NSG-5074

THE CALIBRATION OF PHOTOGRAPHIC AND SPECTROSCOPIC FILMS

I. A MICROSCOPIC ANALYSIS OF IIAO FILMS

II. THE EFFECTS OF AGITATION & SOAKING ON IIAO FILMS

III. THE EFFECTS OF ELECTRIC FIELD ON IIAO FILMS

IV. THE EFFECTS OF X-RAY RADIATION ON IIAO FILMS

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by

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(NASA-CR-158048) THE CALIBRATION OF PHOTOGRAPHIC AND SPECTROSCOPIC FILMS: 1: A MICROSCOPIC ANALYSIS OF IIaO FILMS. 2: THE EFFECTS OF AGITATION AND SOAKING ON IIaO FILMS. 3: THE EFFECTS (Morgan State Univ., G3/35

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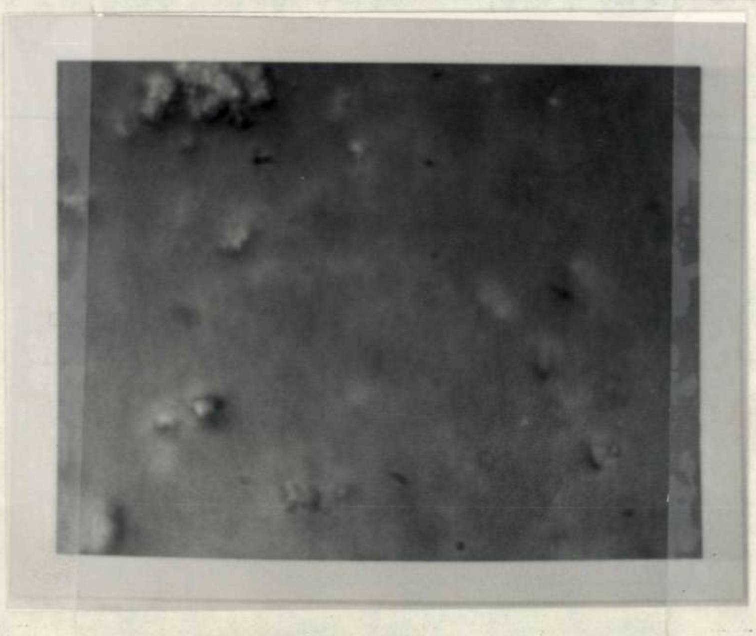
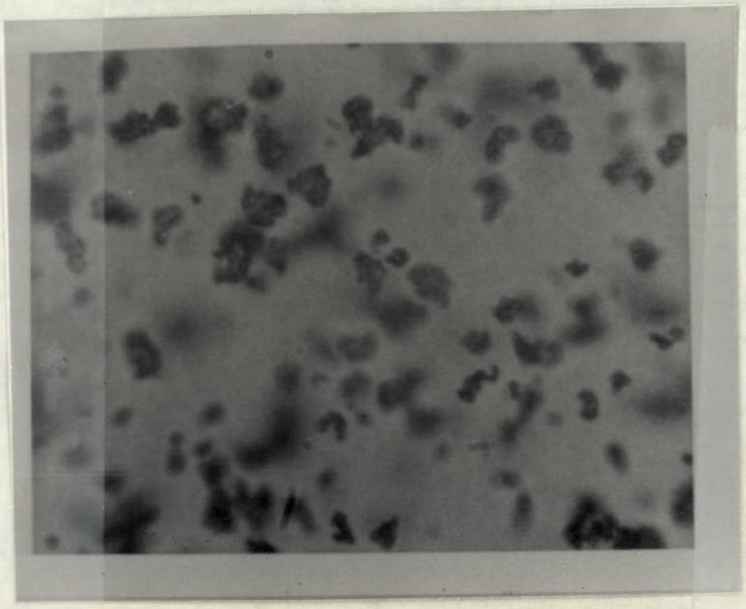
INTRODUCTION

A Microscopic Analysis of Control Film

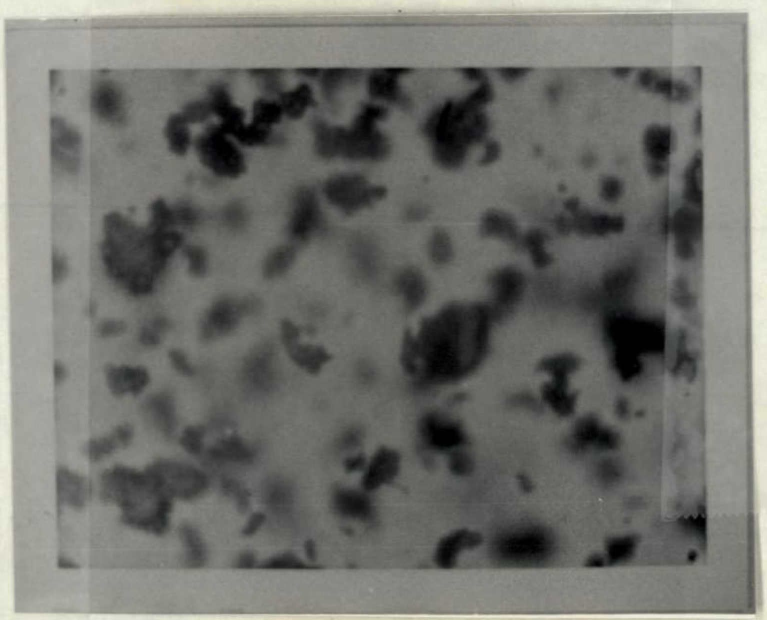
Examining the developed IIaO emulsion at 800X and 1500X magnification using reflective and transmission techniques produces interesting picutres of the surface structure of the IIaO emulsion.

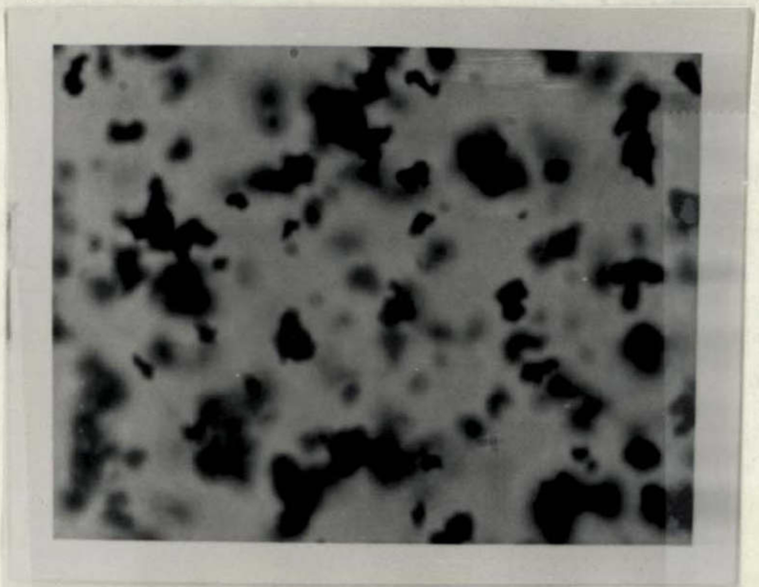
The initial shots show reflected light of the emulsion at the parts of the film with the least density and maximum transmission. The microphotographs also indicate grain clusters which extend beyond the surface of the emulsions, as viewed by the shadows created. There are within each grain clustering cell interesting and colorful point reflections that occur.





AN EXAMINATION OF THE LIGHTEST GRID PATTERN OF THE EMULSION LAYER PRODUCES MORE CLUSTERING IN THE REFLECTION MICROPHOTOGRAPHS, AND INDICATES THE SILHOUETTE OF THE GRAINS PRODUCED WHEN THE TRANSMISSION OF LIGHT THROUGH THE FILM IS PERMITTED.





PICTURES 5 AND 6 INDICATE THE COMBINATION OF REFLECTED AND TRANSMITTED LIGHT SILHOUETTES COMPOSED SUBSTANTIALLY OF THE INDIVIDUAL GRAIN STRUCTURES, WITH THEIR MULTI-FACETED REFLECTING CENTERS IN EACH GRAIN STRUCTURE.

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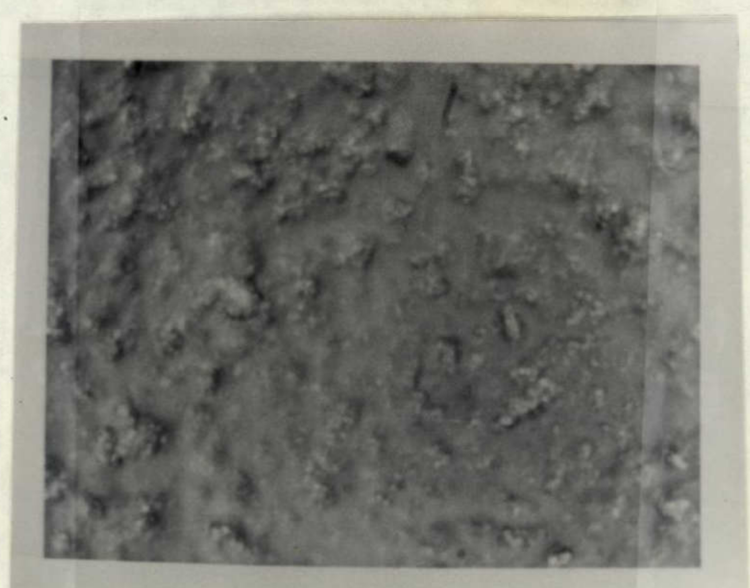
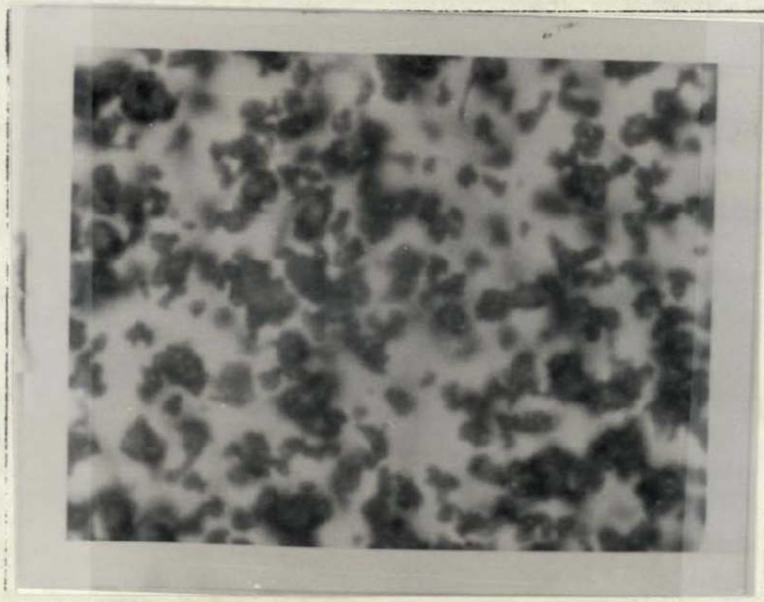
An examination of the mid density grids by the use of the back reflection of light through the microscope further substantiates the ruggedness of the emulsion grain. Some grain crystals seem to project above the normal surfaces of the film. A further analysis of the individual grains shows crystalline reflecting sites within each grain, a result which is not as prominent when viewed on the enclosed microphotographs.



THESE PHOTOGRAPHS CLEARLY INDICATE THE REFLECTED LIGHT FROM THE GRAIN CENTERS. GREATER MAGNIFICATION IS NEEDED TO EXAMINE THIS PHENOMENON IN DETAIL. THE MAGNIFICATION USED IN THE ABOVE PHOTOGRAPHS IS APPROXIMATELY 1400 POWER, WHICH IS THE OPTICAL LIMIT FOR THE BEST MICROSCOPES.

13



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THE ABOVE LISTED PICTURES ARE PRIME EXAMPLES OF THE HIGH DENSITY WEDGES AND THE INCREASED CLUSTERING. PICTURE NUMBER 13 INDICATES A TOTAL REFLECTION VIEW OF THE EMULSION SURFACE AT THE HIGH DENSITY PATTERN. PICTURE 12 IS A MICROPHOTOGRAPH OF A COMBINATION OF TRANSMISSION AND REFLECTION OF THE HIGH

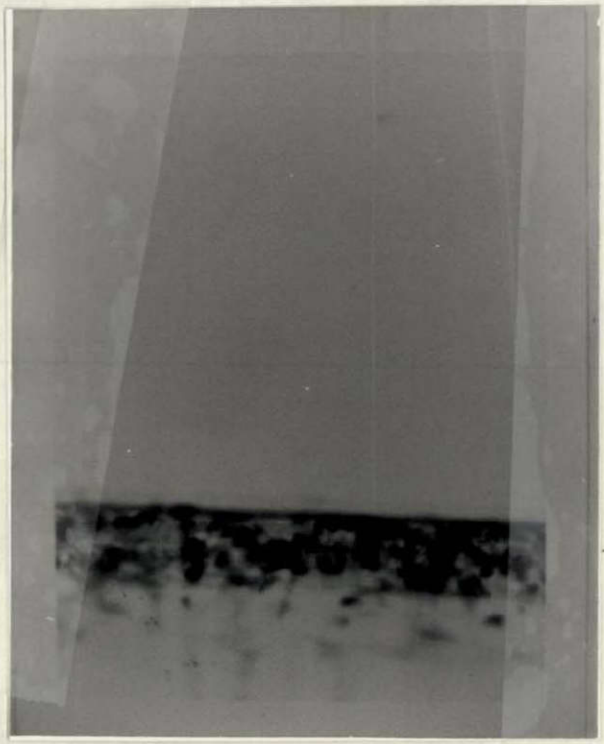
DENSITY GRID PATTERNS. PICTURE 11 (ON PAGE 6) FURTHER ILLUSTRATES POINT REFLECTING PATTERNS FROM INDIVIDUAL GRAIN MOUNDS, WITHIN THE EMULSION.

14

15

16

THE TYPICAL CONTROL IIAO FILM THEN WAS SLICED VERTICALLY TO EXAMINE THE GRAIN STRUCTURE, RELATIVE TO THE DEPTH OF THE EMULSION. PICTURES 14, 15, AND 16 ARE MICROPHOTOGRAPHS OF THE BACKGROUND GRAIN STRUCTURE AT THE LEAST DENSE PART OF THE FILM. THESE PHOTOGRAPHS TEND TO INDICATE LARGER GRAIN STRUCTURES AT THE SURFACE OF THE FILM, WHILE THE GRAIN STRUCTURE CLOSEST TO THE ACETATE BACKING OF THE EMULSION TENDS TO GET SMALLER. THESE LATTER GRAIN STRUCTURES REPRESENT PARTS OF THE FILM WHICH WOULD APPEAR RELATIVELY CLEAR TO THE NAKED EYE. THE DISTRIBUTION OF GRAINS, ON THE WHOLE TEND TO INDICATE A CLUSTERING EFFECT NEAR THE SURFACE FROM THE HORIZONTAL CUT. FURTHER CROSS SECTIONAL ANALYSIS OF THE FILM WILL SUBSTANTIATE CLUSTERING DISTRIBUTION PATTERNS.



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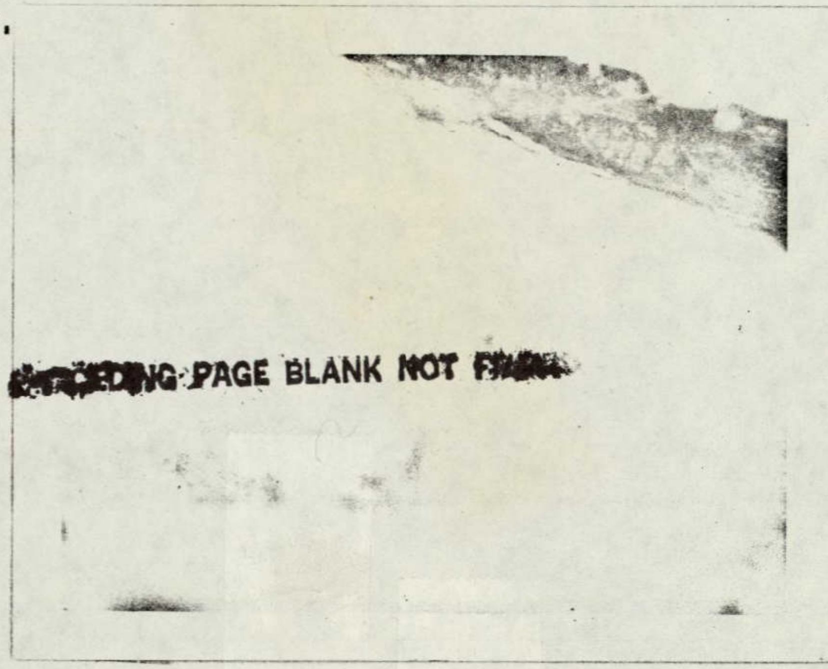
MICROPHOTOGRAPHS OF THE CROSS SECTIONS OF THE MID DENSITY PATTERNS CLEARLY INDICATE GREATER GRAIN CONCENTRATIONS WITH ACCOMPANYING SNAGGING OF THE EMULSION CAUSED BY THE CUTTING TECHNIQUE.



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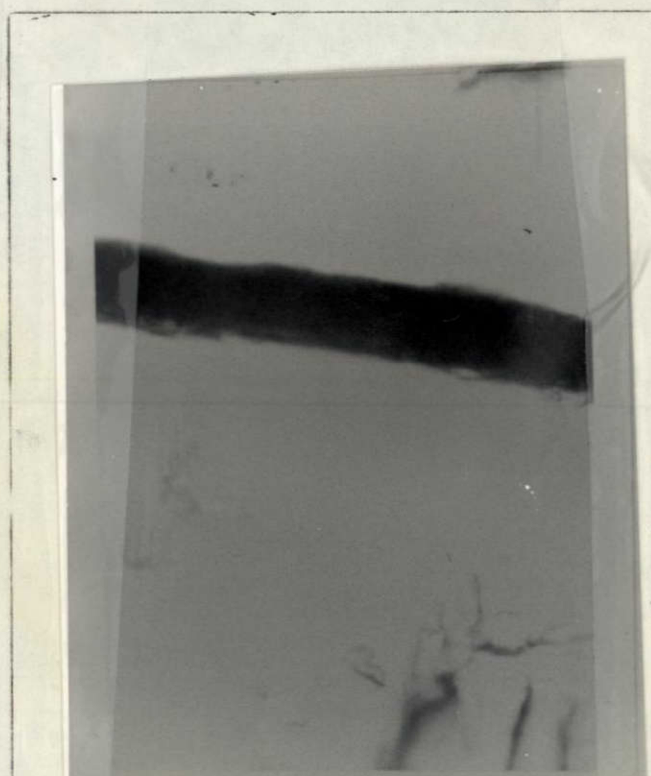

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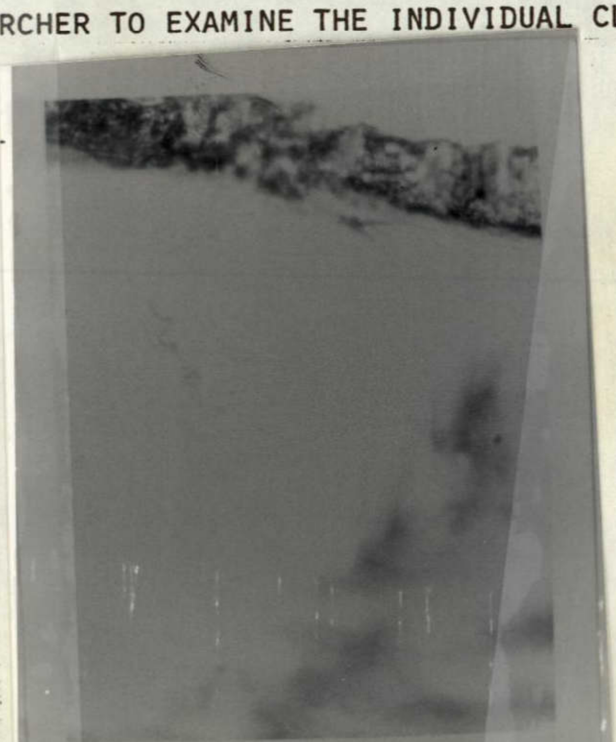
PICTURES 23 AND 24 INDICATE MICROPHOTOGRAPHS, USING BOTH REFLECTED AND TRANSMISSION LIGHT AT THE LOWER LAYERS OF THE EMULSION. THE TRANSMITTED LIGHT TENDS TO INDICATE THE GRAIN-ULAR REFLECTING CENTERS, AS MENTIONED IN THE OVERHEAD VIEW OF THESE PHOTOGRAPHS. REFINEMENT OF THE CUTTING TECHNIQUE ON THE FILM, AND UTILIZATION OF AN ELECTRON MICROSCOPE, WILL ENABLE THIS RESEARCHER TO EXAMINE THE INDIVIDUAL CLUSTERS IN DETAIL.



The Effects of Agitation and Film Soaking on IIaO Film

The photographer for many years has noted the effects of agitation and soaking on all types of commercial films. We have subjected our spectroscopic film IIaO to numerous experiments involving various patterns of soaking and agitating the film. The first graph (figure 1) indicated what happened when the film was soaked in the developer for 4 minutes without any agitation, under standard temperature conditions. The darker grid patterns displayed substantially reduced densities, while the lighter patterns showed similar reductions in these densities due to a prolonged period of soaking. One can further observe that when the film is soaked for 2 minutes and then agitated for 2 minutes, the densities at the high end are reduced. There is the same ringing pattern observed on the 4-minute soaked film.

An examination of the soaking pattern (10 seconds agitation and 5 seconds soaked) produces a smaller reduction in the high density grid (figure 2).

Soaking

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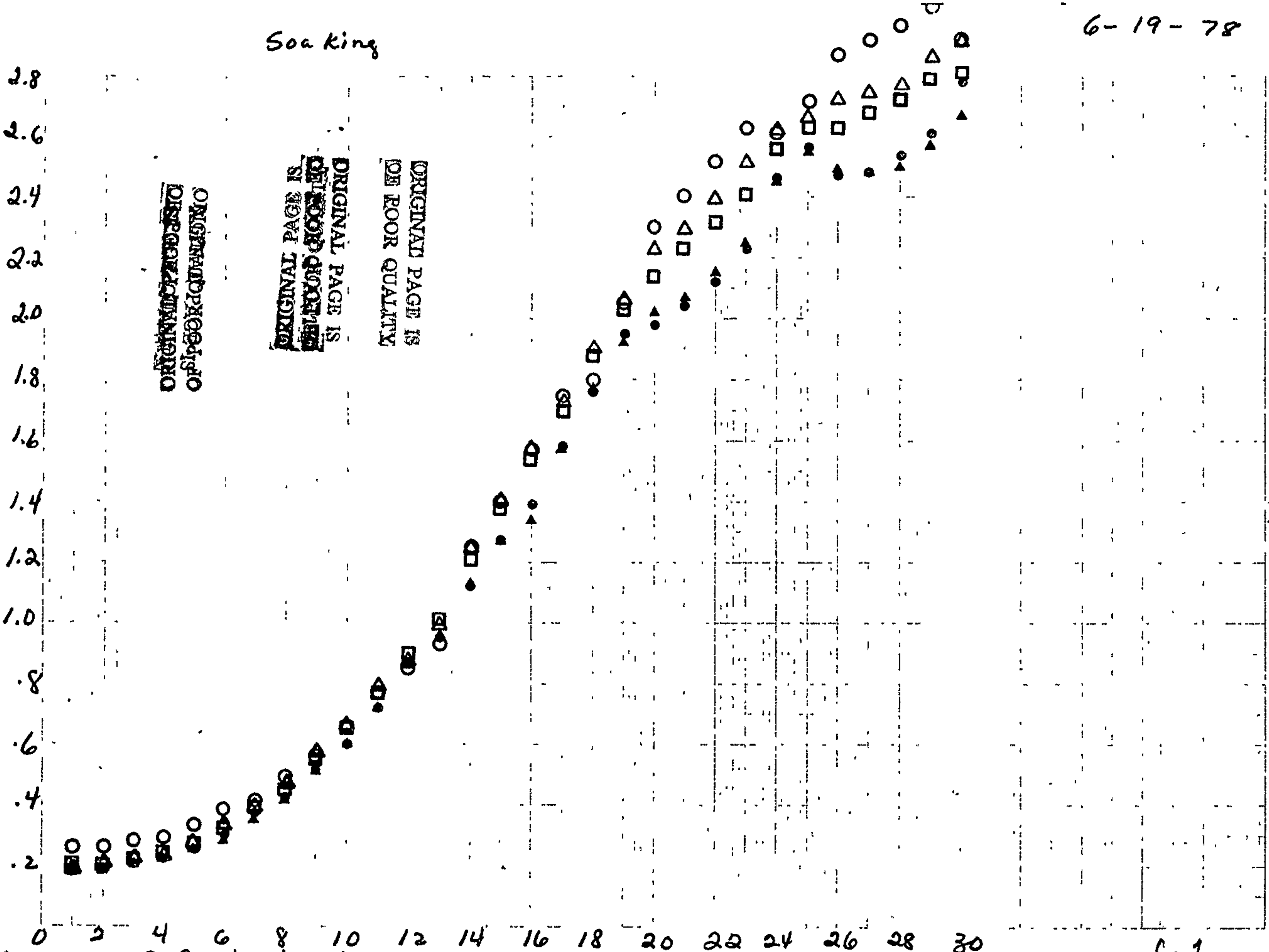


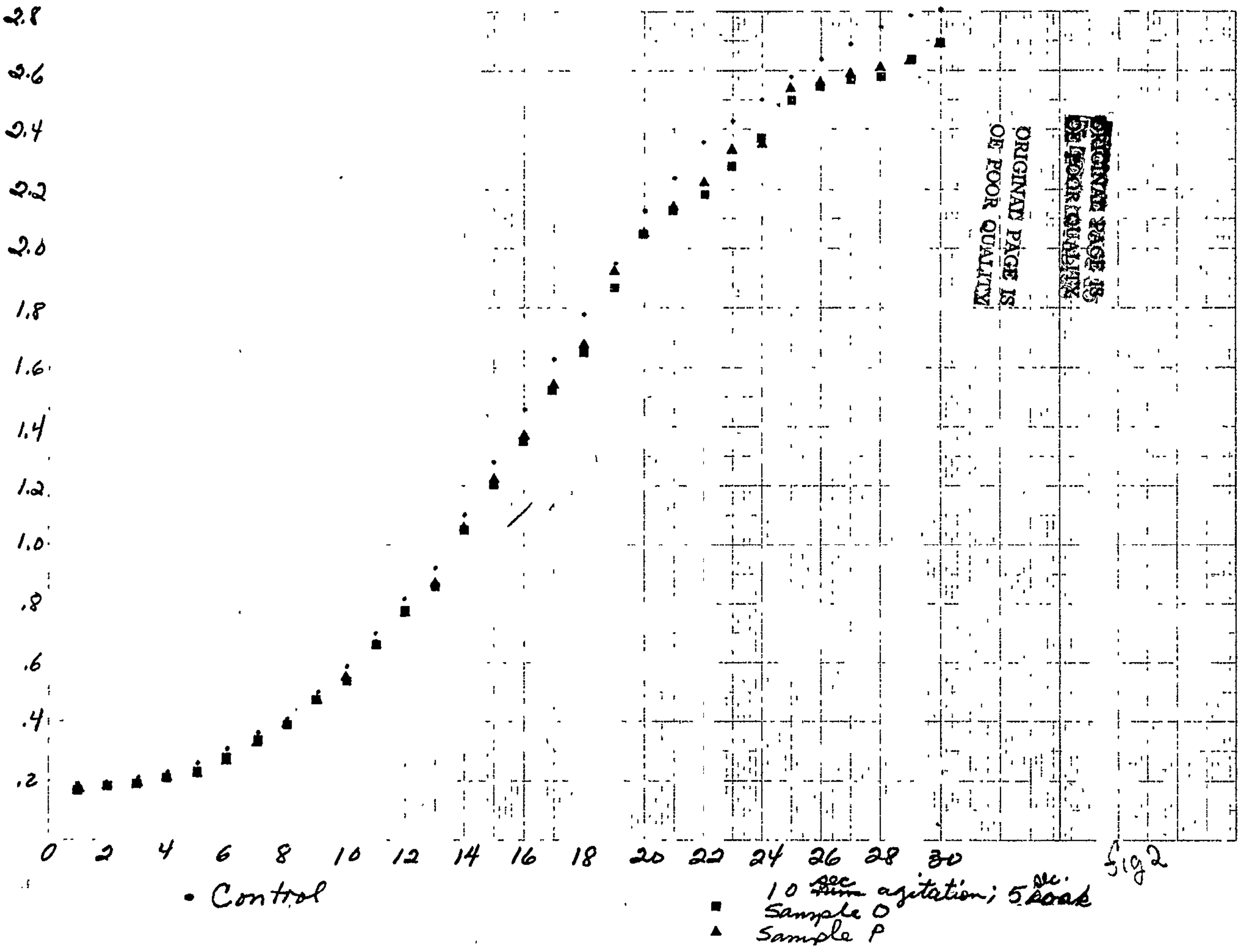
○ Control - New Film

● New Film - Soaked for 4 minutes
Sample D

□ New Film - Soaked 2 minutes; agitated
Sample F

2 minutes

fig 1


2.8
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
.8
.6
.4
.2
0
2
4
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8
10
12
14
16
18
20
22
24
26
28
30
• Control
10 sec agitation; 5 sec. soak
■ Sample O
▲ Sample P

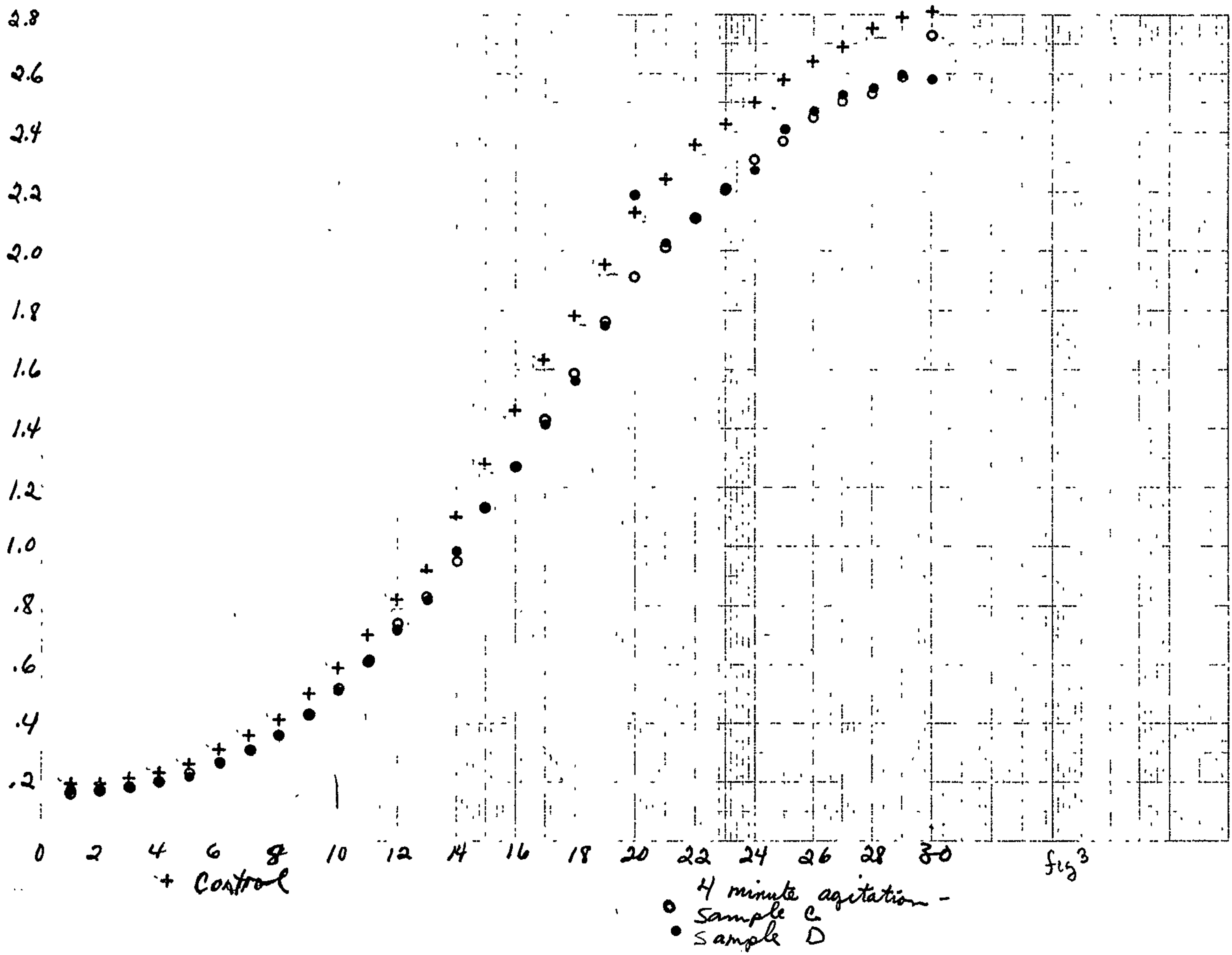
Fig 2

A COMPARISON OF FIGURES 3 AND 4 CLEARLY SHOWS THAT THE 4-MINUTE NONAGITATION OF THE FILM PRODUCES LOWER DENSITIES THAN THE 4 MINUTE CONTINUOUS AGITATION OF THE IIAO FILM (FIGURE 3 & 4).

THE GRAPHS SUBJECTED TO A 15 SECOND SOAK, INITIALLY FOLLOWED WITH A 15 SECOND PERIOD OF AGITATION PRODUCED THE SAME GENERAL CURVATURE AS THE PATTERN WHICH BEGAN WITH A 15 SECOND AGITATION, FOLLOWED BY A 15 SECOND SOAK (FIGURE 5 & 6). IT SHOULD BE NOTED THAT THE FILM FIRST SUBJECTED TO SOAKING AT THE HIGH DENSITIES DID DISPLAY SLIGHTLY REDUCED DENSITIES.

THE IIAO FILM WAS SUBJECTED TO A 2 MINUTE CONTINUOUS PERIOD AND A 2 MINUTE SOAK. THIS CONFIGURATION PRODUCED A PATTERN VERY SIMILAR TO THE CONTROL (FIGURE 7). THERE IS A SLIGHT REDUCTION OF THE FILM DENSITIES OF THE DARKER GRID PATTERNS.

AN EXAMINATION OF THE PATTERN OF THE 2 MINUTE INITIAL SOAK AND 2 MINUTE AGITATION PRODUCED SLIGHT CHANGES IN THE DARKER DENSITY GRID PATTERNS. (FIGURE 8).


2.8
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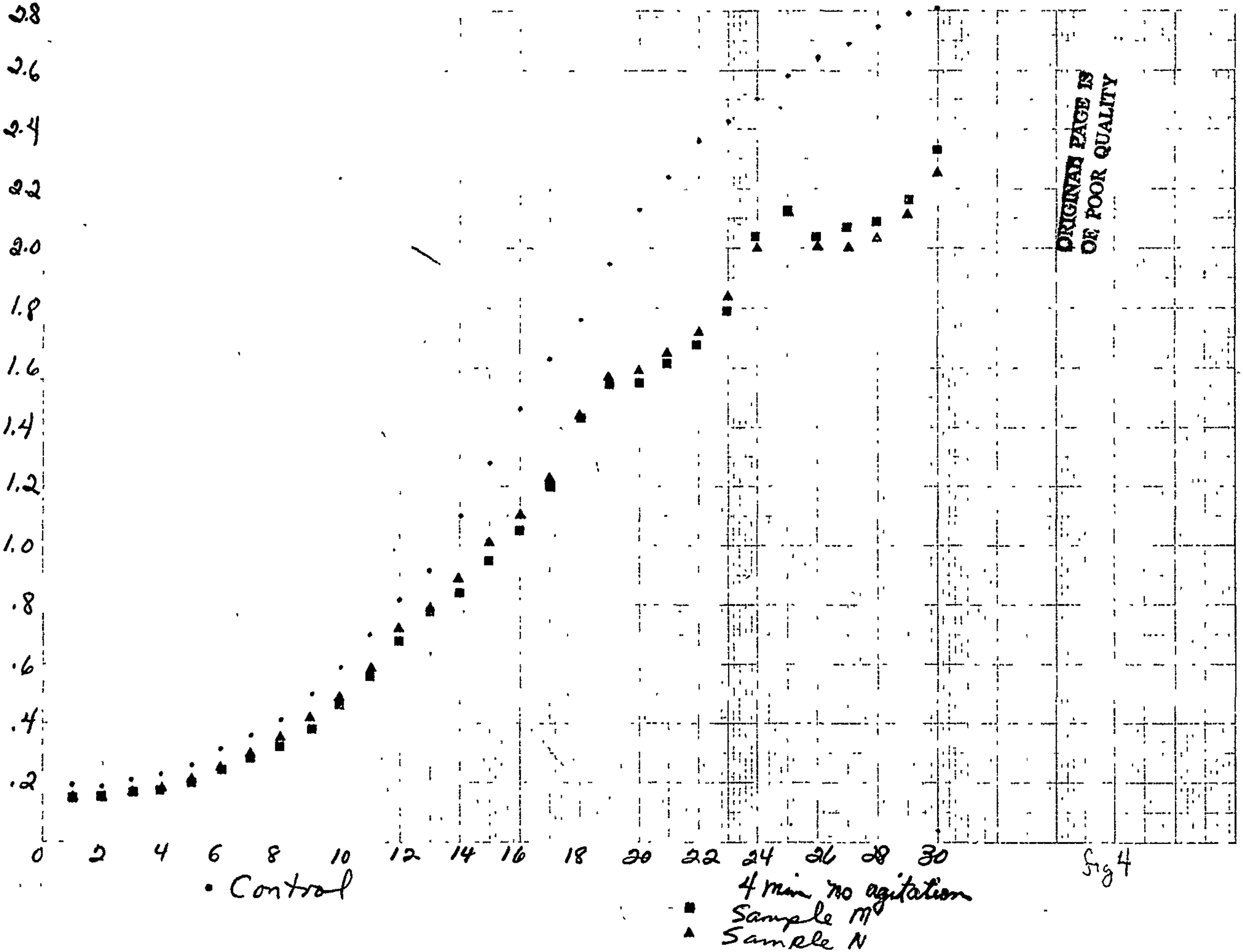
.4
.2
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
+ Control
4 minute agitation -
o sample C
• sample D

fig 3



2.8
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
.8
.6
.4
.2
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
• Control
4 min no agitation
■ Sample M
▲ Sample N
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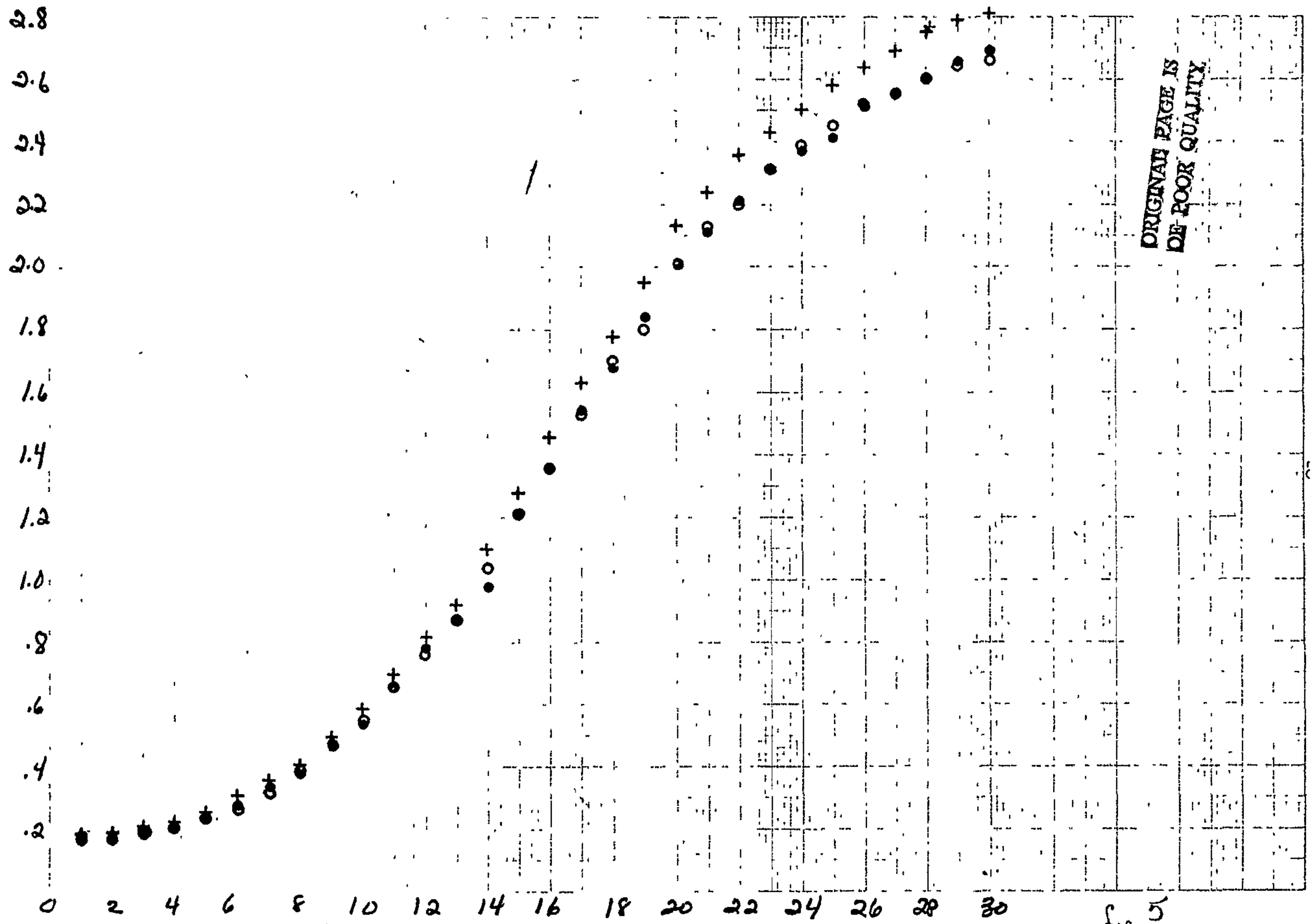
OF POOR QUALITY

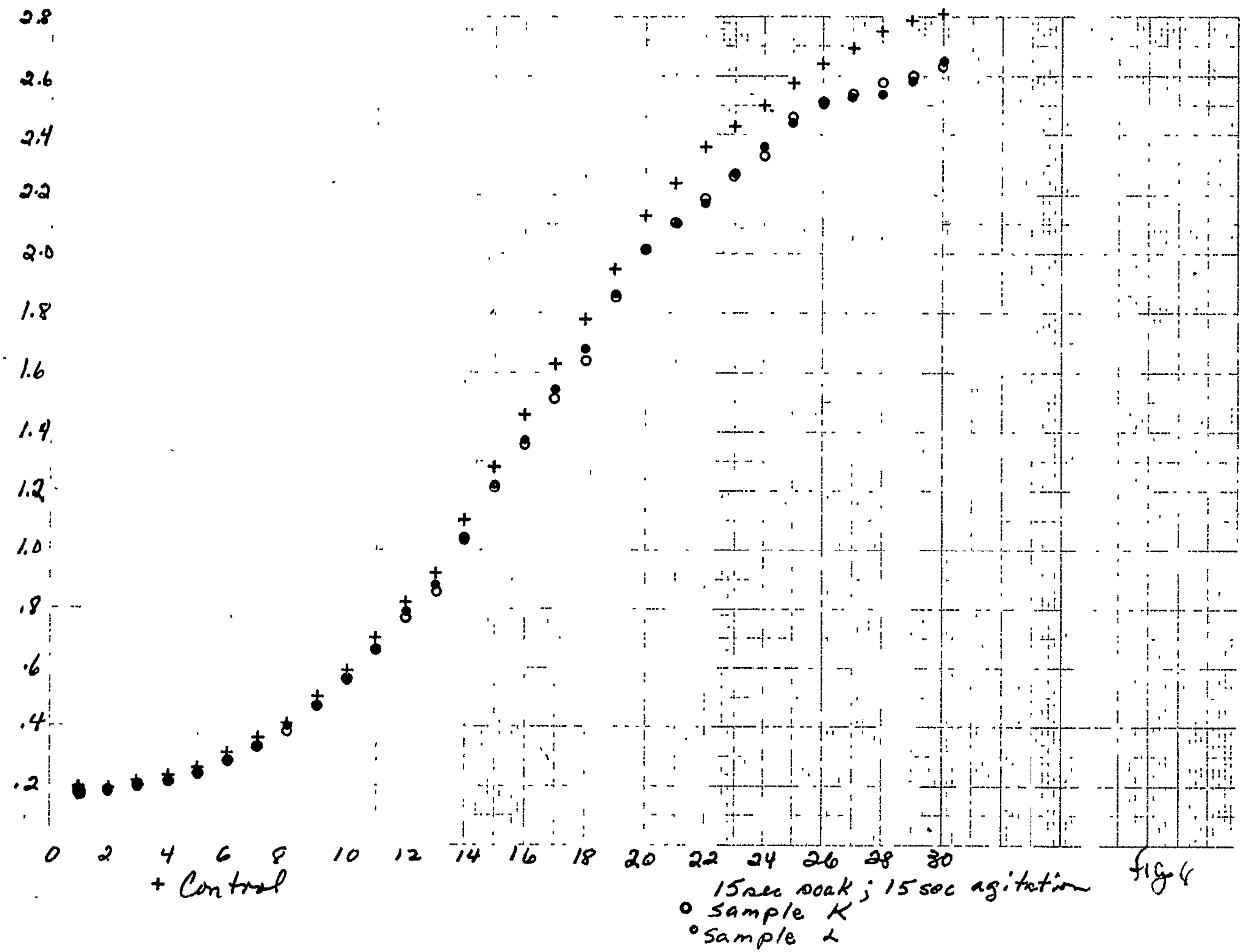
fig 4



+ Contral

15 sec agitation; 15 sec soak
o Sample I
• Sample J

fig 5


2.8
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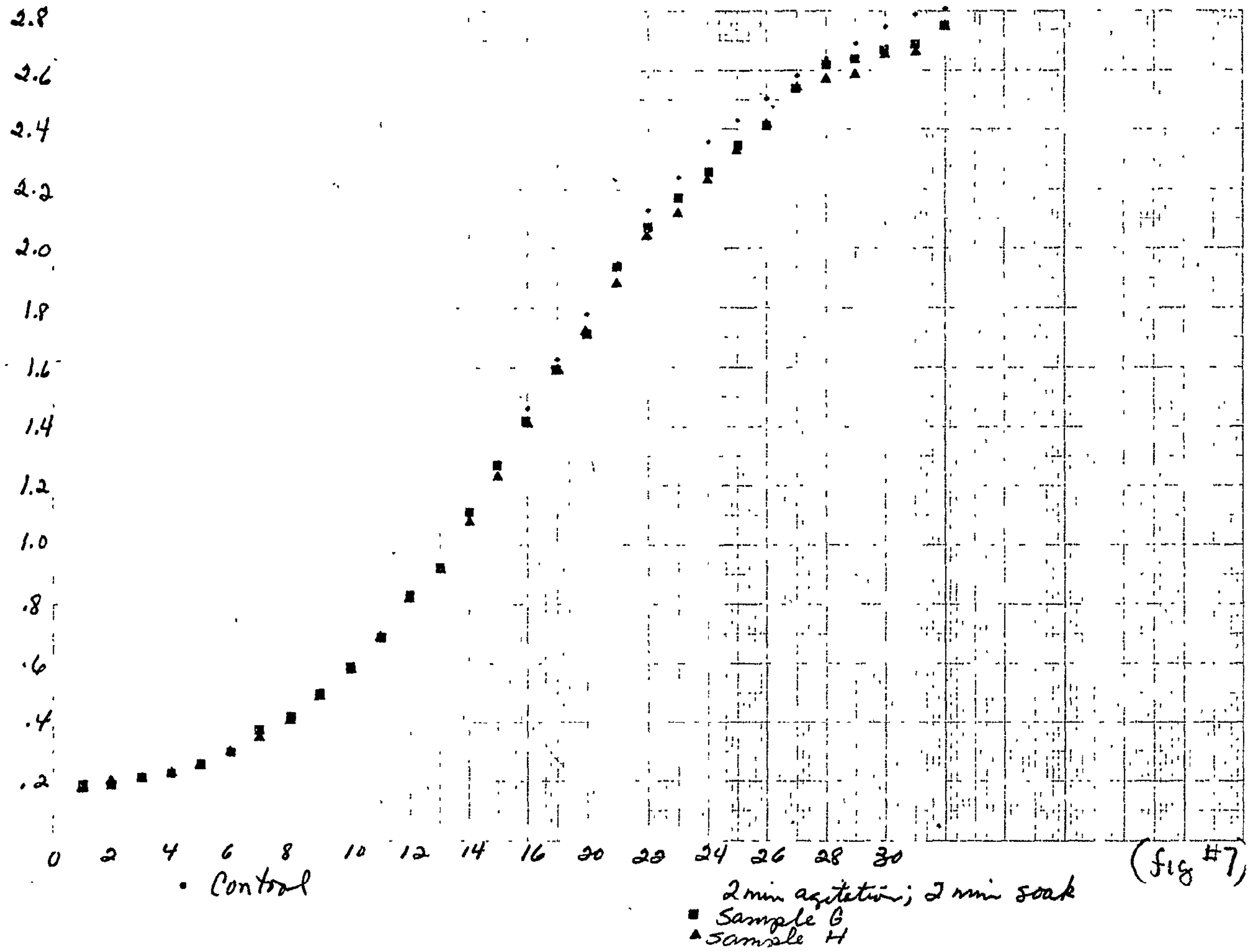
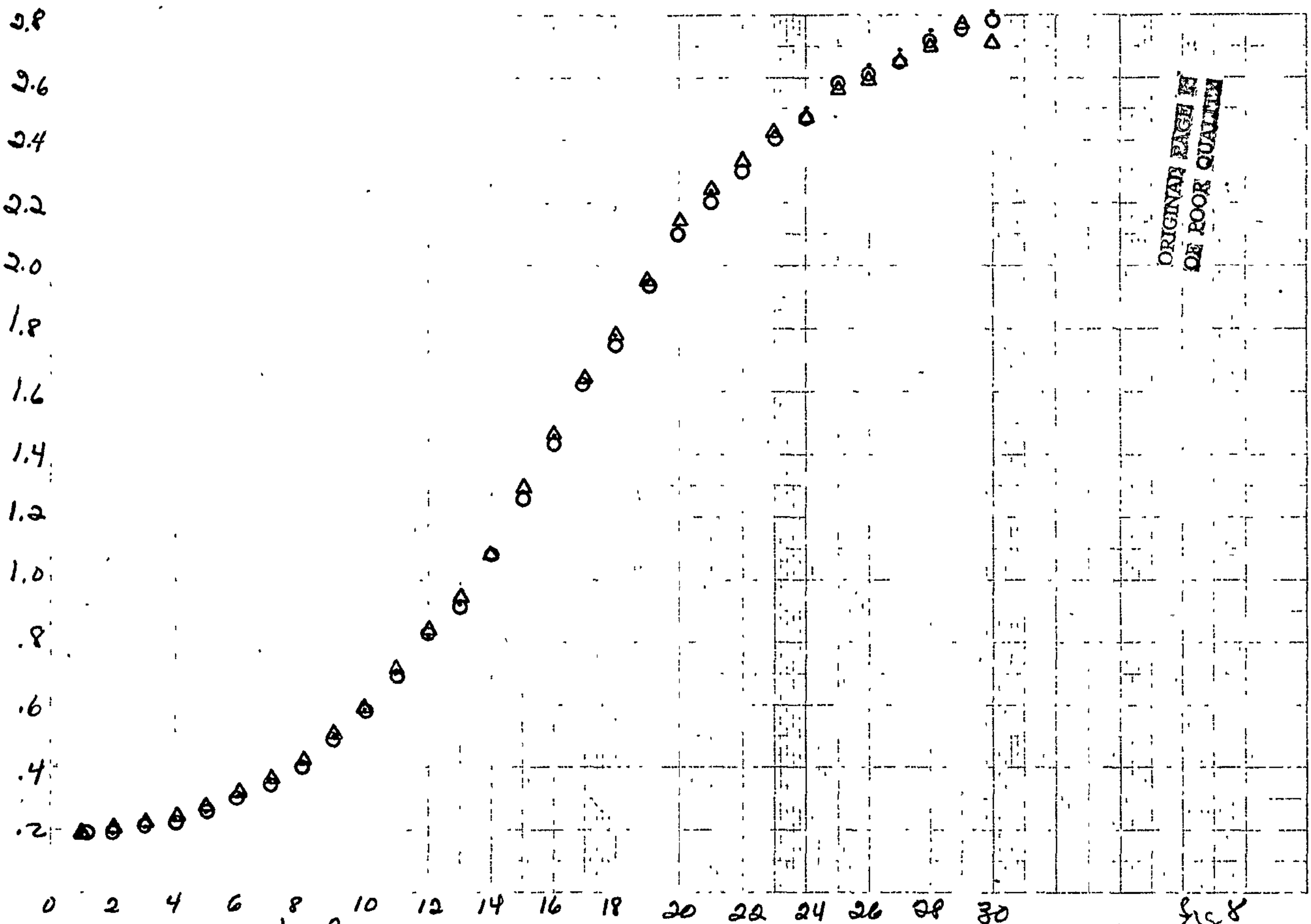
2.0
1.8
1.6
1.4
1.2
1.0
.8
.6
.4
.2
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
+ Control
15 sec soak; 15 sec agitation
o sample K
° sample L

fig 4



2.8
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
.8
.6
.4
.2
0
2
4
6
8
10
12
14
16
20
22
24
26
28
30
• Control
2 min agitation; 2 min soak
■ Sample G
▲ Sample H

(fig #7)



• Control

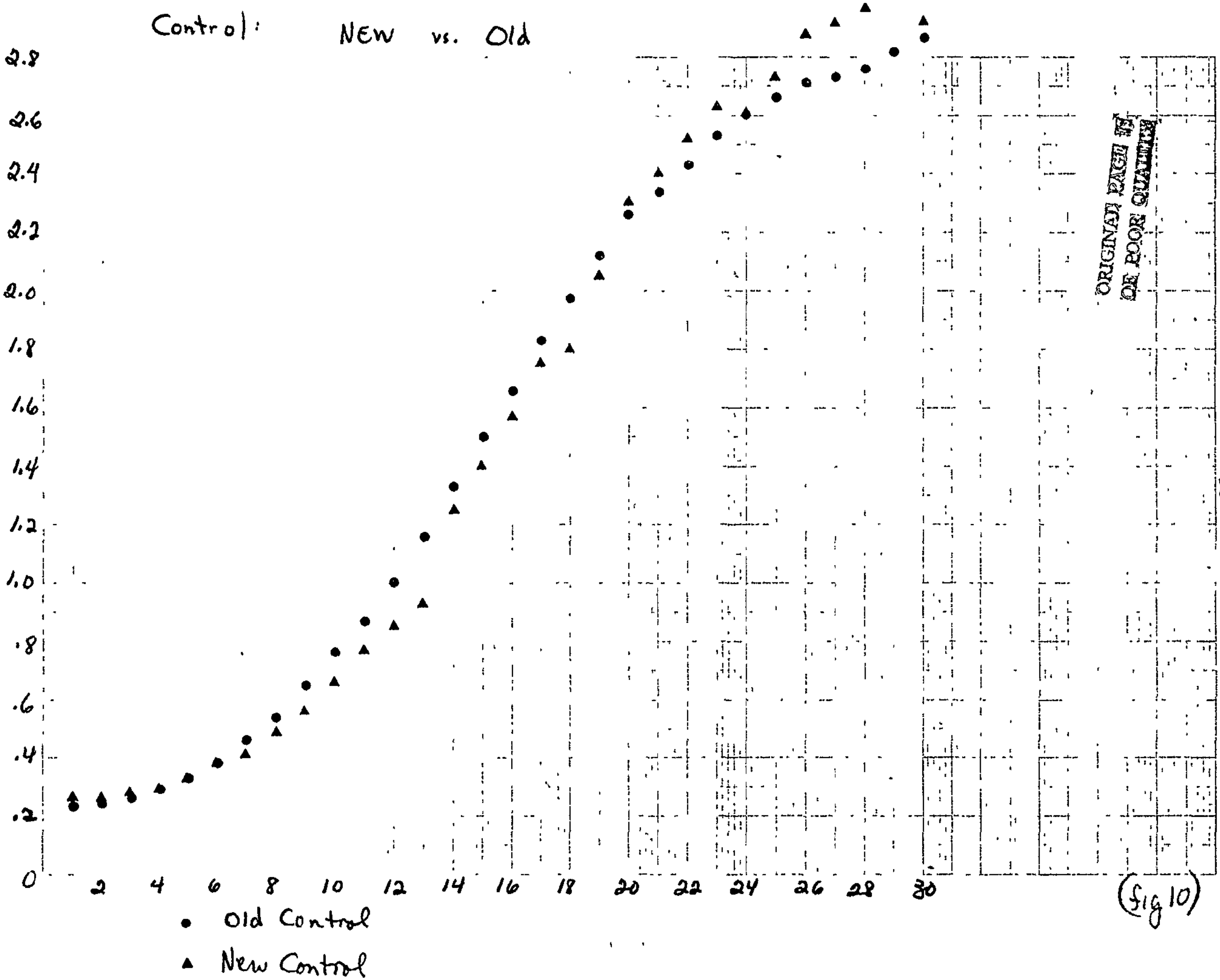
2 min soak; 2 min agitation
Δ Sample E
O Sample F

fig 8

An examination of one of the fundamental problems in calibrating films revealed the problem of batch to batch variation, and probably aging effects. Figure 9 shows the comparison between 3 samples of old control IIaO film, compared to 3 samples of a finished batch of IIaO film. There are substantial variations in densities of the new and old film. The new film seems to display a lower density at the mid-grid patterns and a higher density at the darker grid patterns, while the old film displayed higher densities at the mid-grid pattern range, and its high grid patterns displayed lower densities. (figure 9).

Figure 10 demonstrates the averages of the old control and the new control films. It depicts this variation clearly. (figure 10).

The standard method employed by the NASA group and the Morgan group in the development of old IIaO films is as follows: the initial 20 second period is agitation; the next 10 seconds is non-agitation; then comes 10 seconds agitation;



Control: NEW vs. Old
2.8
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
.8
.6
.4
.2
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
• Old Control
▲ New Control

(fig 10)

NEXT, 60 SECONDS NON-AGITATION; THEN, 10 SECONDS AGITATION; AND FINALLY, 10 SECONDS OF AGITATION. THE LAST 60 SECONDS IS NON-AGITATION, AND THE REMAINING 10 SECONDS OF THE 4 MINUTE DEVELOPMENT PERIOD IS THAT OF AGITATION. THIS WORKS OUT TO BE APPROXIMATELY A 10 SECOND AGITATION EACH HALF MINUTE, WITH THE REMAINING 20 SECONDS ALLOWED FOR SOAKING OF THE FILM. FIGURE 11 CLEARLY INDICATES THE EFFECTIVENESS OF THIS AGREED-UPON, STANDARD PROCEDURE IN TERMS OF AN OVERALL REDUCTION IN THE DENSITIES OF ALL THE GRID PATTERNS FROM THE INITIAL STEP WEDGES INTO THE FINAL STEP WEDGES, WHILE THE 15 SECOND SOAK PATTERN TENDS TO DISPLAY THE LARGEST DENSITIES ACROSS THE ENTIRE GRID SPECTRUM. (FIGURE 11).

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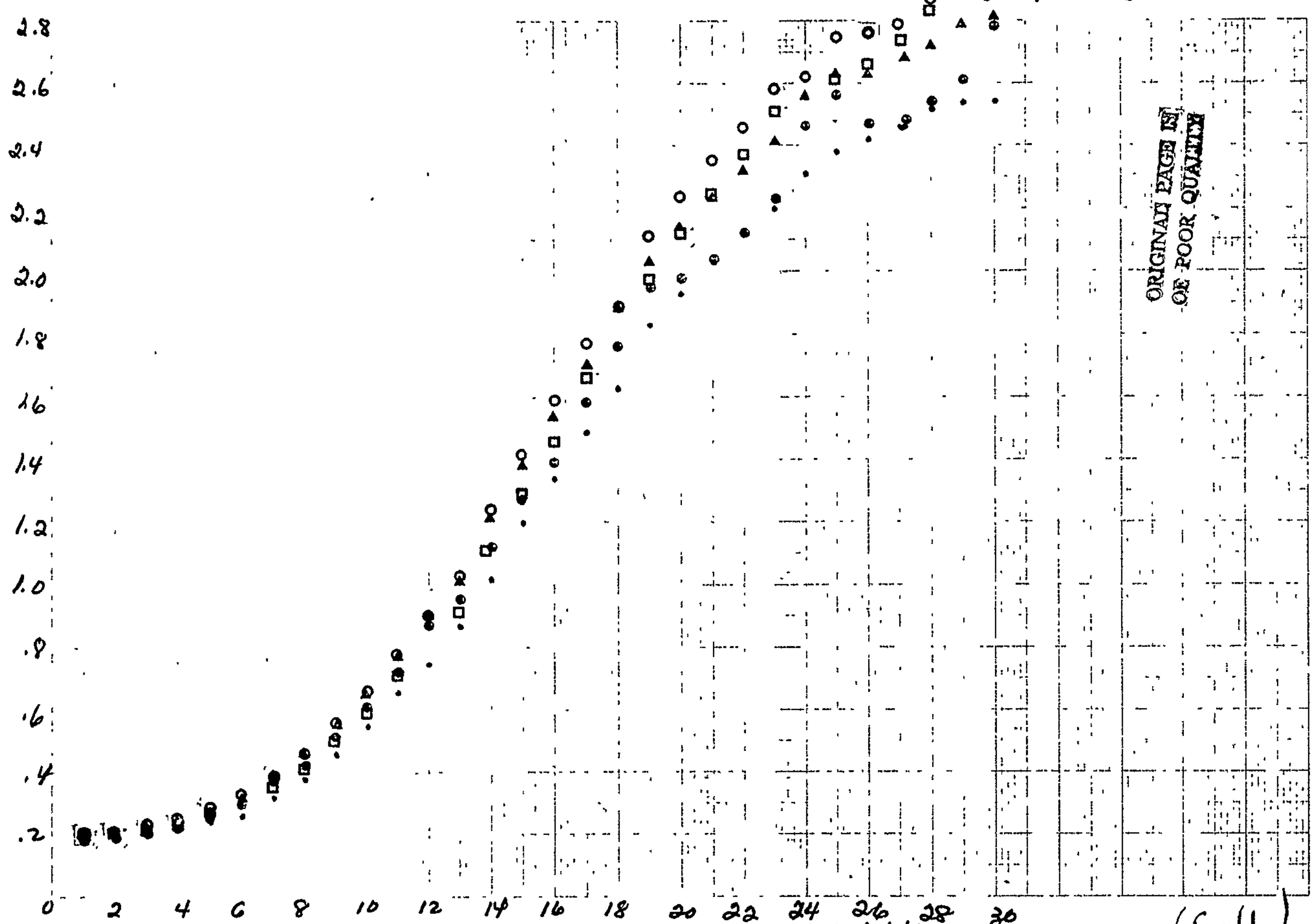
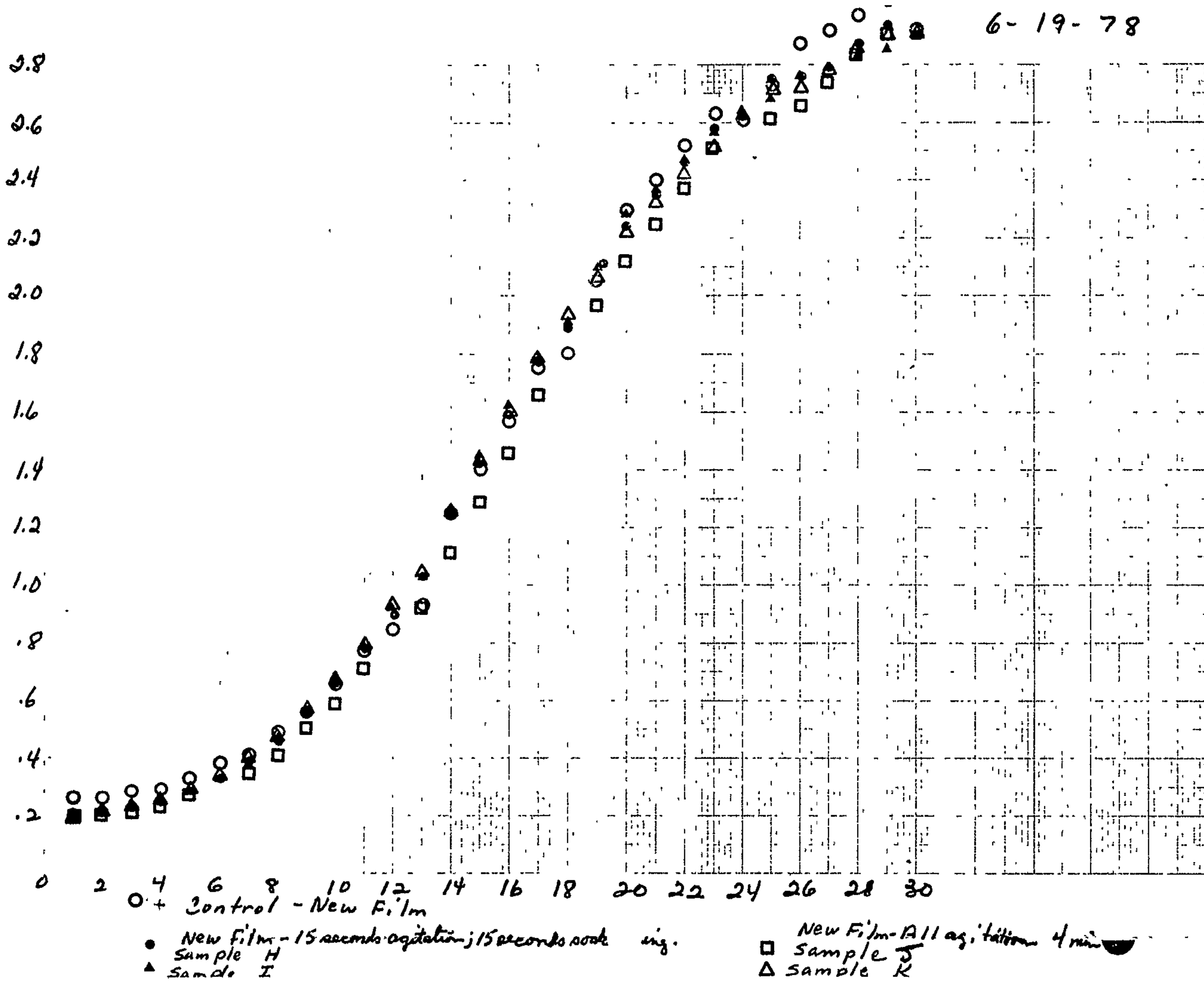


(fig 11)

⊙ Soaked in Devel: 4 minutes Sample D
▲ 2 minutes agitation; 2 min. soaking Sample F
○ 15 sec. agitation; 15 sec. soaking every other [illegible] Sample E
□ All ~~agitation~~ agitation 4 minutes. Sample J



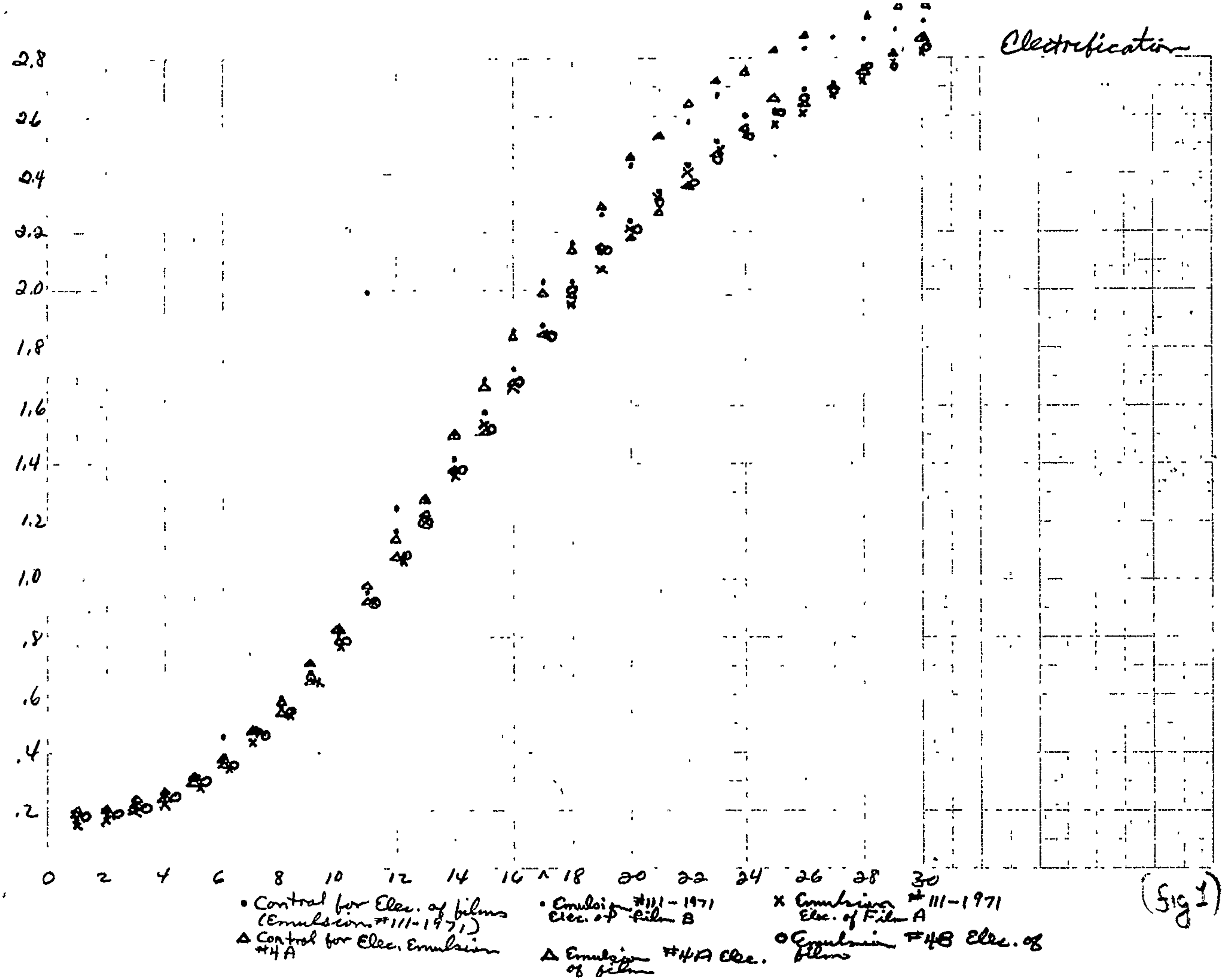
6-19-78
2.8
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
.8
.6
.4
.2
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
O + Control - New Film
● New Film - 15 seconds agitation; 15 seconds soak
Sample H
▲ Sample I
New Film - All agitation 4 min
□ Sample J
Δ Sample K

ELECTRIC FIELD EFFECTS ON IIAO FILM

FILMS EXPOSED TO A TERRESTIAL OR EXTRATERRESTIAL ENVIRONMENT WERE SUBJECTED TO STATIC ELECTRICAL CHANGES, THE EFFECTS OF WHICH WE HAVE EXAMINED IN THE FOLLOWING STUDIES.

IN FIGURE 1 WE SEE THE EFFECT OF A STATIC CHARGE PRODUCED BY A TESLA-COIL ON THE IIAO FILM, AS COMPARED TO THAT PRODUCED BY THE CONTROL FOR THE PARTICULAR BATCH OF FILM. THE EXACT EXPERIMENTAL CONFIGURATION CONSISTED OF TWO PLATES OF ALUMINUM METAL, SEALED WITH BLACK PHOTOGRAPHIC TAPE TO REDUCE THE LIGHT FROM THE ATMOSPHERIC DISCHARGE CAUSED BY THE TESLA-COIL.

IT SHOULD BE NOTED THAT THE UTILIZATION OF THE TESLA-COIL MAY HAVE PRODUCED A QUANTITY OF SOFT X-RAYS. THE EFFECT OF THIS EXPOSURE OF IIAO FILM PRODUCED SUBSTANTIAL DIFFERENCES IN GRID DENSITIES AT THE DARK GRID POSITIONS OF THE FILM. WHILE THE DENSITY MEASUREMENTS OF THE LIGHTER GRIDS SEEM TO INDICATE SOME SEPARATION, THESE DENSITY MEASUREMENTS ARE NOWHERE AS PRONOUNCED AS THE DARK GRID POSITIONS.


Electrification
2.8
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
.8
.6
.4
.2
0
2
4
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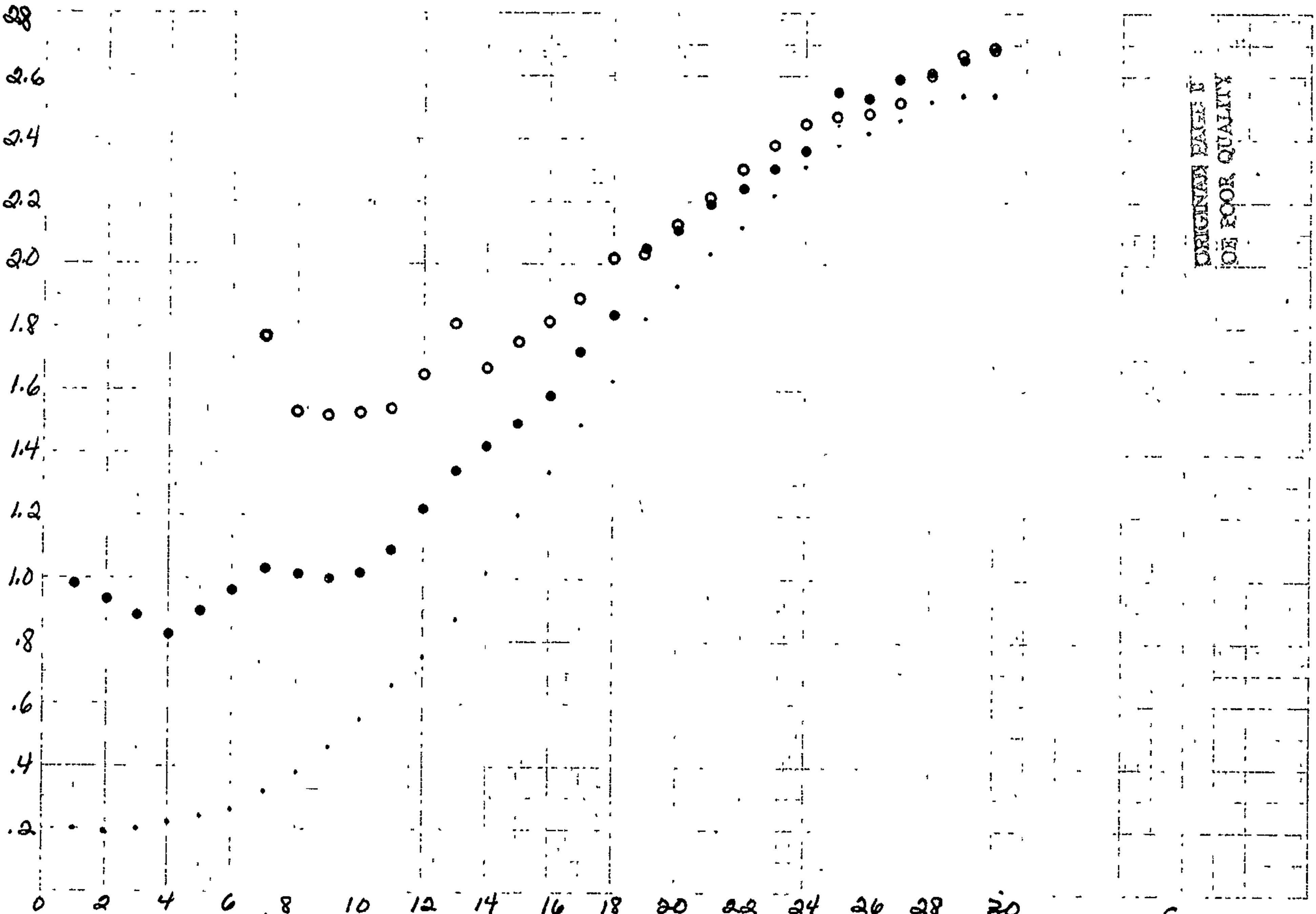
8
10
12
14
16
18
20
22
24
26
28
30
• Control for Elec. of films (Emulsion #111-1971)
△ Control for Elec. Emulsion #4A
• Emulsion #111-1971 Elec. of film B
△ Emulsion #4A Elec. of film
× Emulsion #111-1971 Elec. of Film A
○ Emulsion #4B Elec. of films

(fig 1)

An attempt was made to minimize the effect of the soft X-rays produced by the Tesla-coil by using the Van der Graff generator placed in the dark room, with the film taped to the metallic sphere. There were inherent dangers in doing the experiment because the movement of electrons from the dome of the sphere to the rubber band produced a substantial glow of light, coming from the underside of the dome. Minimal amounts of blue light were detected. The films were exposed, for periods of 2, 6, and 10 minutes respectively to a charge on the sphere, and then the dome of the generator was discharged. The net result of these experiments indicates that the movement of these electrons had a definite effect on the lighter grid patterns. The increase in the lighter grid densities (Figure 2) is the result of the discharge's occurring too close to the attached. The six-minute exposure to the electric field showed the same reduction of density as observed when the Tesla-coils were the primary source of charge. The discharge



• Control - NASA Technique
Sample A

Static Elect. Exp.
• Sample A
∘ Sample B
2 minute

Fig 2

WAS CONTROLLED IN SUCH A WAY THAT THE ASSOCIATED GLOW OF THE DISCHARGE RADIATED AWAY FROM THE FILM. THE PATTERN OBSERVED HERE IS THE SAME THAT WE REPORTED ON WHEN BETA-PARTICLES WERE USED FROM A RADIOACTIVE SUBSTANCE. THE FILM EXPOSED FOR TEN MINUTES DISPLAYED AN UNCHARACTERISTIC INCREASE IN THE LOWER GRID DENSITY, WHILE THE DARK GRIDS DISPLAYED A LOWER DENSITY COMPARED WITH THE LIGHTER GRID PATTERNS. (FIGURE 3)

FIGURE 4 INDICATES THE RESULTS OF A PROLONGED EXPOSURE OF THE IIAO FILM TO THE ELECTRIC FIELD. NOTICE THAT THE DARK DENSITY GRID PATTERNS EXPOSED TO THE FILM ARE SUBSTANTIALLY REDUCED, A FACT WHICH IS CONSISTENT WITH THE OTHER OBSERVATIONS USING THE TESLA-COIL. THE LIGHT DENSITY GRIDS CONTINUE TO DISPLAY THE SAME EFFECT OF INCREASED DENSITIES CAUSED BY THE MOTIONS OF THE ELECTRONS ON THE DOME.

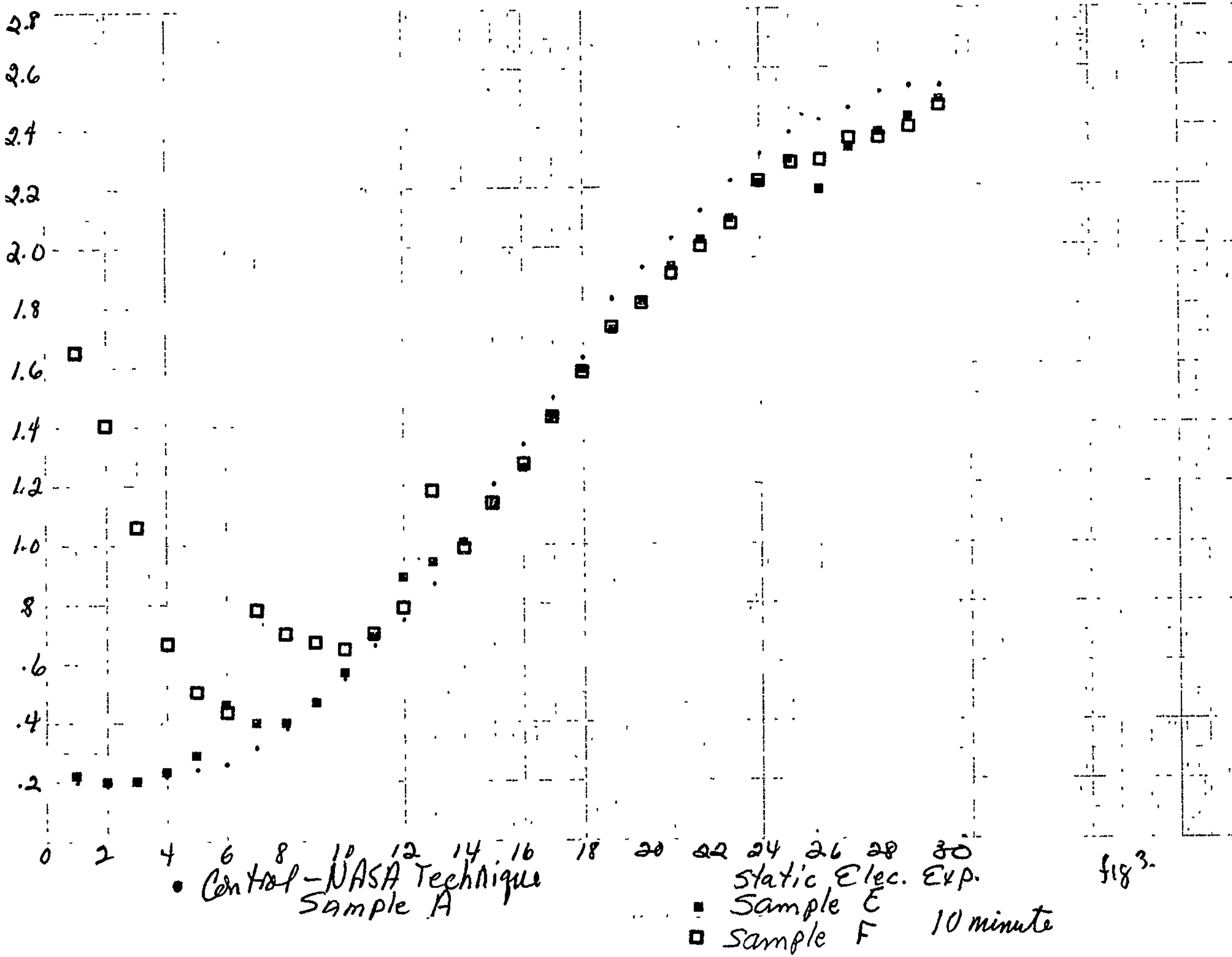
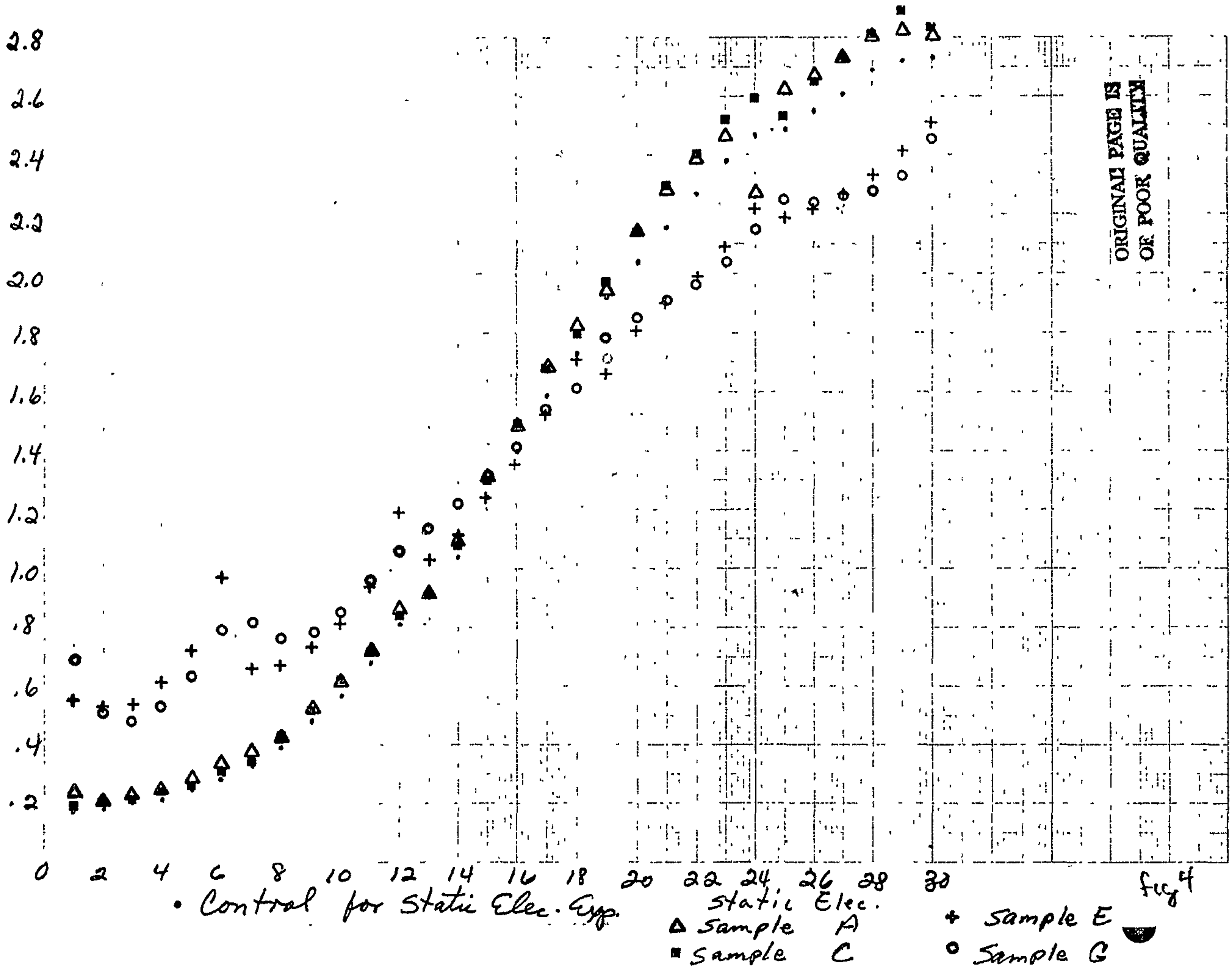

2.8
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
.8
.6
.4
.2
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
• Control—NASA Technique Sample A
Static Elec. Exp.
■ Sample E
□ Sample F
10 minute

fig 3.



2.8
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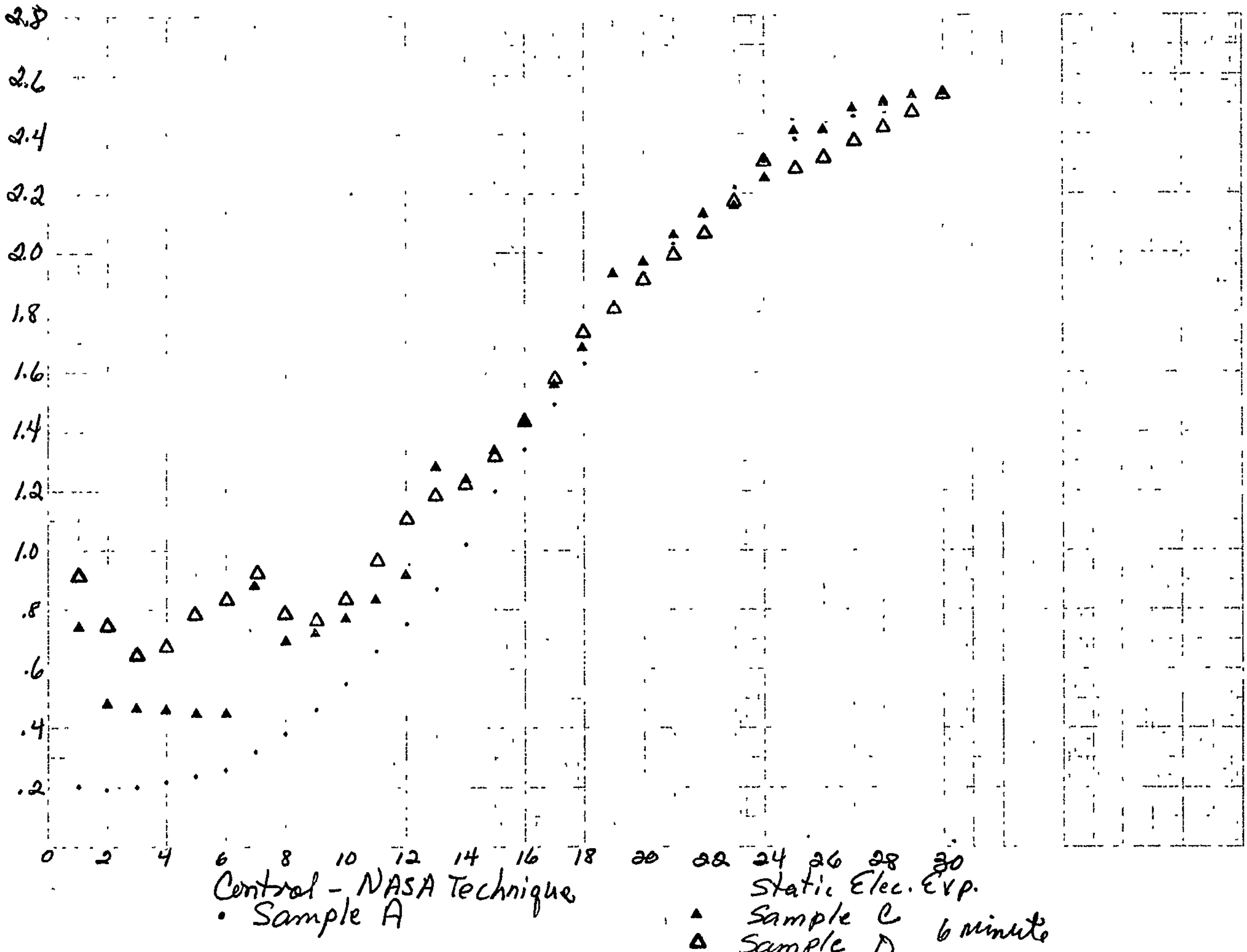
22
24
26
28
30
ORIGINAL PAGE IS OF POOR QUALITY
• Control for Static Elec. Exp.
Static Elec.
△ Sample A
■ Sample C
+ Sample E
○ Sample G

fig 4



2.8
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2.4
2.2
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1.8
1.6
1.4
1.2
1.0
.8
.6
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.2
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2
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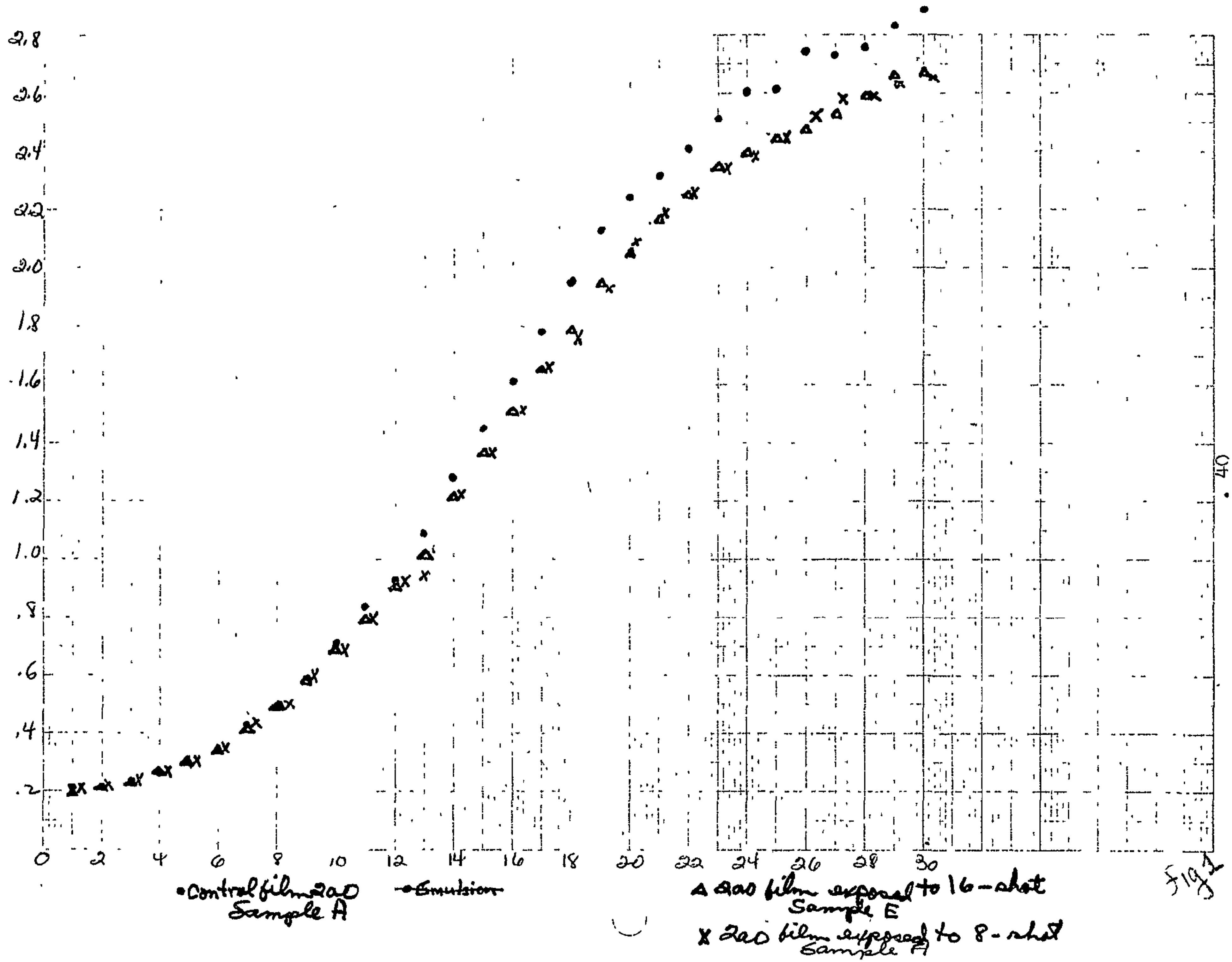
8
10
12
14
16
18
20
22
24
26
28
30
Control - NASA Technique
• Sample A
Static Elec. Evp.
▲ Sample C
△ Sample D
6 minute

CONTAINER TENDED TO SHOW A FURTHER REDUCTION IN DENSITY, AS COMPARED TO THE CONTROL. (FIGURE 1) THIS REDUCED DENSITY IS QUITE CONTINUOUS WITH A MINIMAL FLUCTUATION ACROSS THE GRID PATTERNS, WHILE THE INTERMEDIATE FILM EXPOSED TO THE ONE SHOT DOSE OF RADIATION CONTINUED TO SHOW A MARKED FLUCTUATION. THESE FLUCTUATIONS HAVE THE GREATEST CHANGE IN THE LAST SEVEN PATTERNS OF THE FILM. THESE OBSERVATIONS ARE COMPARABLE TO THE OBSERVATION OF THE LAST GRID PATTERNS OF THE IIAO FILM SUBJECTED TO HIGH ELECTRONIC FIELDS AND SOFT X-RAYS. THE SPECTROSCOPIC FILM EXPOSED TO ONE, FOUR, EIGHT, AND SIXTEEN DOSES (FIGURE 1A, 1B, 1C, 1D) OF X-RAY CONTINUED TO SHOW A LOWER DENSITY READING AT THE HIGHER GRID PATTERNS THAN THE DENSITY READINGS SHOWN BY THE CONTROL IIAO FILM. THE LOW DENSITY PATTERNS CLEARLY SHOW A MARKED REDUCTION IN THE DENSITIES OF THE FILM IN THE METAL CANNISTER. THE LOW DENSITY PATTERNS FOR THE PLASTIC CONTAINERS SHOW A SIMILAR TREND.

FIGURE 2 INDICATES THE VARIATION, AS RELATED TO THE FOUR SHOTS OF X-RAYS FROM THE AIRPORT EQUIPMENT, FOR TWO DIFFERENT TYPES OF FILM - I.E., A NUMBER 3 FILM AND A NUMBER 4 FILM, BOTH OF WHICH VARY IN AGE.

FIGURE 3 CLEARLY INDICATES THE PROTECTIVE EFFECT OF ONE SHOT X-RAYS FOR FILM NUMBER 3 AND FILM NUMBER 4, WHILE EMULSION NUMBER 4 IN THE METAL CONTAINER DISPLAYS SOME ATTENUATION OF THESE X-RAYS.



2.8
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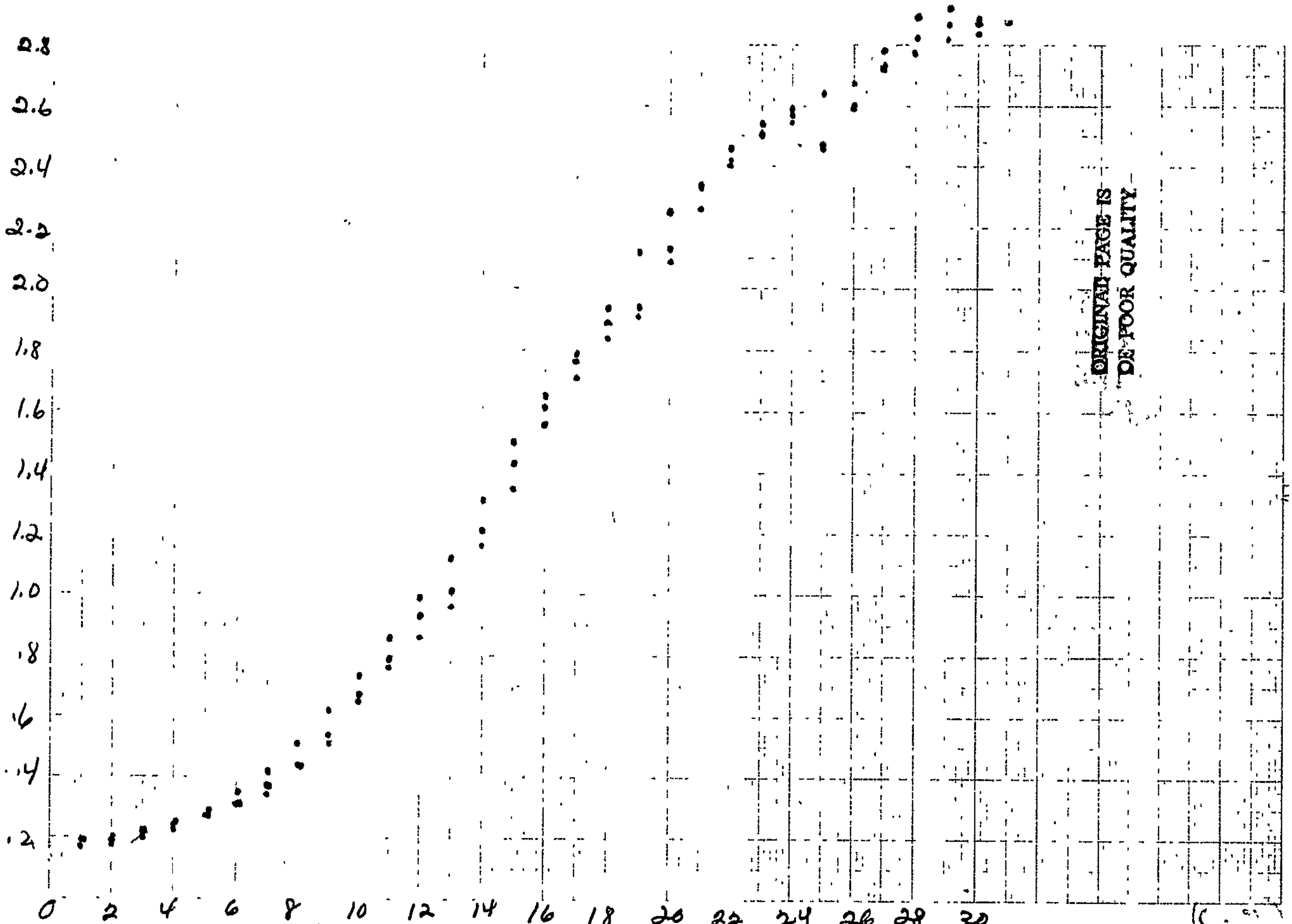
28
30
40
• Control film 2a0 Sample A
Emulsion
▲ 2a0 film exposed to 16-shot Sample E
X 2a0 film exposed to 8-shot Sample A

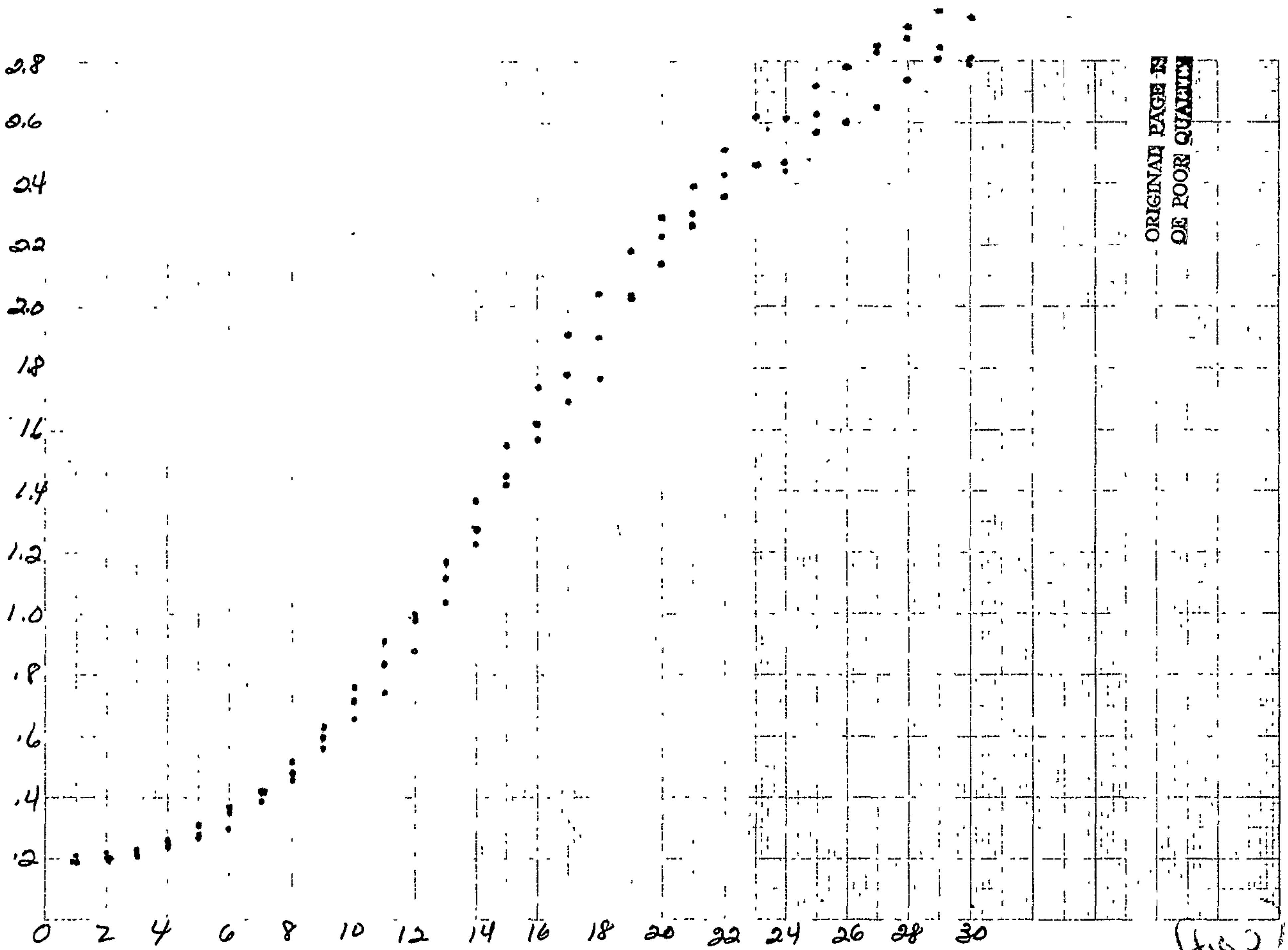
Fig 1



• Emulsion #3 exposed to X-Rays 4 shots Plastic Container

• Emulsion #3 exposed to 4 shots of X-Rays in Metal Container

• Emulsion #4 exposed to 4-shots of X-Rays in Metal Container



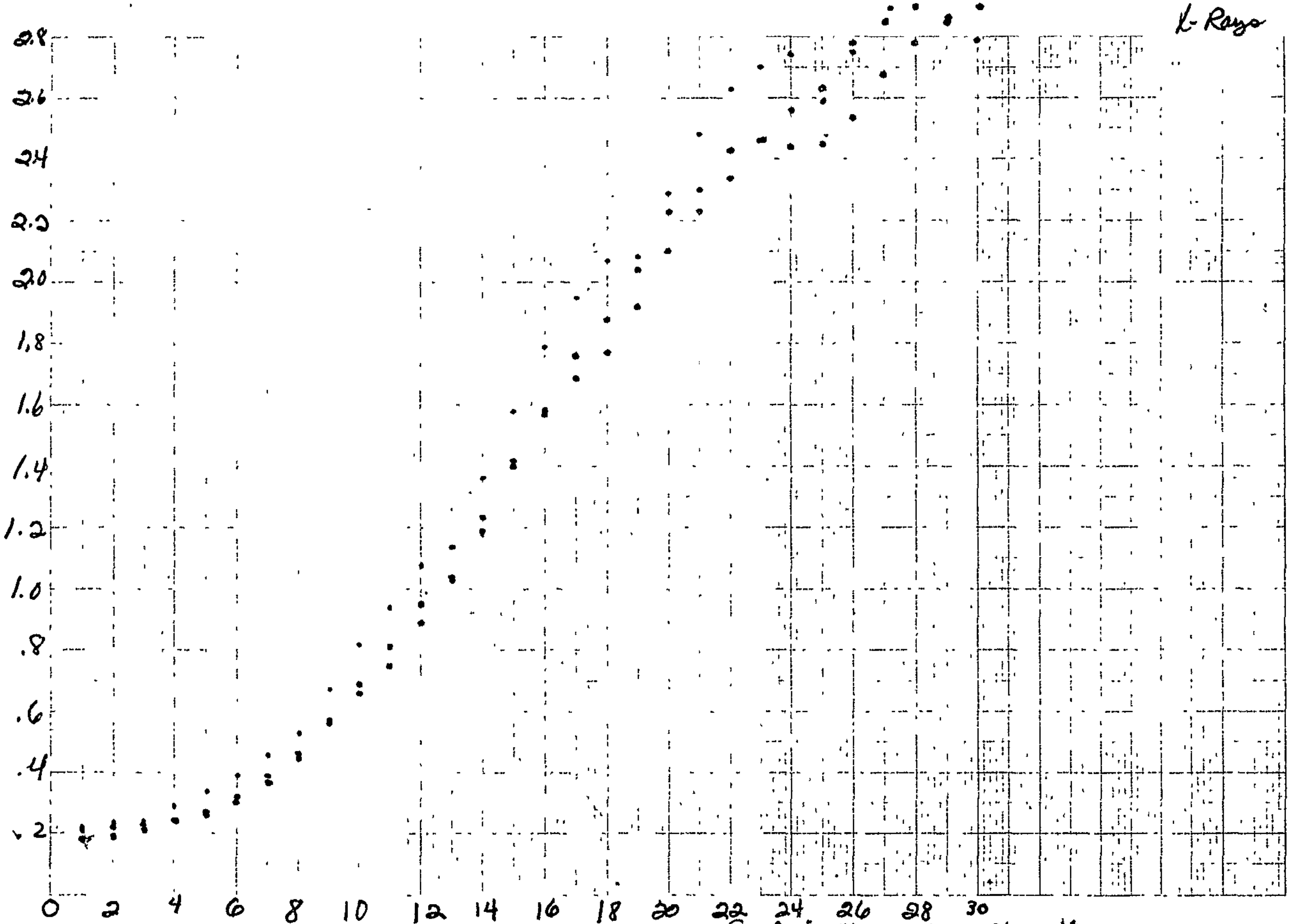
(fig)

• Emulsion #3 X-Ray film
1 Shot Plastic container

• Emulsion #4 Exposed to 1 Shot X-Rays
Metal Con[illegible]

• Emulsion #4 X-Ray film
1 Shot Plastic Container

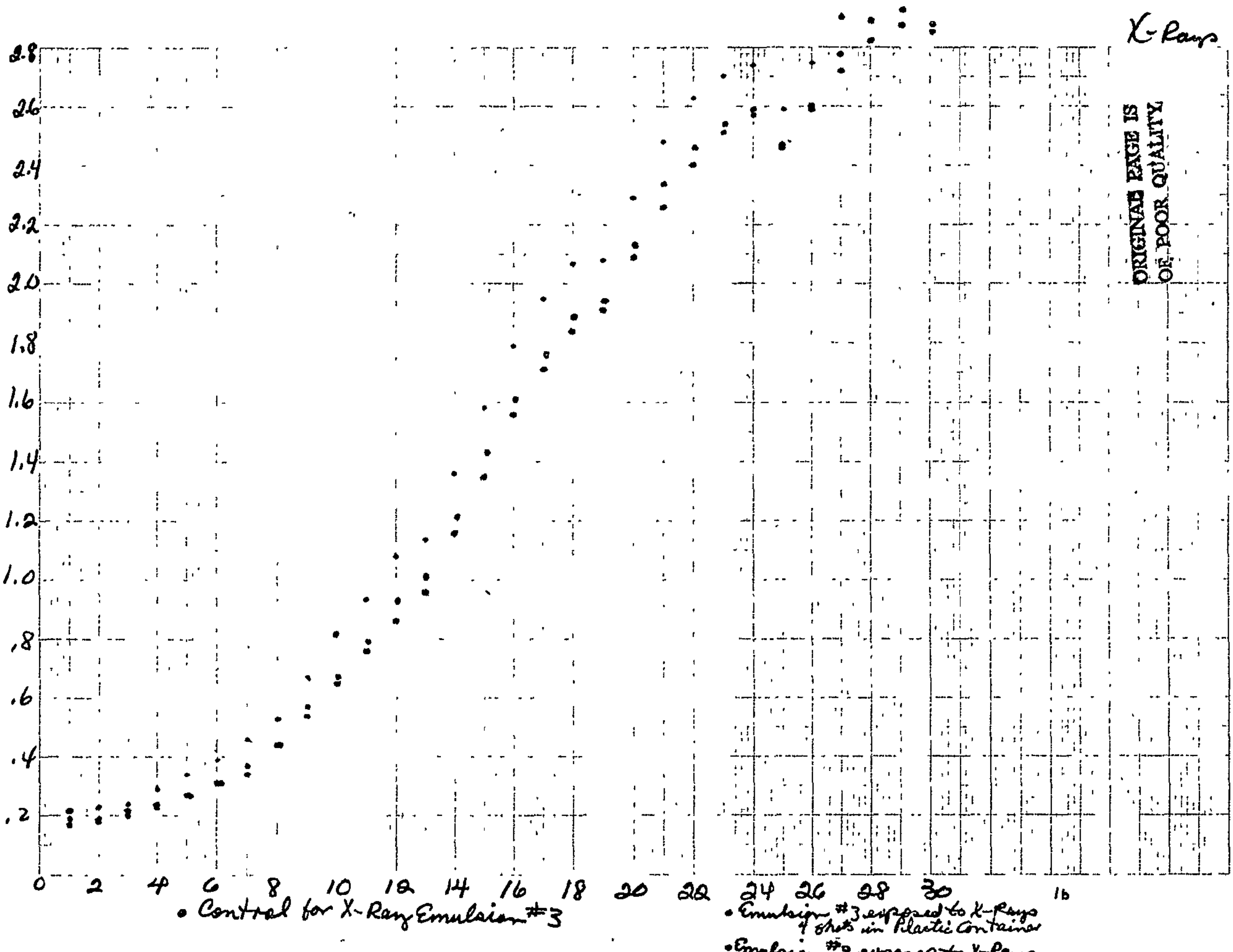
X-Rays



• Control for X-Ray films Emulsion #3

• Emulsion #3 X-Rayed film 1-shot in Plastic Container

• Emulsion #3. X-Rayed film 1-shot in Metal Container



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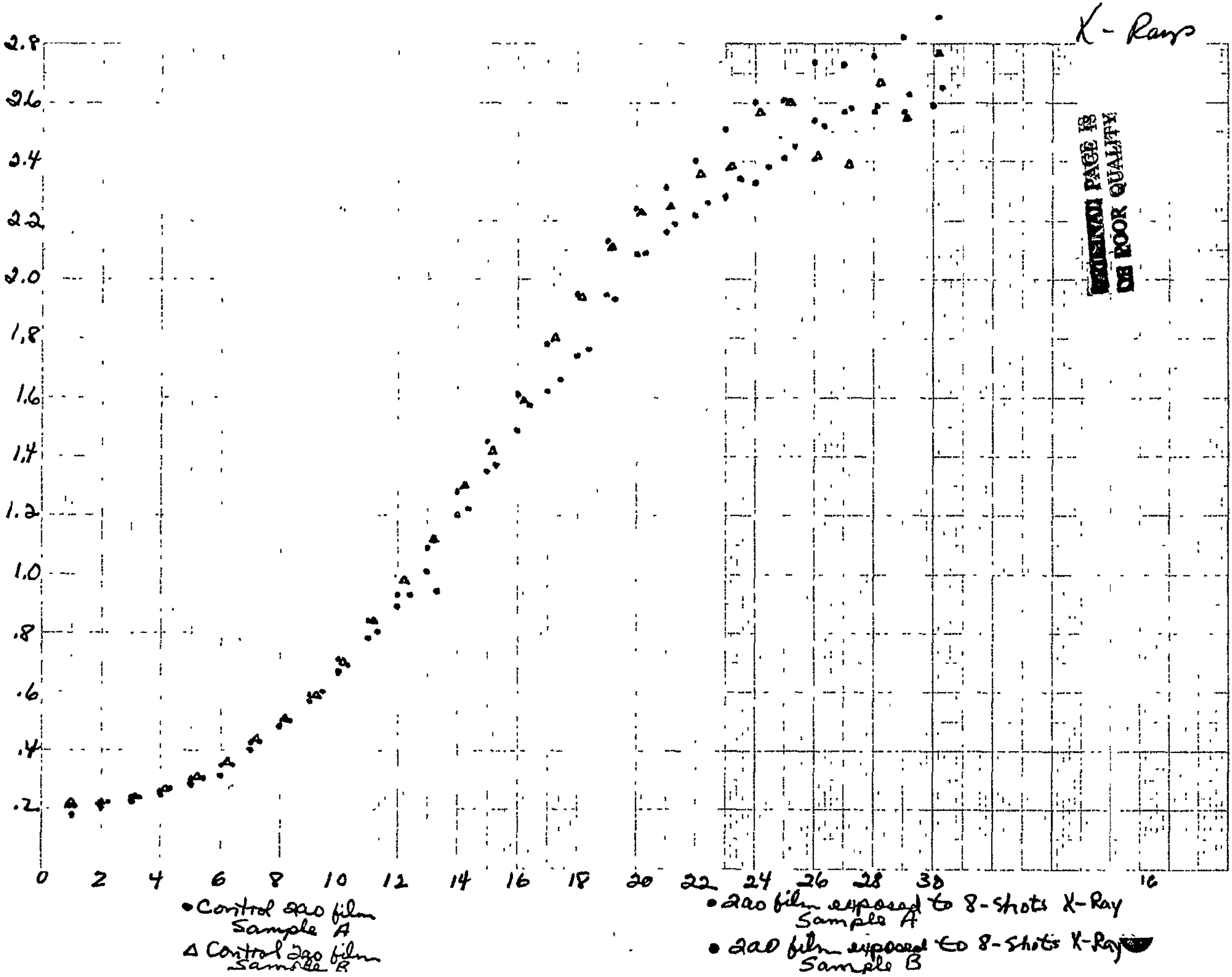

X - Rays
2.8
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.8
.6
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0
2
4
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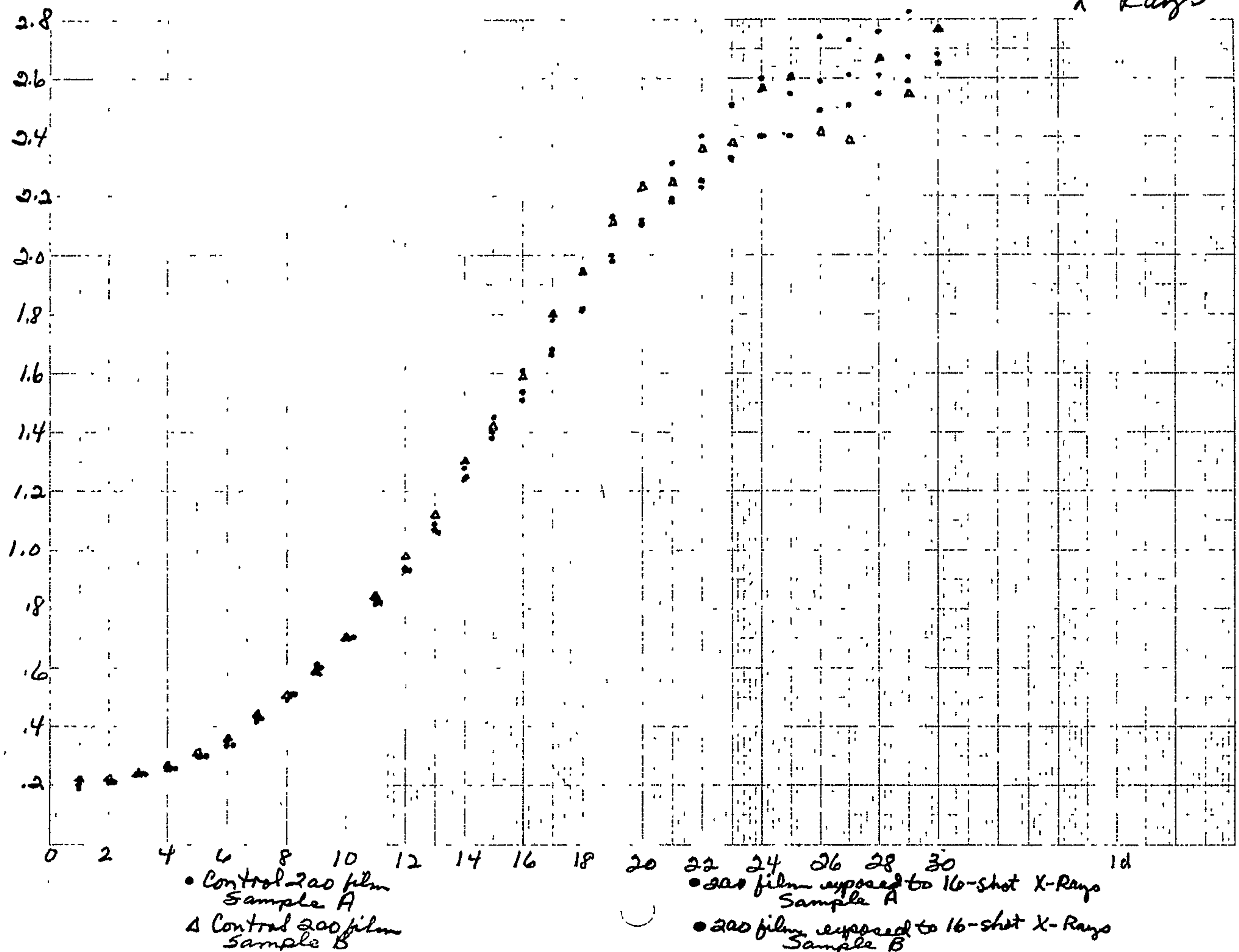
8
10
12
14
16
18
20
22
24
26
28
30
• Control 220 film Sample A
Δ Control 220 film Sample B
• 220 film exposed to 8-shots X-Ray Sample A
• 220 film exposed to 8-shots X-Ray Sample B

X-Rays


2.8
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2.2
2.0
1.8
1.6
1.4
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.8
.6
.4
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2
4
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8
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12
14
16
18
20
22
24
26
28
30
• Control 200 film Sample A
Δ Control 200 film Sample B
• 200 film exposed to 16-shot X-Rays Sample A
• 200 film exposed to 16-shot X-Rays Sample B

AN EXAMINATION OF FIGURE 4 CLEARLY SHOWS THE REDUCTION OF DENSITIES FOR THE X-RAY EXPOSED IIAO FILMS.

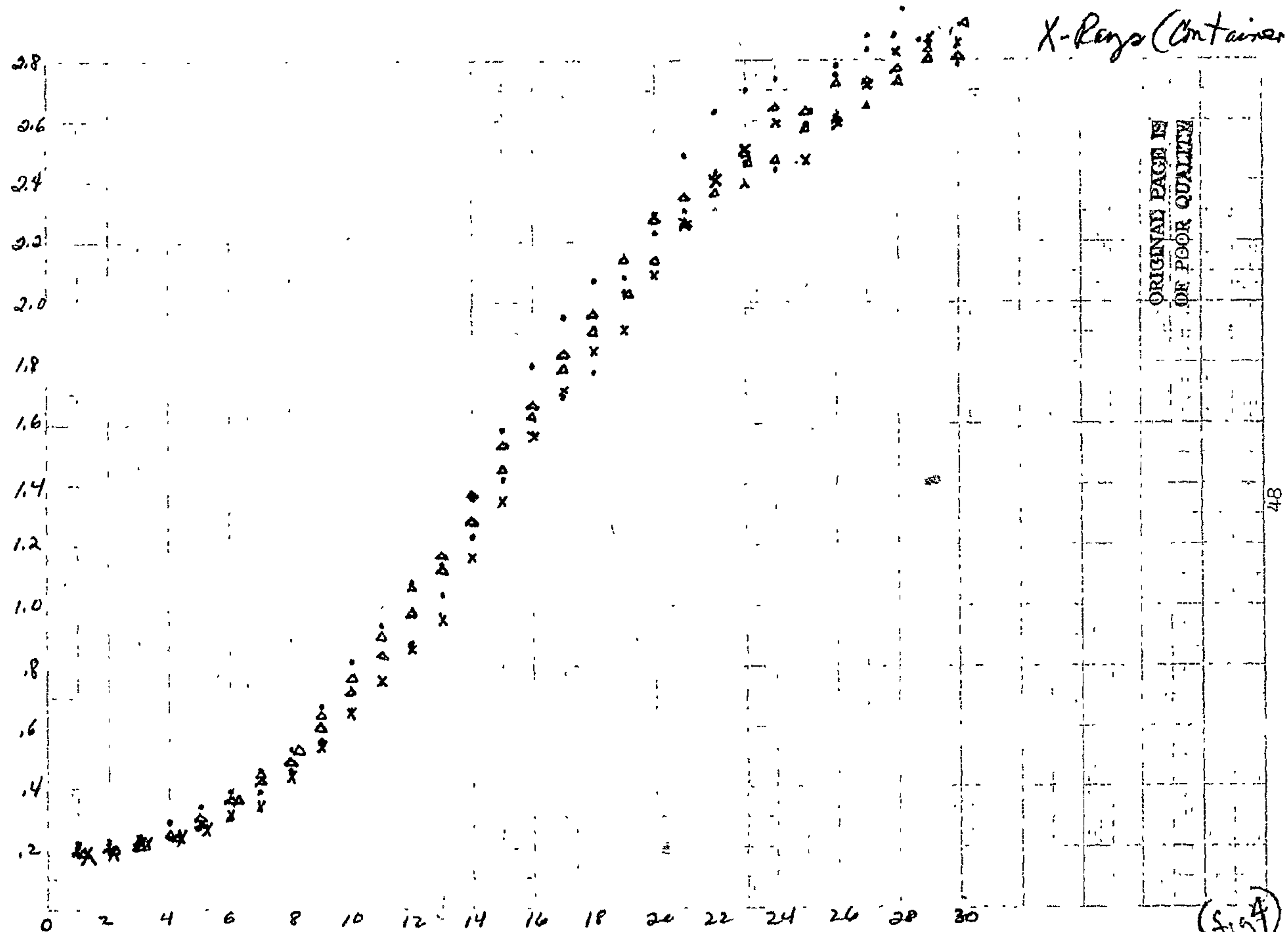
FIGURE 5 SHOWS THE RELATIONSHIP BETWEEN THE ONE SHOT EXPOSURE TO X-RAYS AND THE FOUR SHOT EXPOSURE TO X-RAYS. AT THE HIGHER DENSITIES, THERE ARE WILD FLUCTUATIONS - INDICATIVE OF A TREND OF REDUCED DENSITIES AT THE HIGHER DENSITY GRIDS.

THE EVIDENCE TENDS TO INDICATE THAT THERE IS SOME EFFECT ON THE IIAO FILM FOR SINGULAR AND MULTIPLE EXPOSURES TO THE X-RAYS.

BECAUSE OF THE WIDESPREAD USE OF X-RAY EQUIPMENT IN HOSPITALS AND DOCTOR'S OFFICES, WE THOUGHT IT HELPFUL - IN CALIBRATING THESE X-RAY MACHINES FOR RADIATION OUTPUT - TO UTILIZE A TYPICAL DENTAL X-RAY MACHINE FROM A LOCAL DENTIST. THIS MACHINE IS USED DAILY TO PHOTOGRAPH VARIOUS DENTAL PROBLEMS. THE STATE AND FEDERAL AUTHORITIES ARE CONSTANTLY TESTING AND CALIBRATING THESE COMMERCIAL X-RAY MACHINES. THE UTILIZATION OF OUR IIAO FILM GRID DENSITY PATTERNS AND THE ALREADY IDENTIFIED SENSITIVITY TO X-RAY RADIATION WOULD OFFER THE STATE AND FEDERAL AUTHORITIES A SIMPLE WAY TO CALIBRATE THE X-RAY MACHINE, WITHOUT THE USE OF VARIOUS ELECTRONIC DOSE METERS. MOST HOSPITALS AND DENTAL OFFICES HAVE THEIR OWN DARK ROOM FACILITIES FOR IMMEDIATE DEVELOPING OF FILM, WHICH CAN BE CARRIED TO THE LABORATORY FOR A DENSITOMETRIC ANALYSIS.

FIGURE 6 INDICATES THREE CONTROL IIAO FILMS NOT EXPOSED

X-Rays (Container



• Control for X-Ray film emulsion #3

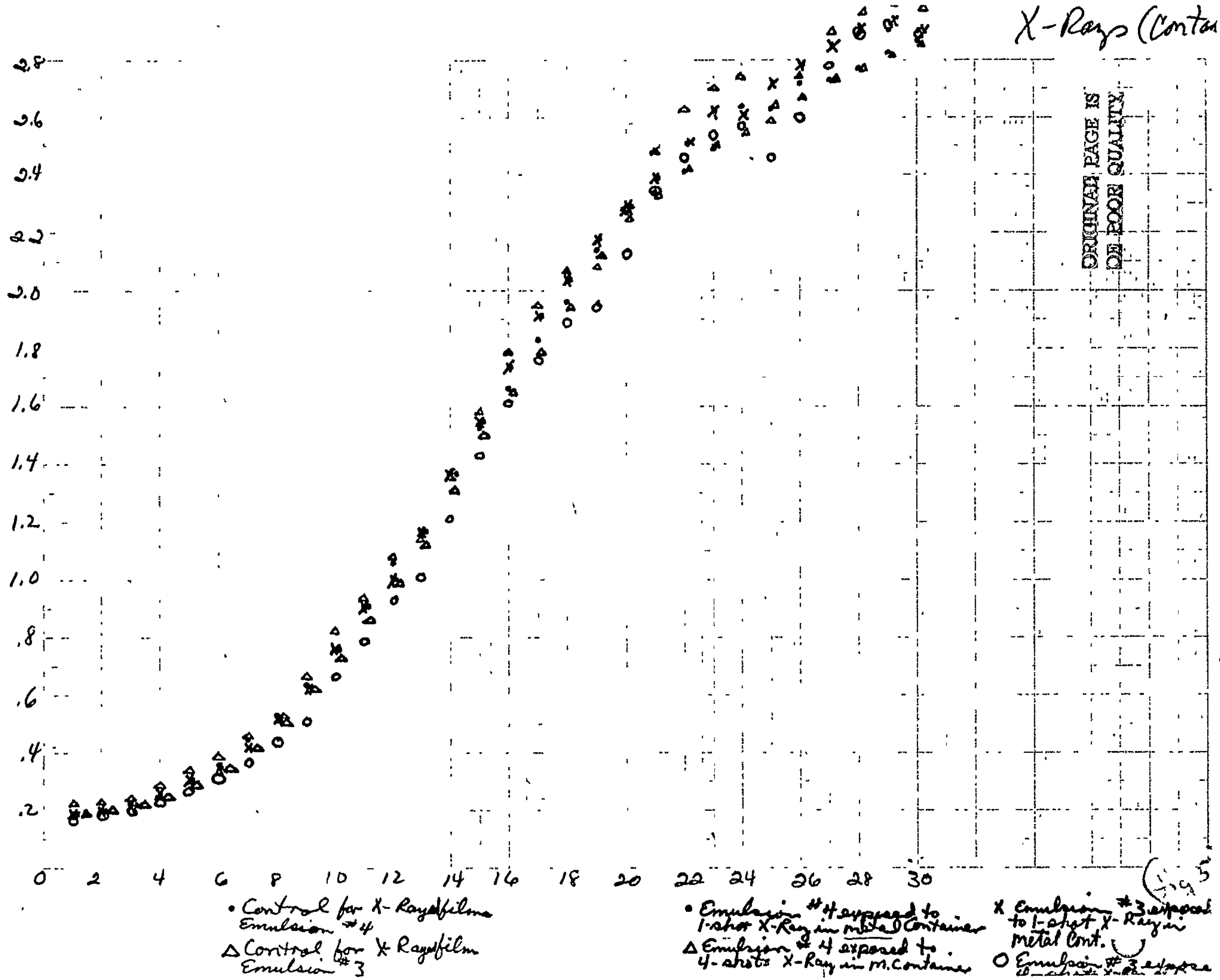
△ Control for X-Ray film emulsion #4

• Emulsion #3 X-Ray film 1 Shot Plas. Cont.

△ Emulsion #4 X-Ray Film 1 Shot Plas. Cont.

X Emulsion #3 exposed to X-Rays 4-shots Plas. Cont

(fig 4)


X-Rays (Contai
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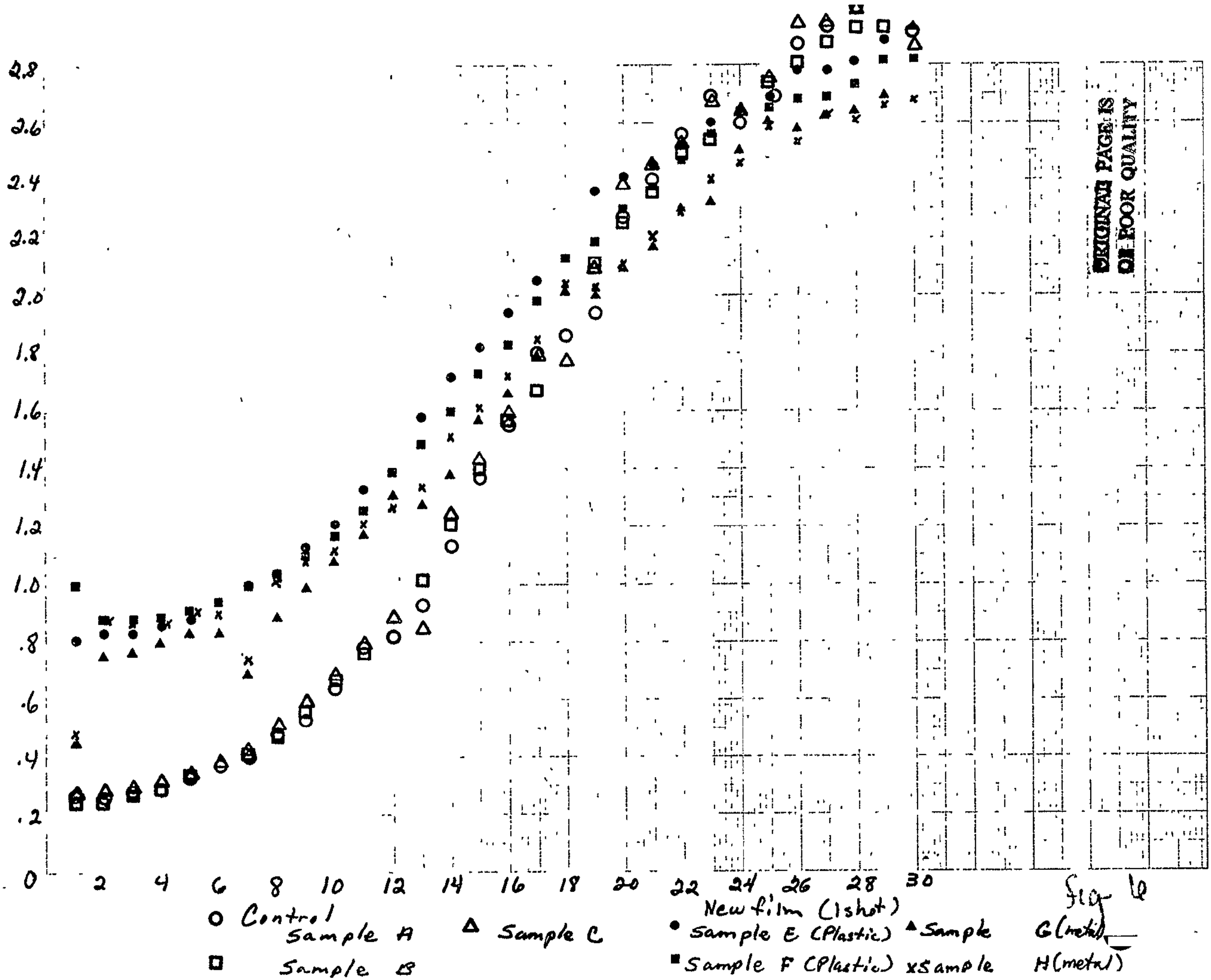
• Control for X-Rayfilm Emulsion #4
△ Control for X-Rayfilm Emulsion #3
• Emulsion #4 exposed to 1-shot X-Ray in metal Container
△ Emulsion #4 exposed to 4-shots X-Ray in M. Container
x Emulsion #3 exposed to 1-shot X-Ray in Metal Cont.
O Emulsion #3 expose
Fig 5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30
New film (1shot)
○ Control
Sample A
△ Sample C
● Sample E (Plastic)
▲ Sample G (metal)
□ Sample B
■ Sample F (Plastic)
x Sample H (metal)

fig 6

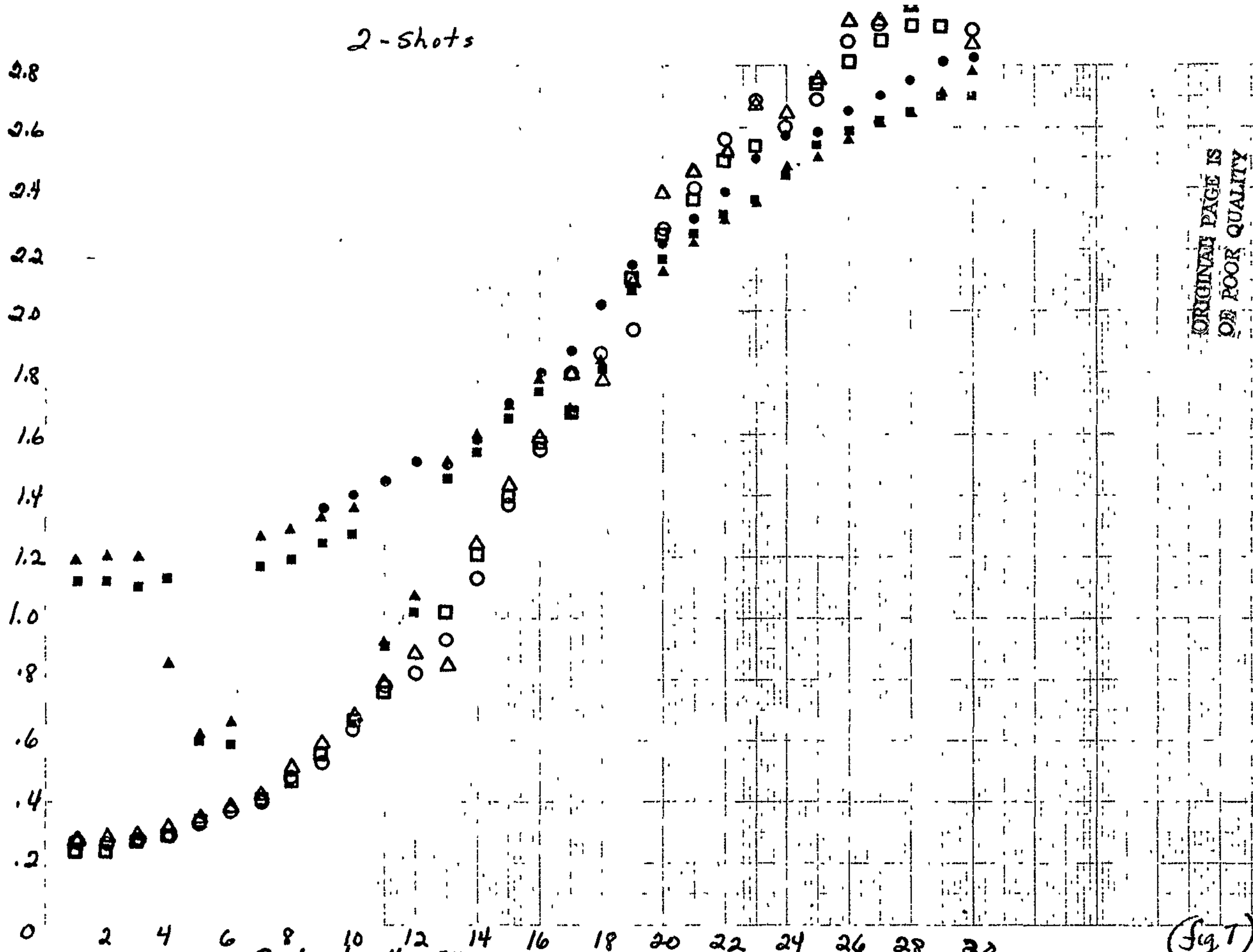
TO X-RAYS; TWO SAMPLES SUBJECTED TO ONE SHOT FROM THE DENTAL X-RAY MACHINE; AND TWO METAL CONTAINERS SUBJECTED TO THIS ONEDOSAGE OF X-RAYS. RESULTS INDICATE THAT THE X-RAYS PENETRATED THE PLASTIC CONTAINER WITH GREATER EASE AND PRODUCED HIGHER DENSITY, PARTICULARLY AT THE LIGHTER GRID PATTERNS; WHILE AT THE DARKER GRID PATTERNS, THE DENSITIES OF THE FILMS WERE SUBSTANTIALLY REDUCED, IN COMPARISON WITH THE CONTROL.

AN ANALYSIS OF FIGURE 7 INDICATES, USING TWO SHOTS FROM THE SAME X-RAY MACHINE, THAT THE X-RAYS CLEARLY AFFECT THE LOW DENSITY GRID PATTERNS SUBSTANTIALLY AND REDUCE THE HIGH DENSITY GRID PATTERNS. ON A WHOLE, THE PLASTIC CONTAINER DISPLAYED CONSISTENTLY HIGHER DENSITIES ACROSS THE GRID SPECTRUM. THE ANOMALIES OBSERVED AT THE LIGHTER GRID PATTERNS ARE PROBABLY CAUSED BY THE CONFIGURATION OF THE FILM WITHIN THE CAN, RELATIVE TO THE X-RAY MACHINE.

FIGURE 8 SHOWS THE RELATIONSHIP BETWEEN THE ONE SHOT IN THE PLASTIC CONTAINER AND THE TWO SHOTS IN THE PLASTIC CONTAINER. NOTE THAT THE TWO-SHOT EXPOSURE PRODUCES A SUBSTANTIAL REDUCTION IN DENSITIES AT THE HIGHER GRID PATTERNS.

FIGURE 9 INDICATES THAT THE ONE SHOT (VERSUS THE TWO SHOT IN THE METAL CONTAINER) DISPLAYS THE SAME REDUCTION OF THE DENSITIES AT THE HIGHER GRID PATTERN NUMBERS, AND REDUCED DENSITIES AT THE LIGHTER GRID PATTERNS. A CAREFUL ARRANGEMENT OF THE FILM CONTAINER AND PRECISE SPACIAL ORIENTATION OF THE CANNISTER COULD PRODUCE THE FLUCTUATIONS OBSERVED IN FIGURE 9.

2-Shots



(fig 7)

Control – New Film

○ Sample A

△ Sample C

□ Sample B

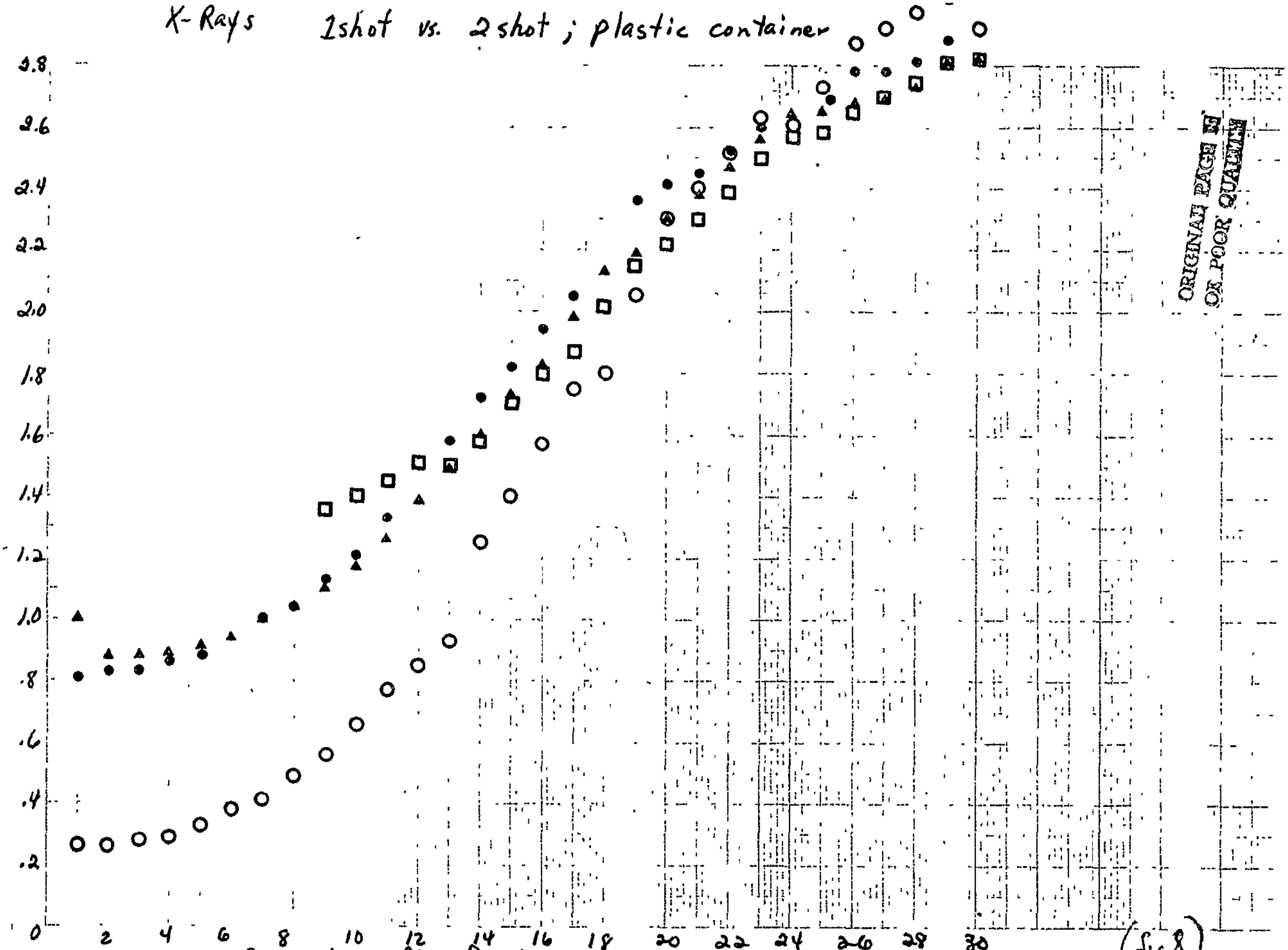
NEW FILM EXPOSED TO X-RAYS

● Sample A (Plastic) 2 shot

▲ Sample C (metal) 2 shots

■ Sample B (metal) 2 shots

X-Rays 1shot vs. 2shot ; plastic container

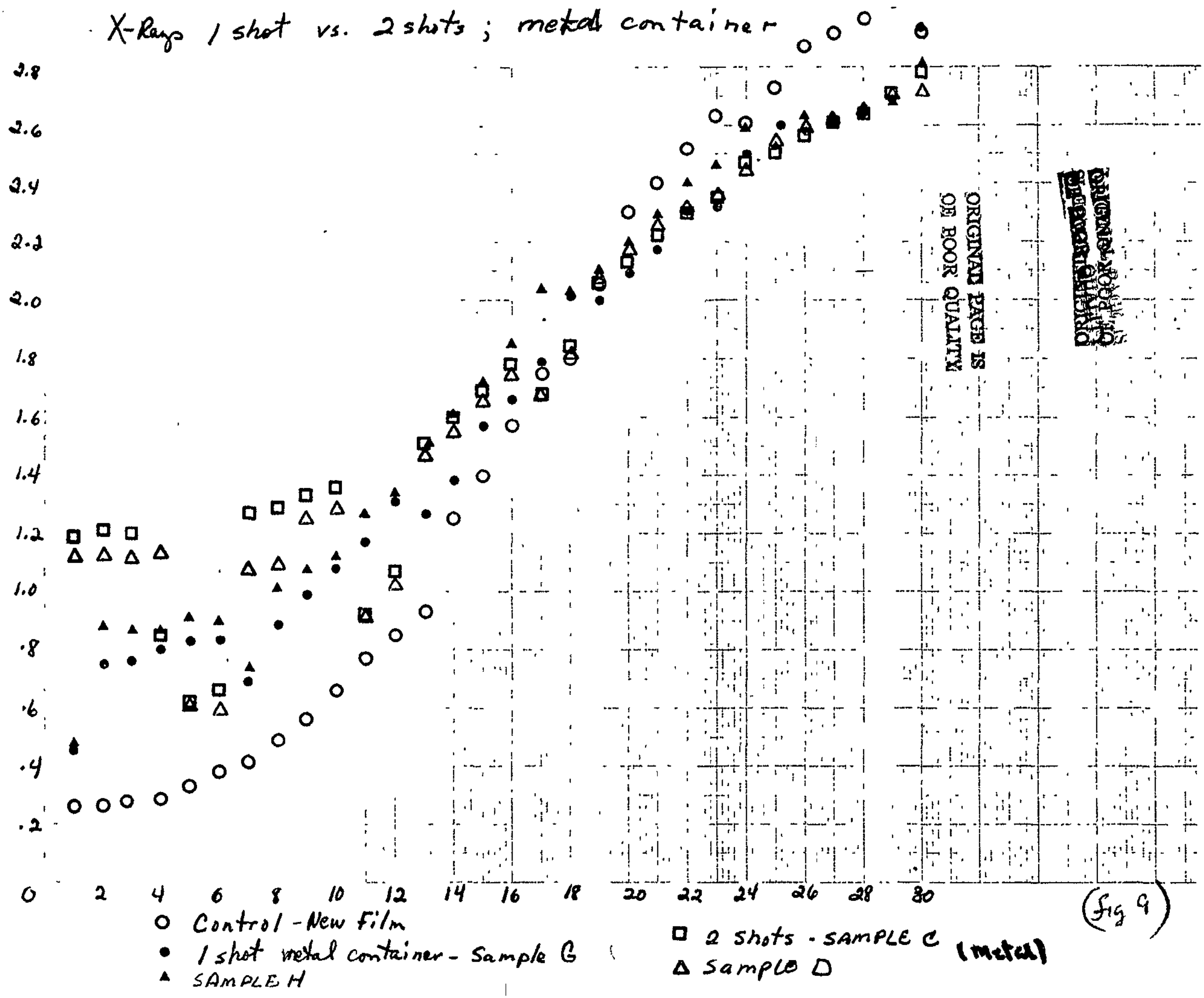


○ Control New film for X-RAYS

● 1shot Plastic container - Sample E □ 2shot Plastic container - Sample A

▲ Sample F

(fig 8)


X-Rays 1 shot vs. 2 shots ; metal container
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30
○ Control - New Film
● 1 shot metal container - Sample G
▲ SAMPLE H
□ 2 shots - SAMPLE C (metal)
△ Sample D
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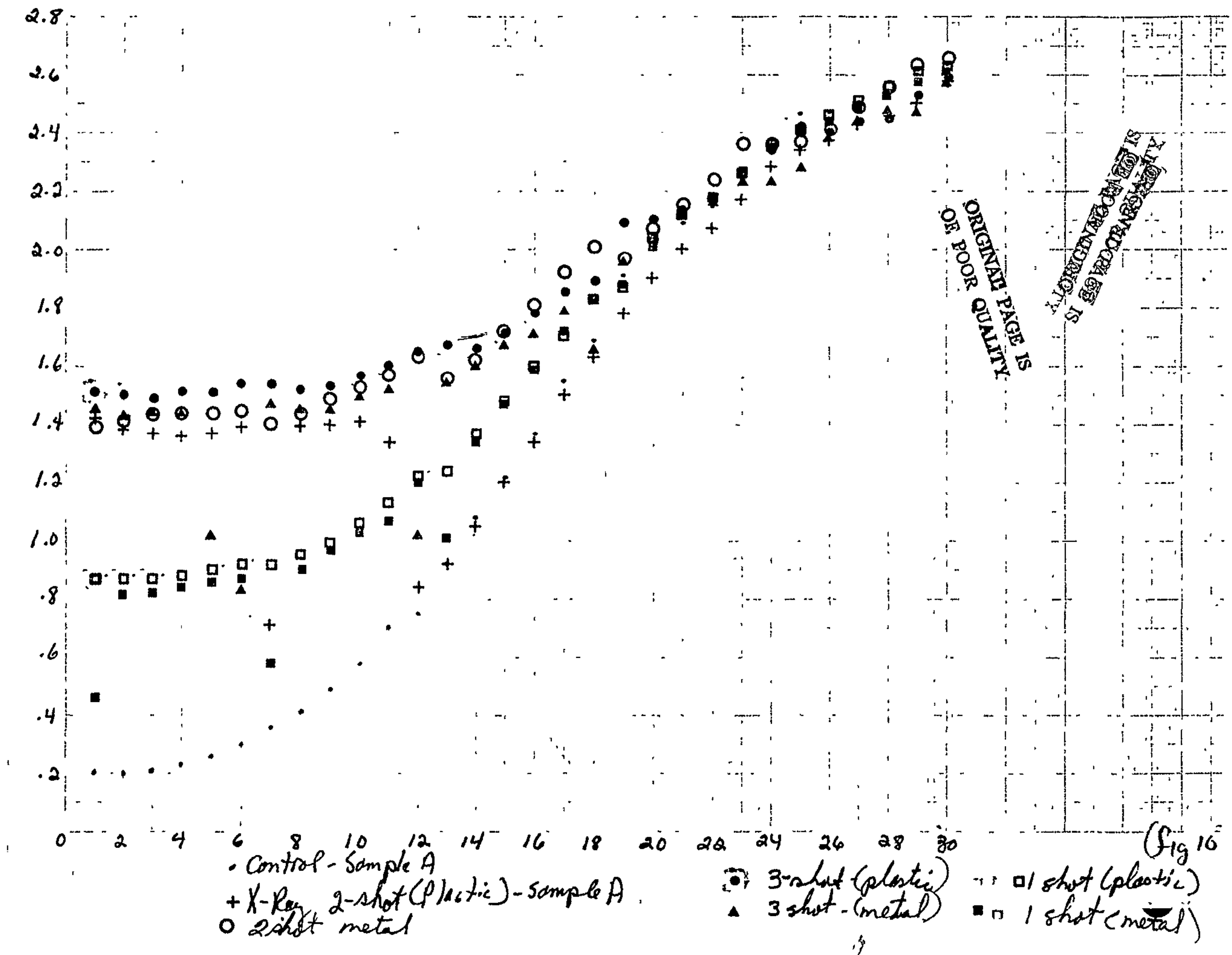
(fig 9)

AN ANALYSIS OF FIGURE 10 INDICATES THE RELATIONSHIP TO THE DENTAL X-RAYS BETWEEN THE ONE SHOT PLASTIC, TWO SHOT PLASTIC, AND THREE SHOT PLASTIC EXPOSURES. IN EITHER CASE, THE METAL CONTAINERS DISPLAYED A SLIGHT REDUCTION IN DENSITIES AT THE LOWER GRID PATTERNS, WHILE THERE IS A CONTINUED SUBSTANTIAL REDUCTION OF DENSITIES AT THE HIGHER GRID NUMBERS.

THE UTILIZATION OF IIAO FILM AS A CALIBRATING DEVICE FOR THE COMMERCIAL X-RAY INDUSTRY OFFERS A VIABLE ALTERNATIVE TO THE CURRENT TECHNIQUES EMPLOYED BY THE INDUSTRY.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ORIGINAL PAGE IS
OF POOR QUALITY
ORIGINAL PAGE IS
OF POOR QUALITY
• Control - Sample A
+ X-Ray 2-shot (Plastic) - Sample A
○ 2shot metal
3-shot (plastic)
▲ 3 shot - (metal)
□ 1 shot (plastic)
■ 1 shot (metal)
(Fig 16)