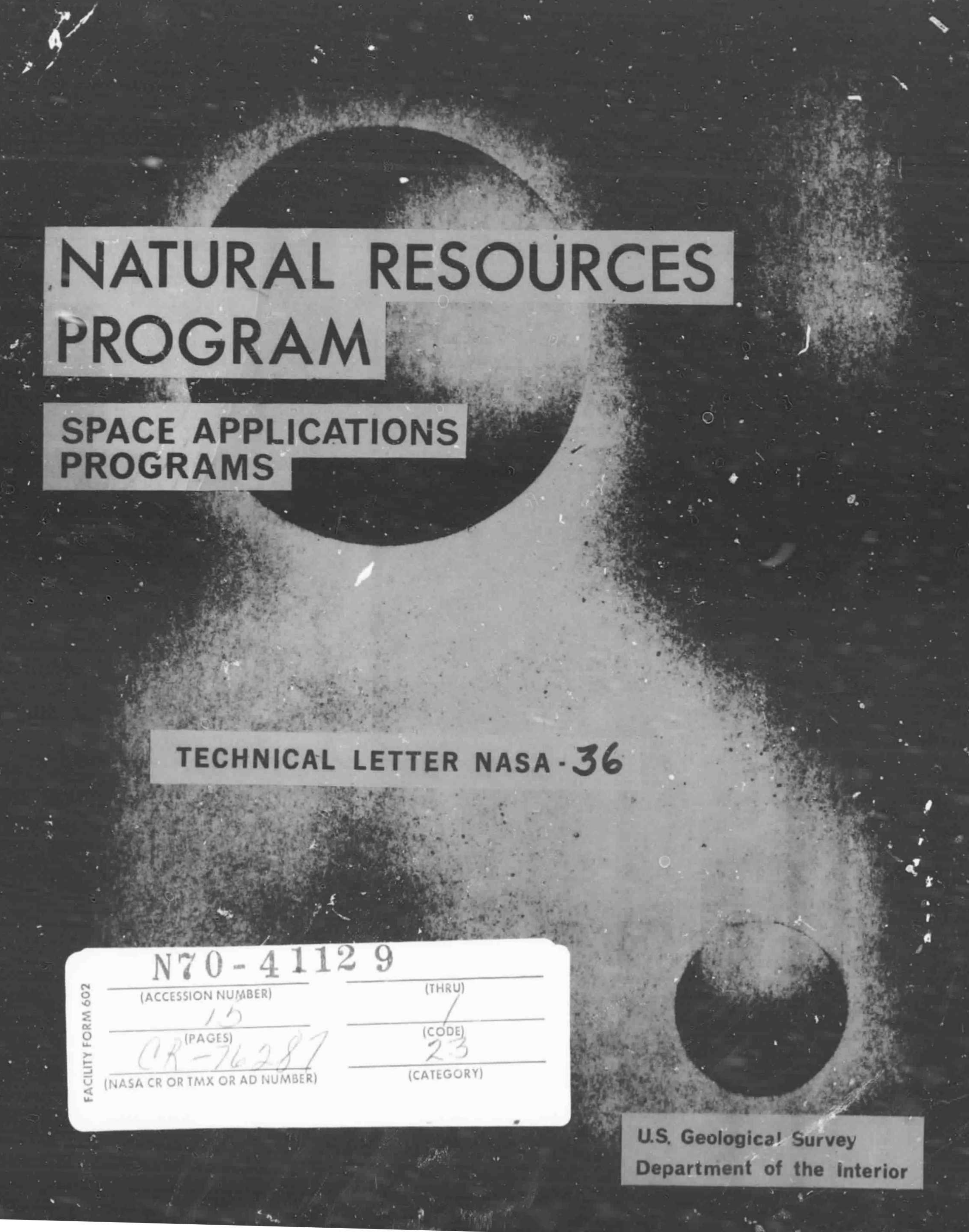

NATURAL RESOURCES PROGRAM

SPACE APPLICATIONS PROGRAMS

TECHNICAL LETTER NASA-36

FACILITY FORM 602

N70-41129	
(ACCESSION NUMBER)	(THRU)
15	1
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CR-76287	23
(NASA CR OR TMX OR AD NUMBER)	(CATEGORY)

U.S. Geological Survey
Department of the Interior

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WASHINGTON, D.C. 20242

Technical Letter
NASA-36
June 1966

Dr. Peter C. Badgley
Chief, Natural Resources Program
Office of Space Science and Applications
Code SAR, NASA Headquarters
Washington, D.C. 20546

Dear Peter:

Transmitted herewith are 3 copies of:

TECHNICAL LETTER NASA-36

THE EFFECT OF ULTRAVIOLET RADIATION ON THE INTENSITY OF LUMINESCENCE*

by

David L. Daniels**

Sincerely yours,

William A. Fischer
Research Coordinator
Earth Orbiter Program

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*Work performed under NASA Contract No. R 146-09-020-006
**U.S. Geological Survey, Washington, D.C.

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UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

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David L. Daniels**

June 1966

These data are preliminary and should
not be quoted without permission

Prepared by the Geological Survey
for the National Aeronautics and
Space Administration (NASA)

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**U.S. Geological Survey, Washington, D.C.

CONTENTS

The effect of ultraviolet radiation on the intensity of luminescence

by

David L. Daniels

Objective

The objective of this experiment is to study the effects of prolonged ($\sim$ 9 days) radiation on luminescing surfaces.

The experiment involves the measurement of changes in luminescent intensity due to prolonged irradiation of a luminescent mineral with ultraviolet radiation.

Procedure

The procedure was to irradiate a luminescent mineral continuously with light from a 175 watt mercury vapor lamp for periods ranging from one hour to as long as nine days. Part of the surface of the sample was masked by a sheet of non-luminescing black painted brass; this area served as control or as a basis for evaluating measurement of output intensity to luminescence and to spurious fluctuations in power and instrument sensitivity.

To perform these measurements, the equipment listed in Technical Letter NASA-3 (part II, p. 2,3) was modified, and a special sample holder was constructed (fig. 1).

The sample, scapolite (127) from Grenville, Ontario, was polished and oriented at the entrance slit in order to direct the specular component of the reflected radiation away from the monochromator entrance slit. The black brass mask with two 1/4-inch diameter holes (1/2 inch separation) was mounted on the sample. One of the two exposed areas was designated the test area, the other a control. A second mask covered one of the holes when the area exposed at the other hole was being measured. The area exposed through the mask was illuminated with an unfiltered 175 watt mercury lamp.

The luminescence was measured at the beginning and end of each irradiation run as well as intermittently during the run. During these measurements, the incident radiation on the sample was temporarily filtered with a Corning 7-60 filter (fig. 2). The luminescence emitted from the sample was passed into the entrance slit of the spectrometer. The entrance slit was covered by a Kodak 4 filter (fig. 2) in order to block reflected ultraviolet light. The grating and the slits of the spectrometer were set to pass the whole luminescence band of scapolite centered at 5450Å (fig. 2). The light issuing from the exit slit was measured with a RCA 1P28 photomultiplier (fig. 1). Luminescence measurement was then repeated with the test area covered and the control area exposed. The control area was then re-covered with the mask, the 7-60 filter removed, and the irradiation of the test area continued. The measuring equipment was turned off during intervals between measurements.

Of the minerals available for study, scapolite (127) was the most suitable for the following reasons:

1) Silicate mineral; similar in composition to typical rock-forming minerals.

2) High luminescent efficiency; keeps signal to noise ratio high.

3) Narrow band emission curve with large wavelength separation between emission and excitation bands. This reduces the problem of reflected light.

4) Luminescent intensity is uniform throughout the two exposed areas of the sample.

Results

The intensity measurements for three runs are shown in figures 3 and 4. The lower curves in each graph are measurements of intensity as a function of time. The upper curve is the ratio of intensities of the test area to the control area. This curve therefore is an index of luminescent intensity corrected for instrument fluctuations.

In the three runs, the only change that is consistent is the small drop in intensity at the start.

Conclusion

No significant change in luminescent intensity due to prolonged exposure to ultraviolet radiation is indicated in this specimen of scapolite.

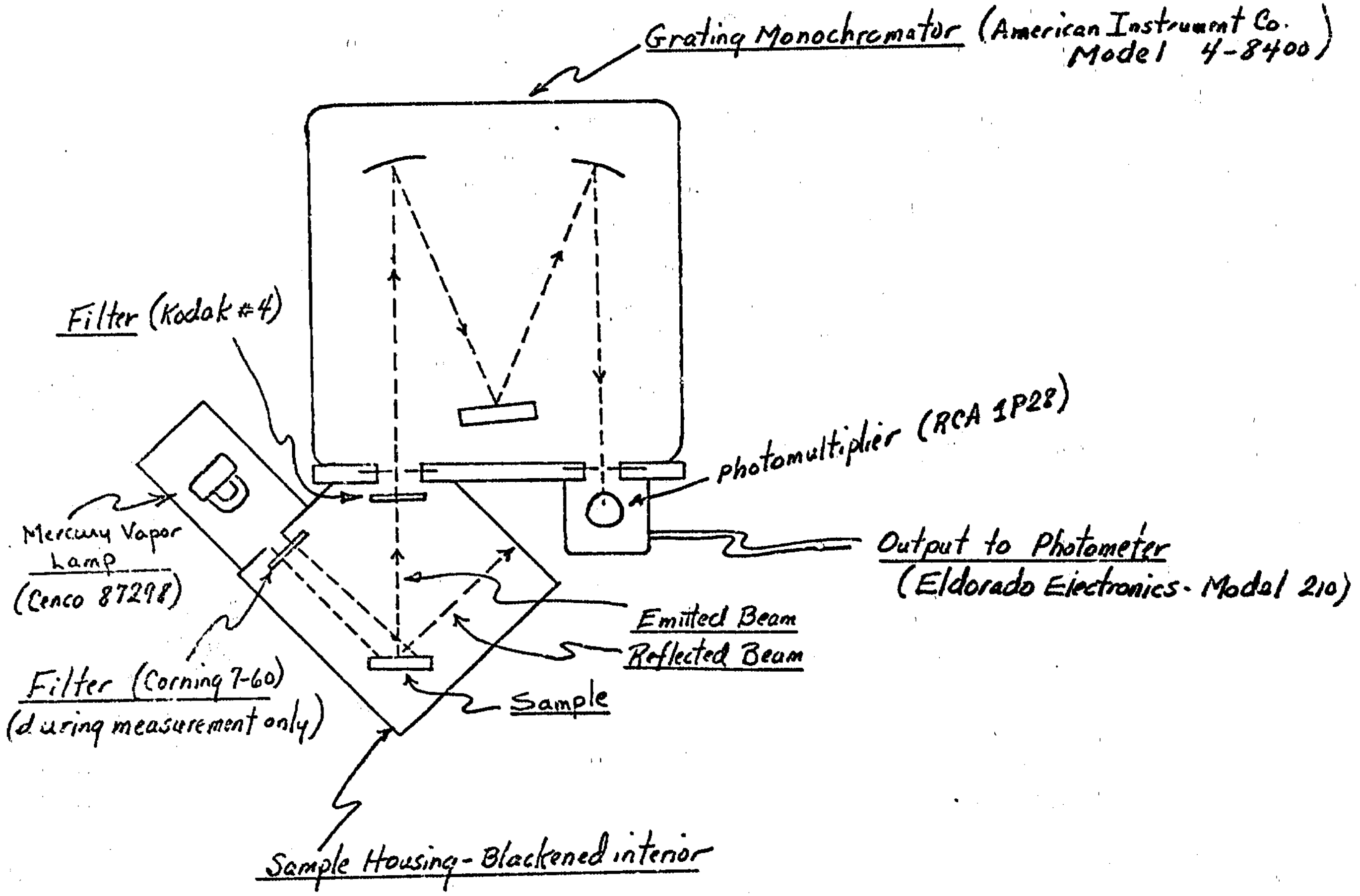


Figure 1 - Instrumentation

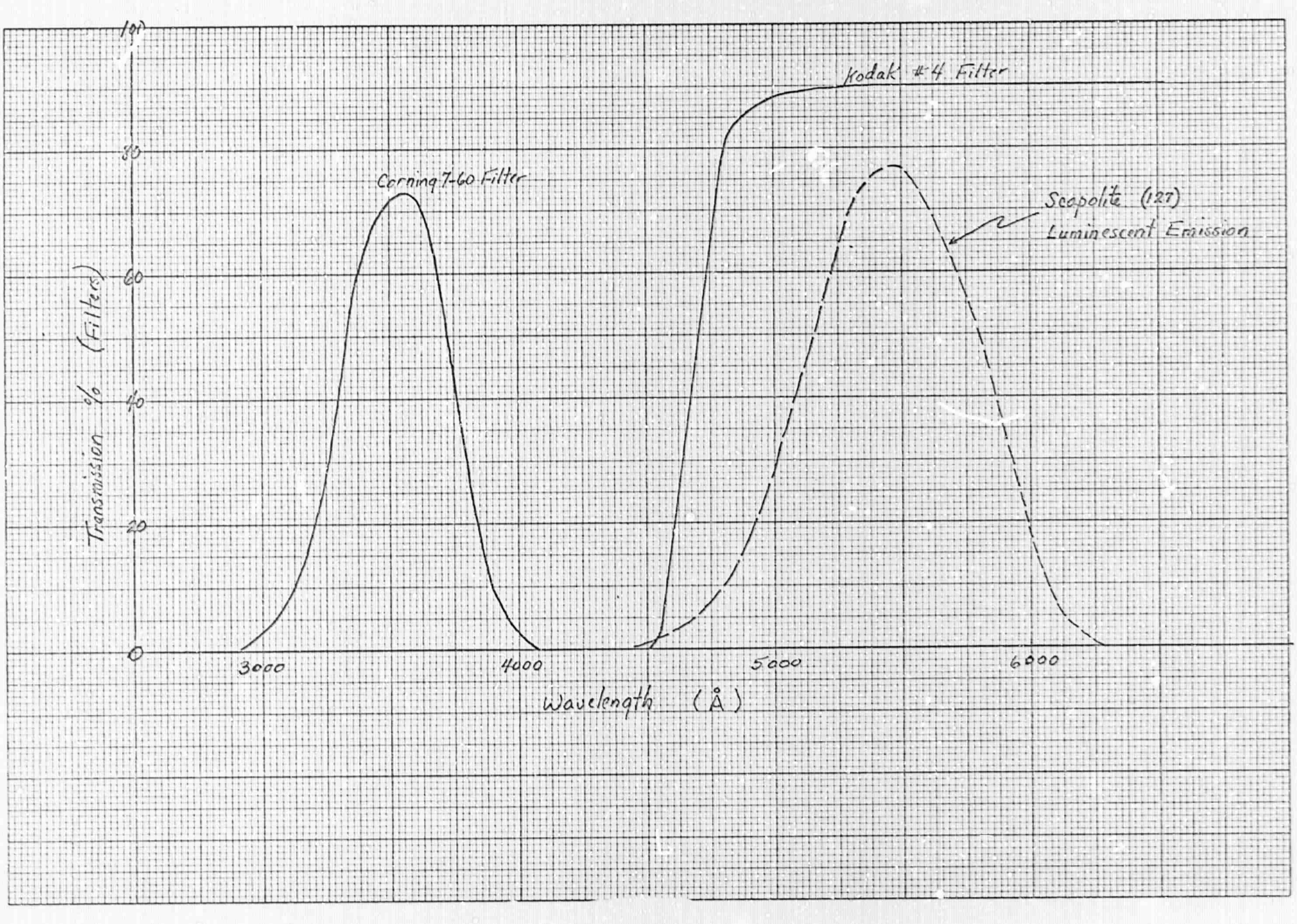

100
80
60
40
20
0
Transmission % (Filters)
Corning 7-60 Filter
Kodak #4 Filter
Scapolite (127)
Luminescent Emission
3000
4000
5000
6000
Wavelength (Å)

Figure 2

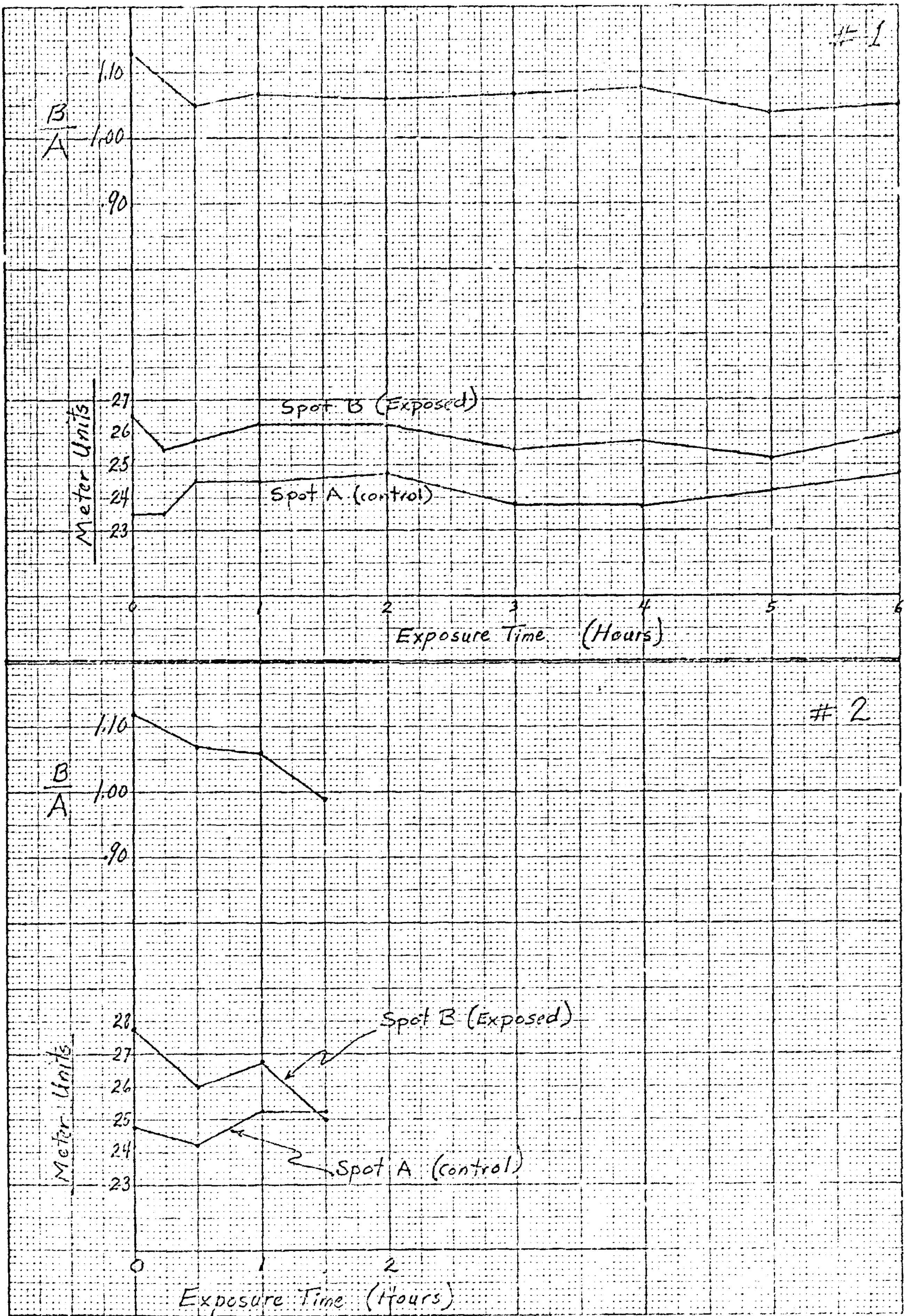
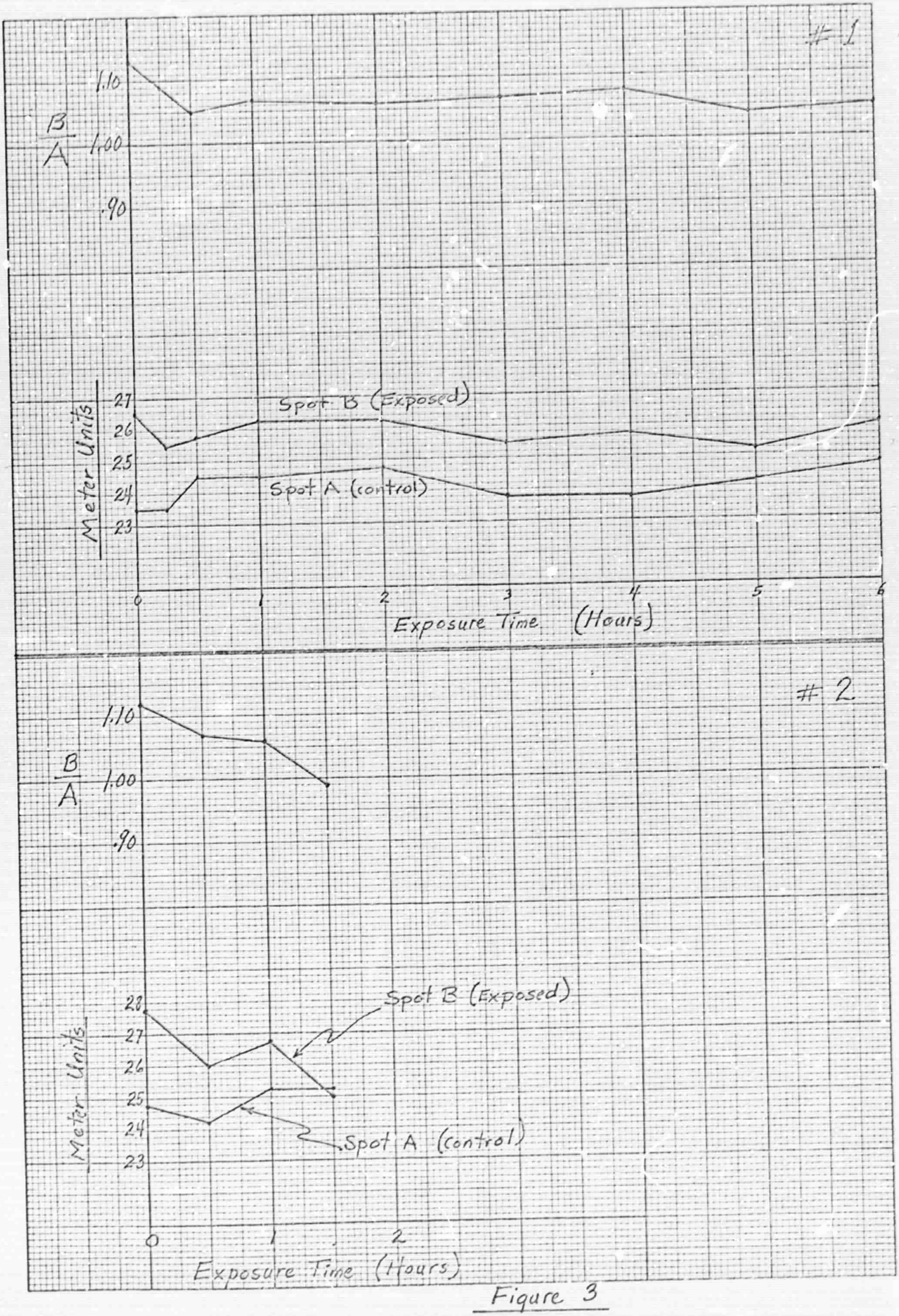

#1
B/A
1.10
1.00
.90
Meter Units
27
26
25
24
23
Spot B (Exposed)
Spot A (control)
0
1
2
3
4
5
6
Exposure Time (Hours)
#2
B/A
1.10
1.00
.90
Meter Units
28
27
26
25
24
23
Spot B (Exposed)
Spot A (control)
0
1
2
Exposure Time (Hours)

Figure 3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Meter Units
27
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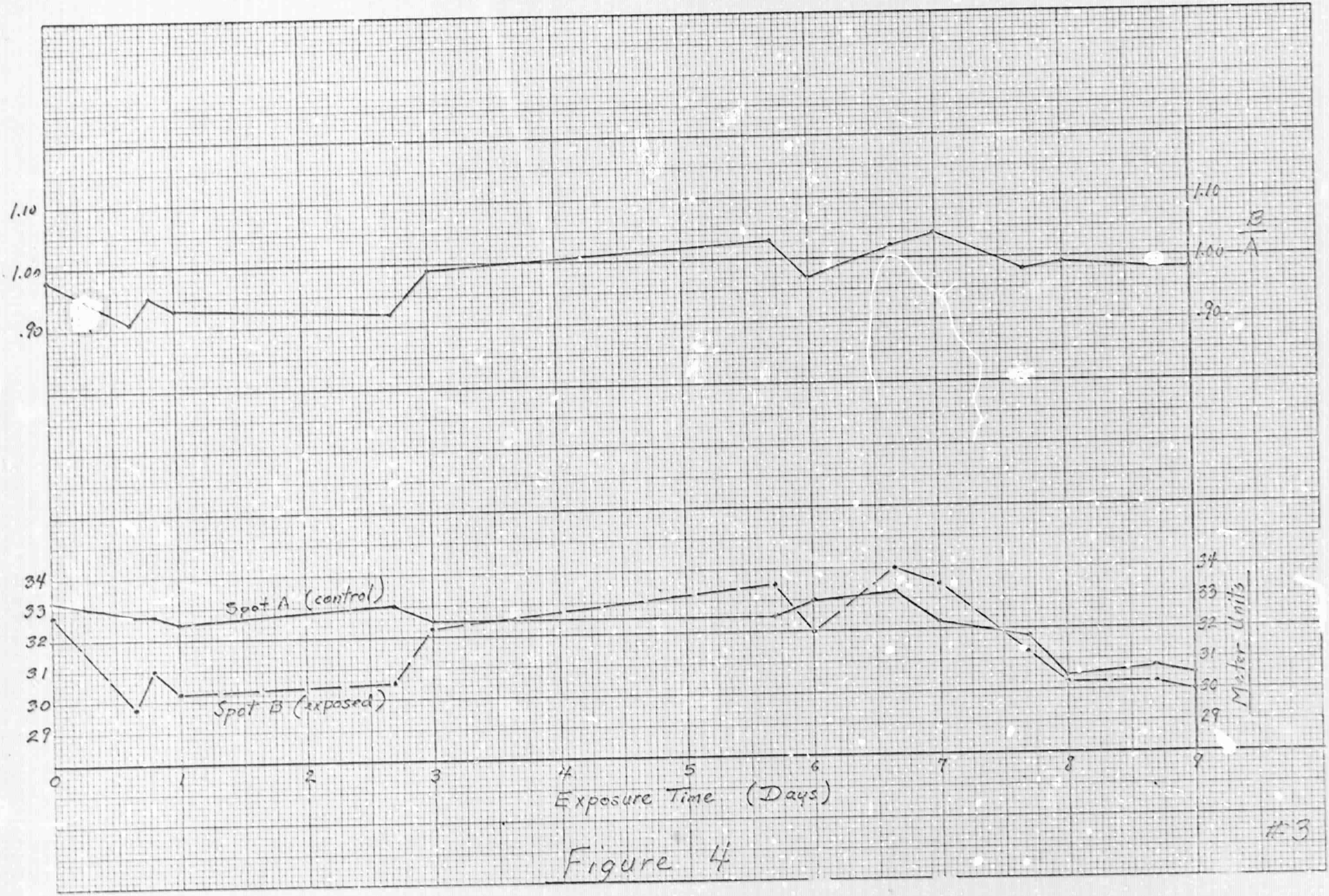
23
Spot B (Exposed)
Spot A (control)
0
1
2
3
4
5
6
Exposure Time (Hours)
#2
B/A
1.10
1.00
.90
Meter Units
28
27
26
25
24
23
Spot B (Exposed)
Spot A (control)
0
1
2
Exposure Time (Hours)

Figure 3


1.10
1.00
.90
34
33
32
31
30
29
Spot A (control)
Spot B (exposed)
0
1
2
3
4
5
6
7
8
9
Exposure Time (Days)
1.10
1.00
.90
B/A
34
33
32
31
30
29
Meter Units

#3

Figure 4