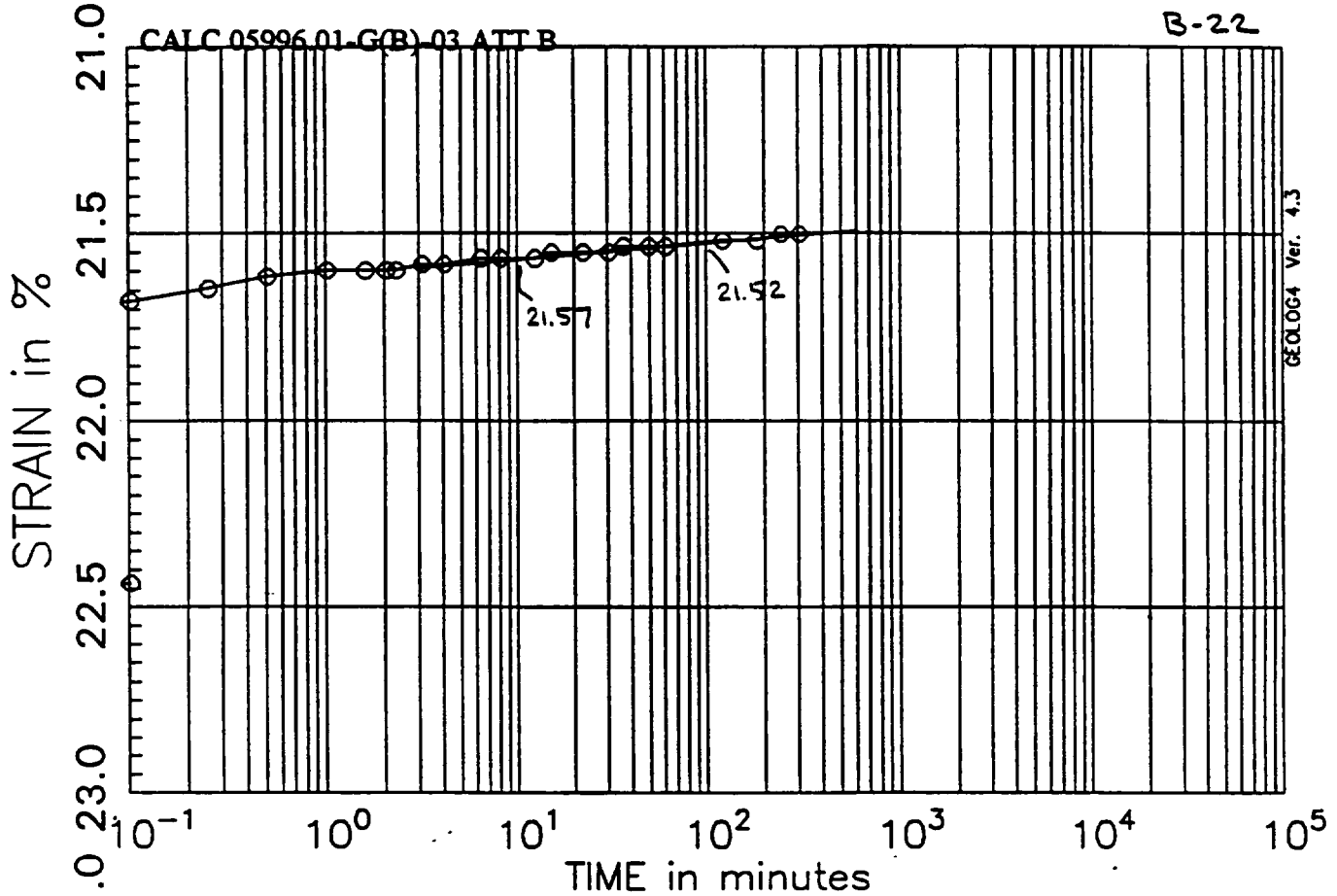
Test No: 2
Testname: C1-U3D

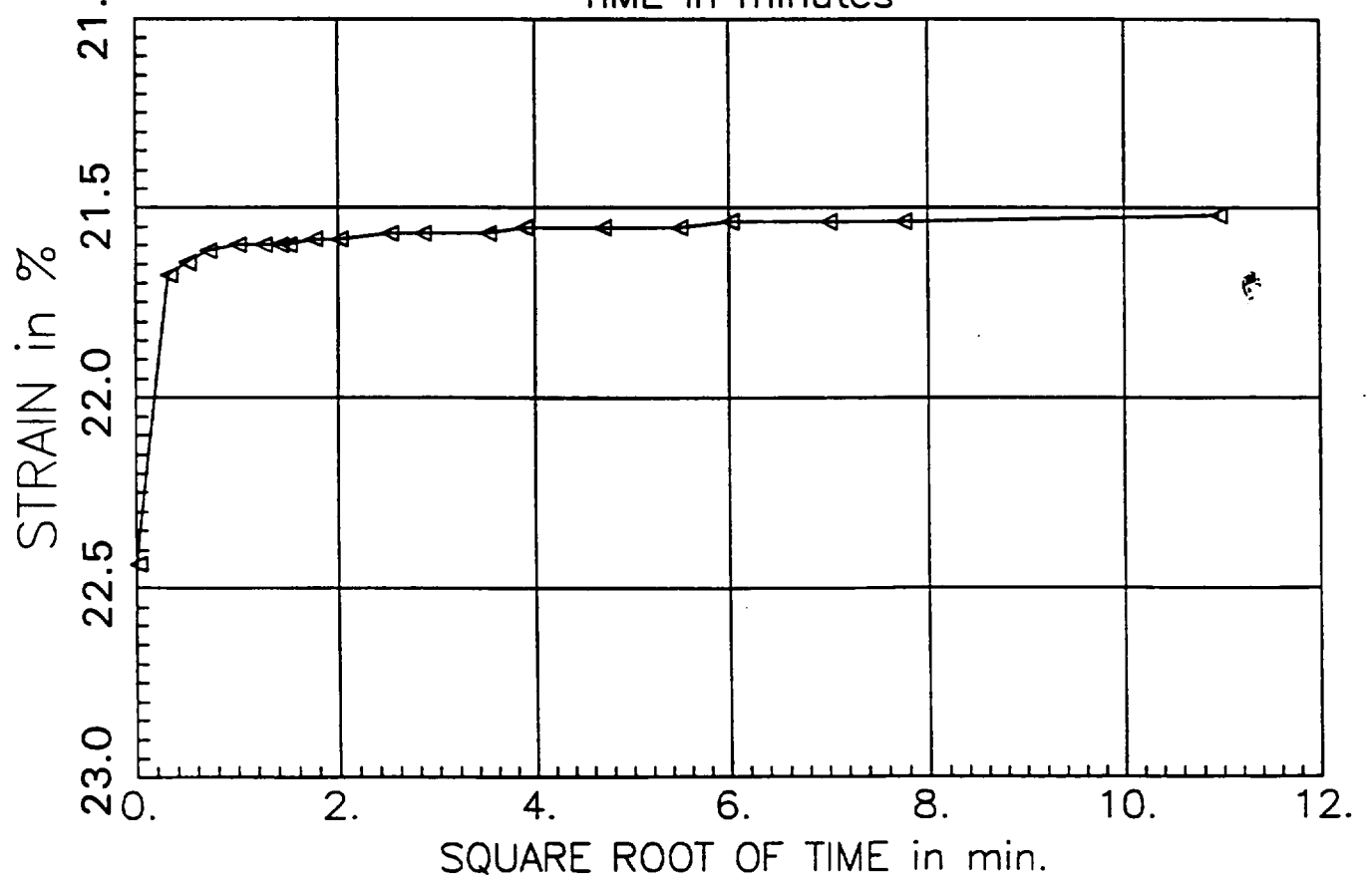




PRESSURE INCREMENT
from 4.00 tsf to 8.00 tsf

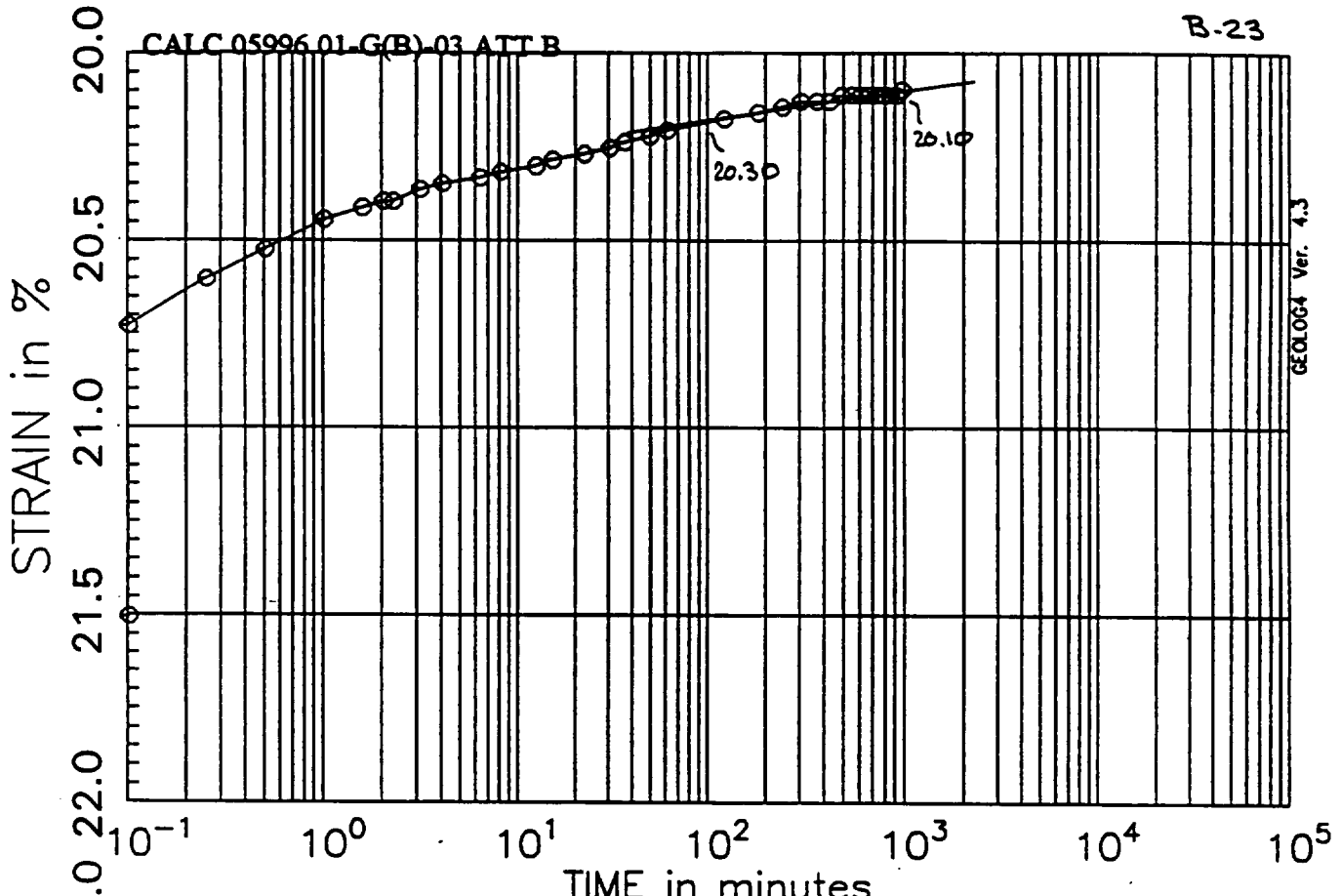
Test No: 2
Testname: C1-U3D

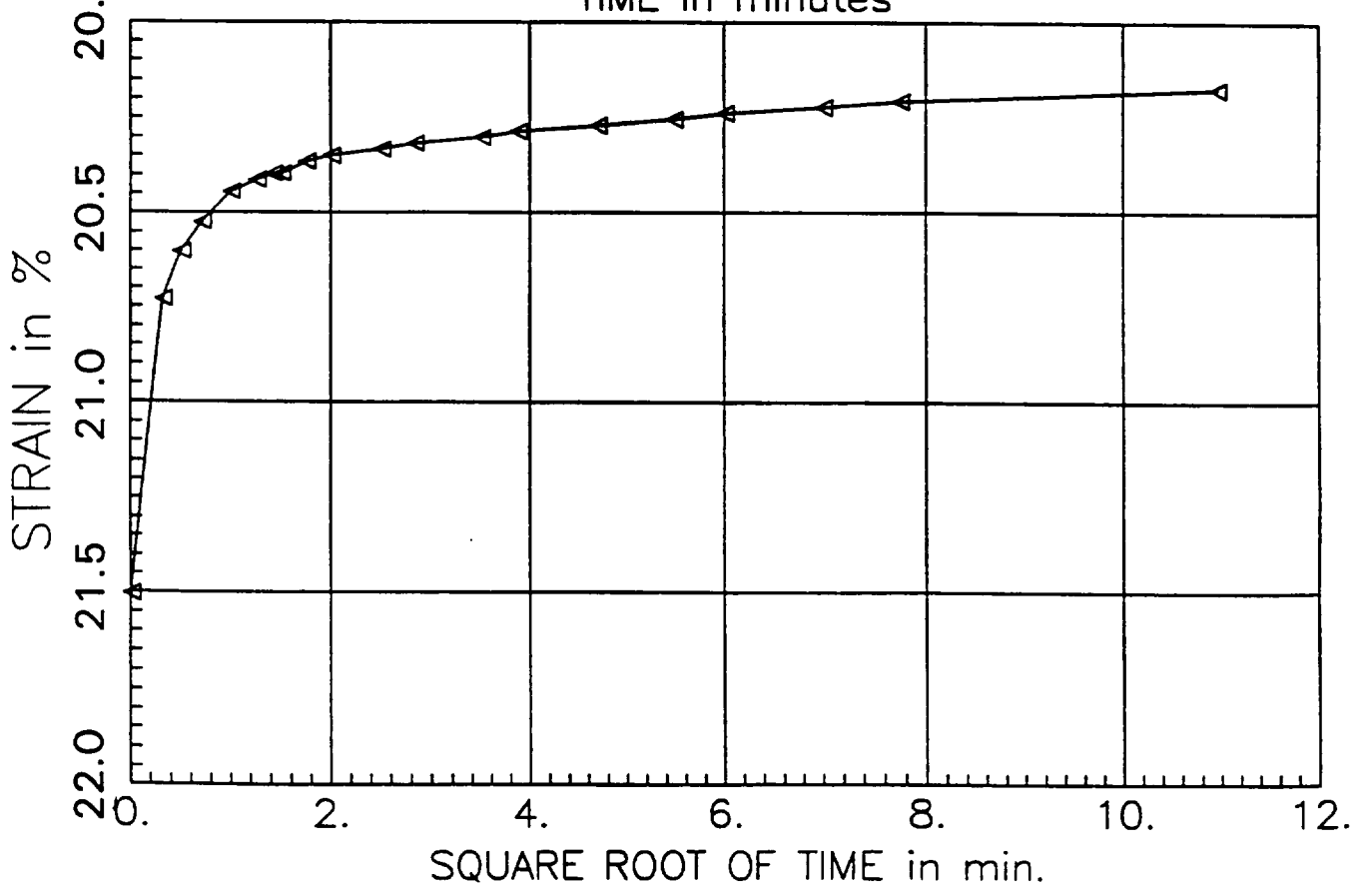




PRESSURE INCREMENT
from 8.00 tsf to 2.00 tsf

Test No: 2
Testname: C1-U3D

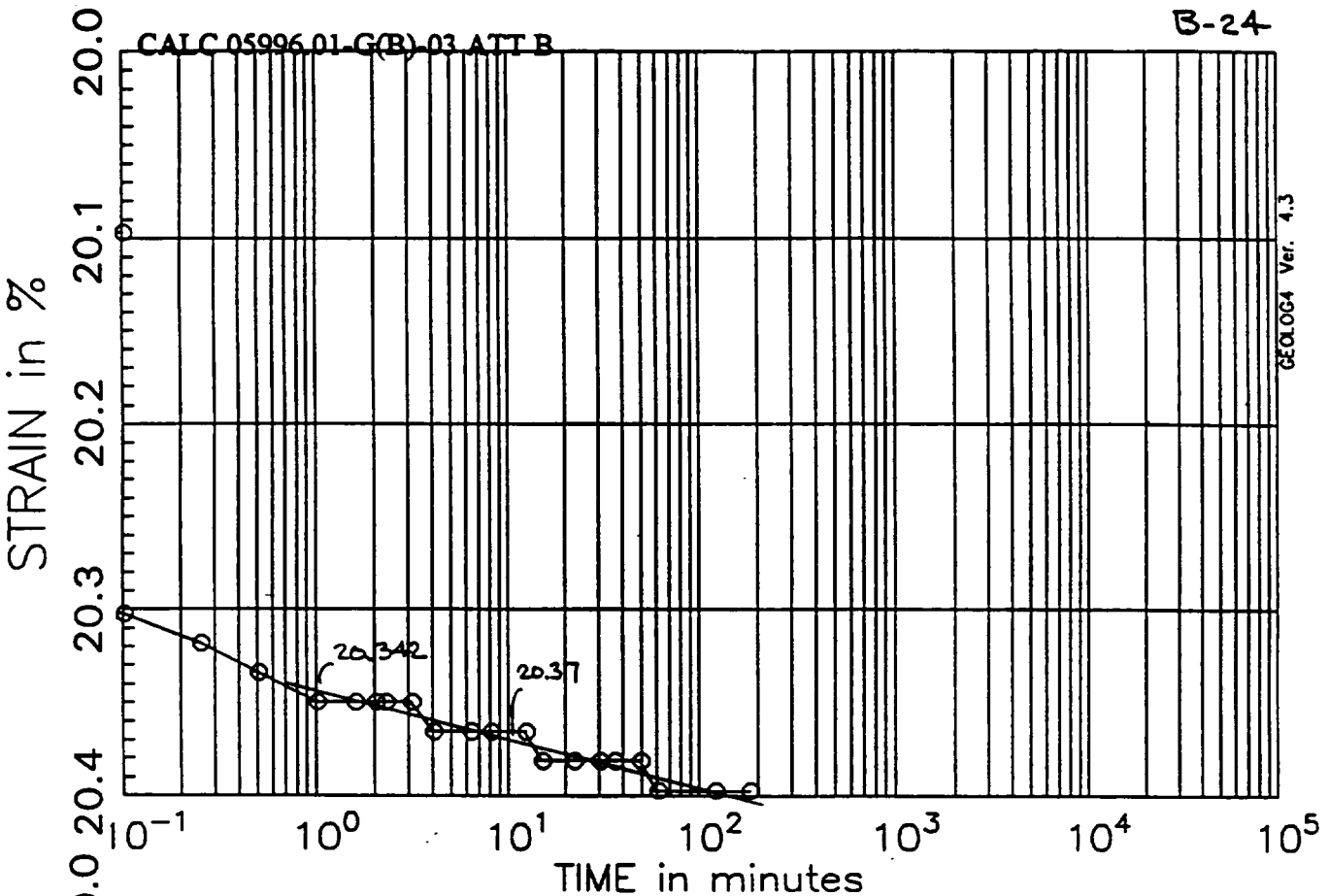


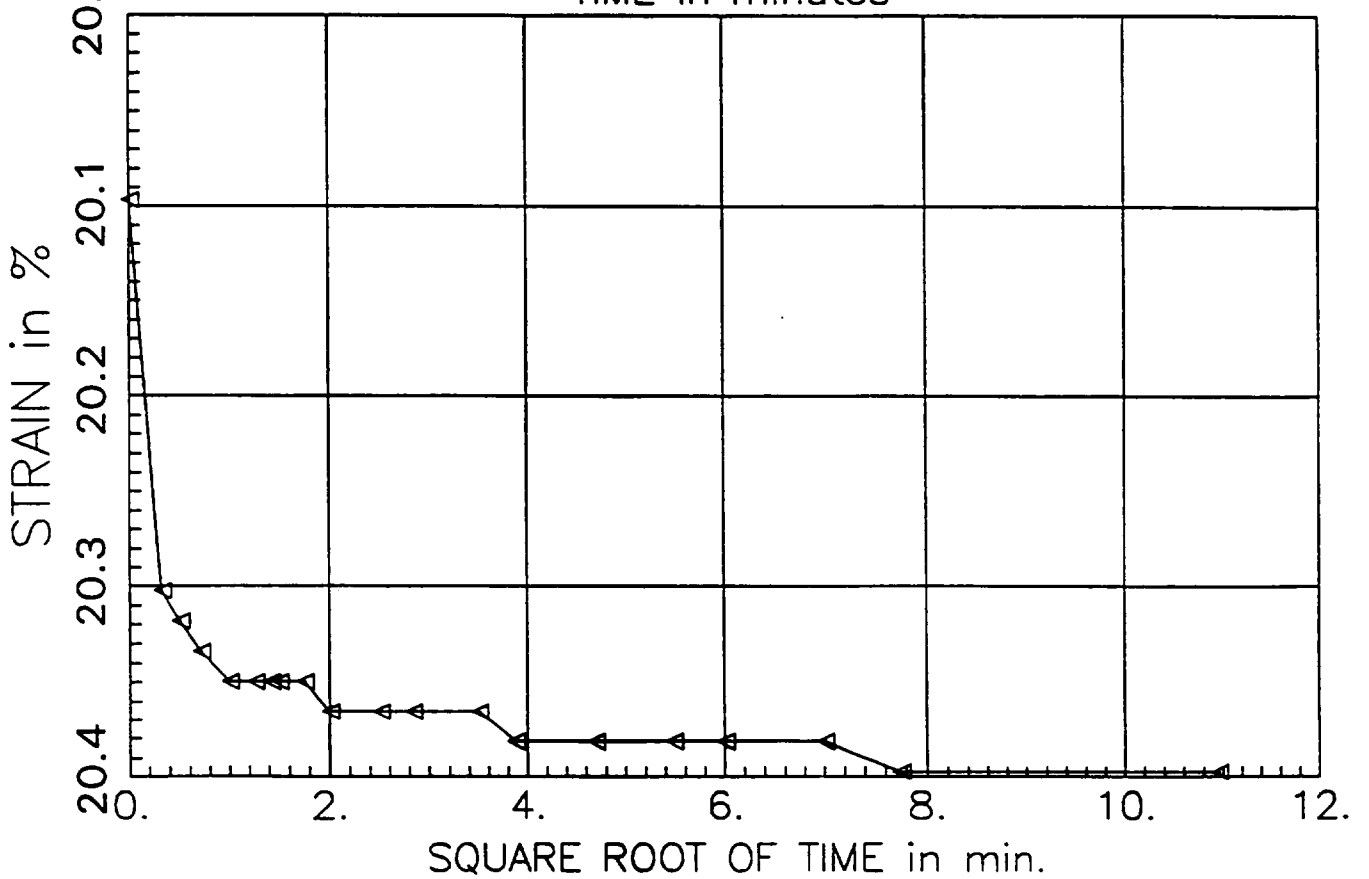


PRESSURE INCREMENT
from 2.00 tsf to 0.50 tsf

Test No: 2
Testname: C1-U3D

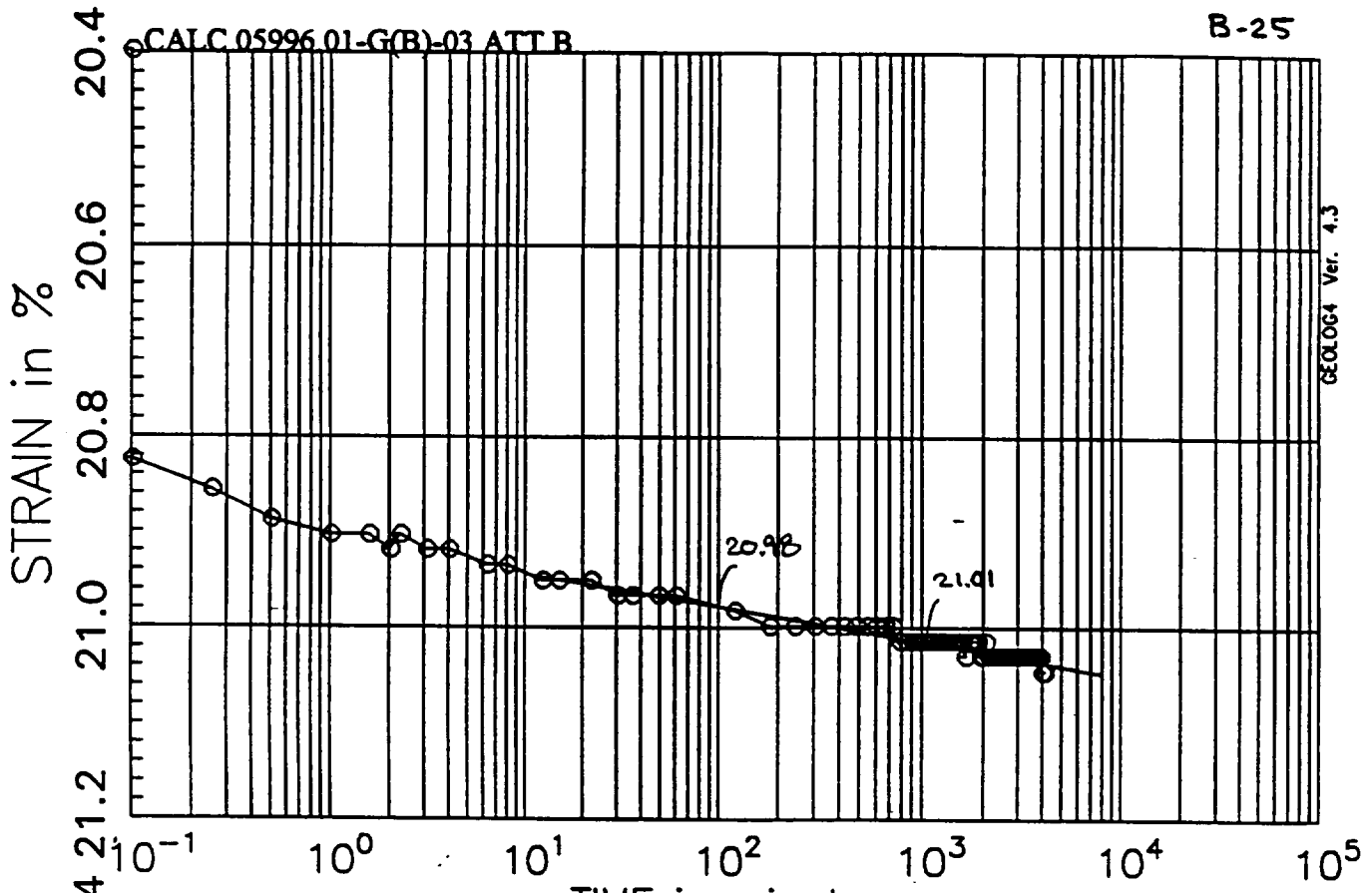
CALC 05996.01-G(B)-03 ATT B

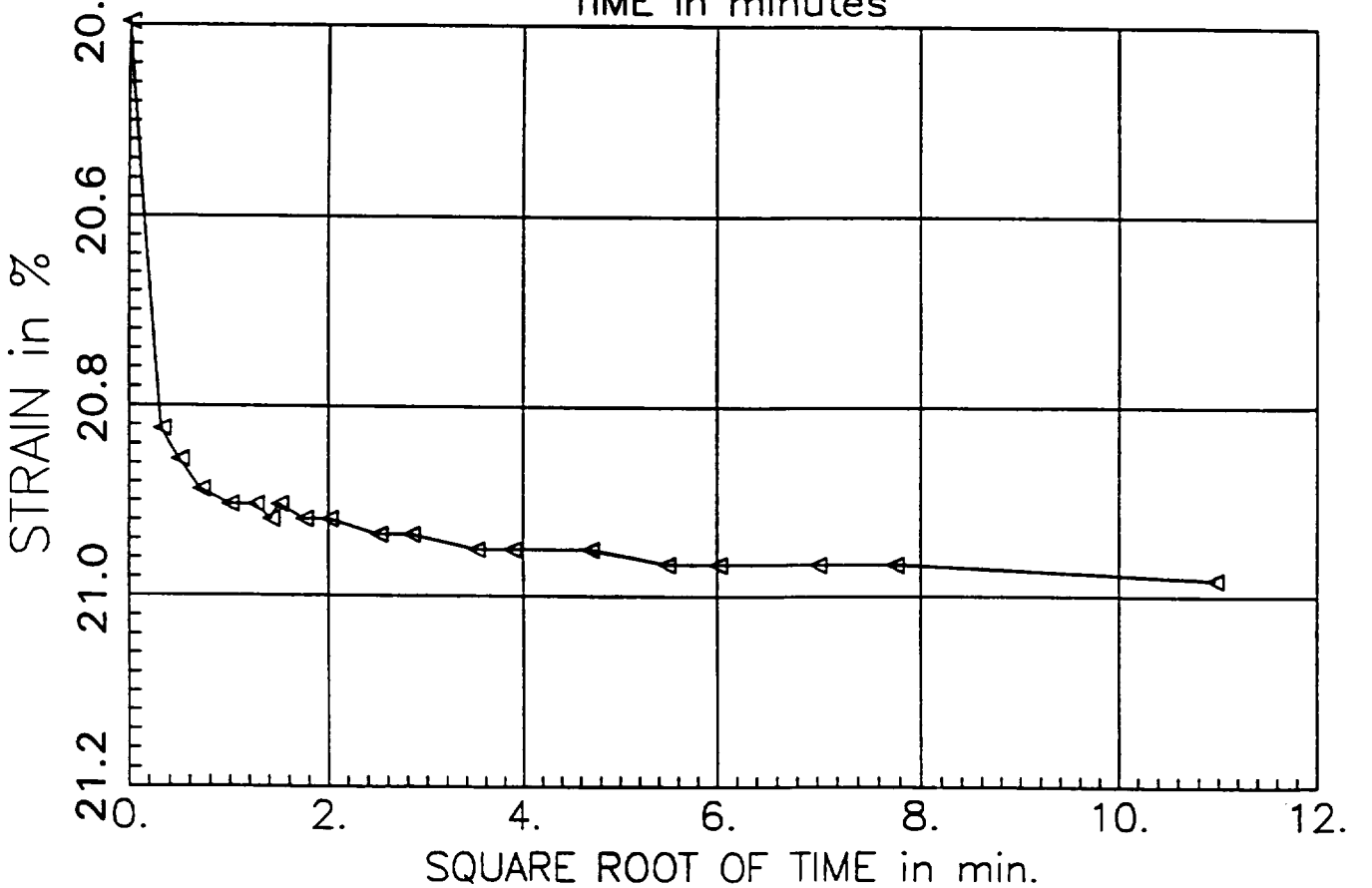




PRESSURE INCREMENT
from 0.50 tsf to 1.00 tsf

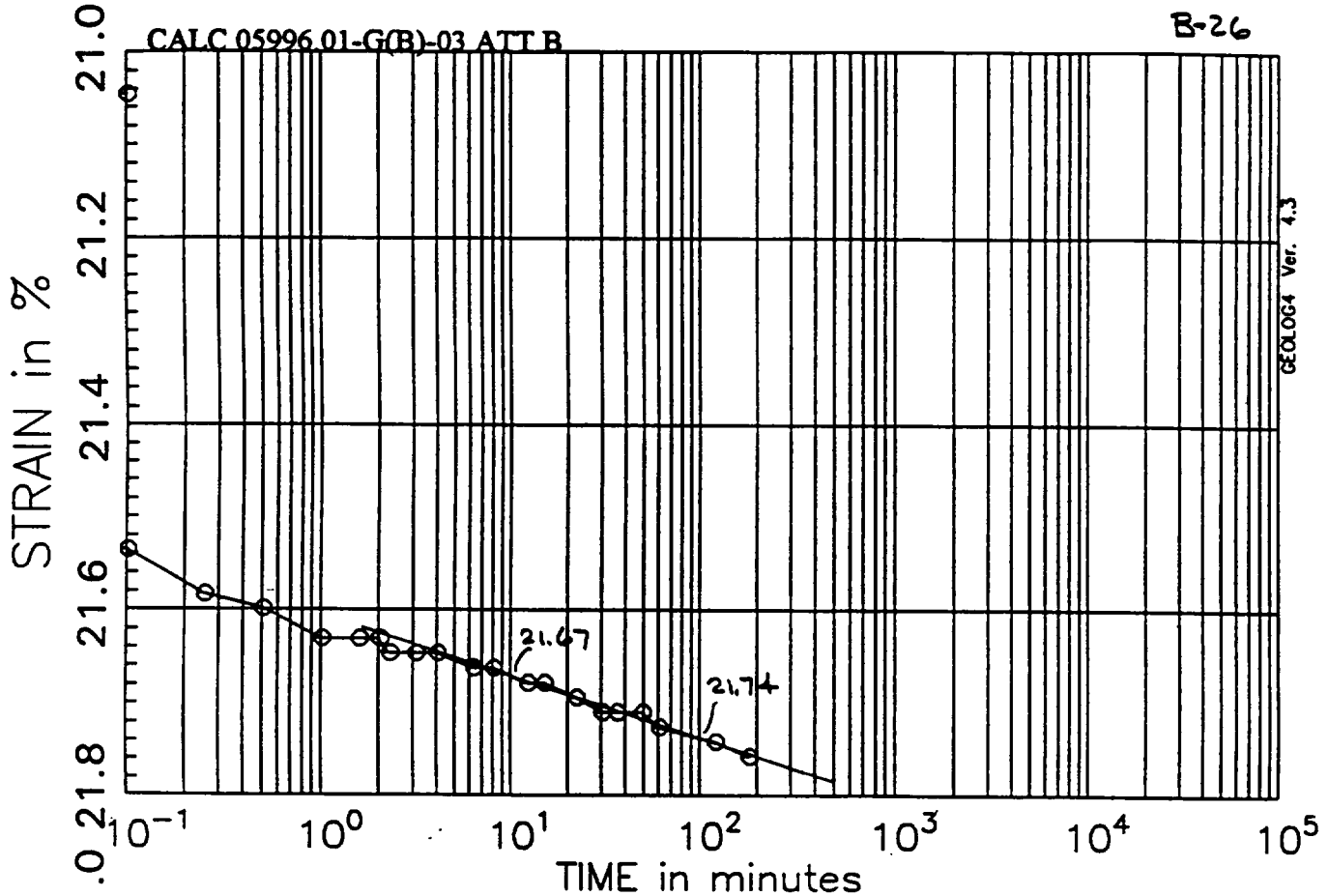
Test No: 2
Testname: C1-U3D

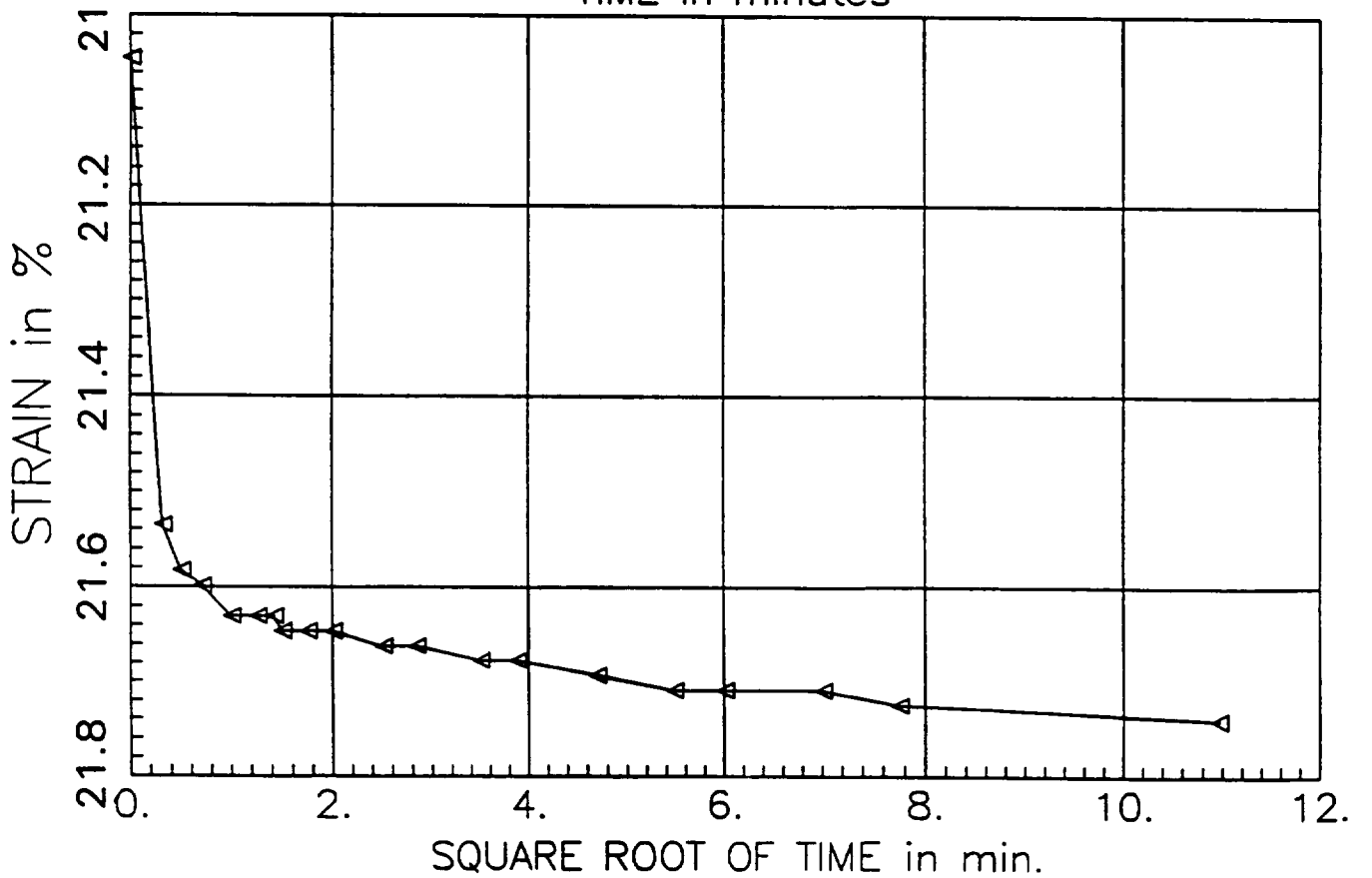




PRESSURE INCREMENT
from 1.00 tsf to 2.00 tsf

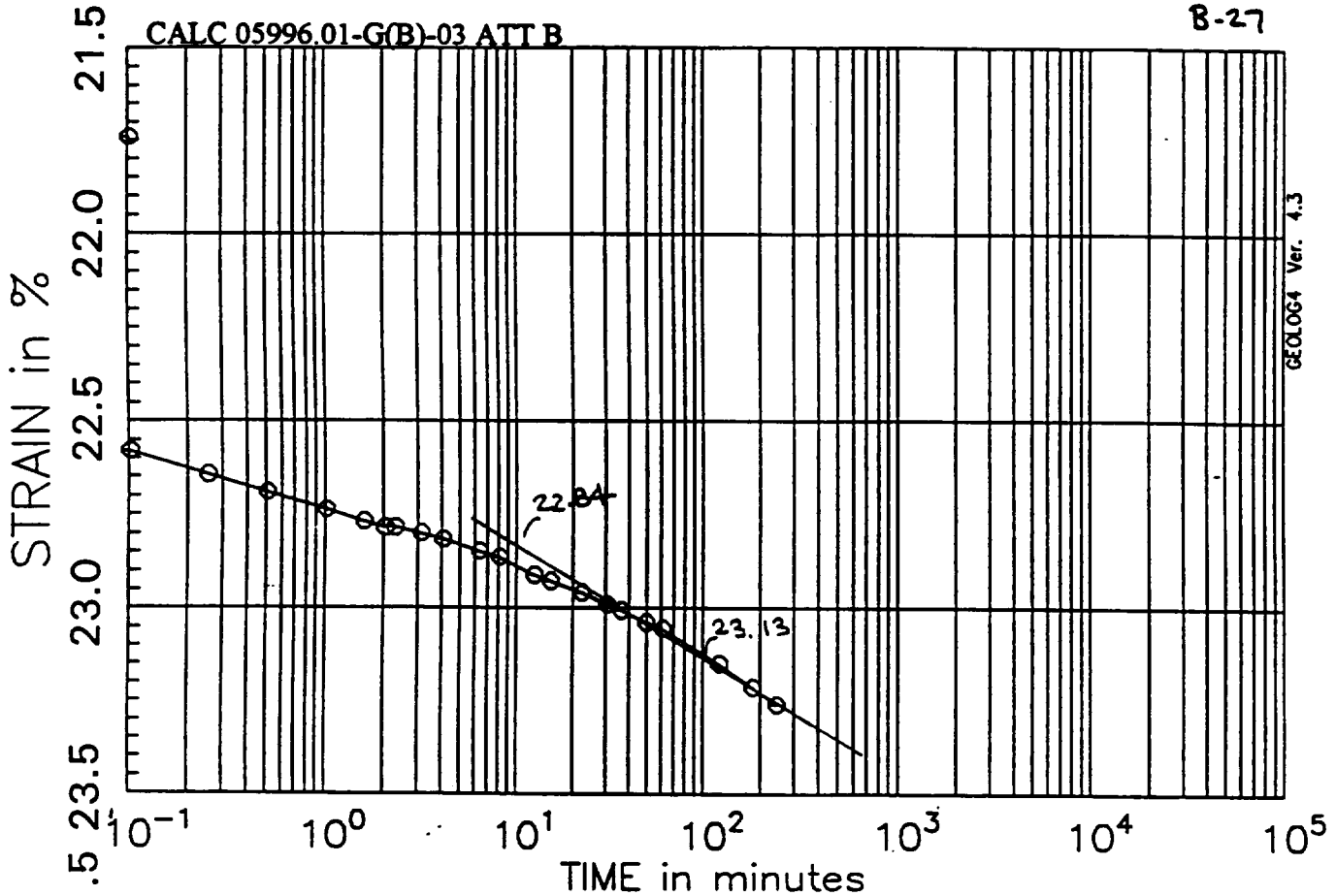
Test No: 2
Testname: C1-U3D

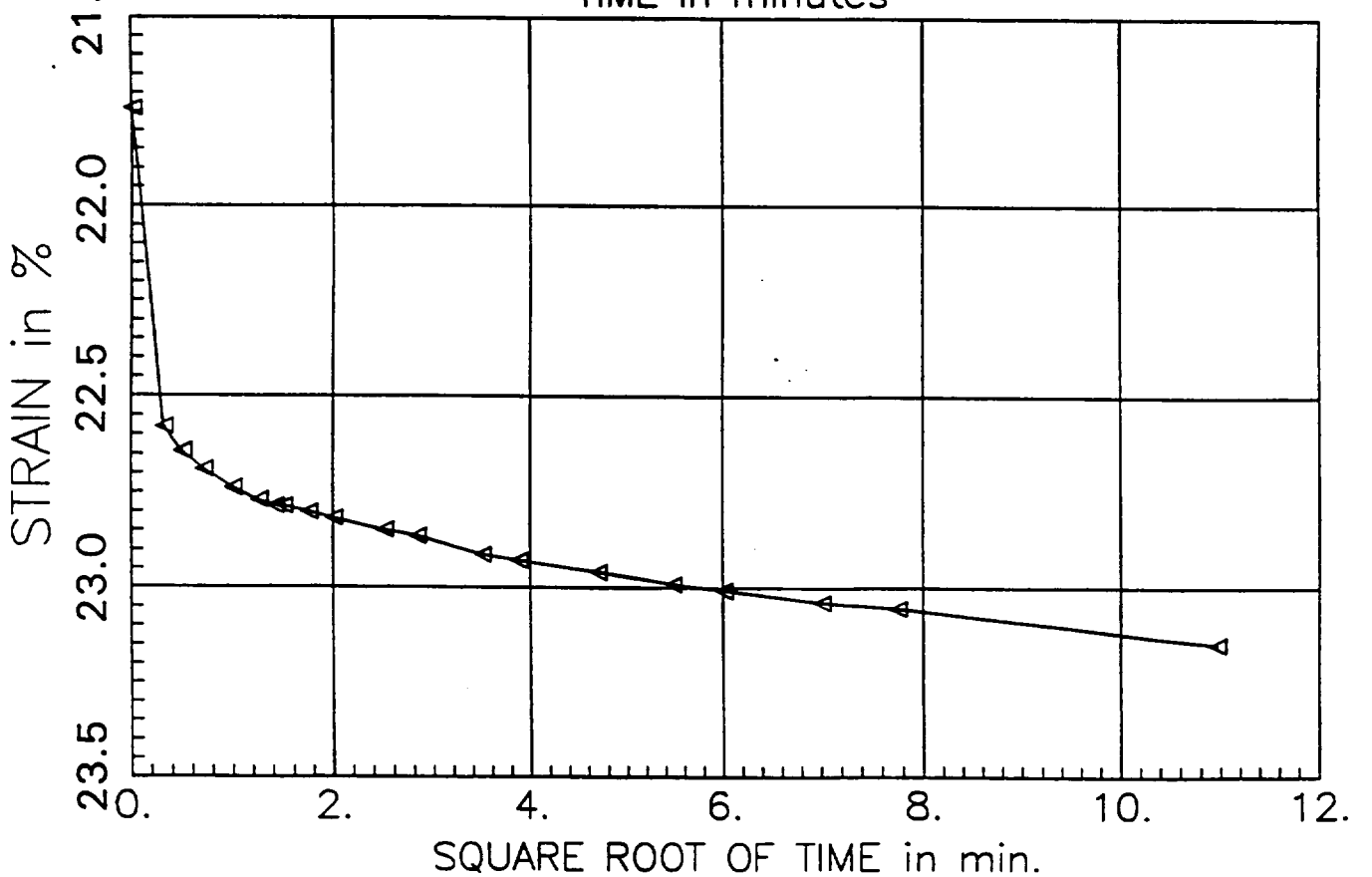




PRESSURE INCREMENT
from 2.00 tsf to 4.00 tsf

Test No: 2
Testname: C1-U3D

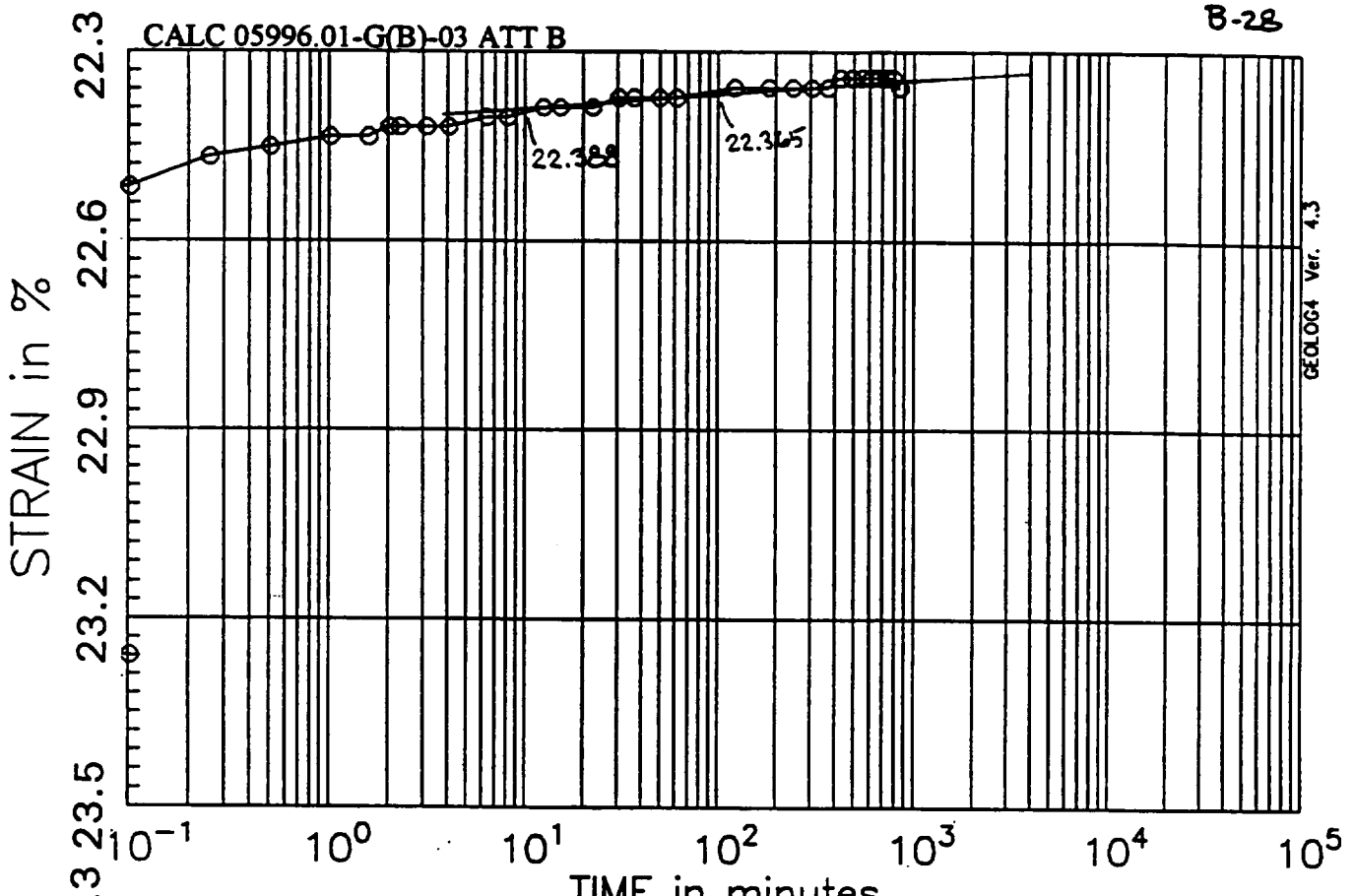


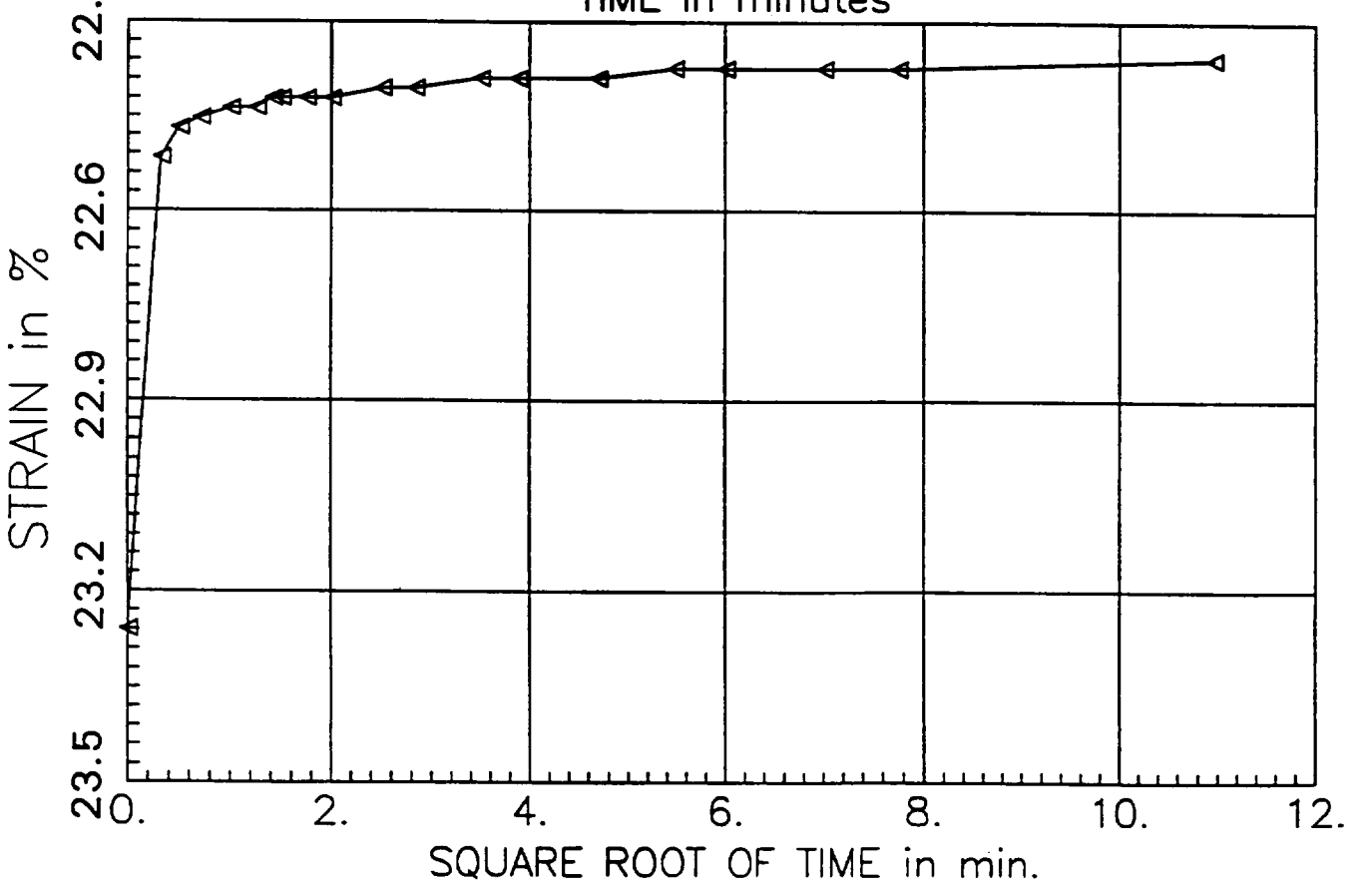


PRESSURE INCREMENT
from 4.00 tsf to 8.00 tsf

Test No: 2
Testname: C1-U3D

CALC 05996.01-G(B)-03 ATT B

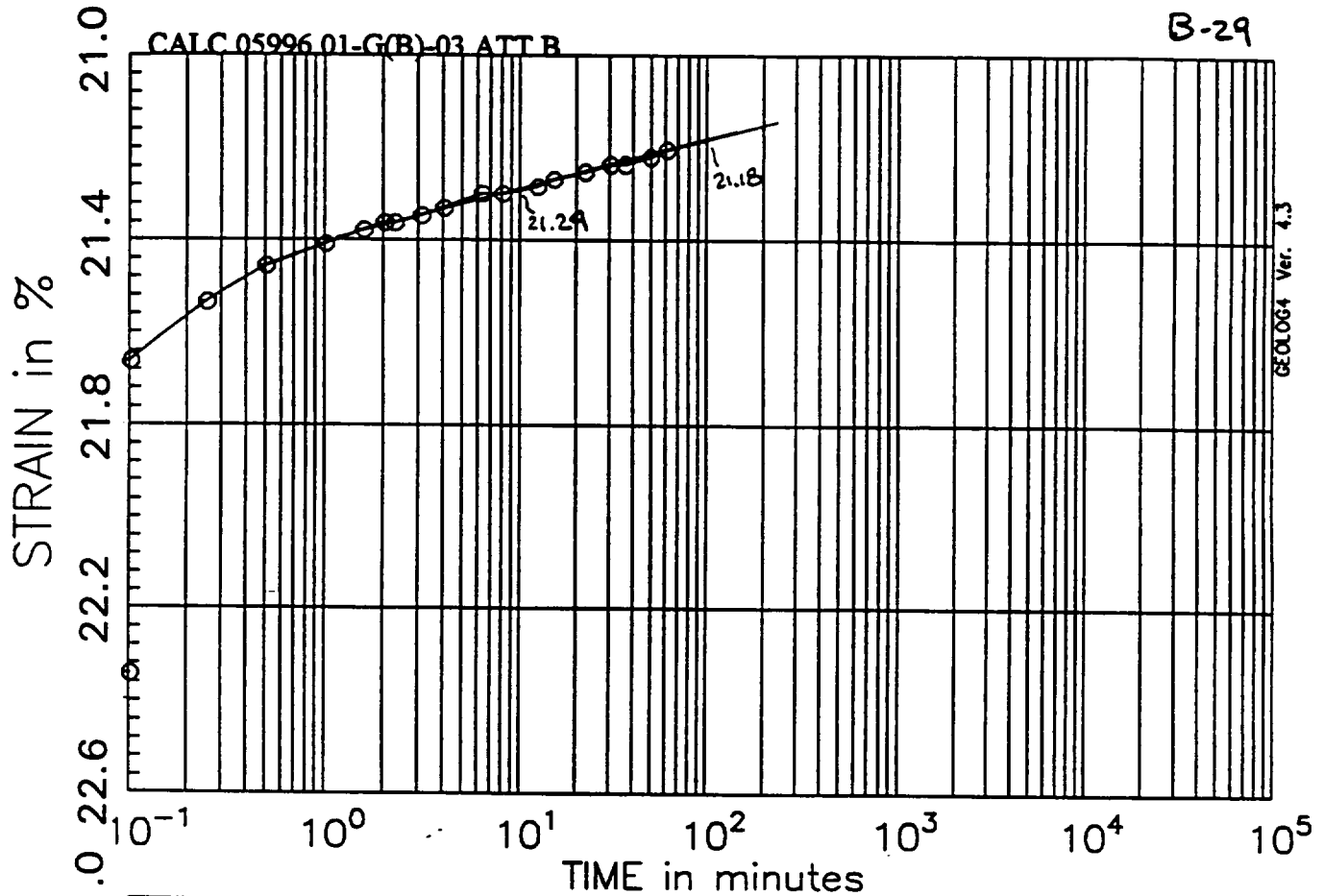


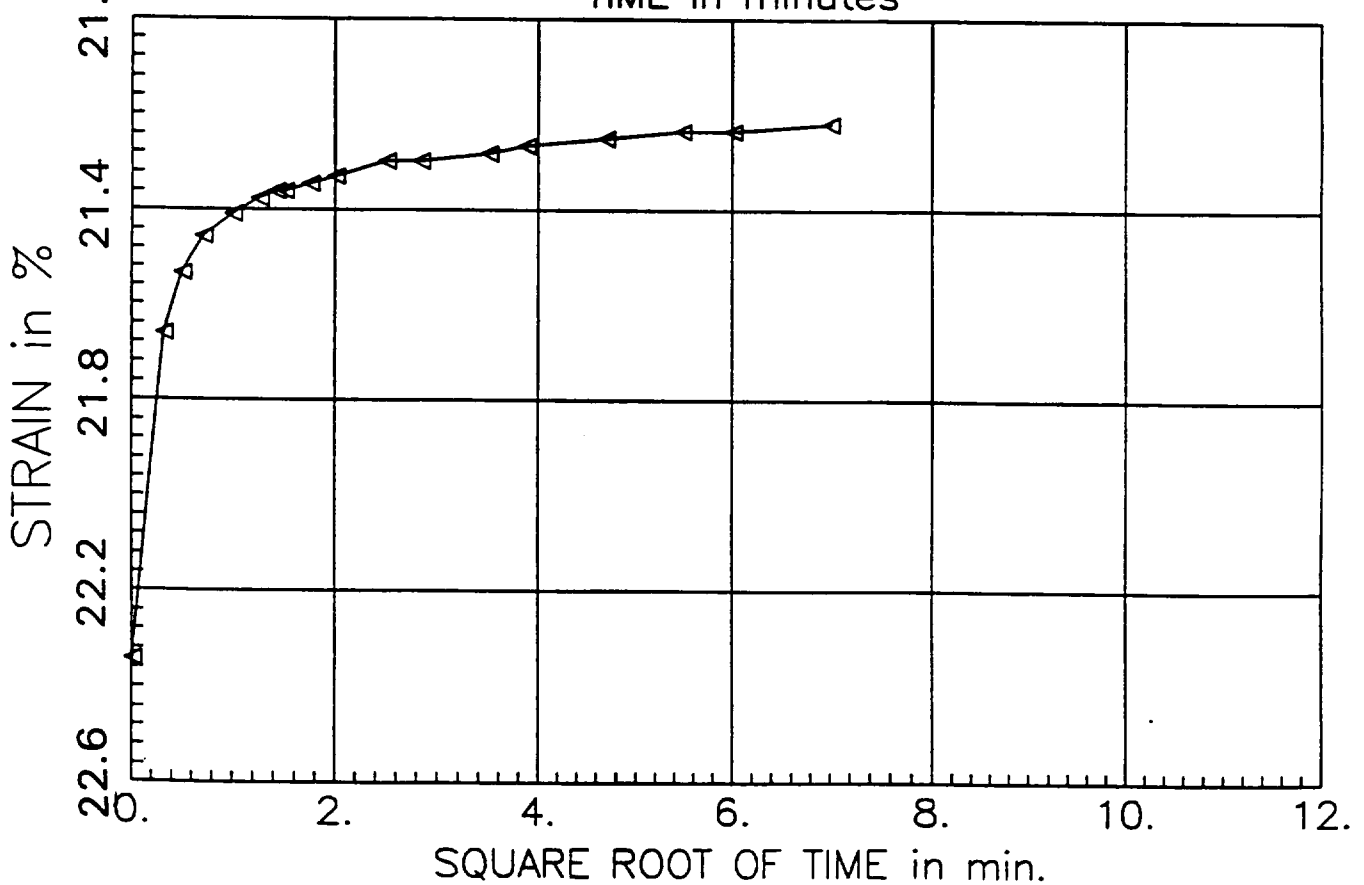


PRESSURE INCREMENT
from 8.00 tsf to 2.00 tsf

Test No: 2
Testname: C1-U3D

CALC 05996.01-G(B)-03 ATT B

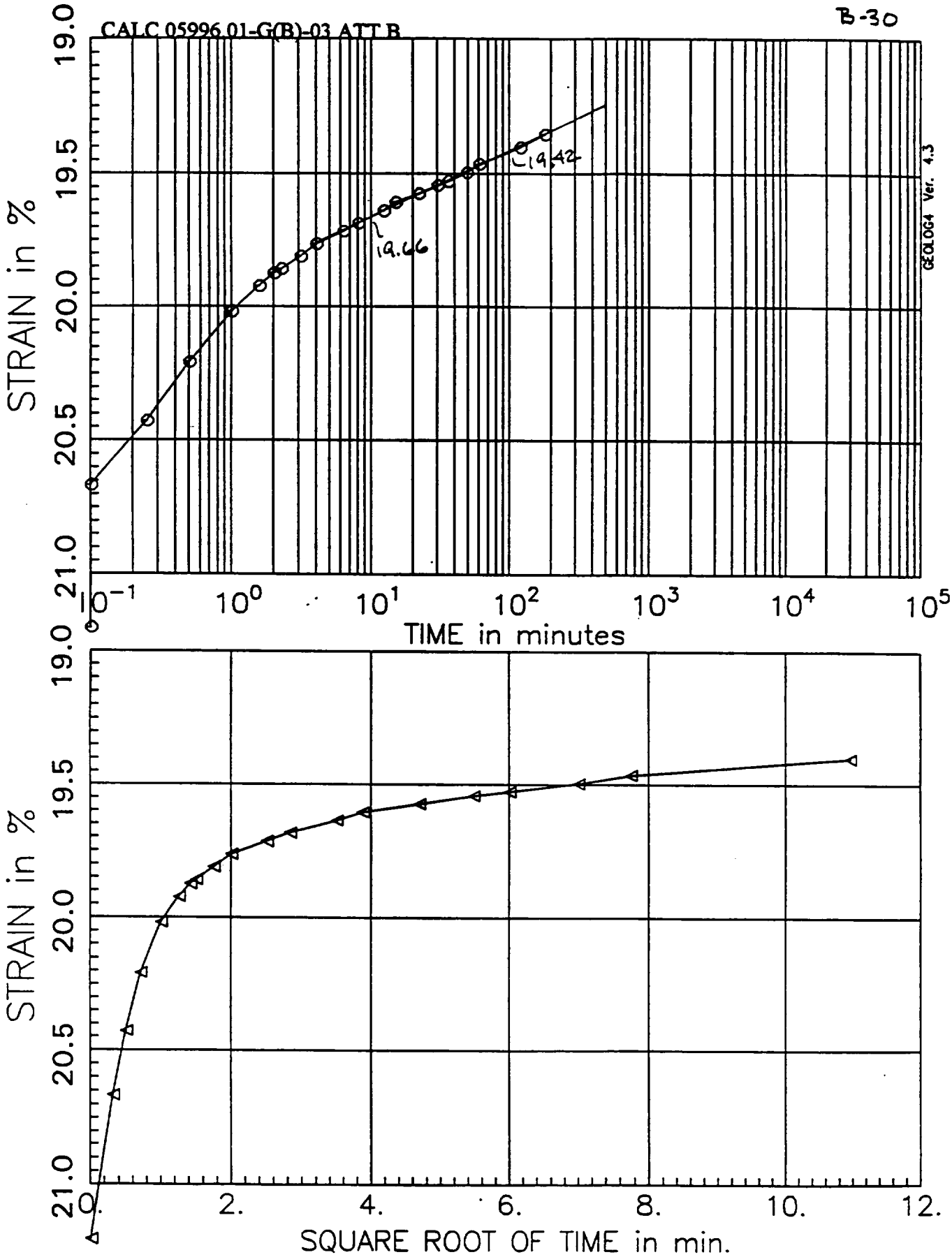




PRESSURE INCREMENT
from 2.00 tsf to 0.50 tsf

Test No: 2
Testname: C1-U3D

CALC 05996.01-G(B)-03 ATT B



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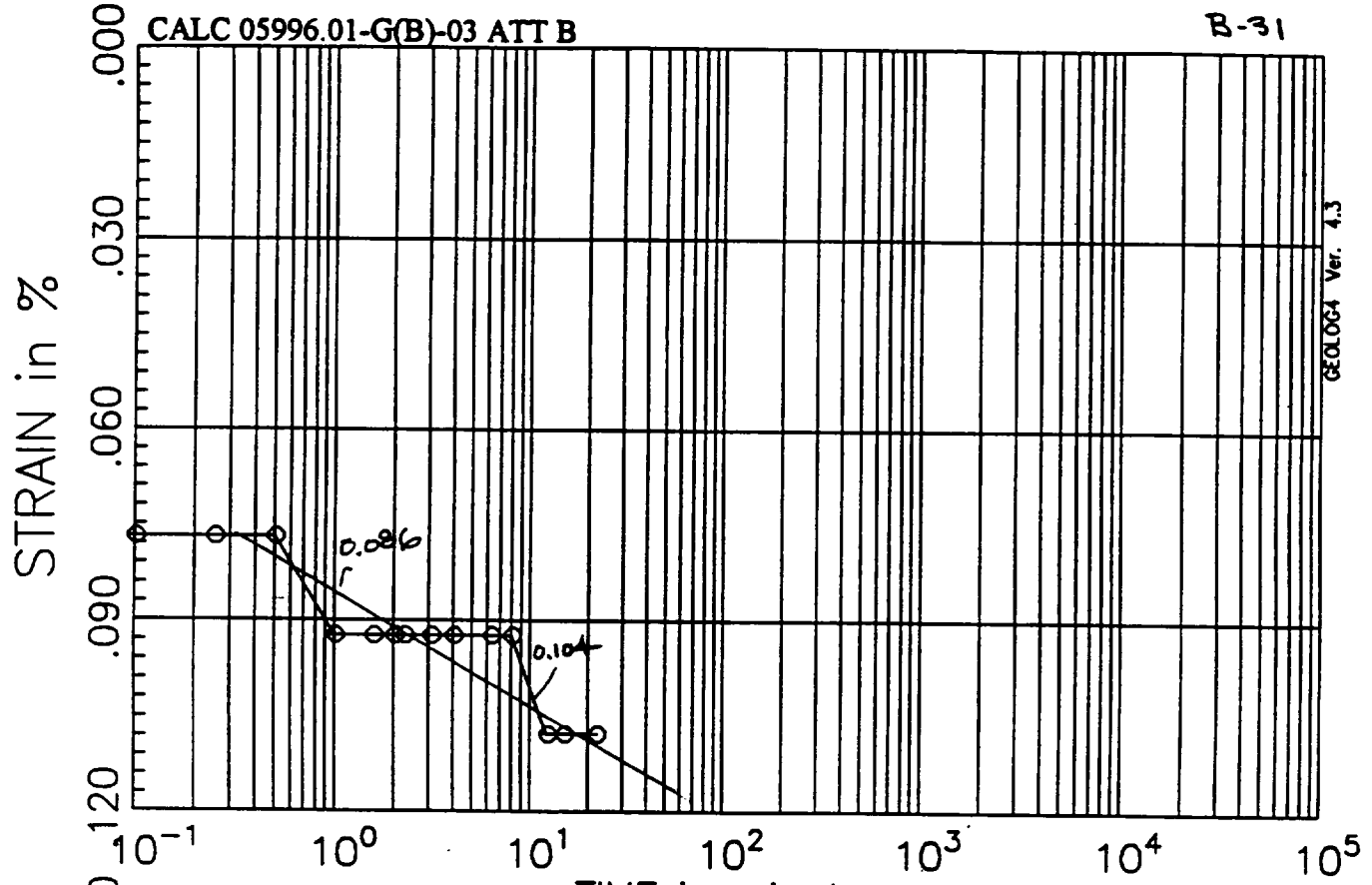
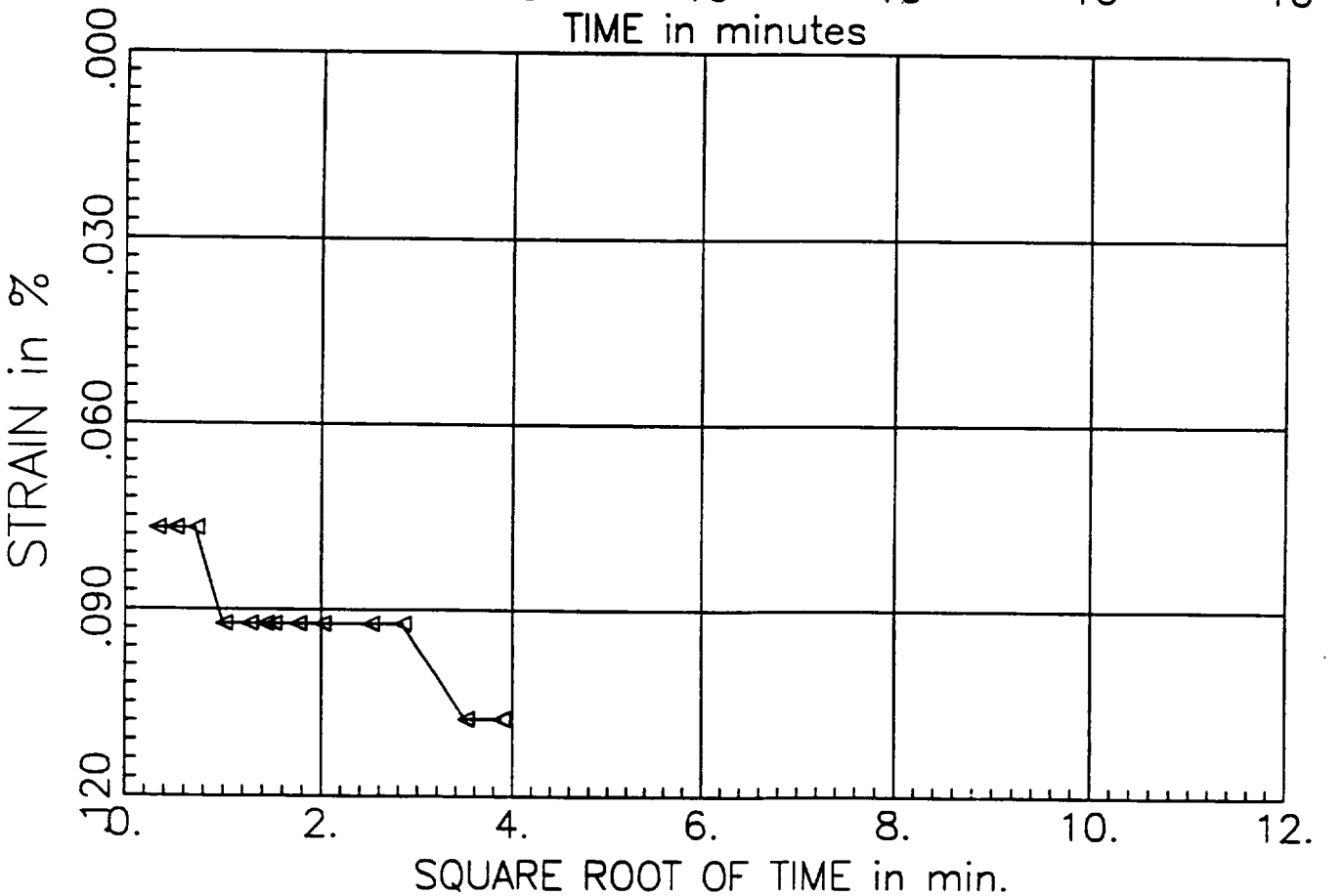
PRESSURE INCREMENT
from 0.50 tsf to 0.10 tsf

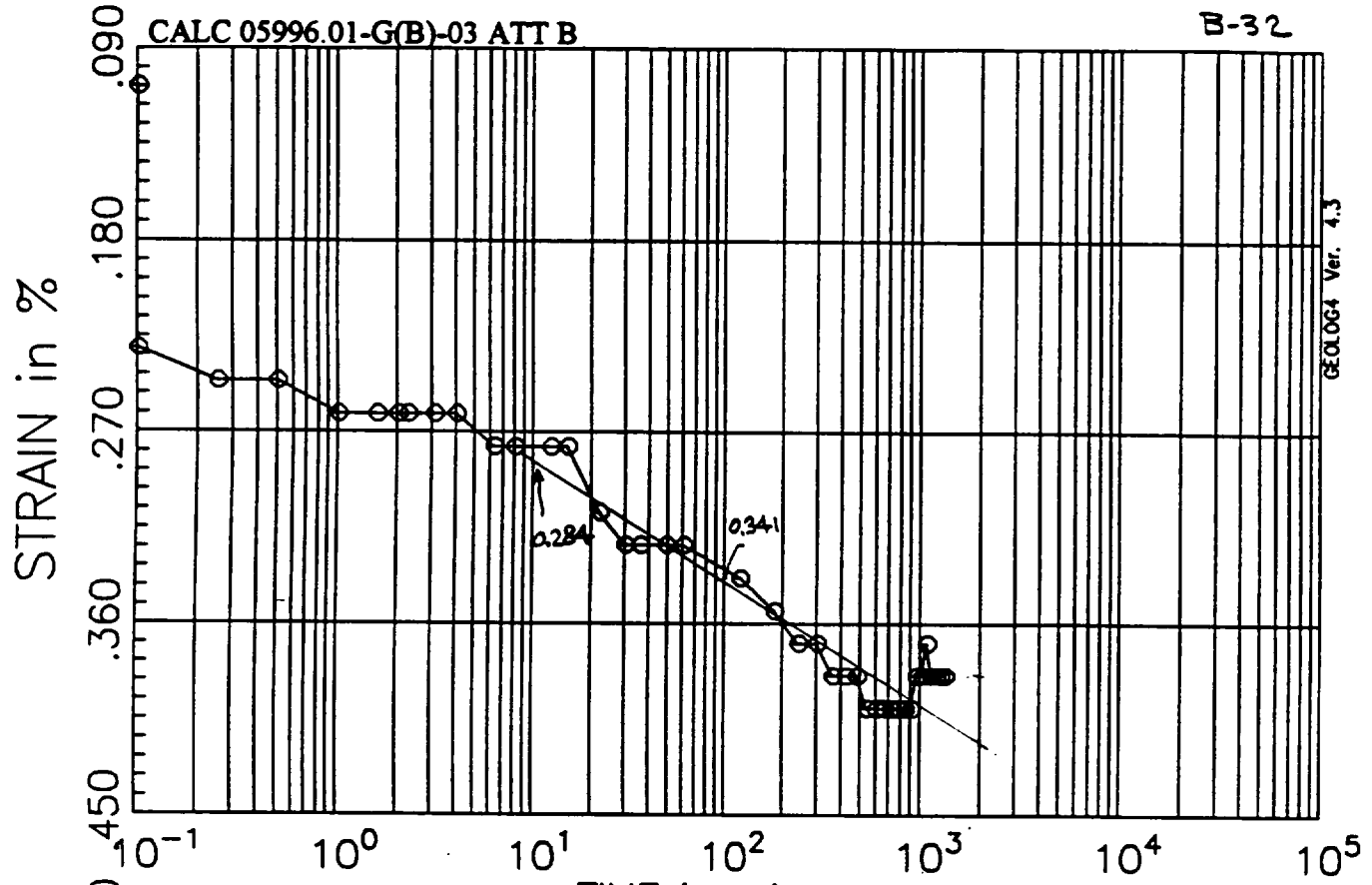
Test No: 2
Testname: C1-U3D

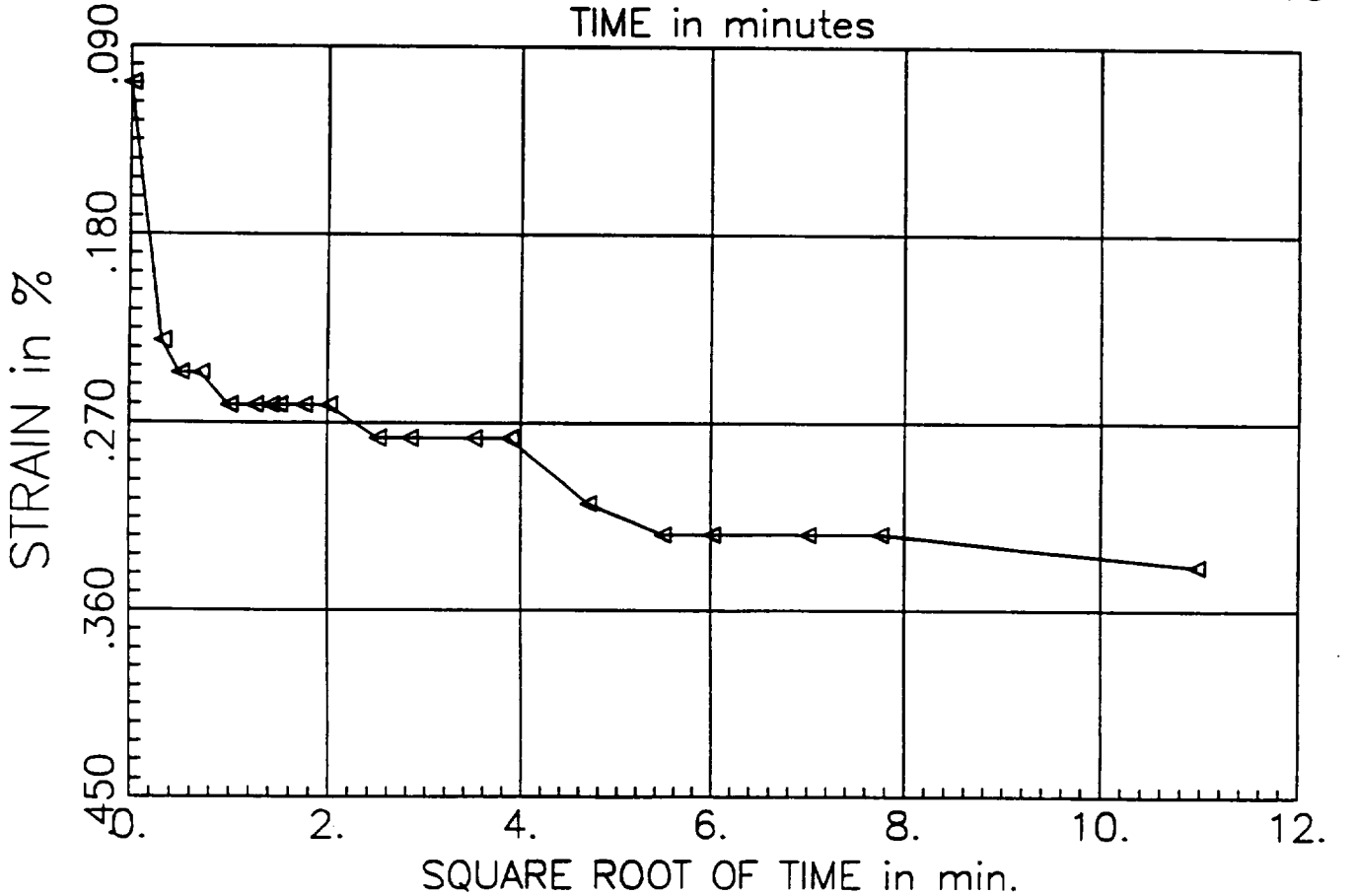




PRESSURE INCREMENT
from 0.00 tsf to 0.10 tsf

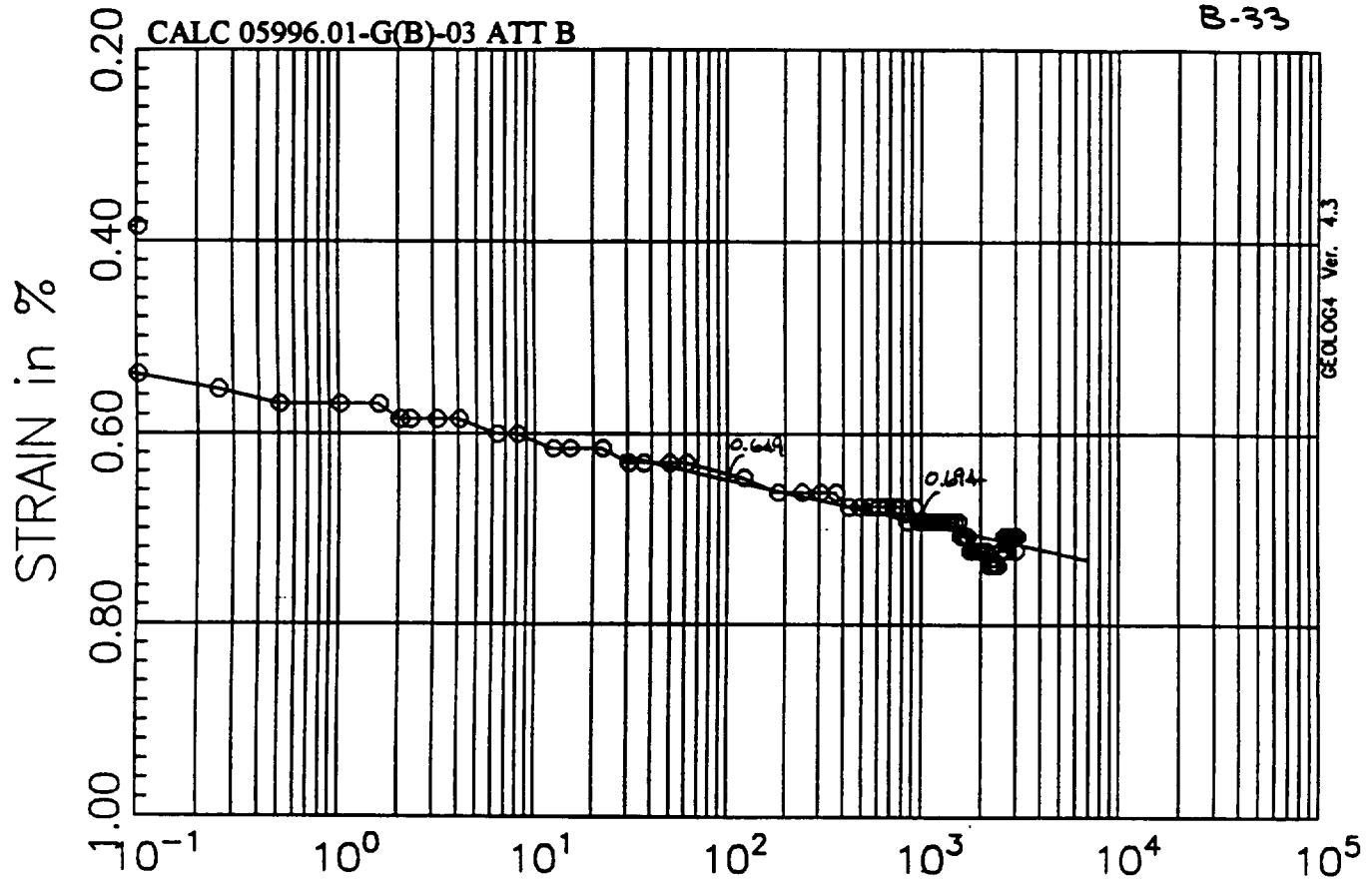
Test No: 3
Testname: C2-U2C





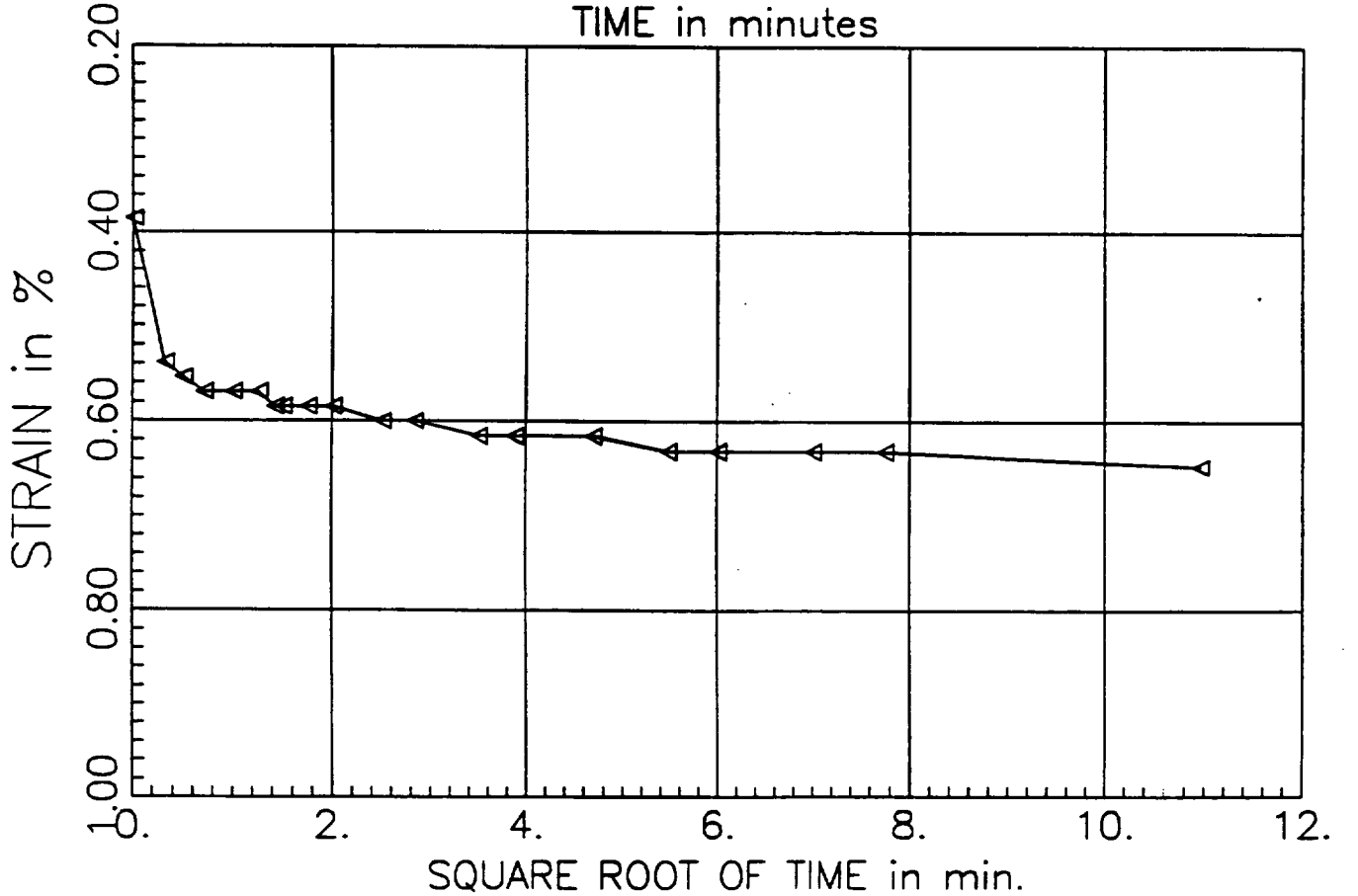
PRESSURE INCREMENT
from 0.10 tsf to 0.25 tsf

Test No: 3
Testname: C2–U2C



0.21

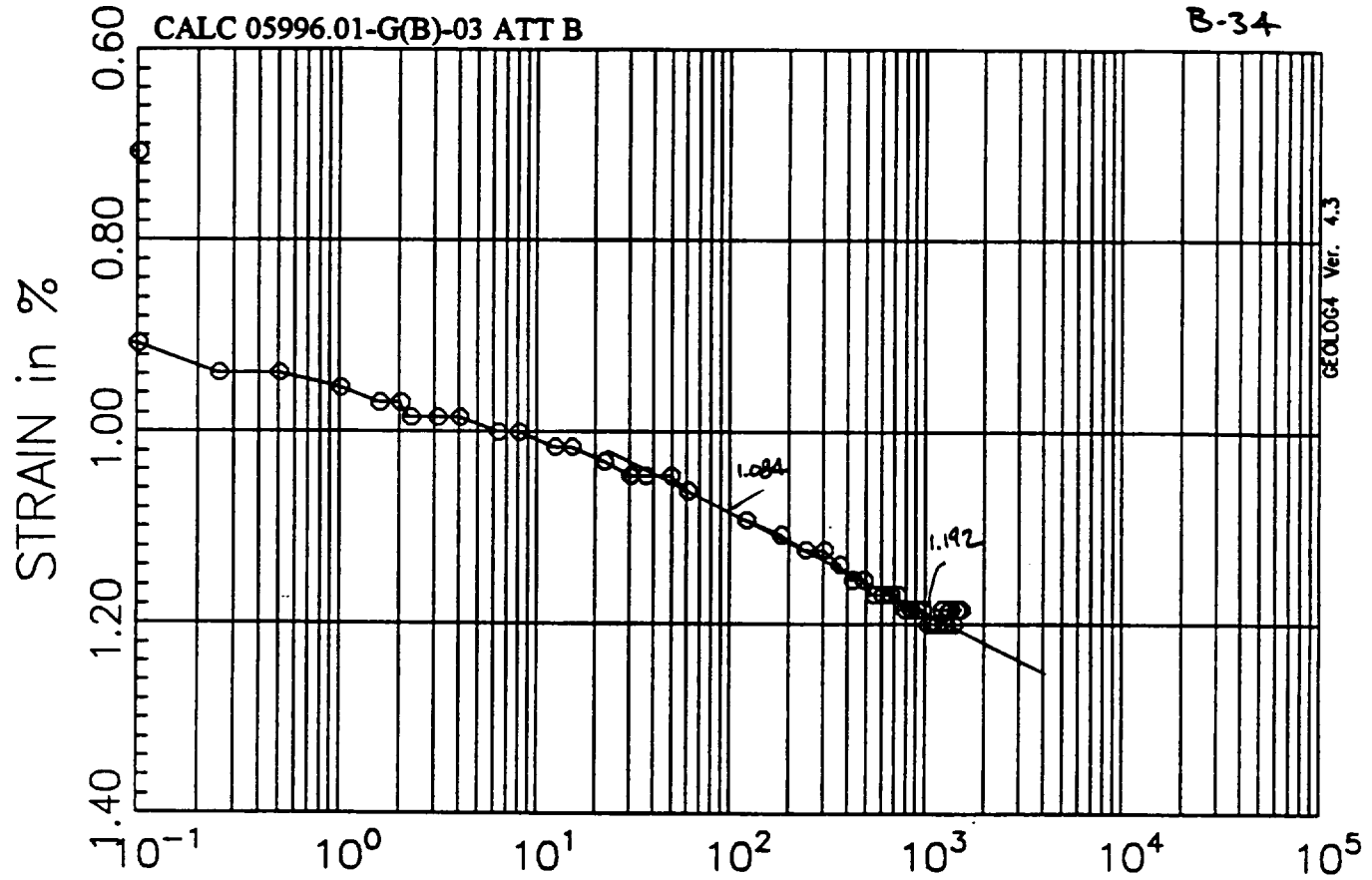
0.48

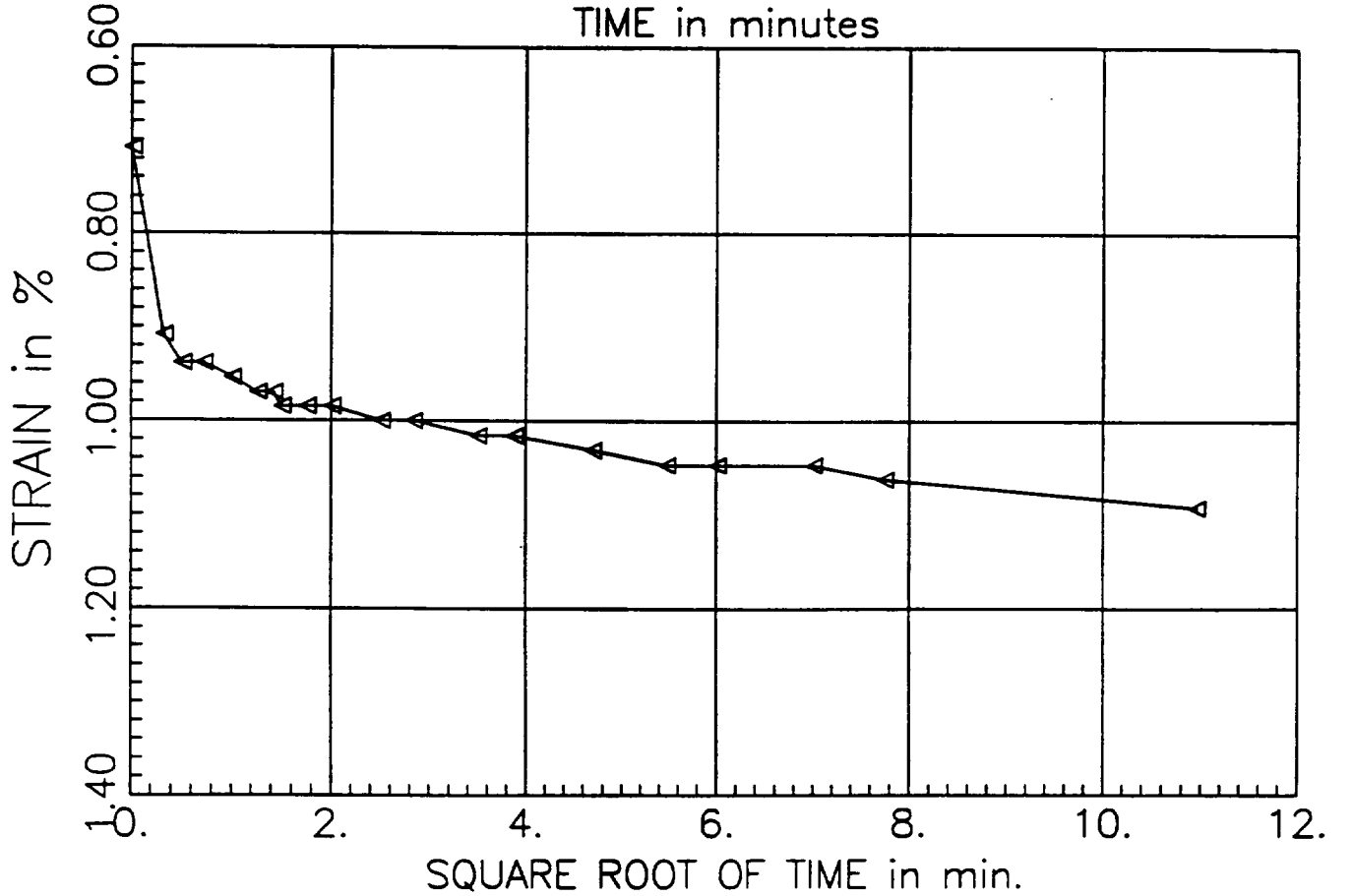


PRESSURE INCREMENT
from 0.25 tsf to 0.50 tsf

Test No: 3
Testname: C2-U2C

B-34



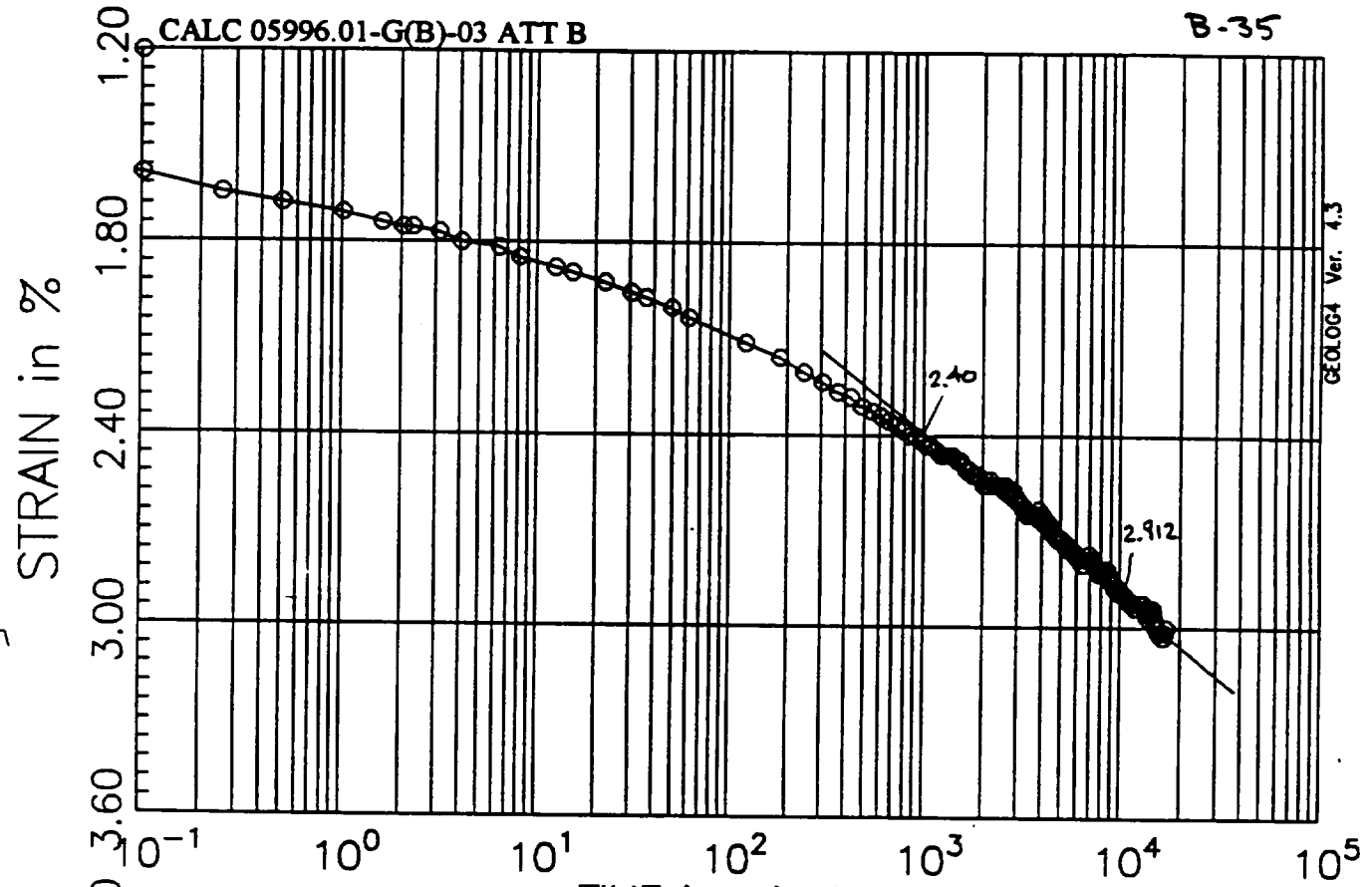


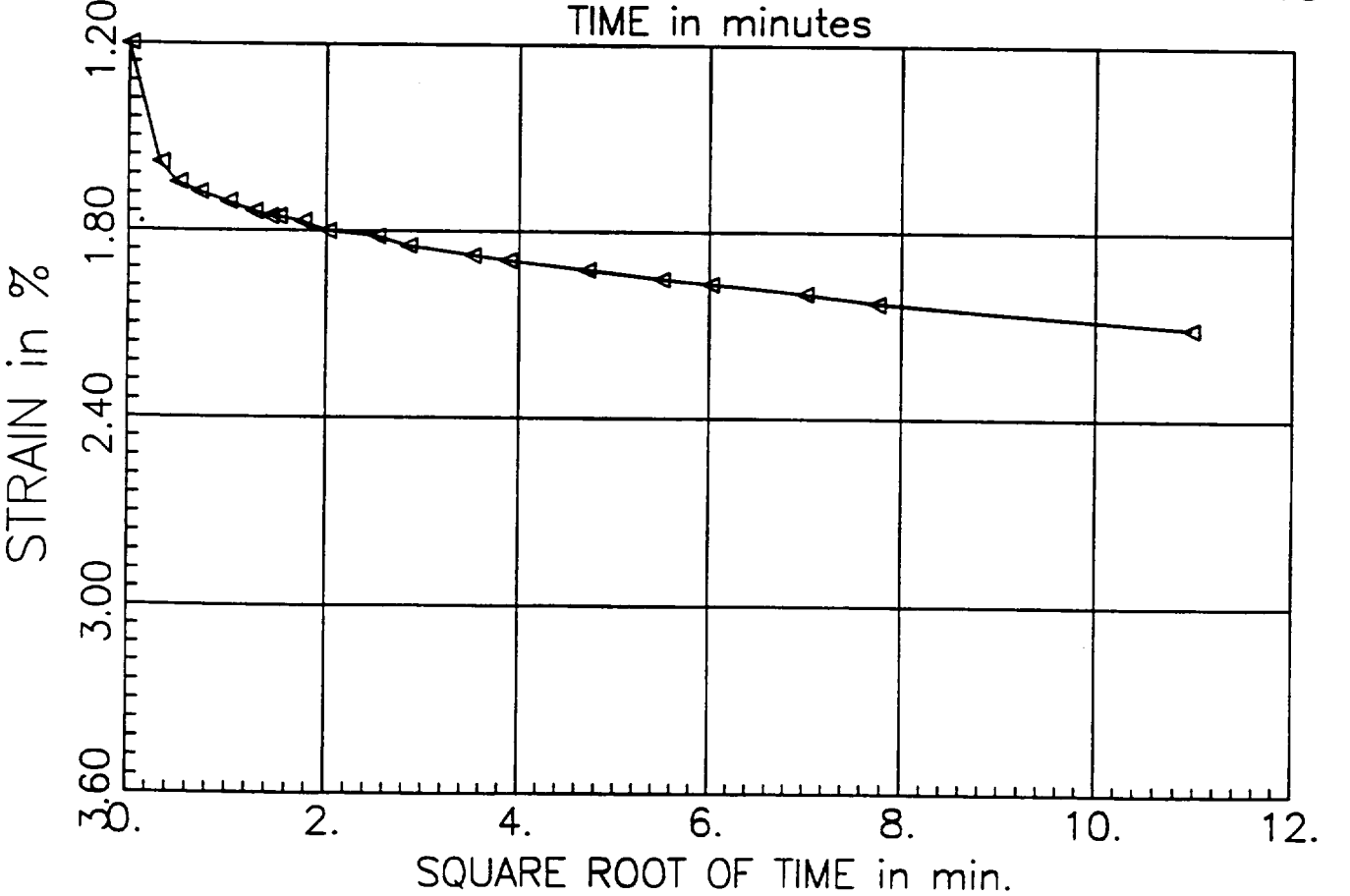
PRESSURE INCREMENT
from 0.50 tsf to 1.00 tsf

Test No: 3
Testname: C2–U2C

CALC 05996.01-G(B)-03 ATT B

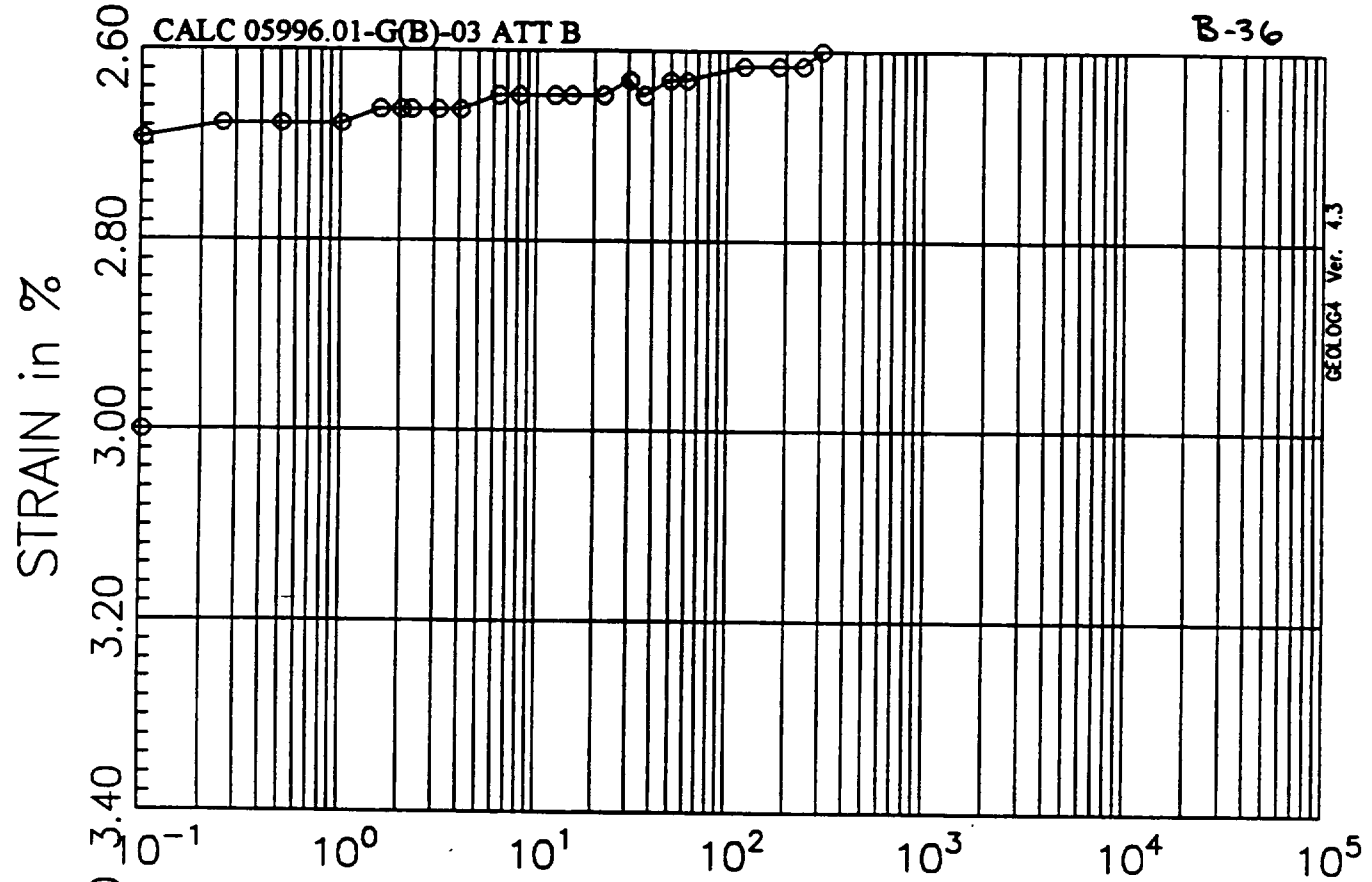
B-35

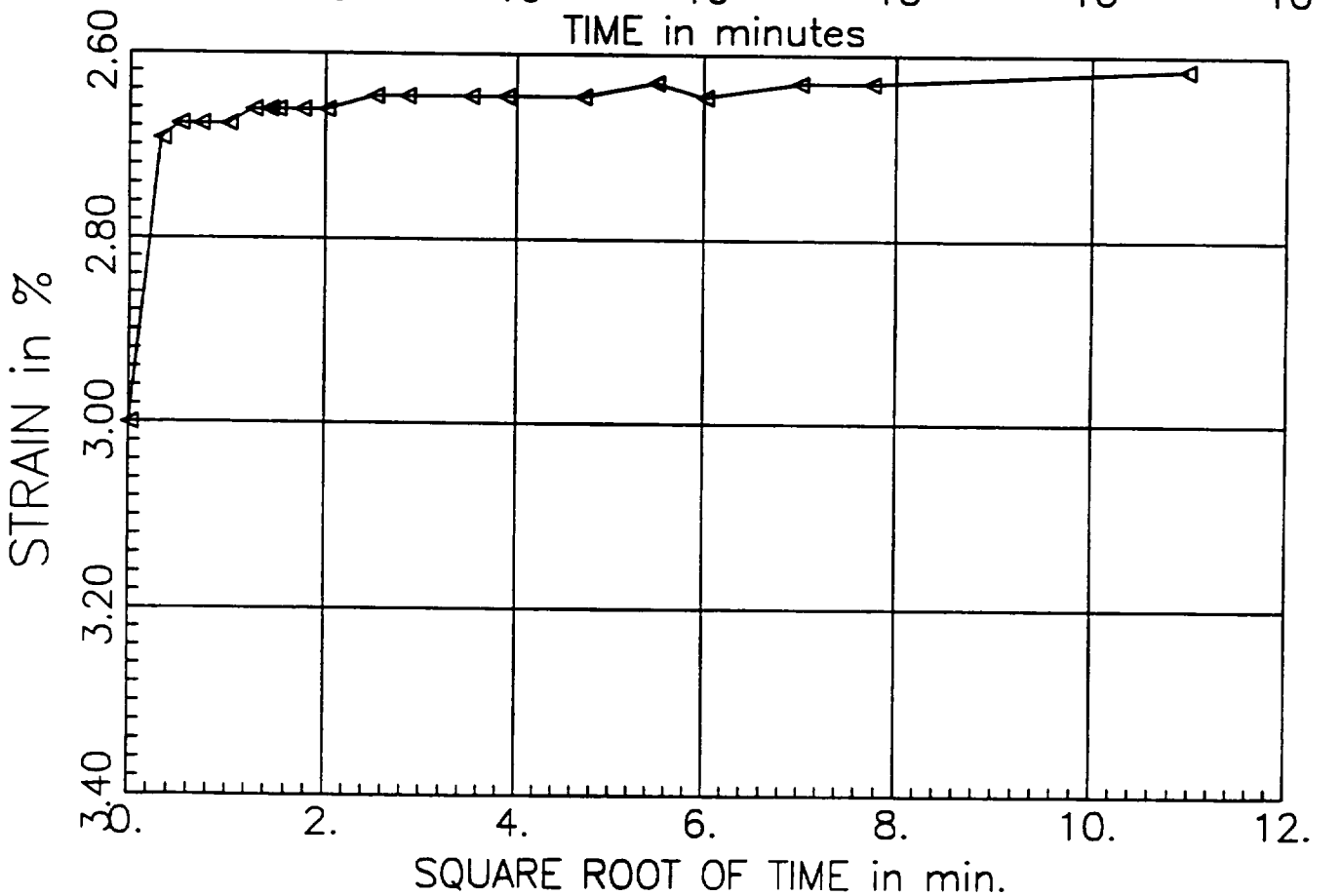




PRESSURE INCREMENT
from 1.00 tsf to 2.00 tsf

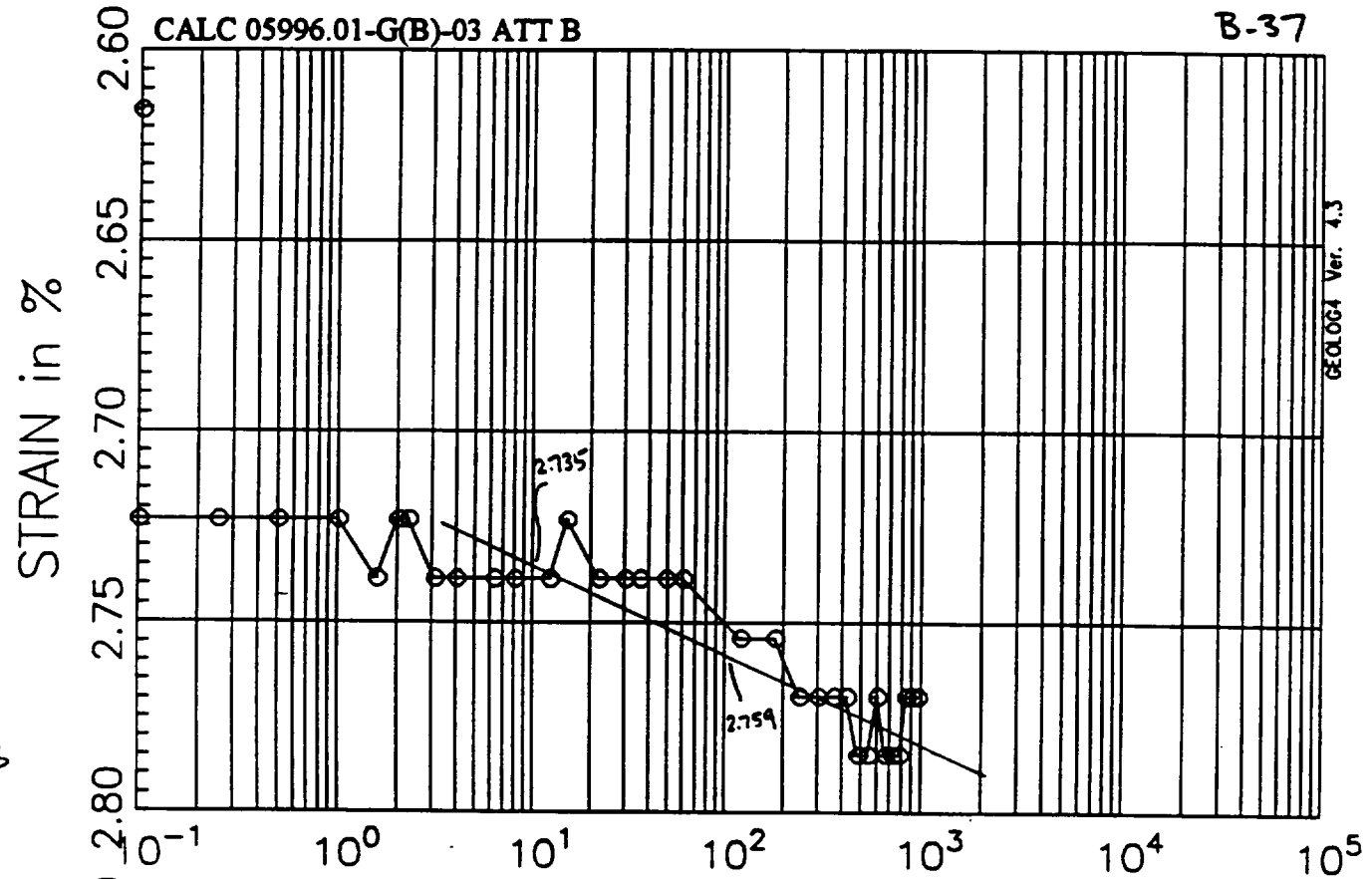
Test No: 3
Testname: C2-U2C





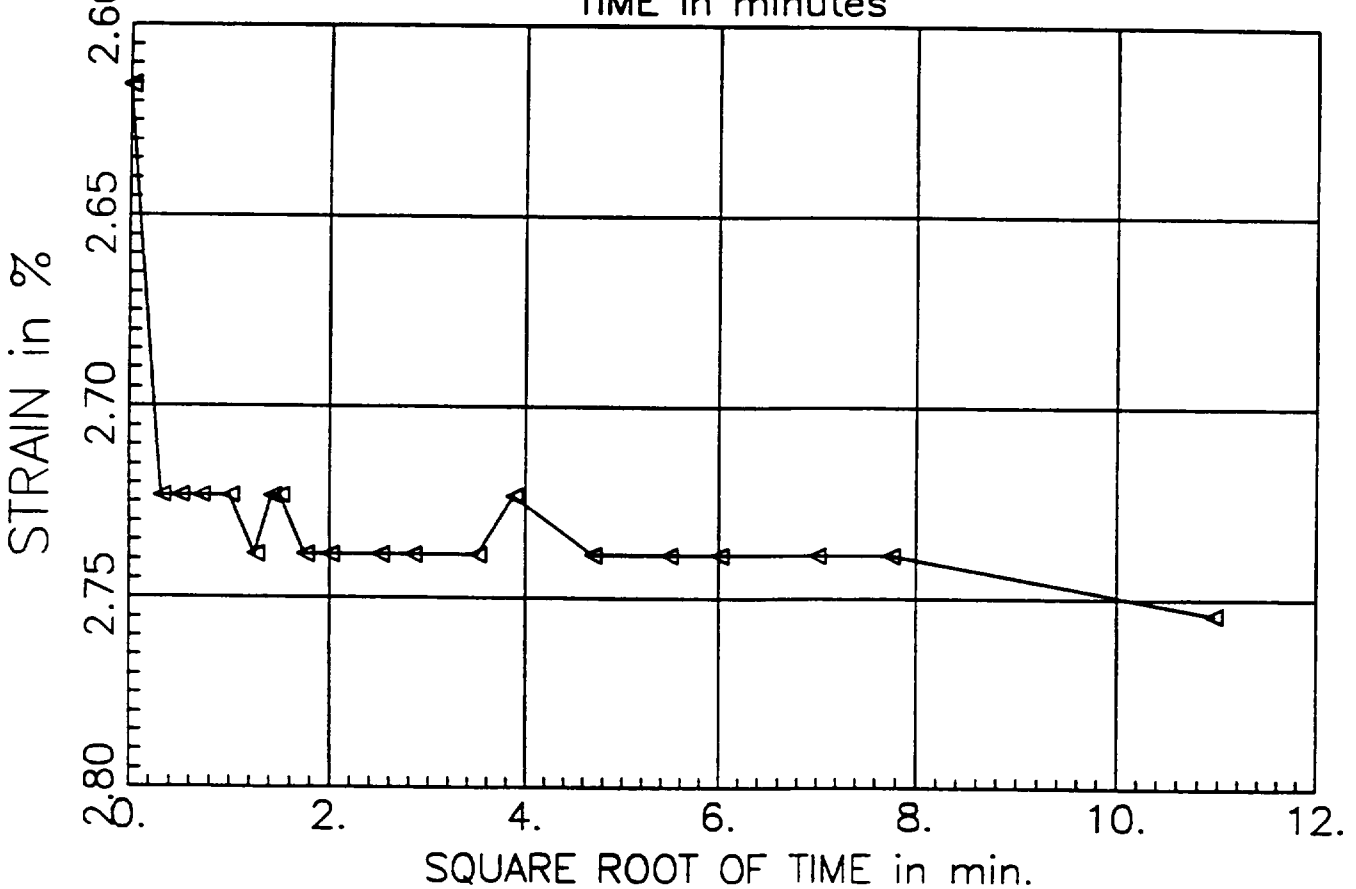
PRESSURE INCREMENT
from 2.00 tsf to 0.50 tsf

Test No: 3
Testname: C2-U2C



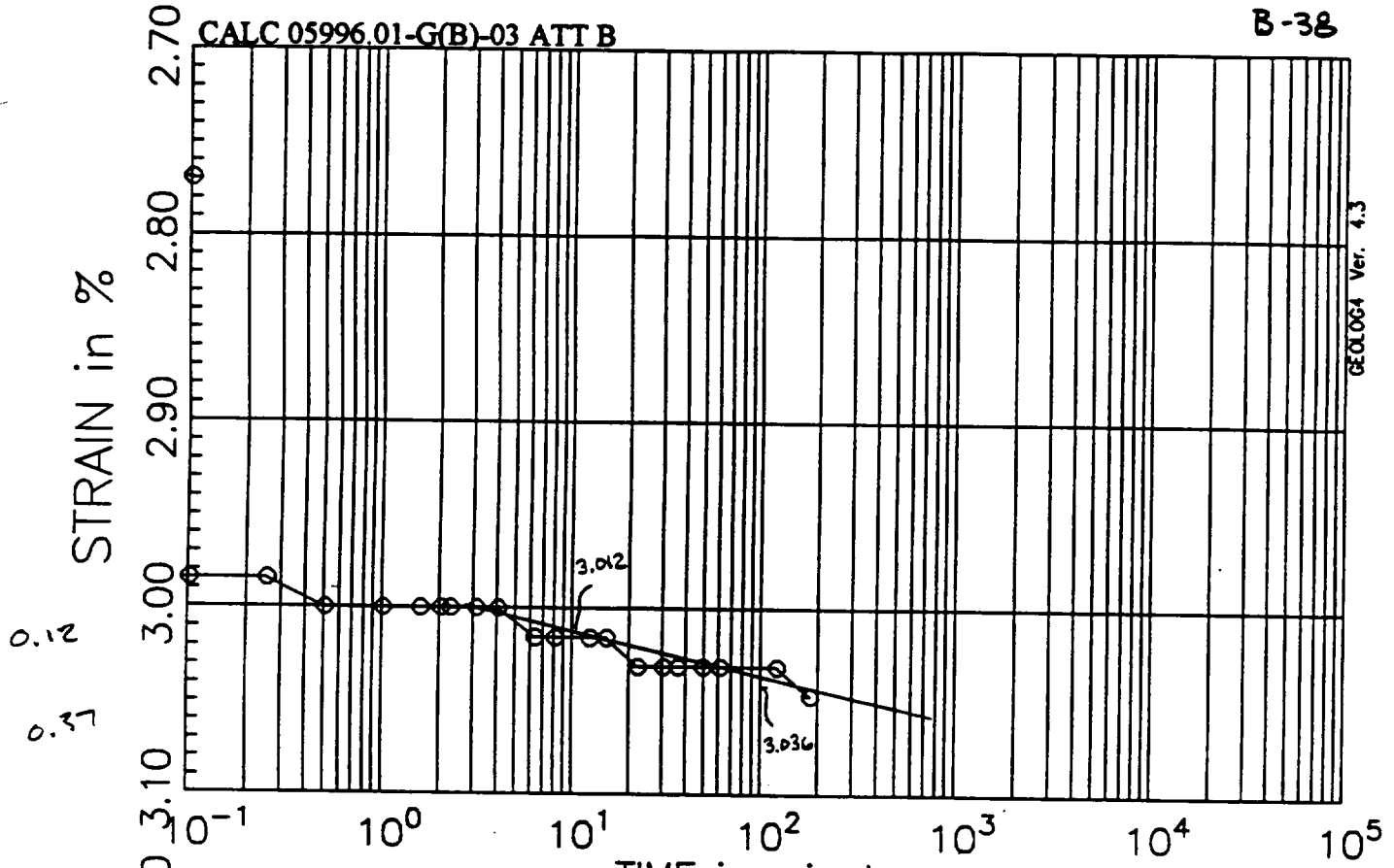
0.72

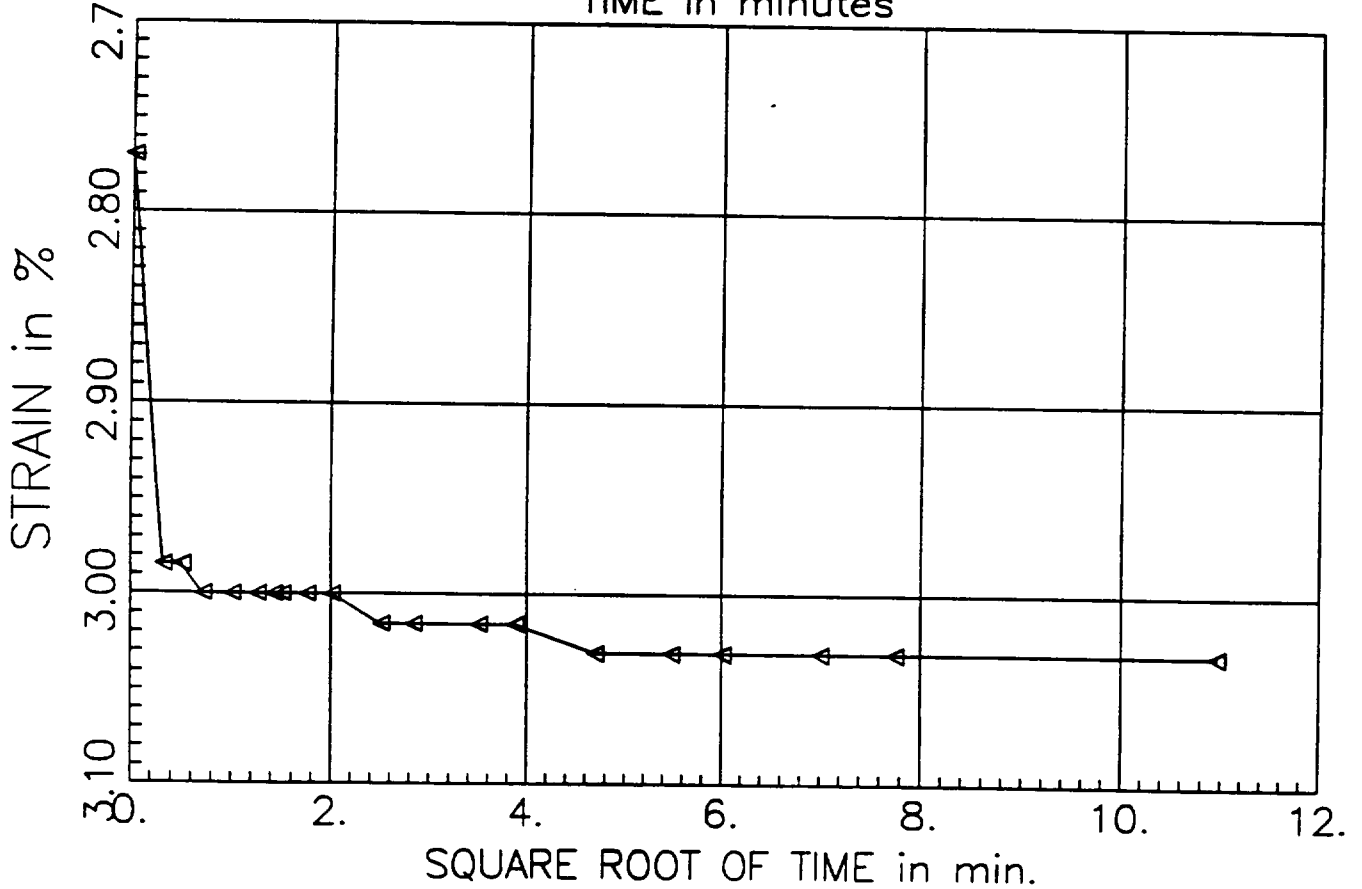
0.18



PRESSURE INCREMENT
from 0.50 tsf to 1.00 tsf

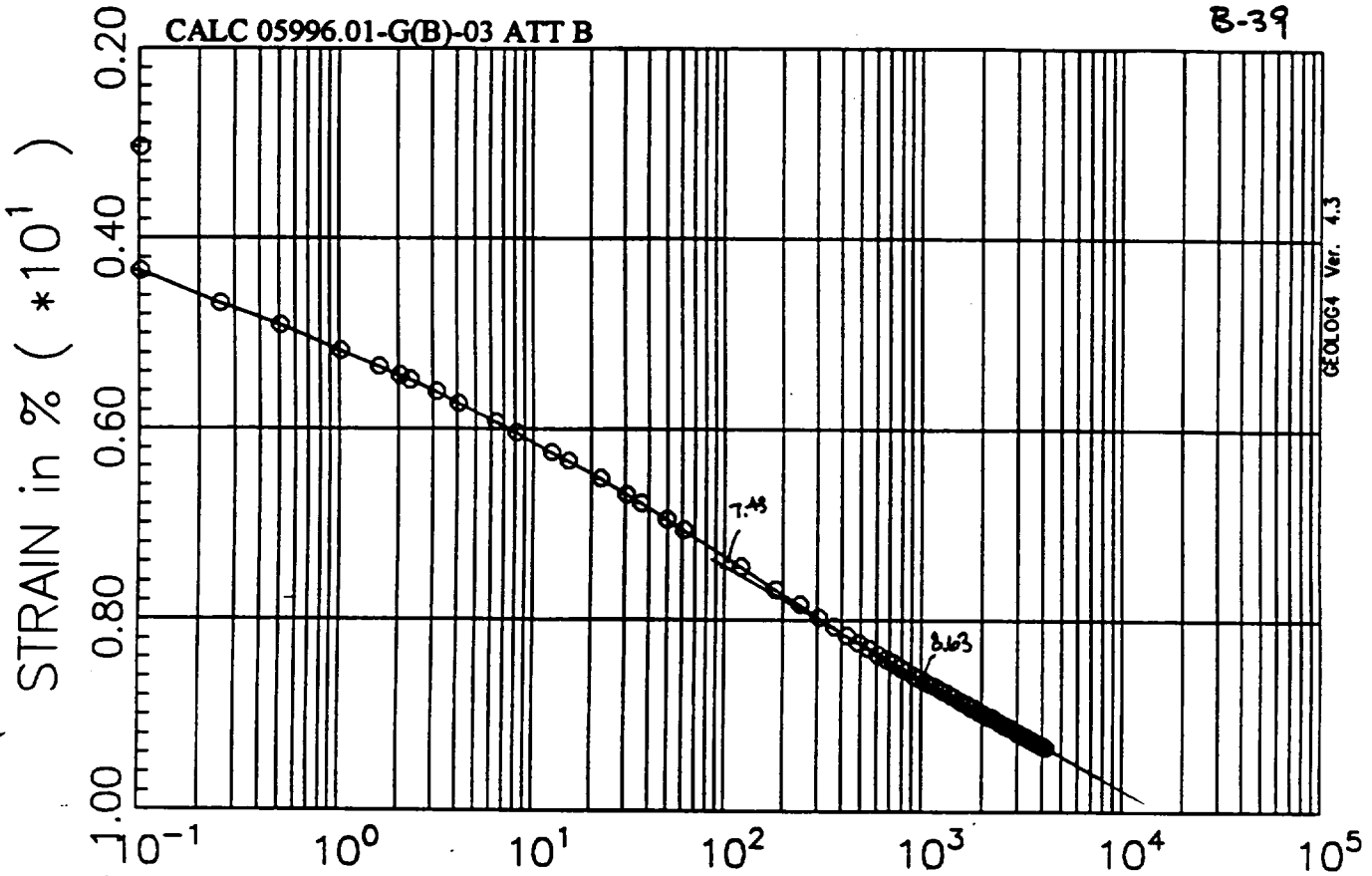
Test No: 3
Testname: C2-U2C





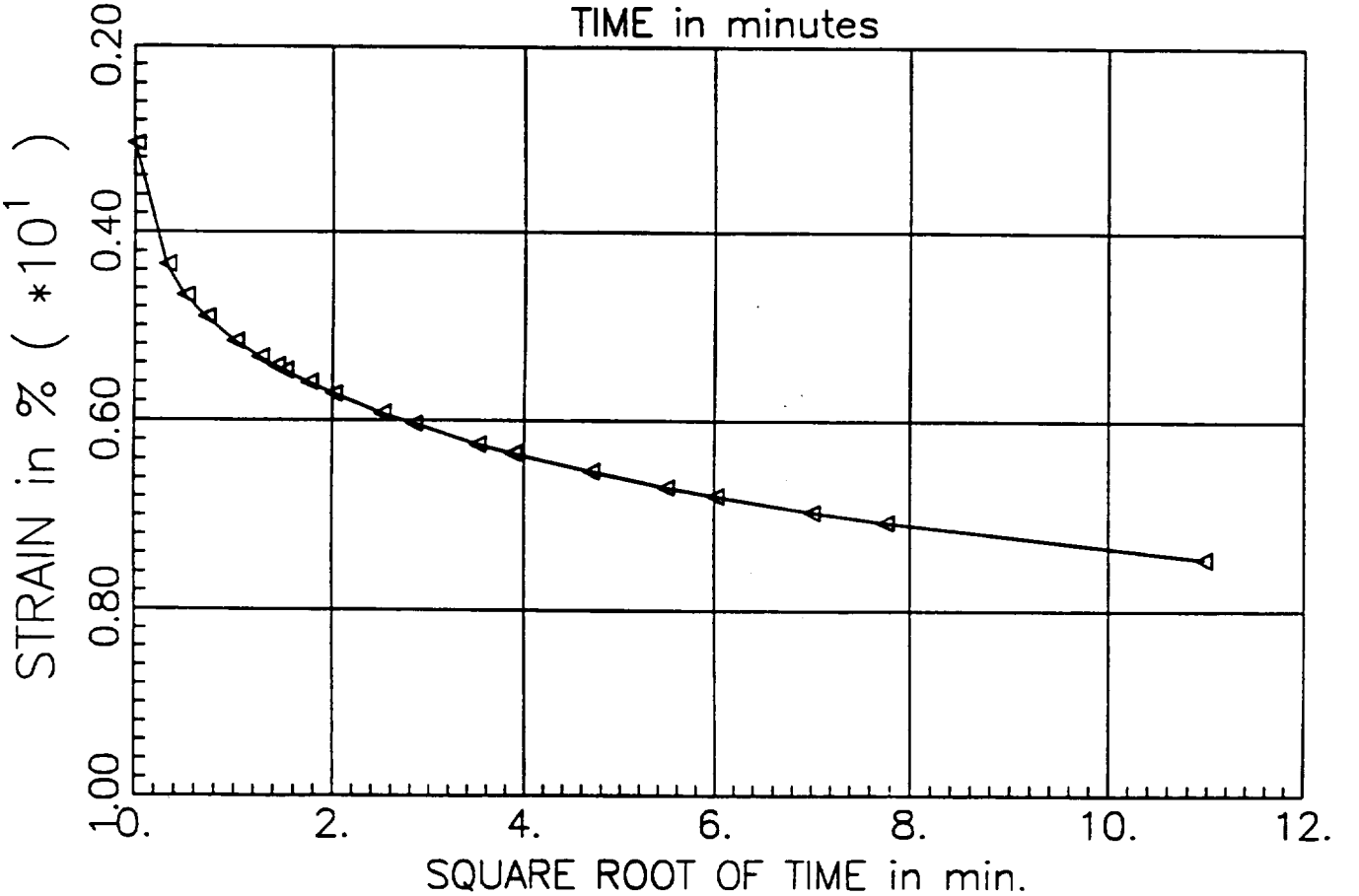
PRESSURE INCREMENT
from 1.00 tsf to 2.00 tsf

Test No: 3
Testname: C2-U2C



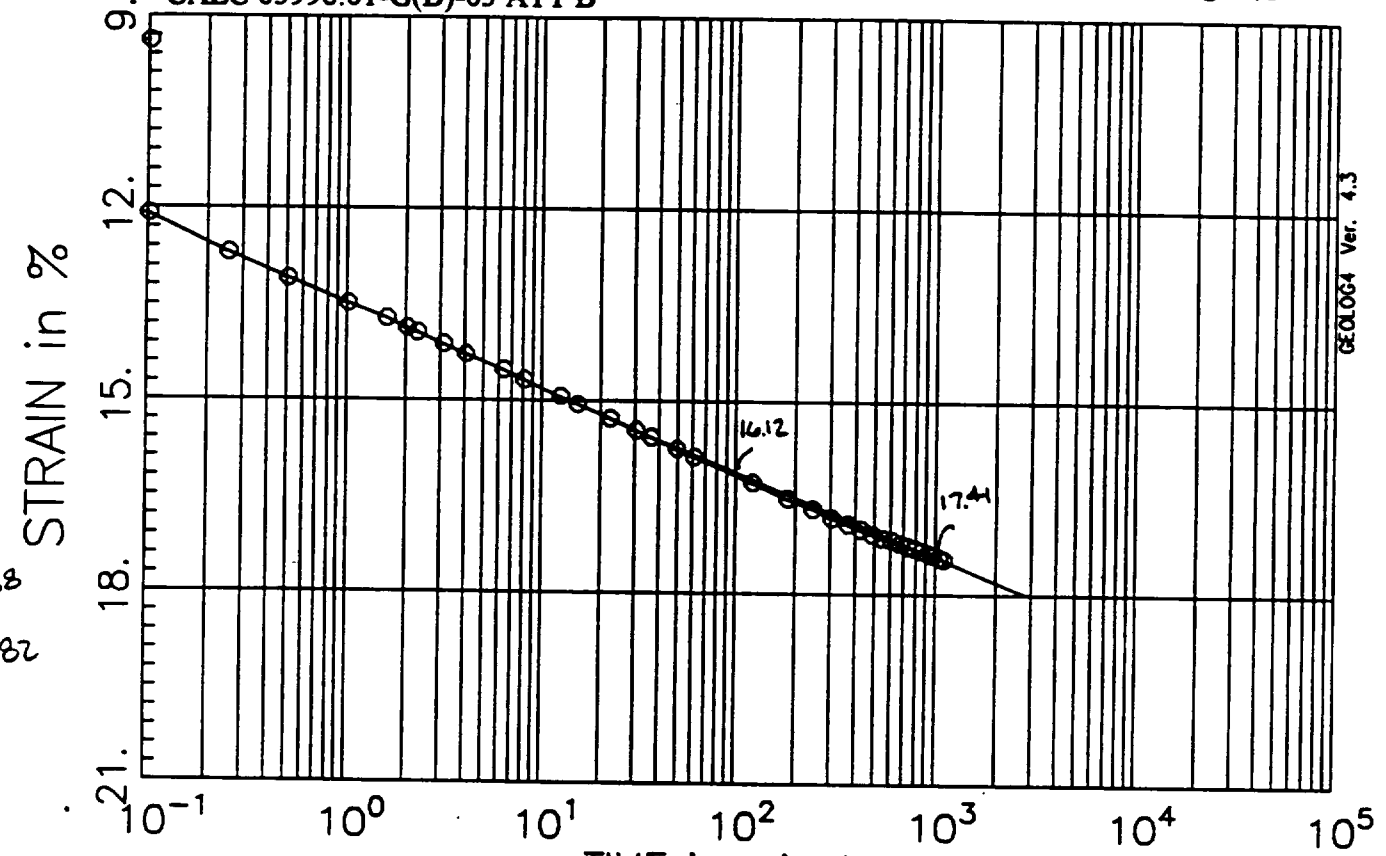
0.73

0.32



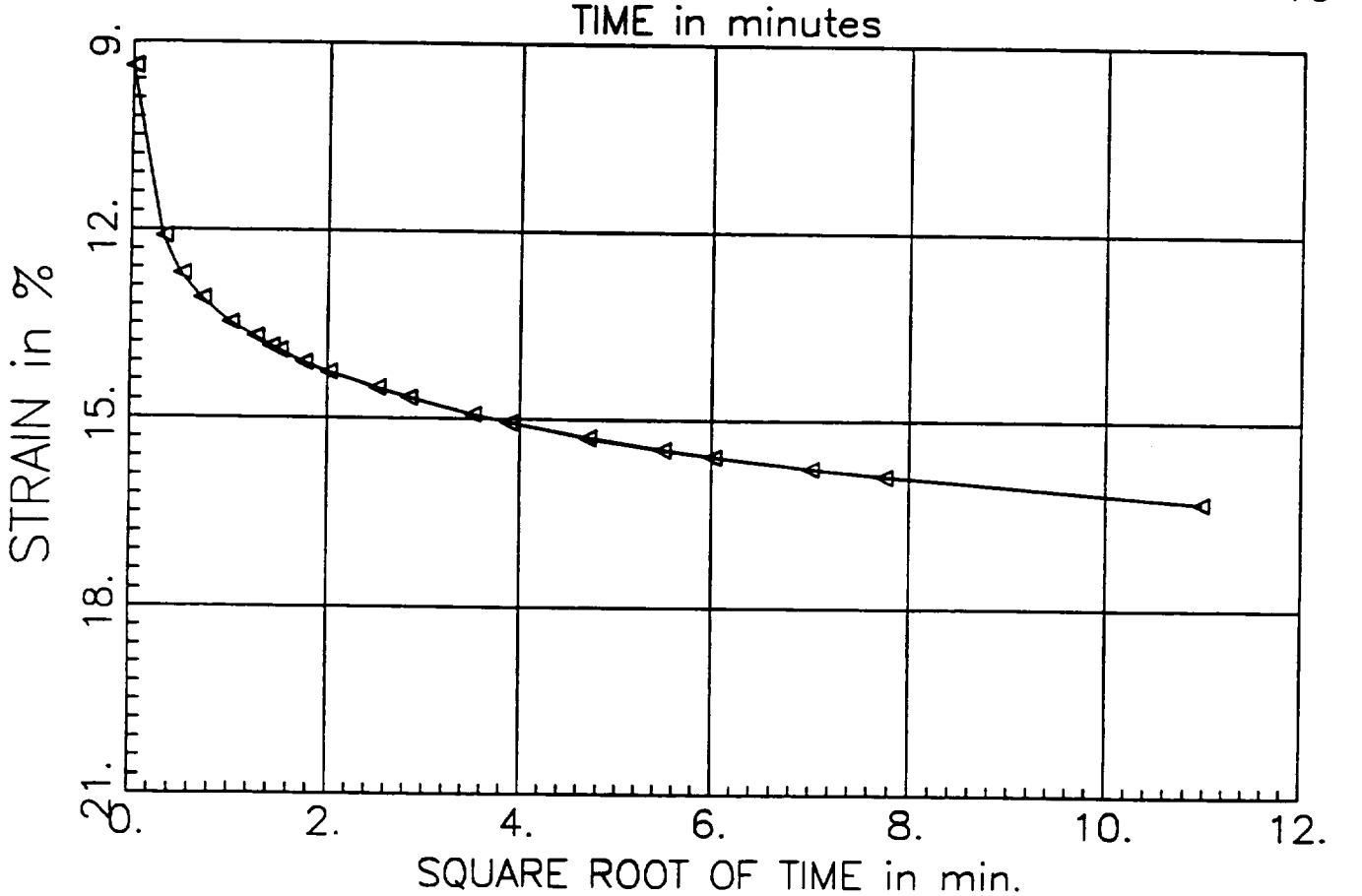
PRESSURE INCREMENT
from 2.00 tsf to 4.00 tsf

Test No: 3
Testname: C2-U2C



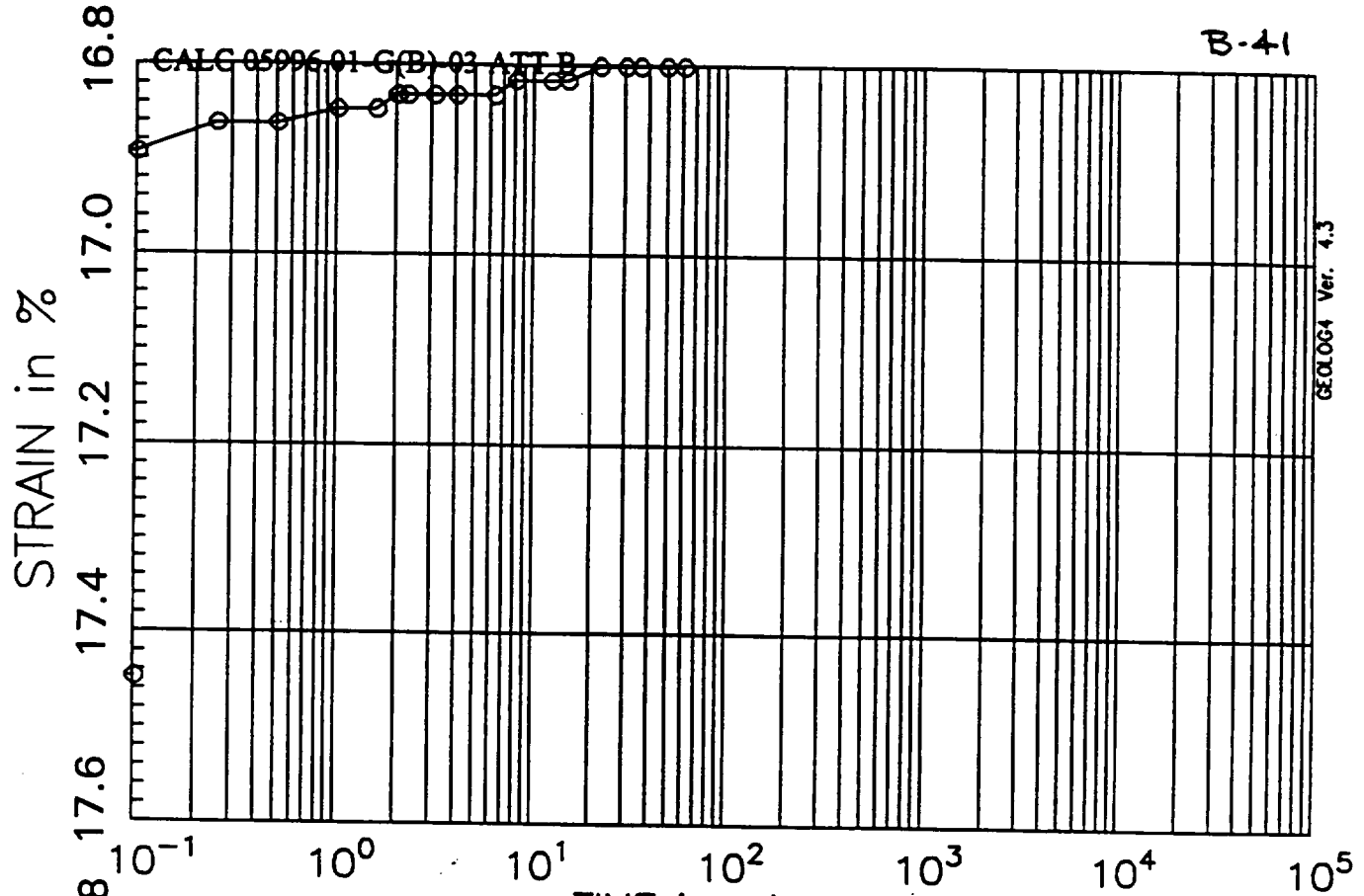
0.38

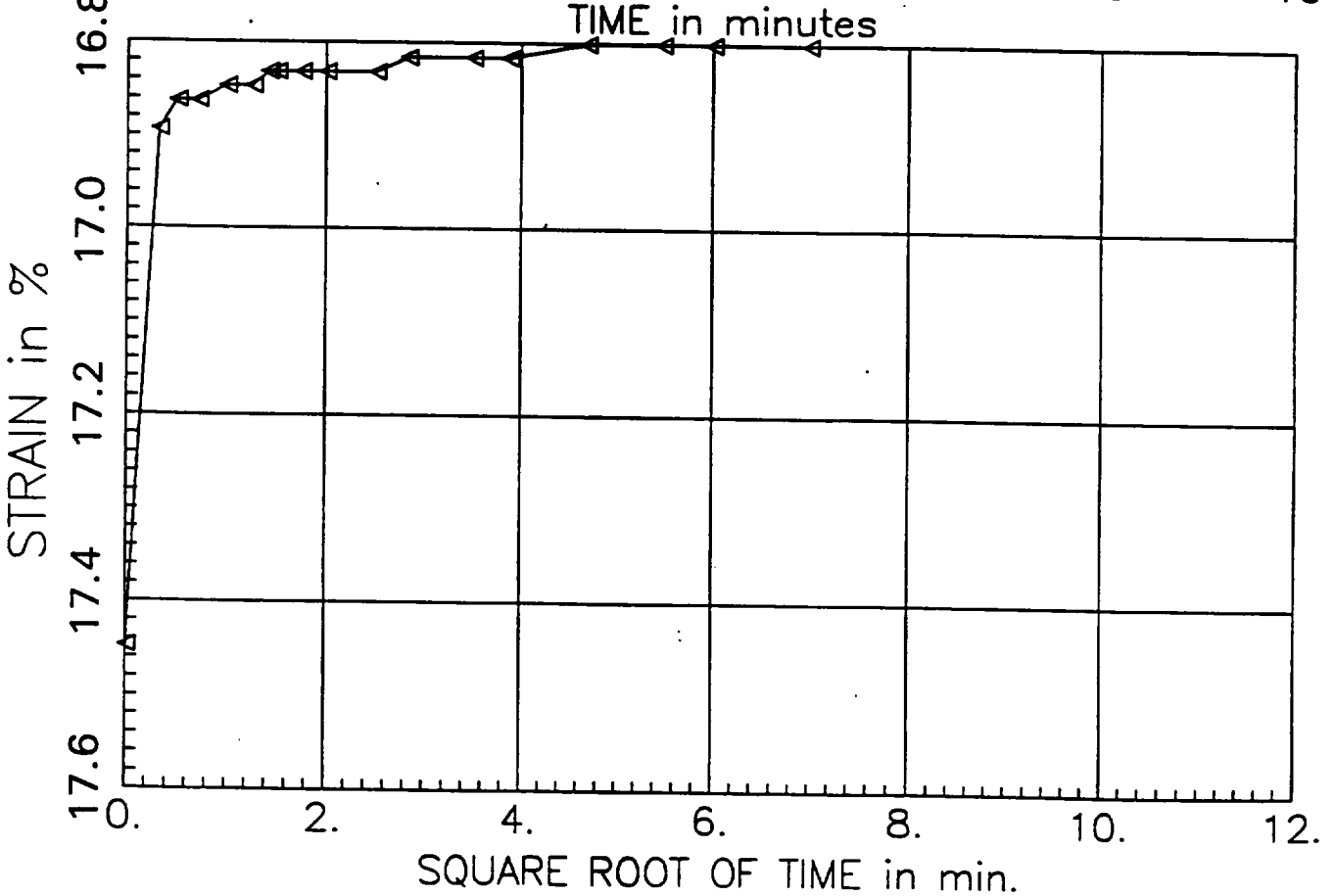
0.82



PRESSURE INCREMENT
from 4.00 tsf to 8.00 tsf

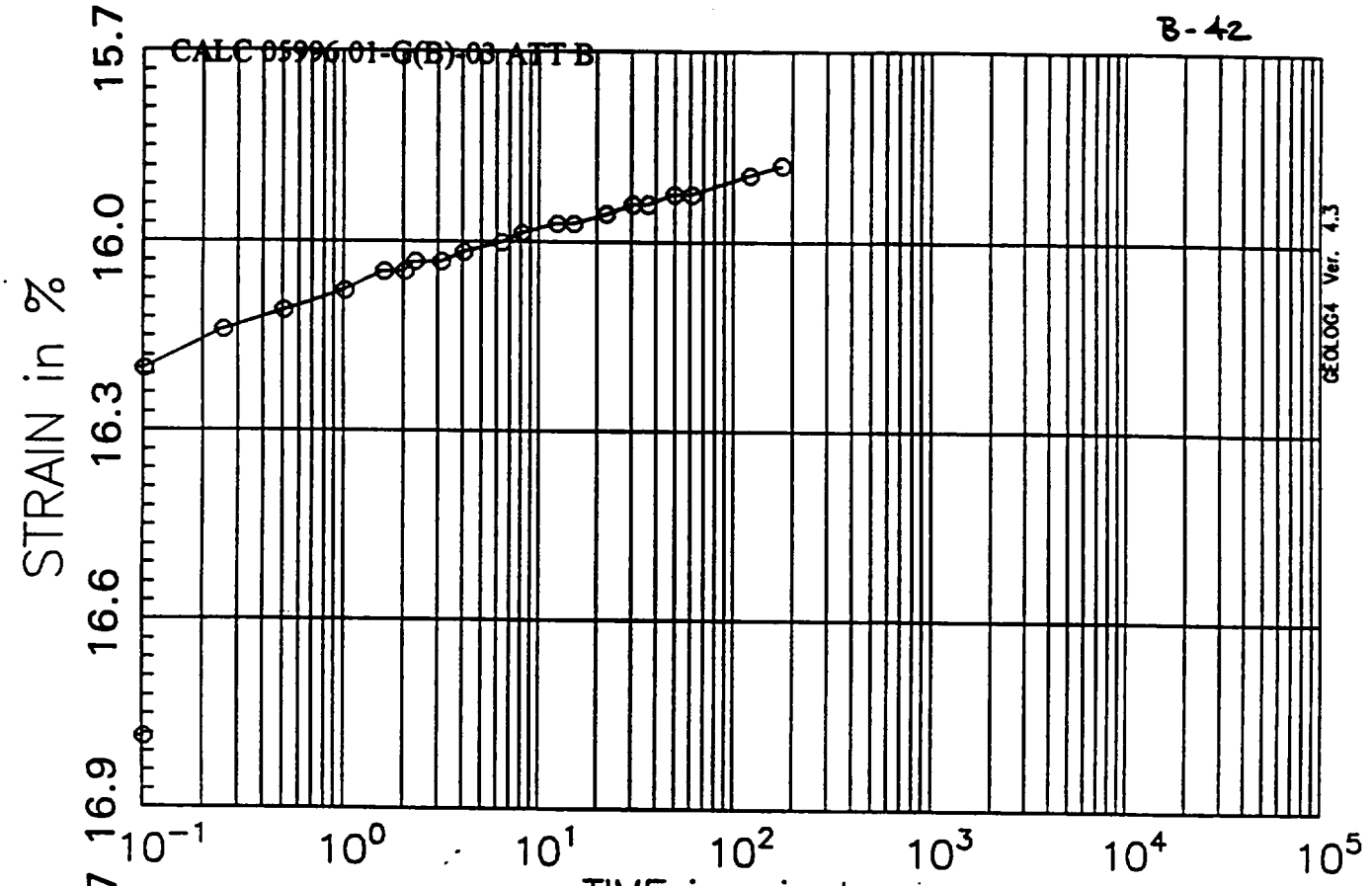
Test No: 3
Testname: C2–U2C

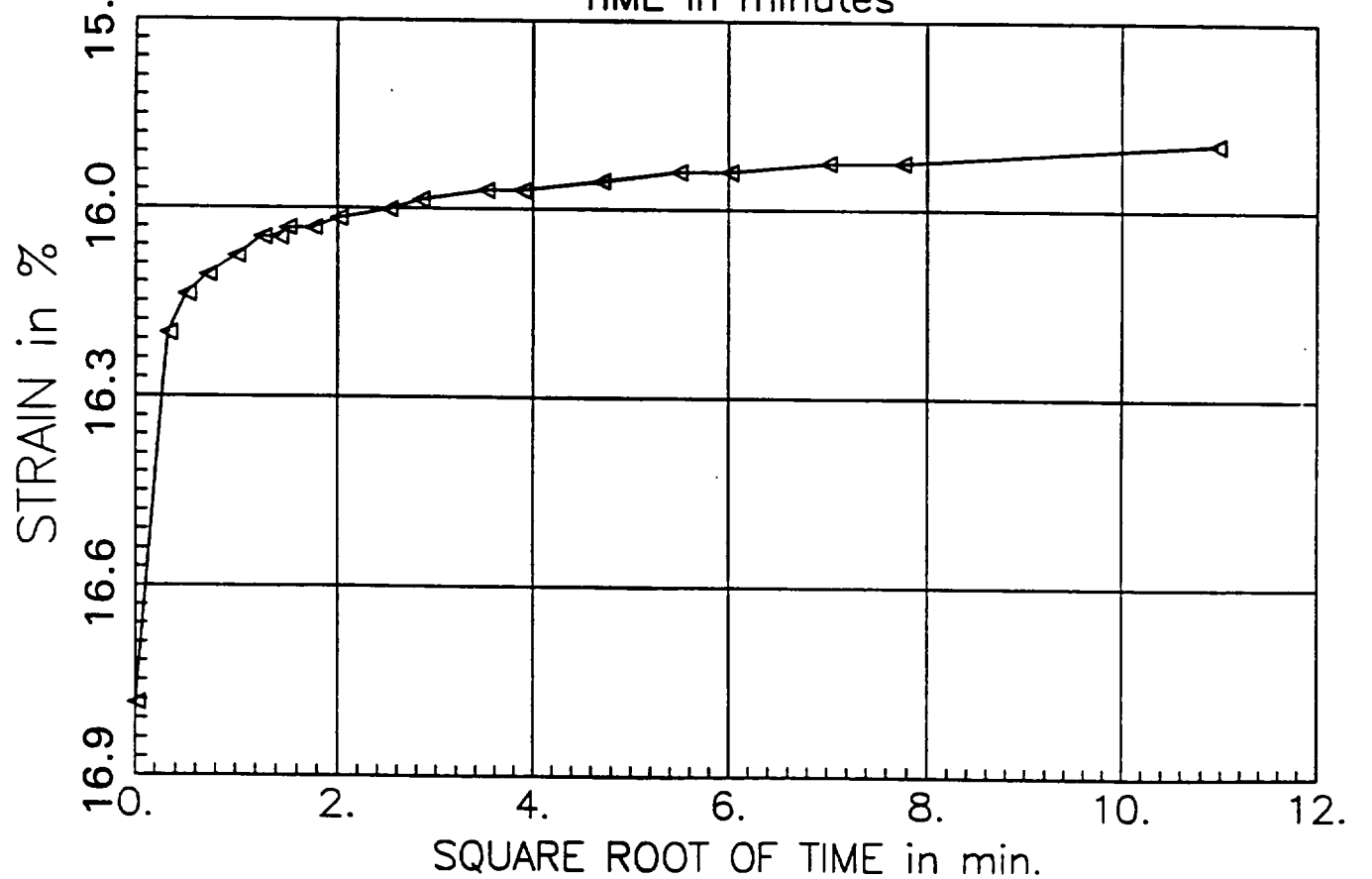




PRESSURE INCREMENT
from 8.00 tsf to 2.00 tsf

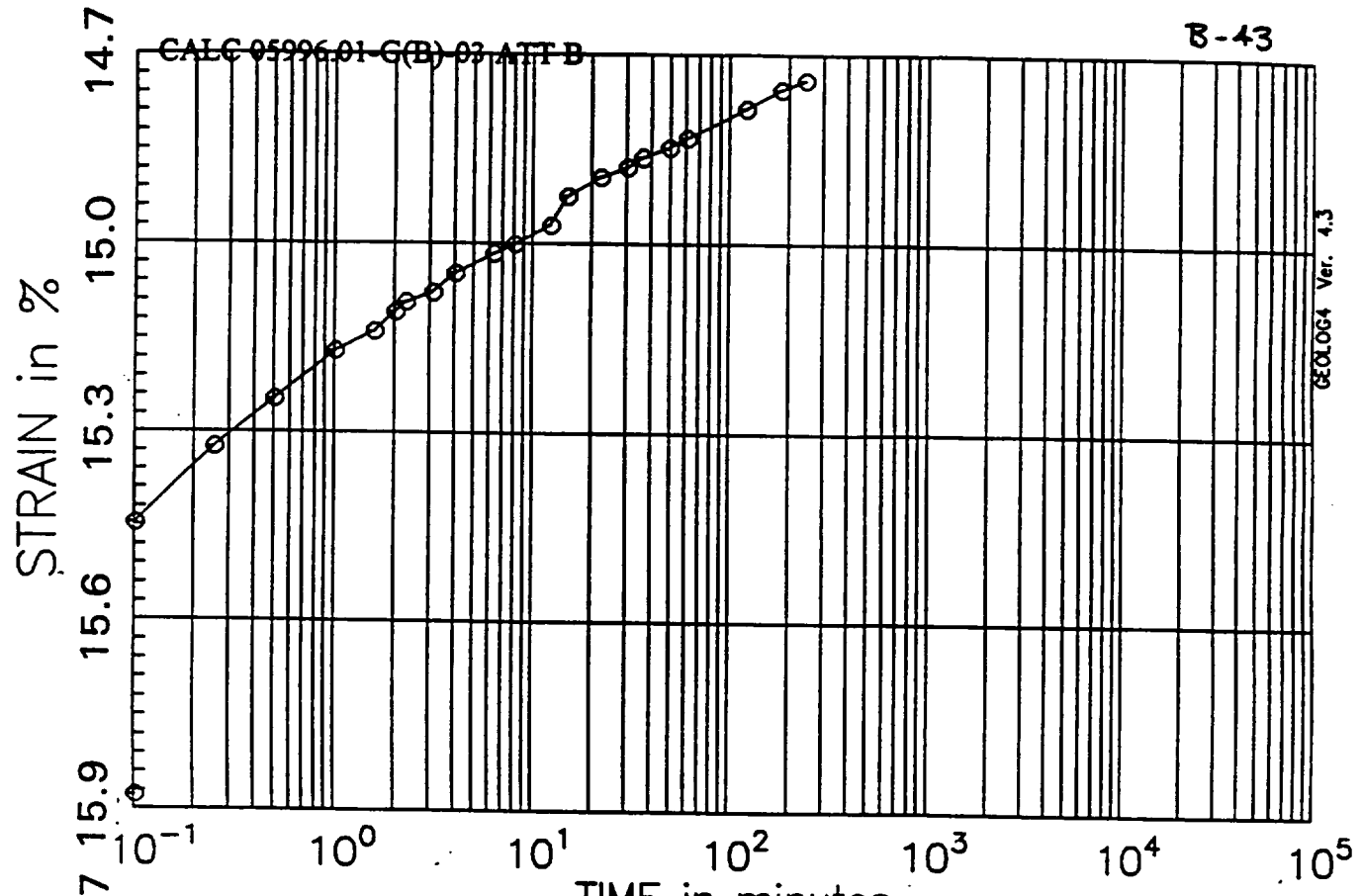
Test No: 3
Testname: C2-U2C

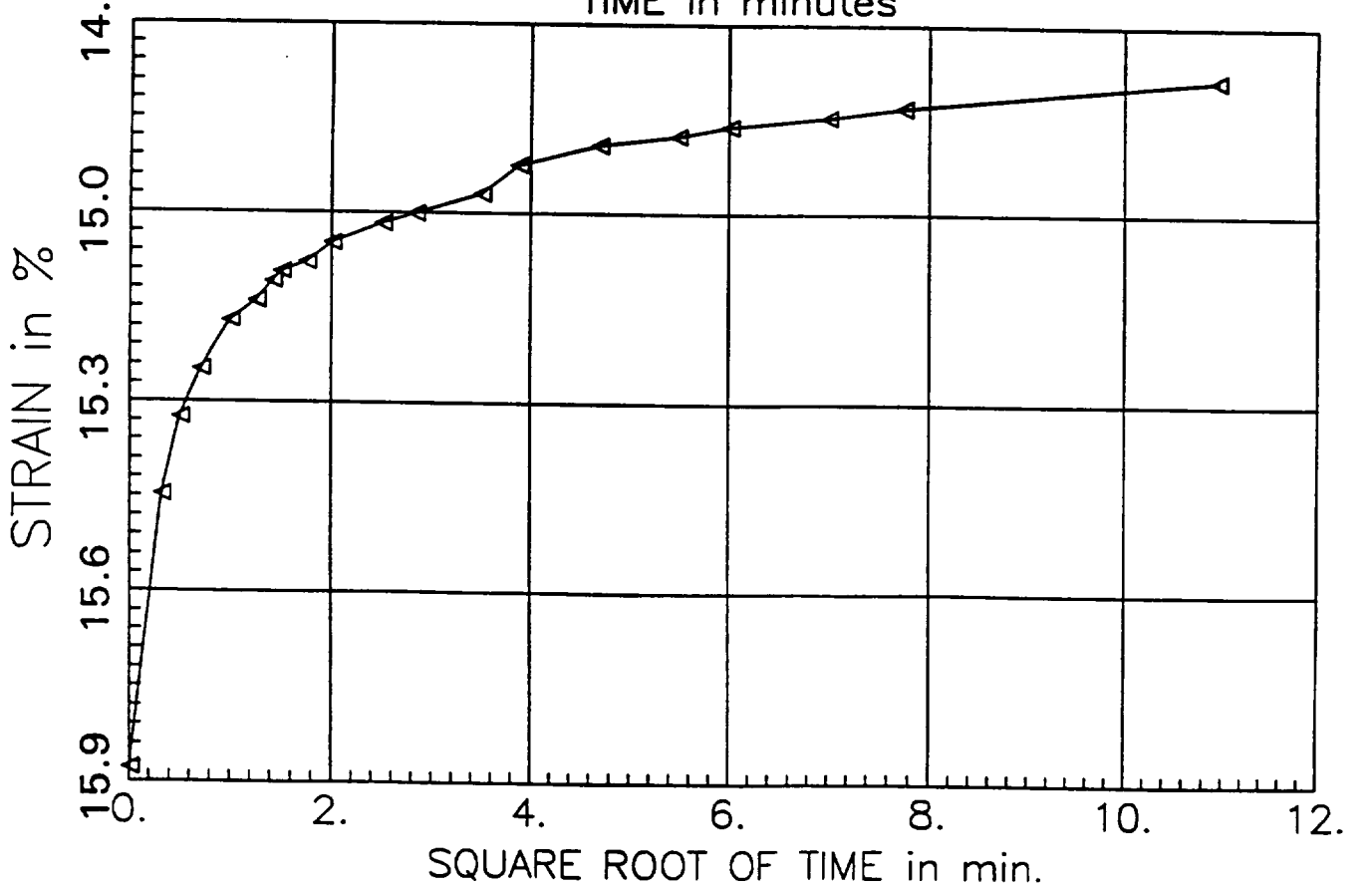




PRESSURE INCREMENT
from 2.00 tsf to 0.50 tsf

Test No: 3
Testname: C2-U2C





PRESSURE INCREMENT
from 0.50 tsf to 0.10 tsf

Test No: 3
Testname: C2-U2C