FORMATION FACTOR DATA

FOR

GULF OIL EXPLORATION & PRODUCTION CO.
ARCHIE HUGHES NO. 1-22 WELL
SHERIDAN COUNTY, KANSAS

CORE LABORATORIES, INC.
Petroleum Reservoir Engineering
DALLAS, TEXAS 75207

May 30, 1978

REPLY TO
SUITE 133
400 SOUTH VERMONT
OKLAHOMA CITY, OKLA.
73108

Gulf Oil Exploration and Production Company
800 Three Twenty Four Building
324 North Robinson
Oklahoma City, Oklahoma 73102

Attn: Mr. Barney Kaminsky

Subject: Formation Factor Data
Archie Hughes No. 1-22 Well
Sheridan County, Kansas
CLI File 3402-9285

Gentlemen:

One-inch diameter core plugs were drilled from Lansing-Kansas City cores that were recovered from the Archie Hughes No. 1-22 Well. Eight representative samples covering the zones of interest were selected for formation resistivity factor measurements. The samples used for analysis are lithologically described and identified as to sample number and depth interval on page one of this report.

The core plugs were extracted of hydrocarbons with toluene, thoroughly leached of salt with water and dried at a temperature of approximately 180°F. Air permeability and Boyle's law porosity were then measured for each sample. A simulated formation brine containing 80,000 parts per million sodium chloride was used as the saturating fluid for the electrical resistivity tests.

Formation resistivity factors were calculated from measurements of the resistivities of the brine and of the 100 per cent saturated samples. These measurements were repeated over a period of several days until the resistivity of the samples had stabilized.

The results of the formation resistivity factor measurements are presented in tabular form on page two, and formation factor as a function of porosity is shown in graphical and mathematical form on page three. Some scatter is evident in the data points, reflecting variations in rock type and lithology. The visual best-fit line relating formation factor and porosity has been drawn to the intercept at which the formation factor equals one and porosity equals 100 per cent. Using Archie's formula, a cementation exponent "m" of 1.88 was calculated from the graphical correlation.

We appreciate the opportunity to perform these additional supplementary tests and to be of further service.

Very truly yours,

CORE LABORATORIES, INC.

Dale E. Boyle (VJP)

Dale E. Boyle
District Manager

DEB:VJP:nt

7 cc - Addressee
1 cc - Gulf Oil Exploration and Production Co.
Attn: Mr. Gene Behrens
800 Three Twenty Four Building
324 North Robinson
Oklahoma City, Oklahoma 73102

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Petroleum Reservoir Engineering
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File 3402-9285

Company GULF OIL EXPLORATION AND PRODUCTION CO.
Well ARCHIE HUGHES NO. 1-22
Field

Formation LANSING-KANSAS CITY
County SHERIDAN
State KANSAS

Identification and Description of Samples

Sample Number	Depth, Feet	Lithological Description
4	3971-72	Lm, bf, fn xln, sl/slty, foss
5	3972-73	Lm, bf, fn xln, sl/slty, foss
21	4150-51	Lm, bf, fn xln, sl/slty, pp vgs
23	4166-67	Lm, bf, fn xln, sl/dol, sl/slty, pp vgs, sl/pyr
25	4168-69	Lm, bf, fn xln, sl/dol, sl/slty, foss
32	4188-89	Lm, gy, fn xln, sl/slty, pp vgs
34	4190-91	Lm, bf, fn xln, sl/slty, pp vgs
35	4191-92	Lm, bf, fn xln, sl/dol, sl/slty, pp vgs, foss

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FORMATION FACTOR DATA

Resistivity of Saturating Brine, Ohm-Meters: 0.096 @ 70°F.

Sample Number	Permeability, Millidarcies	Porosity, Per Cent	Formation Factor
4	0.24	6.4	135
5	0.39	3.5	287
21	0.22	6.9	280
23	2.0	15.8	32.2
25	0.45	12.8	32.4
32	103	16.6	51.3
34	0.04	5.7	141
35	0.22	10.6	78.5

GULF OIL CORP.
P.O. BOX 12116
OKLA. CITY, OK.

#1-22 ARCHIE HUGHES

22-9-29W
C SW SW

CONTR RAINS & WILLIAMSON OIL CTY SHERIDAN

GEOL _____ FIELD WCC

E 2873 KB CM 2/23/78 CARD ISSUED 6/8/78 IP P 22 BOPD + 180 BWPD
LANS 4150-72 OA

API 15-179-20,503

LOG TOPS	DEPTH	DATUM
SC	2475	+ 398
TOP	3278	- 405
HEEB	3948	-1075
TOR	3972	-1099
LKC	3988	-1115
BKC	4237	-1364
PBTD	4240	-1367
TD	4300	-1427

INDEPENDENT OIL & GAS SERVICE
WICHITA, KANSAS

8-5/8" 501/300sx, 5½" 4283/200sx
¢ (1) 3962-4000/FULL REC
¢ (2) 4008-4151/FULL REC
¢ (3) 4166-4226/FULL REC
MICT-SLIDE SLEEVE IN CSG @ 3972-76, 4150-54, 4168-72, 4190-94, OPEN @ 3972-76, SWB DRY, AC 200, SWB DRY, NS, CLOSE 4150-54, OPEN 4168-72, AC 500, CLOSE 4168-72, OPEN 4190-94, AC 500, SWB 22 BO + 158 BW, SWB, CLOSE 4190-94, OPEN 3972-76, SWB 40 BO + 126 BW/8 HRS, SWB 15 BO + 60 BW/4 HRS CLOSE 3972-76, OPEN 4168-72, SWB 74 BO + 96 BW, CLOSE 4168-72, OPEN 4190-94 SWB 8 BO + 41 BW/10 HRS, CLOSE 4190-

(OVER)

GULF OIL CORP. #1-22 ARCHIE HUGHES 22-9-29W C SW SW

94, OPEN 4168-72, SWB 22 BO + 95 BW/9 HRS, OPEN 4150-54, 4168-72, POP, P 60 BO + 160 BW/24 HRS

#1-22 Archie Hughes
22-9S-29W Sheridan County, Kansas

CORE 1

Uncorrected Depths Noted Only
Core Depth + 4 Feet = Log Depth

C-1 B-1 3962-3964.8
All Shale - Fine, Dense, Hard
3962-3963 Gray-Grn
3963 Grn to Red Contact
3963-3964.8 All Red
This Box Has About 8 Large 3-9 Inch Chunks

C-1 B-2 3964.8-3967
All Shale Broken Up (about 30 2 inch chunks)
Mostly Red, Basal 9-12 - Inches Grn-Gray

C-1 B-3 3967-3969.5 Channel
Clay rich rip-up clasts
3967 Grn clayey zone
- Top 4-8" lime clasts
Minor bio-pel clasts (really a carb bio sand)
- Bottom 4" pale grn shale - mud, not limy
3968-3969 1/3 (14" of this)
Grainstone bio-pel clasts
Channel deposit has porosity
Minor grn clay zones, some clay pelloids
Minor solution cavity zones
3969 1/3 (2" of this)
Clay (thick 1/2 - 3/4") styolite zone
Dramatic (pyrite) styolite contact

C-1 B-4 3969.5-3972
Two plugs taken from this interval
Mostly oil stained, styolite throughout
3971 Only labeled piece in this box
White rex lms many fusilinids
These have porosity solution rims
- Clay stringers forming styolites
Top is oil stained (3971)
Basal 6" looks clean (A plug was taken)
Pyrite in styolite, may be oil cut-off
- Balance of box is not marked for footage
Depths are being guessed
3969.5 Clean WHT rex lms (styolitic)
Rex, can't tell what original rock was
(5" chip), oil stain at base
3970-3971 Maybe 14-16" oil stain
Abundant fusulinids, hard, porous
some (non-sealed, open) vertical fractures
-Has styolite within zone (3970)
Good porosity, some clayey pellits (minor)

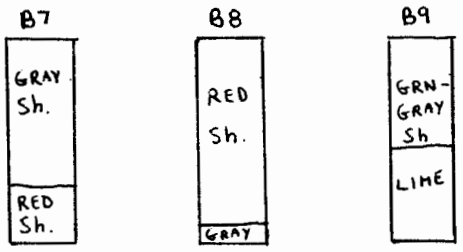
Solid rock, takes red stain well ($CACO_3$)
-40-60% porous fusilinid rich
Balance is fine WHT LMS (buff to gray)
-This entire interval is black, oil saturated

C-1 B-5 3972-3975
All white rex styolite-like
Not styolite
Really clay pseudo beds
Beginning of styolitization
Plug taken about 3974
Many rex fusilinids (all through interval)
Missing 3972-3972 1/2 (must be same)

C-1 B-6 3975-3979
(Probably not a 4' box-not as much shale missing as seems)
3975-3977 1/2 White rex styolite
Many rex fusilinids.
Not really styolite but just clay stringers.
Seems to be bedding-but thin and discontinious, highly distorted.
Soft sed disruption & flow
3975 1/2 A plug was taken
Base (3977 1/2-3979)
Much missing
Dark gray shale frags
Only about 4" worth remain
Could be same clay as thin stringers above

C-1 B-7 3979-3981
All Shale
Top (3979) 2/3 gray (slight green tint)
Base 1/3 red
Depth guessed at for color switch
All slightly calcareous

C-1 B-8 3981-3984 1/2
(Not really down to 3984 1/2)
All red frac shale, hard
Probably 15 3-4" chips (solid).
Except 1 piece at base (or is it top) of gray (maybe green) shale.
Probably base, it's labeled 3983
The red grades into the gray shale (which is also highly red stained)
All is calcareous



C-1 B-9 3983.5-3986
(top) 3983 1/2-3984 Hard calcareous green shale
Several solid chips
(Bottom) 3984 1/2-3986 1/4 White rex styolite (2 foot)
(Photo) Some porosity at base (minor interval)
Biograinstone (pellet & fusilinids)
Minor Ø, pretty tight though
Major styolite contact preserved

C-1 B-10 3986-3988.2
3986-3986 1/2 missing (in box 9)
3986 1/2-3987 3/4 Porosity
This unit has one foot of porosity, an Ooid, fine sand (pellits?) (fusilinids)
Top is styolitic, has distinct porous/non-porous contact
This contact is worth looking at!
3987 3/4-3988 3/4 White rex styolite (11")

C-1 B-11 3989-3991
All white rex styolite
3989 much clay (thick styolite)

C-1 B-12 3991 1/2-3994
All white rex styolite
Chalky non diagnostic

C-1 B-13 3994-3997
All white rex styolite

C-1 B-14 3997-4000 Base of core one
3997-3998 White rex styolite
3998-3998 1/2 Foot of white styolite chips
3998 1/2-4000 Missing
4000 A bag of red clay (debris not solid)

CORE 2

C-2 B-1 4108-4111 (uniform)
Fine grain micritish lime (stains red)
Many clay (styolitic like) stringers, vertical open fractures, well preserved fossils-crinoids, some (many) brac or possibly pelecypod frags
Some vugular porosity (fossil frag related) - very fossil rich
-Clay at base (8-10") Most of this box just gray fine (BIO frag rich) LMS
-Fractures sealed or non-existant except at base only Base has crinoids above fulilinids + Pelec (some pyrite fill) with minor crinoid
-Shallow H_2O calm, clay influx, top has large algal blades, much fine organic debris = gray LMS.

C-2 B-2 4111-4114 No footage marked.
4111 White rex styolite, only piece marked (4" long)
Fine grain micritish gray (org rich) lime
-BIO frags (fusilinids) clay stringers 1/2-1" zone open vertical fracs, below clay zone/micritish zone is a pelecypod rich lime (only minor clay) about 2 1/2" of this, more open water.
-Balance of Box
Many clay stringers, some algal blades (these have dense waxy texture).
8" piece of WHT REX styolite, fine grain REX
-Also a 3" block of crushed pellit grainstone mostly fossil supported rock - gray micritish, fossils now sparry calcite, not porous
Also some snails and fusilinids
-Pellits could be rimmed shell frags
-6" of laminated blk shale very calcareous, fusilinids Has rod-like fossils (?) also some pyrite
-A few chips of dark dense bioclastic grainstone, pelecypods and clay present
Many pellit sized (1-2MM) frags of this

C-2 B-3 4114-4116
Shale (15 frags 2-4" each)
4114-4115 1/2 Blk finely laminated shale
Bryzoan present
Basal 1/2' is solid grn shale.

C-2 B-4 4116-4118
4116-4116 1/2 Grn shale porous (much), about 20% LMS clasts (large)
4116 1/2-4117 40% LMS clasts, these are smaller grading into clean LMS below (less shale)

4117-4118 WHT fine non-descript LMS with irregular and abundant clay stringers
-Thick clays have many small pellits (within) Possibly tidal channel
-Sparse fossils only (poor frags)
-Some large vugs in clay

4118-4118 1/3 Mound?
Ill defined clay stringers in fine WHT-Buff Lms, Algal blades.

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Well ARCHIE HUGHES NO. 1-22
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Field
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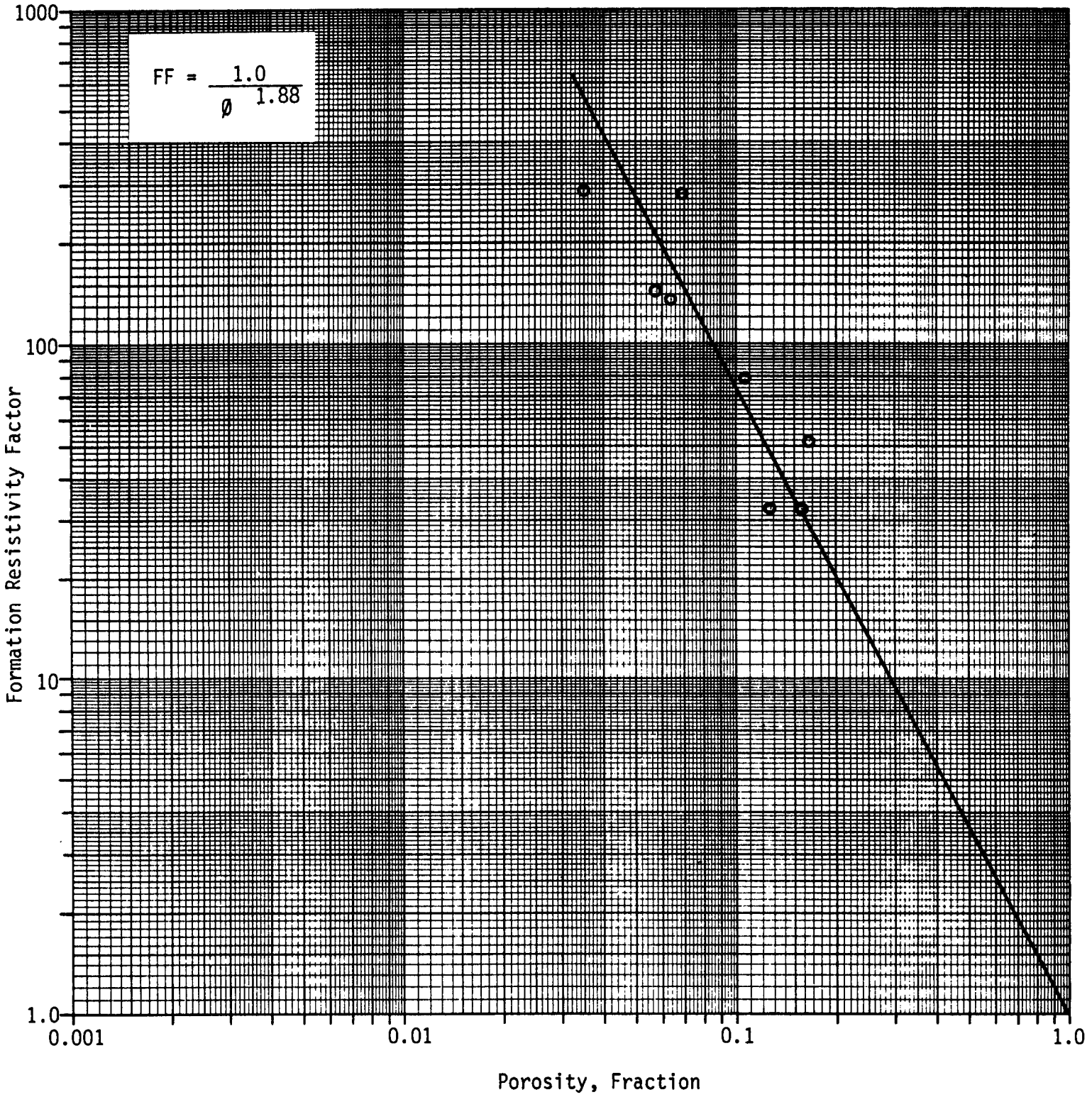

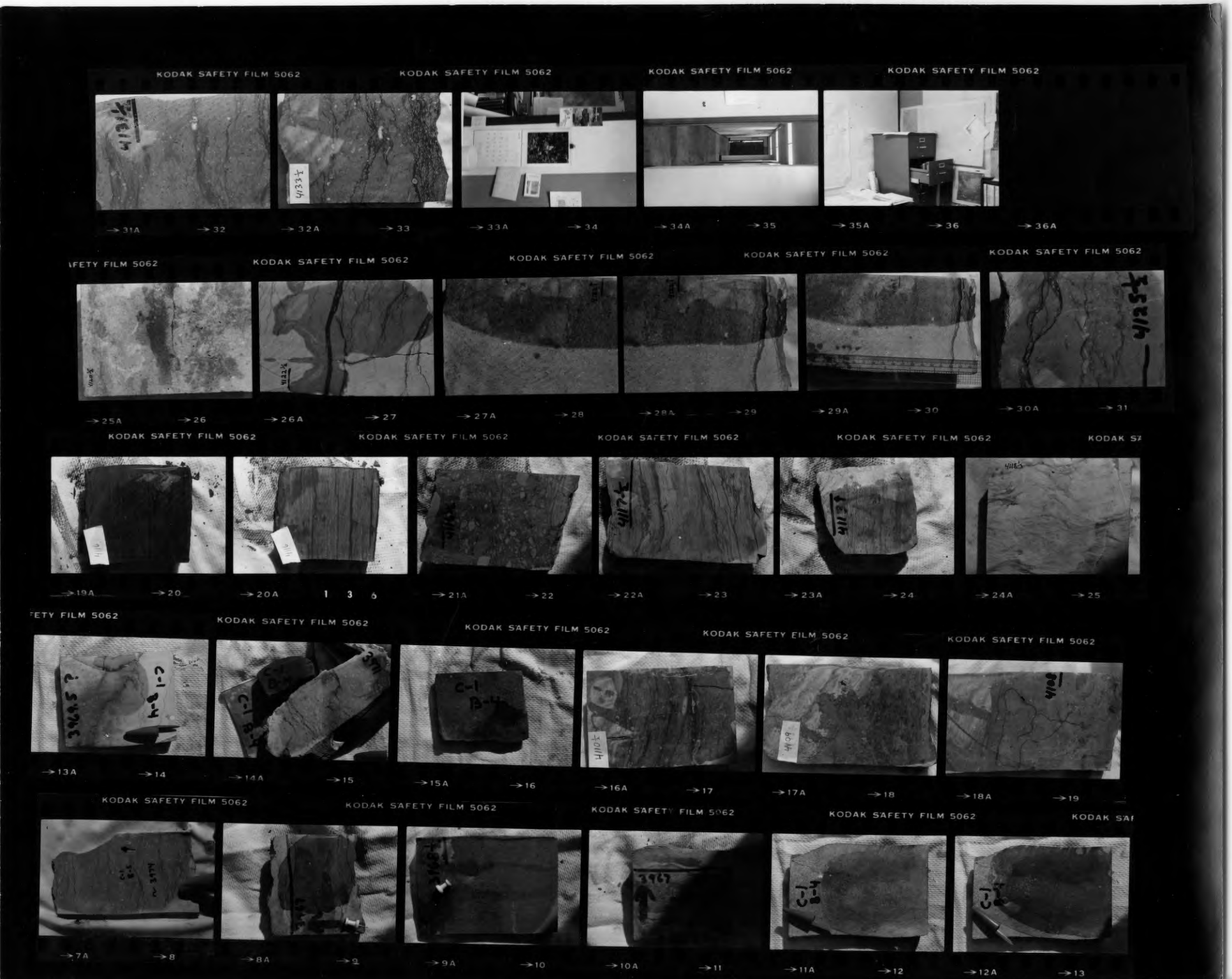
KODAK SAFETY FILM 5062
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→31A →32 →32A →33 →33A →34 →34A →35 →35A →36 →36A
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→25A →26 →26A →27 →27A →28 →28A →29 →29A →30 →30A →31
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→19A →20 →20A →21A →22 →22A →23 →23A →24 →24A →25
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→13A →14 →14A →15 →15A →16 →16A →17 →17A →18 →18A →19
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→7A →8 →8A →9 →9A →10 →10A →11 →11A →12 →12A →13


ETY FILM 5062
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3987
C-1 B-10
3987
C-1 B-10
3988
3988
C-1 B-10
3988
C-1 B-9
3985
3976
C-1 B-6
→1A
→2
→2A
→3
→3A
→4
→4A
→5
→5A
→6
→6A
→7
KODAK SAF
C-1 B-9
3986
→0
→0A
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