BECK

Save

THE TEXAS COMPANY

REFINING DEPARTMENT

TECHNICAL & RESEARCH DIVISION

REPORT ON

BEACON PRESENTATIONS

TULSA MEETING, JANUARY 28-29, 1952

Laboratory_____

Report No._____

Date_____

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GENERAL INFORMATION

Conversion Factors

Lb. MSCF x 16.91 = G/NCM
G/NCM x 0.05914 = Lb./MSCF

Definitions

$$\% C_3 \text{ Selectivity} = \frac{\text{Total } C_3^+ \text{ (incl. W.S.Oxy.)}}{\text{Total } C_1^+} \times 100$$

$$\text{W.S.Oxy Selectivity} = \frac{\text{W.S.Oxy.}}{\text{Total } C_1^+} \times 100$$

Gravelocity = SCFH/lb. of Catalyst

Brownsville Design Data

			Lb./MSCF	G/NCM	Gal./MSCF	
C_1C_2			2.05	34.6		
CO_2			6.01	101.6		
H_2O			11.00	186.0		
	C_3C_6	2.66		44.9	0.54	
	Rec. Oil	6.02		101.8	0.94	
	W.S.Oxy.	0.94		15.8	0.11	
Total	C_3^+		9.62	162.5		1.59

C_3^+ Selectivity = 82.4% W.S.Oxy. Selectivity = 8.1%

Bbl./Day

Gasoline	6079
Gas Oil	947
Fuel Oil	198
W.S.Oxy.	631
	7855

COMPARISON OF METHODS FOR EXPRESSING OXYGENATE YIELDS

(Values in grams/NCM)

Sample	Method I	Method II	Method III	
I	6.7	8.1	8.4	
II	8.2	11.0	10.3	
III	9.8	11.4	12.3	
IV	27.2	31.0	34.0	
V	21.5	23.7	26.9	
VI	16.2	19.8	20.2	
VII	19.4	24.2	24.2	33.1 Refractive Index
A	11.0	16.7	13.7	13.4 Montebello
B	17.8	24.3	22.3	21.5 Montebello

Stu 2nd – F.B. + R.T

METHODS OF CALCULATING OXYGENATE YIELDS

Method I

Assumed weighted density for ethanol-propanol mixture 0.80

Vol. salted out/100 cc. solution x 0.80 = Wt. % Total Oxygenates

Wt. % Oxygenates x Grams NCM Water Produced = Grams NCM Oxygenates

Method II

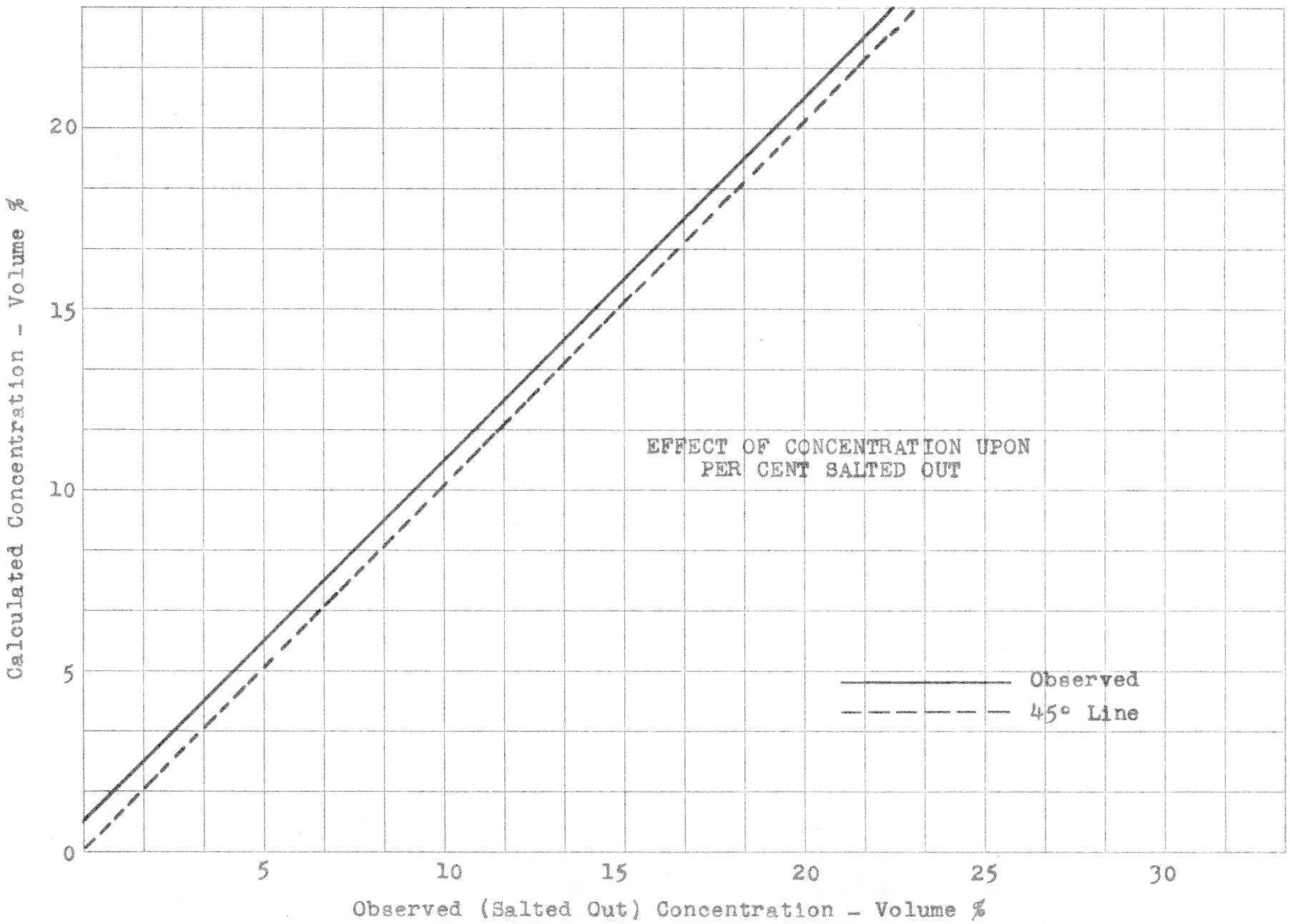
Assume (1) Avg. Density of Water Phase 0.995 g./cc.
(2) Avg. Density of Oxygenates 0.85
(3) 16% Water in Salted-out Oxygenates

Vol. of oxygenates salted out/100 cc. soln. x $\frac{0.850}{0.995}$ x 0.84 = Wt. % Oxygenates

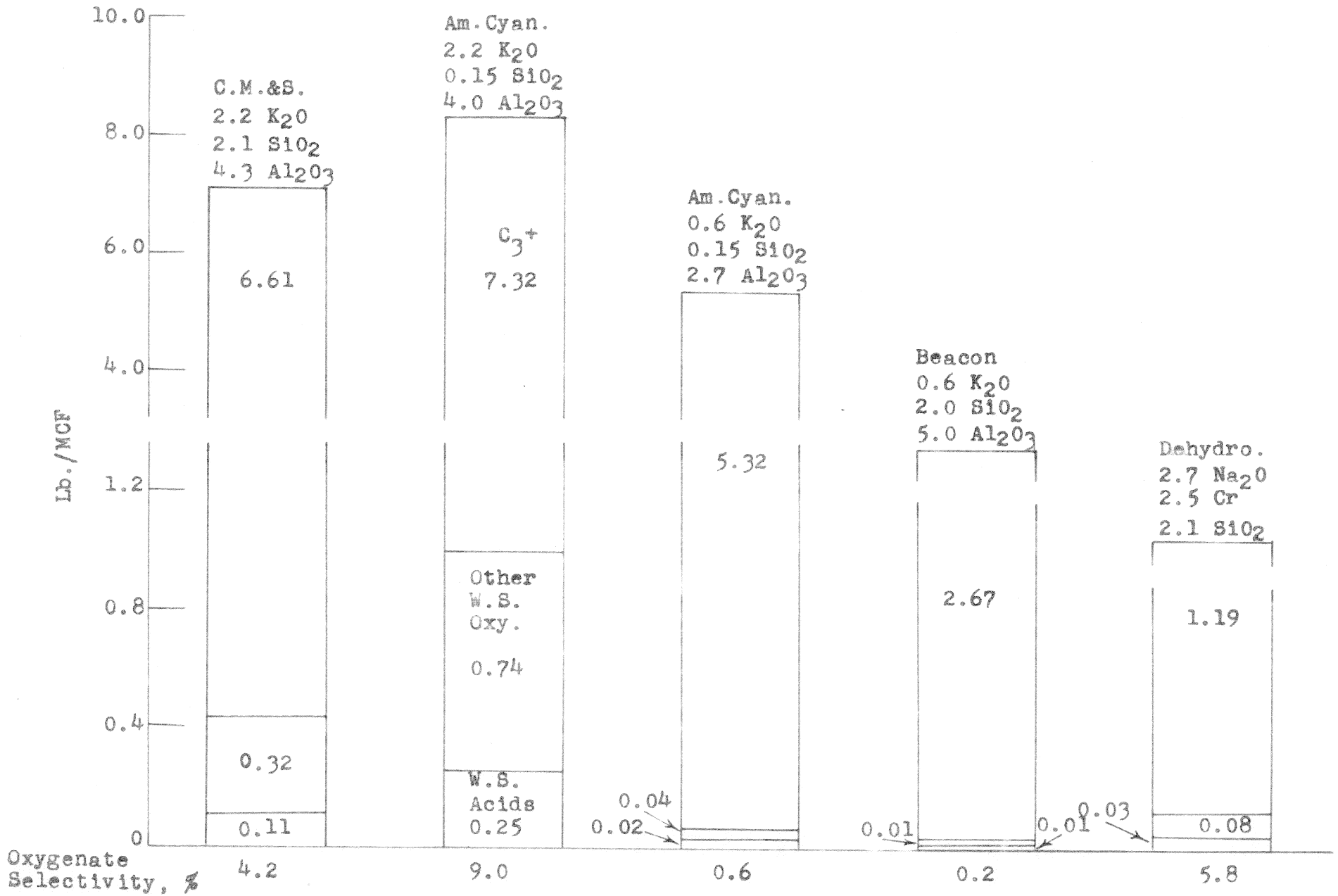
(Vol. % salted out x 0.72 + Wt. % acidity as acetic acid) x Grams/NCM Water Produced = Wt. of Oxygenates/NCM

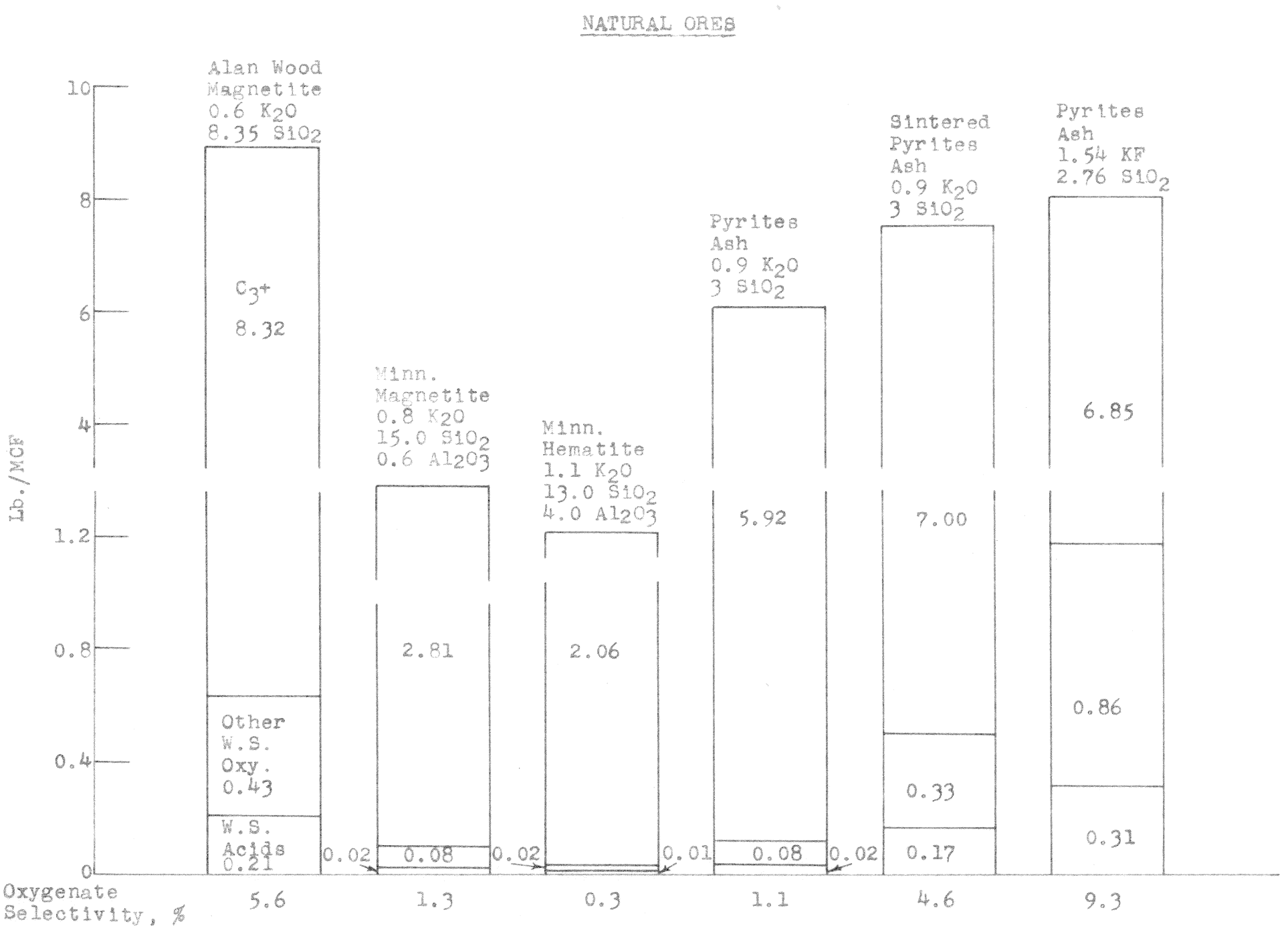
Method III

Vol. % salted out = Wt. % Total Oxygenates

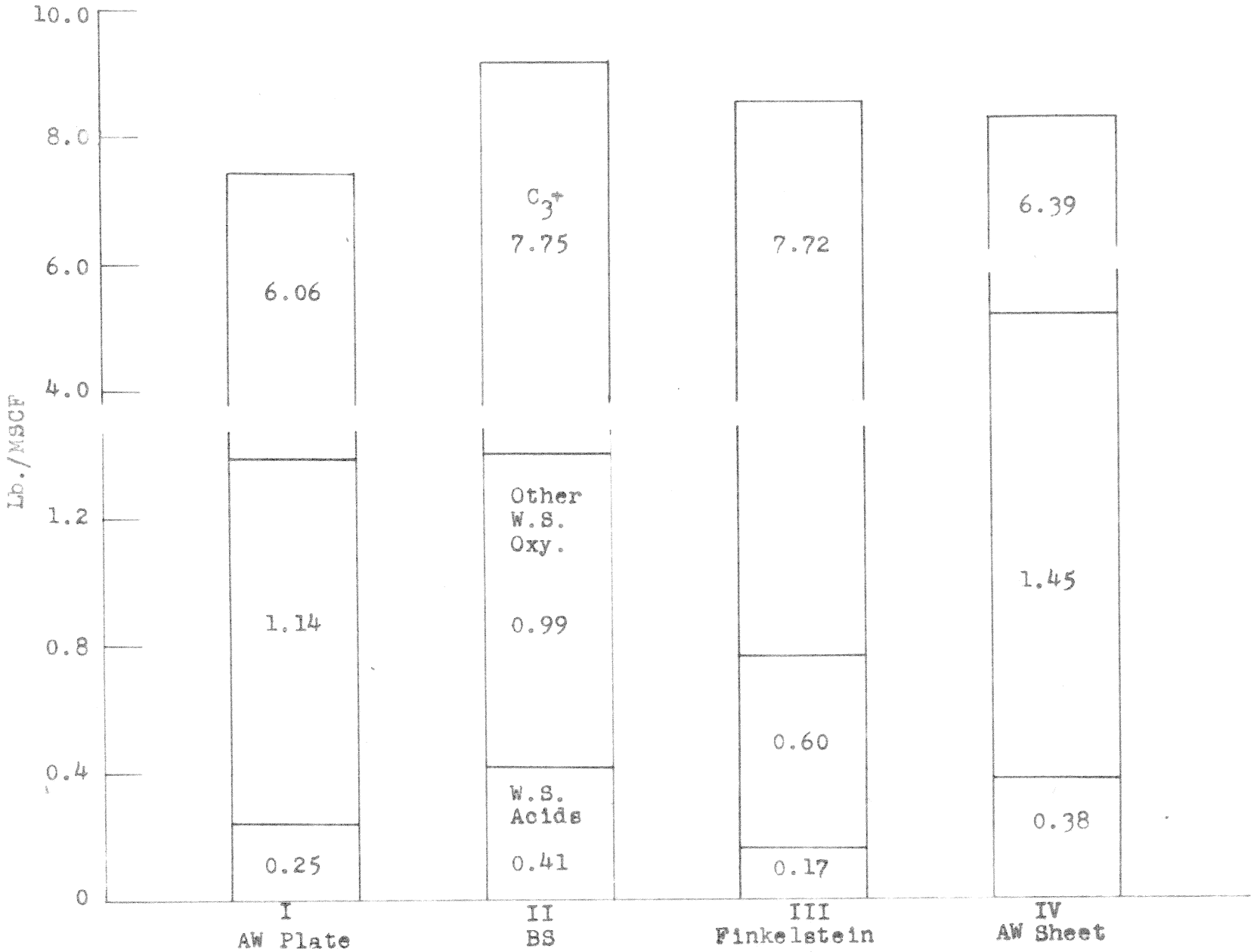

EFFECT OF CONCENTRATION UPON
PER CENT SALTED OUT
Calculated Concentration - Volume %
Observed (Salted Out) Concentration - Volume %
0
5
10
15
20
25
30
Observed
45° Line

FUSED CATALYSTS
650°F. - 200 psig - 2/1 H_2/CO - 2/1 RECYCLE



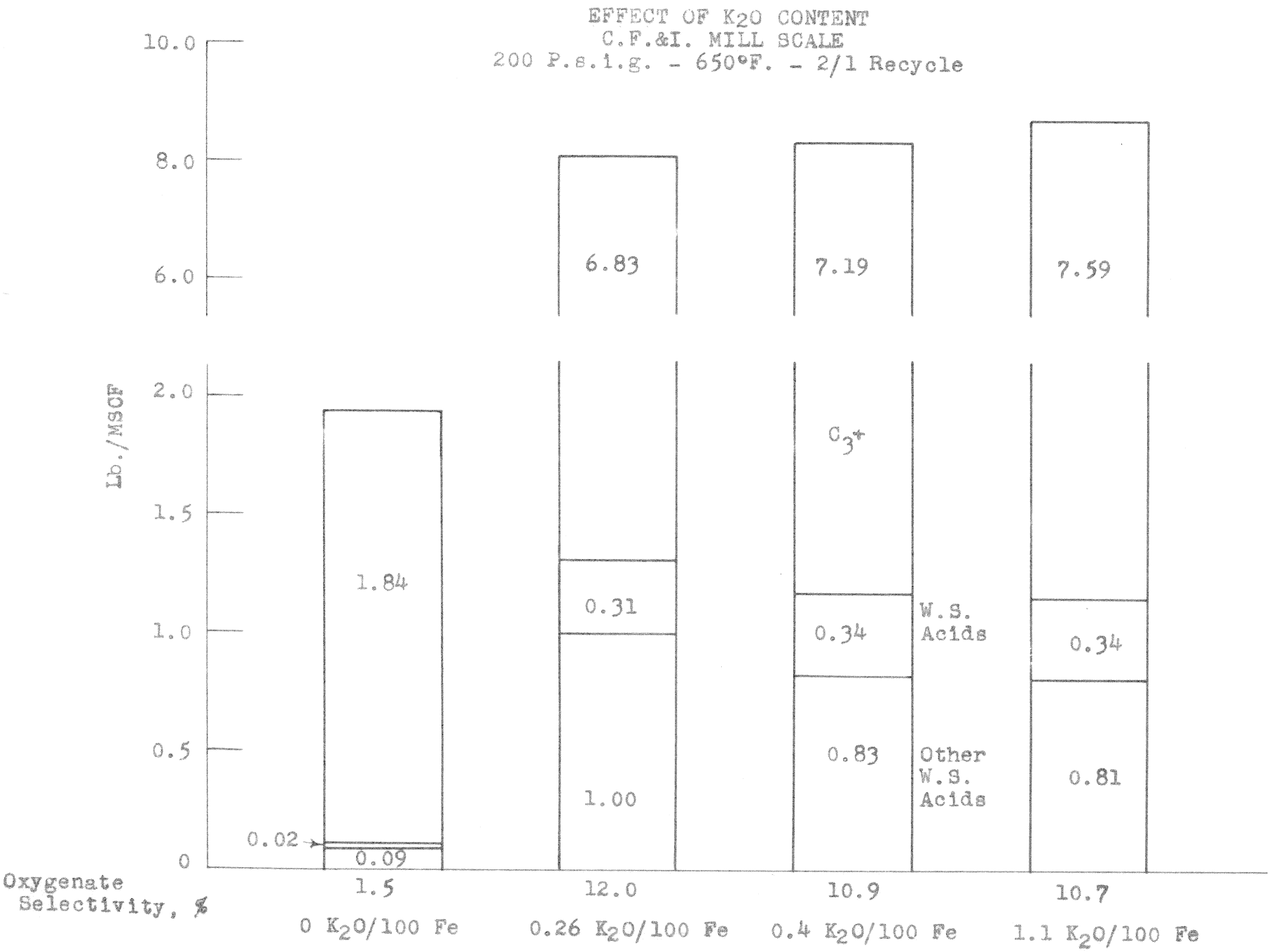

NATURAL ORES
Alan Wood
Magnetite
0.6 K_2O
8.35 SiO_2
Minn.
Magnetite
0.8 K_2O
15.0 SiO_2
0.6 Al_2O_3
Minn.
Hematite
1.1 K_2O
13.0 SiO_2
4.0 Al_2O_3
Pyrites
Ash
0.9 K_2O
3 SiO_2
Sintered
Pyrites
Ash
0.9 K_2O
3 SiO_2
Pyrites
Ash
1.54 KF
2.76 SiO_2
Lb./MCF
10
8
6
4
1.2
0.8
0.4
0
C_{3+}
8.32
2.81
2.06
5.92
7.00
6.85
Other
W.S.
Oxy.
0.43
0.86
0.33
0.31
W.S.
Acids
0.21
0.02
0.08
0.02
0.01
0.08
0.02
0.17
Oxygenate
Selectivity, %
5.6
1.3
0.3
1.1
4.6
9.3

MILL SCALES WITH VARYING OXIDE CONTENTS

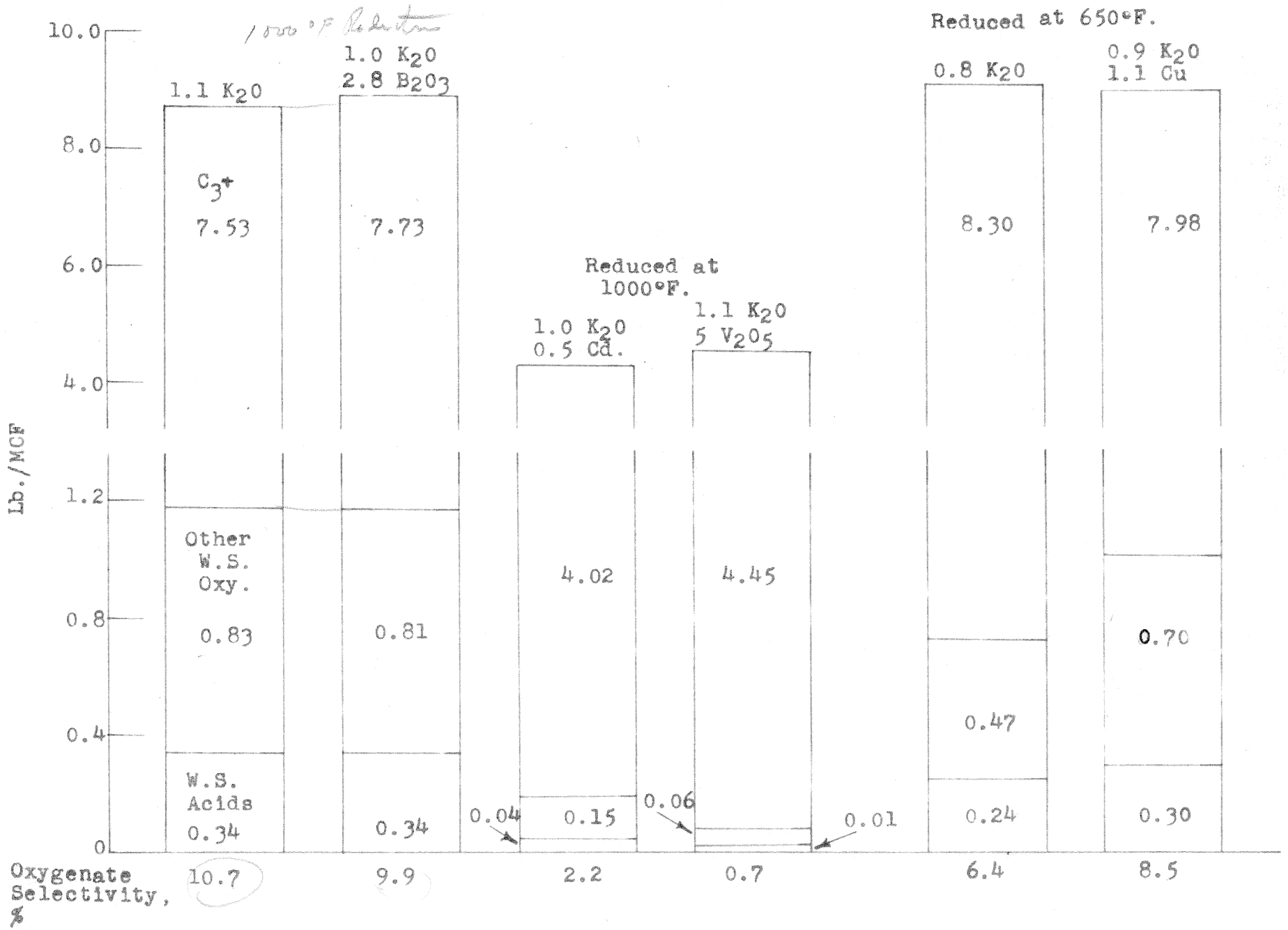


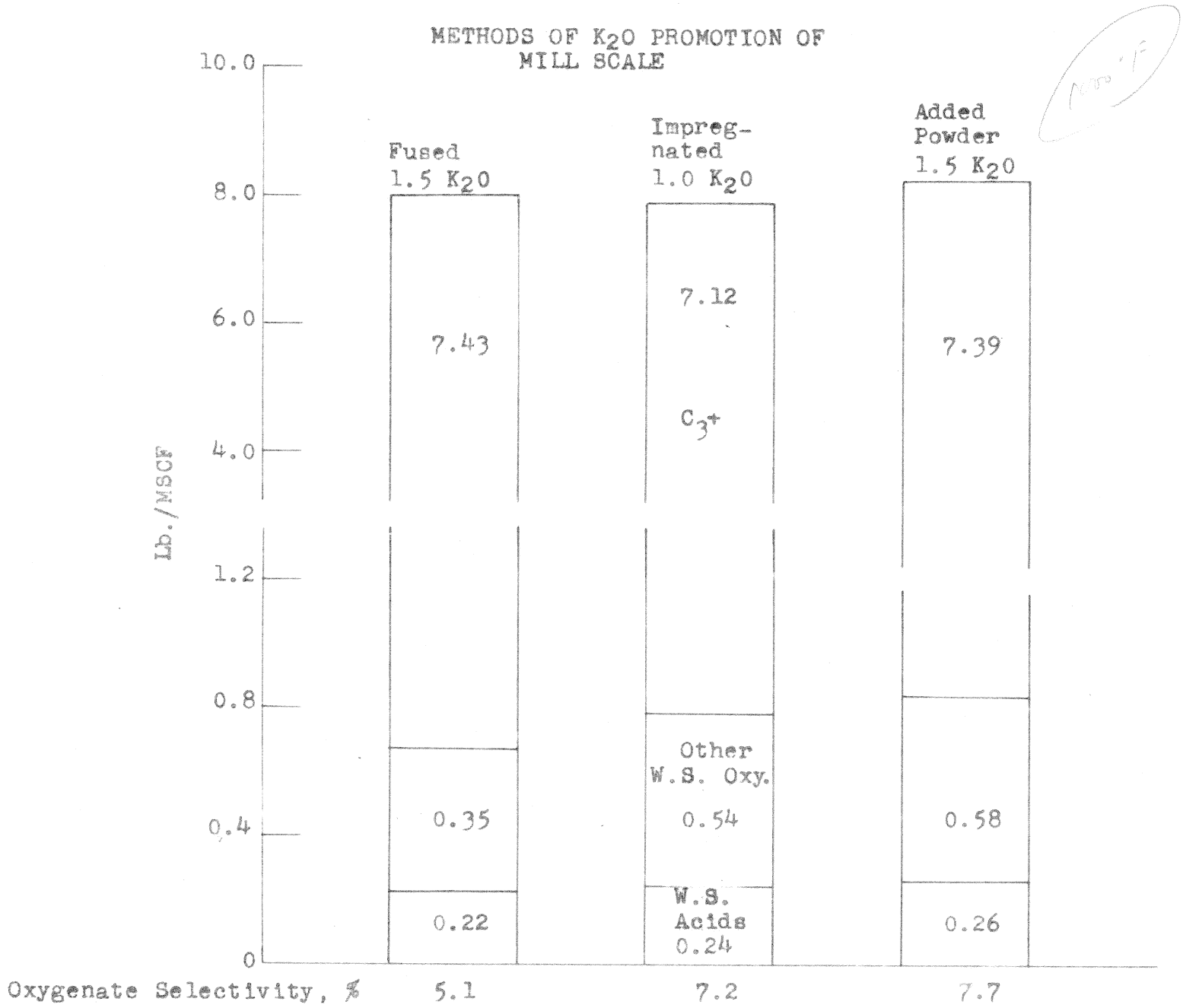
MILL SCALES WITH
VARYING OXIDE CONTENTS

Source	I Alan Wood Plate	II Beth. Steel	III Finkel-stein Rail	IV Alan Wood Sheet
FeO	75	65	60	40
Fe_3O_4	20	30	30	50
Fe_2O_3	5	5	10	10
K_2O	0.5	0.88	0.5	0.4
SiO_2	1.5	0.3	5.5	0.4
Mn	2.3	0.6	1.1	0.4
% Oxy. in Total C_3+	18.7	15.4	9.0	22.4
Oxy. Selectivity	14.1	12.2	6.9	17.0

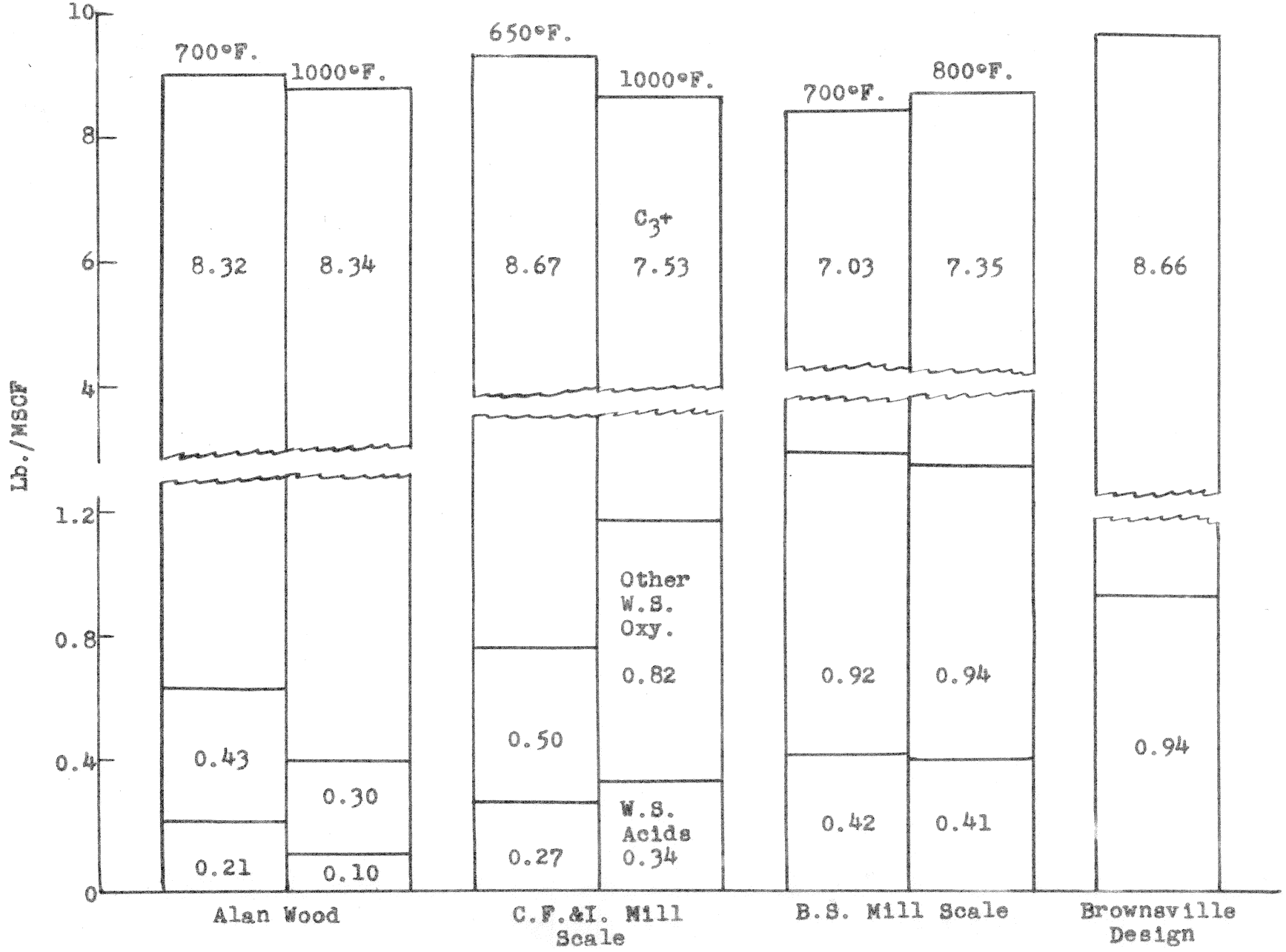

EFFECT OF K_2O CONTENT
C.F.&I. MILL SCALE
200 P.s.i.g. - 650°F. - 2/1 Recycle
Lb./MSCF
10.0
8.0
6.0
2.0
1.5
1.0
0.5
0
6.83
7.19
7.59
C_{3+}
1.84
0.31
0.34
0.34
W.S. Acids
0.83
1.00
0.81
Other W.S. Acids
0.02
0.09
Oxygenate Selectivity, %
1.5
12.0
10.9
10.7
0 K_2O/100 Fe
0.26 K_2O/100 Fe
0.4 K_2O/100 Fe
1.1 K_2O/100 Fe

PROMOTED C.F.&I. MILL SCALE

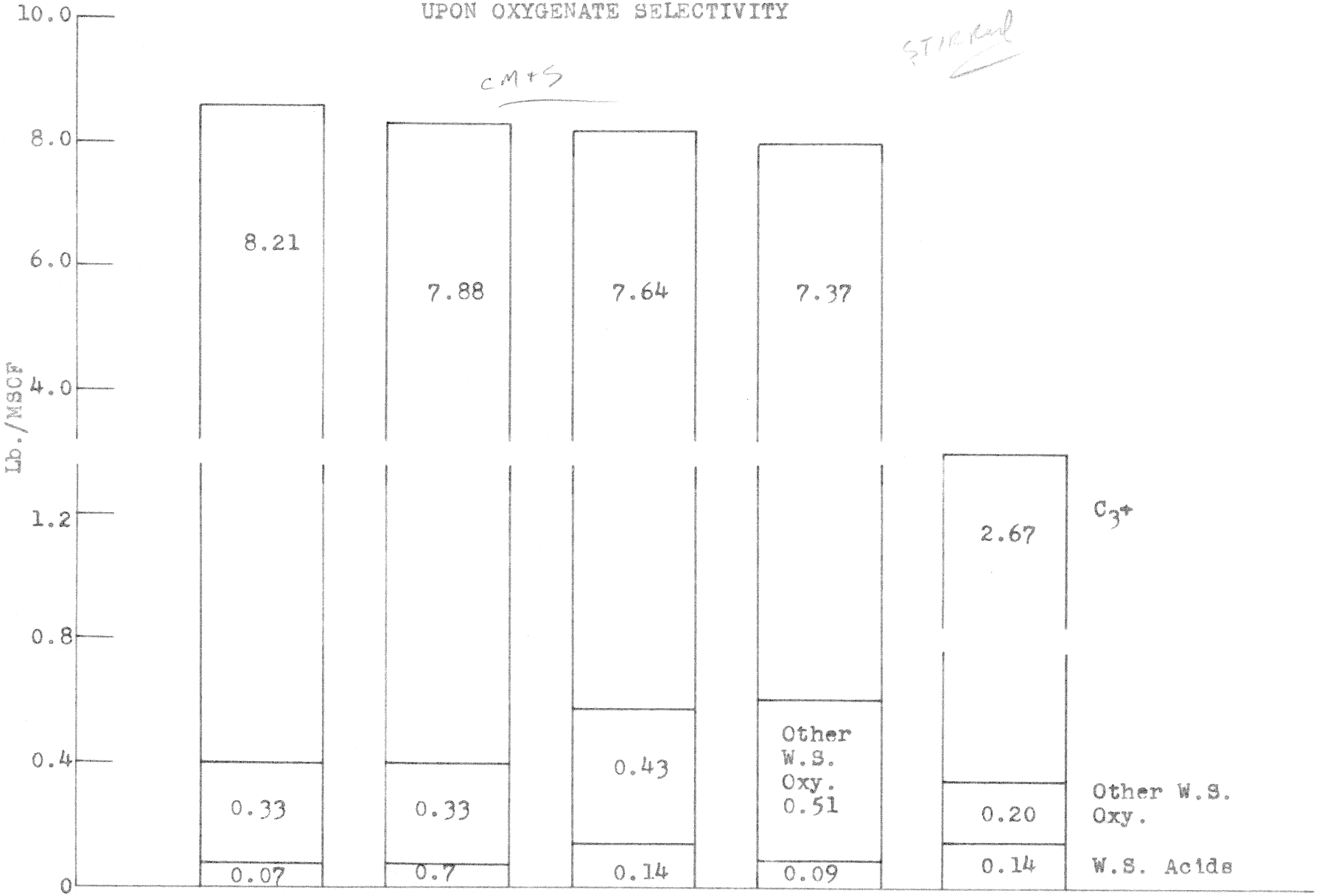



METHODS OF K_2O PROMOTION OF MILL SCALE
Lb./MSCF
10.0
8.0
6.0
4.0
1.2
0.8
0.4
0
Fused
1.5 K_2O
Impreg-
nated
1.0 K_2O
Added
Powder
1.5 K_2O
7.43
7.12
C_{3^+}
7.39
0.35
Other
W.S. Oxy.
0.54
0.58
0.22
W.S.
Acids
0.24
0.26
Oxygenate Selectivity, %
5.1
7.2
7.7

EFFECT OF REDUCTION TEMPERATURE
UPON W.S. OXYGENATES

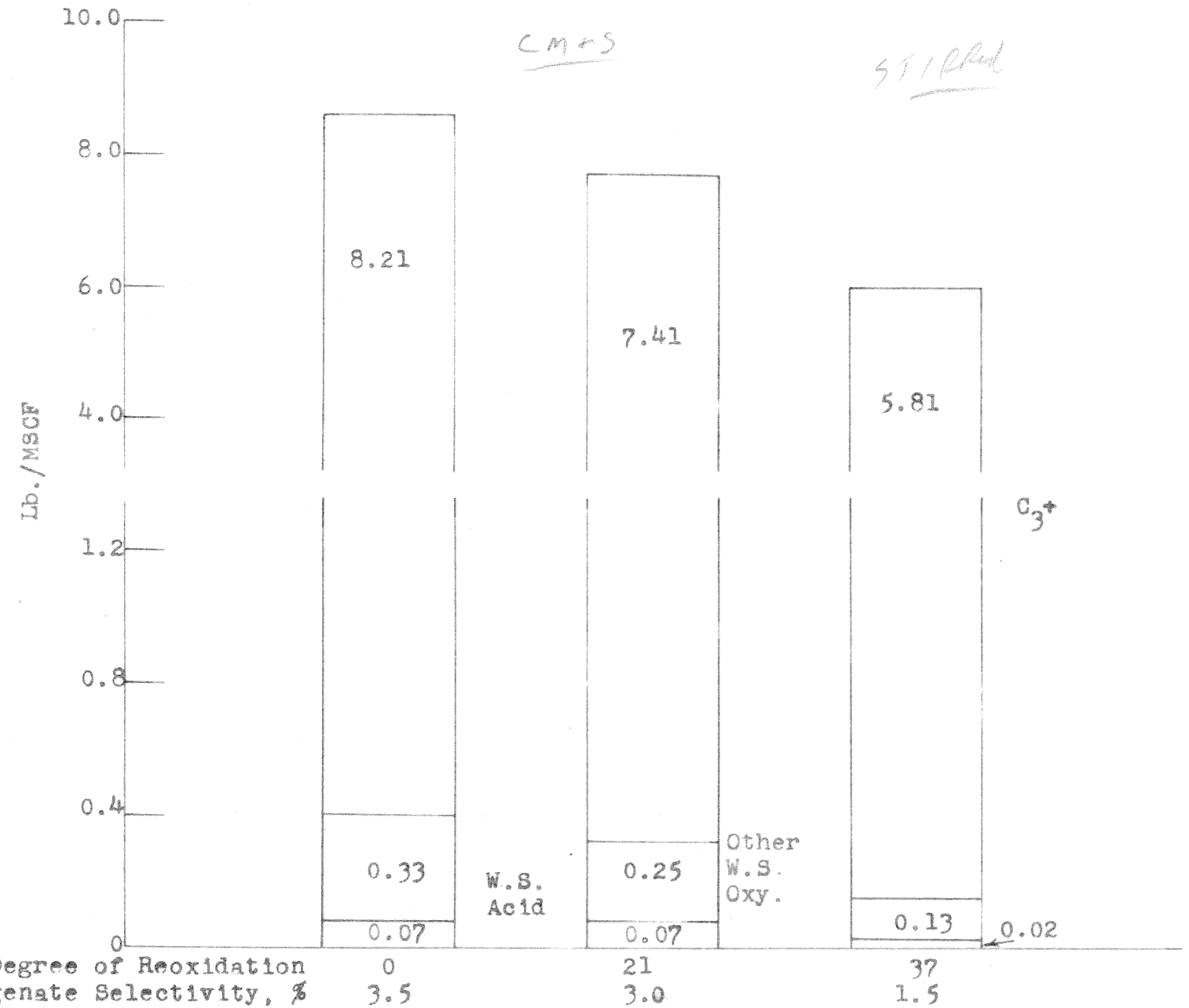


EFFECT OF DEGREE OF REDUCTION
UPON OXYGENATE SELECTIVITY



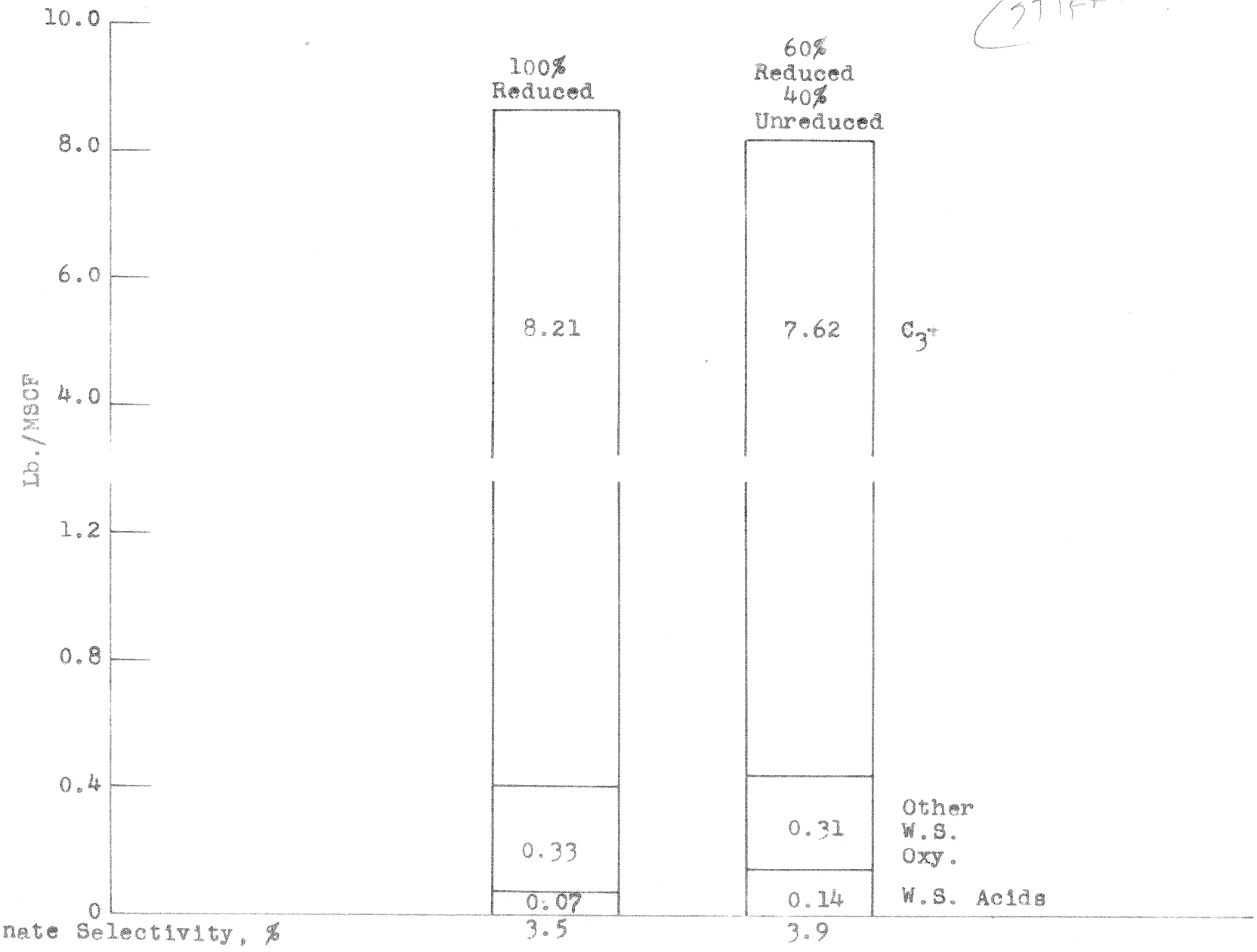
Degree of Reduction, %	100	80	60	40	25
Oxy. Selectivity, %	3.5	3.5	5.5	5.2	8.6

EFFECT OF REOXIDATION

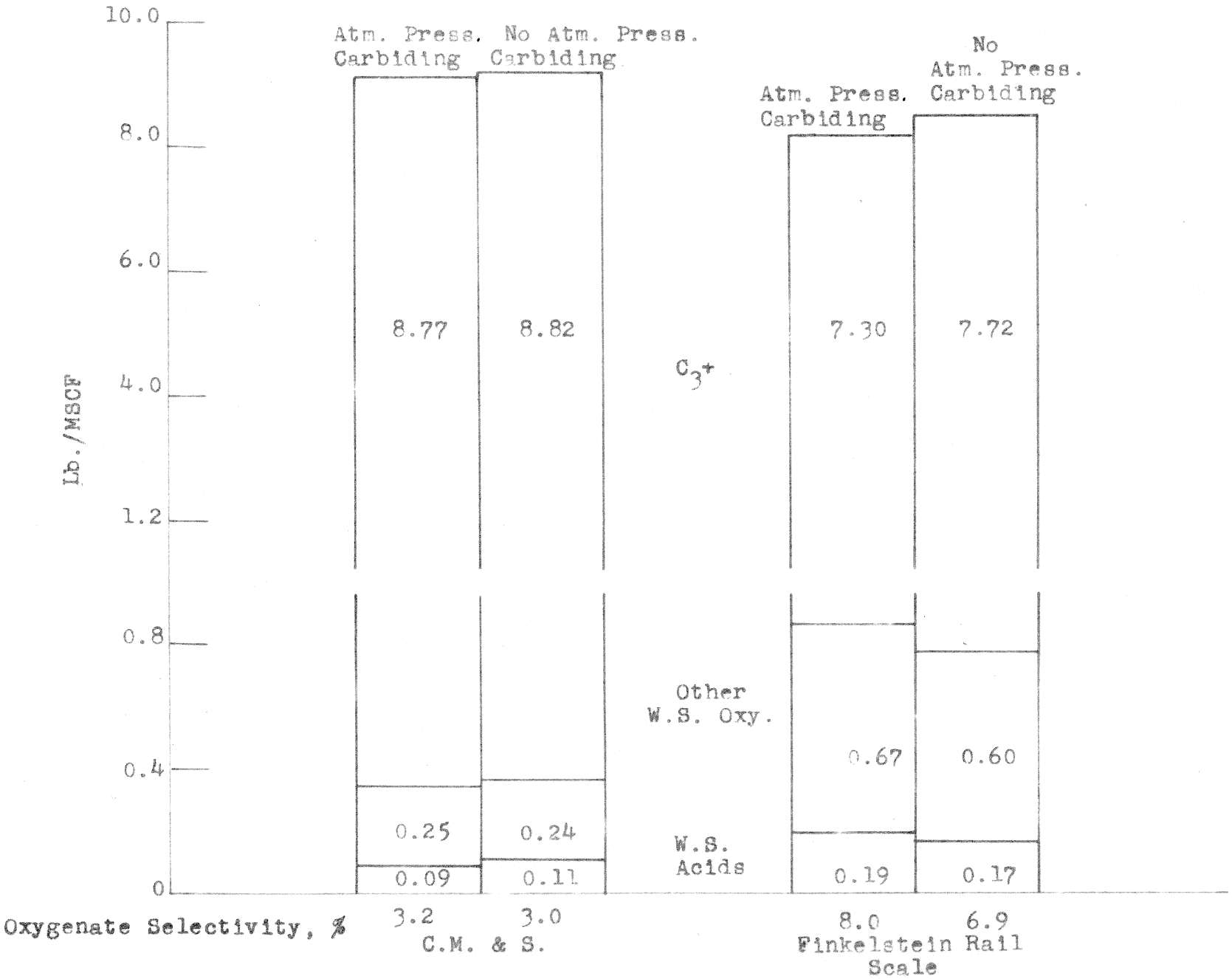


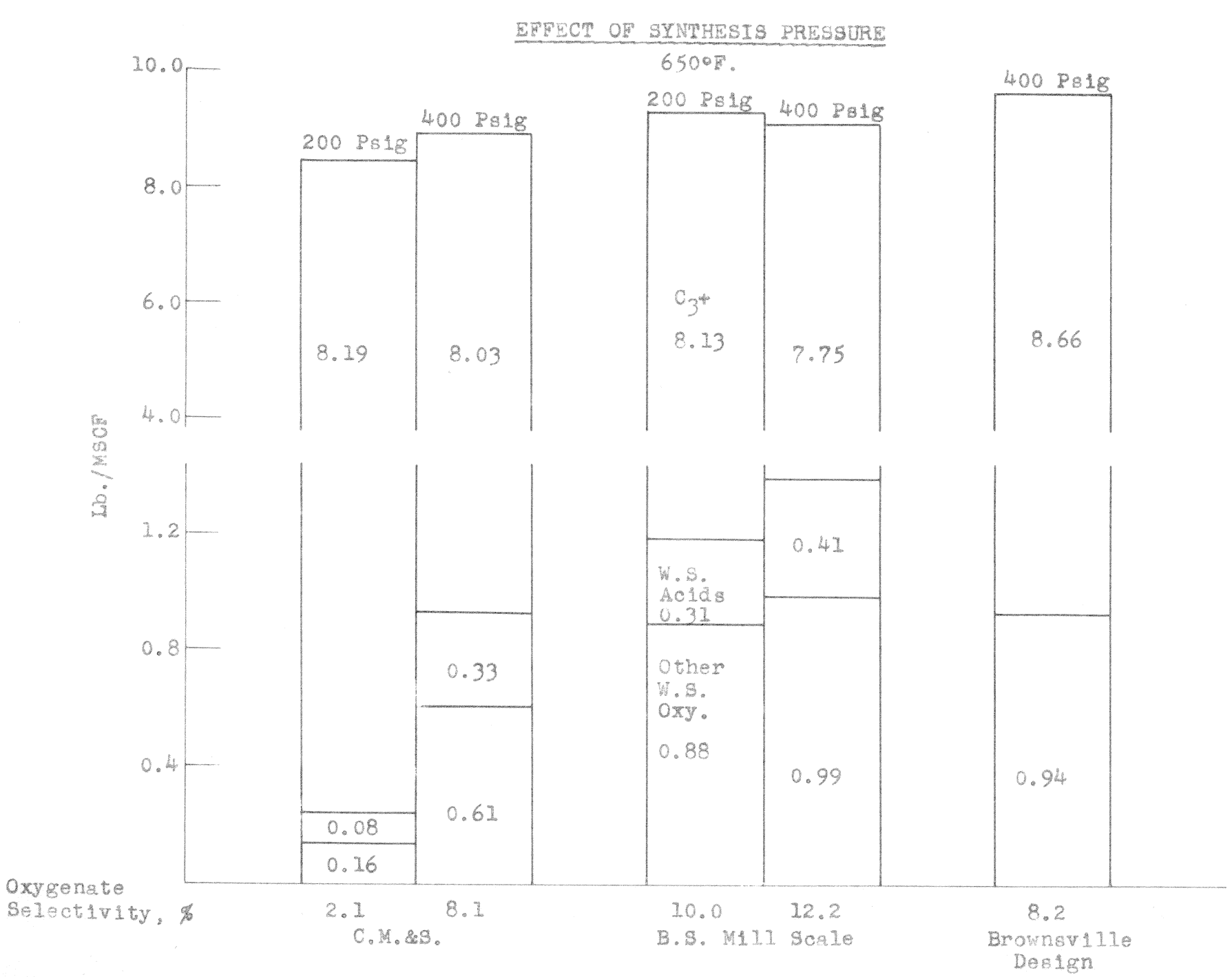
EFFECT OF PHYSICAL MIXTURE OF
REDUCED AND UNREDUCED C.M.&S. CATALYST

STIRRED

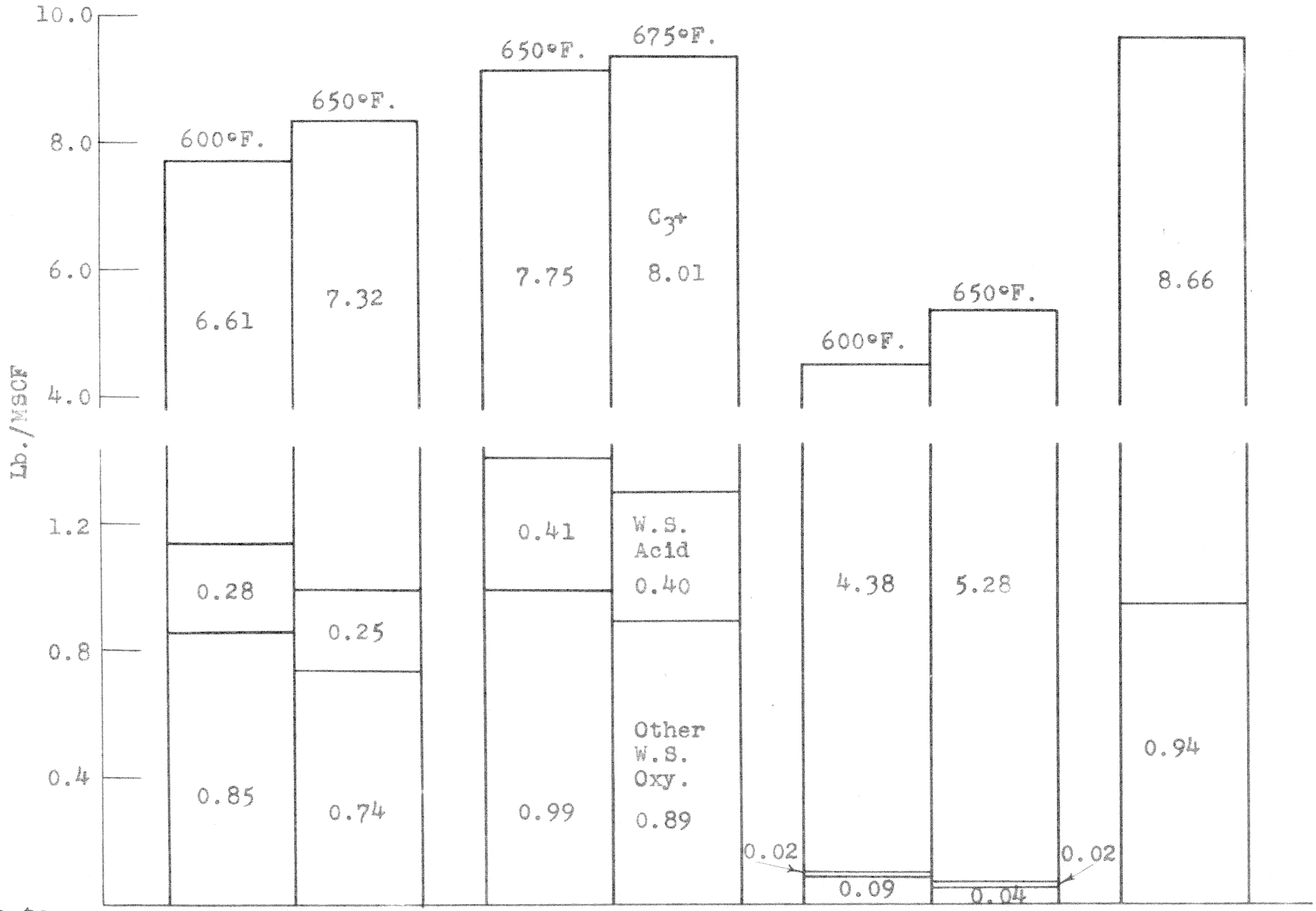


EFFECT OF ATMOSPHERIC PRESSURE CARBIDING
UPON OXYGENATE SELECTIVITY

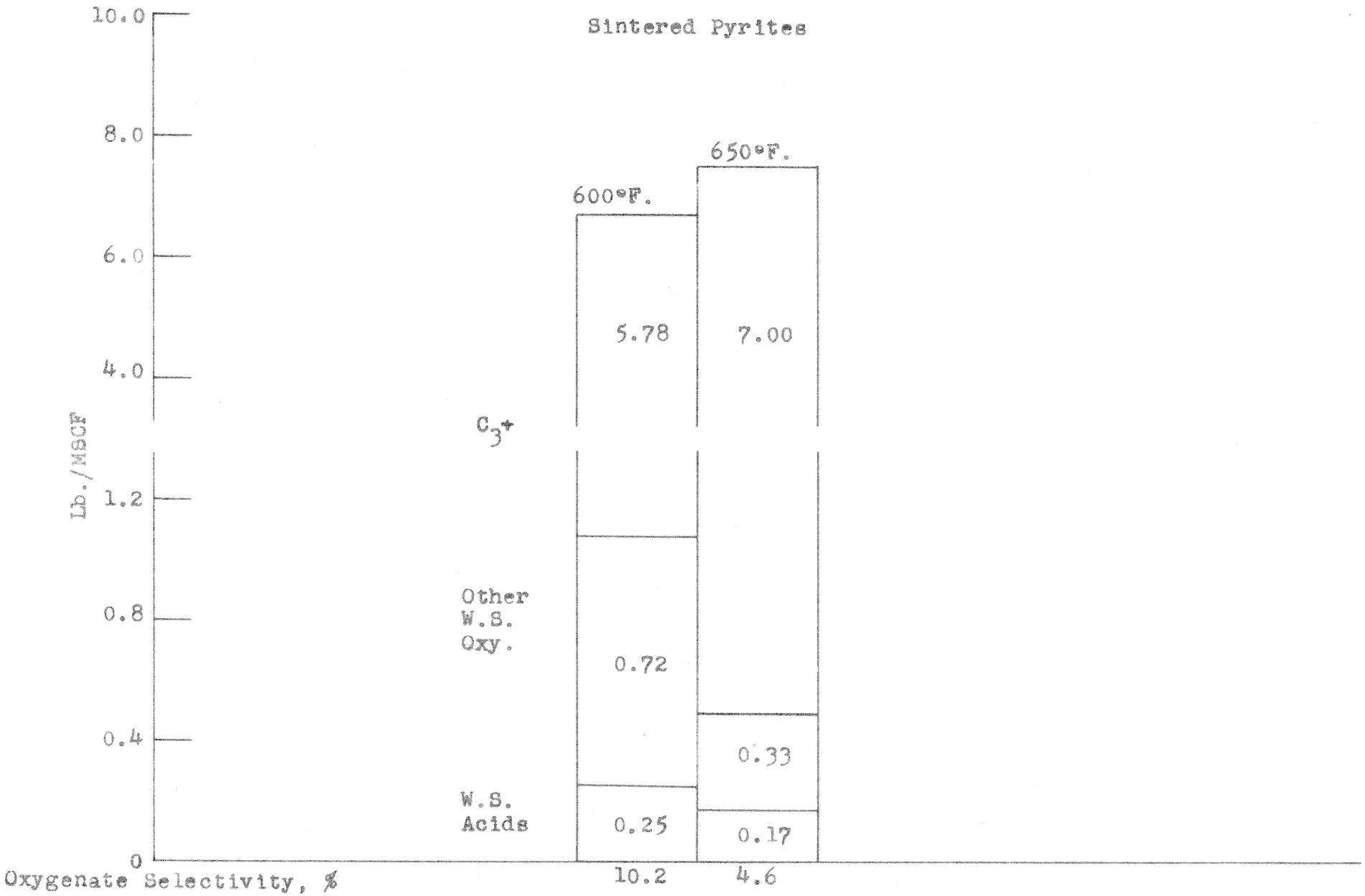



EFFECT OF SYNTHESIS PRESSURE
650°F.
10.0
8.0
6.0
4.0
1.2
0.8
0.4
Lb./MSCF
200 Psig
400 Psig
200 Psig
400 Psig
400 Psig
8.19
8.03
C3+
8.13
7.75
8.66
0.41
W.S. Acids 0.31
0.33
Other W.S. Oxy.
0.88
0.99
0.94
0.08
0.16
0.61
Oxygenate Selectivity, %
2.1
8.1
10.0
12.2
8.2
C.M.&S.
B.S. Mill Scale
Brownsville Design

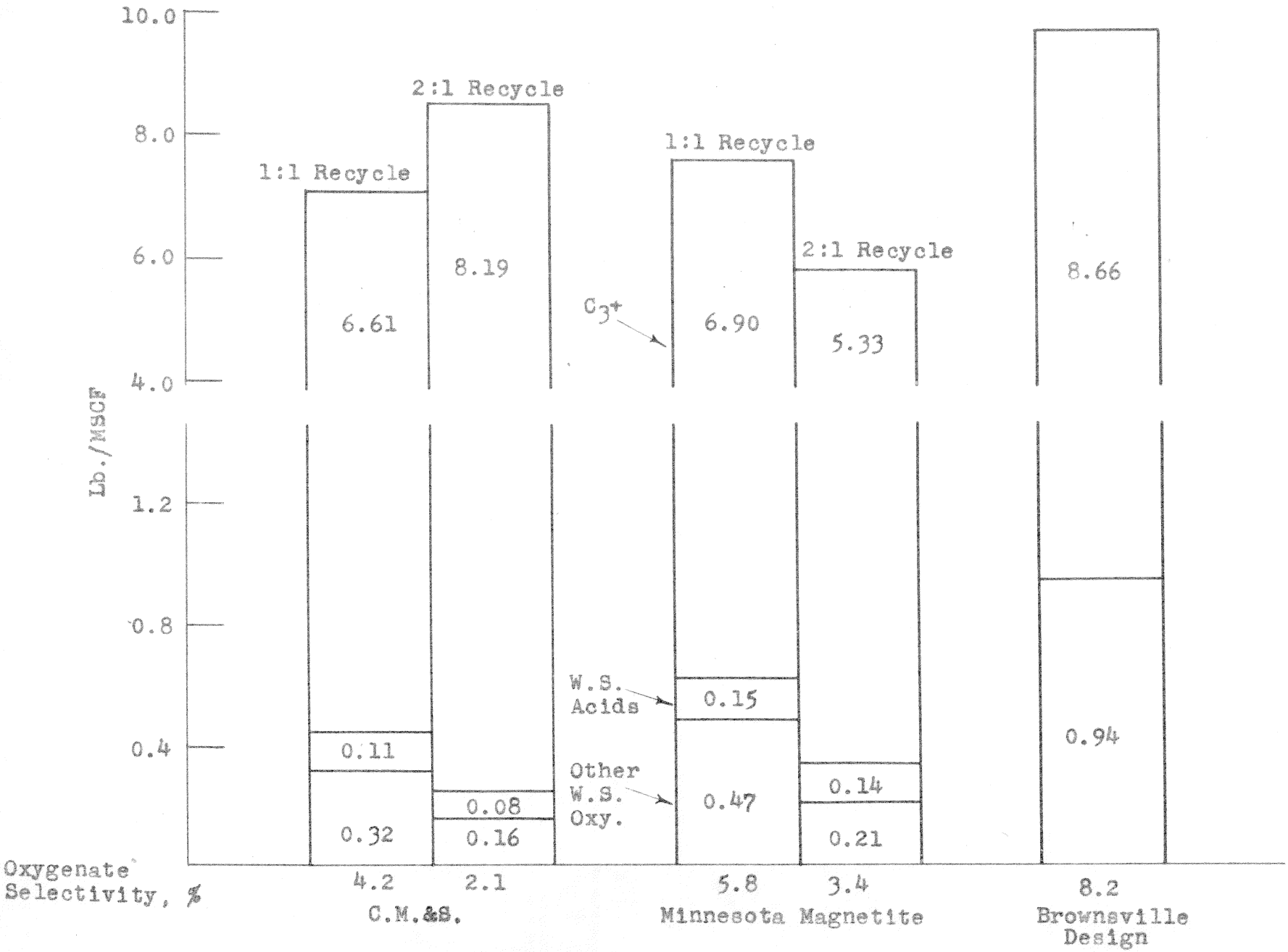
EFFECT OF SYNTHESIS TEMPERATURE

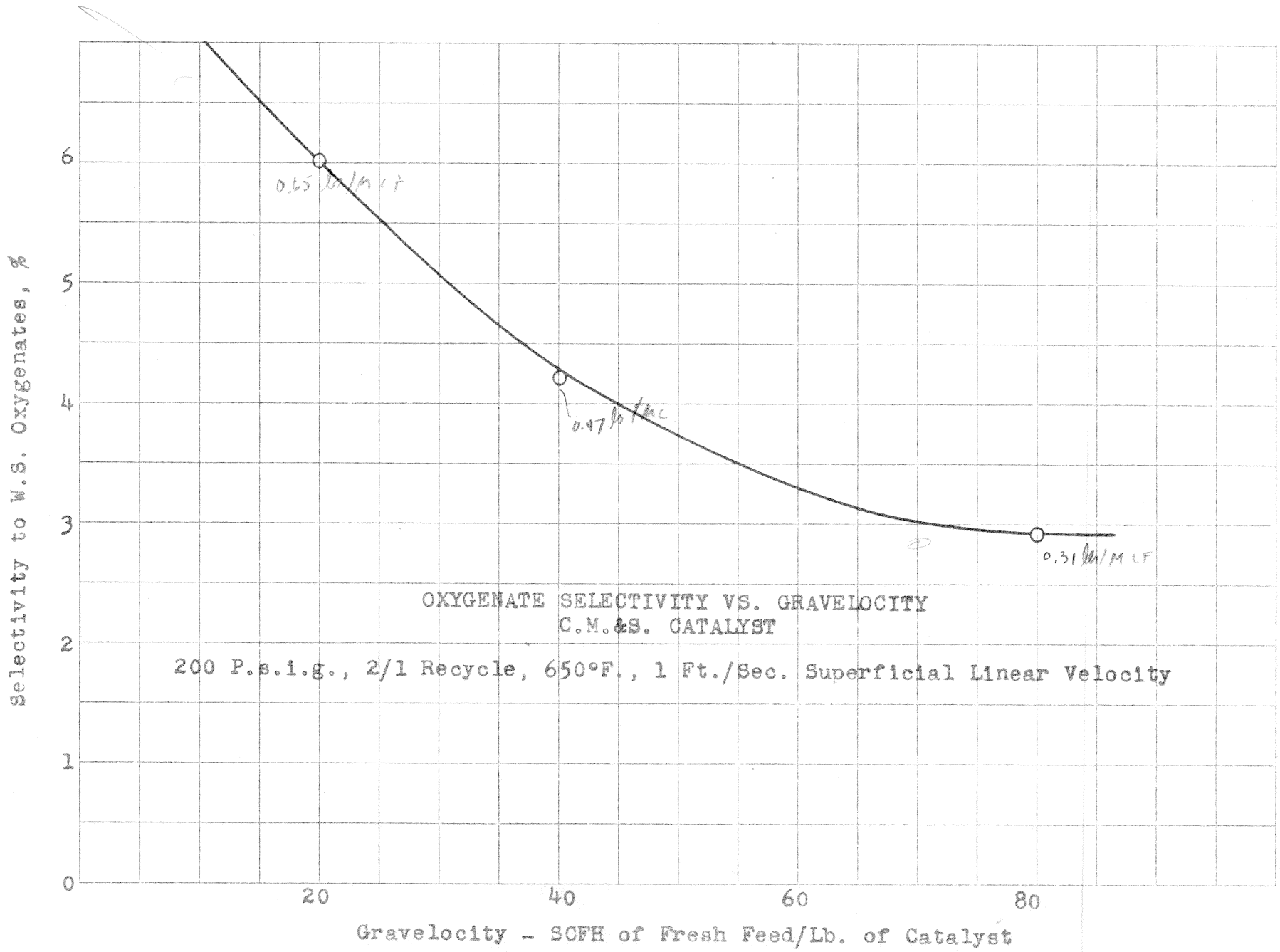


EFFECT OF SYNTHESIS TEMPERATURE



EFFECT OF RECYCLE RATIO

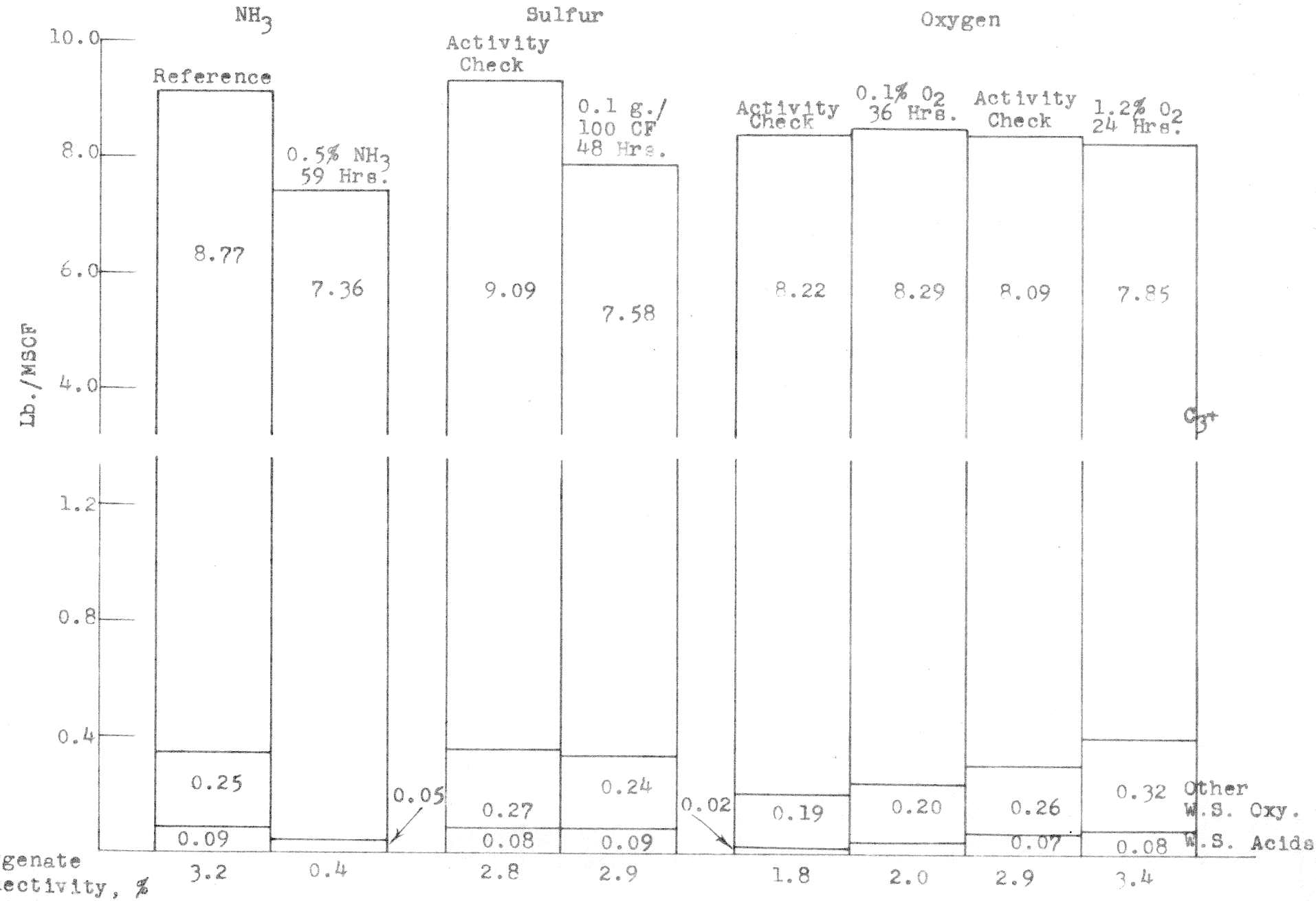


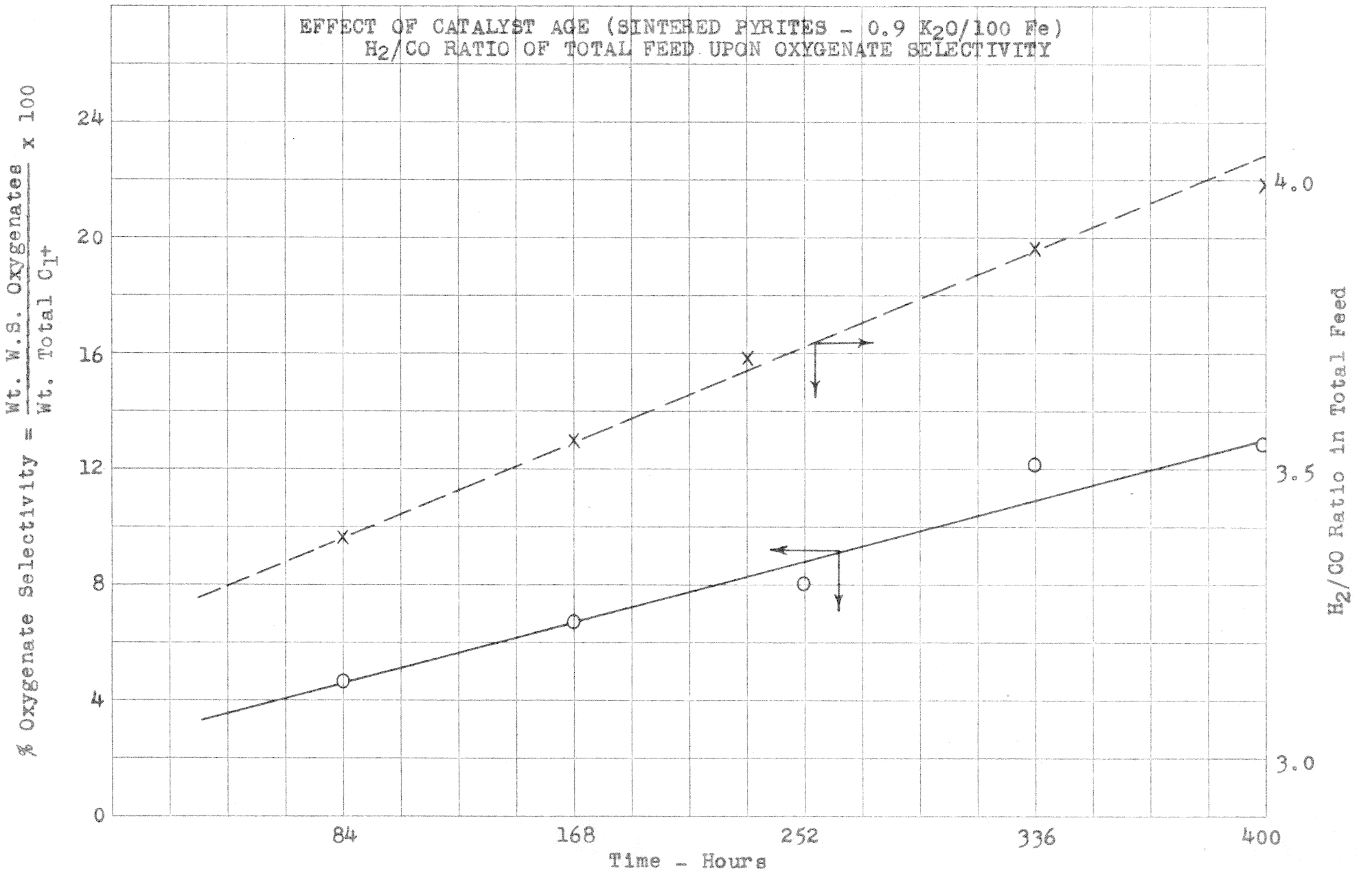


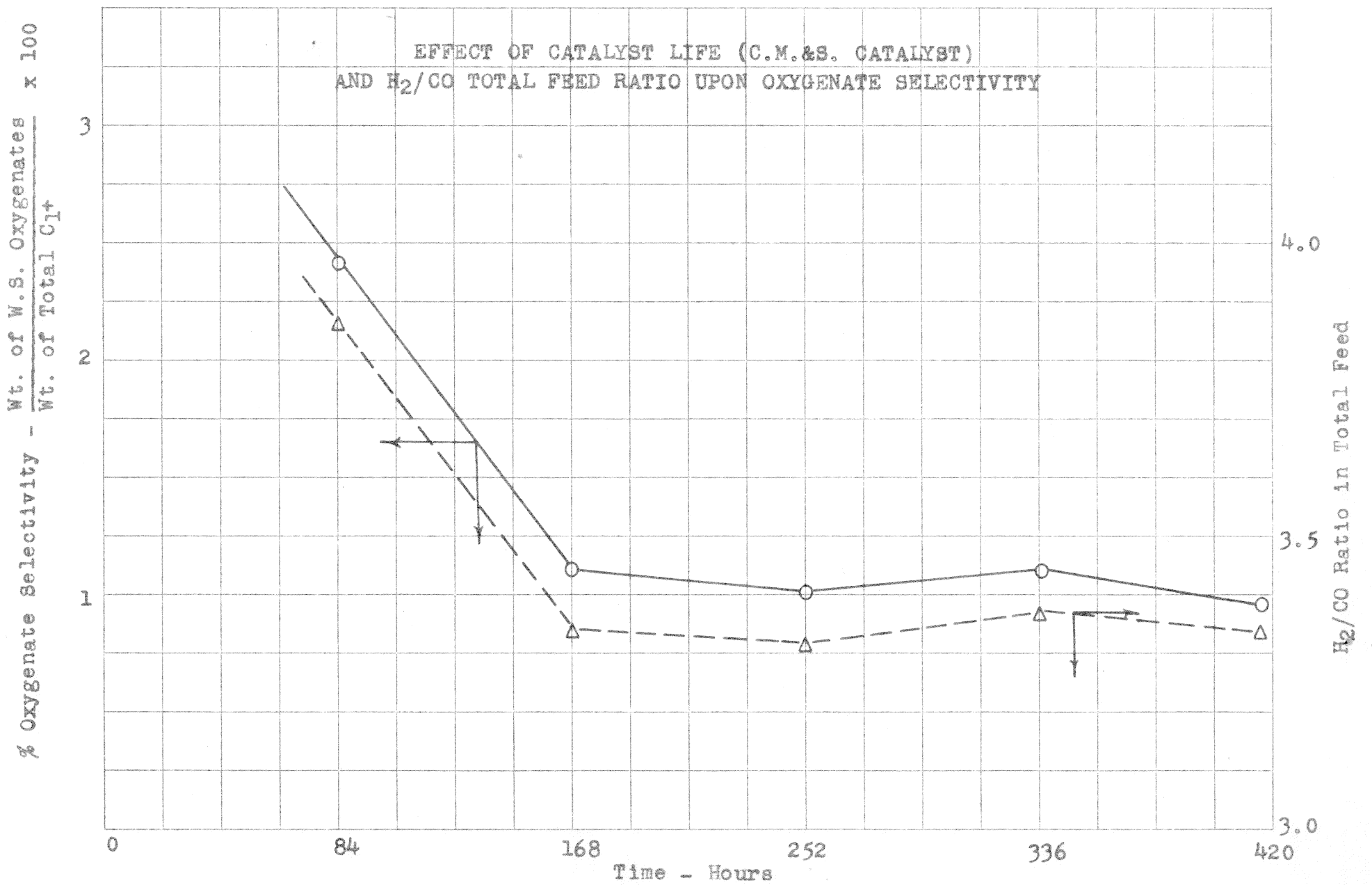
OXYGENATE SELECTIVITY VS. GRAVELOCITY
C.M.&S. CATALYST

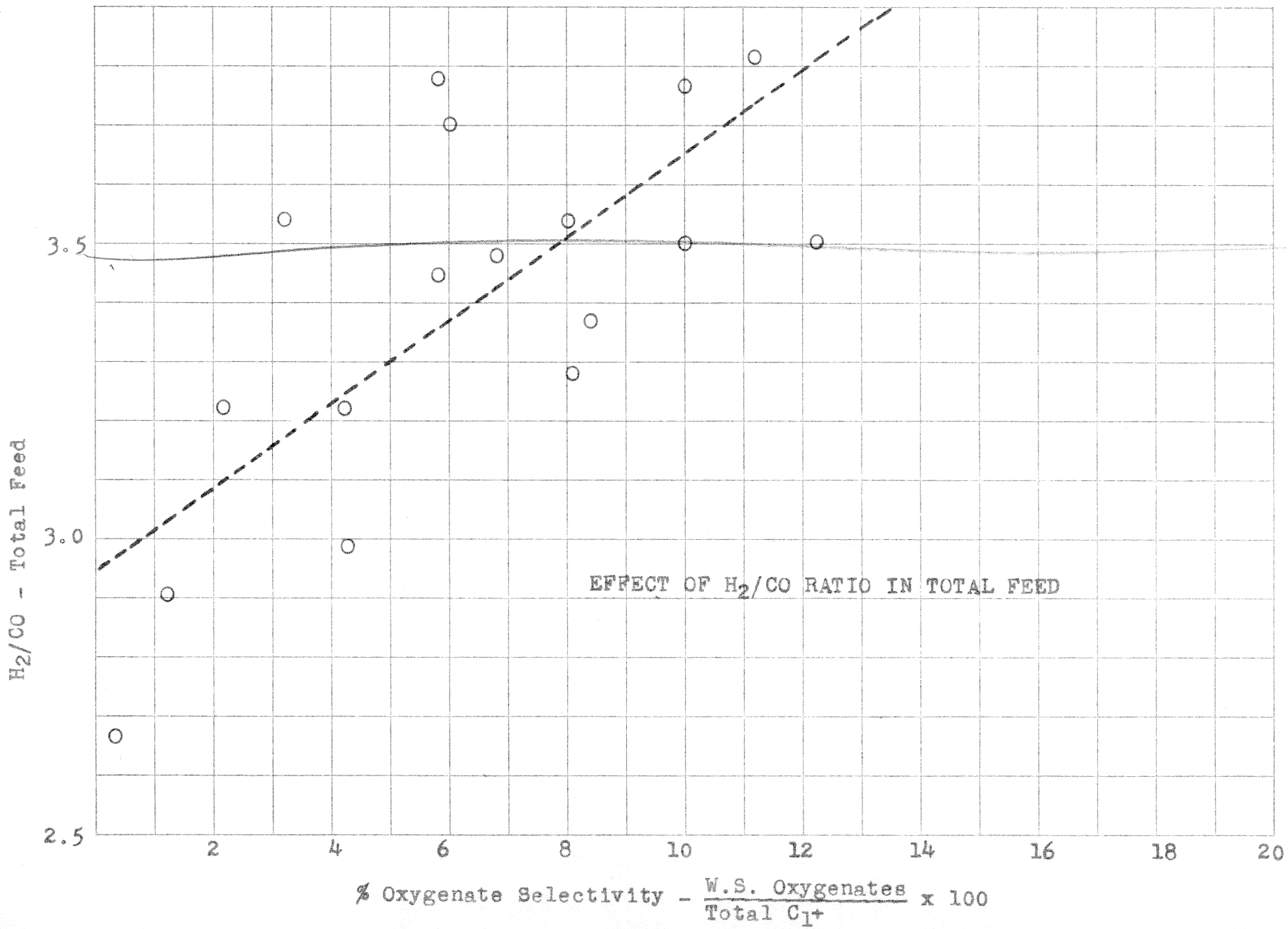
200 P.s.i.g., 2/1 Recycle, 650°F., 1 Ft./Sec. Superficial Linear Velocity

EFFECT OF SMALL PERCENTAGE IMPURITIES IN THE SYNTHESIS FEED




EFFECT OF CATALYST AGE (SINTERED PYRITES - 0.9 K_2O/100 Fe)
H_2/CO RATIO OF TOTAL FEED UPON OXYGENATE SELECTIVITY
% Oxygenate Selectivity = Wt. W.S. Oxygenates / Wt. Total C_1^+ x 100
0
4
8
12
16
20
24
84
168
252
336
400
Time - Hours
3.0
3.5
4.0
H_2/CO Ratio in Total Feed


EFFECT OF CATALYST LIFE (C.M.&S. CATALYST)
AND H_2/CO TOTAL FEED RATIO UPON OXYGENATE SELECTIVITY
% Oxygenate Selectivity - Wt. of W.S. Oxygenates / Wt. of Total C_{1+} x 100
3
2
1
0
84
168
252
336
420
Time - Hours
4.0
3.5
3.0
H_2/CO Ratio in Total Feed


EFFECT OF H_2/CO RATIO IN TOTAL FEED
H_2/CO - Total Feed
3.5
3.0
2.5
2
4
6
8
10
12
14
16
18
20
% Oxygenate Selectivity - $\frac{\text{W.S. Oxygenates}}{\text{Total } C_{1+}} \times 100$