Variation of P & S Wave Velocities Before Earthquakes

By

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ABSTRACT

In this study, predetermined P arrival times were used in conjunction with measured S-P intervals in an effort to detect any significant trends in Vp/Vs ratios preceding earthquakes of magnitude 0.3 or greater.

Records of 47 events, taken from a previous study by Sanford, Budding et al. (1972), were investigated. These events originated in the Rio Grande Rift Zone 20 kilometers north of Socorro, New Mexico at approximately $34^{\circ}13'N$, $106^{\circ}51'W$. They were recorded at four stations, centrally located around the events and at a maximum of 35 km. from the events.

Vp/Vs is plotted with time showing the changes in their ratios before the higher magnitude events. There is a definite increase of the Vp/Vs ratio preceding the higher order events and a decline in this ratio when they occur. These findings do not support the work of Aggarwal, Sykes et al. (1973).

INTRODUCTION

Changes in the ratio of seismic P and S wave velocities have received considerable attention as an effective method of the prediction of earthquakes, and according to Aggarwal, Sykes et al. (1973), have given highly successful results. These changes in P and S wave velocities are a result of dilatation as rock stresses increase. During dilatation, microfractures and cracks open up in the rock and slow down seismic waves since they need rigidity for propogation. These cracks begin to fill with water, thereby increasing the velocity of the waves. Nur and Simmons (1969) have found that Vs is not affected by the introduction of water into the cracks, and that Vp is affected if the pores are in the form of cracks and not in the form of round holes. This water flowing into the rock weakens the rock by increasing the effective stress and the rock eventually fails, causing an earthquake. The more stress applied to the rock, the larger the volume dilated, and the longer the time it takes to fill with water.

Semenov (1969) has found that the size of the earthquake is independent of the variation of Vp/Vs, but is dependent on the time that the lowered Vp/Vs ratio remains in effect. The longer the duration, the larger the event is likely to be.

By monitoring the Vp/Vs ratio through microearthquakes and the time span of these lowered ratios, it should be possible to predict earthquakes of higher magnitudes.

THEORY

The graph of P arrival time vs. the S-P interval indicates the following relations:

$T = D/V$ (T = travel time)

$S\text{-}P = D/Vs - D/Vp$

$S\text{-}P = D(1/Vs - 1/Vp)$

$S\text{-}P = D(Vp/VpVs - 1/Vp)$

$S\text{-}P = D/Vp\ (Vp/Vs - 1)$

$S\text{-}P = Tp\ (Vp/Vs - 1)$

$$\frac{S\text{-}P}{Tp} = (Vp/Vs - 1)$$

$$Slope = (Vp/Vs - 1) \qquad \text{[Formula 1]}$$

The theoretical velocity for P & S waves in an isotropic, homogeneous, linearly elastic substance is

$$Vp = \sqrt{\frac{E(1-\nu)}{\rho(1-2\nu)(1+\nu)}}$$

$$Vs = \sqrt{\frac{E}{2(1+\nu)}}$$

where E is Young's Modulus, ρ is density, and ν is poisson's ratio.

Solving for Vp/Vs,

$$(Vp/Vs)^2 = \frac{\frac{E(1-\nu)}{\rho(1-2\nu)(1+\nu)}}{\frac{E}{2\rho(1+\nu)}}$$

$$(Vp/Vs)^2 = \frac{2(1-\nu)}{(1-2\nu)}$$

So when Poisson's ratio equals 0.25 which is commonly acceptable for most rocks,

$$Vp/Vs = \sqrt{\frac{2(1-0.25)}{[1-(2)(0.25)]}}$$

$$Vp/Vs = \sqrt{3}$$

When $Vp = 5.8$

$$5.8/Vs = \sqrt{3} \quad \text{and}$$

$$Vs = 5.8/\sqrt{3}$$

$$Vp'/Vs' = Vp/Vs$$

$$Vp'/Vs' = Vp/(5.8/\sqrt{3})$$

$$Vp'/Vs' = (Vp\sqrt{3})/5.8 \qquad \text{[Formula 2]}$$

Substituting Formula 2 into Formula 1,

$$\text{Slope} = [(Vp\sqrt{3}/5.8) - 1]$$

$$Vp(\sqrt{3}/5.8) = \text{Slope} + 1$$

$$Vp = (\text{Slope} + 1)5.8/\sqrt{3} \qquad \text{[Formula 3]}$$

$$Vp/Vs = \text{Slope} + 1$$

DATA

All earthquakes reviewed in this study originated at approximately $34^{\circ}13'N$, $106^{\circ}51'$ W and will be referred to as Class I events.

The location and elevation of all seismograph stations used in this study are listed in Table 1. SNM and SRM are both vertical instruments, SNM recording on paper and SRM on film. SBB and SCC are vertical and horizontal instruments recording on magnetic tape. The SRM events were developed on photographic paper, and SBB and SCC were played back on a visicorder for ease in handling and interpretation.

PROCEDURE

From the forty-seven records that were considered to be Class I events, nineteen were rejected because they were poor recordings or were recorded by only two stations. From the remaining records, the S-P interval was measured, and the P arrival time was accepted from previous work (Sanford, 1972.) The S-P interval was very difficult to measure accurately, since the S wave is often very ambiguous. To overcome this difficulty all of the records from each station were reviewed as a whole, making certain that the S waves were chosen consistantly.

From this data P arrival time vs. S-P interval was plotted by the computer and a best fit was obtained by the least squares technique. The program used also gave the slope of the line, the correlation coefficient and the estimated error. The origin time is found at the X intercept (where S-P = 0.0). The P wave velocity is calculated from formula (3), and the travel time is found by taking the P arrival time minus the origin time. From the product of the travel time and the P wave velocity focal distances are calculated. With three or more stations, focal distances are plotted as circles with the station at the center. A correction of 0.66 seconds was applied to station SRM because of the thick section of low velocity rock beneath that station. The epicenters were found by the intersection of the

chords of the circles, and the epicentral distances were measured from the stations. The depth of focus is found by the following relation:

$$FD = \sqrt{R^2 - Del^2}$$

where R is the focal distance and Del is the epicentral distance.

After reviewing the results of P vs. S-P and the epicentral locations, it was determined that all of the SRM S-P intervals were high, causing the P wave velocities to be too low. It is assumed that this resulted from the thick alluvium cover in the vicinity of that station and is partially due to the vertical instrument at that station not fully responding to the S waves. All SRM S-P intervals were discarded, and P vs. S-P was replotted giving more reasonable results for the P wave velocity, although some were still very low. Epicentral locations were plotted again with the new velocities, still using the P arrival times from station SRM.

To further assure consistancy, a comparison was made of the differences in P arrival times for all stations. Events having approximately the same differences in P arrival times were assumed to have the same origin. The change in the Vp/Vs ratio as time increases is plotted, showing the magnitude for the larger events. This plot demonstrates the fluctuation in the Vp/Vs ratio.

PRESENTATION AND DISCUSSION OF DATA

The P arrival times and S-P intervals are listed in Table 2. The P arrival times were taken from previous work (Sanford, 1972) and the S-P intervals were measured from the records. the events that were discarded are denoted by an "X" in the right hand column. In the final plots, the S-P intervals from SRM records were not used, but the P arrival times were.

Focal depths and P wave velocities are listed in Table 3. Focal depths range from 8.35 km. to an anomalously high 36.11 km. The average focal depth is 16.4 km. P wave velocities range from 4.38 to 5.99 with an average of 5.2 km/sec. These P wave velocities seem to be consistantly low as the value of 5.8 is usually accepted for the Rio Grande Rift.

Table 4 lists the magnitudes of most of the events used in this study. These values have been accepted from previous work. The largest event is 2.1, but most of the events are 0.3 or less.

A computer print-out of information concerning each event is included in Table 5. This is taken from the main program and gives the calculated origin time, P wave velocity, focal depth and other values used in plotting the graphs.

The differences in P arrival times for all stations are given in Table 6. A deviation from the mean of 1 second for the differences in arrival time would indicate that it was not

a Class I event.

The changes in the ratio of Vp/Vs with time and magnitude of the events is shown in Figure 1. The spikes from the X axis are the magnitudes of the events and are numbered for events equal to or greater than 0.3. The largest (1.67) and the smallest (1.31) velocity ratios in Figure 1 differ by 22%.

It is shown here that before the higher order events the Vp/Vs ratio increased to a maximum, then decreased slightly over a two to three day period. After this hump the Vp/Vs ratio decreases to a minimum during the higher order event. This does not support the work of Aggarwal, Sykes et al (1973). They find that the Vp/Vs ratio decreased before the higher order events, then returned to a normal value during the event.

The time duration of the lowered Vp/Vs ratio for the 3.3 magnitude earthquake studied by Aggarwal is four days. The study which Whitcomb, Garmany et al. (1973) have made has indicated a relation between the magnitude of an event and its anomaly time of

$$\text{Log } t = 0.68M - 1.31$$

Using this relation to calculate the anomaly time for the 2.1 magnitude event used in this study yields an anomaly time of 2½days. We do not see any decrease for a 2½ day period in the Vp/Vs ratio before this event, but find an increase for a two day period (March 17 and 18). It is assumed that we have different results for one of two reasons: That there is not enough data to

represent the actual situation or that the dilatancy model assumed for this study is not appropriate to this region.

P arrival time vs. S-P interval is plotted in Figure 2. SRM records are not used in the calculation of these plots, but this rejected data is shown for reference. Each station is represented by a different symbol given in the legend and the origin time is given when S-P equals zero. Some of the plots show a large amount of scatter due to the abundance of surficial sediments in the valley, while others indicate very little scattering of data. The Vp/Vs ratio is not shown but can be found easily by adding one to the slope.

The epicentral locations are plotted in Figure 3. The radii of the circles are given by the product of the P wave velocity and the travel time for each station. The intersection of the chords of the circles locates the epicenter. All of the epicenters are within a range of $\pm$ 2.5 km. except four which are within a range of six km. of the cluster.

CONCLUSIONS

There is a definite change in the ratio of Vp/Vs as shown in Figure 1. Changes as large as 22% occurred in the two day period preceding the 2.1 magnitude event. This time is very short compared to geologic events, but large relative to seismic wave propogation. It seems that fluid flow, crack formation and creep would have appropriate time constants and fit the model of dilatation.

The events used in this study were of lower magnitudes, where the time anomaly is short (2 days for the largest event), and the time span between events is large, It would appear that more conclusive results could be reached in a study where such gaps did not exist.

TABLE 1

LOCATION OF SEISMOGRAPH STATIONS

STATION	LOCATION	LAT N	LONG W	ELEVATION (METERS)
SNM	Socorro, N.M.	34°04.2'	106°56.6'	1511
SRM	West of La Joya New Mexico	34°20.5'	106°52.9'	1522
SCC	Magdalena Mts. New Mexico	34°01.0'	107°08.5'	2200
SND	East of Bernardo New Mexico	34°24.5'	106°44.7'	1525

	SXM		SXM		SEB		SEB		
DATE	P	S-P	P	S-P	P	S-P	P	S-P	
1/07 13:35	14.4	2.85	14.4	3.16					M
1/11 20:40	03.4	2.13		2.56					M
2/12 05:17	12.6	2.70	16.9	1.78	20.5	2.34			M
2/13 08:30	38.6	2.50	32.1	2.88	40.4	3.54			
3/02 11:35	04.9	2.25	04.7	2.60	05.0	3.53			
3/17 06:40	56.7	2.33		2.80	58.6	3.61	59.5	3.53	
3/17 08:39	13.1	2.25	13.7	2.61	15.0	3.36	15.8	3.54	
3/17 17:05	34.6	3.02	34.3	3.83	35.3	3.33	36.1	3.59	
3/18 07:20	26.0	2.25	27.1	3.09	28.4	3.84	29.3	3.55	
3/19 16:35	03.3	2.30	03.5	3.85	04.6	3.64	05.7	3.63	
3/20 04:34	56.9	2.41	57.3	3.80	58.6	3.43	59.4	3.59	
3/25 15:33	50.4	2.75			52.0	3.47	52.7	3.84	
3/28 09:02	50.0	2.20	49.6	2.82	55.5	2.20			M
3/30 03:51	47.7	3.25	48.0	1.96		3.40			M
4/13 06:39	03.5	3.30	00.0	1.96					M
4/17 03:06	49.0	2.25	50.0	2.79			52.2	3.72	
4/18 03:44	33.3	2.50	33.2	2.91			35.5	3.76	
4/18 07:11	35.5	3.00	36.1	2.80			38.4	3.80	M
4/18 07:34	59.6	2.50	59.8	2.74			62.1	3.66	
4/18 09:05	01.2	2.50	01.3	2.90			05.2	3.11	M
4/18 09:12	36.9	2.50	37.0	2.90			39.2	4.04	
4/18 09:39	38.1	2.50	38.3	2.89			40.6	4.09	
4/18 19:18	18.7	2.50	19.9	2.81			22.2	3.59	
5/05 22:44	17.9	2.30	18.2	2.89	19.5	3.62	20.3	3.53	
5/05 22:46	53.0	2.50	54.1	3.12	55.3		56.7	3.33	M
5/05 23:03	10.0	2.18	10.2	3.10		3.72	12.3	3.62	
5/11 02:07	51.6	3.13	51.9	2.85					M
5/13 02:31	02.1	2.45	02.8	2.92			04.6	3.66	
6/01 12:23	05.3	2.43	05.6	2.87					M
6/01 15:36	43.4	2.50	43.6	2.83			45.1	4.10	
6/01 22:17	53.8	2.80	54.0	2.67	55.4		56.1	3.50	
6/02 00:23	43.5	2.45	43.8	2.67			45.0	3.56	
6/02 12:24	49.3	2.38	49.6	2.85					M
6/07 08:14	23.7	2.13	23.8	2.82					M
6/14 04:23	26.2	2.48	26.6	3.04			32.6	3.19	M
6/14 04:31	12.9	2.20	13.1	2.86					M
6/14 04:36	31.8	2.38	32.1	2.80	33.4	3.36	34.3	3.65	
6/14 04:36	53.8	2.35	54.1	2.95	55.0	3.21	56.2	3.78	
6/14 07:04	32.8	2.38	33.0	3.11	34.4	4.15	35.2	4.12	
6/14 09:20	13.9	2.63	19.3	3.26	20.5	3.58	21.3		
6/16 05:51	14.0	2.50	14.5		15.0	3.70	16.5		M
6/16 16:50	25.0	2.48	25.2	2.80	26.5		27.5	3.53	
6/17 18:52	50.0	2.25	50.2	2.92					M
6/23 01:33	07.6	2.75		2.90			10.4	4.23	M
6/30 11:34	26.5	2.80	26.6	3.07	27.9	3.76	28.5	3.80	
7/07 02:51	26.3	2.38			26.8	3.69	27.4	3.71	M
7/27 10:26	03.0	2.40			05.5	3.42	06.3	4.21	

TABLE 2

P ARRIVAL TIMES AND S-P INTERVALS

TABLE 2

FOCAL DEPTH AND P WAVE VELOCITY

DATE	TIME	FOCAL DEPTH Km.	P WAVE VELOCITY Km./sec.
2/13	08:36	15.99	5.32
3/02	11:35	8.53	5.73
3/17	05:40	20.51	4.92
3/17	08:30	16.63	5.01
3/17	17:05	15.42	5.13
3/18	07:20	13.06	5.40
3/18	16:35	17.13	5.14
3/20	04:34	16.62	5.09
3/25	15:32	24.93	4.89
4/17	03:06	10.55	5.40
4/18	03:44	14.30	5.27
4/18	07:34	22.25	4.90
4/18	09:12	11.38	5.59
4/18	09:29	12.27	5.40
4/18	10:18	21.31	4.91
5/05	22:44	15.10	5.20
5/05	23:03	9.17	5.45
5/13	02:31	19.76	4.94
6/01	15:36	11.92	5.58
6/01	22:17	36.11	4.38
6/02	00:22	19.05	4.96
6/14	04:36	16.22	5.13
6/14	04:36	13.43	5.24
6/14	07:04	8.35	5.80
6/14	09:20	16.21	5.48
6/16	16:50	10.50	4.85
6/30	11:34	21.11	5.12
9/27	10:36	11.40	5.71

TABLE 4

MAGNITUDE OF EVENTS

DATE	TIME	MAGNITUDE
2/13	08:36	0.30
3/3	11:35	-0.72
3/17	06:40	0.13
3/17	08:39	-0.13
3/17	17:05	0.36
3/18	07:20	0.11
3/18	16:35	0.03
3/20	04:34	0.18
3/25	15:32	2.10
4/17	03:06	0.26
4/18	03:44	0.30
4/18	07:11	-0.35
4/18	07:34	-0.24
4/18	09:12	0.23
4/18	09:29	-0.24
4/18	19:18	0.39
5/5	22:44	0.21
5/5	23:03	-0.32
5/13	02:31	1.00
6/1	15:36	0.03
6/1	22:17	0.65
6/2	00:22	-0.02
6/14	04:36	0.30
6/14	04:36	0.28
6/16	16:50	0.29
6/30	11:34	0.21

T A B L E 5

PRACTICAL INFORMATION FOR EACH EVENT

DATE *	2/13/1970		ORIGIN TIME *			08/26/34.35	
	P	TT	P	S-P			
SNM *	39.60	4.25	22.62	6.50	*	PD	15.49
SRM *	39.10	4.06	21.77	2.63	*	VP	5.32
SBB *	40.37	6.09	32.63	3.54	*	CC	1.00

DATE *	3/02/1970		ORIGIN TIME *			21/36/ 1.64	
	P	TT	S	S-P			
SNM *	4.20	3.16	15.13	4.35	*	PD	6.53
SRM *	4.70	3.00	17.21	2.89	*	VP	5.73
SBB *	6.00	4.96	20.44	3.55	*	CC	1.00

DATE *	3/17/1970		ORIGIN TIME *			06/40/51.59	
	P	TT	P	S-P			
SNM *	56.70	5.17	35.41	2.82	*	PD	20.51
SRM *	0.0	0.0	0.0	0.0	*	VP	4.92
SBB *	58.60	7.37	34.76	3.61	*	CC	0.95
SCC *	59.50	7.97	36.14	3.58	*	FE	0.25

DATE *	3/17/1970		ORIGIN TIME *			08/39/ 8.50	
	P	TT	S	S-P			
SNM *	13.10	4.60	23.07	2.25	*	PD	16.69
SRM *	13.70	4.54	22.77	1.81	*	VP	5.01
SBB *	15.00	6.50	32.60	3.36	*	CC	0.99
SCC *	15.80	7.30	36.61	3.54	*	FE	0.31

DATE *	3/17/1970		ORIGIN TIME *			17/05/29.15	
	P	TT	P	S-P			
SNM *	33.50	4.36	22.22	3.25	*	PD	15.42
SRM *	34.00	4.19	21.40	2.82	*	VP	5.11
SBB *	35.25	6.10	31.17	3.33	*	CC	0.99
SCC *	36.12	6.97	35.62	3.59	*	FE	0.21

DATE * 3/18/1970 ORIGIN TIME * 07/20/22.03

		P	TT	P	S-P			
SNM	*	26.90	3.97	21.43	2.25	*	FD	15.06
SRM	*	27.10	3.51	18.95	0.79	*	VP	5.40
SBB	*	28.40	5.47	29.53	1.04	*	CC	0.86
SCC	*	29.25	6.32	34.12	1.55	*	CF	0.43

DATE * 3/18/1970 ORIGIN TIME * 16/35/-1.40

		P	TT	P	S-P			
SNM	*	3.30	4.76	24.49	2.59	*	FD	17.13
SRM	*	3.50	4.30	22.12	2.35	*	VP	5.34
SBB	*	4.60	6.06	31.13	3.05	*	CC	0.89
SCC	*	5.70	7.16	36.94	3.45	*	EE	0.34

DATE * 3/20/1970 ORIGIN TIME * 04/34/51.65

		P	TT	P	S-P			
SNM	*	56.00	4.98	24.88	2.41	*	FD	16.62
SRM	*	57.30	4.70	23.59	2.30	*	VP	5.00
SBB	*	58.04	6.72	33.57	3.43	*	CC	0.94
SCC	*	59.40	7.49	37.97	3.60	*	EE	0.11

DATE * 3/25/1970 ORIGIN TIME * 19/32/44.41

		P	TT	P	S-P			
SNM	*	50.36	5.95	29.09	2.75	*	FD	24.00
SRM	*	0.0	0.0	0.0	0.0	*	VP	0.00
SBB	*	52.00	7.59	37.12	3.47	*	CC	1.00
SCC	*	52.70	8.29	40.54	3.34	*	EE	0.02

DATE * 4/17/1970 ORIGIN TIME * 03/06/46.15

		P	TT	P	S-P			
SNM	*	49.80	3.67	19.84	2.25	*	FD	10.55
SRM	*	50.00	3.21	17.36	2.79	*	VP	5.40
SCC	*	52.20	6.07	32.70	3.72	*	EE	0.0

DATE * 4/18/1970 ORIGIN TIME * 03/44/28.95

		P	TT	P	S-P			
SNM	*	33.20	4.37	21.29	2.50	*	FD	14.30
SRM	*	33.20	3.61	18.93	2.41	*	VP	5.27
SCC	*	35.50	6.57	34.57	3.76	*	EE	0.0

DATE *	4/10/1970		ORIGIN TIME *	07/34/53.07		
	P	TT	S	S-P		
SNM *	59.60	5.93	26.40	2.58	* FD	22.45
SRM *	59.80	5.47	26.28	2.74	* VP	4.80
SCC *	62.10	8.43	42.50	3.66	* EE	0.0

DATE *	4/18/1970		ORIGIN TIME *	09/12/33.17		
	P	TT	S	S-P		
SNM *	36.90	3.73	20.87	2.53	* FD	11.38
SRM *	37.00	3.17	17.74	2.80	* VP	3.59
SCC *	39.20	6.33	33.75	4.04	* EE	0.0

DATE *	4/18/1970		ORIGIN TIME *	05/29/34.17		
	P	TT	S	S-P		
SNM *	38.10	3.93	21.53	2.50	* FD	12.27
SRM *	38.25	3.42	19.74	2.89	* VP	5.41
SCC *	40.60	6.43	35.23	4.09	* EE	0.0

DATE *	4/18/1970		ORIGIN TIME *	19/11/13.97		
	P	TT	S	S-P		
SNM *	10.70	5.73	27.57	2.50	* FD	21.31
SRM *	19.90	5.27	25.36	2.81	* VP	4.81
SCC *	22.20	8.23	39.59	3.99	* EE	0.0

DATE *	5/05/1970		ORIGIN TIME *	22/04/13.03		
	P	TT	S	S-P		
SNM *	17.90	4.37	22.74	2.30	* FD	15.10
SRM *	18.20	4.01	20.87	2.39	* VP	5.20
SBD *	19.45	5.92	30.81	3.52	* EE	0.51
SCC *	20.30	6.77	35.23	3.69	* EE	0.30

DATE *	5/05/1970		ORIGIN TIME *	23/09/ 6.94		
	P	TT	S	S-P		
SNM *	10.30	3.46	18.88	2.61R	* FD	9.17
SRM *	10.20	3.00	16.37	3.10	* VP	5.45
SCC *	12.30	5.76	31.42	3.52	* EE	0.0

DATE * 5/13/1970			ORIGIN TIME * 22/31/-3.04				
	P	TT	R	S-P			
SNM *	2.10	5.14	25.43	2.45	*	PD	19.76
SRM *	2.30	5.18	26.60	2.91	*	VP	4.94
SCC *	4.64	7.63	37.98	3.00	*	PE	0.0

DATE * 6/01/1970			ORIGIN TIME * 15/36/39.58				
	P	TT	R	S-P			
SNM *	43.40	3.75	20.93	2.50	*	PD	11.92
SRM *	43.60	3.29	19.36	2.83	*	VP	5.80
SCC *	45.80	6.15	34.30	4.10	*	PE	0.0

DATE * 6/01/1970			ORIGIN TIME * 22/17/44.42				
	P	TT	R	S-P			
SNM *	53.30	8.38	41.04	2.88	*	PD	36.11
SRM *	54.00	8.92	39.98	2.67	*	VP	4.35
SCC *	56.10	11.38	51.10	3.56	*	PE	0.0

DATE * 6/02/1970			ORIGIN TIME * 00/02/38.42				
	P	TT	R	S-P			
SNM *	43.50	5.08	25.80	2.46	*	PD	19.05
SRM *	43.80	4.72	23.42	2.67	*	VP	4.96
SCC *	45.80	7.38	36.62	3.56	*	PE	0.0

DATE * 6/14/1970			ORIGIN TIME * 04/36/27.28				
	P	TT	R	S-P			
SNM *	31.80	4.52	23.21	2.38	*	PD	16.20
SRM *	32.10	4.16	21.36	2.89	*	VP	5.13
SBB *	33.40	6.12	31.47	3.36	*	CC	0.00
SCC *	34.25	6.97	35.75	3.65	*	PE	0.00

DATE * 6/14/1970			ORIGIN TIME * 04/36/40.77				
	P	TT	R	S-P			
SNM *	53.80	4.03	21.51	2.35	*	PD	13.42
SRM *	54.10	3.67	19.59	2.85	*	VP	5.34
SBB *	55.00	5.23	27.92	3.31	*	CC	0.99
SCC *	56.20	6.43	34.34	3.73	*	PE	0.00

DATE * 6/14/1970 ORIGIN TIME * 07/44/29.64

		P	TT	R	S-P			
SNM	*	32.90	3.16	18.90	2.38	*	FD	8.35
SRM	*	33.00	2.70	16.18	3.11	*	VP	5.09
SBB	*	34.44	4.80	25.75	4.15	*	CC	0.95
SCC	*	35.20	5.55	33.30	4.10	*	EE	0.35

DATE * 6/14/1970 ORIGIN TIME * 09/20/14.02

		P	TT	R	S-P			
SNM	*	13.90	4.26	23.13	2.62	*	FD	16.21
SRM	*	19.27	3.99	21.57	3.26	*	VP	5.40
SBB	*	20.45	5.42	31.50	3.54	*	CC	1.00

DATE * 6/16/1970 ORIGIN TIME * 26/50/19.60

		P	TT	R	S-P			
SNM	*	25.00	5.40	26.20	3.48	*	FD	19.50
SRM	*	25.20	4.94	23.67	2.29	*	VP	4.56
SCC	*	27.46	7.86	38.14	3.55	*	EE	0.0

DATE * 6/30/1970 ORIGIN TIME * 33/34/01.09

		P	TT	R	S-P			
SNM	*	26.50	5.41	27.74	2.80	*	FD	21.11
SRM	*	26.62	4.87	24.98	3.07	*	VP	5.19
SBB	*	27.80	6.71	34.40	3.76	*	CC	0.96
SCC	*	28.50	7.41	37.90	3.90	*	EE	0.10

DATE * 9/27/1970 ORIGIN TIME * 10/36/ 0.45

		P	TT	R	S-P			
SNM	*	3.90	3.45	19.60	2.48	*	FD	11.48
SRM	*	0.0	0.0	0.0	0.0	*	VP	5.71
SBB	*	5.50	5.05	25.92	3.62	*	CC	0.99
SCC	*	6.30	5.85	29.36	4.21	*	EE	0.12

TABLE 6

DATE	P ARRIVAL TIME			
	SMN	SRM	SBB	SCC
1/07-23:39	14.4	14.8	0.0	0.0
1/11-10:40	5.4	0.0	0.0	0.0
2/12-05:17	18.6	16.9	20.5	0.0
2/14-05:56	38.6	35.1	40.4	0.0
3/09-11:25	4.2	4.7	6.0	0.0
3/17-06:40	56.7	0.0	58.6	59.5
3/17-08:39	13.1	13.7	15.0	15.8
3/23-17:05	35.5	34.0	35.2	36.1
3/27-07:56	26.9	27.1	28.4	29.3
3/28-16:25	2.3	3.5	4.0	5.7
3/30-04:24	56.3	57.3	58.4	59.1
3/25-15:32	50.4	0.0	52.0	52.7
3/10-05:32	50.8	47.6	59.5	0.0
3/30-02:51	47.7	48.0	0.0	0.0
4/17-06:36	49.8	50.0	0.0	52.2
4/14-08:44	34.3	36.2	0.0	35.5
4/14-07:17	35.5	36.1	0.0	38.4
4/18-07:54	59.6	59.3	0.0	62.3
4/20-09:05	1.2	1.3	0.0	5.2
4/18-05:12	36.9	37.0	0.0	39.2
4/15-20:24	38.1	38.2	0.0	40.6
4/11-04:19	19.7	19.9	0.0	22.2
5/05-12:46	17.9	18.2	19.5	20.3
5/06-02:46	51.7	54.1	55.3	56.7
5/25-23:05	10.0	10.2	0.0	12.3
5/11-08:07	51.6	51.9	0.0	0.0
5/15-22:51	2.3	2.6	0.0	4.6
6/01-16:25	5.3	5.6	0.0	0.0
6/02-15:35	43.4	43.6	0.0	45.9
6/03-22:17	53.8	54.0	55.4	56.1
6/02-20:27	43.5	43.8	0.0	45.8
6/02-17:24	43.3	43.6	0.0	0.0
6/07-20:14	23.7	23.9	0.0	0.0
6/14-04:29	26.3	26.6	0.0	32.6
6/14-04:31	12.9	13.1	0.0	0.0
6/14-04:36	31.5	32.1	33.4	34.3
6/14-04:36	53.0	54.1	55.0	56.2
6/14-07:04	32.3	33.0	34.4	35.2
6/14-09:20	18.9	19.3	20.5	21.3
6/16-05:47	14.0	14.5	15.9	16.5
6/16-16:50	25.0	25.2	26.5	27.5
6/17-18:52	50.0	50.2	0.0	0.0
6/14-01:33	7.6	0.0	0.0	10.4
6/30-11:34	26.5	26.6	27.8	28.5
7/07-04:51	26.3	0.0	26.8	27.4
9/27-11:36	3.9	0.0	5.5	6.3

* [illegible]

DATE	S3-1	S5-1	S4-1	S3-2	S4-2	S4-3
1/07-14.25	0.4	0.0	0.0	0.0	0.0	0.0
1/11-20.40	0.0	0.0	0.0	0.0	0.0	0.0
2/12-05.17	-1.7	1.9	0.0	3.6	0.0	0.0
2/12-05.26	0.5	1.8	0.0	1.3	0.0	0.0
3/02-11.15	0.5	1.0	0.0	1.3	0.0	0.0
3/17-05.40	0.0	1.9	2.8	0.0	0.0	0.9
3/17-06.30	0.5	1.9	2.7	1.3	2.1	0.8
3/17-17.05	0.5	1.7	2.6	1.2	2.1	0.9
3/18-07.10	0.2	1.5	2.4	1.3	2.2	0.9
3/19-16.15	0.2	1.3	2.4	1.1	2.2	1.1
3/20-04.34	0.4	1.5	2.5	1.1	2.1	1.0
3/25-15.32	-1.0	1.6	2.3	0.0	0.0	0.7
3/28-09.02	-0.4	5.5	0.0	5.9	0.0	0.0
3/30-02.51	0.3	0.0	0.0	0.0	0.0	0.0
4/17-03.06	0.2	0.0	2.4	0.0	2.2	0.0
4/18-03.44	-0.1	0.0	2.2	0.0	2.3	0.0
4/18-07.11	0.0	0.0	2.9	0.0	2.3	0.0
4/18-07.14	0.2	0.0	2.5	0.0	2.3	0.0
4/18-09.05	0.1	0.0	4.0	0.0	3.9	0.0
4/18-09.22	0.1	0.0	2.3	0.0	2.2	0.0
4/18-09.[illegible]	0.2	0.0	2.5	0.0	2.3	0.0
4/18-19.16	0.2	0.0	2.5	0.0	2.3	0.0
5/05-22.44	0.0	1.6	2.4	1.3	2.1	0.8
5/05-22.44	0.1	1.4	2.8	1.2	2.6	1.4
5/08-23.03	0.2	0.0	2.2	0.0	2.1	0.0
5/11-08.07	0.3	0.0	0.0	0.0	0.0	0.0
5/12-02.31	0.7	0.0	2.5	0.0	1.8	0.0
6/01-12.23	0.3	0.0	0.0	0.0	0.0	0.0
6/01-15.35	0.2	0.0	2.4	0.0	2.2	0.0
6/01-22.17	0.2	1.0	2.3	1.4	2.1	0.7
6/02-00.22	0.3	0.0	2.3	0.0	2.0	0.0
6/02-12.24	0.1	0.0	0.0	0.0	0.0	0.0
6/07-09.14	0.1	0.0	0.0	0.0	0.0	0.0
6/14-04.23	0.4	0.0	6.4	0.0	6.0	0.0
6/14-04.21	0.2	0.0	0.0	0.0	0.0	0.0
6/14-04.36	0.3	1.6	2.5	1.3	2.2	0.9
6/14-04.26	0.3	1.0	2.4	0.9	2.1	1.2
6/14-07.04	0.2	1.6	2.4	1.4	2.2	0.8
6/14-09.10	0.4	1.6	2.4	1.2	2.0	0.8
6/16-05.51	0.5	1.0	2.5	1.4	2.0	0.6
6/16-16.30	0.2	1.5	2.5	1.3	2.3	1.0
6/17-13.52	0.2	0.0	0.0	0.0	0.0	0.0
6/23-01.33	0.0	0.0	2.8	0.0	0.0	0.0
6/30-11.34	0.1	1.3	2.0	1.2	1.9	0.7
7/07-02.51	0.0	0.5	1.1	0.0	0.0	0.6
9/27-10.36	0.0	1.6	2.4	0.0	0.0	0.8

[illegible]

F I G U R E 1

Vs/Vp RATIO Vs. EPIC. Magnitude for larger events are shown

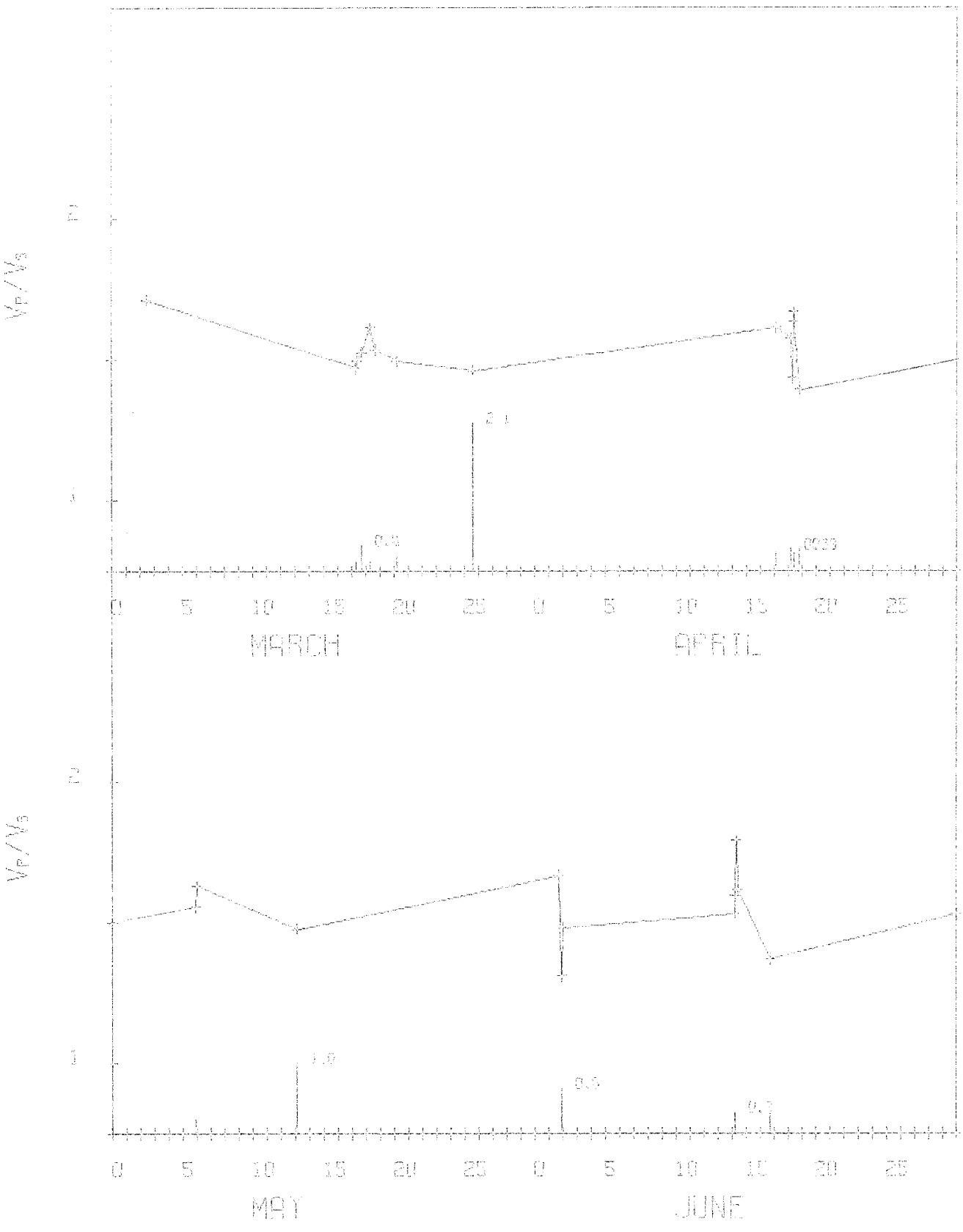
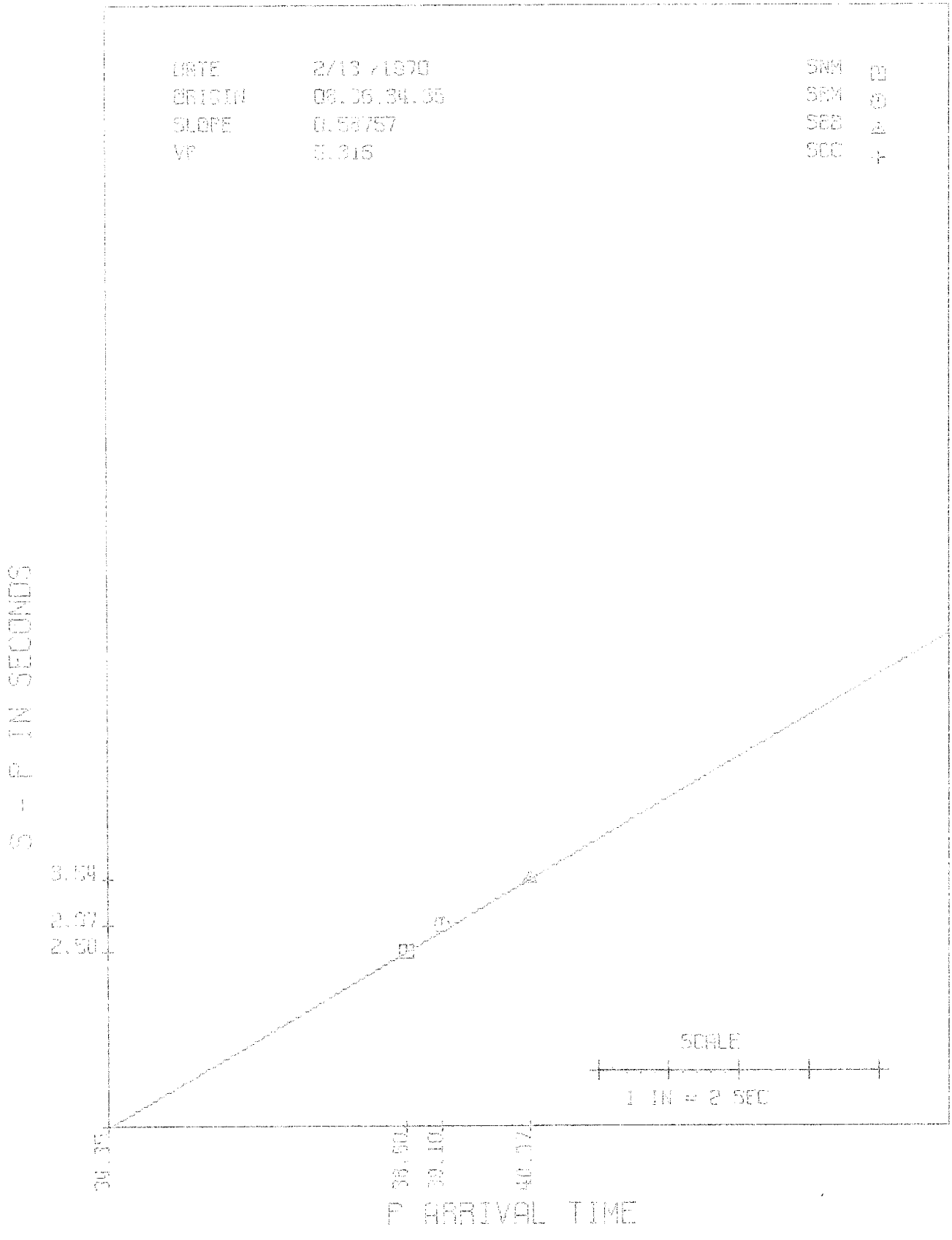
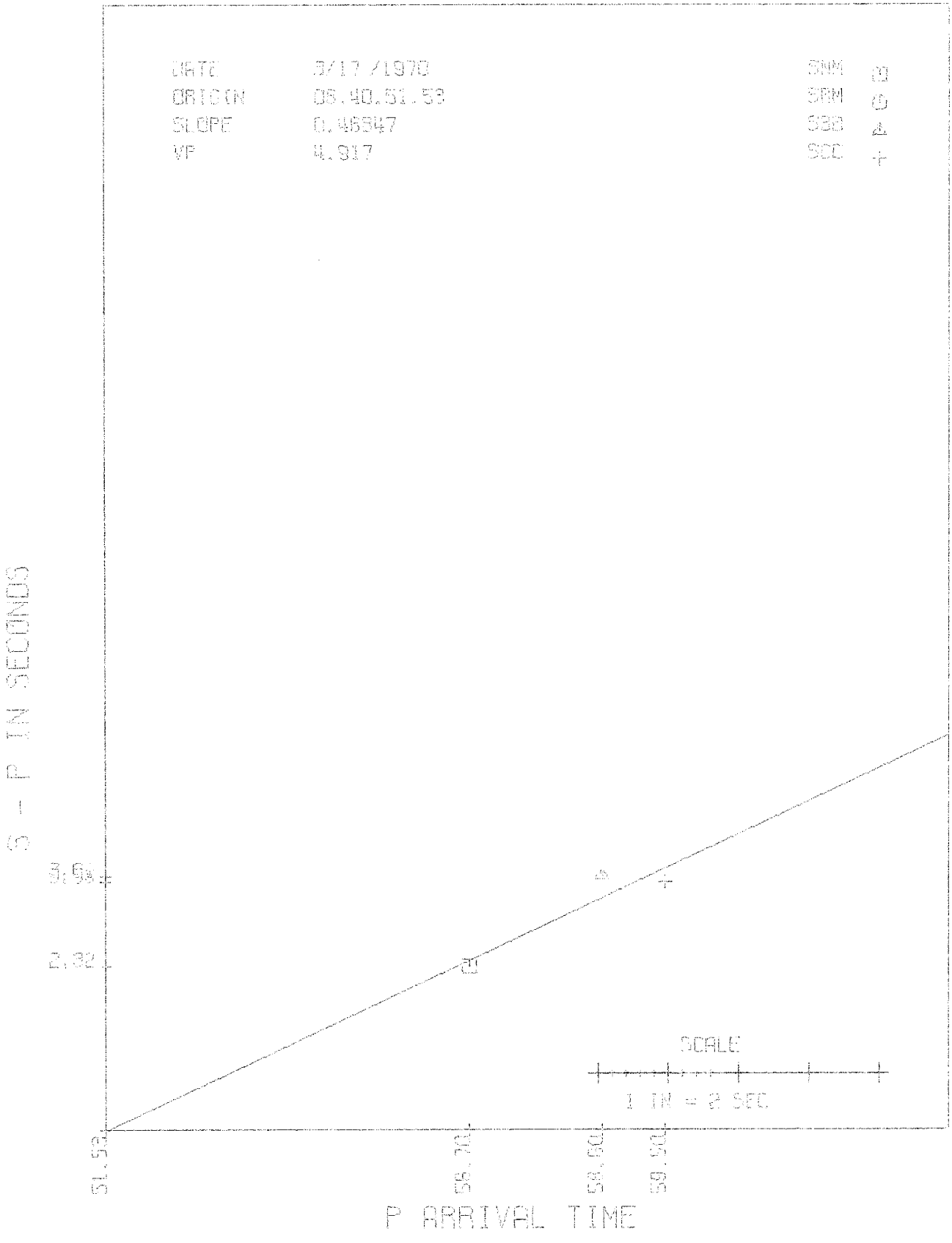

V_P/V_S
2
1
0.3
2.1
0.33
0
5
10
15
20
25
MARCH
APRIL
V_P/V_S
2
1
1.0
0.6
0.2
0
5
10
15
20
25
MAY
JUNE

TABLE 2

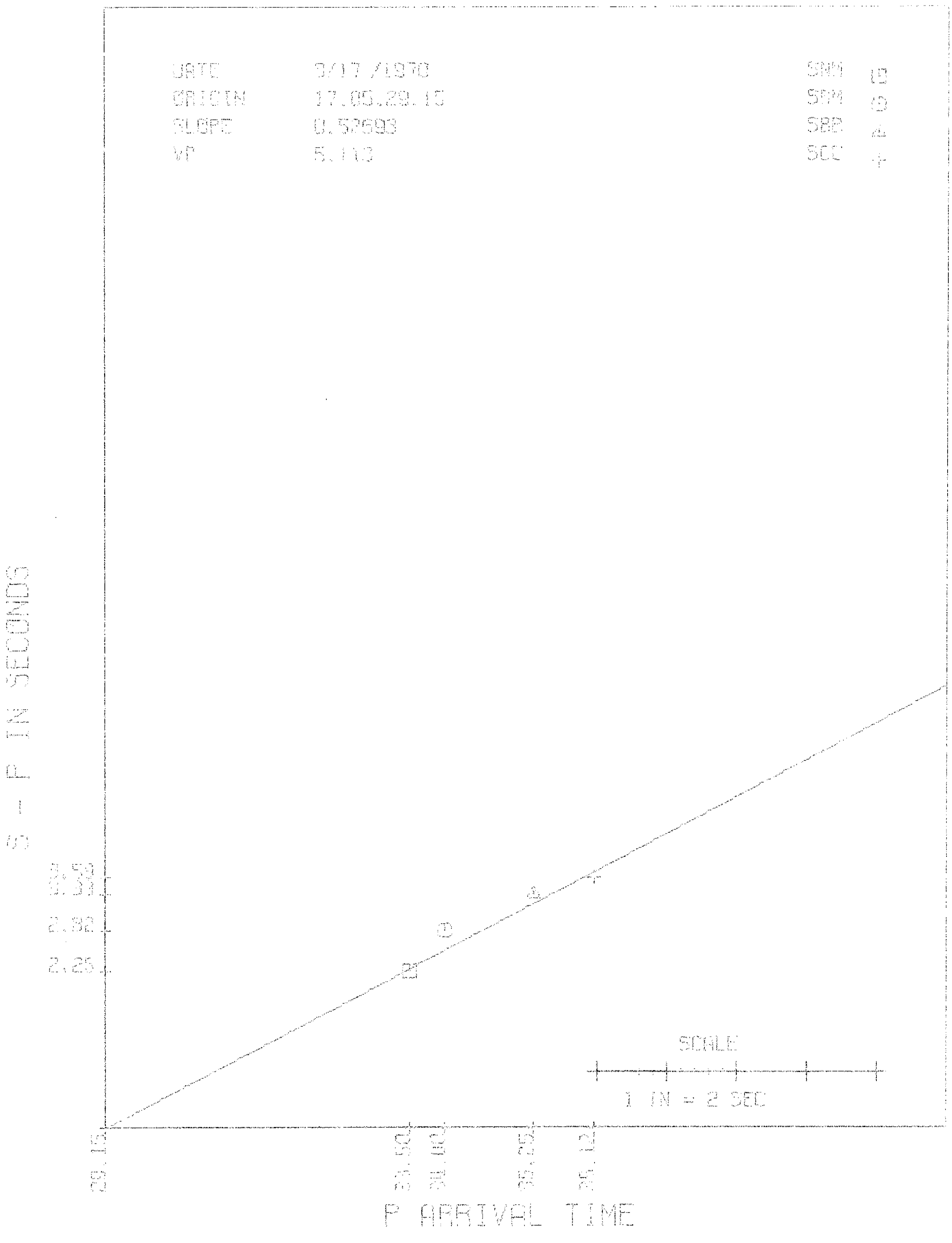
P ARRIVAL TIME Vs. S-P INTERVAL


DATE 2/13/1970
ORIGIN 06.06.34.35
SLOPE 0.557757
VP 3.916
SNM
SBM
SBB
SCC
S - P IN SECONDS
3.59
2.92
2.50
SCALE
1 IN = 2 SEC
P ARRIVAL TIME

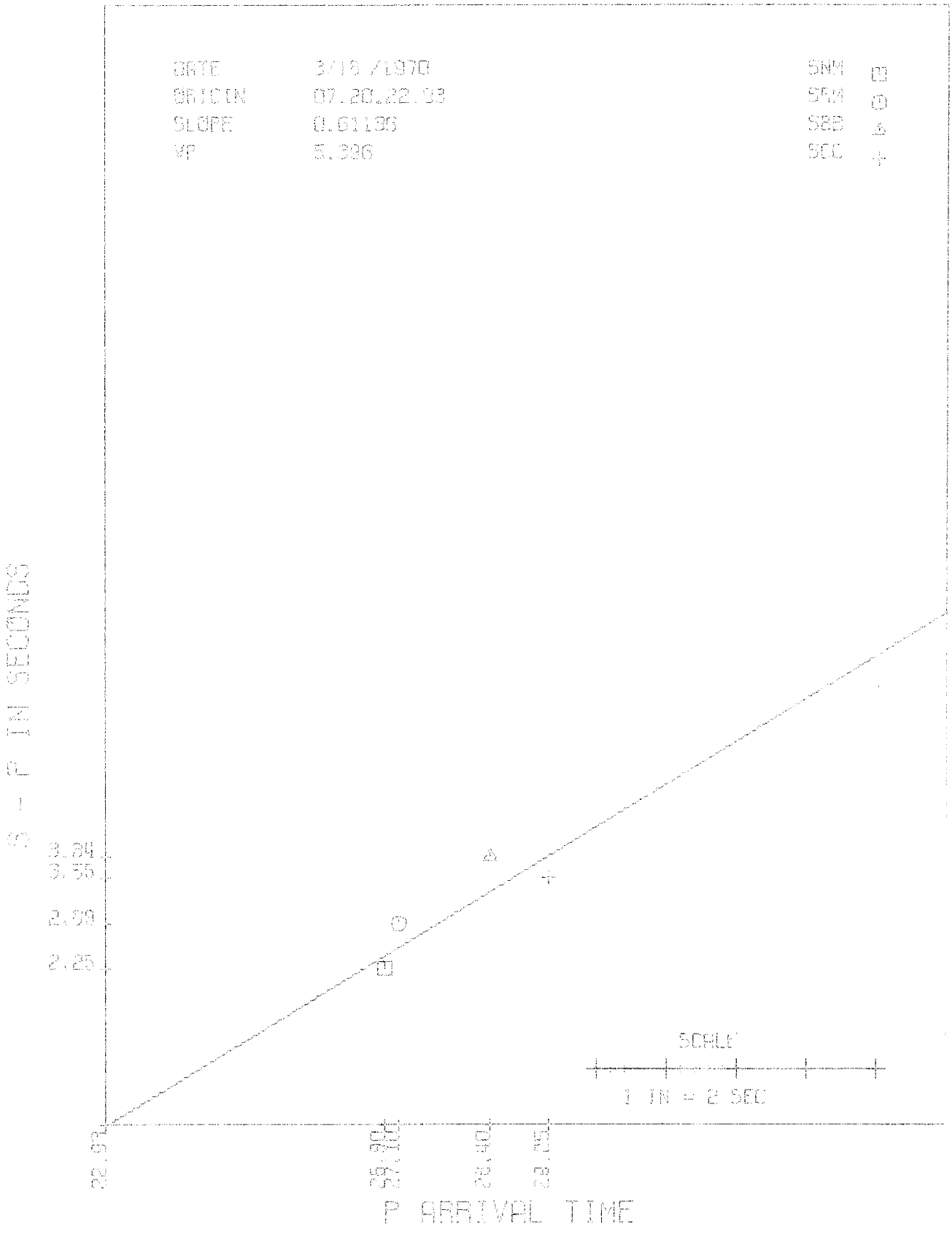
DATE 3/02 /1970
ORIGIN 11.35.1.04
SLOPE 0.71111
VP 5.730
SNM B
SRM A
SEB B
SCC A
S - P IN SECONDS
3.53
2.82
2.20
SCALE
1 IN = 2 SEC
P ARRIVAL TIME

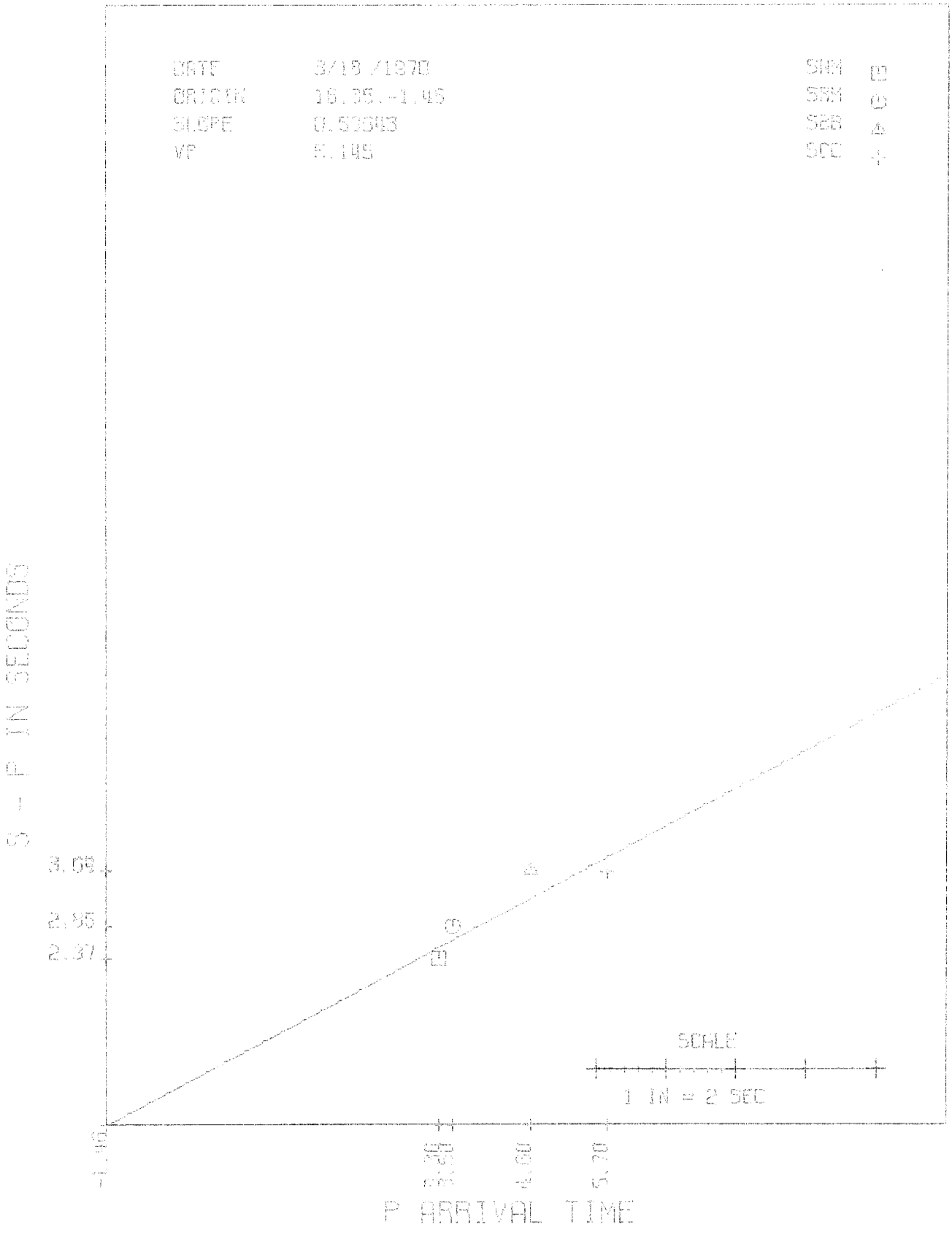

DATE 3/17/1970
ORIGIN 05.40.51.58
SLOPE 0.45547
VP 4.917
SNM
SRM
SBG
SDC
S - P IN SECONDS
3.59
2.32
51.58
55.00
58.00
59.00
P ARRIVAL TIME
SCALE
1 IN = 2 SEC

DATE 3/17/1970
ORIGIN 05:39:0.50
SLOPE 0.497005
VP 5.013
SNM B
SNM D
SBB A
SCC +
S - P IN SECONDS
3.58
3.04
2.51
2.25
B
D
A
+
SCALE
1 IN = 2 SEC
0.00
10.00
15.00
19.29
P ARRIVAL TIME

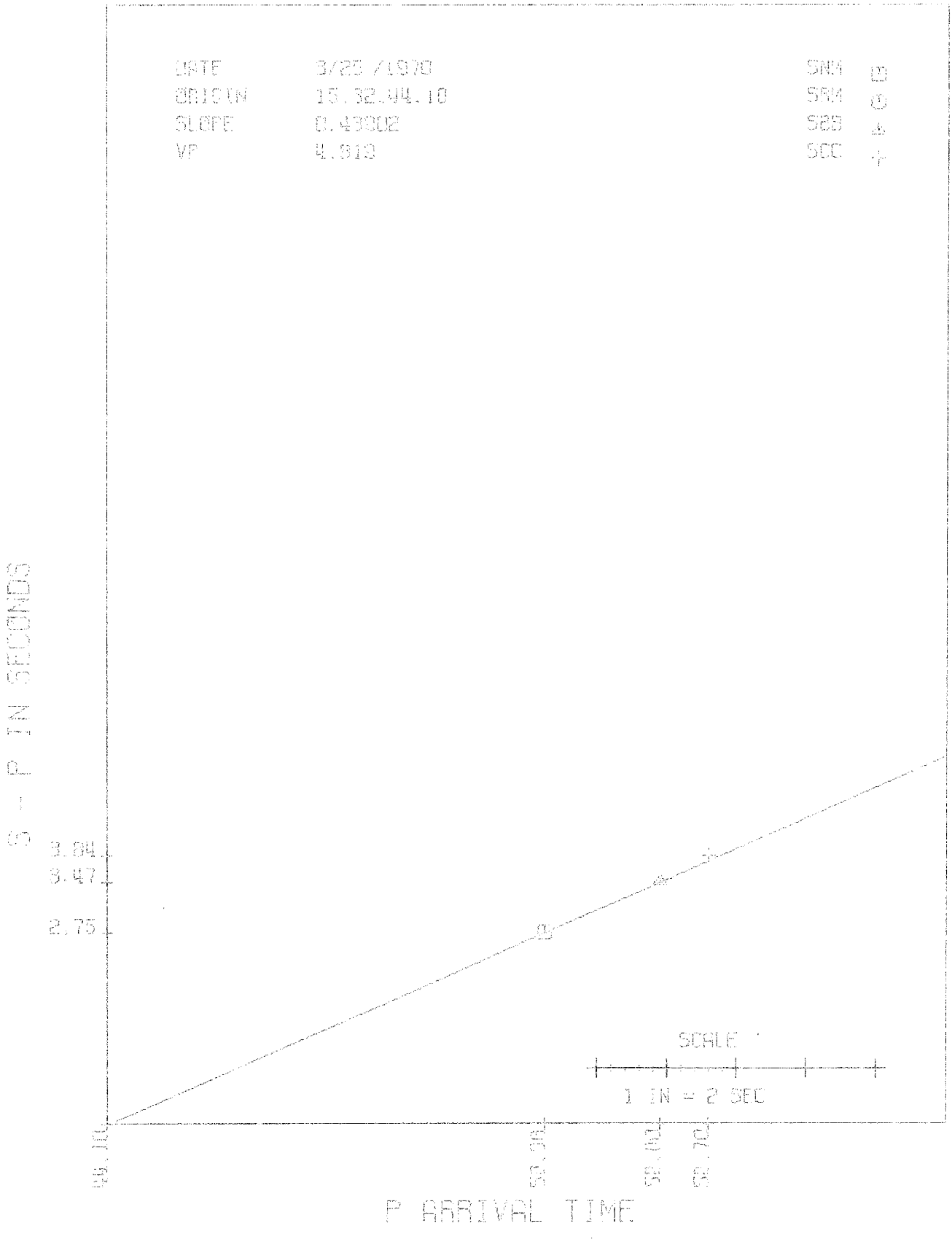


ORIGIN 17.05.29.15
SLOPE 0.57693
SNM
SBP
SCC
S - P IN SECONDS
2.82
2.25
29.15
35.25
P ARRIVAL TIME
SCALE
1 IN = 2 SEC


DATE 3/15/1970
ORIGIN 07.20.22.93
SLOPE 0.611136
VP 5.386
SNM
SPM
SBB
SCC
S - P IN SECONDS
3.84
3.55
2.98
2.25
SCALE
1 IN = 2 SEC
P ARRIVAL TIME

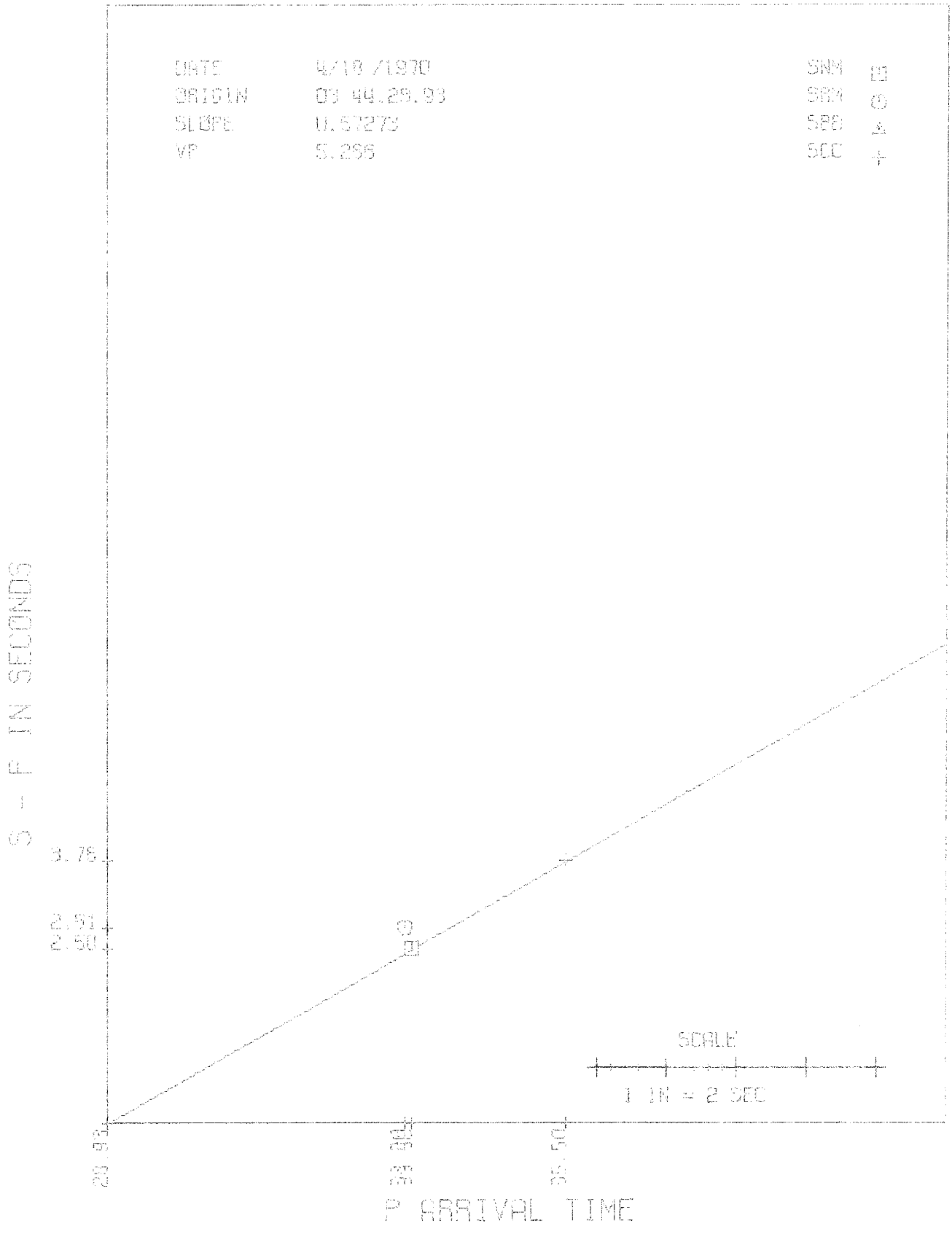

DATE 3/19/1970
ORIGIN 19.35,-1.45
SLOPE 0.53543
VP 5.145
SIM
SPM
SEB
SCC
S - P IN SECONDS
3.09
2.95
2.37
SCALE
1 IN = 2 SEC
SEB
SCC
P ARRIVAL TIME

DATE 3/20/1970
ORIGIN 04:34:51.92
SLOPE 0.48212
VP 4.997
SNM
SRM
SSB
SCC
S - P IN SECONDS
3.69
3.43
2.90
2.41
SCALE
1 IN = 2 SEC
P ARRIVAL TIME


DATE 3/25/1978
ORIGIN 15.32.04.10
SLOPE 0.439802
VP 4.910
SNM
SRM
SBB
SCC
S - P IN SECONDS
3.84
3.47
2.75
SCALE
1 IN = 2 SEC
P ARRIVAL TIME

DATE 3/25/1970
ORIGIN 15:32:48.41
SLOPE 0.4810N
VP 4.592
SNM □
SRM ○
SBB △
SCC +
S - P IN SECONDS
3.84
3.47
2.75
SCALE
1 IN = 2 SEC
48.41
53.05
58.09
63.24
P ARRIVAL TIME

DATE 6/17/1970
ORIGIN 03:05:45.13
SLOPE 0.912500
VF 5.400
SNM
SRM
SBB
SCC
S - P IN SECONDS
3.72
2.70
2.25
SCALE
1 IN = 2 SEC
P ARRIVAL TIME


DATE 4/10/1970
ORIGIN 03 44.29.93
SLOPE 0.57279
VP 5.256
SNM
SRM
SBB
SCC
S - P IN SECONDS
3.75
2.92
2.50
SCALE
1 IN = 2 SEC
25.93
28.44
30.50
P ARRIVAL TIME

DATE	4/18/1970	SNH	13
ORIGIN	07.34.53.07	SRH	0
SLOPE	0.473400	SEC	4
VP	4.902	SCC	7

S - P IN SECONDS

3.08

2.54

SCALE

1 IN = 2 SEC

57

38

19

P ARRIVAL TIME

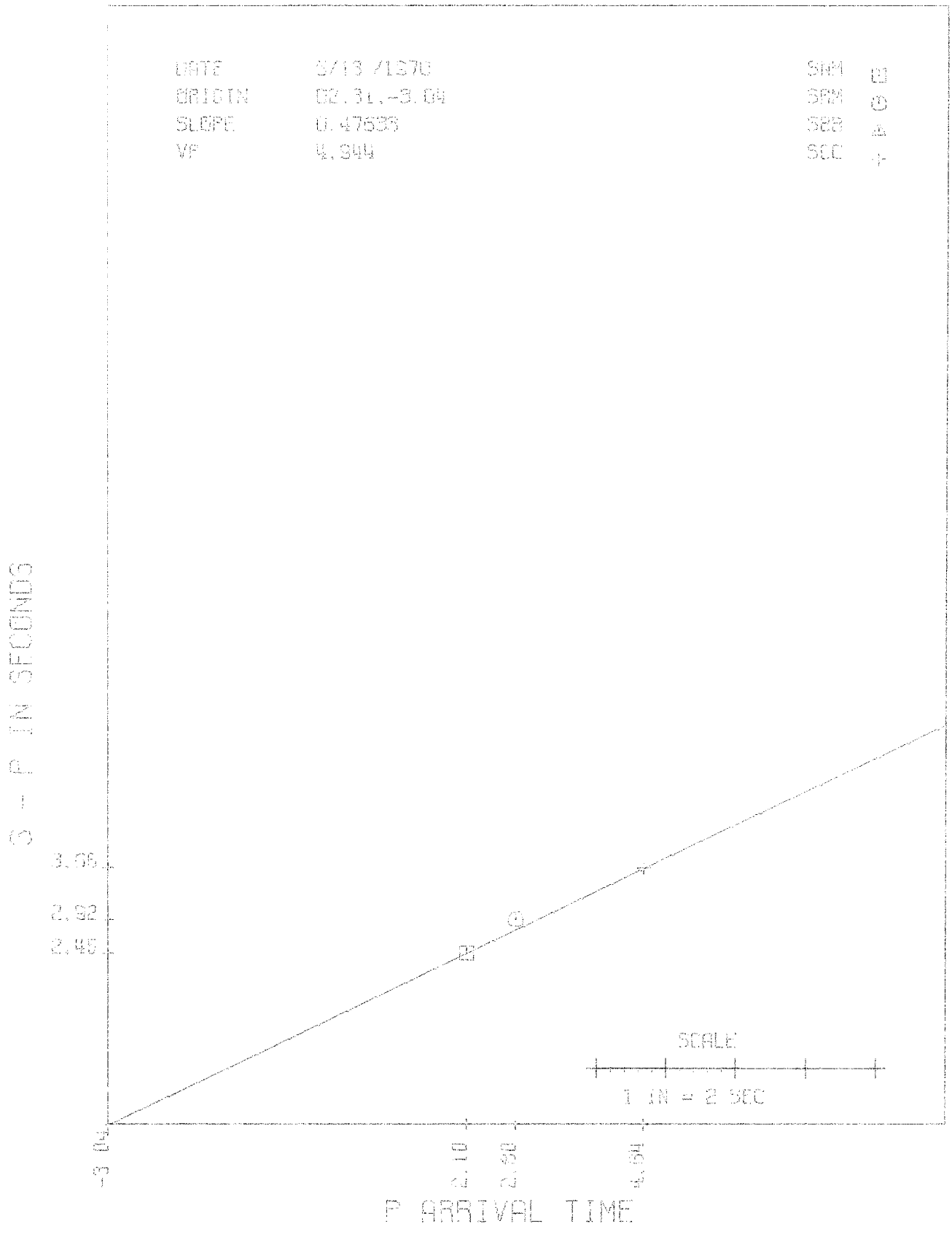
DATE 4/18 /1970
ORIGIN 03.12.33.17
SLOPE 0.05957
VP 5.581
SAM 15
SPM 0
SEC 4
S - P IN SECONDS
4.04
2.80
2.50
SCALE
1 IN = 2 SEC
03.17
03.20
P ARRIVAL TIME

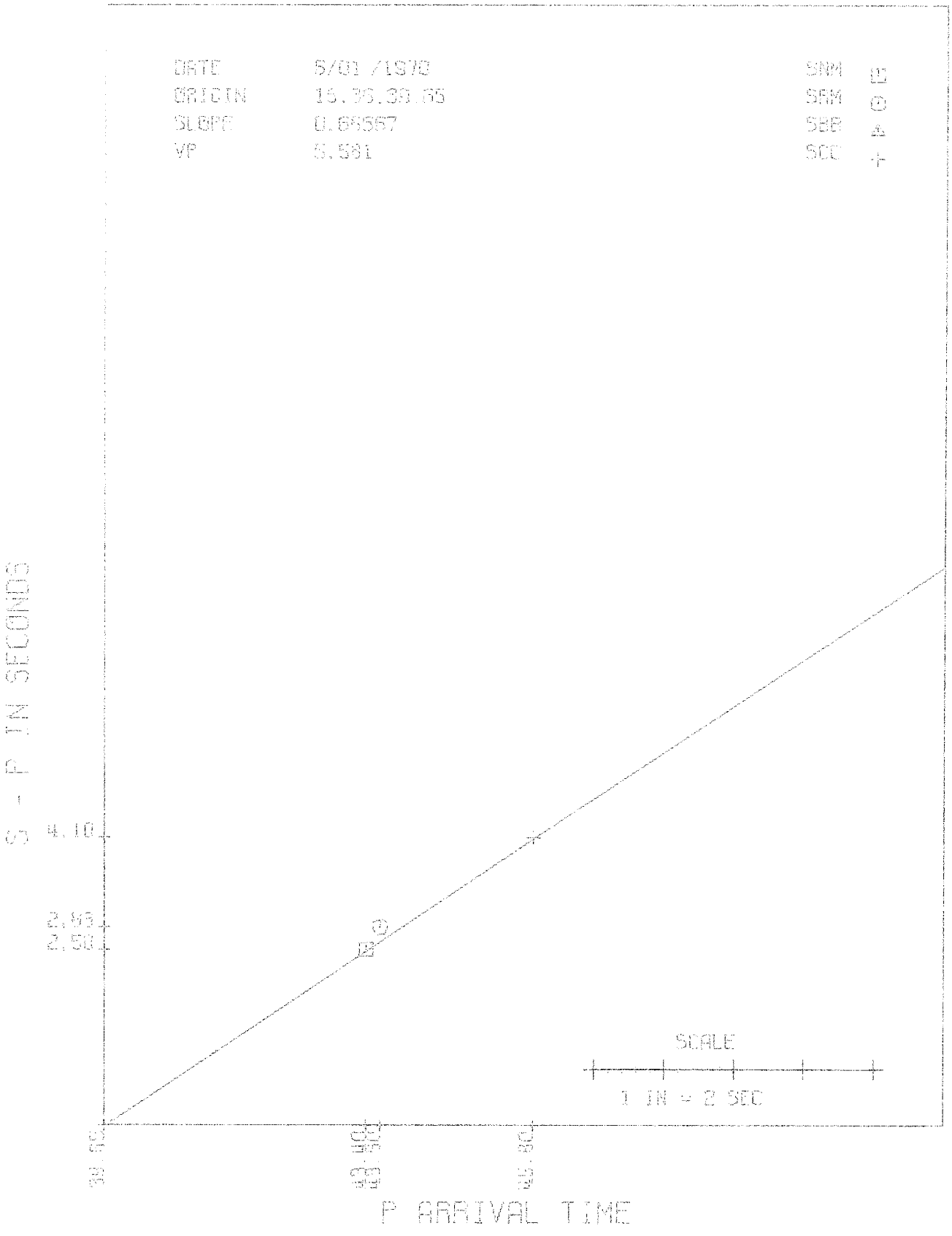
DATE 4/10/1970
ORIGIN 09:29:34.17
SLOPE 0.693000
VP 5.478
SHM
SRM
SEB
SCL
S - P IN SECONDS
4.09
2.69
2.50
SCALE
1 IN = 2 SEC
09:29:47
09:29:55
09:30:04
P ARRIVAL TIME

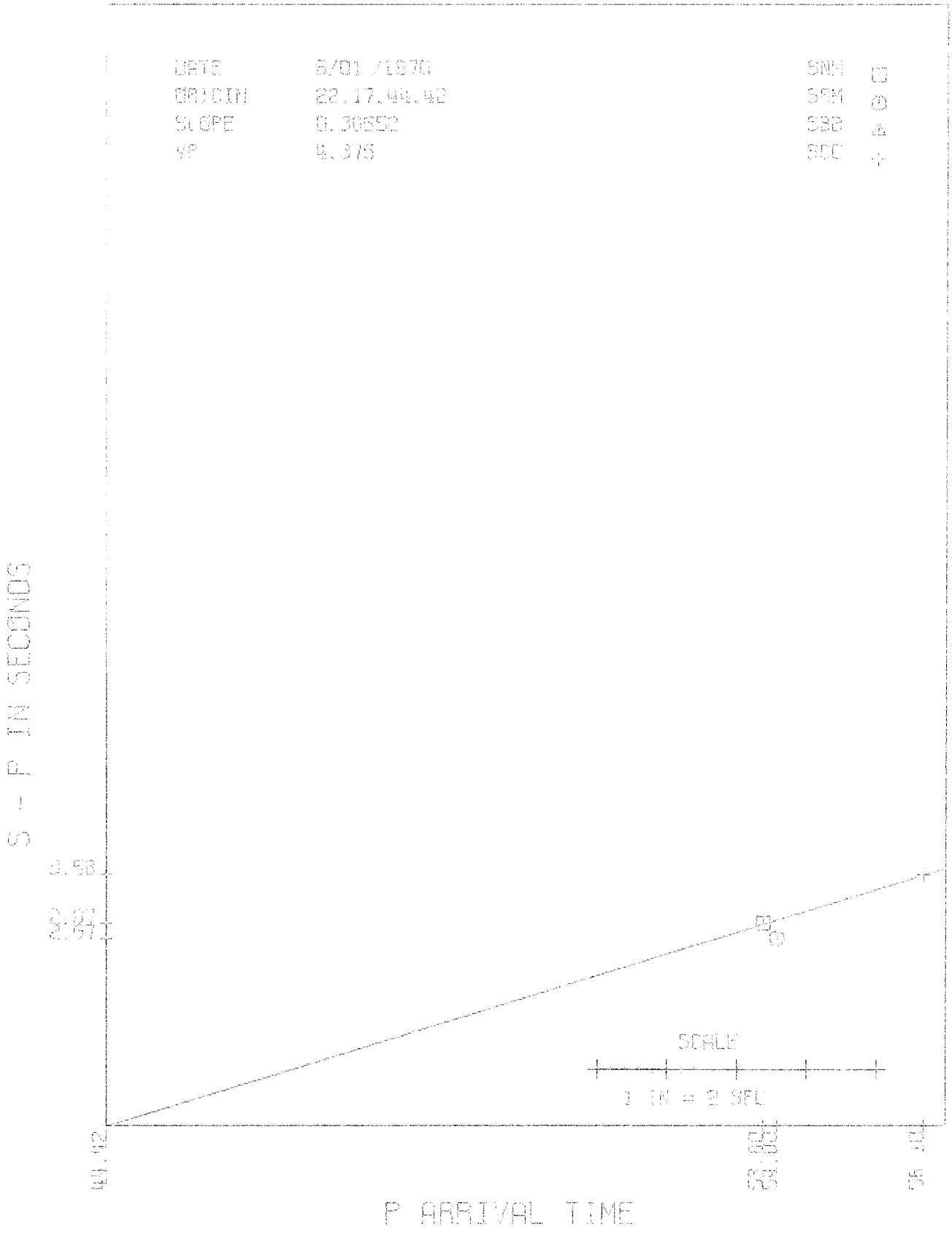
DATE 4/13/1970
ORIGIN 19.18.13.97
SLOPE 0.463503
VP 4.809
SNM
SRM
SBB
SCC
S - P IN SECONDS
0.59
0.81
2.50
SCALE
1 IN = 2 SEC
18.37
22.70
P ARRIVAL TIME

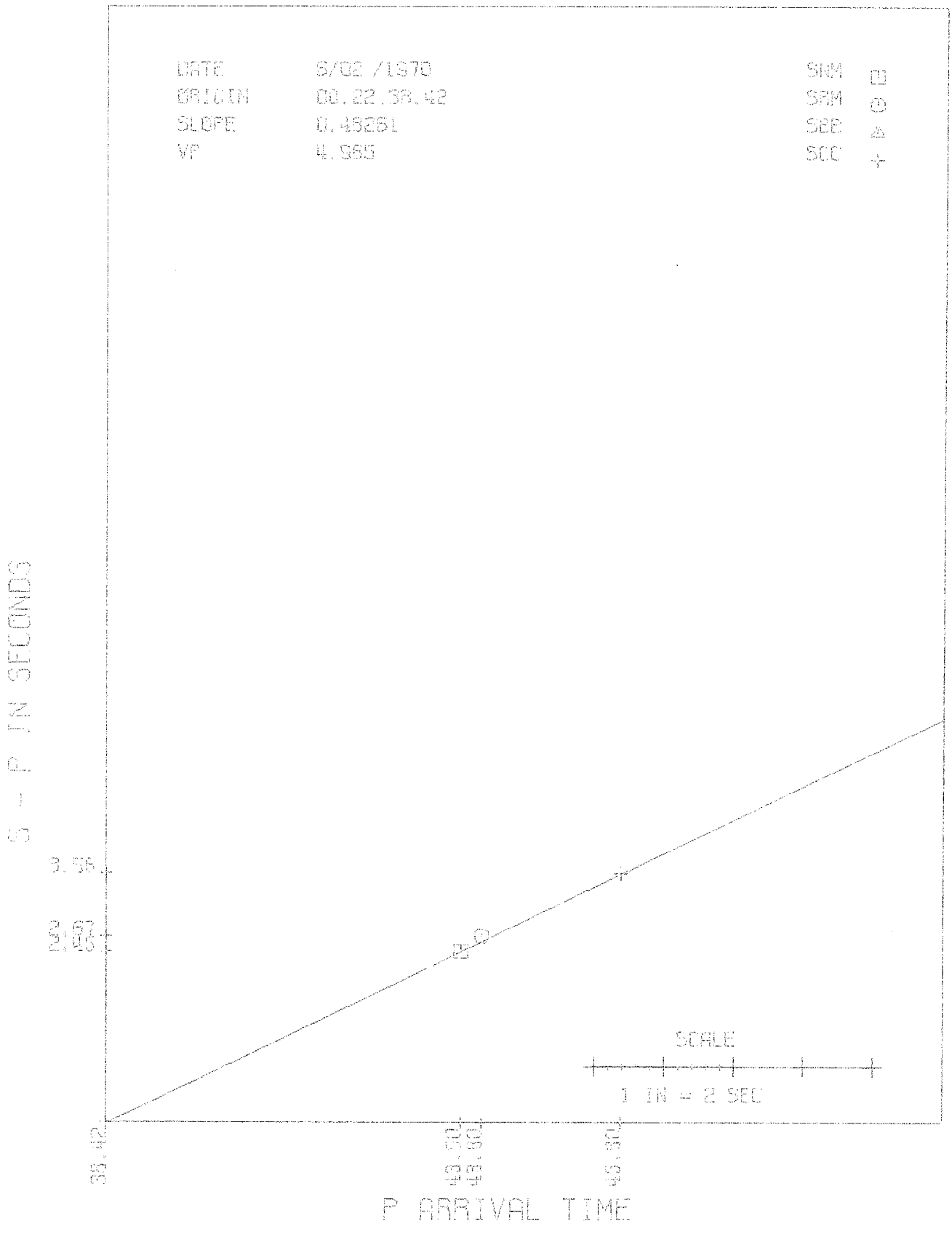
DATE 5/05/1970
ORIGIN 22.44.13.58
SLOPE 0.55391
VP 5.203
SAM □
SAM ○
SBE △
SCC +
S - P IN SECONDS
3.08
2.99
2.30
SCALE
1 IN = 2 SEC
P ARRIVAL TIME

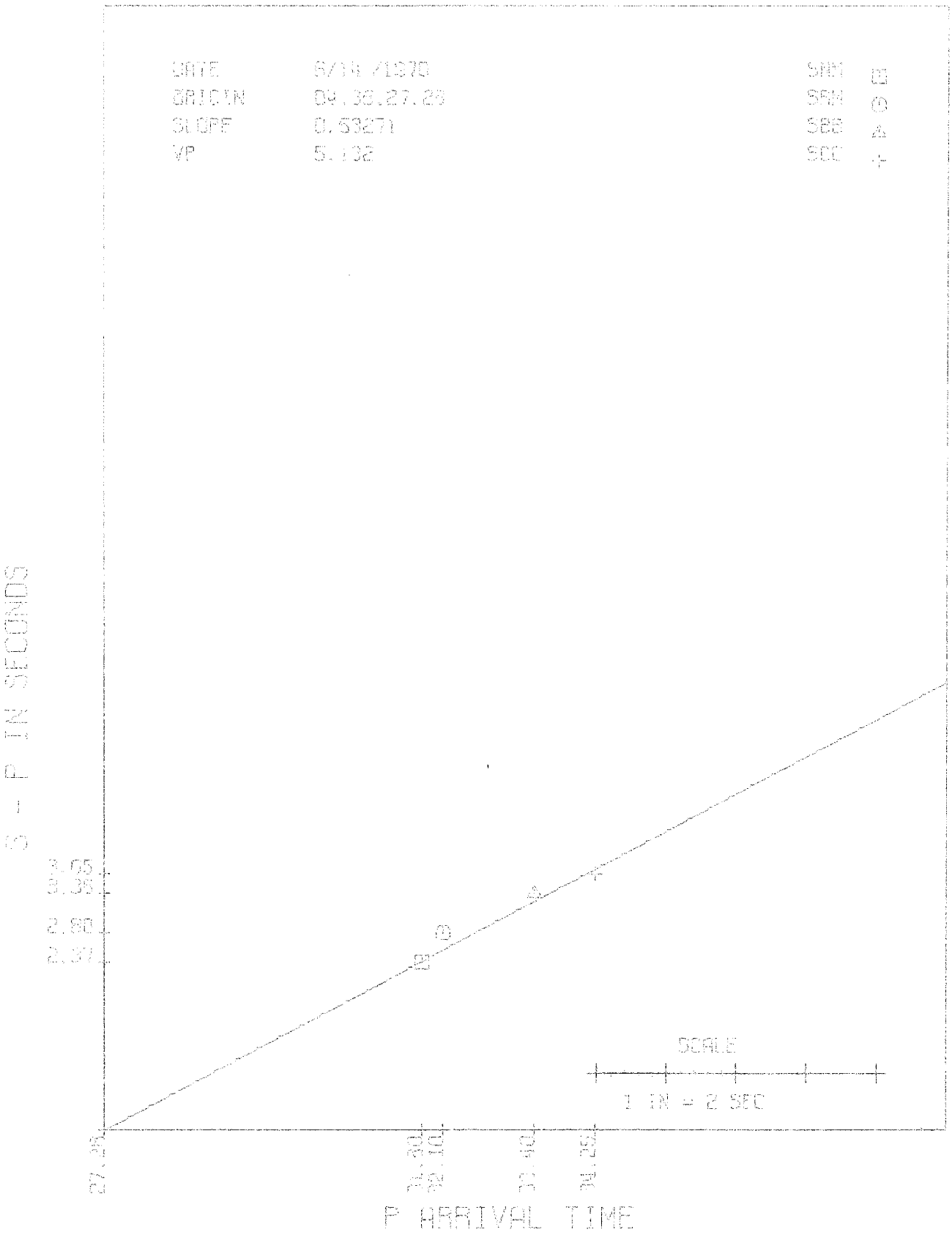
DATE 5/05/1970
ORIGIN 23.03.6.34
SLOPE 0.602826
VP 5.452
SNM
SPM
SEP
SEC
S - P IN SECONDS
3.02
3.18
2.17
SCALE
1 IN = 2 SEC
P ARRIVAL TIME

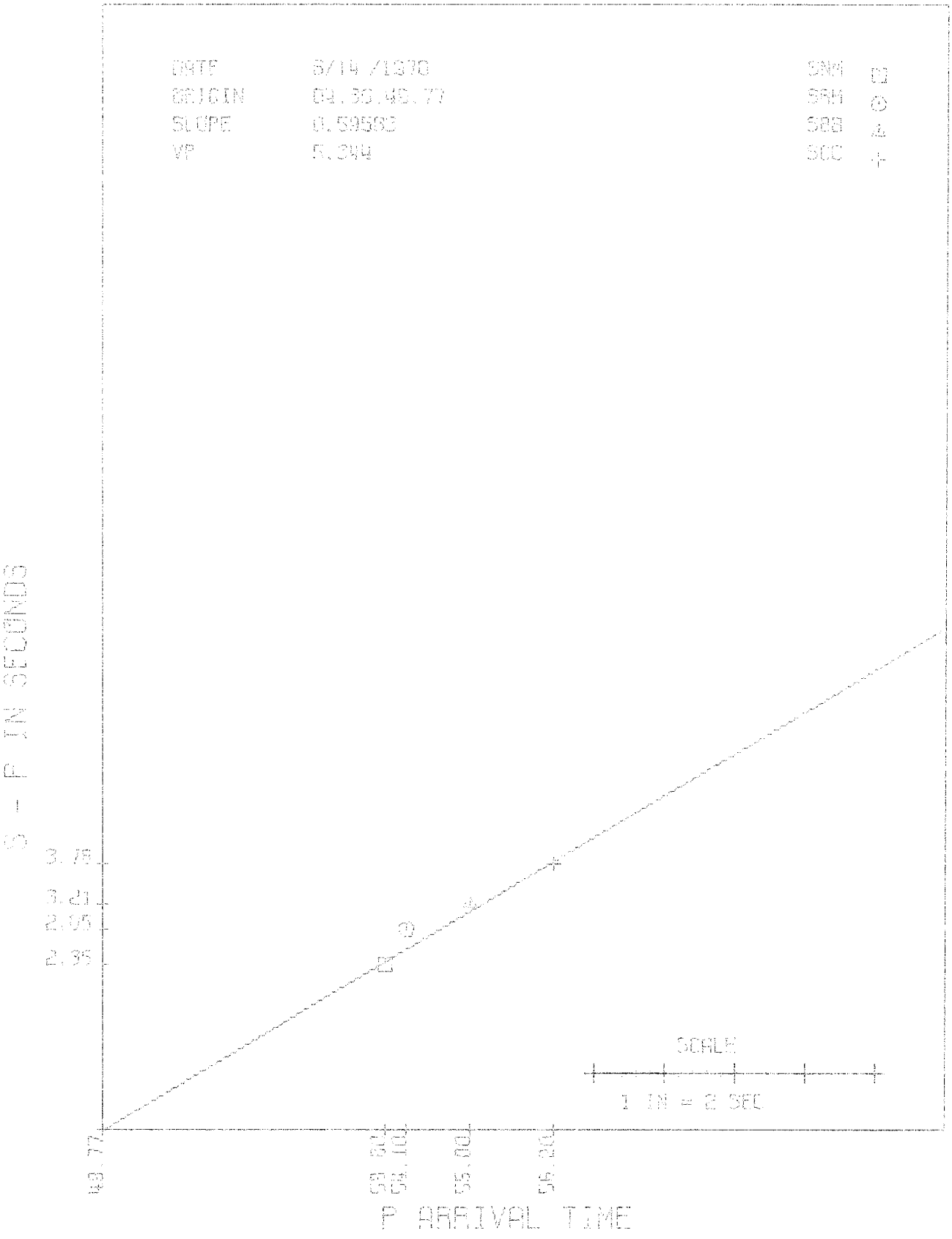

DATE 3/13/1970
ORIGIN 02.31,-3.04
SLOPE 0.475333
VP 4.944
SAM
SPM
SEB
SCC
S - P IN SECONDS
3.06
2.92
2.45
SCALE
1 IN = 2 SEC
2.04
2.45
2.92
3.06
P ARRIVAL TIME

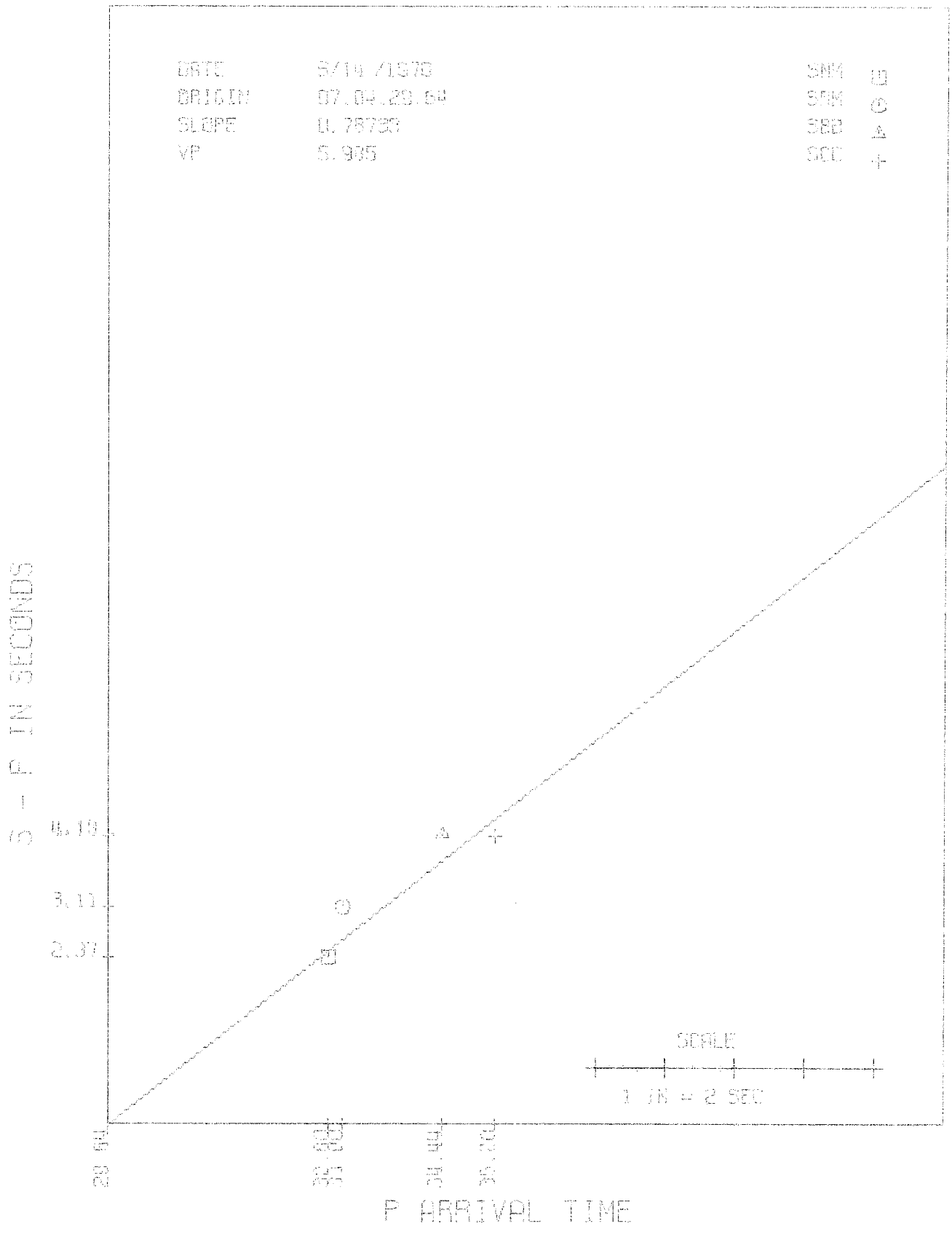

DATE 5/31/1978
ORIGIN 16:36:39.65
SLOPE 0.685567
VP 5.581
SBM
SBB
SCC
S - P IN SECONDS
4.10
2.63
2.50
SCALE
1 IN = 2 SEC
P ARRIVAL TIME

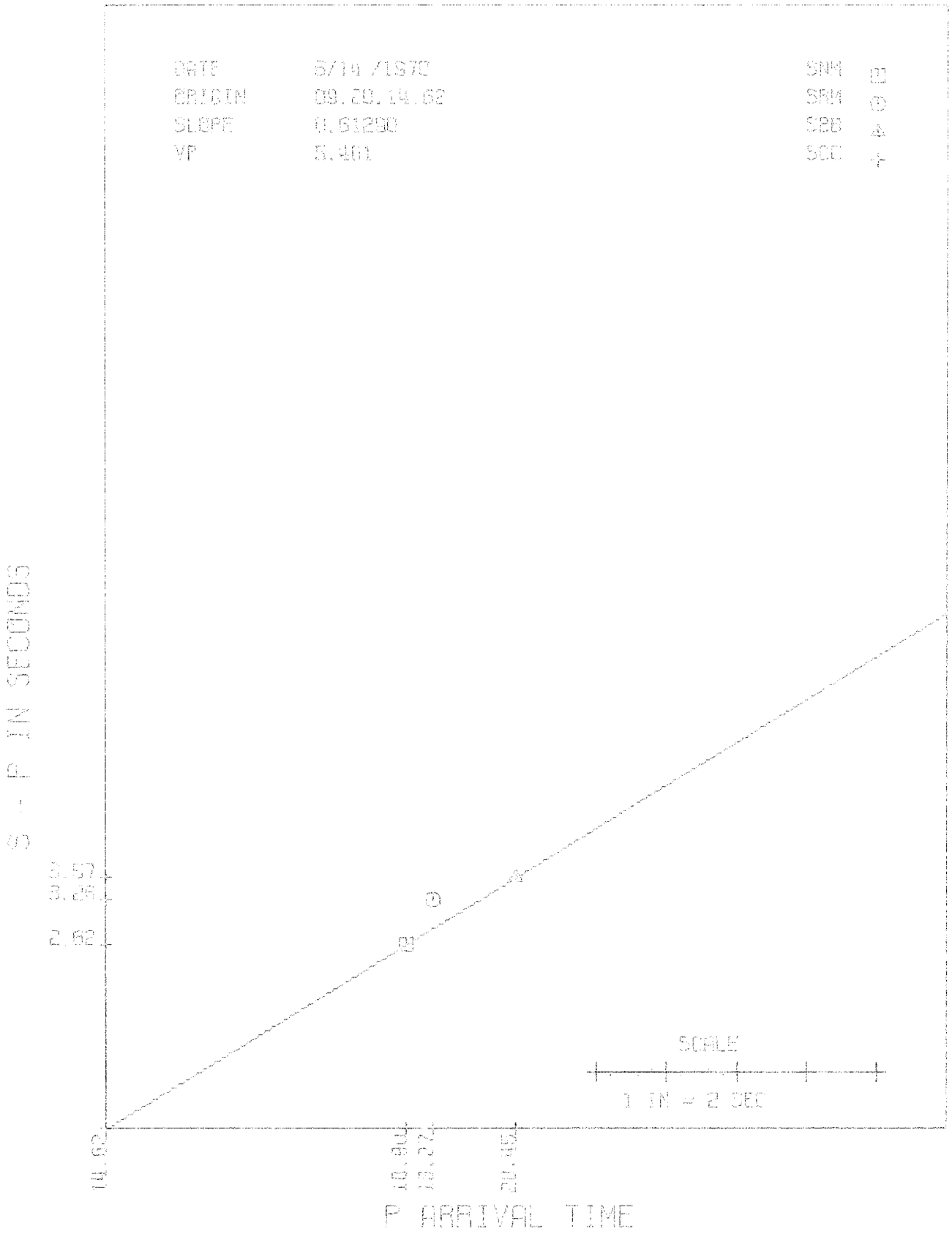

DATE 8/01/1970
ORIGIN 22.17.46.42
SLOPE 0.305532
VP 4.375
SNM
SSM
SSB
SOC
S - P IN SECONDS
3.50
2.97
SCALE
1 IN = 2 SEC
P ARRIVAL TIME

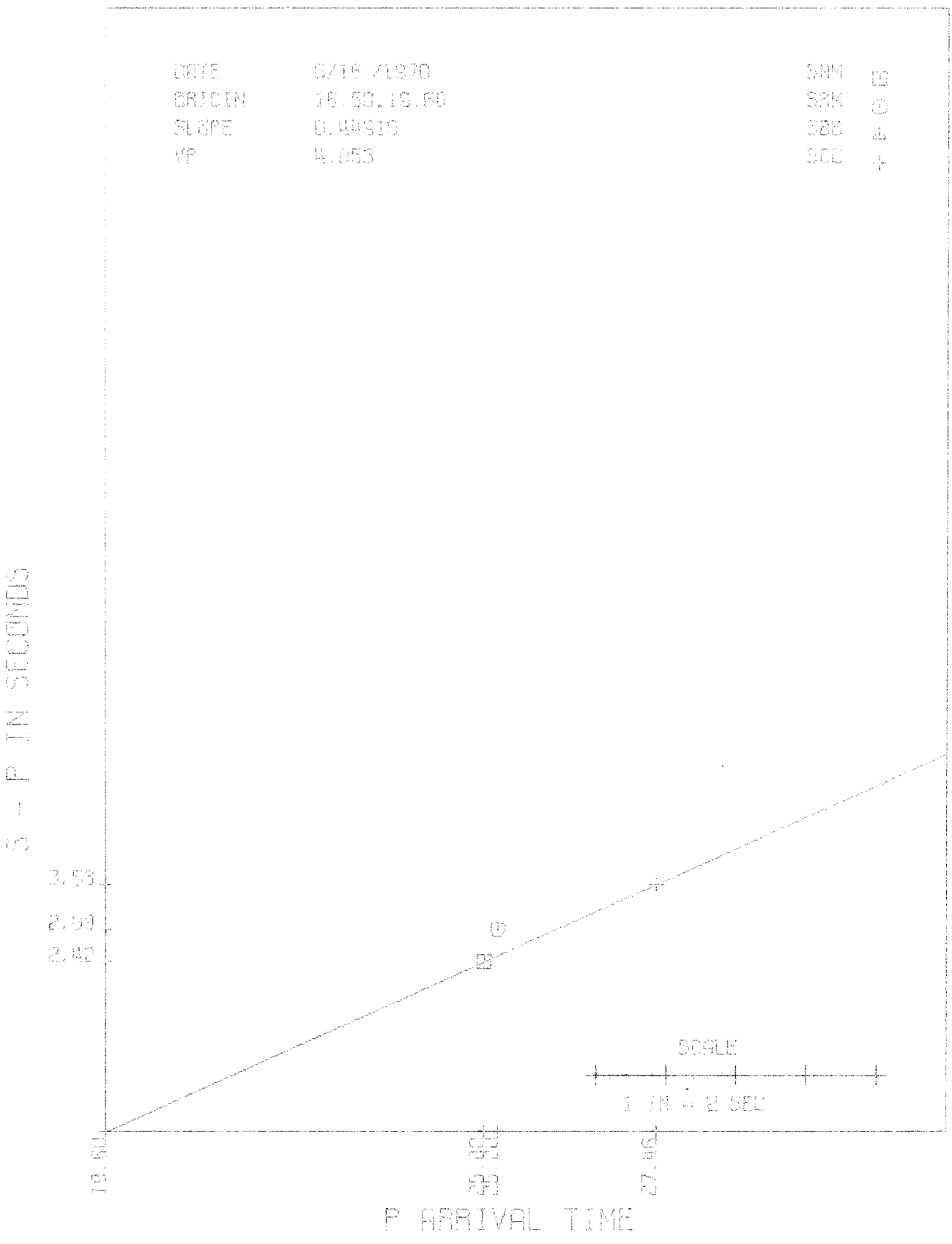

DATE 5/02/1970
ORIGIN 00,22,38.42
SLOPE 0.45251
VP 4.585
SNM
SRM
SEE
SCC
S - P, IN SECONDS
3.56
2.03
2.03
SCALE
1 IN = 2 SEC
55.22
55.22
55.22
P ARRIVAL TIME


DATE 6/15/1979
ORIGIN 04:38:27.28
SLOPE 0.59271
VP 5.132
SBM
SBN
SBE
SBC
S-P INTERVAL IN SECONDS
3.05
3.36
2.80
2.37
SCALE
1 IN = 2 SEC
P ARRIVAL TIME


DATE 5/14/1970
ORIGIN 09:30:46.77
SLOPE 0.595830
VP 5.344
SNM
SRM
SBB
SCC
S - P IN SECONDS
3.78
3.21
2.05
2.35
SCALE
1 IN = 2 SEC
P ARRIVAL TIME


DATE 5/14/1978
ORIGIN 07.04.29.64
SLOPE 0.787353
VP 5.985
SMM D
SRM C
SBB A
SCC +
S - P IN SECONDS
5.19
3.11
2.37
A
C
D
SCALE
1 IN = 2 SEC
P ARRIVAL TIME


DATE 5/14/1970
ORIGIN 09.20.14.62
SLOPE 0.51290
VP 5.401
SNM □
SRM ○
SEB △
SCC +
S - P IN SECONDS
3.57
3.26
2.62
SCALE
1 IN = 2 SEC
P ARRIVAL TIME


DATE 8/15/1970
ORIGIN 15.50.15.60
SLOPE 0.4WS10
VP 4.853
SNM
SPM
SBB
SCC
S - P IN SECONDS
3.53
2.69
2.42
SCALE
1 IN = 2 SEC
P ARRIVAL TIME

DATE 5/30/1970
ORIGIN 11:30:21.09
SLOPE 0.53810
VP 5.12
SAM
SAM
OBS
SEC
S - P IN SECONDS
3.88
3.07
2.80
SCALE
1 IN = 2 SEC
P ARRIVAL TIME

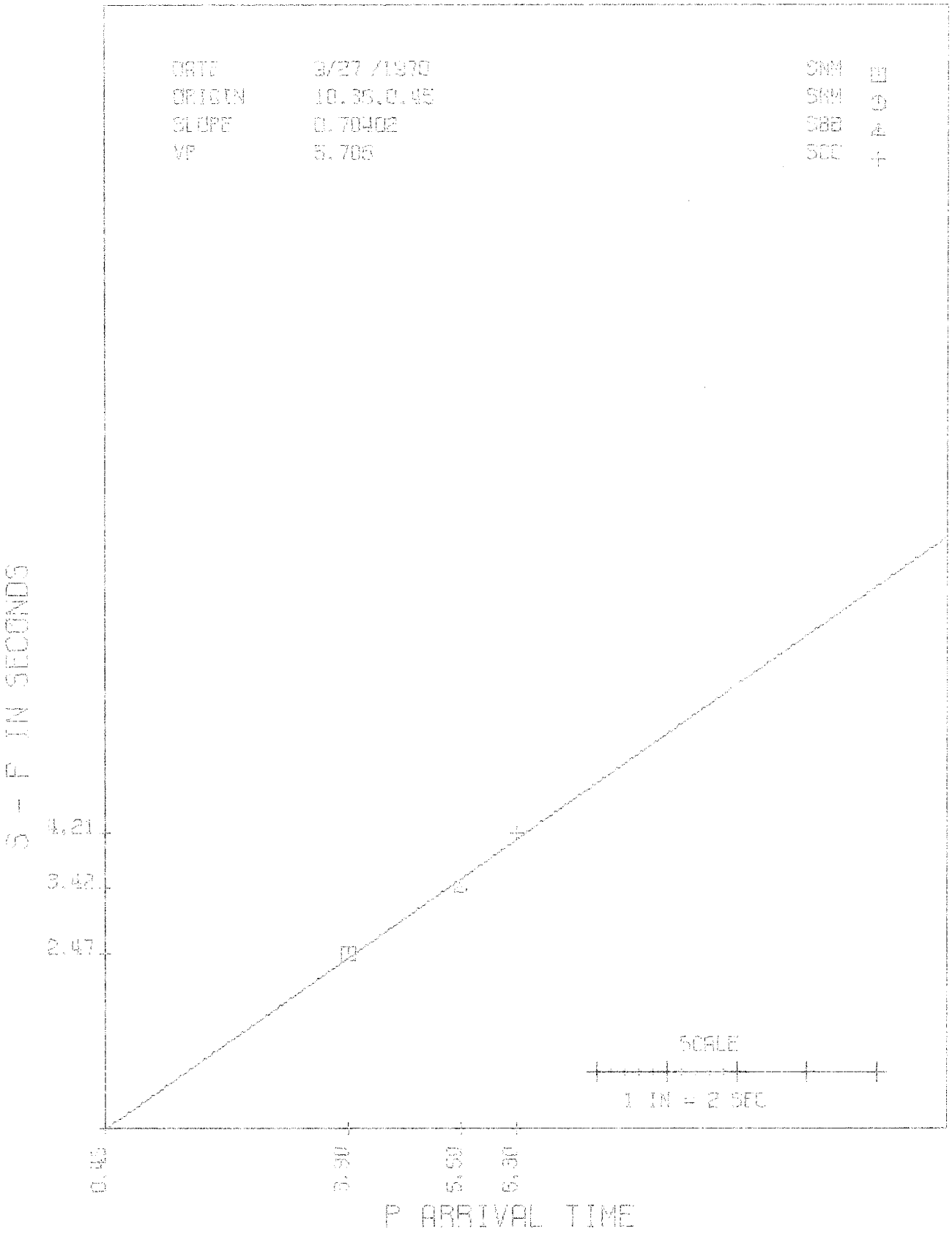
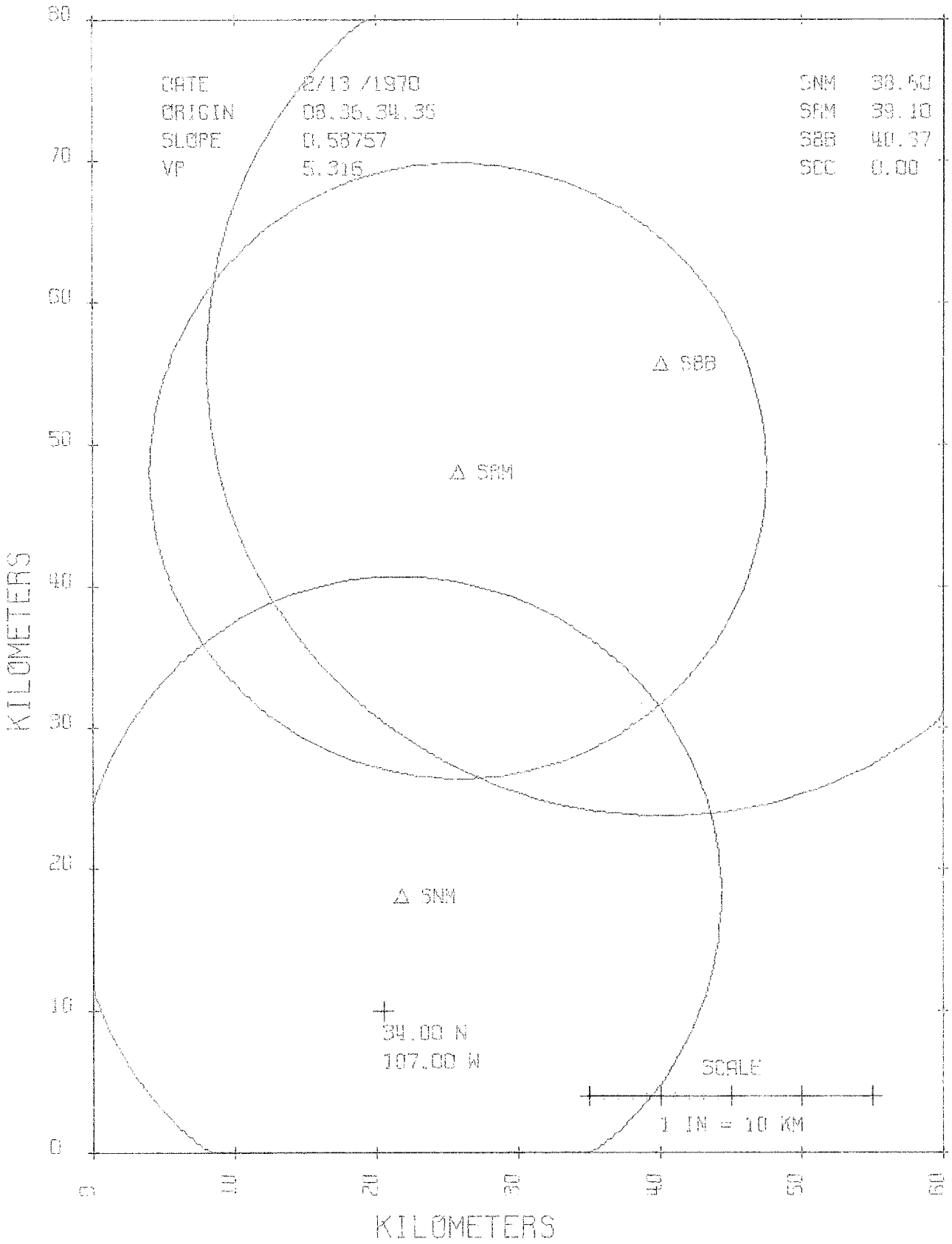
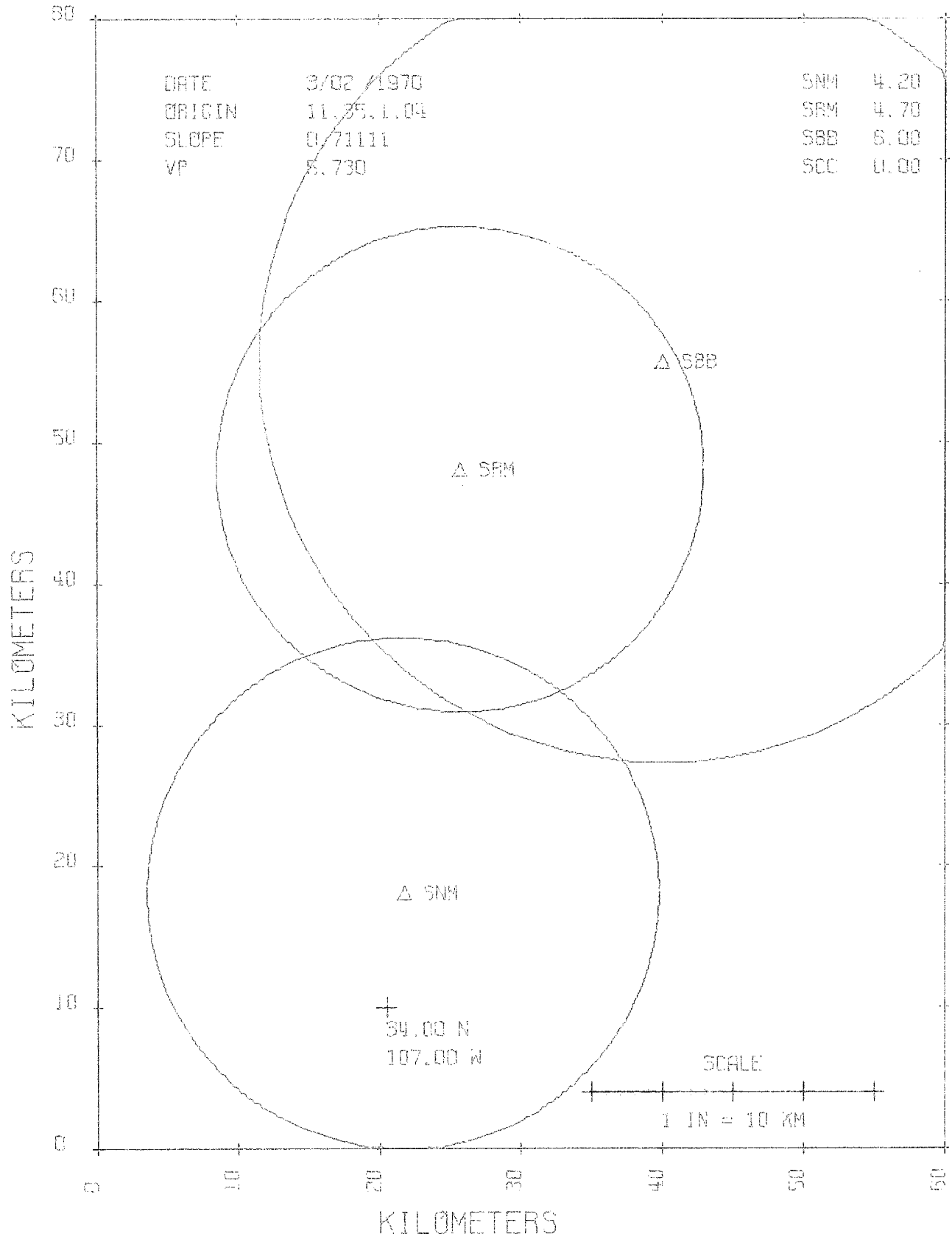

DATE 3/27 /1970
ORIGIN 10.36.0.45
SLOPE 0.704102
VP 5.785
SNM
SIM
SBB
SCC
S - P IN SECONDS
1.21
3.42
2.47
SCALE
1 IN = 2 SEC
P ARRIVAL TIME

FIGURE 2

EPITHERMAL DEPOSITS


DATE 2/13 /1970
ORIGIN 08.36.34.35
SLOPE 0.58757
VP 5.316
SNM 38.60
SPM 39.10
SBB 40.37
SCC 0.00
Δ SBB
Δ SPM
Δ SNM
34.00 N
107.00 W
SCALE
1 IN = 10 KM
KILOMETERS
KILOMETERS
0
10
20
30
40
50
60
70
80
0
10
20
30
40
50
60


DATE 3/02 /1970
ORIGIN 11.35.1.04
SLOPE 0.71111
VP 5.730
SNM 4.20
SRM 4.70
SBB 5.00
SCC 0.00
Δ SBB
Δ SRM
Δ SNM
34.00 N
107.00 W
SCALE
1 IN = 10 KM
KILOMETERS
KILOMETERS
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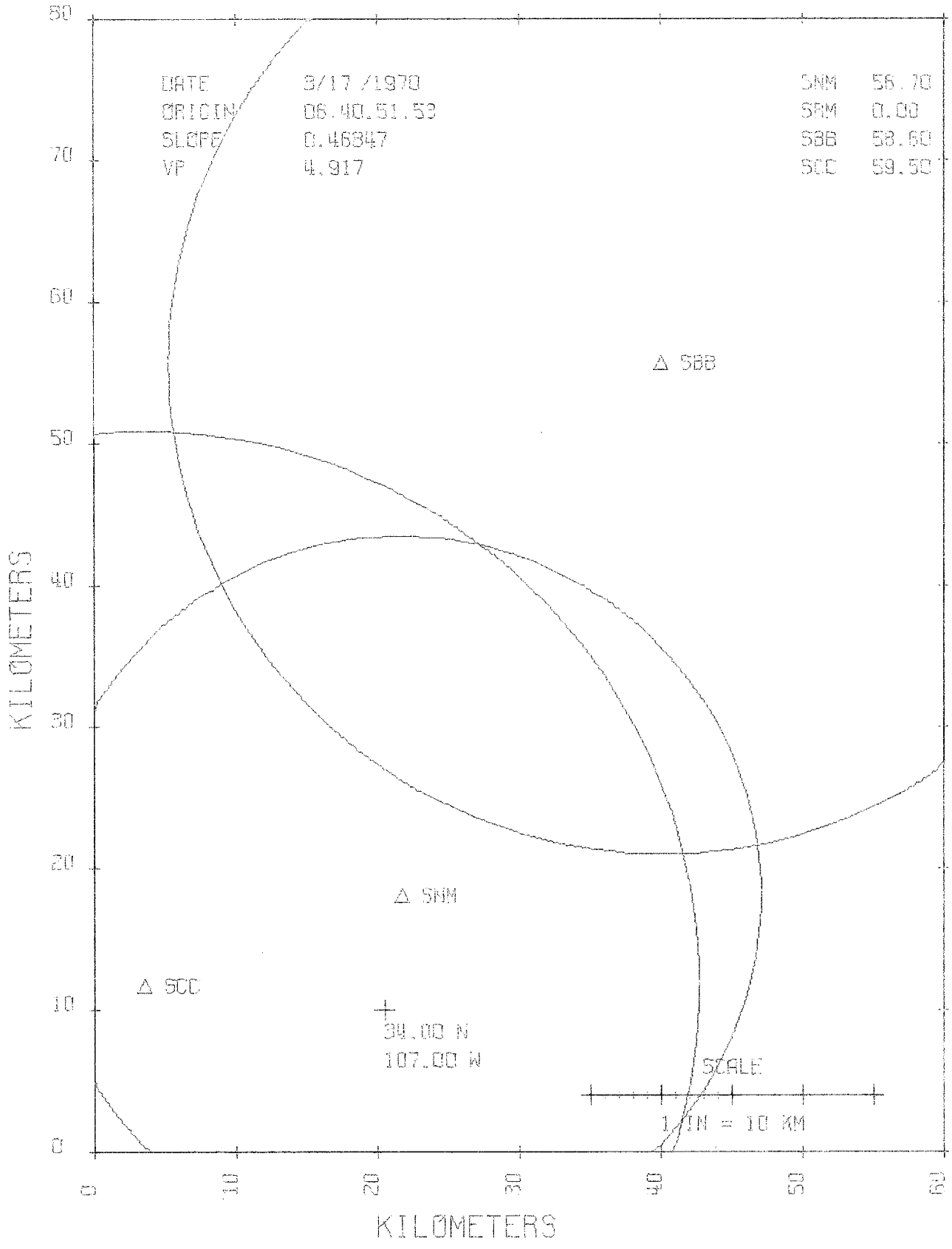
10
20
30
40
50
60
70
80


DATE 3/17 /1970
ORIGIN 06.40.51.53
SLOPE 0.46847
VP 4.917
SNM 56.70
SRM 0.00
SBB 58.60
SCC 59.50
△ SBB
△ SNM
△ SCC
34.00 N
107.00 W
SCALE
1 IN = 10 KM
KILOMETERS
KILOMETERS
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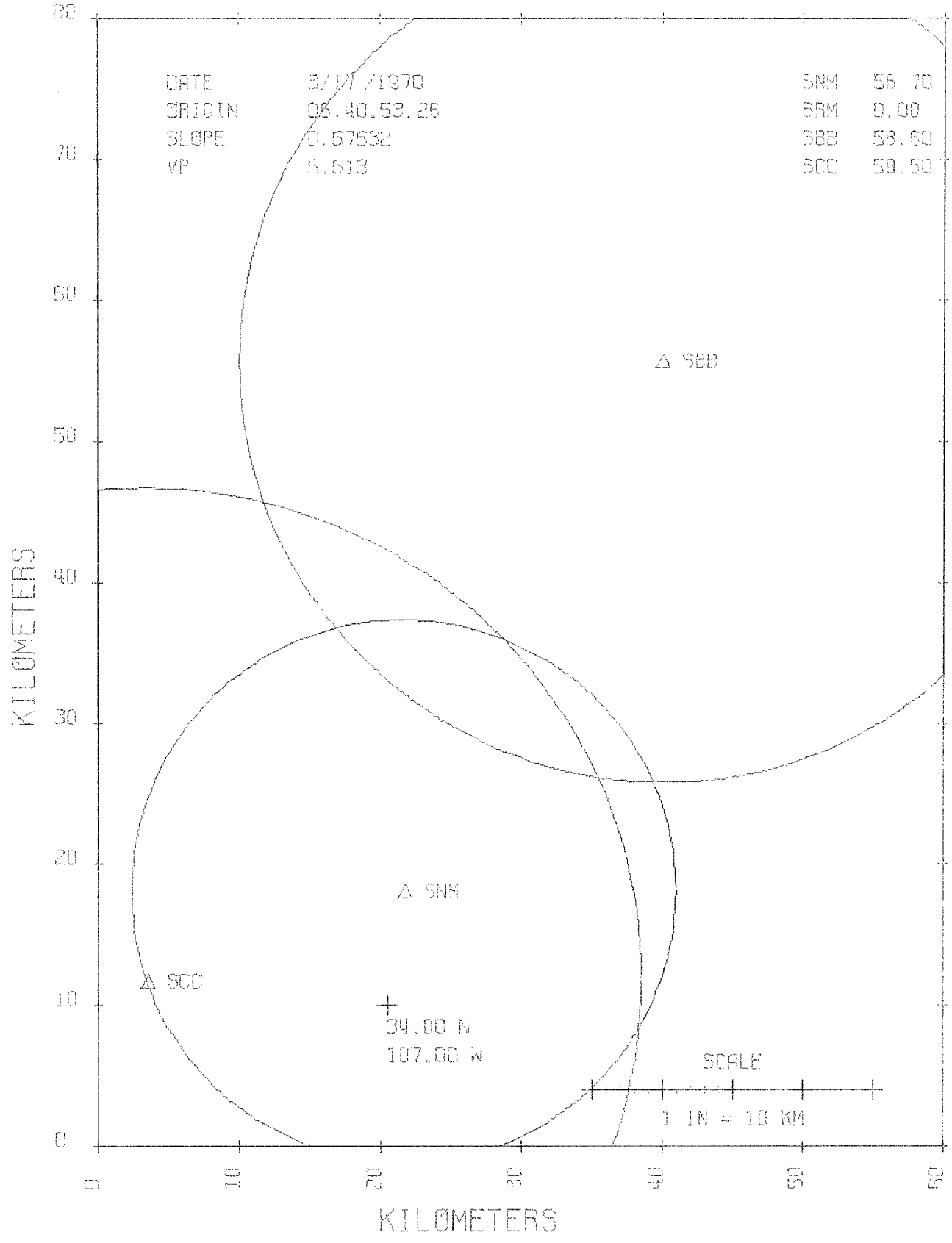
40
50
60
70
80


DATE 3/17/1970
ORIGIN 06.40.53.26
SLOPE 0.67632
VP 5.613
SNM 56.70
SRM 0.00
SBB 58.60
SCC 59.50
Δ SBB
Δ SNM
Δ SCC
34.00 N
107.00 W
SCALE
1 IN = 10 KM
KILOMETERS
KILOMETERS
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80
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30
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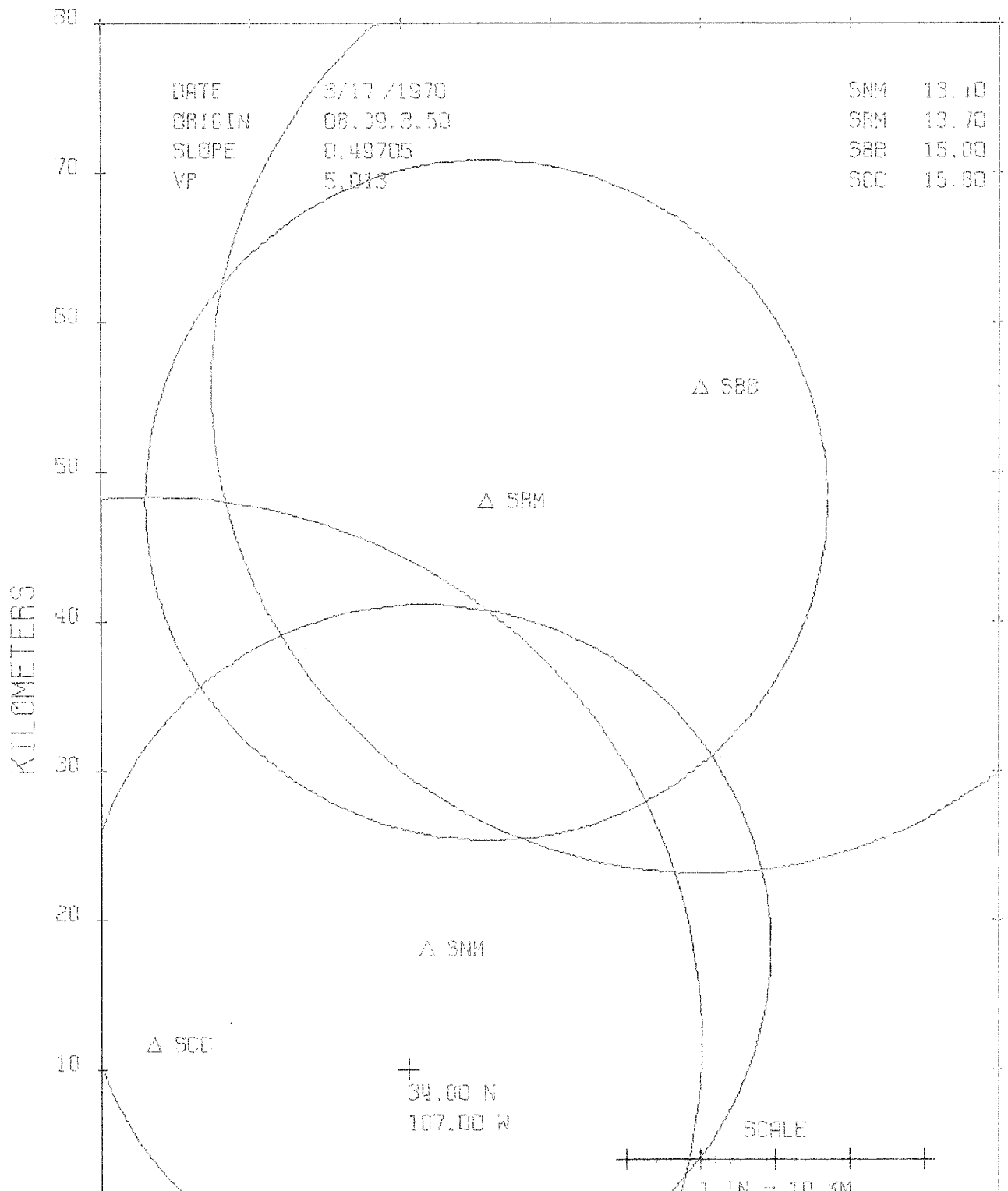
50
60


DATE 3/17/1970
ORIGIN 08.39.3.50
SLOPE 0.49705
VP 5.043
SNM 13.10
SRM 13.70
SBB 15.00
SCC 15.80
Δ SBB
Δ SRM
Δ SNM
Δ SCC
34.00 N
107.00 W
SCALE
1 IN = 10 KM
KILOMETERS
KILOMETERS
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30
40
50
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70
80
0
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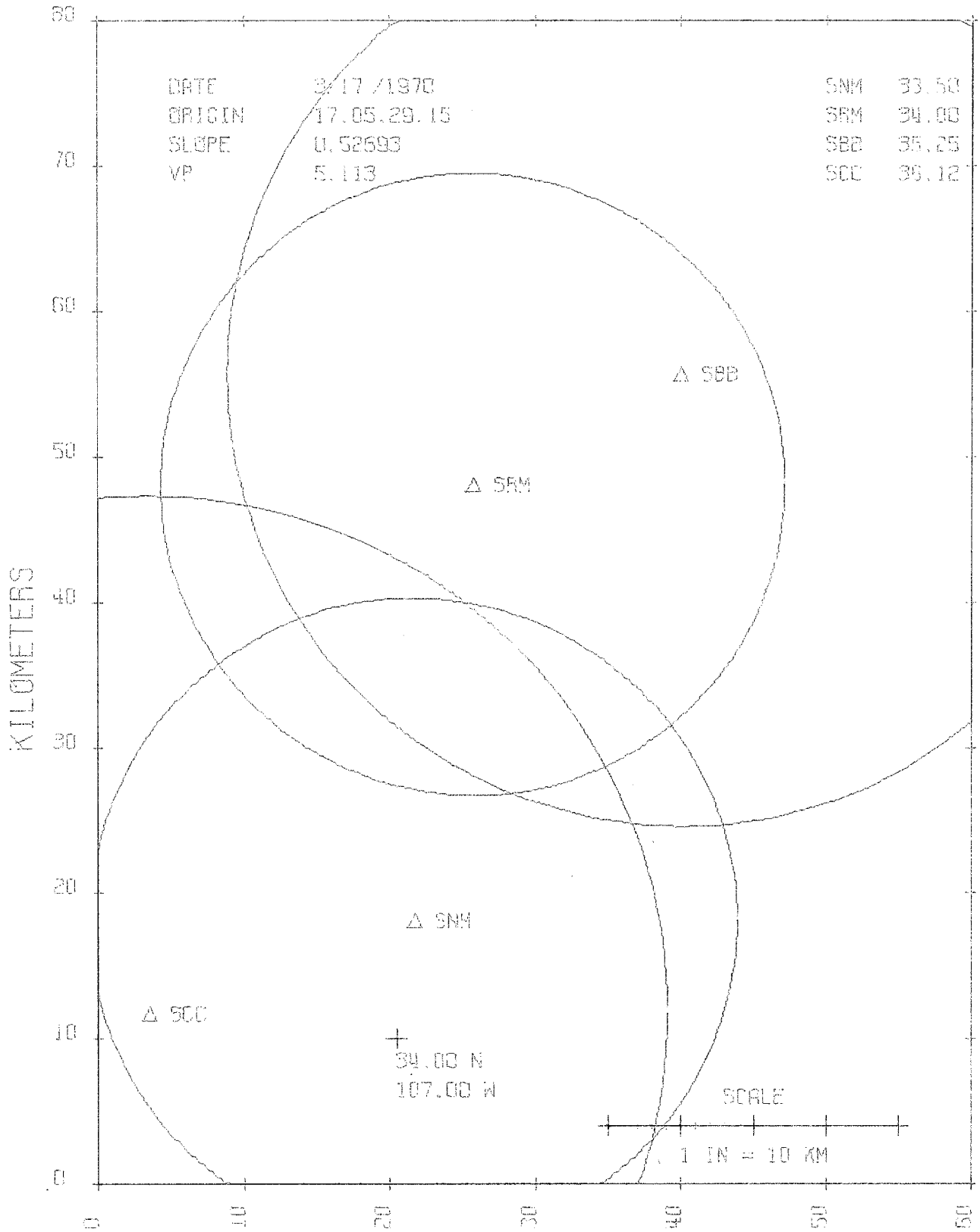
20
30
40
50
60


DATE 3/17/1970
ORIGIN 17.05.29.15
SLOPE 0.52693
VP 5.113
SNM 33.50
SRM 34.00
SBB 35.25
SCC 35.12
Δ SBB
Δ SRM
Δ SNM
Δ SCC
34.00 N
107.00 W
SCALE
1 IN = 10 KM
KILOMETERS
KILOMETERS
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50
60
70
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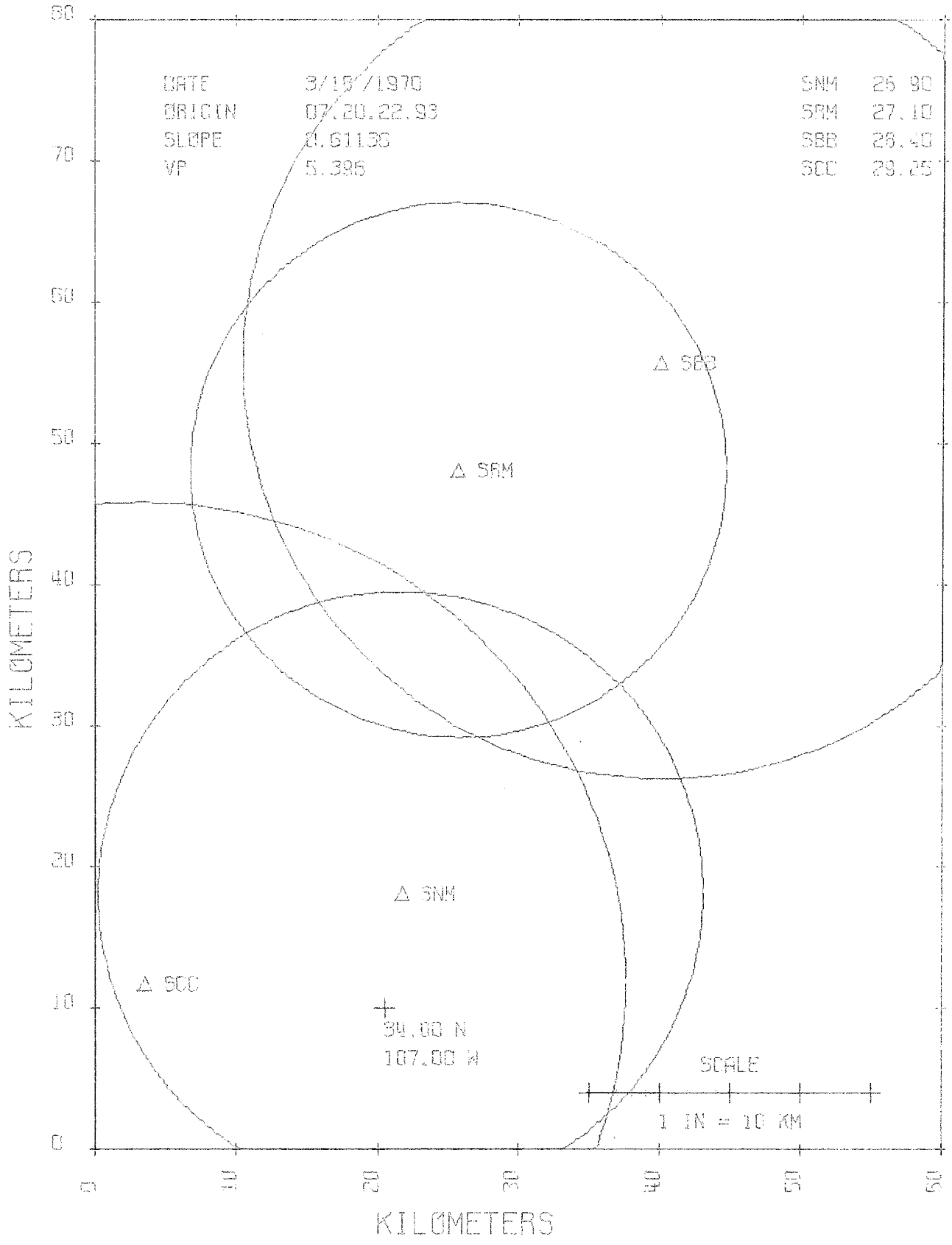
DATE 3/15/1970
ORIGIN 07.20.22.93
SLOPE 0.61130
VP 5.395
SNM 26.90
SRM 27.10
SBB 28.40
SCC 29.25
△ SBB
△ SRM
△ SNM
△ SCC
34.00 N
107.00 W
SCALE
1 IN = 10 KM
KILOMETERS
KILOMETERS
0
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70
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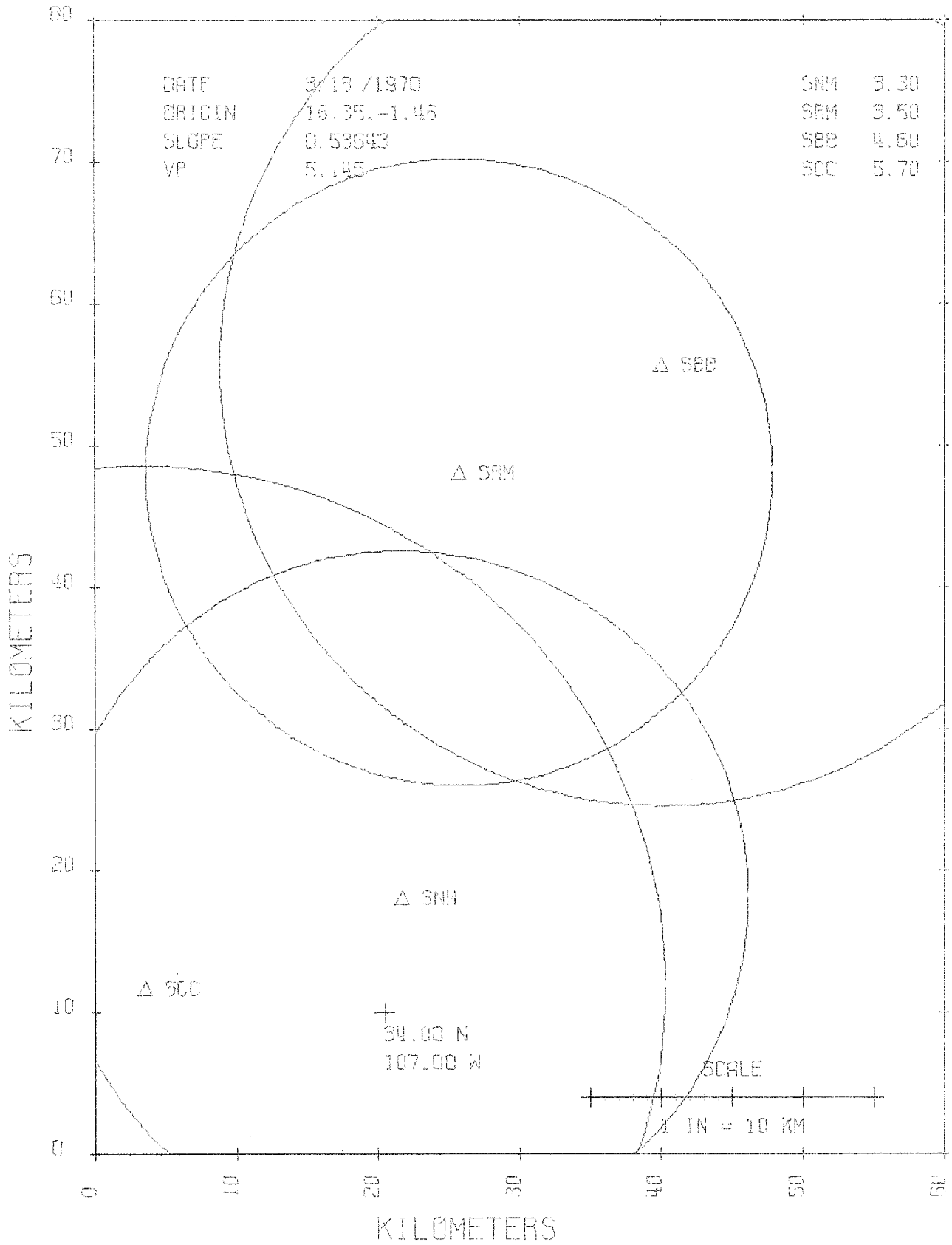
DATE 3/13/1970
ORIGIN 15.35,-1.46
SLOPE 0.53643
VP 5.145
SNM 3.30
SRM 3.50
SBB 4.60
SCC 5.70
Δ SBB
Δ SRM
Δ SNM
Δ SCC
34.00 N
107.00 W
SCALE
1 IN = 10 KM
KILOMETERS
KILOMETERS
0
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30
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70
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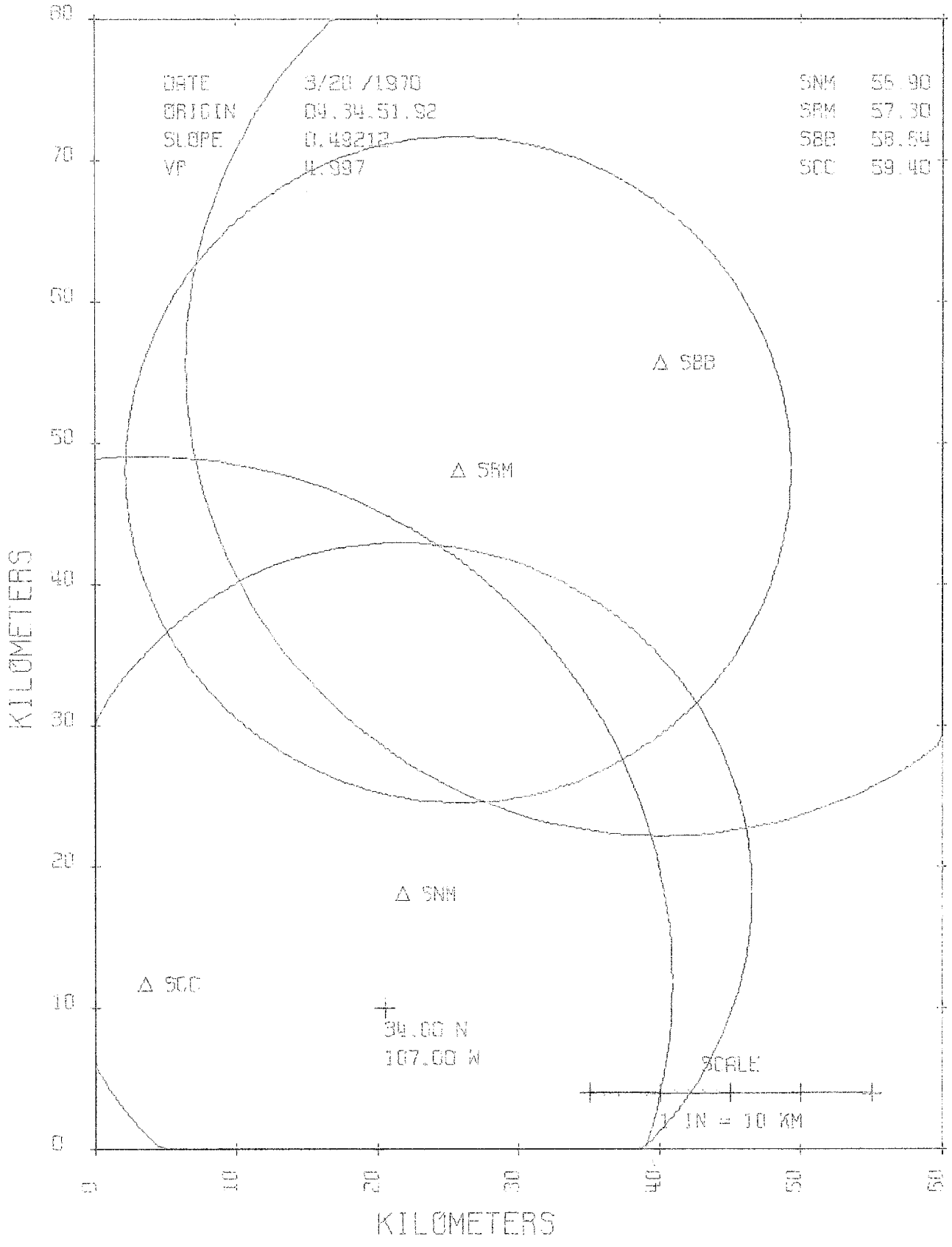
DATE 3/20 /1970
ORIGIN 04.34.51.92
SLOPE 0.43212
VP 4.997
SNM 55.90
SRM 57.30
SBB 58.54
SCC 59.40
Δ SBB
Δ SRM
Δ SNM
Δ SCC
34.00 N
107.00 W
SCALE
1 IN = 10 KM
KILOMETERS
KILOMETERS
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70
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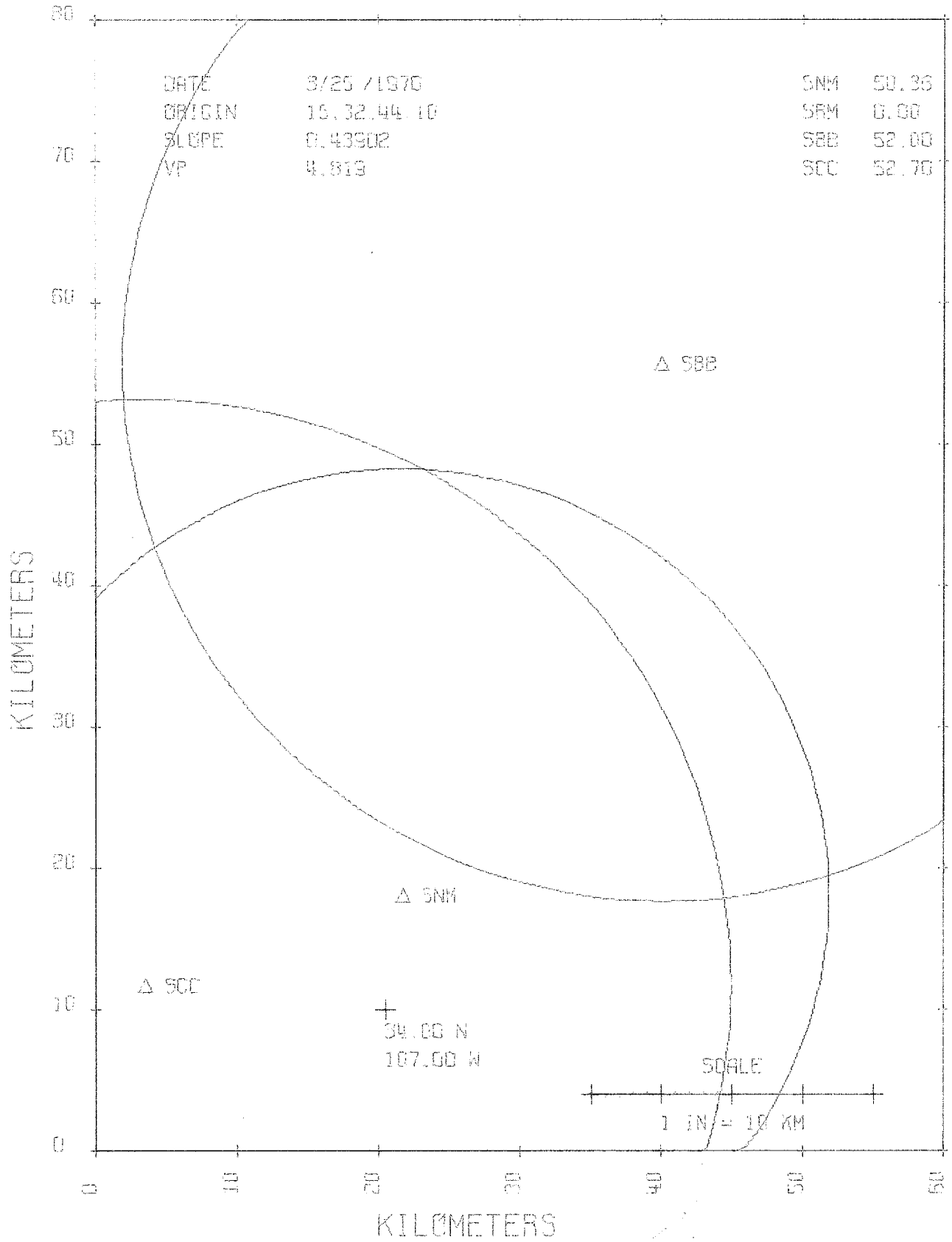
DATE 3/25 /1970
ORIGIN 15.32.44.10
SLOPE 0.43902
VP 4.813
SNM 50.36
SRM 0.00
SBB 52.00
SCC 52.70
Δ SBB
Δ SNM
Δ SCC
34.00 N
107.00 W
SCALE
1 IN = 10 KM
KILOMETERS
KILOMETERS
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70
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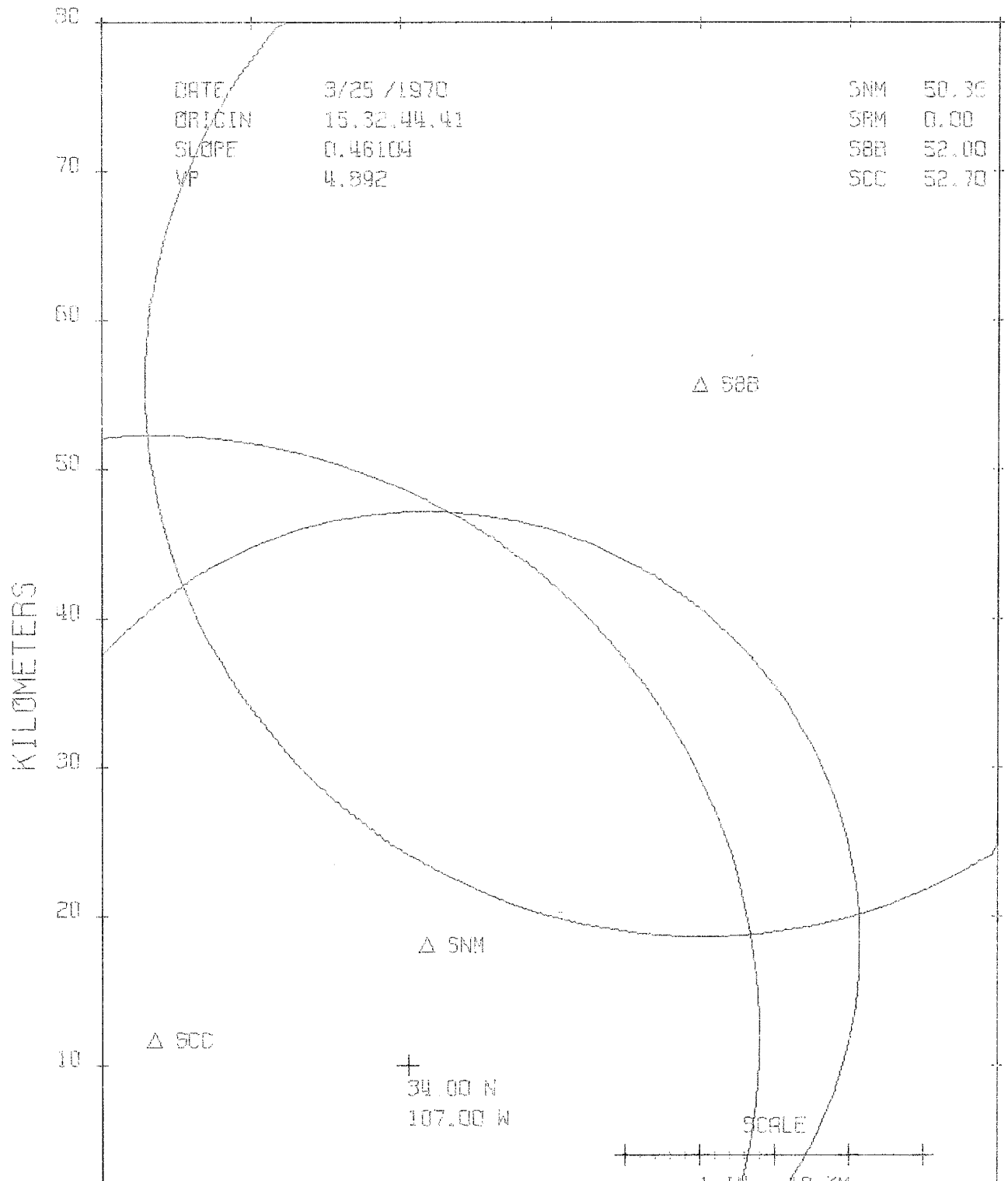
DATE 3/25 /1970
ORIGIN 15.32.44.41
SLOPE 0.46104
VP 4.892
SNM 50.36
SRM 0.00
SBB 52.00
SCC 52.70
Δ SBB
Δ SNM
Δ SCC
34.00 N
107.00 W
SCALE
1 IN = 10 KM
KILOMETERS
KILOMETERS
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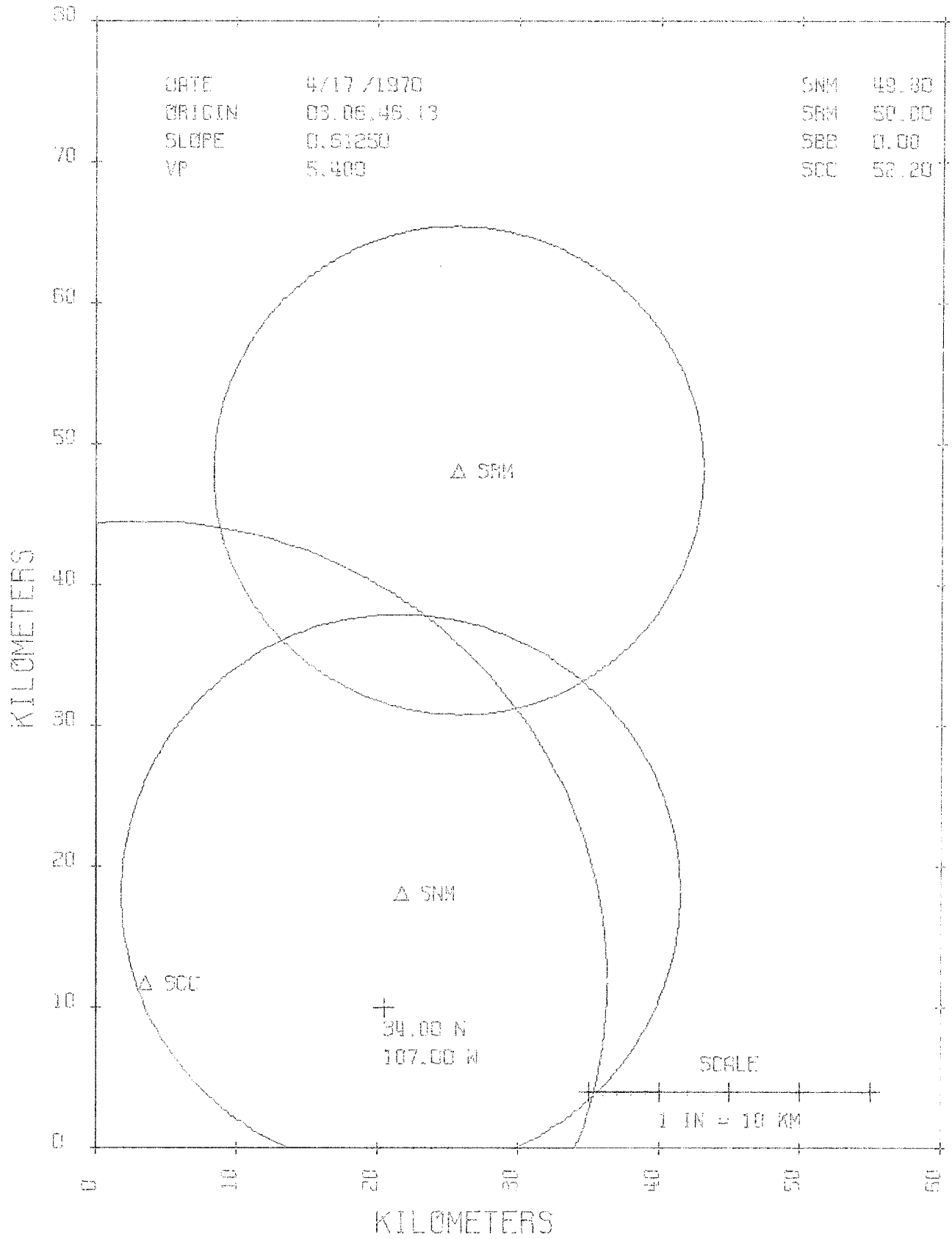
DATE 4/17/1970
ORIGIN 03.06.46.13
SLOPE 0.61250
VP 5.400
SNM 49.30
SRM 50.00
SBB 0.00
SCC 52.20
Δ SRM
Δ SNM
Δ SCC
34.00 N
107.00 W
SCALE
1 IN = 10 KM
KILOMETERS
KILOMETERS
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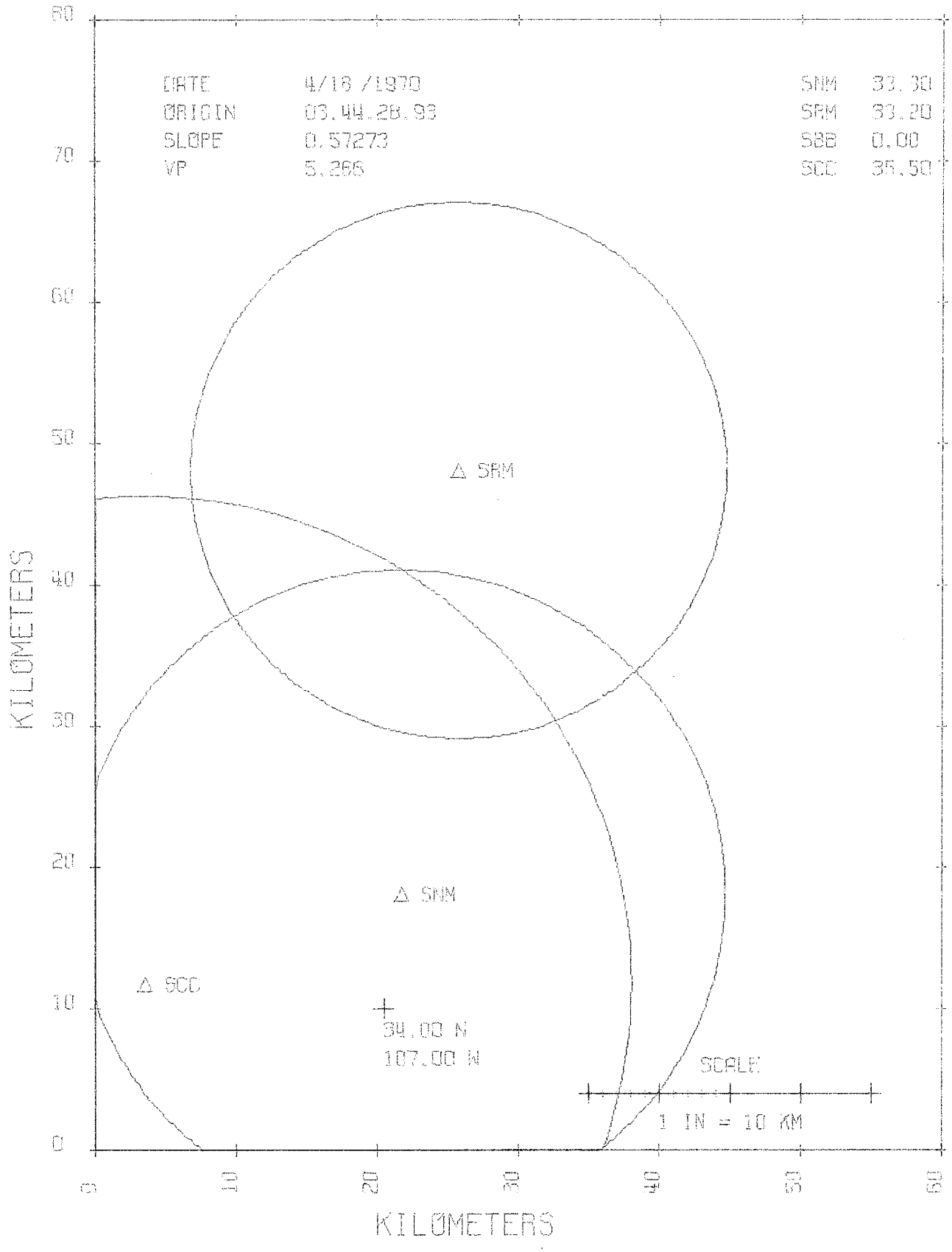
80


DATE 4/18 /1970
ORIGIN 03.44.28.93
SLOPE 0.57273
VP 5.266
SNM 33.30
SRM 33.20
SBB 0.00
SCC 35.50
Δ SRM
Δ SNM
Δ SCC
34.00 N
107.00 W
SCALE
1 IN = 10 KM
KILOMETERS
KILOMETERS
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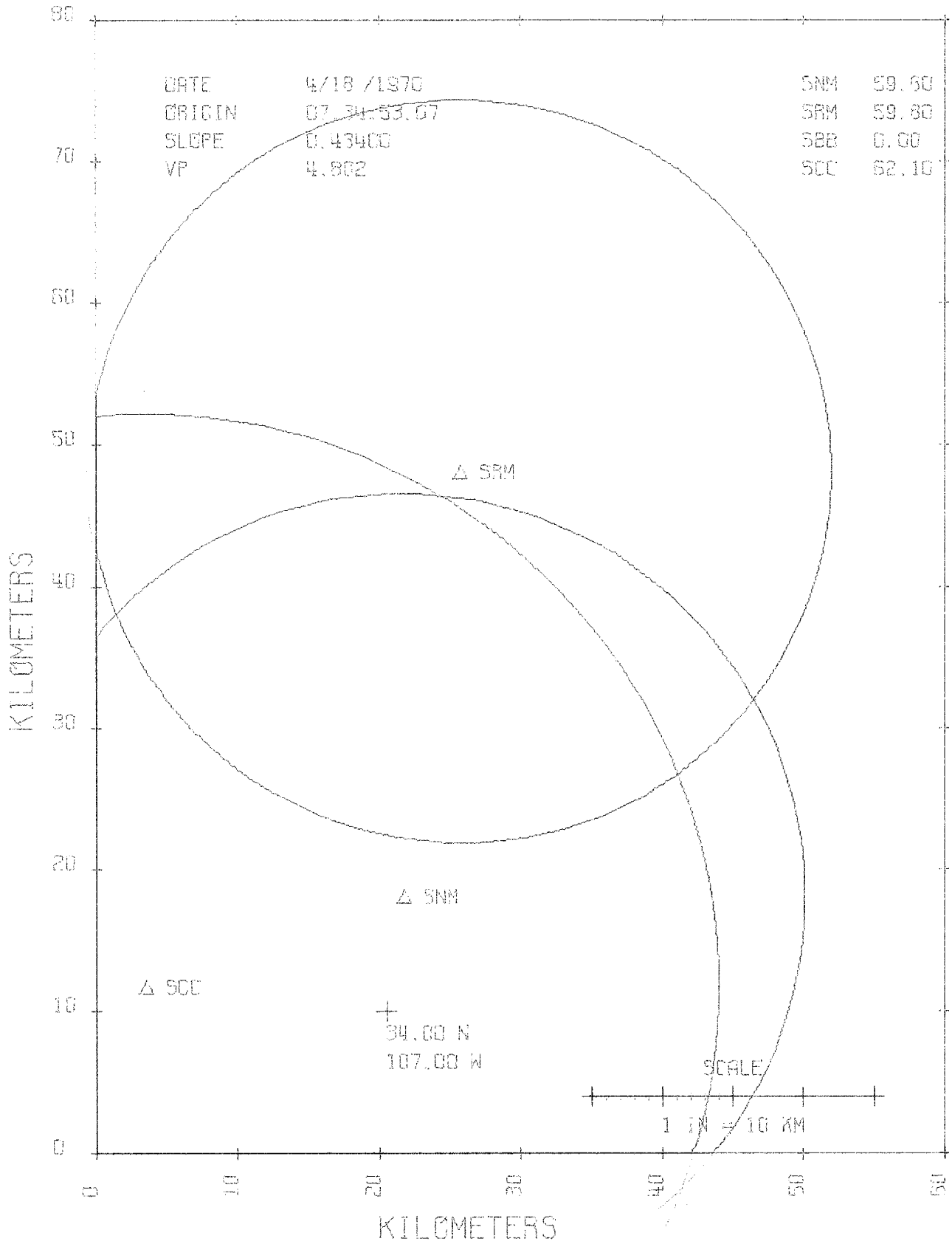
DATE 4/18 /1970
ORIGIN 07 34 53.07
SLOPE 0.43400
VP 4.802
SNM 59.60
SRM 59.80
SBB 0.00
SCC 62.10
Δ SRM
Δ SNM
Δ SCC
34.00 N
107.00 W
SCALE
1 IN = 10 KM
KILOMETERS
KILOMETERS
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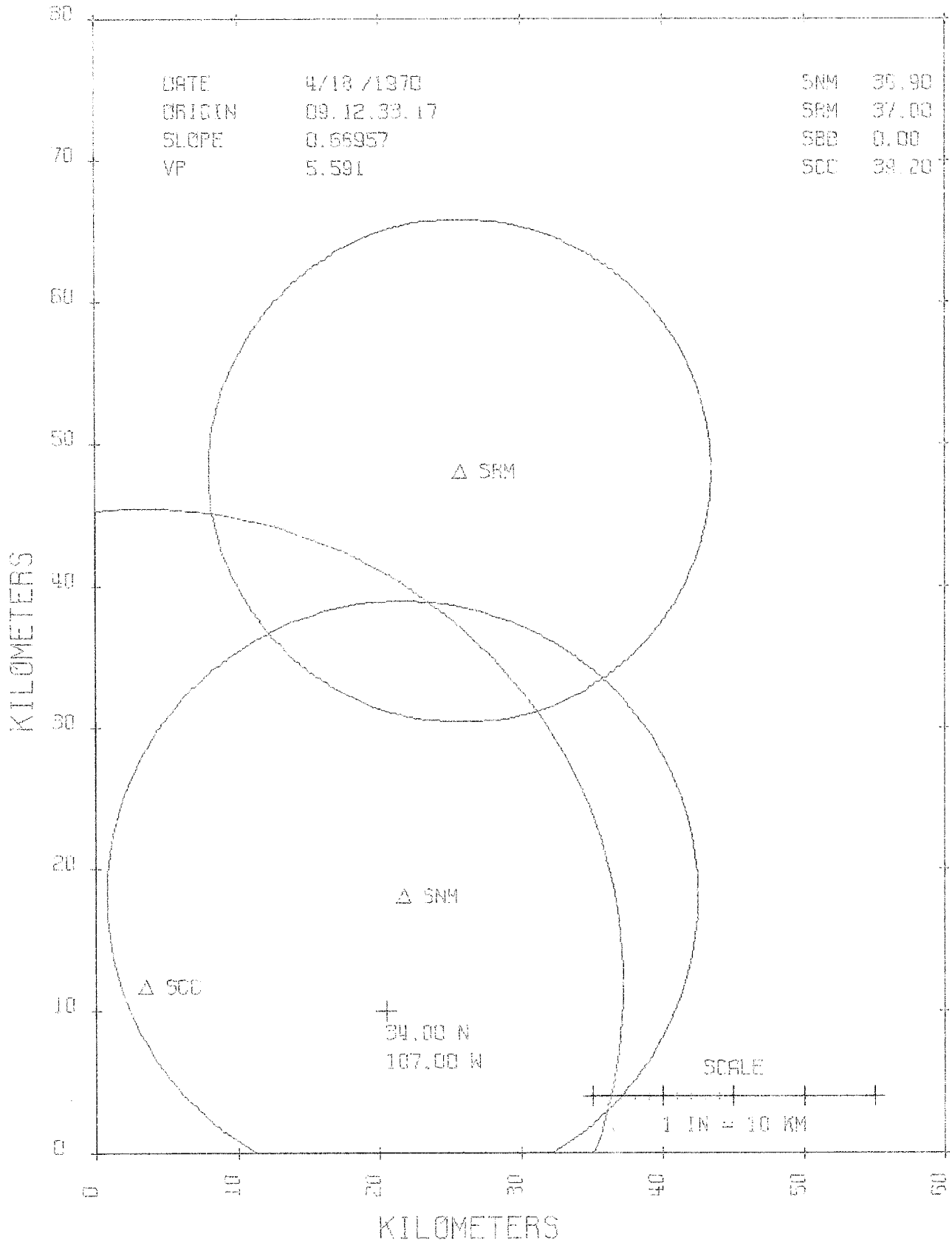
DATE 4/10/1970
ORIGIN 09.12.33.17
SLOPE 0.66957
VP 5.591
SNM 35.90
SRM 37.00
SBB 0.00
SCC 39.20
Δ SRM
Δ SNM
Δ SCC
34.00 N
107.00 W
SCALE
1 IN = 10 KM
KILOMETERS
KILOMETERS
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70
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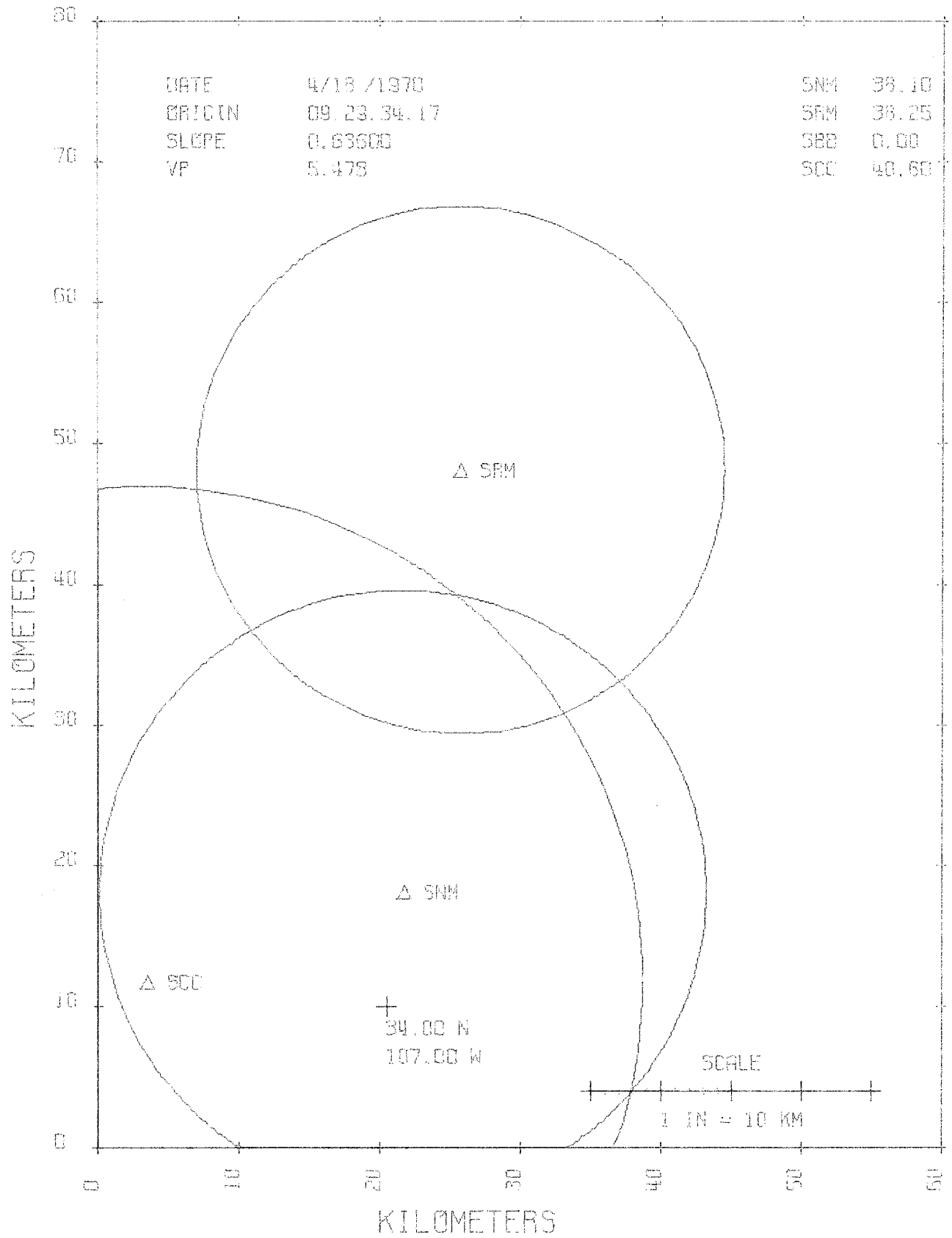
DATE 4/18 /1970
ORIGIN 09.23.34.17
SLOPE 0.63600
VP 5.478
SNM 38.10
SRM 36.25
SBB 0.00
SCC 40.60
Δ SRM
Δ SNM
Δ SCC
34.00 N
107.00 W
SCALE
1 IN = 10 KM
KILOMETERS
KILOMETERS
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70
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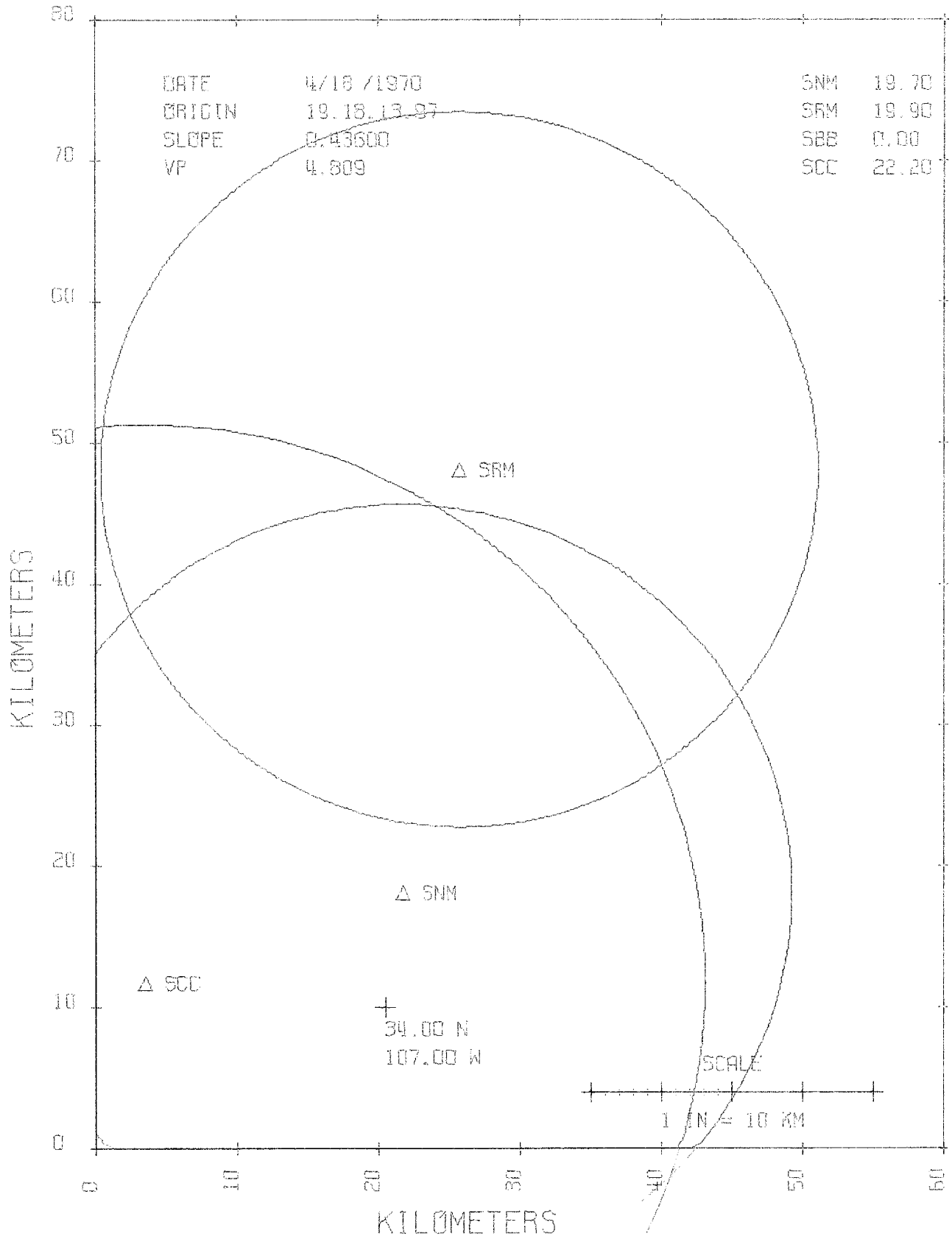
DATE 4/16 /1970
ORIGIN 19.18.13.97
SLOPE 0.43600
VP 4.809
SNM 19.70
SRM 19.90
SBB 0.00
SCC 22.20
Δ SRM
Δ SNM
Δ SCC
34.00 N
107.00 W
SCALE
1 IN = 10 KM
KILOMETERS
KILOMETERS
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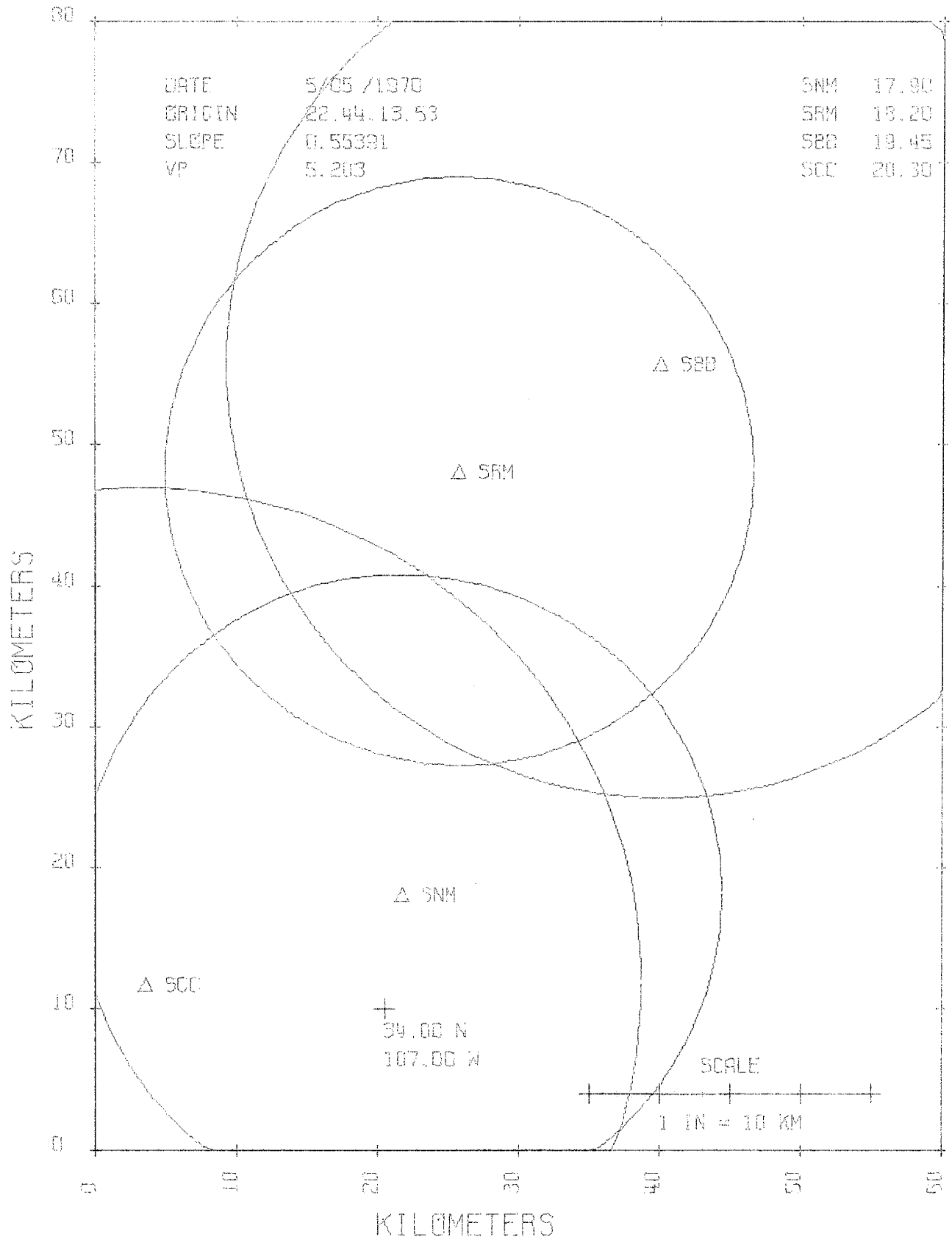
50
60
70
80


DATE 5/05/1970
ORIGIN 22.44.13.53
SLOPE 0.55391
VP 5.203
SNM 17.90
SRM 18.20
SBD 19.45
SCC 20.30
Δ SBD
Δ SRM
Δ SNM
Δ SCC
34.00 N
107.00 W
SCALE
1 IN = 10 KM
KILOMETERS
KILOMETERS
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70
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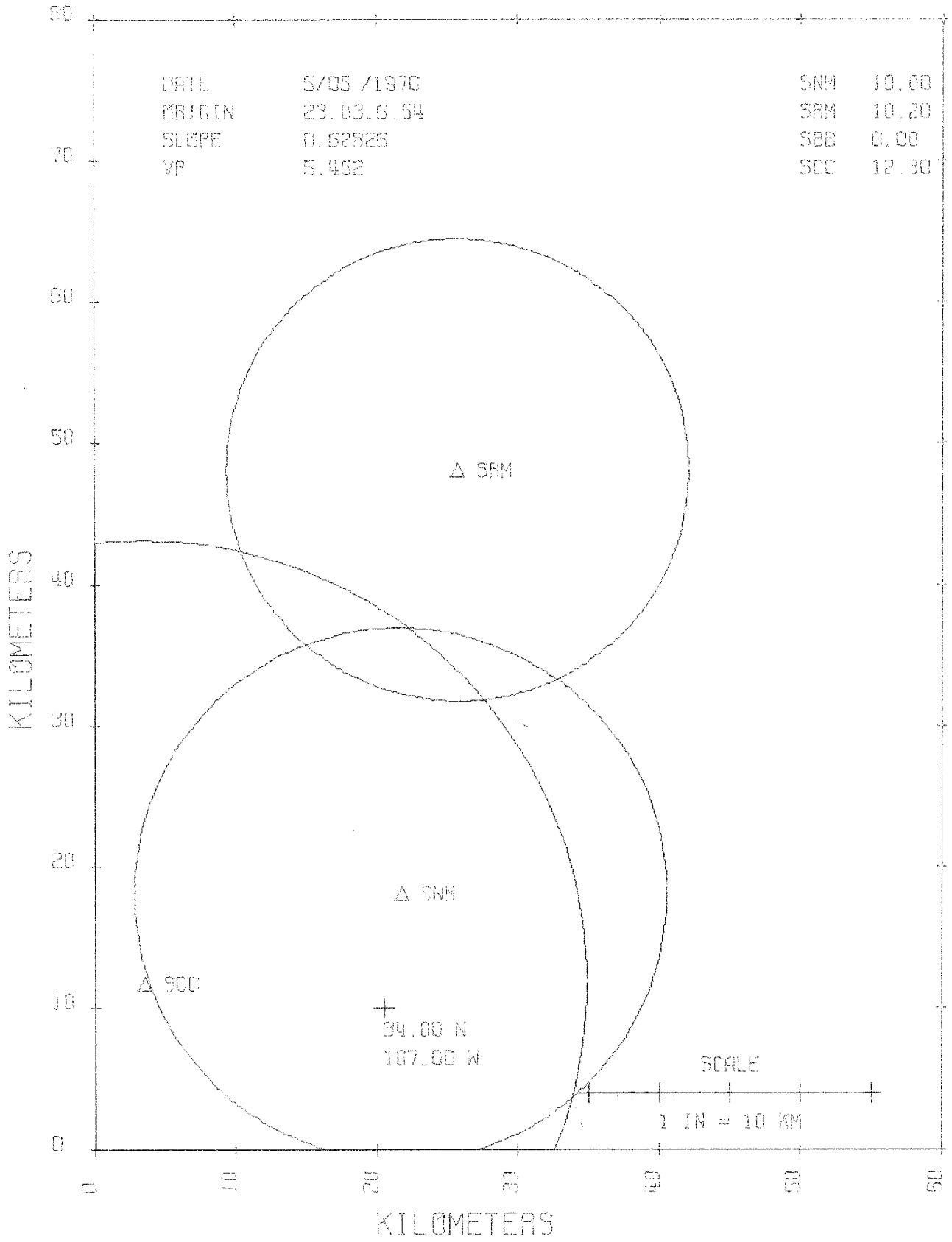
DATE 5/05 /1970
ORIGIN 23.03.5.54
SLOPE 0.628826
VP 5.452
SNM 10.00
SRM 10.20
SBB 0.00
SCC 12.30
Δ SRM
Δ SNM
Δ SCC
34.00 N
107.00 W
SCALE
1 IN = 10 KM
KILOMETERS
KILOMETERS
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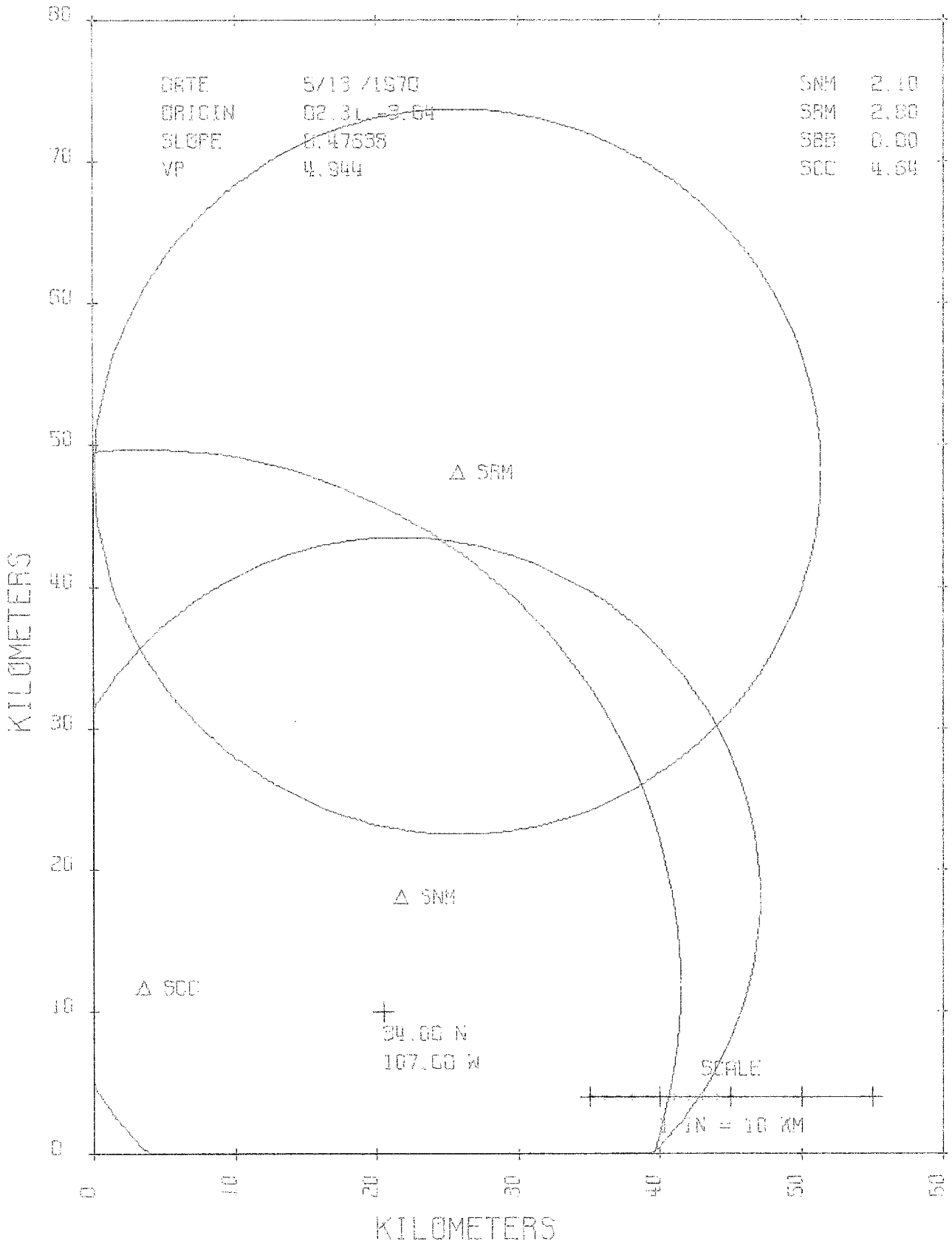
DATE 5/13 /1970
ORIGIN 32.31 -3.64
SLOPE 0.47638
VP 4.944
SNM 2.10
SRM 2.80
SBB 0.00
SCC 4.64
Δ SRM
Δ SNM
Δ SCC
34.00 N
107.00 W
SCALE
1 IN = 10 KM
KILOMETERS
KILOMETERS
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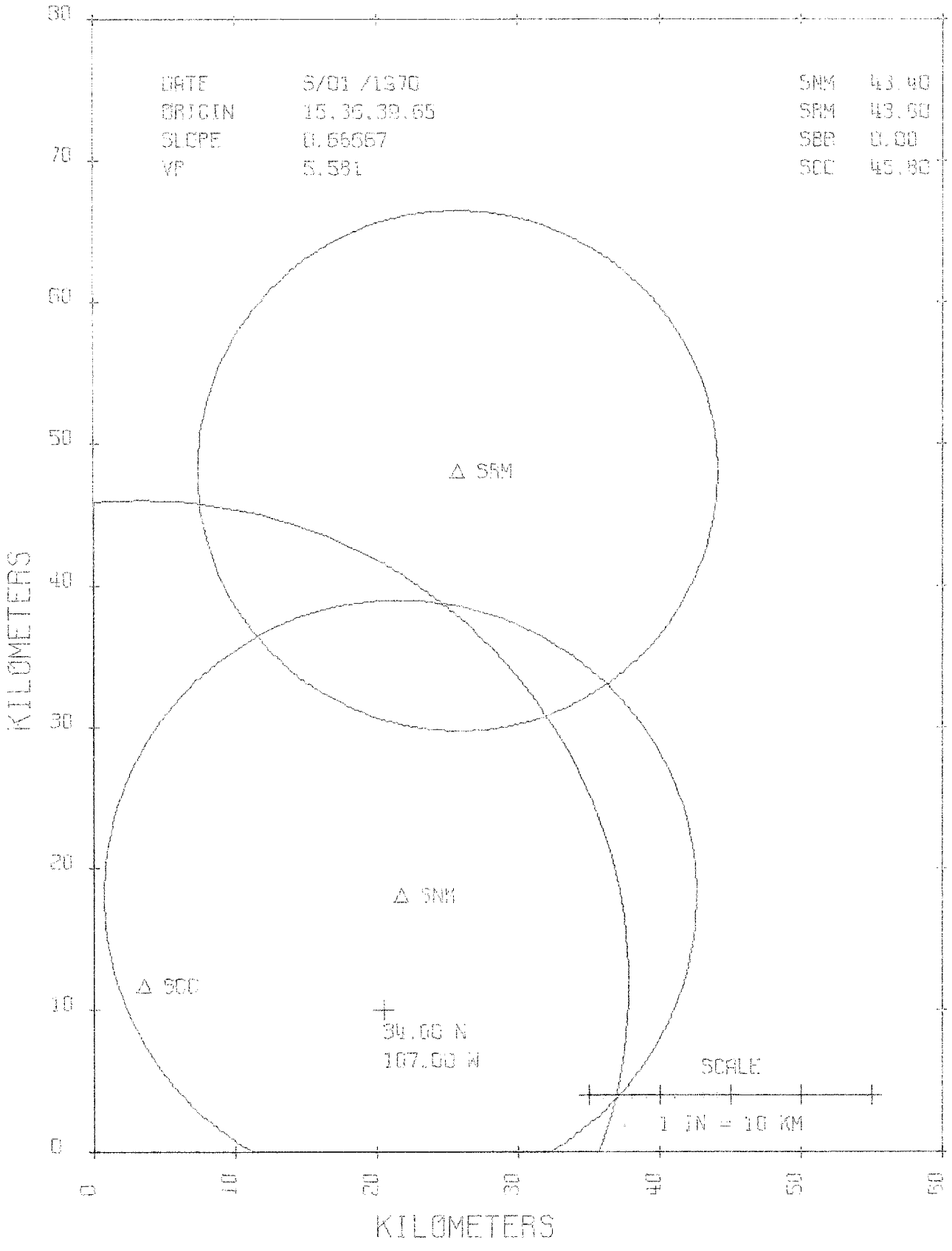
DATE 5/01 /1970
ORIGIN 15.36.38.65
SLOPE 0.66067
VP 5.581
SNM 43.90
SRM 43.50
SBB 0.00
SCC 45.80
Δ SRM
Δ SNM
Δ SCC
34.00 N
107.00 W
SCALE
1 IN = 10 KM
KILOMETERS
KILOMETERS
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80
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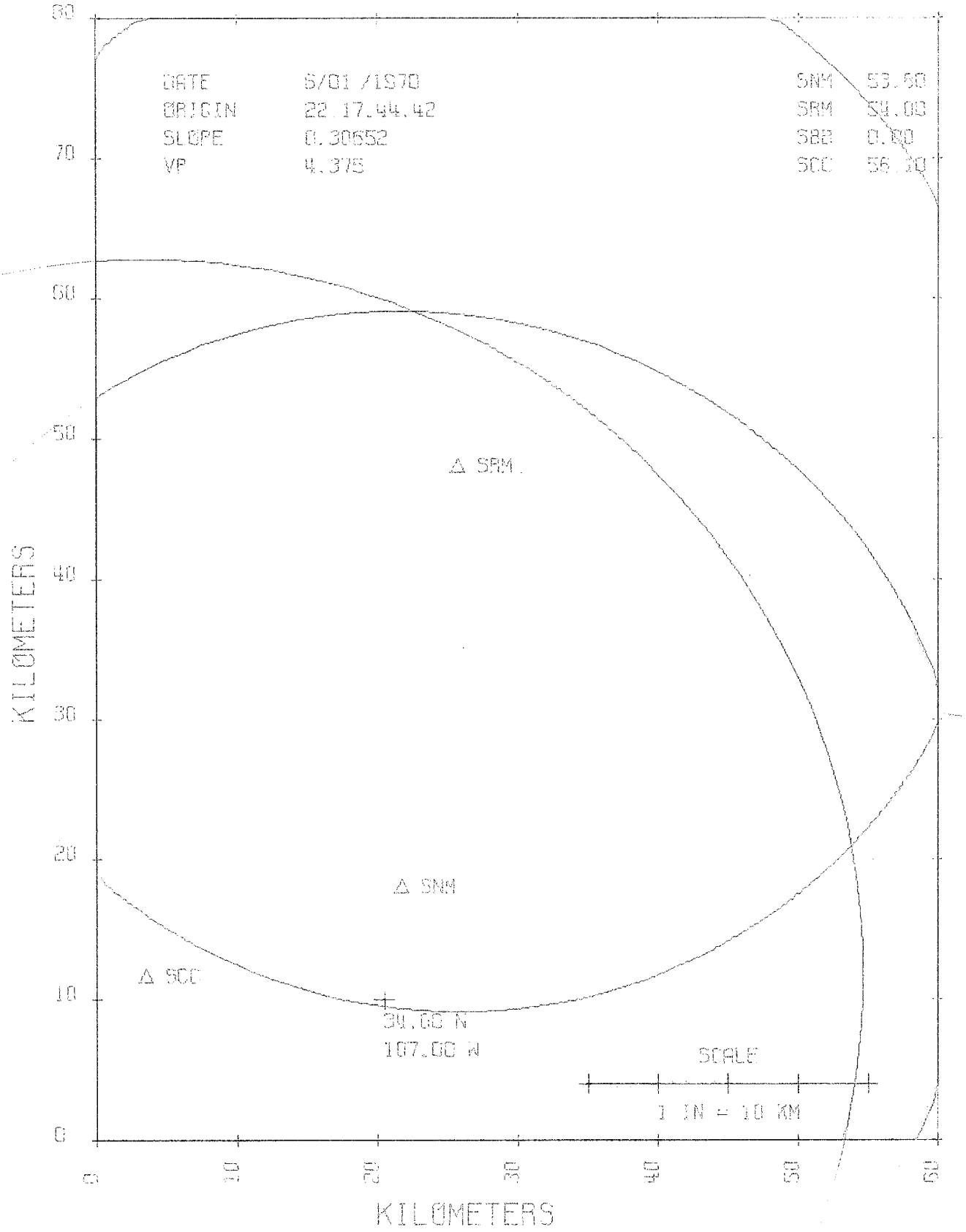
DATE 5/01/1970
ORIGIN 22 17.44.42
SLOPE 0.30652
VP 4.375
SNM 53.60
SRM 54.00
SBB 0.00
SCC 56.30
Δ SRM
Δ SNM
Δ SCC
34.00 N
107.00 W
SCALE
1 IN = 10 KM
KILOMETERS
KILOMETERS
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70
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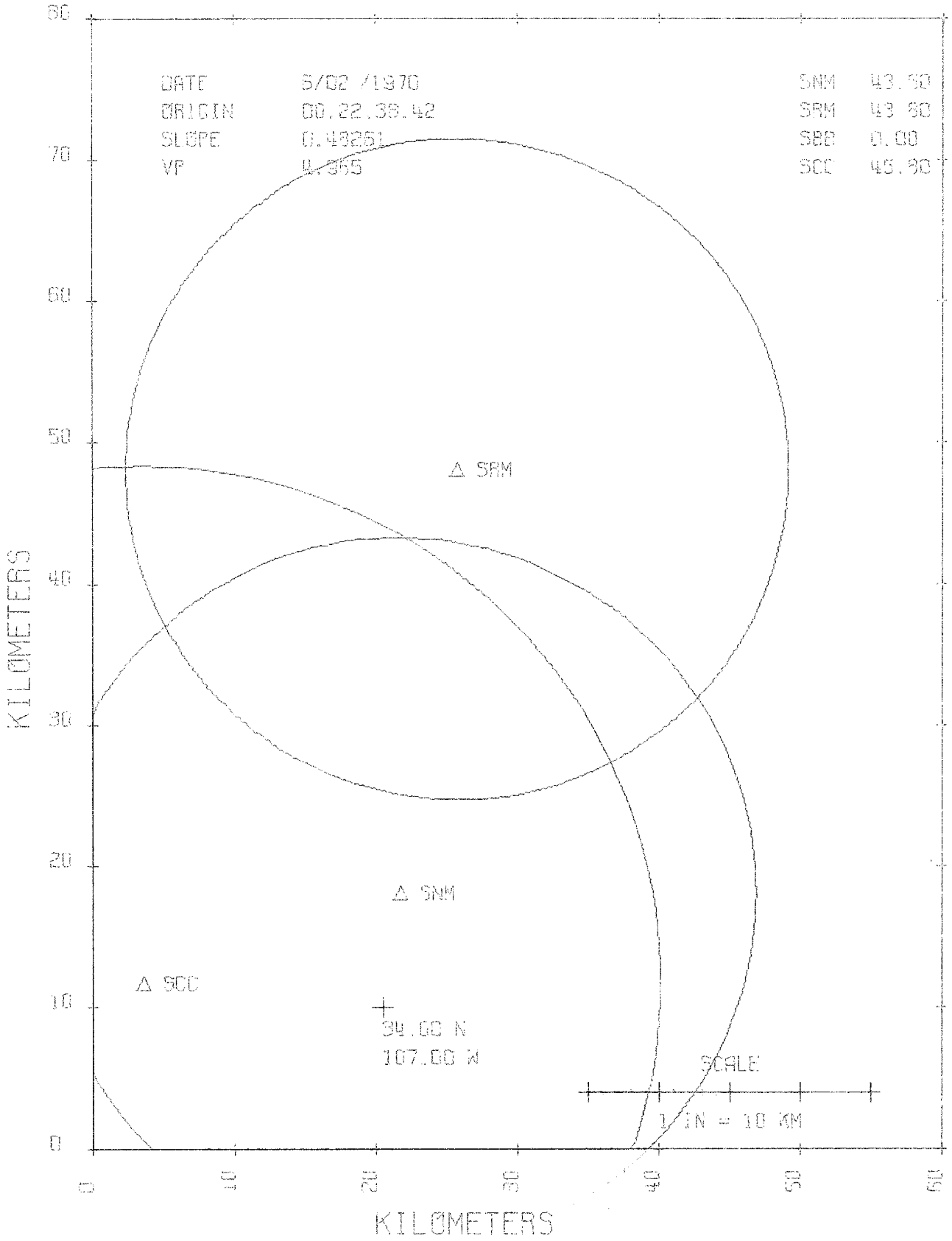
DATE 5/02 /1970
ORIGIN 00.22.39.42
SLOPE 0.48261
VF 0.955
SNM 43.50
SRM 43.80
SBB 0.00
SCC 45.90
Δ SRM
Δ SNM
Δ SCC
34.00 N
107.00 W
SCALE
1 IN = 10 KM
KILOMETERS
KILOMETERS
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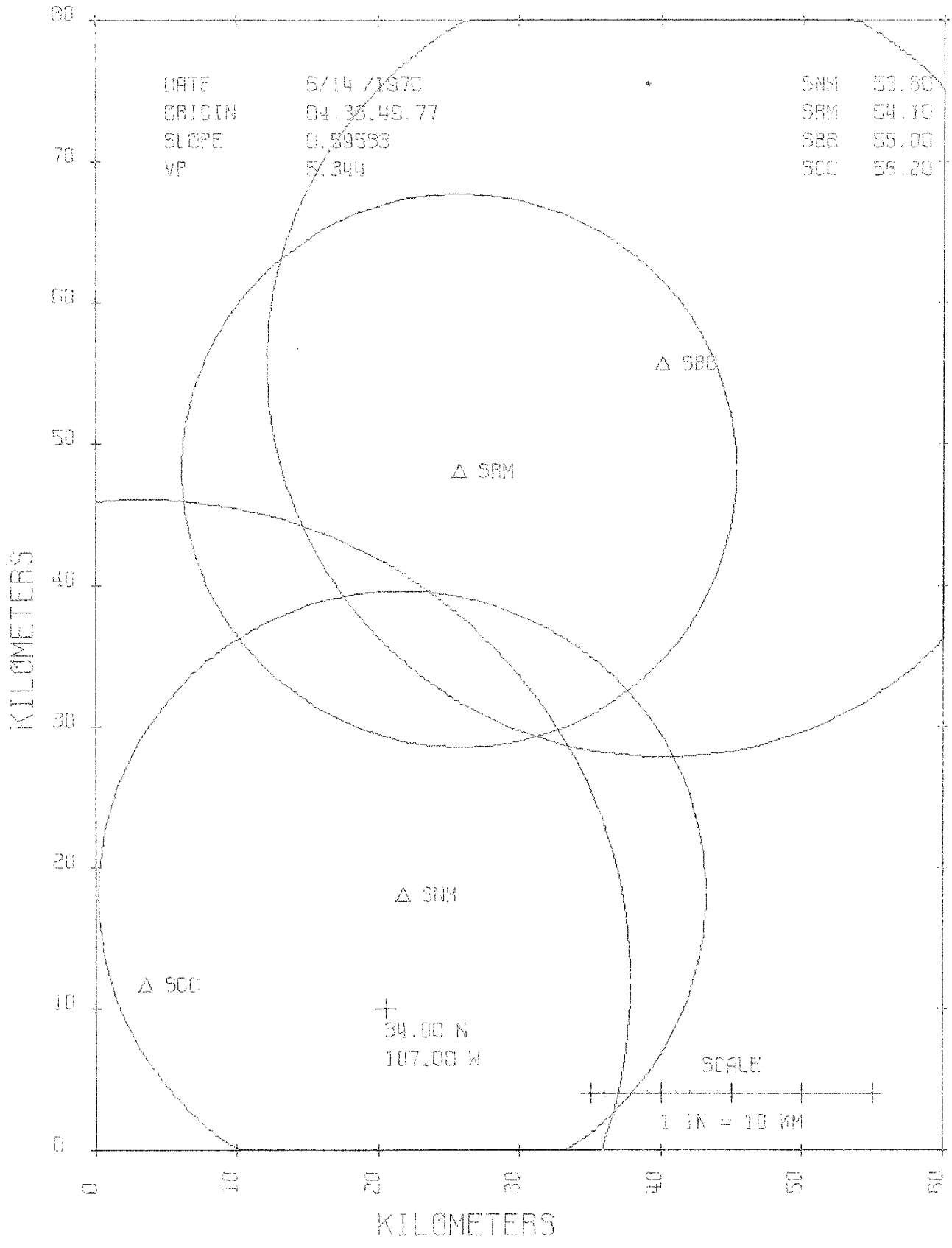
DATE 6/14 /1970
ORIGIN 04.36.45.77
SLOPE 0.895933
VP 5.344
SNM 53.60
SRM 54.10
SBB 55.00
SCC 56.20
Δ SBB
Δ SRM
Δ SNM
Δ SCC
34.00 N
107.00 W
SCALE
1 IN = 10 KM
KILOMETERS
KILOMETERS
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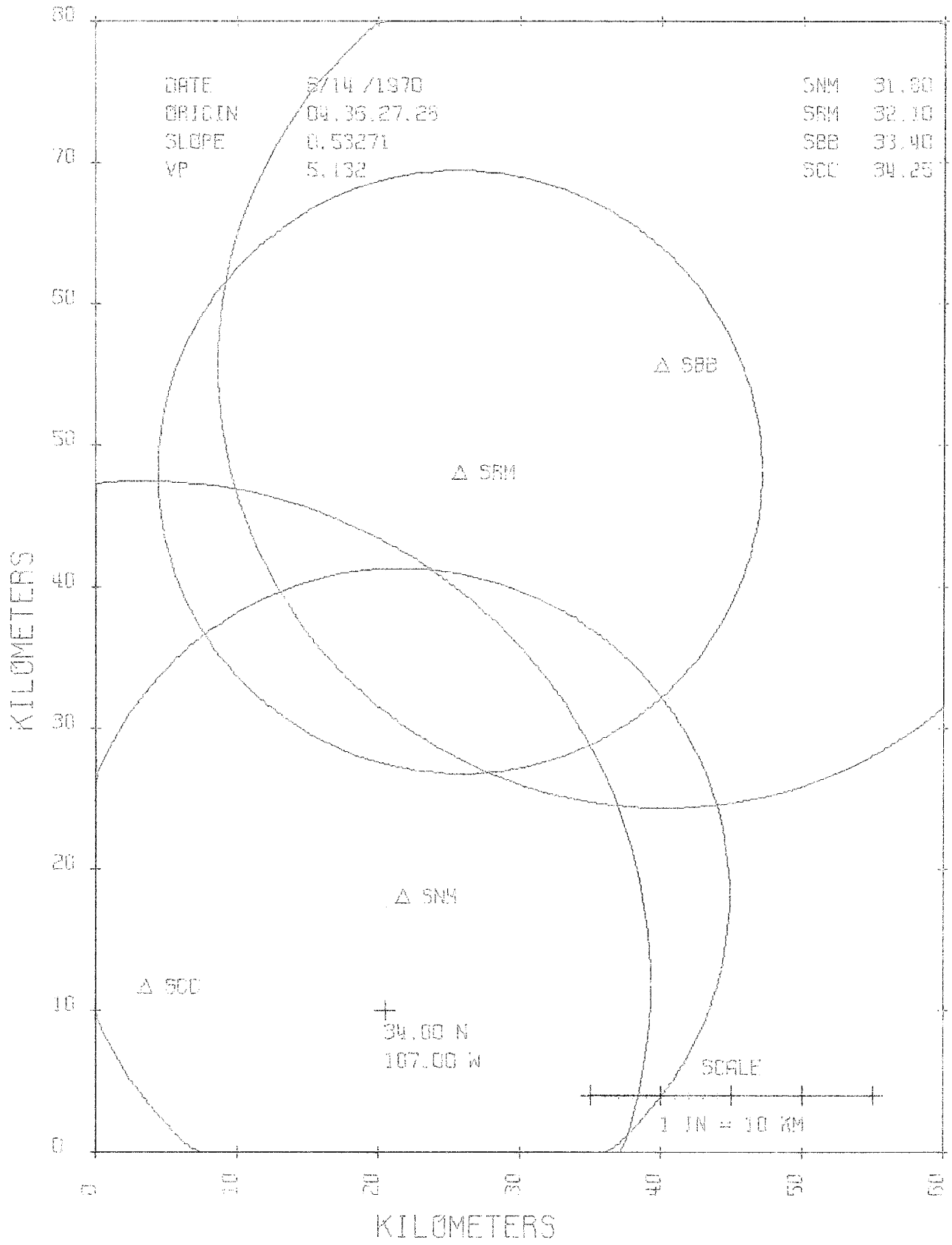
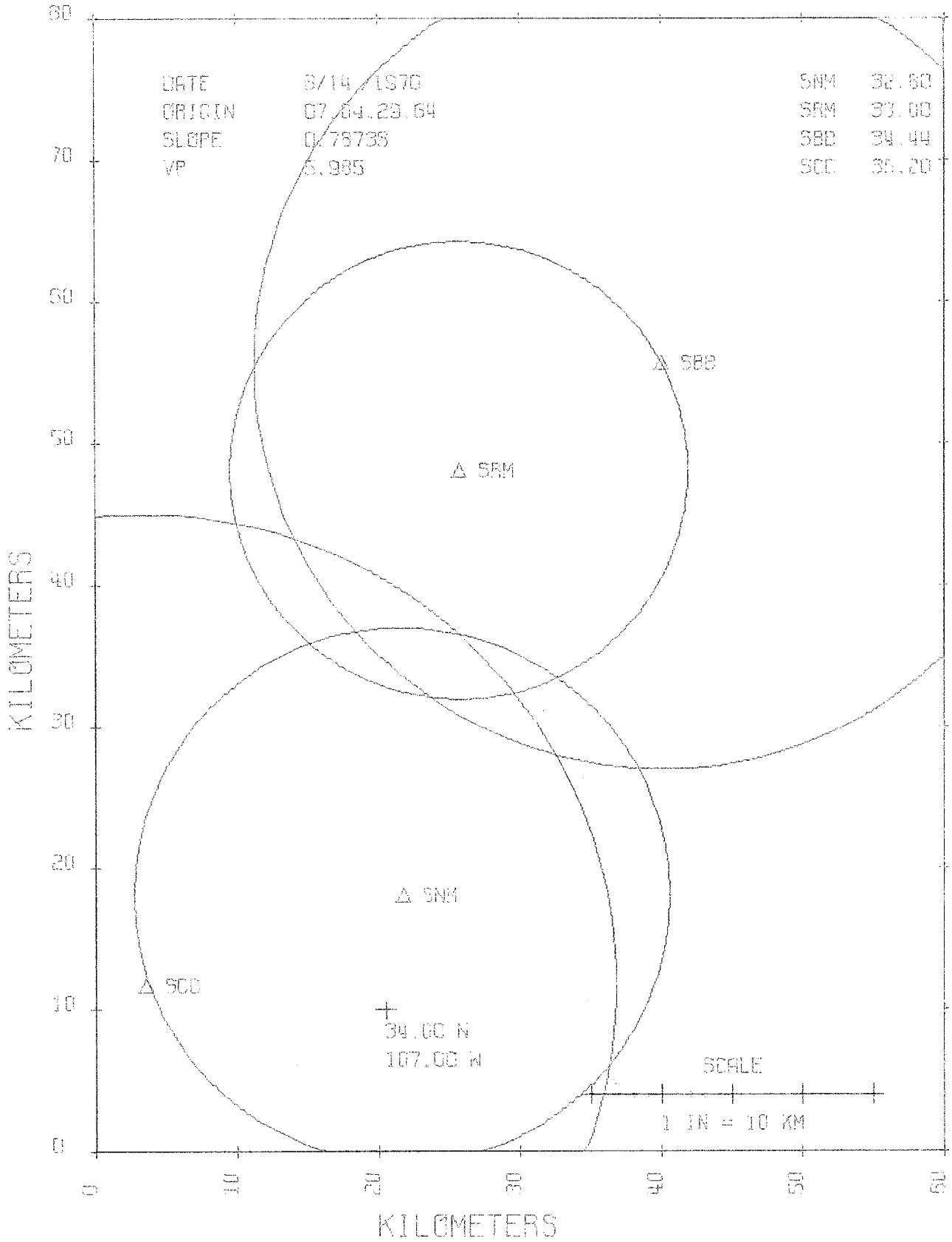
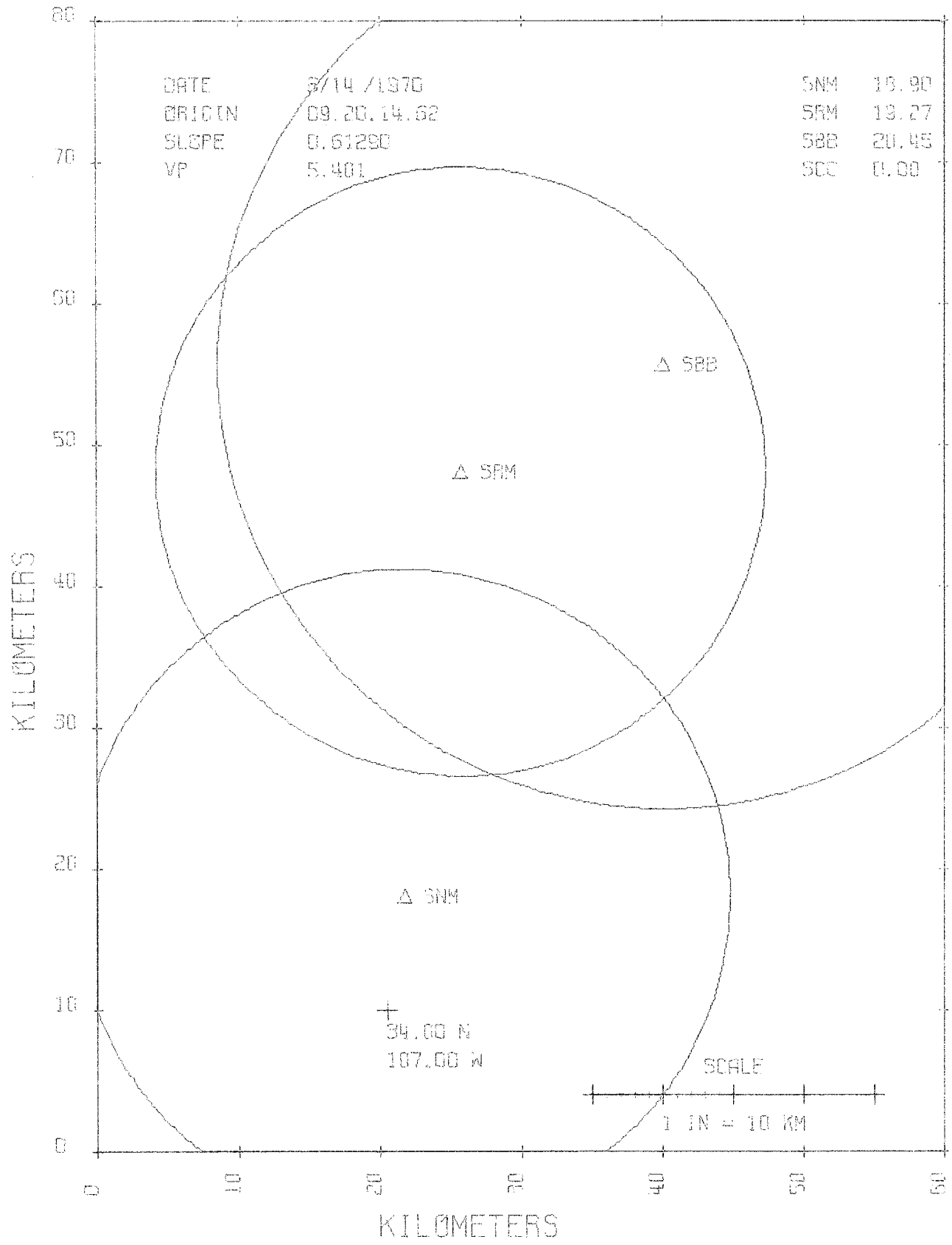
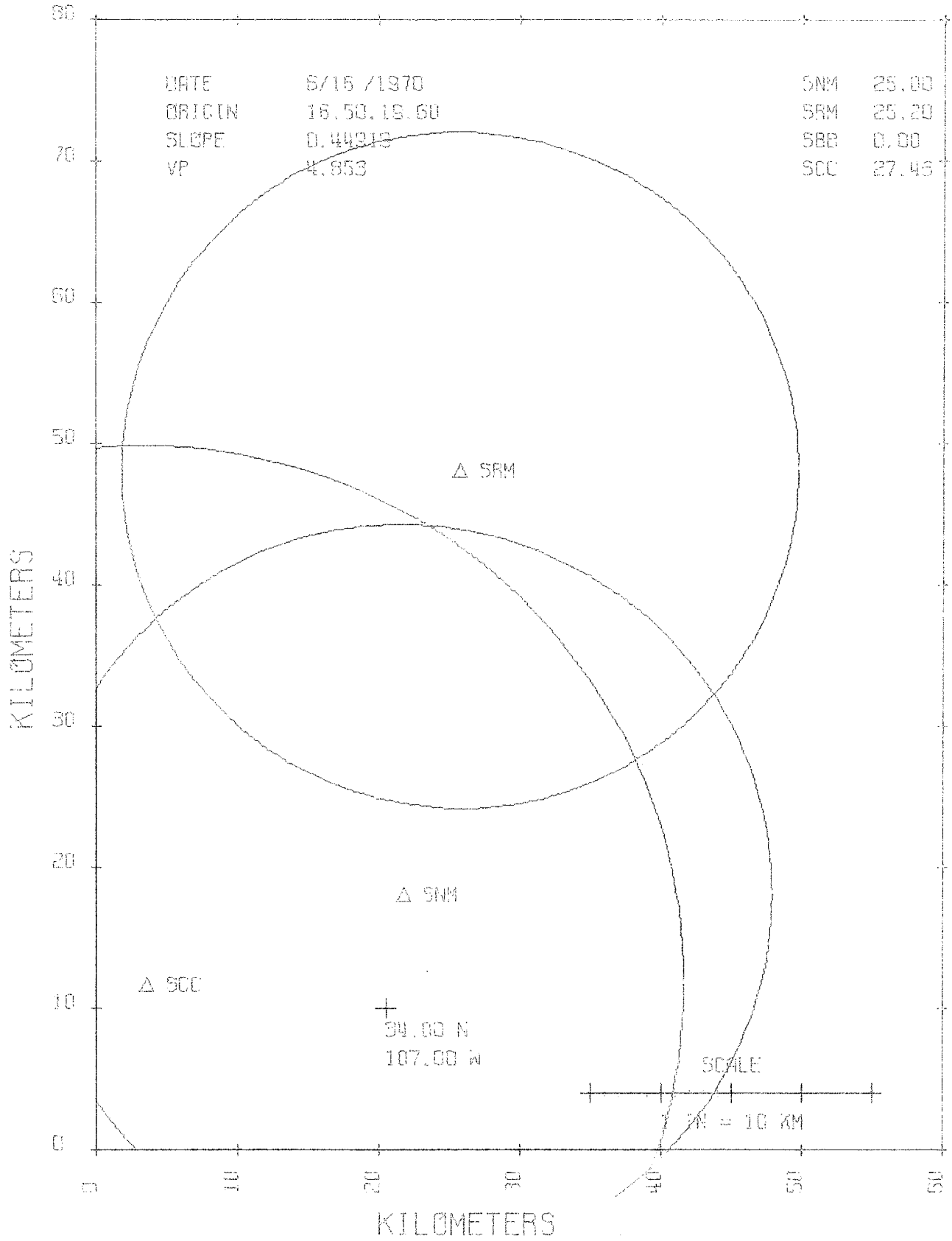
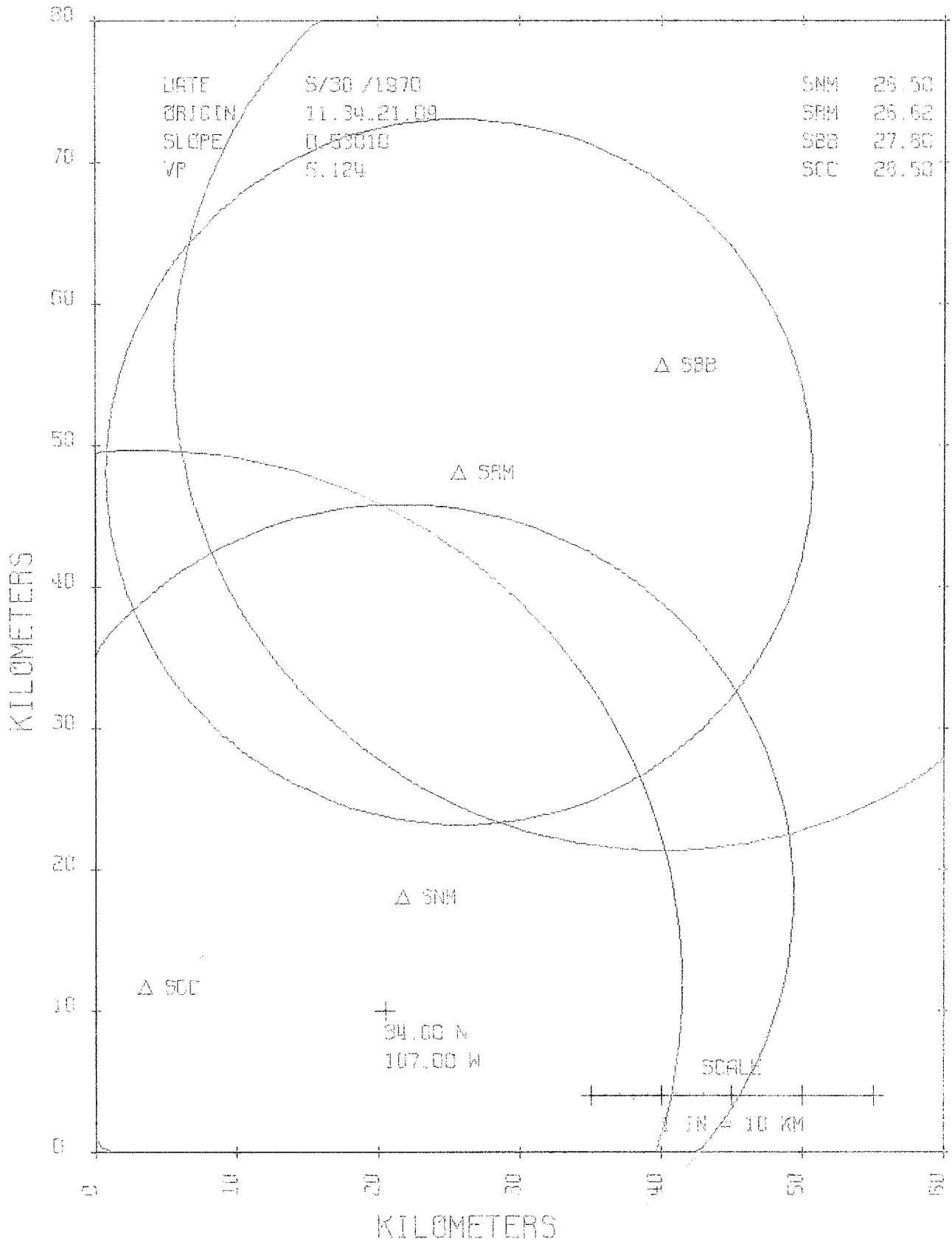
20
30
40
50
60
70
80

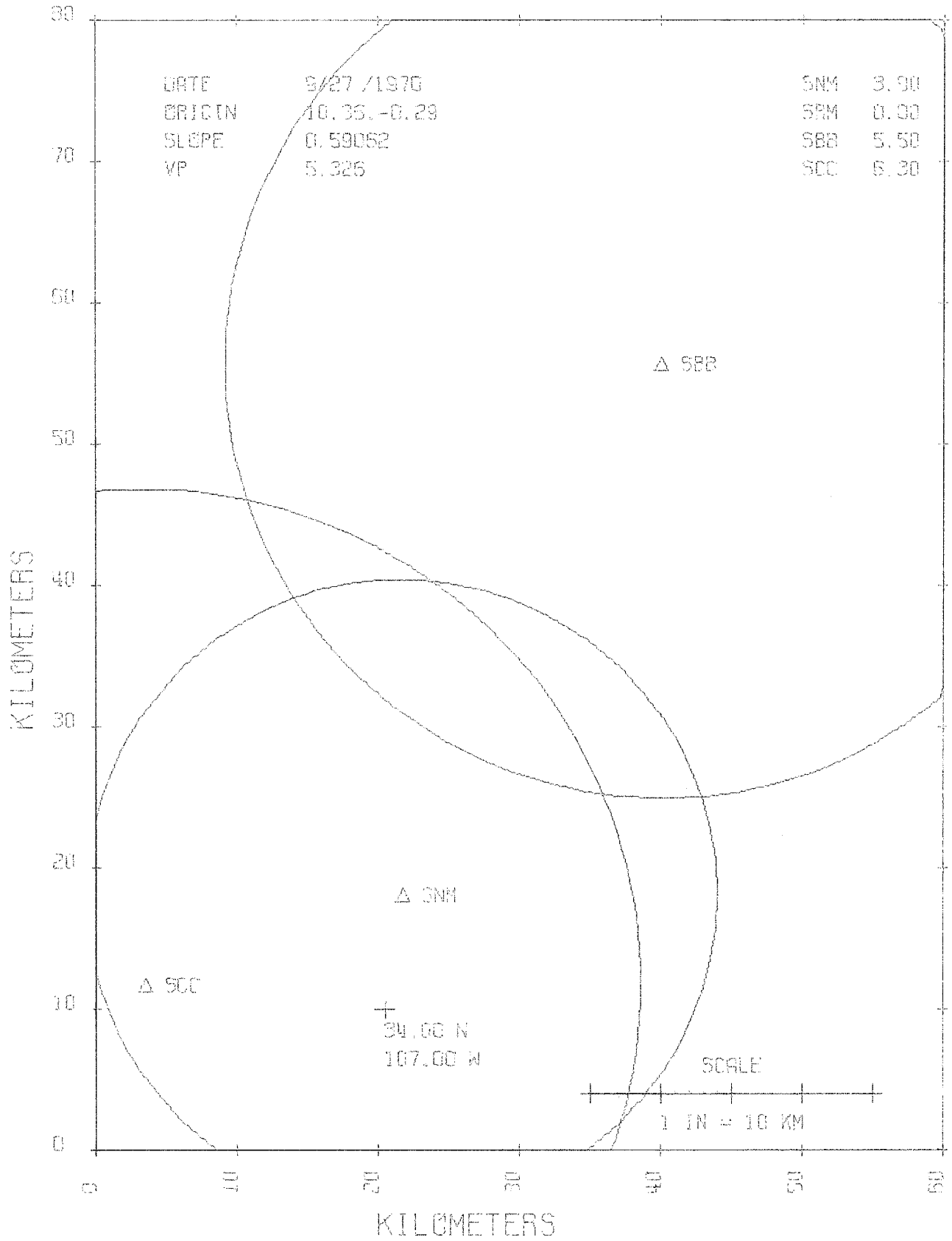

DATE 9/14 /1970
ORIGIN 04.36.27.25
SLOPE 0.59271
VP 5.132
SNM 31.80
SRM 32.10
SBB 33.40
SCC 34.25
△ SBB
△ SRM
△ SNM
△ SCC
34.00 N
107.00 W
SCALE
1 IN = 10 KM
KILOMETERS
KILOMETERS
0
10
20
30
40
50
60
70
80

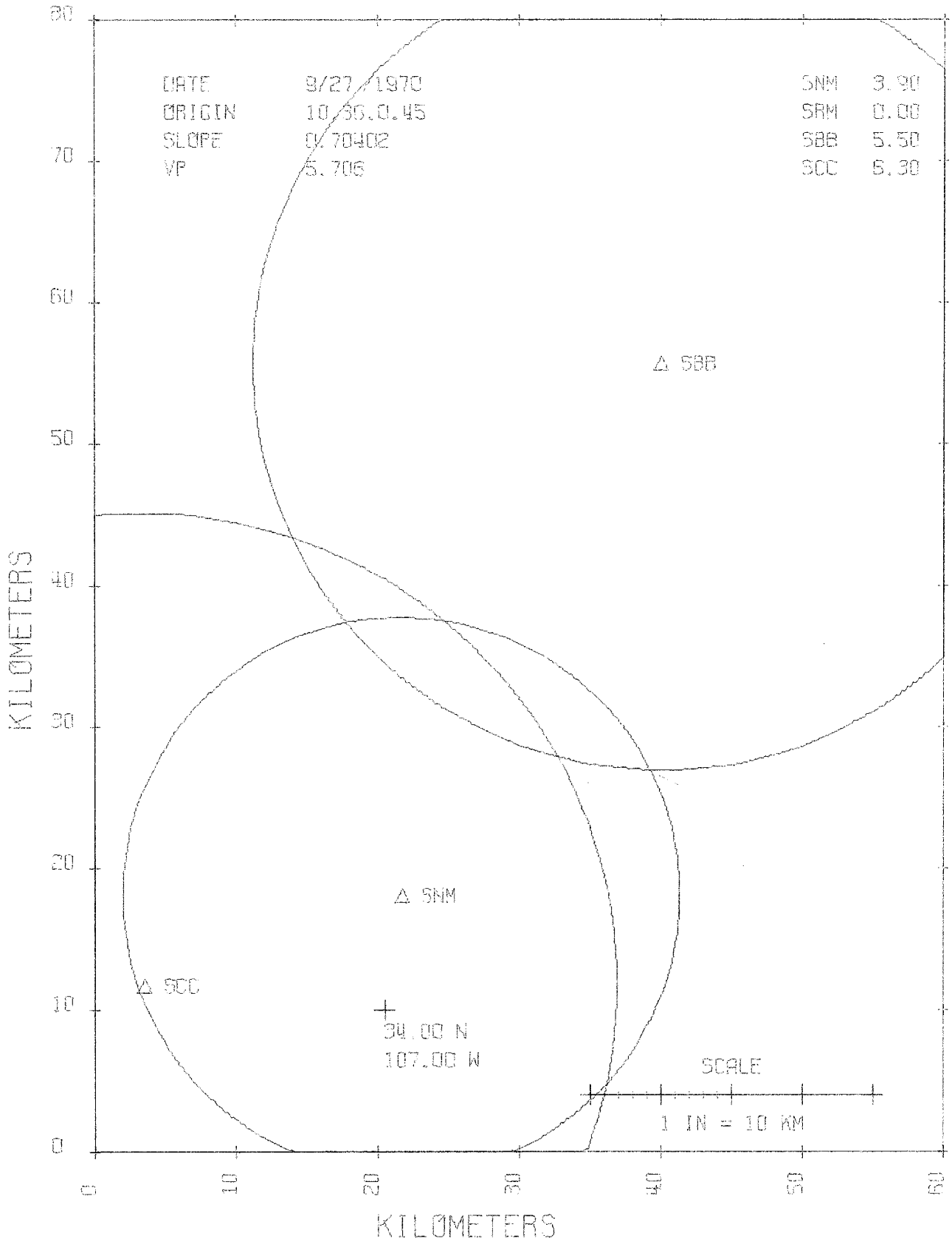

DATE 6/14/1970
ORIGIN 07.04.28.64
SLOPE 0.78738
VP 5.985
SNM 32.60
SRM 33.00
SBB 34.44
SCC 35.20
△ SBB
△ SRM
△ SNM
△ SCC
34.00 N
107.00 W
SCALE
1 IN = 10 KM
KILOMETERS
KILOMETERS
0
10
20
30
40
50
60
70
80


DATE 8/14 /1970
ORIGIN 09.20.14.62
SLOPE 0.612900
VP 5.401
SNM 19.80
SRM 19.27
SBB 20.45
SCC 0.00
Δ SBB
Δ SRM
Δ SNM
34.00 N
107.00 W
SCALE
1 IN = 10 KM
KILOMETERS
KILOMETERS
0
10
20
30
40
50
60
70
80


DATE 6/16 /1970
ORIGIN 16.50.18.60
SLOPE 0.44918
VP 4.853
SNM 25.00
SRM 25.20
SBB 0.00
SCC 27.46
Δ SRM
Δ SNM
Δ SCC
34.00 N
107.00 W
SCALE
1 IN = 10 KM
KILOMETERS
KILOMETERS
0
10
20
30
40
50
60
70
80


DATE 5/30 /1970
ORIGIN 11.34.21.09
SLOPE 0.53010
VP 5.124
SNM 26.50
SRM 26.62
SBB 27.80
SCC 28.50
Δ SBB
Δ SRM
Δ SNM
Δ SCC
34.00 N
107.00 W
SCALE
1 IN = 10 KM
KILOMETERS
KILOMETERS
0
10
20
30
40
50
60
70
80


DATE 9/27/1970
ORIGIN 10.35,-0.29
SLOPE 0.590S2
VP 5.326
SNM 3.90
SPM 0.00
SBB 5.50
SCC 6.30
Δ SBB
Δ SNM
Δ SCC
34.00 N
107.00 W
SCALE
1 IN = 10 KM
KILOMETERS
KILOMETERS
0
10
20
30
40
50
60
70
80


DATE 9/27/1970
ORIGIN 10:30:0.45
SLOPE 0.70402
VP 5.706
SNM 3.90
SRM 0.00
SBB 5.50
SCC 5.30
Δ SBB
Δ SNM
Δ SCC
34.00 N
107.00 W
SCALE
1 IN = 10 KM
KILOMETERS
KILOMETERS
0
10
20
30
40
50
60
70
80

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APPENDIX 1

Programs I, II, and III are the computer programs that were used in calculating the vp/vs ratio and in plotting the graphs.

Program I uses the data of P arrival time and the S-P interval to plot P arrival vs. S-P interval and to calculate the P wave velocity and the origin time. From this the epicenters are plotted.

Program II calculates the differences in P arrival times to check for consistency.

Program III plots vp/vs with the time and magnitude of the events.

P R O G R A M I

```
      IMPLICIT REAL*8(A-H,O-Z), INTEGER(I-N)
      INTEGER STA(4), IDEN (4,4), NSTA(4)
      DIMENSION X(4), Y(4), U(4), V(4), ZX(4), ZY(4), G(4)
C
C
C                    READ DATA
C
C
      READ (5,106) ((STA(I),U(I),V(I)),I=1,4)
C     WRITE (6,107)((STA(I),U(I),V(I)),I=1,4)
      PRINT 236
C
  106 FORMAT ((A3,2F5.3))
  107 FORMAT ((5X,A3,2(5X,F5.3)))
C
      DO 200 I = 1,4
      U(I) = 0.635 * U(I)
      V(I) = 0.635 * V(I) + 1.0
  200 CONTINUE
C
      LAP = 0
C
    5 WRITE(6,1)
    1 FORMAT (//)
C
C
      DO 250 I =1,4
      NSTA(I) = 0.0
      X(I) = 0.0
      Y(I) = 0.0
  250 CONTINUE
C
      DO 10 I=1,5
      READ (5,2,END=3)(IDEN(I,J),J=1,4),NSTA(I),Y(I),X(I),G(I),JJJ
    2 FORMAT (A4,1X,2(A2,1X),A3,I1,1X,3F9.6,36X,I1)
   10 CONTINUE
    3 IF(JJJ)50,4,50
C
    4 NUMB = I-2
      DO 11 I=1,NUMB
C     WRITE (6,6) ( IDEN(I,J),J=1,4),X(I),Y(I)
    6 FORMAT (5X,4A4,2F11.4)
   11 CONTINUE
C
C     ***********************************************************
C
C
C                    CALCULATE A & B IN THE EQN   Y = AX + B
C
C
      SUMX = 0.
      SUMY = 0.
      SUMXS = 0.
      SUMYS = 0.
      SUMXY = 0.
      DO 12 I=1,NUMB
      SUMX = SUMX + X(I)
      SUMY = SUMY + Y(I)
      SUMXS=SUMXS+X(I)**2
      SUMYS=SUMYS+Y(I)**2
```

```
      SUMXY = SUMXY + X(I)*Y(I)
   12 CONTINUE
      FNUMB = NUMB
      AX=FNUMB*SUMXS-SUMX**2
      AY=FNUMB*SUMYS-SUMY**2
      AXY=FNUMB*SUMXY-SUMX*SUMY
      RAX =DSQRT(AX)
      RAY =DSQRT(AY)
      XMEAN = SUMX/FNUMB
      YMEAN = SUMY/FNUMB
      SIGX = DSQRT(AX)/FNUMB
      SIGY = DSQRT(AY)/FNUMB
      A = AXY/AX
      IF (NUMB.EQ.2) GO TO 13
      RXY = AXY/(RAX*RAY)
      R2XY = 1.0-(1.0-RXY**2)*((FNUMB-1.)/(FNUMB-2.))
      Q=(SUMYS-FNUMB*YMEAN*YMEAN)/(FNUMB-1.)*(1.-RXY**2)
      QQ = DABS(Q)
      SYX = DSQRT(QQ)
      GO TO 14
   13 RXY = 1.0
      SYX = 0.0
   14 B = (SUMY*SUMXS-SUMX*SUMXY)/AX
C
C     ***************************************************************
C
C
      LAP = LAP + 1
      IF (LAP.EQ.6) PRINT 216
      IF (LAP.EQ.6) LAP = 0
C
      SLOPE = A
      XINT = - B/A
      VP =(A+1.)*5.8/SQRT(3.0)
C
      DO 301 I = 1,4
      ZX(I) = 0.0
      ZY(I) = 0.0
  301 CONTINUE
      DO 302 I =1,4
      J = NSTA(I)
      IF (J.EQ.0) GO TO 302
      ZX(J) = X(I)
      ZY(J) = Y(I)
  302 CONTINUE
      DO 303 I = 1,4
      X(I) = ZX(I)
      Y(I) = ZY(I)
  303 CONTINUE
C
C
C
C                    WRITE OUTPUT
C
C
      WRITE (6,210) (IDEN(1,J),J=1,3),XINT
      PRINT 215
C
      DO 220 I =1,4
      IN = Y(I)
```

```
      TRTIM = 0.0
      R = 0.0
      FD = 0.0
      IF (IN.EQ.0.AND.I.EQ.2) GO TO 202
      IF (IN.EQ.0) GO TO 220
      TRTIM = X(I) - XINT
      IF (I.EQ.2) TRTIM = X(I) - XINT - 0.66
      R = VP * TRTIM
      IRG = (R*R)-(G(1)*G(1))
      IF (IRG.LT.0.OR.IRG.EQ.0) FD = 0.0
      IF (IRG.LT.0.OR.IRG.EQ.0) GO TO 199
      FD = DSQRT((R*R)-(G(1)*G(1)))
  199 GO TO (201,202,203,204),I
  201 WRITE (6,211)  IDEN(I,4),X(I),TRTIM,R,Y(I),FD
      GO TO 220
  202 WRITE (6,212)      STA(I),X(I),TRTIM,R,Y(I),VP
      GO TO 220
  203 WRITE (6,213)      STA(I),X(I),TRTIM,R,Y(I),RXY
      GO TO 220
  204 WRITE (6,214)      STA(I),X(I),TRTIM,R,Y(I),SYX
  220 CONTINUE
C
C
  210 FORMAT (//10X,'DATE *',2X,A4,'/1970', 7X,'ORIGIN TIME *',2X,A2,':'
     $,A2,'/',F5.2)
  211 FORMAT (10X,A3,2X,'*',4(2X,F5.2),2X,'*  FD',2X,F5.2)
  212 FORMAT (10X,A3,2X,'*',4(2X,F5.2),2X,'*  VP',2X,F5.2)
  213 FORMAT (10X,A3,2X,'*',4(2X,F5.2),2X,'*  CC',2X,F5.2)
  214 FORMAT (10X,A3,2X,'*',4(2X,F5.2),2X,'*  EE',2X,F5.2)
  215 FORMAT (20X,'P',6X,'TT',6X,'R',5X,'S-P')
  216 FORMAT (1H1)
C
C
C     CALL BORDER (IDEN,XINT,A,VP)
C     CALL EPIPLT (X,Y,STA,XINT,VP,U,V)
C     CALL BORDER (IDEN,XINT,A,VP)
C     CALL GRAPH (X,Y,SLOPE,XINT,STA)
C
      GOTO 5
   50 CONTINUE
      PRINT 216
C     CALL PLOT (8.0,0.0,3)
      STOP
      END


MEMORY REQUIREMENTS 001008 BYTES


      SUBROUTINE BORDER (IDEN,XINT,A,VP)
      IMPLICIT REAL*8(A-H,O-Z), INTEGER(I-N)
      INTEGER STA(4), IDEN (4,4)
C
C
C                  DRAW OUTLINE OF PLOT & LABEL THE AXIS
C
C
C       OUTLINE PAGE (8.5IN.X11.0IN.)
      CALL PLOT (0.0,0.0,999)
```

```
      CALL PLOT (8.0,-2.51,-3)
C       OUTLINE PAGE (8.5IN.X11.0IN.)
      CALL PLOT (-.5,0.0, 3)
      CALL PLOT (-.5,11.0, 2)
      CALL PLOT (8.0,11.0,2)
      CALL PLOT (8.0,0.0, 2)
      CALL PLOT (-.5,0.0, 2)
      CALL SYMBOL (-.3,9.5,0.07,'RUN # 2',90.0,7)
      CALL SYMBOL (2.0,10.0,0.1,'DATE',0.0,4)
      CALL SYMBOL (3.0,10.0,0.1,IDEN(1,1),0.0,4)
      CALL SYMBOL (3.4,10.0,0.1,'/1970',0.0,5)
      CALL SYMBOL (2.0,09.8,0.1,'ORIGIN',0.0,6)
      CALL SYMBOL (3.0,09.8,0.1,IDEN(1,2),0.0,2)
      CALL SYMBOL (-0.,-0.,-0.,'.',0.0,1)
      CALL SYMBOL (-0.,-0.,-0.,IDEN(1,3),0.0,2)
      CALL SYMBOL (-0.,-0.,-0.,',',0.0,1)
      CALL NUMBER (-0.,-0.,-0.,XINT,0.0,2)
      CALL SYMBOL (2.0,09.6,0.1,'SLOPE',0.0,5)
      CALL NUMBER (3.0,09.6,0.1,A,0.0,5)
      CALL SYMBOL (2.0,09.4,0.1,'VP',0.0,2)
      CALL NUMBER (3.0,09.4,0.1,VP,0.0,3)
C       OUTLINE PLOT AND ESTABLISH NEW REFERENCE
      CALL PLOT (1.5,2.5,-3)
      CALL PLOT (0.0,8.0,2)
      CALL PLOT (6.0,8.0,2)
      CALL PLOT (6.0,0.0,2)
      CALL PLOT (0.0,0.0,2)
C
      RETURN
      END


MEMORY REQUIREMENTS 000594 BYTES



      SUBROUTINE EPIPLT (X,Y,STA,XINT,VP,U,V)
      IMPLICIT REAL*8(A-H,O-Z), INTEGER(I-N)
      INTEGER STA(4)
      DIMENSION X(4), Y(4), U(4), V(4)
C
C     LABEL THE AXIS
C
      DO 31 I = 1,7
      X1 = I - 1
      X2 = X1 * 10.0
      CALL NUMBER (X1,-0.30,0.10,X2,90.0,-1)
      CALL SYMBOL (X1,0.0,0.07,3,0.0,-1)
   31 CONTINUE
C
      DO 32 I = 1,9
      Y1 = I-1
      Y2 = Y1 * 10.0
      CALL NUMBER (-0.30,Y1,0.10,Y2,00.0,-1)
      CALL SYMBOL (0.0,Y1,0.07,3,0.0,-1)
   32 CONTINUE
C
      DO 33 I = 1,7
      X1 = I - 1
      X2 = X1 * 10.0
```

```
      CALL SYMBOL ( X1,0.0,0.07,3,0.0,-1)
   33 CONTINUE
C
      DO 34 I = 1,9
      Y1 = I - 1
      Y2 = Y1 * 10.0
      CALL SYMBOL (6.0,Y1,0.07,3,0.0,-1)
   34 CONTINUE
C
      XY = 7.5
      DO 35 I = 1,4
      CALL SYMBOL (5.0,XY,0.1,STA(I),0.0,3)
      CALL NUMBER (5.5,XY,0.1,X(I),0.0,2)
      XY = XY - 0.2
   35 CONTINUE
C
C     DRAW SCALE
C
      CALL SYMBOL (4.3,0.55,0.1,'SCALE',0.0,5)
      CALL SYMBOL (4.0,0.15,0.1,'1 IN = 10 KM',0.0,12)
      DO 36 I = 1,11
      XI = I - 1
      XI = XI / 10.0 + 3.5
      CALL SYMBOL (XI,0.40,0.04,3,0.0,-1)
   36 CONTINUE
C
      CALL PLOT (4.0,0.4,3)
      DO 37 I = 1,5
      XI = I - 1
      XI = XI / 2.+ 3.5
      CALL SYMBOL (XI,0.40,0.14,3,0.0,-2)
   37 CONTINUE
C
      CALL SYMBOL (-.45,3.00,0.15,'KILOMETERS',90.0,10)
      CALL SYMBOL (2.0,-.6,0.15,'KILOMETERS',0.0,10)
C
      CALL SYMBOL (2.05,1.0,0.15,3,0.0,-1)
      CALL SYMBOL (2.05,0.8,0.1,'34.00 N',0.0,7)
      CALL SYMBOL (2.05,0.6,0.1,'107.00 W',0.0,8)
C
      DO 110 M = 1,4
      MN = Y(M)
      IF (MN.EQ.0) GO TO 110
      TRTIM = X(M) - XINT
      IF (M.EQ.2) TRTIM = X(M)-XINT-0.66
      R = VP * TRTIM
C
      CALL EPICTR (STA,U,V,R,M)
C
  110 CONTINUE
C
      CALL PLOT (0.0,0.0,3)
      CALL PLOT (0.0,0.0,999)
C
      RETURN
      END

MEMORY REQUIREMENTS 000938 BYTES
```

```
      SUBROUTINE EPICTR(STA,X,Y,R,M)
      IMPLICIT REAL*8(A-H,O-Z), INTEGER(I-N)
      INTEGER STA(4), IDEN (4,4)
      DIMENSION X(4),Y(4),XR(361),YR(361)
C
C
C                     PLOTS STATIONS & DRAWS CIRCLES
C
C
      XXI  = X(M) + 0.15
      XXII = XXI -0.15
      YYI  = Y(M) -0.05
      YYII = YYI + 0.05
      CALL PLOT (XXI,YYI,3)
      CALL SYMBOL(XXI,YYI,.10,STA(M),0.0,3)
      PTX1 = XXII - .05
      PTX2 = XXII + .05
      PTY1 = YYII - .05
      PTY2 = YYII + .05
      CALL PLOT(PTX1,PTY1,3)
      CALL PLOT(PTX2,PTY1,2)
      CALL PLOT(XXII,PTY2,2)
      CALL PLOT(PTX1,PTY1,2)
      CALL CIRC (R,XR,YR)
      DO 150 K=1,181
      XR(K) = X(M) + XR(K)
      YR(K) = Y(M) + YR(K)
      IF(XR(K).GT.06.0)XR(K)=6.0
      IF(XR(K).LT.0.0)XR(K)=0.0
      IF(YR(K).GT.08.0)YR(K)=8.0
      IF(YR(K).LT.0.0)YR(K)=0.0
      IF(K.GT.1)GO TO 160
      CALL PLOT(XR(K),YR(K),3)
      GO TO 150
  160 CONTINUE
      CALL PLOT(XR(K),YR(K),2)
  150 CONTINUE
      RETURN
      END

MEMORY REQUIREMENTS 001C44 BYTES


      SUBROUTINE CIRC (R,XCR,YCR)
      IMPLICIT REAL*8(A-H,O-Z), INTEGER(I-N)
      DIMENSION XCR(361),YCR(361)
      DELTA = 0.0
      PI=3.14159265
      KKK = 181
      STP=(2.0*PI)/180.0
      R = R * 0.1
      DO 1 J=1,KKK
      XCR(J)= R*DCOS(DELTA)
      YCR(J)= R*DSIN(DELTA)
    1 DELTA = DELTA + STP
      RETURN
      END
```

```
MEMORY REQUIREMENTS 000294 BYTES


      SUBROUTINE GRAPH (X,Y,SLOPE,XINT,STA)
      IMPLICIT REAL*8(A-H,O-Z), INTEGER(I-N)
      INTEGER STA(4), IDEN (4,4)
      DIMENSION X(4),Y(4)
C
C
C                    PLOTS P ARRIVAL VS S-P
C
C
      CALL SYMBOL (-0.55,2.0,0.15,'S - P IN SECONDS',90.0,16)
      CALL SYMBOL(2.,-0.7,0.15,'P ARRIVAL TIME',0.0,14)
C
C     LABEL STATIONS
C
      XY = 7.5
      DO 5 I = 1,4
      J = I - 1
      CALL SYMBOL (5.0,XY,0.1,STA(I),0.0,3)
      CALL SYMBOL (5.5,XY,0.1,J,0.0,-1)
      XY = XY - 0.?
    5 CONTINUE
C
C     PLOT POINTS
C
      DO 10 I = 1,4
      MN = X(I)
      IF (MN.EQ.0) GO TO 10
      J = I - 1
      XX = XINT
      XX = X(I) - XX
      YY = Y(I)
      XX = XX * 0.5
      YY = YY * 0.5
      IF (XX.GT.6.0) GO TO 10
      IF (YY.GT.6.0) GO TO 10
      CALL SYMBOL (XX,YY,0.1,J,0.0,-1)
   10 CONTINUE
C
      CALL PLOT (0.0,0.0,3)
C
C     PLOT LINE
C
      DELX = 0.01
      XX = 0.0
      DO 20 I = 1,600
      YY = XX * SLOPE
      XX = XX + DELX
      IF (XX.GT.6.0) GO TO 20
      IF (YY.GT.6.0) GO TO 20
      CALL PLOT (XX,YY,2)
   20 CONTINUE
C
C     LABEL THE AXIS
C
      CALL NUMBER (0.0,-0.45,0.10,XINT,90.0,2)
```

```
      CALL SYMBOL (0.0,0.0,0.07,3,0.0,-1)
      IJK = 0
      DO 30 I = 1,4
      MN = X(I)
      IF (MN.EQ.0) GO TO 30
      XX = XINT
      XX = X(I) - XX
      YY = Y(I)
      XX = XX *0.5
      YY = YY * 0.5
      IF (XX.GT.6.0) GO TO 25
      IF (YY.GT.6.0) GO TO 25
      CALL NUMBER (XX,-0.45,0.10,X(I),90.0,2)
      CALL SYMBOL (XX,0.0,0.07,3,0.0,-1)
      GO TO 30
   25 CONTINUE
      IF (IJK.EQ.1) GO TO 30
      IJK = 1
      XY = 7.5
      DO 27 J = 1,4
      CALL NUMBER (3.0,XY,0.1,X(J),0.0,2)
      CALL NUMBER (4.0,XY,0.1,Y(J),0.0,2)
      XY = XY -0.2
   27 CONTINUE
   30 CONTINUE
C
      DO 40 I = 1,4
      MN = X(I)
      IF (MN.EQ.0) GO TO 40
      YY = Y(I)
      YY = YY * 0.5
      IF (YY.GT.6.0) GO TO 40
      CALL NUMBER (-0.40,YY,0.10,Y(I),0.0,2)
      CALL SYMBOL (0.0,YY,0.07,3,0.0,-1)
   40 CONTINUE
C
C     DRAW SCALE
C
      CALL SYMBOL (4.1,0.55,0.1,'SCALE',0.0,5)
      CALL SYMBOL (3.7,0.15,0.1,'1 IN = 2 SEC',0.0,12)
C
      DO 50 I = 1,11
      XI = I - 1
      XI = XI/10.0 + 3.5
      CALL SYMBOL (XI,0.4,0.04,3,0.0,-1)
   50 CONTINUE
C
      CALL PLOT (4.0,0.4,3)
      DO 60 I = 1,5
      XI = I - 1
      XI = XI/02.0 + 3.5
      CALL SYMBOL (XI,0.4,0.14,3,0.0,-2)
   60 CONTINUE
C
      CALL PLOT (0.0,0.0,999)
C
      RETURN
      END
```

PROGRAM II

```
      INTEGER IDEN(50,4)
      DIMENSION S(50,4), DIF(50,6)
C
      PRINT 14
      PRINT 16
      PRINT 17
C
      I=1
    2 READ (5,1,END=50)(IDEN(I,J),J=1,4),(S(I,J),J=1,4)
      WRITE (6,3)       (IDEN(I,J),J=1,4),(S(I,J),J=1,4)
      I = I + 1
      GO TO 2
    1 FORMAT (4A4,4(1X,F4.1))
    3 FORMAT ((20X,4A4,4(2X,F4.1)))
C
   50 CONTINUE
      PRINT 14
      PRINT 15
C
      NUMB = I - 1
C
      DO 10 I = 1,NUMB
C
      DIF(I,1) = S(I,2) - S(I,1)
      DIF(I,2) = S(I,3) - S(I,1)
      DIF(I,3) = S(I,4) - S(I,1)
      DIF(I,4) = S(I,3) - S(I,2)
      DIF(I,5) = S(I,4) - S(I,2)
      DIF(I,6) = S(I,4) - S(I,3)
C
      IF (S(I,2).EQ.0.0.OR.S(I,1).EQ.0.0)DIF(I,1) = 0.0
      IF (S(I,3).EQ.0.0.OR.S(I,1).EQ.0.0)DIF(I,2) = 0.0
      IF (S(I,4).EQ.0.0.OR.S(I,1).EQ.0.0)DIF(I,3) = 0.0
      IF (S(I,3).EQ.0.0.OR.S(I,2).EQ.0.0)DIF(I,4) = 0.0
      IF (S(I,4).EQ.0.0.OR.S(I,2).EQ.0.0)DIF(I,5) = 0.0
      IF (S(I,4).EQ.0.0.OR.S(I,3).EQ.0.0)DIF(I,6) = 0.0
C
      WRITE (6,20) (IDEN(I,J),J=1,4),(DIF(I,L),L=1,6)
C
C
   14 FORMAT (1H1)
   15 FORMAT(13X,'DATE',12X,'S2-1    S3-1   S4-1   S3-2   S4-2   S4-3'/)
   16 FORMAT (22X,'DATE',17X,'P ARRIVAL TIME'/)
   17 FORMAT  (39X,'SNM   SRM   SBB   SCC'/)
   20 FORMAT ((10X,4A4,6(2X,F5.1)))
C
   10 CONTINUE
      PRINT 14
      STOP
      END
```

```
EMORY REQUIREMENTS 001160 BYTES

IGHEST SEVERITY CODE WAS   0
OADER                                                    00.00.07

IEST SEVERITY WAS   0  --  EXECUTION
```

P R O G R A M III

```
      CALL BORDER
C
      K = 1
      CALL PLOT (0.0,4.0,-3)
C
    1 READ (5,10,END=2) XMO,DA,HR,XMIN,SEC,VP,JJJ,XMAG
C     WRITE   (6,10)    XMO,DA,HR,XMIN,SEC,VP,JJJ,XMAG
   10 FORMAT (5(1X,F4.1),1X,F4.2,2X,I1,3X,F4.2)
C
C
      IF (JJJ.EQ.0) PRINT 12
   12 FORMAT ('JJJ = 0')
C
      IF (JJJ) 3,4,3
    3 X =(XMO*30. + DA + HR/24. + XMIN/1440. + SEC/86400.)*6./60.
      Y =(VP * SQRT(3.0)/5.8*2.0) -1.5
C     WRITE (6,11) X,Y
   11 FORMAT (2(2X,F4.2))
      GO TO (20,30),JJJ
   20 CALL SYMBOL(X,Y,0.07,3,0.0,-K)
C
      IF (XMAG.LT.0.1) GO TO 25
      X1 = X + 0.1
      YMAG = XMAG
      XMAG = XMAG / 2.0
      IF (YMAG.LT.0.3) GO TO 24
      CALL NUMBER (X1,XMAG,0.07,YMAG,0.0,1)
   24 CALL PLOT (X,0.0,3)
      CALL PLOT (X,XMAG,2)
      CALL PLOT (X,Y,3)
C
   25 K = 2
      GO TO 2
   30 CALL PLOT (0.0,-4.0,-3)
      IF (XMAG.LT.0.1) GO TO 35
      X1 = X + 0.1
      YMAG = XMAG
      XMAG = XMAG / 2.0
      IF (YMAG.LT.0.3) GO TO 34
      CALL NUMBER (X1,XMAG,0.07,YMAG,0.0,1)
   34 CALL PLOT (X,0.0,3)
      CALL PLOT (X,XMAG,2)
   35 CALL PLOT (X,Y,3)
      CALL SYMBOL(X,Y,0.07,3,0.0,-2)
    2 IF (JJJ) 1,4,1
    4 CALL PLOT (0.0,0.0,999)
      STOP
      END

MEMORY REQUIREMENTS 0005b8 BYTES


      SUBROUTINE BORDER
      CALL PLOT (0.0,0.0,999)
      CALL PLOT (0.0,0.0,3)
      CALL PLOT (0.0,11.0,2)
      CALL PLOT (8.5,11.0,2)
      CALL PLOT (8.5,0.0,2)
```

```
      CALL PLOT (0.0,0.0,2)
      CALL PLOT (2.0,2.5,-3)
      CALL PLOT (0.0,8.0,2)
      CALL PLOT (6.0,8.0,2)
      CALL PLOT (6.0,0.0,2)
      CALL PLOT (0.0,0.0,2)
      CALL PLOT (0.0,4.0,3)
      CALL PLOT (6.0,4.0,2)
      CALL PLOT (9.0,0.0,3)
C
C
C
C
      DO 10 I = 1,2
      Y = I
      YY = Y * 2.0 - 1.5
      CALL NUMBER (-0.3,YY,0.1,Y,0.0,-1)
      CALL SYMBOL (0.0,YY,0.07,3,0.0,-1)
      XY = YY + 1.0
      IF (I.EQ.1) CALL SYMBOL (0.0,XY,0.07,3,0.0,-1)
   10 CONTINUE
C
C
      DO 15 I = 1,2
      Y = I
      YY = Y * 2.0 - 1.5
      YY = YY + 4.0
      CALL NUMBER (-0.3,YY,0.1,Y,0.0,-1)
      CALL SYMBOL (0.0,YY,0.07,3,0.0,-1)
      XY = YY + 1.0
      IF (I.EQ.1) CALL SYMBOL (0.0,XY,0.07,3,0.0,-1)
   15 CONTINUE
C
C
      YY = -0.3
      DO 20 I =1,4
      DO 20 J =1,6
      X = J - 1
      XX = X / 2.0
      X = X * 5.0
      IF (I.EQ.2.OR.I.EQ.4) XX = XX + 3.0
      IF (I.EQ.3.OR.I.EQ.4) YY = 3.7
      CALL NUMBER (XX,YY,0.1,X,0.0,-1)
   20 CONTINUE
C
C
      YY = 0.0
      DO 25 I =1,2
      IF (I.EQ.2) YY = 4.0
      DO 25 J = 1,61
      X = J - 1
      XX = X / 10.0
      CALL SYMBOL (XX,YY,0.07,3,0.0,-1)
   25 CONTINUE
C
C
      DO 40 I = 1,4
      GO TO (31,32,33,34),I
   31 CALL SYMBOL (1.0,-0.6,0.15,'MAY',0.0,3)
      GO TO 40
```

```
   32 CALL SYMBOL (4.0,-0.6,0.15,'JUNE',0.0,4)
      GO TO 40
   33 CALL SYMBOL (1.0,3.4,0.15,'MARCH',0.0,5)
      GO TO 40
   34 CALL SYMBOL (4.0,3.4,0.15,'APRIL',0.0,5)
   40 CONTINUE
C
C
      X = 1.8
      DO 50 I = 1,2
      IF (I.EQ.2) X = X + 4.0
      CALL SYMBOL (-0.6, X ,0.15,'V',90.0,1)
      CALL SYMBOL (-0.6,-0.,0.07,'P',90.0,1)
      CALL SYMBOL (-0.6,-0.,0.15,'/V',90.0,2)
      CALL SYMBOL (-0.6,-0.,0.07,'S',90.0,1)
   50 CONTINUE
C
C
      RETURN
      END

MEMORY REQUIREMENTS 0003F0 BYTES

HIGHEST SEVERITY CODE WAS  0
                                                                    00.00.1
```

Date	SNM		SRM		SBB		SCC		SNM	SRM	SBB	SCC
1/7 - 13:35	2.85	F	3.16	P					7.345	5.95		
1/11 - 20:40	2.125	P	2.56	P					4.45	5.95		
2/12 - 05:17	2.25	P	1.78	F	2.34	P			5.00	3.11	7.09	
2/13 - 08:36	2.50	F	2.875	F	3.54	F			7.50	4.75		
3/2 - 11:35	2.25	P	2.89	F	3.53	P			6.75	4.66	6.76	
3/17 - 06:40	2.325	F	2.80	F	3.61	F	3.53	G	7.00	4.13	7.36	6.9
3/17 - 08:39	2.25	F	2.81	F	3.36	P	3.54	F	7.00	4.17	7.44	7.02
3/17 - 17:05	2.25	F	3.82	F	3.33	F	3.59	P	7.00	4.89	7.33	6.92
3/18 - 07:20	2.25	G	2.89	G	3.84	P	3.55	P	7.125	4.83	7.53	6.97
3/18 - 16:35	2.375	F	3.85	F	3.64	F	3.63	F	7.35	5.37?	7.87	6.89
3/20 - 04:34	2.4125	F	2.80	F	3.43	G	3.59	G	7.25	4.54	7.27	7.1
3/25 - 15:32	2.75	F			3.47	G	3.84	G	7.125		7.63	6.7
3/28 - 09:02	2.20	F	2.82	F	2.2	P			7.00	4.77	6.44	
3/30 - 02:51	3.25	F	1.96	P	3.40	P			7.25	4.25	6.68	
4/13 - 06:29	3.80	P	1.94	P						4.13		

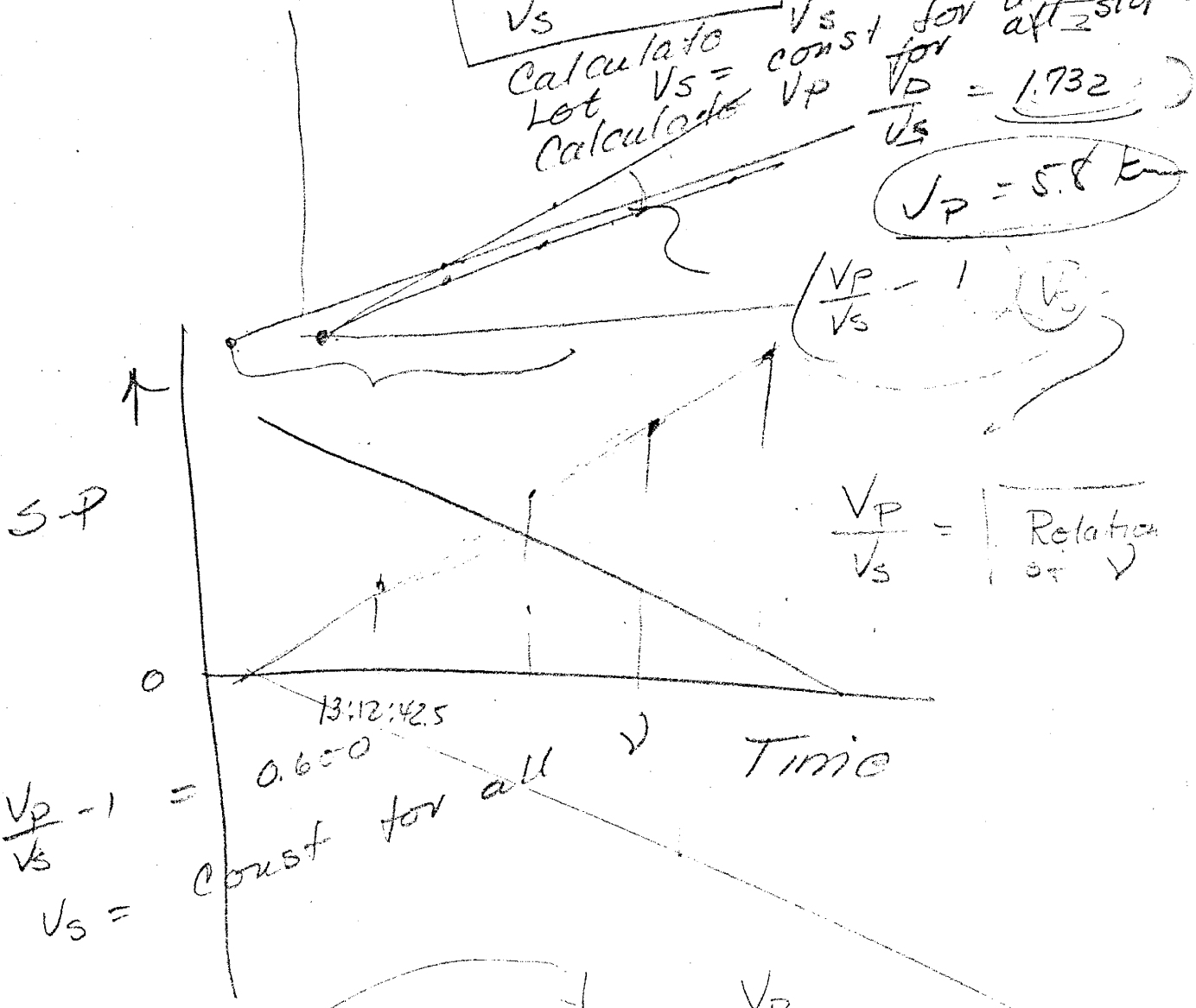
Date	SNM		SRM		SBB		SCC		SNM	SRM	SBB	SCC
4/17 - 03:06	2.25	F	2.79	F			3.72	F	7.25	4.46		7.1
4/18 - 02:44	2.50	F	2.81	F			3.76	F	7.00	4.55		7.14
4/18 - 04:11	3.00	VP	2.88	P			3.80	F	7.75	4.87		7.06
4/18 - 07:34	2.575	G	2.74	P			3.66	G	7.25	4.32		7.30
4/18 - 09:05	2.575	G	2.80	F			3.11	VP	7.19			8.8 ?
4/18 - 09:12	2.50	F	2.80	F			4.04	G	7.125	4.52		7.125
4/18 - 01:29	2.50	P	2.89	P			4.09	F	7.00			7.17
4/18 - 19:18	2.50	P	2.81	P			3.59		6.87	4.79		7.05
5/5 - 22:44	2.30	P	2.89	P	3.62		3.53	F	7.1	4.67	6.92	
5/5 - 22:44	2.50	P	3.12	F			3.33		7.25	4.89		
5/5 - 23:03	2.175	G	3.10	P	3.72	F	3.62	G	7.00	4.25	7.05	7.16
5/11 - 08:07	3.125	G	2.85	P					7.00	4.67		
5/13 - 02:31	2.45	F	2.92	F			3.66	F	6.875	4.83		6.98
6/1 - 12:23	2.425	G	2.87	P						5.42		
6/1 - 15:36	2.50	F	2.83	F			4.10	F	7.50	5.42		6.88

Date	SBM	SRM	SBB	SCC	SBM	SRM	SBB	SCC
6/1 - 22:19	2.375	P 2.67 F		3.58 F	7.175	5.375		7.14
6/2 - 00:22	2.45	G 2.67 P		3.56 G	7.375	4.5		7.02
6/2 - 12:24	2.375	F 2.86 P			7.25	4.1		
6/7 - 09:14	2.125	F 2.82 P			6.875	5.40		
6/14 - 04:23	2.475	F 3.04 P		3.19 G	7.125	4.61		7.07
6/14 - 04:31	2.20	F 2.86 P			7.00	4.88		
6/14 - 04:36	2.375	F 2.80 G	3.36 G	3.65 G	7.125	5.39	8.15 ?	7.24
6/14 - 04:36	2.350	F 2.85 F	3.21 G	3.78 G	7.125	5.41	7.5	7.4
6/14 - 07:04	2.375	P 3.11 F	4.15 G	4.13	7.125	5.53	7.7	7.44
6/14 - 09:20	2.625	F 3.26 P	3.575 G		7.5	5.7	7.125	
6/16 - 05:51	2.50	G	3.79 G		7.075		7.27	
6/16 - 16:50	2.425	G 2.89 G		3.53 G	7.125	4.70		7.33
6/17 - 1852	2.25	F 2.92 F			7.00	4.78		
6/23 - 01:33	2.75	F 2.39 P		4.23 G	7.15	3.8		6.74
6/30 - 11:34	2.80	F 3.07 G	3.76 F	3.80 F		5.6	7.26	7.27
7/7 - 02:51	3.375	P	3.68 F	3.71 F	7.00		7.10	7.25
9/27 - 10:36	2.475	G	3.42 G	4.21 P	7.25		6.78	7.24

$\frac{V_P}{V_S} = \sqrt{3}$

Calculate V_S const for all slopes
Let V_S = const for all slopes
Calculate V_P $\frac{V_P}{V_S} = 1.732$

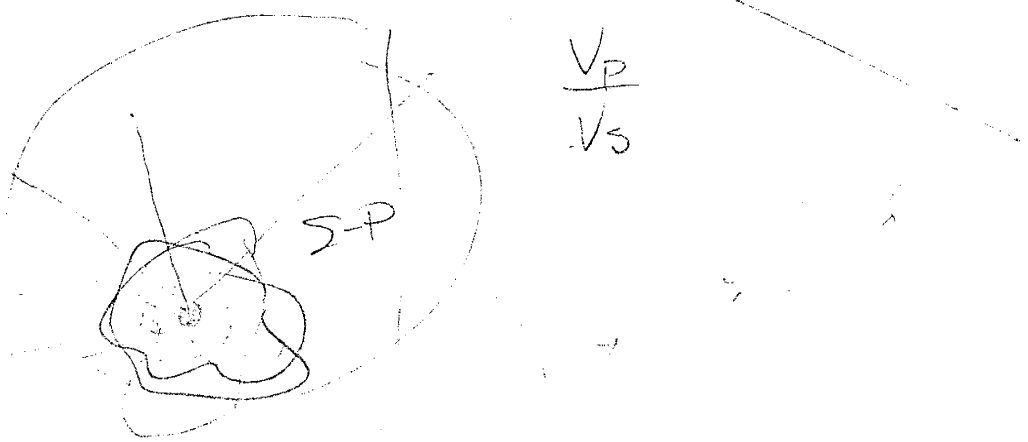
$V_P = 5.8$ km/sec

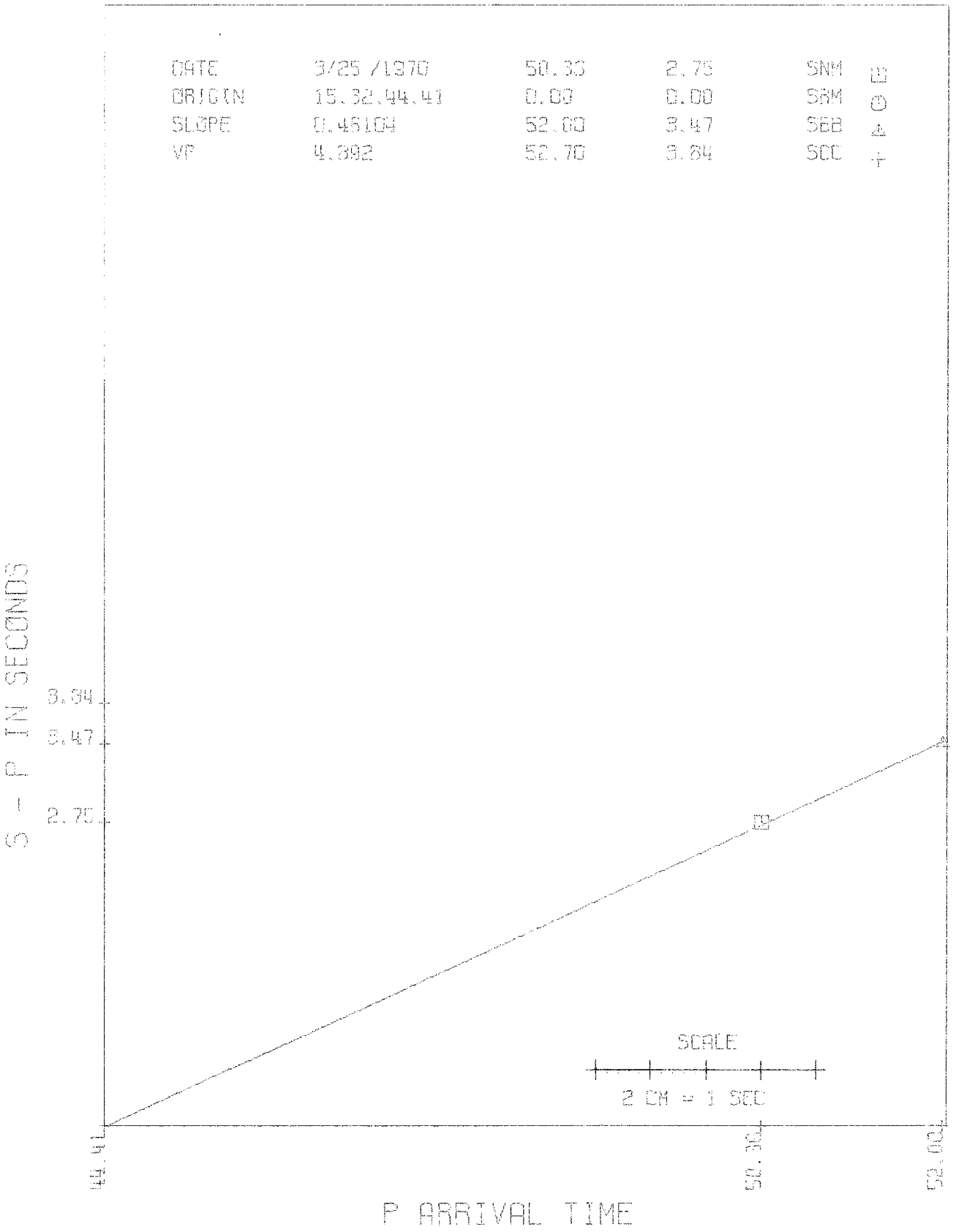


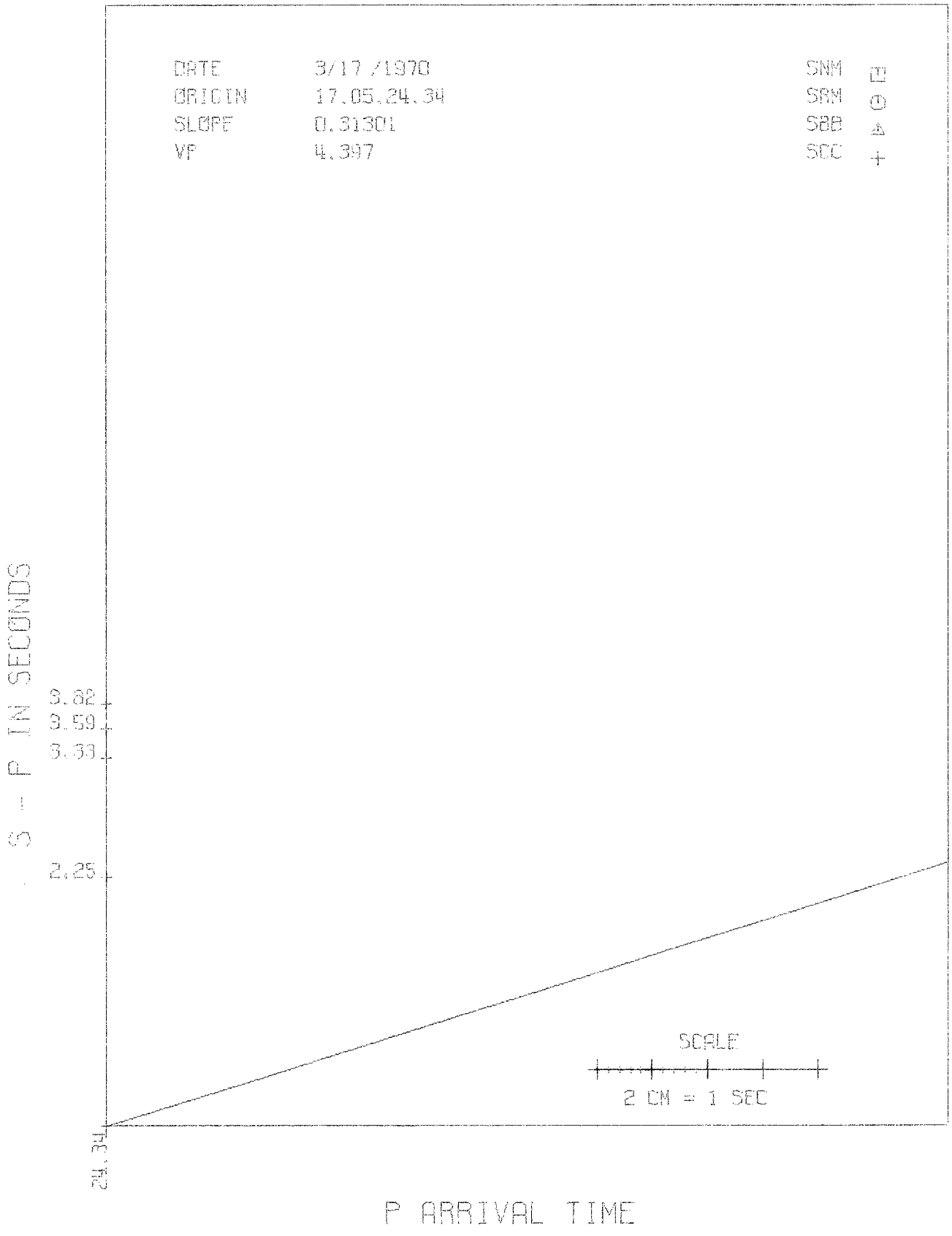
$\frac{V_P}{V_S} =$ Relation of V

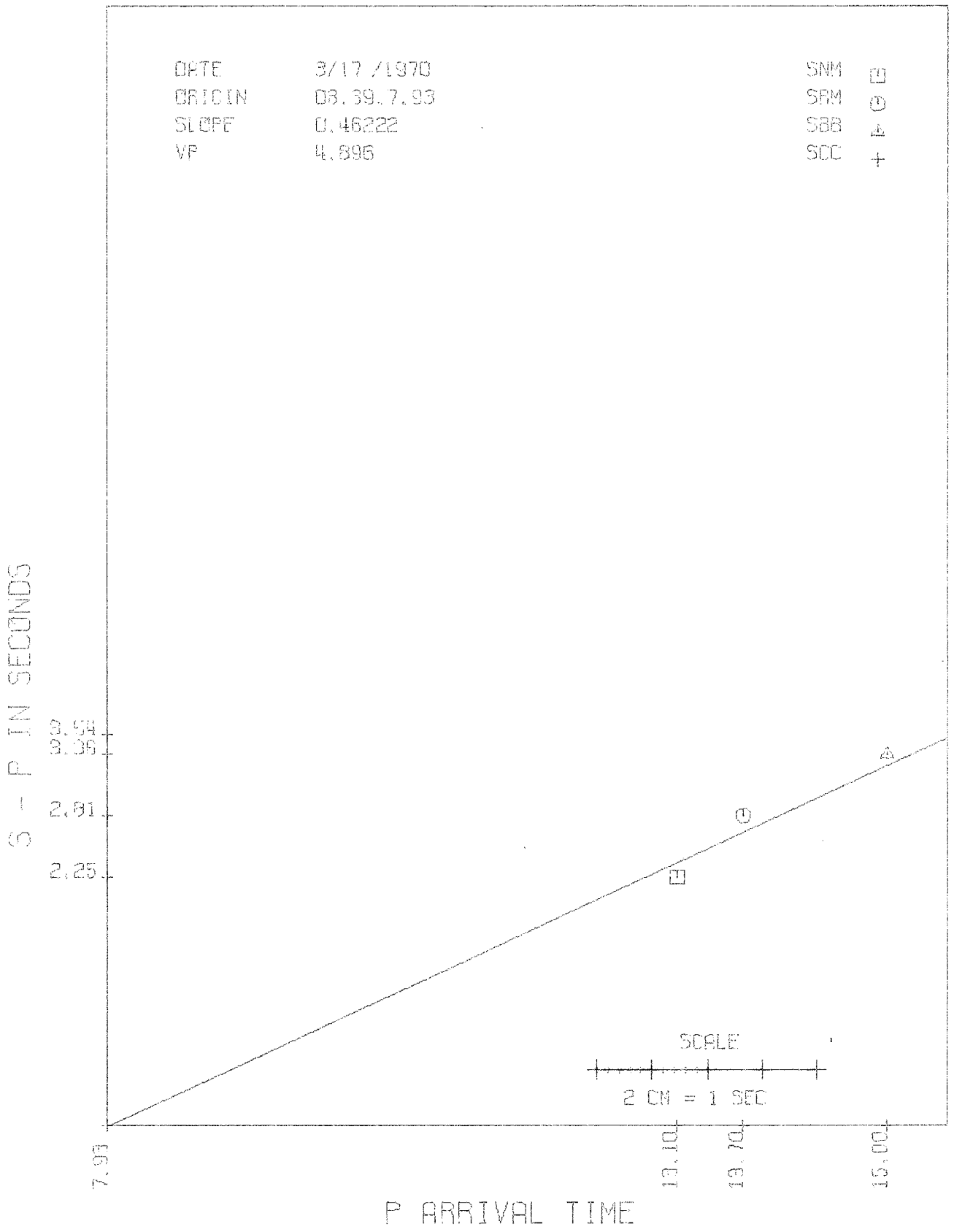
$\frac{V_P}{V_S} - 1 = 0.6 \pm 0$

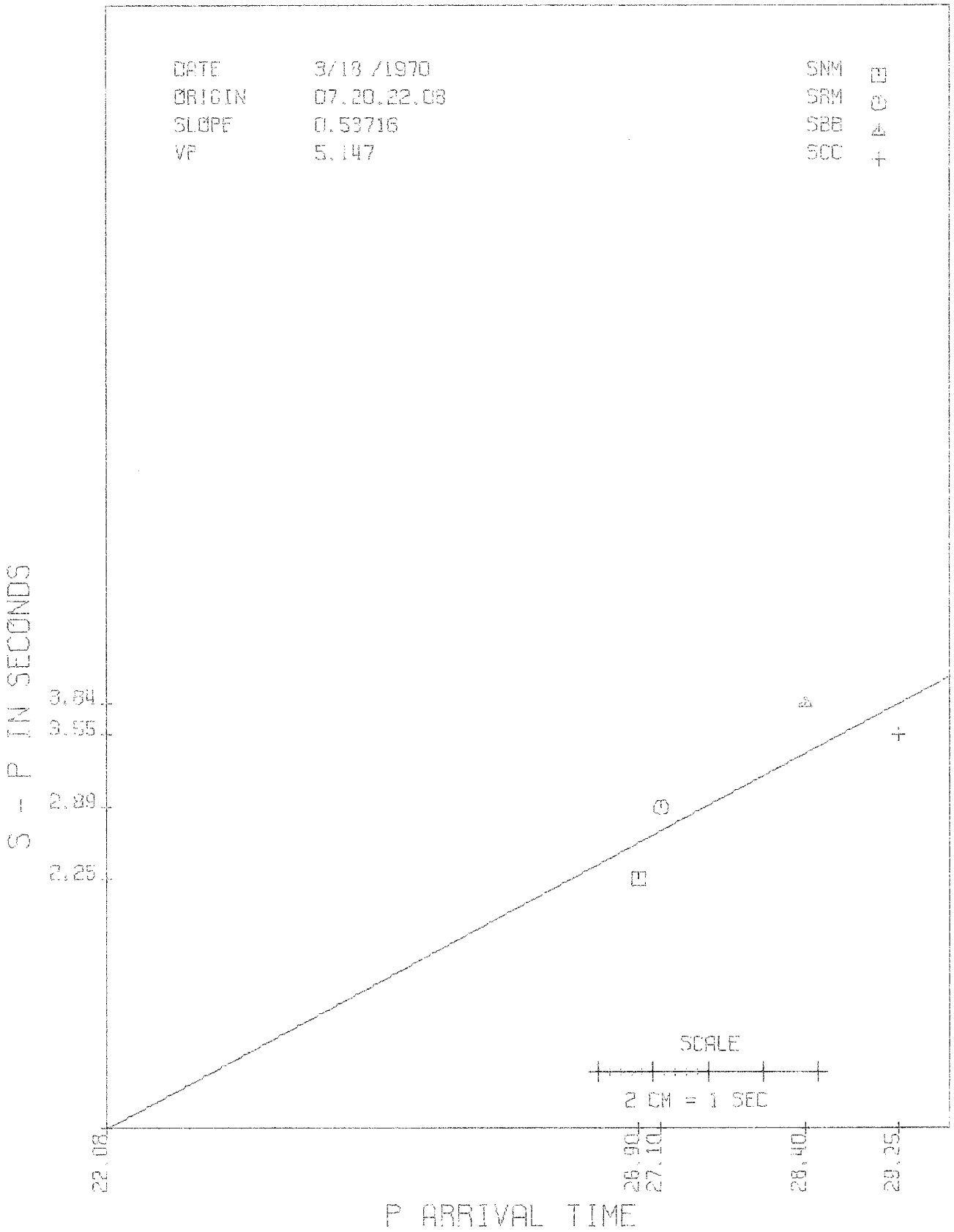
$V_S =$ const for all V

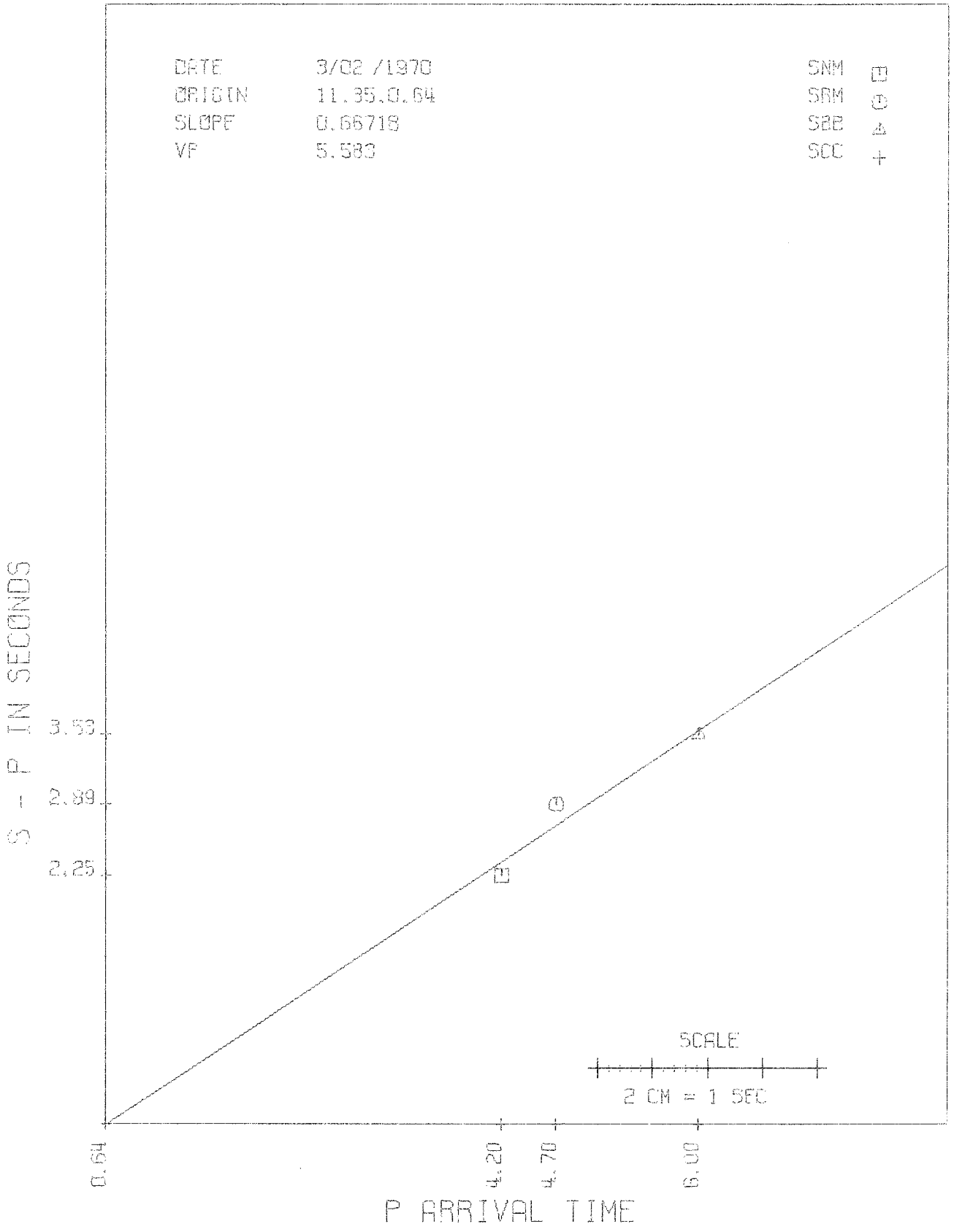



DATE 3/25 /1970 50.33 2.75 SNM
ORIGIN 15.32.44.41 0.00 0.00 SRM
SLOPE 0.46104 52.00 3.47 SEE
VP 4.392 52.70 3.84 SDC
DATA
S - P IN SECONDS
3.84
3.47
2.75
SCALE
2 CM = 1 SEC
44.41
50.33
52.00
P ARRIVAL TIME


DATE 3/17/1970
ORIGIN 17.05.24.34
SLOPE 0.31301
VP 4.397
SNM □
SRM ①
SBB △
SCC +
S - P IN SECONDS
3.82
3.59
3.33
2.25
24.34
SCALE
2 CM = 1 SEC
P ARRIVAL TIME


DATE 3/17/1970
ORIGIN 08.39.7.93
SLOPE 0.46222
VP 4.895
SNM □
SRM ○
SBB △
SCC +
S - P IN SECONDS
3.54
3.36
2.81
2.25
7.05
13.10
19.70
15.00
P ARRIVAL TIME
SCALE
2 CM = 1 SEC


DATE 3/13 /1970
ORIGIN 07.20.22.08
SLOPE 0.53716
VP 5.147
SNM □
SRM ○
S2B △
SCC +
S - P IN SECONDS
3.84
3.55
2.89
2.25
22.08
26.90
27.10
28.40
28.75
P ARRIVAL TIME
SCALE
2 CM = 1 SEC


DATE 3/02 /1970
ORIGIN 11.35.0.64
SLOPE 0.66718
VF 5.583
SNM □
SAM ○
SBB △
SCC +
S - P IN SECONDS
3.53
2.89
2.25
SCALE
2 CM = 1 SEC
0.64
4.20
4.70
6.00
P ARRIVAL TIME

DATE	3/17 /1970	56.70	2.32	SNM
ORIGIN	06.40.51.53	58.60	3.61	SKM
SLOPE	0.46847	59.50	3.53	SBB
VP	4.917	0.00	0.00	SCC

□ ○ △ +

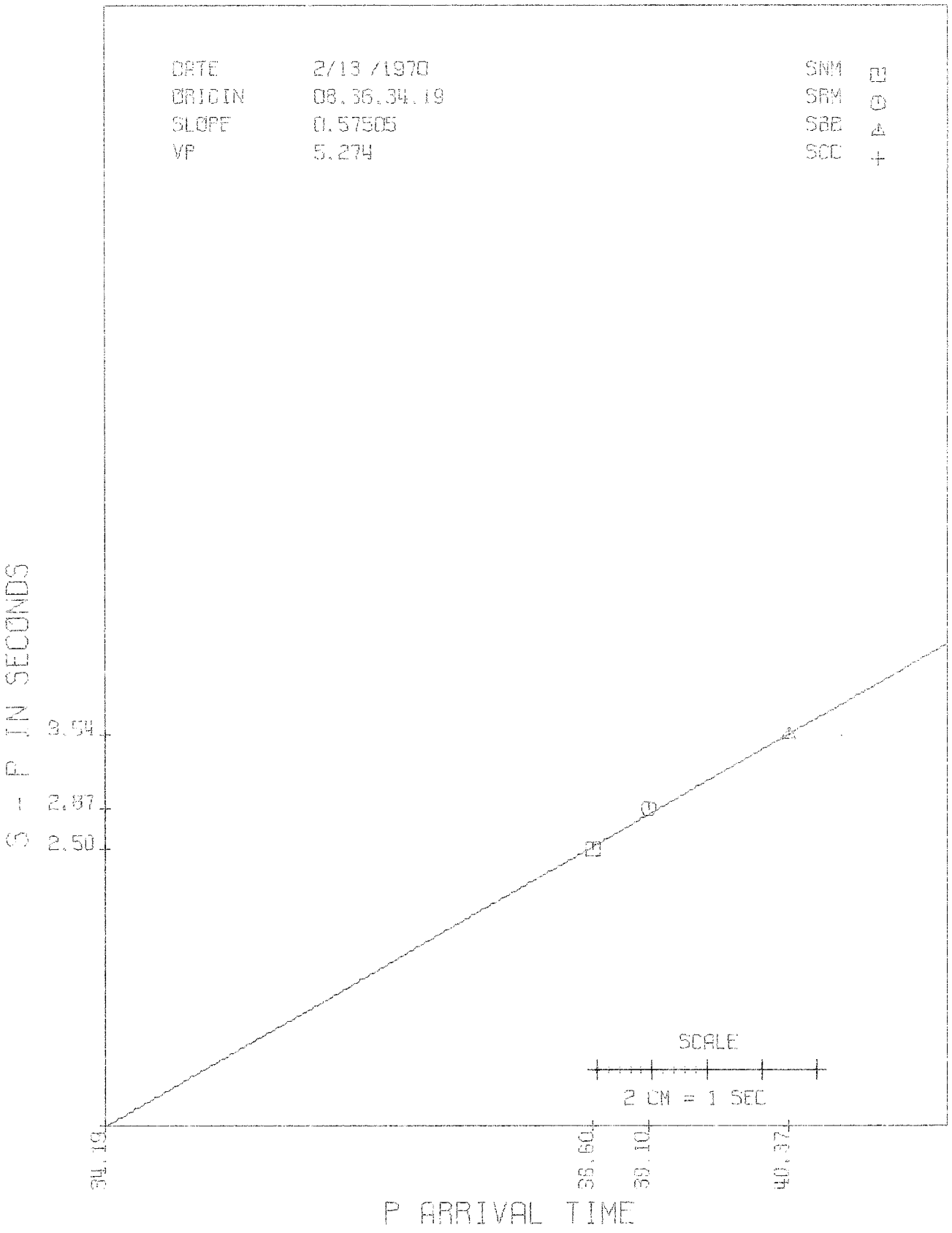
S - P IN SECONDS

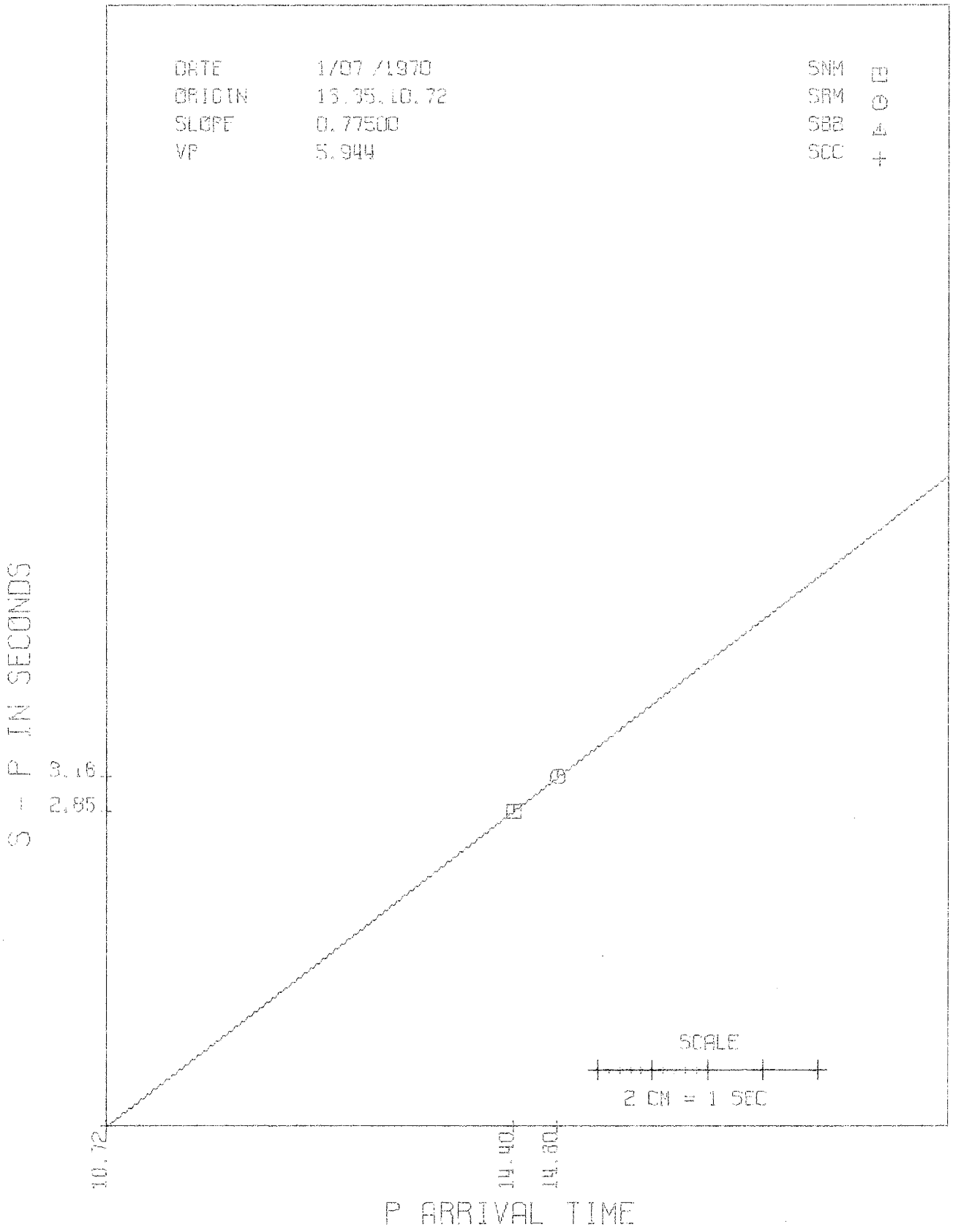
3.61
2.32

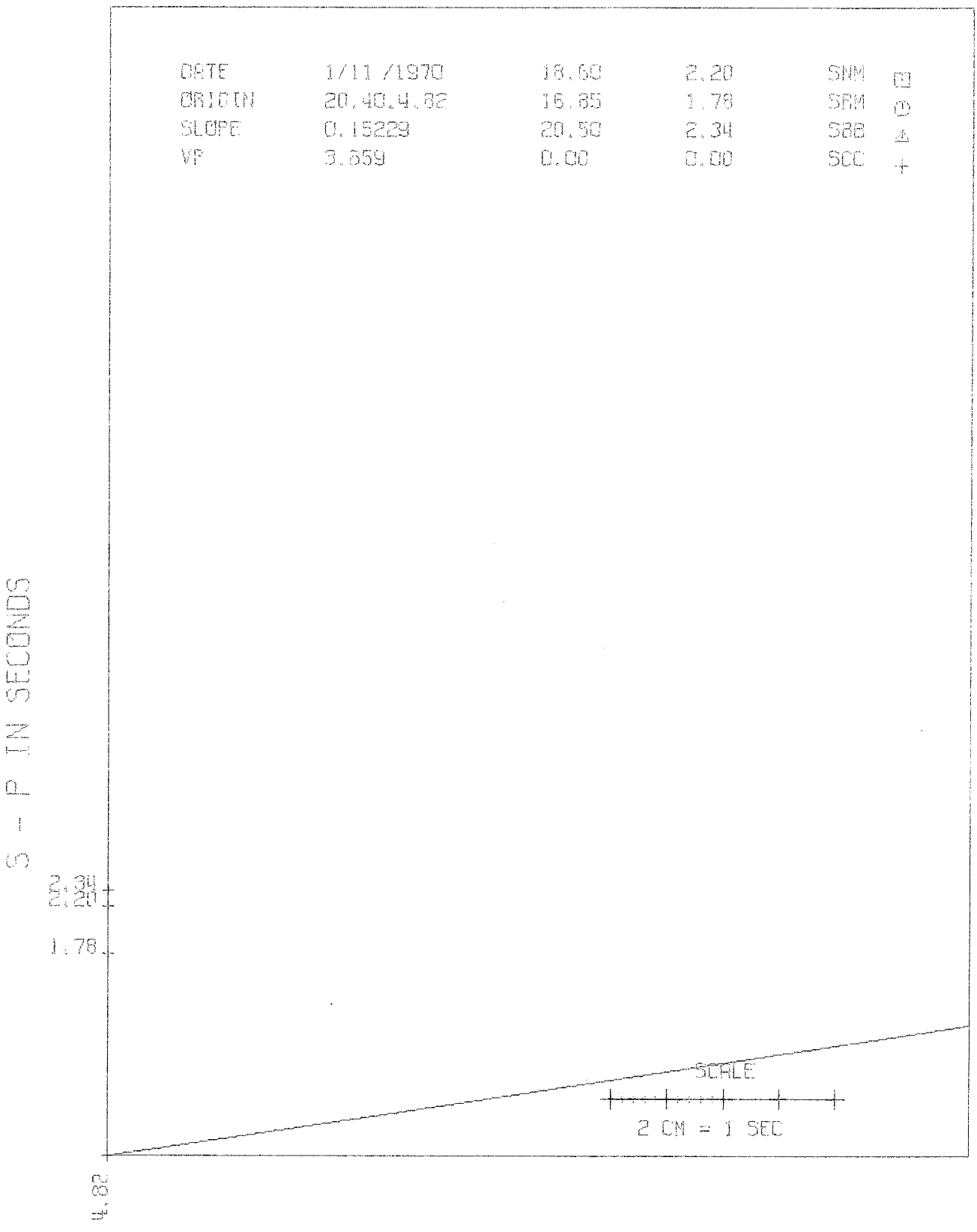
SCALE
2 CM = 1 SEC

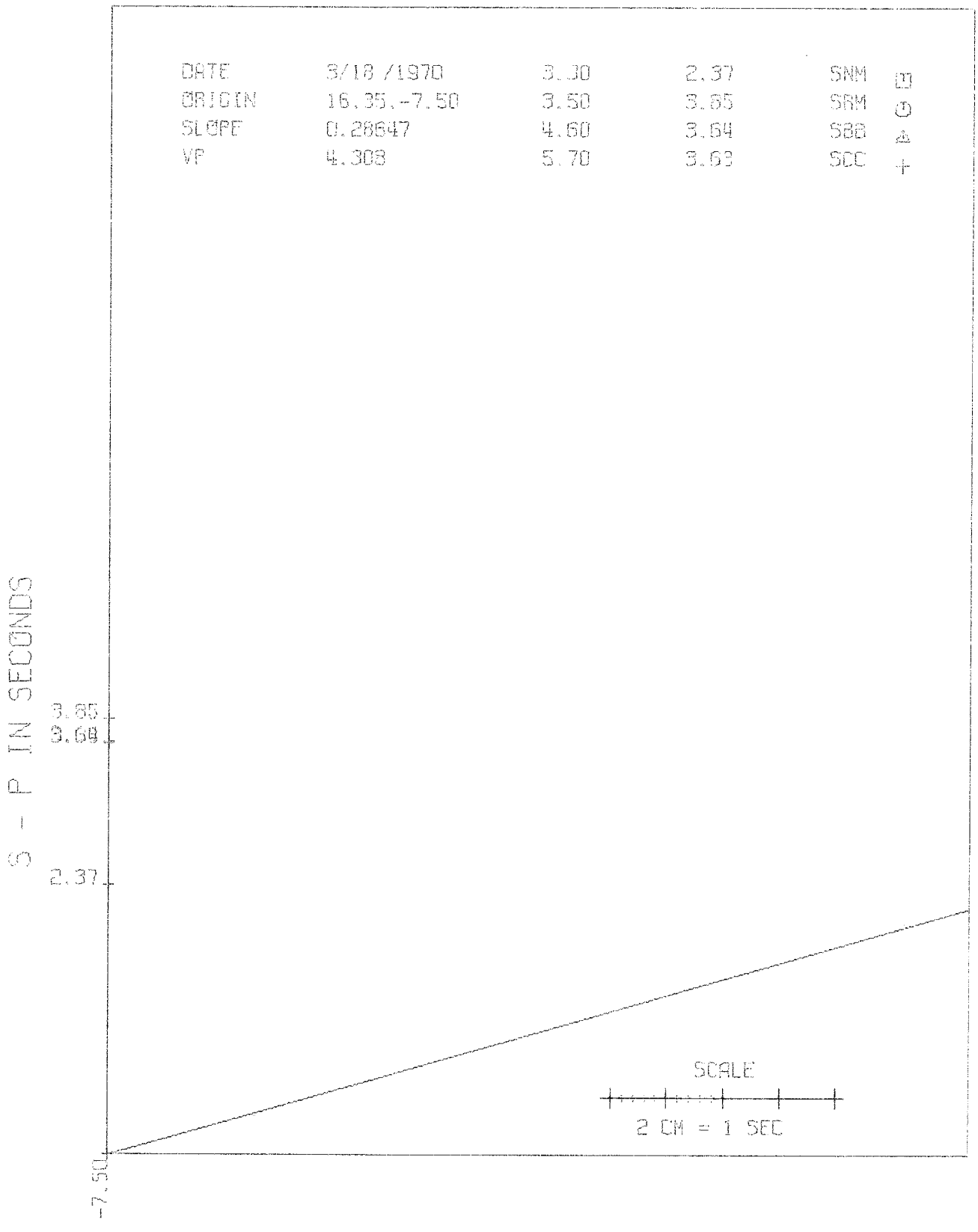
51.53
56.70
58.60

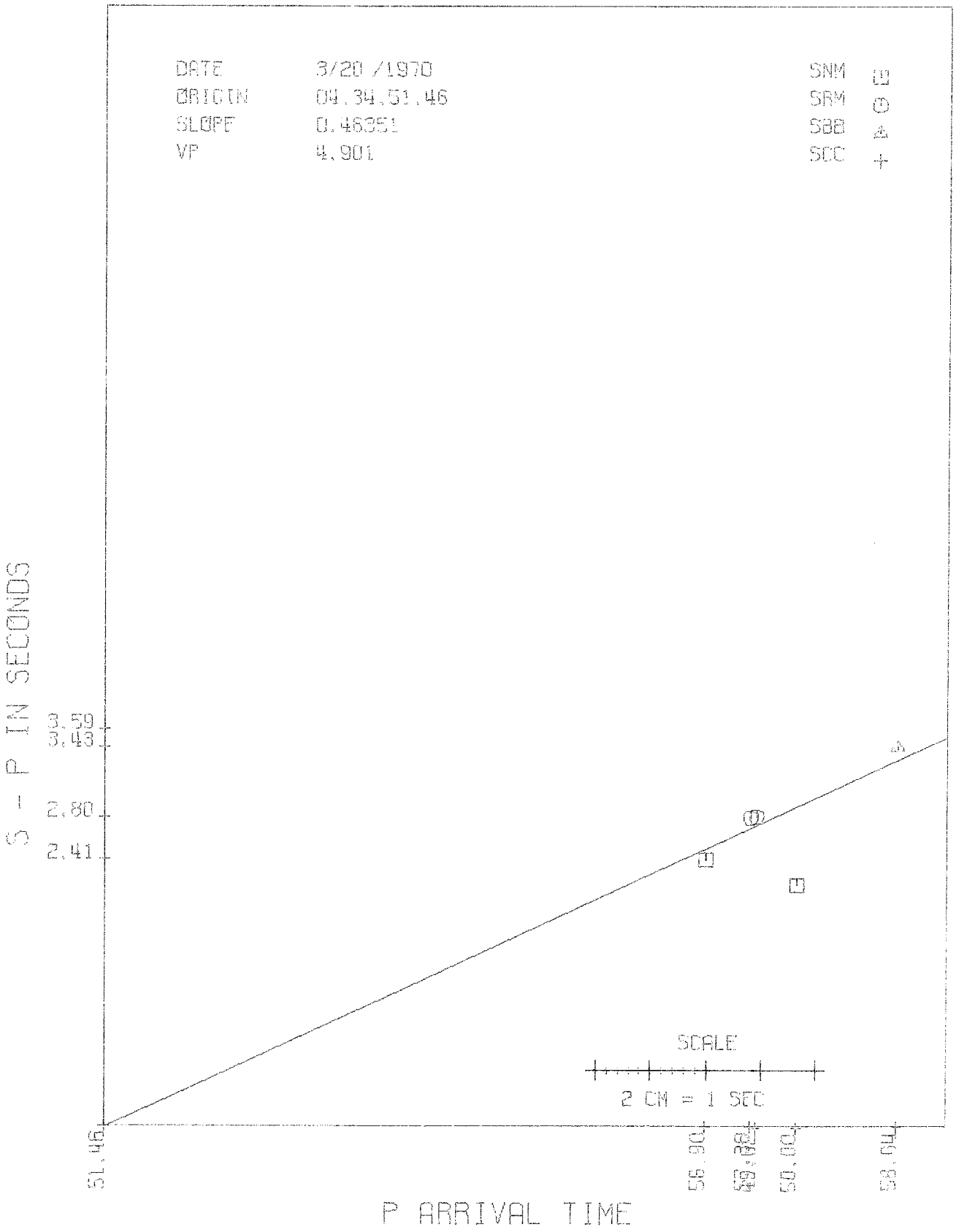
P ARRIVAL TIME

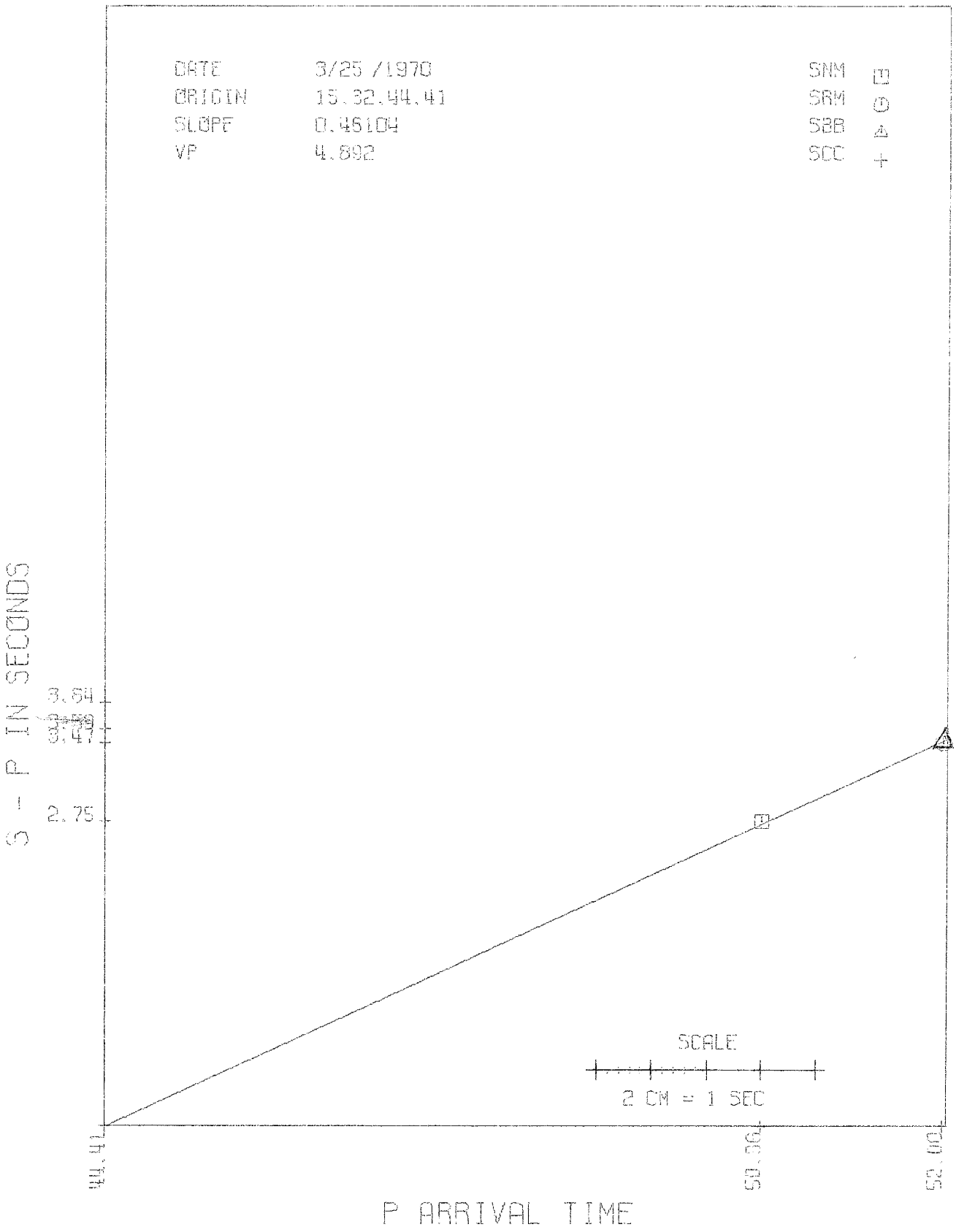

DATE 2/13 /1970
ORIGIN 08.36.34.19
SLOPE 0.575Ø5
VP 5.274
SNM □
SRM ①
SBE △
SCC +
S - P IN SECONDS
3.54
2.87
2.50
SCALE
2 CM = 1 SEC
34.19
38.60
39.10
40.37
P ARRIVAL TIME

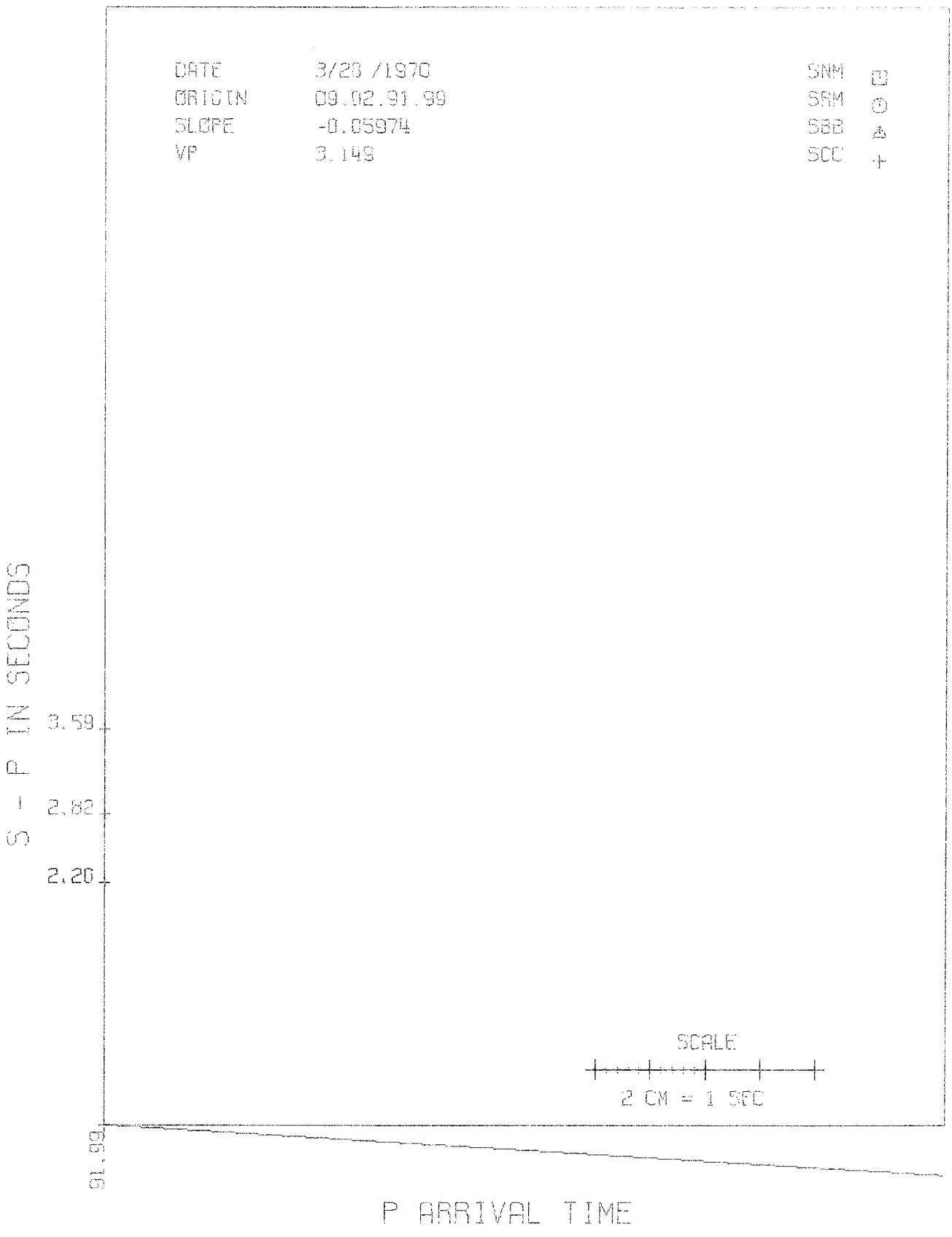

DATE 1/07/1970
ORIGIN 15.35.10.72
SLOPE 0.77500
VP 5.944
SNM
SRM
SBB
SCC
S - P IN SECONDS
3.16
2.85
10.72
14.40
14.80
P ARRIVAL TIME
SCALE
2 CM = 1 SEC


DATE 1/11 /1970 18.60 2.20 SNM
ORIGIN 20.40.4.82 16.85 1.78 SRM
SLOPE 0.15229 20.50 2.34 SBB
VP 3.859 0.00 0.00 SCC
S - P IN SECONDS
2.34
2.20
1.78
4.82
SCALE
2 CM = 1 SEC
P ARRIVAL TIME


DATE 3/18 /1970
ORIGIN 16.35.-7.50
SLOPE 0.28647
VP 4.308
3.30 2.37
3.50 3.65
4.60 3.64
5.70 3.63
SNM
SRM
SBB
SCC
S - P IN SECONDS
3.65
3.60
2.37
-7.50
SCALE
2 CM = 1 SEC
P ARRIVAL TIME


DATE 3/20 /1970
ORIGIN 04.34.51.46
SLOPE 0.46351
VP 4.901
SNM
SRM
SBB
SCC
S - P IN SECONDS
3.59
3.43
2.80
2.41
51.46
56.00
55.00
54.00
53.00
SCALE
2 CM = 1 SEC
P ARRIVAL TIME


DATE 3/25 /1970
ORIGIN 15.32.44.41
SLOPE 0.46104
VP 4.892
SNM
SRM
SBB
SCC
3.64
3.47
2.75
S - P IN SECONDS
SCALE
2 CM = 1 SEC
44.41
50.00
55.35
P ARRIVAL TIME


DATE 3/28 /1970
ORIGIN 09.02.91.99
SLOPE -0.05974
VP 3.149
SNM
SRM
SSB
SCC
S - P IN SECONDS
3.59
2.82
2.20
SCALE
2 CM = 1 SEC
91.99
P ARRIVAL TIME

47.70 45.00 55.50

2.20
1.96

DATE	3/30 /1970	SNM	□
ORIGIN	02.51.48.46	SRM	○
SLOPE	-4.30000	SBB	△
VP	-11.050	SCC	+

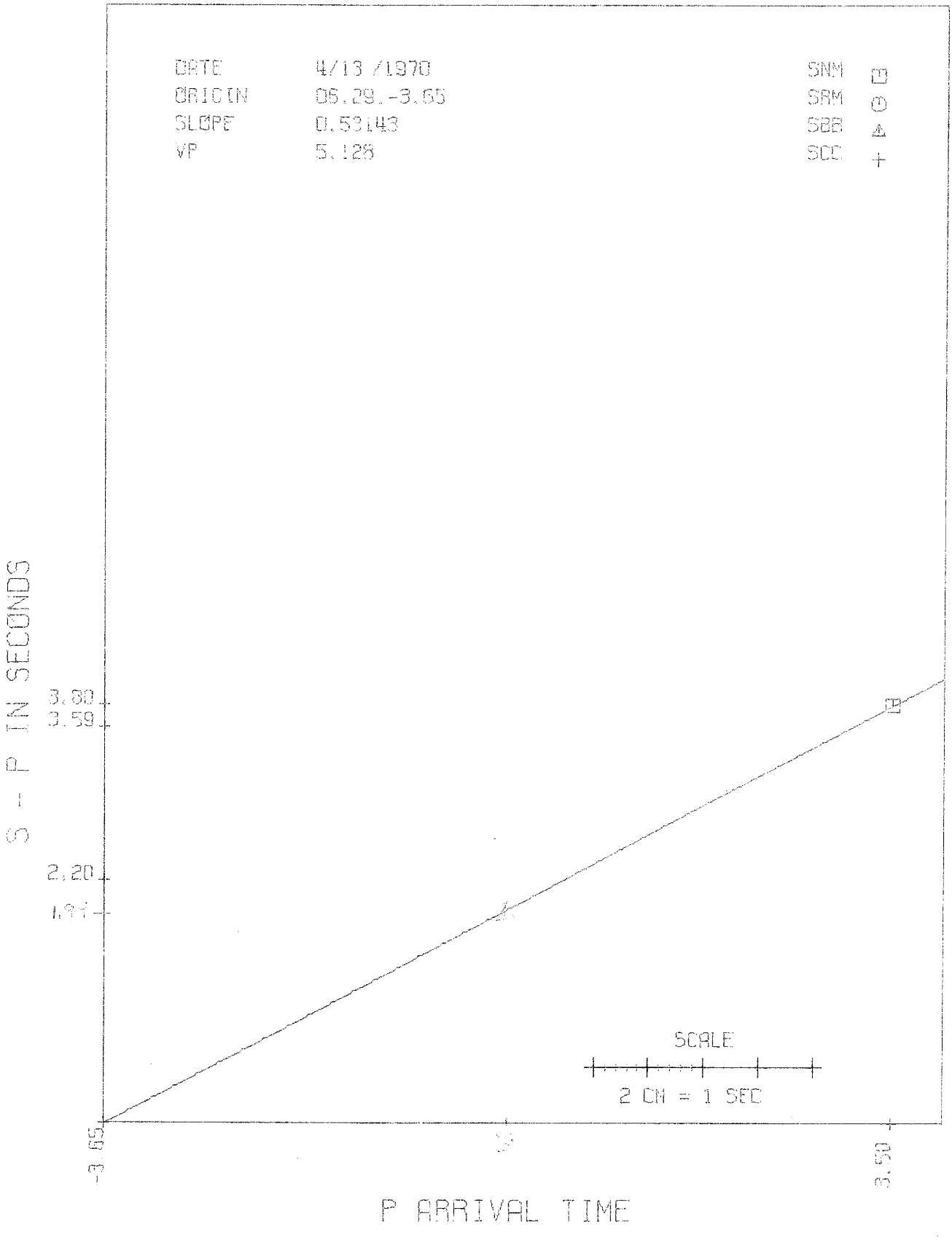
SCALE

2 CM = 1 SEC

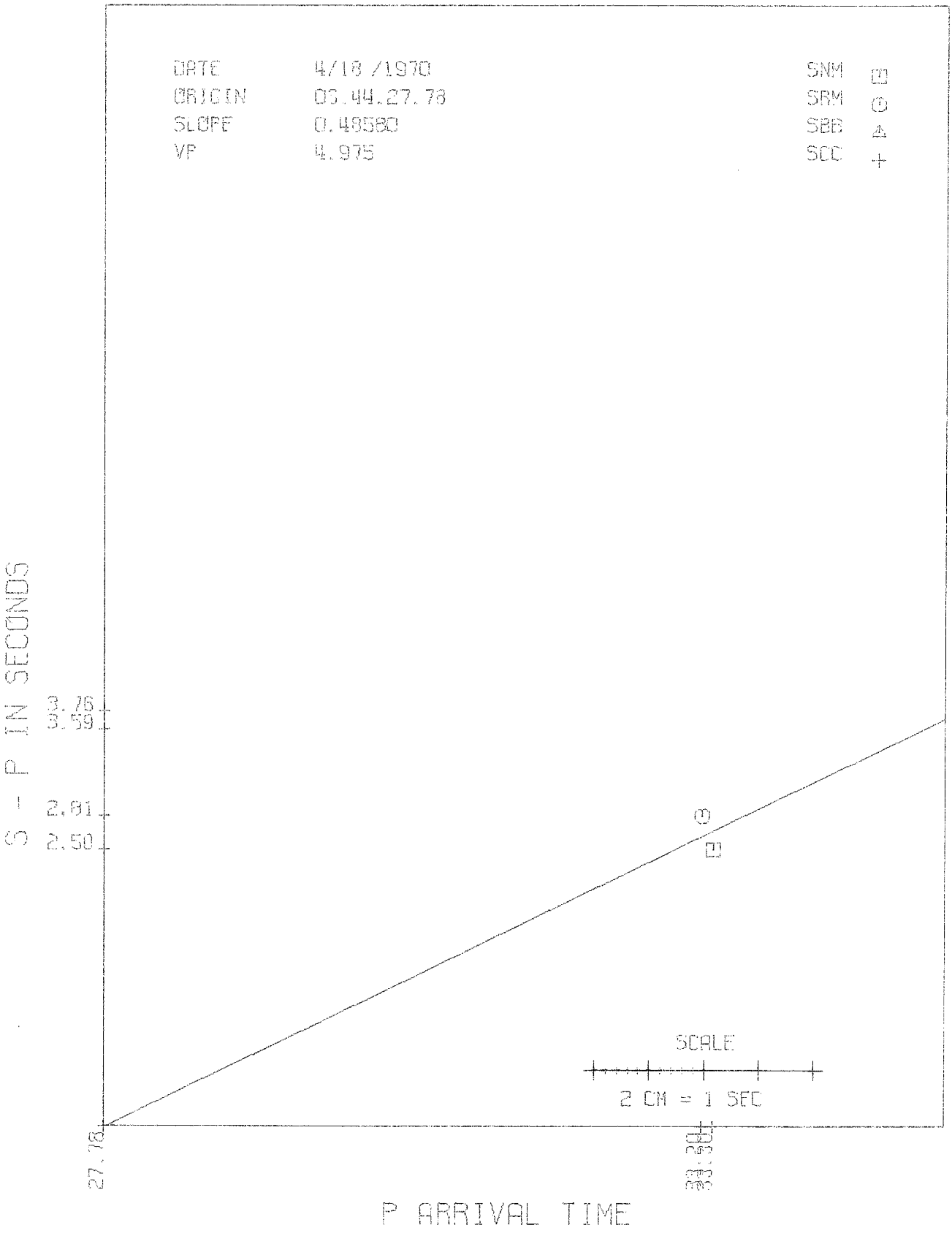
S - P IN SECONDS

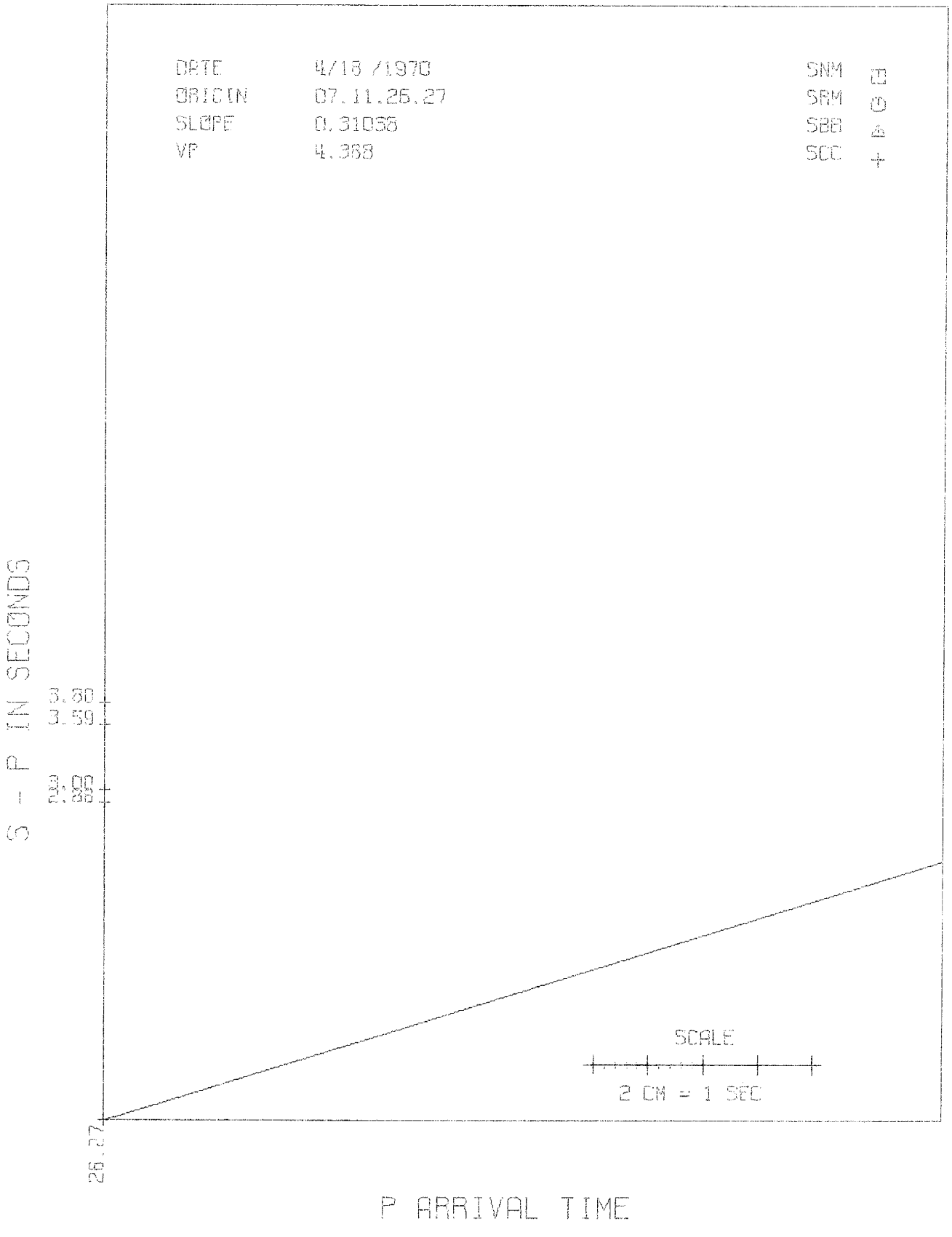
0

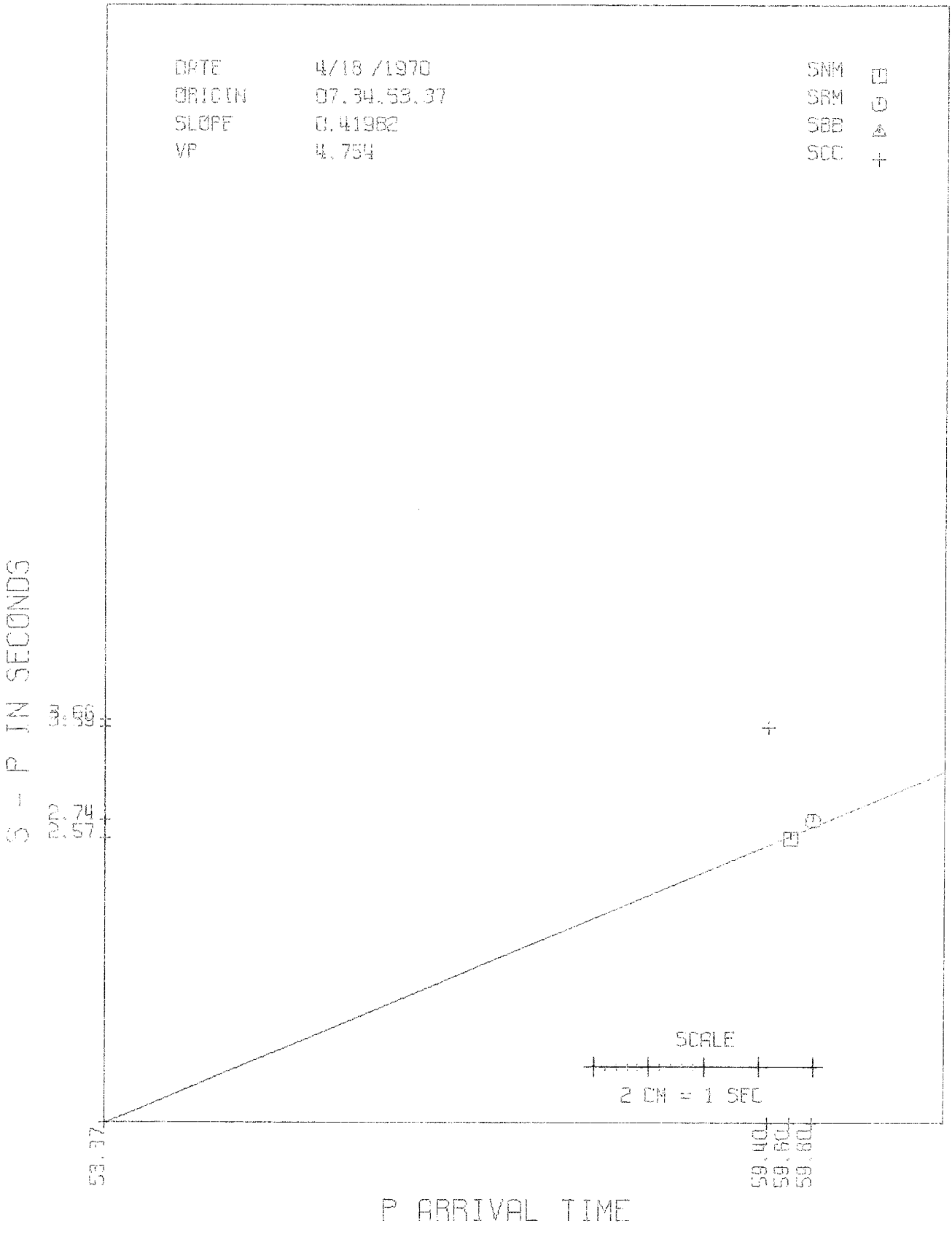
P ARRIVAL TIME

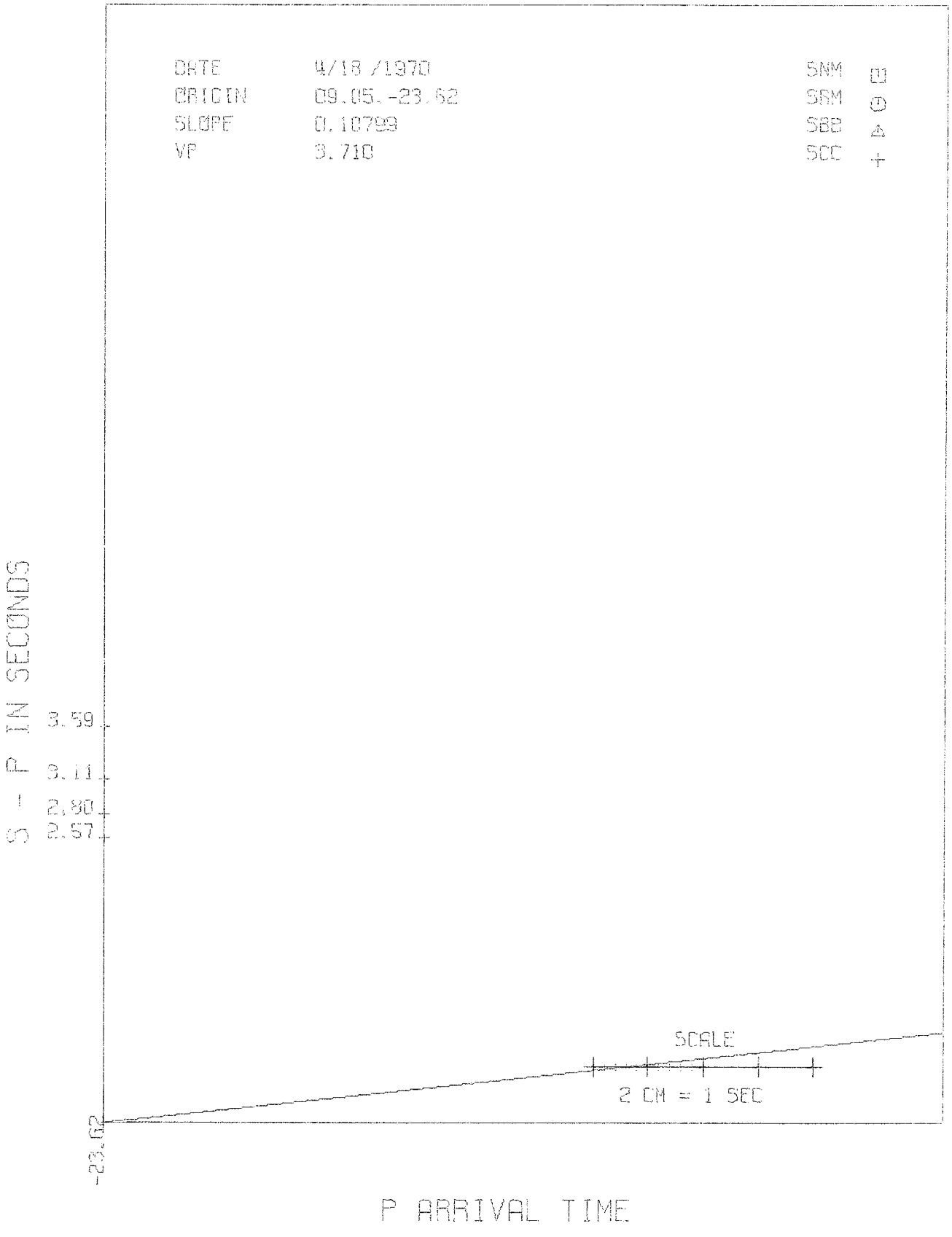

DATE 4/13 /1970
ORIGIN 06.29.-3.65
SLOPE 0.59143
VP 5.128
SNM □
SRM ○
SBB △
SCC +
S - P IN SECONDS
3.80
3.59
2.20
1.99
-3.65
3.50
SCALE
2 CM = 1 SEC
P ARRIVAL TIME

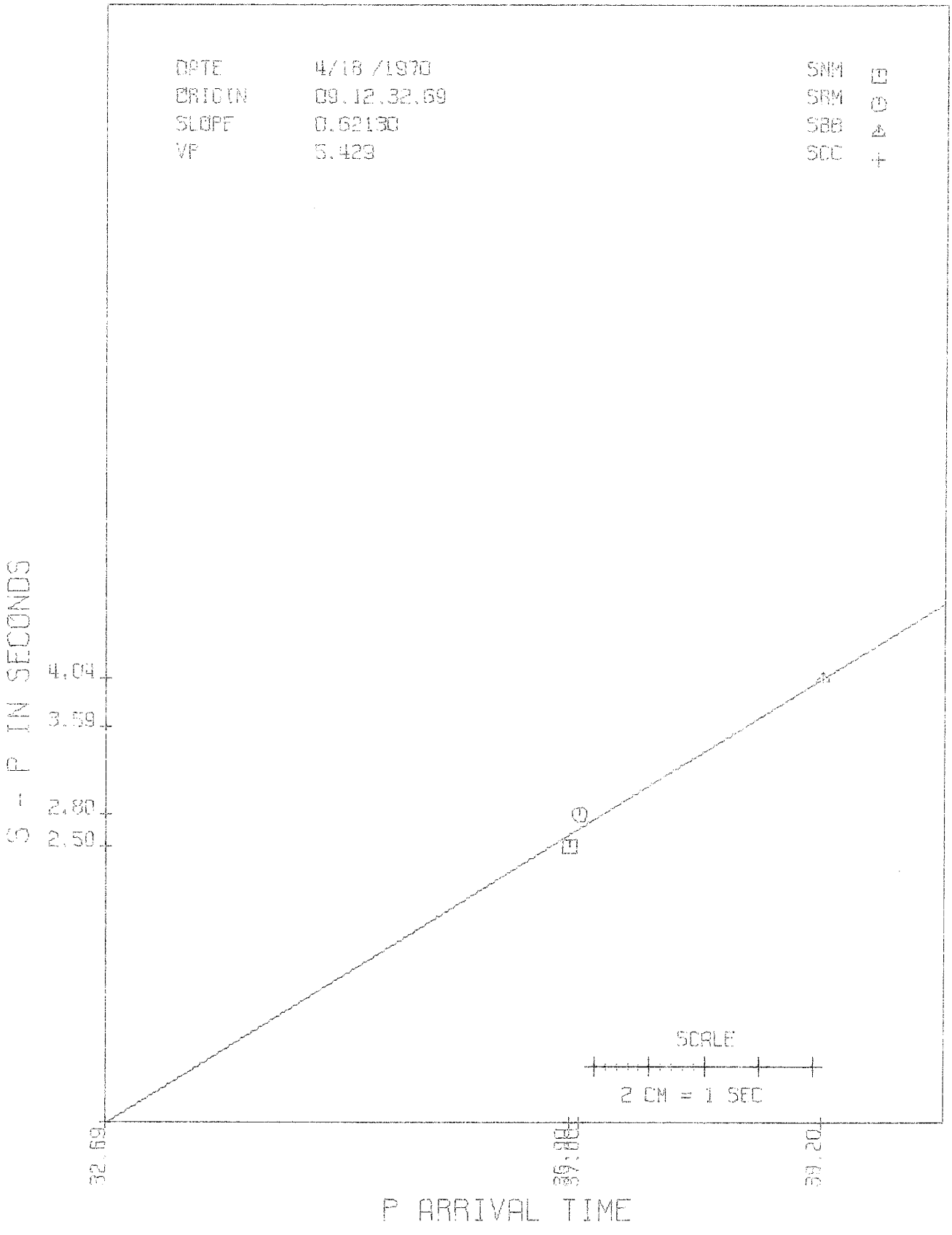
DATE 4/17 /1970
ORIGIN 03.06.45.20
SLOPE 0.534002
VP 5.137
SNM
SRM
SBB
SCC
S - P IN SECONDS
3.25
2.79
2.25
45.20
49.80
50.00
52.20
P ARRIVAL TIME
SCALE
2 CM = 1 SEC

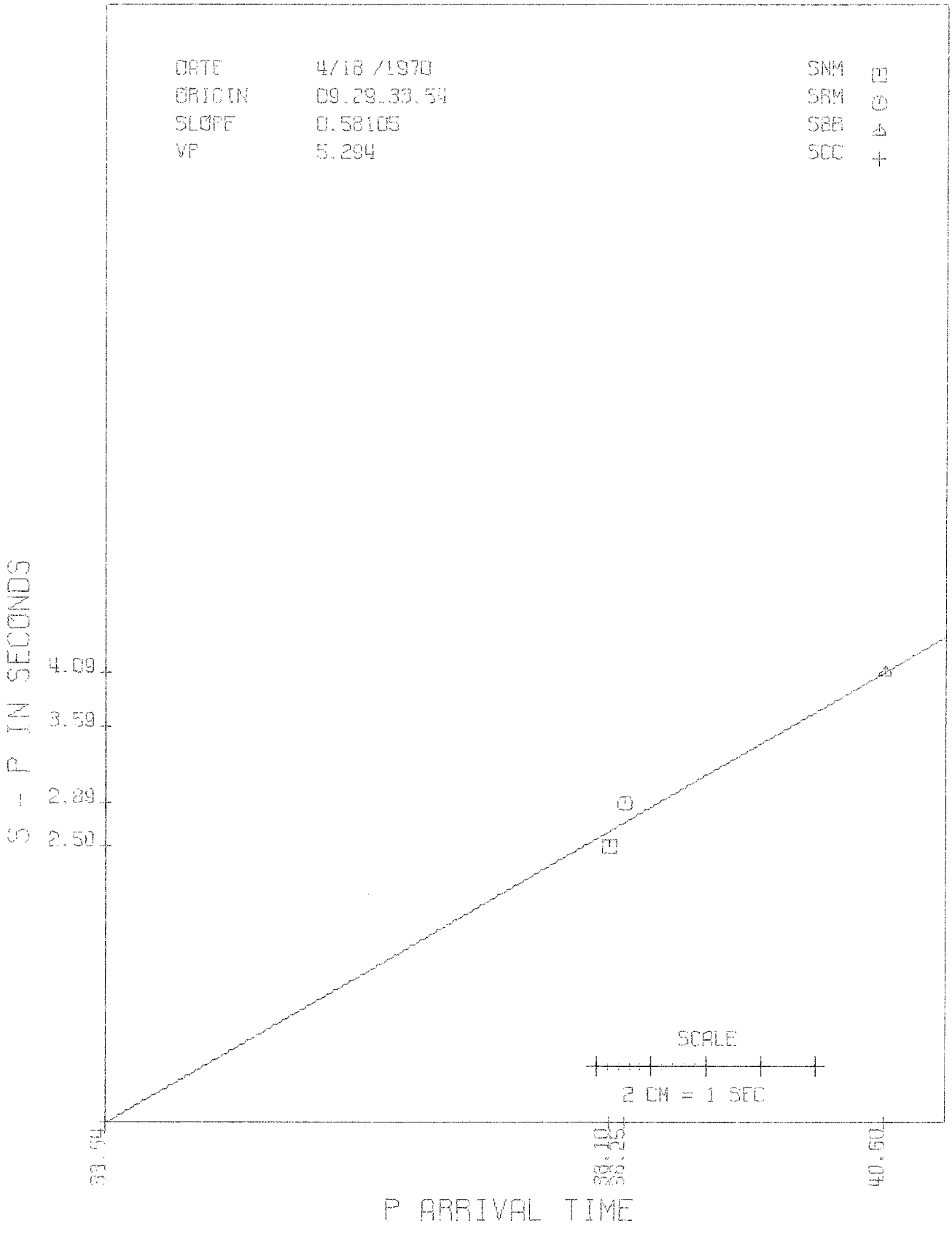

DATE 4/18 /1970
ORIGIN 03.44.27.78
SLOPE 0.48580
VF 4.975
SNM □
SRM ○
SBB △
SCC +
S - P IN SECONDS
3.76
3.59
2.81
2.50
27.78
SCALE
2 CM = 1 SEC
P ARRIVAL TIME

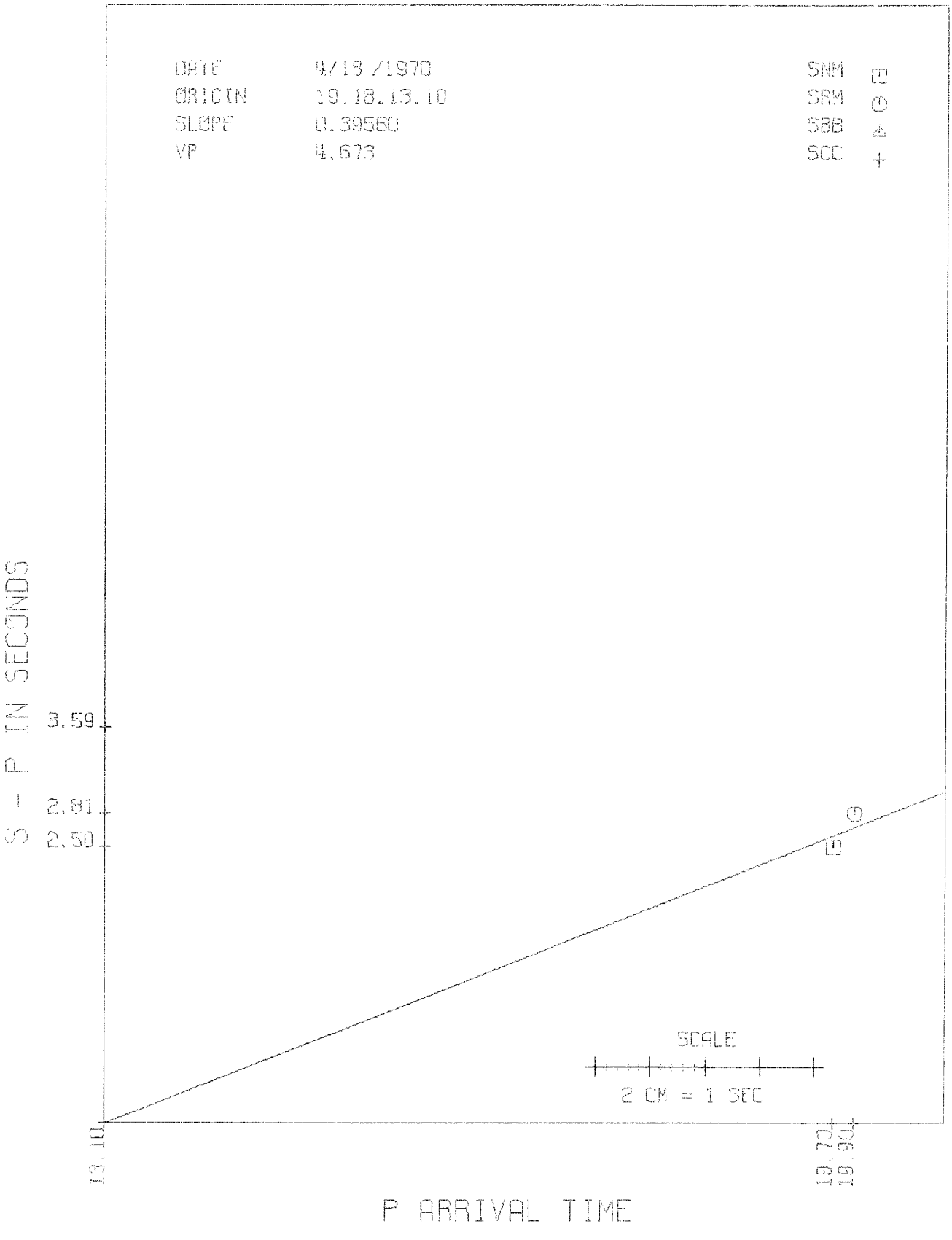

DATE 4/16 /1970
ORIGIN 07.11.26.27
SLOPE 0.31038
VP 4.368
SNM □
SRM ○
SBB △
SCC +
S - P IN SECONDS
3.60
3.59
26.27
SCALE
2 CM = 1 SEC
P ARRIVAL TIME


DATE 4/18 /1970
ORIGIN 07.34.53.37
SLOPE 0.41982
VP 4.754
SNM
SRM
SBB
SCC
S - P IN SECONDS
3.98
2.74
2.57
SCALE
2 CM = 1 SEC
53.37
59.40
59.60
59.80
P ARRIVAL TIME


DATE 4/18 /1970
ORIGIN 09.05.-23.62
SLOPE 0.10799
VP 3.710
SNM
SRM
SBB
SCC
S - P IN SECONDS
3.59
3.11
2.80
2.57
-23.62
SCALE
2 CM = 1 SEC
P ARRIVAL TIME

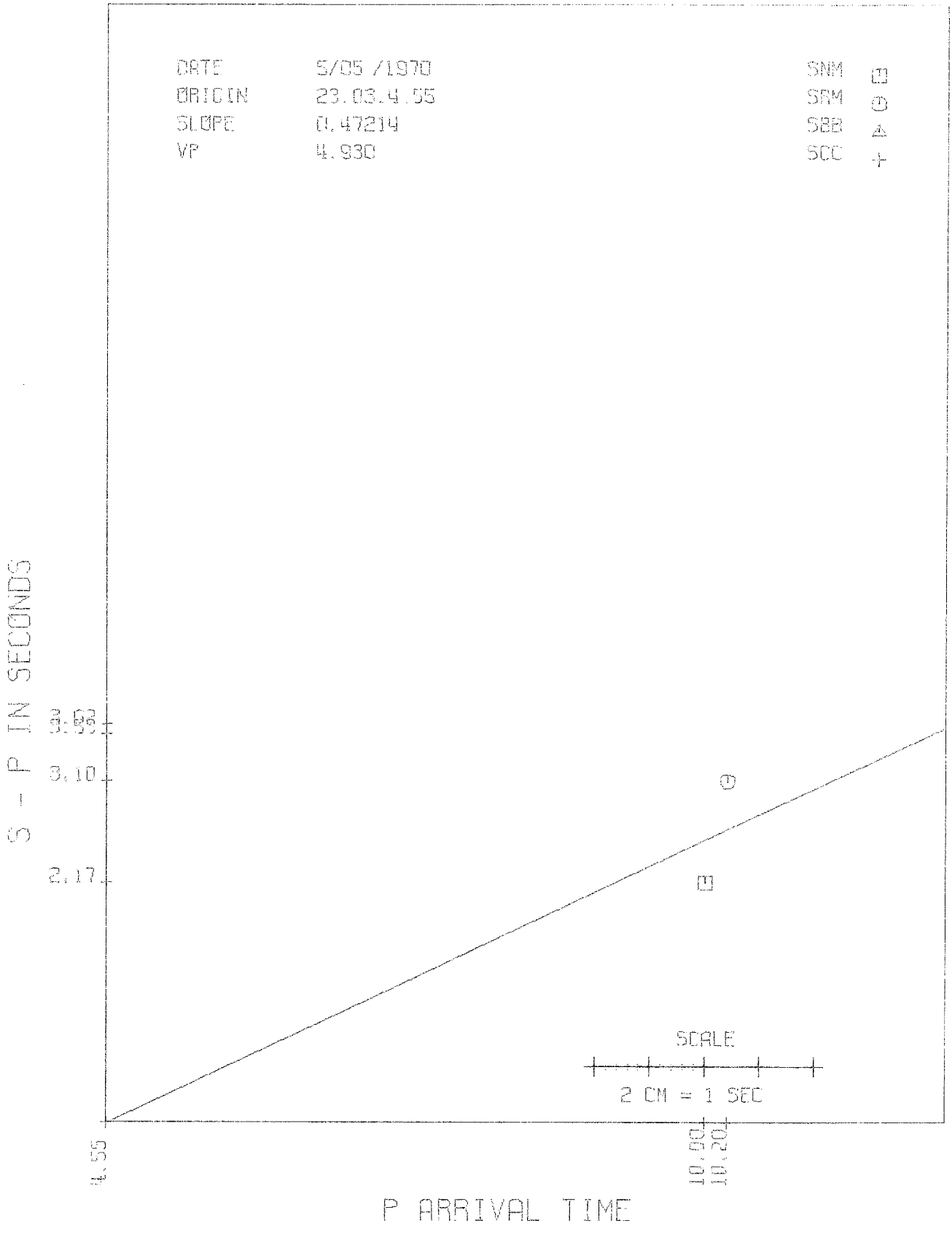

DATE 4/18 /1970
ORIGIN 09.12.32.69
SLOPE 0.62130
VP 5.423
SNM
SRM
SBB
SCC
S - P IN SECONDS
4.04
3.59
2.80
2.50
32.69
39.20
P ARRIVAL TIME
SCALE
2 CM = 1 SEC

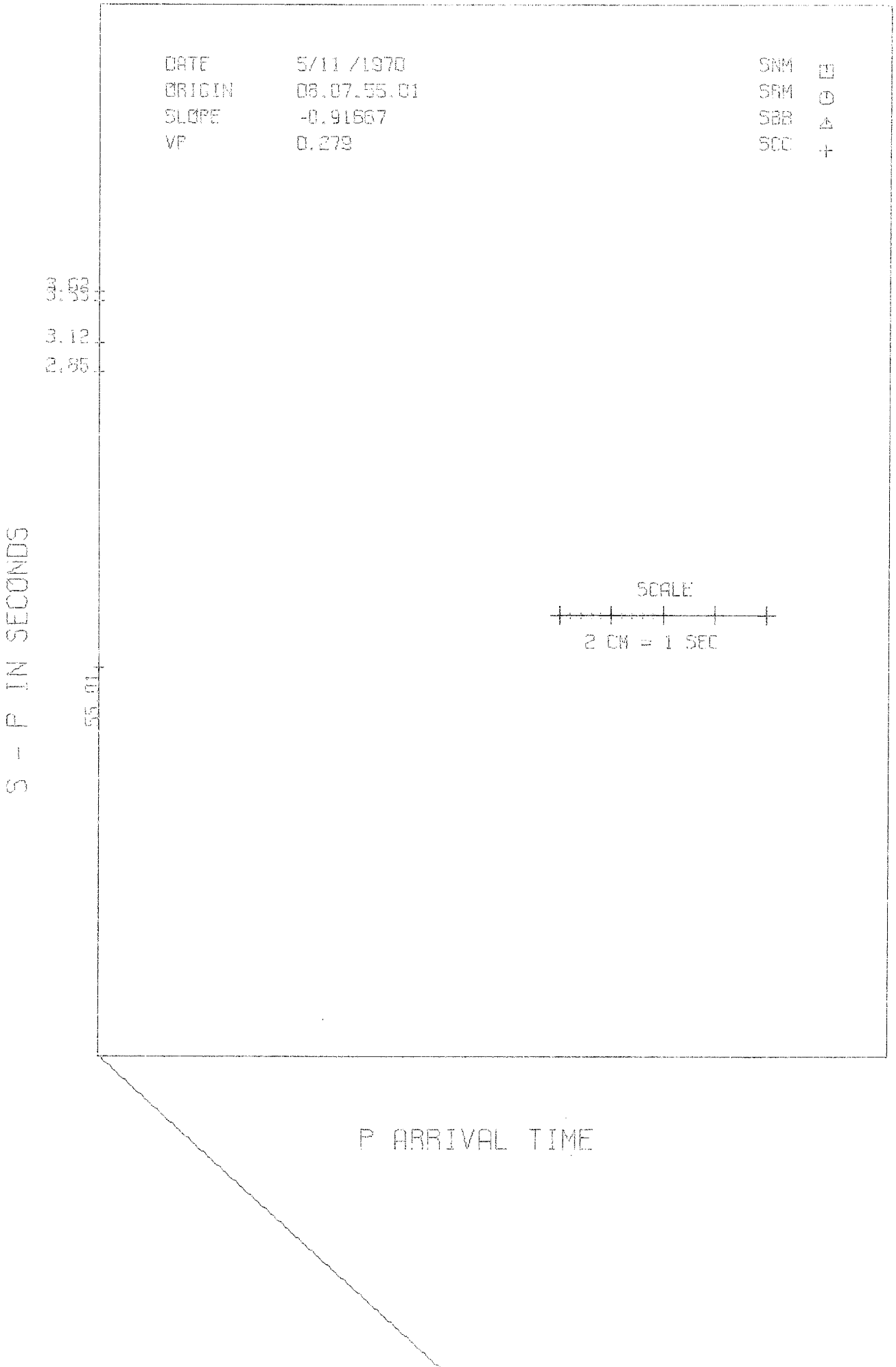

DATE 4/18 /1970
ORIGIN 09.29.33.54
SLOPE 0.58105
VP 5.294
SNM
SRM
SBB
SCC
S - P IN SECONDS
4.09
3.59
2.89
2.50
SCALE
2 CM = 1 SEC
33.64
39.10
39.25
40.60
P ARRIVAL TIME

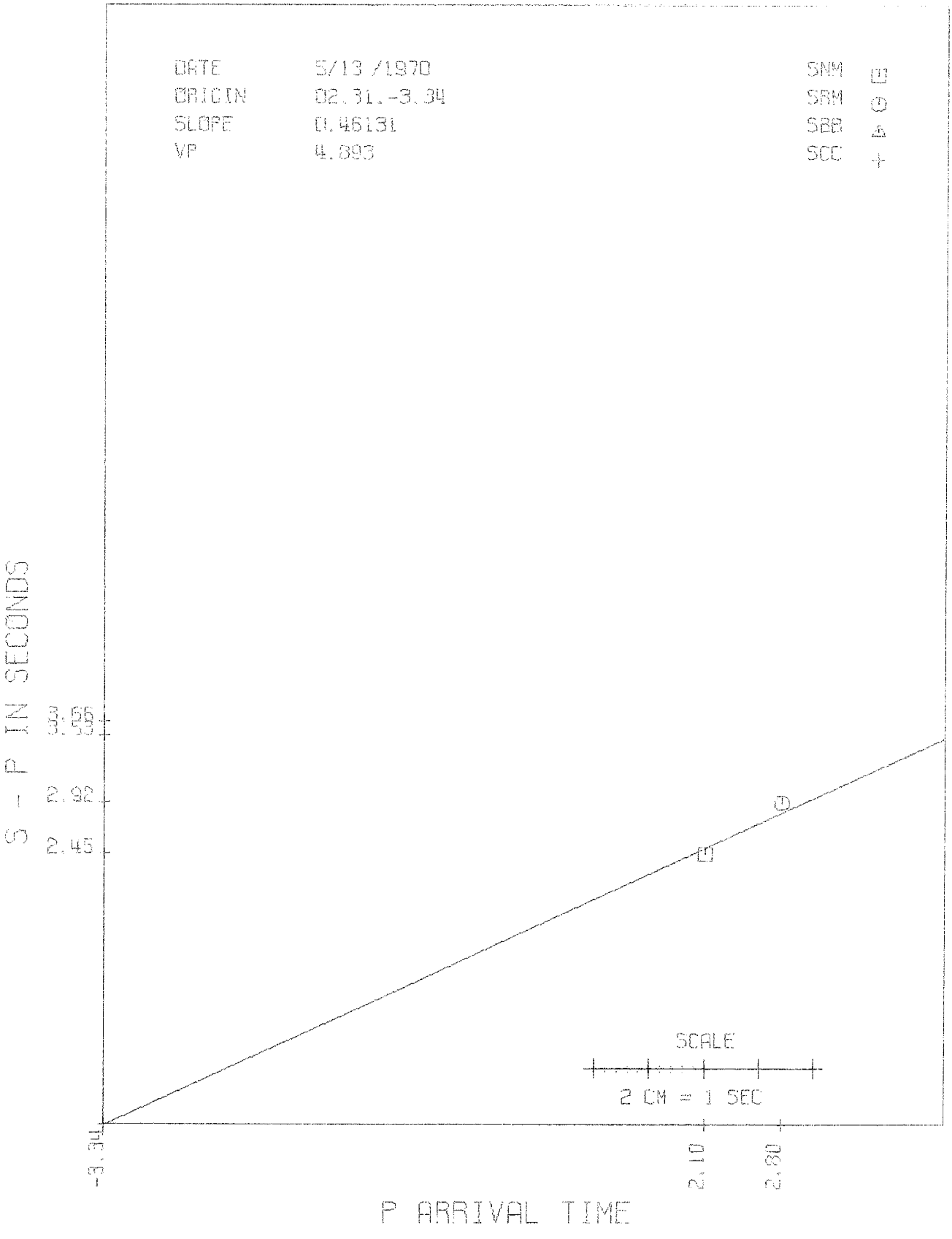

DATE 4/18 /1970
ORIGIN 19.18.13.10
SLOPE 0.39560
VP 4.673
SNM □
SRM ○
SBB △
SCC +
S - P IN SECONDS
3.59
2.81
2.50
13.10
19.70
19.90
SCALE
2 CM = 1 SEC
P ARRIVAL TIME

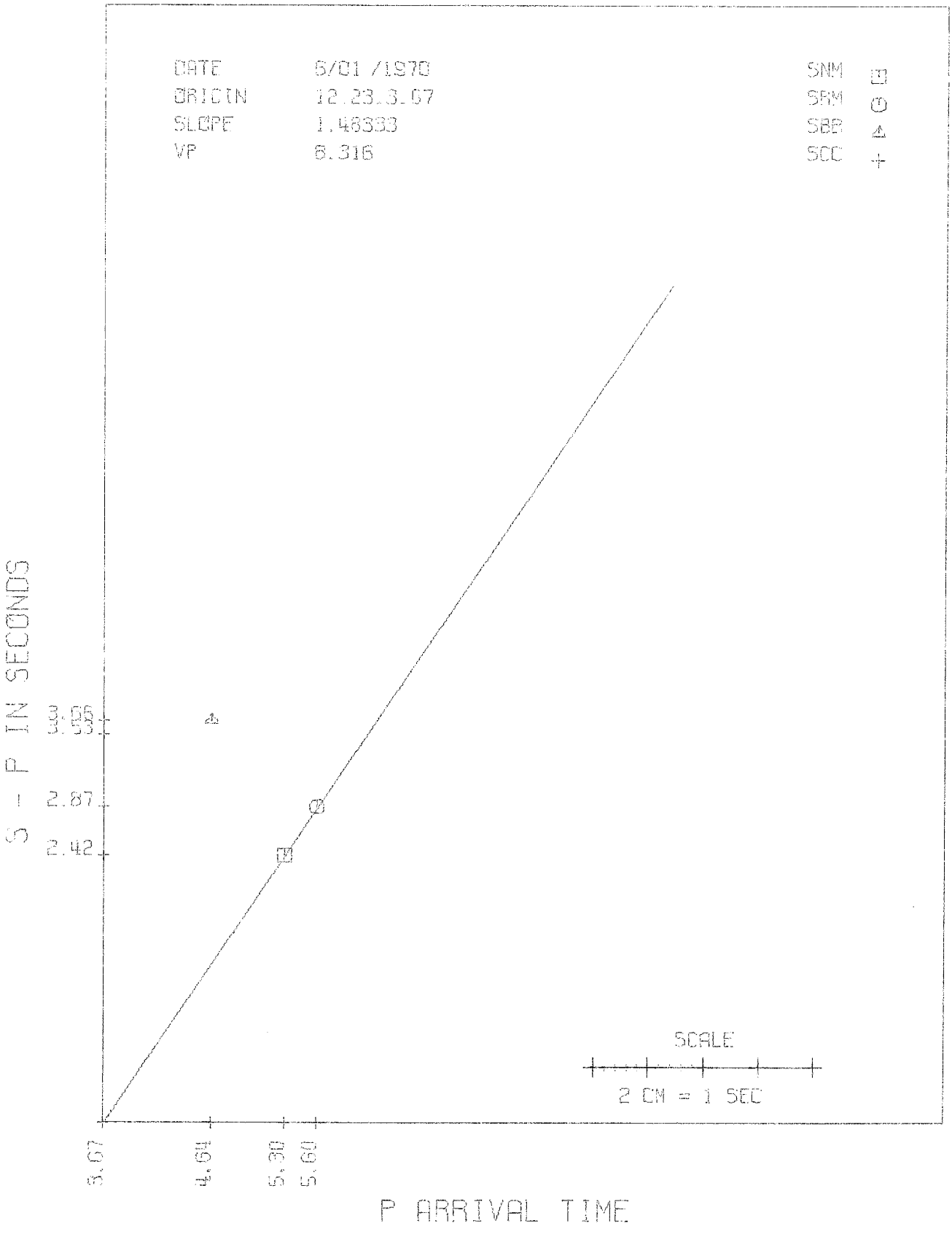
DATE 5/05 /1970
ORIGIN 22.44.12.69
SLOPE 0.49206
VP 4.996
SNM
SPM
SBB
SCC
S - P IN SECONDS
2.89
2.30
SCALE
2 CM = 1 SEC
12.69
20.30
17.90
18.20
19.45
20.30
P ARRIVAL TIME

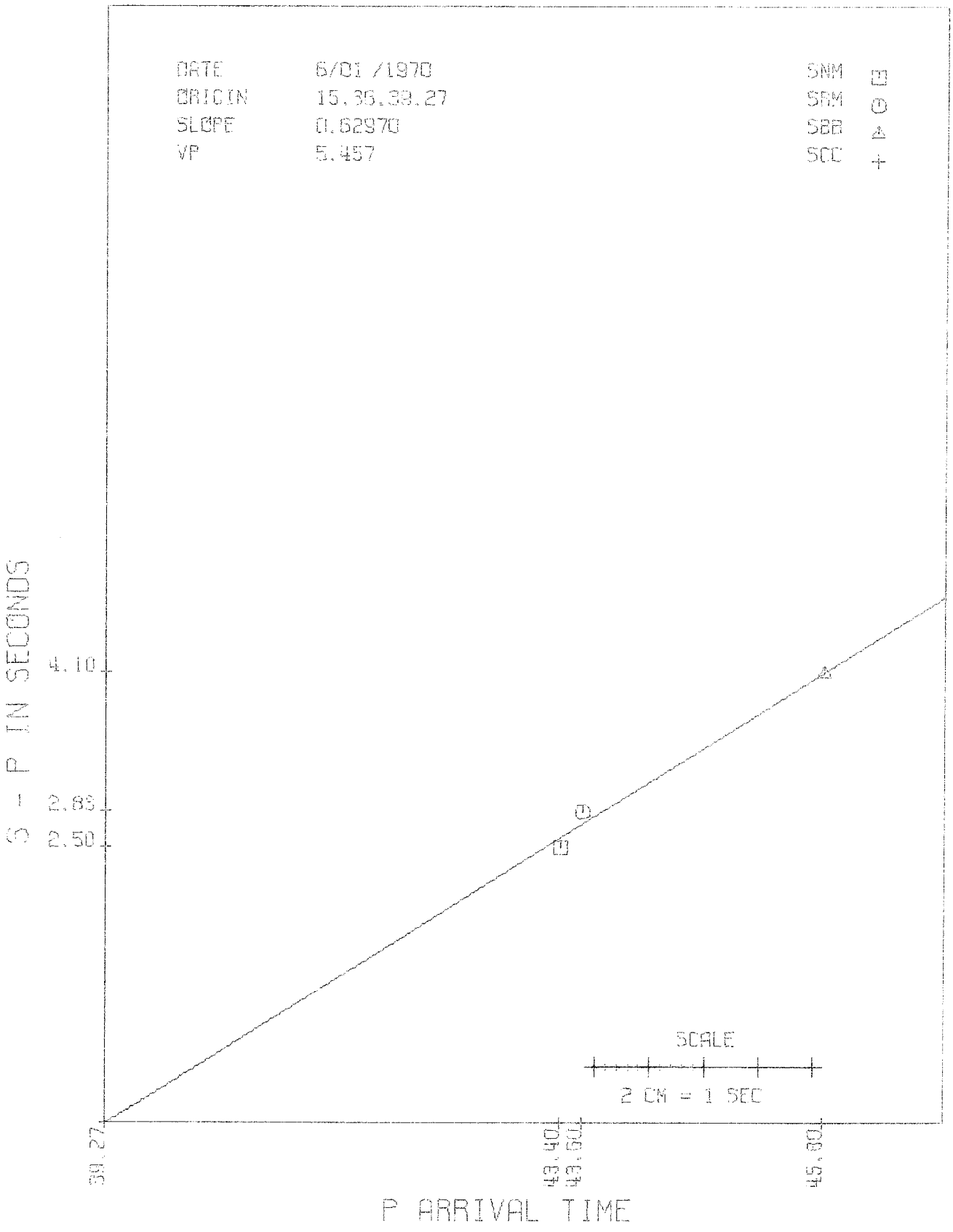
DATE 5/05 /1970
ORIGIN 22.44.40.31
SLOPE 0.20451
VP 4.033
SNM □
SRM ○
SBB △
SCC +
S - P IN SECONDS
3.58
3.33
3.12
2.50
12.50
40.31
SCALE
2 CM = 1 SEC
P ARRIVAL TIME

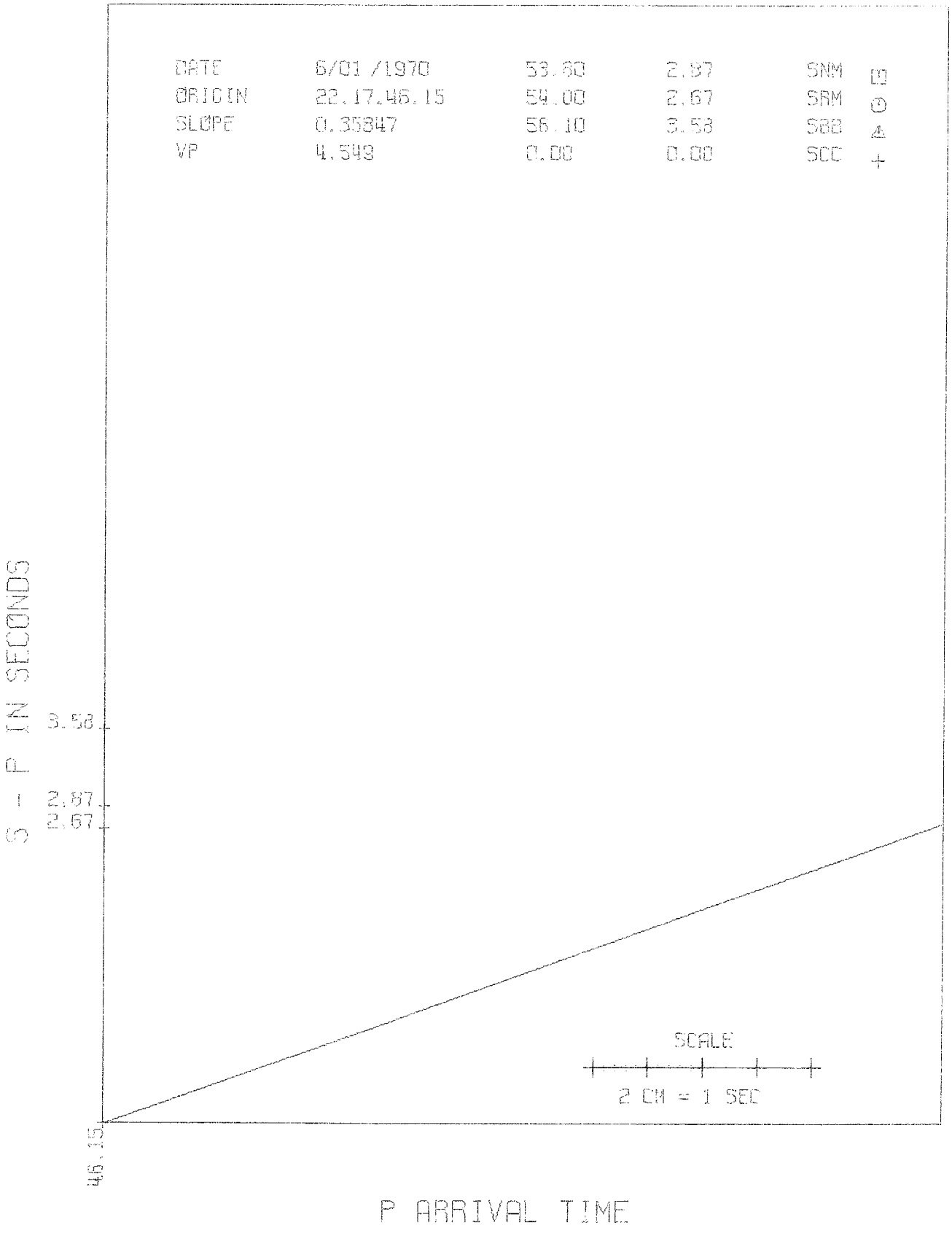

DATE 5/05 /1970
ORIGIN 23.03.4.55
SLOPE 0.47214
VP 4.930
SNM
SAM
SBB
SCC
S - P IN SECONDS
3.03
3.10
2.17
SCALE
2 CM = 1 SEC
4.55
10.50
10.20
P ARRIVAL TIME


DATE 5/11 /1970
ORIGIN 08.07.55.01
SLOPE -0.91667
VP 0.279
SNM
SRM
SBR
SCC
3.63
3.38
3.12
2.85
55.01
S - P IN SECONDS
SCALE
2 CM = 1 SEC
P ARRIVAL TIME

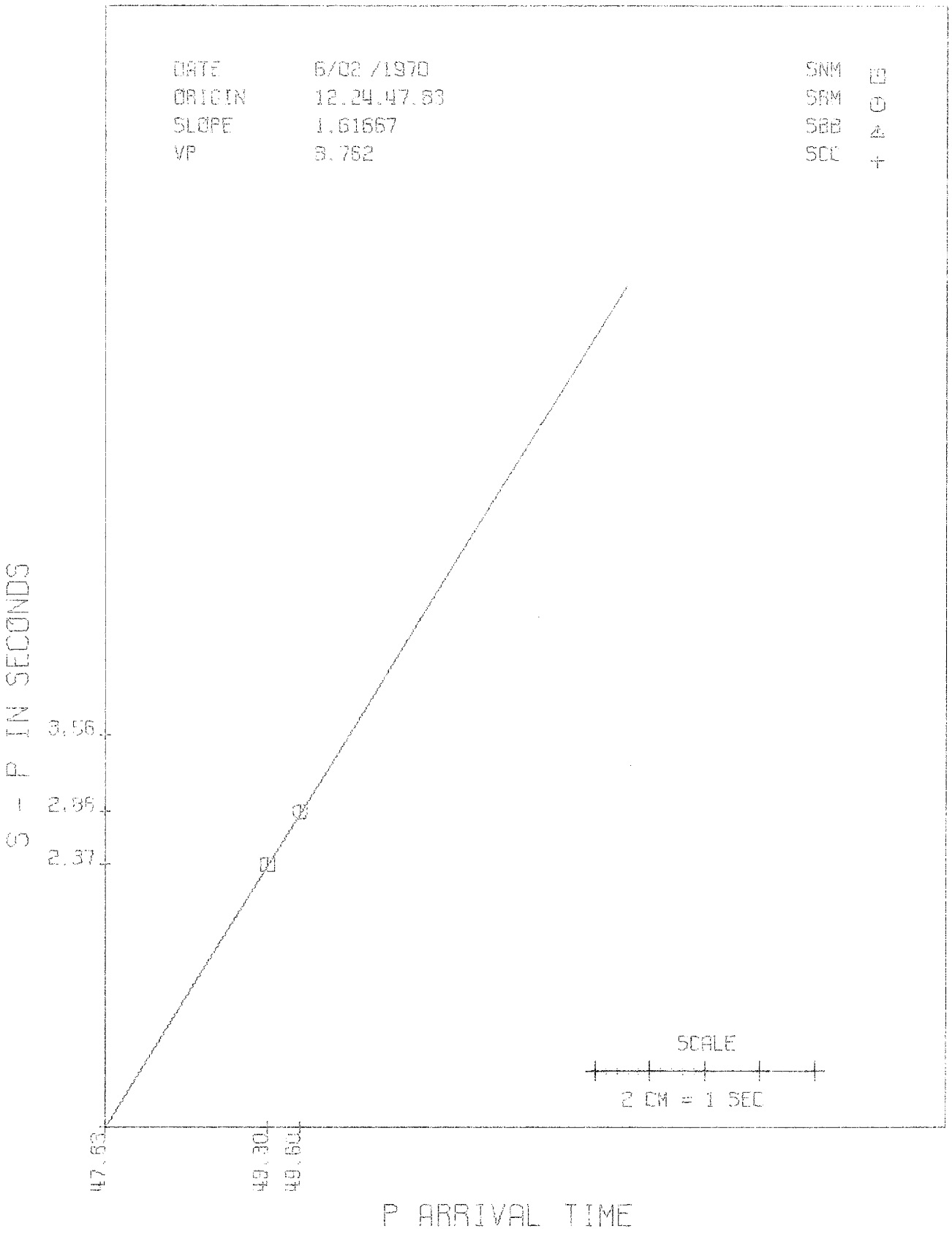

DATE 5/13/1970
ORIGIN 02.31,-3.34
SLOPE 0.46131
VP 4.893
SNM
SRM
SBB
SCC
S - P IN SECONDS
3.83
3.56
2.92
2.45
-3.34
SCALE
2 CM = 1 SEC
2.10
2.60
P ARRIVAL TIME

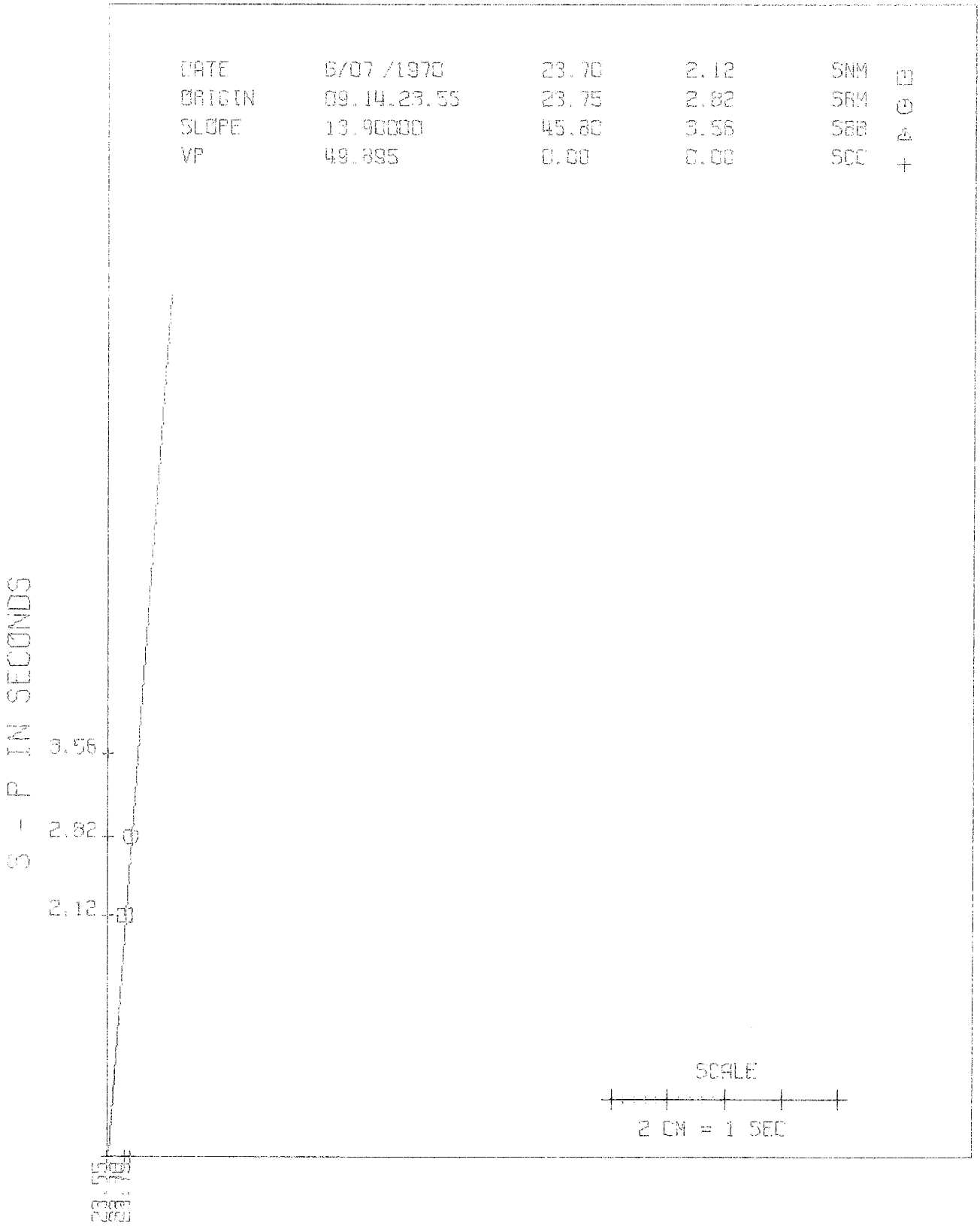

DATE 6/01 /1970
ORIGIN 12.23.3.07
SLOPE 1.46333
VP 6.316
SNM
SRM
SBB
SCC
S - P IN SECONDS
2.87
2.42
SCALE
2 CM = 1 SEC
5.67
4.64
5.30
5.60
P ARRIVAL TIME

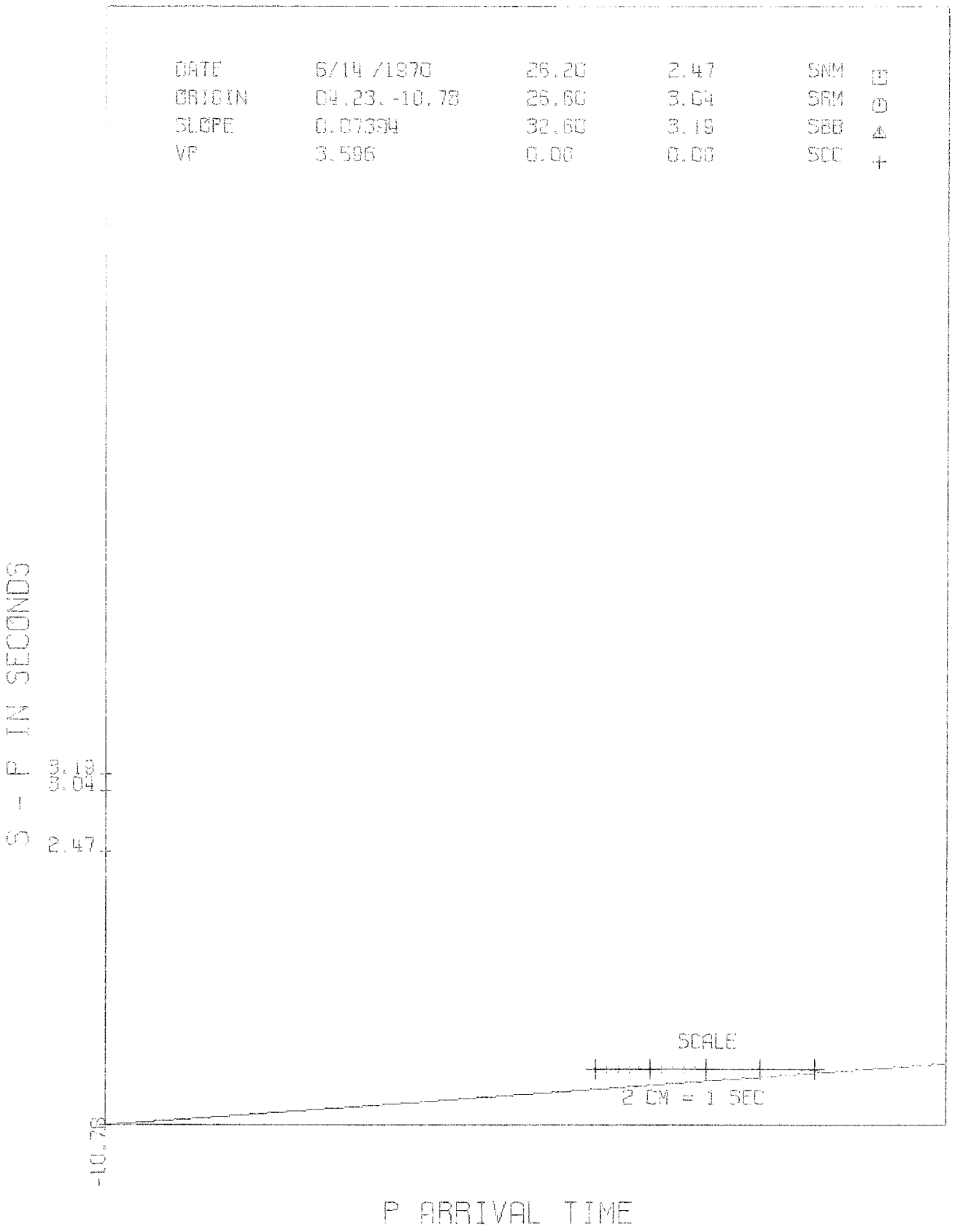

DATE 6/01 /1970
ORIGIN 15.36.38.27
SLOPE 0.62970
VP 5.457
SNM
SRM
SBB
SCC
S - P IN SECONDS
4.10
2.88
2.50
39.27
43.60
43.60
45.60
P ARRIVAL TIME
SCALE
2 CM = 1 SEC

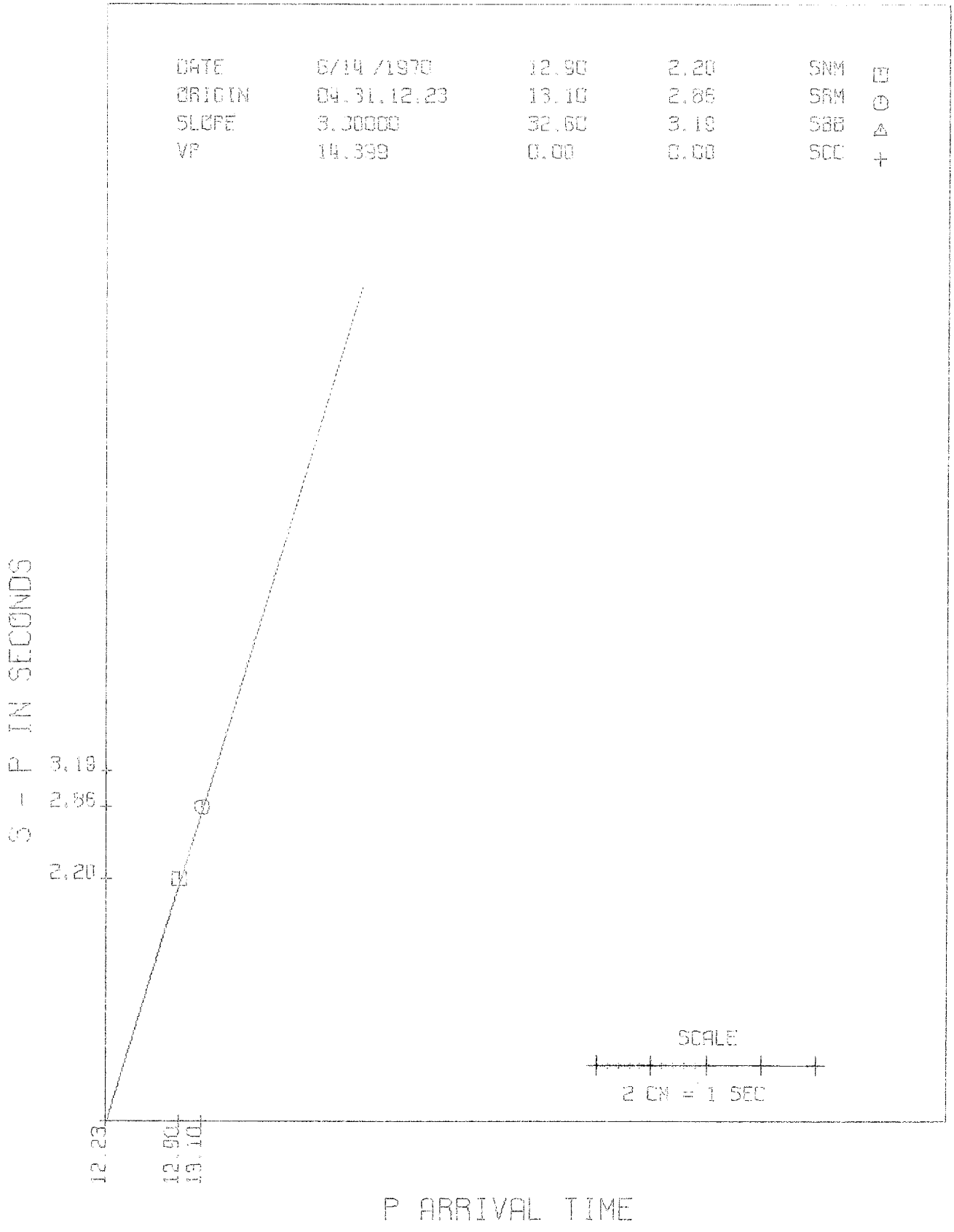

DATE 6/01/1970 53.60 2.87 SNM
ORIGIN 22.17.46.15 54.00 2.67 SRM
SLOPE 0.35847 56.10 3.58 SBB
VP 4.543 0.00 0.00 SCC
S - P IN SECONDS
3.58
2.87
2.67
46.15
SCALE
2 CM = 1 SEC
P ARRIVAL TIME

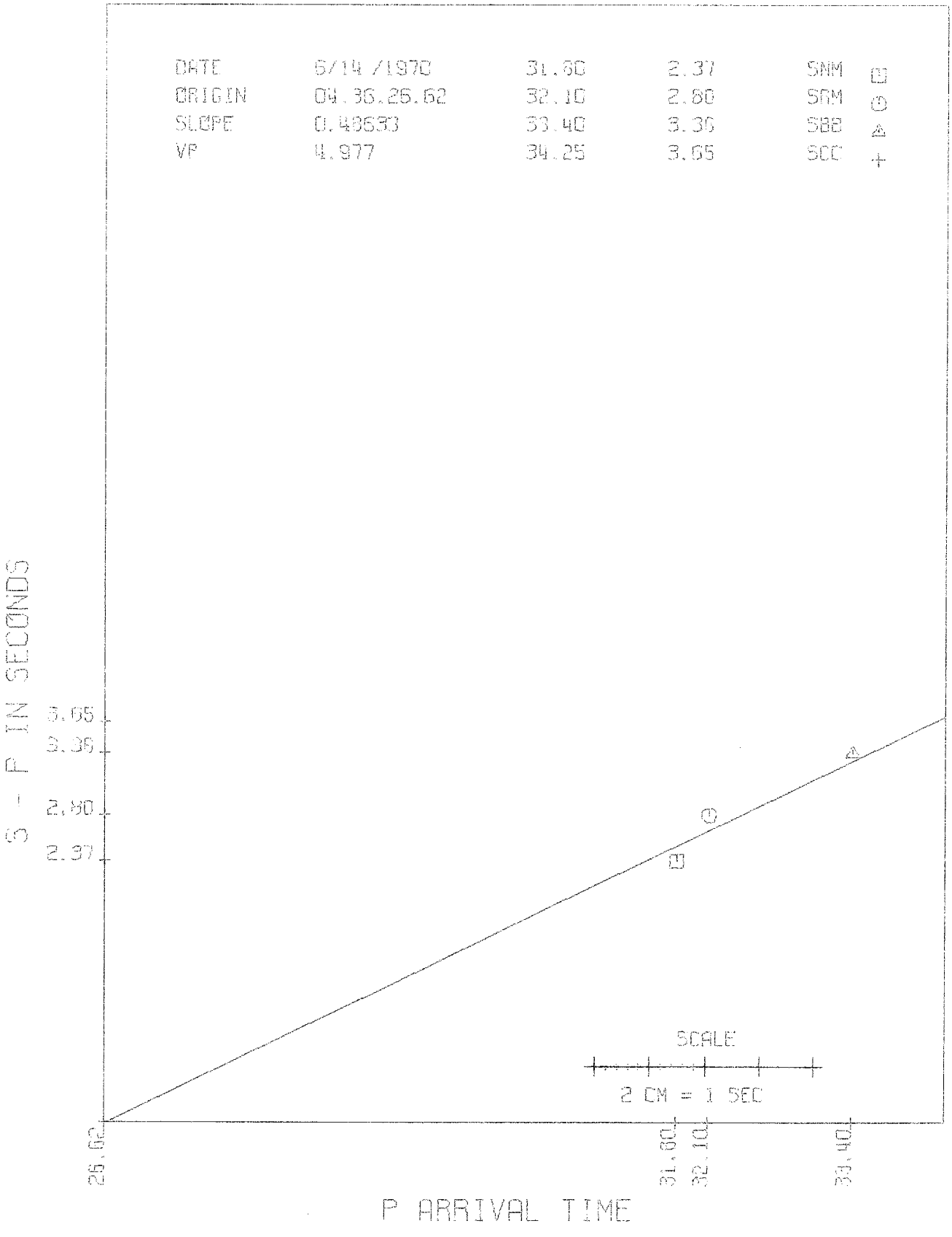
DATE 6/02 /1970
ORIGIN 00.22.36.20
SLOPE 0.46898
VP 4.919
SNM □
SRM ○
SBB △
SCC +
S - P IN SECONDS
3.55
2.97
2.45
SCALE
2 CM = 1 SEC
56.20
43.50
43.60
45.30
P ARRIVAL TIME


DATE 6/02 /1970
ORIGIN 12.24.47.63
SLOPE 1.61667
VP 8.782
SNM
SAM
SBB
SCC
S - P IN SECONDS
3.56
2.86
2.37
47.63
49.30
49.60
P ARRIVAL TIME
SCALE
2 CM = 1 SEC

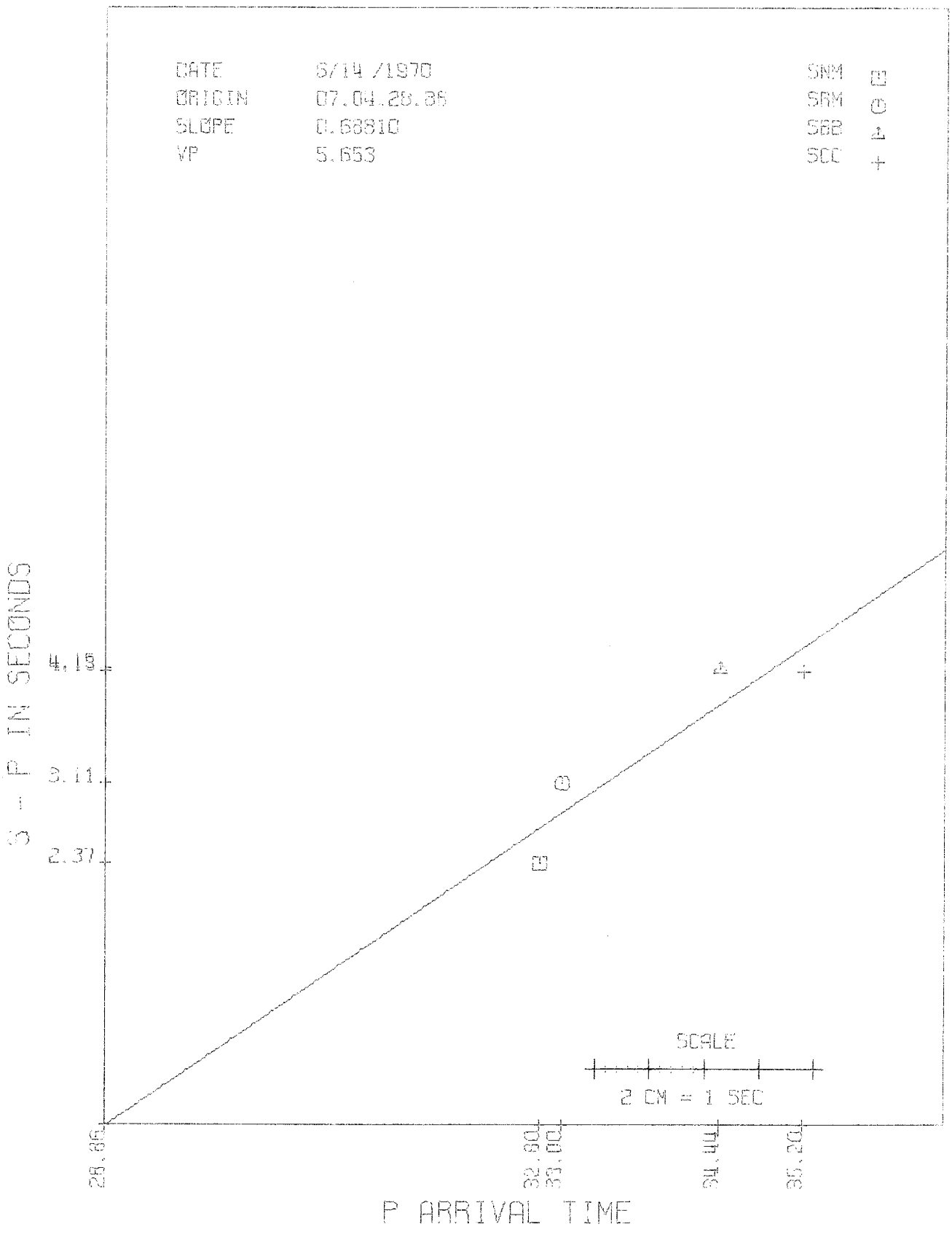

DATE 6/07/1970 23.70 2.12 SMM
ORIGIN 09.14.23.55 23.75 2.82 SRM
SLOPE 13.90000 45.80 3.56 SBB
VP 49.895 0.00 0.00 SCC
S - P IN SECONDS
3.56
2.82
2.12
SCALE
2 CM = 1 SEC
P ARRIVAL TIME


DATE 6/14 /1870 26.20 2.47 SNM
ORIGIN 04.23. -10.78 25.60 3.04 SRM
SLOPE 0.073394 32.60 3.19 SBB
VP 3.596 0.00 0.00 SCC
S - P IN SECONDS
3.19
3.04
2.47
-10.78
SCALE
2 CM = 1 SEC
P ARRIVAL TIME


DATE 6/14 /1970 12.90 2.20 SNM □
ORIGIN 04.31.12.23 13.10 2.86 SRM ○
SLOPE 3.30000 32.60 3.18 SBB △
VP 14.399 0.00 0.00 SCC +
S - P IN SECONDS
3.18
2.86
2.20
12.23
12.90
13.10
SCALE
2 CM = 1 SEC
P ARRIVAL TIME


DATE 6/14 /1970
ORIGIN 04.36.26.62
SLOPE 0.48633
VP 4.977
31.60 2.37 SMM
32.10 2.80 SRM
33.40 3.36 SBB
34.25 3.65 SCC
S - P IN SECONDS
3.65
3.36
2.80
2.37
26.02
31.60
32.10
33.40
P ARRIVAL TIME
SCALE
2 CM = 1 SEC

DATE 6/14 /1970
ORIGIN 04.36.49.16
SLOPE 0.54301
VP 5.167
SNM 3
SBM 2
SBB 4
SCC +
S - P IN SECONDS
3.76
3.21
2.85
2.35
49.15
53.80
54.10
55.00
56.20
P ARRIVAL TIME
SCALE
2 CM = 1 SEC


DATE 6/14 /1970
ORIGIN 07.04.28.85
SLOPE 0.68810
VP 5.653
SNM B
SRM C
SBB A
SCC +
S - P IN SECONDS
4.15
3.11
2.37
28.85
32.00
33.00
34.44
35.20
SCALE
2 CM = 1 SEC
P ARRIVAL TIME

DATE	6/14 /1970	18.90	2.62	SNM	□
ORIGIN	09.20.13.58	18.27	3.26	SRM	⊙
SLOPE	0.52880	20.45	3.57	SBB	△
VP	5.119	35.20	4.13	SCC	+

S - P IN SECONDS

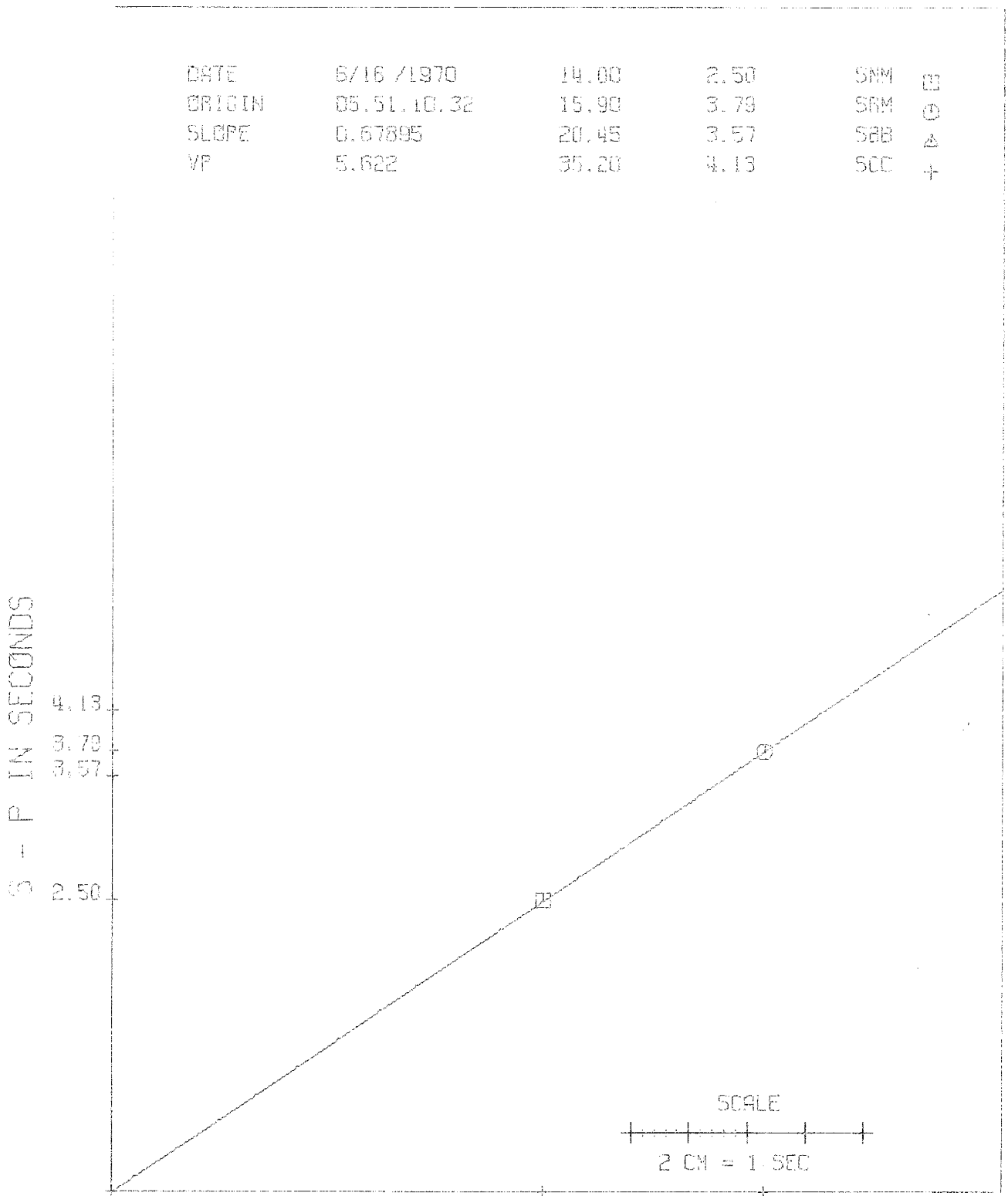
4.13
3.57
3.26
2.62

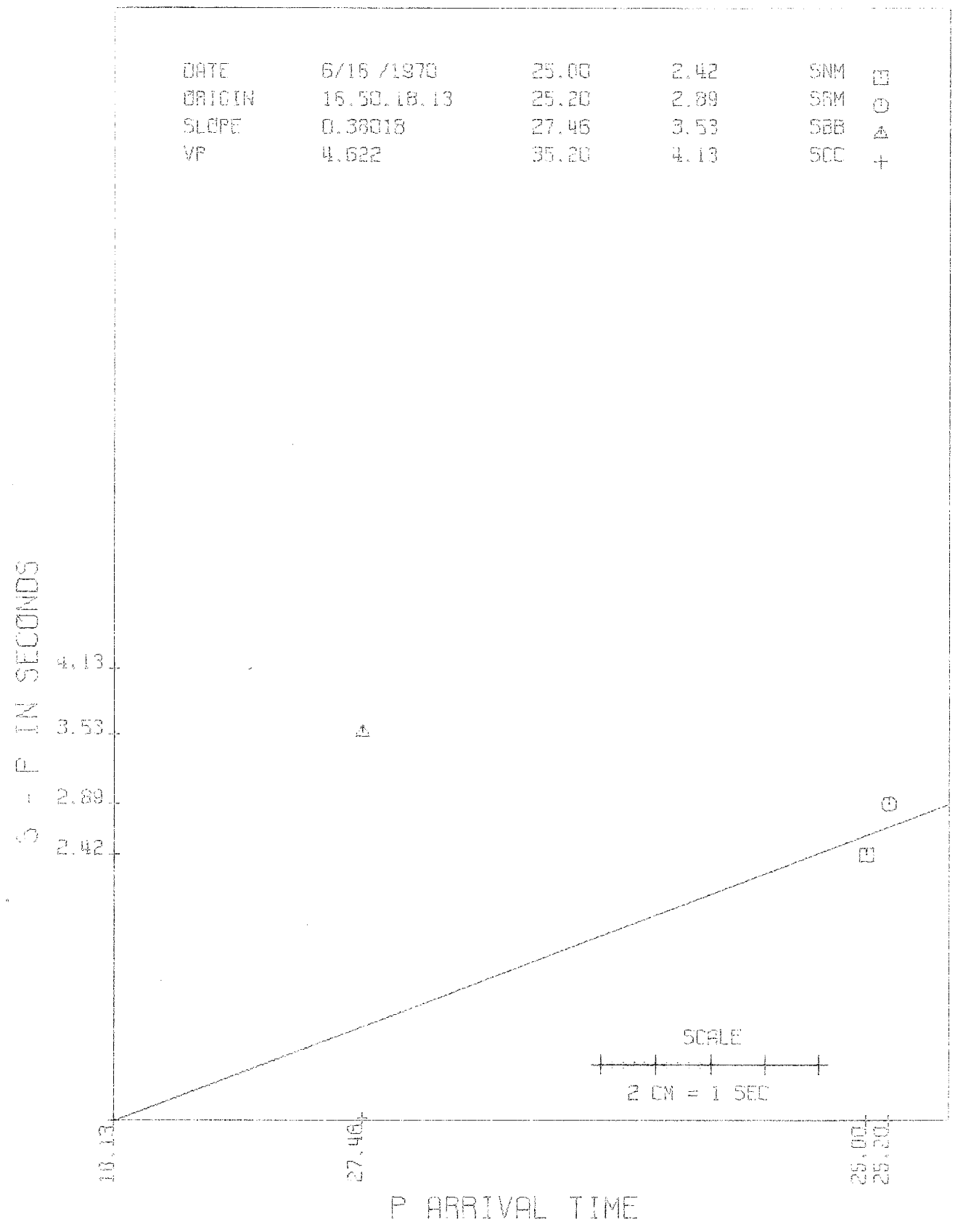
13.58

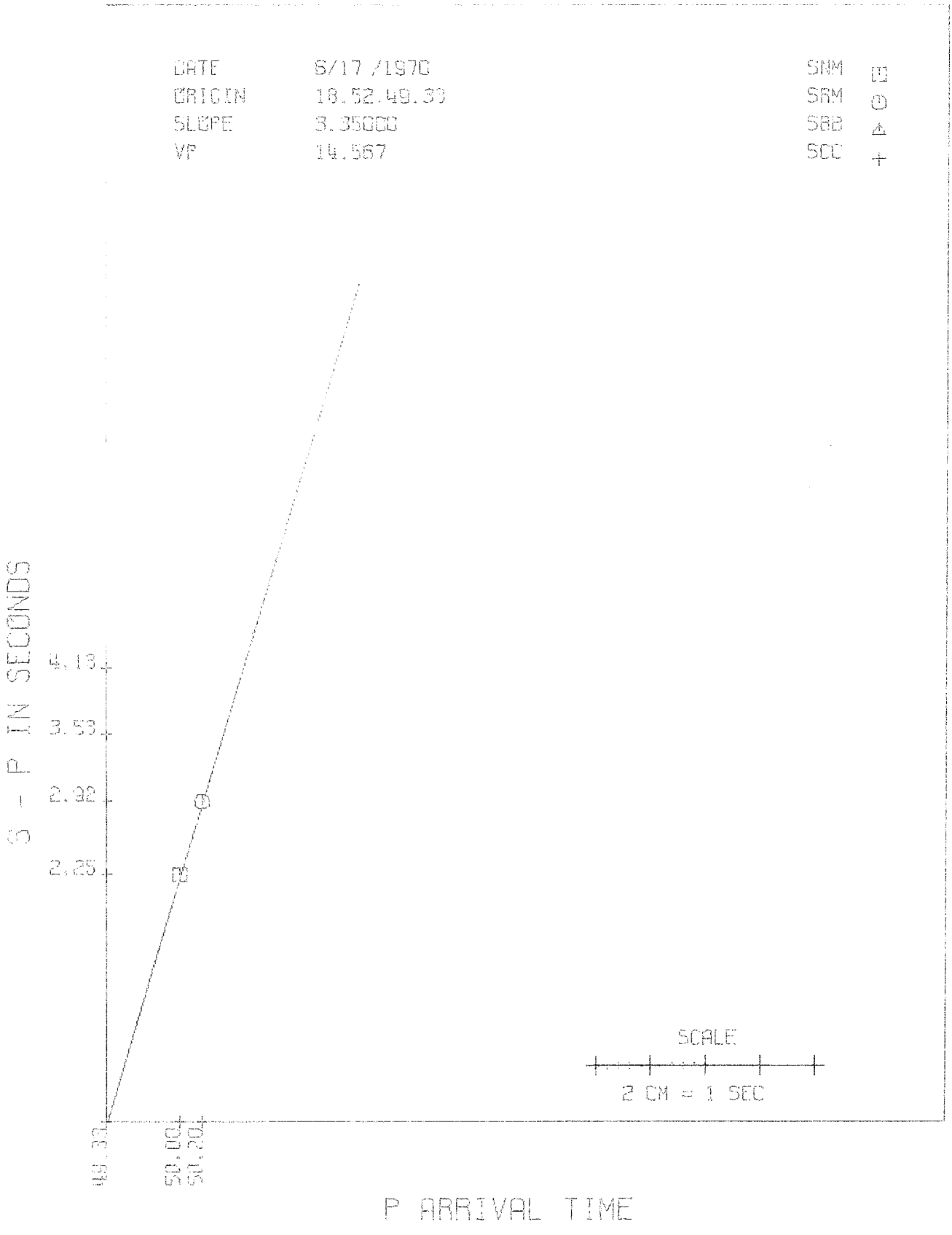
18.90
18.27
20.45

P ARRIVAL TIME

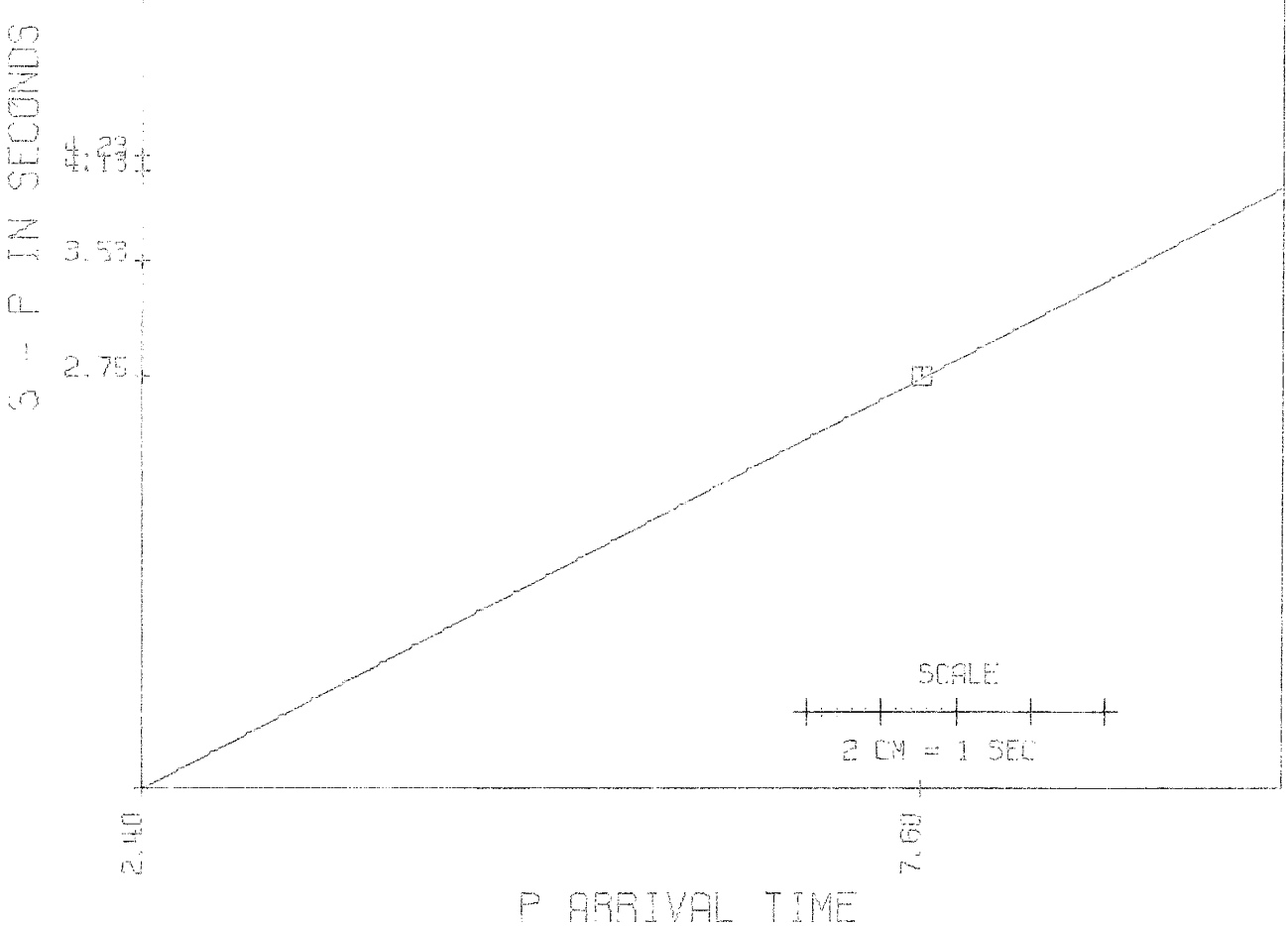
SCALE
2 CM = 1 SEC

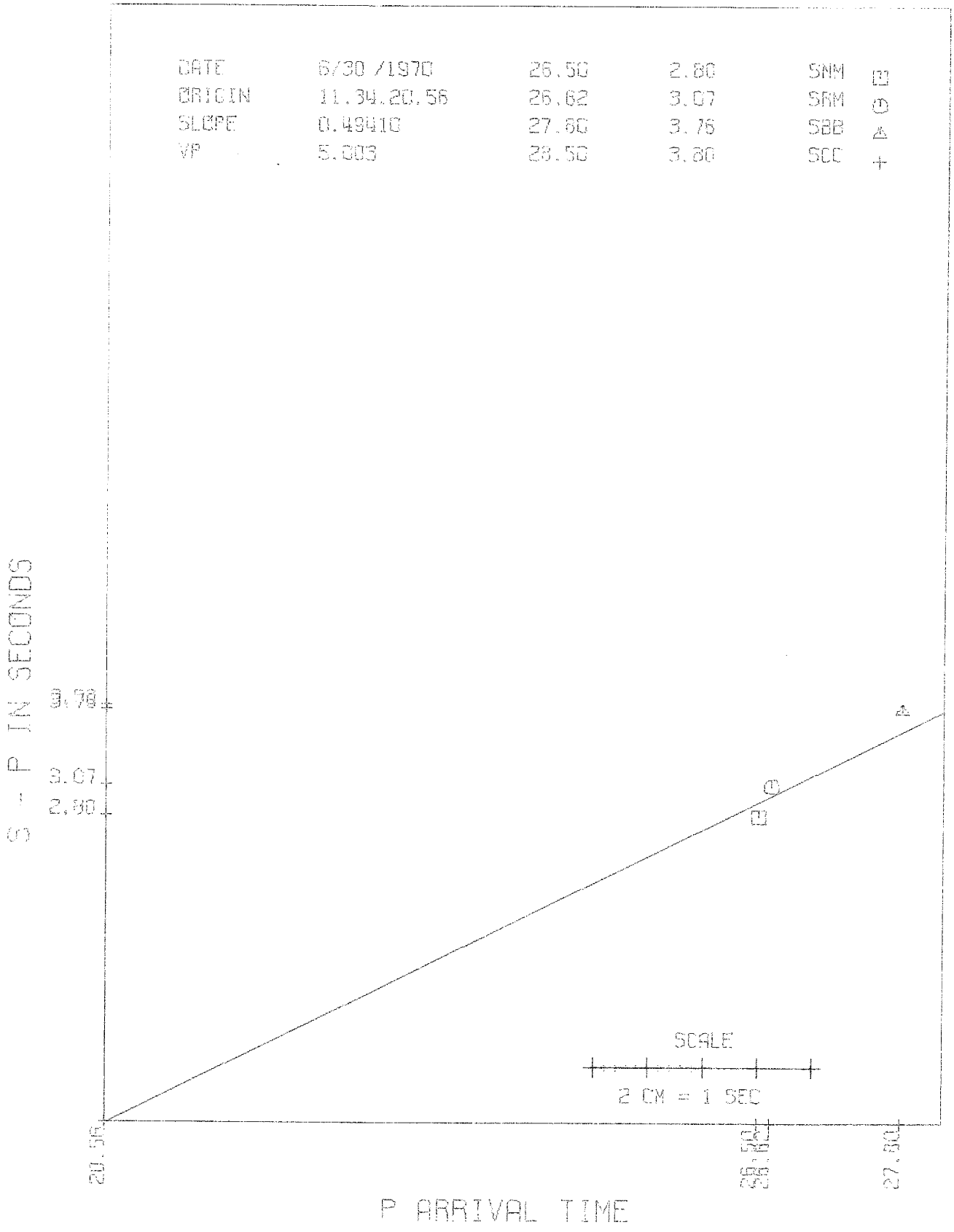

DATE 6/16 /1970
ORIGIN 05.51.10.32
SLOPE 0.67895
VP 5.622
14.00 2.50 SNM
15.90 3.79 SRM
20.45 3.57 SBB
35.20 4.13 SCC
S - P IN SECONDS
4.13
3.79
3.57
2.50
10.32
14.00
15.90
P ARRIVAL TIME
SCALE
2 CM = 1 SEC

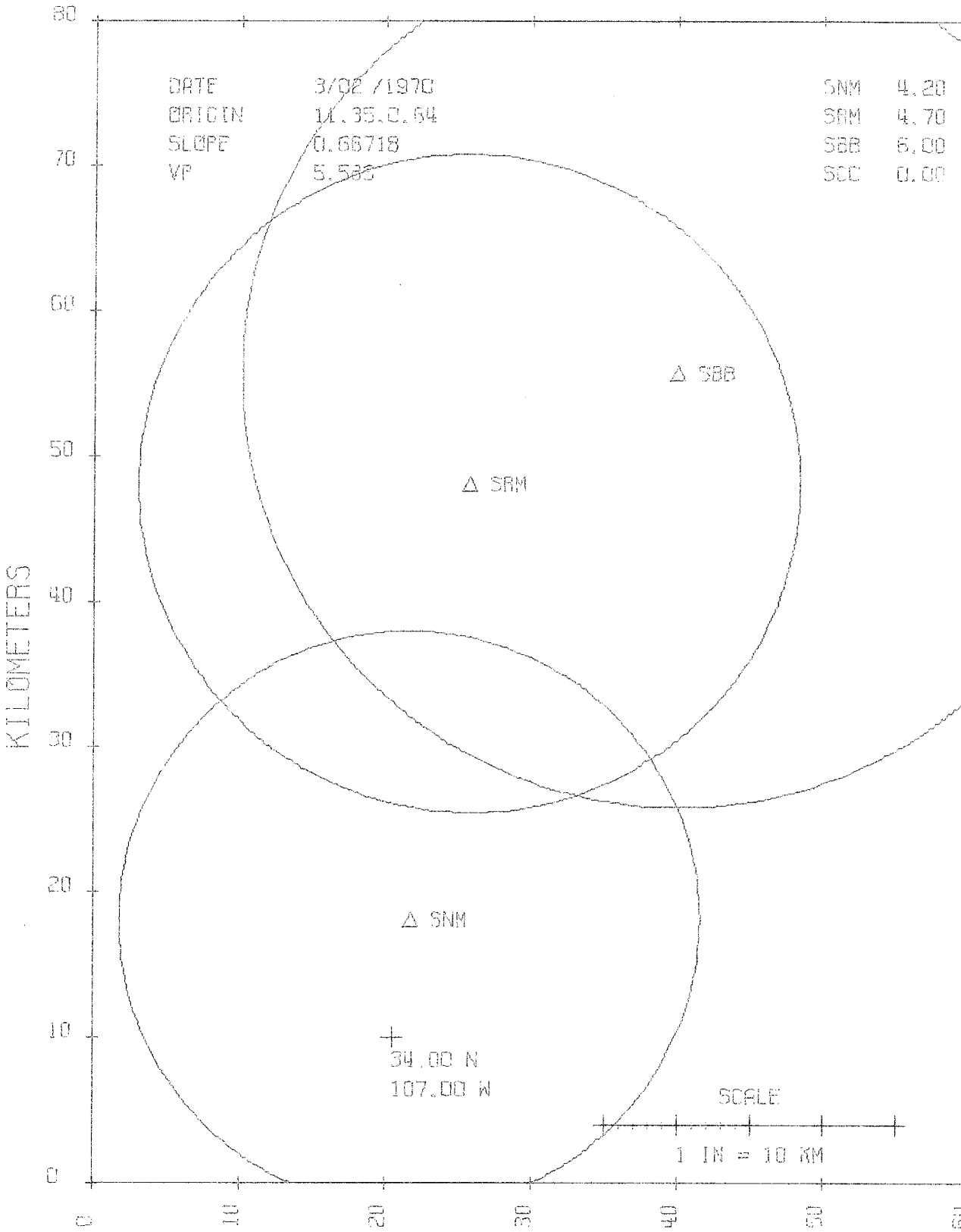

DATE 6/16 /1970
ORIGIN 16.50.18.13
SLOPE 0.38018
VP 4.622
25.00 2.42 SNM
25.20 2.89 SBM
27.46 3.53 SBB
35.20 4.13 SCC
+ Δ ⊙ □
S - P IN SECONDS
4.13
3.53
2.89
2.42
SCALE
2 CM = 1 SEC
18.13
27.46
25.00
25.20
P ARRIVAL TIME

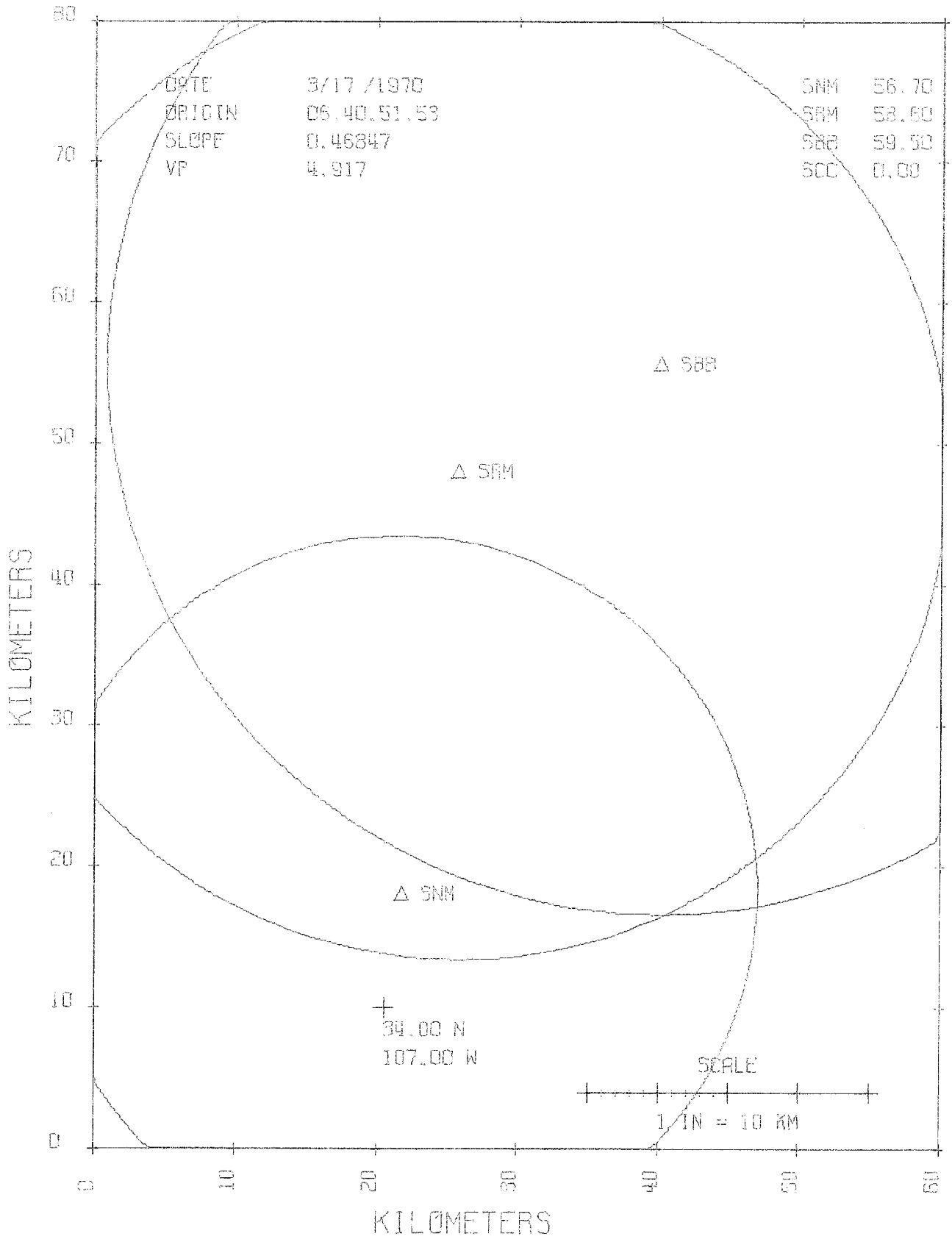

DATE 6/17/1970
ORIGIN 18.52.49.30
SLOPE 3.35000
VP 14.567
SNM
SRM
SBB
SCC
S - P IN SECONDS
4.13
3.53
2.92
2.25
49.33
50.00
50.30
SCALE
2 CM = 1 SEC
P ARRIVAL TIME

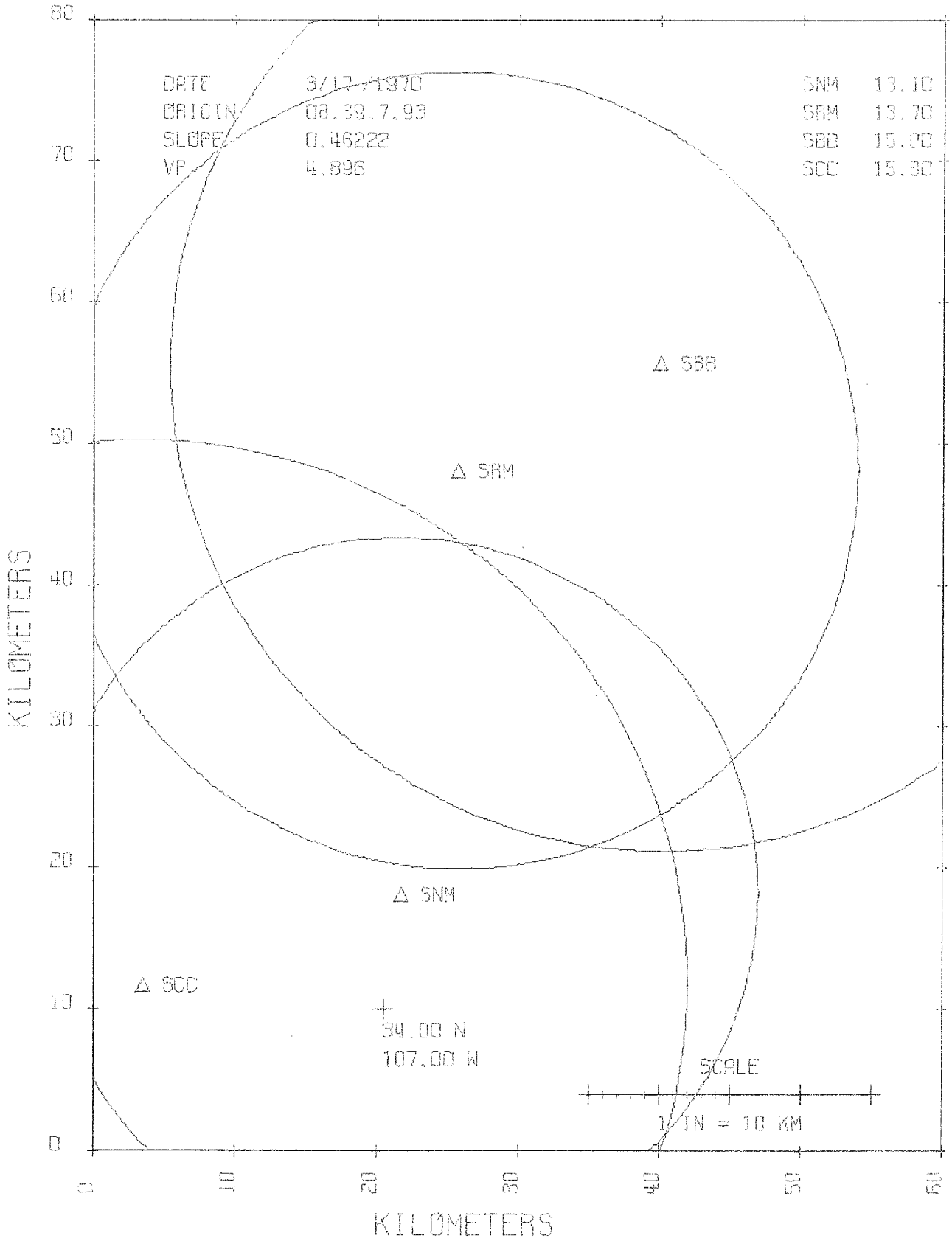
DATE	6/23 /1970	7.60	2.75	SNM
ORIGIN	01.33.2.40	10.40	4.23	SRM
SLOPE	0.52857	27.46	3.53	SEE
VP	5.119	35.20	4.19	SCC




DATE 6/30 /1970
ORIGIN 11.34.20.56
SLOPE 0.49410
VP 5.003
26.50 2.80 SNM
26.62 3.07 SAM
27.60 3.76 SBB
28.50 3.80 SCC
S - P IN SECONDS
3.76
3.07
2.80
SCALE
2 CM = 1 SEC
26.50
26.62
27.60
P ARRIVAL TIME


DATE 3/02/1970
ORIGIN 14.35.0.64
SLOPE 0.66718
VP 5.588
SNM 4.20
SRM 4.70
SBB 6.00
SCC 0.00
Δ SBB
Δ SRM
Δ SNM
34.00 N
107.00 W
SCALE
1 IN = 10 KM
KILOMETERS
KILOMETERS
0
10
20
30
40
50
60
70
80


DATE 3/17/1970
ORIGIN 06.40.51.59
SLOPE 0.46847
VP 4.917
SNM 56.70
SRM 58.60
SBB 59.50
SCC 0.00
Δ SBB
Δ SRM
Δ SNM
34.00 N
107.00 W
SCALE
1 IN = 10 KM
KILOMETERS
KILOMETERS
0
10
20
30
40
50
60
70
80


DATE 3/12/1970
ORIGIN 08.39.7.93
SLOPE 0.46222
VP 4.896
SNM 13.10
SRM 13.70
SBB 15.00
SCC 15.80
Δ SBB
Δ SRM
Δ SNM
Δ SCC
34.00 N
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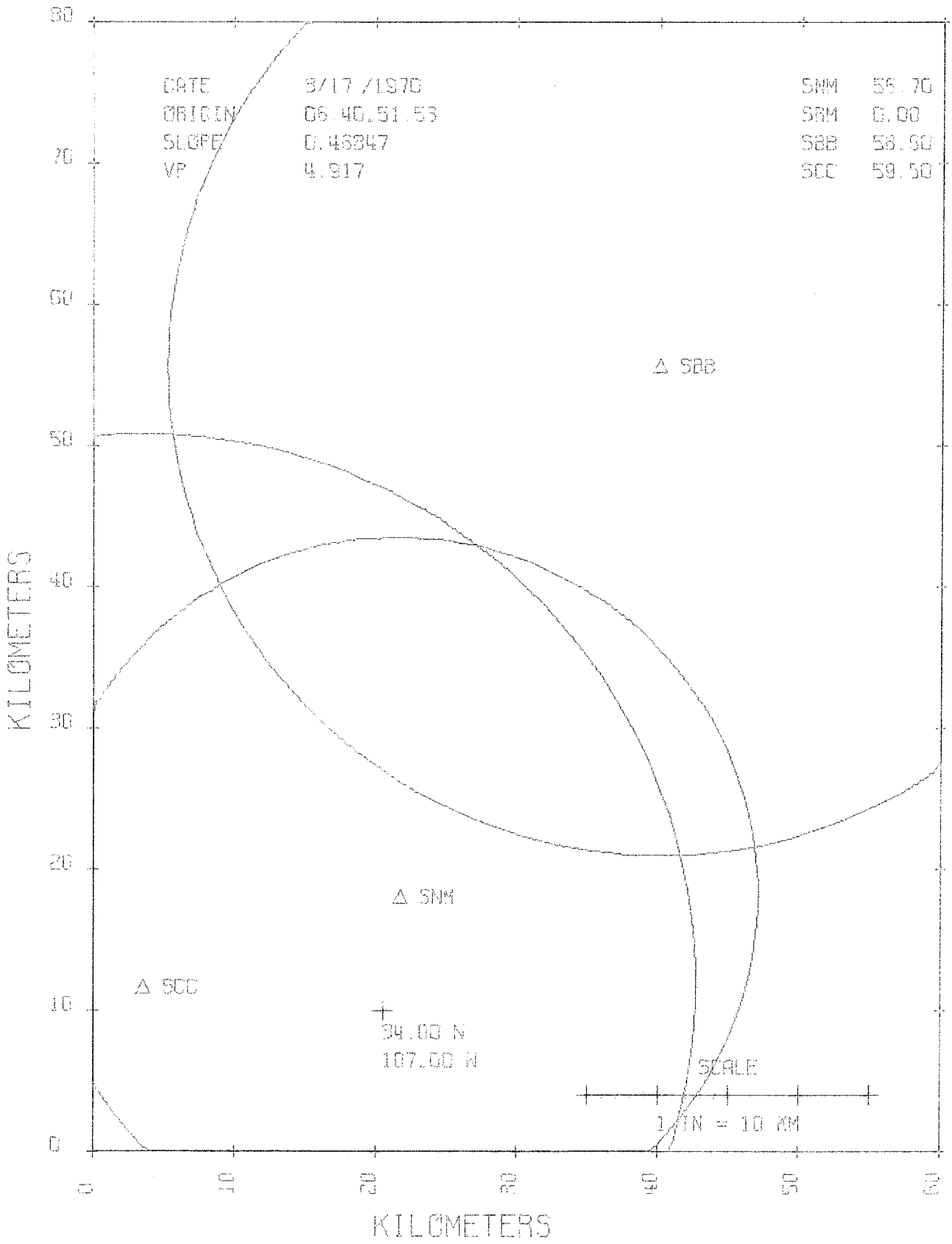
DATE 9/17/1970
ORIGIN 06.40.51.53
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SCC 59.50
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Δ SCC
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107.00 W
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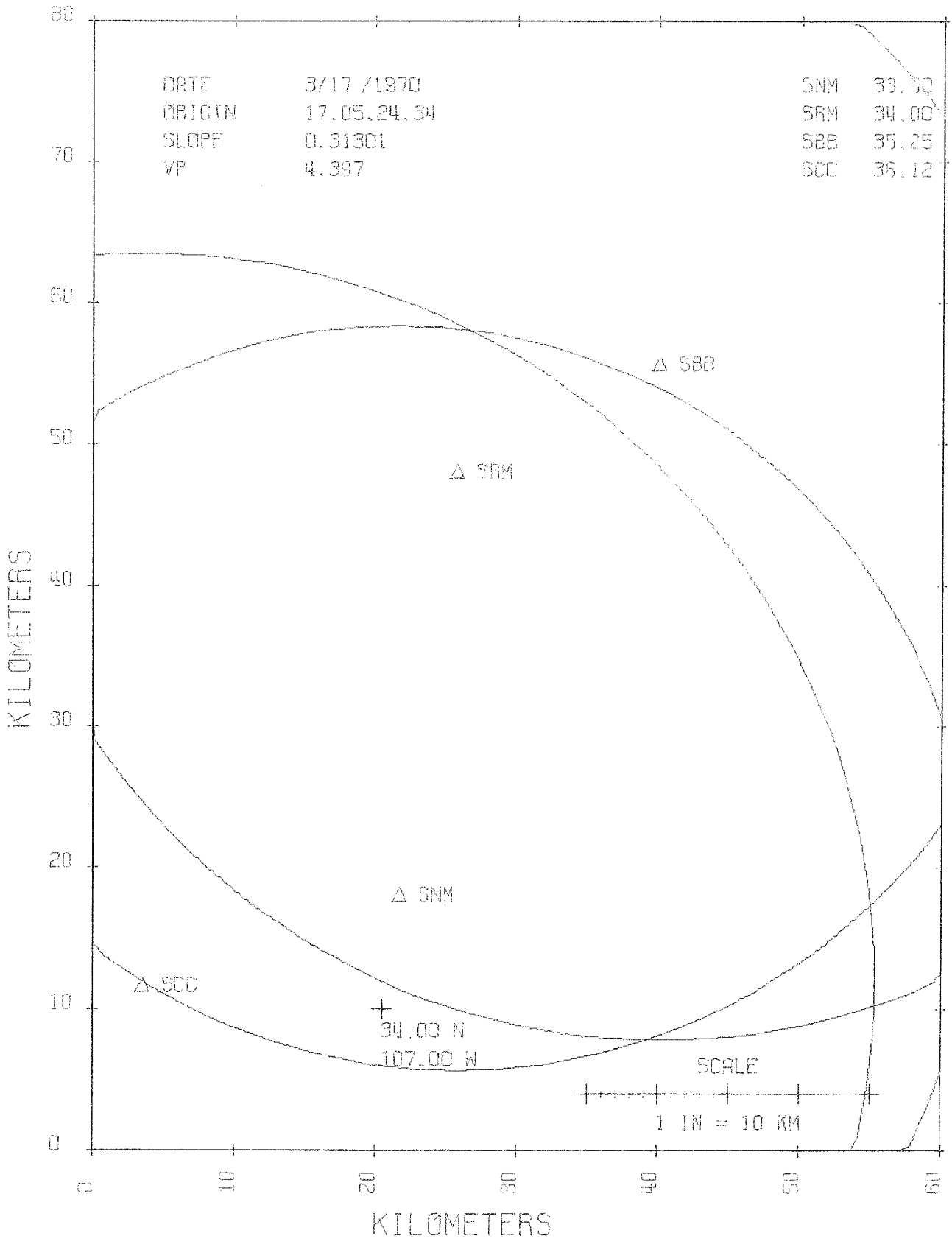
DATE 3/17/1970
ORIGIN 17.05.24.34
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VP 4.397
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Δ SCC
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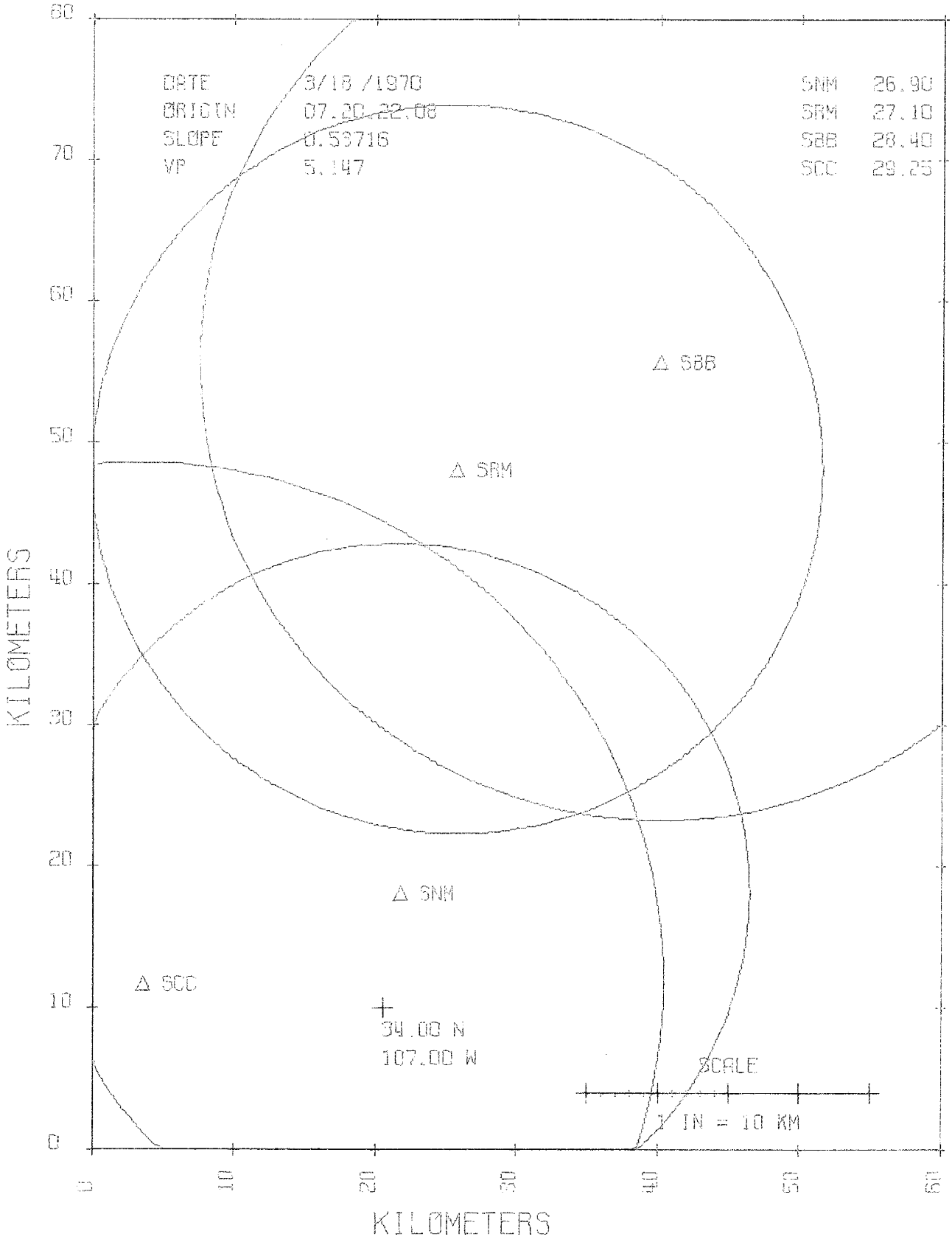
DATE 3/18 /1970
ORIGIN 07.20 22.00
SLOPE 0.53716
VP 5.147
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107.00 W
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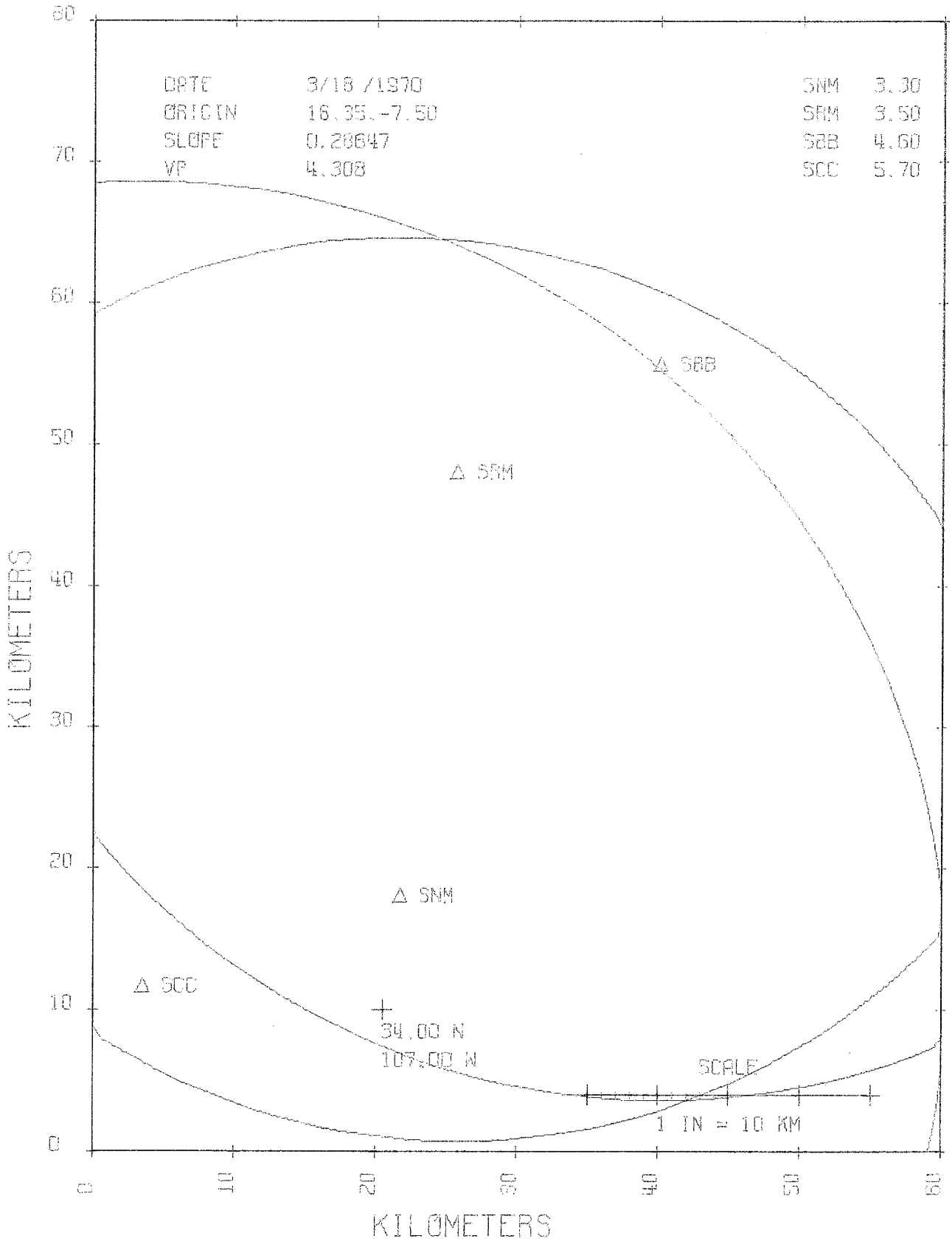
DATE 3/18 /1970
ORIGIN 16.35.-7.50
SLOPE 0.20647
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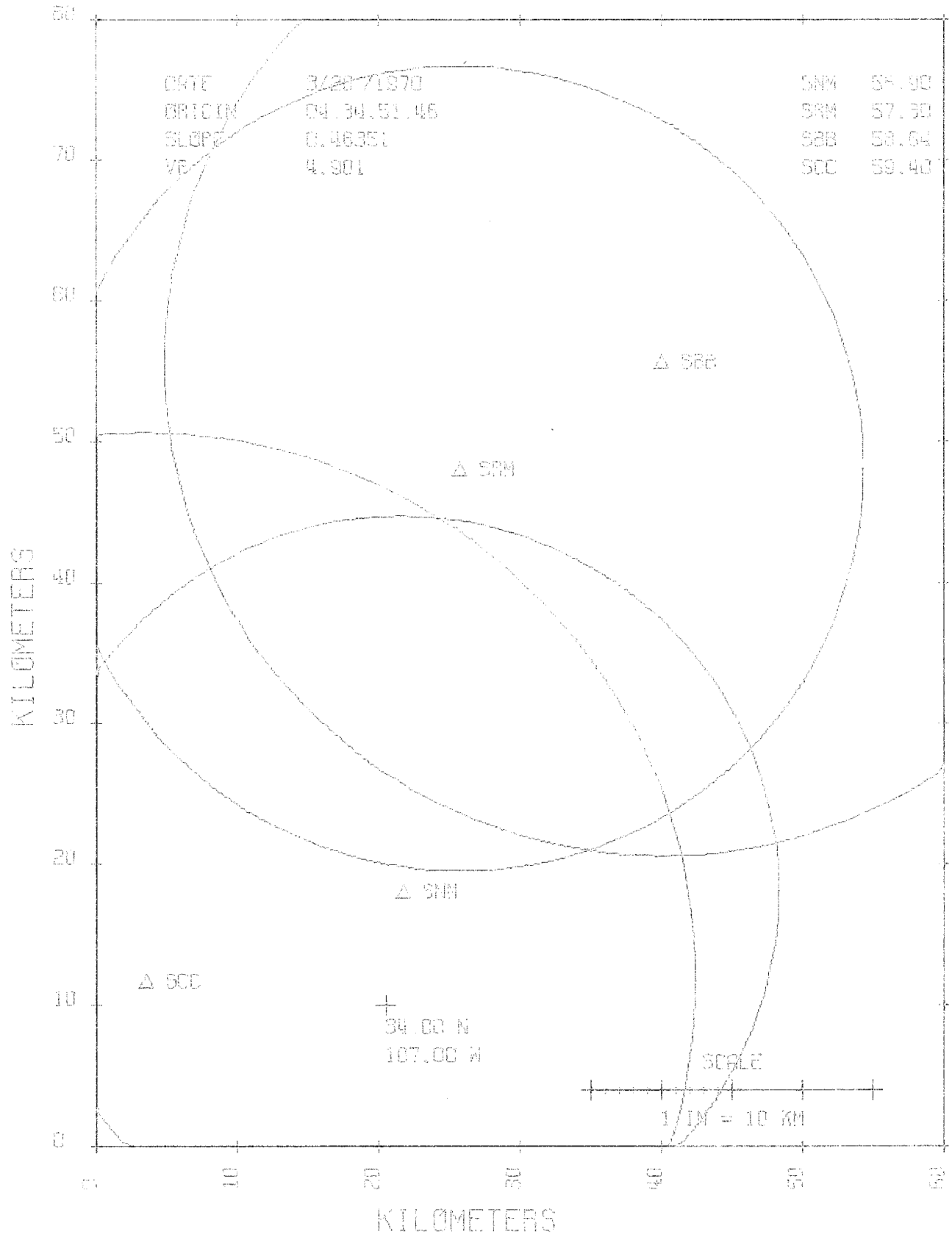
DATE 3/28/1970
ORIGIN 04.30.51.46
SLOPE 0.46351
VP 4.901
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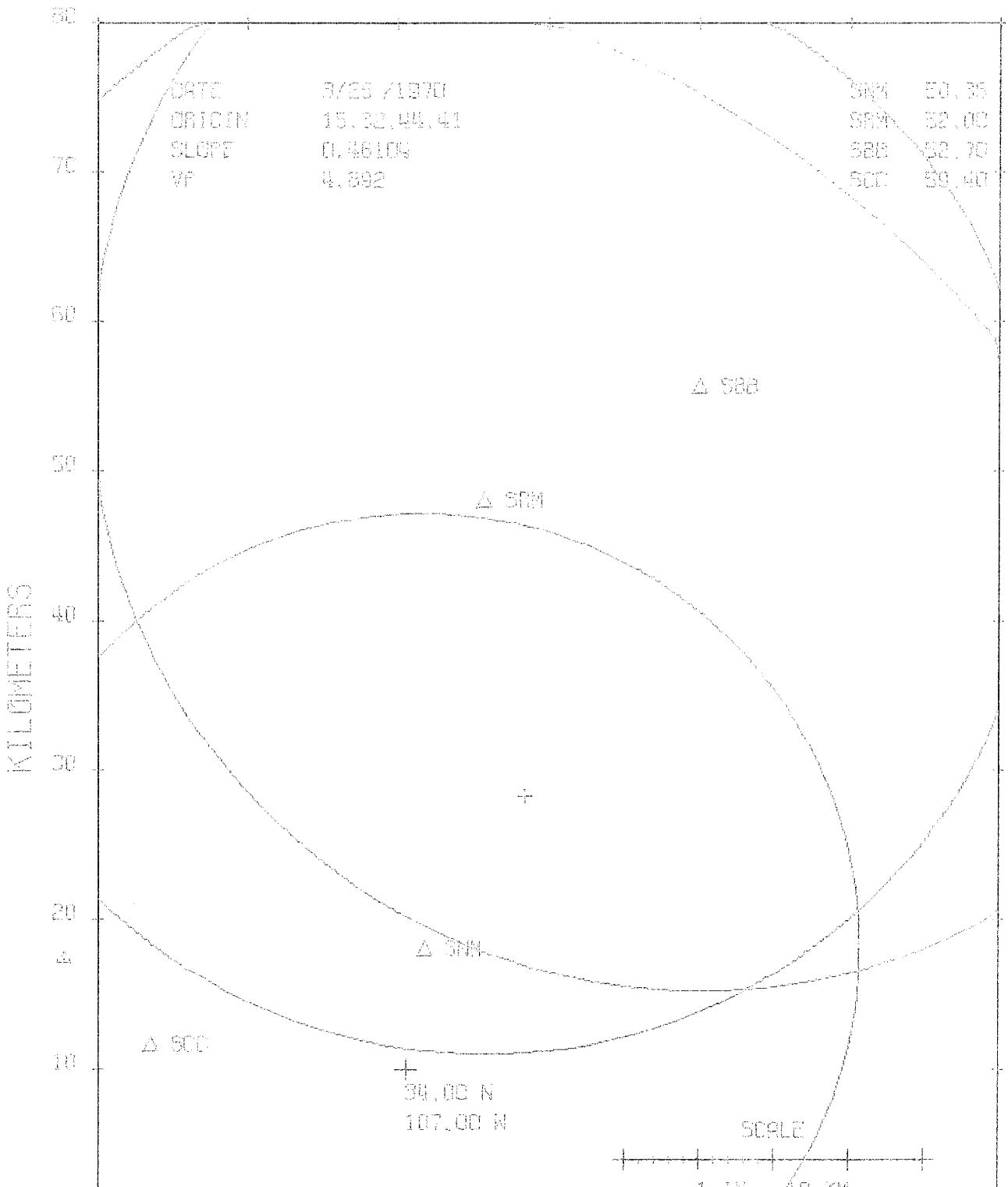
DATE 3/25/1970
ORIGIN 15,30,44.41
SLOPE 0.46104
VF 4.892
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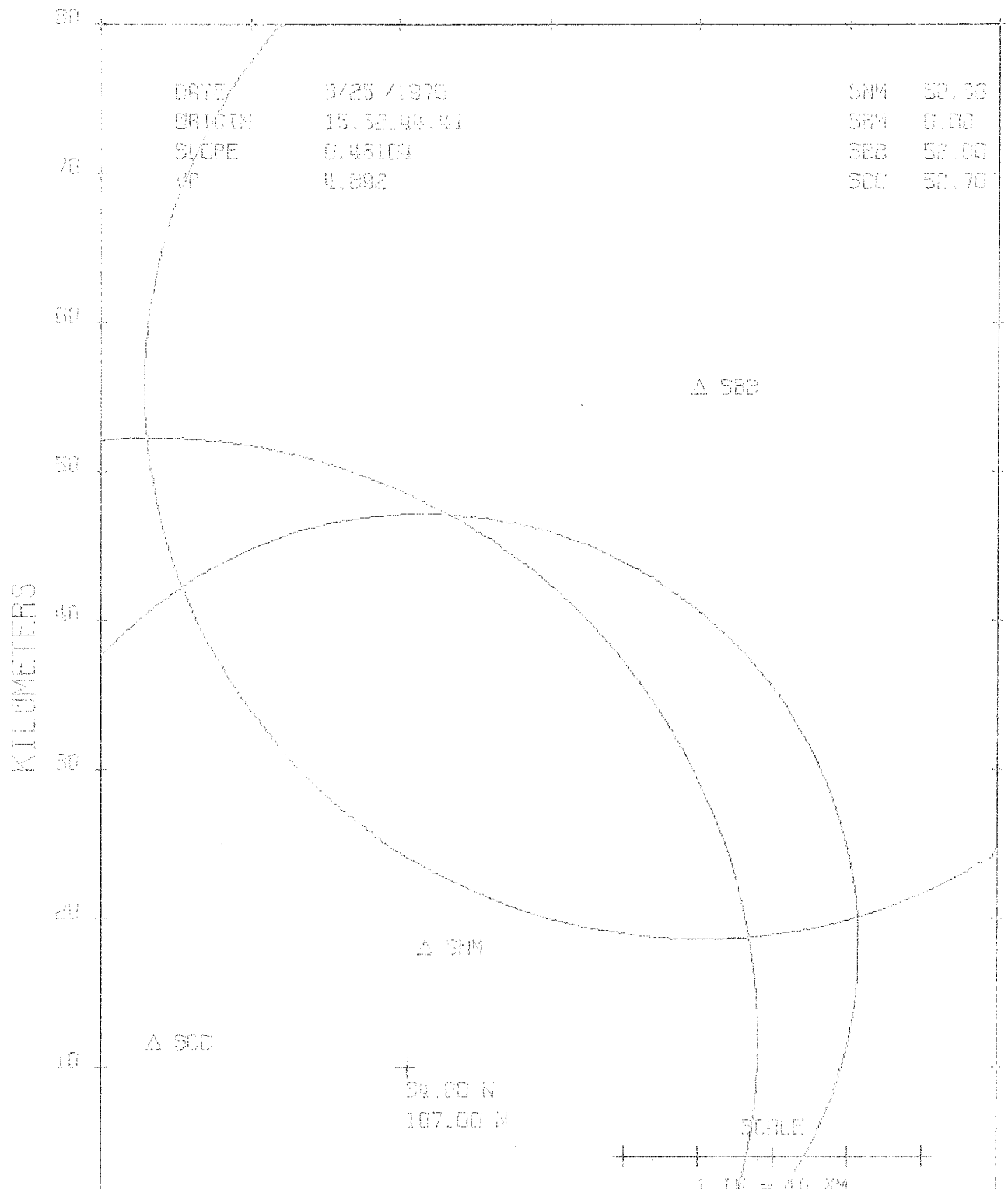
DATE 3/25 /1975
ORIGIN 15.32.46.51
SCOPE 0.46103
VP 4.692
SNM 50.30
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SEB 52.00
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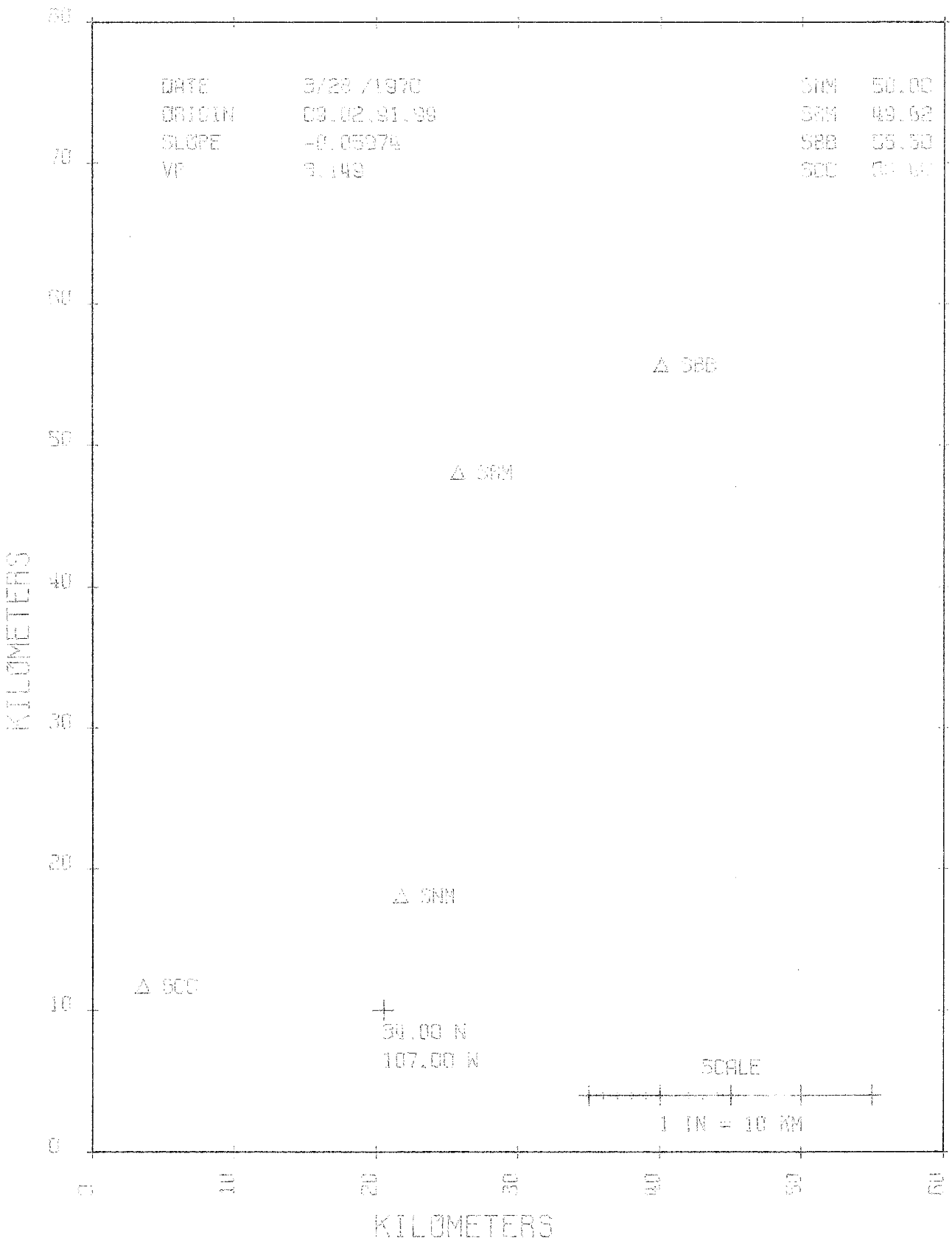
DATE 9/22/1970
ORIGIN 09.02.31.99
SLOPE -0.05974
VF 9.149
SNM 50.00
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SCC 31.47
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SRM
SNN
SCC
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107.00 W
SCALE
1 IN = 10 KM
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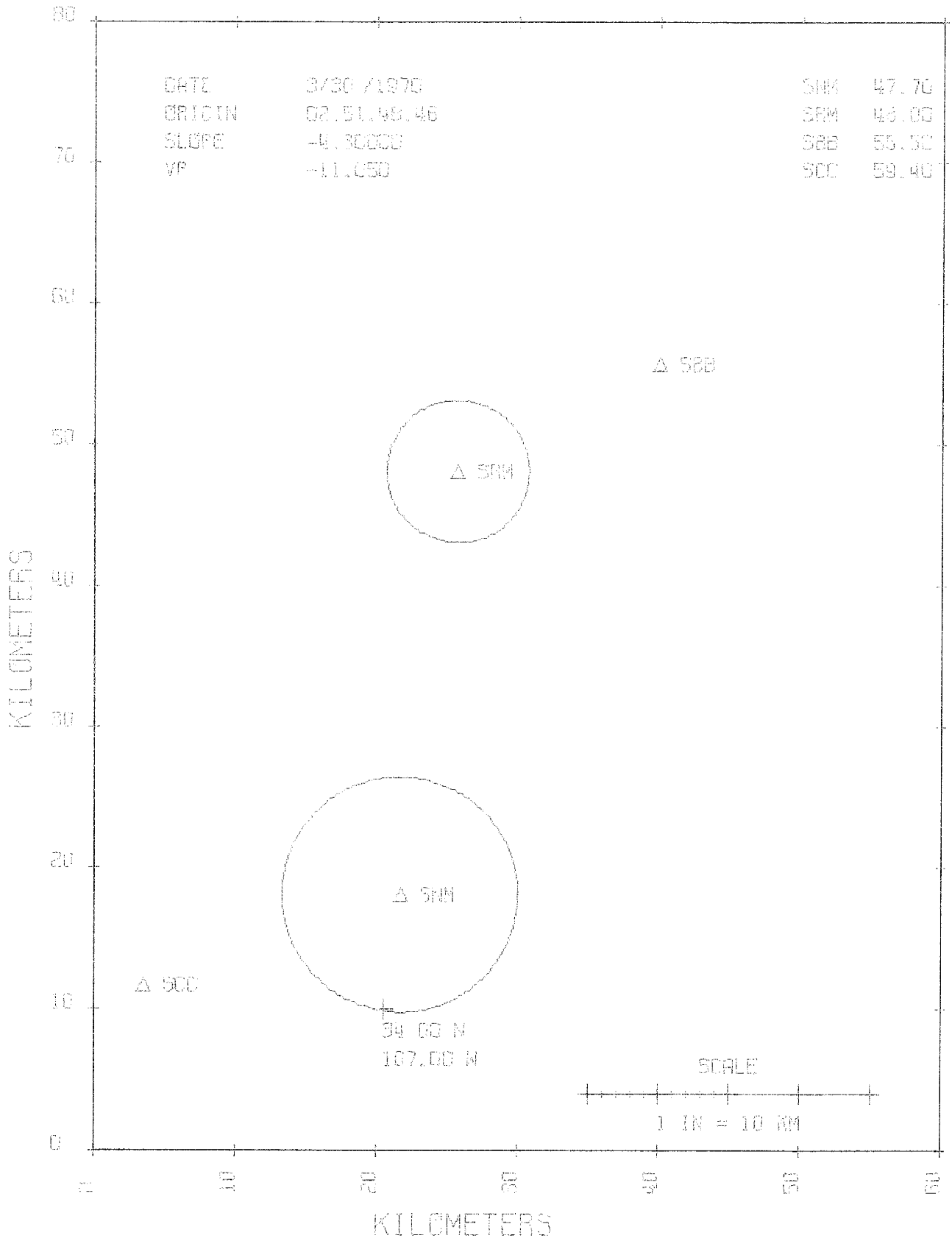
DATE 3/30/1970
ORIGIN 02.51.48.46
SLOPE -6.300000
VP -11.050
SHM 47.70
SRM 46.00
SRB 55.30
SCC 59.40
Δ SRB
Δ SRM
Δ SHM
Δ SCC
39.00 N
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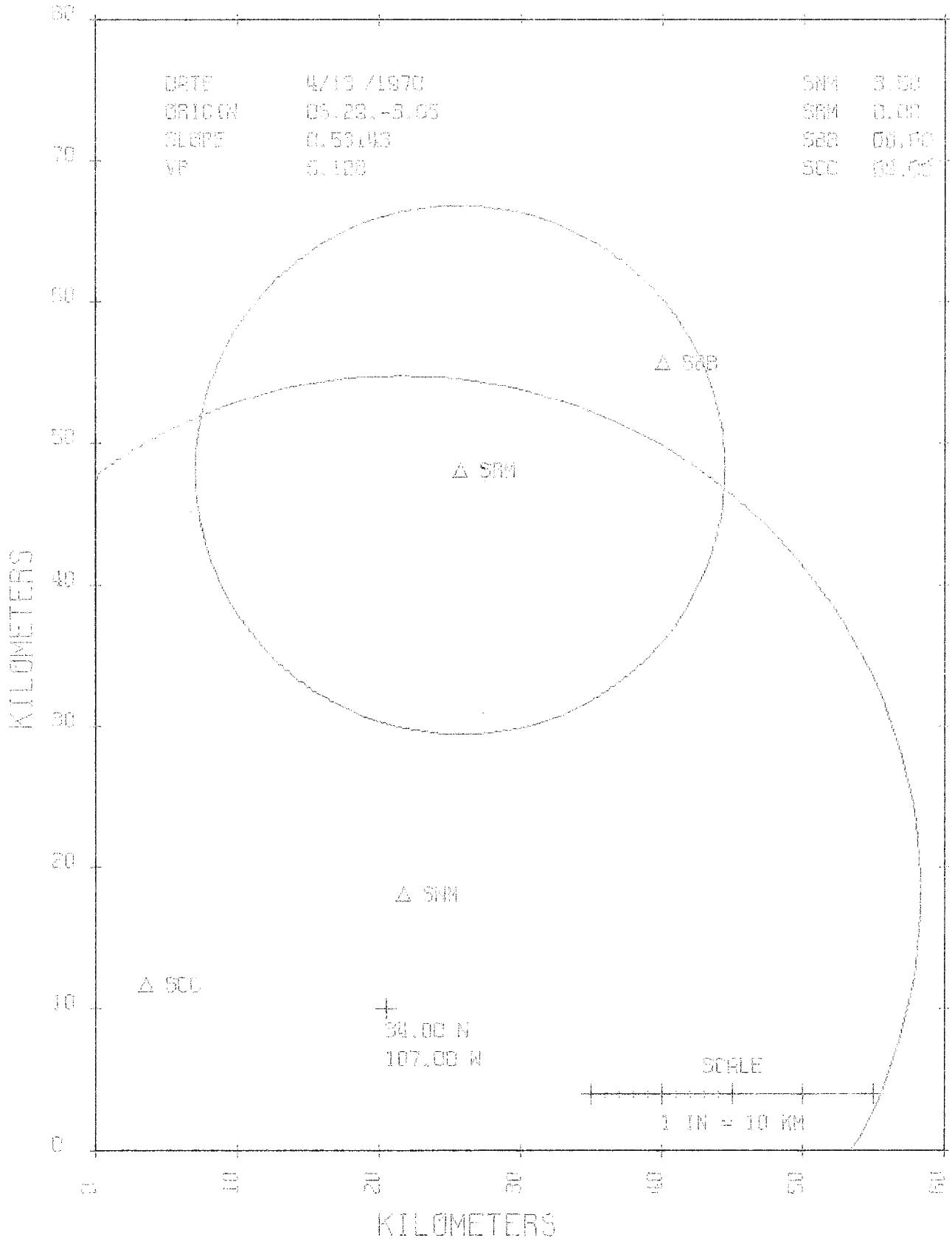
DATE 4/13/1970
ORIGIN 05.23,-3.05
SLOPE 0.53443
VP 5.100
SNM 3.50
SRM 0.00
SSB 05.00
SCC 60.00
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Δ SRM
Δ SNM
Δ SCC
34.00 N
107.00 W
SCALE
1 IN = 10 KM
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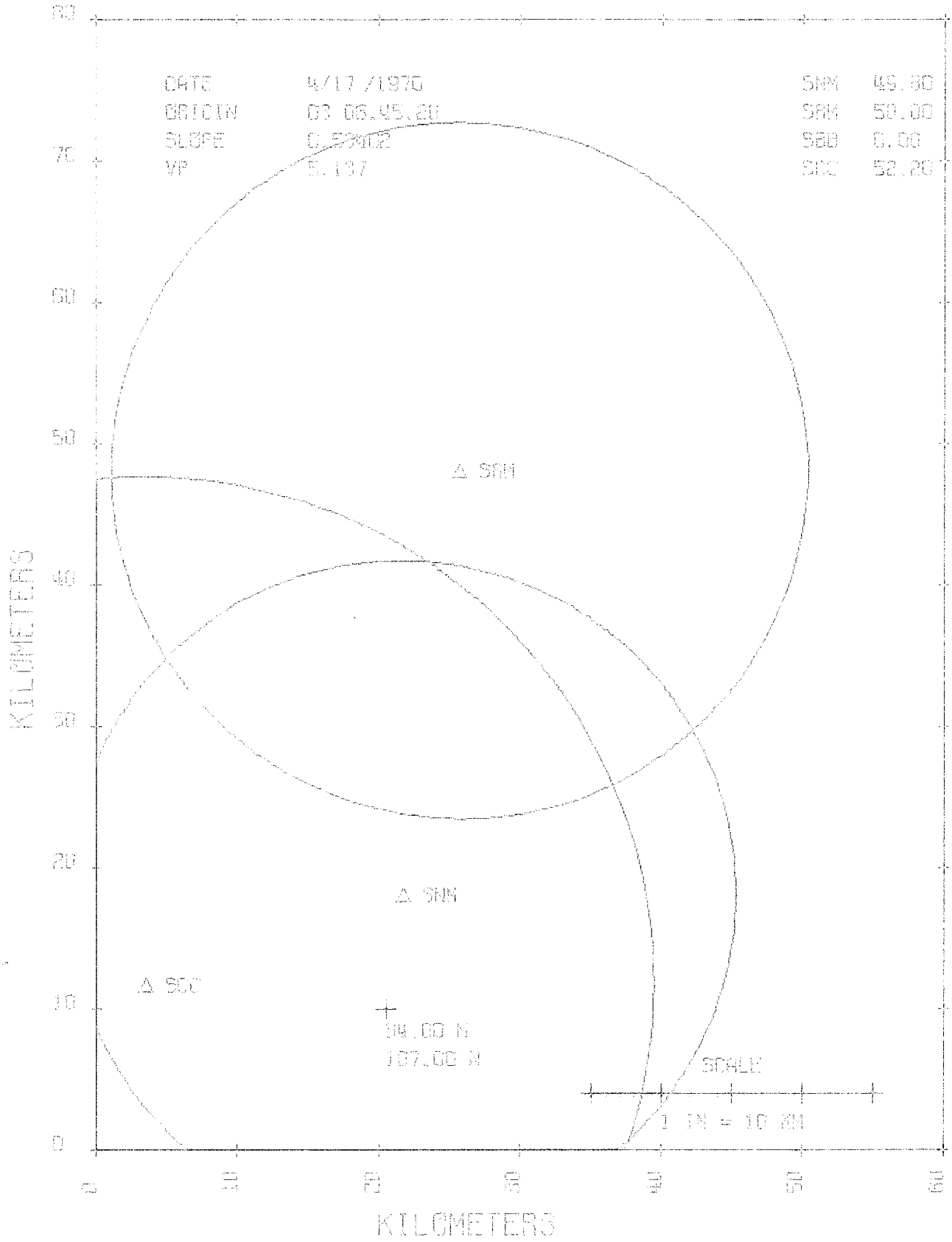
DATE 4/17/1976
BRGIN 03 06.45.20
SLOPE 0.53402
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SDC 52.20
Δ SNM
Δ SNM
Δ SDC
34.00 N
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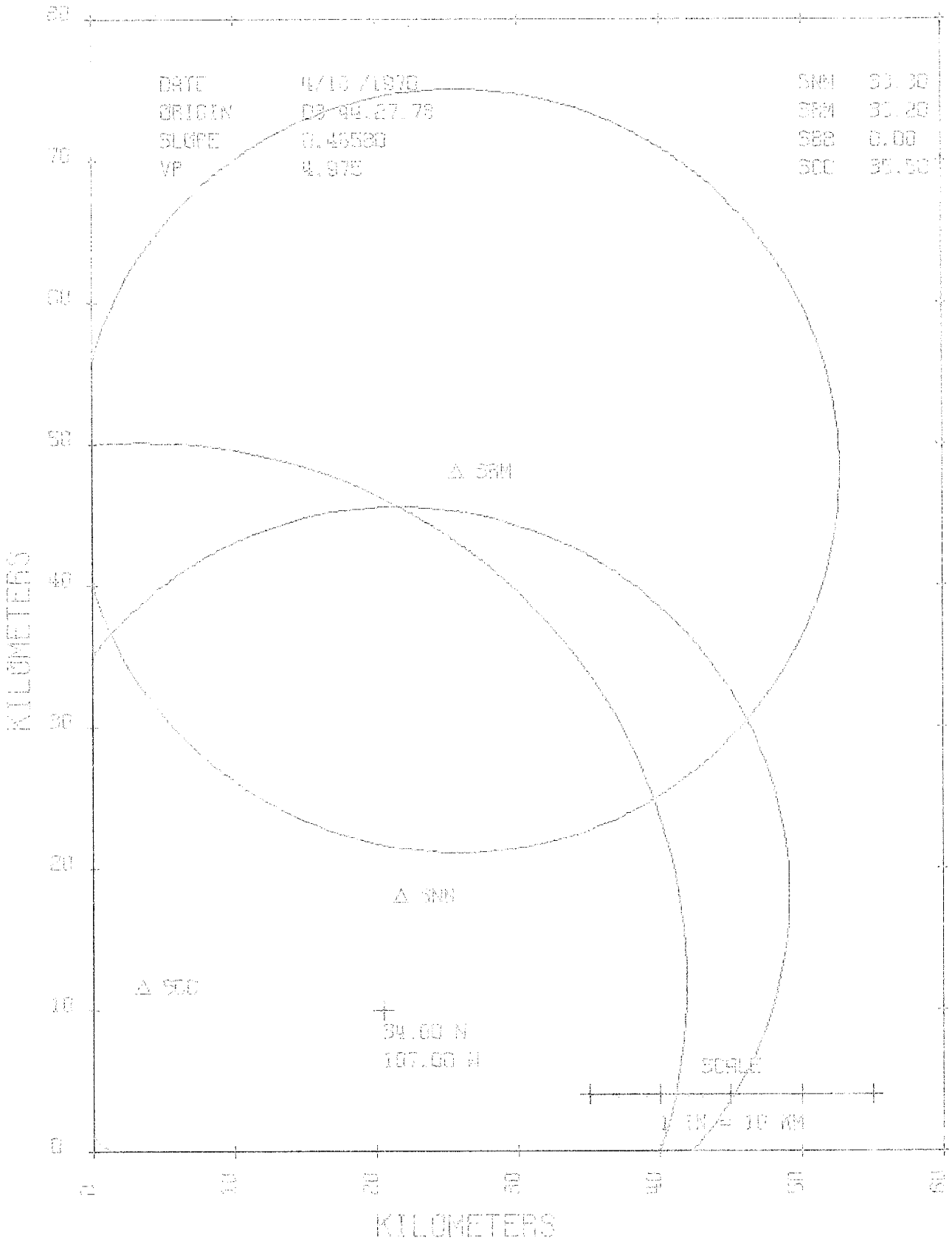
DATE 4/15/1990
ORIGIN D2-99:27.75
SLOPE 0.465383
VP 4.975
SMM 33.30
SRM 35.20
SBB 0.00
SCC 35.50
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Δ RNN
Δ SCC
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107.00 W
SCALE
1 IN = 10 KM
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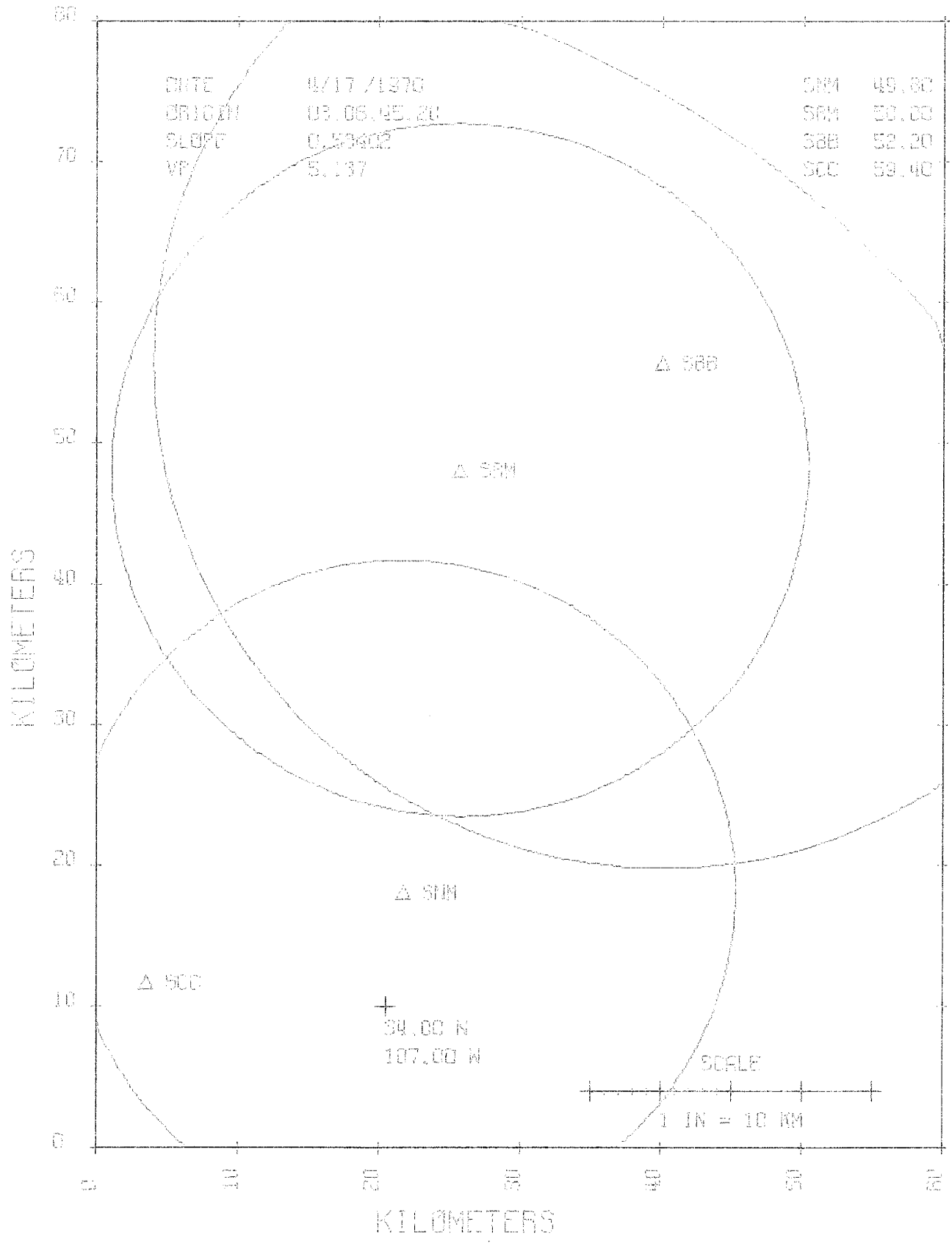
DATE 4/17/1970
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SCC 59.40
Δ SBB
Δ SRM
Δ SNM
Δ SCC
34.00 N
107.00 W
SCALE
1 IN = 10 KM
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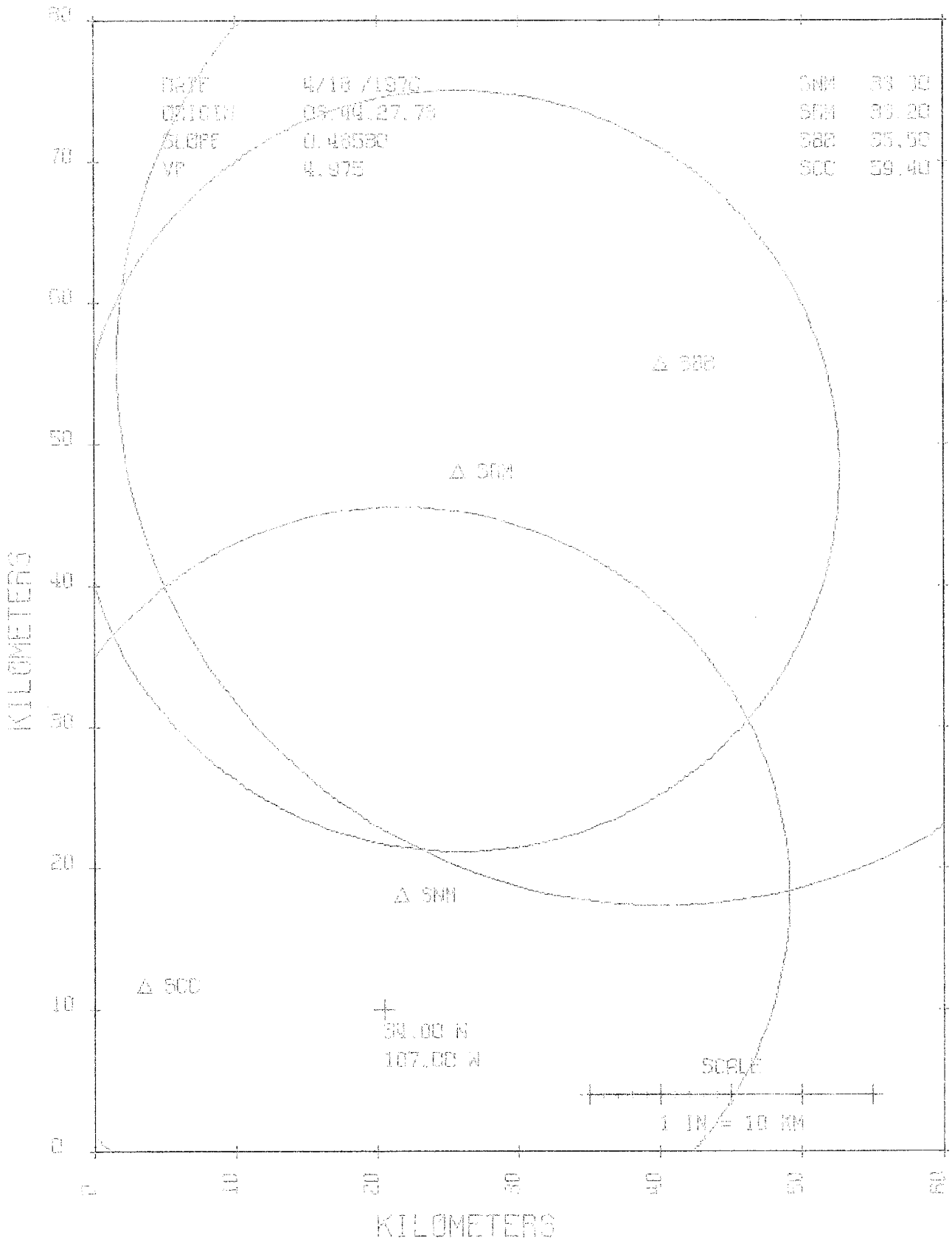
DATE 4/18/1979
ORIGIN 08°04'27.7W
SLOPE 0.483330
VP 4.975
SNM 33.30
SMM 30.20
SBB 25.50
SCC 39.40
Δ SBB
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Δ SNM
Δ SCC
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107.00 W
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1 IN = 10 KM
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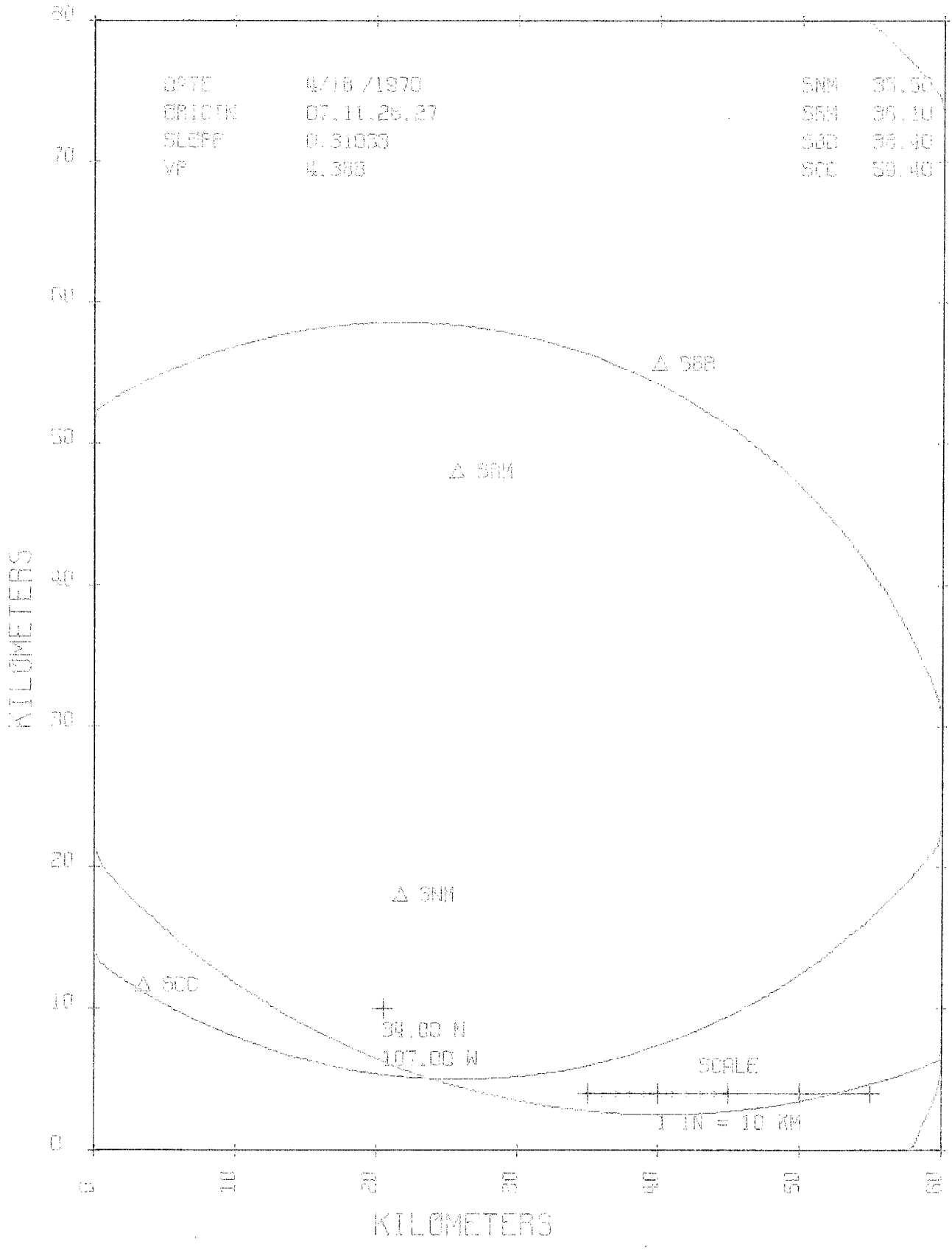
DATE 4/16/1970
ORIGIN 07.11.26.27
SLOPE 0.31333
VP 4.303
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SRM 35.10
SBB 35.40
SDC 59.40
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Δ 3NM
Δ SDC
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107.00 W
SCALE
1 IN = 10 KM
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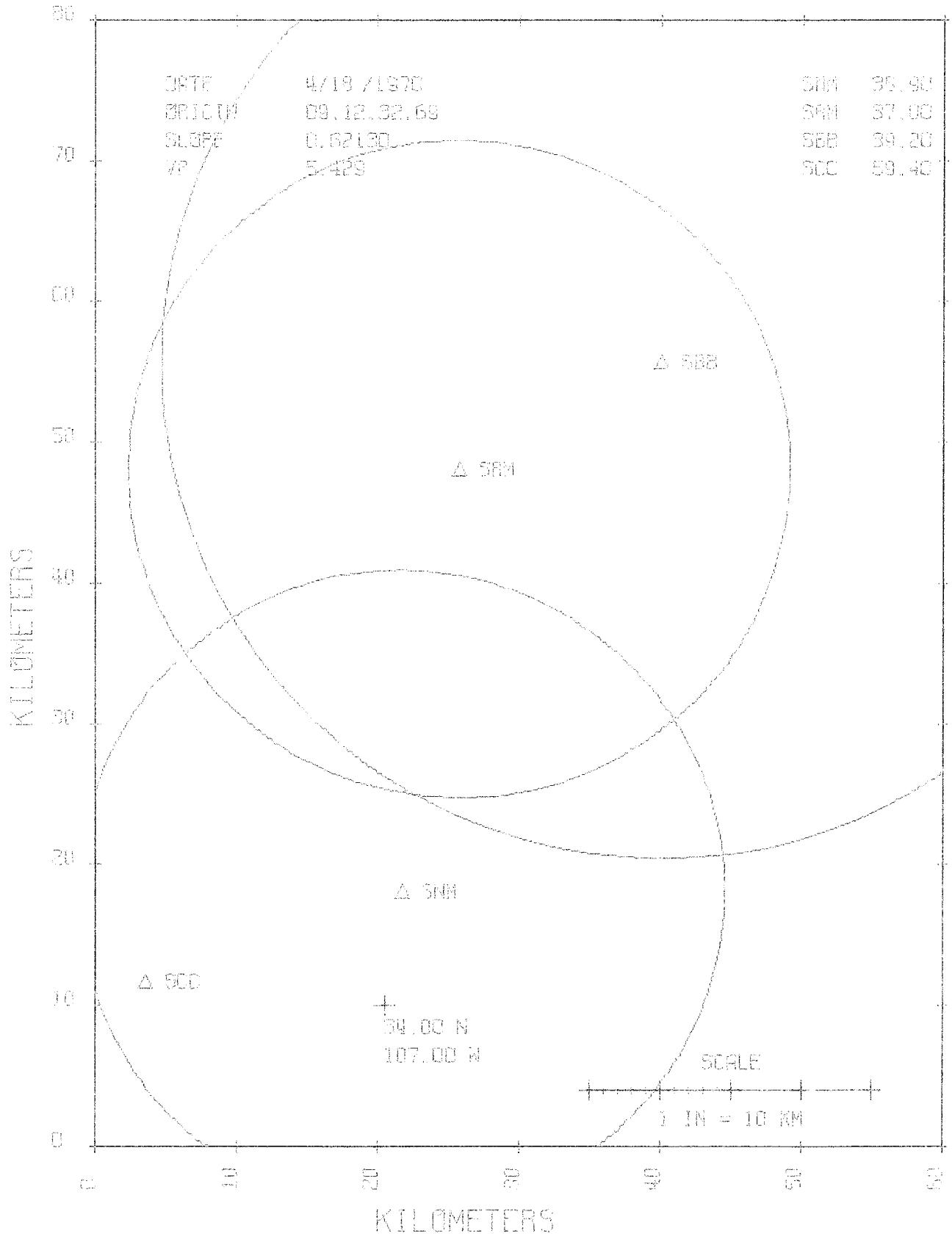
DATE 4/19/1970
ORIGIN 09.12.32.69
SLOPE 0.021300
VP 5.429
SNM 35.90
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SBB 39.20
SCC 59.40
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△ SRM
△ SNM
△ SCC
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107.00 W
SCALE
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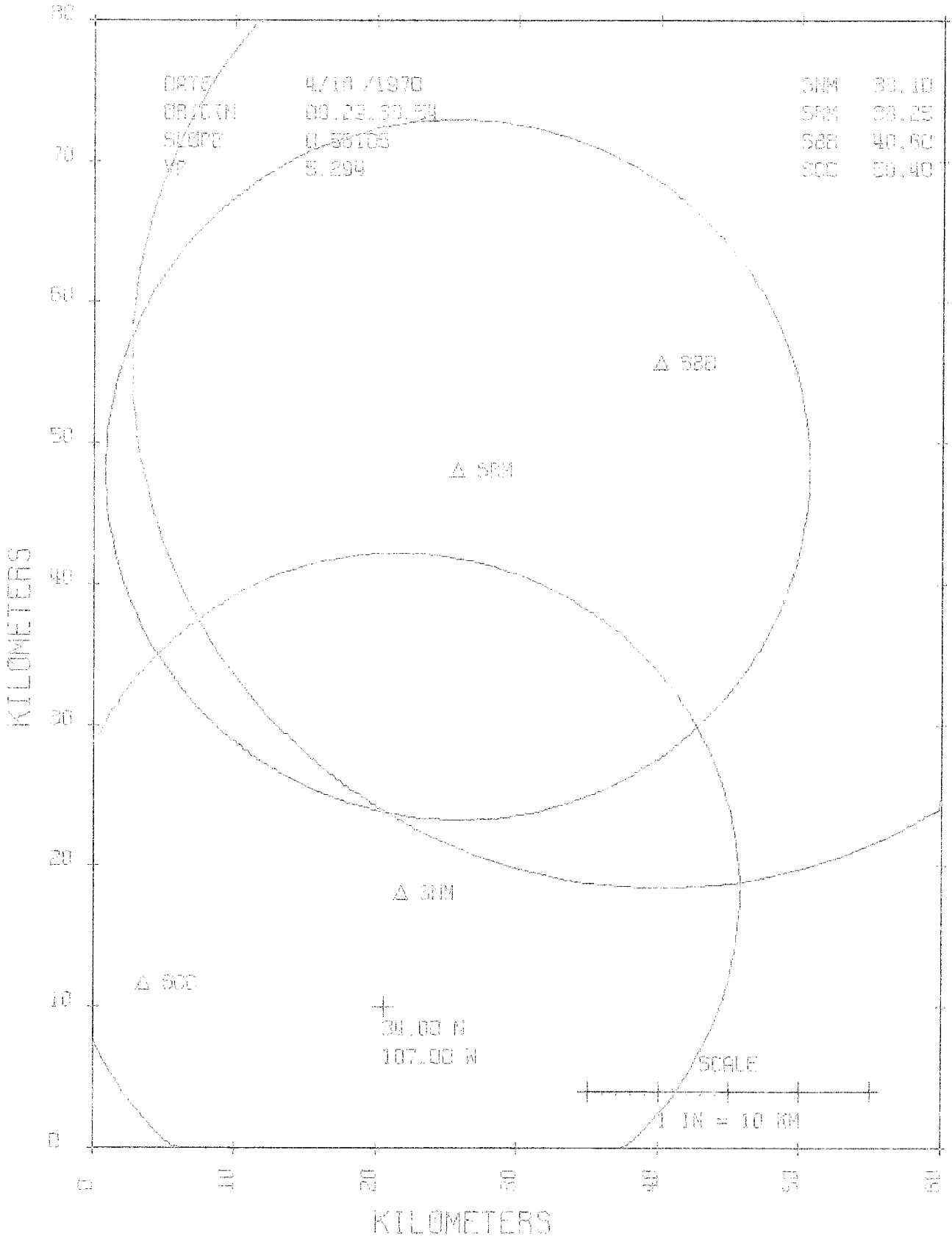
DATE 4/10/1970
ORIGIN 00:23:30.5N
SLOPE 0.586105
VP 5.294
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SBB 40.60
SCC 50.40
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Δ SCC
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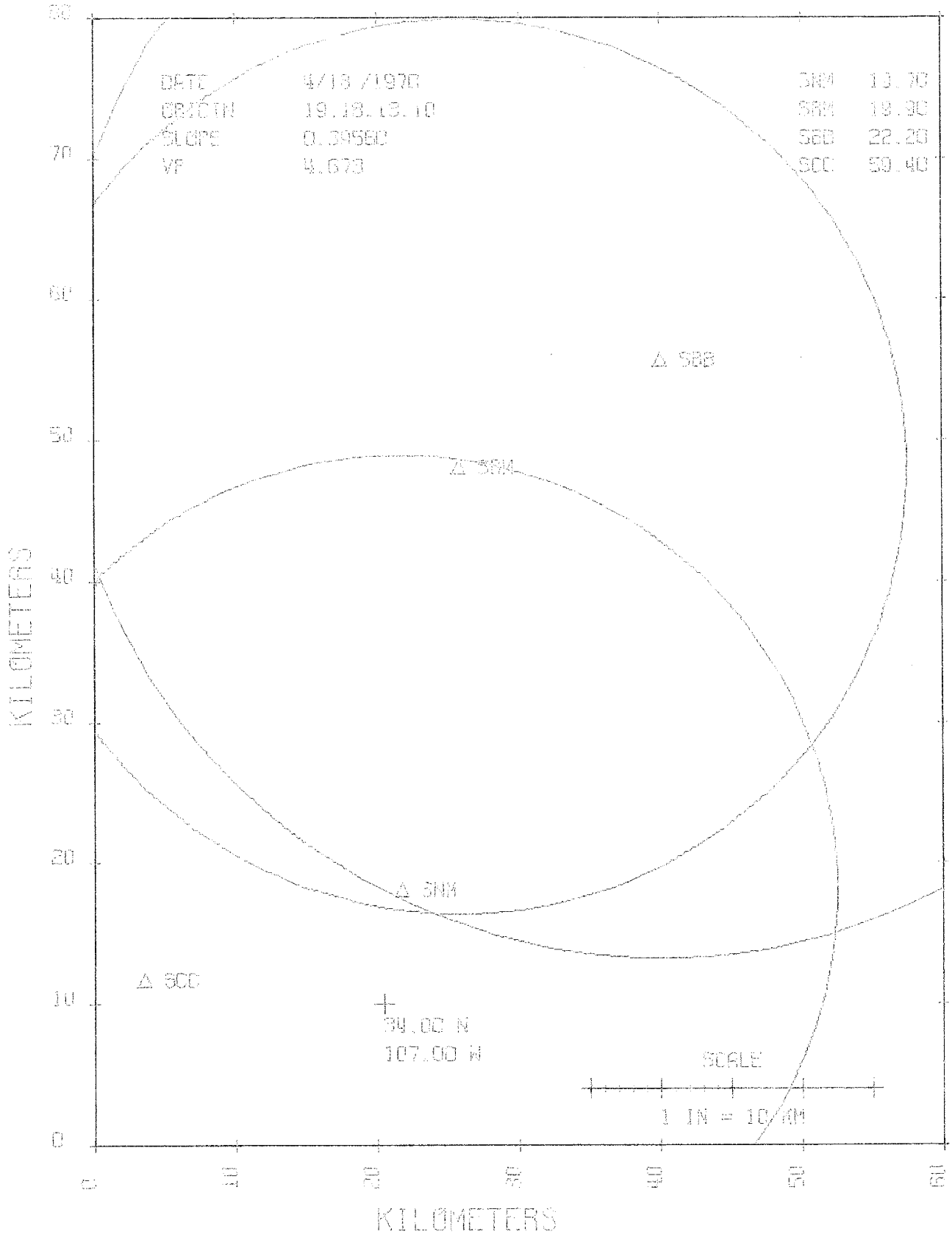
DATE 4/13/1978
ORIGIN 19.18.19.10
SLOPE 0.394582
VF 4.673
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Δ SBM
Δ SNM
Δ SCC
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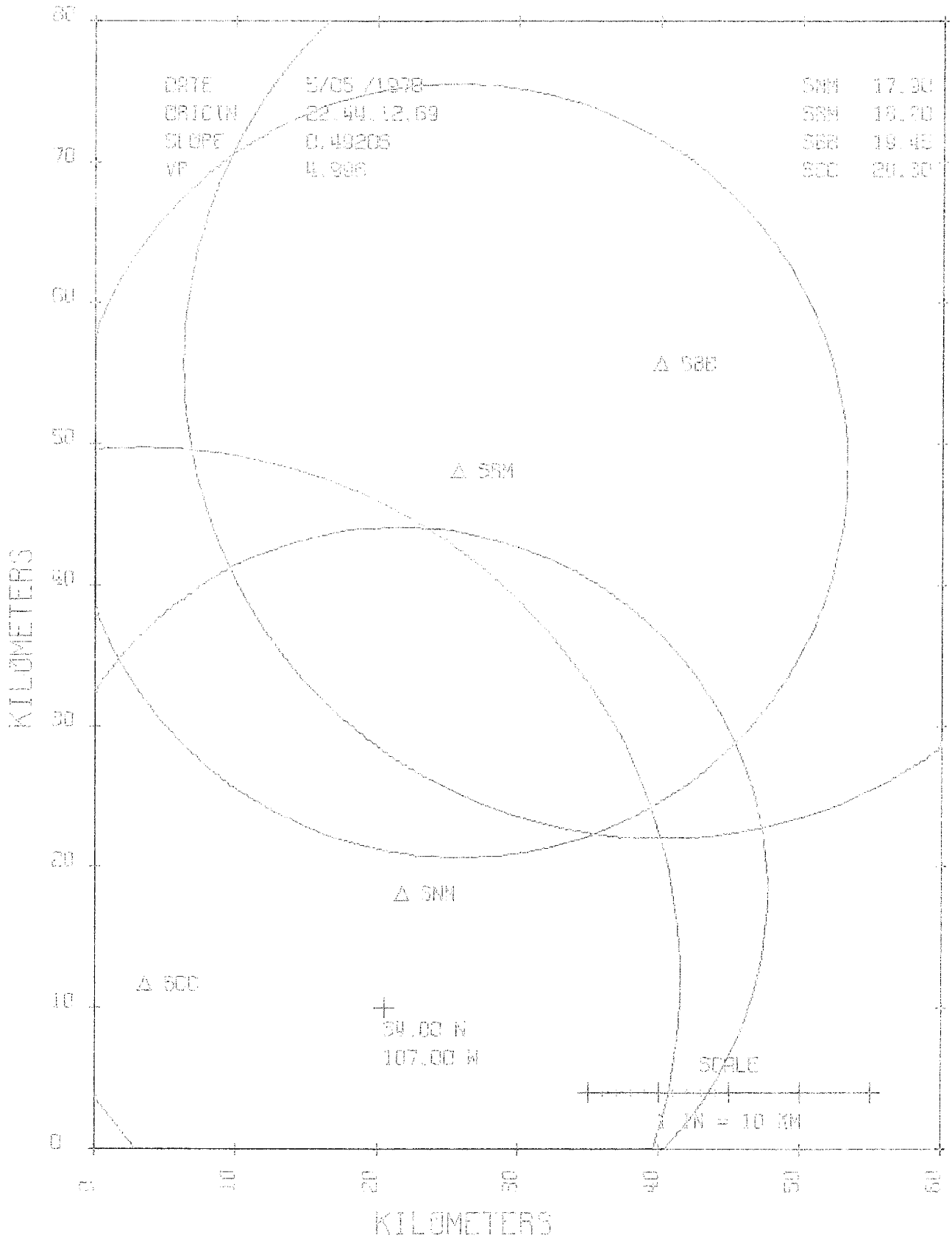
DATE 5/05/1998
ORIGIN 32.40N,112.60W
SLOPE 0.402205
VP 4.906
SNM 17.30
SRM 18.70
SBB 19.45
SDD 20.30
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Δ SRM
Δ SNM
Δ SDD
34.00 N
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SCALE
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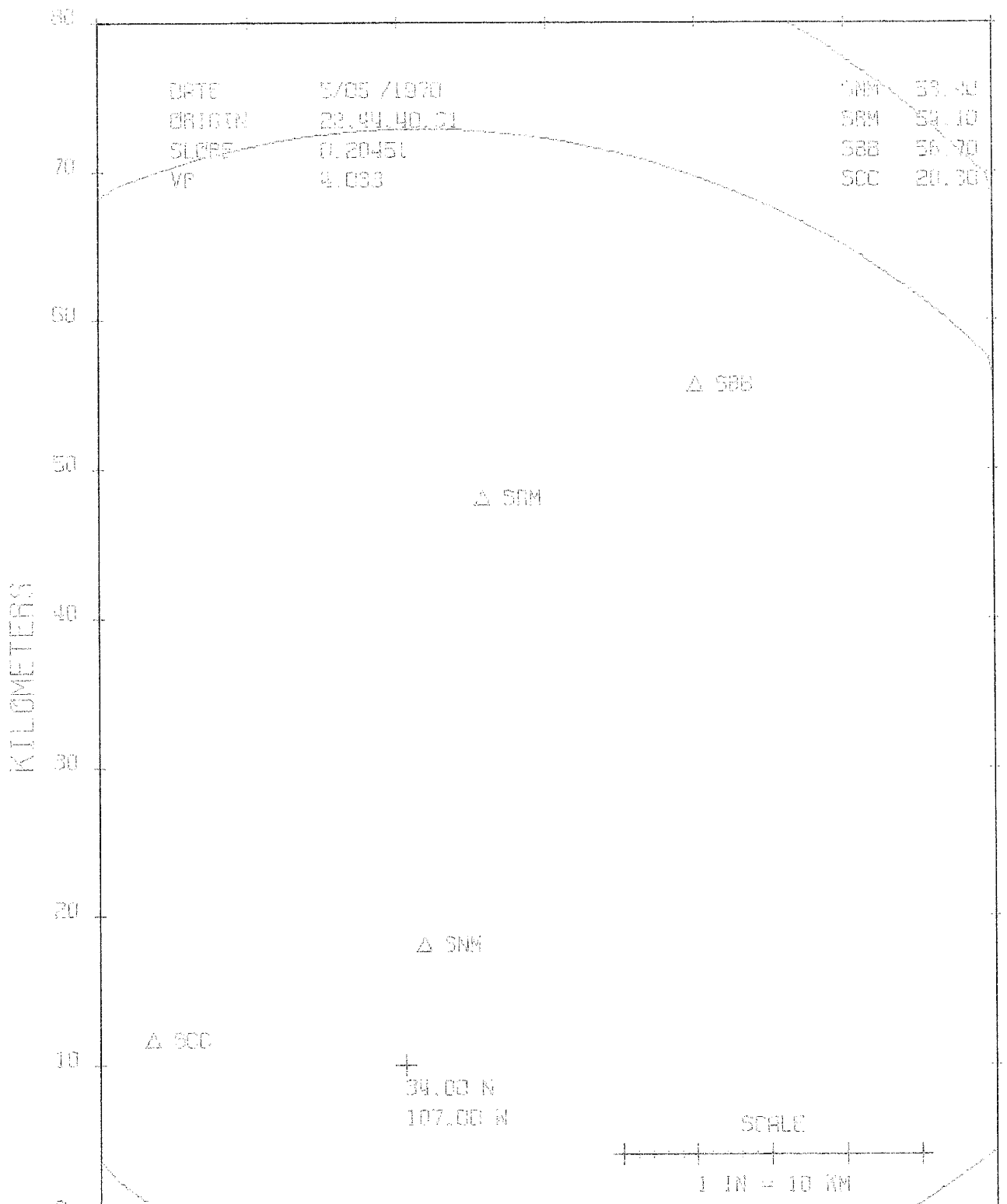
DPTC 5/05/1970
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SLOPE 0.20451
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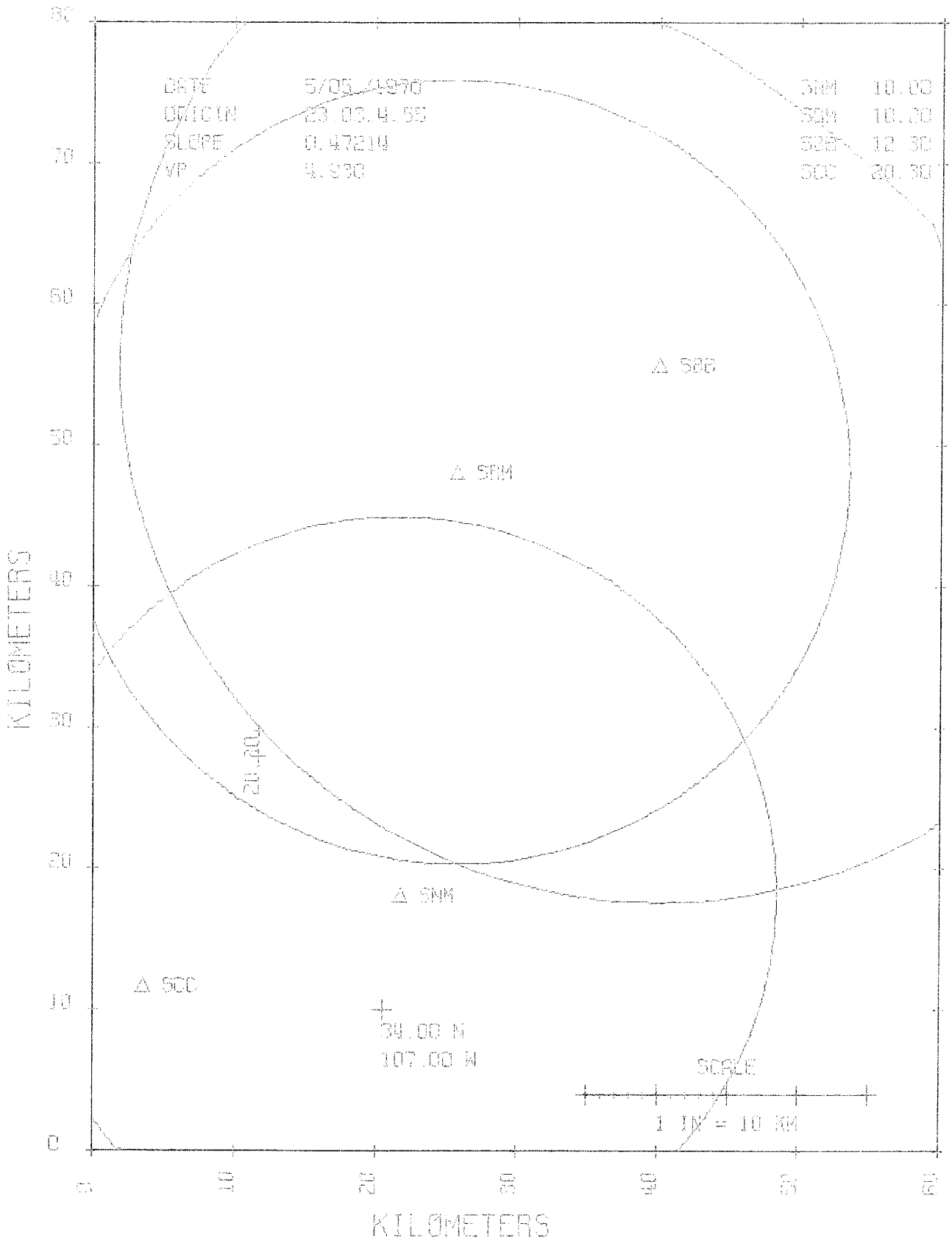
DATE 5/05/1970
ORIGIN 23.03.4.5E
SLOPE 0.4721N
VP 4.93D
5NM 10.0D
50M 10.2D
535 12.3D
50C 20.3D
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△ 50M
△ 535
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107.00 W
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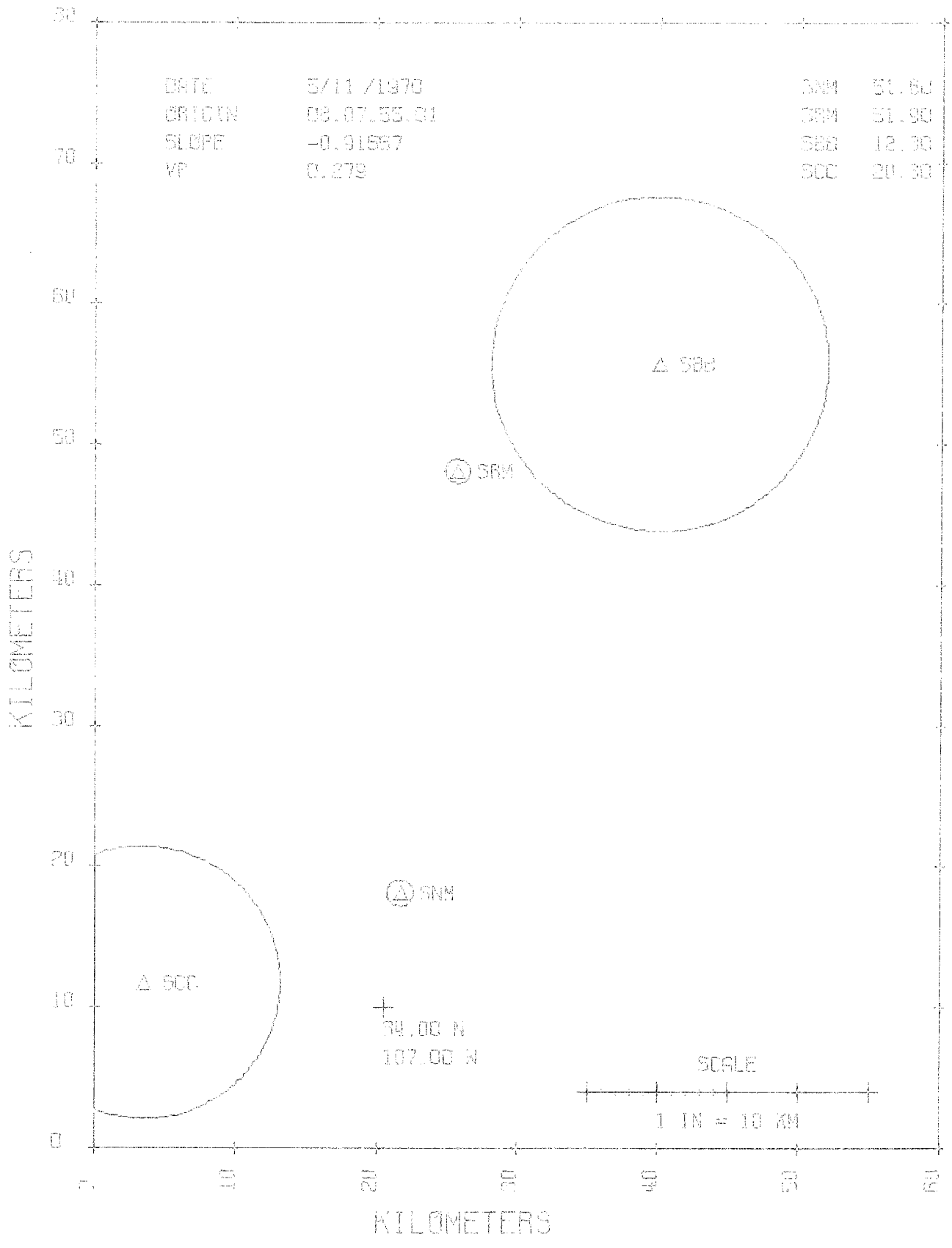
DATE 5/11/1970
ORIGIN 08.07.55.81
SLOPE -0.91557
VP 0.279
SNM 51.60
SRM 51.90
SBB 12.30
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SRM
SNM
SCC
30.00 N
107.00 W
SCALE
1 IN = 10 KM
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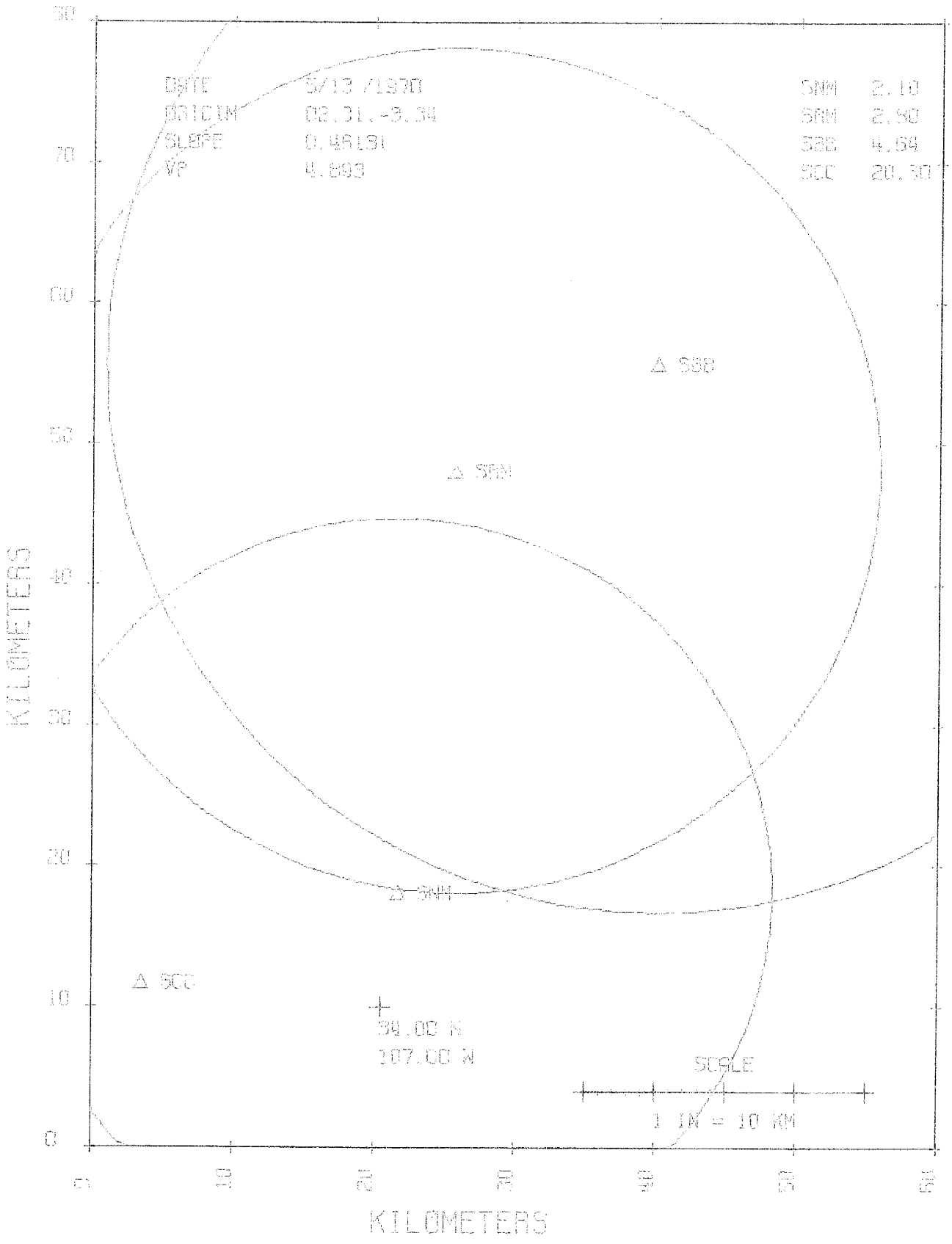
DATE 5/13 /1970
EPICUM 02.31,-3.34
SLOPE 0.4A(S)
VP 4.893
SNM 2.10
SRM 2.50
SBB 4.64
SCC 20.30
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Δ SNM
Δ SCC
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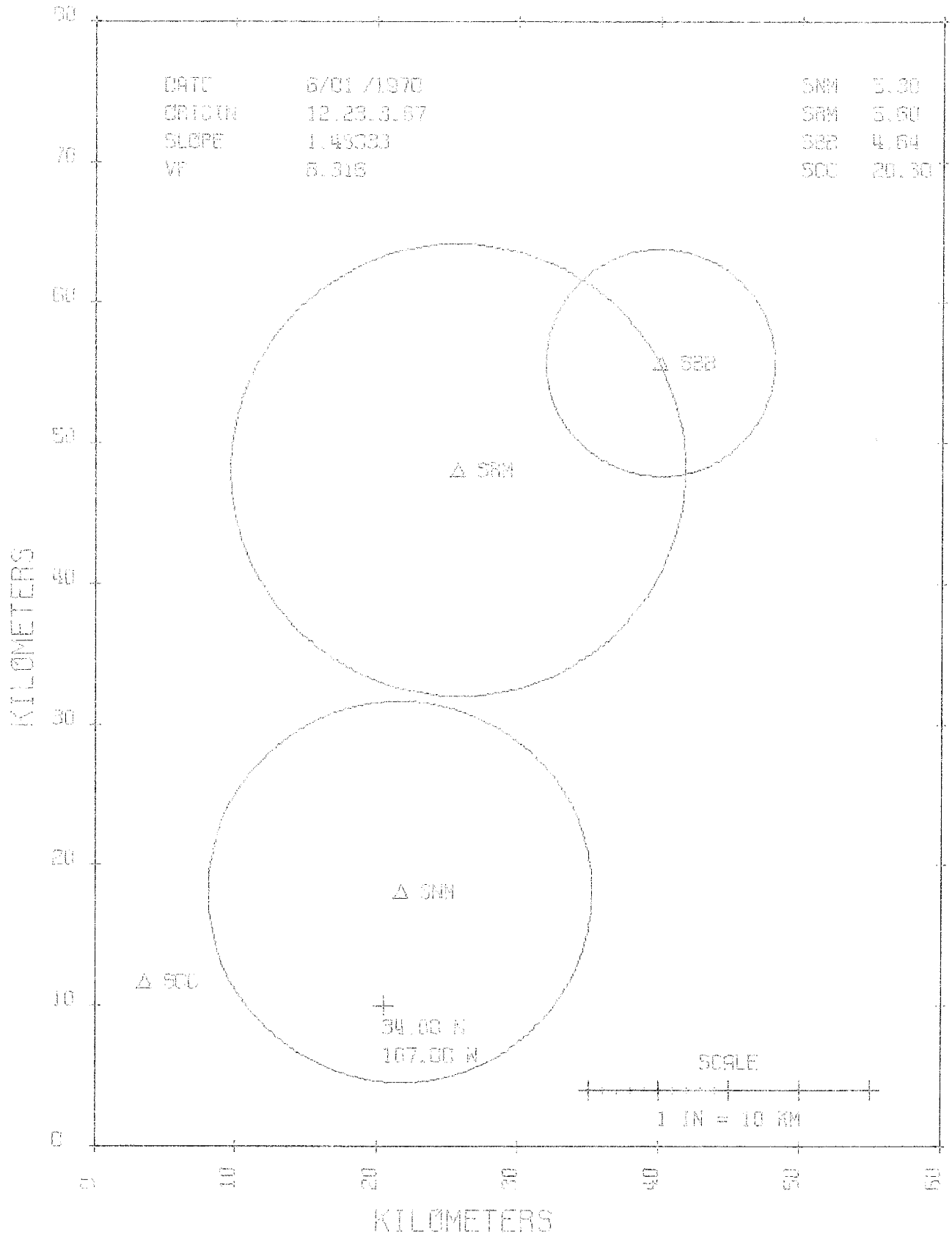
DATE 6/01/1970
ORIGIN 12.23.3.67
SLOPE 1.45333
VF 5.315
SNN 5.30
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Δ SRM
Δ SNN
Δ SCC
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107.00 W
SCALE
1 IN = 10 KM
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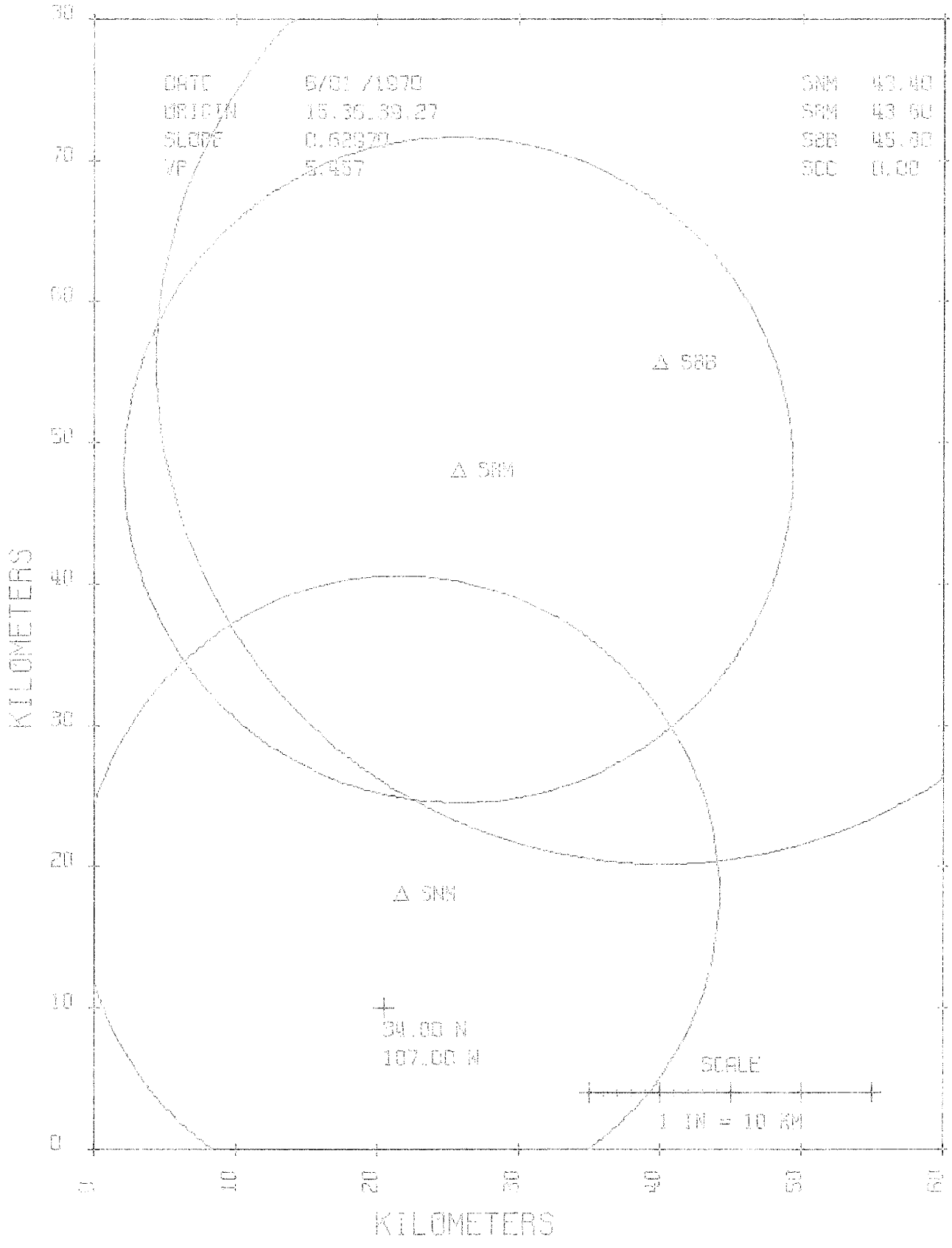
DATE 6/01/1970
ORIGTM 16.35.39.27
SLOPE 0.628920
YF 5.7457
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SDD 0.00
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Δ SPM
Δ SNM
34.00 N
107.00 W
SCALE
1 IN = 10 KM
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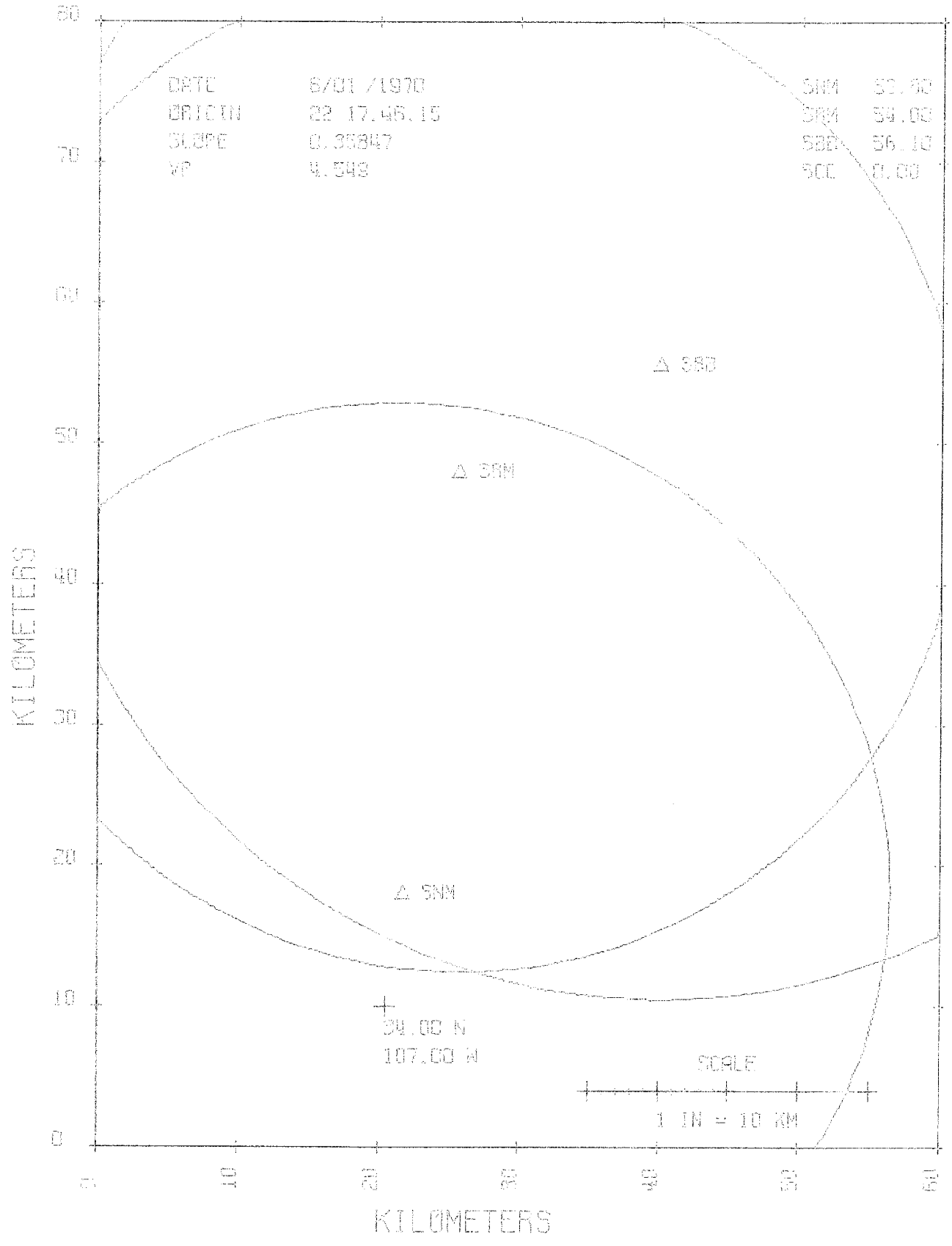
DATE 6/01/1970
ORIGIN 22 17.46.15
SLOPE 0.35847
VP 4.548
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SBM 56.10
SCL 0.00
Δ SBM
Δ SRM
Δ SNM
34.00 N
107.00 W
SCALE
1 IN = 10 KM
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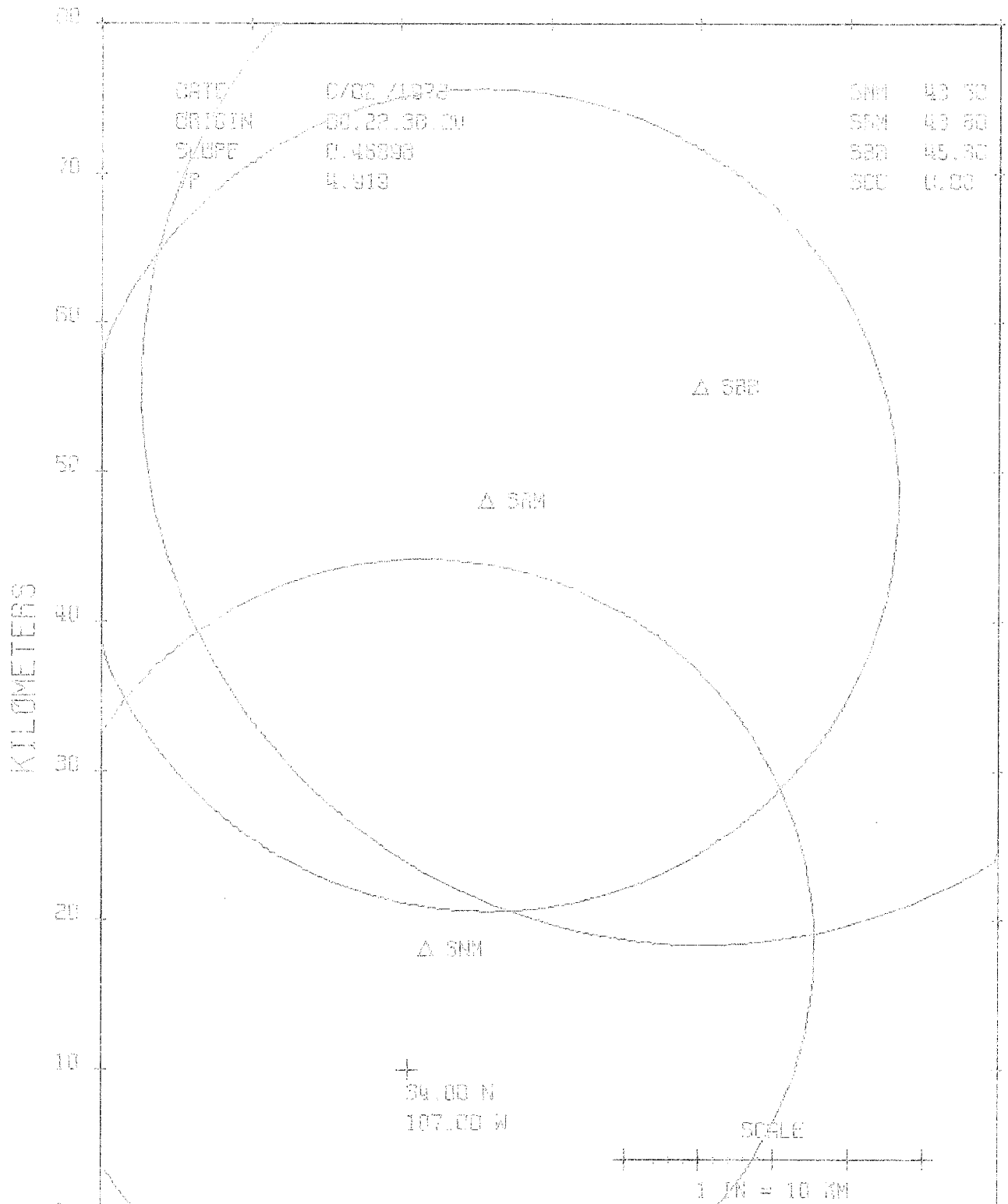
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VP 4.913
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SCC 0.00
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Δ SRM
Δ SNM
34.00 N
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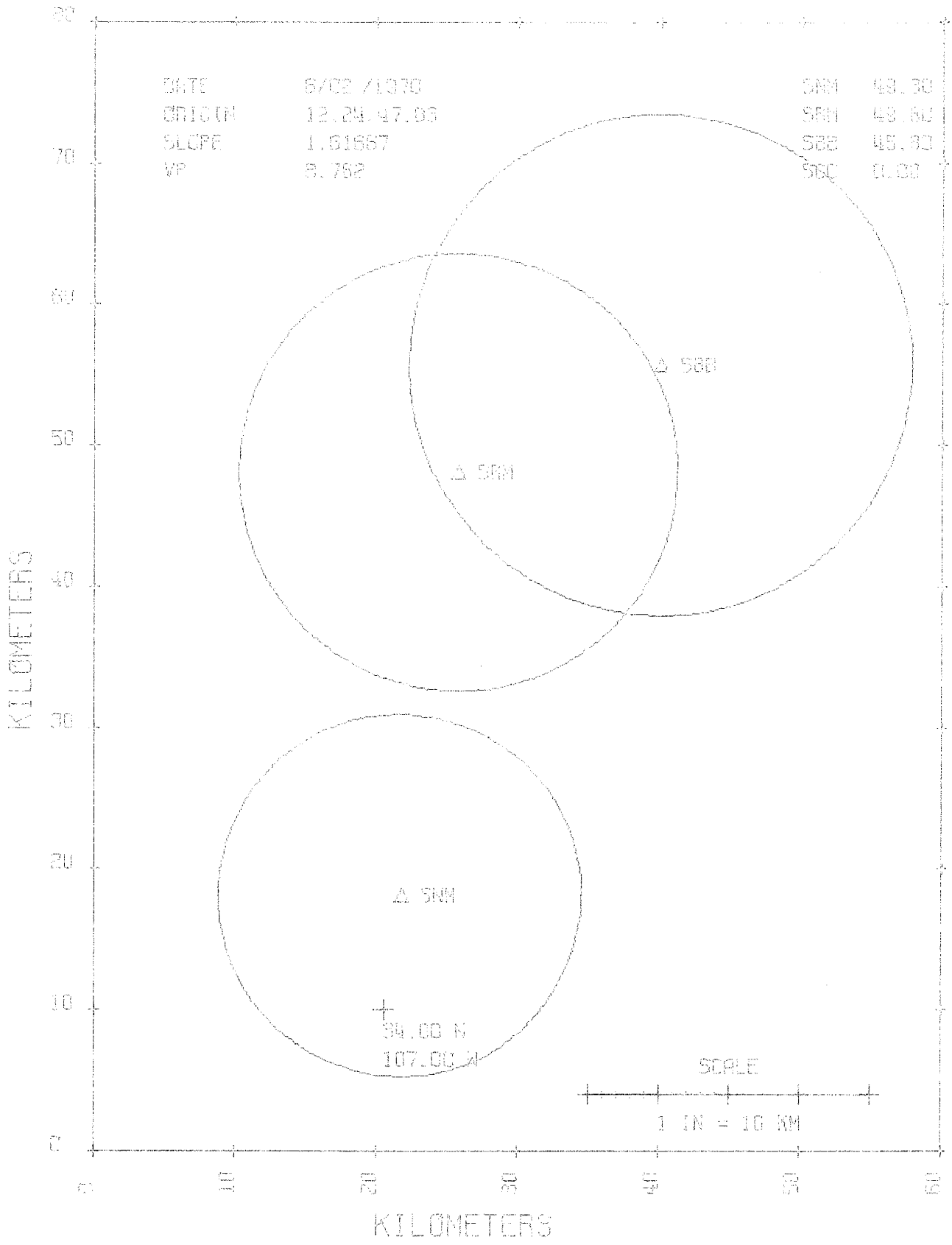
DATE 6/02/1978
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WP 8.762
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SRM
SNM
34.00 N
107.00 W
SCALE
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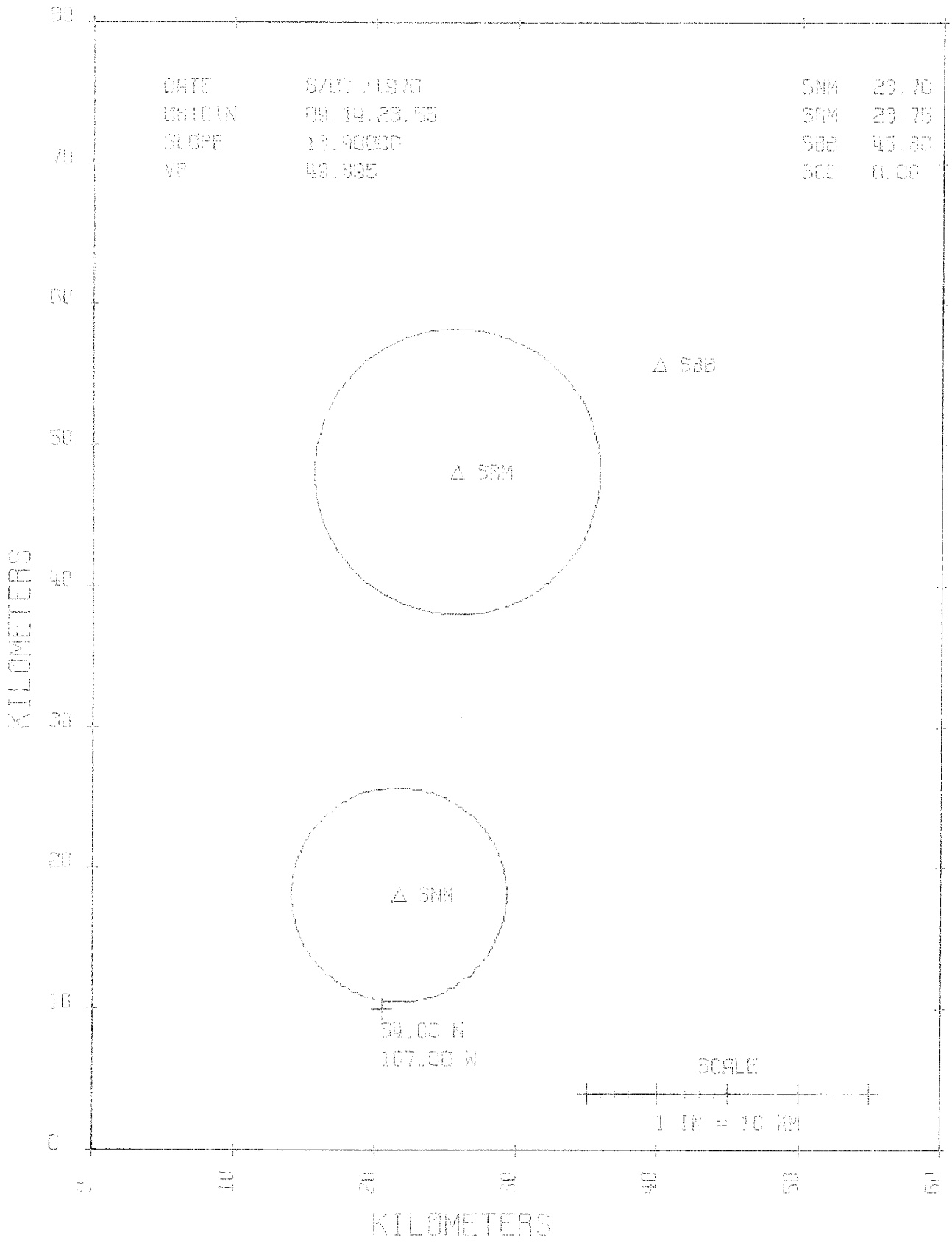
DATE 5/07/1970
ORIGIN 09.14.23.55
SLOPE 18.900000
VP 48.985
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Δ SRM
Δ SNM
34.03 N
107.00 W
SCALE
1 IN = 10 KM
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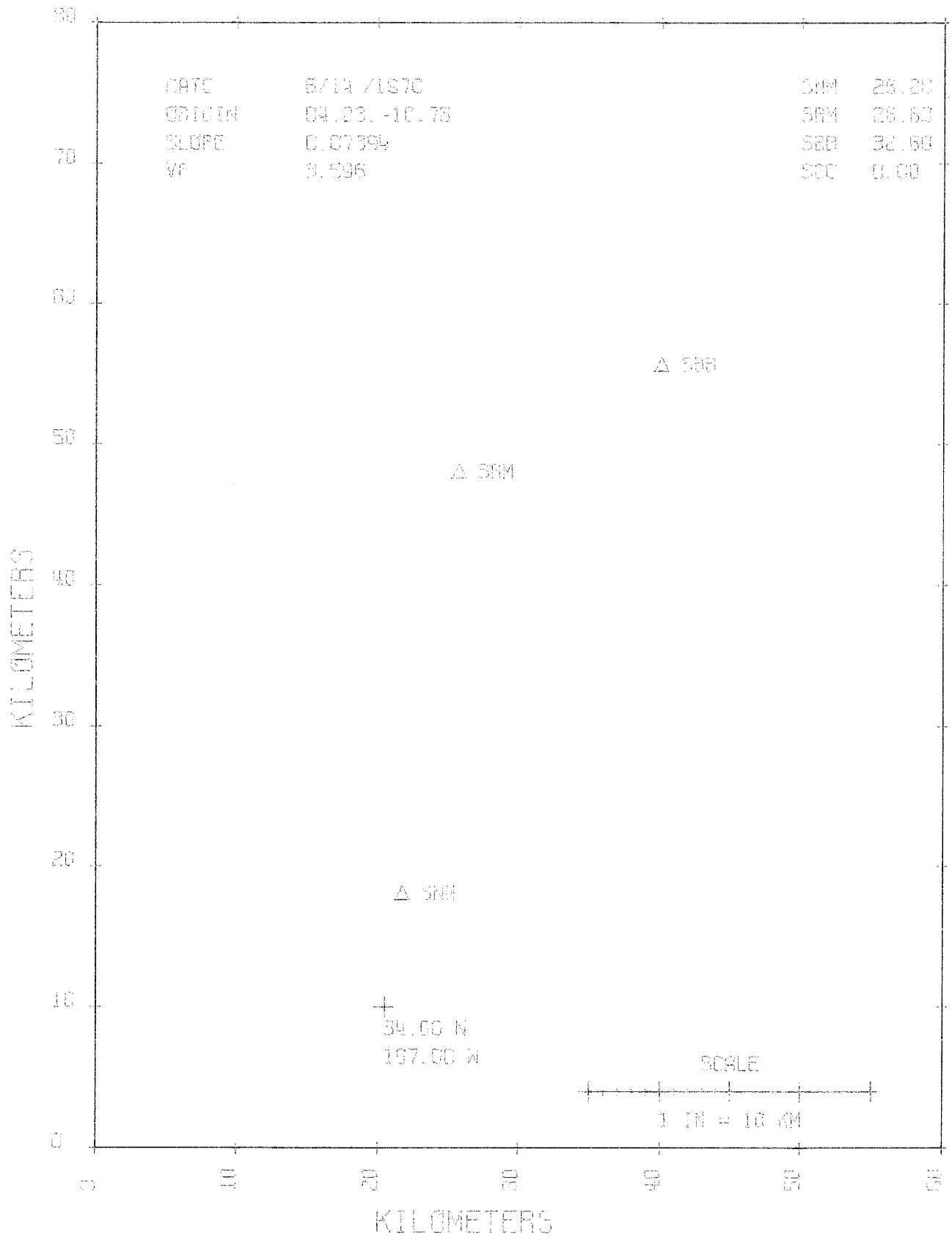
DATE 6/14 /1970
ORIGIN 04.23. -10.76
SLOPE 0.27394
VF 0.595
SMM 25.25
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SBB 32.50
SCC 0.00
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Δ SBM
Δ SMM
34.00 N
197.00 W
SCALE
1 IN = 10 KM
KILOMETERS
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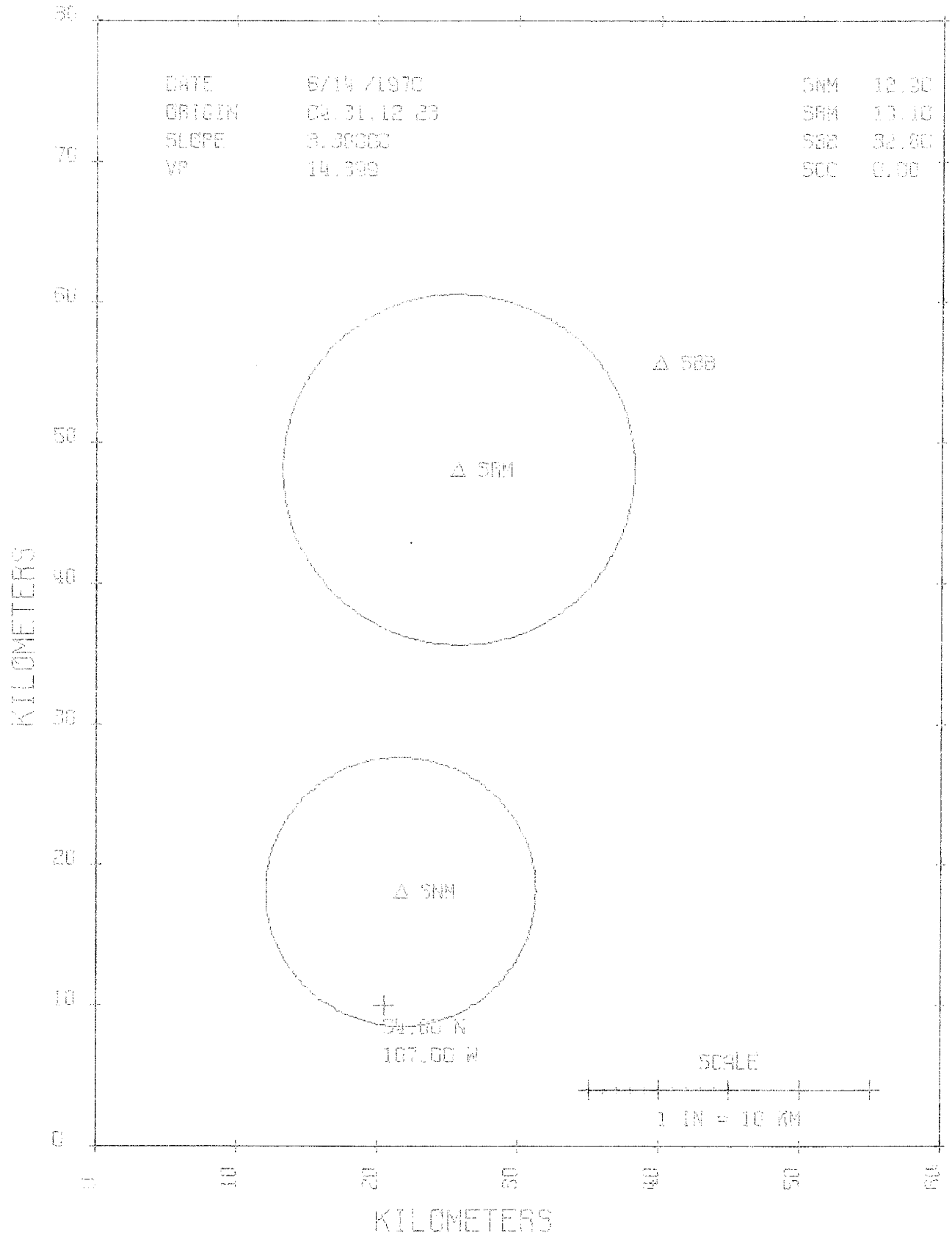
DATE 6/14 /1970
ORIGIN 04 31 12 29
SLOPE 3.30000
VP 14.999
SNM 12.30
SRM 17.10
SBB 32.60
SCC 0.00
Δ SBB
Δ SRM
Δ SNM
34.60 N
107.00 W
SCALE
1 IN = 10 KM
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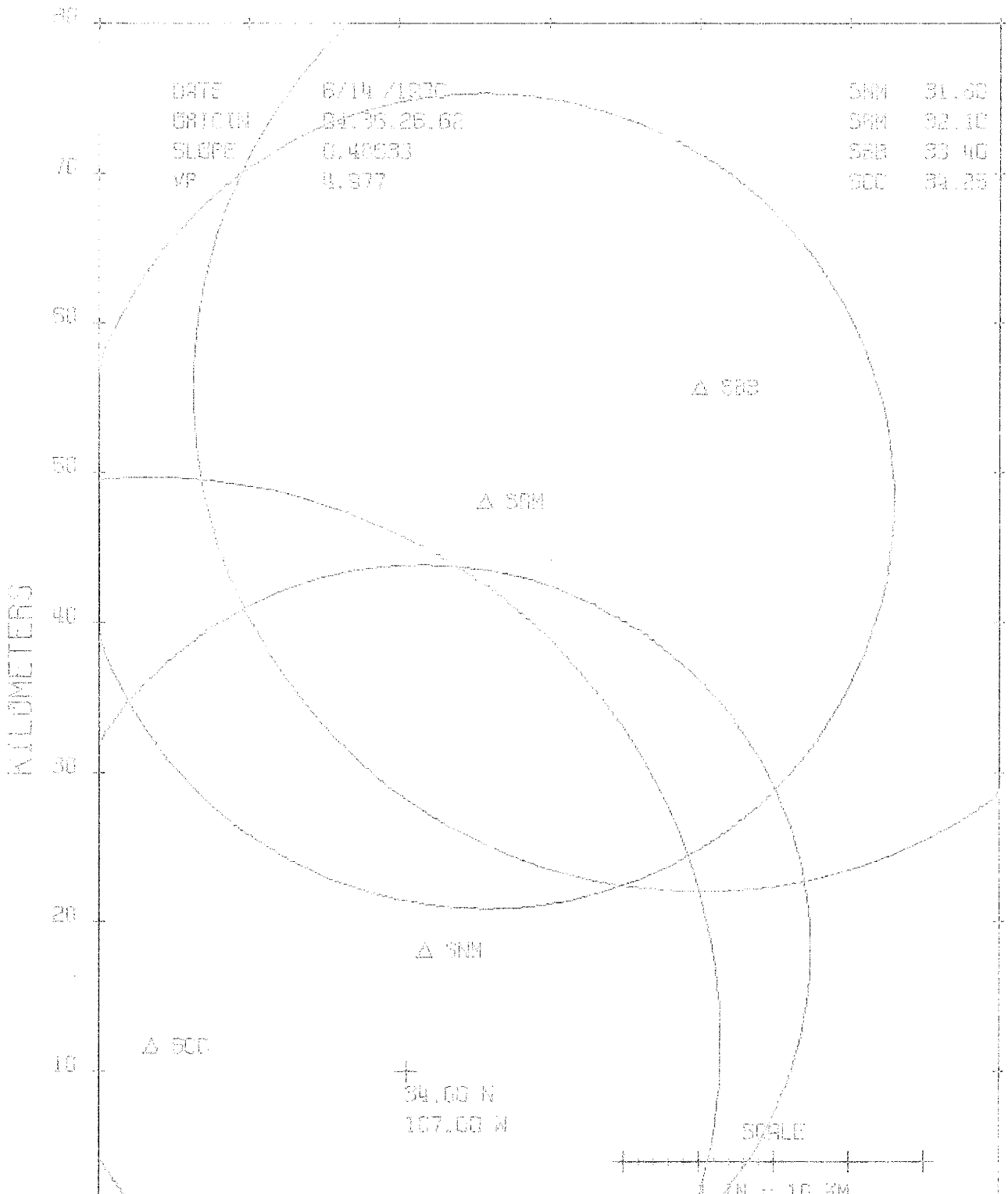
DATE 6/14/1980
ORIGIN 34°35.25.66
SLOPE 0.486633
VP 0.977
SNM 31.60
SRM 32.10
SBR 33.40
SCC 34.25
Δ SBR
Δ SRM
Δ SNM
Δ SCC
34.00 N
167.00 W
SCALE
1 IN = 10 KM
KILOMETERS
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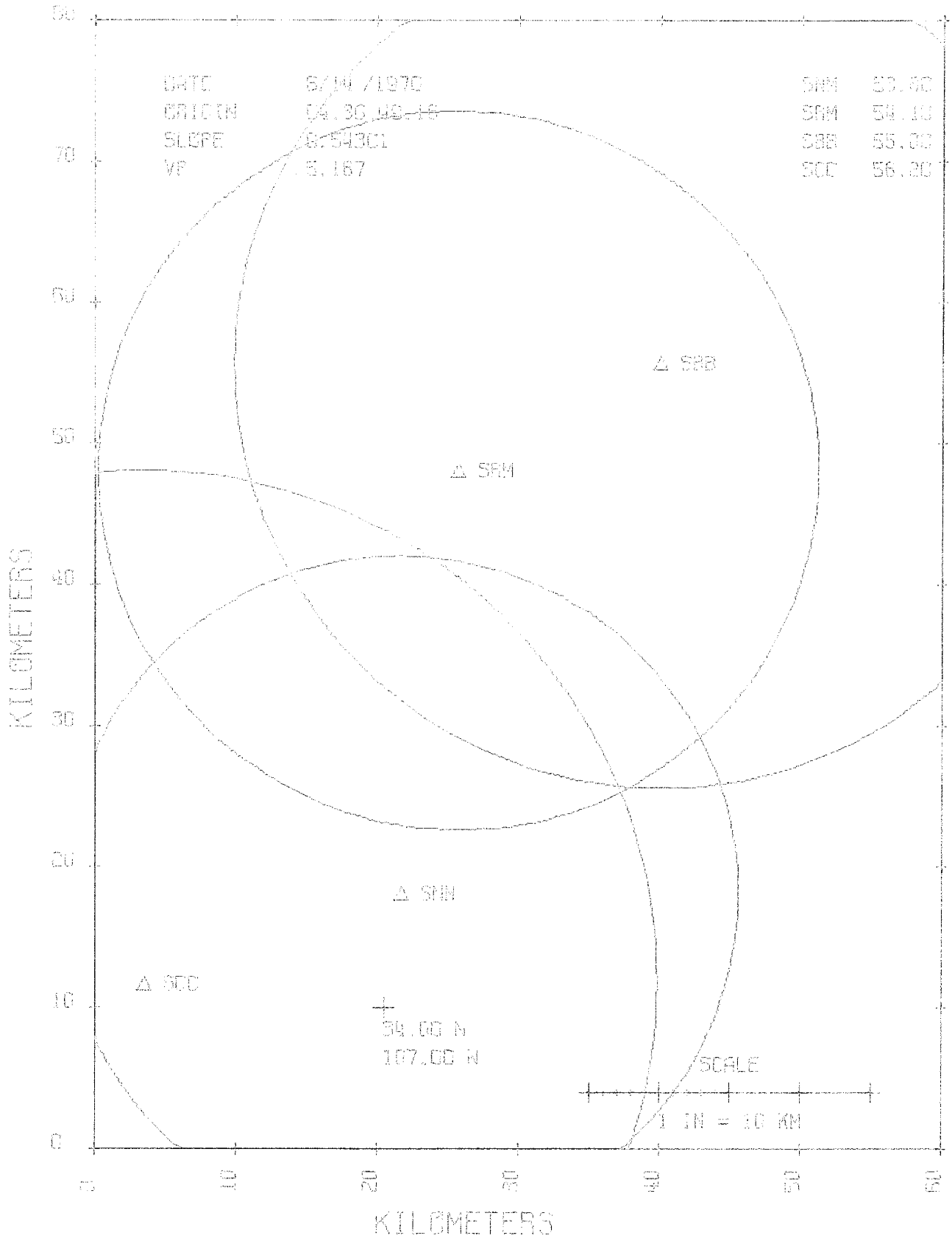
DATE 6/14/1970
ORIGIN 04.30 MS-10
SLOPE .0543C1
VP 5.167
SRM 53.50
SRM 54.10
SBS 55.00
SCC 56.00
△ SRB
△ SRM
△ SRM
△ SCC
34.00 N
107.00 W
SCALE
1 IN = 10 KM
KILOMETERS
KILOMETERS
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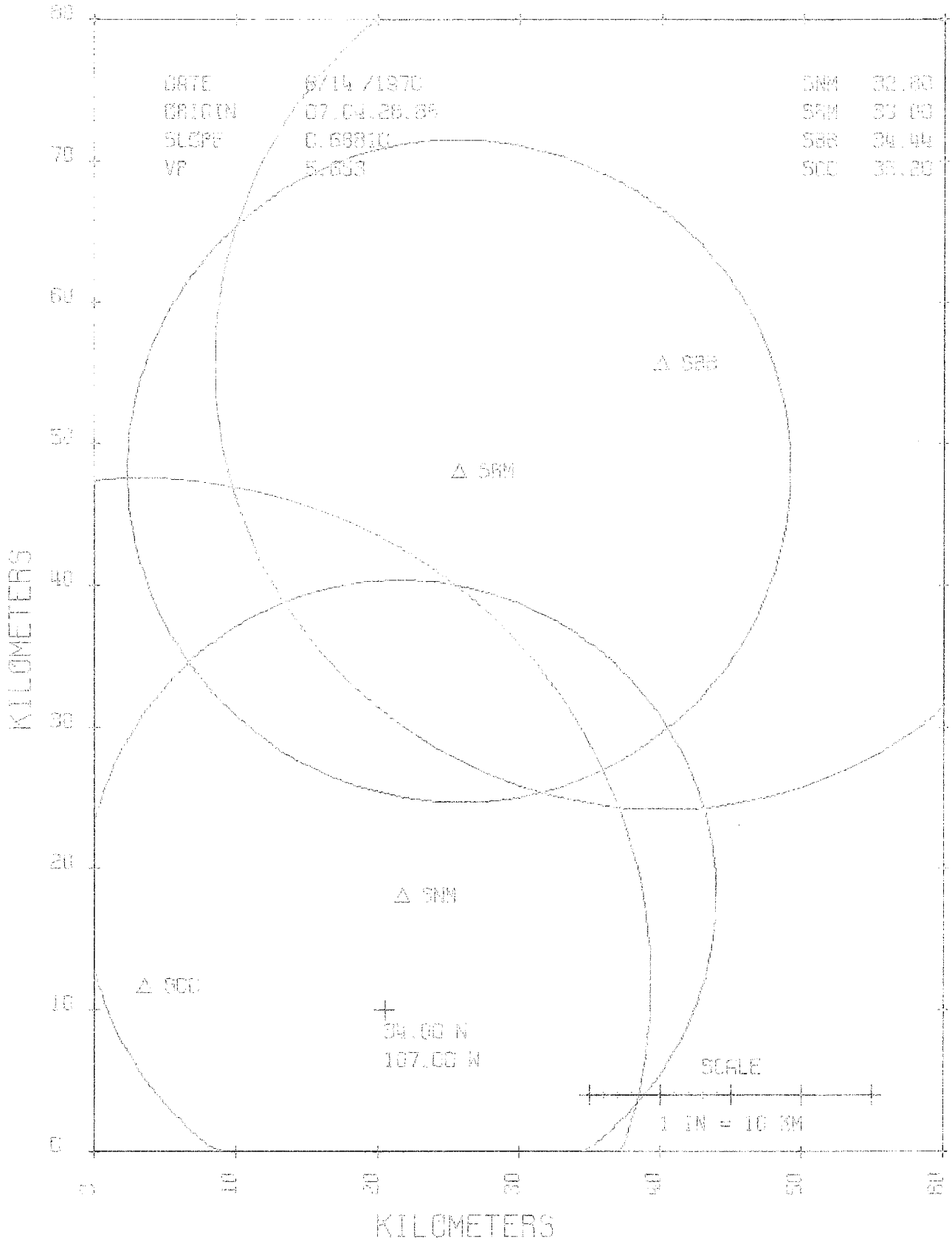
DATE 8/14 /1970
ORIGIN 37.04,-25.05
SLOPE 0.68816
VP 5.6053
SNM 32.80
SRM 33.03
SBB 34.44
SCC 35.20
Δ SBB
Δ SRM
Δ SNN
Δ SCC
34.00 N
107.00 W
SCALE
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KILOMETERS
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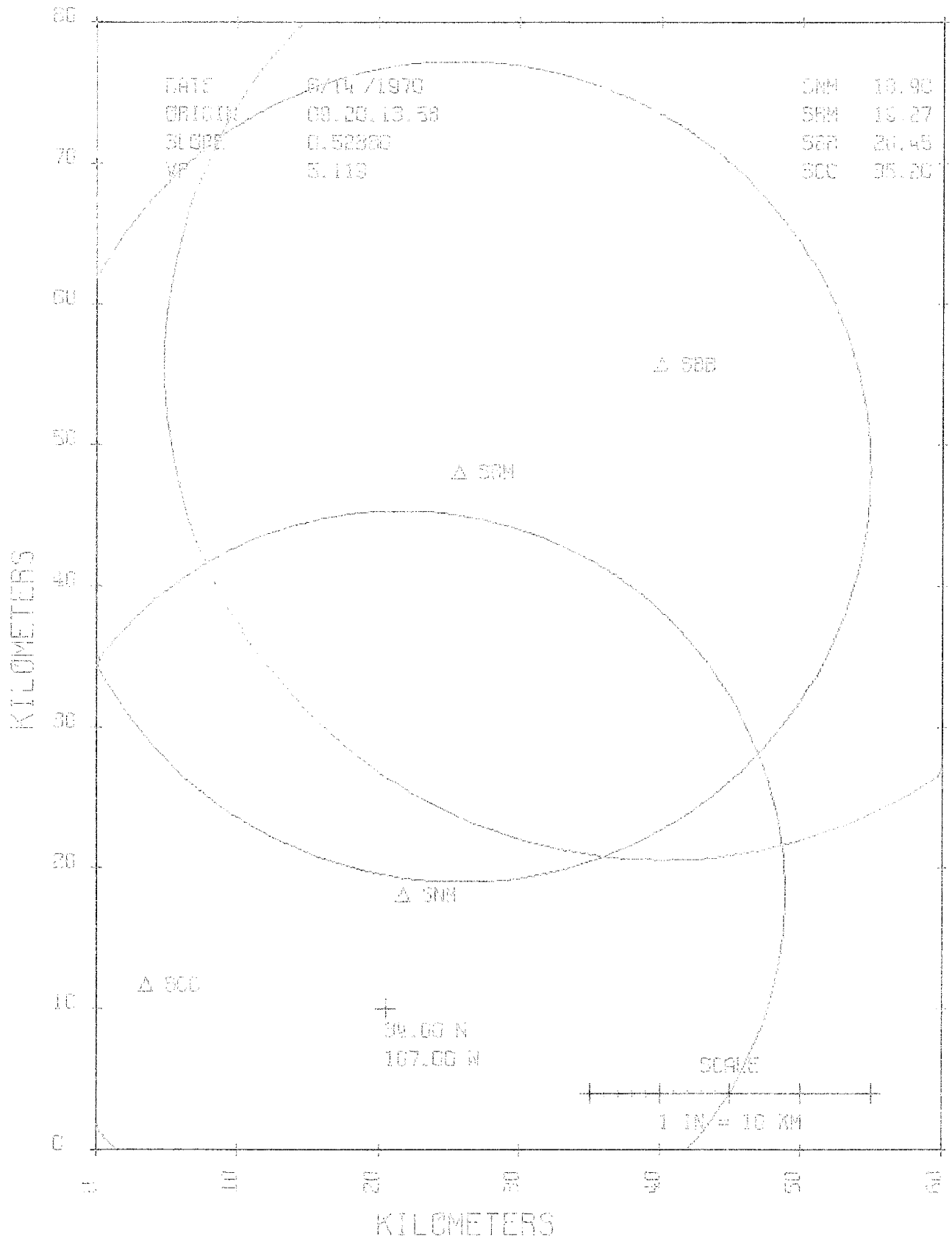
DATE 8/14/1978
ORIGIN 09:20:13.38
SLOPE 0.528952
XP 5.119
5NM 10.90
5RM 16.27
5EP 21.45
50C 35.80
Δ 50C
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Δ 3NM
Δ 90C
39.00 N
107.00 W
SCALE
1 IN = 10 KM
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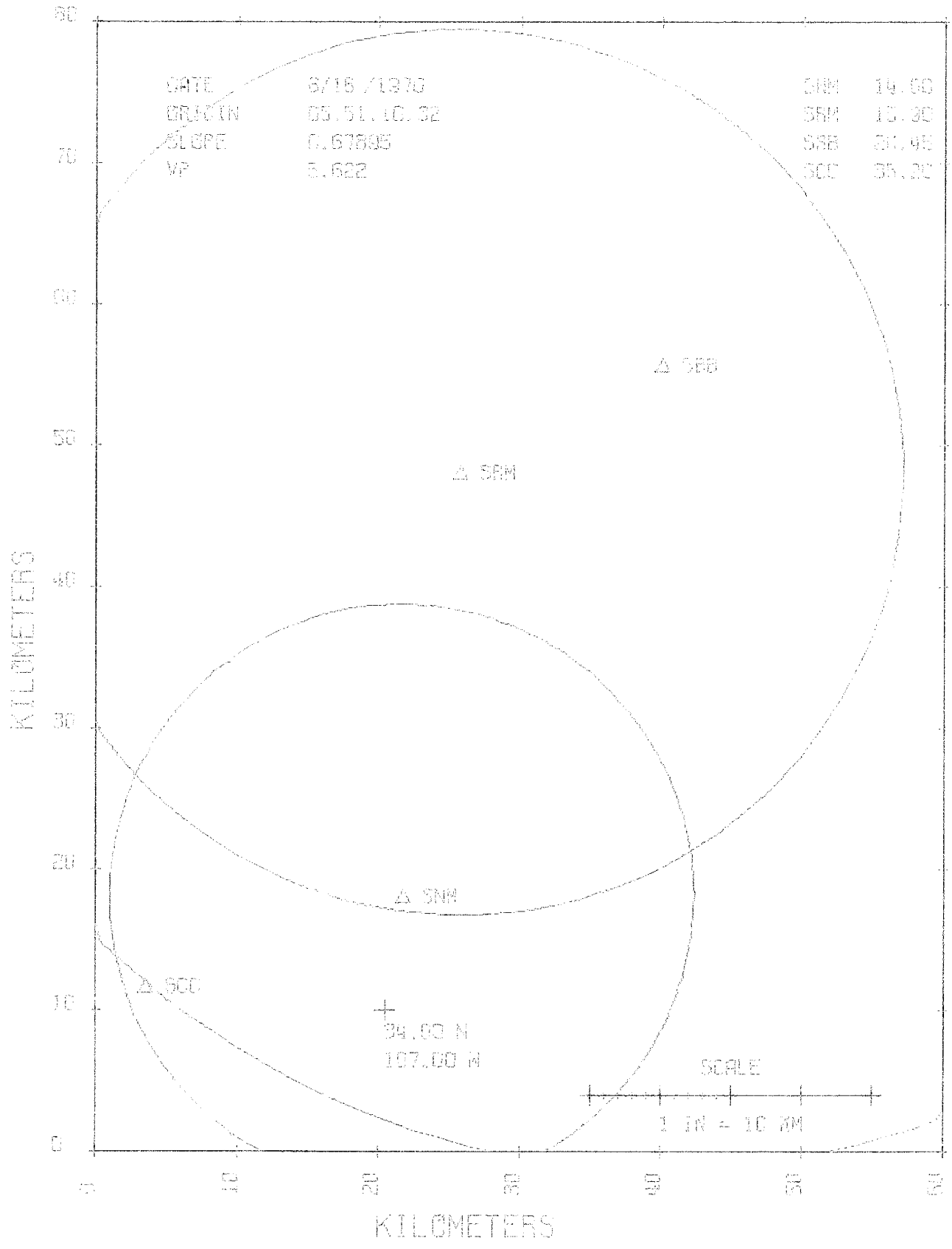
KILOMETERS


DATE 6/16/1970
ORIGIN 35.51.10.32
SLOPE 0.978835
VP 5.622
SNM 19.00
SRM 10.00
SBB 30.00
SCC 35.00
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Δ SNM
Δ SCC
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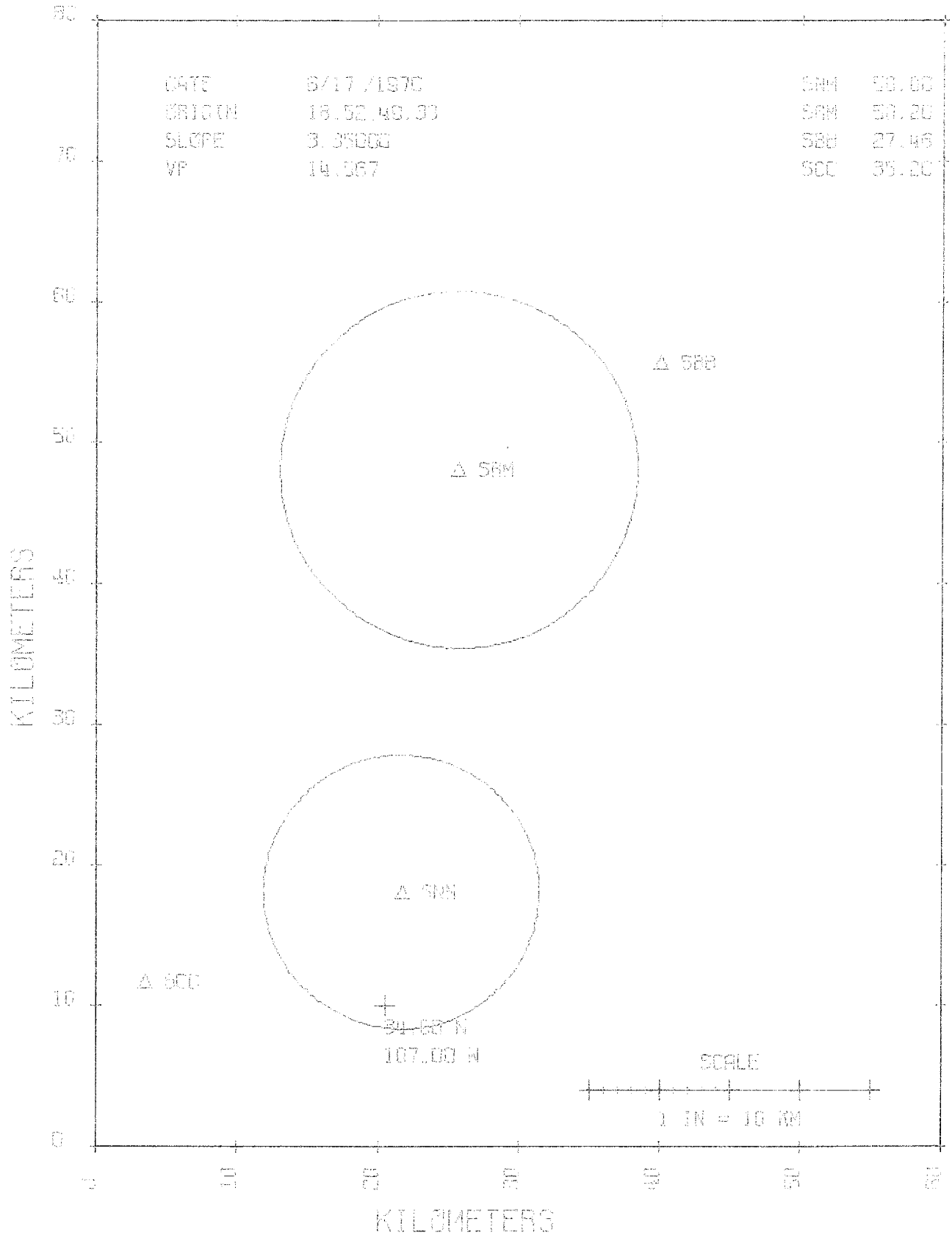
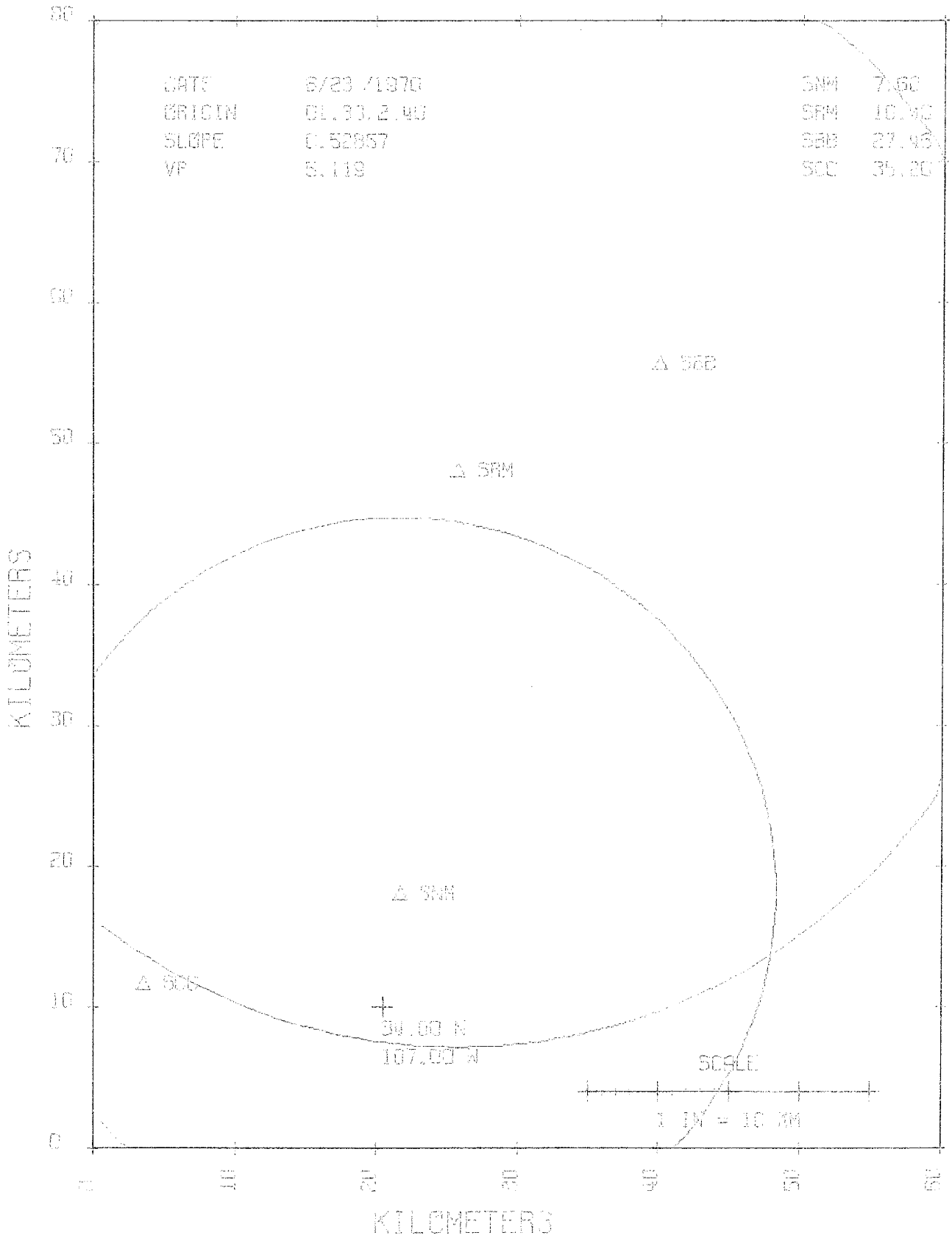
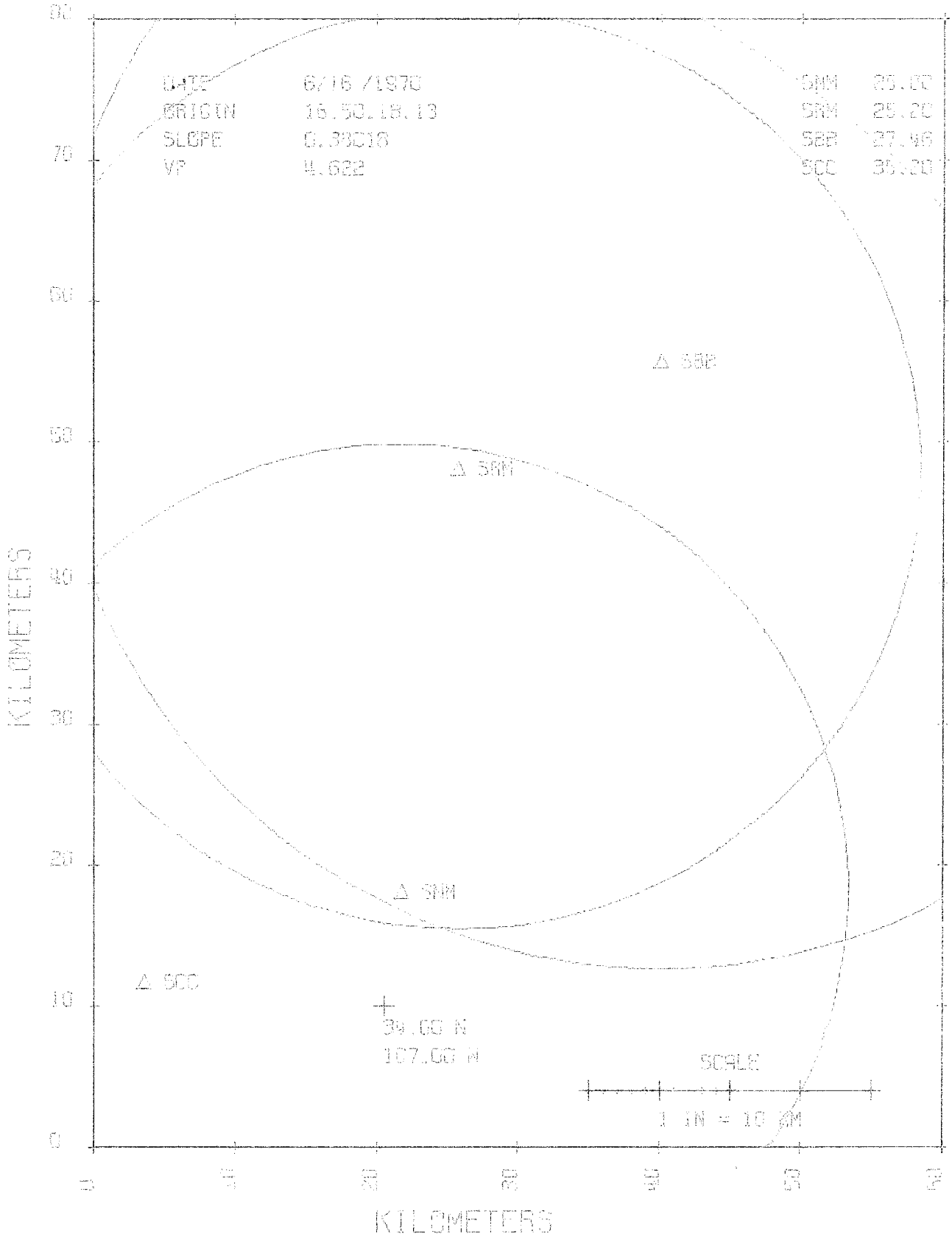
107.00 W
SCALE
1 IN = 10 KM
KILOMETERS
KILOMETERS


DATE 6/17/1970
ORIGIN 16.50.40.00
SLOPE 3.35000
VP 14.067
SNM 50.00
SRM 50.20
SBB 27.46
SCC 35.20
△ SBB
△ SRM
△ SNM
△ SCC
34.60 N
107.00 W
SCALE
1 IN = 10 KM
KILOMETERS
KILOMETERS


DATE 6/23/1970
ORIGIN 34.00 N 107.00 W
SLOPE 0.52857
VP 5.119
SNM 7.66
SRM 10.96
SEE 27.46
SCC 35.20
△ SEE
△ SRM
△ SNM
△ SCC
SCALE
1 IN = 10 KM
KILOMETERS
KILOMETERS


DATE 6/16/1970
ORIGIN 16.50.18.13
SLOPE 0.33016
VP 4.622
DMM 35.00
SRM 25.20
SBB 37.46
SCC 35.00
Δ SBB
Δ SRM
Δ DMM
Δ SCC
34.60 N
107.00 W
SCALE
1 IN = 10 KM
KILOMETERS
KILOMETERS
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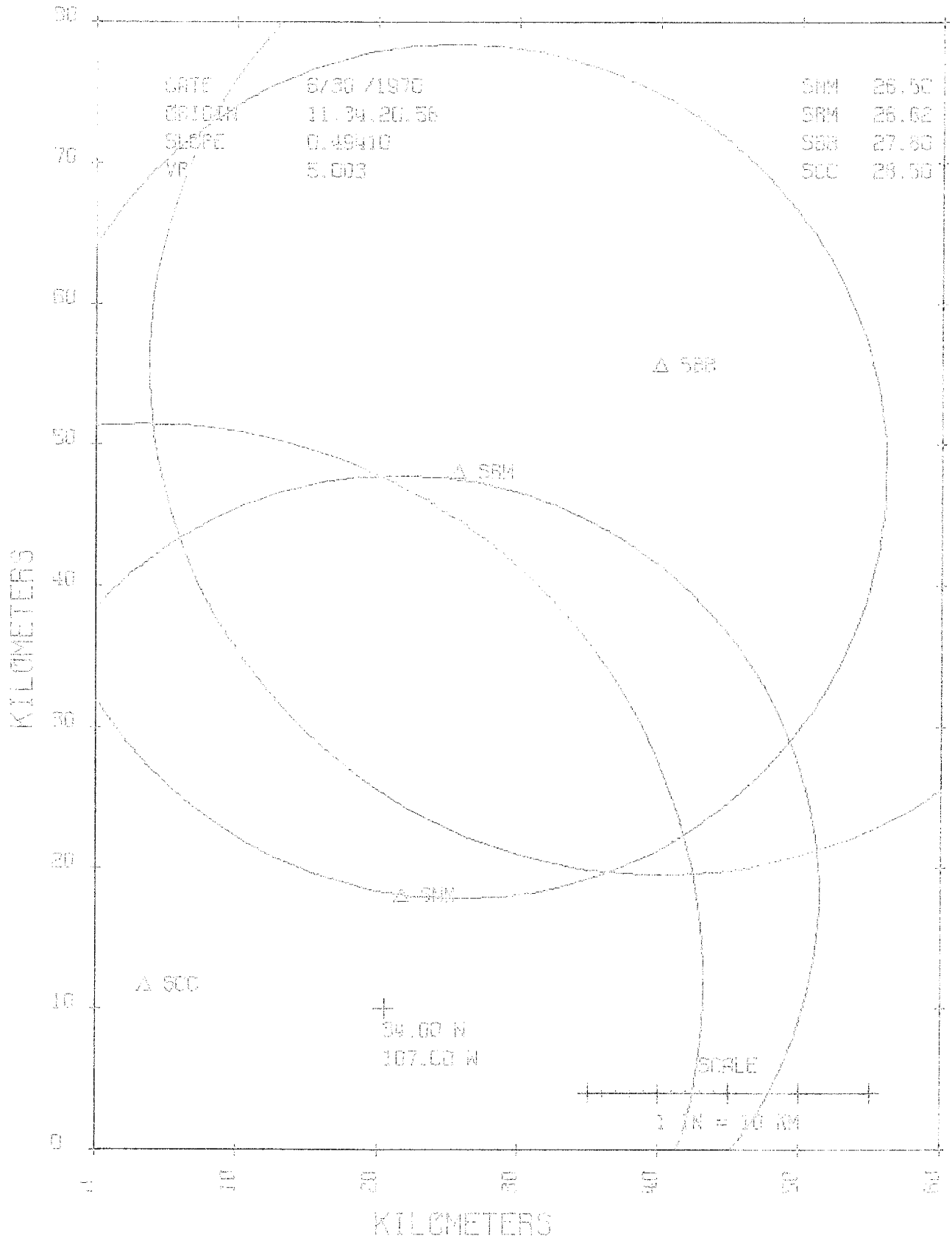
DATE 6/30/1970
ORIGIN 11:34:20.56
SLOPE 0.49410
VP 5.003
SHM 26.50
SRM 26.02
SBB 27.60
SCC 29.00
△ SBB
△ SRM
△ SHM
△ SCC
34.00 N
107.00 W
SCALE
1 IN = 10 KM
KILOMETERS
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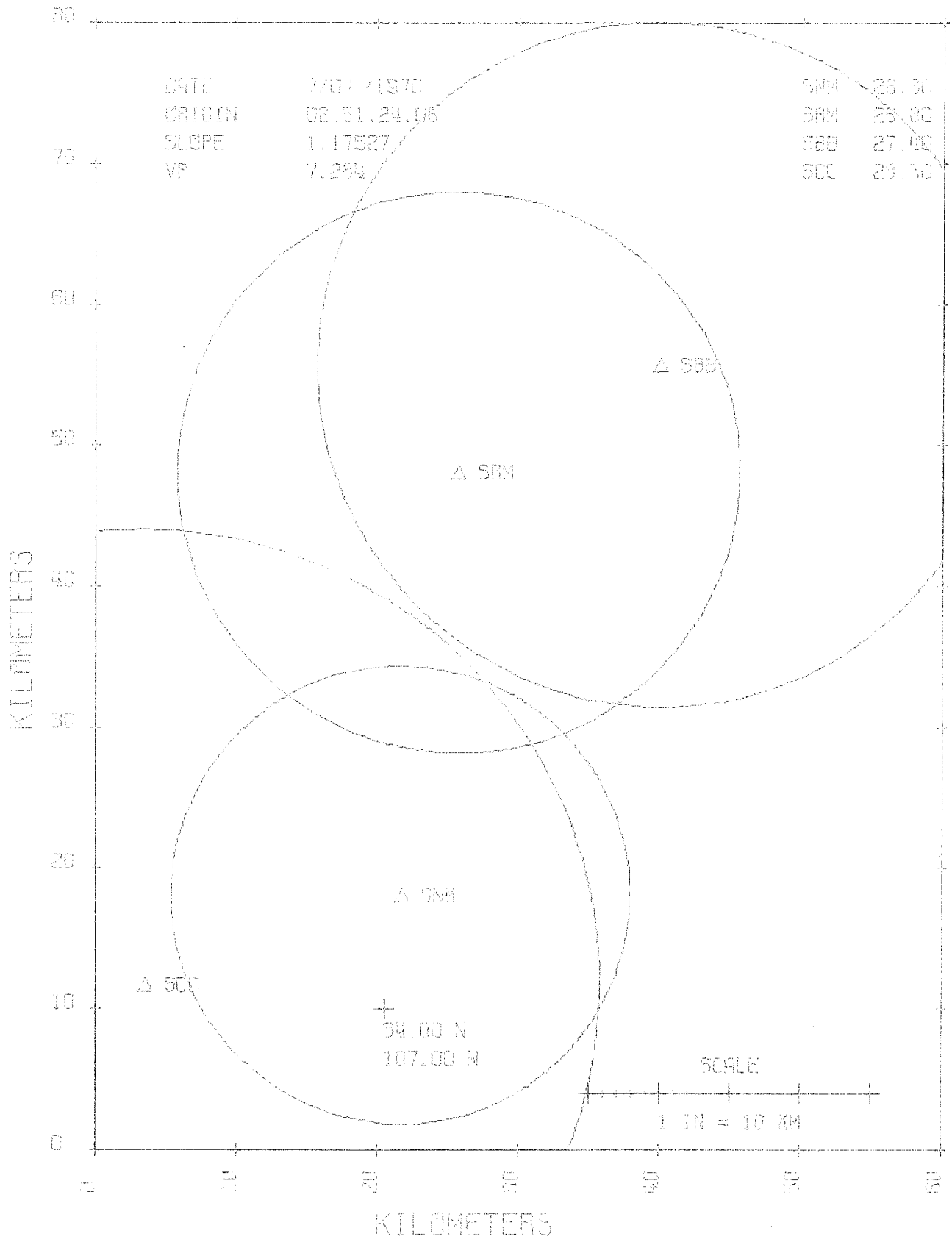
DATE 7/07/1970
ORIGIN 02.51.24.06
SLOPE 1.175527
VF 7.254
SNM 25.50
SRM 25.00
SBB 27.00
SCC 23.50
Δ SBB
Δ SRM
Δ SNM
Δ SCC
34.00 N
107.00 W
SCALE
1 IN = 10 KM
KILOMETERS
KILOMETERS
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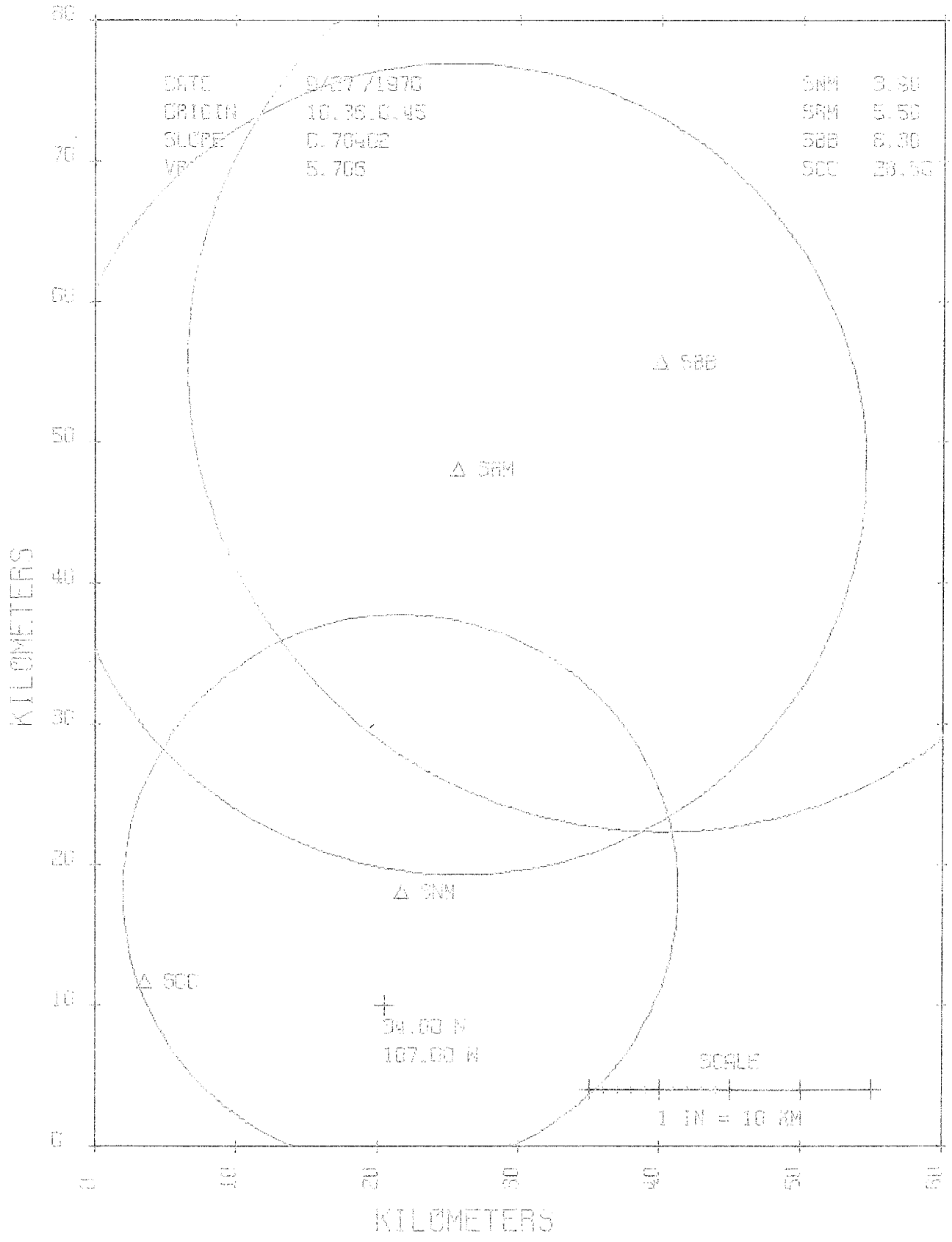
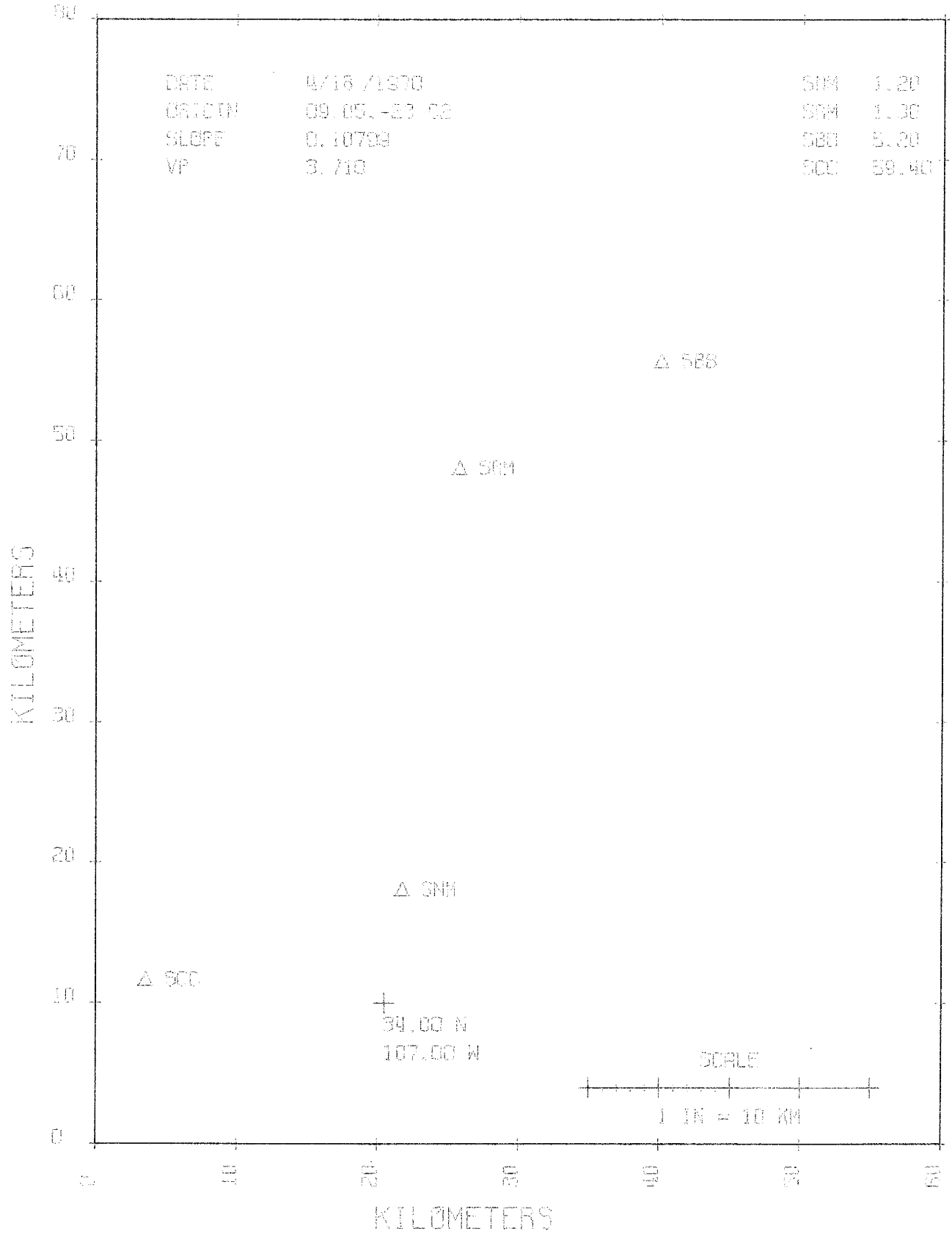

DATE 04/27/1976
ORIGIN 10.35.0.45
SLOPE 0.70402
VR 5.705
SNM 3.50
SRM 5.50
SBB 6.30
SCC 30.50
Δ SBB
Δ SRM
Δ SNM
Δ SCC
34.00 N
107.00 W
SCALE
1 IN = 10 KM
KILOMETERS
KILOMETERS


DATE 4/16 /1970
ORIGIN 09.05,-23.68
SLOPE 0.107939
VP 3.718
SRM 1.20
SBM 1.30
SBO 5.20
SOO 59.40
Δ SBO
Δ SRM
Δ SNM
Δ SOO
34.00 N
107.00 W
SCALE
1 IN = 10 KM
KILOMETERS
KILOMETERS
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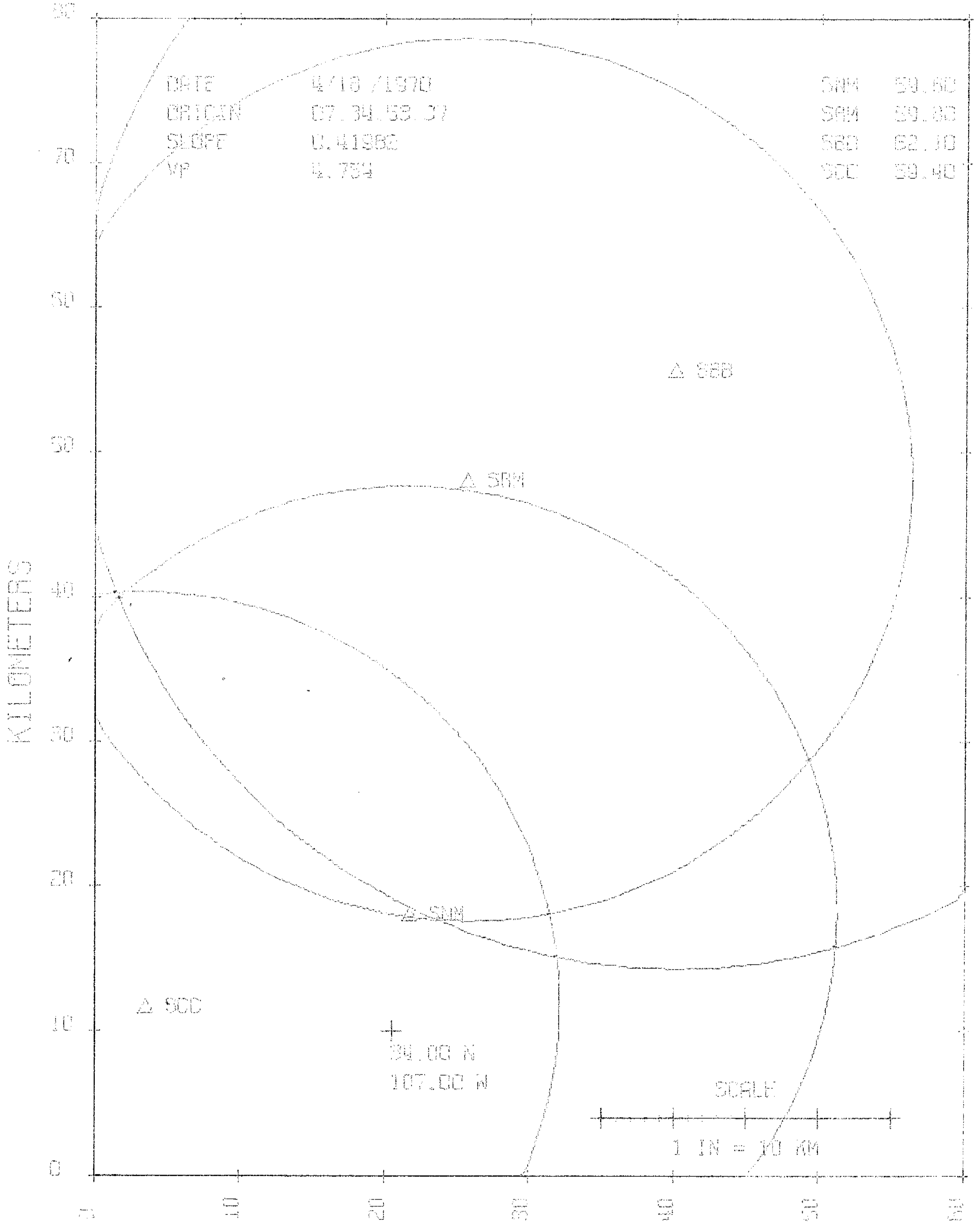

DATE 4/18 /1970
ORIGIN 07.34.53.07
SLOPE 0.41980
VP 4.754
SNM 59.60
SAM 59.80
SBB 62.10
SCC 59.40
SBB
SAM
SNM
SCC
34.00 N
107.00 W
SCALE
1 IN = 10 KM
KILOMETERS
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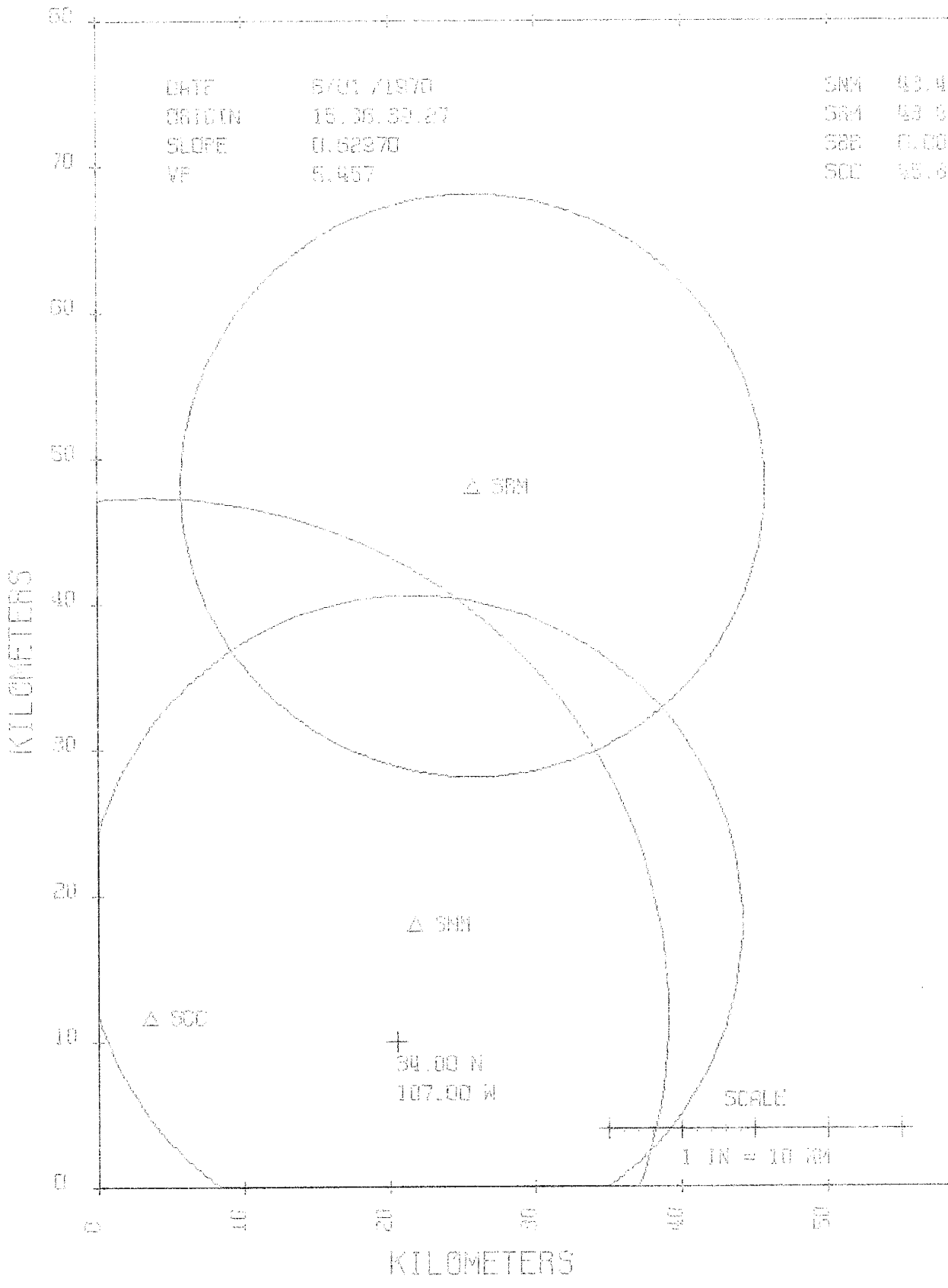
DATE 6/01/1970
SLOPE 0.52370
VF 5.457
SNM
SRM
SBE
SCC
△ SRM
△ SNM
△ SCC
34.00 N
107.00 W
SCALE:
1 IN = 10 KM
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KILOMETERS
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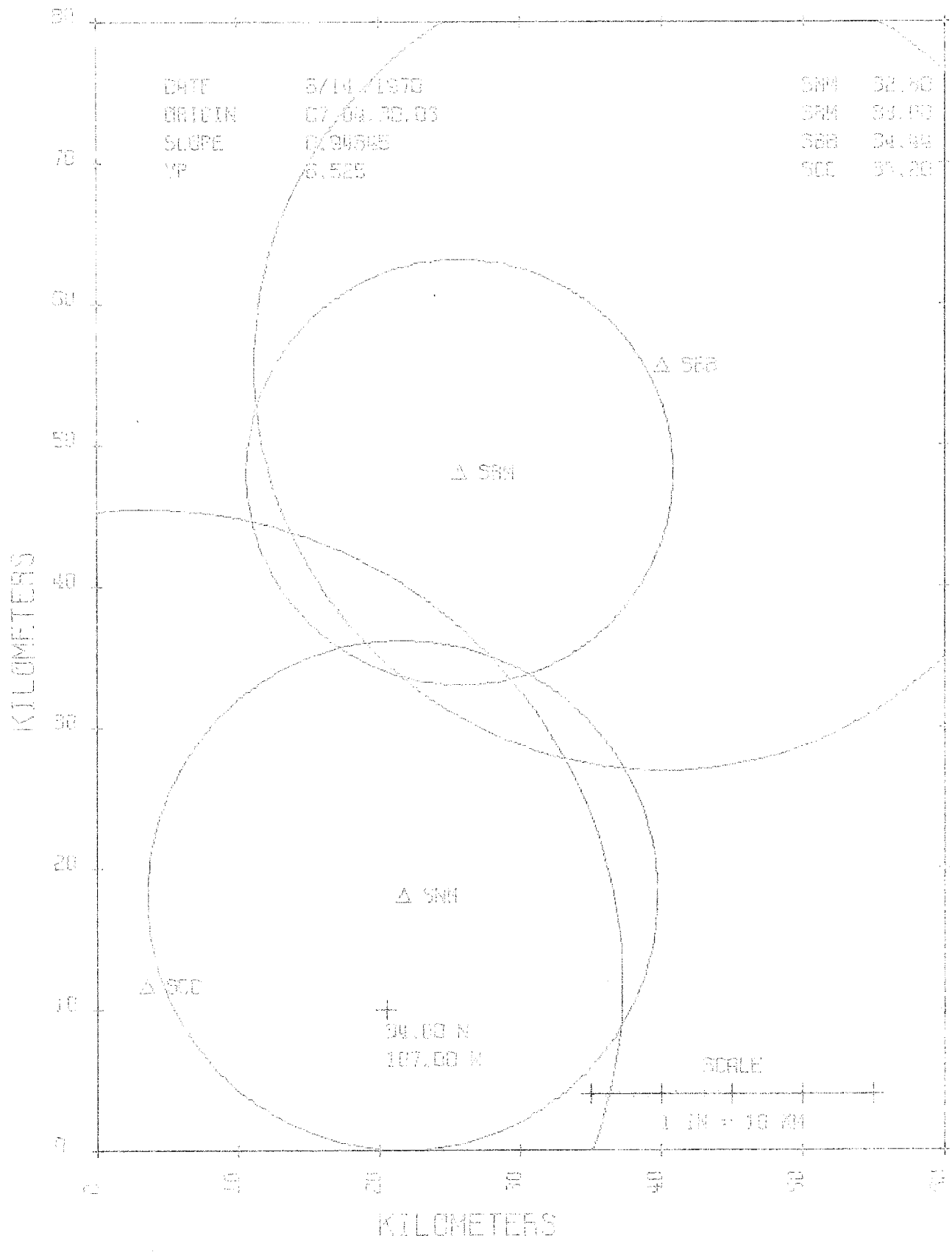
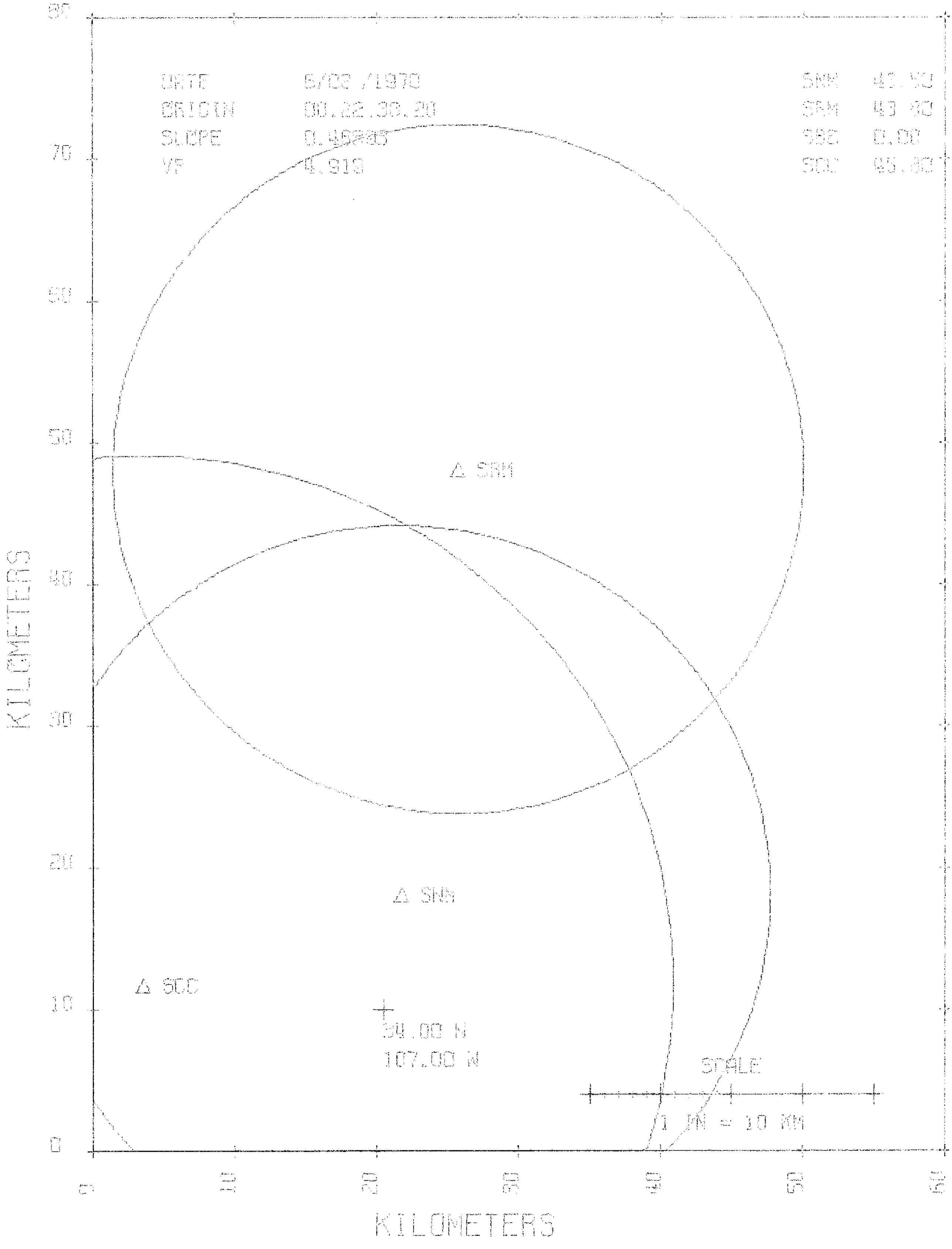
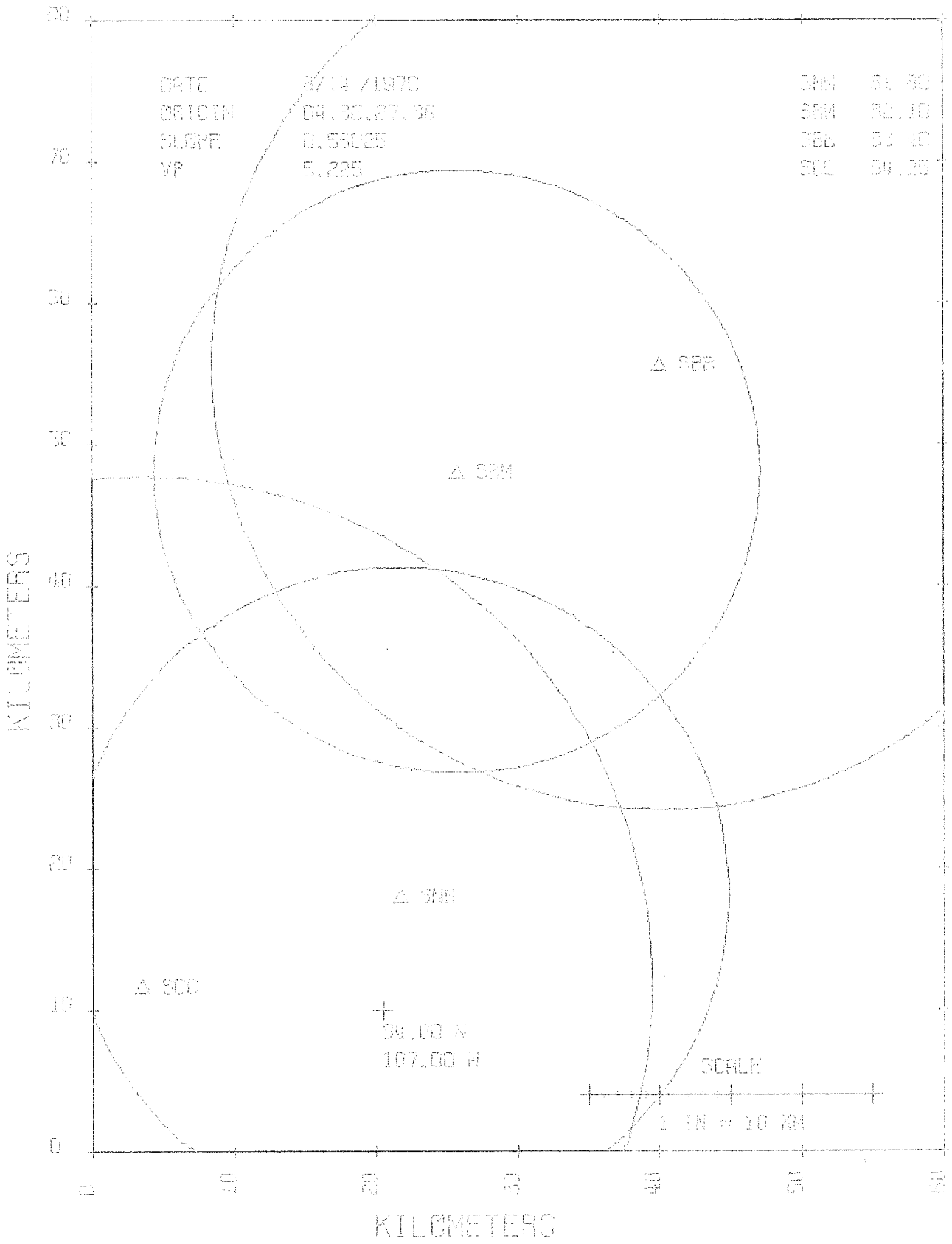
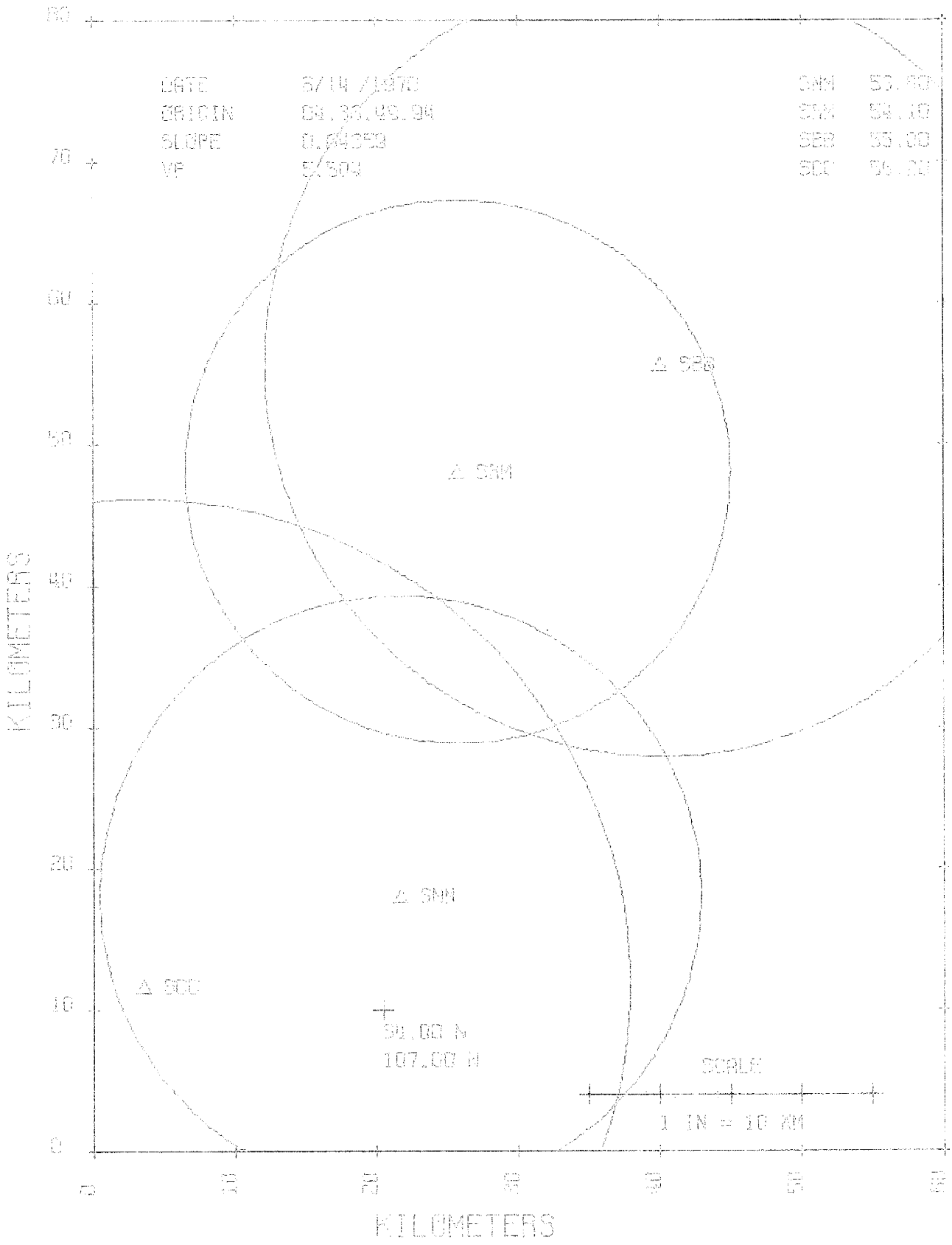
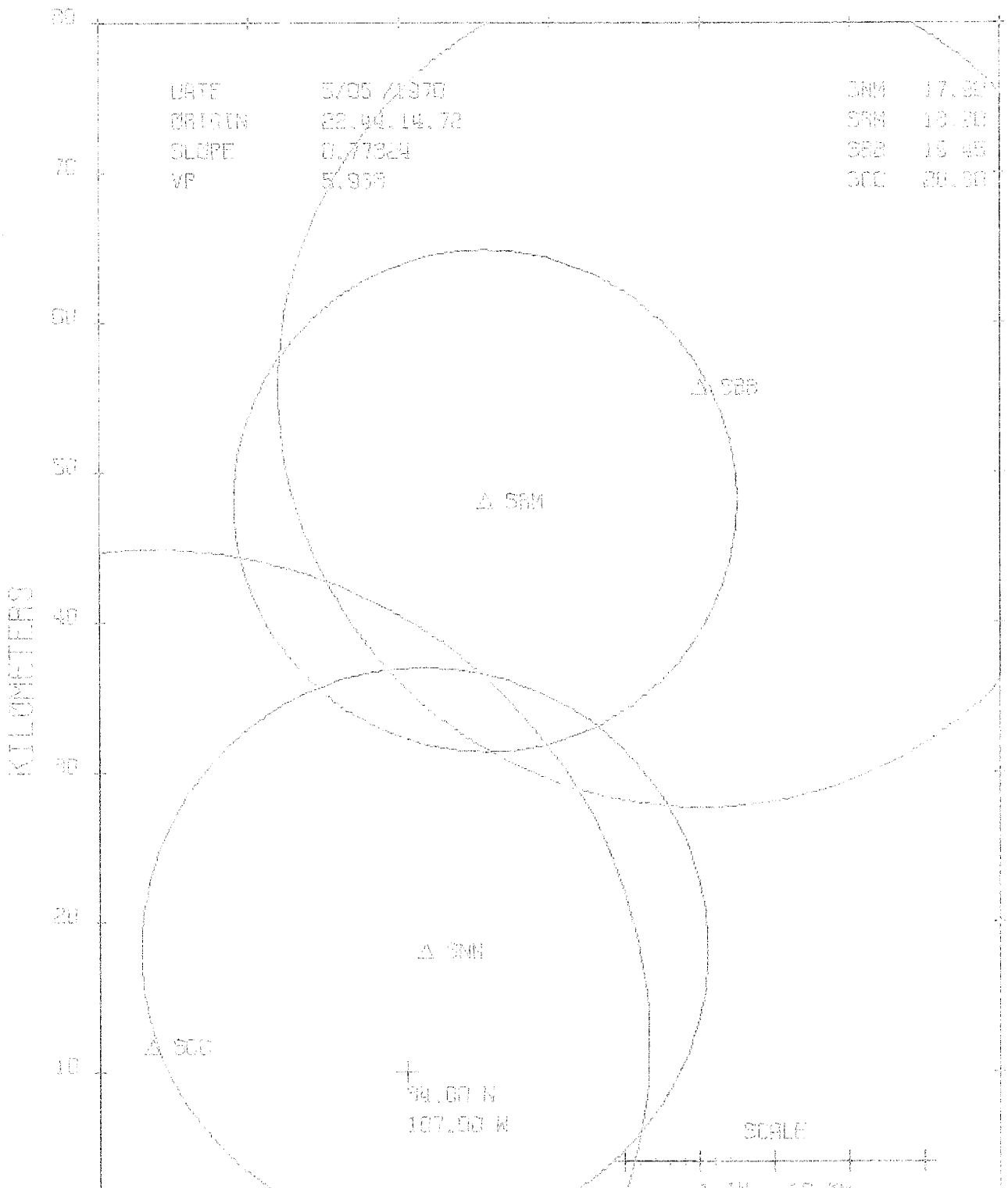

DATE
ORIGIN
SLOPE
YP
SRM
SRM
SGG
SCC
Δ SGG
Δ SRM
Δ SNM
Δ SCC
36.00 N
107.00 W
SCALE
1 IN = 10 KM
KILOMETERS
KILOMETERS


ORIGIN 00.22.30.20
SNM
SRM
SCC
Δ SRM
Δ SNM
Δ SCC
38.00 N
107.00 W
SCALE
1 IN = 10 KM
KILOMETERS
KILOMETERS


DATE 6/14/1970
ORIGIN 04.30.27.36
SLOPE 0.556025
VP 5.225
Δ SBB
Δ SBM
Δ SBR
Δ SCC
39.00 N
107.00 W
SCALE
1 IN = 10 KM
KILOMETERS
KILOMETERS


DATE 6/14/1970
ORIGIN 38.33.25.94
SLOPE 0.843529
VP 5/30W
SNM 53.00
SVA 54.10
SEB 55.00
SCC 56.20
△ SEB
△ SNM
△ SNM
△ SCC
38.00 N
107.00 W
SCALE
1 IN = 10 KM
KILOMETERS
KILOMETERS


DATE 5/05/1970
ORIGIN 22.96, 14.72
SLOPE 0.77824
VP 5.979
SNM 17.35
SRM 19.20
SBB 15.45
SCC 20.30
Δ SBB
Δ SRM
Δ SNN
Δ SCC
94.07 N
107.53 W
SCALE
1 IN = 10 KM
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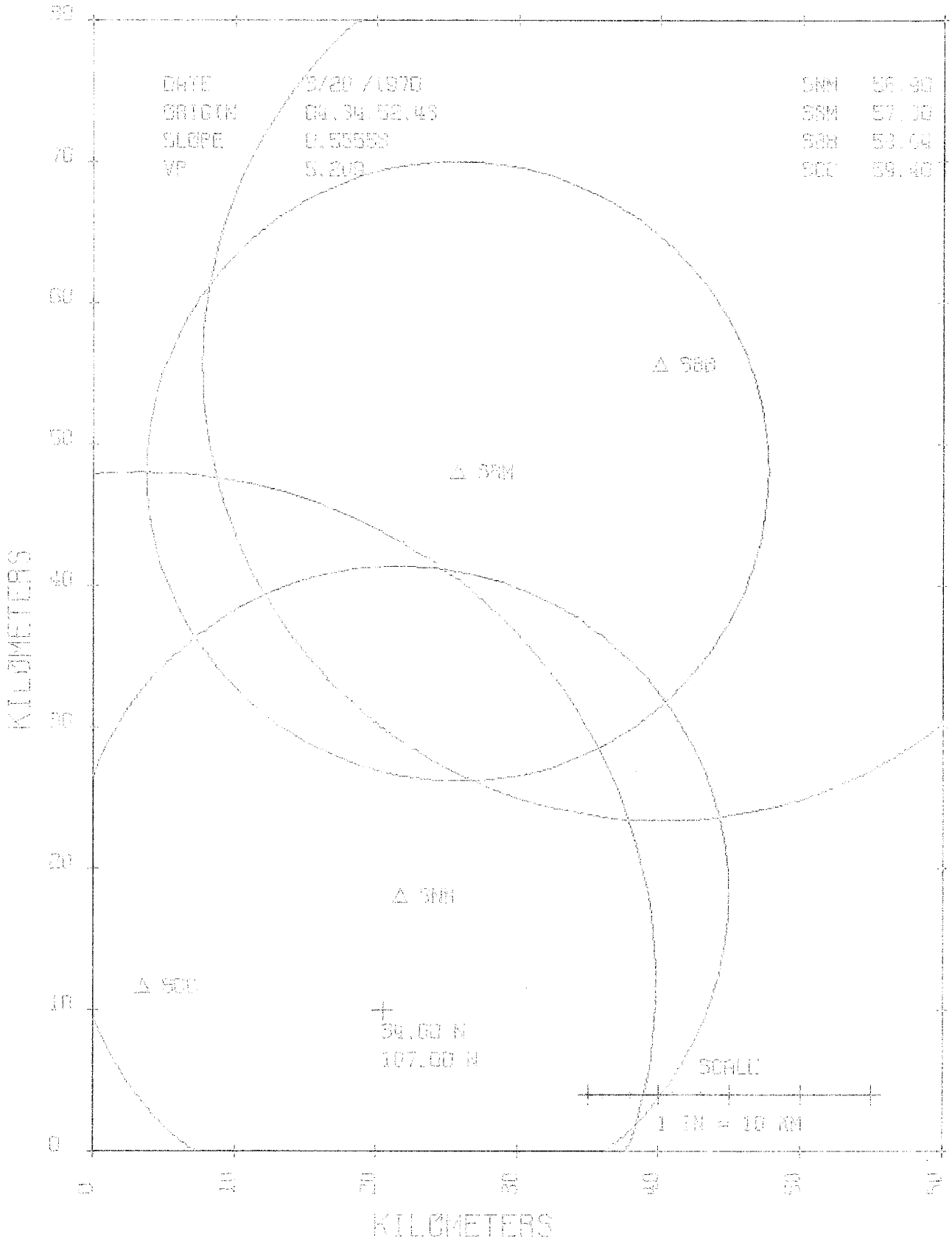
KILOMETERS


DATE 3/20/1970
ORIGIN 64.34.52.43
SLOPE 0.555553
VP 5.243
SNM 56.30
SSM 57.10
SSB 53.04
SSE 59.40
Δ SSB
Δ SSM
Δ SNM
Δ SSE
36.00 N
107.00 W
SCALE:
1 IN = 10 KM
KILOMETERS
KILOMETERS
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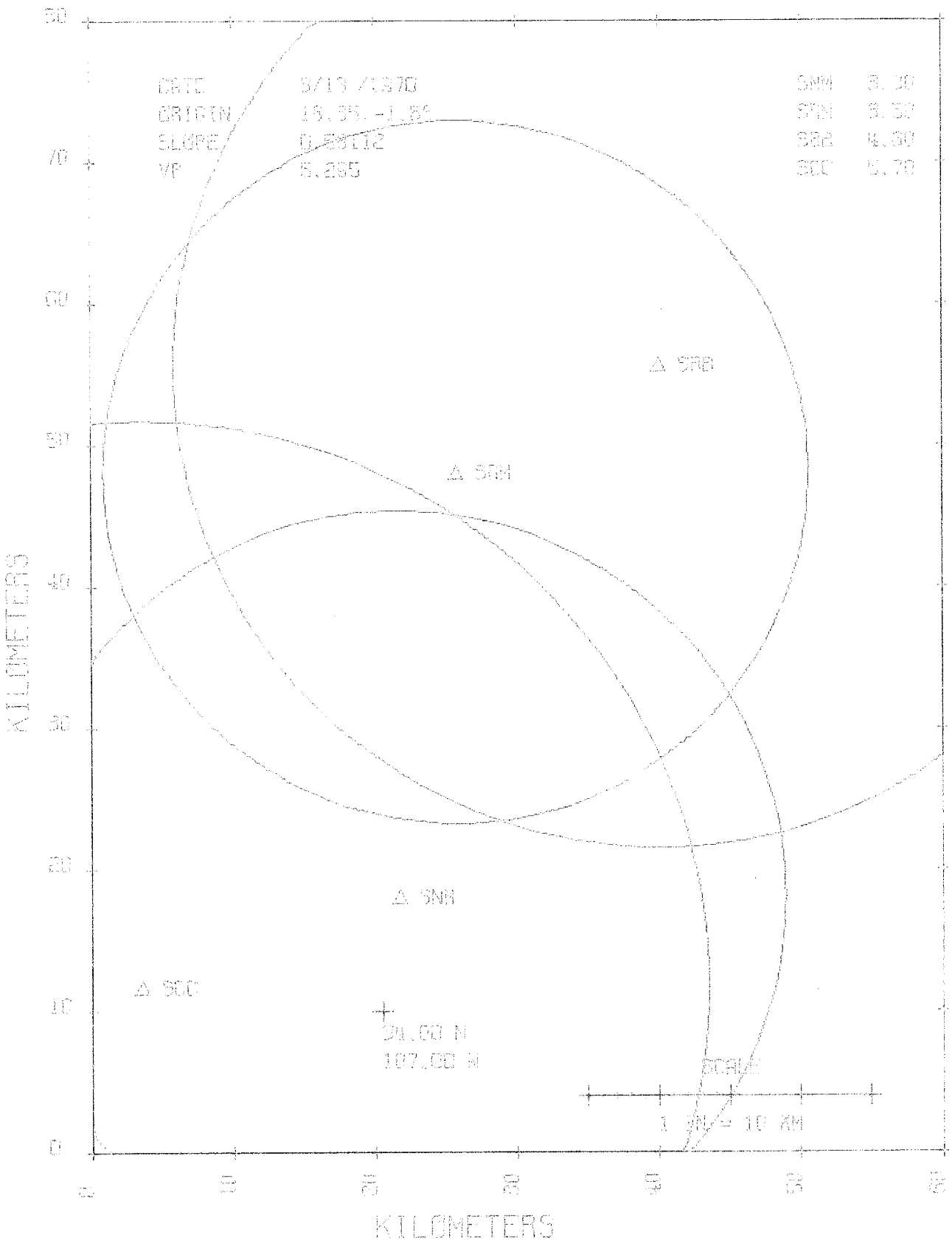
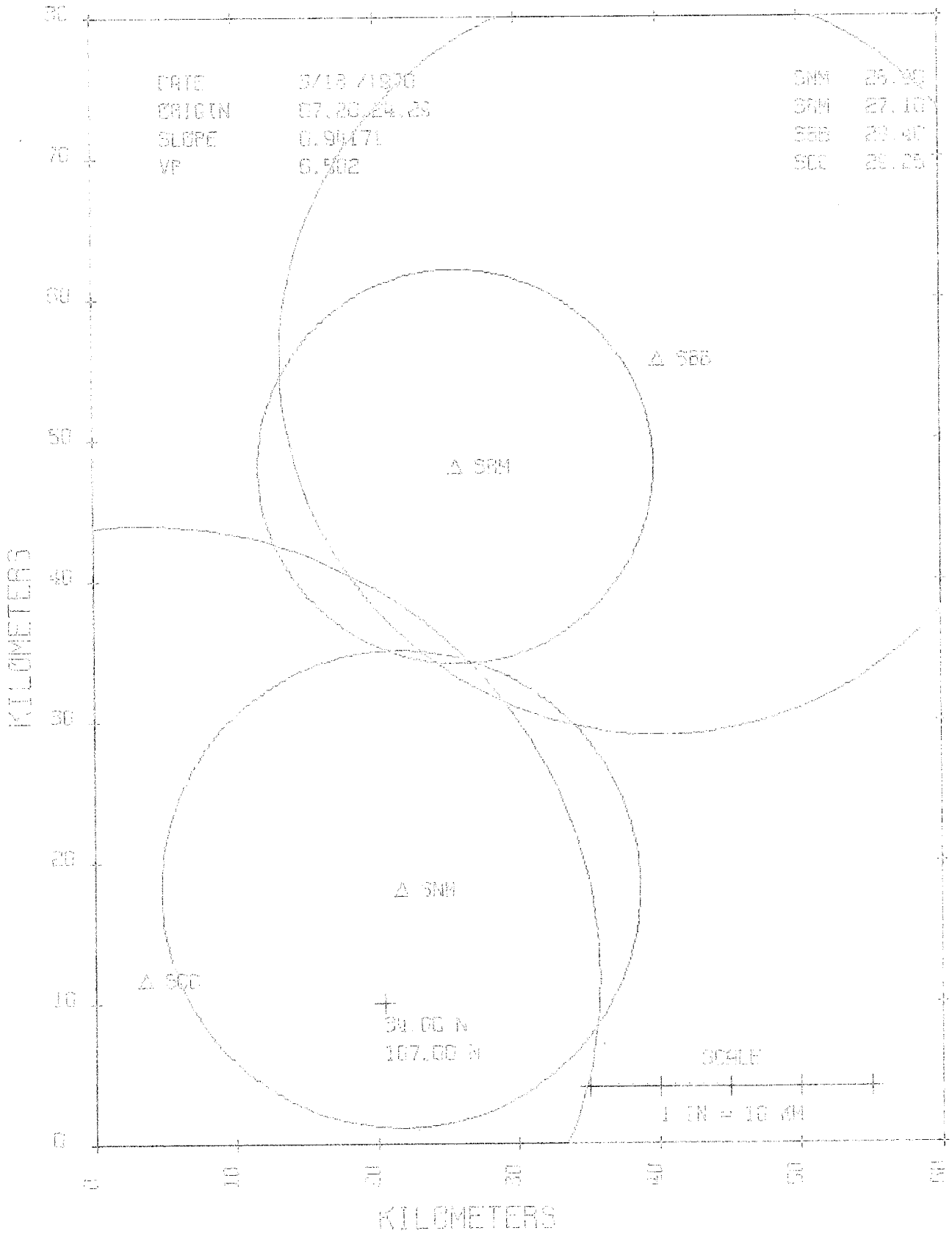
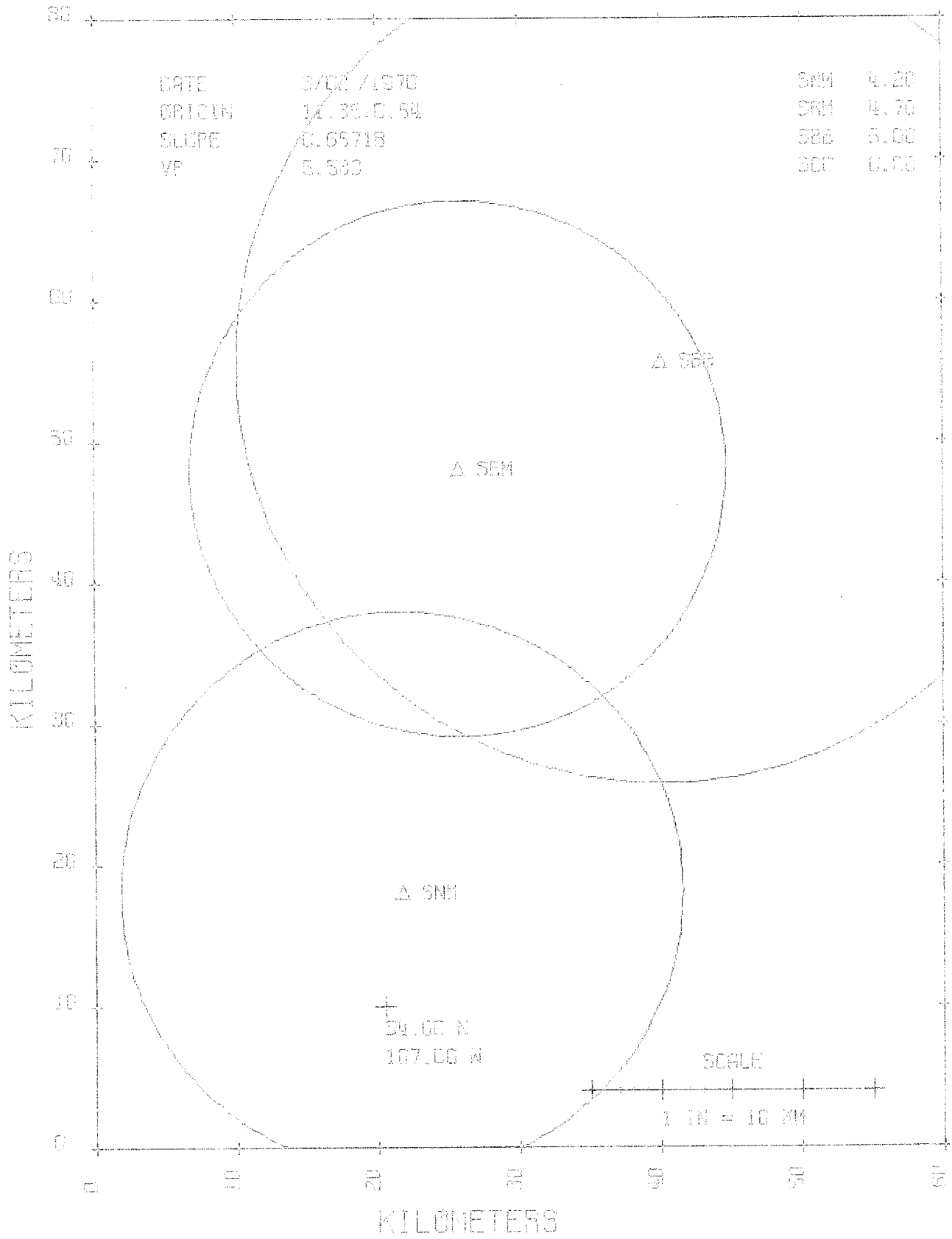
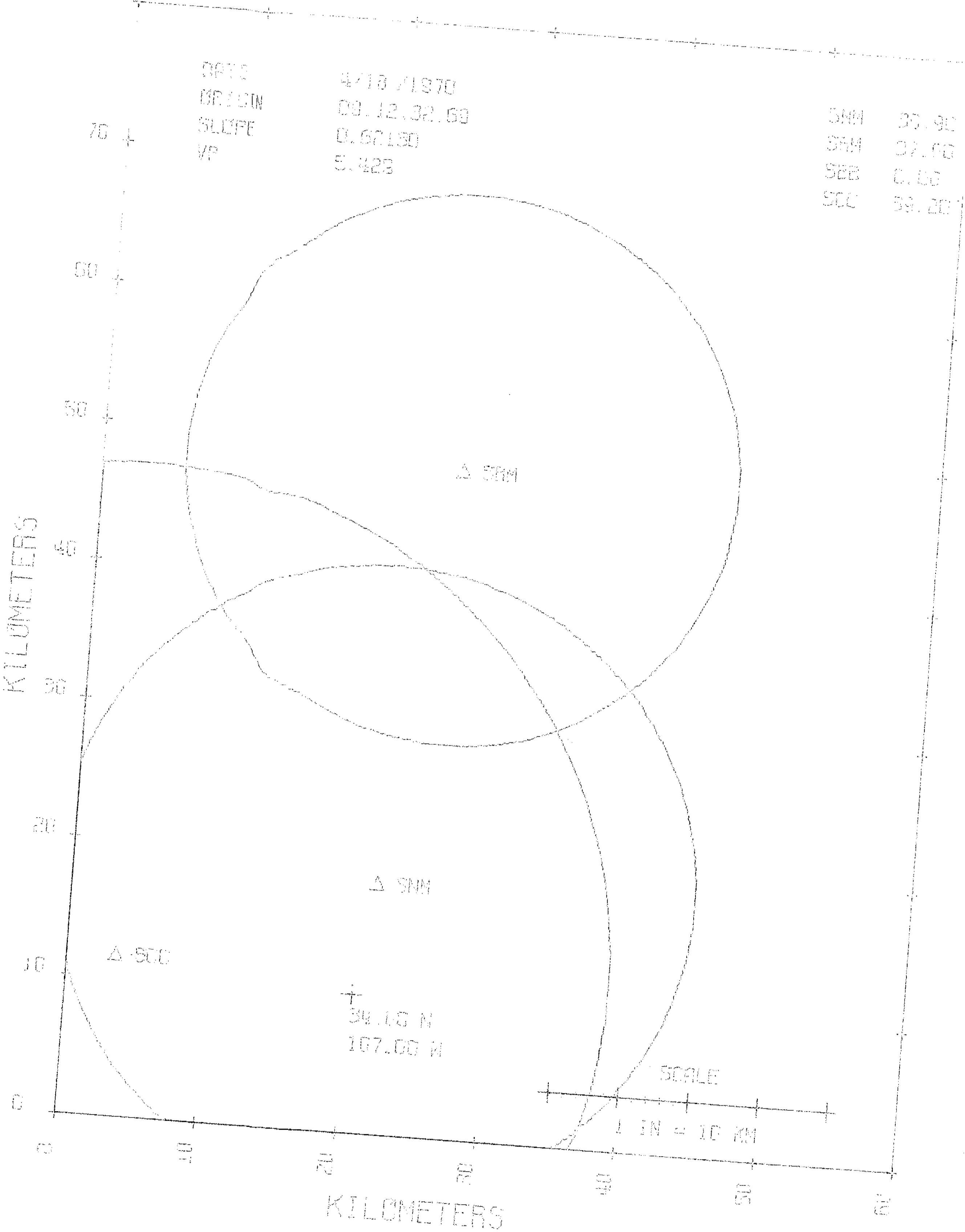

DATE 3/13/1970
ORIGIN 15.35,-1.56
SLOPE 0.581112
VP 5.255
SNM 8.30
STN 9.50
SBB 4.30
SCC 5.70
Δ SRB
Δ SBM
Δ SNM
Δ SCC
20.00 N
107.00 W
SCALE
1 IN = 10 KM
KILOMETERS
KILOMETERS


DATE 5/13/1970
ORIGIN 07:20:24.23
SLOPE 0.9947
VP 6.582
SNM 25.96
SRM 27.10
SSB 23.45
SCC 25.25
Δ SBB
Δ SRM
Δ SNM
Δ SCC
30.00 N
167.00 W
SCALE
1 IN = 10 KM
KILOMETERS
KILOMETERS


DATE 9/04/1970
ORIGIN 14.35.0.54
SLOPE 0.65715
VP 5.563
SRM 4.20
SRM 4.70
SBB 5.00
SBT 0.00
Δ SBB
Δ SRM
Δ SNM
34.00 N
107.00 W
SCALE
1 IN = 10 KM
KILOMETERS
KILOMETERS



SLOPE
VP
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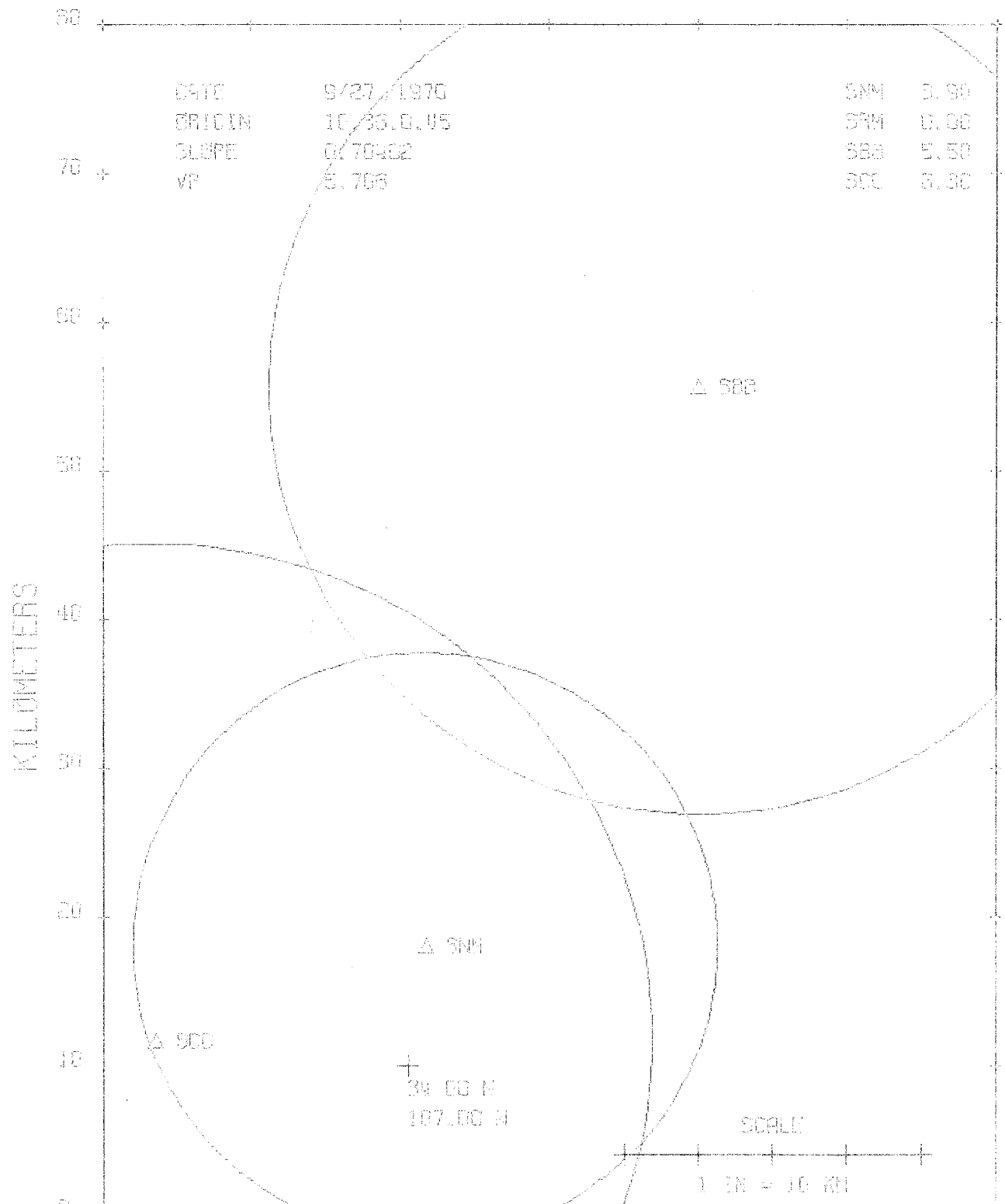
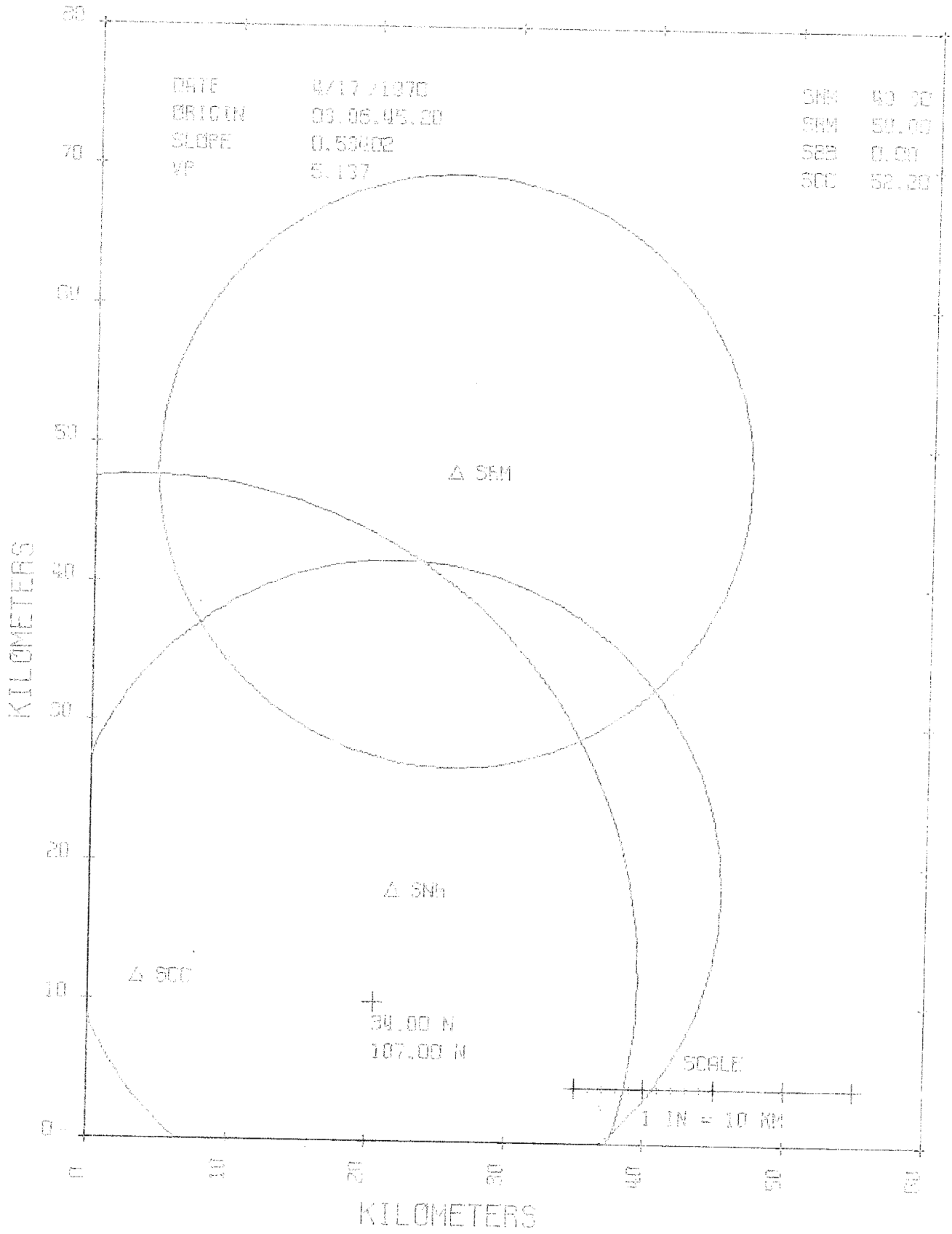
KILOMETERS
SNM
SCC
SCALE
1 IN = 10 KM


DATE 9/27/1970
ORIGIN 10/36.0.05
SLOPE 0/70402
VP 5.703
SNM 3.90
SPM 0.00
SBB 5.50
SCC 3.30
Δ SBB
Δ SNM
Δ SCC
36 00 N
107.00 W
SCALE
1 IN = 10 MI
KILOMETERS
KILOMETERS


DATE 6/17/1970
ORIGIN 03.06.45.20
SLOPE 0.554002
VP 5.137
SMS 50.00
SMM 50.00
SSS 0.00
SCC 52.20
Δ SSM
Δ SNM
Δ SCC
30.00 N
107.00 N
SCALE
1 IN = 10 KM
KILOMETERS
KILOMETERS
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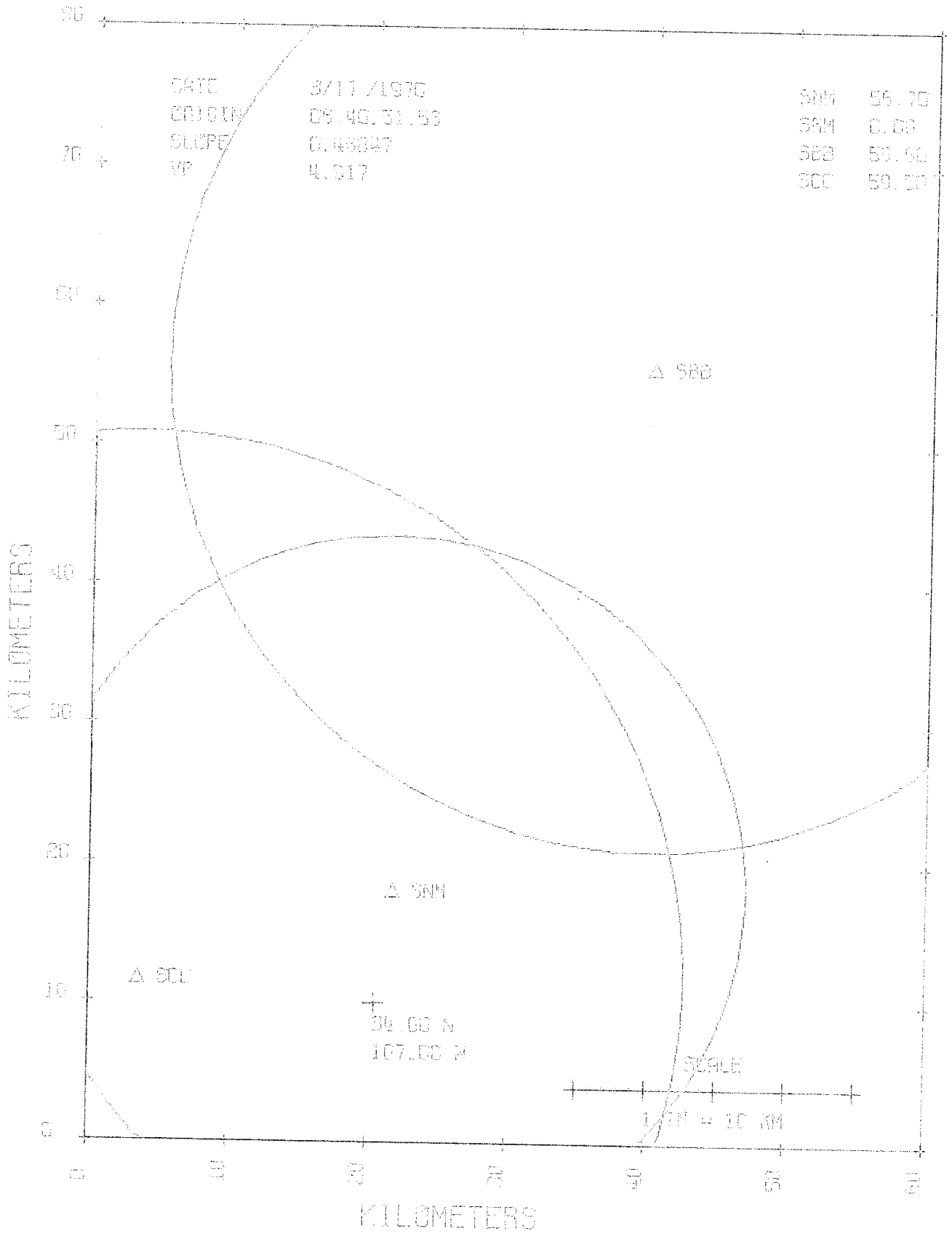
DATE 3/17/1976
ORIGIN 05:40:31.53
SLOPE 0.446047
VP 4.017
SNM 56.70
SRM 0.00
SBB 59.50
SCC 59.50
Δ SBB
Δ SNM
Δ SCC
34.00 N
107.00 W
SCALE
1 CM = 10 KM
KILOMETERS
KILOMETERS
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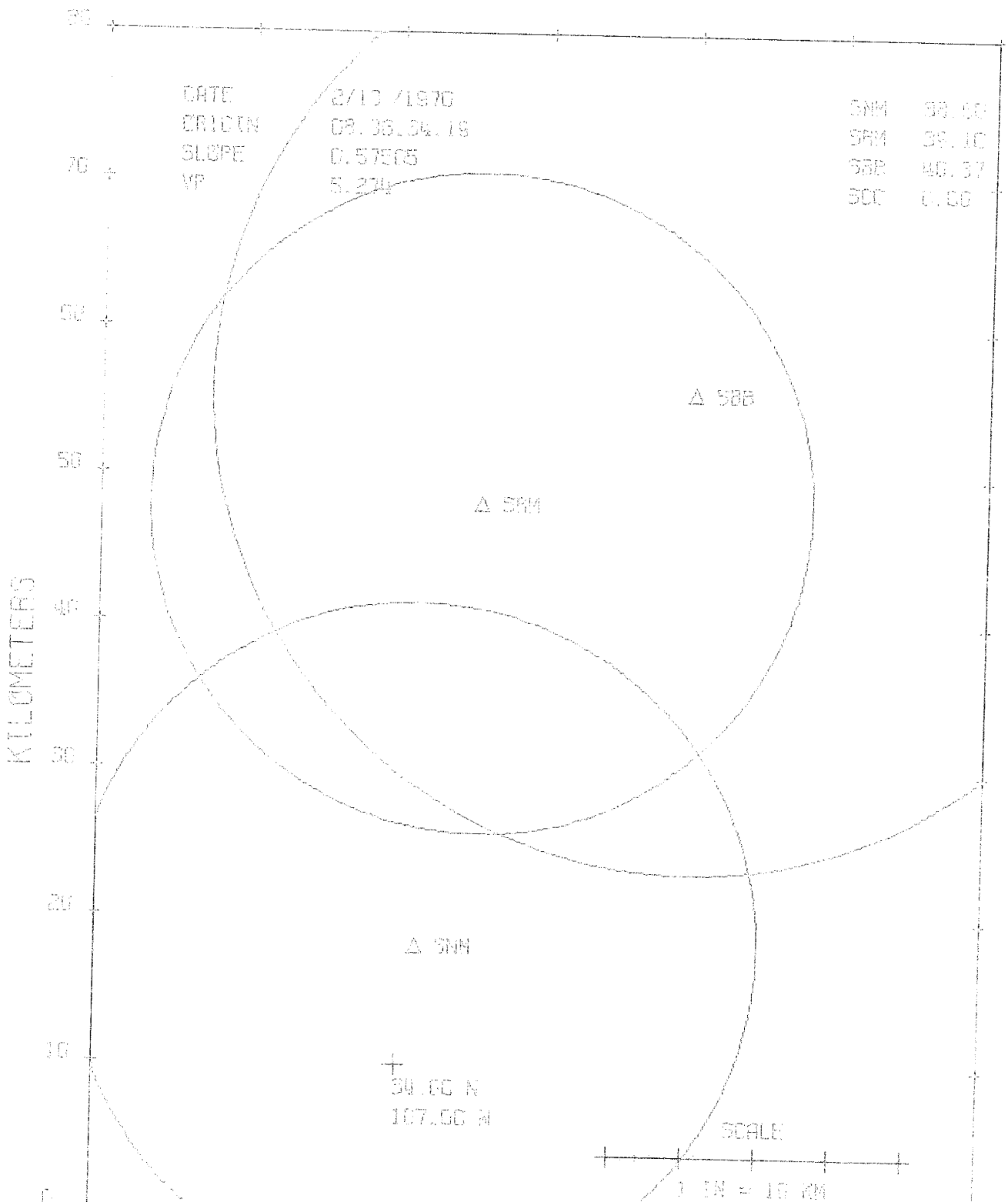
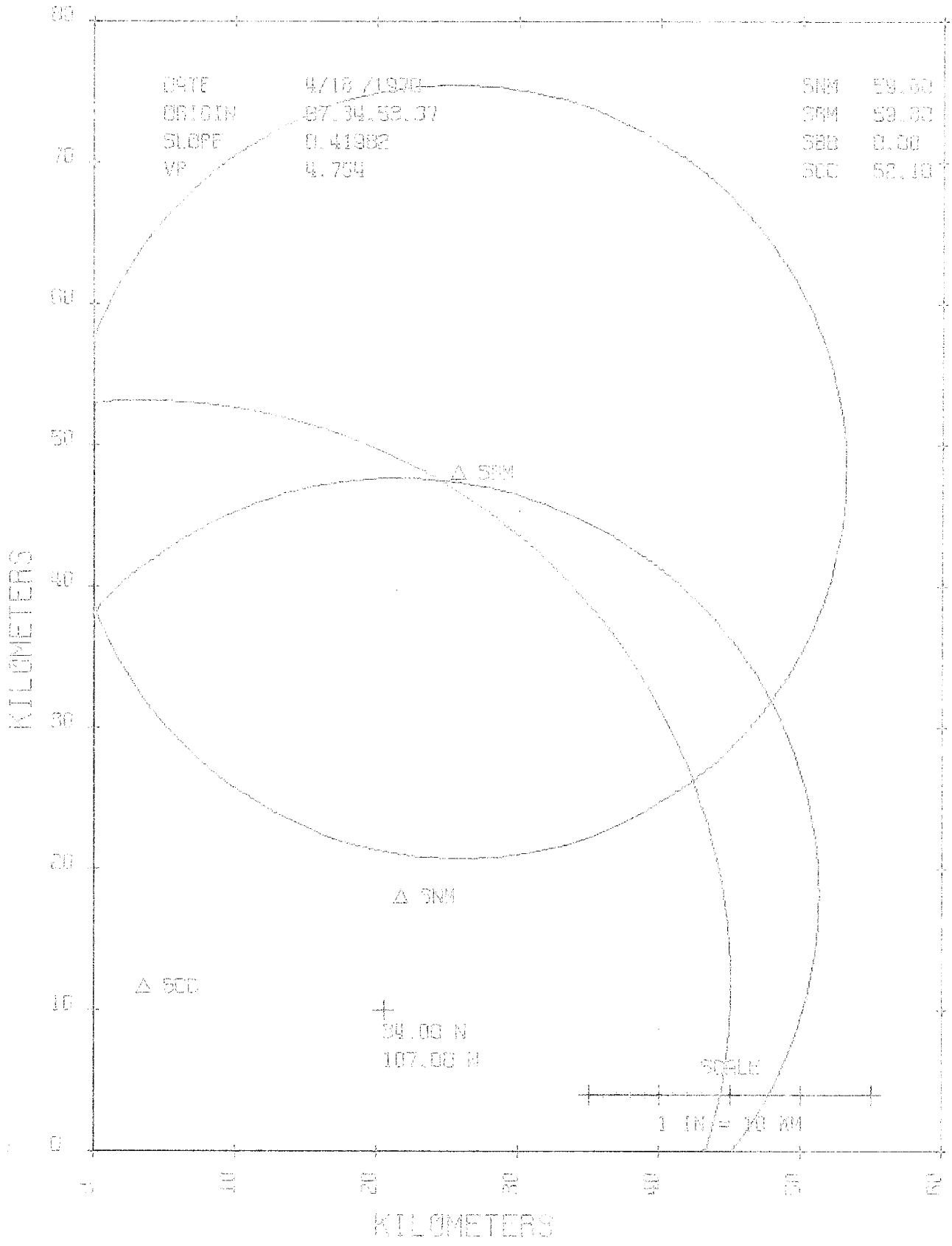
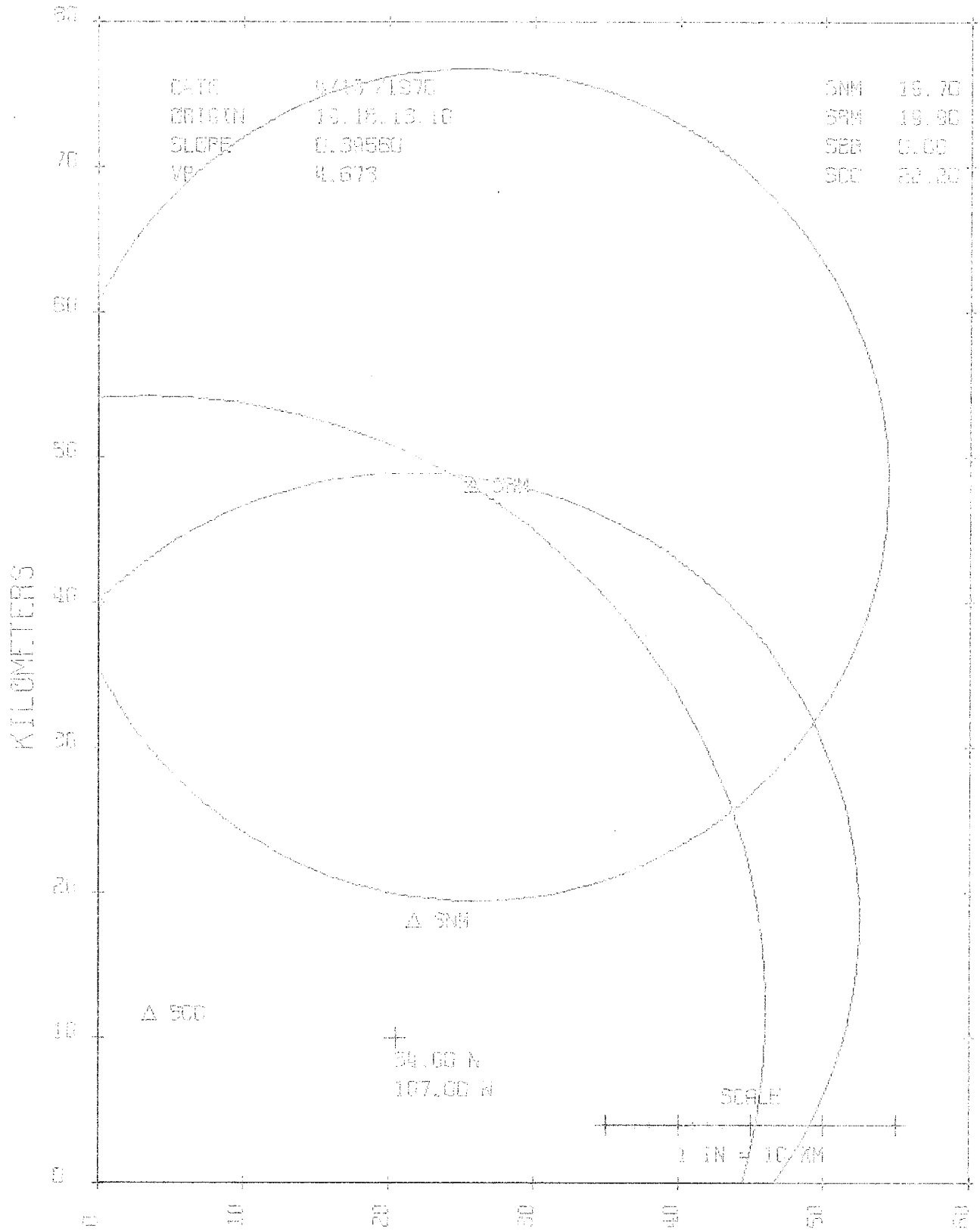
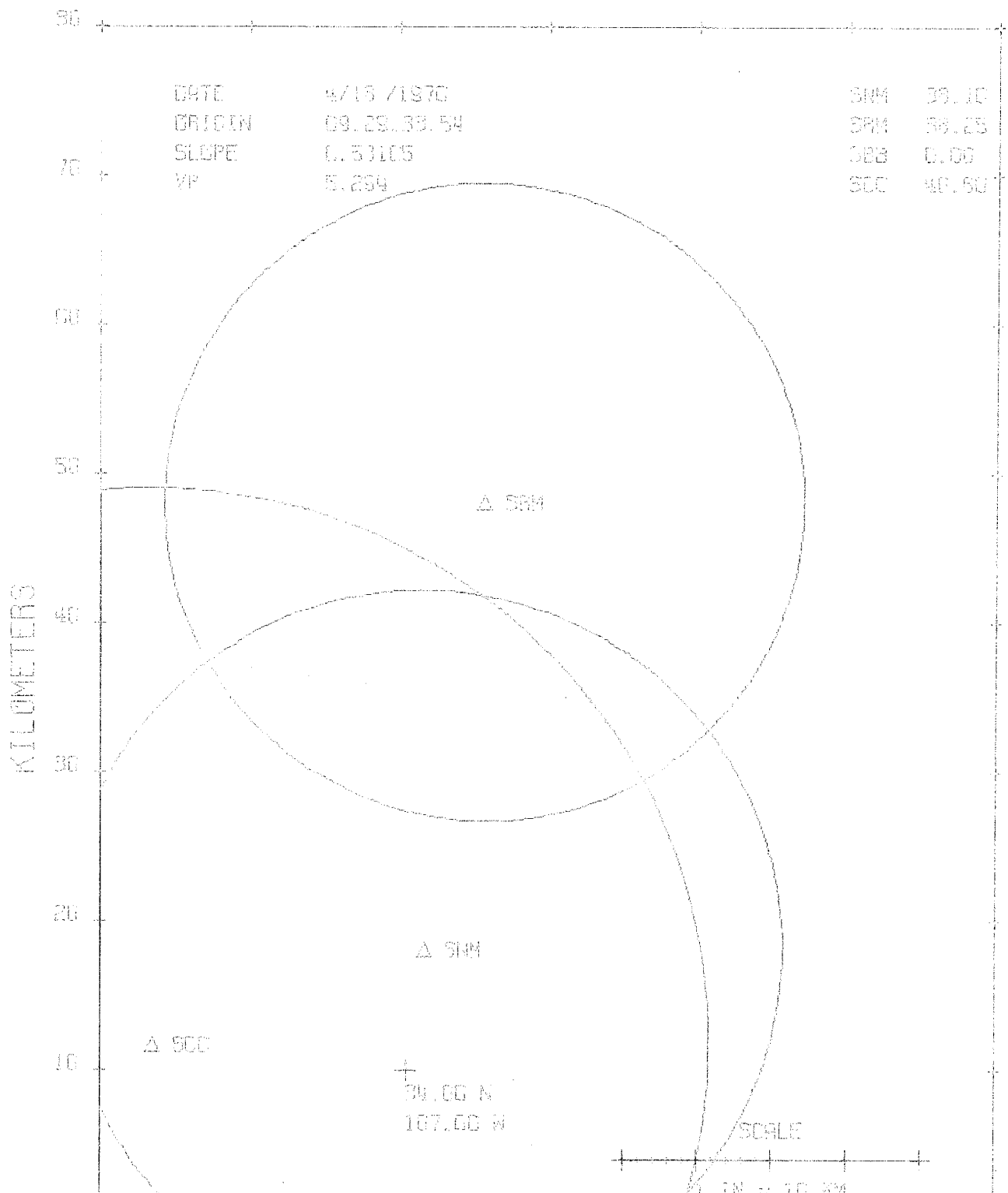
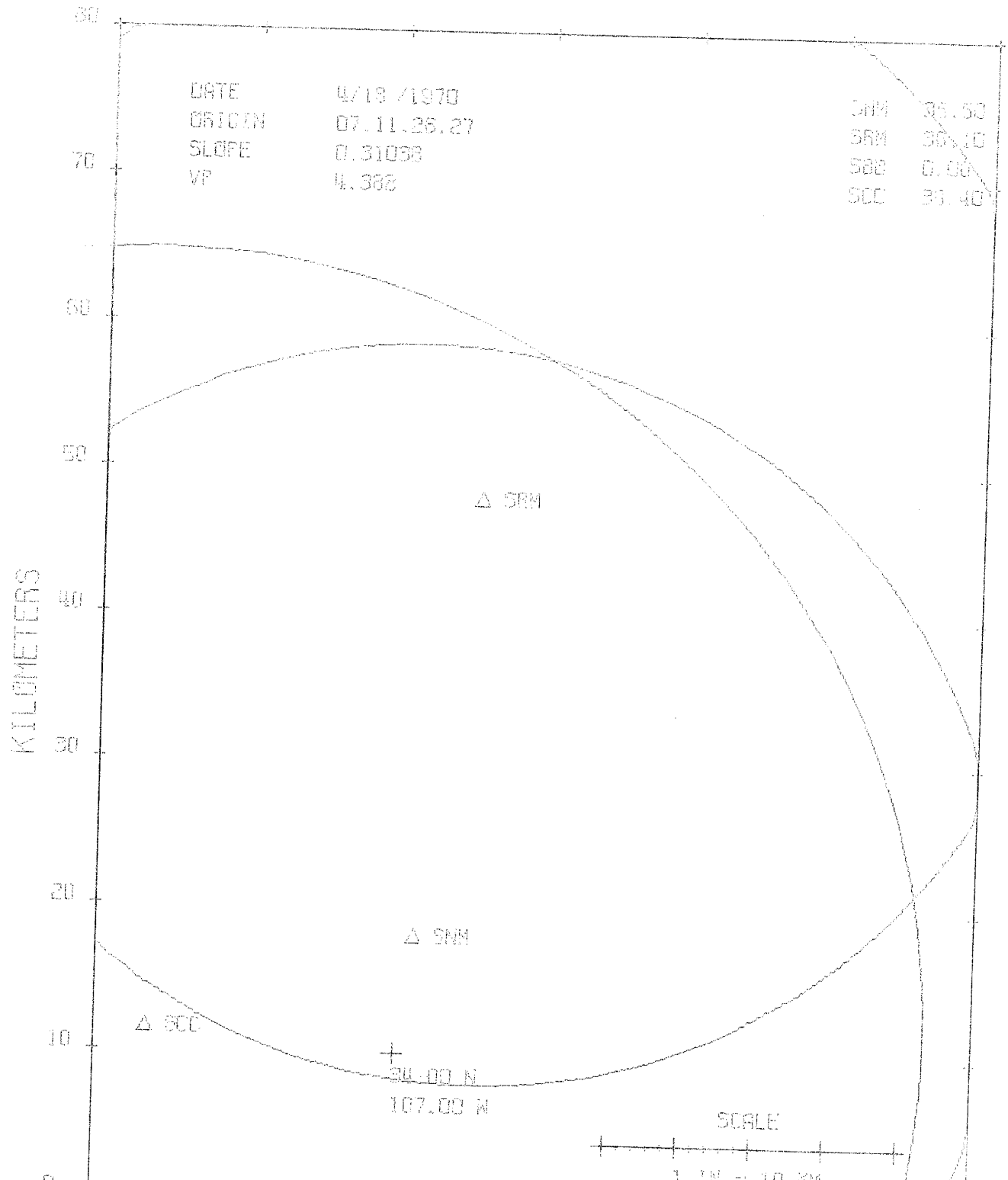
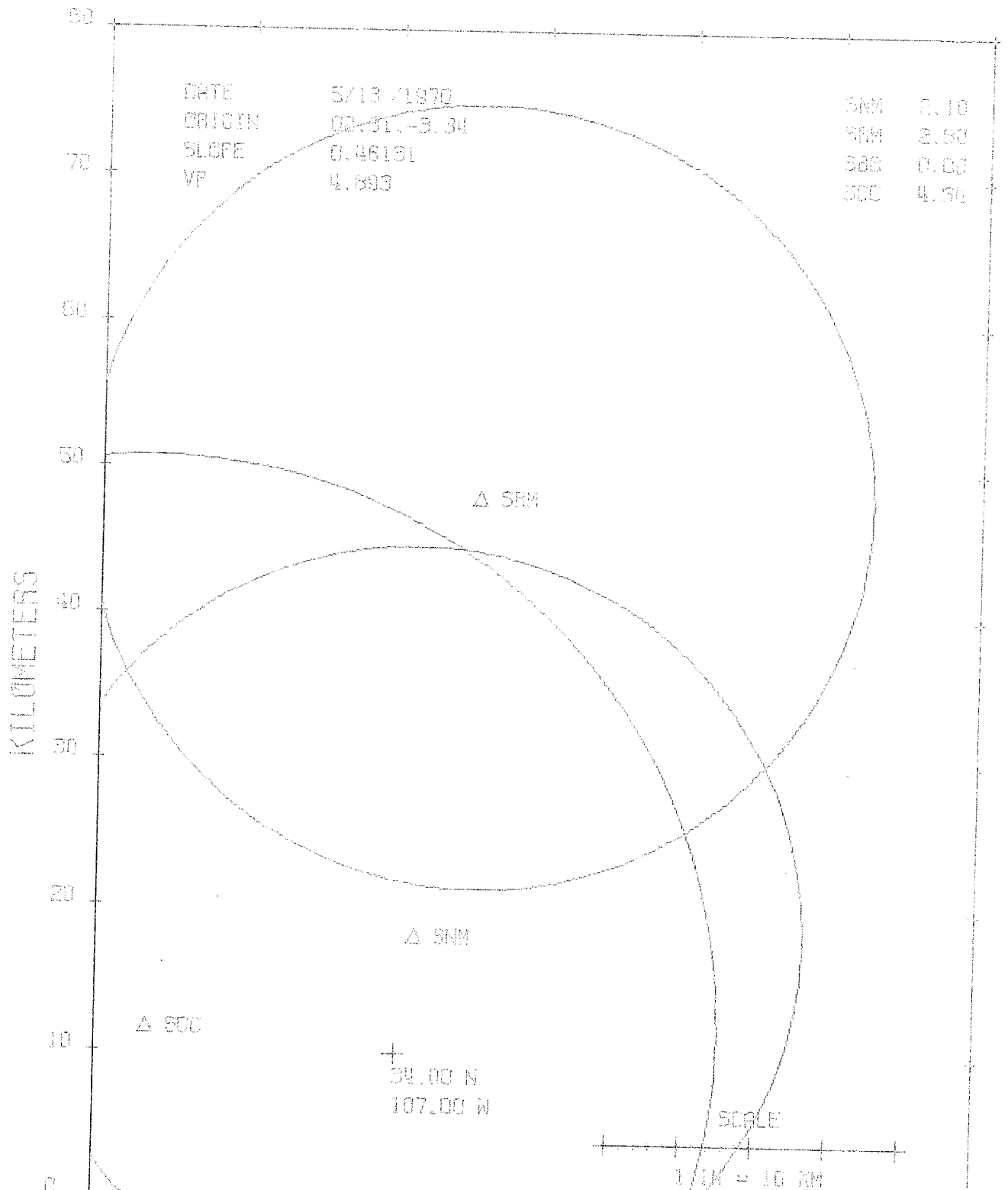

DATE 2/10/1970
ORIGIN 08:36:04.18
SLOPE 0.57585
VP 5.234
SNM 38.58
SRM 38.10
SBB 40.37
SCC 0.00
Δ SBB
Δ SRM
Δ SNM
30.00 N
107.00 W
SCALE
1 IN = 10 KM
KILOMETERS
KILOMETERS


DATE 4/18/1936
ORIGIN 37.34.52.37
SLOPE 0.413982
VP 4.754
SNM 59.50
SRM 53.00
SBB 0.00
SCC 52.10
Δ SRM
Δ SNM
Δ SCC
34.00 N
107.00 W
SCALE
1 IN = 20 KM
KILOMETERS
KILOMETERS


DATE 04/27/1976
ORIGIN 19.18.13.10
SLOPE 0.395601
VP 4.673
SNM 16.70
SRM 19.90
SZD 0.00
SCC 62.30
Δ SRM
Δ SNM
Δ SCC
39.00 N
107.00 W
SCALE
1 IN = 10 NM
KILOMETERS
KILOMETERS


DATE 4/15/1970
ORIGIN 09.25.33.5W
SLOPE 0.53105
VP 5.294
SRM 30.10
SRM 50.25
SDB 0.00
SDC 40.50
Δ SRM
Δ SNM
Δ SDC
30.00 N
107.00 W
SCALE
1 IN = 10 KM
KILOMETERS
KILOMETERS
0
10
20
30
40
50
60
70
80


DATE 4/18/1970
ORIGIN 07.11.26.27
SLOPE 0.31058
VP 4.388
DRM 36.60
SRM 36.10
SBB 0.00
SCC 36.40
Δ SRM
Δ SNM
Δ SCC
34.00 N
107.00 W
SCALE
1 IN = 10 KM
KILOMETERS
KILOMETERS


DATE 5/13/1970
ORIGIN 02-51.-9.34
SLOPE 0.96131
VP 4.693
SNM 0.10
4NM 2.80
SBB 0.00
SCC 4.50
Δ 5BM
Δ 5NM
Δ SCC
34.00 N
107.00 W
SCALE
1 CM = 10 KM
KILOMETERS
KILOMETERS
0
10
20
30
40
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60
70
80
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30
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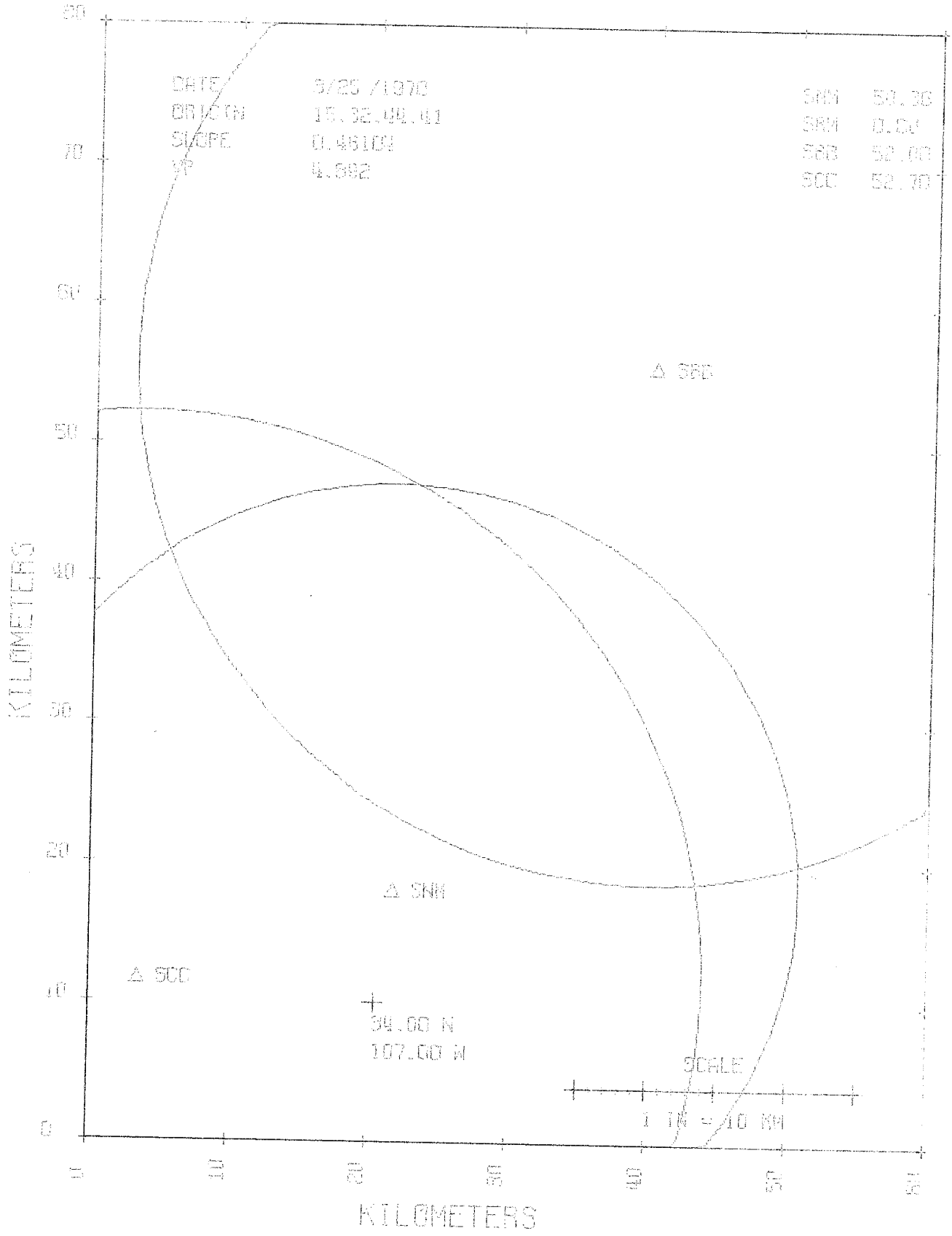
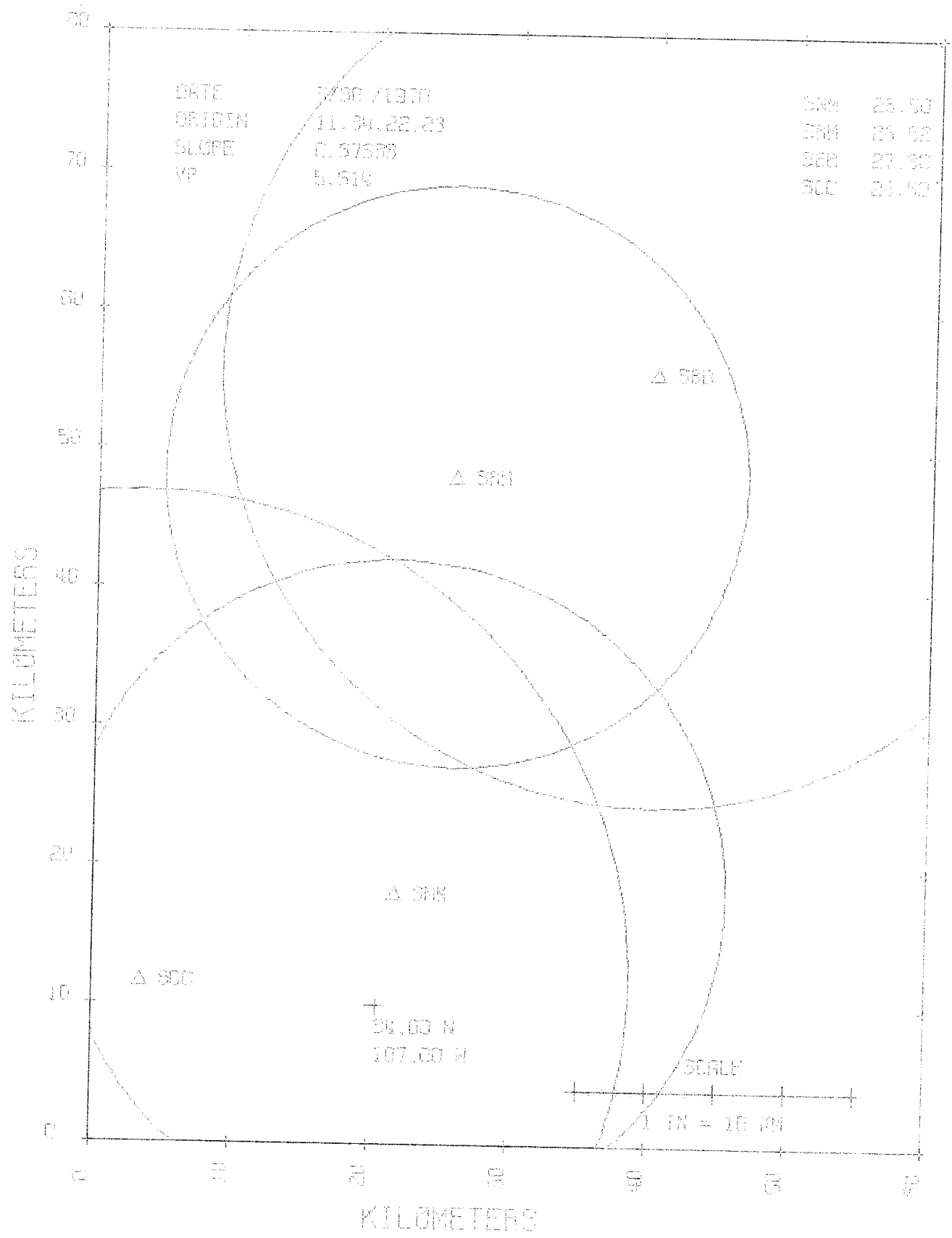
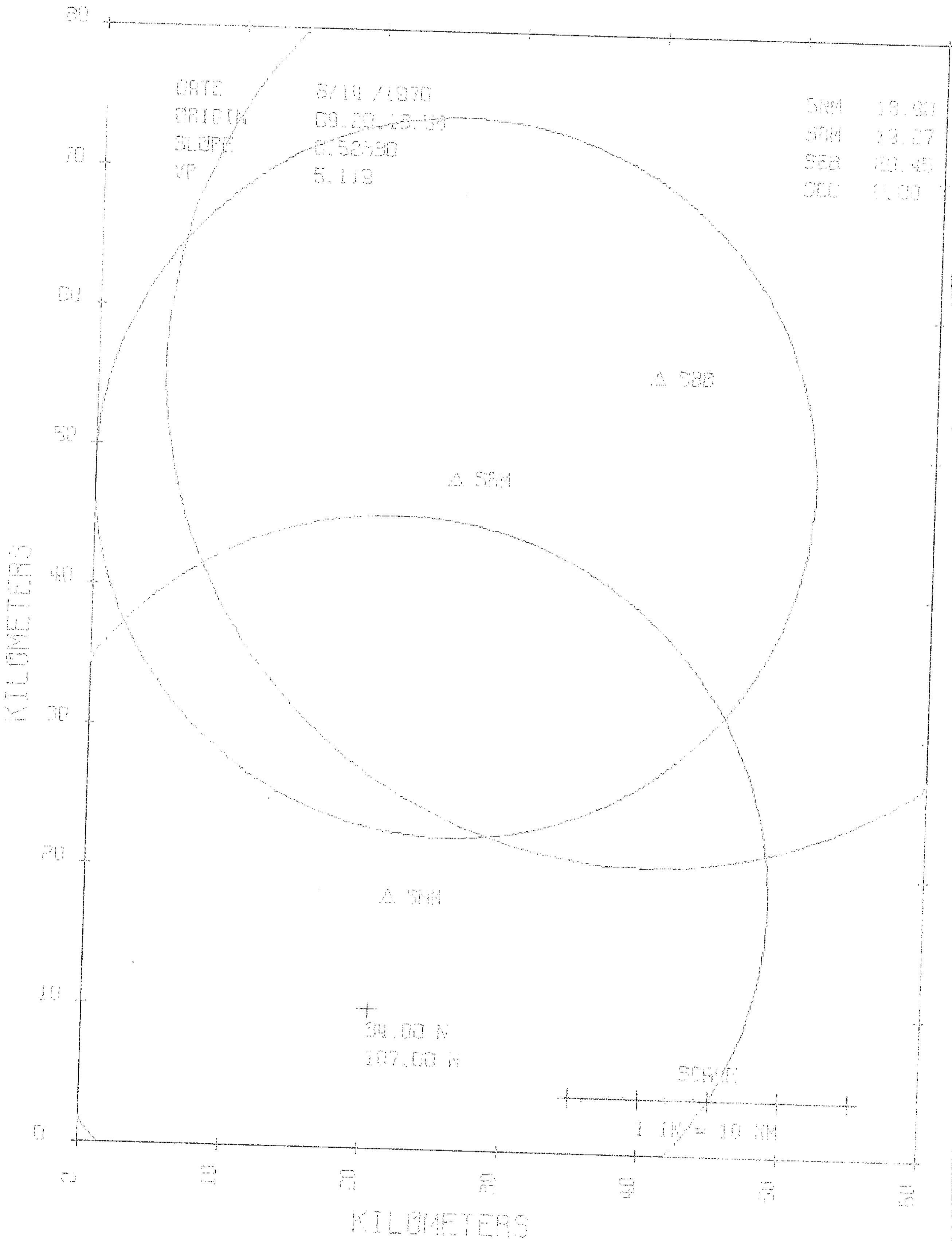
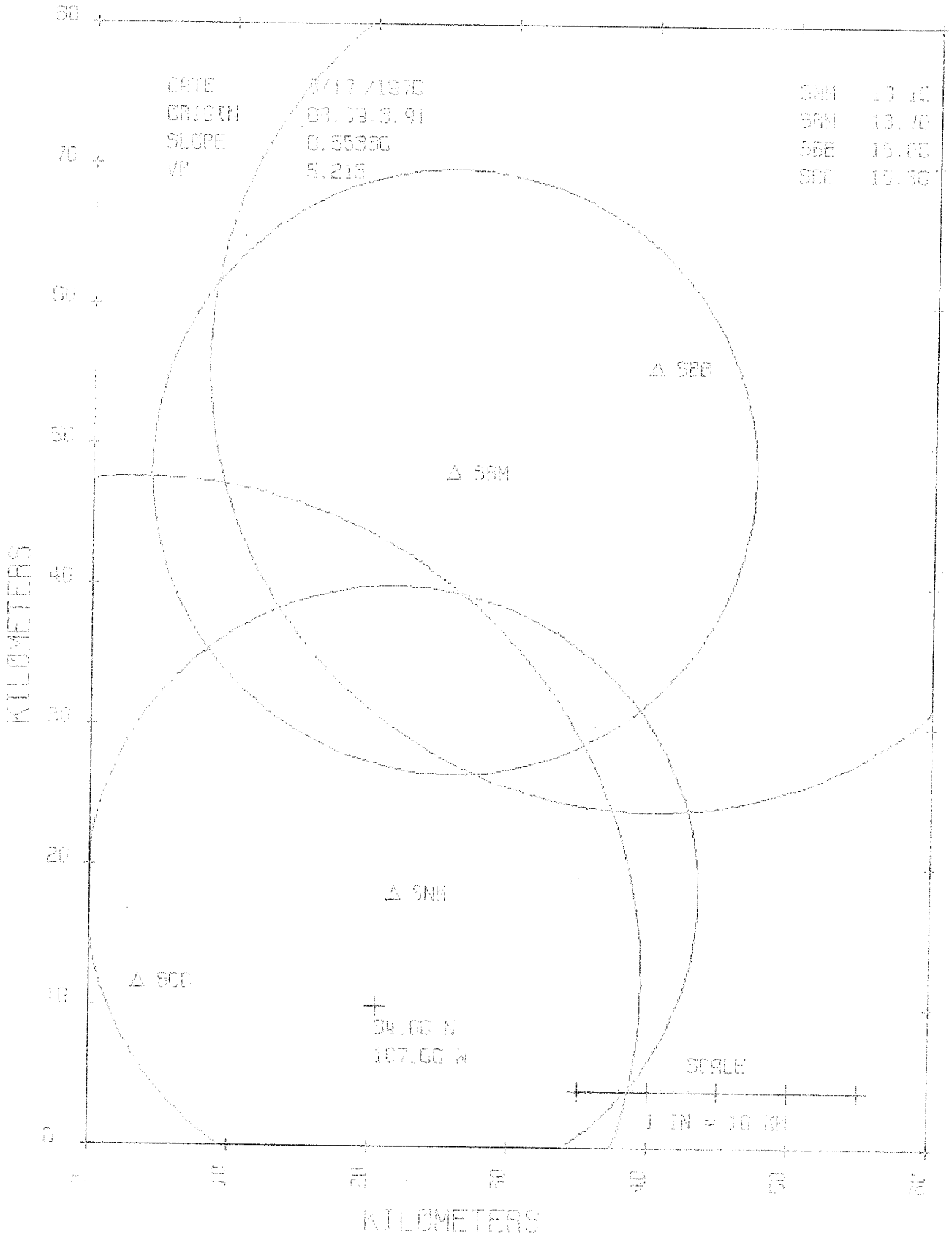
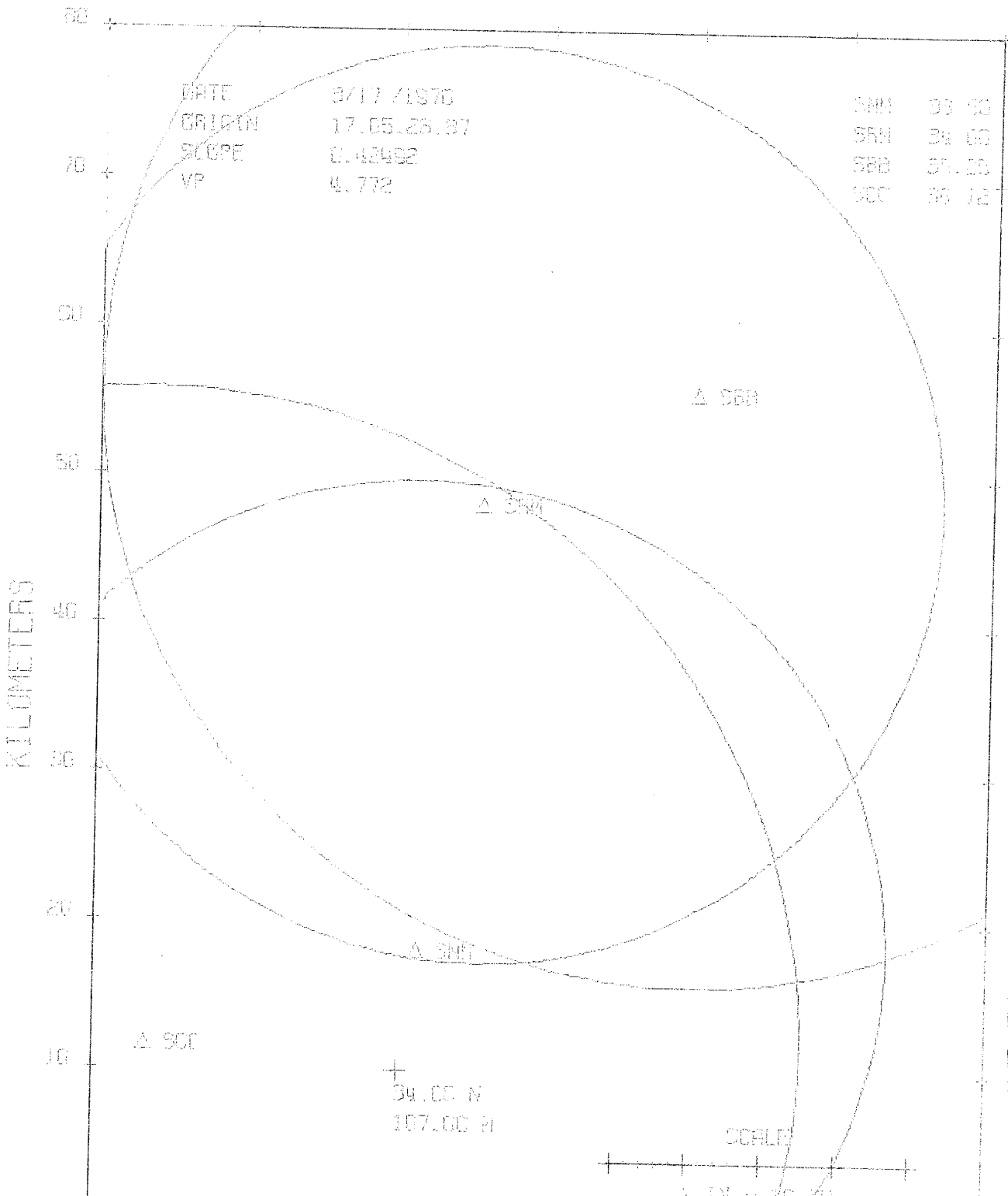
50
60

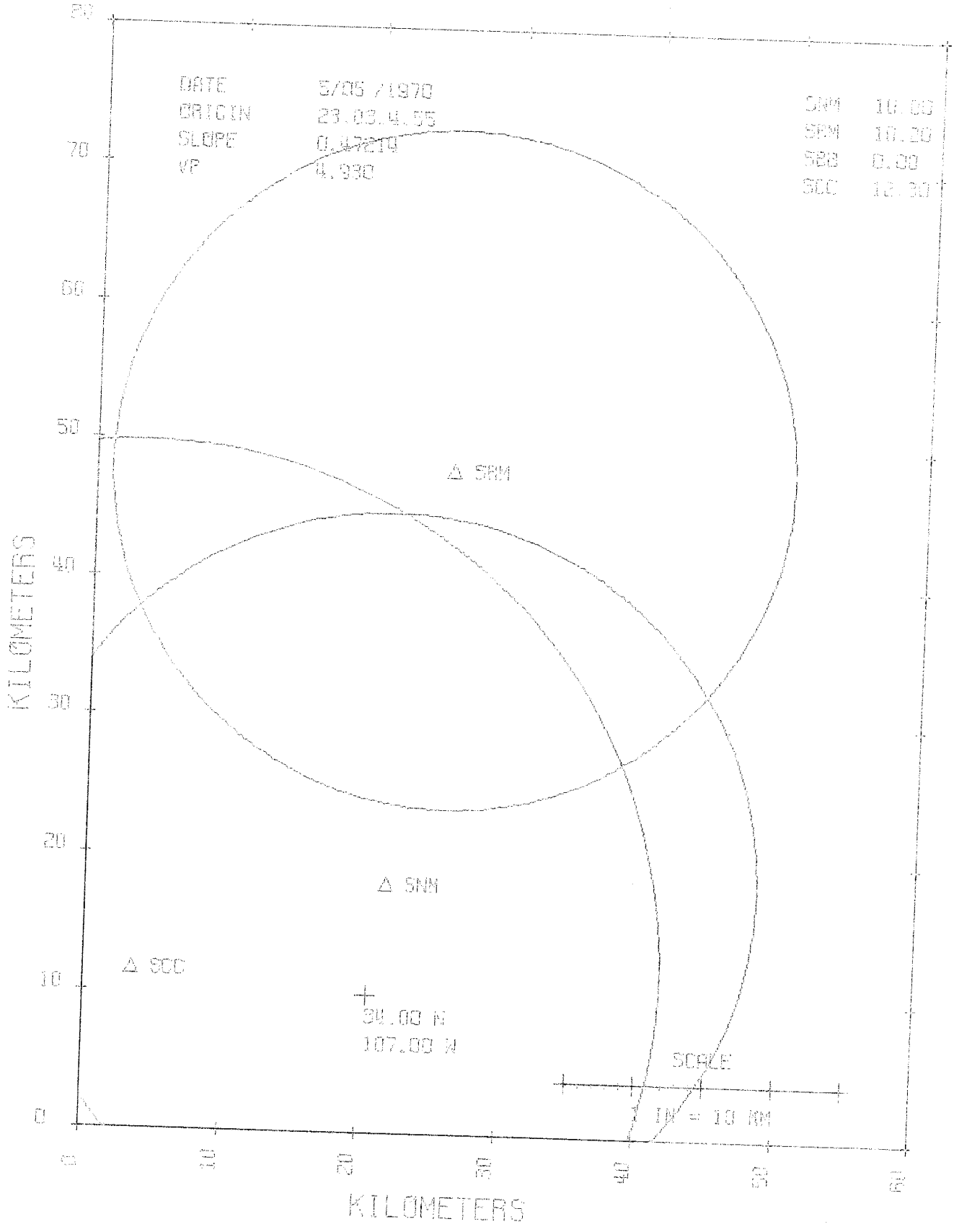

DATE 9/25/1970
ORIGIN 15.32.00.61
SLOPE 0.461031
AP 4.992
SNN 50.36
SNM 0.00
SEE 52.00
SCC 52.70
Δ SEE
Δ SNM
Δ SCC
34.00 N
107.00 W
SCALE
1 IN = 10 KM
KILOMETERS
KILOMETERS
0
10
20
30
40
50
60
70
80
0
10
20
30
40
50
60


DATE 3/30/1978
ORIGIN 11.34.22.43
SLOPE 0.97578
VP 5.614
SNW 25.50
SNN 25.92
SEE 27.30
SCC 24.42
Δ SEE
Δ SNN
Δ SNW
Δ SCC
34.00 N
107.00 W
SCALE
1 IN = 10 KM
KILOMETERS
KILOMETERS
0
10
20
30
40
50
60
70
80
0
10
20
30
40
50
60
70


DATE
SLOPE
VP
SRM
SGB
SCC
SGB
SSM
SNM
KILOMETERS
KILOMETERS


DATE 8/17/1970
ORIGIN OR. 39.3, 91
SLOPE 0.55330
VP 5.215
SRM 10.00
SRM 10.00
SBB 10.00
SCC 10.00
Δ SBB
Δ SRM
Δ SNM
Δ SCC
39.00 N
107.00 W
SCALE
1 IN = 10 MM
KILOMETERS
KILOMETERS


DATE 3/17/1976
ORIGIN 17.05.25.97
SLOPE 0.42452
VP 4.772
SNM 33.50
SRM 34.00
SBB 34.50
SCC 35.12
Δ SBB
Δ SRM
Δ SNM
Δ SCC
34.00 N
107.00 W
SCALE
1 IN = 10 KM
KILOMETERS
KILOMETERS


DATE 3/05 /1970
ORIGIN 23.03.4.55
SLOPE 0.47219
VP 4.930
SNM 10.00
SRM 10.20
SSS 0.00
SCC 10.30
Δ SRM
Δ SNM
Δ SCC
30.03 N
107.03 W
SCALE
1" = 10 KM
KILOMETERS
KILOMETERS
0
10
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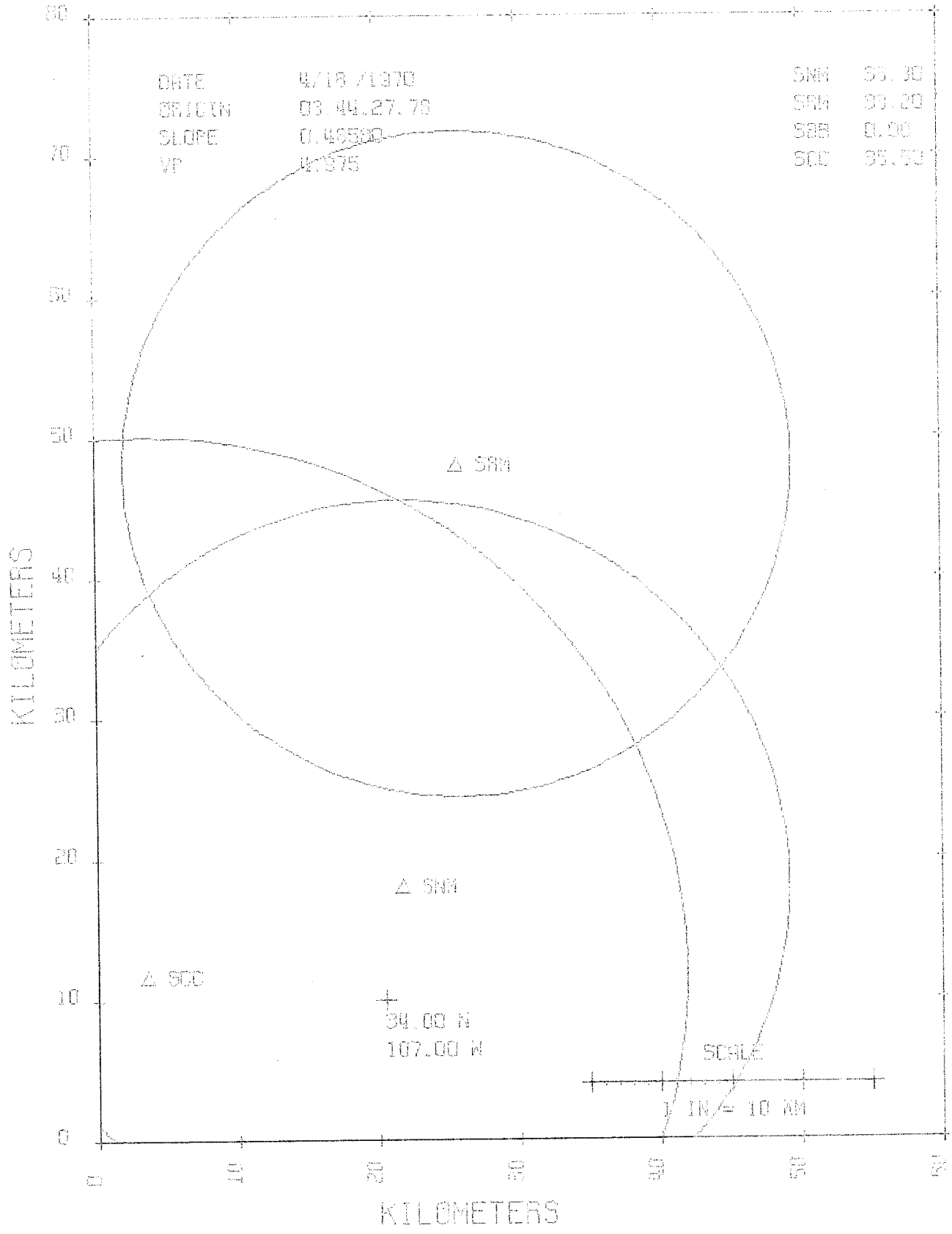
DATE 4/16/1970
ORIGIN 03 44.27.78
SLOPE 0.405800
VP 4.575
SNM 55.30
SRM 33.20
SBB 0.90
SCC 35.50
△ SRM
△ SNM
△ SCC
34.00 N
107.00 W
SCALE
1 IN = 10 KM
KILOMETERS
KILOMETERS
0
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CLASS I EVENTS 38 Events

ate	Time	Magnitude		log A	Date	Time	Magnitude		log A
1969		C.T.I	LRSM	SRM	1970		C.T.I	LRSM	SRM
ne 14	02:35	-0.3		0.60	May 5	22:44	0.14		1.21
ne 27	09:35	-0.1		0.78	May 5	22:44	0.21		1.34
ly 7	08:58	-0.74		0.60	May 5	23:03	-0.32		0.78
ly 7	09:03	-0.14		0.85	May 11	08:07	0.15		1.00
ly 7	11:25	-0.43		0.60	May 13	02:31	Sat	1.0	1.73 ×
ly 12	04:05	0.2		1.00	June 1	12:23	-0.16		0.70
ly 18	04:07	0.6	0.50	1.65	June 1	15:36	0.03		0.78
ly 18	11:39	-0.1		0.78	June 1	22:17	Sat	0.65	1.45
ly 18	02:34	0.05		0.78	June 2	00:22	-0.02		0.81
ly 19	05:50	-0.23		0.78	June 2	12:24	-0.29		0.48
y 30	10:47	0.2		—	June 7	09:14	-0.48		0.30
g. 9	02:34	-0.5		0.40	June 14	04:31	0.28		0.30
t. 15	04:41	-0.35		0.65	June 14	04:36	0.30		1.35
t. 9	13:12	0.12		1.18	June 14	04:36	0.28		1.53
t. 9	15:10	0.18		0.88	June 16	16:50	0.29		1.51
c. 4	17:30	0.21		1.37	June 17	18:52	-0.02		0.84
c. 31	03:06	0.0		0.69	June 23	01:33	0.22		—
n. 7, 70	13:35	0.27		—	June 30	11:34	0.21		1.32
n 11	20:40	-0.35		0.00					
b. 12	05:17	0.05		0.78					
b. 13	08:36	0.30		1.18					
ar. 2	11:35	-0.72		0.85					
r. 17	06:40	0.13		—					
r. 17	08:37	-0.13		0.84					
r. 17	17:05	0.36		1.43 ×					
r. 18	07:20	0.11		1.02					
r. 18	16:35	0.03		1.02					
r. 20	04:34	0.18		1.15					
r. 25	15:31	Sat	2.10	—					
r. 28	09:02	-0.24		0.48					
r. 30	03:51	-0.10		0.60					
r. 13	06:29	-0.34		0.48					
r. 17	03:06	0.26		1.08					
r. 18	03:14	0.30		1.21					
r. 18	07:11	-0.35		0.40					
r. 18	07:34	-0.24		0.96					
r. 18	09:05	-0.24		1.34 ×					
r. 18	09:12	0.23		1.34 ×					
r. 18	09:29	-0.24		0.30					
r. 18	19:18	0.30		1.32					

SNM			SRM		
Magnitude	N	$\leq N$	Log A	N	$\leq N$
2.10	1	1	0.0	1	1
1.00	1	2	0.1	0	1
0.60	1	3	0.2	0	1
0.50	1	4	0.3	3	4
0.40	1	5	0.4	2	6
0.30	9	14	0.5	3	9
0.20	10	24	0.6	5	14
0.10	5	29	0.7	2	16
0.00	5	34	0.8	12	28
−0.10	5	39	0.9	1	29
−0.20	5	44	1.0	6	35
−0.30	8	52	1.1	1	36
−0.40	1	53	1.2	4	40
−0.50	2	55	1.3	5	45
−0.60	0	55	1.4	3	48
−0.70	2	57	1.5	2	50
−0.80	0	57	1.6	1	51
			1.7	1	52
			1.8	0	52
			1.9	0	52
			2.0	0	52
			2.1	1	53

Class I

March 15, 1972

Date	Ss-P Times SNM	SRM	SCC	SBB	ALQ	S-P Times SNM	SRM	SCC	SBB	ALQ
1970										
March 20	7.25	—	7.20	7.32		2.4?	3.1?	3.98?	3.43	
June 1	7.00	—	7.15	7.43		2.2(LRSM)	2.75	4.10	3.58	11.0
June 14	7.05	—	7.24	7.37		2.3	2.83	4.0	3.4	
June 14	7.15	—	7.18	7.38		2.45	3.25	3.80	3.80	10.0
June 21	7.20	—	7.20?	7.50		2.50		3.70	3.60	11.0
June 16	7.35		7.40	7.30		2.37		4.00	3.77	11.0
June 16	7.13		7.13	7.30		2.22		4.02	3.61	
June 30	?		7.15	7.32		2.24		4.10	3.98	10.5
July 7	7.10		7.20	7.25		2.50		4.00	3.70	10.5
Sept. 27	7.12		7.25			2.30		4.10	3.60	11.2

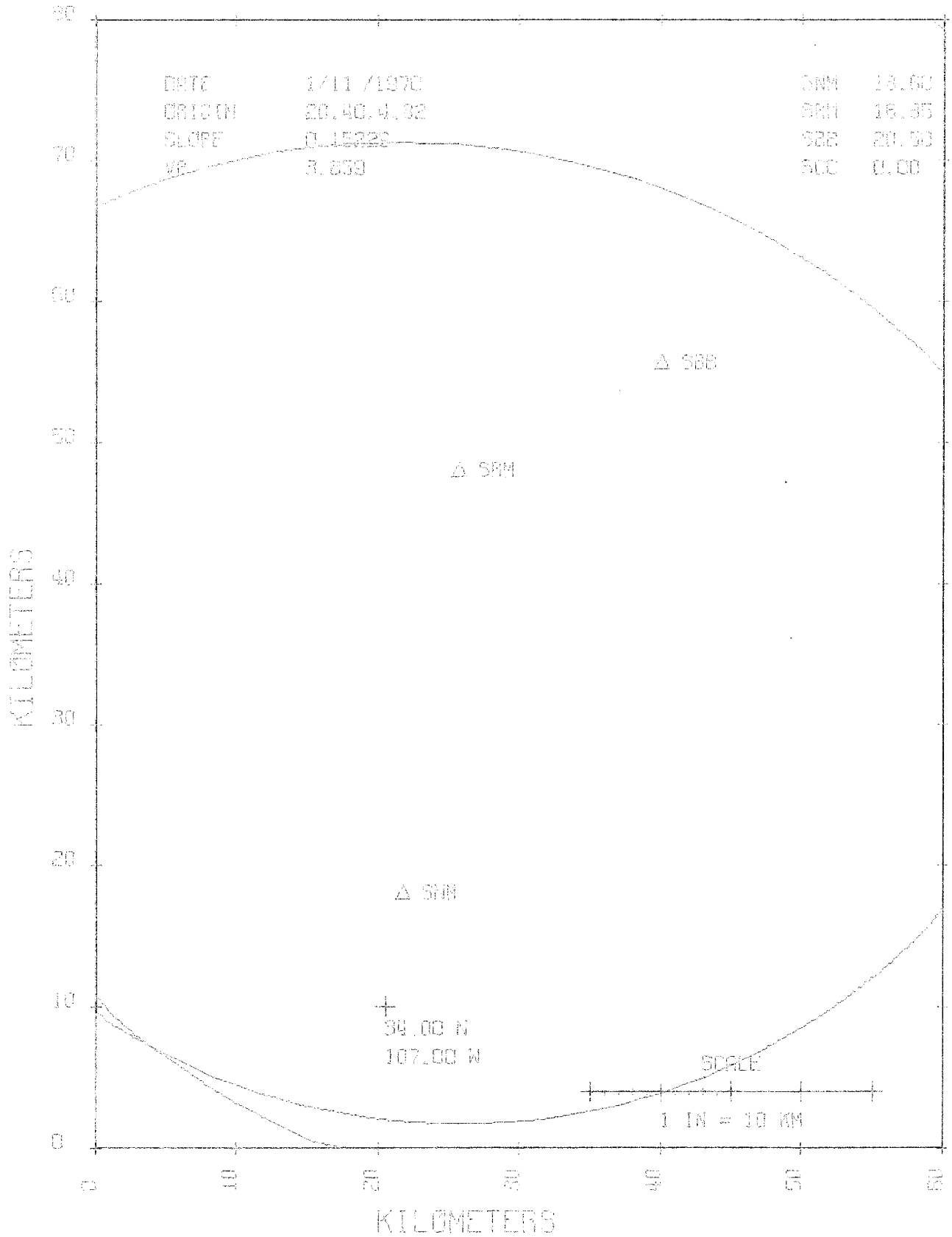
Class I —

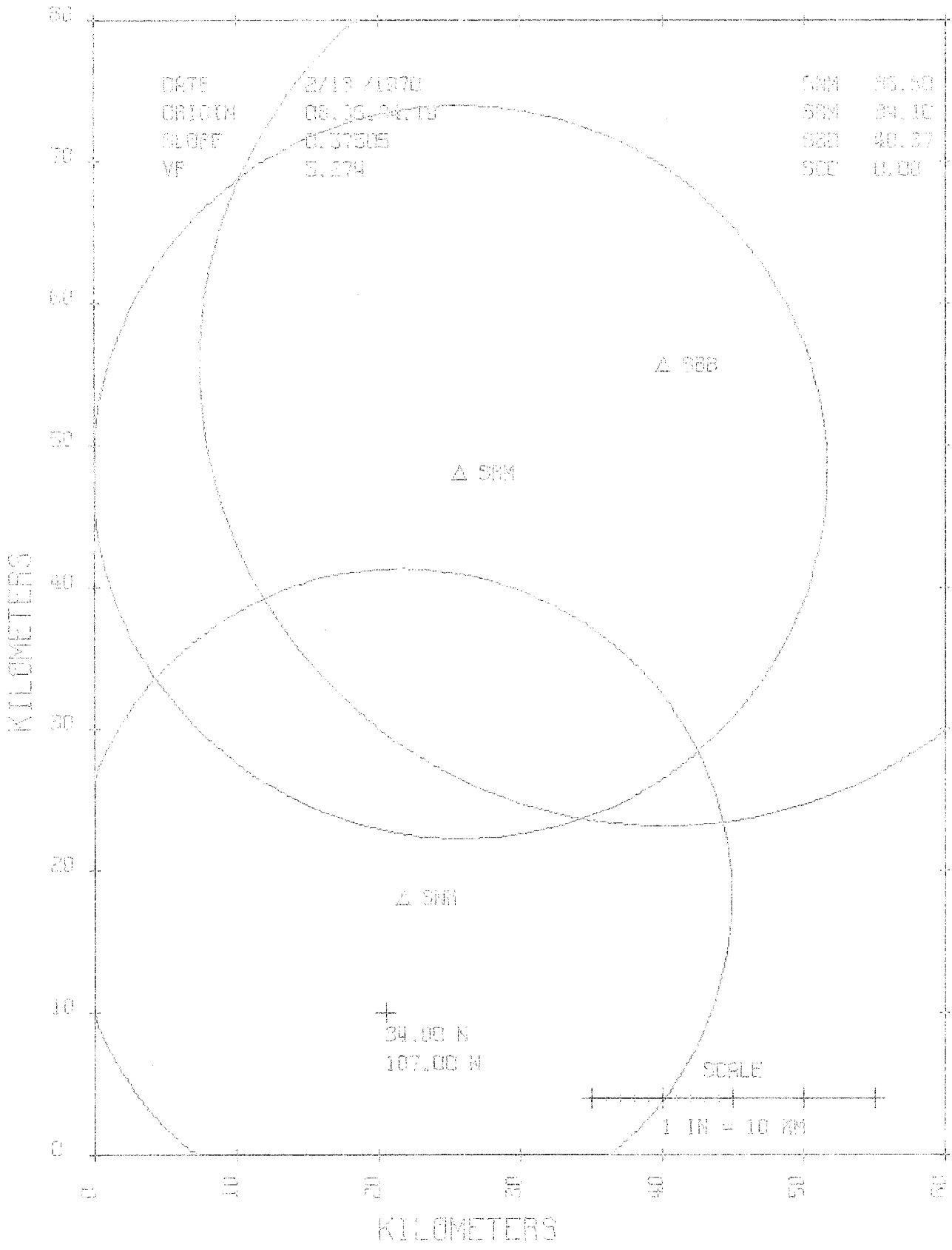
March 15, 1972

Date	SNH	SRH	SCC	SBB	ALQ	SNH-SRH	SNH-SCC	SNH-SBB	SNH-ALQ	Quick Times
1970										
March 20	56.9 (3.0)	57.3 (3.4)	59.4 (3.5)	0.8	58.6 (4.1)	—	−0.4	−2.5	−1.7	—
June 1	53.9 (LRSH) (3.1)	54.0 (3.3)	54.1* (3.4)	0.7	55.4 (4.9)	66.0 (15.3)	−0.1	−2.2	−1.5	−12.1
June 14	31.8 (3.1)	32.1 (3.4)	34.2 (3.5)	0.8	32.4 (4.7)	44.3 (15.3)	−0.3	−2.4	−1.6	−12.3
June 14	33.2 (3.1)	33.0 (3.3)	35.2 (3.5)	0.8	34.4 (4.7)	46.5? (14.1?)	−0.2	−2.4	−1.6	−13.0
June 14	18.2 (LRSH) (2.9)	19.3 (3.5)	21.3 (3.5)	0.9	20.4 (4.6)	31.5 (15.9)	−0.5	−2.5	−1.6	−12.7
June 16	14.0 (3.0)	14.5 (3.5)	16.5 (3.5)	0.6	15.9 (4.9)	26.2 (15.5)	−0.5	−2.5	−1.9	−12.5
June 16	25.0 (3.2)	25.2 (3.4)	27.5 (3.9)	1.0	26.5 (4.7)	—	−0.2	−2.5	−1.5	—
June 30	26.3 (3.4)	26.6 (3.5)	28.5 (3.4)	0.7	27.8 (4.7)	38.3 (15.4)	−0.1	−2.0	−1.2	−12.0
July 7	35.2 (3.4)	—	37.4 (3.5)	0.6	36.5 (4.9)	37.5 (15.1)	—	−2.1	−1.5	−12.2
Sept. 27	04.1 (LRSH) (3.2)	—	06.3 (3.5)	0.8	05.5 (4.7)	16.2 (15.4)	—	−2.2	−1.4	−12.1
							2.30	23.3	15.5	98.8
						n =	8	10	10	8
							0.288	2.33	1.55	12.35
						SNH:				
						3.0	3.288 − 0.660	5.33	4.55	15.35
						17.4	15.2	20.9	26.4	99.0
						3.1	3.388 − 0.66	5.43	4.65	15.45
						18.0	15.8	31.5	29.0	99.6
						3.2	3.488 − 0.66	5.53	4.75	15.55

* No direct time check

Date	S-P SNM	S-P SRM	S-P SBB	S-P SCC	SxS-P SNM	SxS-P SRM	SxS-P SBB	SxS-P SCC
1/7 - 13:35	2.85 F	3.16 P			7.375	5.95		
1/11 - 20:40	2.125 P	2.56 P			4.75	5.95		
2/12 - 05:19	2.20 P	1.78 F	2.34 P		5.00	3.11	7.09	
2/13 - 08:36	2.50 F	2.875 F	3.54 F		7.50	4.75		
3/2 - 11:35	2.25 P	2.89 F	3.53 P		6.75	4.66	6.76	
3/17 - 06:40	2.325 F	2.80 F	3.61 F	3.53 G	7.00	4.13	7.36	6.9
3/17 - 08:34	2.25 F	2.81 F	3.36 P	3.54 F	7.00	4.17	7.44	7.02
3/17 - 19:05	2.25 F	3.82 F	3.33 F	3.59 P	7.00	4.89	7.33	6.92
3/18 - 07:20	2.25 G	2.89 G	3.84 P	3.55 P	7.125	4.83	7.53	6.97
3/18 - 16:35	2.375 F	3.85 F	3.64 F	3.63 F	7.35	5.37?	7.87	6.89
3/20 - 01:34	2.4125 F	2.80 F	3.43 G	3.59 G	7.25	4.54	7.27	7.1
3/25 - 15:32	2.75 F		3.47 G	3.84 G	7.125		7.63	6.7
3/28 - 01:02	2.20 F	2.82 F	2.2 P		7.00	4.77	6.44	
3/30 - 02:51	3.25 F	1.96 P	3.40 P		7.25	4.25	6.68	
4/13 - 06:29	3.80 P	1.94 P				4.13		


DATE 1/11/1970
ORIGIN 20.40.41.32
SLOPE 0.152326
VR 8.859
SNM 18.60
SRM 16.35
SBB 20.50
SCC 0.00
Δ SBB
Δ SRM
Δ SNM
34.00 N
102.00 W
SCALE
1 IN = 10 KM
MILLIMETERS
KILOMETERS


DATE 2/19/1970
ORIGIN 08:30:04.75
SLOPE 0.373605
VF 5.274
SNM 36.50
SRM 34.10
SBB 40.37
SCC 0.00
△ SBB
△ SRM
△ SNM
34.00 N
102.00 W
SCALE
1 IN = 10 KM
KILOMETERS
KILOMETERS

ate	Time	Magnitude		log A	Date	Time	Magnitude		log A
1969		C.T.I	LRSM	SRM	1970		C.T.I	LRSM	SRM
ne 14	02:35	-0.3		0.60	May 5	22:44	0.14		1.21
ne 27	09:35	-0.1		0.78	May 5	22:44	0.21		1.34
y 7	08:58	-0.74		0.60	May 5	23:03	-0.32		0.78
y 7	09:03	-0.14		0.85	May 11	08:07	0.15		1.00
y 7	11:25	-0.43		0.60	May 13	02:31	Sat	1.0	1.73 ×
y 12	04:05	0.2		1.00	June 1	12:23	-0.16		0.70
y 18	04:07	0.6	0.50	1.65	June 1	15:36	0.03		0.78
y 18	11:39	-0.1		0.78	June 1	22:17	Sat	0.65	1.45
y 18	02:34	0.05		0.78	June 2	00:22	-0.02		0.81
y 19	05:50	-0.23		0.78	June 2	12:24	-0.29		0.48
y 30	10:47	0.2		—	June 7	09:14	-0.48		0.30
g. 9	02:34	-0.5		0.40	June 14	04:31	0.28		0.30
t. 15	04:41	-0.35		0.65	June 14	04:36	0.30		1.35
t. 9	13:12	0.12		1.18	June 14	04:36	0.28		1.53
. 9	15:10	0.18		0.88	June 16	16:50	0.29		1.51
c. 4	17:30	0.21		1.37	June 17	18:52	-0.02		0.84
c. 31	03:06	0.0		0.69	June 23	01:33	0.22		—
. 7, 70	13:35	0.27		—	June 30	11:34	0.21		1.32
11	20:40	-0.35		0.00					
6. 12	05:17	0.05		0.78					
6. 13	08:36	0.30		1.18					
2. 2	11:35	-0.72		0.85					
2. 17	06:40	0.13		—					
17	08:37	-0.13		0.84					
17	17:05	0.36		1.43 ×					
18	07:20	0.11		1.02					
18	16:35	0.03		1.02					
20	04:34	0.18		1.15					
25	15:31	Sat	2.10	—					
28	09:02	-0.34		0.48					
30	03:51	-0.10		0.60					
13	06:29	-0.34		0.48					
17	03:06	0.26		1.08					
18	03:44	0.30		1.21					
18	07:11	-0.35		0.40					
18	07:34	-0.34		0.96					
18	09:05	-0.24		1.34 ×					
18	09:12	0.23		1.34 ×					
18	09:29	-0.24		0.30					
18	19:18	0.30		1.32					

Date	Snm		SRM		SBB	Scc	Snm	SRM	SBB	Scc
4/17 - 03:06	2.25	F	2.79	F		3.72 F	7.25	4.46		7.1
4/18 - 03:44	2.50	F	2.81	F		3.76 F	7.00	4.55		7.14
4/18 - 09:11	3.00	VP	2.88	P		3.80 F	7.75	4.87		7.06
4/18 - 09:34	2.575	G	2.74	P		3.66 G	7.25	4.32		7.30
4/18 - 09:05	2.575	G	2.80	F		3.11 VP	7.19			8.8 ?
4/18 - 09:12	2.50	F	2.80	F		4.04 G	7.125	4.52		7.125
4/18 - 09:29	2.50	P	2.89	P		4.09 F	7.00			7.17
4/18 - 19:18	2.50	P	2.81	P		3.59	6.87	4.79		7.05
5/5 - 22:44	2.30	P	2.89	P	3.62	3.53 F	7.1	4.67	6.92	
5/5 - 22:44	2.50	P	3.12	F		3.33	7.25	4.89		
5/5 - 23:03	2.175	G	3.10	P	3.72 F	3.62 G	7.00	4.25	7.05	7.16
5/11 - 08:09	3.125	G	2.85	P			7.00	4.67		
5/13 - 02:31	2.45	F	2.92	F		3.66 F	6.875	4.83		6.98
6/1 - 12:23	2.425	G	2.87	P				5.42		
6/1 - 15:36	2.50	F	2.83	F		4.10 F	7.50	5.42		6.88

Date	SBM		SRM		SBB		Sec		SBM		SRM		SBB		Sec
6/1 - 22:17	2.875	P	2.67	F			3.58	F	7.175		5.375				7.14
6/2 - 00:22	2.45	G	2.69	P			3.56	G	7.375		4.5				7.02
6/2 - 12:24	2.375	F	2.86	P					7.25		4.1				
6/7 - 09:14	2.125	F	2.82	P					6.875		5.40				
6/14 - 04:23	2.475	F	3.04	P			3.19	G	7.125		4.61				7.07
6/14 - 04:31	2.20	F	2.86	P					7.00		4.88				
6/14 - 04:36	2.375	F	2.80	G	3.36	G	3.65	G	7.125		5.39		8.15	?	7.24
6/14 - 04:36	2.350	F	2.85	F	3.21	G	3.78	G	7.125		5.41		7.5		7.4
6/14 - 07:04	2.375	P	3.11	F	4.15	G	4.13		7.125		5.53		7.7		7.44
6/14 - 09:20	2.625	F	3.26	P	3.595	G			7.5		5.7		7.125		
6/16 - 05:51	2.50	G			3.79	G			7.075				7.27		
6/16 - 16:50	2.425	G	2.89	G			3.53	G	7.125		4.70				7.33
6/17 - 18:52	2.25	F	2.92	F					7.00		4.78				
6/23 - 01:33	2.75	F	2.39	P			4.23	G	7.15		3.8				6.74
6/30 - 11:39	2.80	F	3.09	G	3.76	F	3.80	F			5.6		7.26		7.27
7/7 - 02:51	2.375	P			3.68	F	3.71	F	7.00				7.10		7.25
9/27 - 10:36	2.475	G			3.42	G	4.21	P	7.25				6.78		7.29

Comments:

1. [illegible]

2. [illegible]

3. [illegible]

4. [illegible]

[illegible]