NGU Report 96.101

Magnetic Susceptibility Measurements on Cores from the North Sea.

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REPORT

Report no.: 96.101	ISSN 0800-3416	Grading: Åpen

Title:
Magnetic Susceptibility Measurements on Cores from the North Sea.

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County:	Commune:
Map-sheet name (M=1:250.000)	Map-sheet no. and -name (M=1:50.000)
Deposit name and grid-reference:	Number of pages: 12 Price (NOK): kr. 32,- Map enclosures:

Fieldwork carried out:	Date of report:	Project no.:	Person responsible:
20.06.1996	29.08.1996	2562.01	Jan S. Rønning

Summary:

This report presents results from 160 magnetic susceptibility measurements on cores from seven exploration wells (3/7-1, 3/7-2, 7/3-1, 8/3-1, 16/6-1, 17/4-1 and 18/11-1) in the southern Norwegian sector of the North Sea. Together the cores represent a total of 136 meters in basement gneiss and schist, Cambro-Silurian mica schist, Permian conglomerate, sandstone, shale and volcanics, Lower Triassic sandstone, Middle Jurassic sandstone and Upper Cretaceous and Palaeocene chalk. These results will be used to aid in interpretation of offshore aeromagnetic measurements.

Collectively the sedimentary formations are characterised by diamagnetic or paramagnetic behaviour, or a combination of both. Sandstone and chalk have low susceptibility (diamagnetic - paramagnetic) while the Permian volcanics and the gneisses within the basement have the highest susceptibility (ferromagnetic). The Upper Cretaceous chalk and the lower Triassic sandstone are partly diamagnetic. Arithmetic mean values for the Palaeocene and Upper Cretaceous chalk is 0.00003 and -0.00003 SI, respectively. Arithmetic mean values for the Middle Jurassic, Lower Triassic and Permian sandstones are 0.00015, 0.00002 and 0.000015 SI, respectively. The mean values for the ferromagnetic basement gneiss and Permian volcanics are 0.00128 and 0.01630.

Keywords: Geofysikk	Petrofysikk	Magnetometri
		Fagrapport

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1 INTRODUCTION

In connection with interpretation of offshore aeromagnetic measurements at Elf Petroleum, a total of 160 magnetic susceptibility measurements were carried out on 136 metres of cores from seven wells in the southern Norwegian sector of the North Sea. The seven wells are 3/7-1, 3/7-2, 7/3-1, 8/3-1, 16/6-1, 17/4-1 and 18/11-1. The interval, lithology and stratigraphy of the cores are presented in Table 1.

Table 1. The cores interval, lithology and stratigraphy.

WELL	UTM coordinates ED-50, zone 32	CORE	DEPTH m	LITHOLOGY	STRATIGRAPHY	
					UNIT	GROUP
3/7-1	192160-6268850	1	3221-3227	M00	SGR	Basement
3/7-2	196570-6272720	1-2	2570-2588	S41	PAL	Danian
		3	2602-2604	S41	UCR	(Upper Cretaceous)
		4	2911-2918	S13-S28	MJU	(Bajocian)
		5	4310-4319	V22	PER	Rotliegendes
7/3-1	129190-6428540	1	4381-4385	S22	PER	Zechstein
		2-3	4414-4575	S13	PER	Rotliegendes
8/3-1	185040-6439850	1-2	2075-2082	S13	MJU	(Middle Jurassic)
		3	2206-2215	S13	LTR	(Lower Triassic/ Zechstein)
		4	2969-2971	S24	SGR	Basement
		5	3007-3011	M00	SGR	Basement
16/6-1	147510-6523010	1	2058-2061	S24	SIL	(Cambro-Silurian)
17/4-1	167240-6509480	1	2271-2288	S13	MJU	(Middle-Lower Jurassic)
		2	3881-3884	S00	PER	Rotliegendes
18/11-1	236620-6445680	1	2082-2086	S11	PER	(Permian)

Explanation to table:

Lithologic codes:

S00 conglomerate
S11 quartzite
S13 sandstone

S22 shale
S24 mica-schist
S28 siltstone
S41 chalk
V22 basalt
M00 gneiss

Stratigraphic codes:

PAL Palaeocene
UCR Upper Cretaceous
MJU Middle Jurassic
LTR Lower Triassic
PER Permian
SIL Silurian
SGR Basement

2 MEASUREMENTS

The magnetic susceptibility measurements on cores at the NPD in Stavanger were carried out by using the Bartington MS2 Magnetic Susceptibility System (Dearing 1994) and the JH-8 Susceptibility Meter from Geoinstruments Ky. The description of the two methods are given in Appendix A. The measurements were carried out by technician Finn Ove Pettersen, NGU.

The MS2 Magnetic Susceptibility System is designed to measure volume susceptibility, of continuous sections of core. This instrument was used on all the cores for measurements at approximately intervals of 0.80 m. The applied coil diameter was 80 mm for all cores except those from wells 3/7-2 and 18/11-1 where a coil diameter of 60 mm was used due to smaller core dimensions. The varying size of cores was taken into account in the calculation of the susceptibility.

The handheld JH-8 Susceptibility Meter was used to measure the cores between these intervals to make sure that no magnetic parts of the cores were passed over by the MS2 instrument. Before commencing measurements one made sure that the sites were well away from any possible sources of magnetic interference.

3 RESULTS AND COMMENTS

The results from the measurements are presented in Appendix B. The range, arithmetic middle and standard deviation of susceptibilities for the rock units are presented in Table 2.

Table 2. Statistical data of susceptibility measurements.

Rock-unit	No.	Min. value	Max. value	Ar. mid.	Std. dev.
Palaeocene chalk	15	0.00002	0.00006	0.00003	0.00001
Upper Cretaceous chalk	2	-0.00006	0.00000	-0.00003	0.00003
Middle Jurassic sandst./siltst.	34	0.00000	0.00038	0.00015	0.00011
Lower Triassic sandstone	12	-0.00002	0.00012	0.00002	0.00004
Permian sandstone	54	0.00008	0.00033	0.00015	0.00004
Permian volcanics (basalt)	15	0.00004	0.04267	0.01630	0.01139
Permian shale	5	0.00016	0.00048	0.00023	0.00012
Cambro-Silurian mica-schist	3	0.00012	0.00021	0.00016	0.00004
Basement, mica-schist	9	0.00028	0.00066	0.00047	0.00012
Basement, gneiss	8	0.00042	0.00241	0.00128	0.00065

The lowest susceptibility is found in the chalk and the sandstones. The upper Cretaceous chalk and the lower Triassic sandstone are partly diamagnetic, indicated by the negative susceptibility values. The Permian volcanics and the gneisses within the basement have the highest susceptibility. Especially the volcanics have high susceptibility and reveal a ferromagnetic character.

4 CONCLUSIONS

Collectively the formations are characterised by diamagnetic or paramagnetic behaviour, or a combination of both. Sandstone and chalk have low susceptibility while basement gneisses and in particular Permian basalts have high susceptibility and are to a great extent ferromagnetic.

Arithmetic mean values for the Palaeocène and Upper Cretaceous chalk is 0.00003 and -0.00003 SI, respectively. Arithmetic mean values for the Middle Jurassic, Lower Triassic and Permian sandstones are 0.00015, 0.00002 and 0.000015 SI, respectively. The mean values for the ferromagnetic basement gneiss and Permian volcanics are 0.00128 and 0.01630.

5 REFERENCES

Dearing, J. 1994: Environmental Magnetic Susceptibility. *Bartington Users Manual, 102 pp.*

APPENDIX A
METHOD DESCRIPTIONS

MS2 System, Bartington Instruments Limited

The MS2 Magnetic Susceptibility System comprises a portable measuring instrument, the MS2 meter, which displays the magnetic susceptibility value of materials when these are brought within the influence of the MS2C sensor. The MS2C sensor is designed for the volume susceptibility measurements of continuous sections of core. The core is passed through the sensor and measurements are taken at different intervals.

The sensor is connected to the MS2 meter via a simple coaxial cable. An RS232 serial interface allows the instrument to operate in conjunction with custom IBM compatible software running on a portable PC. The circuitry within the MS2 powers the sensor and processes the measurement information produced by it. The measurements are obtained digitally using a time dependent method. This results in precise and repeatable measurements.

Also the MS2C sensor operate on the principle of a.c. induction. Power is supplied to the oscillator circuit within the sensor. This generates a low intensity alternating magnetic field. Any material brought within the influence of this field will bring about a change in oscillator frequency. The frequency information is returned in pulse form to the MS2 meter where it is converted into a value of magnetic susceptibility. The sensor is particularly insensitive to sample conductivity. The sensor subjects the sample to a non-saturating field which has the advantage of measuring initial susceptibility without destroying any sample magnetic remanance.

Accuracy of this instrument is 0.1×10^{-5} SI.

JH-8, Geoinstruments ky

The function of JH-8 is based on electromagnetic induction. There are two coils placed orthogonally to each other in the detector head, which is mounted in the bottom of the instrument case. In non-magnetic environment the voltage induced from transmitter coil to receiver coil is zero. When a sample is brought near the coils, a voltage which is proportional to magnetic susceptibility of the sample is induced to the receiver coil. This signal is detected by a phase-locked amplifier and after rectification it is used to drive an analogue panel meter, which is thermally compensated and directly calibrated for susceptibility. Improved sensitivity is achieved by this method, which makes the use of low frequency possible. This reduces the error caused by possible electric conductivity in the sample to a normally insignificant value.

Accuracy of the instrument is 2×10^{-5} SI.

APPENDIX B

DATA FROM SUSCEPTIBILITY MEASUREMENTS ON CORES

Lithologic codes:

S00	conglomerate
S11	quartzite
S13	sandstone
S22	shale
S24	mica-schist
S28	siltstone
S41	chalk
V22	basalt
M00	gneiss

Stratigraphic codes:

PAL	Palaeocene
UCR	Upper Cretaceous
MJU	Middle Jurassic
LTR	Lower Triassic
PER	Permian
SIL	Silurian
SGR	Basement

Well No.	Core No.	Sample No.	UTM zone	UTM-coord. 10 m	Lit. code	Strat. code	Rock-name	Suscept. SI	Depth m
17/04-1	1	1	32	16724 650948	S13	MJU	SANDSTONE	0.00018	2271.5
17/04-1	1	2	32	16724 650948	S13	MJU	SANDSTONE	0.00025	2272.3
17/04-1	1	3	32	16724 650948	S13	MJU	SANDSTONE	0.00027	2273.2
17/04-1	1	4	32	16724 650948	S13	MJU	SANDSTONE	0.00017	2274.1
17/04-1	1	5	32	16724 650948	S13	MJU	SANDSTONE	0.00038	2275.2
17/04-1	1	6	32	16724 650948	S13	MJU	SANDSTONE	0.00038	2276.0
17/04-1	1	7	32	16724 650948	S13	MJU	SANDSTONE	0.00021	2276.5
17/04-1	1	8	32	16724 650948	S13	MJU	SANDSTONE	0.00016	2277.6
17/04-1	1	9	32	16724 650948	S13	MJU	SANDSTONE	0.00028	2279.0
17/04-1	1	10	32	16724 650948	S13	MJU	SANDSTONE	0.00023	2279.8
17/04-1	1	11	32	16724 650948	S13	MJU	SANDSTONE	0.00030	2281.0
17/04-1	1	12	32	16724 650948	S13	MJU	SANDSTONE	0.00026	2281.9
17/04-1	1	13	32	16724 650948	S13	MJU	SANDSTONE	0.00014	2283.0
17/04-1	1	14	32	16724 650948	S13	MJU	SANDSTONE	0.00023	2283.9
17/04-1	1	15	32	16724 650948	S13	MJU	SANDSTONE	0.00019	2284.9
17/04-1	1	16	32	16724 650948	S13	MJU	SANDSTONE	0.00014	2286.9
17/04-1	1	17	32	16724 650948	S13	MJU	SANDSTONE	0.00021	2287.8
17/04-1	2	18	32	16724 650948	S00	PER	CONGLOMERATE(RED)	0.00030	3881.5
17/04-1	2	19	32	16724 650948	S00	PER	CONGLOMERATE(RED)	0.00033	3882.7
17/04-1	2	20	32	16724 650948	S00	PER	CONGLOMERATE(RED)	0.00035	3883.5
16/06-1	1	1	32	14751 652301	S24	SIL	MICA SCHIST	0.00012	2058.8
16/06-1	1	2	32	14751 652301	S24	SIL	MICA SCHIST	0.00021	2059.7
16/06-1	1	3	32	14751 652301	S24	SIL	MICA SCHIST	0.00014	2060.7
3/07-02	1	1	32	19657 627272	S41	PAL	CHALK	0.00005	2570.3
3/07-02	1	2	32	19657 627272	S41	PAL	CHALK	0.00004	2571.6
3/07-02	2	3	32	19657 627272	S41	PAL	CHALK	0.00006	2576.0
3/07-02	2	4	32	19657 627272	S41	PAL	CHALK	0.00004	2577.2
3/07-02	2	5	32	19657 627272	S41	PAL	CHALK	0.00003	2578.2
3/07-02	2	6	32	19657 627272	S41	PAL	CHALK	0.00002	2579.5
3/07-02	2	7	32	19657 627272	S41	PAL	CHALK	0.00002	2580.1
3/07-02	2	8	32	19657 627272	S41	PAL	CHALK	0.00004	2581.5
3/07-02	2	9	32	19657 627272	S41	PAL	CHALK	0.00004	2582.4
3/07-02	2	10	32	19657 627272	S41	PAL	CHALK	0.00004	2583.4
3/07-02	2	11	32	19657 627272	S41	PAL	CHALK	0.00002	2584.4
3/07-02	2	12	32	19657 627272	S41	PAL	CHALK	0.00005	2585.4
3/07-02	2	13	32	19657 627272	S41	PAL	CHALK	0.00002	2586.3
3/07-02	2	14	32	19657 627272	S41	PAL	CHALK	0.00002	2587.3
3/07-02	2	15	32	19657 627272	S41	PAL	CHALK	0.00002	2588.3
3/07-02	3	16	32	19657 627272	S41	UCR	CHALK	-0.00006	2602.5
3/07-02	3	17	32	19657 627272	S41	UCR	CHALK	0.00000	2603.5
3/07-02	4	18	32	19657 627272	S13	MJU	DARK SANDSTONE	0.00005	2911.5
3/07-02	4	19	32	19657 627272	S13	MJU	LIGHT SANDSTONE	0.00000	2912.8
3/07-02	4	20	32	19657 627272	S13	MJU	LIGHT SANDSTONE	0.00017	2913.8
3/07-02	4	21	32	19657 627272	S13	MJU	LIGHT SANDSTONE	0.00005	2914.3
3/07-02	4	22	32	19657 627272	S13	MJU	LIGHT SANDSTONE	0.00025	2915.5
3/07-02	4	23	32	19657 627272	S28	MJU	SILTSTONE	0.00008	2916.8
3/07-02	4	24	32	19657 627272	S28	MJU	SILTSTONE	0.00004	2918.3
3/07-02	5	25	32	19657 627272	V22	PER	VOLCANIC ROCK/BASALT	0.02425	4310.2
3/07-02	5	26	32	19657 627272	V22	PER	VOLCANIC ROCK/BASALT	0.01762	4310.8
3/07-02	5	27	32	19657 627272	V22	PER	VOLCANIC ROCK/BASALT	0.00004	4311.5
3/07-02	5	28	32	19657 627272	V22	PER	VOLCANIC ROCK/BASALT	0.00838	4312.4
3/07-02	5	29	32	19657 627272	V22	PER	VOLCANIC ROCK/BASALT	0.02325	4312.8
3/07-02	5	30	32	19657 627272	V22	PER	VOLCANIC ROCK/BASALT	0.01922	4313.2
3/07-02	5	31	32	19657 627272	V22	PER	VOLCANIC ROCK/BASALT	0.01587	4313.7
3/07-02	5	32	32	19657 627272	V22	PER	VOLCANIC ROCK/BASALT	0.02476	4314.1
3/07-02	5	33	32	19657 627272	V22	PER	VOLCANIC ROCK/BASALT	0.02195	4314.8
3/07-02	5	34	32	19657 627272	V22	PER	VOLCANIC ROCK/BASALT	0.04267	4315.3
3/07-02	5	35	32	19657 627272	V22	PER	VOLCANIC ROCK/BASALT	0.02748	4315.8
3/07-02	5	36	32	19657 627272	V22	PER	VOLCANIC ROCK/BASALT	0.00111	4316.5
3/07-02	5	37	32	19657 627272	V22	PER	VOLCANIC ROCK/BASALT	0.00225	4317.4
3/07-02	5	38	32	19657 627272	V22	PER	VOLCANIC ROCK/BASALT	0.00848	4318.1
3/07-02	5	39	32	19657 627272	V22	PER	VOLCANIC ROCK/BASALT	0.00724	4318.8
8/03-01	1	1	32	18504 643985	S13	MJU	SANDSTONE	0.00007	2075.0

Well No.	Core No.	Sample No.	UTM zone	UTM-coord. 10 m	Lit. code	Strat. code	Rock-name	Suscept. SI	Depth m
8/03-01	1	2	32	18504 643985	S13	MJU	SANDSTONE	0.00005	2075.8
8/03-01	1	3	32	18504 643985	S13	MJU	SANDSTONE	0.00002	2076.2
8/03-01	1	4	32	18504 643985	S13	MJU	SANDSTONE	0.00002	2076.7
8/03-01	1	5	32	18504 643985	S13	MJU	SANDSTONE	0.00004	2079.1
8/03-01	2	6	32	18504 643985	S13	MJU	SANDSTONE	0.00006	2080.3
8/03-01	2	7	32	18504 643985	S13	MJU	SANDSTONE	0.00006	2080.5
8/03-01	2	8	32	18504 643985	S13	MJU	SANDSTONE	0.00001	2081.2
8/03-01	2	9	32	18504 643985	S13	MJU	SANDSTONE	0.00003	2082.1
8/03-01	2	10	32	18504 643985	S13	MJU	SANDSTONE	0.00000	2082.4
8/03-01	3	11	32	18504 643985	S13	LTR	SANDSTONE	0.00012	2206.1
8/03-01	3	12	32	18504 643985	S13	LTR	SANDSTONE	0.00004	2206.8
8/03-01	3	13	32	18504 643985	S13	LTR	SANDSTONE	0.00006	2207.5
8/03-01	3	14	32	18504 643985	S13	LTR	SANDSTONE	0.00002	2208.5
8/03-01	3	15	32	18504 643985	S13	LTR	SANDSTONE	0.00001	2208.8
8/03-01	3	16	32	18504 643985	S13	LTR	SANDSTONE	-0.00001	2209.6
8/03-01	3	17	32	18504 643985	S13	LTR	SANDSTONE	-0.00001	2210.5
8/03-01	3	18	32	18504 643985	S13	LTR	SANDSTONE	0.00001	2211.4
8/03-01	3	19	32	18504 643985	S13	LTR	SANDSTONE	0.00001	2211.9
8/03-01	3	20	32	18504 643985	S13	LTR	SANDSTONE	0.00001	2212.9
8/03-01	3	21	32	18504 643985	S13	LTR	SANDSTONE	0.00000	2213.9
8/03-01	3	22	32	18504 643985	S13	LTR	SANDSTONE	-0.00002	2214.5
8/03-01	4	23	32	18504 643985	S24	SGR	SCHISTS	0.00051	2968.5
8/03-01	4	24	32	18504 643985	S24	SGR	SCHISTS	0.00040	2969.6
8/03-01	4	25	32	18504 643985	S24	SGR	SCHISTS	0.00066	2970.5
8/03-01	4	26	32	18504 643985	S24	SGR	SCHISTS	0.00054	2971.2
8/03-01	5	27	32	18504 643985	S24	SGR	SCHISTS	0.00063	3007.1
8/03-01	5	28	32	18504 643985	S24	SGR	SCHISTS	0.00044	3007.5
8/03-01	5	29	32	18504 643985	S24	SGR	SCHISTS	0.00049	3008.5
8/03-01	5	30	32	18504 643985	S24	SGR	SCHISTS	0.00030	3009.5
8/03-01	5	31	32	18504 643985	S24	SGR	SCHISTS	0.00028	3010.5
3/07-01	1	1	32	19216 626885	M00	SGR	GNEISS	0.00054	3221.1
3/07-01	1	2	32	19216 626885	M00	SGR	GNEISS	0.00241	3221.8
3/07-01	1	3	32	19216 626885	M00	SGR	GNEISS	0.00042	3222.9
3/07-01	1	4	32	19216 626885	M00	SGR	GNEISS	0.00122	3223.7
3/07-01	1	5	32	19216 626885	M00	SGR	GNEISS	0.00115	3224.8
3/07-01	1	6	32	19216 626885	M00	SGR	GNEISS	0.00087	3225.4
3/07-01	1	7	32	19216 626885	M00	SGR	GNEISS	0.00164	3226.1
3/07-01	1	8	32	19216 626885	M00	SGR	GNEISS	0.00197	3226.8
18/11-1	1	1	32	23662 644568	S11	PER	QUARTZITE	0.00013	2082.0
18/11-1	1	2	32	23662 644568	S11	PER	QUARTZITE	0.00012	2082.6
18/11-1	1	3	32	23662 644568	S11	PER	QUARTZITE	0.00012	2083.5
18/11-1	1	4	32	23662 644568	S11	PER	QUARTZITE	0.00014	2083.9
18/11-1	1	5	32	23662 644568	S11	PER	QUARTZITE	0.00015	2085.5
7/03-01	1	1	32	12919 642854	S22	PER	SHALE	0.00017	4380.9
7/03-01	1	2	32	12919 642854	S22	PER	SHALE	0.00017	4382.4
7/03-01	1	3	32	12919 642854	S22	PER	SHALE	0.00018	4383.3
7/03-01	1	4	32	12919 642854	S22	PER	SHALE	0.00048	4383.9
7/03-01	1	5	32	12919 642854	S22	PER	SHALE	0.00016	4384.8
7/03-01	2	6	32	12919 642854	S13	PER	SANDSTONE	0.00021	4414.7
7/03-01	2	7	32	12919 642854	S13	PER	SANDSTONE	0.00018	4416.5
7/03-01	2	8	32	12919 642854	S13	PER	SANDSTONE	0.00020	4417.2
7/03-01	2	9	32	12919 642854	S13	PER	SANDSTONE	0.00013	4419.0
7/03-01	2	10	32	12919 642854	S13	PER	SANDSTONE	0.00008	4420.2
7/03-01	2	11	32	12919 642854	S13	PER	SANDSTONE	0.00017	4422.9
7/03-01	2	12	32	12919 642854	S13	PER	SANDSTONE	0.00017	4423.6
7/03-01	2	13	32	12919 642854	S13	PER	SANDSTONE	0.00017	4424.5
7/03-01	2	14	32	12919 642854	S13	PER	SANDSTONE	0.00014	4425.4
7/03-01	2	15	32	12919 642854	S13	PER	SANDSTONE	0.00033	4426.9
7/03-01	2	16	32	12919 642854	S13	PER	SANDSTONE	0.00022	4427.5
7/03-01	2	17	32	12919 642854	S13	PER	SANDSTONE	0.00017	4428.1
7/03-01	2	18	32	12919 642854	S13	PER	SANDSTONE	0.00027	4428.7
7/03-01	2	19	32	12919 642854	S13	PER	SANDSTONE	0.00011	4429.3
7/03-01	2	20	32	12919 642854	S13	PER	SANDSTONE	0.00013	4430.3

Well No.	Core No.	Sample No.	UTM zone	UTM-coord. 10 m	Lit. code	Strat. code	Rock-name	Suscept. SI	Depth m
7/03-01	2	21	32	12919 642854	S13	PER	SANDSTONE	0.00018	4430.9
7/03-01	2	22	32	12919 642854	S13	PER	SANDSTONE	0.00019	4431.8
7/03-01	2	23	32	12919 642854	S13	PER	SANDSTONE	0.00012	4432.7
7/03-01	2	24	32	12919 642854	S13	PER	SANDSTONE	0.00023	4433.6
7/03-01	3	25	32	12919 642854	S13	PER	SANDSTONE	0.00014	4547.9
7/03-01	3	26	32	12919 642854	S13	PER	SANDSTONE	0.00018	4548.8
7/03-01	3	27	32	12919 642854	S13	PER	SANDSTONE	0.00013	4549.7
7/03-01	3	28	32	12919 642854	S13	PER	SANDSTONE	0.00011	4550.7
7/03-01	3	29	32	12919 642854	S13	PER	SANDSTONE	0.00013	4551.6
7/03-01	3	30	32	12919 642854	S13	PER	SANDSTONE	0.00008	4552.5
7/03-01	3	31	32	12919 642854	S13	PER	SANDSTONE	0.00012	4553.4
7/03-01	3	32	32	12919 642854	S13	PER	SANDSTONE	0.00017	4554.3
7/03-01	3	33	32	12919 642854	S13	PER	SANDSTONE	0.00019	4555.2
7/03-01	3	34	32	12919 642854	S13	PER	SANDSTONE	0.00014	4556.1
7/03-01	3	35	32	12919 642854	S13	PER	SANDSTONE	0.00017	4557.1
7/03-01	3	36	32	12919 642854	S13	PER	SANDSTONE	0.00015	4558.0
7/03-01	3	37	32	12919 642854	S13	PER	SANDSTONE	0.00012	4558.9
7/03-01	3	38	32	12919 642854	S13	PER	SANDSTONE	0.00015	4559.8
7/03-01	3	39	32	12919 642854	S13	PER	SANDSTONE	0.00013	4560.7
7/03-01	3	40	32	12919 642854	S13	PER	SANDSTONE	0.00011	4561.6
7/03-01	3	41	32	12919 642854	S13	PER	SANDSTONE	0.00011	4562.5
7/03-01	3	42	32	12919 642854	S13	PER	SANDSTONE	0.00011	4563.5
7/03-01	3	43	32	12919 642854	S13	PER	SANDSTONE	0.00011	4564.4
7/03-01	3	44	32	12919 642854	S13	PER	SANDSTONE	0.00014	4565.3
7/03-01	3	45	32	12919 642854	S13	PER	SANDSTONE	0.00012	4566.2
7/03-01	3	46	32	12919 642854	S13	PER	SANDSTONE	0.00014	4567.1
7/03-01	3	47	32	12919 642854	S13	PER	SANDSTONE	0.00012	4568.3
7/03-01	3	48	32	12919 642854	S13	PER	SANDSTONE	0.00009	4568.9
7/03-01	3	49	32	12919 642854	S13	PER	SANDSTONE	0.00014	4569.9
7/03-01	3	50	32	12919 642854	S13	PER	SANDSTONE	0.00012	4570.8
7/03-01	3	51	32	12919 642854	S13	PER	SANDSTONE	0.00012	4571.7
7/03-01	3	52	32	12919 642854	S13	PER	SANDSTONE	0.00012	4572.6
7/03-01	3	53	32	12919 642854	S13	PER	SANDSTONE	0.00012	4573.5
7/03-01	3	54	32	12919 642854	S13	PER	SANDSTONE	0.00014	4575.3