cc: R & D Files
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INTER-OFFICE CORRESPONDENCE / SUBJECT:
BARTLESVILLE, OKLAHOMA

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North Sea/Norwegian Sector NW Tor 2/4-10X
Characterization of Water and Oil Samples
DAM-43-75

Mr. C. P. Kaiser, Manager
Oslo Office

Geochemical characterization has been completed on fluids recovered from Danian Limestone in the Tor 2/4-10X well, Norwegian Sector, North Sea. These include both crude oil and water taken in drill stem tests which tested intervals between depths of 3182 and 3322 m (10,440-10,900 ft).

Conclusions and interpretations resulting from this study are as follows:

1. The crude oils are high in saturates, i.e., paraffins and naphthenes, with a density averaging 0.8339 (38.1 API gravity), 0.13 weight percent sulfur, 0.09 weight percent nitrogen, and are quite similar to other oils produced from Danian-Cretaceous reservoirs in the area.

2. The oils are identical and originated in source rock facies of Paleocene age and were generated from organic matter deposited in a marine environment.

3. Waters from the 3182-3203 m (10,440-10,510 ft, DST 6, flow 6 and DST 6 post-acid flow), 3243-3248 m (10,640-10,655 ft), and 3304-3322 m (10,840-10,900 ft) intervals which were recovered by flowing DST are representative of the intervals tested. Formation water recovered from the 3182-3203 m interval has a resistivity of 0.123 ohm-meters and a total dissolved solids content of about 5.7 wt. wt. percent. Water recovered from the 3243-3248 m interval has a resistivity of 0.118 ohm-meters and a salinity of about 6 wt. wt. percent. Water from the 3304-3322 m interval has a resistivity of 0.121 ohm-meters and a salinity of about 5.6 wt. wt. percent. In terms of composition these waters essentially are identical and suggest the three intervals tested are in hydrostatic communication.

4. Evidence indicates that formation water recovered by DST 6 from the 3182-3203 m (10,440-10,510 ft) interval has come in contact with a wet gas, condensate or crude oil.

These conclusions and interpretations are based on data presented in Tables I through XVI and Figures 1 through .

David A. Morris

DAM/JBF/pam
Attachments: Tables I-XVI
Figures 1-

TABLE I

CHARACTERIZATION OF CRUDE OILS
PHYSICAL, CHEMICAL, AND ISOTOPIC PROPERTIES
FROM THE NW TOR 2/4-10X WELL, NORWEGIAN SECTOR, NORTH SEA

Geochem. Br. Code	Depth m.	Depth Ft	API Gravity	Density	Pour Point Deg-C	Viscosity 21 Deg C CS	Viscosity 38 Deg C CS	Heteroelements Sulfur Wt. %	Heteroelements Nitrogen Wt. %	Heteroelements Vanadium Wt. %	Heteroelements Nickel Wt. %	Total Crude C-13	Saturates Wt.%	Saturates C-13	Aromatics Wt.%	Aromatics C-13	Asphaltics Wt.%	Asphaltics C-13	Odd-Even Predominance OEP
MWN(1)	3243-3248	10,640-10,655	-	-	-	-	-	-	-	-	-	-27.4	70.9	-28.3	22.7	-27.2	6.4	-25.7	1.02
MWO	3304-3322	10,840-10,900	38.2	0.8334	-7.0	7.6	4.6	0.15	0.06	<0.54	1.24	-28.2	69.1	-28.1	24.9	-27.2	6.0	-26.6	1.03
MWP	"	"	38.1	0.8339	10.0	7.3	4.7	0.13	0.10	<0.39	1.40	-27.9	47.2	-28.1	44.1	-27.5	8.7	-27.1	1.03
MWQ	"	"	38.0	0.8344	10.0	7.2	4.7	0.12	0.08	<0.39	1.32	-27.9	61.7	-28.0	33.5	-27.2	4.8	-26.5	1.03
MXS(2)	"	"	38.3	0.8329	-12.0	8.2	5.3	0.11	0.10	<0.39	1.96	-28.2	61.1	-28.1	32.3	-27.5	6.6	-26.8	1.03

(1) Insufficient sample for physical and heteroelemental determinations.

(2) Pressurized companion pair collected (MXR is gas sample); remainder are atmospheric oil samples recovered from the DST intervals indicated.

TABLE II

COMPOSITIONAL ANALYSIS OF OIL, GAS, AND CALCULATED COMBINED STREAMS FOR PETROLEUM COMPANION SAMPLES

LIQUID SAMPLE = MXS L From the 3304-3322 m (10840-10900 ft) interval in
GAS SAMPLE = MXR G the NW Thor 2/4-10X, Norwegian Sector, North Sea

COMPONENT	GAS SAMPLE		LIQUID SAMPLE		COMBINED STREAM	
	WT PCT.	MOL PCT	WT PCT.	MOL PCT	WT PCT.	MOL PCT
HELIUM	0.000	0.000	0.000	0.000	0.000	0.000
HYDROGEN SULFIDE	0.000	0.000	0.000	0.000	0.000	0.000
OXYGEN + ARGON	0.000	0.000	0.000	0.000	0.000	0.000
NITROGEN	4.694	3.688	0.028	0.184	0.039	0.250
CARBON DIOXIDE	19.150	9.579	0.445	1.860	0.491	2.005
METHANE	56.814	77.965	0.709	8.132	0.843	9.445
ETHANE	5.381	3.939	0.212	1.297	0.225	1.347
PROPANE	3.064	1.529	0.276	1.151	0.284	1.158
ISOBUTANE	1.399	0.529	0.216	0.683	0.220	0.680
N-BUTANE	1.979	0.749	0.462	1.461	0.468	1.448
ISOPENTANE	1.507	0.459	0.609	1.553	0.615	1.533
N-PENTANE	1.671	0.509	0.815	2.077	0.822	2.048
NEOHEXANE	0.037	0.009	0.019	0.040	0.019	0.040
CYCLOPENTANE	0.045	0.014	0.045	0.119	0.045	0.117
2,3-DIMETHYLBUTANE	0.090	0.023	0.078	0.166	0.078	0.164
2-METHYLPENTANE	0.707	0.180	0.591	1.261	0.595	1.241
3-METHYLPENTANE	0.360	0.092	0.341	0.729	0.344	0.717
N-HEXANE	0.909	0.232	1.064	2.271	1.070	2.232
METHYLCYCLOPENTANE + 2,2-DIMETHYLPENTANE	0.269	0.070	0.415	0.907	0.417	0.891
2,4-DIMETHYLPENTANE	0.051	0.011	0.072	0.133	0.072	0.130
BENZENE + 2,2,3-TRIMETHYLBUTANE	0.071	0.020	0.122	0.287	0.122	0.25
CYCLOHEXANE + 3,3-DIMETHYLPENTANE	0.196	0.051	0.439	0.959	0.441	0.942
2-METHYLHEXANE	0.161	0.035	0.413	0.759	0.415	0.745
2,3-DIMETHYLPENTANE + 1,1-DIMECYCLOPENT.	0.076	0.016	0.193	0.354	0.194	0.348
3-METHYLHEXANE	0.158	0.034	0.443	0.812	0.445	0.798
1-CIS-3-DIMETHYLCYCLOPENTANE	0.043	0.009	0.124	0.232	0.124	0.228
1-TRANS-3-DIMECYPENTANE + 3-ETHYLPENTANE	0.047	0.010	0.147	0.275	0.147	0.270
1-TRANS-2-DIMETHYLCYCLOPENTANE	0.064	0.014	0.198	0.371	0.199	0.365
N-HEPTANE	0.347	0.076	1.252	2.298	1.258	2.256
1-CIS-2-DIMETHYLCYCLOPENTANE	0.011	0.002	0.049	0.092	0.049	0.091
MECYHEX + 2,2-DIMEHEX +1,1,3-TRIMECYPENT	0.269	0.060	1.300	2.435	1.306	2.390
2,5-DIMETHYLHEXANE	0.013	0.002	0.061	0.098	0.061	0.096
2,4-DIMETHYLHEXANE + ETHYLCYCLOPENTANE	0.025	0.004	0.141	0.227	0.142	0.223
2,2,3-TRIMETHYLPENTANE	0.001	0.000	0.006	0.010	0.006	0.010

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TABLE II (Cont'd)

1-TRANS-2-CIS-4-TRIMETHYLCYCLOPENTANE	0.011	0.002	0.080	0.131	0.080	0.128
3,3-DIMETHYLHEXANE	0.002	0.000	0.017	0.027	0.017	0.027
TOLUENE	0.025	0.006	0.187	0.375	0.188	0.368
1-TRANS-2-CIS-3-TRIMETHYLCYCLOPENTANE	0.003	0.000	0.024	0.040	0.024	0.039
2,3,4-TRIMETHYLPENTANE	0.000	0.000	0.006	0.010	0.006	0.010
2,3-DIMEHEX+2,3,3-TRIMEPENT+2-ME3-ETPENT	0.010	0.002	0.098	0.158	0.098	0.155
2-METHYLHEPTANE + 4-METHYLHEPTANE	0.048	0.009	0.506	0.815	0.508	0.800
3,4-DIMEHEX + 1-CIS-2-TRAN-4-TRIMECYPENT	0.015	0.002	0.142	0.229	0.143	0.225
3-ETHYLHEXANE	0.002	0.000	0.029	0.047	0.029	0.046
3-METHYLHEPTANE + 3-ME-3-ETHYLPENTANE	0.033	0.006	0.368	0.592	0.369	0.581
2,2,5-TRIMEHEX+1,1,3-TR-4-TETRAMECYPENT.	0.001	0.000	0.018	0.026	0.018	0.026
1-CIS-2-CIS-4-TRIMETHYLCYCLOPENTANE	0.001	0.000	0.020	0.033	0.020	0.032
1-TRANS-4 + 1-CIS-3 + 1,1-DIMECYHEXANE	0.041	0.008	0.525	0.860	0.527	0.84
1-ME-3-ETHCYPENT + 2,2,4-TRIMETHYLHEXANE	0.006	0.001	0.070	0.115	0.070	0.113
1-ME-TRANS-2 + 1-ME-CIS-3-ETHYLCYPENTANE	0.005	0.001	0.070	0.115	0.070	0.113
CYCLOHEPTANE	0.001	0.000	0.015	0.028	0.015	0.028
N-OCTANE + 1-TRANS-2-DIMETHYLCYCLOHEXANE	0.064	0.012	1.211	1.949	1.216	1.913
1-CIS-4-DIMETHYLCYCLOHEXANE	0.016	0.003	0.153	0.250	0.153	0.246
1-TRANS-3-DIMETHYLCYCLOHEXANE	0.007	0.001	0.109	0.180	0.110	0.176
2,2,4-TRIMEHEXANE + ISOPROPYLCYCLOPENT.	0.001	0.000	0.026	0.038	0.026	0.037
2,3,5-TRIMEHEXANE + 2,2-DIMETHYLHEPTANE	0.001	0.000	0.032	0.046	0.032	0.045
1-METHYL-CIS-2-ETHYLCYCLOPENTANE	0.002	0.000	0.083	0.137	0.084	0.134
2,4-DIMEHEPTANE + 2,2,3-TRIMETHYLHEXANE	0.005	0.000	0.167	0.240	0.168	0.235
2,6-DIMEHEPTANE + 1-CIS-2-DIMECYHEXANE	0.002	0.000	0.071	0.102	0.072	0.101
N-PROPYLCYPENT + 2,5- + 3,5-DIMEHEPTANE	0.003	0.000	0.122	0.200	0.122	0.196
ETHYLCYCLOHEXANE	0.014	0.002	0.409	0.670	0.410	0.658
ETHYLBENZENE	0.001	0.000	0.042	0.073	0.042	0.072
3,3-DIMETHYLHEPTANE +1,1,3-TRIMECYHEXANE	0.005	0.000	0.194	0.279	0.195	0.274
2,3,3-TRIMETHYLHEXANE	0.000	0.000	0.043	0.062	0.043	0.061
2-METHYL-3-ETHYLHEXANE	0.000	0.000	0.021	0.030	0.021	0.030
P-XYLENE	0.003	0.000	0.190	0.329	0.190	0.323
M-XYLENE + 2,3,4-TRIMETHYLHEXANE	0.003	0.000	0.130	0.225	0.130	0.22
2,3- + 3,4-DIMETHYLHEPTANE	0.000	0.000	0.057	0.081	0.057	0.08
4-METHYLOCTANE	0.005	0.000	0.315	0.451	0.316	0.443
2-METHYLOCTANE	0.003	0.000	0.204	0.293	0.205	0.287
3-ETHYLHEPTANE	0.000	0.000	0.035	0.050	0.035	0.049
3-METHYLOCTANE	0.002	0.000	0.231	0.332	0.232	0.326
O-XYLENE (+ A C-10 ALKANE)	0.001	0.000	0.110	0.191	0.110	0.187
2,2,4-TRIMETHYLHEPTANE	0.000	0.000	0.030	0.038	0.030	0.038
2,2,5-TRIMETHYLHEPTANE	0.000	0.000	0.075	0.096	0.075	0.095
2,2,6-TRIMETHYLHEPTANE	0.000	0.000	0.000	0.000	0.000	0.000
*** UNKNOWN ***	0.000	0.000	0.049	0.064	0.049	0.063
2,5,5-TRIMETHYLHEPTANE	0.000	0.000	0.028	0.037	0.029	0.036

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TABLE II (Cont'd)

2,4,4-TRIMETHYLHEPTANE	0.000	0.000	0.018	0.023	0.018	0.023
*** A C-9 NAPHTHENE ***	0.001	0.000	0.182	0.266	0.183	0.261
ISOPROPYLBENZENE	0.000	0.000	0.099	0.151	0.099	0.148
N-NONANE	0.009	0.001	1.113	1.596	1.118	1.566
C-9 NAPHTHENES + C-10 ALKANES	0.002	0.000	2.374	3.458	2.383	3.393
N-PROPYLBENZENE	0.000	0.000	0.033	0.051	0.033	0.050
1-METHYL-3-ETHYLBENZENE	0.000	0.000	0.163	0.250	0.164	0.245
1-METHYL-4-ETHYLBENZENE	0.000	0.000	0.039	0.061	0.040	0.060
1-METHYL-2-ETHYLBENZENE	0.000	0.000	0.206	0.315	0.206	0.309
1,3,5-TRIMETHYLBENZENE	0.000	0.000	0.259	0.396	0.260	0.38
1,2,4-TRIMETHYLBENZENE	0.000	0.000	0.190	0.290	0.190	0.285
1,2,3-TRIMETHYLBENZENE	0.000	0.000	0.076	0.117	0.077	0.115
N-DECANE	0.002	0.000	1.100	1.421	1.104	1.394
UNDECANES AND HEAVIER	0.000	0.000	76.510	48.281	76.192	47.373

MOL PERCENT C6'S = 6.630

MOL PERCENT C7+ = 73.452

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TABLE III

FORMATION WATER CHARACTERIZATION
FLUID NW TOR 2/4-10X NORTH SEA NORWAY FLOW-2 **(10,840-10,900 FT)**
OIL AND WATER TAKEN AT TEST HEAD MANIFOLD 11/22/73

GEOCHEMISTRY BRANCH CODE, MWO
TOTAL DISSOLVED CHROMIUM = **Not detected**
RESISTIVITY, 25 DEG. C, 0.121 OHM METERS
PH = 6.60

TOTAL DISSOLVED SOLIDS = 5.58

INORGANIC CONSTITUENTS

CATIONS	CONCENTRATION WT/WT PER CENT	EQUIVALENTS PER 100 GRAMS	ANIONS	CONCENTRATION WT/WT PER CENT	EQUIVALENTS PER 100 GRAMS
SODIUM	2.0300	0.0883	CHLORIDE	3.2100	0.0905
POTASSIUM	0.0246	0.0006	BROMIDE	0.0160	0.0002
CALCIUM	0.1600	0.0080	IODIDE	0.0025	0.0000
MAGNESIUM	0.0210	0.0017	SULFATE	0.0330	0.0007
AMMONIUM	0.0000	0.0000	PHOSPHATE	0.0000	0.0000
AMMONIA	0.0000	0.0000	BICARBONATE	0.0390	0.0006
BARIUM	<0.00055	0.0000	CARBONATE	0.0000	0.0000
STRONTIUM	0.0440	0.0010			
TOTAL =	2.2802	TOTAL = 0.0996	TOTAL =	3.3004	TOTAL = 0.0920

DISSOLVED AROMATIC HYDROCARBONS

COMPOUND	CONCENTRATION PPM
BENZENE	**Suspended oil present**
TOLUENE	

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TABLE IV

FORMATION WATER CHARACTERIZATION
FLUID NW TOR 2/4-10 NORTH SEA NORWAY FLOW-2 **(10,840-10,900 FT)**
OIL AND WATER TAKEN AT TEST HEAD MANIFOLD 11/22/73

GEOCHEMISTRY BRANCH CODE, MWP
TOTAL DISSOLVED CHROMIUM = **Not detected**
RESISTIVITY, 25 DEG. C, 0.122 OHM METERS
PH = 7.30

TOTAL DISSOLVED SOLIDS = 5.59

INORGANIC CONSTITUENTS

CATIONS	CONCENTRATION WT/WT PER CENT	EQUIVALENTS PER 100 GRAMS	ANIONS	CONCENTRATION WT/WT PER CENT	EQUIVALENTS PER 100 GRAMS
SODIUM	2.0300	0.0883	CHLORIDE	3.2200	0.0908
POTASSIUM	0.0245	0.0006	BROMIDE	0.0160	0.0002
CALCIUM	0.1600	0.0080	IODIDE	0.0025	0.0000
MAGNESIUM	0.0207	0.0017	SULFATE	0.0334	0.0007
AMMONIUM	0.0000	0.0000	PHOSPHATE	0.0000	0.0000
AMMONIA	0.0000	0.0000	BICARBONATE	0.0380	0.0006
BARIUM	< 0.00055	0.0000	CARBONATE	0.0000	0.0000
STRONTIUM	0.0445	0.0010			
TOTAL =	2.2803	TOTAL = 0.0996	TOTAL =	3.3098	TOTAL = 0.0923

DISSOLVED AROMATIC HYDROCARBONS

COMPOUND	CONCENTRATION PPM
BENZENE	**Suspended**
TOLUENE	**oil present**

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TABLE V

FORMATION WATER CHARACTERIZATION
FLUID NW TOR 2/4-10X NORTH SEA NORWAY FLOW-2 **(10,840-10,900 FT)**
OIL AND WATER TAKEN AT TEST HEAD MANIFOLD 11/22/73

GEOCHEMISTRY BRANCH CODE, MWO
TOTAL DISSOLVED CHROMIUM = **Not detected**
RESISTIVITY, 25 DEG. C, 0.121 OHM METERS
PH = 7.45

TOTAL DISSOLVED SOLIDS = 5.50

INORGANIC CONSTITUENTS

CATIONS	CONCENTRATION WT/WT PER CENT	EQUIVALENTS PER 100 GRAMS	ANIONS	CONCENTRATION WT/WT PER CENT	EQUIVALENTS PER 100 GRAMS
SODIUM	1.9900	0.0866	CHLORIDE	3.1700	0.0894
POTASSIUM	0.0238	0.0006	BROMIDE	0.0165	0.0002
CALCIUM	0.1600	0.0080	IODIDE	0.0025	0.0000
MAGNESIUM	0.0209	0.0017	SULFATE	0.0322	0.0007
AMMONIUM	0.0000	0.0000	PHOSPHATE	0.0000	0.0000
AMMONIA	0.0000	0.0000	BICARBONATE	0.0400	0.0007
BARIUM	<0.00055	0.0000	CARBONATE	0.0000	0.0000
STRONTIUM	0.0460	0.0010			
TOTAL =	2.2413	TOTAL = 0.0979	TOTAL =	3.2611	TOTAL = 0.0909

DISSOLVED AROMATIC HYDROCARBONS

COMPOUND	CONCENTRATION PPM
BENZENE	**Suspended oil present**
TOLUENE	

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TABLE VI

FORMATION WATER CHARACTERIZATION
FLUID NW TOR 2/4-10X NORTH SEA NORWAY DST-2 , **FLOW 2 (10,640-10,655 FT)**
OIL AND WATER TAKEN AT SEPARATOR WATER OUTLET 11/29/73

GEOCHEMISTRY BRANCH CODE, MWK
TOTAL DISSOLVED CHROMIUM = **Not detected**
RESISTIVITY, 25 DEG. C, 0.118 OHM METERS
PH = 6.90

TOTAL DISSOLVED SOLIDS = 5.82

INORGANIC CONSTITUENTS

CATIONS	CONCENTRATION WT/WT PER CENT	EQUIVALENTS PER 100 GRAMS	ANIONS	CONCENTRATION WT/WT PER CENT	EQUIVALENTS PER 100 GRAMS
SODIUM	2.0000	0.0870	CHLORIDE	3.4000	0.0959
POTASSIUM	0.0240	0.0006	BROMIDE	0.0165	0.0002
CALCIUM	0.2600	0.0130	IODIDE	0.0030	0.0000
MAGNESIUM	0.0238	0.0020	SULFATE	0.0175	0.0004
AMMONIUM	0.0046	0.0002	PHOSPHATE	<0.0005	0.0000
AMMONIA	0.0000	0.0000	BICARBONATE	0.0260	0.0004
BARIUM	<0.00095	0.0000	CARBONATE	0.0000	0.0000
STRONTIUM	0.0555	0.0013			
TOTAL =	2.3642	TOTAL = 0.1038	TOTAL =	3.4634	TOTAL = 0.0969

DISSOLVED AROMATIC HYDROCARBONS

COMPOUND	CONCENTRATION PPM
BENZENE	**Suspended**
TOLUENE	**oil present**

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TABLE VII

FORMATION WATER CHARACTERIZATION
FLUID NW TOR 2/4-10X NORTH SEA NORWAY DST-2, **FLOW 2 (10,640-10,655 FT)**
OIL AND WATER TAKEN AT SEPARATOR WATER OUTLET 11/29/73

GEOCHEMISTRY BRANCH CODE, MWL
TOTAL DISSOLVED CHROMIUM = **Not detected**
RESISTIVITY, 25 DEG. C, 0.117 OHM METERS
PH = 6.88

TOTAL DISSOLVED SOLIDS = 6.09

INORGANIC CONSTITUENTS

CATIONS	CONCENTRATION WT/WT PER CENT	EQUIVALENTS PER 100 GRAMS	ANIONS	CONCENTRATION WT/WT PER CENT	EQUIVALENTS PER 100 GRAMS
SODIUM	1.9800	0.0861	CHLORIDE	3.6900	0.1041
POTASSIUM	0.0231	0.0006	BROMIDE	0.0165	0.0002
CALCIUM	0.2600	0.0130	IODIDE	0.0030	0.0000
MAGNESIUM	0.0226	0.0019	SULFATE	0.0191	0.0004
AMMONIUM	0.0045	0.0002	PHOSPHATE	< 0.0005	0.0000
AMMONIA	0.0000	0.0000	BICARBONATE	0.0250	0.0004
BARIUM	< 0.00065	0.0000	CARBONATE	0.0000	0.0000
STRONTIUM	0.0550	0.0013			
TOTAL =	2.3414	TOTAL = 0.1028	TOTAL =	3.7540	TOTAL = 0.1051

DISSOLVED AROMATIC HYDROCARBONS

COMPOUND	CONCENTRATION PPM
BENZENE	**Suspended**
TOLUENE	**oil present**

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TABLE VIII

FORMATION WATER CHARACTERIZATION
FLUID NW TOR 2/4-10X NORTH SEA NORWAY DST-2, **FLOW 2 (10,640-10,655 FT)**
OIL AND WATER TAKEN AT SEPARATOR WATER OUTLET 11/29/73

GEOCHEMISTRY BRANCH CODE, MWM
TOTAL DISSOLVED CHROMIUM = **Not detected**
RESISTIVITY, 25 DEG. C, 0.118 OHM METERS
PH = 6.78

TOTAL DISSOLVED SOLIDS = 6.05

INORGANIC CONSTITUENTS

CATIONS	CONCENTRATION WT/WT PER CENT	EQUIVALENTS PER 100 GRAMS	ANIONS	CONCENTRATION WT/WT PER CENT	EQUIVALENTS PER 100 GRAMS
SODIUM	1.9500	0.0848	CHLORIDE	3.7000	0.1044
POTASSIUM	0.0230	0.0006	BROMIDE	0.0175	0.0002
CALCIUM	0.2300	0.0115	IODIDE	0.0030	0.0000
MAGNESIUM	0.0198	0.0016	SULFATE	0.0196	0.0004
AMMONIUM	0.0046	0.0002	PHOSPHATE	<0.0005	0.0000
AMMONIA	0.0000	0.0000	BICARBONATE	0.0250	0.0004
BARIUM	<0.00065	0.0000	CARBONATE	0.0000	0.0000
STRONTIUM	0.0645	0.0015			
TOTAL =	2.2880	TOTAL = 0.1000	TOTAL =	3.7655	TOTAL = 0.1054

DISSOLVED AROMATIC HYDROCARBONS

COMPOUND	CONCENTRATION PPM
BENZENE	**Suspended**
TOLUENE	**oil present**

DAM-43-75

TABLE IX

FORMATION WATER CHARACTERIZATION
FLUID NW TOR 2/4-10X NORTH SEA NORWAY DST-2, **FLOW 2 (10,640-10,655 FT)**
OIL AND WATER TAKEN AT SEPARATOR WATER OUTLET 11/29/73

GEOCHEMISTRY BRANCH CODE, MWN
TOTAL DISSOLVED CHROMIUM = **Not detected**
RESISTIVITY, 25 DEG. C, 0.118 OHM METERS
PH = 7.00

TOTAL DISSOLVED SOLIDS = 6.04

INORGANIC CONSTITUENTS

CATIONS	CONCENTRATION WT/WT PER CENT	EQUIVALENTS PER 100 GRAMS	ANIONS	CONCENTRATION WT/WT PER CENT	EQUIVALENTS PER 100 GRAMS
SODIUM	1.9600	0.0853	CHLORIDE	3.6500	0.1030
POTASSIUM	0.0230	0.0006	BROMIDE	0.0180	0.0002
CALCIUM	0.2600	0.0130	IODIDE	0.0030	0.0000
MAGNESIUM	0.0219	0.0018	SULFATE	0.0196	0.0004
AMMONIUM	0.0044	0.0002	PHOSPHATE	<0.0005	0.0000
AMMONIA	0.0000	0.0000	BICARBONATE	0.0260	0.0004
BARIUM	<0.00075	0.0000	CARBONATE	0.0000	0.0000
STRONTIUM	0.0645	0.0015			
TOTAL =	2.3302	TOTAL = 0.1021	TOTAL =	3.7170	TOTAL = 0.1040

DISSOLVED AROMATIC HYDROCARBONS

COMPOUND	CONCENTRATION PPM
BENZENE	**Suspended oil present**
TOLUENE	

DAM-43-75

TABLE X

FORMATION WATER CHARACTERIZATION
TOP NW TOR 2/4-10X NORTH SEA NORWAY DST-6, **FLOW 3 (10,440-10,510 FT)**
WATER TAKEN FROM FLOOR MANIFOLD 12/13/73
(POST ACID)

GEOCHEMISTRY BRANCH CODE, MWC
TOTAL DISSOLVED CHROMIUM = **Not detected**
RESISTIVITY, 25 DEG. C, 0.123 OHM METERS
PH = 6.08

TOTAL DISSOLVED SOLIDS = 5.75

INORGANIC CONSTITUENTS

CATIONS	CONCENTRATION WT/WT PER CENT	EQUIVALENTS PER 100 GRAMS	ANIONS	CONCENTRATION WT/WT PER CENT	EQUIVALENTS PER 100 GRAMS
SODIUM	1.7000	0.0739	CHLORIDE	3.4100	0.0962
POTASSIUM	0.0120	0.0003	BROMIDE	0.0095	0.0001
CALCIUM	0.5000	0.0250	IODIDE	0.0020	0.0000
MAGNESIUM	0.0215	0.0018	SULFATE	0.0200	0.0004
AMMONIUM	0.0026	0.0001	PHOSPHATE	< 0.0005	0.0000
AMMONIA	0.0000	0.0000	BICARBONATE	0.0430	0.0007
BARIUM	< 0.00105	0.0000	CARBONATE	0.0000	0.0000
STRONTIUM	0.0320	0.0007			
TOTAL =	2.2665	TOTAL = 0.1017	TOTAL =	3.4849	TOTAL = 0.0974

DISSOLVED AROMATIC HYDROCARBONS

COMPOUND	CONCENTRATION PPM
BENZENE	**3.00**
TOLUENE	**0.00**

DAM-43-75

TABLE XI

FORMATION WATER CHARACTERIZATION
MIDDLE NW TOR 2/4-10X NORTH SEA NORWAY DST-6, **FLOW 3 (10,440-10,510 FT)**
WATER TAKEN FROM FLOOR MANIFOLD 12/13/73
(POST ACID)

GEOCHEMISTRY BRANCH CODE, MWD
TOTAL DISSOLVED CHROMIUM = **Not detected**
RESISTIVITY, 25 DEG. C, 0.125 OHM METERS
PH = 6.18

TOTAL DISSOLVED SOLIDS = 5.56

INORGANIC CONSTITUENTS

CATIONS	CONCENTRATION WT/WT PER CENT	EQUIVALENTS PER 100 GRAMS	ANIONS	CONCENTRATION WT/WT PER CENT	EQUIVALENTS PER 100 GRAMS
SODIUM	1.7000	0.0739	CHLORIDE	3.2300	0.0911
POTASSIUM	0.0123	0.0003	BROMIDE	0.0095	0.0001
CALCIUM	0.4900	0.0245	IODIDE	0.0020	0.0000
MAGNESIUM	0.0219	0.0018	SULFATE	0.0198	0.0004
AMMONIUM	0.0026	0.0001	PHOSPHATE	< 0.0005	0.0000
AMMONIA	0.0000	0.0000	BICARBONATE	0.0430	0.0007
BARIUM	< 0.00105	0.0000	CARBONATE	0.0000	0.0000
STRONTIUM	0.0310	0.0007			
TOTAL =	2.2562	TOTAL = 0.1012	TOTAL =	3.3047	TOTAL = 0.0923

DISSOLVED AROMATIC HYDROCARBONS

COMPOUND	CONCENTRATION PPM
BENZENE	2.30
TOLUENE	0.00

DAM-43-75

TABLE XII

FORMATION WATER CHARACTERIZATION
BOTTOM NW TOR 2/4-10X NORTH SEA NORWAY DST-6 , **FLOW 3 (10,440-10,510 FT)**
WATER TAKEN FROM FLOOR MANIFOLD 12/13/73
(POST ACID)

GEOCHEMISTRY BRANCH CODE, MWE
TOTAL DISSOLVED CHROMIUM = **Not detected**
RESISTIVITY, 25 DEG. C, 0.126 OHM METERS
PH = 6.29 TOTAL DISSOLVED SOLIDS = 5.60

INORGANIC CONSTITUENTS

CATIONS	CONCENTRATION WT/WT PER CENT	EQUIVALENTS PER 100 GRAMS	ANIONS	CONCENTRATION WT/WT PER CENT	EQUIVALENTS PER 100 GRAMS
SODIUM	1.7000	0.0739	CHLORIDE	3.2900	0.0928
POTASSIUM	0.0122	0.0003	BROMIDE	0.0110	0.0001
CALCIUM	0.4700	0.0235	IODIDE	0.0020	0.0000
MAGNESIUM	0.0212	0.0017	SULFATE	0.0188	0.0004
AMMONIUM	0.0026	0.0001	PHOSPHATE	0.0005	0.0000
AMMONIA	0.0000	0.0000	BICARBONATE	0.0420	0.0007
BARIUM	< 0.00105	0.0000	CARBONATE	0.0000	0.0000
STRONTIUM	0.0345	0.0008			
TOTAL =	2.2389	TOTAL = 0.1002	TOTAL =	3.3642	TOTAL = 0.0940

DISSOLVED AROMATIC HYDROCARBONS

COMPOUND	CONCENTRATION PPM
BENZENE	1.40
TOLUENE	0.00

DAM-43-75

TABLE XIII

FORMATION WATER CHARACTERIZATION
TOP NW TOR 2/4-10X NORTH SEA NORWAY DST-6, **FLOW 3 (10,440-10,510 FT)**
WATER TAKEN FROM FLOOR TEST MANIFOLD 12/13/73

GEOCHEMISTRY BRANCH CODE, MWG
TOTAL DISSOLVED CHROMIUM = **Not detected**
RESISTIVITY, 25 DEG. C, 0.123 OHM METERS
PH = 6.10

TOTAL DISSOLVED SOLIDS = 5.71

INORGANIC CONSTITUENTS

CATIONS	CONCENTRATION WT/WT PER CENT	EQUIVALENTS PER 100 GRAMS	ANIONS	CONCENTRATION WT/WT PER CENT	EQUIVALENTS PER 100 GRAMS
SODIUM	1.7000	0.0739	CHLORIDE	3.3300	0.0939
POTASSIUM	0.0125	0.0003	BROMIDE	0.0105	0.0001
CALCIUM	0.5400	0.0269	IODIDE	0.0020	0.0000
MAGNESIUM	0.0238	0.0020	SULFATE	0.0195	0.0004
AMMONIUM	0.0026	0.0001	PHOSPHATE	<0.0005	0.0000
AMMONIA	0.0000	0.0000	BICARBONATE	0.0440	0.0007
BARIUM	<0.00105	0.0000	CARBONATE	0.0000	0.0000
STRONTIUM	0.0355	0.0008			
TOTAL =	2.3128	TOTAL = 0.1039	TOTAL =	3.4064	TOTAL = 0.0952

DISSOLVED AROMATIC HYDROCARBONS

COMPOUND	CONCENTRATION PPM
BENZENE	2.70
TOLUENE	0.00

DAA-43-76

TABLE XIV

FORMATION WATER CHARACTERIZATION
MIDDLE NW TOR 2/4-10X NORTH SEA NORWAY DST-6, **FLOW 3 (10,440-10,510 FT)**
WATER TAKEN FROM FLOOR TEST MANIFOLD 12/13/73

GEOCHEMISTRY BRANCH CODE, MWH
TOTAL DISSOLVED CHROMIUM = **Not detected**
RESISTIVITY, 25 DEG. C, 0.123 OHM METERS
PH = 6.08

TOTAL DISSOLVED SOLIDS = 5.65

INORGANIC CONSTITUENTS

CATIONS	CONCENTRATION WT/WT PER CENT	EQUIVALENTS PER 100 GRAMS	ANIONS	CONCENTRATION WT/WT PER CENT	EQUIVALENTS PER 100 GRAMS
SODIUM	1.7000	0.0739	CHLORIDE	3.2800	0.0925
POTASSIUM	0.0127	0.0003	BROMIDE	0.0105	0.0001
CALCIUM	0.5300	0.0264	IODIDE	0.0020	0.0000
MAGNESIUM	0.0230	0.0019	SULFATE	0.0203	0.0004
AMMONIUM	0.0026	0.0001	PHOSPHATE	0.0005	0.0000
AMMONIA	0.0000	0.0000	BICARBONATE	0.0440	0.0007
BARIUM	<0.00095	0.0000	CARBONATE	0.0000	0.0000
STRONTIUM	0.0340	0.0008			
TOTAL =	2.3006	TOTAL = 0.1034	TOTAL =	3.3572	TOTAL = 0.0938

DISSOLVED AROMATIC HYDROCARBONS

COMPOUND	CONCENTRATION PPM
BENZENE	2.60
TOLUENE	0.00

DAM-43-73

TABLE XV

FORMATION WATER CHARACTERIZATION
BOTTOM NW TOR 2/4-10X NORTH SEA NORWAY DST-6, **FLOW 3 (10,440-10,510 FT)**
WATER TAKEN FROM FLOOR TEST MANIFOLD 12/13/73

GEOCHEMISTRY BRANCH CODE, NWI
TOTAL DISSOLVED CHROMIUM = **Not detected**
RESISTIVITY, 25 DEG. C, 0.123 OHM METERS
PH = 6.22

TOTAL DISSOLVED SOLIDS = 5.74

INORGANIC CONSTITUENTS

CATIONS	CONCENTRATION WT/WT PER CENT	EQUIVALENTS PER 100 GRAMS	ANIONS	CONCENTRATION WT/WT PER CENT	EQUIVALENTS PER 100 GRAMS
SODIUM	1.7000	0.0739	CHLORIDE	3.3700	0.0951
POTASSIUM	0.0127	0.0003	BROMIDE	0.0105	0.0001
CALCIUM	0.5300	0.0264	IODIDE	0.0020	0.0000
MAGNESIUM	0.0223	0.0018	SULFATE	0.0216	0.0004
AMMONIUM	0.0027	0.0001	PHOSPHATE	0.0005	0.0000
AMMONIA	0.0000	0.0000	BICARBONATE	0.0430	0.0007
BARIUM	<0.00095	0.0000	CARBONATE	0.0000	0.0000
STRONTIUM	0.0340	0.0008			
TOTAL =	2.2999	TOTAL = 0.1033	TOTAL =	3.4475	TOTAL = 0.0963

DISSOLVED AROMATIC HYDROCARBONS

COMPOUND	CONCENTRATION PPM
BENZENE	2.50
TOLUENE	0.00

DAM-43-75

TABLE XVI

FORMATION WATER CHARACTERIZATION
DRILLING MUD NW TOK 2/4-10X NORTH SEA NORWAY DST-6, **FLOW 3 (10,440-10,510 FT)**
WATER TAKEN FROM FLOOR TEST MANIFOLD 12/13/73

GEOCHEMISTRY BRANCH CODE, MWJ
TOTAL DISSOLVED CHROMIUM = **Not detected**
RESISTIVITY, 25 DEG. C, 0.123 OHM METERS
PH = 6.08 TOTAL DISSOLVED SOLIDS = 5.75

INORGANIC CONSTITUENTS

CATIONS	CONCENTRATION WT/WT PER CENT	EQUIVALENTS PER 100 GRAMS	ANIONS	CONCENTRATION WT/WT PER CENT	EQUIVALENTS PER 100 GRAMS
SODIUM	1.7000	0.0739	CHLORIDE	3.3900	0.0956
POTASSIUM	0.0127	0.0003	BROMIDE	0.0105	0.0001
CALCIUM	0.5200	0.0259	IODIDE	0.0020	0.0000
MAGNESIUM	0.0226	0.0019	SULFATE	0.0195	0.0004
AMMONIUM	0.0026	0.0001	PHOSPHATE	0.0005	0.0000
AMMONIA	0.0000	0.0000	BICARBONATE	0.0420	0.0007
BARIUM	<0.00095	0.0000	CARBONATE	0.0000	0.0000
STRONTIUM	0.0335	0.0008			
TOTAL =	2.2897	TOTAL = 0.1028	TOTAL =	3.4644	TOTAL = 0.0968

DISSOLVED AROMATIC HYDROCARBONS

COMPOUND	CONCENTRATION PPM
BENZENE	3.30
TOLUENE	0.00

DAM-43-75

FIGURE 1

COMPONENT COMPOSITION OF COMBINED STREAM THROUGH N-DECANE, BP = 345.4F (= 174.1C)

NW TOR 2/4-10X, NORWEGIAN SECTOR, NORTH SEA

COMPONENT	MIR/MIS 3304-3322 m (10,840-10,900 ft)
HELIUM	0.000
HYDROGEN SULFIDE	0.000
OXYGEN + ARGON	0.000
NITROGEN	0.039
CARBON DIOXIDE	0.491
METHANE	0.843
ETHANE	0.225
PROPANE	0.284
ISOBUTANE	0.220
N-BUTANE	0.468
ISOPENTANE	0.615
N-PENTANE	0.822
NEOHEXANE	0.019
CYCLOPENTANE	0.045
2,3-DIMETHYLBUTANE	0.078
2-METHYLPENTANE	0.595
3-METHYLPENTANE	0.344
N-HEXANE	1.070
ETHYLCYCLOPENTANE + 2,2-DIMETHYLPENTANE	0.417
2,4-DIMETHYLPENTANE	0.072
BENZENE + 2,2,3-TRIMETHYLBUTANE	0.122
CYCLOHEXANE + 3,3-DIMETHYLPENTANE	0.441
2-METHYLHEXANE	0.415
2,3-DIMETHYLPENTANE + 1,1-DIMECYCLOPENT.	0.194
3-METHYLHEXANE	0.445
1-CIS-3-DIMETHYLCYCLOPENTANE	0.124
1-TRANS-3-DIMECYPENTANE + 3-ETHYLPENTANE	0.147
1-TRANS-2-DIMETHYLCYCLOPENTANE	0.199
N-HEPTANE	1.258
1-CIS-2-DIMETHYLCYCLOPENTANE	0.049
MECYHEX + 2,2-DIMEHEX + 1,1,3-TRIMECYPENT	1.306
2,5-DIMETHYLHEXANE	0.061
2,4-DIMETHYLHEXANE + ETHYLCYCLOPENTANE	0.142
2,2,3-TRIMETHYLPENTANE	0.006
1-TRANS-2-CIS-4-TRIMETHYLCYCLOPENTANE	0.080
3,3-DIMETHYLHEXANE	0.017
TOLUENE	0.188
1-TRANS-2-CIS-3-TRIMETHYLCYCLOPENTANE	0.024
2,3,4-TRIMETHYLPENTANE	0.006
2,3-DIMEHEX + 2,3,3-TRIMEPENT + 2-ME3-ETPENT	0.098
2-METHYLHEPTANE + 4-METHYLHEPTANE	0.508
3,4-DIMEHEX + 1-CIS-2-TRAN-4-TRIMECYPENT	0.143
3-ETHYLHEXANE	0.029
3-METHYLHEPTANE + 3-ME-3-ETHYLPENTANE	0.369
2,2,5-TRIMEHEX + 1,1,3-TR-4-TETRAMECYPENT.	0.018
1-CIS-2-CIS-4-TRIMETHYLCYCLOPENTANE	0.020
1-TRANS-4 + 1-CIS-3 + 1,1-DIMECYHEXANE	0.527
1-ME-3-ETHCYPENT + 2,2,4-TRIMETHYLHEXANE	0.070
1-ME-TRANS-2 + 1-ME-CIS-3-ETHYLCYPENTANE	0.070
CYCLOHEPTANE	0.015
N-OCTANE + 1-TRANS-2-DIMETHYLCYCLOHEXANE	1.216
1-CIS-4-DIMETHYLCYCLOHEXANE	0.153
1-TRANS-3-DIMETHYLCYCLOHEXANE	0.110
2,2,4-TRIMEHEXANE + ISOPROPYLCYCLOPENT.	0.026
2,3,5-TRIMEHEXANE + 2,3-DIMETHYLHEPTANE	0.032
1-METHYL-CIS-2-ETHYLCYCLOPENTANE	0.084
2,4-DIMEHEPTANE + 2,2,3-TRIMETHYLHEXANE	0.168
2,6-DIMEHEPTANE + 1-CIS-2-DIMECYHEXANE	0.072
N-PROPYLCYPENT + 2,5- + 3,5-DIMEHEPTANE	0.122
ETHYLCYCLOHEXANE	0.410
ETHYLBENZENE	0.042
3,3-DIMETHYLHEPTANE + 1,1,3-TRIMECYHEXANE	0.195
2,3,3-TRIMETHYLHEXANE	0.043
2-METHYL-3-ETHYLHEXANE	0.021
P-XYLENE	0.190
M-XYLENE + 2,3,4-TRIMETHYLHEXANE	0.130
2,3- + 3,4-DIMETHYLHEPTANE	0.057
4-METHYLOCTANE	0.316
2-METHYLOCTANE	0.205
3-ETHYLHEPTANE	0.035
3-METHYLOCTANE	0.232
O-XYLENE (+ A C-10 ALKANE)	0.110
2,2,4-TRIMETHYLHEPTANE	0.030
2,2,5-TRIMETHYLHEPTANE	0.075
2,2,6-TRIMETHYLHEPTANE	0.000
UNKNOWN	0.049
2,5,5-TRIMETHYLHEPTANE	0.029
2,4,4-TRIMETHYLHEPTANE	0.018
A C-9 NAPHTHENE	0.183
ISOPROPYLBENZENE	0.099
N-NONANE	1.118
C-9 NAPHTHENES + C-10 ALKANES	2.383
N-PROPYLBENZENE	0.033
1-METHYL-3-ETHYLBENZENE	0.164
1-METHYL-4-ETHYLBENZENE	0.040
1-METHYL-2-ETHYLBENZENE	0.206
1,3,5-TRIMETHYLBENZENE	0.260
1,2,4-TRIMETHYLBENZENE	0.190
1,2,3-TRIMETHYLBENZENE	0.077
N-DECANE	1.104
UNDECANES AND HEAVIER	76.192

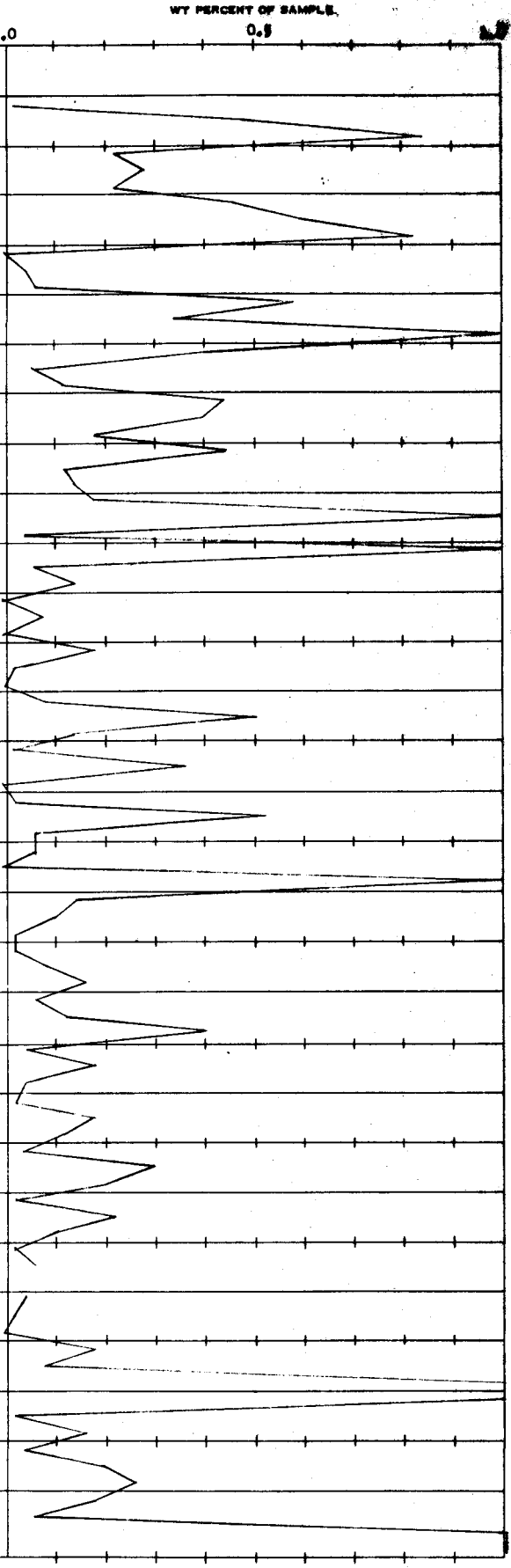


Figure 2. Odd-Even Predominance (OEP) as a Function of Carbon Number for Crude Oil Recovered From Danian Carbonate in the NW Tor 2/4-10X, Norwegian Sector, North Sea

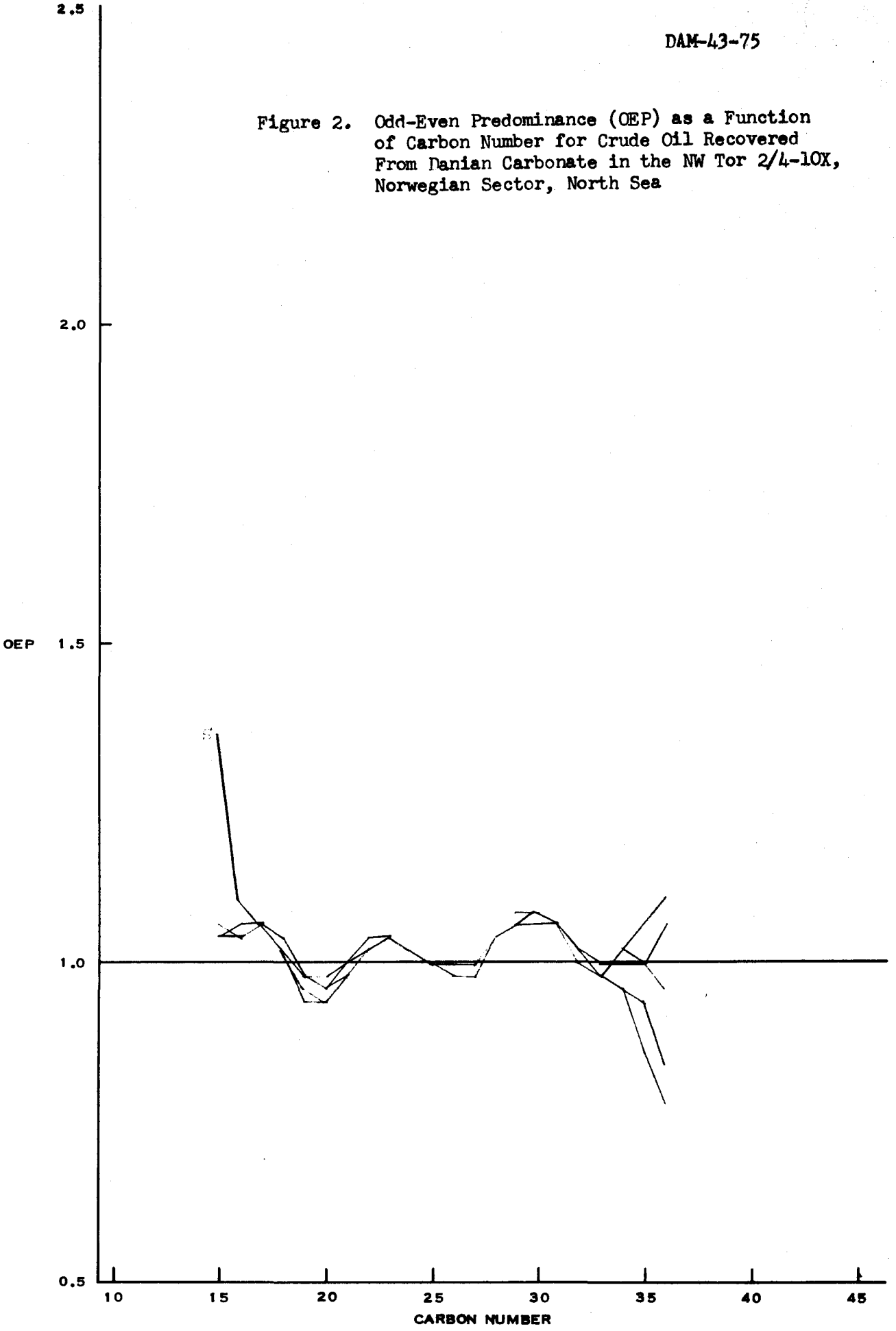


Figure 3. Concentration of n-Alkanes by Carbon Number for Crude Oil Recovered from Danian Carbonate in the NW Tor 2/4-10X, Norwegian Sector, North Sea. The abundance maximum of n-alkanes in the C_{20} range is quite similar to the distribution for oil produced from Danian reservoirs in the region.

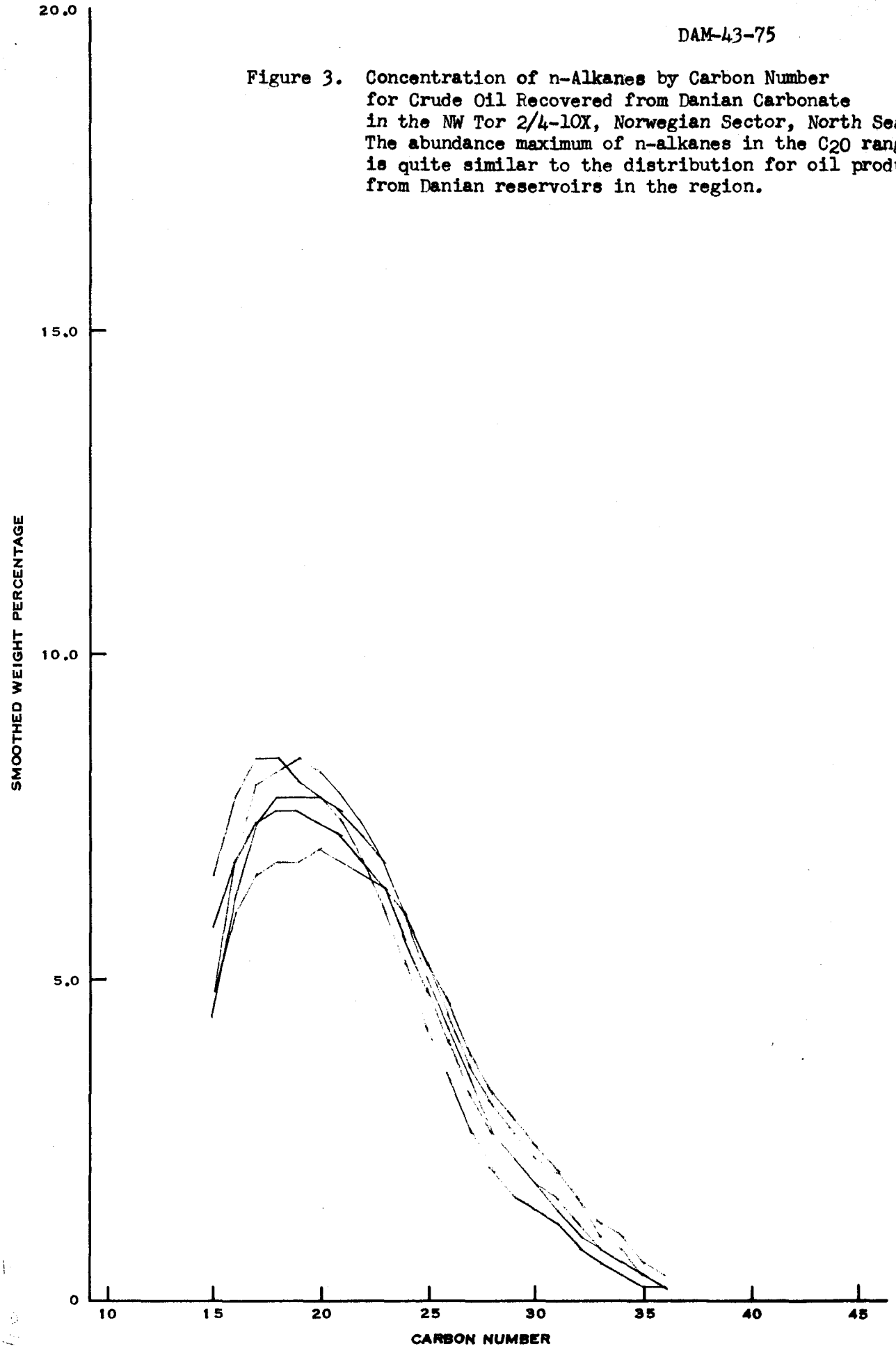


Figure 4. Ratios of Components Not Easily Fractionated in the Earth. Curves Represent Oil Recovered from the NW Tor 2/4-10X were Compared with Average Curve for Oil Produced from Danian Reservoirs in the Tor Field and in the Neighboring Edda Field. The similarity of the three curves indicates that the crude oils are of a common origin.

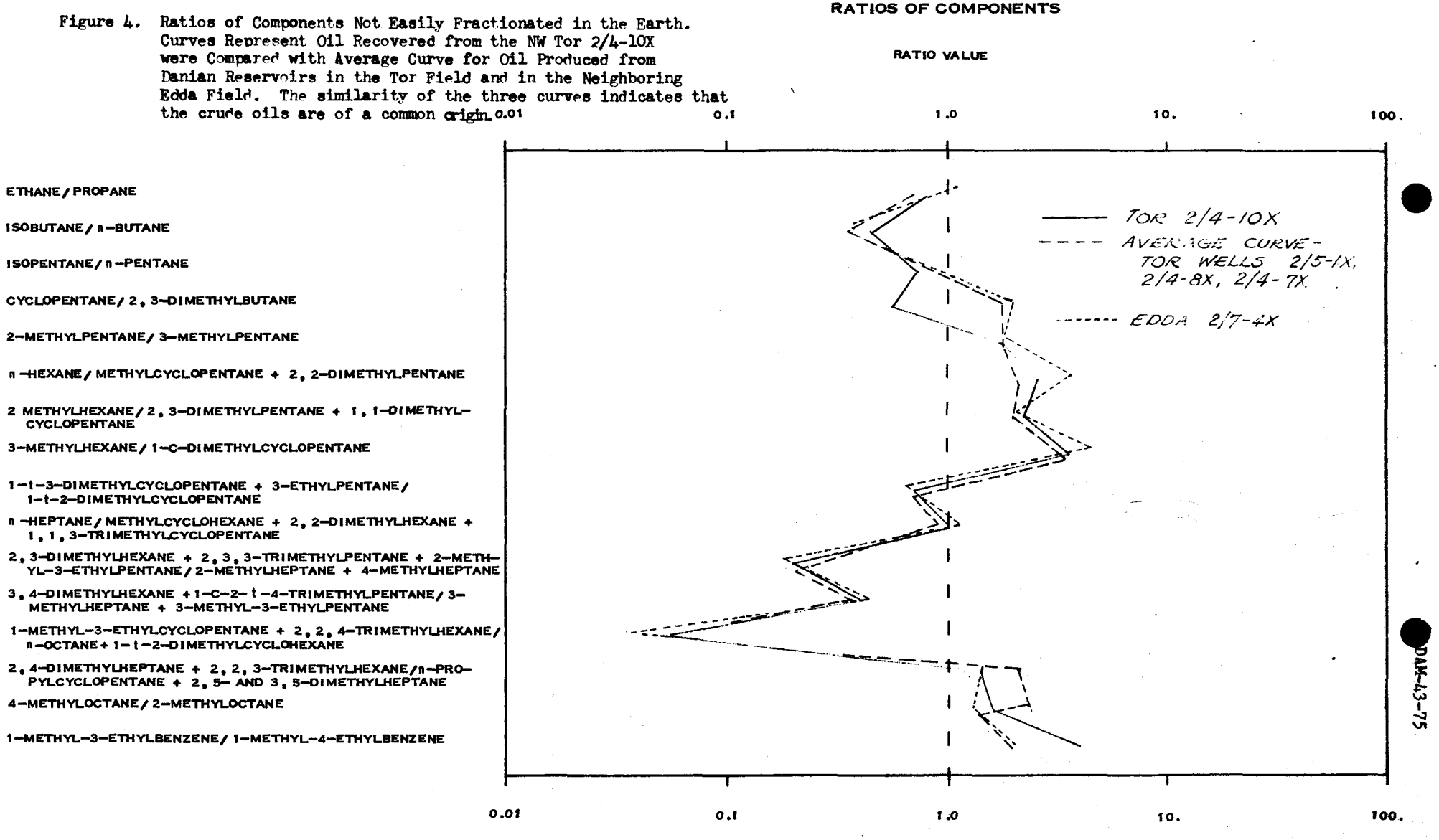
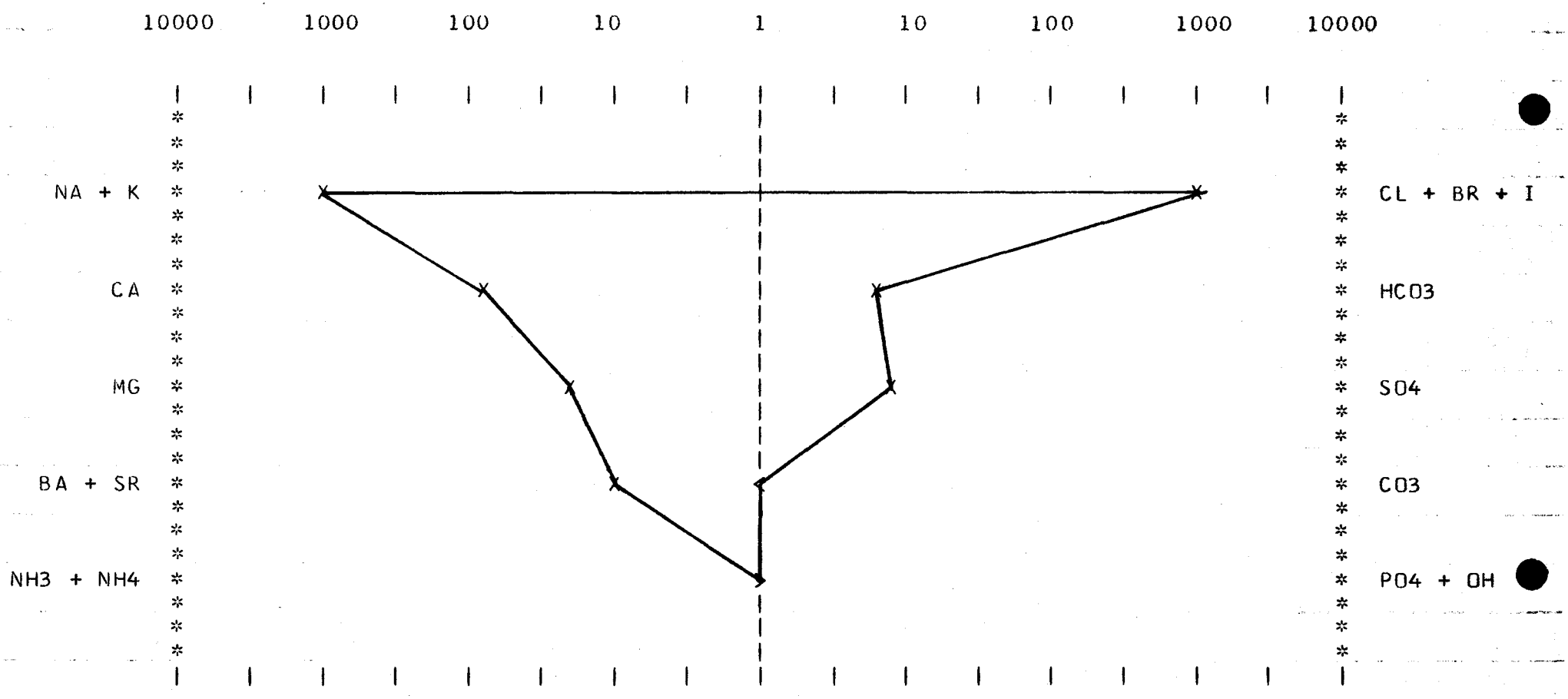


FIGURE 5

STIFF DIAGRAM FOR WATER SAMPLE MWO

FLUID NW TOR 2/4-10X NORTH SEA NORWAY FLOW-2
OIL AND WATER TAKEN AT TEST HEAD MANIFOLD 11/22/73

MILLIEQUIVALENTS / LITER



DAM-4-3-75

FIGURE 6

STIFF DIAGRAM FOR WATER SAMPLE MWP

FLUID NW TOR 2/4-10 NORTH SEA NORWAY FLOW-2
OIL AND WATER TAKEN AT TEST HEAD MANIFOLD 11/22/73

MILLIEQUIVALENTS / LITER

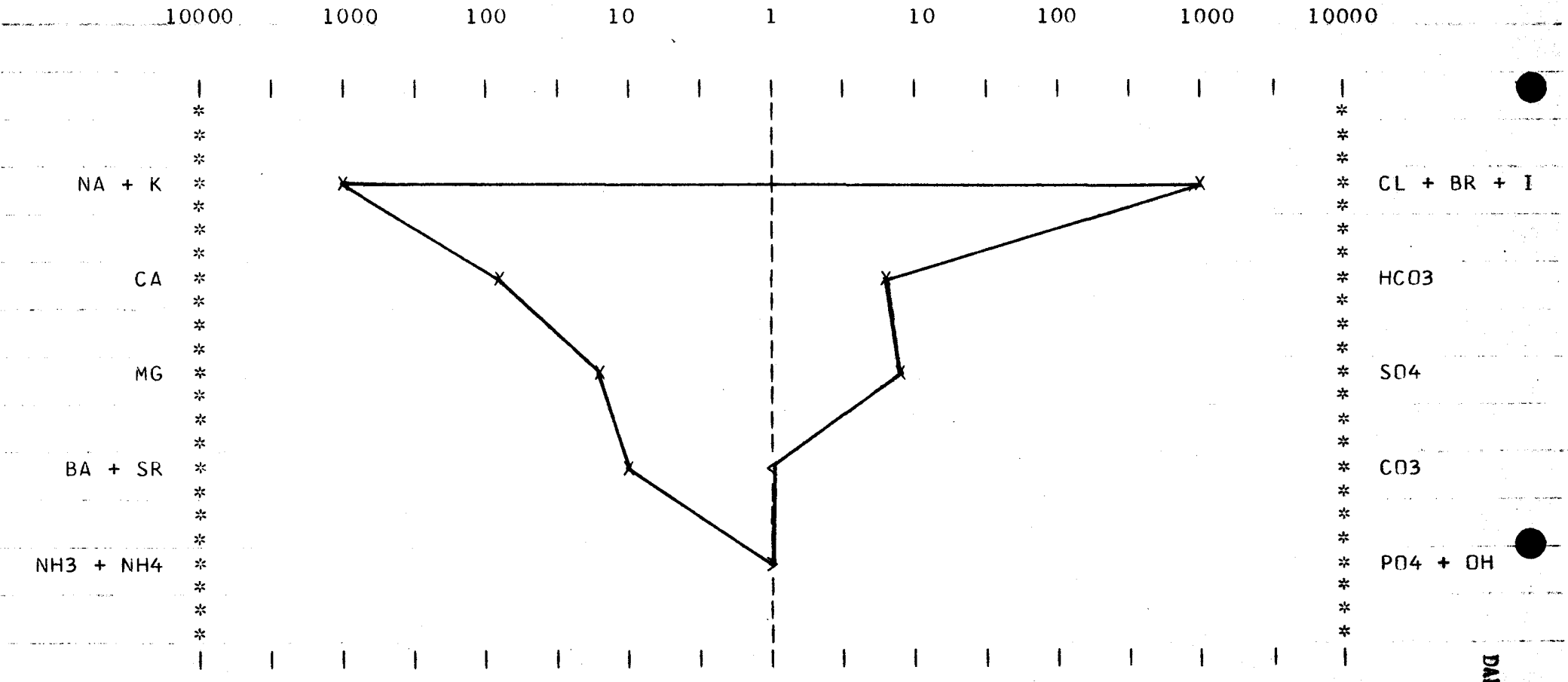


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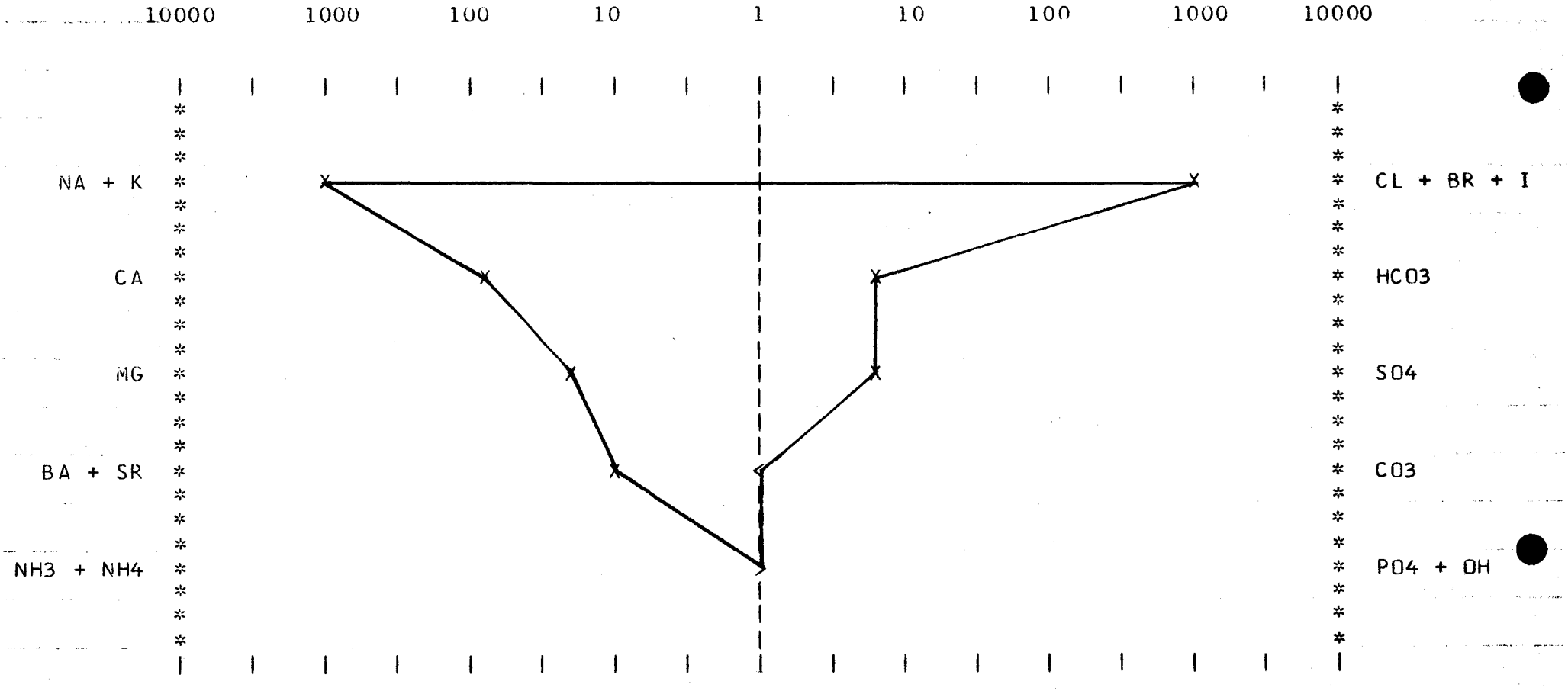
FIGURE 7

STIFF DIAGRAM FOR WATER SAMPLE MWQ

FLUID NW TOR 2/4-10X NORTH SEA NORWAY FLOW-2
OIL AND WATER TAKEN AT TEST HEAD MANIFOLD 11/22/73

MILLIEQUIVALENTS / LITER



DAM-4-3-75

FIGURE 8

STIFF DIAGRAM FOR WATER SAMPLE MWK

FLUID NW TOR 2/4-10X NORTH SEA NORWAY DST-2
OIL AND WATER TAKEN AT SEPARATOR WATER OUTLET 11/29/73

MILLIEQUIVALENTS / LITER

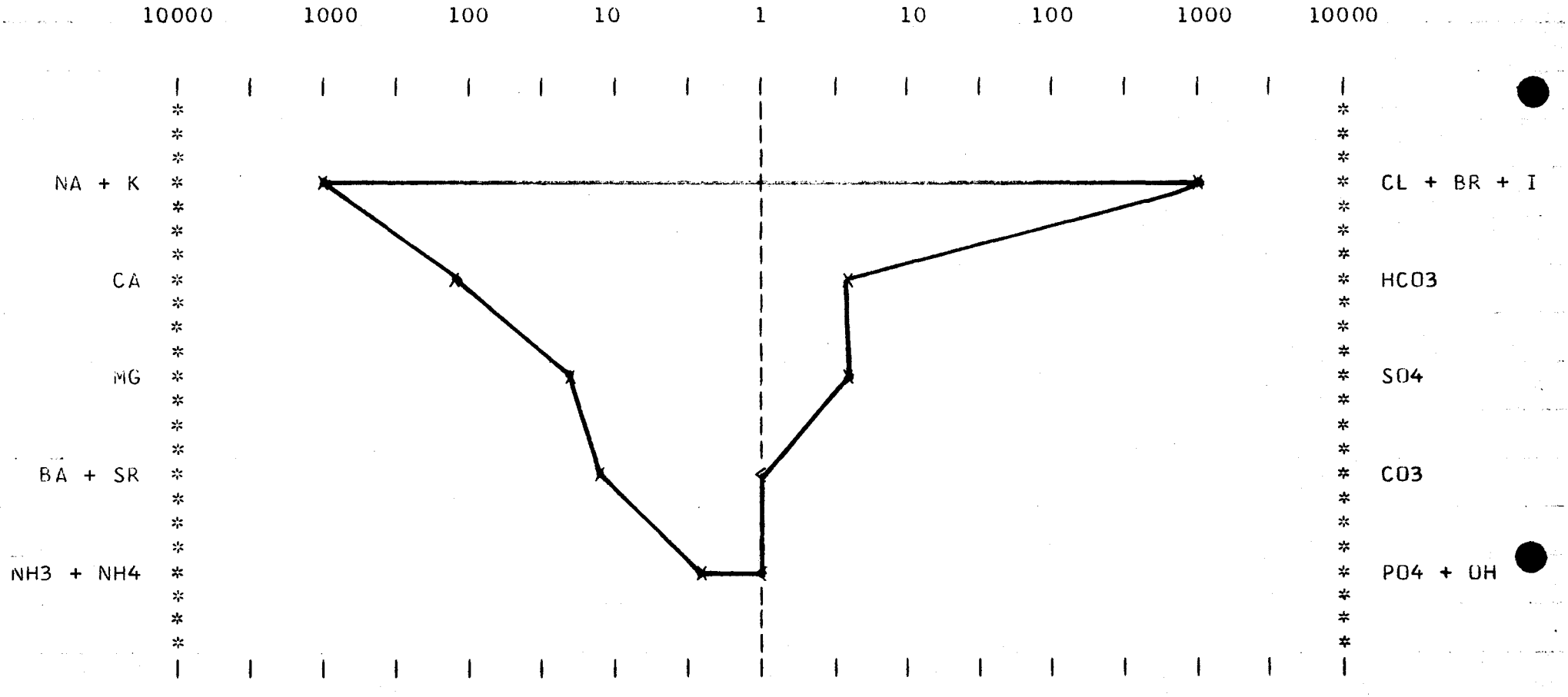


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FIGURE 9

STIFF DIAGRAM FOR WATER SAMPLE MWL

FLUID NW TOR 2/4-10X NORTH SEA NORWAY DST-2
OIL AND WATER TAKEN AT SEPARATOR WATER OUTLET 11/29/73

MILLIEQUIVALENTS / LITER

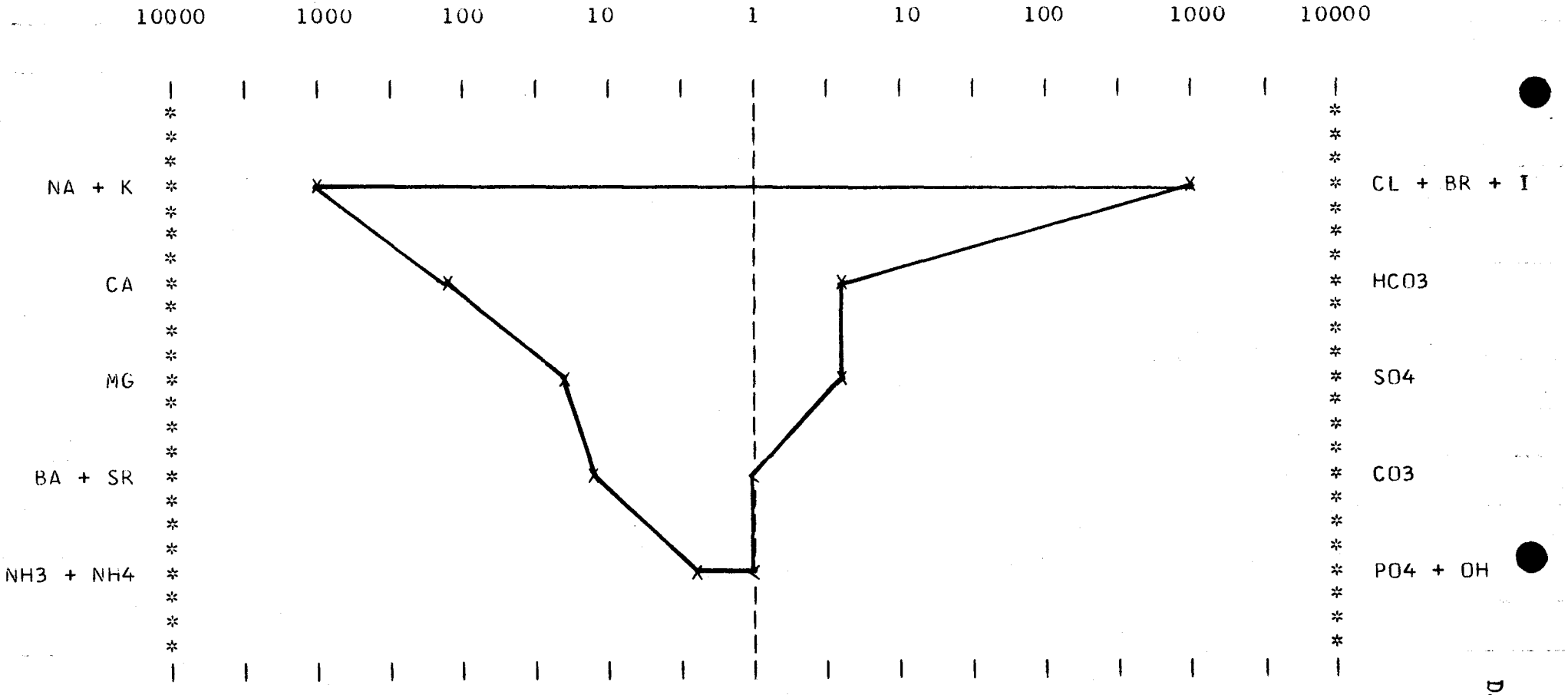

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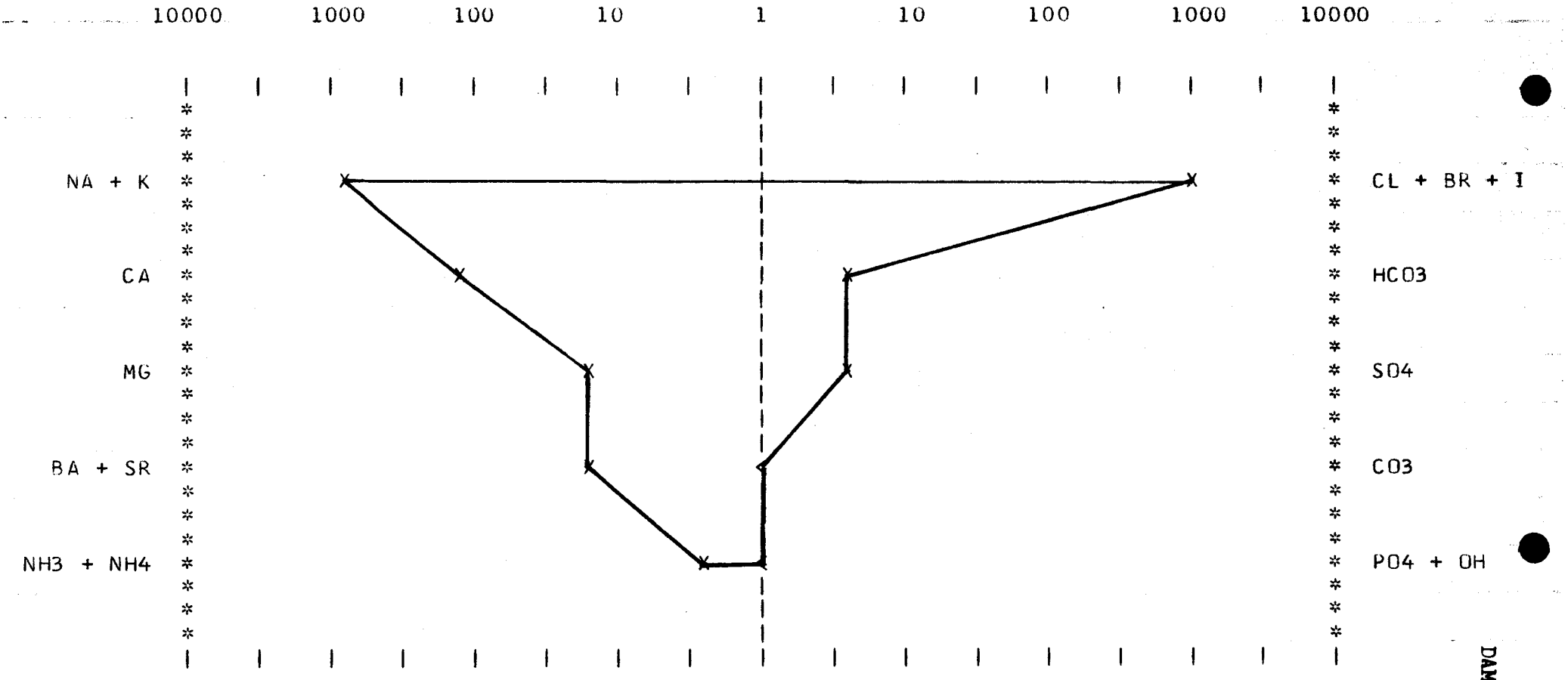
FIGURE 10

STIFF DIAGRAM FOR WATER SAMPLE MWM

FLUID NW TOR 2/4-10X NORTH SEA NORWAY DST-2
OIL AND WATER TAKEN AT SEPARATOR WATER OUTLET 11/29/73

MILLIEQUIVALENTS / LITER



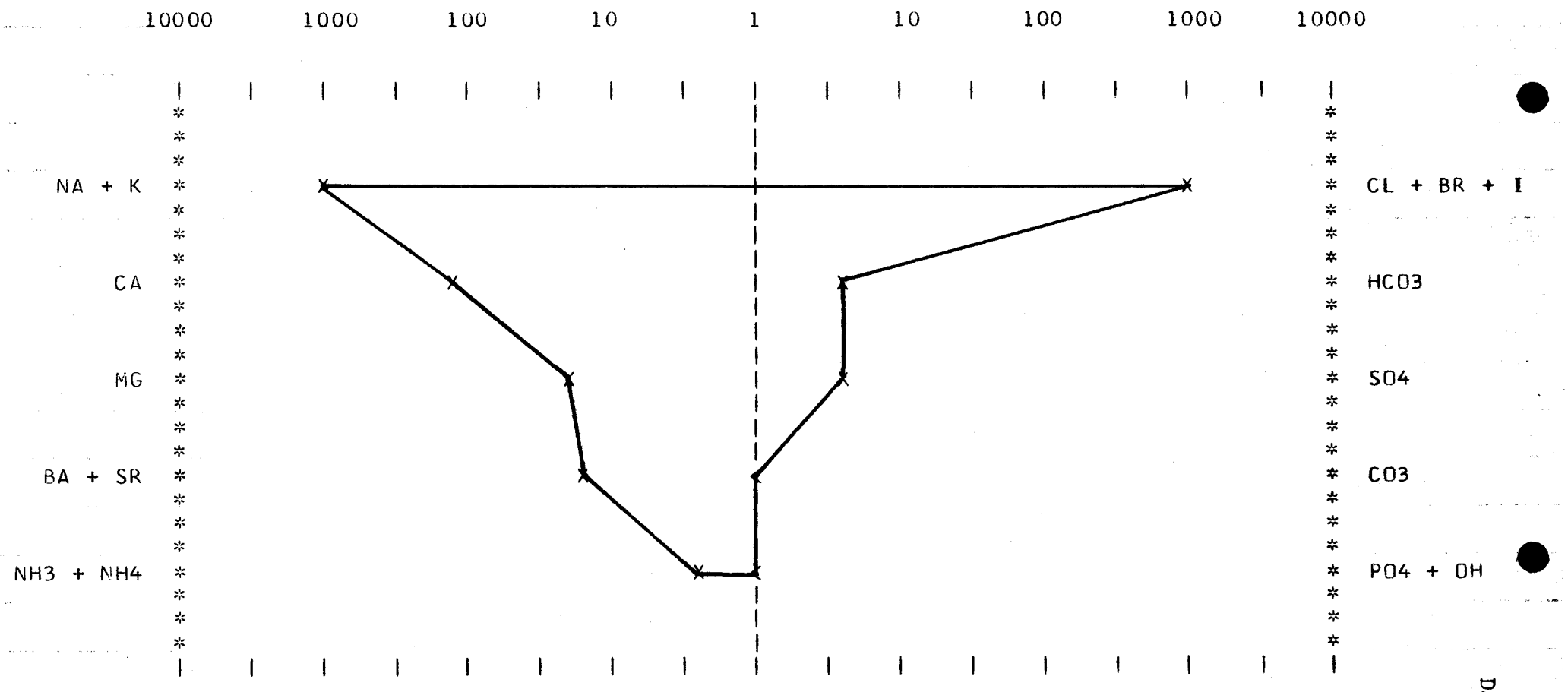
DAM-43-75

FIGURE 11

STIFF DIAGRAM FOR WATER SAMPLE MWN

FLUID NW TOR 2/4-10X NORTH SEA NORWAY DST-2
OIL AND WATER TAKEN AT SEPARATOR WATER OUTLET 11/29/73

MILLIEQUIVALENTS / LITER



DAM-4-3-75

FIGURE 12

STIFF DIAGRAM FOR WATER SAMPLE MWC

TOP NW TOR 2/4-10X NORTH SEA NORWAY DST-6
WATER TAKEN FROM FLOOR MANIFOLD 12/13/73

MILLIEQUIVALENTS / LITER

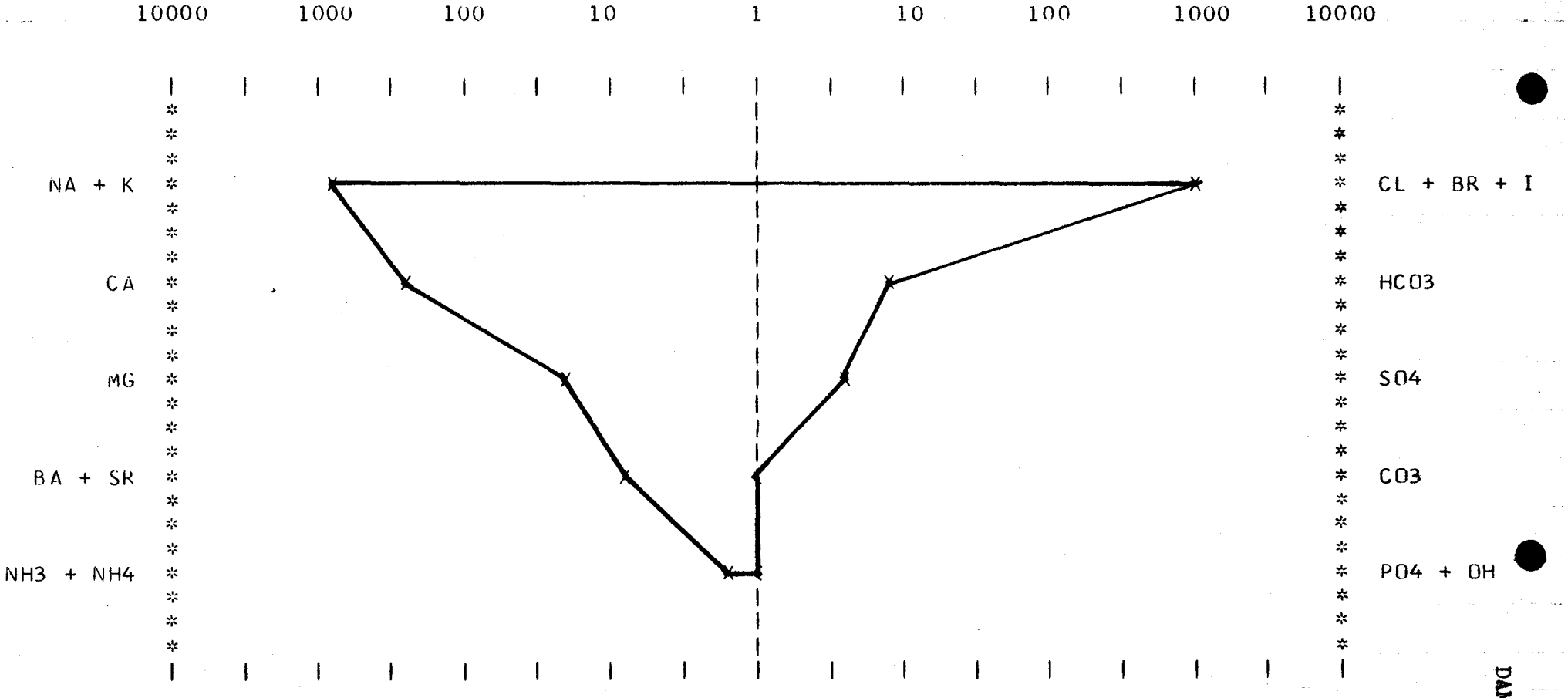


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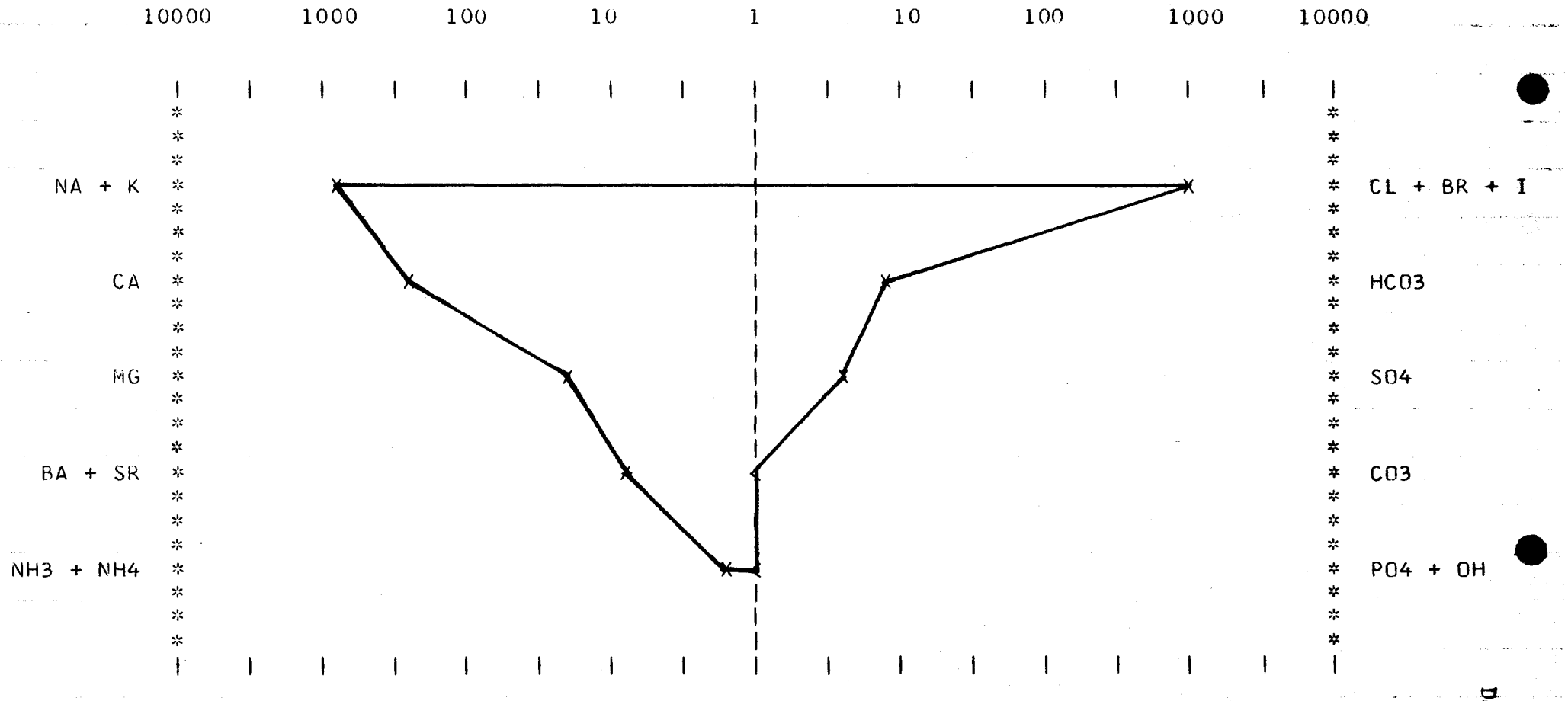
FIGURE 13

STIFF DIAGRAM FOR WATER SAMPLE MWD

MIDDLE NW TOR 2/4-10X NORTH SEA NORWAY DST-6
WATER TAKEN FROM FLOOR MANIFOLD 12/13/73

MILLIEQUIVALENTS / LITER



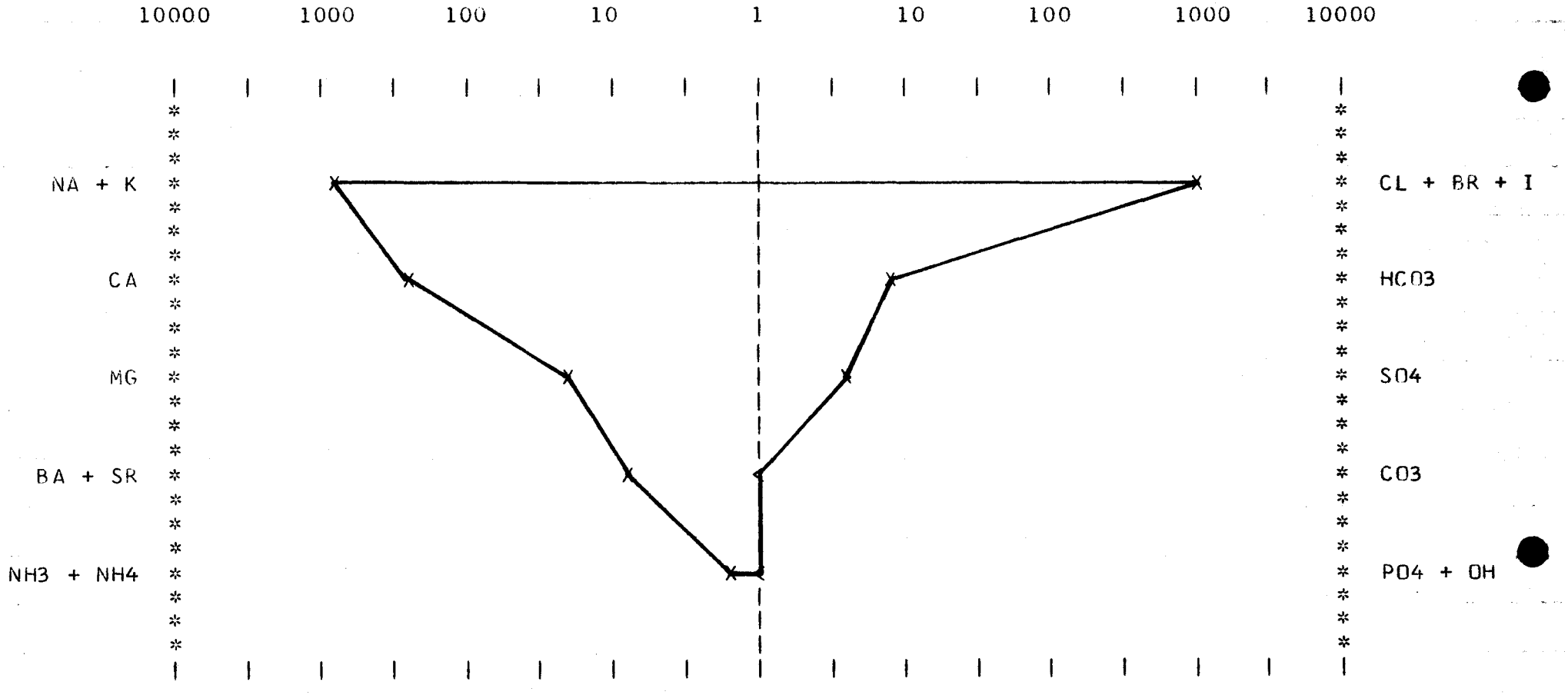
DAM-43-73

FIGURE 14

STIFF DIAGRAM FOR WATER SAMPLE MWE

BOTTOM NW TOR 2/4-10X NORTH SEA NORWAY DST-6
WATER TAKEN FROM FLOOR MANIFOLD 12/13/73

MILLIEQUIVALENTS / LITER



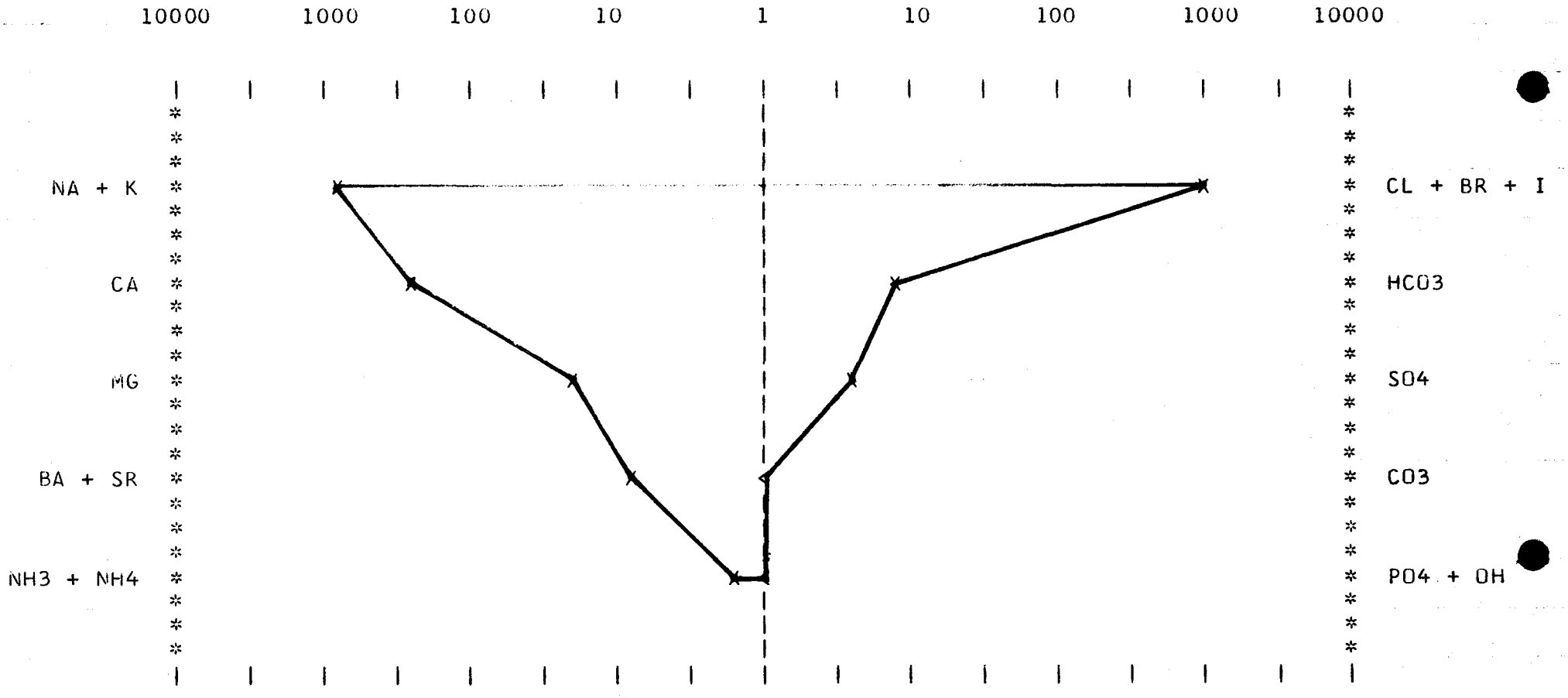
DAM-4-3-75

FIGURE 15

STIFF DIAGRAM FOR WATER SAMPLE MWG

TOP NW TOR 2/4-10X NORTH SEA NORWAY DST-6
WATER TAKEN FROM FLOOR TEST MANIFOLD 12/13/73

MILLIEQUIVALENTS / LITER



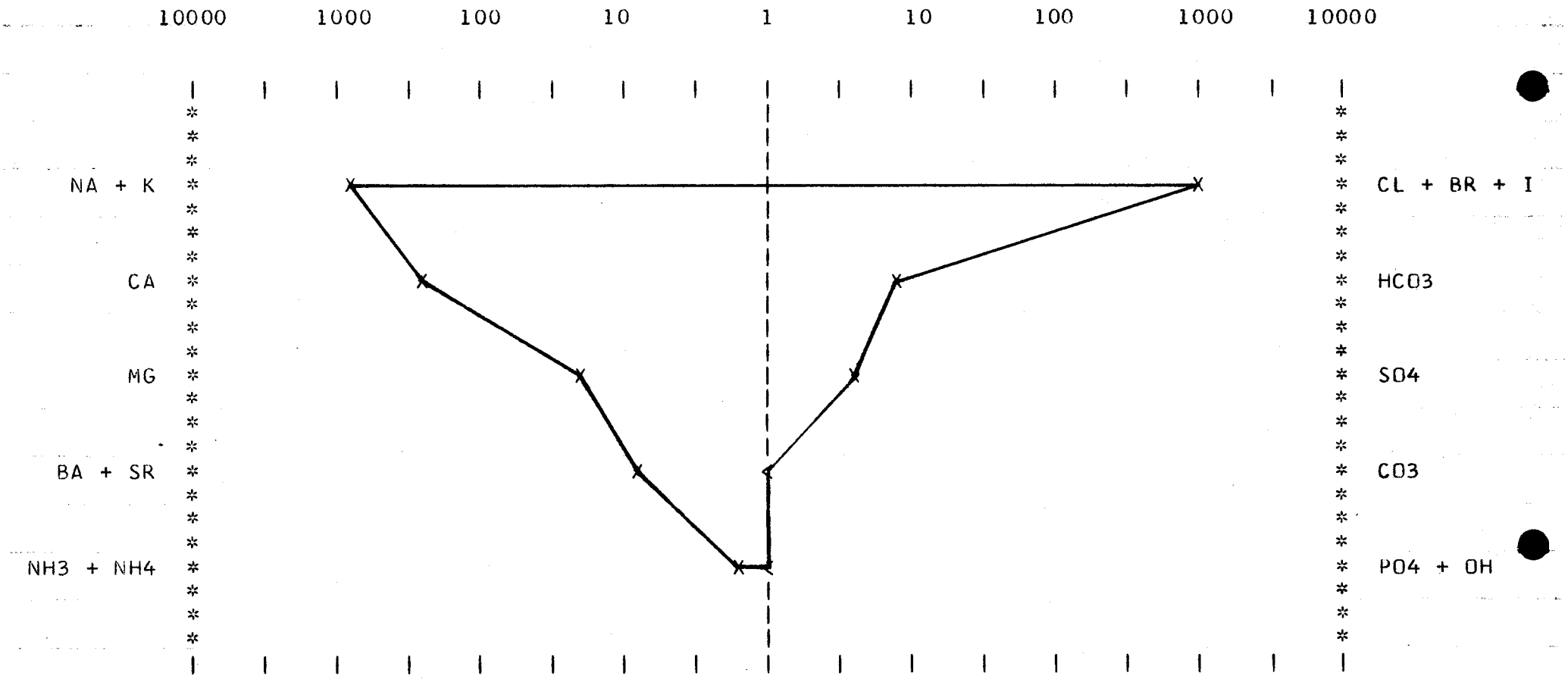
DAK-43-75

FIGURE 16

STIFF DIAGRAM FOR WATER SAMPLE MWH

MIDDLE NW TOR 2/4-10X NORTH SEA NORWAY DST-6
WATER TAKEN FROM FLOOR TEST MANIFOLD 12/13/73

MILLIEQUIVALENTS / LITER



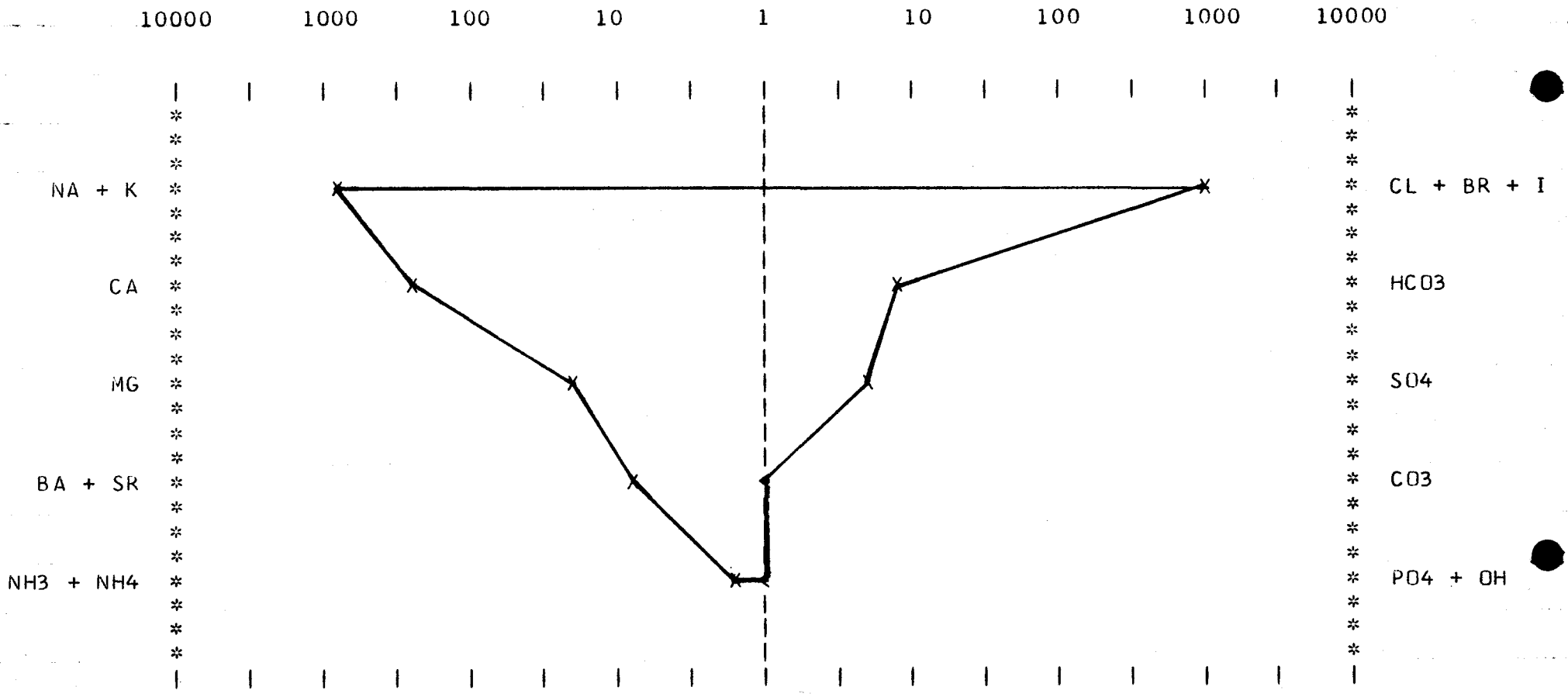
DAM-43-75

FIGURE 17

STIFF DIAGRAM FOR WATER SAMPLE MWI

BOTTOM NW TOR 2/4-10X NORTH SEA NORWAY DST-6
WATER TAKEN FROM FLOOR TEST MANIFOLD 12/13/73

MILLIEQUIVALENTS / LITER



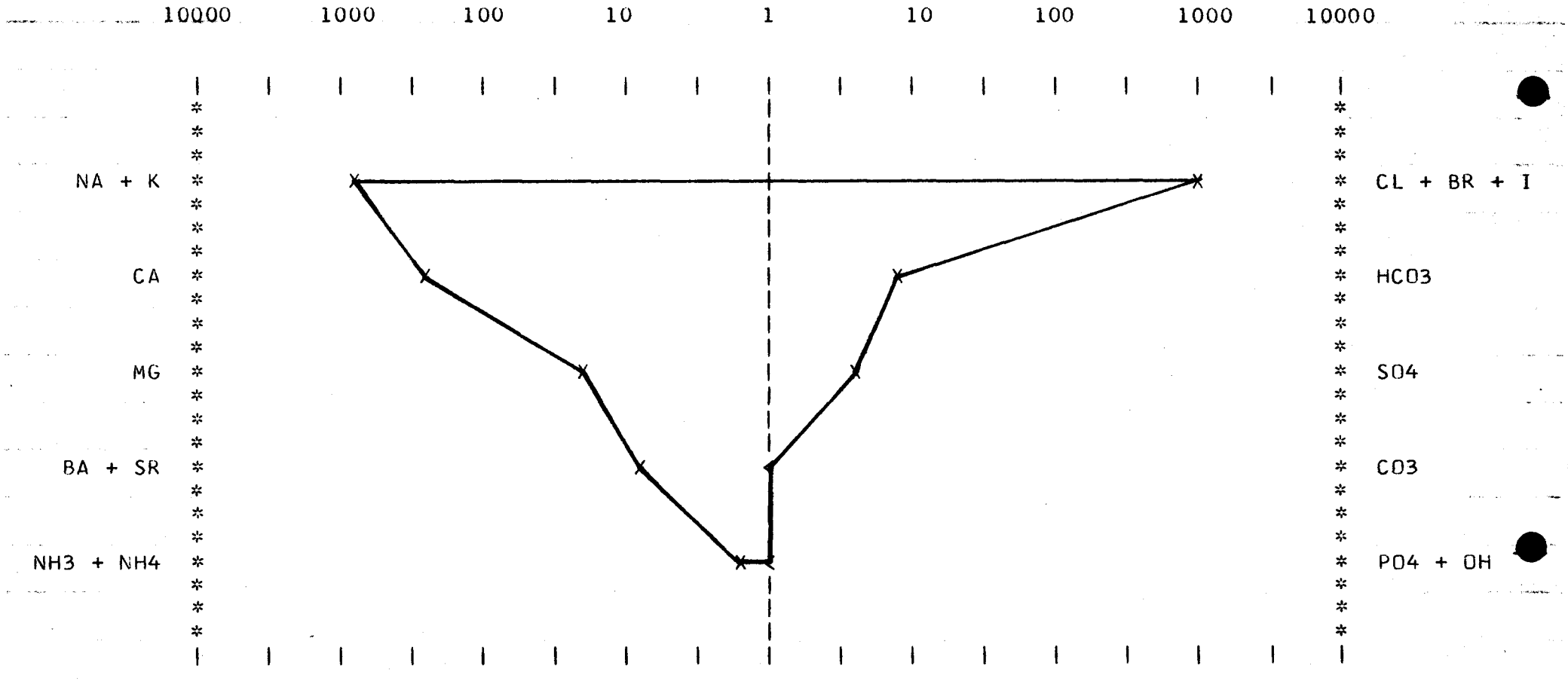
DAM-43-75

FIGURE 18

STIFF DIAGRAM FOR WATER SAMPLE MWJ

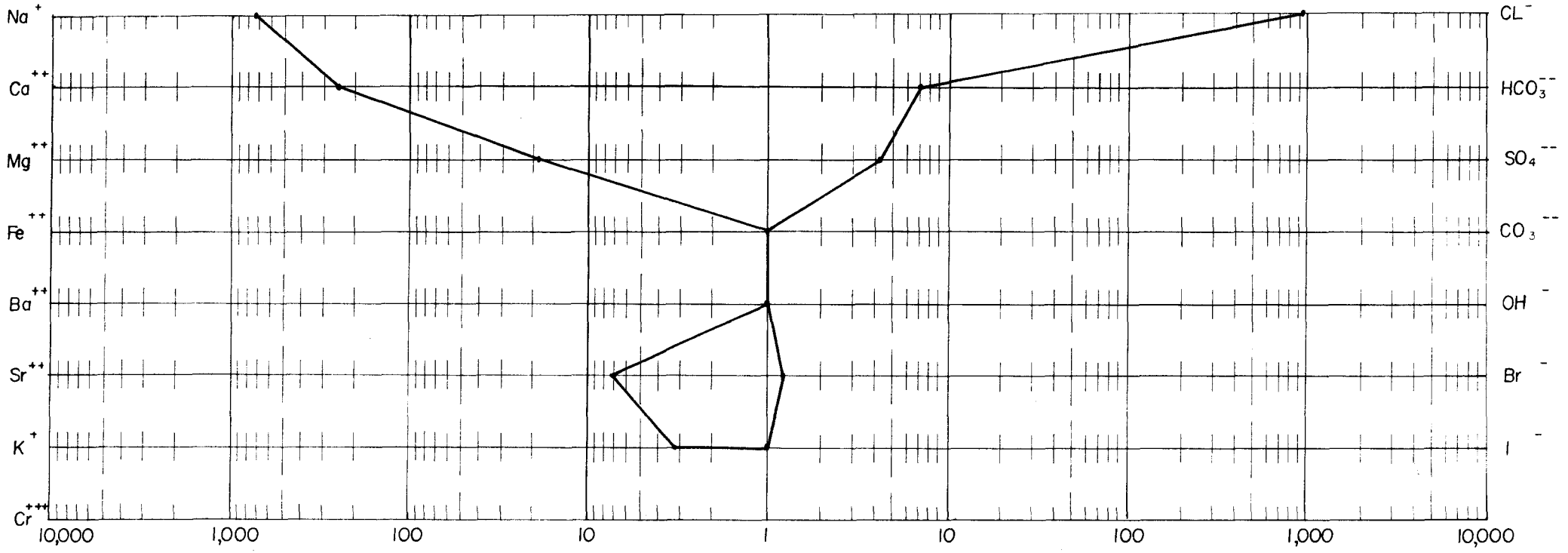
DRILLING MUD NW TOR 2/4-10X NORTH SEA NORWAY DST-6
WATER TAKEN FROM FLOOR TEST MANIFOLD 12/13/73

MILLIEQUIVALENTS / LITER



DAM-4-3-75

STIFF DIAGRAM (LOGARITHMIC SCALE)



FIELD: N.W. TDR WELL: 2/4-10 X

FORMATION: EKOFISK

TYPE RESERVOIR: OIL

PERFORATED INTERVAL: 10,440'–10,510'

SAMPLE POINT: FLOOR MANIFOLD

SAMPLE DATE + TIME: 13 Dec 73 DST #6 Flow 3

DATE OF ANALYSIS: ?

ANALYSIS BY: B'VILLE R+D

SAMPLE NUMBER: MWD

REMARKS: POST-ACID

SPECIFIC GRAVITY = ? AT ____

Ph = 6.18 AT ____

TOTAL DISSOLVED SOLIDS (LAB) = 55,598 Mg/L

T.D.S. / S.G. = ____ P.P.M. (CALC)

1.645 x Cl P.P.M. = ____ P.P.M. NaCl EQUIVALENT

LAB MEASURED RESISTIVITY = 0.1374 / 0.1256 Ohm-METERS AT 21°C / 26°C

ELEVATED RESISTIVITY = 0.0418 Ohm-METERS AT 118.33° / 215°F

ARP'S EQUATION

T_1 = TEMP. MEASURED

T_2 = ELEVATED TEMP.

R_1 RESIST. AT T_1

R_2 = RESIST. AT T_2

$R_2 = R_1 \left(\frac{T_1+6.77}{T_2+6.77}\right)$ °F

$R_2 = R_1 \left(\frac{T_1+21.5}{T_2+21.5}\right)$ °C

DISSOLVED SOLIDS

CATION	Mg/L	FACTOR	Meq/L	P.P.M.	ANION	Mg/L	FACTOR	Meq/L	P.P.M.
Na^+	16999	.0435	739		CL^-	32299	.0282	911	
Ca^{++}	4899	.0499	244		HCO_3^{--}	429	.0164	7	
Mg^{++}	218	.0823	18		SO_4^{--}	197	.0208	4.1	
Fe^{++}	—	.0358	—	—	CO_3^{--}	0	.0333	0	0
Ba^{++}	9	.0146	0.1		OH^-	0	.0588	0	0
Sr^{++}	309	.0228	7		Br^-	94	.0125	1.2	
K^+	122	.0256	3.1		I^-	19	.0079	0.2	
Cr^{+++}	—	.0577	—	—					
Li^+	—	.1441	—	—					

Meq/L = $\frac{\text{Mg/L} \times \text{VALENCE}}{\text{MOLECULAR wt}}$ P.P.M. = $\frac{\text{Mg/L}}{\text{SPECIFIC GRAVITY}}$

TABLE XII

FORMATION WATER CHARACTERIZATION
BOTTOM NW TOR 2/4-10X NORTH SEA NORWAY DST-6 , **FLOW 3 (10,440-10,510 FT)**
WATER TAKEN FROM FLOOR MANIFOLD 12/13/73
(POST ACID)

GEOCHEMISTRY BRANCH CODE, MWE
TOTAL DISSOLVED CHROMIUM = **Not detected**
RESISTIVITY, 25 DEG. C, 0.126 OHM METERS
PH = 6.29 TOTAL DISSOLVED SOLIDS = 5.60

INORGANIC CONSTITUENTS

CATIONS	CONCENTRATION WT/WT PER CENT	EQUIVALENTS PER 100 GRAMS	ANIONS	CONCENTRATION WT/WT PER CENT	EQUIVALENTS PER 100 GRAMS
SODIUM	1.7000	0.0739	CHLORIDE	3.2900	0.0928
POTASSIUM	0.0122	0.0003	BROMIDE	0.0110	0.0001
CALCIUM	0.4700	0.0235	IODIDE	0.0020	0.0000
MAGNESIUM	0.0212	0.0017	SULFATE	0.0188	0.0004
AMMONIUM	0.0026	0.0001	PHOSPHATE	0.0005	0.0000
AMMONIA	0.0000	0.0000	BICARBONATE	0.0420	0.0007
BARIUM	< 0.00105	0.0000	CARBONATE	0.0000	0.0000
STRONTIUM	0.0345	0.0008			
TOTAL =	2.2389	TOTAL = 0.1002	TOTAL =	3.3642	TOTAL = 0.0940

DISSOLVED AROMATIC HYDROCARBONS

COMPOUND	CONCENTRATION PPM
BENZENE	1.40
TOLUENE	0.00

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FIGURE 14

STIFF DIAGRAM FOR WATER SAMPLE MWE

BOTTOM NW TOR 2/4-10X NORTH SEA NORWAY DST-6
WATER TAKEN FROM FLOOR MANIFOLD 12/13/73

MILLIEQUIVALENTS / LITER

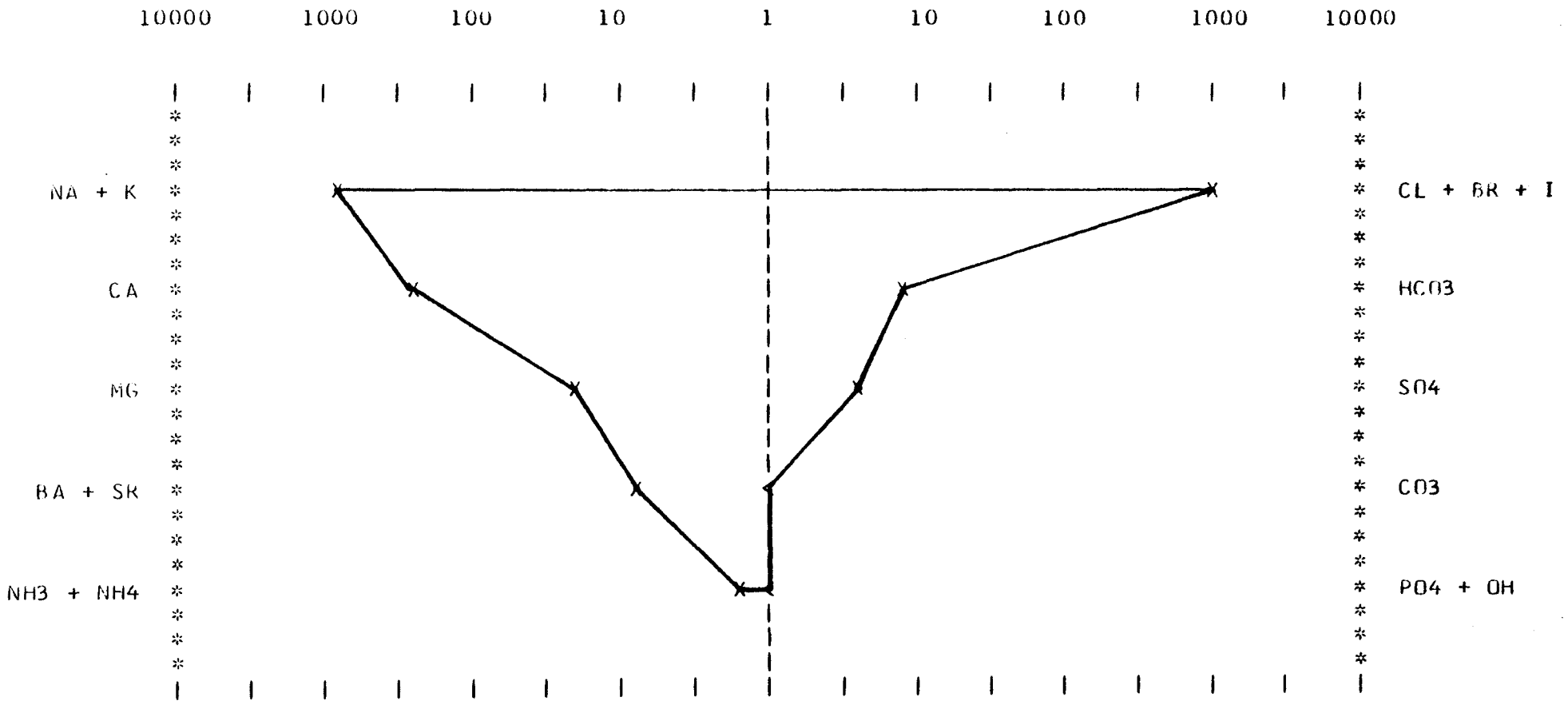

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TABLE

FORMATION WATER CHARACTERIZATION

NORWAY NORTH SEA TORFELT 2/4-10X

GEOLOGICAL BRANCH CODE: G174MWE
TOTAL DISSOLVED CHROMIUM = .0000
RESISTIVITY, 25 DEG. C= .1261 OHM METERS
PH = 6.2899 TOTAL DISSOLVED SOLIDS = 5.6020

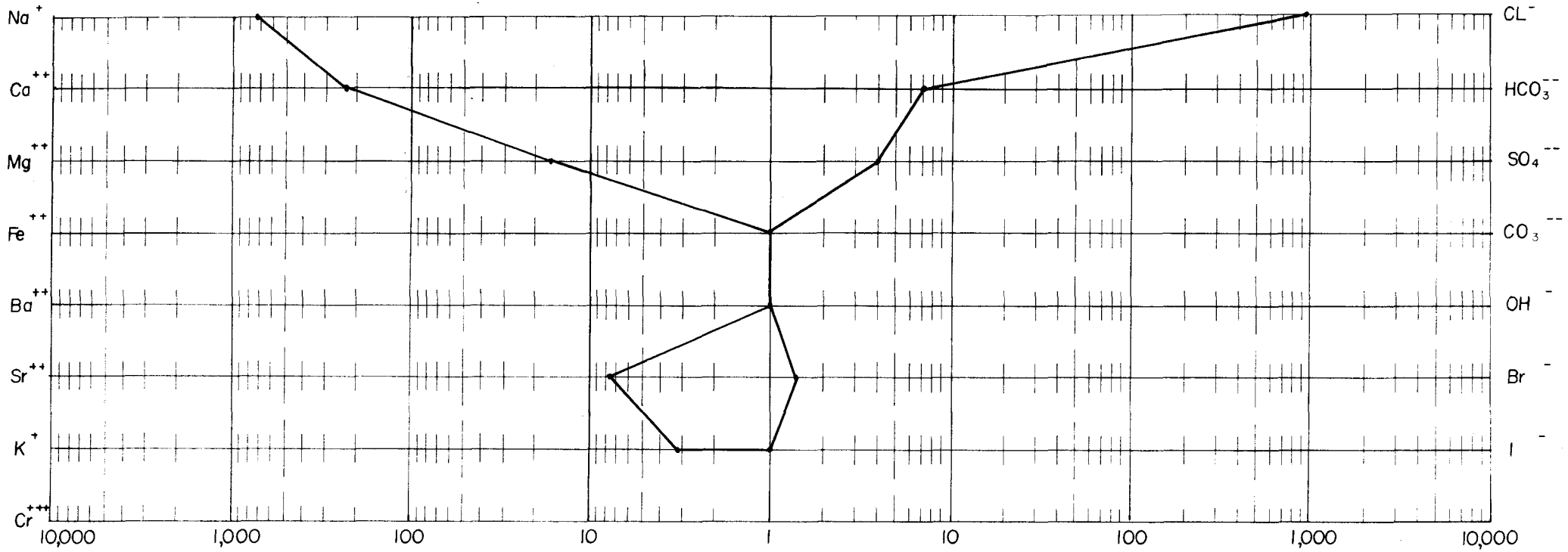
INORGANIC CONSTITUENTS

CATIONS	CONCENTRATION WT/WT PER CENT	EQUIVALENTS PER 100 GRAMS	ANIONS	CONCENTRATION WT/WT PER CENT	EQUIVALENTS PER 100 GRAMS
SODIUM	1.6969	.0739	CHLORIDE	3.2899	.0927
POTASSIUM	.0121	.0003	BROMIDE	.0109	.0001
CALCIUM	.4699	.0234	IODIDE	.0019	.0000
MAGNESIUM	.0211	.0017	SULFATE	.0187	.0003
AMMONIUM	.0000	.0000	PHOSPHATE	.0004	.0000
AMMONIA	.0000	.0000	BICARBONATE	.0419	.0006
BARIUM	.0009	.0000	CARBONATE	.0000	.0000
STRONTIUM	.0344	.0007	HYDROXIDE	.0000	.0000
TOTAL =	2.2363	TOTAL = .1000	TOTAL =	3.3637	TOTAL = .0937

DISSOLVED AROMATIC HYDROCARBONS

COMPOUND	CONCENTRATION PPM
BENZENE	1.39
TOLUENE	.00

STIFF DIAGRAM (LOGARITHMIC SCALE)



FIELD: N.W. TOR WELL: 2/4-10

FORMATION: EKOFISK TYPE RESERVOIR: OIL

PERFORATED INTERVAL: 10440'-10510'

SAMPLE POINT: FLOOR MANIFOLD

SAMPLE DATE + TIME: 13 Dec 73 DST #6 Flow 3

DATE OF ANALYSIS: ?

ANALYSIS BY: B'VILLE R+D SAMPLE NUMBER: MWE

REMARKS: POST-ACID

SPECIFIC GRAVITY = ? AT

Ph = 6.29 AT

TOTAL DISSOLVED SOLIDS (LAB) = 56,020 Mg/L

T.D.S. / S.G. = P.P.M. (CALC)

1.645 x Cl P.P.M. = P.P.M. NaCl EQUIVALENT

LAB MEASURED RESISTIVITY = 0.1380 / 0.1261 Ohm-METERS AT 21°C / 38°C

ELEVATED RESISTIVITY = 0.0419 Ohm-METERS AT 118.33°C 245°F

ARP'S EQUATION
T_1 = TEMP. MEASURED
T_2 = ELEVATED TEMP.
R_1 RESIST. AT T_1
R_2 = RESIST. AT T_2

$R_2 = R_1 \left(\frac{T_1+6.77}{T_2+6.77}\right)$ °F

$R_2 = R_1 \left(\frac{T_1+21.5}{T_2+21.5}\right)$ °C

DISSOLVED SOLIDS

CATION	Mg/L	FACTOR	Meq/L	P.P.M.	ANION	Mg/L	FACTOR	Meq/L	P.P.M.
Na^+	16,999	.0435	739		CL^-	32,899	.0282	928	
Ca^{++}	4699	.0499	234		HCO_3^{--}	419	.0164	7	
Mg^{++}	211	.0823	17		SO_4^{--}	187	.0208	4	
Fe^{++}	—	.0358	—	—	CO_3^{--}	0	.0333	0	0
Ba^{++}	9	.0146	0.1		OH^-	0	.0588	0	0
Sr^{++}	344	.0228	7.8		Br^-	109	.0125	1.4	
K^+	121	.0256	3.1		I^-	19	.0079	0.2	
Cr^{+++}	—	.0577	—	—					
Li^+	—	.1441	—	—					

Meq/L = $\frac{\text{Mg/L} \times \text{VALENCE}}{\text{MOLECULAR wt}}$ P.P.M. = $\frac{\text{Mg/L}}{\text{SPECIFIC GRAVITY}}$

TABLE

FORMATION WATER CHARACTERIZATION

NORWAY NORTH SEA TORFELT 2/4-10X

GEOLOGICAL BRANCH CODE: G1/4MWF
TOTAL DISSOLVED CHROMIUM = .0000
RESISTIVITY, 25 DEG. C= .0000 OHM METERS
PH = .0000

TOTAL DISSOLVED SOLIDS = .0000

INORGANIC CONSTITUENTS

CATIONS	CONCENTRATION WT/WT PER CENT	EQUIVALENTS PER 100 GRAMS	ANIONS	CONCENTRATION WT/WT PER CENT	EQUIVALENTS PER 100 GRAMS
SODIUM	.0000	.0000	CHLORIDE	.0000	.0000
POTASSIUM	.0000	.0000	BROMIDE	.0000	.0000
CALCIUM	.0000	.0000	IODIDE	.0000	.0000
MAGNESIUM	.0000	.0000	SULFATE	.0000	.0000
AMMONIUM	.0000	.0000	PHOSPHATE	.0000	.0000
AMMONIA	.0000	.0000	BICARBONATE	.0000	.0000
BARIUM	.0000	.0000	CARBONATE	.0000	.0000
STRONTIUM	.0000	.0000	HYDROXIDE	.0000	.0000
TOTAL =	.0000	TOTAL = .0000	TOTAL =	.0000	TOTAL = .0000

DISSOLVED AROMATIC HYDROCARBONS

COMPOUND	CONCENTRATION PPM
BENZENE	.00
TOLUENE	.49

MUD SAMPLE

TABLE XIII

FORMATION WATER CHARACTERIZATION
TOP NW TOR 2/4-10X NORTH SEA NORWAY DST-6, **FLOW 3 (10,440-10,510 FT)**
WATER TAKEN FROM FLOOR TEST MANIFOLD 12/13/73

GEOCHEMISTRY BRANCH CODE, MWG
TOTAL DISSOLVED CHROMIUM = **Not detected**
RESISTIVITY, 25 DEG. C, 0.123 OHM METERS
PH = 6.10

TOTAL DISSOLVED SOLIDS = 5.71

INORGANIC CONSTITUENTS

CATIONS	CONCENTRATION WT/WT PER CENT	EQUIVALENTS PER 100 GRAMS	ANIONS	CONCENTRATION WT/WT PER CENT	EQUIVALENTS PER 100 GRAMS
SODIUM	1.7000	0.0739	CHLORIDE	3.3300	0.0939
POTASSIUM	0.0125	0.0003	BROMIDE	0.0105	0.0001
CALCIUM	0.5400	0.0269	IODIDE	0.0020	0.0000
MAGNESIUM	0.0238	0.0020	SULFATE	0.0195	0.0004
AMMONIUM	0.0026	0.0001	PHOSPHATE	<0.0005	0.0000
AMMONIA	0.0000	0.0000	BICARBONATE	0.0440	0.0007
BARIUM	<0.00105	0.0000	CARBONATE	0.0000	0.0000
STRONTIUM	0.0355	0.0008			
TOTAL	= 2.3128	TOTAL = 0.1039	TOTAL	= 3.4064	TOTAL = 0.0952

DISSOLVED AROMATIC HYDROCARBONS

COMPOUND	CONCENTRATION PPM
BENZENE	2.70
TOLUENE	0.00

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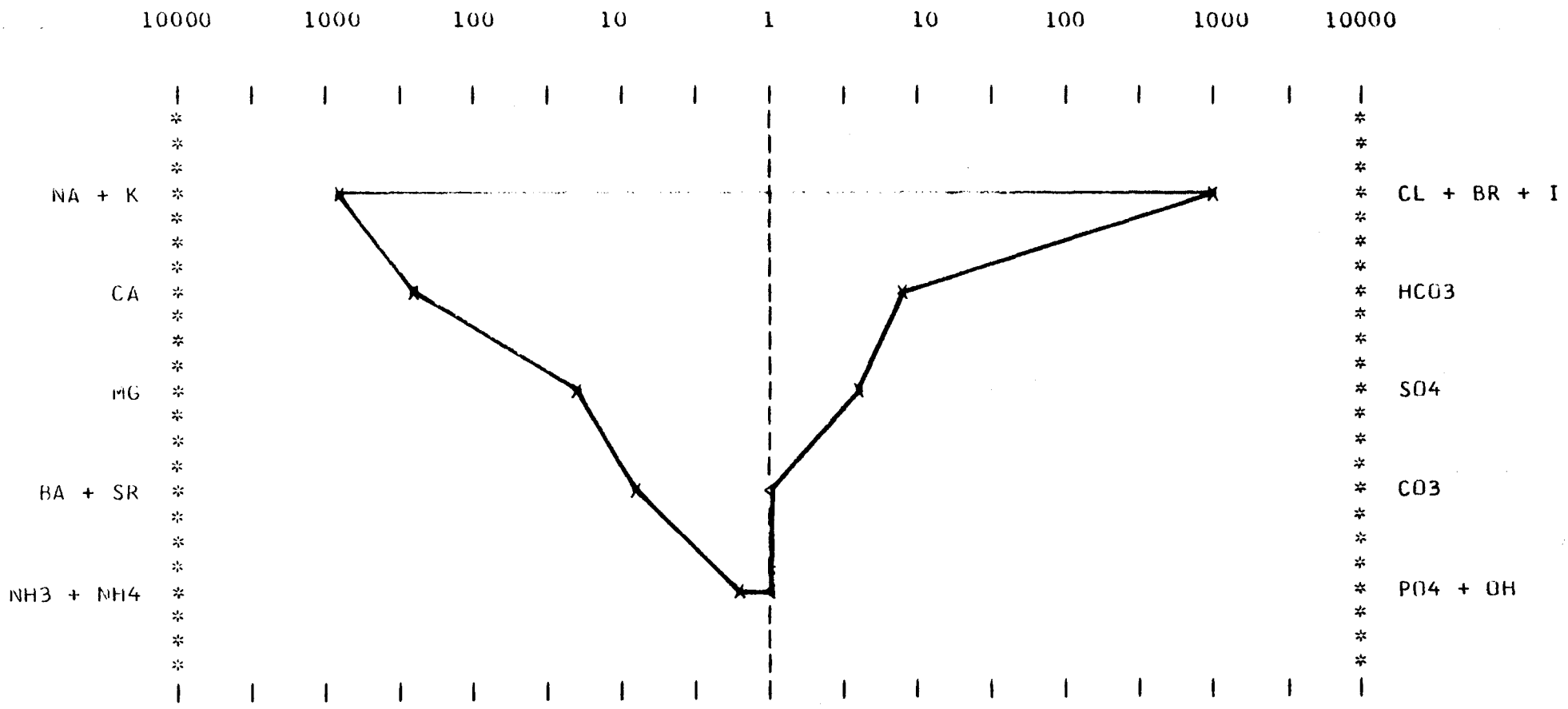
FIGURE 15

STIFF DIAGRAM FOR WATER SAMPLE MWG

TOP NW TOR 2/4-10X NORTH SEA NORWAY DST-6
WATER TAKEN FROM FLOOR TEST MANIFOLD 12/13/73

MILLIEQUIVALENTS / LITER



DAK-43-75

TABLE

FORMATION WATER CHARACTERIZATION

NORWAY NORTH SEA TORFELT 2/4-10X

GEOLOGICAL BRANCH CODE: GI74MWG
TOTAL DISSOLVED CHROMIUM = .0000
RESISTIVITY, 25 DEG. C= .1235 OHM METERS
PH = 6.0999

TOTAL DISSOLVED SOLIDS = 5.7181

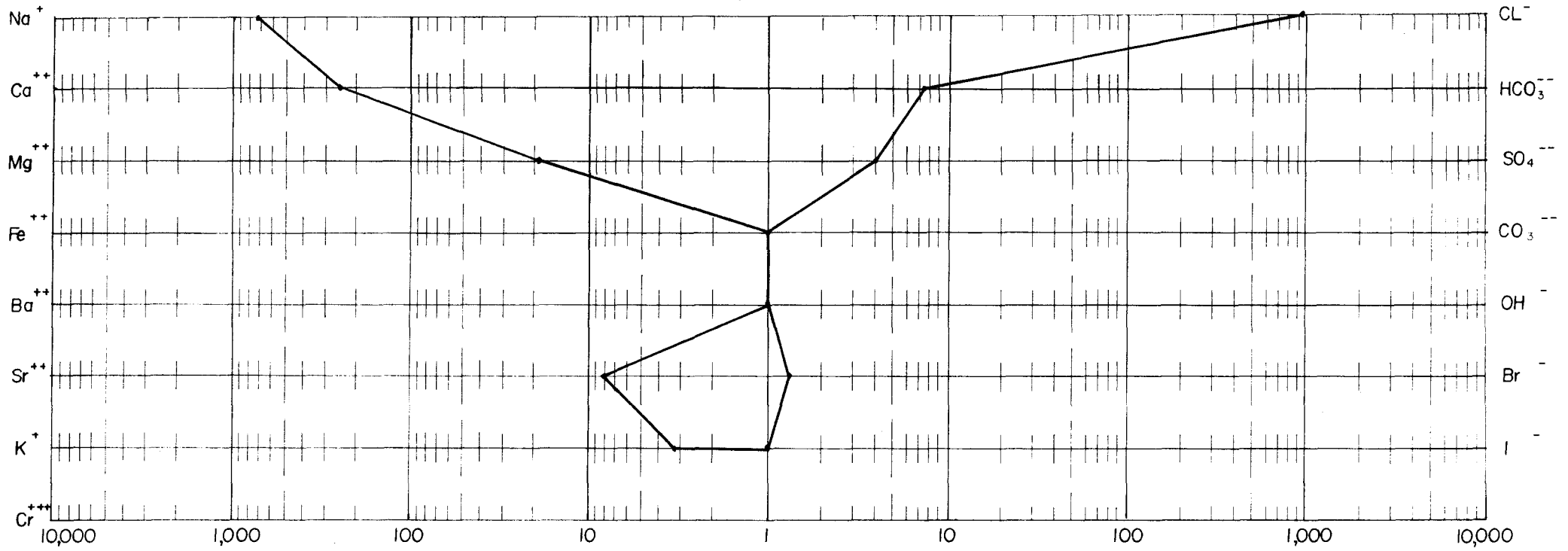
INORGANIC CONSTITUENTS

CATIONS	CONCENTRATION WT/WT PER CENT	EQUIVALENTS PER 100 GRAMS	ANIONS	CONCENTRATION WT/WT PER CENT	EQUIVALENTS PER 100 GRAMS
SODIUM	1.6999	.0739	CHLORIDE	3.3299	.0939
POTASSIUM	.0124	.0003	BROMIDE	.0104	.0001
CALCIUM	.5399	.0269	IODIDE	.0019	.0000
MAGNESIUM	.0237	.0019	SULFATE	.0194	.0004
AMMONIUM	.0000	.0000	PHOSPHATE	.0004	.0000
AMMONIA	.0000	.0000	BICARBONATE	.0439	.0007
BARIUM	.0009	.0000	CARBONATE	.0000	.0000
STRONTIUM	.0354	.0008	HYDROXIDE	.0000	.0000
TOTAL =	2.3122	TOTAL = .1038	TOTAL =	3.4059	TOTAL = .0951

DISSOLVED AROMATIC HYDROCARBONS

COMPOUND	CONCENTRATION PPM
BENZENE	2.69
TOLUENE	.00

STIFF DIAGRAM (LOGARITHMIC SCALE)



FIELD: N.W. TOR WELL: 214-10 X

FORMATION: EKOFISK TYPE RESERVOIR: OIL

PERFORATED INTERVAL: 10440-10530'

SAMPLE POINT: FLOW TEST MANIFOLD

SAMPLE DATE + TIME: 13 Dec 1977 DST#6 Flow 3

DATE OF ANALYSIS: ?

ANALYSIS BY: B'VILLE R+D SAMPLE NUMBER: MWG

REMARKS: POST-ACID

SPECIFIC GRAVITY = ? AT ____

Ph = 6.10 AT ____

TOTAL DISSOLVED SOLIDS (LAB) = 57,181 Mg/L

T.D.S. / S.G. = ____ P.P.M. (CALC)

1.645 x Cl P.P.M. = ____ NaCl EQUIVALENT

LAB MEASURED RESISTIVITY = 0.1351 Ohm-METERS AT 21°C

ELEVATED RESISTIVITY = 0.0411 Ohm-METERS AT 110.33°C 245°F

ARP'S EQUATION
T_1 = TEMP MEASURED
T_2 = ELEVATED TEMP.
R_1 RESIST. AT T_1
R_2 = RESIST. AT T_2

$R_2 = R_1 \left(\frac{T_1+6.77}{T_2+6.77}\right)°F$

$R_2 = R_1 \left(\frac{T_1+21.5}{T_2+21.5}\right)°C$

DISSOLVED SOLIDS

CATION	Mg/L	FACTOR	Meq/L	P.P.M.	ANION	Mg/L	FACTOR	Meq/L	P.P.M.
Na^+	16999	.0435	739		CL^-	33299	.0282	939	
Ca^{++}	5399	.0499	269		HCO_3^{--}	439	.0164	7.2	
Mg^{++}	237	.0823	19		SO_4^{--}	194	.0208	4	
Fe^{++}	—	.0358	—	—	CO_3^{--}	0	.0333	0	0
Ba^{++}	9	.0146	0.1		OH^-	0	.0588	0	0
Sr^{++}	354	.0228	8		Br^-	104	.0125	1.3	
K^+	124	.0256	3.2		I^-	19	.0079	0.2	
Cr^{+++}	—	.0577	—	—					
Li^+	—	.1441	—	—					

Meq/L = $\frac{\text{Mg/L} \times \text{VALENCE}}{\text{MOLECULAR wt}}$ P.P.M. = $\frac{\text{Mg/L}}{\text{SPECIFIC GRAVITY}}$

TABLE XIV

FORMATION WATER CHARACTERIZATION
MIDDLE NW TOR 2/4-10X NORTH SEA NORWAY DST-6, FLOW 3 (10,440-10,510 FT)
WATER TAKEN FROM FLOOR TEST MANIFOLD 12/13/73

GEOCHEMISTRY BRANCH CODE, MWH
TOTAL DISSOLVED CHROMIUM = Not detected
RESISTIVITY, 25 DEG. C, 0.123 OHM METERS
PH = 6.08

TOTAL DISSOLVED SOLIDS = 5.65

INORGANIC CONSTITUENTS

CATIONS	CONCENTRATION WT/WT PER CENT	EQUIVALENTS PER 100 GRAMS	ANIONS	CONCENTRATION WT/WT PER CENT	EQUIVALENTS PER 100 GRAMS
SODIUM	1.7000	0.0739	CHLORIDE	3.2800	0.0925
POTASSIUM	0.0127	0.0003	BROMIDE	0.0105	0.0001
CALCIUM	0.5300	0.0264	IODIDE	0.0020	0.0000
MAGNESIUM	0.0230	0.0019	SULFATE	0.0203	0.0004
AMMONIUM	0.0026	0.0001	PHOSPHATE	0.0005	0.0000
AMMONIA	0.0000	0.0000	BICARBONATE	0.0440	0.0007
BARIUM	<0.00095	0.0000	CARBONATE	0.0000	0.0000
STRONTIUM	0.0340	0.0008			
TOTAL =	2.3006	TOTAL = 0.1034	TOTAL =	3.3572	TOTAL = 0.0938

DISSOLVED AROMATIC HYDROCARBONS

COMPOUND	CONCENTRATION PPM
BENZENE	2.60
TOLUENE	0.00

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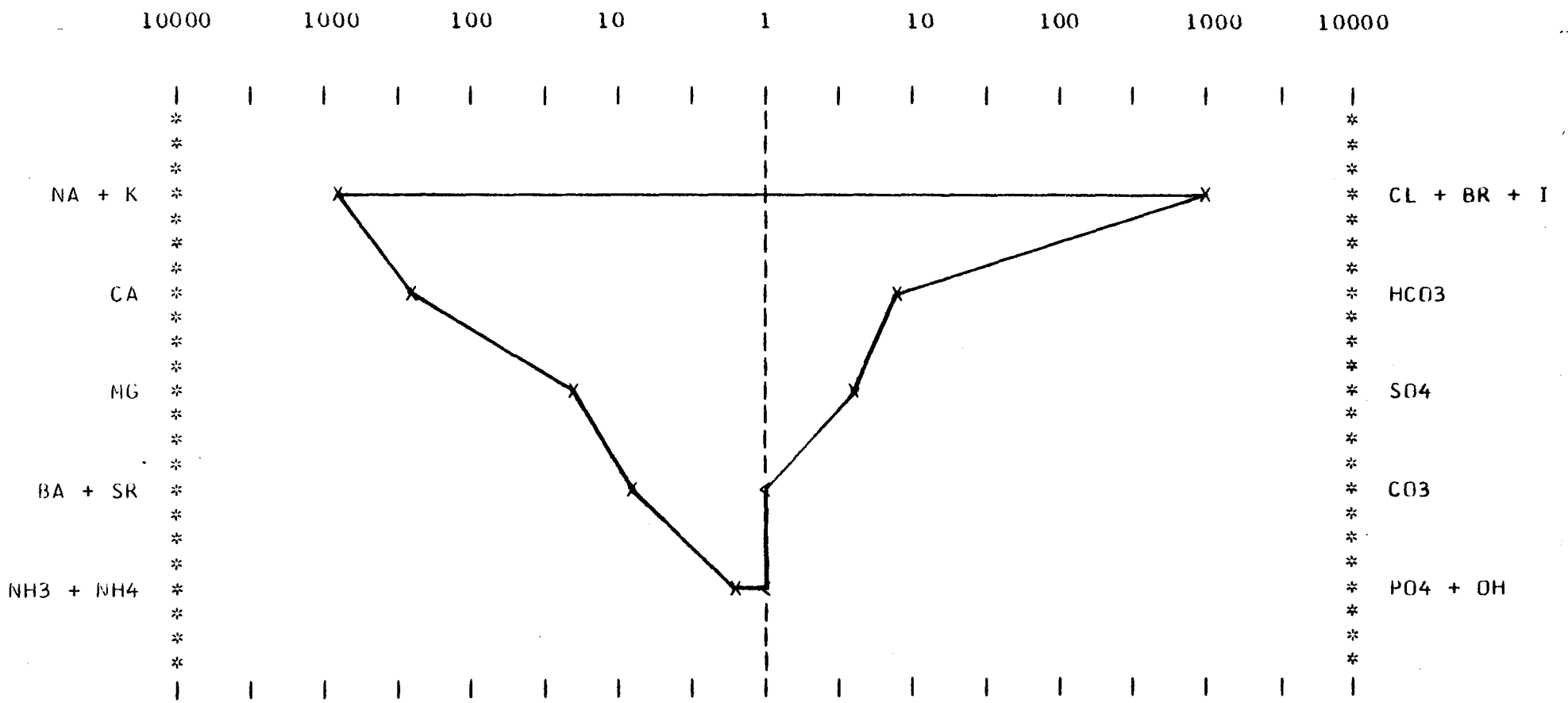
FIGURE 16

STIFF DIAGRAM FOR WATER SAMPLE MWH

MIDDLE NW TOR 2/4-10X NORTH SEA NORWAY DST-6
WATER TAKEN FROM FLOOR TEST MANIFOLD 12/13/73

MILLIEQUIVALENTS / LITER



DAM-4-3-75

TABLE

FORMATION WATER CHARACTERIZATION

NORWAY NORTH SEA TURFELT 2/4-10X

GEOLOGICAL BRANCH CODE: G174MWH
TOTAL DISSOLVED CHROMIUM = .0000
RESISTIVITY, 25 DEG. C= .1232 OHM METERS
PH = 6.0799 TOTAL DISSOLVED SOLIDS = 5.6567

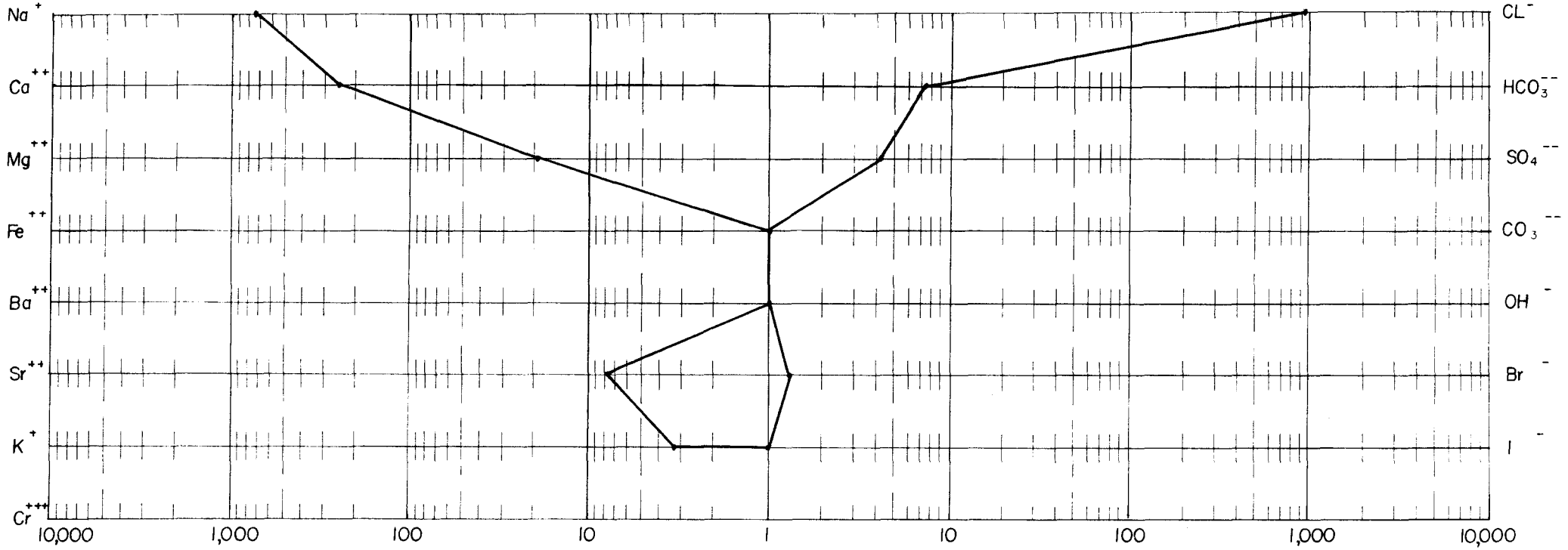
INORGANIC CONSTITUENTS

CATIONS	CONCENTRATION WT/WT PER CENT	EQUIVALENTS PER 100 GRAMS	ANIONS	CONCENTRATION WT/WT PER CENT	EQUIVALENTS PER 100 GRAMS
SODIUM	1.6999	.0739	CHLORIDE	3.2799	.0925
POTASSIUM	.0126	.0003	BROMIDE	.0104	.0001
CALCIUM	.5299	.0264	IODIDE	.0019	.0000
MAGNESIUM	.0229	.0018	SULFATE	.0202	.0004
AMMONIUM	.0000	.0000	PHOSPHATE	.0004	.0000
AMMONIA	.0000	.0000	BICARBONATE	.0439	.0007
BARIUM	.0006	.0000	CARBONATE	.0000	.0000
STRONTIUM	.0339	.0007	HYDROXIDE	.0000	.0000
TOTAL = 2.3000	TOTAL = .1051		TOTAL = 3.3567	TOTAL = .0937	

DISSOLVED AROMATIC HYDROCARBONS

COMPOUND	CONCENTRATION PPM
BENZENE	2.59
TOLUENE	.00

STIFF DIAGRAM (LOGARITHMIC SCALE)



FIELD: N.W. TDR WELL: 2/4-10 K

FORMATION: EKOFISK TYPE RESERVOIR: OIL

PERFORATED INTERVAL: 10,440' - 10,510'

SAMPLE POINT: FLOW TEST MANIFOLD

SAMPLE DATE + TIME: Dec 13, 1983 DST#6 FLOW 3

DATE OF ANALYSIS: ?

ANALYSIS BY: B'VILLE R+D SAMPLE NUMBER: MWH

REMARKS: POST-ACID

SPECIFIC GRAVITY = ? AT ____

Ph = 6.08 AT ____

TOTAL DISSOLVED SOLIDS (LAB) = 56,567 Mg/L

T.D.S. / S.G. = ____ P.P.M. (CALC)

1.645 x Cl P.P.M. = ____ Na Cl EQUIVALENT

LAB MEASURED RESISTIVITY = 0.1348 / 0.1232 Ohm-METERS AT 25°C

ELEVATED RESISTIVITY = 0.0410 Ohm-METERS AT 118.33°C 245°F

ARP'S EQUATION
T_1 = TEMP. MEASURED
T_2 = ELEVATED TEMP.
R_1 RESIST. AT T_1
R_2 = RESIST. AT T_2

$R_2 = R_1 \left(\frac{T_1+6.77}{T_2+6.77}\right)°F$

$R_2 = R_1 \left(\frac{T_1+21.5}{T_2+21.5}\right)°C$

DISSOLVED SOLIDS

CATION	Mg/L	FACTOR	Meq/L	P.P.M.	ANION	Mg/L	FACTOR	Meq/L	P.P.M.
Na^+	16999	.0435	739		CL^-	32799	.0282	925	
Ca^{++}	5299	.0499	264		HCO_3^{--}	439	.0164	7.2	
Mg^{++}	229	.0823	19		SO_4^{--}	202	.0208	4.2	
Fe^{++}	—	.0358	—	—	CO_3^{--}	0	.0333	0	0
Ba^{++}	8	.0146	0.1		OH^-	0	.0588	0	0
Sr^{++}	339	.0228	7.7		Br^-	104	.0125	1.3	
K^+	126	.0256	3.2		I^-	19	.0079	0.2	
Cr^{+++}	—	.0577	—	—					
Li^+	—	.1441	—	—					

Meq /L = $\frac{\text{Mg/L x VALENCE}}{\text{MOLECULAR wt}}$ P.P.M. = $\frac{\text{Mg/L}}{\text{SPECIFIC GRAVITY}}$

TABLE XV

FORMATION WATER CHARACTERIZATION
BOTTOM NW TOK 2/4-10X NORTH SEA NORWAY DST-6, **FLOW 3 (10,440-10,510 FT)**
WATER TAKEN FROM FLOOR TEST MANIFOLD 12/13/73

GEOCHEMISTRY BRANCH CODE, MWI
TOTAL DISSOLVED CHROMIUM = **Not detected**
RESISTIVITY, 25 DEG. C, 0.123 OHM METERS
PH = 6.22 TOTAL DISSOLVED SOLIDS = 5.74

INORGANIC CONSTITUENTS

CATIONS	CONCENTRATION WT/WT PER CENT	EQUIVALENTS PER 100 GRAMS	ANIONS	CONCENTRATION WT/WT PER CENT	EQUIVALENTS PER 100 GRAMS
SODIUM	1.7000	0.0739	CHLORIDE	3.3700	0.0951
POTASSIUM	0.0127	0.0003	BROMIDE	0.0105	0.0001
CALCIUM	0.5300	0.0264	IODIDE	0.0020	0.0000
MAGNESIUM	0.0223	0.0018	SULFATE	0.0216	0.0004
AMMONIUM	0.0027	0.0001	PHOSPHATE	0.0005	0.0000
AMMONIA	0.0000	0.0000	BICARBONATE	0.0430	0.0007
BARIUM	< 0.00095	0.0000	CARBONATE	0.0000	0.0000
STRONTIUM	0.0340	0.0008			
TOTAL =	2.2999	TOTAL = 0.1033	TOTAL =	3.4475	TOTAL = 0.0963

DISSOLVED AROMATIC HYDROCARBONS

COMPOUND	CONCENTRATION PPM
BENZENE	2.50
TOLUENE	0.00

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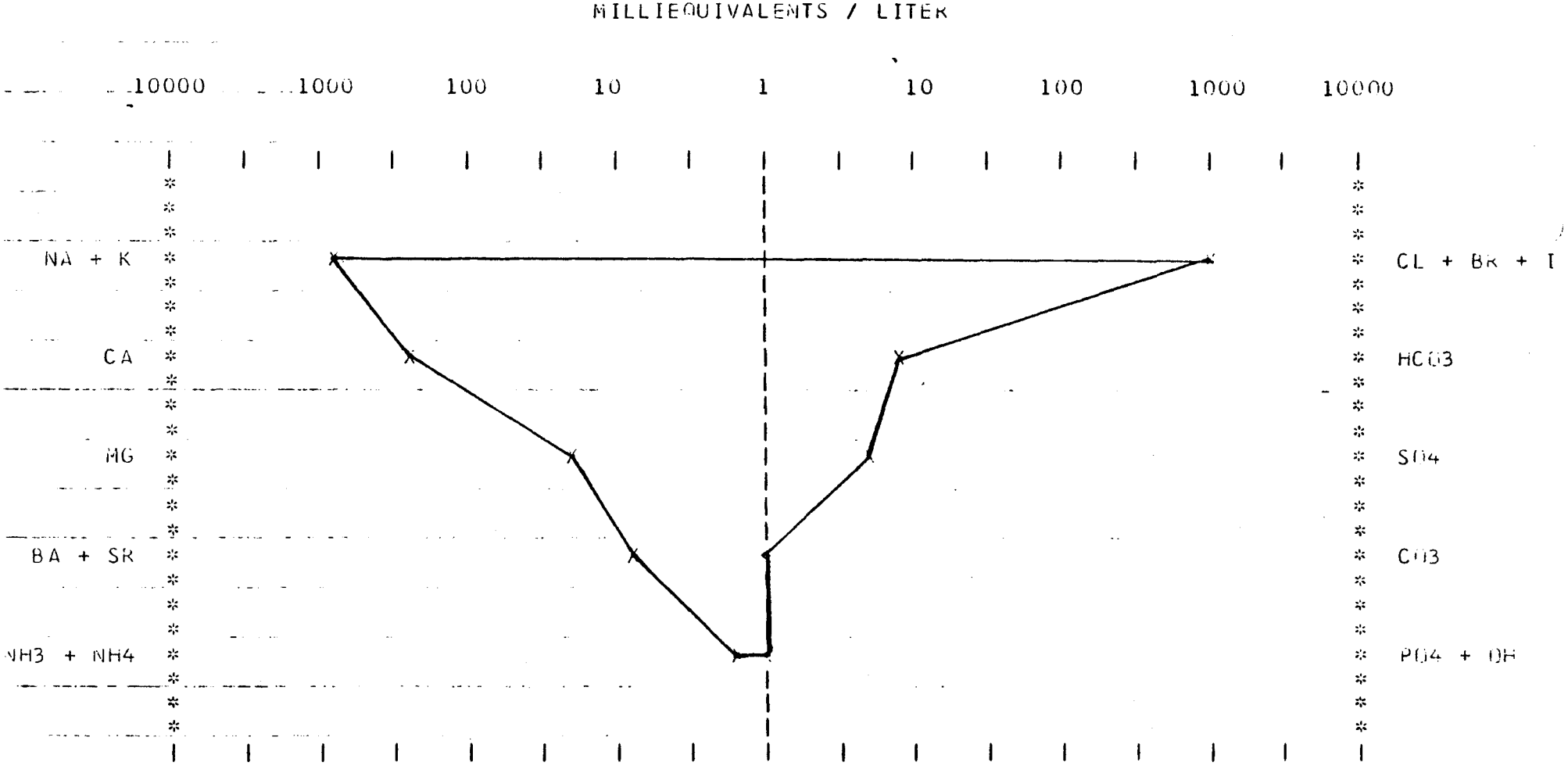
FIGURE 8
STIFF DIAGRAM FOR WATER SAMPLE MWI

BOTTOM MW TOR 2/4-10X NORTH SEA NORWAY DST-6
WATER TAKEN FROM FLOOR TEST MANIFOLD 12/13/73



TABLE

FORMATION WATER CHARACTERIZATION

NORWAY NORTH SEA TORFELT 2/4-10X

GEOLOGICAL BRANCH CODE: GI74MWI
TOTAL DISSOLVED CHROMIUM = .0000
RESISTIVITY, 25 DEG. C= .1231 OHM METERS
PH = 6.2199

TOTAL DISSOLVED SOLIDS = 5.7463

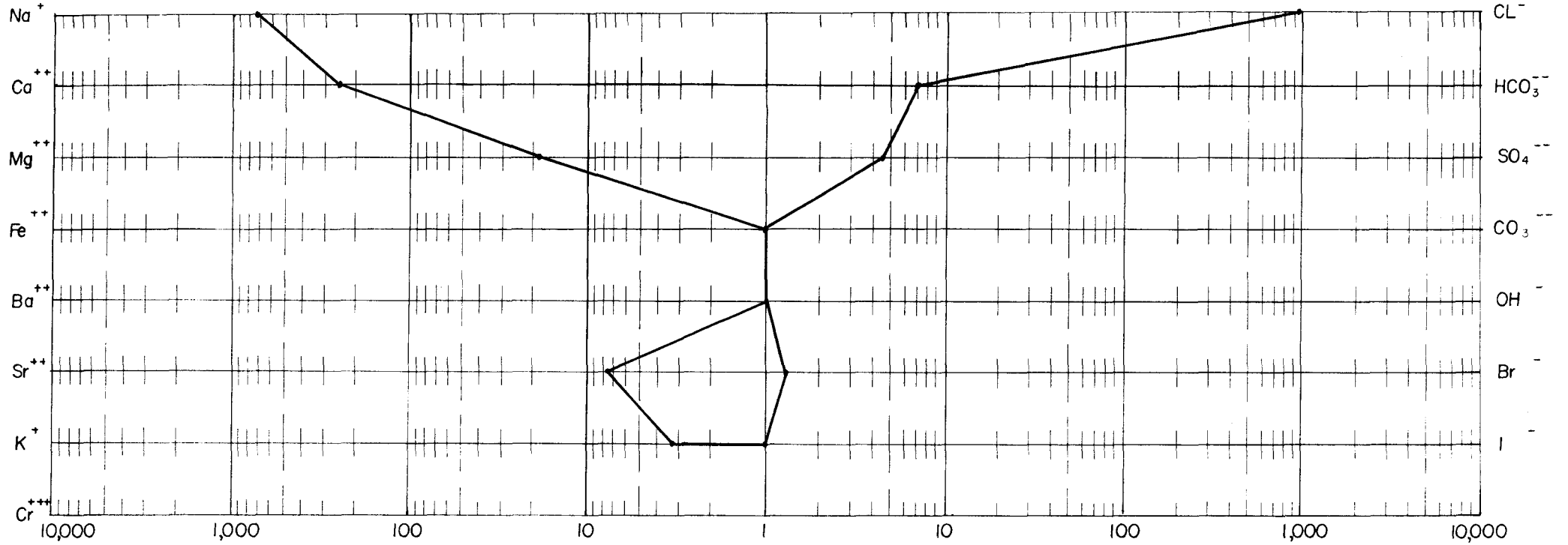
INORGANIC CONSTITUENTS

CATIONS	CONCENTRATION WT/WT PER CENT	EQUIVALENTS PER 100 GRAMS	ANIONS	CONCENTRATION WT/WT PER CENT	EQUIVALENTS PER 100 GRAMS
SODIUM	1.6999	.0739	CHLORIDE	3.3699	.0950
POTASSIUM	.0126	.0003	BROMIDE	.0104	.0001
CALCIUM	.5299	.0264	IODIDE	.0019	.0000
MAGNESIUM	.0222	.0018	SULFATE	.0215	.0004
AMMONIUM	.0000	.0000	PHOSPHATE	.0004	.0000
AMMONIA	.0000	.0000	BICARBONATE	.0429	.0007
BARIUM	.0008	.0000	CARBONATE	.0000	.0000
STRONTIUM	.0339	.0007	HYDROXIDE	.0000	.0000
TOTAL =	2.2993	TOTAL = .1031	TOTAL =	3.4470	TOTAL = .0962

DISSOLVED AROMATIC HYDROCARBONS

COMPOUND	CONCENTRATION PPM
BENZENE	2.49
TOLUENE	.00

STIFF DIAGRAM (LOGARITHMIC SCALE)



FIELD: N.W. TOR WELL: 2/4-10 X

FORMATION: EKOFISK TYPE RESERVOIR: O/C

PERFORATED INTERVAL: 10440 - 10510'

SAMPLE POINT: FLOOR TEST MANIFOLD

SAMPLE DATE + TIME: 13 DEC 1973 DST-6 FLOW 3

DATE OF ANALYSIS: ?

ANALYSIS BY: B'VILLE R+D SAMPLE NUMBER: MWI

REMARKS: POST-ACID

SPECIFIC GRAVITY = ? AT ____

Ph = 6.32 AT ____

TOTAL DISSOLVED SOLIDS (LAB) = 57463 Mg/L

T.D.S. / S.G. = ____ P.P.M. (CALC)

1.645 x Cl P.P.M. = ____ P.P.M. NaCl EQUIVALENT

LAB MEASURED RESISTIVITY = 0.1347 / 0.1237 Ohm-METERS AT 21°C / 25°C

ELEVATED RESISTIVITY = 0.0409 Ohm-METERS AT 118.33°C 245°F

ARP'S EQUATION

T_1 = TEMP. MEASURED

T_2 = ELEVATED TEMP.

R_1 RESIST. AT T_1

R_2 = RESIST. AT T_2

$R_2 = R_1 \left(\frac{T_1+6.77}{T_2+6.77}\right)°F$

$R_2 = R_1 \left(\frac{T_1+21.5}{T_2+21.5}\right)°C$

DISSOLVED SOLIDS

CATION	Mg/L	FACTOR	Meq/L	P.P.M.	ANION	Mg/L	FACTOR	Meq/L	P.P.M.
Na^+	16999	.0435	739		CL^-	33699	.0282	950	
Ca^{++}	5299	.0499	264		HCO_3^{--}	429	.0164	7	
Mg^{++}	222	.0823	18.3		SO_4^{--}	215	.0208	4.5	
Fe^{++}	—	.0358	—	—	CO_3^{--}	0	.0333	0	0
Ba^{++}	8	.0146	0.1		OH^-	0	.0588	0	0
Sr^{++}	339	.0228	7.7		Br^-	104	.0125	1.3	
K^+	126	.0256	3.2		I^-	19	.0079	0.2	
Cr^{+++}	—	.0577	—	—					
Li^+	—	.1441	—	—					

$\text{Meq/L} = \frac{\text{Mg/L} \times \text{VALENCE}}{\text{MOLECULAR wt}}$ $\quad \text{P.P.M.} = \frac{\text{Mg/L}}{\text{SPECIFIC GRAVITY}}$

TABLE XVI

FORMATION WATER CHARACTERIZATION
DRILLING MUD NW TOK 2/4-10X NORTH SEA NORWAY DST-6, FLOW 3 (10,440-10,510 FT)
WATER TAKEN FROM FLOOR TEST MANIFOLD 12/13/73

GEOCHEMISTRY BRANCH CODE, MWJ
TOTAL DISSOLVED CHROMIUM = Not detected
RESISTIVITY, 25 DEG. C, 0.123 OHM METERS
PH = 6.08 TOTAL DISSOLVED SOLIDS = 5.75

INORGANIC CONSTITUENTS

CATIONS	CONCENTRATION WT/WT PER CENT	EQUIVALENTS PER 100 GRAMS	ANIONS	CONCENTRATION WT/WT PER CENT	EQUIVALENTS PER 100 GRAMS
SODIUM	1.7000	0.0739	CHLORIDE	3.3900	0.0956
POTASSIUM	0.0127	0.0003	BROMIDE	0.0105	0.0001
CALCIUM	0.5200	0.0259	IODIDE	0.0020	0.0000
MAGNESIUM	0.0226	0.0019	SULFATE	0.0195	0.0004
AMMONIUM	0.0026	0.0001	PHOSPHATE	0.0005	0.0000
AMMONIA	0.0000	0.0000	BICARBONATE	0.0420	0.0007
BARIUM	<0.00095	0.0000	CARBONATE	0.0000	0.0000
STRONTIUM	0.0335	0.0008			
TOTAL =	2.2897	TOTAL = 0.1028	TOTAL =	3.4644	TOTAL = 0.0968

DISSOLVED AROMATIC HYDROCARBONS

COMPOUND	CONCENTRATION PPM
BENZENE	3.30
TOLUENE	0.00

DAM-43-75

FIGURE 18

STIFF DIAGRAM FOR WATER SAMPLE MWJ

DRILLING MUD NW TOR 2/4-10X NORTH SEA NORWAY DST-6
WATER TAKEN FROM FLOOR TEST MANIFOLD 12/13/73

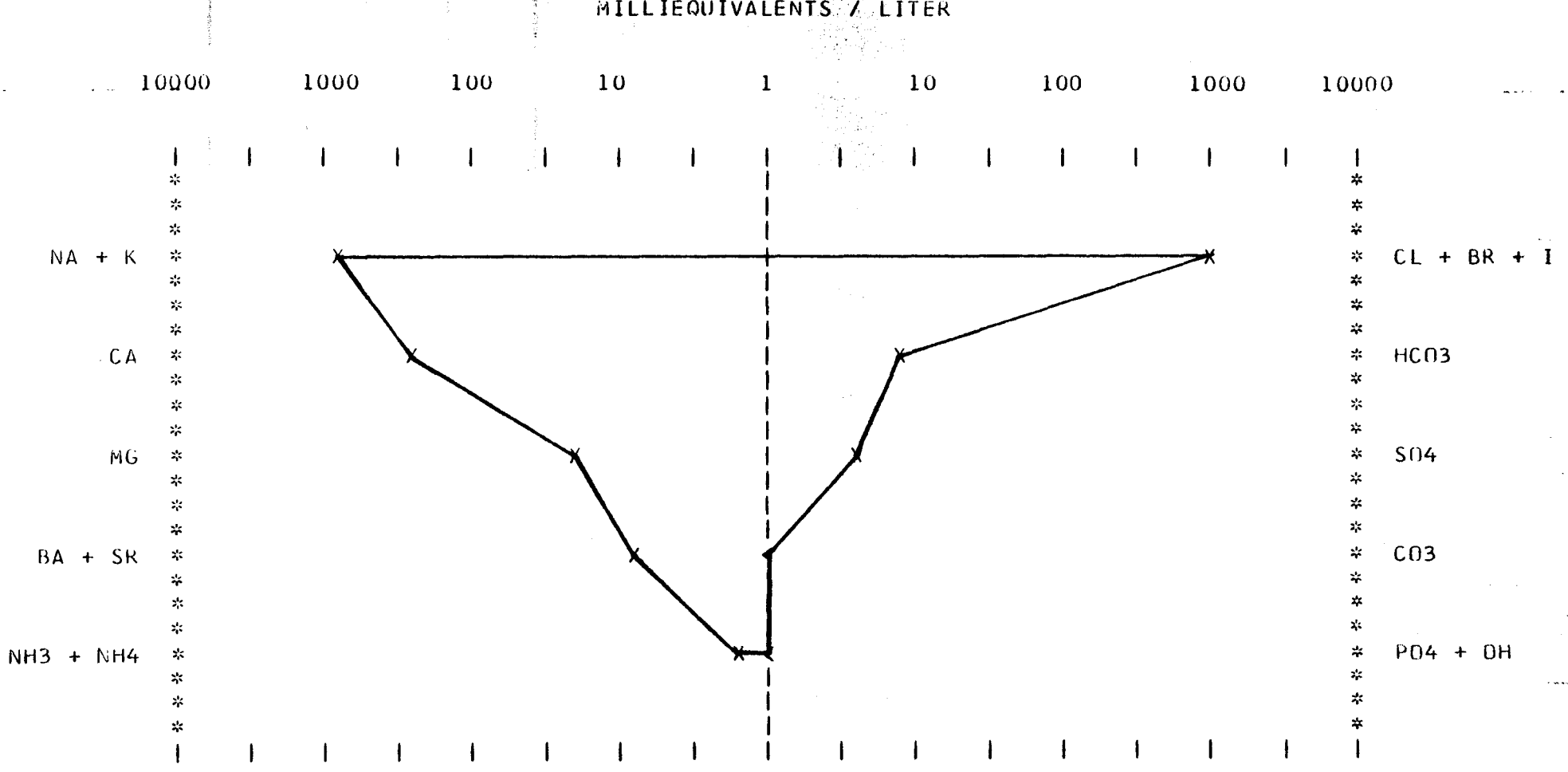


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TABLE

FORMATION WATER CHARACTERIZATION

NORWAY NORTH SEA TORFELT 2/4-10X

GEOLOGICAL BRANCH CODE: GI74MWJ
TOTAL DISSOLVED CHROMIUM = .0000
RESISTIVITY, 25 DEG. C= .1236 OHM METERS
PH = 6.0799 TOTAL DISSOLVED SOLIDS = 5.7530

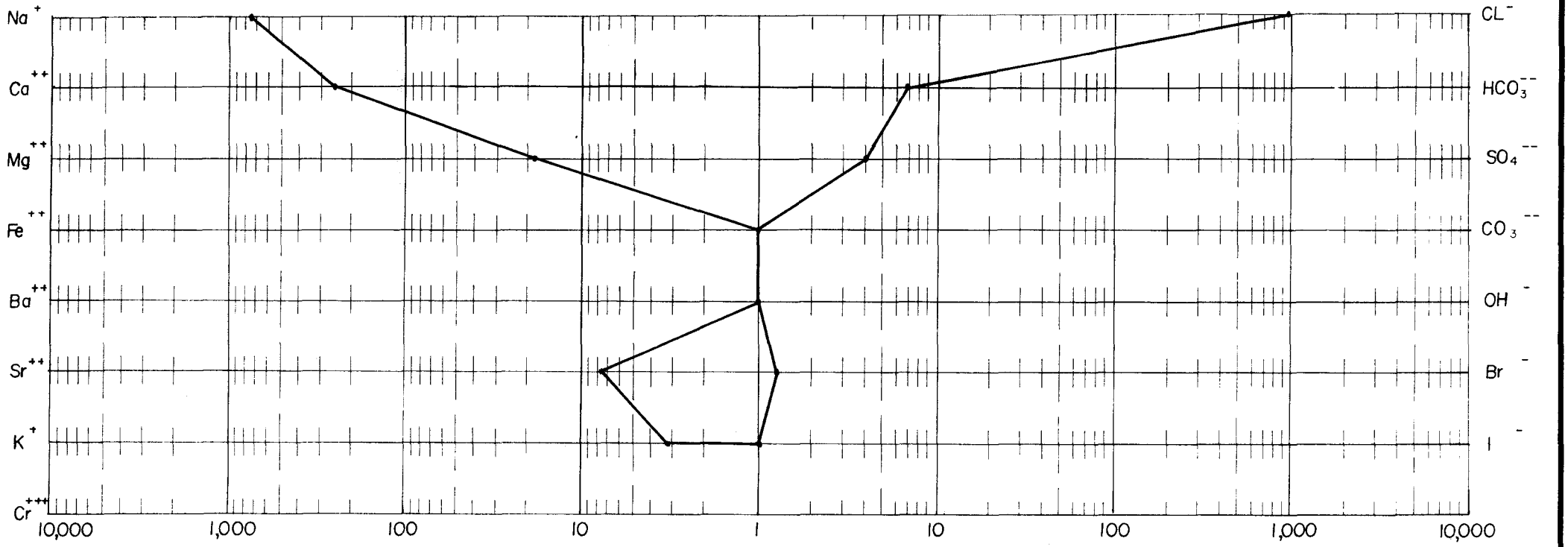
INORGANIC CONSTITUENTS

CATIONS	CONCENTRATION WT/WT PER CENT	EQUIVALENTS PER 100 GRAMS	ANIONS	CONCENTRATION WT/WT PER CENT	EQUIVALENTS PER 100 GRAMS
SODIUM	1.6999	.0739	CHLORIDE	3.3699	.0956
POTASSIUM	.0126	.0003	BROMIDE	.0104	.0001
CALCIUM	.5199	.0259	IODIDE	.0019	.0000
MAGNESIUM	.0225	.0018	SULFATE	.0194	.0004
AMMONIUM	.0000	.0000	PHOSPHATE	.0004	.0000
AMMONIA	.0000	.0000	BICARBONATE	.0419	.0006
BARIUM	.0008	.0000	CARBONATE	.0000	.0000
STRONTIUM	.0334	.0007	HYDROXIDE	.0000	.0000
TOTAL =	2.2891	TOTAL = .1026	TOTAL =	3.4639	TOTAL = .0967

DISSOLVED AROMATIC HYDROCARBONS

COMPOUND	CONCENTRATION PPM
BENZENE	3.29
TOLUENE	.00

STIFF DIAGRAM (LOGARITHMIC SCALE)



FIELD: N.W.TOR WELL: 2/4-10X

FORMATION: EKOFISK TYPE RESERVOIR: OIL

PERFORATED INTERVAL: 10440 – 10510'

SAMPLE POINT: FLOW TEST MANIFOLD

SAMPLE DATE + TIME: 13 DEC 1973 DSF6 FLOW 3

DATE OF ANALYSIS: ?

ANALYSIS BY: B'VILLE RHD SAMPLE NUMBER: MW5

REMARKS: POST-ACID

SPECIFIC GRAVITY = ? AT ____

Ph = 6.08 AT ____

TOTAL DISSOLVED SOLIDS (LAB) = 57,530 Mg/L

T.D.S. / S.G. = ____ P.P.M. (CALC)

1.645 x Cl P.P.M. = ____ P.P.M. NaCl EQUIVALENT

LAB MEASURED RESISTIVITY = 0.1352 / 0.1236 Ohm-METERS AT 21°C / 25°C

ELEVATED RESISTIVITY = 0.0411 Ohm-METERS AT 118.33? 245°F

ARP'S EQUATION
T_1 = TEMP. MEASURED
T_2 = ELEVATED TEMP.
R_1 RESIST. AT T_1
R_2 = RESIST. AT T_2

$R_2 = R_1 \left(\frac{T_1+6.77}{T_2+6.77}\right)$ °F

$R_2 = R_1 \left(\frac{T_1+21.5}{T_2+21.5}\right)$ °C

DISSOLVED SOLIDS

CATION	Mg/L	FACTOR	Meq/L	P.P.M.	ANION	Mg/L	FACTOR	Meq/L	P.P.M.
Na^+	16999	.0435	739		Cl^-	33899	.0282	956	
Ca^{++}	5799	.0499	259		HCO_3^{--}	419	.0164	6.9	
Mg^{++}	225	.0823	18.6		SO_4^{--}	194	.0208	4	
Fe^{++}	—	.0358	—	—	CO_3^{--}	0	.0333	0	0
Ba^{++}	8	.0146	0.1		OH^-	0	.0588	0	0
Sr^{++}	334	.0228	7.6		Br^-	104	.0125	1.3	
K^+	126	.0256	3.2		I^-	19	.0079	0.2	
Cr^{+++}	—	.0577	—	—					
Li^+	—	.1441	—	—					

Meq/L = $\frac{\text{Mg/L} \times \text{VALENCE}}{\text{MOLECULAR wt}}$ P.P.M. = $\frac{\text{Mg/L}}{\text{SPECIFIC GRAVITY}}$

TABLE VI

FORMATION WATER CHARACTERIZATION
FLUID NW TOR 2/4-10X NORTH SEA NORWAY DST-2 , **FLOW 2 (10,640-10,655 FT)**
OIL AND WATER TAKEN AT SEPARATOR WATER OUTLET 11/29/73

GEOCHEMISTRY BRANCH CODE, MWK
TOTAL DISSOLVED CHROMIUM = **Not detected**
RESISTIVITY, 25 DEG. C, 0.118 OHM METERS
PH = 6.90

TOTAL DISSOLVED SOLIDS = 5.82

INORGANIC CONSTITUENTS

CATIONS	CONCENTRATION WT/WT PER CENT	EQUIVALENTS PER 100 GRAMS	ANIONS	CONCENTRATION WT/WT PER CENT	EQUIVALENTS PER 100 GRAMS
SODIUM	2.0000	0.0870	CHLORIDE	3.4000	0.0959
POTASSIUM	0.0240	0.0006	BROMIDE	0.0165	0.0002
CALCIUM	0.2600	0.0130	IODIDE	0.0030	0.0000
MAGNESIUM	0.0238	0.0020	SULFATE	0.0175	0.0004
AMMONIUM	0.0046	0.0002	PHOSPHATE	<0.0005	0.0000
AMMONIA	0.0000	0.0000	BICARBONATE	0.0260	0.0004
BARIUM	<0.00095	0.0000	CARBONATE	0.0000	0.0000
STRONTIUM	0.0555	0.0013			
TOTAL =	2.3642	TOTAL = 0.1038	TOTAL =	3.4634	TOTAL = 0.0969

DISSOLVED AROMATIC HYDROCARBONS

COMPOUND	CONCENTRATION PPM
BENZENE	**Suspended**
TOLUENE	**oil present**

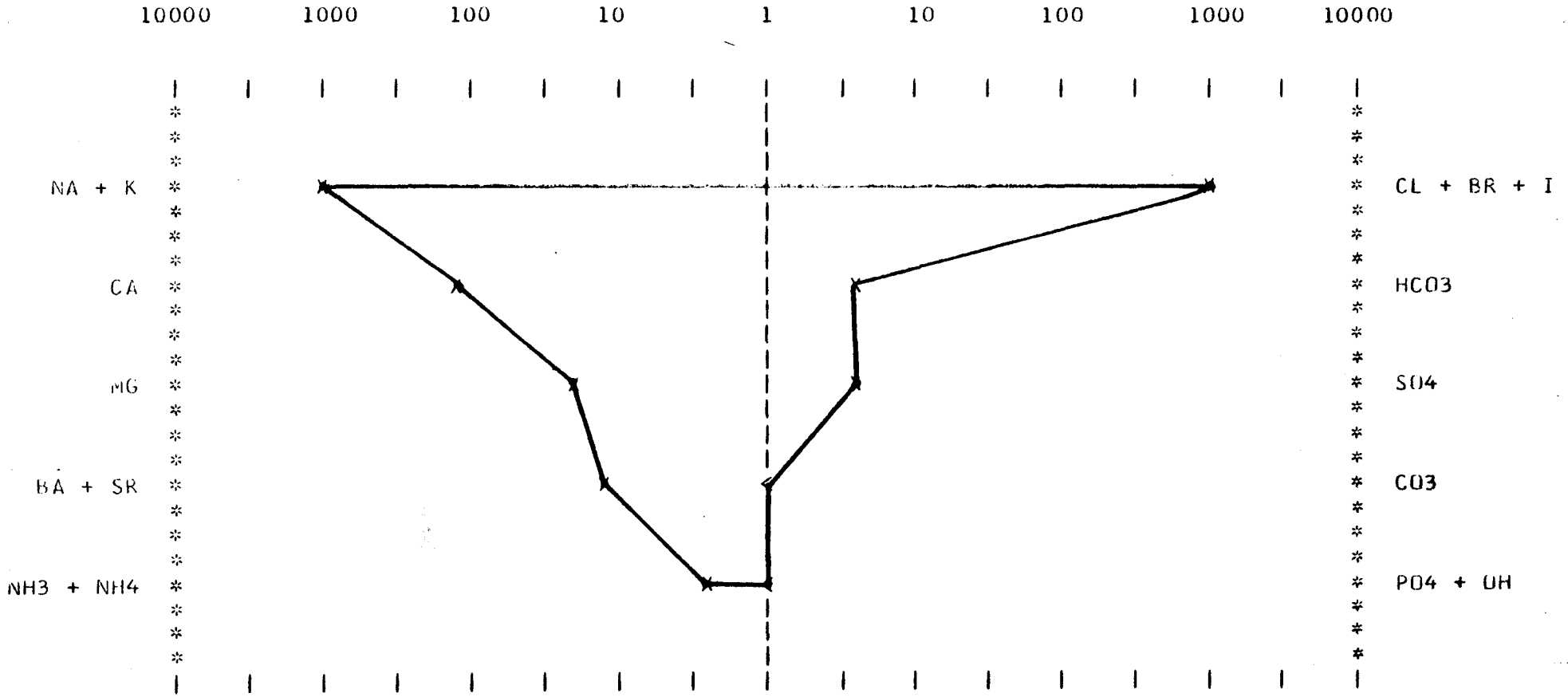
DAH-43-75

FIGURE 8

STIFF DIAGRAM FOR WATER SAMPLE MWK

FLUID NW TOR 2/4-10X NORTH SEA NORWAY DST-2
OIL AND WATER TAKEN AT SEPARATOR WATER OUTLET 11/29/73

MILLIEQUIVALENTS / LITER



DAH-13-75

TABLE

FORMATION WATER CHARACTERIZATION

NORWAY NORTH SEA TORFELT 2/4-10X

GEOLOGICAL BRANCH CODE: G174MWK
TOTAL DISSOLVED CHROMIUM = .0000
RESISTIVITY, 25 DEG. C= .1163 OHM METERS
PH = 5.8999 TOTAL DISSOLVED SOLIDS = 5.8266

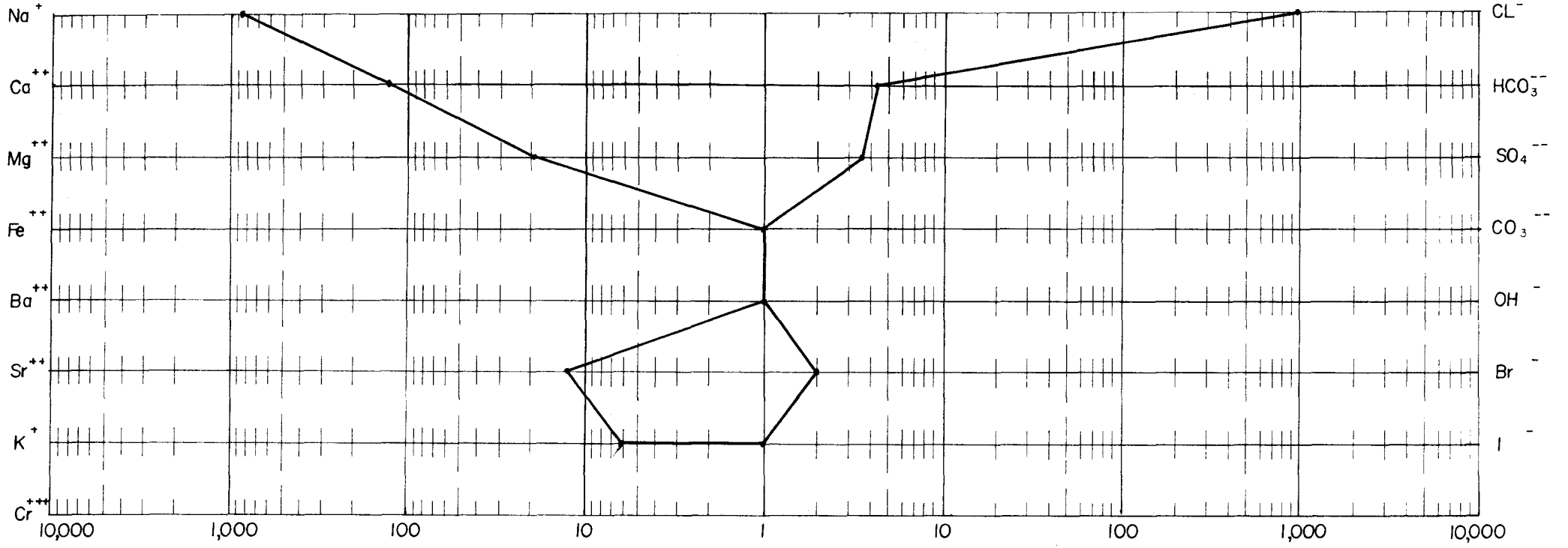
INORGANIC CONSTITUENTS

CATIONS	CONCENTRATION WT/WT PER CENT	EQUIVALENTS PER 100 GRAMS	ANIONS	CONCENTRATION WT/WT PER CENT	EQUIVALENTS PER 100 GRAMS
SODIUM	2.0000	.0869	CHLORIDE	3.3999	.0958
POTASSIUM	.0239	.0006	BROMIDE	.0164	.0002
CALCIUM	.2599	.0129	IODIDE	.0029	.0000
MAGNESIUM	.0237	.0019	SULFATE	.0174	.0003
AMMONIUM	.0000	.0000	PHOSPHATE	.0004	.0000
AMMONIA	.0000	.0000	BICARBONATE	.0259	.0004
BARIUM	.0008	.0000	CARBONATE	.0000	.0000
STRONTIUM	.0554	.0012	HYDROXIDE	.0000	.0000
TOTAL =	2.3657	TOTAL = .1035	TOTAL =	3.4629	TOTAL = .0967

DISSOLVED AROMATIC HYDROCARBONS

COMPOUND	CONCENTRATION PPM
BENZENE	.00
TOLUENE	.00

STIFF DIAGRAM (LOGARITHMIC SCALE)



FIELD: N.W. TOR WELL: 2/4-10X

FORMATION: EKOFISK TYPE RESERVOIR: OIL

PERFORATED INTERVAL: 10,640 - 10655

SAMPLE POINT: SEPARATOR WATER OUTLET

SAMPLE DATE + TIME: 29 NOV. 1973 DST-2 Flow 2

DATE OF ANALYSIS: ?

ANALYSIS BY: B'VILLE R+D SAMPLE NUMBER: MWK

REMARKS: POST-ACID

SPECIFIC GRAVITY = ? AT

Ph = 6.9 AT

TOTAL DISSOLVED SOLIDS (LAB) = 58,266 Mg/L

T.D.S. / S.G. = P.P.M. (CALC)

1.645 x Cl P.P.M. = P.P.M. NaCl EQUIVALENT

LAB MEASURED RESISTIVITY = .1294 / .1183 Ohm-METERS AT 35°C

ELEVATED RESISTIVITY = 0.0393 Ohm-METERS AT 118.35°C 245°F

ARP'S EQUATION

T_1 = TEMP. MEASURED

T_2 = ELEVATED TEMP.

R_1 RESIST. AT T_1

R_2 = RESIST. AT T_2

$R_2 = R_1 \left(\frac{T_1+6.77}{T_2+6.77}\right)$ °F

$R_2 = R_1 \left(\frac{T_1+21.5}{T_2+21.5}\right)$ °C

DISSOLVED SOLIDS

CATION	Mg/L	FACTOR	Meq/L	P.P.M.	ANION	Mg/L	FACTOR	Meq/L	P.P.M.
Na^+	20,000	.0435	870		CL^-	33,999	.0282	959	
Ca^{++}	2599	.0499	130		HCO_3^{--}	259	.0164	4.2	
Mg^{++}	237	.0823	19.5		SO_4^{--}	174	.0208	3.6	
Fe^{++}	—	.0358	—	—	CO_3^{--}	0	.0333	0	0
Ba^{++}	8	.0146	0.1		OH^-	0	.0588	0	0
Sr^{++}	554	.0228	12.6		Br^-	164	.0125	2.0	
K^+	239	.0256	6.1		I^-	29	.0079	0.2	
Cr^{+++}	—	.0577	—	—					
Li^+	—	.1441	—	—					

Meq/L = $\frac{\text{Mg/L} \times \text{VALENCE}}{\text{MOLECULAR wt}}$ P.P.M. = $\frac{\text{Mg/L}}{\text{SPECIFIC GRAVITY}}$

TABLE VII

FORMATION WATER CHARACTERIZATION
FLUID NW TOR 2/4-10X NORTH SEA NORWAY DST-2, **FLOW 2 (10,640-10,655 FT)**
OIL AND WATER TAKEN AT SEPARATOR WATER OUTLET 11/29/73

GEOCHEMISTRY BRANCH CODE, MWL
TOTAL DISSOLVED CHROMIUM = **Not detected**
RESISTIVITY, 25 DEG. C, 0.117 OHM METERS
PH = 6.88

TOTAL DISSOLVED SOLIDS = 6.09

INORGANIC CONSTITUENTS

CATIONS	CONCENTRATION WT/WT PER CENT	EQUIVALENTS PER 100 GRAMS	ANIONS	CONCENTRATION WT/WT PER CENT	EQUIVALENTS PER 100 GRAMS
SODIUM	1.9800	0.0861	CHLORIDE	3.6900	0.1041
POTASSIUM	0.0231	0.0006	BROMIDE	0.0165	0.0002
CALCIUM	0.2600	0.0130	IODIDE	0.0030	0.0000
MAGNESIUM	0.0226	0.0019	SULFATE	0.0191	0.0004
AMMONIUM	0.0045	0.0002	PHOSPHATE	<0.0005	0.0000
AMMONIA	0.0000	0.0000	BICARBONATE	0.0250	0.0004
BARIUM	<0.00065	0.0000	CARBONATE	0.0000	0.0000
STRONTIUM	0.0550	0.0013			
TOTAL =	2.3414	TOTAL = 0.1026	TOTAL =	3.7540	TOTAL = 0.1051

DISSOLVED AROMATIC HYDROCARBONS

COMPOUND	CONCENTRATION PPM
BENZENE	**Suspended**
TOLUENE	**oil present**

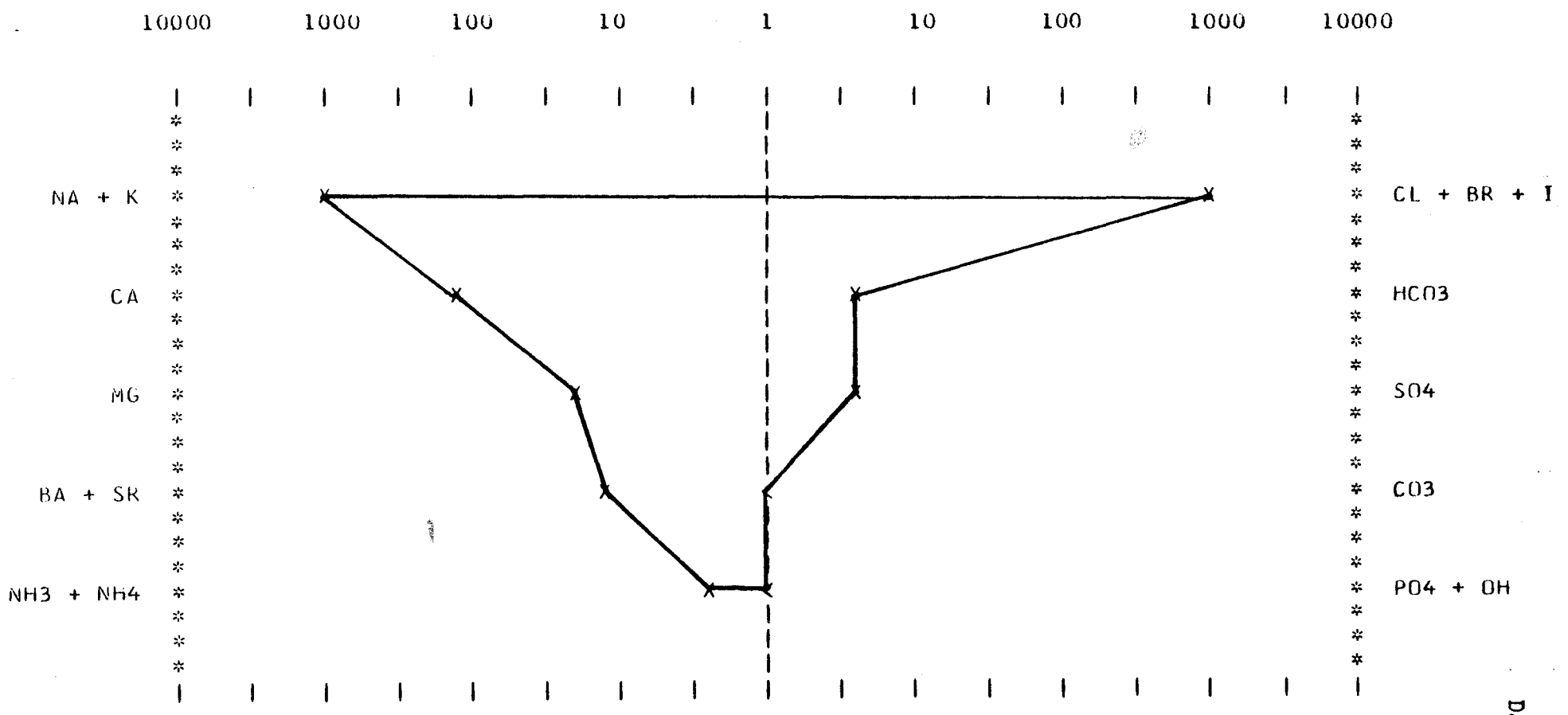
DAM-43-75

FIGURE 9

STIFF DIAGRAM FOR WATER SAMPLE MWL

FLUID NW TOR 2/4-10X NORTH SEA NORWAY DST-2
OIL AND WATER TAKEN AT SEPARATOR WATER OUTLET 11/29/73

MILLIEQUIVALENTS / LITER



DAM-43-75

TABLE

FORMATION WATER CHARACTERIZATION

NORWAY NORTH SEA TORFELT 2/4-10X

GEOLOGICAL BRANCH CODE: GI74MWL
TOTAL DISSOLVED CHROMIUM = 1.0000
RESISTIVITY, 25 DEG. C= .1177 OHM METERS
PH = 6.8799

TOTAL DISSOLVED SOLIDS = 6.0942

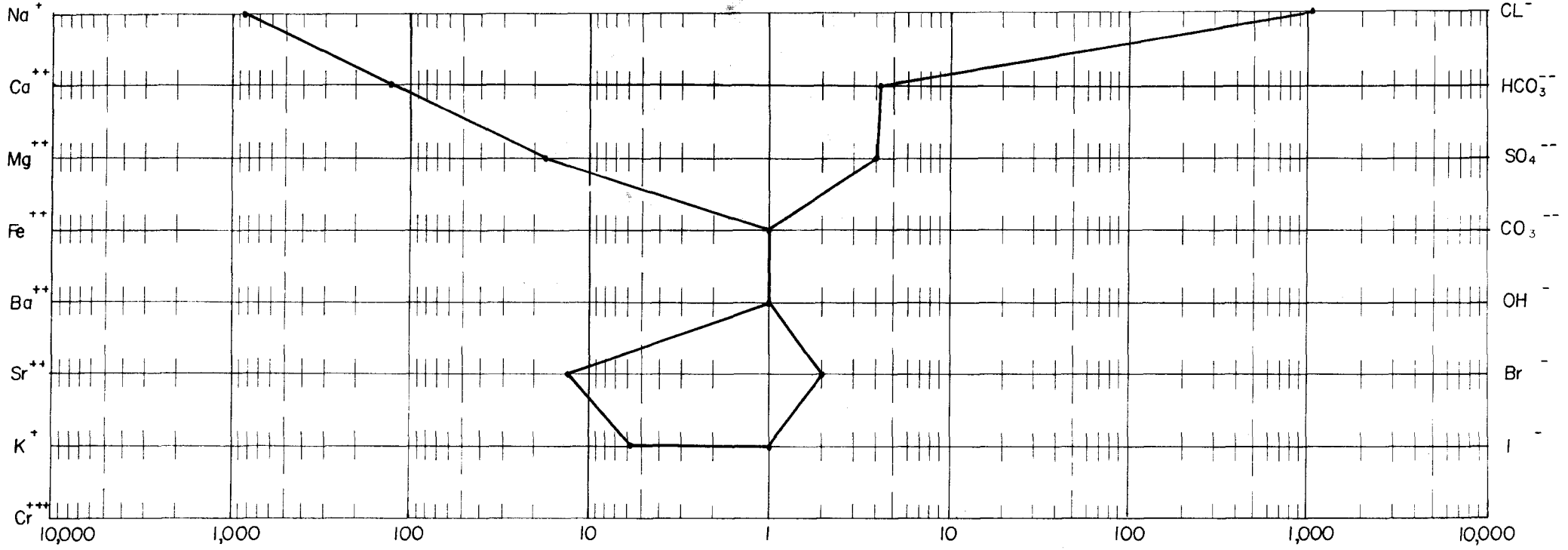
INORGANIC CONSTITUENTS

CATIONS	CONCENTRATION WT/WT PER CENT	EQUIVALENTS PER 100 GRAMS	ANIONS	CONCENTRATION WT/WT PER CENT	EQUIVALENTS PER 100 GRAMS
SODIUM	1.9799	.0861	CHLORIDE	3.6899	.1040
POTASSIUM	.0230	.0005	BROMIDE	.0164	.0002
CALCIUM	.2599	.0129	IODIDE	.0029	.0000
MAGNESIUM	.0225	.0018	SULFATE	.0190	.0003
AMMONIUM	.0000	.0000	PHOSPHATE	.0004	.0000
AMMONIA	.0000	.0000	BICARBONATE	.0249	.0004
BARIUM	.0005	.0000	CARBONATE	.0000	.0000
STRONTIUM	.0549	.0012	HYDROXIDE	.0000	.0000
TOTAL =	2.3407	TOTAL = .1025	TOTAL =	3.7535	TOTAL = .1049

DISSOLVED AROMATIC HYDROCARBONS

COMPOUND	CONCENTRATION PPM
BENZENE	.00
TOLUENE	.00

STIFF DIAGRAM (LOGARITHMIC SCALE)



FIELD: NW. TOR WELL: 2/4-10X

FORMATION: EKOFISK TYPE RESERVOIR: OIL

PERFORATED INTERVAL: 10640'-10655'

SAMPLE POINT: SEPARATOR WATER OUTLET

SAMPLE DATE + TIME: 29 NOV 1973 DST-2 FLOW 2

DATE OF ANALYSIS: ?

ANALYSIS BY: B'VILLE R+D SAMPLE NUMBER: MWL

REMARKS: POST-ACID

SPECIFIC GRAVITY = ? AT

Ph = 6.88 AT

TOTAL DISSOLVED SOLIDS (LAB) = 60,942 Mg/L

T.D.S. / S.G. = P.P.M. (CALC)

1.645 x Cl P.P.M. = P.P.M. NaCl EQUIVALENT

LAB MEASURED RESISTIVITY = 0.1288 Ohm-METERS AT 21°C / 0.1177 AT 25°C

ELEVATED RESISTIVITY = 0.0391 Ohm-METERS AT 118.33°C 245°F

ARP'S EQUATION

T_1 = TEMP. MEASURED

T_2 = ELEVATED TEMP.

R_1 = RESIST. AT T_1

R_2 = RESIST. AT T_2

$R_2 = R_1 \left(\frac{T_1+6.77}{T_2+6.77}\right)$ °F

$R_2 = R_1 \left(\frac{T_1+21.5}{T_2+21.5}\right)$ °C

DISSOLVED SOLIDS

CATION	Mg/L	FACTOR	Meq/L	P.P.M.	ANION	Mg/L	FACTOR	Meq/L	P.P.M.
Na^+	19,799	.0435	861		CL^-	36899	.0282	1041	
Ca^{++}	2599	.0499	130		HCO_3^{--}	249	.0164	4.1	
Mg^{++}	225	.0823	18.5		SO_4^{--}	190	.0208	4	
Fe^{++}	—	.0358	—	—	CO_3^{--}	0	.0333	0	0
Ba^{++}	5	.0146	0.1		OH^-	0	.0588	0	0
Sr^{++}	549	.0228	12.5		Br^-	164	.0125	2.0	
K^+	230	.0256	5.9		I^-	29	.0079	0.2	
Cr^{+++}	—	.0577	—	—					
Li^+	—	.1441	—	—					

Meq/L = $\frac{\text{Mg/L} \times \text{VALENCE}}{\text{MOLECULAR wt}}$ P.P.M. = $\frac{\text{Mg/L}}{\text{SPECIFIC GRAVITY}}$

TABLE VIII

FORMATION WATER CHARACTERIZATION
FLUID NW TOR 2/4-10X NORTH SEA NORWAY DST-2, **FLOW 2 (10,640-10,655 FT)**
OIL AND WATER TAKEN AT SEPARATOR WATER OUTLET 11/29/73

GEOCHEMISTRY BRANCH CODE, MWM
TOTAL DISSOLVED CHROMIUM = **Not detected**
RESISTIVITY, 25 DEG. C, 0.118 OHM METERS
PH = 6.78

TOTAL DISSOLVED SOLIDS = 6.05

INORGANIC CONSTITUENTS

CATIONS	CONCENTRATION WT/WT PER CENT	EQUIVALENTS PER 100 GRAMS	ANIONS	CONCENTRATION WT/WT PER CENT	EQUIVALENTS PER 100 GRAMS
SODIUM	1.9500	0.0848	CHLORIDE	3.7000	0.1044
POTASSIUM	0.0230	0.0006	BROMIDE	0.0175	0.0002
CALCIUM	0.2300	0.0115	IODIDE	0.0030	0.0000
MAGNESIUM	0.0198	0.0016	SULFATE	0.0196	0.0004
AMMONIUM	0.0046	0.0002	PHOSPHATE	<0.0005	0.0000
AMMONIA	0.0000	0.0000	BICARBONATE	0.0250	0.0004
BARIUM	<0.00065	0.0000	CARBONATE	0.0000	0.0000
STRONTIUM	0.0645	0.0015			
TOTAL =	2.2880	TOTAL = 0.1000	TOTAL =	3.7655	TOTAL = 0.1054

DISSOLVED AROMATIC HYDROCARBONS

COMPOUND	CONCENTRATION PPM
BENZENE	**Suspended**
TOLUENE	**oil present**

DAM-43-75

FIGURE 10

STIFF DIAGRAM FOR WATER SAMPLE MWM

FLUID NW TOR 2/4-10X NORTH SEA NORWAY DST-2
OIL AND WATER TAKEN AT SEPARATOR WATER OUTLET 11/29/73

MILLIEQUIVALENTS / LITER

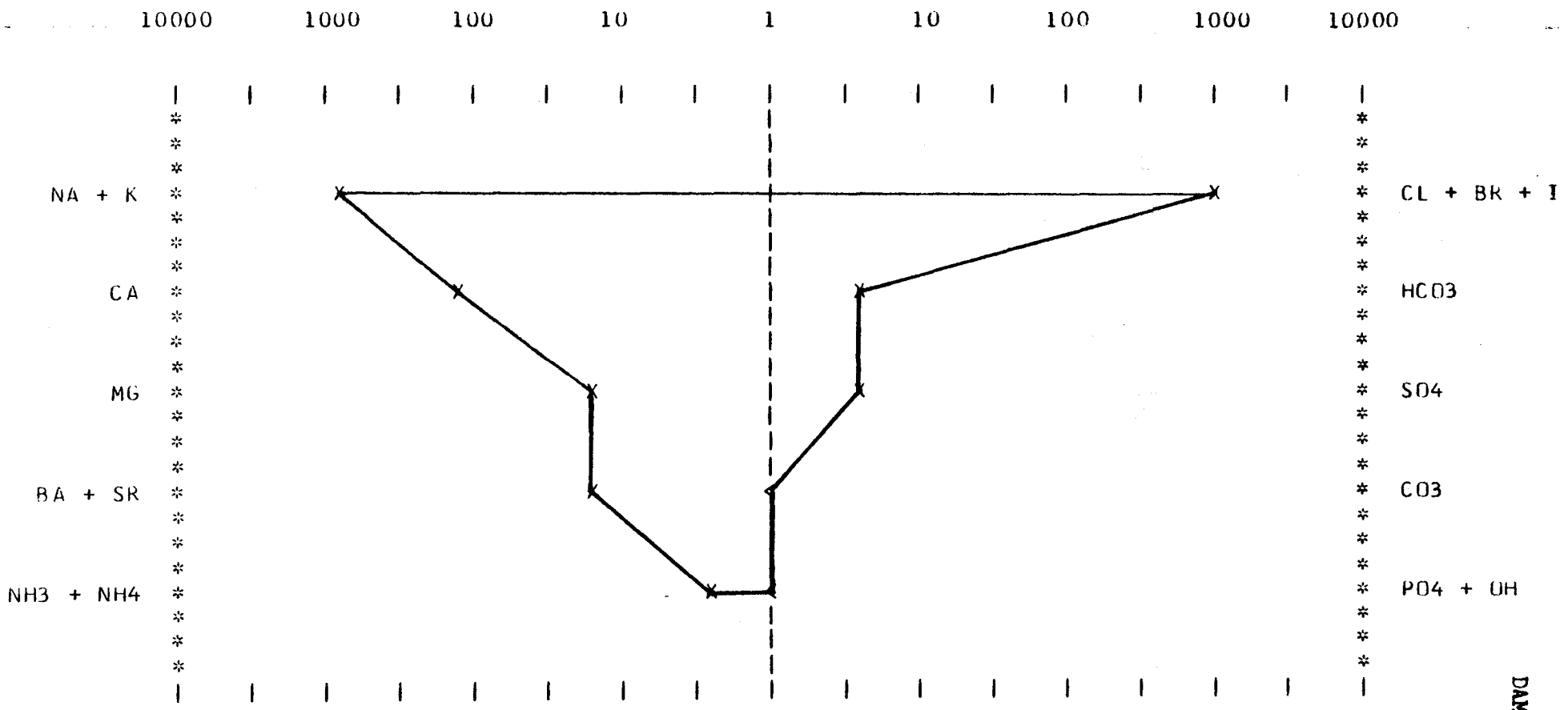


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TABLE

FORMATION WATER CHARACTERIZATION

NORWAY NORTH SEA TORFELT 2/4-10X

GEOLOGICAL BRANCH CODE: G174MWM
TOTAL DISSOLVED CHROMIUM = 1.0000
RESISTIVITY, 25 DEG. C= .1181 OHM METERS
PH = 6.7799 TOTAL DISSOLVED SOLIDS = 6.0523

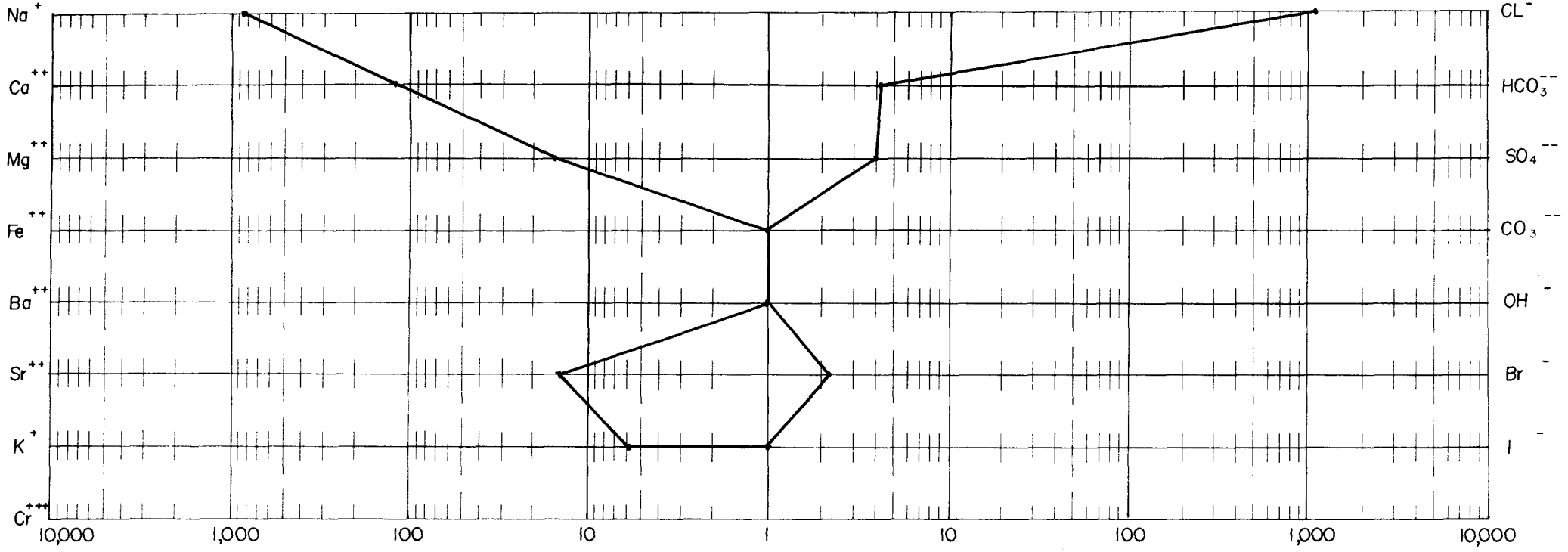
INORGANIC CONSTITUENTS

CATIONS	CONCENTRATION WT/WT PER CENT	EQUIVALENTS PER 100 GRAMS	ANIONS	CONCENTRATION WT/WT PER CENT	EQUIVALENTS PER 100 GRAMS
SODIUM	1.9499	.0848	CHLORIDE	3.6999	.1043
POTASSIUM	.0229	.0005	BROMIDE	.0174	.0002
CALCIUM	.2299	.0114	IODIDE	.0029	.0000
MAGNESIUM	.0197	.0016	SULFATE	.0195	.0004
AMMONIUM	.0000	.0000	PHOSPHATE	.0004	.0000
AMMONIA	.0000	.0000	BICARBONATE	.0249	.0004
BARIUM	.0005	.0000	CARBONATE	.0000	.0000
STRONTIUM	.0044	.0014	HYDROXIDE	.0000	.0000
TOTAL =	2.2673	TOTAL = .0997	TOTAL =	3.7650	TOTAL = .1053

DISSOLVED AROMATIC HYDROCARBONS

COMPOUND	CONCENTRATION PPM
BENZENE	.00
TOLUENE	.00

STIFF DIAGRAM (LOGARITHMIC SCALE)



FIELD: N.W. TOR WELL: 2/4-10X

FORMATION: EKOFISK TYPE RESERVOIR: O/L

PERFORATED INTERVAL: 10640', 10655'

SAMPLE POINT: SEPARATOR WATER OUTLET

SAMPLE DATE + TIME: 09 NOV. 1973 DST-2 Flow 2

DATE OF ANALYSIS: ?

ANALYSIS BY: B'VILLE R+D SAMPLE NUMBER: MWM

REMARKS: POST-ACID

SPECIFIC GRAVITY = 1.- AT ____

Ph = 6.78 AT ____

TOTAL DISSOLVED SOLIDS (LAB) = 60,523 Mg/L

T.D.S. / S.G. = ____ P.P.M. (CALC)

1.645 x Cl P.P.M. = ____ P.P.M. NaCl EQUIVALENT

LAB MEASURED RESISTIVITY = 0.1292 / 0.1187 Ohm-METERS AT 25°C

ELEVATED RESISTIVITY = 0.0393 Ohm-METERS AT 118.33°C 245°F

ARP'S EQUATION
T_1 = TEMP. MEASURED
T_2 = ELEVATED TEMP.
R_1 RESIST. AT T_1
R_2 = RESIST. AT T_2

$R_2 = R_1 \left(\frac{T_1+6.77}{T_2+6.77}\right)$ °F

$R_2 = R_1 \left(\frac{T_1+21.5}{T_2+21.5}\right)$ °C

DISSOLVED SOLIDS

CATION	Mg/L	FACTOR	Meq/L	P.P.M.	ANION	Mg/L	FACTOR	Meq/L	P.P.M.
Na^+	19499	.0435	848		CL^-	36,999	.0282	1043	
Ca^{++}	2299	.0499	115		HCO_3^{--}	249	.0164	4.1	
Mg^{++}	197	.0823	16.2		SO_4^{--}	195	.0208	4.0	
Fe^{++}	—	.0358	—	—	CO_3^{--}	0	.0333	0	0
Ba^{++}	5	.0146	0.1		OH^-	0	.0588	0	0
Sr^{++}	644	.0228	14.7		Br^-	174	.0125	2.2	
K^+	229	.0256	5.9		I^-	29	.0079	0.2	
Cr^{+++}	—	.0577	—	—					
Li^+	—	.1441	—	—					

Meq /L = $\frac{\text{Mg/L x VALENCE}}{\text{MOLECULAR wt}}$ P.P.M. = $\frac{\text{Mg/L}}{\text{SPECIFIC GRAVITY}}$

TABLE IX

FORMATION WATER CHARACTERIZATION
FLUID NW TOR 2/4-10X NORTH SEA NORWAY DST-2, **FLOW 2 (10,640-10,655 FT)**
OIL AND WATER TAKEN AT SEPARATOR WATER OUTLET 11/29/73

GEOCHEMISTRY BRANCH CODE, MWN
TOTAL DISSOLVED CHROMIUM = **Not detected**
RESISTIVITY, 25 DEG. C, 0.118 OHM METERS
PH = 7.00

TOTAL DISSOLVED SOLIDS = 6.04

INORGANIC CONSTITUENTS

CATIONS	CONCENTRATION WT/WT PER CENT	EQUIVALENTS PER 100 GRAMS	ANIONS	CONCENTRATION WT/WT PER CENT	EQUIVALENTS PER 100 GRAMS
SODIUM	1.9600	0.0853	CHLORIDE	3.6500	0.1030
POTASSIUM	0.0230	0.0006	BROMIDE	0.0180	0.0002
CALCIUM	0.2600	0.0130	IODIDE	0.0030	0.0000
MAGNESIUM	0.0219	0.0018	SULFATE	0.0196	0.0004
AMMONIUM	0.0044	0.0002	PHOSPHATE	<0.0005	0.0000
AMMONIA	0.0000	0.0000	BICARBONATE	0.0260	0.0004
BARIUM	<0.00075	0.0000	CARBONATE	0.0000	0.0000
STRONTIUM	0.0645	0.0015			
TOTAL =	2.3302	TOTAL = 0.1021	TOTAL =	3.7170	TOTAL = 0.1040

DISSOLVED AROMATIC HYDROCARBONS

COMPOUND	CONCENTRATION PPM
BENZENE	**Suspended**
TOLUENE	**oil present**

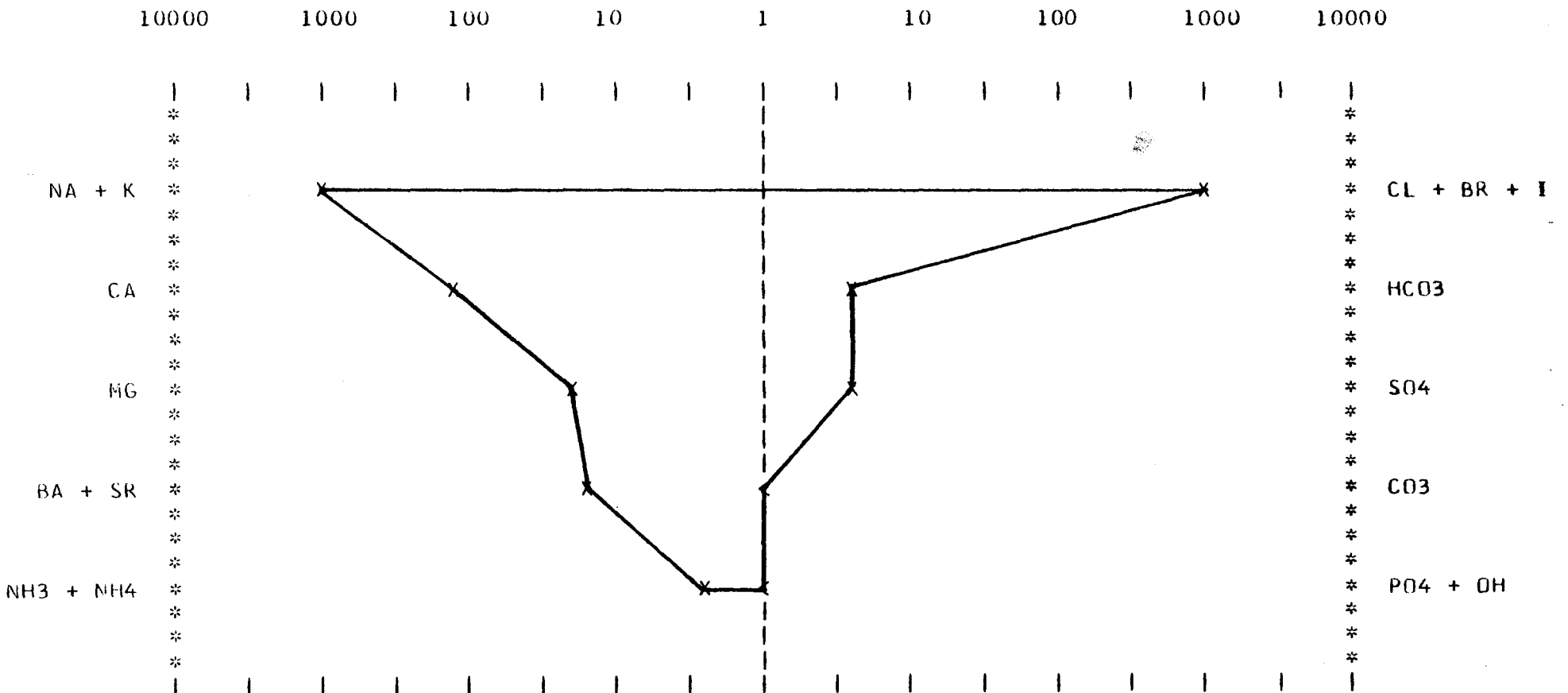
DAM-43-75

FIGURE 11

STIFF DIAGRAM FOR WATER SAMPLE MWN

FLUID NW TOR 2/4-10X NORTH SEA NORWAY DST-2
OIL AND WATER TAKEN AT SEPARATOR WATER OUTLET 11/29/73

MILLIEQUIVALENTS / LITER



DAM-3-75

TABLE

FORMATION WATER CHARACTERIZATION

NORWAY NORTH SEA TORFELT 2/4-10X

GEOLOGICAL BRANCH CODE: G174MWN
TOTAL DISSOLVED CHROMIUM = 1.0000
RESISTIVITY, 25 DEG. C= .1180 OHM METERS
PH = 7.0000 TOTAL DISSOLVED SOLIDS = 6.0460

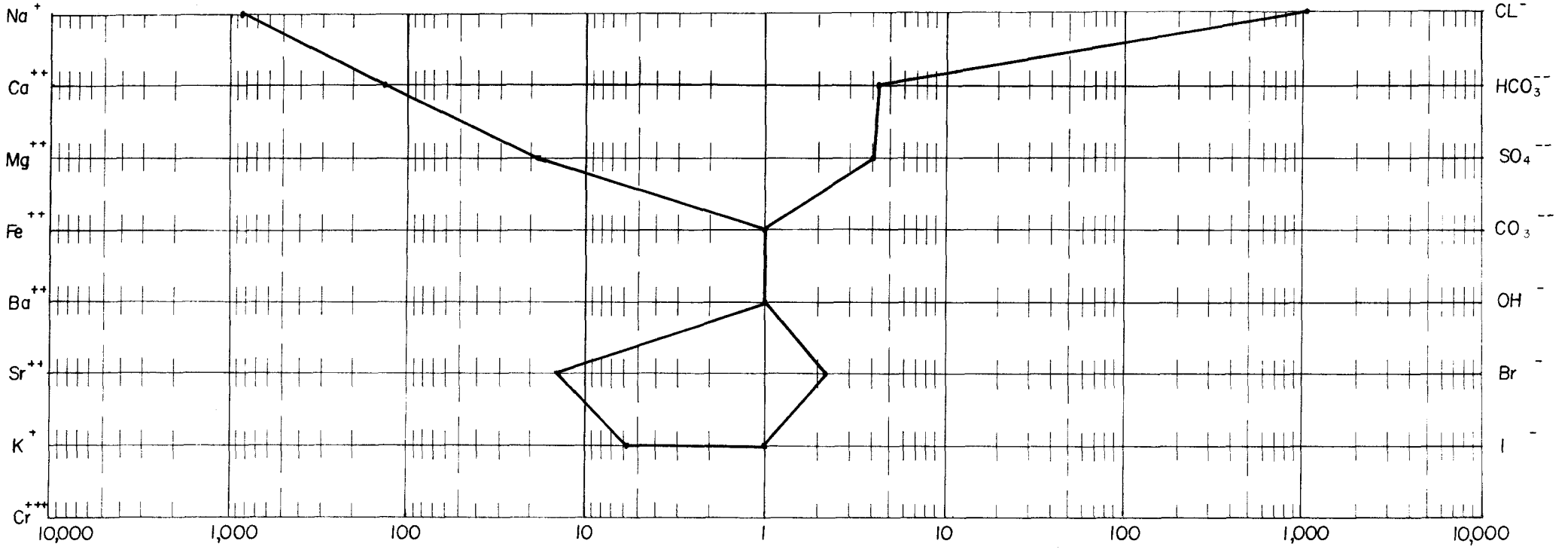
INORGANIC CONSTITUENTS

CATIONS	CONCENTRATION WT/WT PER CENT	EQUIVALENTS PER 100 GRAMS	ANIONS	CONCENTRATION WT/WT PER CENT	EQUIVALENTS PER 100 GRAMS
SODIUM	1.9599	.0852	CHLORIDE	3.6499	.1029
POTASSIUM	.0229	.0005	BROMIDE	.0179	.0002
CALCIUM	.2599	.0129	IODIDE	.0029	.0000
MAGNESIUM	.0218	.0017	SULFATE	.0195	.0004
AMMONIUM	.0000	.0000	PHOSPHATE	.0004	.0000
AMMONIA	.0000	.0000	BICARBONATE	.0259	.0004
BARIUM	.0006	.0000	CARBONATE	.0000	.0000
STRONTIUM	.0044	.0014	HYDROXIDE	.0000	.0000
TOTAL =	2.3295	TOTAL = .1017	TOTAL =	3.7165	TOTAL = .1039

DISSOLVED AROMATIC HYDROCARBONS

COMPOUND	CONCENTRATION PPM
BENZENE	.00
TOLUENE	.00

STIFF DIAGRAM (LOGARITHMIC SCALE)



FIELD: N.W. TOR WELL: 2/4-10K

FORMATION: EKO FISK TYPE RESERVOIR: O/C

PERFORATED INTERVAL: 10640'-10655'

SAMPLE POINT: SEPARATOR WATER OUTLET

SAMPLE DATE + TIME: 09 NOV 1973 DST-2 Flow 2

DATE OF ANALYSIS: ?

ANALYSIS BY: B'VILLE R+D SAMPLE NUMBER: MWN

REMARKS: POST-ACID

SPECIFIC GRAVITY = ? AT ____

Ph = 7.0 AT ____

TOTAL DISSOLVED SOLIDS (LAB) = 60460 Mg/L

T.D.S. / S.G. = ____ P.P.M. (CALC)

1.645 x Cl P.P.M. = ____ NaCl EQUIVALENT

LAB MEASURED RESISTIVITY = .1291 / .1180 Ohm-METERS AT 21°C

ELEVATED RESISTIVITY = 0.0392 Ohm-METERS AT 118.33°C 245°F

ARP'S EQUATION
T_1 = TEMP. MEASURED
T_2 = ELEVATED TEMP.
R_1 RESIST. AT T_1
R_2 = RESIST. AT T_2

$R_2 = R_1 \left(\frac{T_1+6.77}{T_2+6.77}\right)$ °F

$R_2 = R_1 \left(\frac{T_1+21.5}{T_2+21.5}\right)$ °C

DISSOLVED SOLIDS

CATION	Mg/L	FACTOR	Meq/L	P.P.M.	ANION	Mg/L	FACTOR	Meq/L	P.P.M.
Na^+	19599	.0435	853		CL^-	36499	.0282	1029	
Ca^{++}	2599	.0499	130		HCO_3^{--}	259	.0164	4.2	
Mg^{++}	218	.0823	18		SO_4^{--}	195	.0208	4.0	
Fe^{++}	—	.0358	—	—	CO_3^{--}	0	.0333	0	0
Ba^{++}	6	.0146	0.1		OH^-	0	.0588	0	0
Sr^{++}	644	.0228	14.7		Br^-	179	.0125	2.2	
K^+	229	.0256	5.9		I^-	19	.0079	0.2	
Cr^{+++}	—	.0577	—	—					
Li^+	—	.1441	—	—					

Meq/L = $\frac{\text{Mg/L x VALENCE}}{\text{MOLECULAR wt}}$ P.P.M. = $\frac{\text{Mg/L}}{\text{SPECIFIC GRAVITY}}$