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COMPACTION STUDY BLOCK 31/2 OFFSHORE NORWAY

by

J.A. de Waal and J.D. de Graaf

KONINKLIJKE / SHELL EXPLORATIE EN PRODUKTIE LABORATORIUM
RIJSWIJK, THE NETHERLANDS

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Investigation 8.21.391

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RIJSWIJK, THE NETHERLANDS

(Shell Research B.V.)

CONTENTS

SUMMARY

At the request of Shell Forus, the compaction behaviour of 18 friable sandstone samples from well 31/2-4 (block 31/2), offshore Norway has been determined. The results of these measurements are presented in this report. Based on these results a tentative estimate is made of the reservoir compaction and associated sea-bottom subsidence, which is about 3 m at a pressure drop of 100 bar.

KEYWORDS

Norway, 31/2-4, compaction, compressibility, triaxial test, subsidence, friable sandstone, depletion.

COMPACTION STUDY BLOCK 31/2, OFFSHORE NORWAY

INTRODUCTION

During measurements of acoustic velocities under in-situ stress conditions on two samples from well 31/2-1 offshore Norway (see Fig. 1) information was also obtained on the compaction properties of the samples. It was concluded that conditional upon the measured compressibilities being representative of the reservoir, compaction/subsidence upon depletion could well amount to several metres, which may have consequences for well completion operations and marine riser design. After consultation with Shell Forus, it was then decided to conduct some 30 triaxial compaction experiments on samples from wells 31/2-4 and 31/2-5, in order to look into the compaction behaviour of the reservoir rock in block 31/2.

2. COMPACTION EXPERIMENTS

2.1 Sample selection

Core material from wells 31/2-4 and 31/2-5 was sent to KSEPL in the form of some 300 sealed core samples with a length of 10 cm each. These full diameter core pieces were taken at approximately 1 m intervals over the total core lengths. Originally, these samples were sent to KSEPL primarily for sand failure experiments, but sufficient material was available to select samples for the compaction study as well.

Based on the BHN profile measured on 31/2-4 cores 6-21 (gas-bearing zone) a number of full-diameter core pieces were selected to be used for the compaction study. They were selected to cover the total range of BHN values over the total core interval at a more or less constant sampling density. As the selected intervals consisted mainly of very friable sandstone, just like the total core, only 18 plugs suitable for triaxial compaction experiments could be taken. The main problems were encountered with coarse-grained material. As a result, the sample selection is probably biased towards the finer grained intervals. Additional plugs were taken at five depth intervals after freezing the core material. The latter samples were drilled using a liquid-nitrogen-cooled core bit. It was feared, however, that the very weak constitution of the core material would be disturbed by the freezing process.

As the quality of the 31/2-5 core was considerably poorer than that of the 31/2-4 core, it was felt that samples from this core would not be suitable to check the data obtained on the 31/2-4 core. The experiments were therefore restricted to samples from well 31/2-4.

A description of the samples selected is given in Table 1. The sample numbers correspond to those of the core pieces from which the samples were taken. The samples that have been frozen are marked with an additional letter F. Facies typing has been carried out by a KSEPL geologist (see also Table 2).

2.2 Description of experimental procedures

The compaction behaviour of friable sandstone samples is measured in a triaxial compaction cell as shown in Fig. 2. Axial pressure on the sample is exerted by means of a piston. Radial stress is applied by fluid pressure along the circumference of the sample, which is enclosed by an impermeable elastomer sleeve. Axial and radial stress can be varied independently. The ratio is kept at such a value that no lateral strain occurs, thus simulating reservoir conditions. The axial load is applied at a rate of approximately 100 bar/h. Pore pressure is kept atmospheric. The samples are wet, but not 100% saturated. Axial pressure, radial pressure, axial loading rate, radial loading rate, axial displacement and in some experiments radial displacement are recorded.

2.3 Results

Twenty triaxial compaction tests have been carried out on 18 samples from well 31/2-4. Compaction and compressibilities obtained are presented in tables A1-A21 and computers plots (figs. A1-A18) in Appendix A. Compaction was calculated from

$$\varepsilon_z = \frac{h(P_z) - h(P_{z,ref})}{h(P_{z,ref})} \qquad (1)$$

where

ε_z	compaction at axial effective stress P_z
$h(P_z)$	sample height at axial stress P_z
$P_z = \sigma_z - P_{pore}$	axial effective stress
σ_z	total axial stress
P_{pore}	pore pressure
$P_{z,ref}$	axial stress corresponding to the initial in-situ vertical effective stress

$P_{z,ref}$ is calculated according to the empirical relation

$$P_{z,ref} = 0.2\ (D-361) + 3.7\ 10^{-6}\ (D-361)^2 - 153 + 31 \qquad (2)$$

where

$P_{z,ref}$	initial in-situ vertical effective stress (in bar)
D	depth (in m bdf)
361	distance between derrick floor and sea-bottom at 31/2-4 (in m)
153	initial reservoir pressure (in bar)
31	pore pressure at sea-bottom level (in bar)

The value of $P_{z,ref}$ is given as 'reference pressure' in the tables of Appendix A. The calculated values for the samples tested (covering more or less the total reservoir interval) vary between 87 and 124 bar (see also Table 1). The uniaxial compressibility $c_{m,o}$ is calculated from

$$c_{m,o} = \frac{1}{h(P_z)} \left(\frac{d\ h(P_z)}{d\ P_z} \right) \qquad (3)$$

Given the inital effective stresses and the initial reservoir pore pressure of 153 bar, the possible range of in-situ stresses is limited to values of 100-200 bar. The actual range that will occur in-situ during production can be considerably lower depending on the maximum amount of depletion that will be reached.

Results obtained between 0 and 300 bar are presented in Figs. A1-A18 and Tables A1-A2.

3. DISCUSSION OF EXPERIMENTAL RESULTS

The experimental results obtained are shown in Table 1 and Figs. 3 to 6. The following observations are relevant:

- The average uniaxial compressibilities $c_{m,o}$ vary between 0.2 - 4 10^{-4} bar^{-1} over the possible stress range during depletion (100-200 bar). The lowest compressibilities (0.2 and 0.3 10^{-4} bar^{-1}) have been found for the two low porosity samples originating from carbonate streaks. If we exclude these two samples, the average uniaxial compressibility $c_{m,o}$ = 1.5 ± 0.8 10^{-4} bar^{-1} for the remaining 16 samples between 100 and 200 bar (the stress range of interest). This value is at the low end of the range usually found for unconsolidated sands (1.5 - 4.0 10^{-4} bar^{-1}) over the same stress range. This value is considerably higher than what is considered representative of friable to consolidated sandstones (0.5-4.0 10^{-5} bar^{-1}). The average compressibility of 1.5 ± 0.8 10^{-4} therefore appears to be in agreement with the very friable nature of the rock.

- The shape of the compressibility-pressure curves for the individual samples is rather complicated. Their characteristic shape-as emerged from Fig. A3 and from some experiments at higher stresses (not shown)-is depicted in Fig. 3. After a 'normal' decrease in $c_{m,o}$ with increasing stress (point 1 → 2 in Fig. 3), $c_{m,o}$ starts to increase again, in most cases at stresses above 150-200 bar, but sometimes at higher values. These increases in compressibility can be very sharp. After reaching a maximum (point 3 in Fig.3) $c_{m,o}$ levels off again at higher stresses (point 3 → 4 in Fig. 3). The occurrence of the increases and maxima in $c_{m,o}$ are probably related to the deterioration of cementation and/or increased grain breakage at higher stresses. With a few exceptions, like e.g. sample C13 - P 5 (Fig. A6), strong increases and maxima in $c_{m,o}$ are well above the range of possible in-situ stresses. For most samples, however, $c_{m,o}$ increases to above 200 bar. No correlations have been found between the stress level at which $c_{m,o}$ starts to increase, the stress at which the maximum is reached, the grain size, sorting etc. The underlying process is probably complex, possibly involving a large number of interrelated parameters.

- As shown in Fig. 4, some correlation appears to exist between BHN and the average compressibility between 100 and 200 bar ($c_{m,o}$). This correlation becomes more apparent when the influence of facies type is taken into account.
- A similar correlation appears to exist between atmospheric porosity and $c_{m,o}$ (Fig. 5), while the correlation between the porosity at in-situ stress and $c_{m,O}$ is even somewhat better (Fig. 6). The fact that sample C13-P5 does not fit any of these correlations is probably related to the fact that this sample, in contrast to the other samples, shows a large increase in $c_{m,o}$ below 200 bar (see Fig. A6). Finally, it should be noted that the correlations between porosity and $c_{m,o}$ point to higher compressibilities with decreasing porosity, in contrast to what one would expect. Again however this could be due to a complex relationship between porosity, grain size, sorting, cementation, compressibility, etc.
- In contrast to what was expected, no significant difference has been found between the compaction behaviour of samples obtained from frozen and non-frozen core material (see Figs. 4 to 6). This suggests that the core material is not disturbed by the freezing process. This means that samples for possible future measurements can be taken from frozen core material, thus avoiding the problems involved in taking samples from

non-frozen (coarse-grained) core material (see also section 2.1).

4. PREDICTION OF FIELD BEHAVIOUR

An accurate prediction of field behaviour as a function of depletion would require a sophisticated calculation, requiring the input of a geometrical reservoir model, the expected depletion scheme and measured compressibilities. Considering the existing uncertainties in the future pressure pattern and the limited data now available, the reliability of such a prediction would be very limited. Therefore for the time being an order of magnitude figure for compaction and related sea-bottom subsidence to be expected has been calculated on the following assumptions.

average initial reservoir pressure 150 bar
average initial effective stress 100 bar
maximum drop in pore pressure 100 bar
no previous deeper burial.
a one-to-one relationship between compaction and subsidence
average reservoir thickness 200 m
average uniaxial compressibility 1.6 10^{-4} bar^{-1}.

Using the above data in our compaction model, we arrive at a compaction subsidence figure of the order of 3 metres (at 100 bar pressure drop).

The assumption of a one-to-one relationship between compaction and subsidence is approximately correct for the case where a rigid basement underlies the reservoir. In cases where the elasticity of the base rock is more or less the same as that of the overburden, the subsidence is approximately half of the reservoir compaction. In practice, the ratio of subsidence and reservoir compaction will lie between 0.5 and 1.0. As the assumption of a rigid basement will be approximately correct for most situations, the assumed one-to-one relationship between compaction and subsidence is reasonable.

5. CONCLUSIONS

1. An average value of $c_{m,o} = 1.6 \pm 0.8\ 10^{-4}\ bar^{-1}$ has been found for 16 core samples from well 31/2-4 (offshore Norway)
2. Considerably lower compressibilities have been found for two samples from tight carbonate streaks ($c_{m,o}$=2-3 $10^{-5}\ bar^{-1}$).
3. No difference has been found between the compaction behaviour of samples taken from frozen and from non-frozen core material.
4. When facies type is taken into account, some correlation appears to exist between uniaxial compressibility ($c_{m,o}$), porosity (ϕ) and Brinell hardness (BHN).
5. Taking the above compressibilities as representative of the reservoir, and considering the in-situ stress condition, the reservoir compaction and sea-bottom subsidence will be of the order of 3 m at a reservoir pressure drop of 100 bar (assuming that a rigid basement underlies the reservoir).

6. RECOMMENDATIONS

As there appears to be no adverse effect of freezing on the core material, samples for compaction experiments can be taken in the future from frozen core material. In this way the problems encountered in taking samples from the very friable coarse-grained core material in block 31/2 can be avoided.

GLOSSARY OF TERMS AND SYMBOLS

reservoir compaction - reduction of reservoir thickness by increasing vertical effective stress.

core compaction - reduction in height of cylindrical samples under increasing axial effective stress at zero lateral strain, simulating reservoir compaction conditions.

uniaxial compressibility - axial strain per unit of axial stress change as determined from a compaction test. As the lateral strain in this test is zero, the axial strain equals the volume strain. It thus corresponds to the relative change in porosity by compaction if the compressibility of the rock matrix itself is ignored.

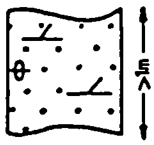
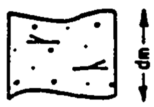
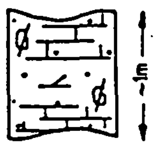
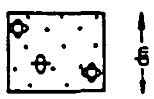
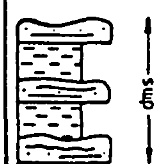
axial effective stress - total axial stress minus the pore fluid pressure

BHN -	Brinell Hardness Number
$c_{m,o}$ -	uniaxial compressibility as measured during a constant loading rate experiment
D -	depth
$h(P_z)$	- Sample height at axial stress P_z
P_z -	axial effective stress PVC (hydrostat.)
$P_{z,ref}$	- initial in-situ vertical effective stress
ε_z -	compaction
ϕ -	porosity

Table 1 - Sample selection and survey of experimental results

Sample no. core part	depth (mbdf)	ϕ initial (%)	ϕ in-situ (%)	BHN (10^2 bar)	$c_{m,o}$ (bar^{-1})	facies type *)
C 6 P15	1392.3	34.2	31.4	3.0	$1.2\ 10^{-4}$	D
C 8 P 1	1410.1	32.3	31.4	2.1	$0.6\ 10^{-4}$	C
C 8 P 4	1412.8	31.5		0.5	$1.5\ 10^{-4}$	E
C 8 P 7	1414.9	26.0	21.6	1.4	$1.9\ 10^{-4}$	D
FC 9 P 7	1421.8	0.5	0.2	18.4	$0.3\ 10^{-4}$	D
C 13 P 5	1458.6	31.8	31.5	2.3	$4.0\ 10^{-4}$	D
C 13 P13	1465.5	22.2	14.8	0.6	$2.2\ 10^{-4}$	F
C 13 P15	1467.4	23.7	14.2	0.4	$2.5\ 10^{-4}$	F
C 14 P 1	1473.1	27.2	23.9	0.6	$1.8\ 10^{-4}$	F
C 14 P 4	1475.8	15.6	15.1	19.5	$0.2\ 10^{-4}$	A
FC16 P 3	1487.1	29.3	28.0	1.6	$0.7\ 10^{-4}$	F
C 17 P12	1500.0	28.7	26.8	0.8	$1.2\ 10^{-4}$	F
C 17 P14	1501.8	28.8	26.3	1.2	$1.3\ 10^{-4}$	F
FC18 P 5	1511.9	26.3	23.6	1.1	$1.2\ 10^{-4}$	F
C18 P11	1517.3	21.6	20.3	1.8	$0.8\ 10^{-4}$	F
C19 P10	1534.6	36.8	34.2	0.5	$0.9\ 10^{-4}$	E
FC20 P 2	1545.8	26.0	23.9	0.7	$1.4\ 10^{-4}$	E
FC21 P 3	1563.3	24.8	21.8	0.5	$1.6\ 10^{-4}$	E

*) See Table 2.

LITHOFACIES		DESCRIPTION	PROCESSES	POSSIBLE RANGE OF ENVIRONMENTS
A*		Poorly sorted, coarse sand to granular grade, intensely bioturbated and shelly. Occasionally pyritic, glauconitic and calcitic.	Biological and hydrodynamic reworking of sediment. High energy but with relatively slow deposition, close to coarse supply.	WINNOWED DEPOSITS BASE OF GRADED BEDS. HIGH ENERGY SHOREFACE.
B		Massive to weakly cross-bedded, occasionally ripple bedded. Moderately well sorted, coarse sands, occasionally shelly with deep vertical burrows. Generally poorly consolidated.	'High energy', close close to coarse sand source. Often current-dominated.	FORESHORE TO SHELF (very high energy); or NON-TIDAL CHANNEL FILL, MOUTH BAR; or VARIOUS COASTAL PLAIN ENVIRONMENTS
C*		Cross-bedded (occasionally cross laminated), low-angle, cm to dm thick beds, rarely 1-2 m in fining-upward sequences. Coarse or medium sands, moderately well sorted, occasionally rich in large organic clasts, poorly bioturbated.	'Sporadic deposition' 'protected' from bioturbation and close to sand source. Current or wave energy.	SHOREFACE (when interbedded with burrowed facies E and F); or VARIOUS COASTAL PLAIN ENVIRONMENTS.
D		Cross-bedded, dm scale. Coarse or medium sands with shell hash, generally calcite-cemented. Occasionally rich in mica and pyrite, poorly bioturbated.	'High energy', with a low proportion of burrows. Current-dominated	FORESHORE TO INNER SHELF
E		Medium to fine sand, rich in mica and matrix, occasionally organics. Thoroughly bioturbated (mottled), burrows approx. 1 cm diameter, ripple bedding sometimes recognisable. Occasionally calcite and siderite concretions and cements. Relatively well consolidated.	Bioturbation rate approx. equal to or exceeding deposition rate. Relatively close to sand source.	SHOREFACE TO INNER SHELF
F		Fine to very fine sand, micaceous. Thoroughly bioturbated (mottled), burrows approximately 2-3 mm diameter. Occasionally calcite and siderite concretions and cements. Well consolidated.	Bioturbation rare approx. equal to or exceeding deposition rate. Relatively distal to sand source.	LOWER SHOREFACE TO OUTER SHELF
G*		Laminated, organic-rich shales and ripple- or plane-laminated fine sands. Extremely micaceous with organic matter in discrete laminae, poorly bioturbated.	Low-energy deposition with slightly fluctuations in bottom energy conditions. Close to organic source.	'VARIABLE' poss-NEARSHORE MARINE, (UPPER SHOREFACE TO COASTAL PLAIN) and other PROXIMAL, QUIET WATER ENVIRONMENTS.
H		Pure shales, generally not rich in organic material.	High quantity of suspended sediment load.	(UNDIAGNOSTIC)

coarser

A **lithofacies** is made up of units of sediment which are similar in terms of their physical, biological and chemical character. Lithofacies, so defined, have been observed in the geological interpretation and description of core 31/2-5. These lithofacies are similarly recognised in other cores described from the 31/2 block.

SUMMARY OF LITHOFACIES

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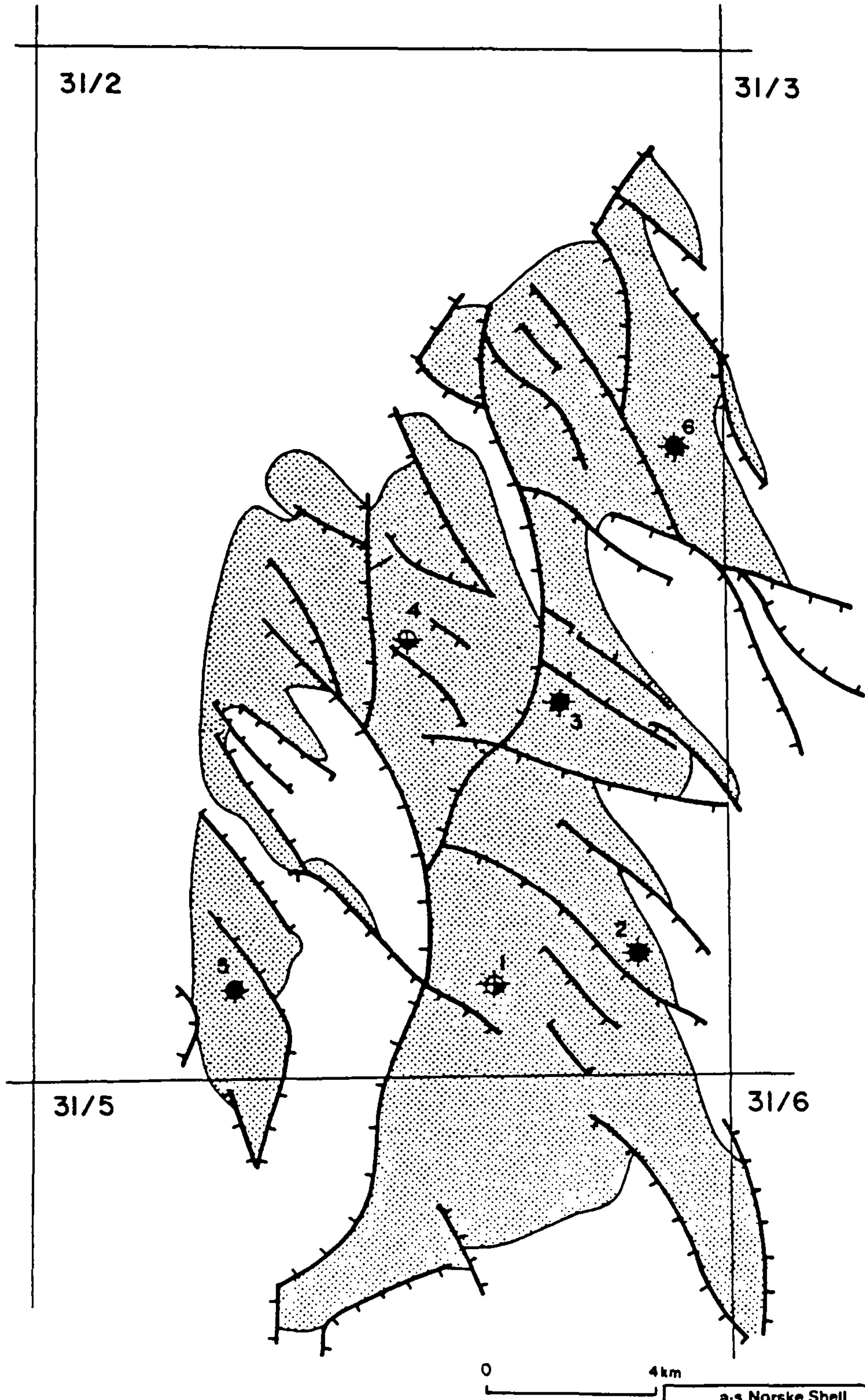
Author DWA
Drawn

Dr.nr. 31071A

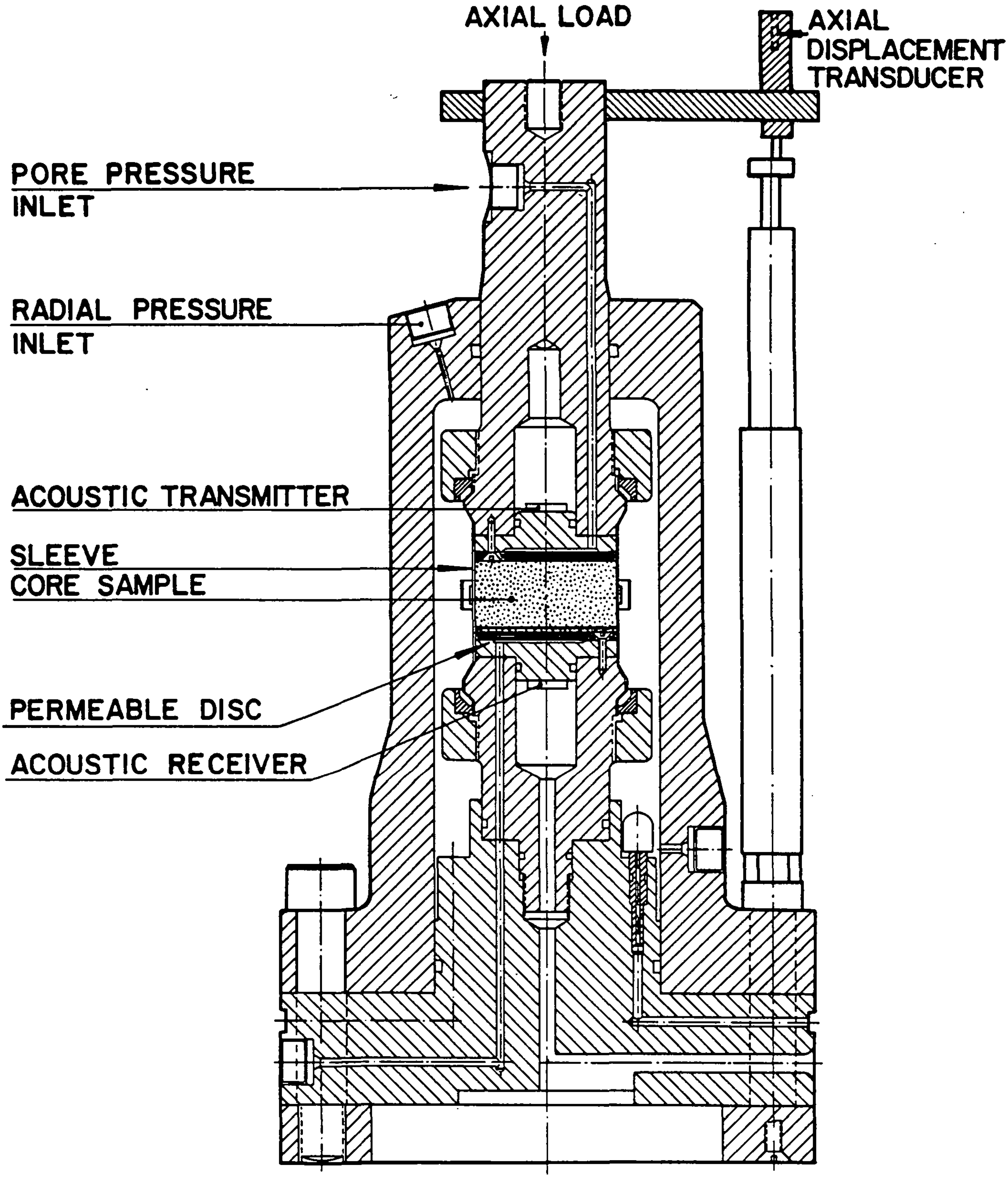
Table 2



EXTENT OF GAS RESERVOIR

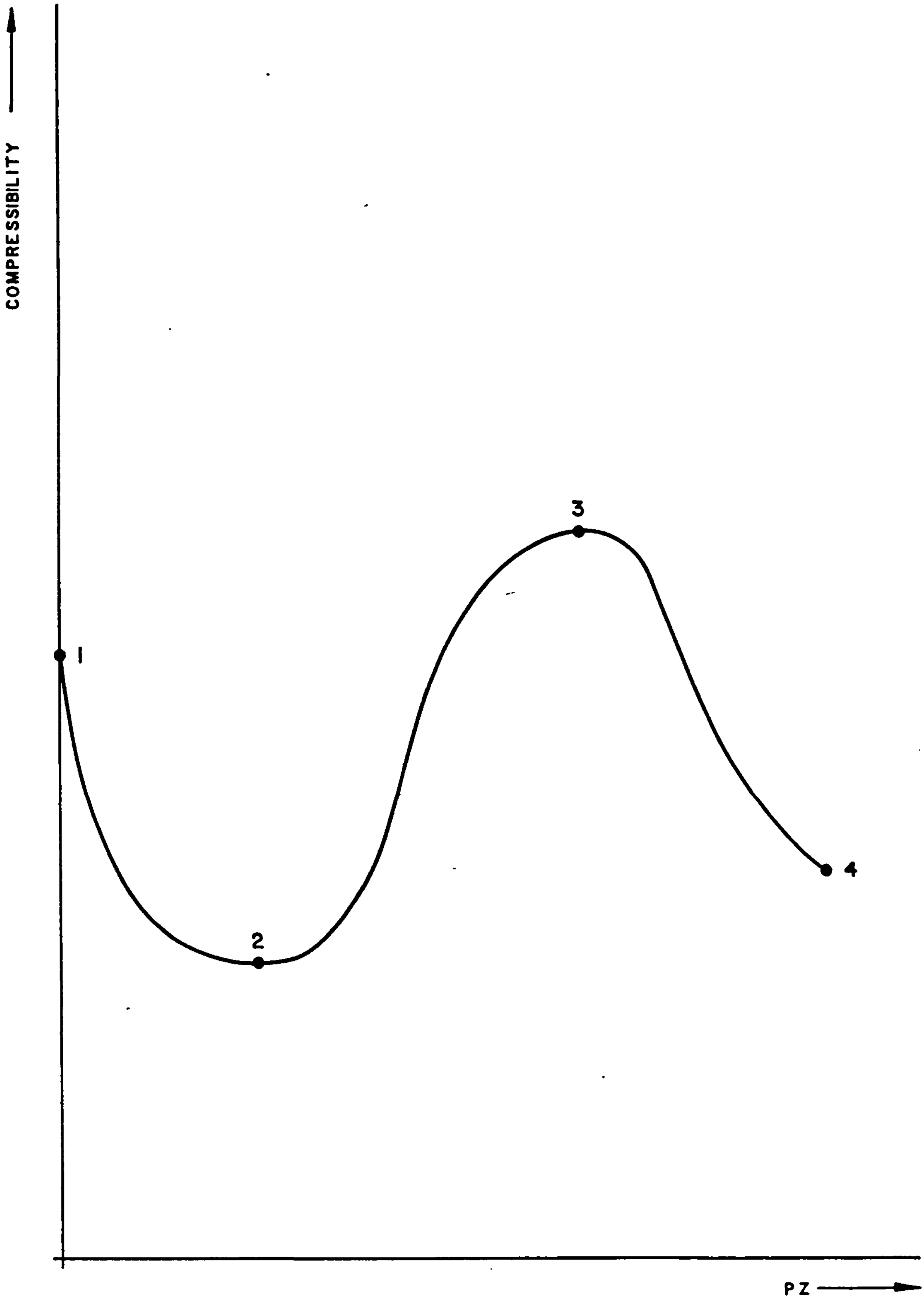
a-s Norske Shell
EXPLORATION & PRODUCTION FORUS

31/2
WELL LOCATION MAP

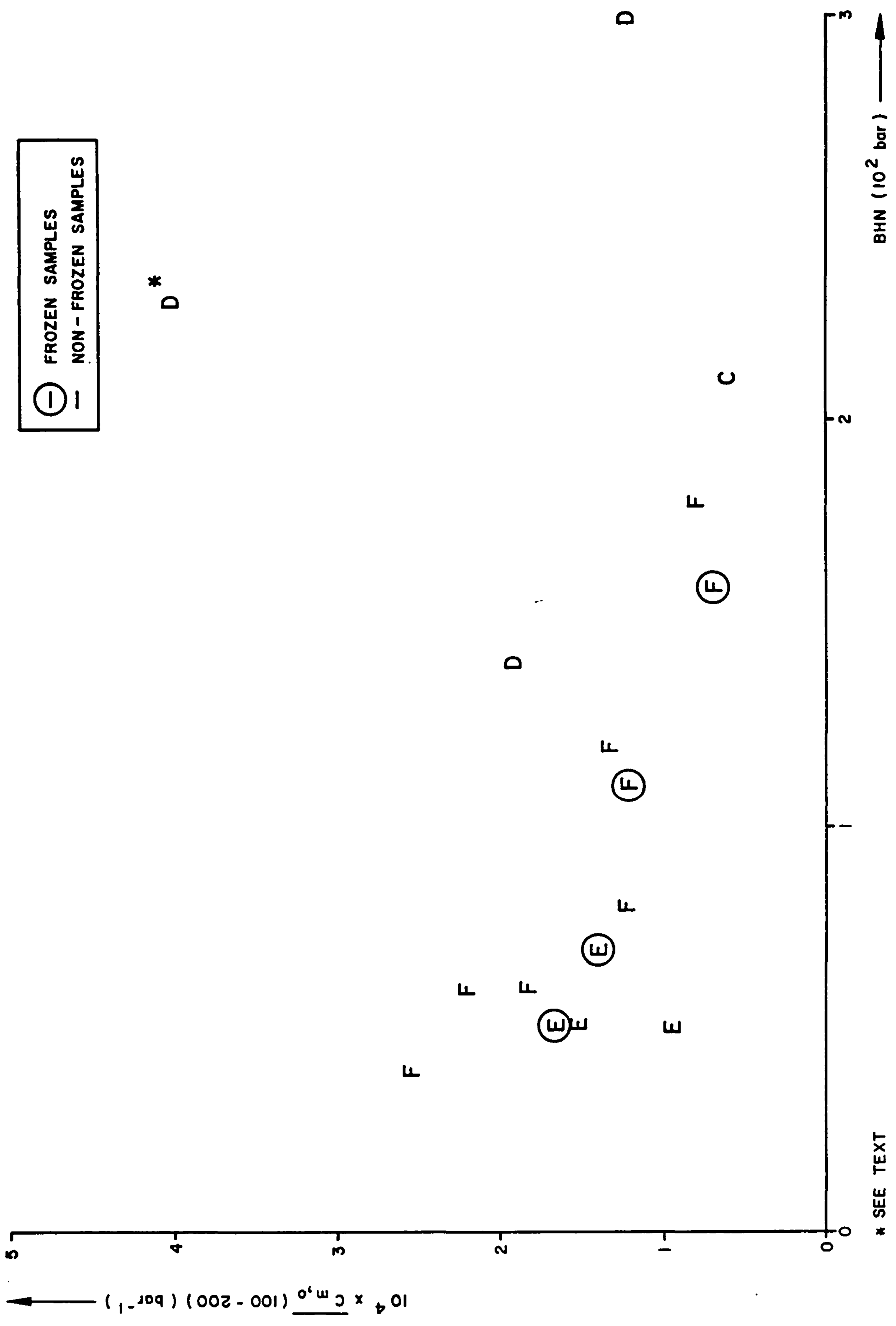


2" TRIAXIAL COMPACTION CELL

Dr.[redacted]5018



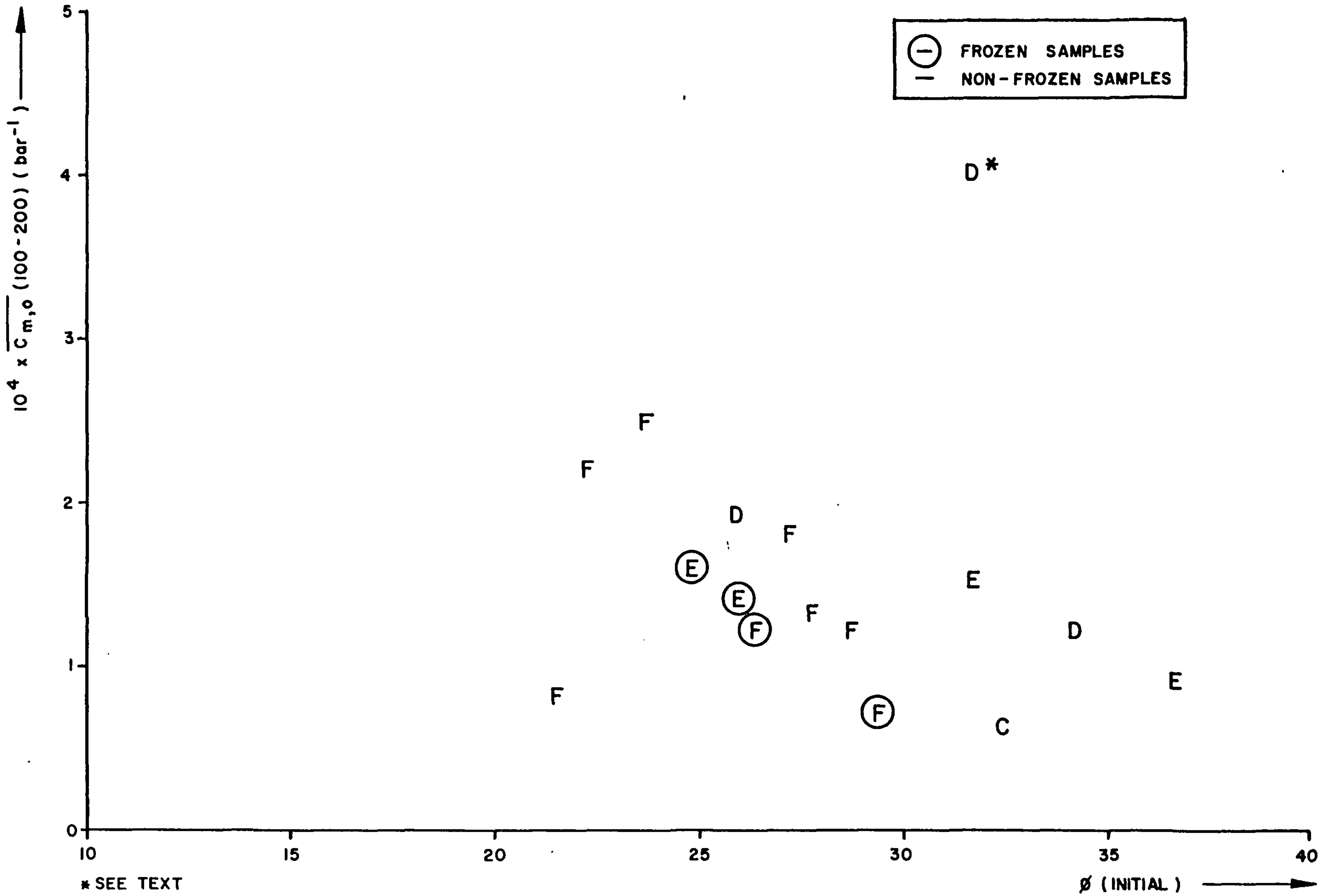
GENERAL PICTURE OF THE DEPENDENCE OF UNIAXIAL COMPRESSIBILITY ON AXIAL LOAD



BRINELL HARDNESS VERSUS AVERAGE UNIAXIAL COMPRESSIBILITY BETWEEN 100 AND 200 bar
(LETTERS : LITHOFACIES. SEE TABLE 2)

D[redacted]510

CONFIDENTIAL



ATMOSPHERIC POROSITY VERSUS AVERAGE UNIAXIAL COMPRESSIBILITY BETWEEN 100 AND 200 bar
(LETTERS : LITHOFACIES. SEE TABLE 2)

Author : Dwa/Grf
Drawn : K Dr.nr. 35108

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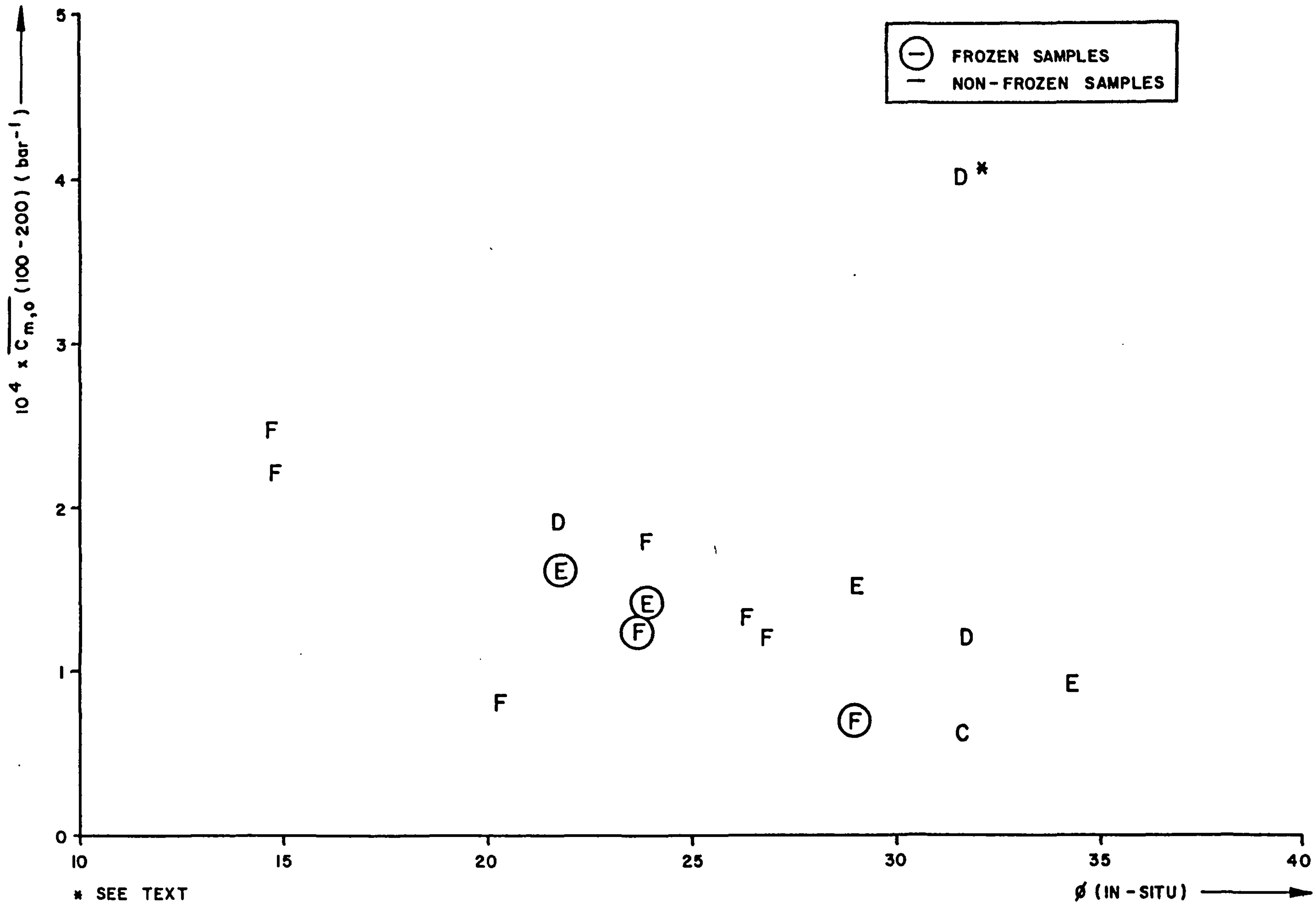
FIG.5



IN-SITU POROSITY VERSUS AVERAGE UNIAXIAL COMPRESSIBILITY BETWEEN 100 AND 200 bar
(LETTERS: LITHOFACIES. SEE TABLE 2)

APPENDIX A

RESULTS OF TRIAXIAL COMPACTION TESTS

TABLE - A1

Confidential

OB/

31/2-4 SAMPLE C6-P15

SAMPLE NR C6-P15 2 CURVES POROSITY 34.2% DEPTH 1392.2 M REFERENCE PRESSURE 88.2 BAR

Vatrn. trykk /PORH

Netto overlagrings-trykk.

CURVE NR. 2 /PNC /CPU

POINT NR.	FZ IN BAR	HEIGHT IN MM	POROSITY %	COMPACTION	COMPRESSIBILITY IN 1/BAR
1	20.0	24.726	32.14	-.105666-001	.276325-003
2	40.0	24.618	31.84	-.615972-002	.146812-003
3	60.0	24.547	31.65	-.326049-002	.133012-003
4	80.0	24.491	31.49	-.979922-003	.117815-003
5	100.0	24.438	31.34	.120696-002	.104105-003
6	120.0	24.385	31.19	.335298-002	.119514-003
7	140.0	24.334	31.05	.545918-002	.894711-004
8	160.0	24.285	30.91	.743870-002	.104062-003
9	180.0	24.234	30.76	.951838-002	.124213-003
10	200.0	24.171	30.58	.121180-001	.148344-003
11	220.0	24.090	30.35	.154015-001	.184333-003
12	240.0	23.988	30.05	.195738-001	.243177-003
13	260.0	23.875	29.72	.242141-001	.220900-003
14	280.0	23.760	29.38	.288870-001	.257986-003
15	300.0	23.637	29.01	.339402-001	.253535-003

INTERPOLATED HEIGHT AT REFERENCE PRESSURE: 24.467

POROSITY AT REFERENCE PRESSURE: 31.42

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TABLE - A2

Confidential

31/2-4 SAMPLE CB-P1

SAMPLE NR CB-P1   3 CURVES   POROSITY 32.3%   DEPTH 1410.1 M   REFERENCE PRESSURE 91.9 BAR

CURVE NR. 2

POINT NR.	PZ IN BAR	HEIGHT IN MM	POROSITY %	COMPACTION	COMPRESSIBILITY IN 1/BAR
1	20.0	25.441	31.88	-.692008-002	.132327-003
2	40.0	25.379	31.71	-.445711-002	.103479-003 x100000
3	60.0	25.332	31.58	-.257270-002	.858468-004
4	80.0	25.290	31.47	-.936817-003	.780995-004
5	100.0	25.252	31.37	.580019-003	.677763-004
6	120.0	25.220	31.28	.182140-002	.631405-004
7	140.0	25.189	31.20	.306549-002	.567853-004
8	160.0	25.161	31.12	.417920-002	.571904-004
9	180.0	25.132	31.04	.532908-002	.540234-004
10	200.0	25.107	30.97	.632255-002	.520525-004
11	220.0	25.079	30.89	.744414-002	.545030-004
12	240.0	25.052	30.82	.848027-002	.553926-004
13	260.0	25.023	30.74	.965176-002	.588078-004
14	280.0	24.993	30.65	.108437-001	.611970-004
15	300.0	24.960	30.56	.121496-001	.713802-004

INTERPOLATED HEIGHT AT REFERENCE PRESSURE: 25.267

POROSITY AT REFERENCE PRESSURE: 31.41

TABLE - A3

Confidential

31/2-4 SAMPLE C8-P4

SAMPLE NR C8-P4 7 CURVES POROSITY 31.5% DEPTH 1412.7 M REFERENCE PRESSURE 92.4 BAR

CURVE NR. 6

POINT NR.	PZ IN BAR	HEIGHT IN MM	POROSITY %	COMPACTION	COMPRESSIBILITY IN 1/BAR
1	20.0	25.168	30.19	-.164145-001	.414910-003
2	40.0	24.999	29.72	-.958932-002	.275151-003
3	60.0	24.902	29.44	-.565686-002	.186165-003
4	80.0	24.817	29.20	-.221062-002	.161415-003
5	100.0	24.737	28.97	.985283-003	.140991-003
6	120.0	24.669	28.78	.374407-002	.129416-003
7	140.0	24.609	26.60	.617737-002	.130551-003
8	160.0	24.541	28.40	.893295-002	.146614-003
9	180.0	24.462	28.17	.121164-001	.178993-003
10	200.0	24.361	27.87	.162022-001	.239318-003
11	220.0	24.224	27.47	.217041-001	.329331-003
12	240.0	24.033	26.89	.294204-001	.421921-003
13	260.0	23.835	26.28	.374262-001	.453115-003
14	280.0	23.613	25.59	.463774-001	.444150-003
15	300.0	23.416	24.97	.543451-001	.407462-003

INTERPOLATED HEIGHT AT REFERENCE PRESSURE: 24.762

POROSITY AT REFERENCE PRESSURE: 29.04

RKER 82.242

Confidential

TABLE - A4

31/2-4 SAMPLE C8-P7

SAMPLE NR C8-P7 3 CURVES POROSITY 26.0% DEPTH 1414.9 M REFERENCE PRESSURE 92.9 BAR

CURVE NR. 2

POINT NR.	PZ IN BAR	HEIGHT IN MM	POROSITY %	COMPACTION	COMPRESSIBILITY IN 1/BAR
1	10.0	25.316	24.00	-.312203-001	.956791-003
2	20.0	25.086	23.30	-.218397-001	.966002-003
3	30.0	25.020	23.10	-.191663-001	.367122-003
4	40.0	24.912	22.77	-.147480-001	.367053-003
5	50.0	24.821	22.49	-.110745-001	.334037-003
6	60.0	24.749	22.26	-.814370-002	.290428-003
7	70.0	24.688	22.07	-.564715-002	.258417-003
8	80.0	24.618	21.85	-.280855-002	.237476-003
9	90.0	24.565	21.68	-.623563-003	.217640-003
10	100.0	24.517	21.52	.133454-002	.205133-003
11	110.0	24.464	21.35	.348316-002	.196579-003
12	120.0	24.416	21.20	.544174-002	.189238-003

INTERPOLATED HEIGHT AT REFERENCE PRESSURE: 24.549

POROSITY AT REFERENCE PRESSURE: 21.63

TABLE - A5

31/2-4 SAMPLE FC9-P7

SAMPLE NR FC9-P7 2 CURVES POROSITY .5% DEPTH 1421.7 M REFERENCE PRESSURE 94.3 BAR

CURVE NR. 1

POINT NR.	PZ IN BAR	HEIGHT IN MM	POROSITY %	COMPACTION	COMPRESSIBILITY IN 1/BAR
1	30.0	23.966	.38	-.208445-002	.342080-004
2	40.0	23.958	.35	-.173163-002	.342197-004
3	50.0	23.948	.30	-.131680-002	.342313-004
4	60.0	23.941	.28	-.102702-002	.342428-004
5	70.0	23.934	.25	-.730212-003	.342545-004
6	80.0	23.926	.21	-.396986-003	.342662-004
7	90.0	23.919	.19	-.123074-003	.296200-004
8	100.0	23.913	.16	.162421-003	.296288-004
9	110.0	23.906	.13	.453549-003	.296376-004

INTERPOLATED HEIGHT AT REFERENCE PRESSURE: 23.917

POROSITY AT REFERENCE PRESSURE: .17

TABLE - A6

Confidential

31/2-4 SAMPLE FC9-P7

Denne siden legges ikke inn i SFINX !

SAMPLE NR FC9-P7   2 CURVES   POROSITY .5%   DEPTH 1421.7 M   REFERENCE PRESSURE 94.3 BAR

CURVE NR. 2

POINT NR.	FZ IN BAR	HEIGHT IN MM	POROSITY %	COMPACTION	COMPRESSIBILITY IN 1/BAR
1	20.0	23.961	.36	-.243903-002	.276961-004
2	40.0	23.943	.28	-.169476-002	.272548-004
3	60.0	23.925	.21	-.950489-003	.268129-004
4	80.0	23.909	.14	-.277513-003	.262733-004
5	100.0	23.900	.10	.110259-003	.253439-004
6	120.0	23.891	.06	.498041-003	.244135-004
7	140.0	23.881	.02	.898890-003	.234724-004
8	160.0	23.871	-.02	.131925-002	.225044-004
9	180.0	23.860	-.06	.177924-002	.215057-004
10	200.0	23.849	-.11	.223076-002	.204430-004
11	220.0	23.841	-.14	.258762-002	.193205-004
12	240.0	23.832	-.18	.294407-002	.181677-004
13	260.0	23.823	-.22	.332389-002	.169859-004
14	280.0	23.814	-.26	.371055-002	.157801-004
15	300.0	23.807	-.28	.398454-002	.146060-004

NB!

INTERPOLATED HEIGHT AT REFERENCE PRESSURE: 23.903

POROSITY AT REFERENCE PRESSURE: .11

TABLE - A7

Confidential

31/2-4 SAMPLE C13-P5

SAMPLE NR C13-P5 1 CURVE POROSITY 31.8% DEPTH 1458.6 M REFERENCE PRESSURE 102.0 BAR

CURVE NR. 1

POINT NR.	PZ IN BAR	HEIGHT IN MM	POROSITY %	COMPACTION	COMPRESSIBILITY IN 1/BAR
1	20.0	25.838	31.77	-.387427-002	.389614-004
2	40.0	25.821	31.72	-.320719-002	.355573-004
3	60.0	25.804	31.68	-.254641-002	.361852-004
4	80.0	25.783	31.62	-.173466-002	.427318-004
5	100.0	25.748	31.53	-.374987-003	.165749-003
6	120.0	25.632	31.22	.410860-002	.178949-003
7	140.0	25.559	31.02	.693535-002	.120328-003
8	160.0	25.486	30.83	.978684-002	.285600-003
9	180.0	25.136	29.86	.234000-001	.721007-003
10	200.0	24.904	29.21	.324037-001	.518256-003
11	220.0	24.620	28.39	.434441-001	.577346-003
12	240.0	24.339	27.57	.543680-001	.515848-003
13	260.0	24.093	26.83	.639177-001	.581156-003
14	280.0	23.816	25.97	.746887-001	.475066-003
15	300.0	23.619	25.36	.823188-001	.416051-003

INTERPOLATED HEIGHT AT REFERENCE PRESSURE: 25.738

POROSITY AT REFERENCE PRESSURE: 31.50

Confidential

TABLE - A8

31/2-4 SAMPLE C13-P13

SAMPLE NR C13-P13 2 CURVES POROSITY 22.2% DEPTH 1465.5 M REFERENCE PRESSURE 103.4 BAR

CURVE NR. 1

POINT NR.	PZ IN BAR	HEIGHT IN MM	POROSITY %	COMPACTION	COMPRESSIBILITY IN 1/BAR
1	20.0	24.388	17.86	-.371677-001	.614485-003
2	40.0	24.080	16.81	-.240646-001	.622125-003
3	60.0	23.847	15.99	-.141247-001	.419977-003
4	80.0	23.673	15.37	-.672822-002	.317744-003
5	100.0	23.534	14.87	-.810845-003	.265634-003
6	120.0	23.425	14.48	.380498-002	.226900-003
7	140.0	23.323	14.11	.812197-002	.203806-003
8	160.0	23.231	13.76	.120563-001	.191971-003
9	180.0	23.143	13.44	.157931-001	.186200-003
10	200.0	23.058	13.12	.193935-001	.179024-003
11	220.0	22.976	12.81	.229163-001	.179382-003
12	240.0	22.895	12.50	.263597-001	.182809-003
13	260.0	22.807	12.16	.300654-001	.191388-003
14	280.0	22.720	11.82	.337849-001	.202528-003
15	300.0	22.625	11.46	.378080-001	.217581-003

INTERPOLATED HEIGHT AT REFERENCE PRESSURE: 23.514

POROSITY AT REFERENCE PRESSURE: 14.80

TABLE - A9

31/2-4 SAMPLE C13-P15

SAMPLE NR C13-P15   1 CURVE   POROSITY 23.7%   DEPTH 1967.4 M   REFERENCE PRESSURE 103.8 BAR

CURVE NR. 1

POINT NR.	PZ IN BAR	HEIGHT IN MM	POROSITY %	COMPACTION	COMPRESSIBILITY IN 1/BAR
1	20.0	24.682	18.23	-.496681-001	.788473-003
2	40.0	24.259	16.81	-.316793-001	.734053-003
3	60.0	23.996	15.90	-.205076-001	.479366-003
4	80.0	23.741	14.99	-.965350-002	.537927-003
5	100.0	23.525	14.21	-.473184-003	.264169-003
6	120.0	23.432	13.87	.346477-002	.238640-003
7	140.0	23.313	13.43	.851948-002	.248943-003
8	160.0	23.196	13.00	.135088-001	.253424-003
9	180.0	23.078	12.55	.185472-001	.253624-003
10	200.0	22.961	12.10	.235214-001	.254105-003
11	220.0	22.846	11.66	.284058-001	.254073-003
12	240.0	22.730	11.21	.333179-001	.259275-003
13	260.0	22.611	10.75	.383859-001	.263561-003
14	280.0	22.488	10.26	.436374-001	.261034-003
15	300.0	22.374	9.80	.484459-001	.257751-003

INTERPOLATED HEIGHT AT REFERENCE PRESSURE: 23.514

POROSITY AT REFERENCE PRESSURE: 14.17

TABLE - A10

31/2-4 SAMPLE C14-P1

SAMPLE NR C14-P1　　3 CURVES　　POROSITY 27.2%　　DEPTH 1473.1 M　　REFERENCE PRESSURE 105.0 BAR

CURVE NR. 2

POINT NR.	PZ IN BAR	HEIGHT IN MM	POROSITY %	COMPACTION	COMPRESSIBILITY IN 1/BAR
1	20.0	25.201	26.05	-.289082-001	.392226-003
2	40.0	24.981	25.40	-.198993-001	.416181-003
3	60.0	24.784	24.80	-.118667-001	.336000-003
4	80.0	24.635	24.35	-.579257-002	.263654-003
5	100.0	24.520	23.99	-.108075-002	.224014-003
6	120.0	24.417	23.67	.310452-002	.197167-003
7	140.0	24.326	23.39	.684082-002	.175121-003
8	160.0	24.242	23.12	.102681-001	.172065-003
9	180.0	24.161	22.86	.135865-001	.174864-003
10	200.0	24.071	22.58	.172270-001	.172823-003
11	220.0	23.992	22.32	.204851-001	.176903-003
12	240.0	23.903	22.03	.240922-001	.183658-003
13	260.0	23.817	21.75	.276238-001	.187094-003
14	280.0	23.727	21.45	.313036-001	.191379-003
15	300.0	23.637	21.15	.349771-001	.191021-003

INTERPOLATED HEIGHT AT REFERENCE PRESSURE: 24.493

POROSITY AT REFERENCE PRESSURE: 23.91

TABLE - A11

Confidential

31/2-4 SAMPLE C14-P4

SAMPLE NR C14-P4　　2 CURVES　　POROSITY 15.67　　DEPTH 1475.8 M　　REFERENCE PRESSURE 105.6 BAR

CURVE NR. 1

POINT NR.	PZ IN BAR	HEIGHT IN MM	POROSITY %	COMPACTION	COMPRESSIBILITY IN 1/BAR
1	20.0	25.648	15.26	-.234143-002	.303535-003
2	40.0	25.619	15.17	-.120971-002	.268332-004
3	60.0	25.609	15.13	-.811634-003	.151278-004
4	80.0	25.600	15.11	-.469754-003	.150812-004
5	100.0	25.592	15.08	-.141478-003	.149588-004
6	120.0	25.583	15.05	.218409-003	.147618-004
7	140.0	25.575	15.02	.501695-003	.145154-004
8	160.0	25.569	15.00	.743932-003	.142420-004
9	180.0	25.563	14.98	.993336-003	.139523-004
10	200.0	25.553	14.95	.135281-002	.136602-004
11	220.0	25.548	14.93	.154834-002	.133805-004
12	240.0	25.540	14.91	.187179-002	.131297-004
13	260.0	25.535	14.89	.206754-002	.129224-004
14	280.0	25.529	14.87	.231802-002	.127706-004
15	300.0	25.523	14.85	.254790-002	.126731-004

INTERPOLATED HEIGHT AT REFERENCE PRESSURE: 25.588

POROSITY AT REFERENCE PRESSURE: 15.07

TABLE - A12

Confidential

31/2-4 SAMPLE FC16-P3

SAMPLE NR FC16-P3   3 CURVES   POROSITY 29.3%   DEPTH 1487.1 M   REFERENCE PRESSURE 107.9 BAR

CURVE NR. 1

POINT NR.	PZ IN BAR	HEIGHT IN MM	POROSITY %	COMPACTION	COMPRESSIBILITY IN 1/BAR
1	40.0	23.910	28.44	-.657312-002	.122836-003
2	60.0	23.853	28.27	-.415892-002	.110976-003
3	80.0	23.805	28.13	-.212767-002	.892012-004
4	100.0	23.768	28.01	-.580088-003	.743436-004
5	120.0	23.733	27.91	.896615-003	.658926-004
6	140.0	23.703	27.82	.215104-002	.601974-004
7	160.0	23.675	27.73	.332277-002	.590218-004
8	180.0	23.647	27.65	.451220-002	.592444-004
9	200.0	23.618	27.56	.571620-002	.594708-004
10	220.0	23.589	27.47	.693821-002	.612909-004
11	240.0	23.563	27.39	.805503-002	.652279-004
12	260.0	23.529	27.28	.947170-002	.706584-004
13	280.0	23.495	27.18	.108929-001	.789382-004
14	300.0	23.455	27.05	.125913-001	.912429-004

INTERPOLATED HEIGHT AT REFERENCE PRESSURE: 23.754

POROSITY AT REFERENCE PRESSURE: 27.97

TABLE - A13

Confidential

31/2-4 SAMPLE FC16-P3

Legges ikke inn i SFINX !

SAMPLE NR FC16-P3 3 CURVES POROSITY 29.3% DEPTH 1487.1 M REFERENCE PRESSURE 107.9 BAR

CURVE NR. 2

POINT NR.	PZ IN BAR	HEIGHT IN MM	POROSITY %	COMPACTION	COMPRESSIBILITY IN 1/BAR
1	20.0	23.282	26.51	-.560708-002	.478538-035
2	40.0	23.258	26.44	-.458162-002	.697579-004
3	60.0	23.225	26.33	-.314025-002	.673124-004
4	80.0	23.197	26.24	-.193416-002	.647778-004
5	100.0	23.162	26.13	-.402143-003	.598277-004
6	120.0	23.140	26.06	.533152-003	.543548-004
7	140.0	23.116	25.99	.154883-002	.519279-004
8	160.0	23.093	25.91	.256739-002	.500412-004
9	180.0	23.067	25.83	.369077-002	.467825-004
10	200.0	23.050	25.77	.443397-002	.438451-004
11	220.0	23.027	25.70	.542276-002	.409742-004
12	240.0	23.008	25.64	.620774-002	.392611-004
13	260.0	22.994	25.59	.685294-002	.395951-004
14	280.0	22.974	25.53	.768583-002	.418165-004
15	300.0	22.955	25.47	.850415-002	.442122-004

INTERPOLATED HEIGHT AT REFERENCE PRESSURE: 23.152

POROSITY AT REFERENCE PRESSURE: 26.10

TABLE - A14

Confidential

31/2-4 SAMPLE C17 P12

SAMPLE NR C17-P12 2 CURVES POROSITY 28.7% DEPTH 1500.0 M REFERENCE PRESSURE 110.6 BAR

CURVE NR. 2

POINT NR.	PZ IN BAR	HEIGHT IN MM	POROSITY %	COMPACTION	COMPRESSIBILITY IN 1/BAR
1	20.0	25.756	28.02	-.175543-001	.209859-003
2	40.0	25.658	27.75	-.136982-001	.216059-003
3	60.0	25.540	27.42	-.901196-002	.211425-003
4	80.0	25.438	27.12	-.498085-002	.187711-003
5	100.0	25.349	26.87	-.148417-002	.158108-003
6	120.0	25.275	26.67	.127794-002	.131903-003
7	140.0	25.218	26.49	.368099-002	.115021-003
8	160.0	25.163	26.33	.586263-002	.105805-003
9	180.0	25.111	26.18	.793453-002	.992824-004
10	200.0	25.062	26.03	.987286-002	.968518-004
11	220.0	25.013	25.89	.118148-001	.962235-004
12	240.0	24.964	25.74	.137194-001	.969268-004
13	260.0	24.915	25.59	.156730-001	.996267-004
14	280.0	24.866	25.45	.175912-001	.104684-003
15	300.0	24.812	25.28	.197557-001	.113056-003

INTERPOLATED HEIGHT AT REFERENCE PRESSURE: 25.312

POROSITY AT REFERENCE PRESSURE: 26.76

Confidential

TABLE - A15

31/2-4 SAMPLE C17-P14

SAMPLE NR C17-P14 1 CURVE POROSITY 28.8% DEPTH 1501.8 M REFERENCE PRESSURE 111.0 BAR

CURVE NR. 1

POINT NR.	PZ IN BAR	HEIGHT IN MM	POROSITY %	COMPACTION	COMPRESSIBILITY IN 1/BAR
1	20.0	25.962	28.01	-.235066-001	.458477-003
2	40.0	25.746	27.41	-.149732-001	.339778-003
3	60.0	25.602	27.00	-.930206-002	.194736-003
4	80.0	25.495	26.69	-.508973-002	.184525-003
5	100.0	25.409	26.44	-.171133-002	.158677-003
6	120.0	25.335	26.23	.123341-002	.134204-003
7	140.0	25.276	26.06	.356085-002	.121167-003
8	160.0	25.209	25.86	.617545-002	.114485-003
9	180.0	25.155	25.70	.831630-002	.114925-003
10	200.0	25.093	25.52	.107647-001	.120354-003
11	220.0	25.033	25.34	.131396-001	.126678-003
12	240.0	24.966	25.14	.157510-001	.134073-003
13	260.0	24.900	24.94	.183869-001	.148594-003
14	280.0	24.818	24.69	.216057-001	.171405-003
15	300.0	24.725	24.41	.252508-001	.193898-003

INTERPOLATED HEIGHT AT REFERENCE PRESSURE: 25.366

POROSITY AT REFERENCE PRESSURE: 26.32

RKER.82.242

TABLE - A18

31/2-4 SAMPLE FC 18-P5

SAMPLE NR FC18-P5 2 CURVES POROSITY 26.3% DEPTH 1511.9 M REFERENCE PRESSURE 113.1 BAR

CURVE NR. 1

POINT NR.	PZ IN BAR	HEIGHT IN MM	POROSITY %	COMPACTION	COMPRESSIBILITY IN 1/BAR
1	20.0	24.206	25.35	-.240228-001	.412426-003
2	40.0	24.081	24.71	-.154121-001	.357432-003
3	60.0	23.941	24.27	-.949483-002	.266263-003
4	80.0	23.838	23.95	-.516296-002	.192636-003
5	100.0	23.759	23.69	-.182566-002	.147162-003
6	120.0	23.697	23.49	.812957-003	.119472-003
7	140.0	23.643	23.32	.308714-002	.104198-003
8	160.0	23.595	23.16	.511520-002	.965105-004
9	180.0	23.553	23.02	.687224-002	.905624-004
10	200.0	23.509	22.88	.872054-002	.854778-004
11	220.0	23.470	22.75	.103527-001	.826019-004
12	240.0	23.434	22.63	.118991-001	.829681-004
13	260.0	23.392	22.50	.136395-001	.869692-004
14	280.0	23.350	22.36	.154190-001	.920657-004
15	300.0	23.305	22.20	.173397-001	.981945-004

INTERPOLATED HEIGHT AT REFERENCE PRESSURE: 23.716

POROSITY AT REFEFENCE PRESSURE: 23.55

TABLE - A17

Confidential

31/2-4 SAMPLE C18-P11

SAMPLE NR C18-P11 2 CURVES POROSITY 21.6% DEPTH 1517.3 M REFERENCE PRESSURE 114.2 BAR

CURVE NR. 2

POINT NR.	F2 IN BAR	HEIGHT IN MM	POROSITY %	COMPACTION	COMPRESSIBILITY IN 1/BAR
1	20.0	24.772	21.35	-.135503-001	.151855-003
2	40.0	24.667	21.02	-.925200-002	.176786-003
3	60.0	24.590	20.77	-.610592-002	.137771-003
4	80.0	24.527	20.57	-.353795-002	.122966-003
5	100.0	24.470	20.38	-.121853-002	.103160-003
6	120.0	24.426	20.24	.616206-003	.891852-004
7	140.0	24.385	20.11	.227011-002	.765504-004
8	160.0	24.350	19.99	.369242-002	.687154-004
9	180.0	24.316	19.88	.509315-002	.671296-004
10	200.0	24.287	19.78	.627381-002	.564333-004
11	220.0	24.255	19.69	.740937-002	.558725-004
12	240.0	24.232	19.60	.852145-002	.528575-004
13	260.0	24.208	19.52	.951832-002	.530305-004
14	280.0	24.181	19.43	.106413-001	.491808-004
15	300.0	24.158	19.36	.115525-001	.452085-004

INTERPOLATED HEIGHT AT REFERENCE PRESSURE: 24.441

POROSITY AT REFERENCE PRESSURE: 20.29

TABLE - A18

Confidential

31/2-4 SAMPLE C19-P10

SAMPLE NR C19-P10 1 CURVE POROSITY 36.8% DEPTH 1534.6 M REFERENCE PRESSURE 117.8 BAR

CURVE NR. 1

POINT NR.	PZ IN BAR	HEIGHT IN MM	POROSITY %	COMPACTION	COMPRESSIBILITY IN 1/BAR
1	20.0	25.471	35.11	-.142897-001	.266491-003
2	40.0	25.346	34.80	-.933124-002	.169835-003
3	60.0	25.267	34.59	-.616113-002	.138137-003
4	80.0	25.207	34.43	-.376459-002	.109997-003
5	100.0	25.154	34.30	-.166342-002	.961218-004
6	120.0	25.108	34.18	.154214-003	.868004-004
7	140.0	25.066	34.07	.181894-002	.814838-004
8	160.0	25.025	33.96	.346065-002	.775067-004
9	180.0	24.988	33.86	.494288-002	.747093-004
10	200.0	24.952	33.77	.637402-002	.735411-004
11	220.0	24.915	33.67	.782868-002	.747007-004
12	240.0	24.877	33.57	.934022-002	.751532-004
13	260.0	24.838	33.46	.105059-001	.797919-004
14	280.0	24.797	33.35	.125522-001	.875646-004
15	300.0	24.750	33.23	.143961-001	.982988-004

INTERPOLATED HEIGHT AT REFERENCE PRESSURE: 25.112

TABLE - A19

31/2-4 SAMPLE FC20-P2

SAMPLE NR FC20-P2   2 CURVES   POROSITY 26.0%   DEPTH 1545.7 M   REFERENCE PRESSURE 120.1 BAR

CURVE NR. 1

POINT NR.	FZ IN BAR	HEIGHT IN MM	POROSITY %	COMPACTION	COMPRESSIBILITY IN 1/BAR
1	10.0	24.975	25.63	-.231898-001	.533061-003
2	20.0	24.837	25.22	-.175639-001	.572472-003
3	30.0	24.722	24.87	-.128443-001	.400775-003
4	40.0	24.619	24.55	-.860974-002	.382727-003
5	50.0	24.536	24.30	-.524058-002	.324747-003
6	60.0	24.460	24.06	-.211842-002	.282191-003
7	70.0	24.403	23.89	.224660-003	.239229-003
8	80.0	24.347	23.71	.252119-002	.676009-004
9	90.0	24.641	24.62	-.952513-002	-.782115-003
10	100.0	24.538	24.31	-.532291-002	.397786-003
11	110.0	24.435	23.99	-.109887-002	.591451-003
12	120.0	24.409	23.90	-.269592-005	.839860-003
13	130.0	24.404	23.89	.184739-003	.128068-002

INTERPOLATED HEIGHT AT REFERENCE PRESSURE: 24.409

POROSITY AT REFERENCE PRESSURE: 23.90

TABLE - A20

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31/2-4 SAMPLE FC20-P2

Denne siden legges ikke inn i SFinx!

SAMPLE NR FC20-P2 2 CURVES POROSITY 26.0% DEPTH 1545.7 M REFERENCE PRESSURE 120.1 BAR

CURVE NR. 2

POINT NR.	PZ IN BAR	HEIGHT IN MM	POROSITY %	COMPACTION	COMPRESSIBILITY IN 1/BAR
1	120.0	24.171	23.16	-.200534-004	.138389-003
2	140.0	24.103	22.94	.280480-002	.136305-003
3	160.0	24.040	22.74	.539939-002	.130588-003
4	180.0	23.977	22.53	.800709-002	.123819-003
5	200.0	23.920	22.35	.103579-001	.118177-003
6	220.0	23.867	22.18	.125848-001	.114893-003
7	240.0	23.810	21.99	.149047-001	.113308-003
8	260.0	23.757	21.82	.171314-001	.114004-003
9	280.0	23.701	21.63	.194139-001	.116772-003
10	300.0	23.645	21.45	.217487-001	.120894-003

INTERPOLATED HEIGHT AT REFERENCE PRESSURE: 24.171

POROSITY AT REFERENCE PRESSURE: 23.16

TABLE - A21

31/2-4 SAMPLE FC21-P3

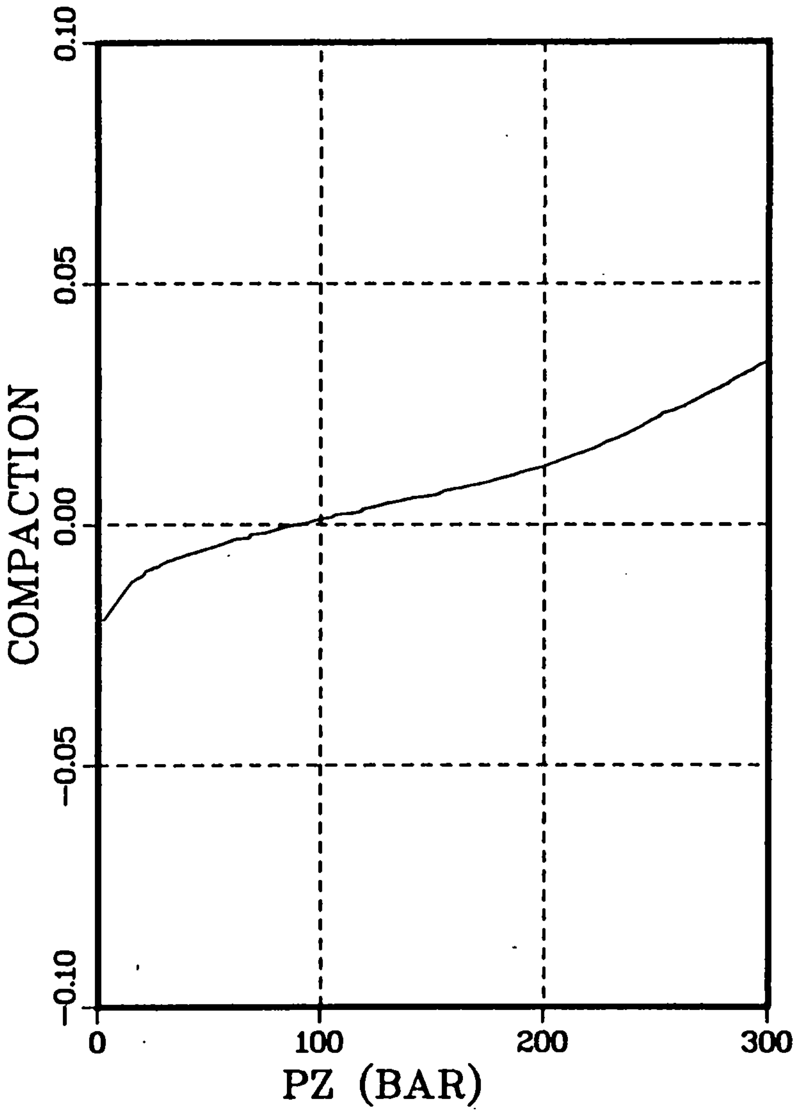
SAMPLE NR FC21-P3 1 CURVE POROSITY 24.8% DEPTH 1563.3 M REFERENCE PRESSURE 123.8 BAR

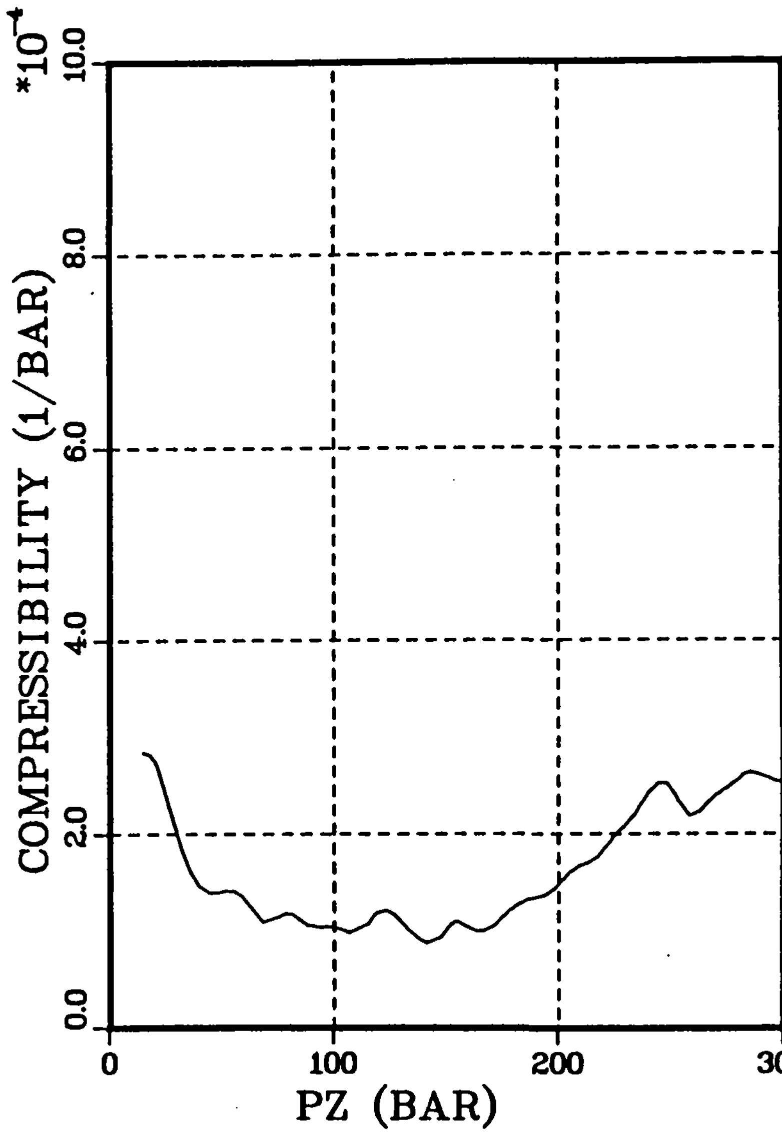
CURVE NR. 1

POINT NR.	PZ IN BAR	HEIGHT IN MM	POROSITY %	COMPACTION	COMPRESSIBILITY IN 1/BAR
1	20.0	25.797	24.06	-.301368-001	.273463-003
2	40.0	25.589	23.44	-.218072-001	.387505-003
3	60.0	25.409	22.90	-.146148-001	.316007-003
4	80.0	25.269	22.47	-.903336-002	.248688-003
5	100.0	25.154	22.12	-.445988-002	.203295-003
6	120.0	25.062	21.84	-.776924-003	.175470-003
7	140.0	24.978	21.57	.257651-002	.156125-003
8	160.0	24.902	21.33	.561065-002	.146876-003
9	180.0	24.830	21.10	.850287-002	.138676-003
10	200.0	24.764	20.90	.111064-001	.128298-003
11	220.0	24.702	20.70	.135931-001	.127954-003
12	240.0	24.638	20.49	.161687-001	.136536-003
13	260.0	24.568	20.26	.189514-001	.145546-003
14	280.0	24.494	20.02	.219147-001	.154641-003
15	300.0	24.418	19.77	.249444-001	.164100-003

INTERPOLATED HEIGHT AT REFERENCE PRESSURE: 25.043

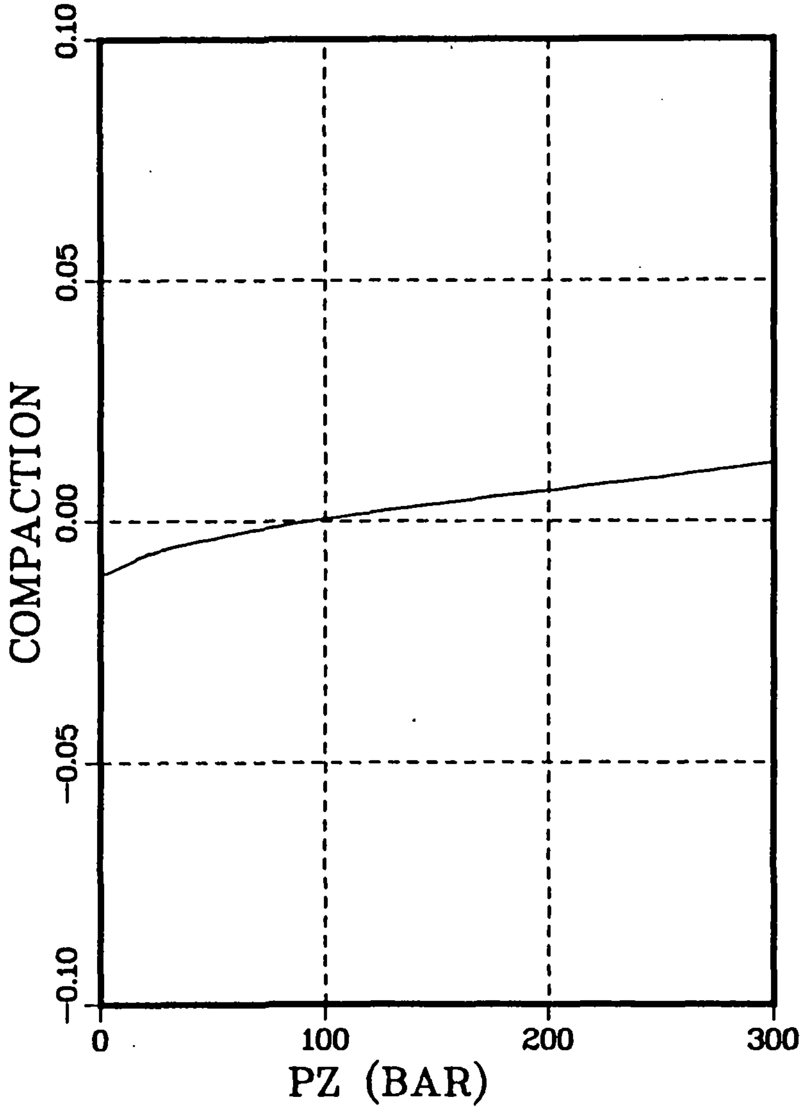
POROSITY AT REFERENCE PRESSURE: 21.77

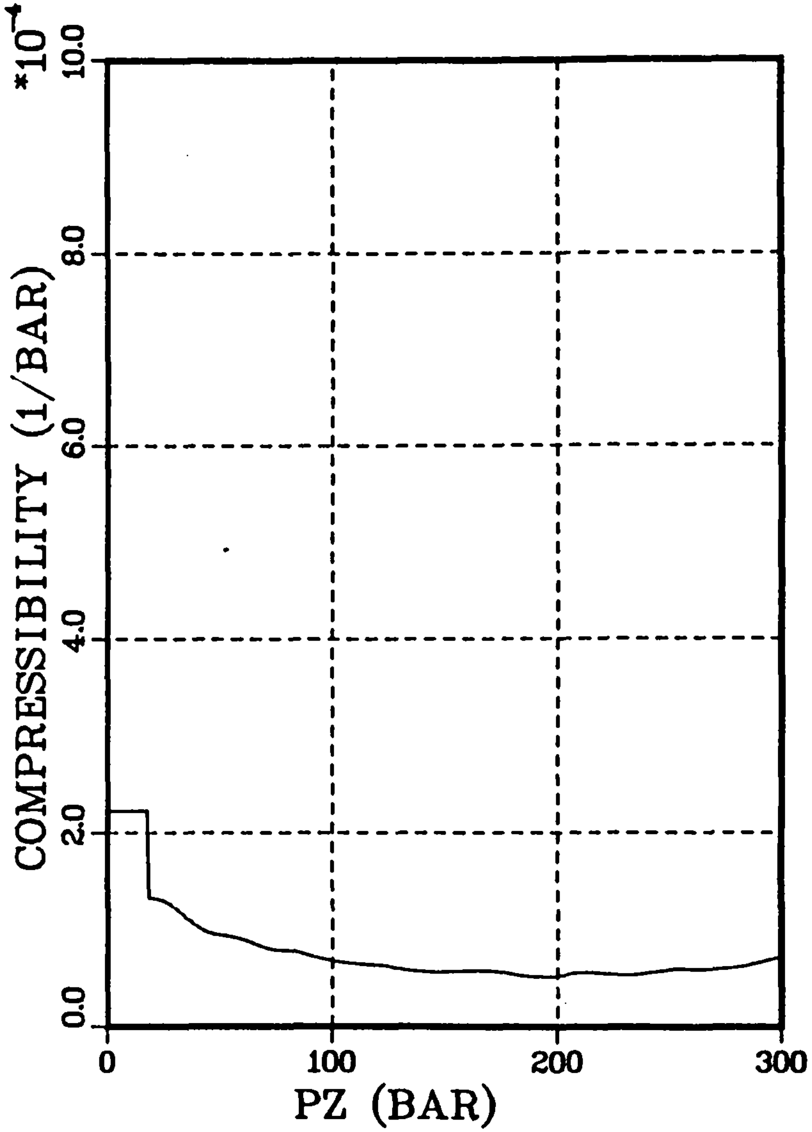




SAMPLE NO. C6-P15
DEPTH 1392.3 M
POROSITY 34.2%

31/2-4 SAMPLE C6-P15

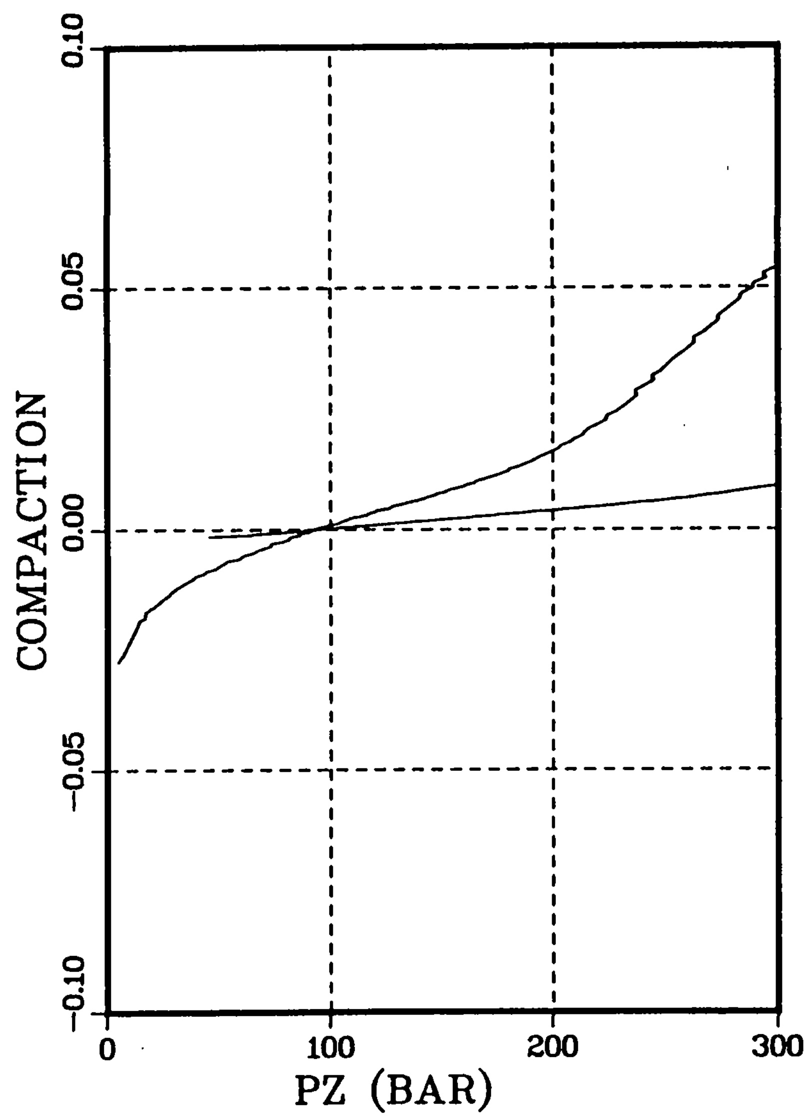


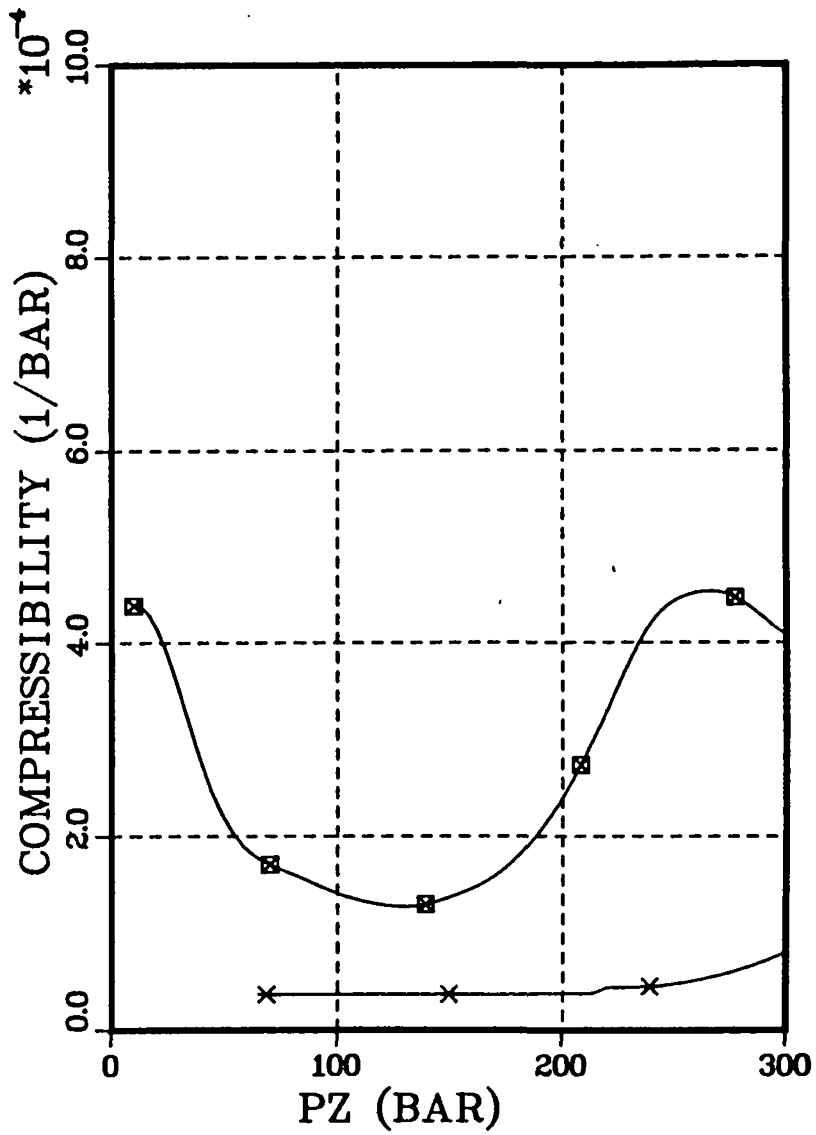


SAMPLE NO.	C8-P1
DEPTH	1410.1 M
POROSITY	32.3%

31/2-4 SAMPLE C8-P1

FIG.A2

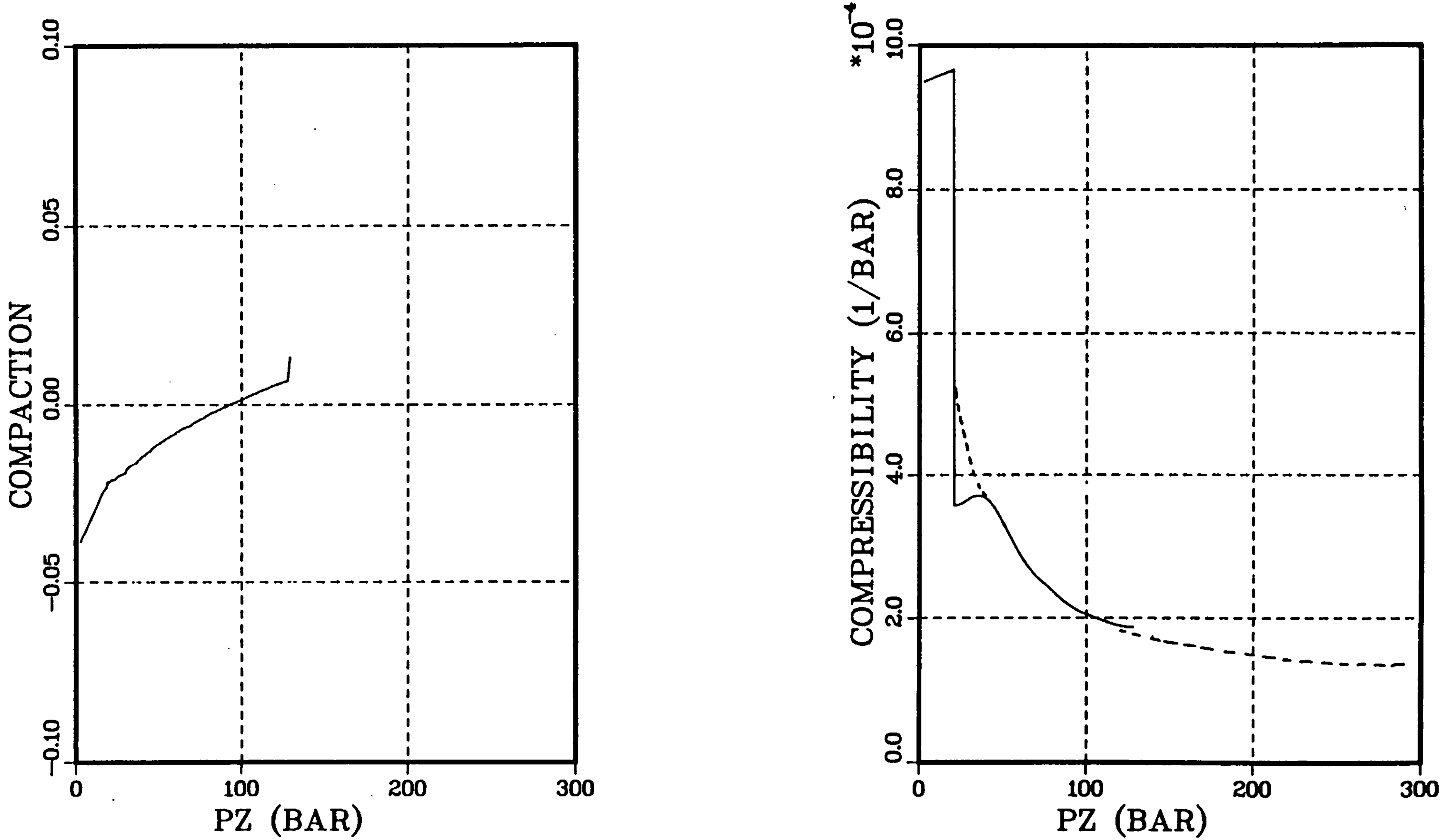




LEGEND
⊠ = FIRST CYCLE
× = SECOND CYCLE

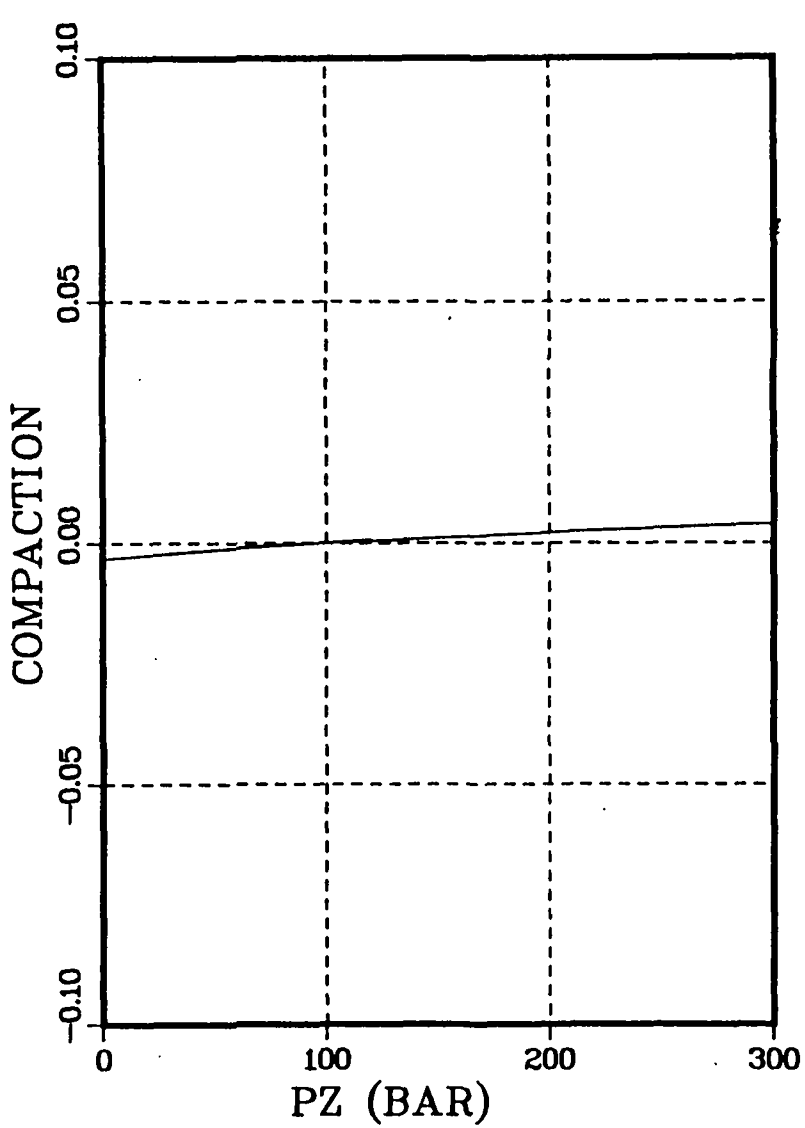
SAMPLE NO. C8–P4
DEPTH 1412.8 M
POROSITY 31.5%

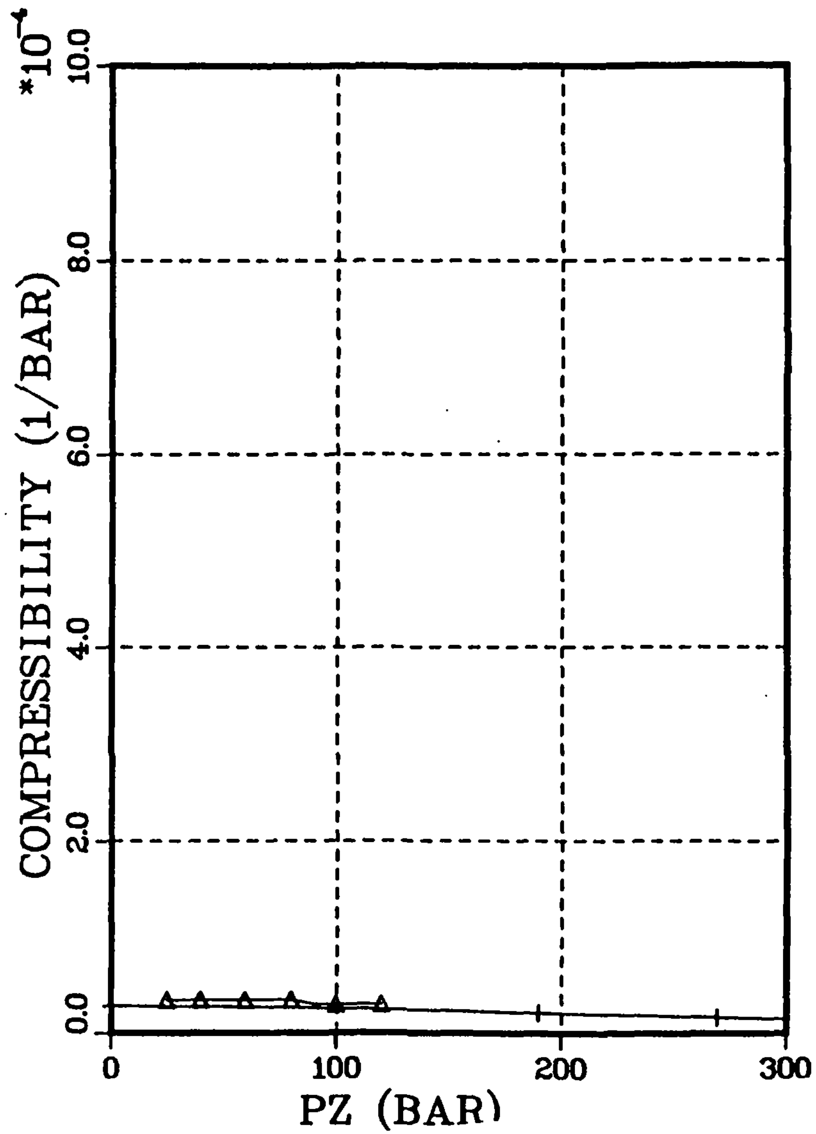
31/2–4 SAMPLE C8–P4



SAMPLE NO. C8–P7
DEPTH 1414.9 M
POROSITY 26.0%

31/2–4 SAMPLE C8–P7

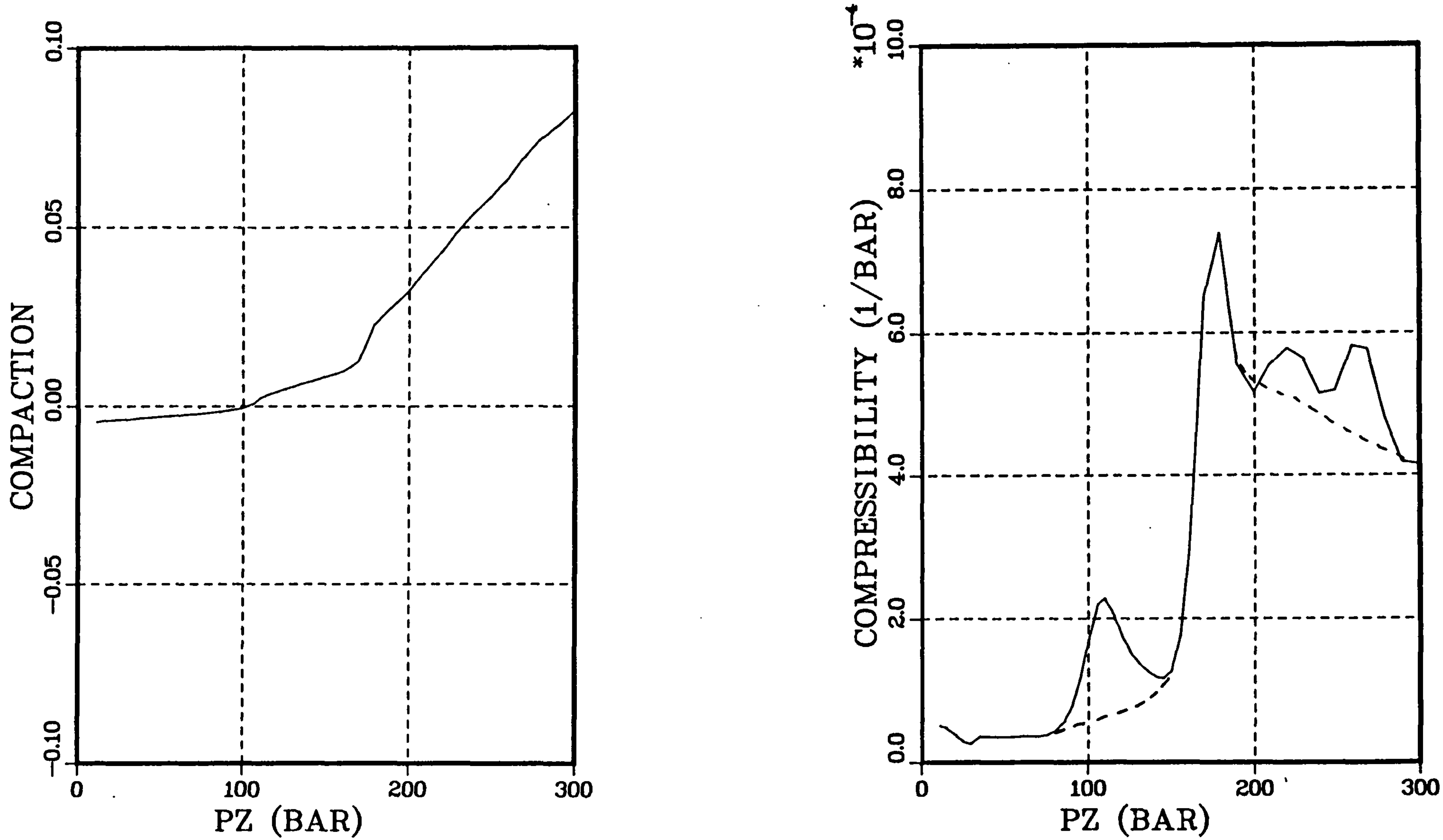




LEGEND
△ = FIRST CYCLE
+ = SECOND CYCLF

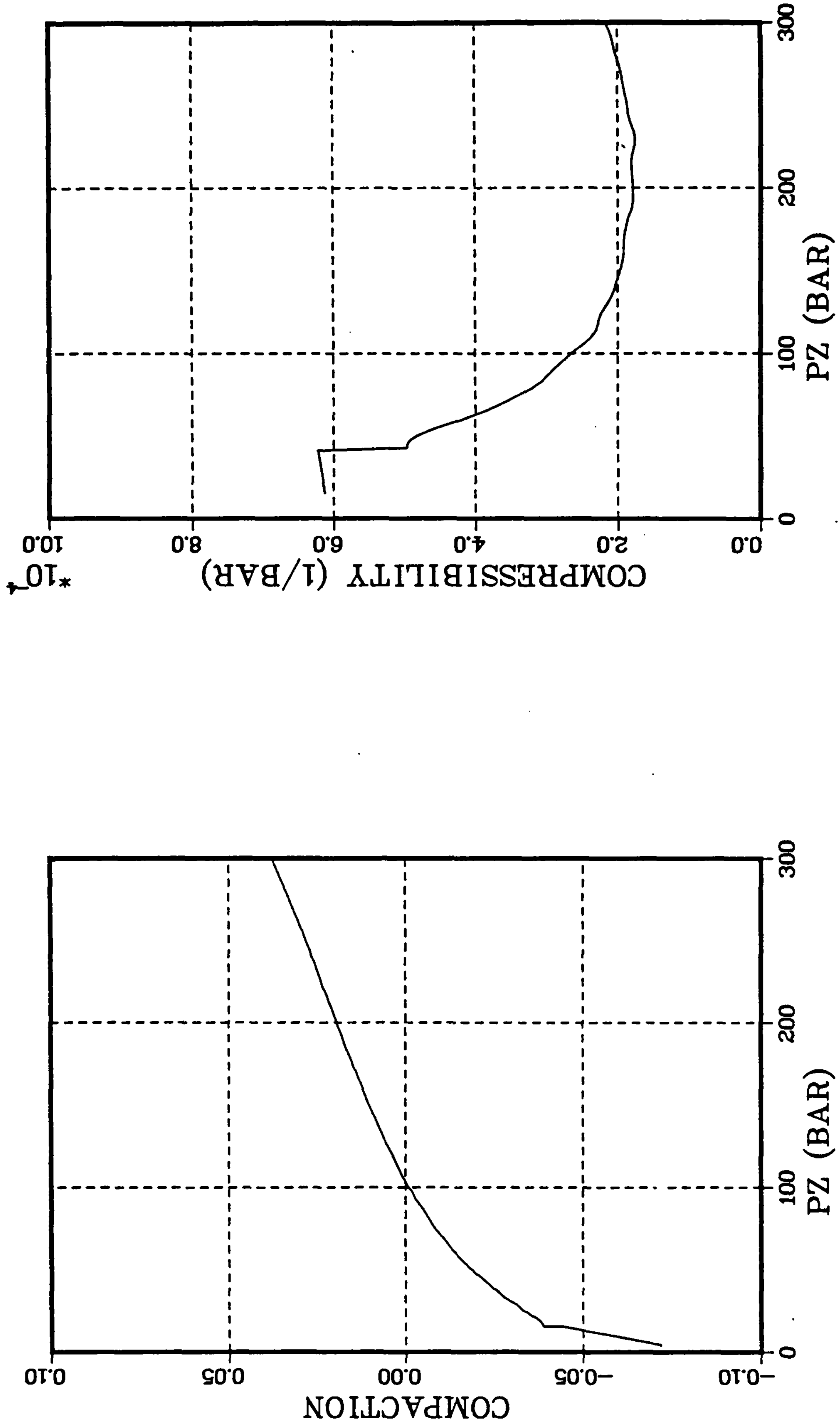
SAMPLE NO. FC9-P7
DEPTH 1421.8 M
POROSITY 0.5%

31/2-4 SAMPLE FC9-P7



SAMPLE NO. C13-P5
DEPTH 1458.6 M
POROSITY 31.8%

31/2-4 SAMPLE C13-P5



SAMPLE NO. C13–P13
DEPTH 1465.5 M
POROSITY 22.2%

31/2–4 SAMPLE C13–P13

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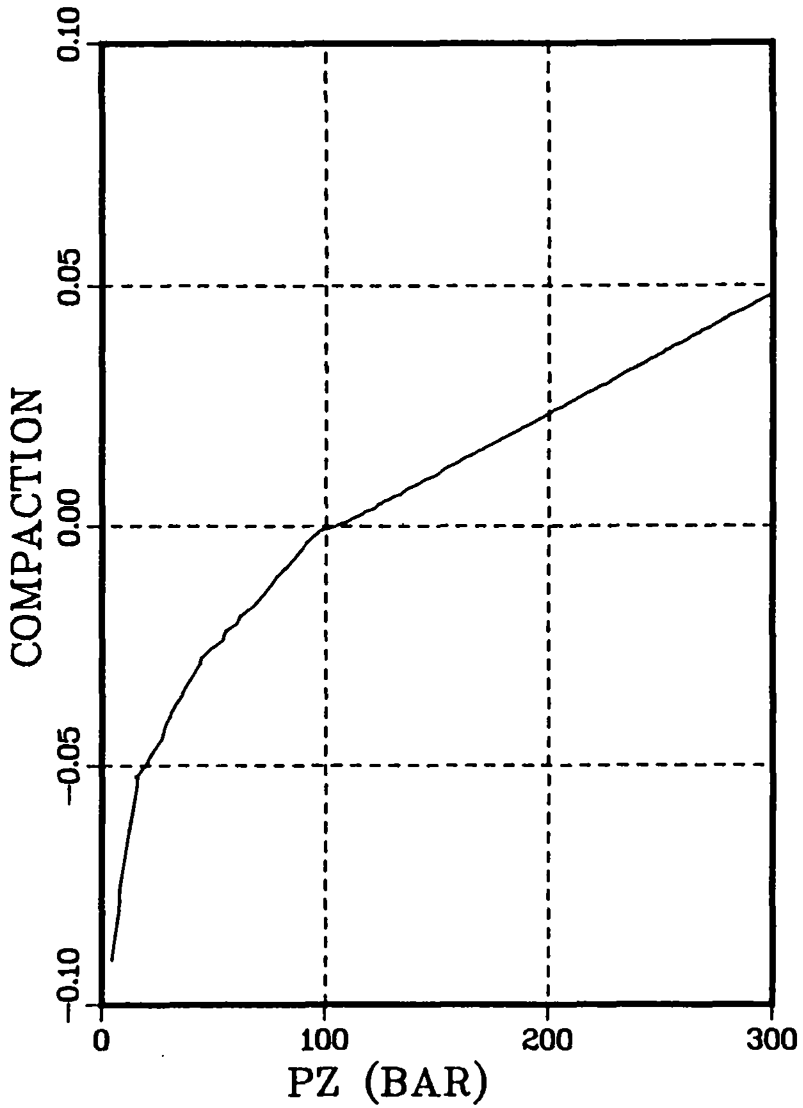
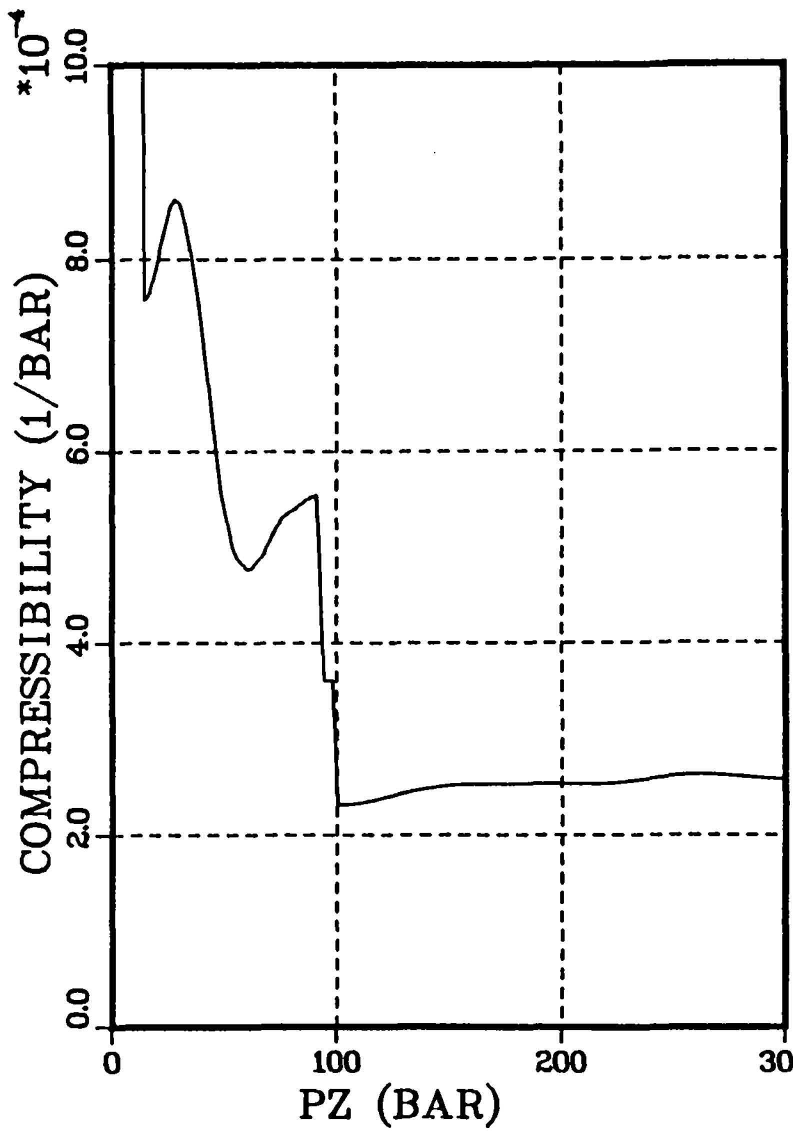
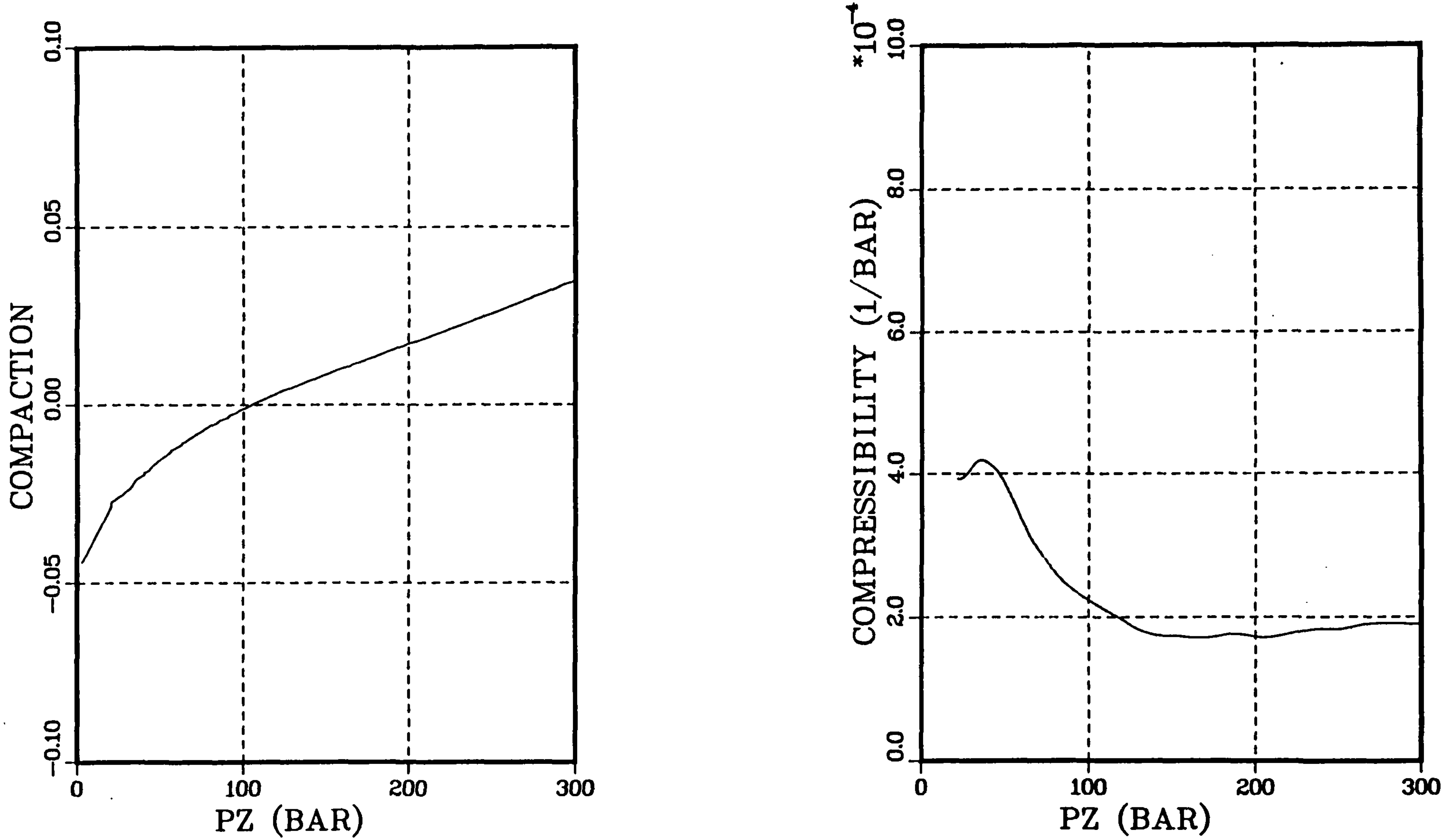




SAMPLE NO. C13–P15
DEPTH 1467.4 M
POROSITY 23.7%

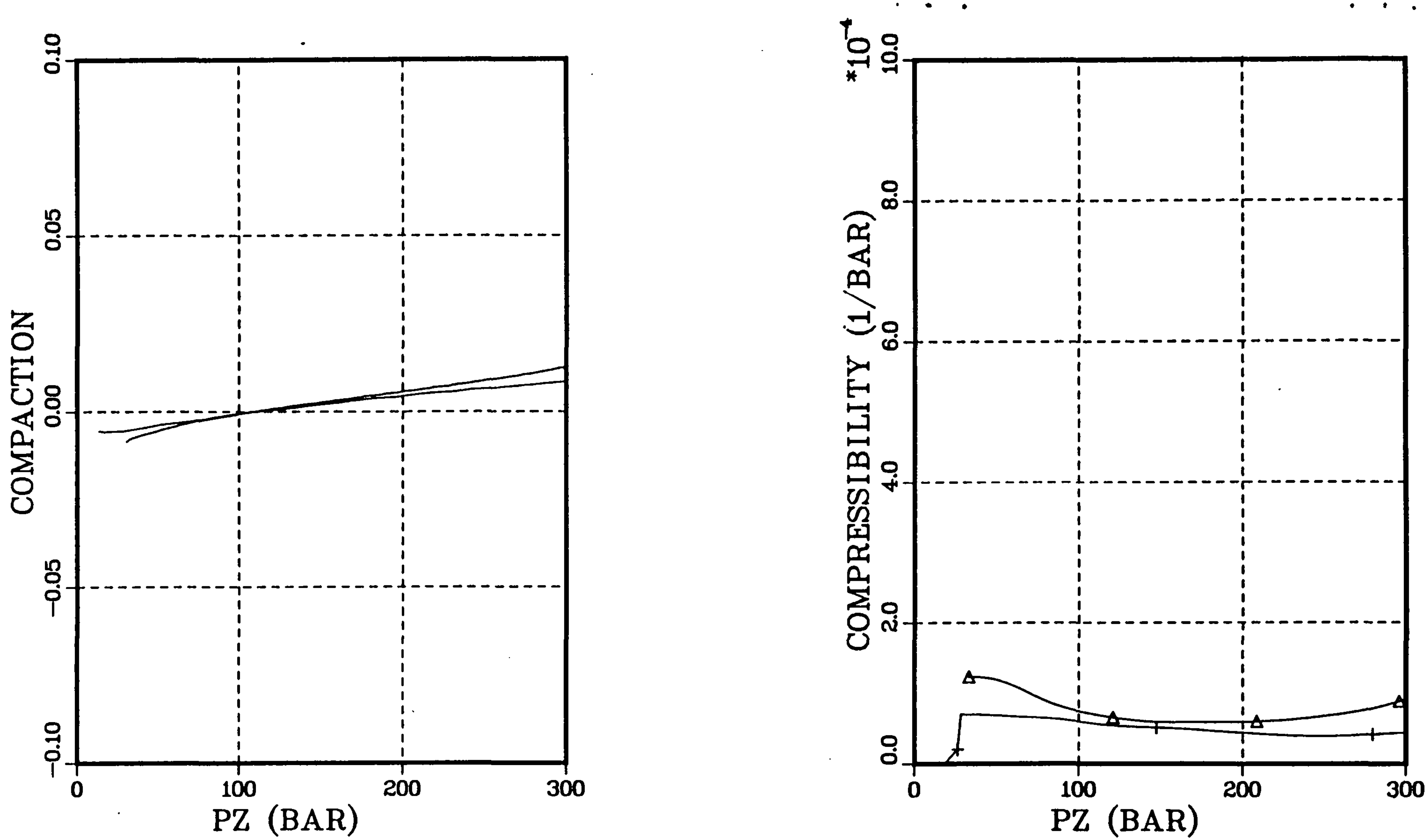
31/2–4 SAMPLE C13–P15



SAMPLE NO. C14-P1
DEPTH 1473.1 M
POROSITY 27.2%

31/2-4 SAMPLE C14-P1

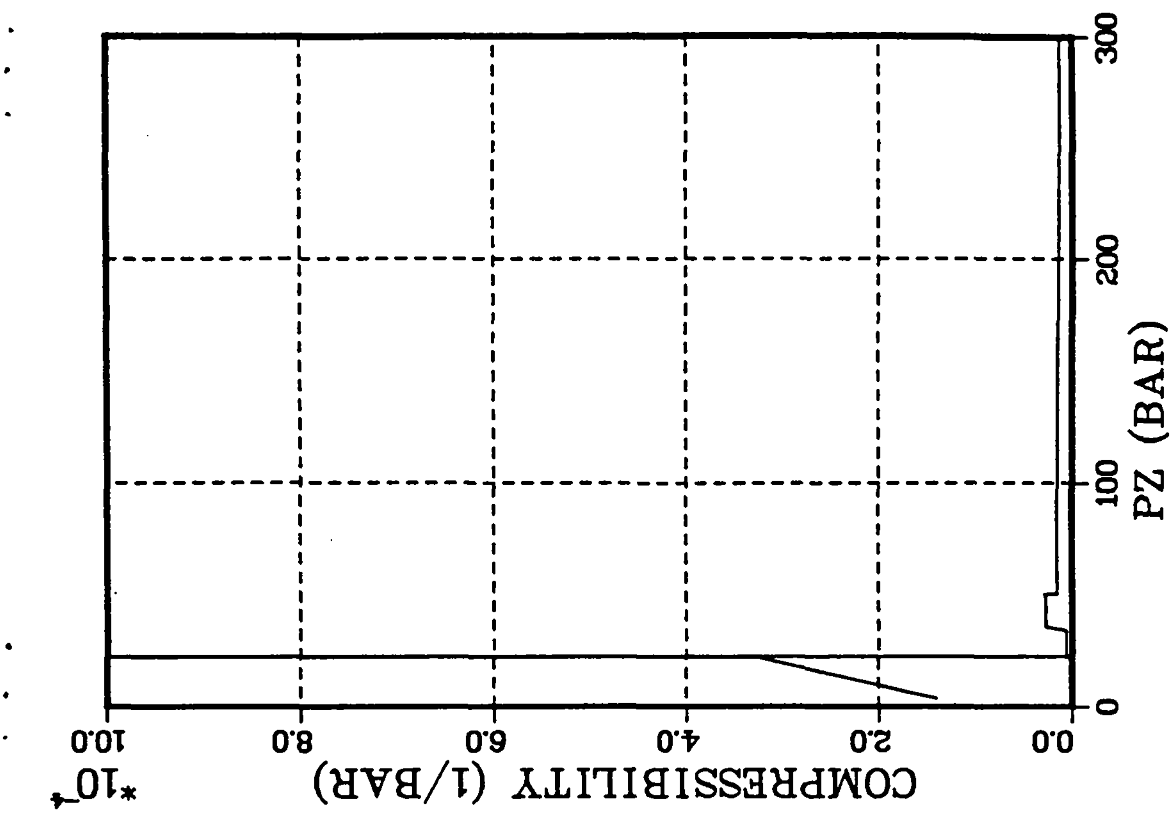
D[redacted]5119

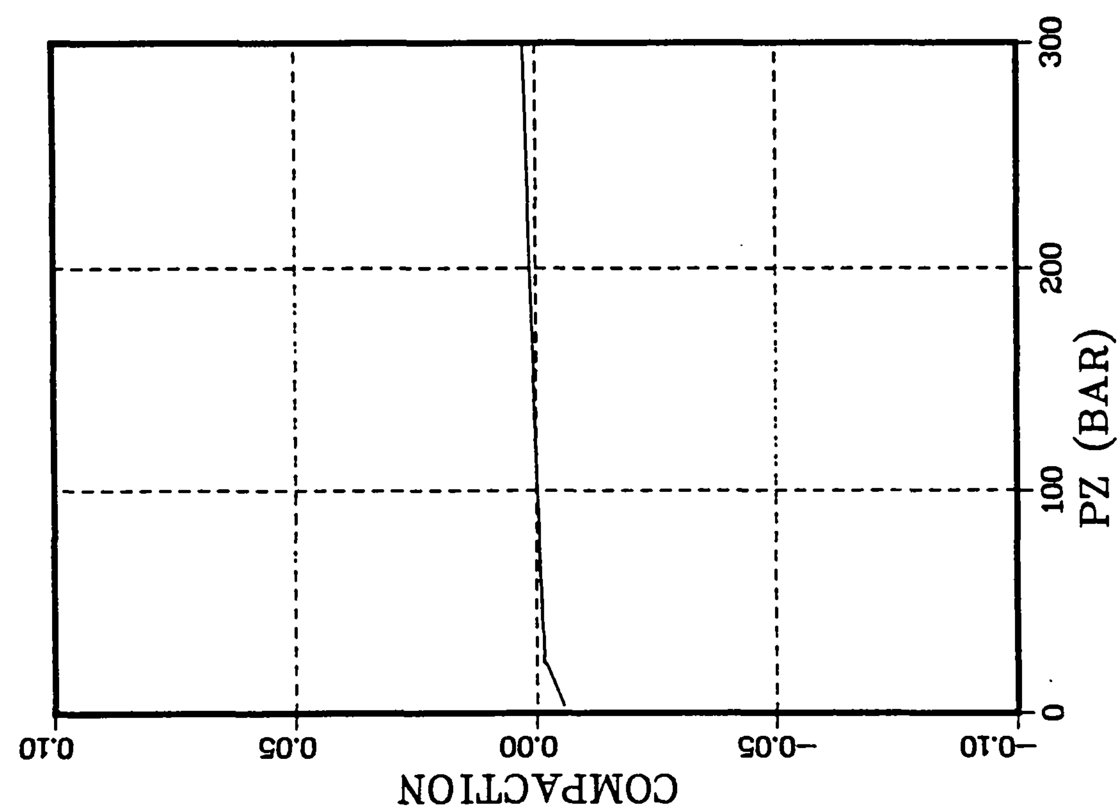


LEGEND
△ = FIRST CYCLE
+ = SECOND CYCLE

SAMPLE NO. FC16–P3
DEPTH 1487.1 M
POROSITY 29.3%

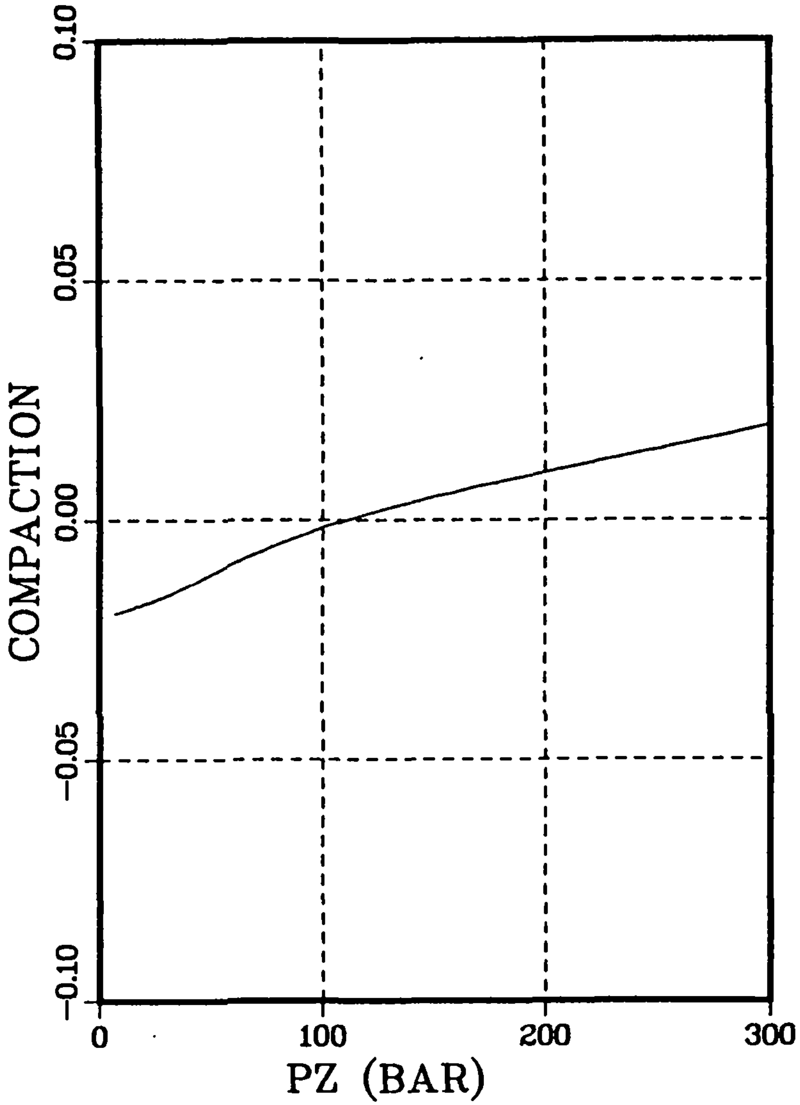
31/2–4 SAMPLE FC16–P3

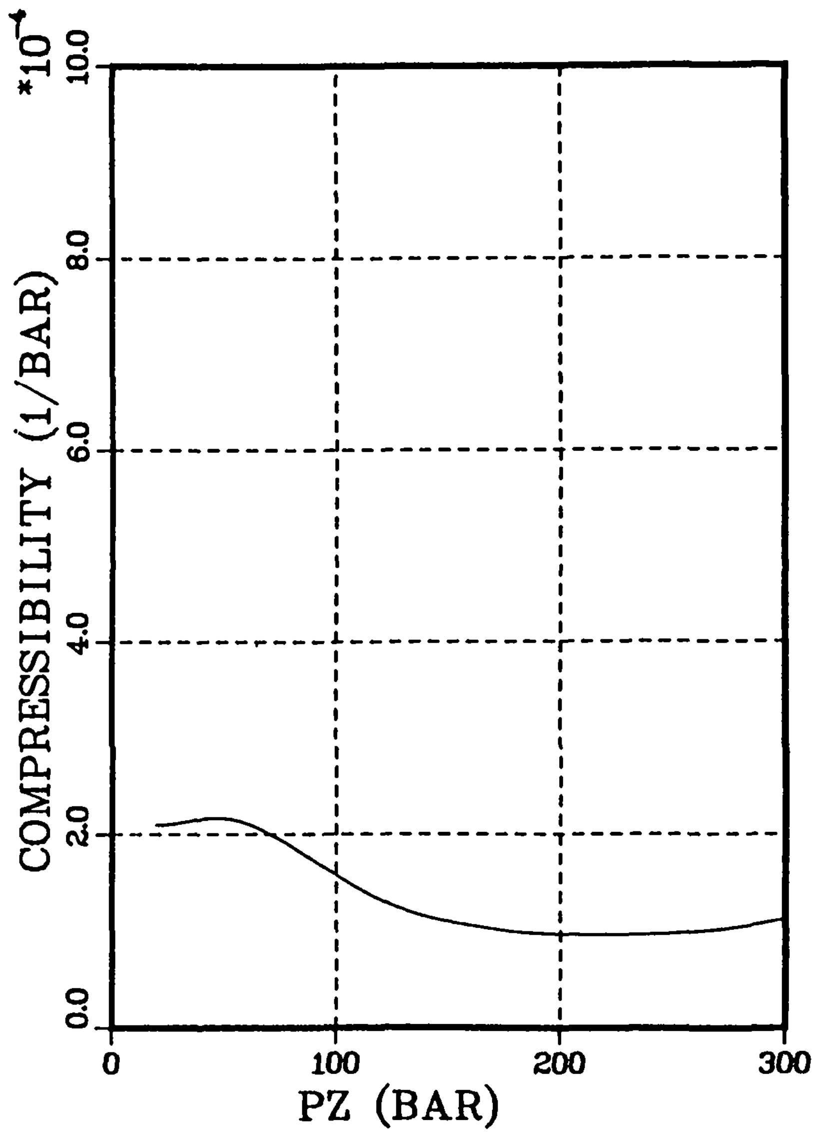




SAMPLE NO. C14-P4
DEPTH 1475.8 M
POROSITY 15.6%

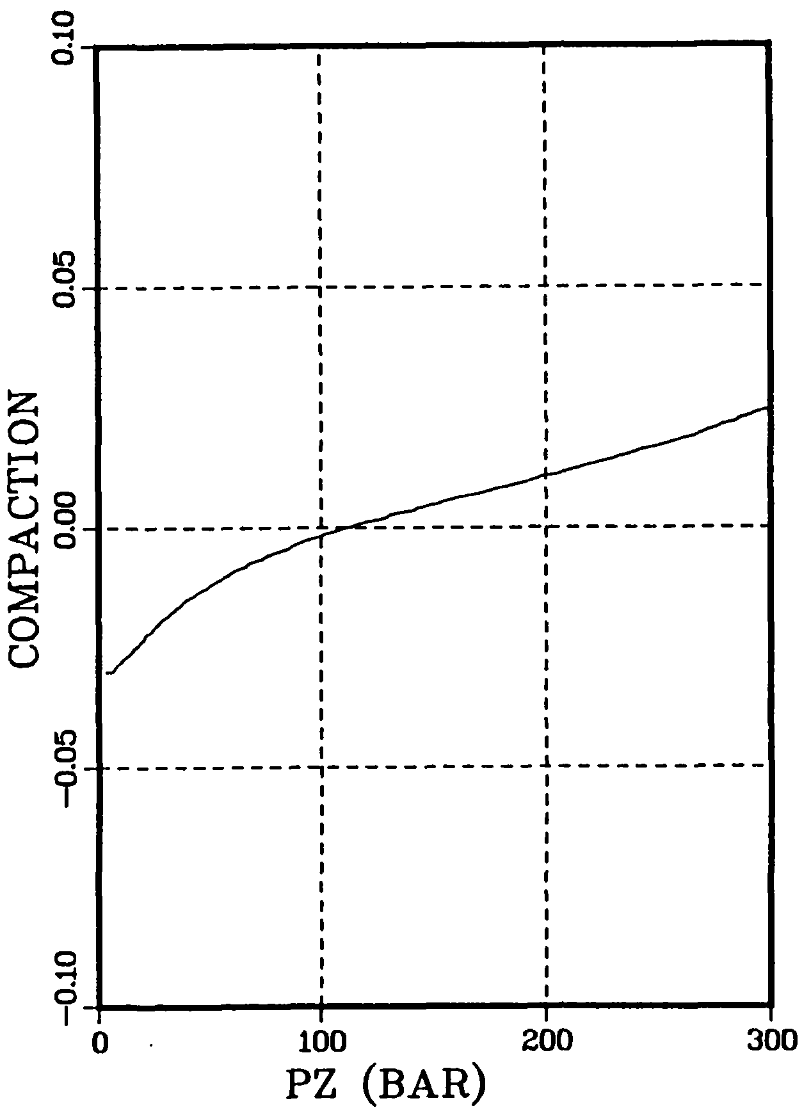
31/2-4 SAMPLE C14-P4

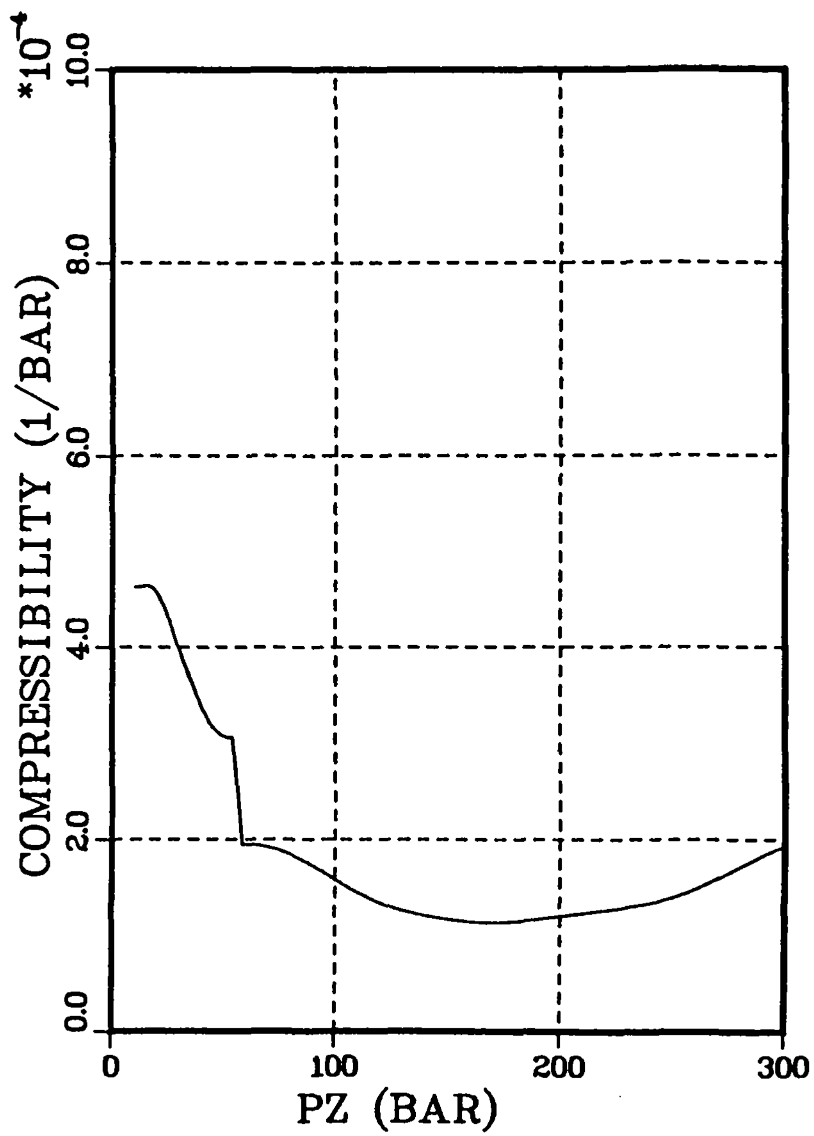




SAMPLE NO.	C17–P12
DEPTH	1500.0 M
POROSITY	28.7%

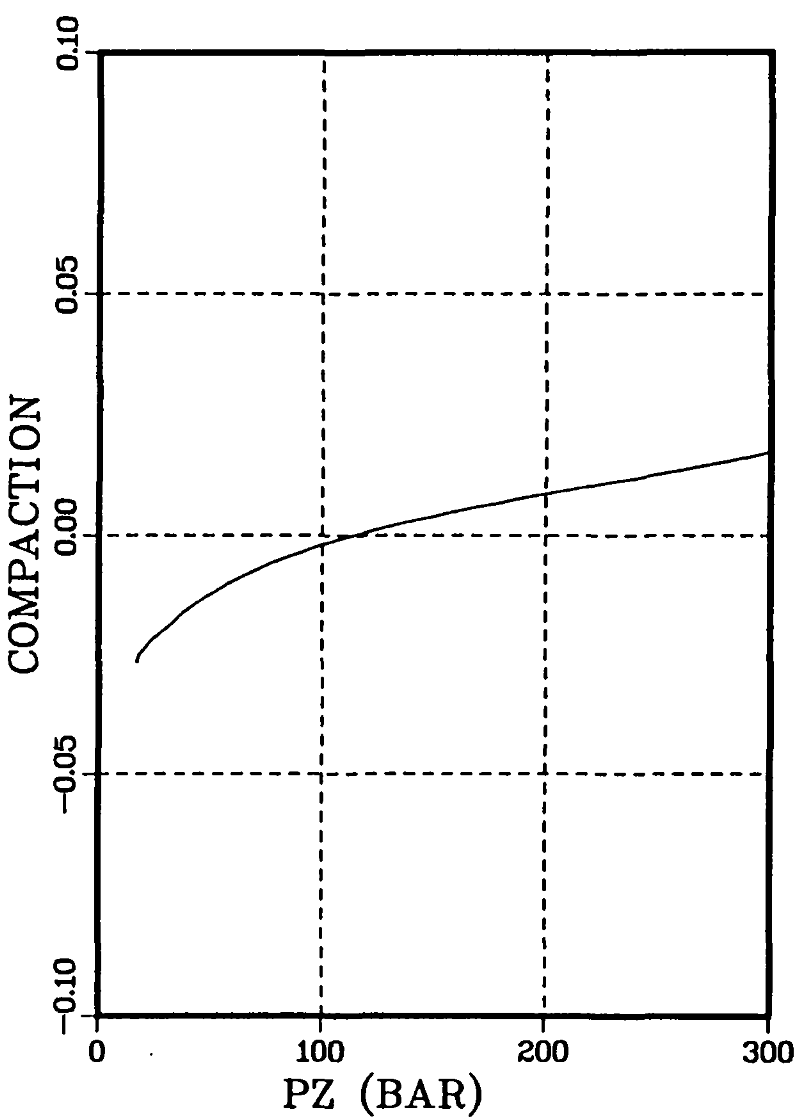
31/2–4 SAMPLE C17 P12

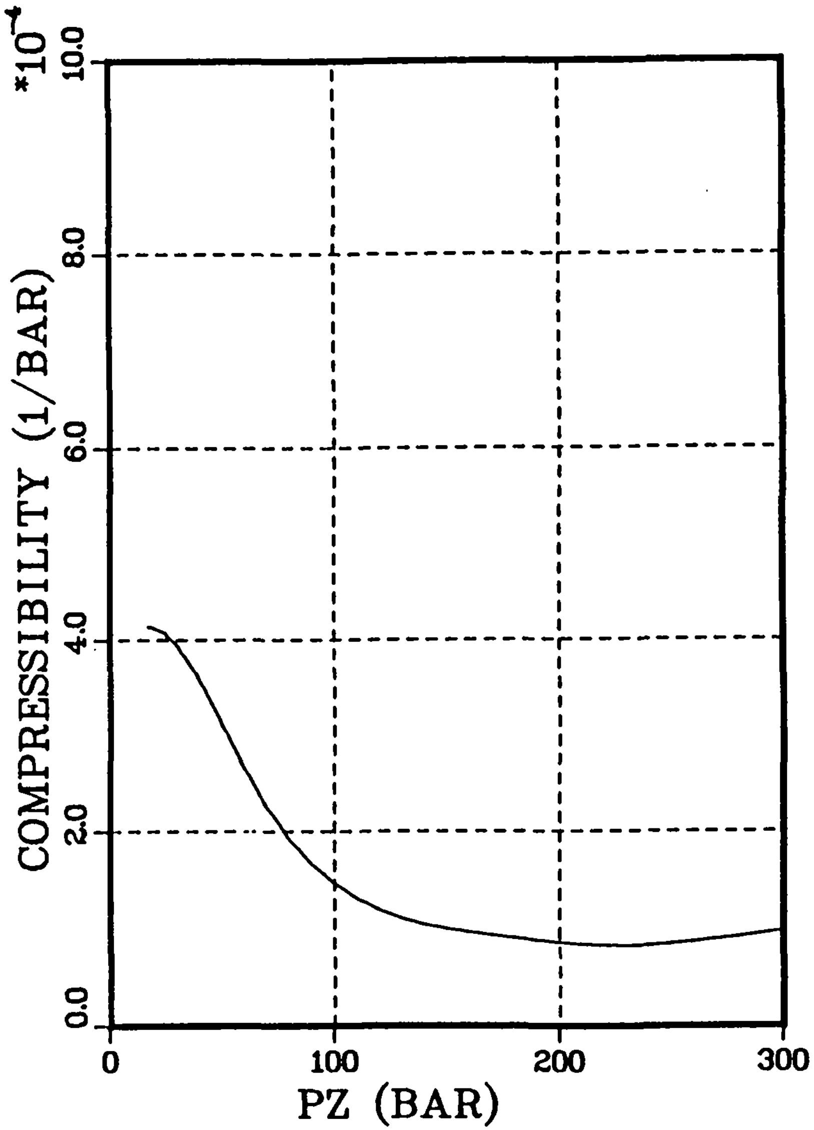




SAMPLE NO. C17–P14
DEPTH 1501.8 M
POROSITY 28.8%

31/2–4 SAMPLE C17–P14





SAMPLE NO. FC18–P5
DEPTH 1511.9 M
POROSITY 26.3%

31/2–4 SAMPLE FC 18–P5

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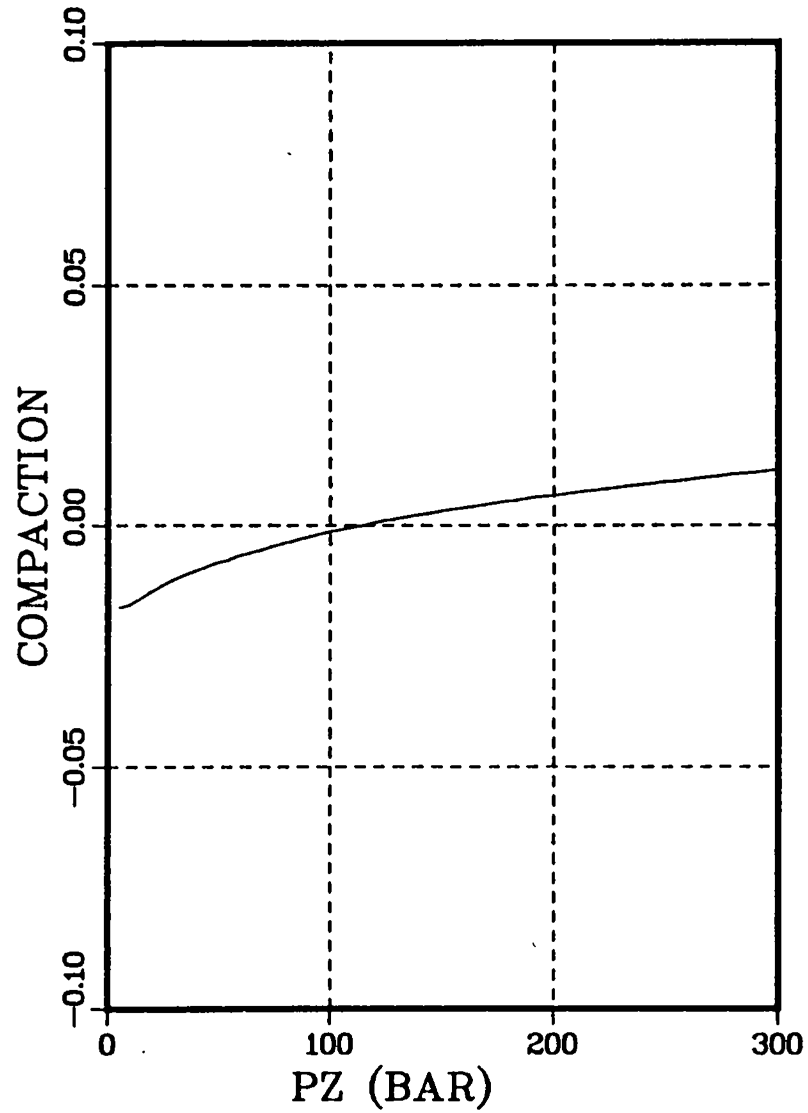

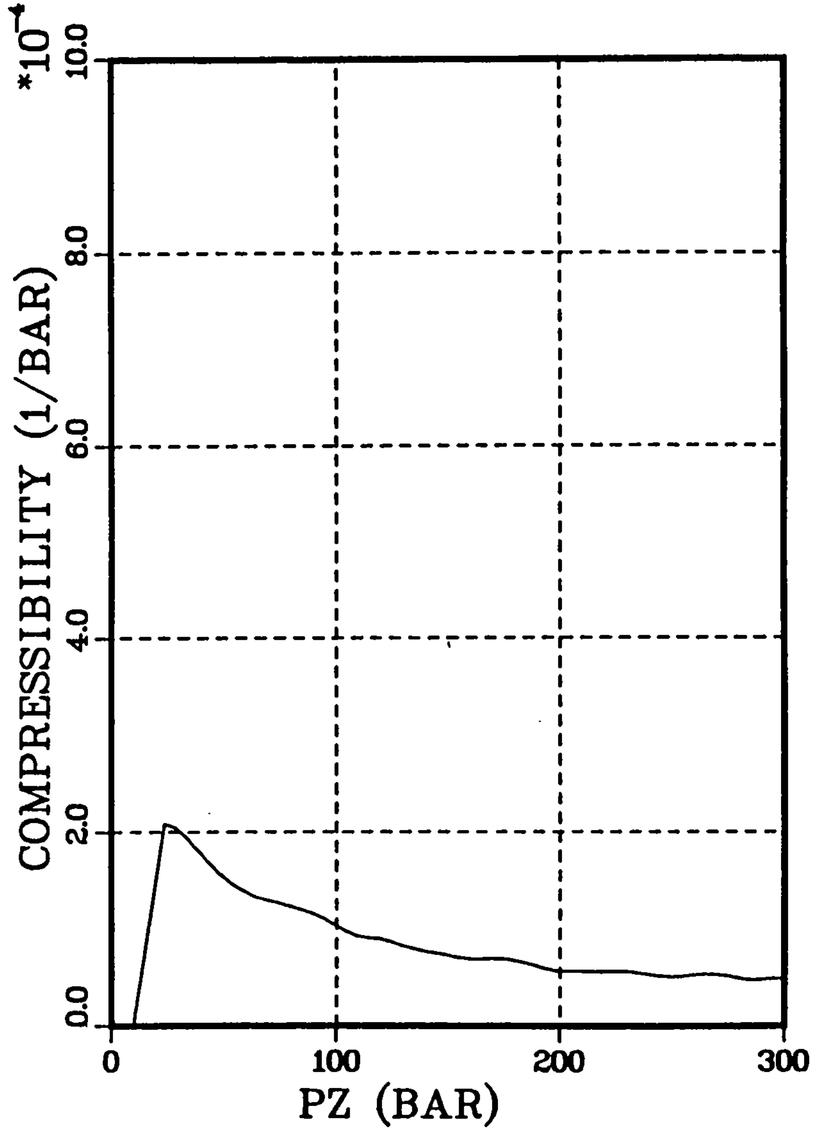

SAMPLE NO. C18-P11
DEPTH 1517.3 M
POROSITY 21.6%

31/2-4 SAMPLE C18-P11

Author : Dwa/Grf Dr.nr.35124
Drawn :

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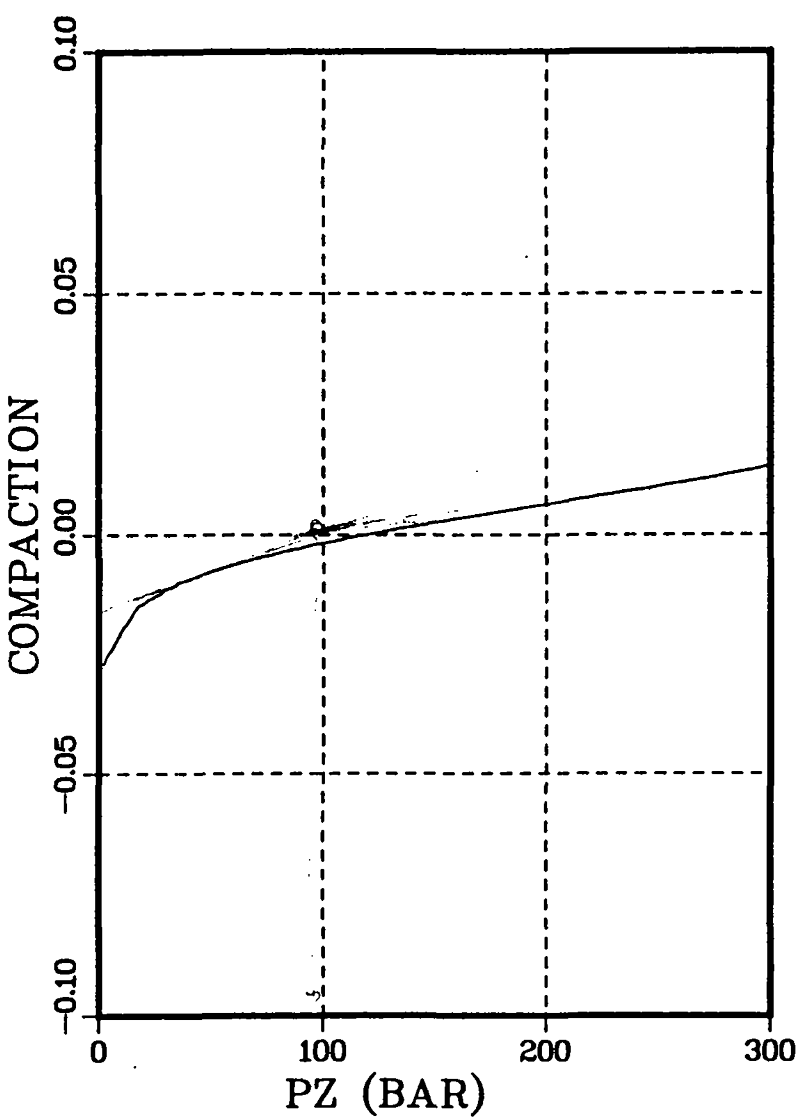
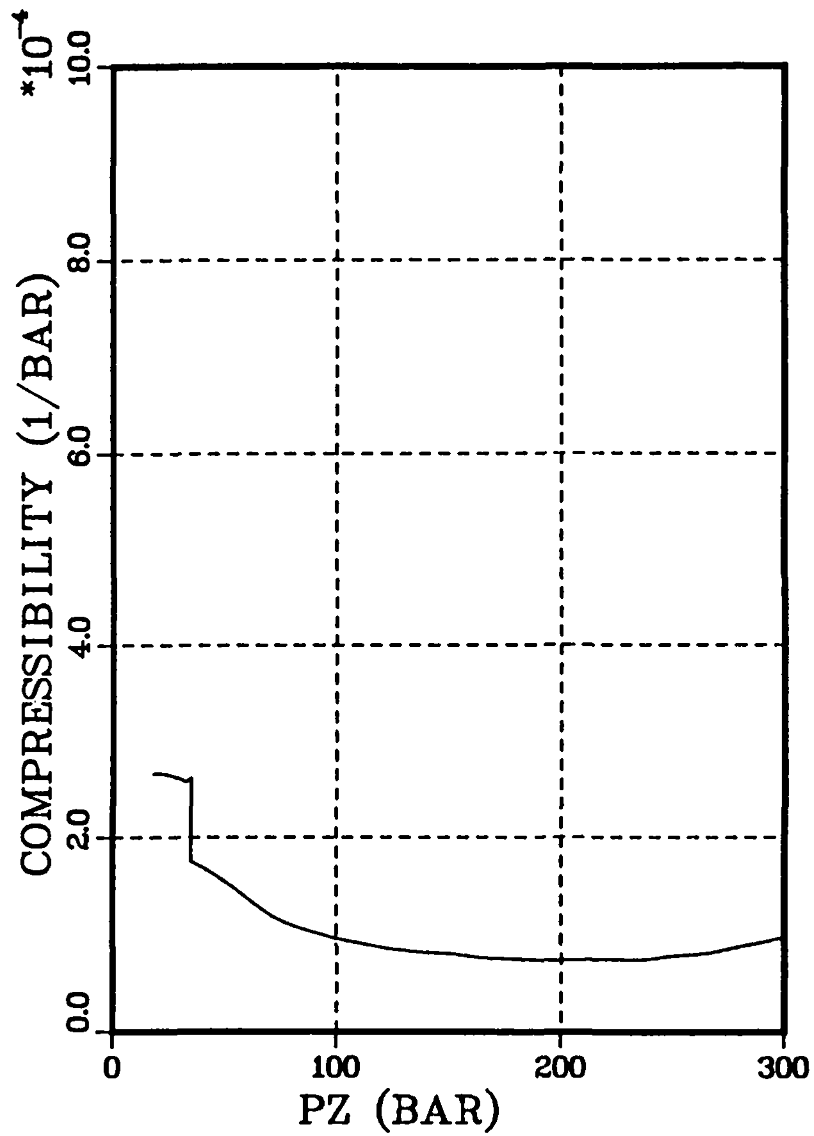
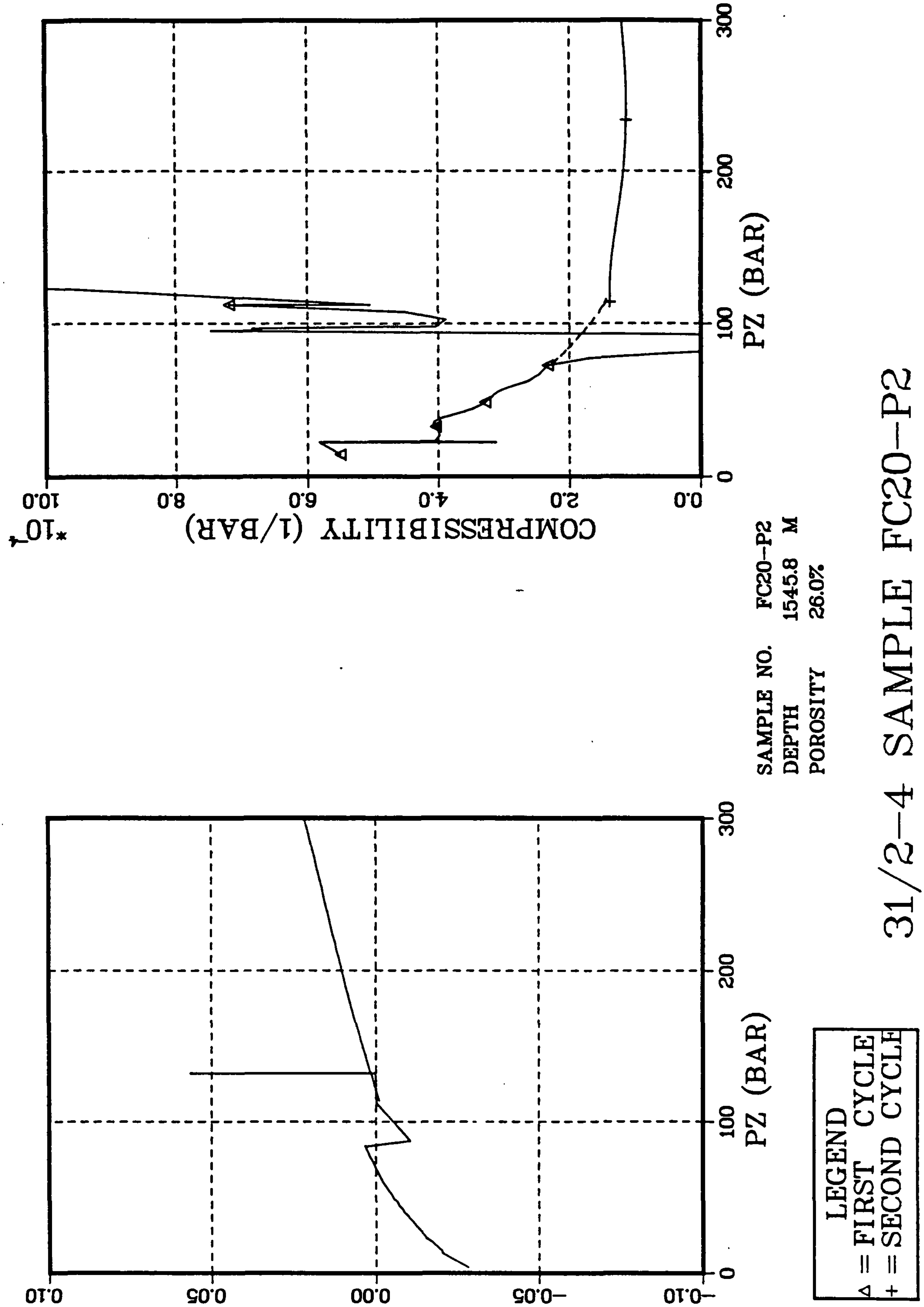
FIG. A15

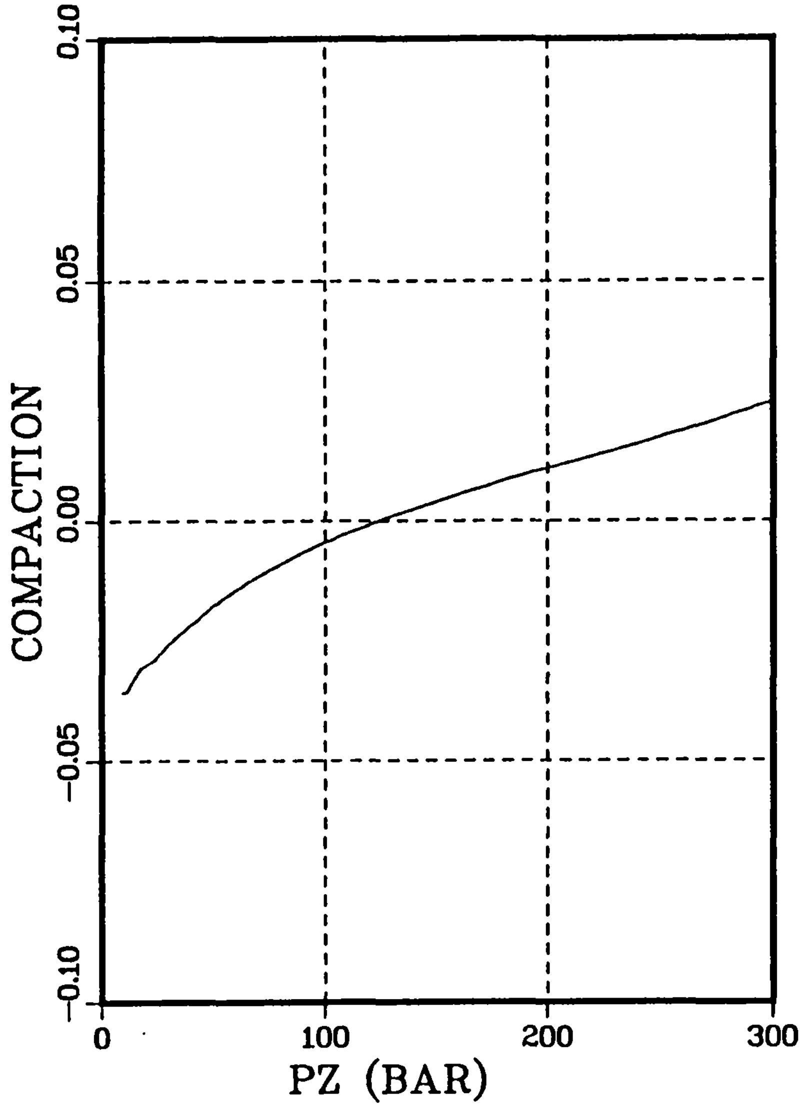


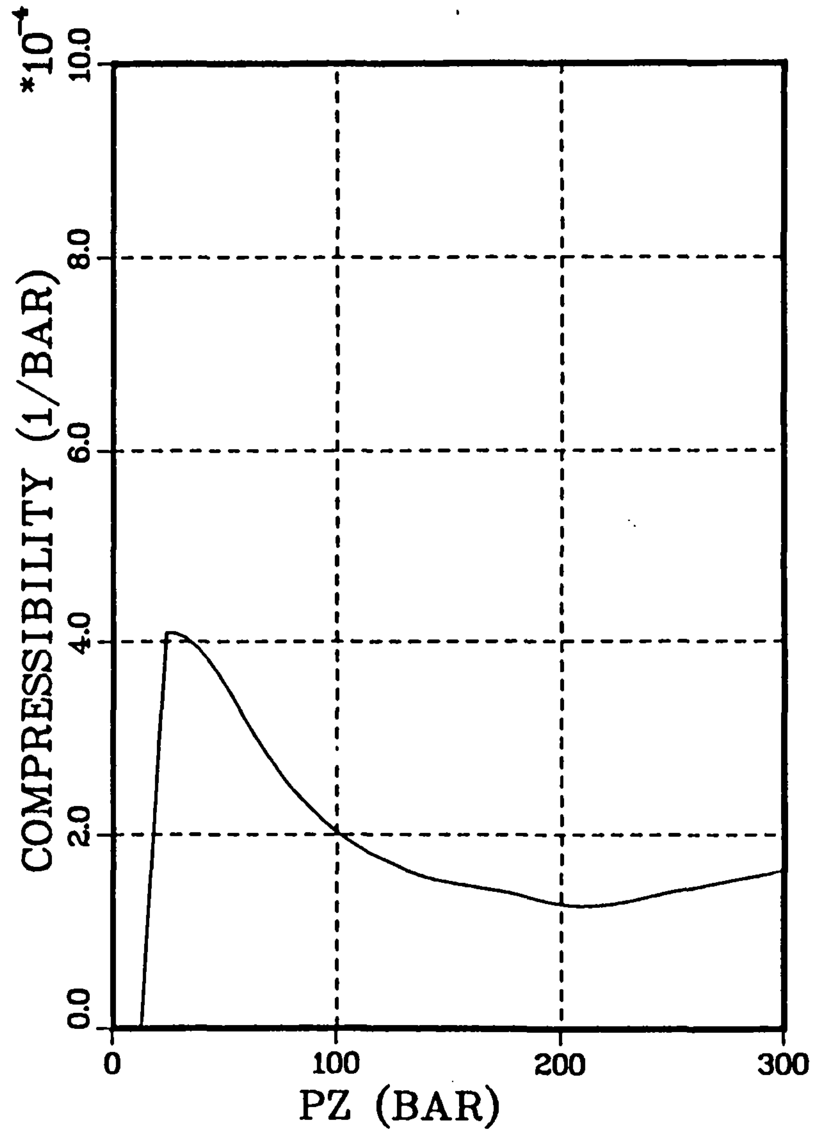


SAMPLE NO.	C19–P10
DEPTH	1534.6 M
POROSITY	36.8%

31/2–4 SAMPLE C19–P10


31/2–4 SAMPLE FC20–P2
SAMPLE NO. FC20–P2
DEPTH 1545.8 M
POROSITY 26.0%
COMPRESSIBILITY (1/BAR) *10⁻⁴
0.0
2.0
4.0
6.0
8.0
10.0
PZ (BAR)
0
100
200
300
COMPACTION
−0.10
−0.05
0.00
0.05
0.10
LEGEND
△ = FIRST CYCLE
+ = SECOND CYCLE





SAMPLE NO. FC21-P3
DEPTH 1563.3 M
POROSITY 24.8%

31/2-4 SAMPLE FC21-P3

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