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GROUND ACTIVITY AFTER THE TRINITY SHOT

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Ground Activity After the Trinity Shot

In a recent search for data on ground activity after a nuclear explosion, the available data appeared to be quite scant.

The author has found some unpublished personal notes made shortly after the Trinity test which may be useful in forming an estimate of gamma activity to be expected on the ground, after a nuclear explosion. The data was received by radio or directly recorded. Measurements were made on Watts type radiation meters with ranges from 100 R/hr to .1 R/hr. Most of the results and all those made near the crater were received by radio from H. L. Anderson collecting dirt samples, with a special Sherman tank described in LA-356. This data was obtained by two Watts type meters #1 and #2 mounted on the front of the tank 24" above the ground, a meter #3 on top of the tank and meter #4 inside the tank. The tank data are from two runs; one starting from south 10,000 yards beginning about one hour after the shot and running in to within 120 yards of the crater center, the second run beginning about 8½ hours after the shot and running in from the west to within 30 yards of the crater center.

The following table summarizes (A) the radioed data obtained, (1) from the two tank runs, (2) various miscellaneous locations and (B) later direct measurements obtained at 500 yards west and Jumbo (800 yards northwest).

The first column of the table gives the time when the measurement

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was made, the second column the hours after zero time (5:30 a.m. July 16), the third column the actual intensity measured, the fourth column the distance in yards from zero point at which the data was obtained, the fifth column reduces all the data to ~~zero~~ UNIT time assuming a decay law $\sim t^{-1.2}$, and the sixth column gives the product of roentgens/hour and yards squared from zero x 10^{-6}. The last column lists various pertinent remarks concerning each particular data record.

Fig. 1 is a plot of column 4 and 5; Fig. 2 is a plot of column 4 squared x column 6 vs. column 4. In these two plots only the south and west points are indicated except for the reading at Jumbo. Readings in the region 300 yard - 400 yard can be expected to fluctuate considerably due to the numerous streamers at the edge of the fused region of the crater.

Figs. 3, 4, and 5 are photographs of the crater taken at different times shortly after the explosion. Distances of closest approach of the tank were obtained from these photographs. Fig. 3 has the tank routes marked in to aid in locating the tracks in the untouched picture of Fig. 4. Other tank positions were obtained at the time the intensity data was received. These positions were determined by spotters with aiming circles or odometer readings observed on the tank itself.

The accuracy of the data is uncertain since the various meters used were not intercalibrated; the results, however, should give a good estimate of the ground activity to be expected under similar conditions in future shots.

Table 2 gives values read from LA-539 at similar crater points

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to those listed in Table 1, again assuming a decay $t^{-1.2}$. This data is plotted in Fig. 1. The agreement of this 28 day old decay data is quite good and would seem to indicate that $t^{-1.2}$ is nearly the correct decay law for the ground activity even for a long decay time.

Theoretical and experimental values for the decay of fission products are summarized in CC 3032. The experimental results given in this report for the gamma energy indicate a decay law in which the exponent for (t) changes from -1.2, for short times to -1.4 for decay times, 50 - 100 days. The calculated gamma values for the exponent for (t) vary from -1.28 to -2.0 in the region 16 - 240 days decay times and also a value of -1.4 for $t > 1$ day.

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TABLE 1

Zero Time 5:30 a.m. July 16

Absolute Time	Hours Delay (t)	Intensity R/hr (I) as measured	Distance in Yards (R)	Io=It$^{1.2}$	Io$\times$R^{2}x10^{-6}	Remarks
July 16	..	10	10,000 N			Effect of cloud probably present. Shows much greater intensity towards north.
6:15 a.m.	.75	.2	10,000 W			
7:10	1.67	~0	4,000 S	~0		Beginning of tank data coming in from S. 10,000 yards.
7:50	2.3	.016	1,500 S	.044	.099	
8:30	3.0	.53	800 S	1.98	1.27	
8:38	3.13	1.9	600 S	7.5	2.7	
8:47	3.3	10.7	400 S	44.8	7.17	Meter # 2.
8:48	3.3	.011	1,500 S	.046	.104	Radioed from carry all
8:54	3.4	25.	400-375 S	108.5	17.4-15.3	Meter # 2; reading on top of tank meter # 3 .19 R/hr - most intensity from ground.
9:02	3.5	10.7	400-375	48	7.7-6.7	Meter # 2; meter # 1 gave 12 R/hr.
9:10	3.66	12	374	57	8.2	Meter # 2; meter # 1 gave 15 R/hr; meter #3 on top - 12 R/hr meter #4 inside .04 R/hr
9:15	3.8	60 *	286	298	24.4	Distances based on point of nearest approach measured on photograph (Fig. 1) and recorded odometer readings from tank inside readings 9:15-9:18 .17 R/hr; .22 R/hr; .25 R/hr; 1.7 R/hr. Tank returns to 10,000 S. H.L.S. has received 1.5 total dose. Tank tread [redacted] 2 R/hr.
9:16	3.8	66 *	250	327	20.4	
9:16	3.8	75 *	228	372	19.3	
9:16	3.8	510 *	~120	2530	36.4	

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Table 1 (Cont'd)

Absolute Time	Hours Delay (t)	Intensity R/hr (I) as meausred	Distance in Yards	(R) $Io = It^{1.2}$	$Io \times R^2 \times 10^{-6}$	Remarks
12 noon	6.5	.7	3,000 N	6.61		
3:10	8.66	15 *	385 W	200	29.6	Second run of tank procedure from west 0.5 R/hr inside.
3:20	8.8	60 *	217 W	816	38.4	.2 R/hr inside.
3:25	8.9	390 *	107 W	5380	61.6	1.3 R/hr inside.
3:30	9.0	510 *	88 W	7140	55.3	1.7 R/hr inside.
6:30 p.m.	12.0	1440 *	50 W	28400	70.9	4.8 R/hr inside
6:30	12.0	6000 *	30 W	118000	106	Over 20 R/hr inside End second run of tank.
July 18						
9:30 a.m.	28.0	.2	500 W	10.9	2.72	Measured at rocket launching site.
11:00	29.5	.04	800 NW	2.32	1.48	Measured at Jumbo.

* Intensity figured from measurement on inside of tank 6 R/hr outside found to equal .02 R/hr inside; hence, factor of 300 used above.

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TABLE 2

Time	Delay Hours	Intensity (I) R/hr as Read	Distance (R) in Yards	$I_o = It^{1.2}$
Aug 13-15	672	1	120 S	2470
"	"	.25	200 S	618
"	"	.12	300 S	296
"	"	.028	400 S	69
"	"	.01	500 S	42
"	"	1.9	70 W	4690

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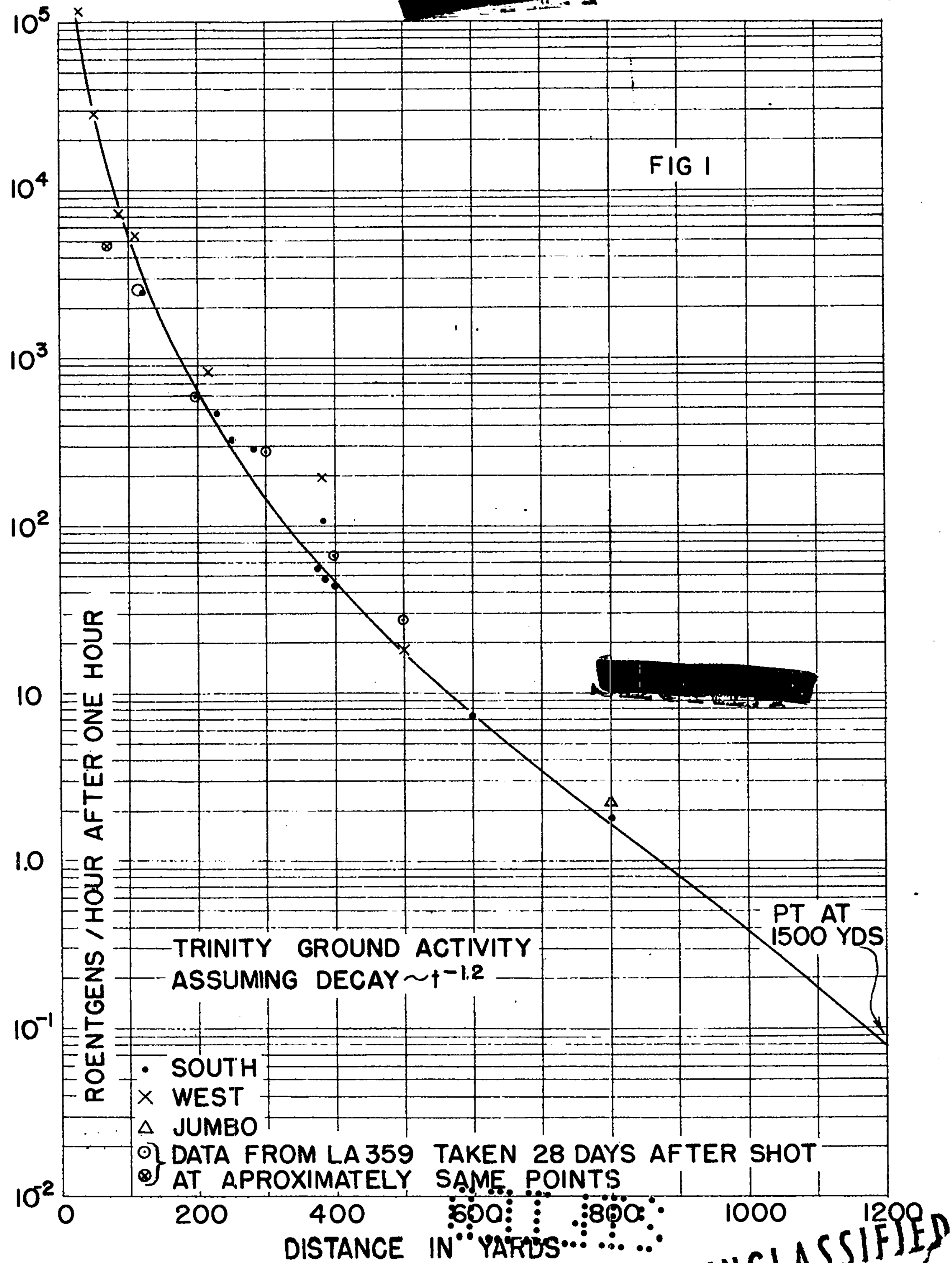

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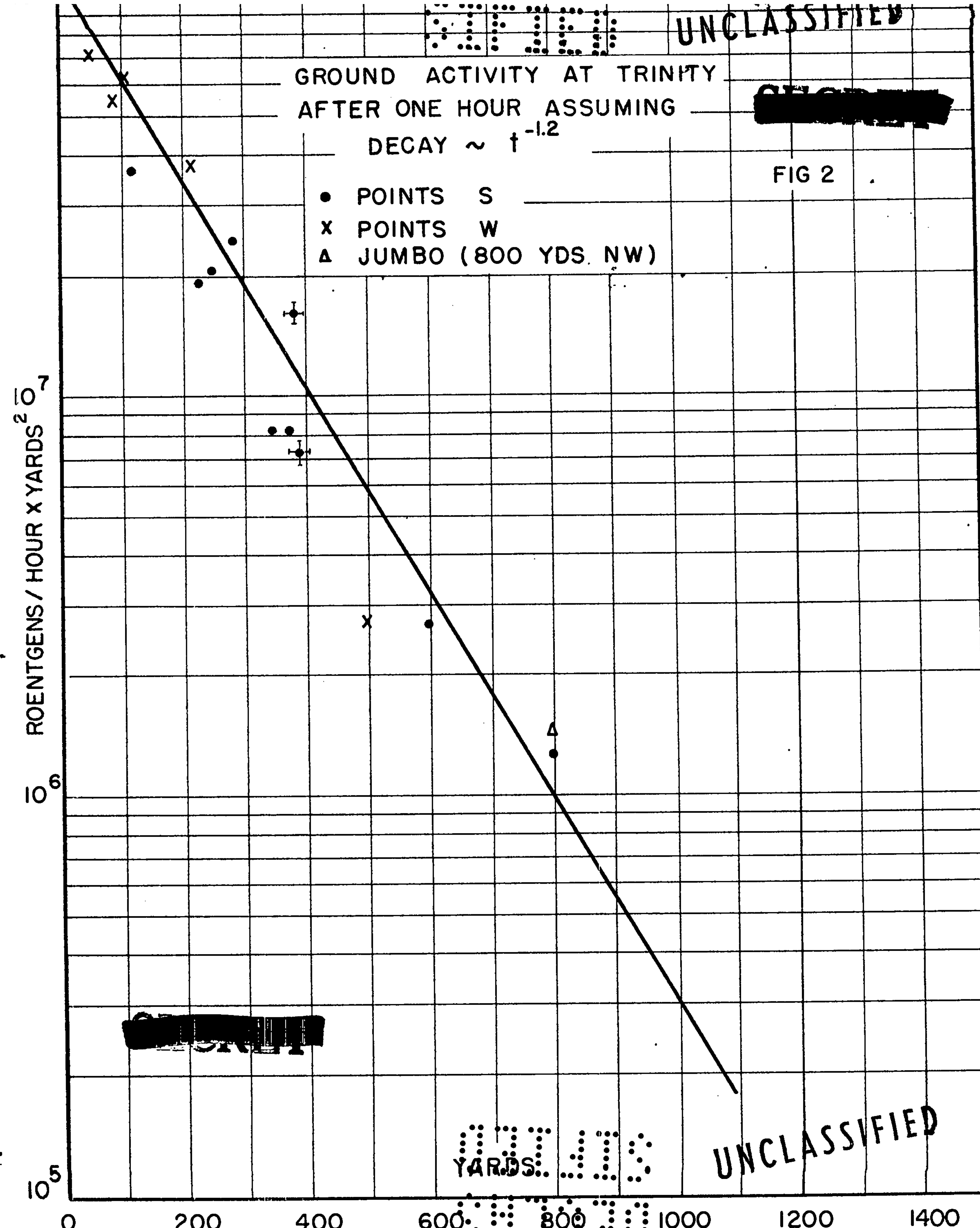
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GROUND ACTIVITY AT TRINITY
AFTER ONE HOUR ASSUMING
DECAY ~ $t^{-1.2}$
[redacted]
● POINTS S
X POINTS W
Δ JUMBO (800 YDS. NW)
ROENTGENS / HOUR X YARDS^2
10^7
10^6
10^5
0
200
400
600
800
1000
1200
1400
YARDS
[redacted]
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FIG 2

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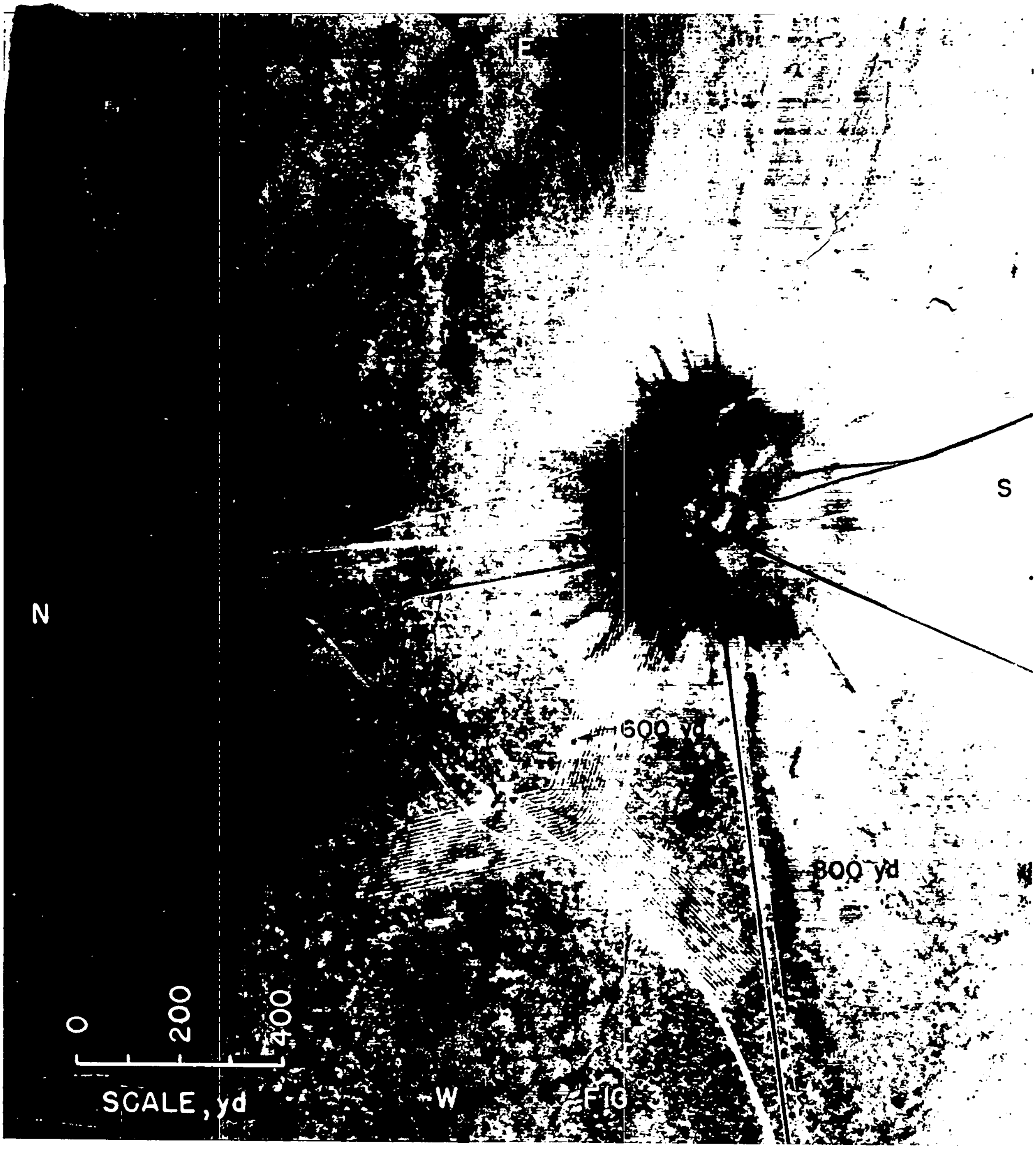

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FIG 4

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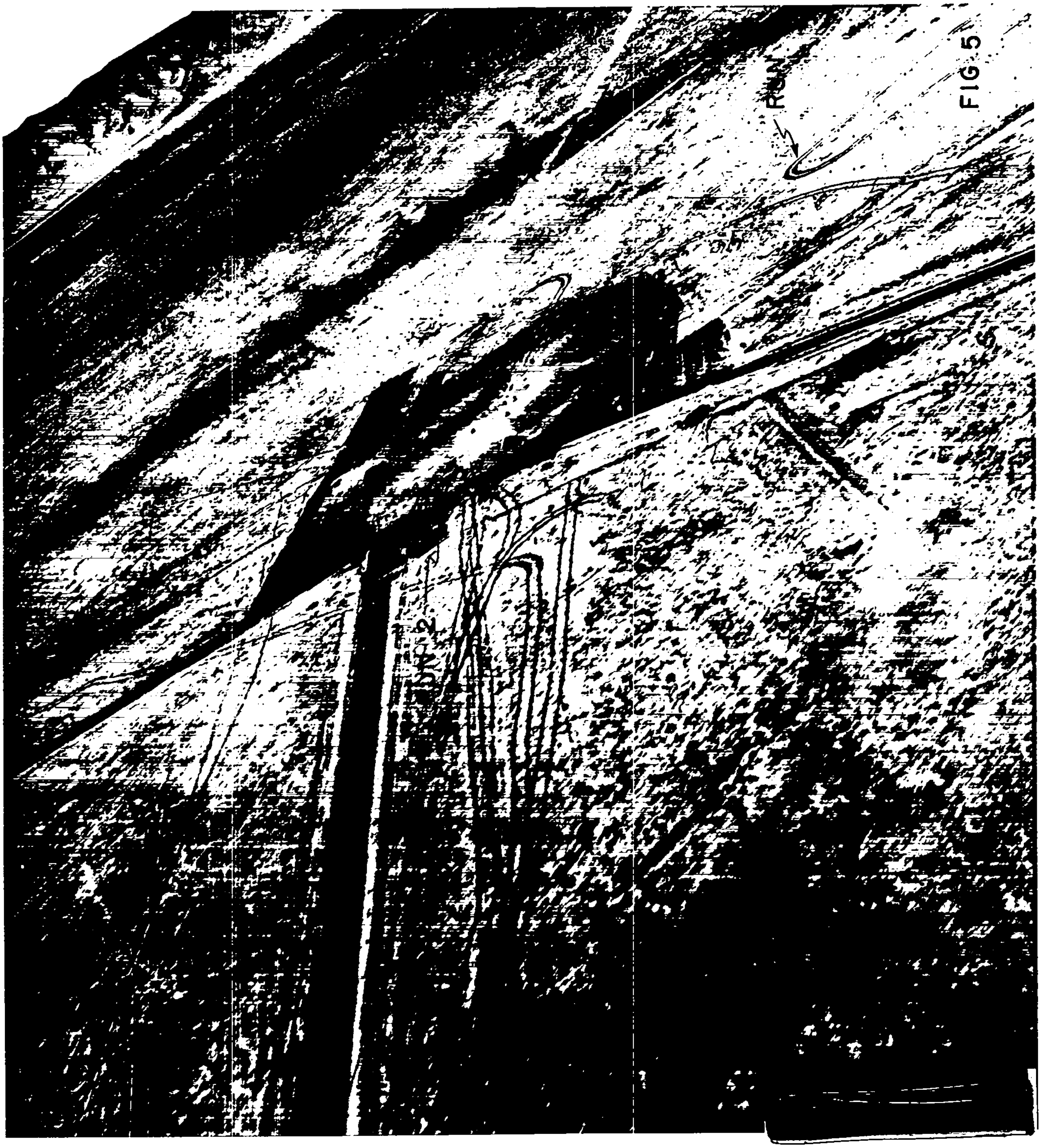

FIG. 5

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