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TARGET CHARTS (FIELD)

Miscellaneous.

Frequent types and formats in target charts may be found in various southeastern Asia and Far Eastern theaters. These are made under various authorities and air forces. Limited in quantity and distribution they are included as interesting types.

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TARGET CHARTS (FIELD)

Eastern Air Command (S.E.A.)

These target charts have a 14 mile radius, are based on topographic maps with compilation from photo sources for the target area, scale 1:150,000. They carry a back-up usually variable scale which is a photo-lithographed photo-mosaic reproduced on fluorescent base.

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TARGET CHARTS (FIELD)

Twentieth Bomber Command

The Twentieth B.C. has made a number of target charts and strip approach charts. Frequently using AAF Target Charts as bases, the tendency has been to redraft and reduce these to secure greater coverage, and to make corrections from photography. A very well done sequence finds a strip approach scale 1:500,000 - bearing a nautical mile bar scale. An approach chart scale 1:250,000 with 26 mile radius (nautical). A recognition chart with radius of 22,000 feet, scale 1:40,000 and a series of perspectives with bombardier grid computations printed adjacent to and on the perspective sheet. These are units of tangency - and the distance grid on the perspective is in nautical miles.

This use of nautical miles is a very important transition and deserves particular attention.

Charts and approaches made by the Twentieth B.C. are designed to fold or be cut so that they fit into the AAF black bombardier folder whose page dimensions are approximately 8" x 15½" single page and 16" x 15½" two page.

The distribution of these excellent charts is very limited outside the Twentieth A.F.

A representative preliminary list is attached.

Twenty-first Bomber Command

Target Charts of almost identical format have been and are being produced by the Twenty-first B.C. though no list is attached.

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LIST ILLUSTRATING XX BOMBER COMMAND CHARTS - NUMBERING AND COVERAGES

<u>No.</u>	<u>Name</u>	<u>Scale</u>
2	Tokyo Area	1:250,000
3	Tokyo Area	1:126,720
5	Kobe Area	1:250,000
6	Kobe Area	1:126,720
7	Yawata Area	1:250,000
7	Yawata Area	2nd Ed. 1:250,000
7A	Yawata Area	1:40,000
7A	Yawata Area	Perspective 123°15'T
7B	Yawata Area	Perspective 129°0'T
7C	Yawata Area	Perspective 70°15'T
8	Yawata Area	126,720
9	Yawata Area	1:500,000
9	Yawata Area	1:500,000 2nd Ed.
10	Bangkok Area	1:500,000
11	Bangkok Area	1:250,000
11A	Bangkok Area	Perspective 331°0'T
11B	Bangkok Area	Perspective 50°0'T (20 mi.)
11C	Bangkok Area	Perspective 50°0'T (15 mi.)
11D	Bangkok Area	Perspective 48°0'T
11E	Bangkok Area	Perspective 67°30'T
12	Anshan Area	1:500,000
12	Anshan Area	1:500,000 2nd Ed.
13	Anshan Area	1:250,000
13A	Anshan Area	1:40,000
13A	Anshan Area	Perspective 83°15'T
13B	Anshan Area	Perspective
13C	Anshan Area	Perspective 43°0'T (15 miles)
13D	Anshan Area	Perspective 43°0'T (25)
13E	Anshan Area	Perspective 3°15' (15 mi.)
13F	Anshan Area	Perspective 3°15' (25 mi.)
13G	Anshan Area	Perspective 132°0'T
13H	Anshan Area	Perspective 125°15'T
13I	Anshan Area	Perspective 310°15'T (15 mi.)
13J	Anshan Area	Perspective 310°15'T (25 mi.)
13K	Anshan Area	Perspective 83°15'T
15	Halliday I. Area	1:500,000
16	Halliday I. Area	1:250,000
16A	Halliday I. Area	Perspective
16B	Halliday I. Area	Perspective
17	Pladjoe Area	1:500,000
18	Pladjoe Area	1:250,000
18A	Pladjoe Area	Perspective 131°31'T (15 mi.)
18B	Pladjoe Area	1 perspective 131°31'T (25 mi.)
20	Sasebo Area	1:250,000
20A	Sasebo Area	1:40,000
20B	Sasebo Area	Perspective 50°30'T
21	Nagasaki Area	1:500,000
22	Nagasaki Area	1:250,000
22A	Nagasaki Area	1:40,000
23	Omura Area	1:250,000
23A	Omura Area	1:40,000
23A	Omura Area	Perspective 66°12'T
23B	Omura Area	Perspective 90°0'T
24	Pangkalanbrandan	1:250,000
25	Pladjoe Area	1:500,000
27	Penhsihu Area	1:500,000
28	Penhsihu Area	1:250,000
28A	Penhsihu Area	1:40,000
29	Moulmein Area	1:500,000

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<u>No.</u>	<u>Name</u>	<u>Scale</u>
30	Moulmein Area	1:250,000
30A	Moulmein Area	Perspective 71T
31	Mergui Area	1:250,000
31A	Mergui Area	Perspective 141T
32	Okayama Area	1:500,000
33	Okayama Area	1:250,000
33A	Okayama Area	1:40,000
33A	Okayama Area	Perspective 116 <sup>o</sup> T
34	Takao Area	1:250,000
34A	Takao Area	1:40,000
34A	Takao Area	Perspective 347 <sup>o</sup> T
35	Shinchiku Area	1:500,000
36	Shinchiku Area	1:250,000
36A	Shinchiku Area	1:40,000
36A	Shinchiku Area	Perspective 105T
37	Mukden Area	1:500,000
38	Mukden Area	1:250,000
38A	Mukden Area	1:40,000
38A	Mukden Area	Perspective 51 <sup>o</sup> T
39	Fukuoka Area	1:500,000 new format
40	Fukuoka Area	1:250,000
40A	Fukuoka Area	1:40,000
40A	Fukuoka Area	Perspective 37 <sup>o</sup> T
41	Rangoon Area	1:250,000
41A	Rangoon Area	Perspective 46 <sup>o</sup> T
42	Keelung Area	1:500,000
43	Keelung Area	1:250,000
43A	Keelung Area	1:40,000
43A	Keelung Area	Perspective 138 <sup>o</sup> T
44	Formosa-Pescadores	1:500,000
45	Heito Area	1:250,000
45A	Heito Area	1:40,000
47A	Tachiari Area	1:40,000
47A	Tachiari Area	Perspective 103T
48	Saigon Area	1:500,000
49	Saigon Area	1:250,000
50A	Saigon Area	1:40,000
51	Shanghai Area	1:250,000
51B	Shanghai Area	1:40,000
52	Bassein Area	1:500,000
53	Bassein Area	1:250,000
56	Dairen Area	1:500,000
57	Dairen Area	1:250,000

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## TARGET CHARTS (Field)

### Fourteenth Air Force

The Fourteenth Air Force currently makes its own target charts as well as certain maps from photographic sources. The coverage of both these are primarily China, French Indo-China with incidental coverages of Japan, Manchuria, Burma, Formosa. These target charts are variable in format and scale. The most frequent type is a chart bearing a 7 mile radius at the scale of 1 inch to 1 mile (1:63,360). These are frequently accompanied by approach charts at 1:250,000. Charts in the following list are of the scale of 1:63,360 with the exception of those followed by an asterisk. Charts followed by an asterick are of the scale of 1:250,000, and charts followed by both ampersand sign and an asterick are reproduced twice; once at each of the two scales.

The Fourteenth Air Force apparently does not print perspectives.

The Fourteenth Air Force charts do not carry target numbers or outlines conforming to either Twentieth Air Force or AC/AS, Intelligence (Joint Target Group) and U. S. Navy listings.

The distribution of these charts is extremely limited beyond the Fourteenth Air Force.

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SAMPLE LISTING 14TH AF CHARTS

<u>No.</u>	<u>Name</u>	<u>No.</u>	<u>Name</u>
1	Samah Bay	59	Siaokan
2	Chiengmai	60	Campha Port
3	Pescadores	61	Hong Gay
4	Shasi	62	Sheklung
5	Ichang	63	White Cloud A/D
6	Pailiuchi A/D	64	Canton
7	Yochow	65	Whampoa
8	Nanchang	66	Swatow
9	Lampang	67	Tainan
10		68	Shayang
11	Canton Area Ala	69	Changkiangfow
12	Myitikyina	70	Weichow Is.
13	wuhu	71	Sanchau Is.
14	Hukow	72	Hangchow
15	Ft. Bayard	73	Hsekawi
16	Bakli Bay &*	74	Shoka
17	Hong Kong	75	Taito R. Bridge
18	Shanghai	76	Sinyang
19		77	Sinsiang
20		78	Kaifeng
21	Lashio &*	79	Yellow R. Bridge
22		80	Shoka Sugar Refinery
23		81	Kagi
24	Bhamo	82	
25	Tenchung &*	83	
26	Lungling &*	84	Konai Area
27	Bangkok	85	Kaifeng
28	Takao	86	Koshun
29	Hanoi	87	Dap Cau &*
30	Satahib Bay &*	88	
31	Nanking	89	
32	Toyohara	90	Poai
33	Taichu	91	Nha Trang
34	Heito	92	
35	Toko	93	Chenghsien
36	Okayama	94	
37	Vinh	95	Giran
38	Tong Aid &*	96	Anyang
39	Nam Dinh &*	97	Hai Duong
40	Yin Bay &*	98	
41	Shihhweiyao	99	Yuchent A/D
42	Dara &*	100	Cape St. Jacques
43	Bhisanulok &*	101	Saigon
44	Uttaradit &*	102	Amoy
45	Dong Guong &*	103	Amoy A/D
46	Lao Kay &*	104	Tai, an
47	Cam Duong &*	105	Taiyuan S.
48	Phu Tho &*	106	Hankow
49	Phu Ly &*	107	Wuchang
50	Chiengrai	108	
51	Vinh Yen &*	109	Cat Bai A/D
52	Lambhuh	110	Loyang
53	Chiengsu	111	Jungyang
54	Kiungshan	112	
55	Fuflo	113	
56	Nagom Sawarn	113A	Changsha
57	Tangyang	114	Yungcheng A/D NW
58	Kentung	115	Anyi A/D

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<u>No.</u>	<u>Name</u>	<u>No.</u>	<u>Name</u>
116		NF48-23	Hanoi
117	Kiukiang	NF49-22	Sanchau I.*
118	Pailiuchi A/D	NG50-10	Amoy*
119	Navy Yard-Sasebo	NH50-101	Hankow-Wuchang
120		NF49-13	Canton
121		493AIV-DII	Yangtze River*
122	Ichingpu	NH50-105	Kiukiang
123	Puchou A/F	NH-49	Kingmen
124	Puchow Satellite L/S	NH49-2	Yochow &*
125		NE49-34	Samah Bay &*
126	Anking Sattelite		
127	Hsuchang		
128	SW Mukden		
129	Fu-shun Aluminum Plant		
130	Kinhwa A/F		
131			
132	Naval Air Sta. Sasebo		
133	A/C Factory Sasebo		
134	Hangchow City		
135			
136	Ashiya A/D		
137	Synthetic Chemicals & Coke Plant		
138	Yawata I.I.S.W.		
139	Wakamatsu Shipyard		
140	Tobata I.I.S.W.		
141	Kokura Arsenal		
142	Moji Wharves		
143	Hiko I. Zinc Refinery		
144	Shihchiachuang		
145			
146			
147			
148			
149	Yulin		
150			
151	Maanchan		
159	Tientsin A/F		
160	Yochow		
161	Siangtan		
178	Sianning		
181	Fu-shun SMR Shale Oil Plant		
182	Fu-shun Storage Area		
183	W. Mukden A/D		
184			
185	E. Mukden A/D & A/C Assembly Plant		
186	Suchiatun, RR Yards		
187	Mukden RR Terminal		
188	Ta Shen Chingtzu A/F		
216	Samshui		

NO NUMBERS

Burma Road\*  
 Salween River\*  
 Yangtze River (Hankow E)\*  
 Yangtze River (Hankow W)\*  
 Yangtze River (Yochow E)\*  
 Shanghai  
 Takao  
 Hankow-Wuchang\*

MISCELLANEOUS NUMBERS

494CM Yochow\*  
 494CII Yangtze Riv.\*  
 494CIII Yangtze Riv.\*  
 494CIV Yangtze Riv.\*  
 NF48-7 Haiphong

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RECAPITULATION OF SELECTED TARGET  
CHART TYPES

Authority	Approach Scale	Coverage	Recognition or Back-up	Coverage	Perspectives	Comment
AAF (AC/AS Int.)	1:180,000	20 mi.	1:36,000	4 miles	5 headings 30,000', 10 & 20 Miles.	1 Chart
U.S. Navy (Opnav 16V)	1:740,000	75 mi.(naut.)	1:6,000	7,500 Yds., (approx.)	None	2 Charts each 8" X 8" - land tint green.
20th. AF	1:500,000 1:250,000	26 mi.(naut.)	1:40,000	2,200 Yds.	1 to 11 headings 15 mi. 25,000' also 25 mi. 25,000'	3 charts - later edition - green base
14th. AF	1:63,360	7 mi.	None	None	None	Occassional 1:250,000 strips, white base.
C.I.U. (Central Intelligence Unit)	Variable	up to 100 mi.	none or photo			Relief shading- monotone base gray
USAFISPA	Variable	7 mi.	Variable	Variable	None	Relief shading - white base
EAC (Eastern Air Command)	1:150,000	16 mi.	Photo mosaic	Variable	None	Monotone base pale tan
AHQ India	1:63,360	6-8 mi.	Photos	Variable	None	Vegetation, color contrast featured
	1:264,000	14 mi.	1:63,360	5 mi. and variable	None	3 charts on single sheet
AAFSWPA	Various	18 mi.	Various - very large scale & Photos	Various	None	2 charts and photos on one sheet, various arrangements

C O N F I D E N T I A L

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## TARGET CHARTS

### General Observations and Comments

1. From foregoing examples it is apparent that there is great variation in format and style of Target Charts.
2. In effect there is no such thing as a standard target chart.
3. There are two main differences; a. scale; b. more than one chart at different scales for the same target.
4. Target Charts for and by tactical air forces incline to larger scale single chart presentation and much smaller area coverage.
5. Only primarily high-level strategic forces use perspectives and customarily a complementing series of charts for one target.
6. The tendency to ignore vegetation - to limit and generalize culture seems fairly universal (with but one exception) viz. SEA command.
7. The lack of representation of topography by other than spot elevations is very noticeable.
8. These seem to be increasing tendency to secure greater area coverage for approaches.
9. In contrast to charts in the European theater the tendency is for finer line drafting and cultural representation.
10. The contrast in scale is very noticeable among the operating forces - the 1:63,360 - 1 mi. to inch - as contrasted to 1:500,000, 1:250,000, 1:40,000 series - based on Nautical miles.

### Some Comments on Target Chart Trends

1. It is probable that the ultimate in target charts is far from having been reached.
2. A clear understanding of the use - high-level or low is of course primary.
3. High-level use without goggles allows finer drafted detail.
4. The use of a color background - the pale green used by the Nov. 1944 Twentieth A.F. charts is an example
5. It seems possible that on 1:250,000 and 1:500,000 charts persistent radar signals may be symbolized by color spots.
6. The use of dominant vegetation features where verified by photography, viz cultivated land - rice paddy and forest.
7. The study of key recognition values from photos is now possible.
8. The minor recognition value of railroads and the superior recognition value of dikes and new barracks (worker or military) as recognition points.
9. The use of topographic features - ridge and valley trends, craters, dominant isolated conic peaks.

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10. The shifting to nautical miles due to radar use.
11. The great care taken to show variable water areas - (as 14th AF series) - with notation of monthly or seasonal minima and maxima.
12. Only those roads shown that have been selected from particular analysis from photographs in which the road classification becomes "most visible roads" rather than primary or secondary which are classifications of ground utility or type and not necessarily air visibility.
13. In Japan, Formosa and parts of Manchuria a green cover overprint is one of the obvious and best ways to show relief for slopes of over 15° are usually forested or at least do not bear cultivated field patterns.
14. Generalization of city layout with particular attention to "lead-ins" or dominant air-visibility in relation to the Target.
15. The total overprint of a fine circular-radiating grid on the larger scale charts.
16. These are provocative points for discussion and investigation and have grown out of analyses of various types of target charts, and has reference only to Target Charts which might be projected for The Far Eastern Theater.

Some comments on Basic Geographical Differences between Operational Areas of Europe and Japan-Manchuria-Korea.

There are certain striking differences between the European Theater and the Far Eastern Theater particularly Japan, Korea, and Manchuria. A brief summary of some of these salient facts may be some aid in both the interpretation and use of maps, charts and the design and conception of target charts.

1. Relief: Almost all of Japan, Korea and all of Manchuria except the great central plains is mountainous. These mountains are extraordinarily complex, sharp - ridged and intricate. Occasional isolated volcanic peaks like Fuji-san (Fuji-yama) or Hakuto-zan create unusual landmarks.
2. The great cultural landmarks of multi-tracked trunk railways and highways are absent.
3. The topography plays a major part in both controlling the cultural pattern but also masking cities or installations from long range view.
4. At the same time this mountainous character - combined with the fact that most of the large industrial areas are on flat foreshores or river mouths - running into the sea results in narrow points jagged and complex bays and inlets. Though producing an irregular coastline there is a distinguishing land-water contact pattern valuable for both visual and radar recognition.
5. The terrain of most of strategic industrial Europe is a comparatively flat highly developed land. The land use has become so established that geometrical masses of trees have proved this value in air recognition. Such cannot be said of Japan, Korea or Manchuria. In Japan most of the land even to 80° slopes are intensively cultivated in rice or similar low-growing crops. Trees are cleared off and forest on tree growth follows the slopes of rough terrain too steep to be possibly cultivated. Forest cover and

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mountains then become almost synonymous and the terrain is so rough that forest cover has a different significance. The distinguishing factor becomes the patterns of the valleys which do not bear forest cover. The situation is similar in Korea and in eastern Manchuria.

6. Drainage: In a very general way drainage in the European Theater may be considered as well defined large rivers - visible at distances commensurate with a lack of gorges and relatively flat terrain. Only in Manchuria and China does the same hold true in the Far East. Both Japan and Korea present short narrow rivers and river valleys. However the Japanese rivers present two striking features. Sand bars and intricate "braided" channels and dike control plus highly cultivated margins. Thus even streams which appear insignificant on maps may be very marked in vertical or near vertical air perspective or when view in oblique in line with their course - yet at angles to them they can be masked by the rough topography.

7. Railroads in Japan are narrow gauge (3'6") with a few minor exceptions. In both Manchuria (east) Korea and Japan they are very disrupted by tunnels and do not retain anywhere near the recognition value of railroads in Europe. The same generalization may be made concerning roads.

8. In many parts of the Far East the extraordinarily small field and crop patterns act in a way as a sort of natural camouflage to cultural features which have become accustomed recognition features in Europe.

9. These items are but a few generalizations affording a background for consideration in the use of air charts or preparation of air use maps. Specific attacks on the problem is now possible with photography available.

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RUBBER MODELS

A number of rubber relief models of various scales have been made and distributed. Further models are in process. For Far Eastern Areas the bulk of these have been prepared at the Naval Air Station, Annapostia, D.C. These have been distributed on request by AC/AS, Intelligence, to various interested Air Forces. These are topographic, relief models with the naval vertical exaggeration 1.6. They bear cover and cultural detail painted upon the rubber base.

II Relief Models

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## TERRAIN MODEL LIST

<u>NAME OF MODEL</u>	<u>NUMBER</u>	<u>SCALE</u>	<u>VERT EX.</u>	<u>APPROX. SIZE</u>
1. Kiska	1-1-1-9-4M	1:32,500	none	6' x 3'6"
2. Nauru	12-11-11M	1:6,450	2x	4'2" x 4'2"
3. Buka Passage	12-25-2-1M	1:5,000	none	6' x 4'2"
4. Kahili Airdrome	12-24-1-1M	1:19,000	2	2'4" x 4'2"
5. Tarawa	12-11-17M	1:26,000	1.37	6'10" x 4'2"
6. Makin Island	12-11-9M	1:31,300	8.7	
7. Ocean	12-11-13M	1:3,948	1.73	4'1" x 4'1"
8. Apanama	12-11-1-1M	1:10,434	none	49" x 49"
9. Rabaul	12-1-21-23M	1:10,560	8	8' x 4'2"
10. East New Guinea Experimental		1:3,948	2	5'1" x 4'
11. Kaveing	12-1-23M	1:5,400	2	6'8" x 4'2"
12. Wake	12-19-32M	1:4,840	none	3'11" x 6'
<u>Kuriles</u>				
13. Paramushiru & Shimushiru	7B-5-1-1M&2M	1:50,000	2	4'1" x 9'6"
14. Araido	7B-5-1-1M&2M	1:50,000	2	4'1" x 2'3"
15. Paramushiru & Kaikyo	7B-5-1-1M&2M(A)	1:16,500	2	3'8" x 7'10"
16. Onkotan	7B-5-2-1M	1:50,000	2	6'5" x 3'4"
17. Shasukotan	7B-5-2-6M	1:50,000	2	5'5" x 3'9"
18. Shimushiru	7B-5-3-1M	1:50,000	2	6'2" x 22"
19. Matsuwa	7B-5-3-3M	1:50,000	2	1'2" x 3'3"
20. Uruppu	7B-5-18M	1:50,000	2	2'8" x 8'4"
21. Bouganville	12-25-1M	1:25,000	2.1	4'5" x 7'10"
22. Wewak	8A-10-2-4M	1:7,500	2	4'5" x 6'4"
23. Madang & Alexishaven	8A-10-2-1M	1:7,500	2	5' x 8'9"
24. Saipan	12-17-15M	1:11,765	2.1	3'11" x 7'11"
25. Jaluit	12-19-12M	1:2,500	none	2'4" x 6'5"
26. Mille	12-19-22M	1:4,340	3.1	4'1" x 4'2"

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<u>NAME OF MODEL</u>	<u>NUMBER</u>	<u>SCALE</u>	<u>VERT EX.</u>	<u>APPROX. SIZE</u>
27. Ponape	12-2-32M	1:20,000	2	6' x 6'
28. Marcus	10-12-17M	1:2,400	none	3'8" x 3'7"
29. Tarao	12-19-20M	1:2,250	1.5	3'11" x 3'9"
30. Yap	12-2-40M	1:20,000	2	4'2" x 4'10"
31. New Britain b.	12-1-21M	1:125,000	2	4'7" x 8' 4'7" x 6'8"
32. Guam #1	12-17-8M	1:20,000	none	4'1" x 9'1"
33. Guam #2	28-5-44M	1:31,250	2.6	3" x 5"
34. Palau Is.	12-2-24M	1:40,000	3.3	6'1" x 3'9"
35. Kusaie	12-2-10M	1:16,500	2	3'8" x 3'1"
36. Kwajalein	12-19-14-38M	1:3,000	none	4'1" x 4'1"
37. Wotje	12-19-34M	1:4,800	2	3'1" x 3'4"
38. Roi & Namur	12-19-14-54M	1:3,000	2	3'9" x 3'7"
<u>Azores</u>				
39. Graciosa	10-1M-C	1:50,000	1.9	2'2" x 1'8"
40. Terceira	10-1M-D	1:50,000	2	2'6" x 2'10"
41. Fayal-Jorge- Pico	10-1M-B	1:50,000	2	6'6" x 3'1"
42. Corvo & Flores	10-1M-A	1:50,000	1.9	2'2" x 3'
43. Santa Maria	10-1M-F	1:50,000	2	16" x 29"
44. San Miguel	10-1M-E	1:50,000	1.9	2'8" x 4'10"
45. Truk Islands	29-4-44M	1:20,000		
46. Ebeye	12-19-14-11M	1:3,000	2	3'2" x 2'4"
47. Haha Jima	7B-8-1-2-2M	1:12,500	1.7	5'5" x 3'5"
48. Chichi Jima	7B-8-1-1-2M	1:12,500	1.7	5'3" x 2'8"
49. Engebi	12-19-9-12M	1:3,000	2	3'11" x 2'9"
50. Honshu	7B-3M	1:500,000	4.1	4'2" x 8'10"
51. Formosa	L592M	1:150,000	3	3'11" x 9'5"
52. Hankow	15-3-44M	1:25,000	2.1	2'4" x 2'9"
53. Hongkong (Kowloon)	18-3-44	1:25,344	2.2	4'1" x 3'2"
54. Nanking	17-3-44M	1:25,000	2	2'4" x 2'8"

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<u>NAME OF MODEL</u>	<u>NUMBER</u>	<u>SCALE</u>	<u>VERT EX.</u>	<u>APPROX. SIZE</u>
55. Swatow	21-3-44M	1:25,000	1.6	4'1" x 3'6"
56. Hongkong Area	3-24-44M	1:100,000	2.6	7'7" x 4'1"
57. Hankow Area	25-3-44M	1:100,000	2.6	4'11" x 3'9"
58. Amoy	7-4-44M	1:25,000	1.6	26" x 26"
59. Hainan	11-4-44M	1:150,000	2.4	3'11" x 7'
60. Shanghai	14-4-44M	1:25,000	none	3'9" x 5'1"
61. Kato	18-4-44M	1:20,000	2	2' x 2'
62. Bangkok	20-4-44M	1:25,000	none	2'11" x 7'6"
63. Kiungshan	27-4-44M	1:20,000	none	2' x 3'
64. Takao	4-27-44M	1:25,000	2	4' x 4'
65. Anshan	18-5-44M	1:50,000	1.6	4' x 4'
66. Tenian	29-5-44M	1:20,000	1.67	2' x 3'
<u>Philippines</u>				
67. Sulu Archipelago	1-6-44M9	1:200,000	3.0	4' x 6'
68. Palawan	1-6-44M7	1:200,000	3.0	2'6" x 8'5"
69. Southern Mindanao	1-6-44M10	1:200,000	3.0	4' x 7'8"
70. Central Mindanao	1-6-44M8	1:200,000	3.0	4' x 9'
71. Samar Leyte	1-6-44M6	1:200,000	3.0	4' x 8'3"
72. Southern Luzon	1-6-44M4	1:200,000	3.0	4' x 4'9"
73. Panay Negros	1-6-44M5	1:200,000	3.0	4'7" x 8'3"
74. Central Luzon	1-6-44M2	1:200,000	3.0	4' x 5'4"
75. North Luzon & Batan	1-6-44M1	1:200,000	3.0	4' x 6'
76. Manila	1-6-44M3	1:200,000	3.0	4' x 9'5"
77. Nagoya	31-5-44M	1:50,000	1.6	4' x 6'
<u>Tokyo Bay Area</u>				
78. Tokyo Area	14-5-44M	1:50,000	1.6	4' x 6'
79. Yokosuka	20-6-44M	1:50,000	1.6	4' x 6'
80. Fujiyama	30-6-44M	1:50,000	1.6	4' x 10'

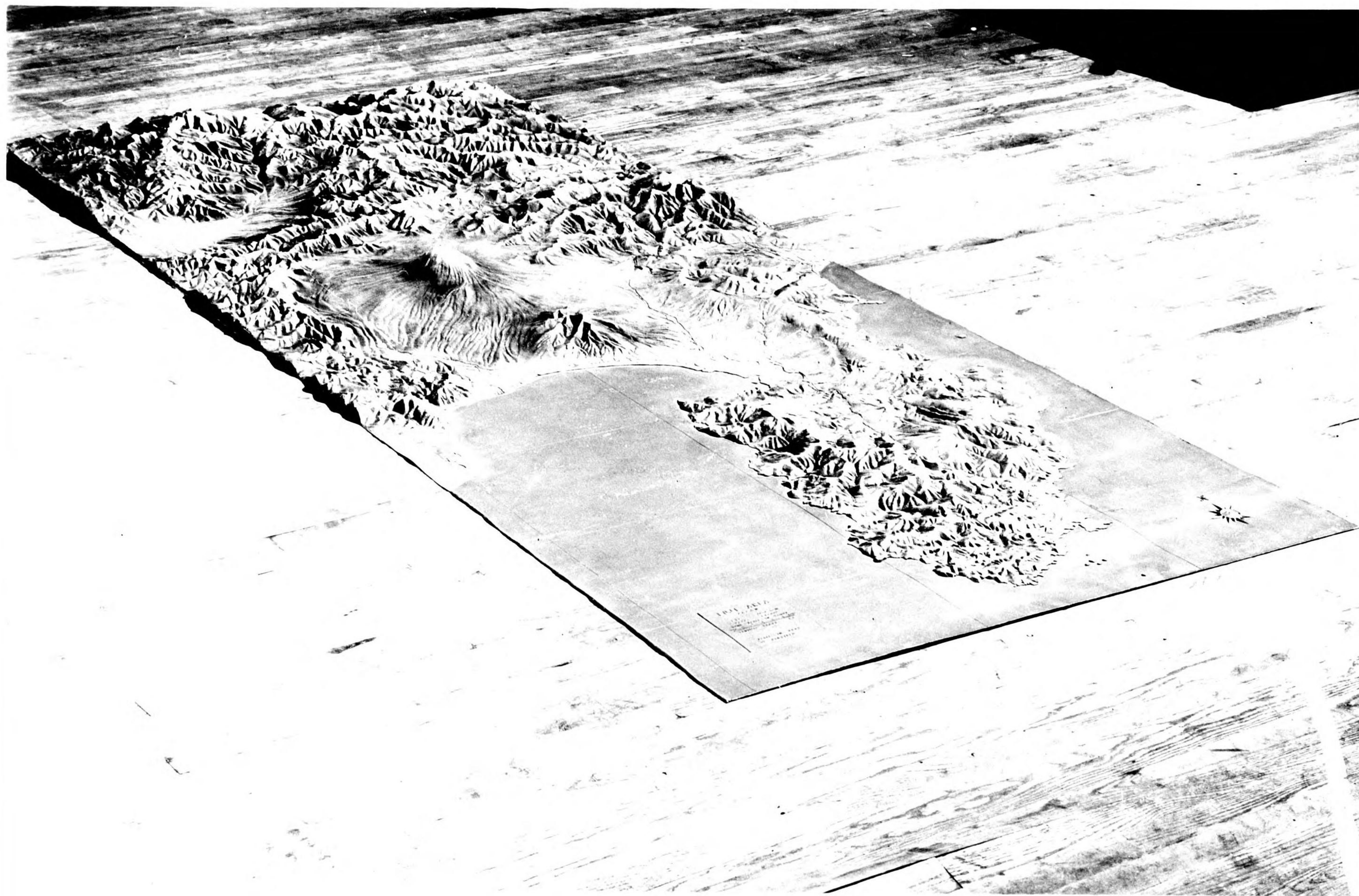


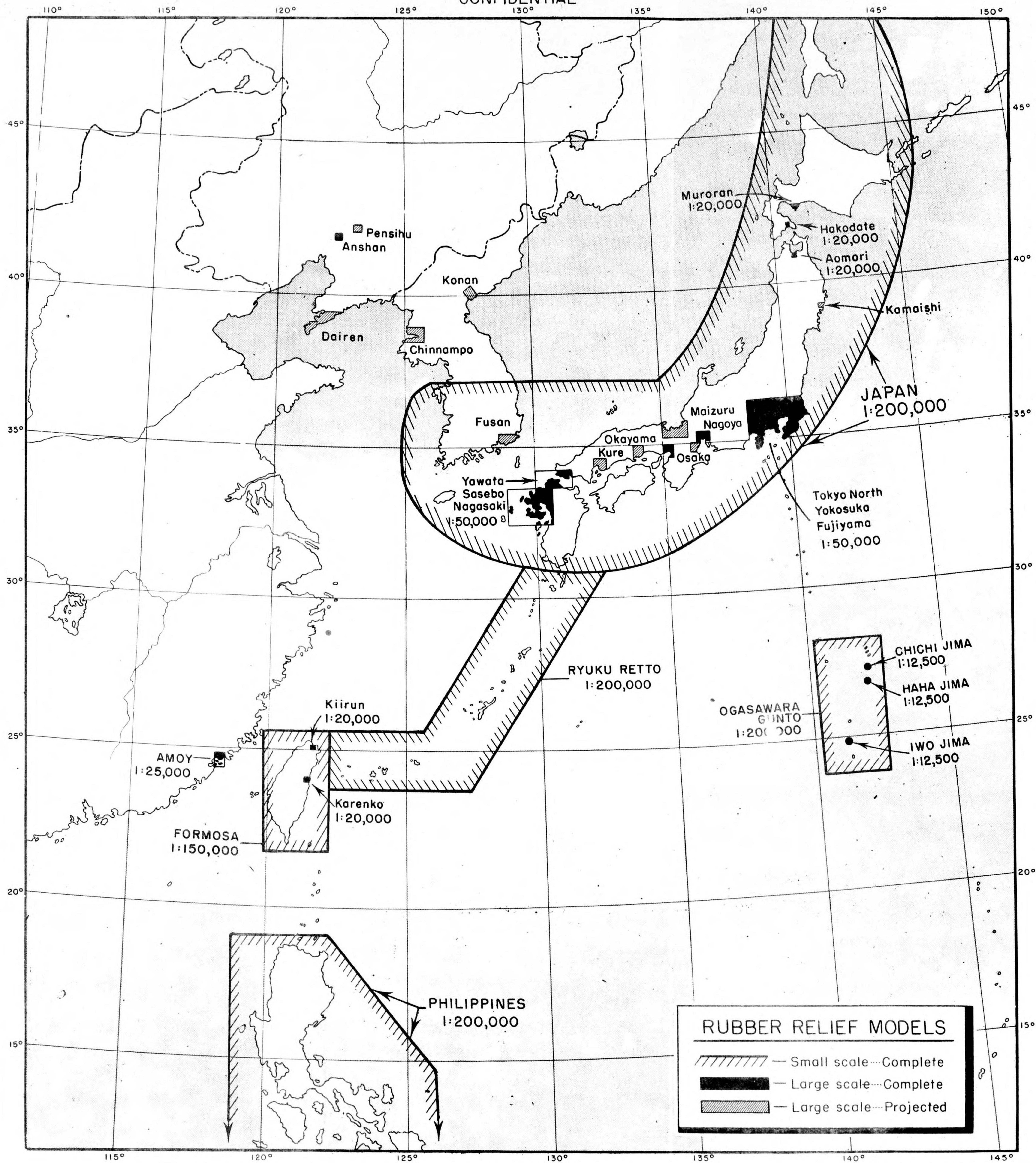
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<u>NAME OF MODEL</u>	<u>NUMBER</u>	<u>SCALE</u>	<u>VERT EX.</u>	<u>APPROX. SIZE</u>
<u>Saigon Area</u>				
81. Cape St. Jacques	16-6-44M-A	1:25,000	2.4	4' x 8'
82. Saigon	16-6-44M-B	1:25,000		4' x 8'
83. Yawata	7-7-44M	1:50,000	1.6	4' x 7'
84. Nagasaki	1-7-44M	1:50,000	1.6	4' x 6'
85. Sasebo	12-7-44M	1:50,000	1.6	4' x 8'
86. Aliso Canyon	15-7-44M	1:10,000	none	4'3" x 4'
87. San Clemente	14-7-44M	1:20,000	none	2" x 4"
88. San Diego Bay Area	18-7-44M	1:10,000	none	4' x 7'9"
89. Osaka	P.I.C.89	1:50,000	1.6	65" x 59"
90. Shemya Island (4 sections)	P.I.C.90	1:1,500	none	48" x 110"
91. Shemya Airfield (4 sections)	P.I.C.91	1:420	none	48" x 97"
92. Ota Area	P.I.C. 92	1:50,000	1.6	46" x 82"
93. Utsunomiya	P.I.C.93	1:50,000	1.6	47" x 85"
94. Mito Area	P.I.C.94	1:50,000	1.6	51" x 96"
95. Pyramid Cove	P.I.C.95	1:9,000	none	38" x 38"
96. Toko-Kato	P.I.C.96	1:25,000	2	50" x 56"
97. Iwo Jima	P.I.C.97	1:12,500	1.4	30" x 39"
98. North Nansei	P.I.C.98	1:200,000	2.5	37" x 138"
99. South Nansei	P.I.C.99	1:200,000	2.5	48" x 110"
100. Bonin & Volcano	P.I.C.100	1:200,000	2.5	30" x 87"
101. Hachijo Area	P.I.C.101	1:200,000	2.5	16" x 94"
102. West Kyushu	P.I.C.102	1:200,000	2.5	48" x 25"
103. East Kyushu	P.I.C.103	1:200,000	2.5	48" x 114"
104. Shikoku Honshu	P.I.C.104	1:200,000	2.5	51" x 74"
105. Central Honshu	P.I.C.105	1:200,000	2.5	102" x 57"
106. No. Central Honshu	P.I.C.106	1:200,000	2.5	110" x 48"
107. North Honshu	P.I.C.107	1:200,000	2.5	52" x 52"
108. South Hokkaido	P.I.C.108	1:200,000	2.5	52" x 84"



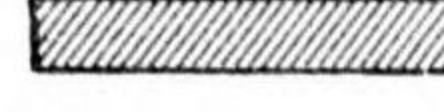
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<u>NAME OF MODEL</u>	<u>NUMBER</u>	<u>SCALE</u>	<u>VERT EX.</u>	<u>APPROX. SIZE</u>
109. North Hokkaido	P.I.C.109	1:200,000	2.5	52" x 100"
110. South Karafuto	P.I.C.110	1:200,000	2.5	52" x 69"
111. Central Karafuto	P.I.C.111	1:200,000	2.5	52" x 52"
112. Etorufu Is. (Kuriles)	P.I.C.112	1:200,000	1.5	
113. Shimshiri Island (Kuriles)	P.I.C.113	1:200,000	2.5	
114. Paramushiro Is.	P.I.C.114	1:200,000	2.5	
115. Chejo Island	P.I.C.115	1:200,000	2.5	
116. South Korea	P.I.C.116	1:200,000	2.5	
117. Central Korea	P.I.C.117	1:200,000	2.5	





**RUBBER RELIEF MODELS**

-  — Small scale...Complete
-  — Large scale...Complete
-  — Large scale...Projected

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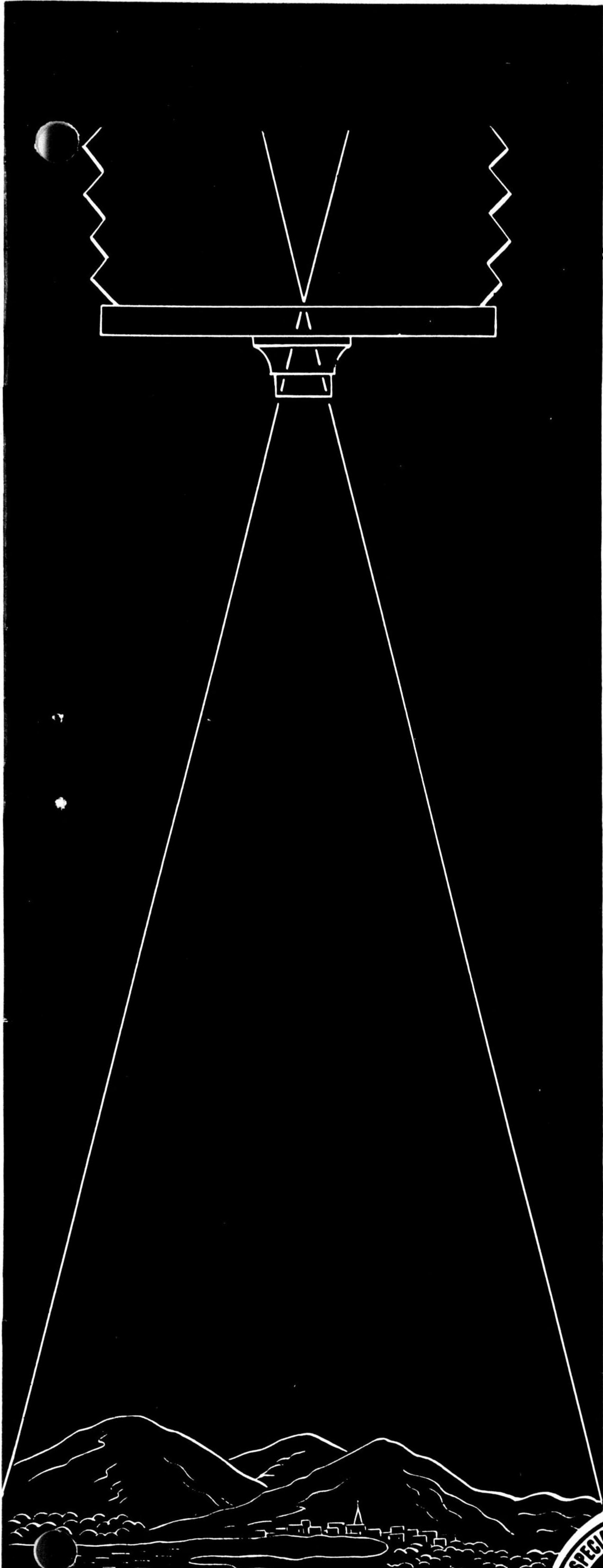
## PHOTO SURFACE MODELS

The making of photo surface models has been particularly developed by the Special Devices Division (Design Section), Bureau of Aeronautics, U.S. Navy. Specific requests for these have been received through AC/AS, Intelligence, Joint Target Group and models sent to the field. Limited Air Force personnel have been trained in this medium.

These models are essentially three dimensional photographic prints, both a photograph and a model. They are relief models (laminated paper - thermo-plastics) whose surface is coated with a photo-sensitive emulsion, and photo mosaics are projected upon them. They have particular application to targets in rough and mountainous terrain, or involving terrain considerations in approach.

An excellent technical manual on these models has been published - "Photo Surface Modeling" CO-NAVAER No. 30-160R-31.

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# PHOTO SURFACE MODELING

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DEVICE NO. 16-B-2



CO - NAVAER NO. 30-160R-31



## HOW TO READ THIS MANUAL

1. Readers interested only in a quick summary of Photo Surface Model production methods should read the introduction.
2. Readers interested in a more complete summary should read the introduction, and look at the illustrations, reading the explanations beneath them.
3. Readers interested in the details of Photo Surface Model production should read the text.

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**INTRODUCTION**

The Photo Surface Model process is a quick, accurate technique for printing a photograph of terrain onto a laminated paper relief model of that terrain, and should not be confused with the "photographic skin" process employed by the British.

Photo Surface Models have the following advantages over other types of terrain models in military operations:

1. The models are quickly produced.
2. The production methods are quickly learned.
3. The models are light in weight, yet sturdy.
4. The models are more accurate than vertical photographs because they eliminate the mechanical error of the flat-surface photographic print.
5. The models are more accurate than hand-made terrain models, because they eliminate the human error of surface detail interpretation.

This manual explains the method of making Photo Surface Models. The manual is non-technical wherever possible, but it assumes that persons following its directions are experienced in the techniques of model making and of photography.

The steps in making a Photo Surface Model are these:

1. From a photograph or photo-mosaic of the area to be represented, a copy negative and a positive transparency, identical size, are made.

2. The positive transparency is put into the enlarger. On the enlarger table, a clay terrain model is made, with the terrain image from the transparency falling onto the clay as a guide for the modeler. From this clay model a plaster negative mold is made.

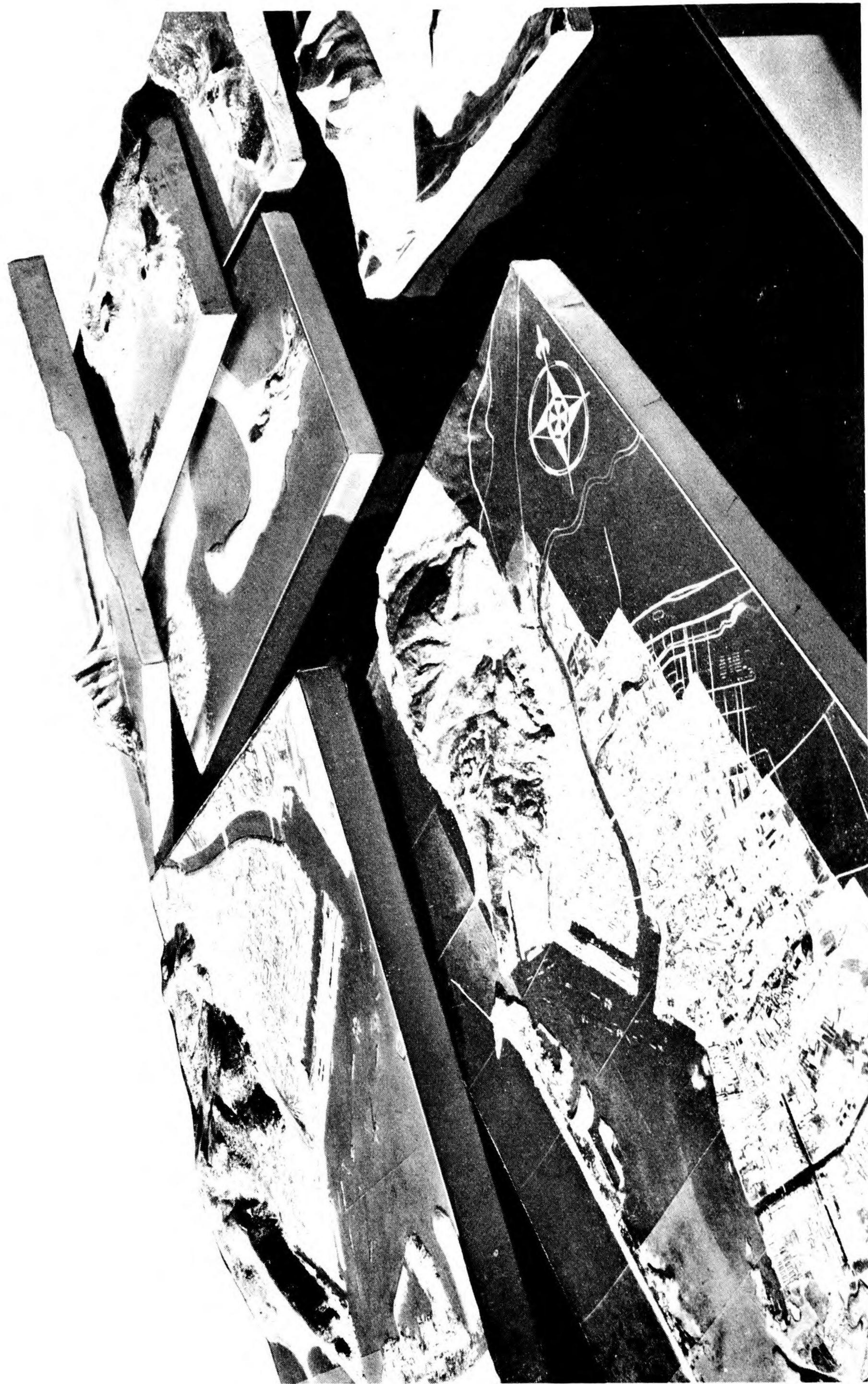
3. A laminated paper model is cast in this negative mold. This model (an exact reproduction of the original model) is coated with a photo-sensitive emulsion.

4. The copy negative is placed in the enlarger. The sensitized model, placed on the enlarger table, is exposed to the image from the negative, in register with terrain detail. Then, standard photographic development procedure follows.

5. The finished model is a three-dimensional photographic print—*both a photograph and a model.*

Requests for further information on Photo Surface Models may be addressed to: Chief, Bureau of Aeronautics, U.S. Navy, Attention: Special Devices Division (Design Section).





*A group of Photo Surface Models of varying sizes. Note that the large model in the foreground has been produced from an uncontrolled mosaic.*

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## FIRST PHOTOGRAPHIC STEPS

### 1. Preparing the Photo Original.

(a) The best possible vertical photographs, of the area to be represented, are selected on a basis of photographic quality and accuracy.

(b) Scale and size of the Photo Surface Models to be produced are determined.

(c) Information on contours is also necessary—either a contour map or a contour guide produced from height finder examination of stereo pairs.

(d) If a single print of all the area to be represented on the models is available, it is smoothly mounted on stiff cardboard.

(e) If several prints are required for complete coverage, an uncontrolled mosaic is made. Prints are neatly mounted with non-warp adhesive. See 55 (c). Photographic detail must match properly at joints between prints. Prints must be matched for tone value and contrast.

(f) If services of a photogrammetrist are available, a controlled mosaic may be made, if ground control is available, with necessary corrections in tip-and-tilt, scale, etc. This is a functional refinement, the value of which must be determined by the producing unit.



*A photo mosaic being prepared as a photo original. Note the white crosses which are added as registration marks. The Gray Scale is attached. Spotting colors have been used.*

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(g) This photographic material, which provides the basis for future steps, is called the Photo Original.

## 2. Processing the Photo Original.

(a) The image of the terrain on the Photo Original will appear on the completed Photo Surface Model.

(b) Accordingly, all needed changes and additions are made on the Photo Original. The prints are carefully spotted to eliminate dust and scratches. Map symbols, directional marks, etc., may be drawn over the Photo Original by standard retouching methods. If desired, air strips, roads, etc., may be emphasized by retouching.

(c) Correction of slight differences in tone and of small areas of weak tone may be made with neutral-density dye. Dye is applied with a fine-point hair brush or with an air brush.

(d) Four registration marks are made, indicated by small crosses. See Section 6.

(e) A Gray Scale is attached to the Photo Original, so that it will be reproduced on the copy negative.

(f) Wrinkles or loose mounting, which cause inaccuracies and reflections, are corrected.

## 3. The Gray Scale.

(a) The Gray Scale serves as a guide for the photographer in determining proper contrast of copy negative and of finished PSM.

(b) The Gray Scale is fastened to the Photo Original so that the Scale's image appears on an inactive part of the copy negative. Or, if desired, it may be included on an area which will appear on the finished model, so that the Scale may be used for reference throughout the processing.

(c) The same Gray Scale may be used repeatedly, if fastened down lightly so that it may be removed from the Photo Original after the copy negative is made.

## 4. Copying the Photo Original.

(a) Best size for the copy negative and positive transparency, made from the Photo Original, is 8 x 10 inches.

(b) Place the Photo Original on the copy-board of a good copy or process camera. Carefully light to eliminate all reflection, from windows, walls, etc.

(c) If illumination picks up scratches or blemishes, lightly coat the Photo Original's surface with white vaseline, and rub off visible surplus with a wad of cotton. Vaseline also produces a more brilliant image.

(d) Using any long-scale film such as Commercial Ortho, make three copy negatives with identical

exposure. Develop one normally; develop one a bit under normal for less contrast; and develop one a bit over normal, for greater contrast.

(e) Thus, the negative of best contrast may be selected for exposing the models. PSM Emulsion is available in only one degree of contrast (about that of No. 2 enlarging paper).

(f) Without changing camera setting, make a positive transparency on direct copy film. Or the positive may be made by contact printing from the negative, using a contrasty film, such as Contrast Process Ortho. This produces a brilliant, transparent positive when developed in D-72.

(g) Copy negatives must be made of the finest possible quality. Best equipment and processing is necessary. A good process lens (such as the apochromatic Artar, 14 to 19 inch, focal length) should be used. Negatives should be developed carefully in a fine grain developer; DK-20 produces finest definition and quality.

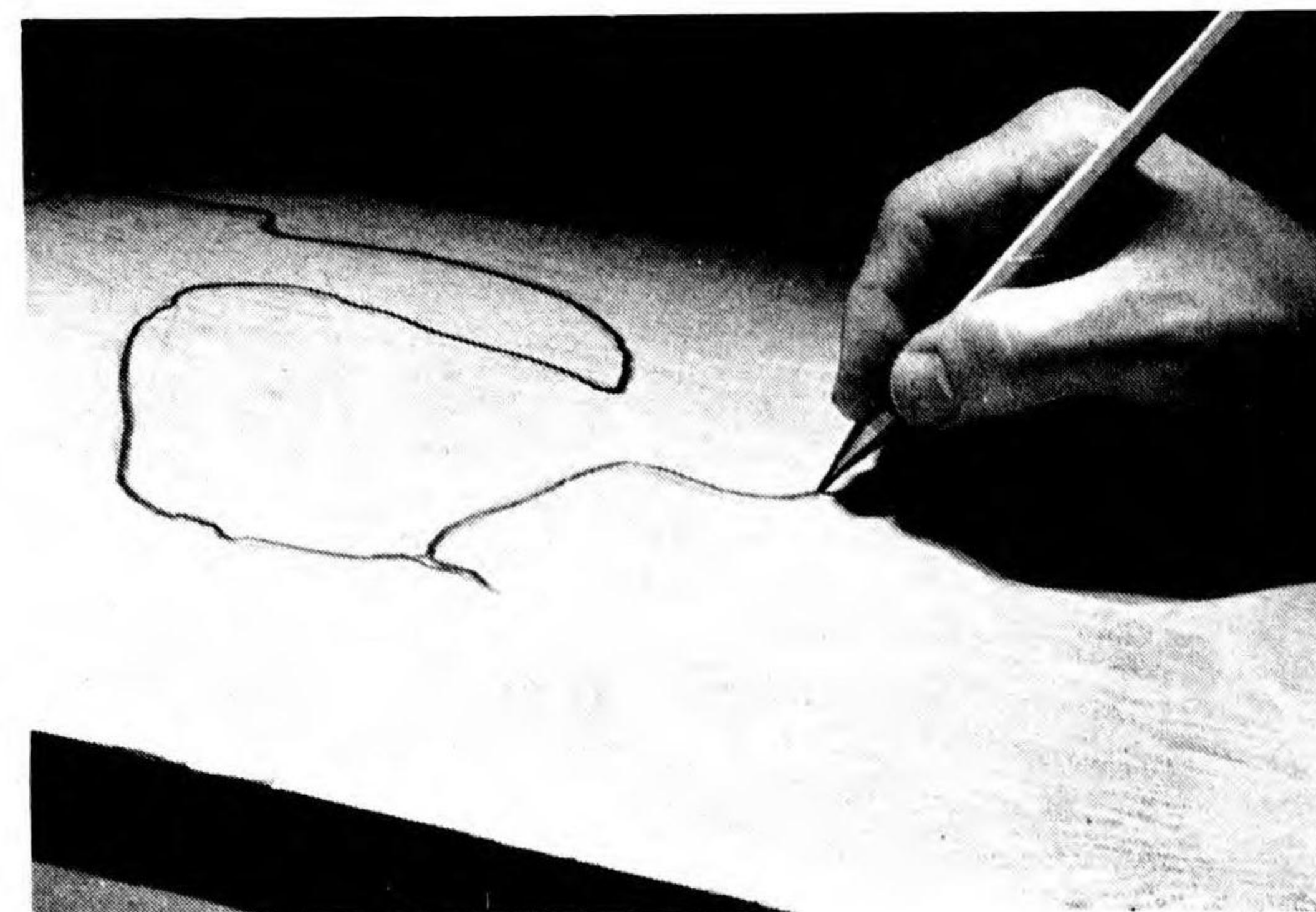
## MAKING THE CLAY MODEL

### 5. The First Steps.

(a) The photographer makes from the Photo Original: (1) A copy negative. (2) A positive transparency.

(b) The positive transparency is placed in the enlarger.

(c) Under the enlarger a sheet of plywood, of the length and width of the pressed paper models to be produced, is placed.



*Tracing the image of the Zero elevation cast by the enlarger onto the plywood sheet.*

(d) With black pencil, the projected image of the base line is traced on the plywood. Location of the first contour is oriented to this base line.

(e) Shore line of the sea makes the base line easiest to use. Or, the base line may be the outline of a river or lake known to be at the lowest possible elevation in the terrain represented.

(f) Over the sheet of plywood, a sheet of single-weight glass is placed.

(g) If no glass is available, the plywood is sanded and sealed with thin shellac, to produce a glass-like surface. Modeling clay must adhere to this surface. But the plaster of the Negative Mold, produced later, must not stick.

(h) If glass is used, tightly fasten it to the plywood with DuPont 5448 Cement or another adhesive which clings satisfactorily to glass.

(i) Images of the two registration marks on the Zero elevation area are marked on the glass. These marks are used to establish correct registration when the model (after being roughly covered with clay) is put under the enlarger for final modeling.

### 6. Steps in Registration.

(a) Four registration marks are placed on the Photo Original. These four marks appear on both copy negative and positive transparency.

(b) Two of the marks are placed on the area of Zero elevation (sea or river or lake, for example). The other two marks are placed on the area of higher-than-Zero elevation (in the hills, for example).

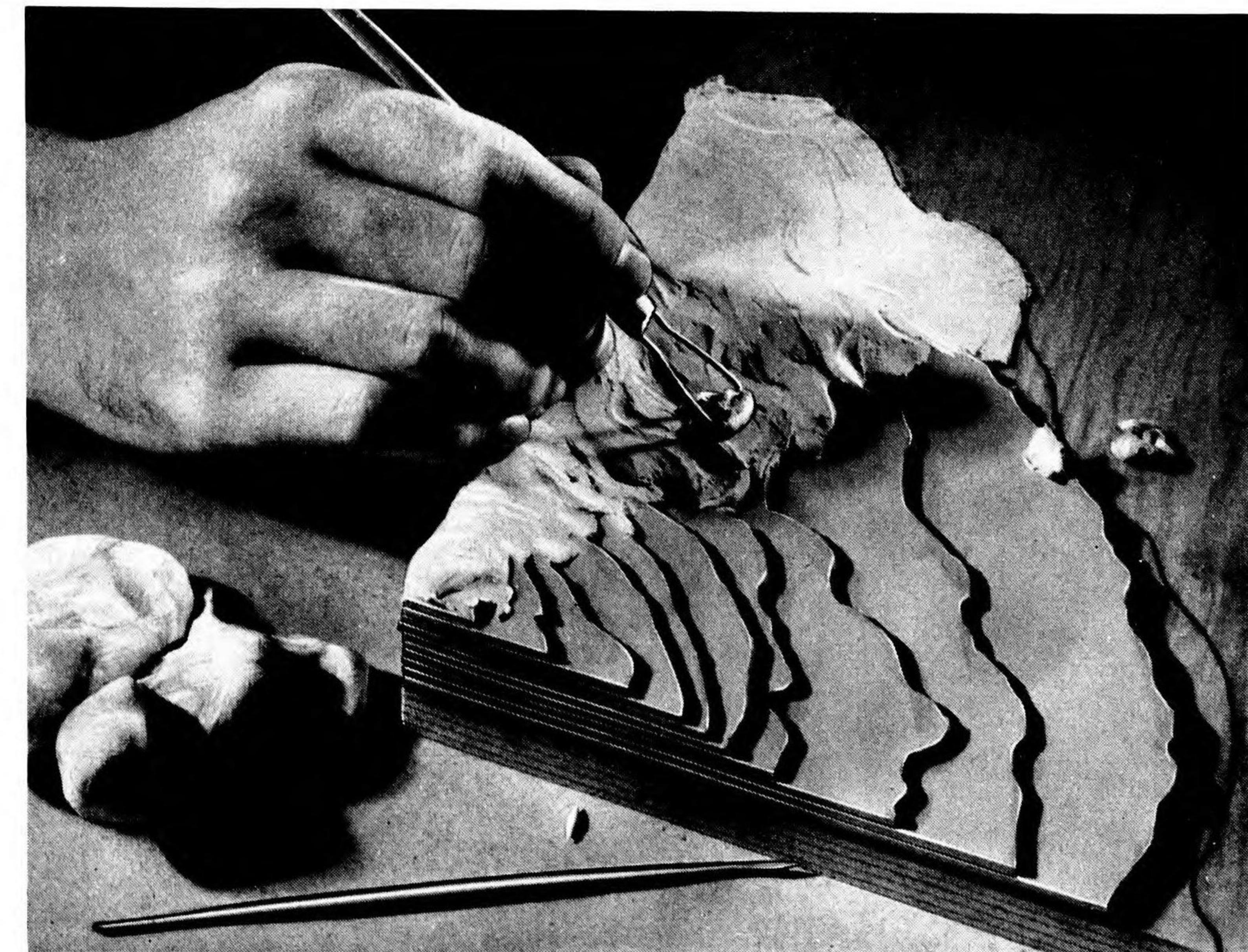
(c) Registration marks at Zero elevation are used until final modeling of the clay-surfaced model is completed.

(d) Then, before the model is moved from its correctly-registered position beneath the enlarger, the registration system switches to the use of the other two registration marks, which are on the area of higher-than-Zero elevation.

(e) The marks of the Zero elevation appear on the model's glass. Small ink crosses will serve. There is no indication of these marks on the finished paper casting.

(f) The marks of the higher-than-Zero elevation, however, appear as small holes or crosses on the clay surface of the completed clay model. Accordingly, they appear as slightly raised points on the Negative Mold. And they appear as small holes on the finished paper casting. But they are concealed on the finished model by the photographic image.

(g) Experienced modelers, who know how to use the terrain itself for registration, have little need for registration marks. Beginners, however, should use the marks.



*Roughly covering the cardboard contours with white modeling clay. Note the image of the Zero elevation, at which the clay "stops."*

## 7. The Contours.

(a) Photo Surface Models are made, by present methods, without vertical exaggeration.

(b) Cardboard contours are cut in the standard manner. A contour map, if available, is used as a guide in cutting the contours.

(c) If no contour map is available, contours are determined from aerial photographs by means of an optical-mechanical device. (For example, the stereo-comparagraph, K.E.K. Plotter, or multiplex.)

(d) The contour layers are glued together. The bottom contour, properly oriented to the base line, is glued to the glass (or the plywood) with DuPont 5448 Cement or a similar adhesive.

(e) Modeling clay of the plastelene type (which may be used repeatedly) is modeled superficially over the contours. The only aim at this point is to cover the contours.

(f) The clay should be light in color. White is best. See P. 33.

(g) The model is now ready for final modeling under the enlarger.

## 8. The Modeling of the Clay Surface.

(a) The clay-covered model is put under the enlarger. Room lights are dimmed. The image

from the positive transparency is projected onto the model.

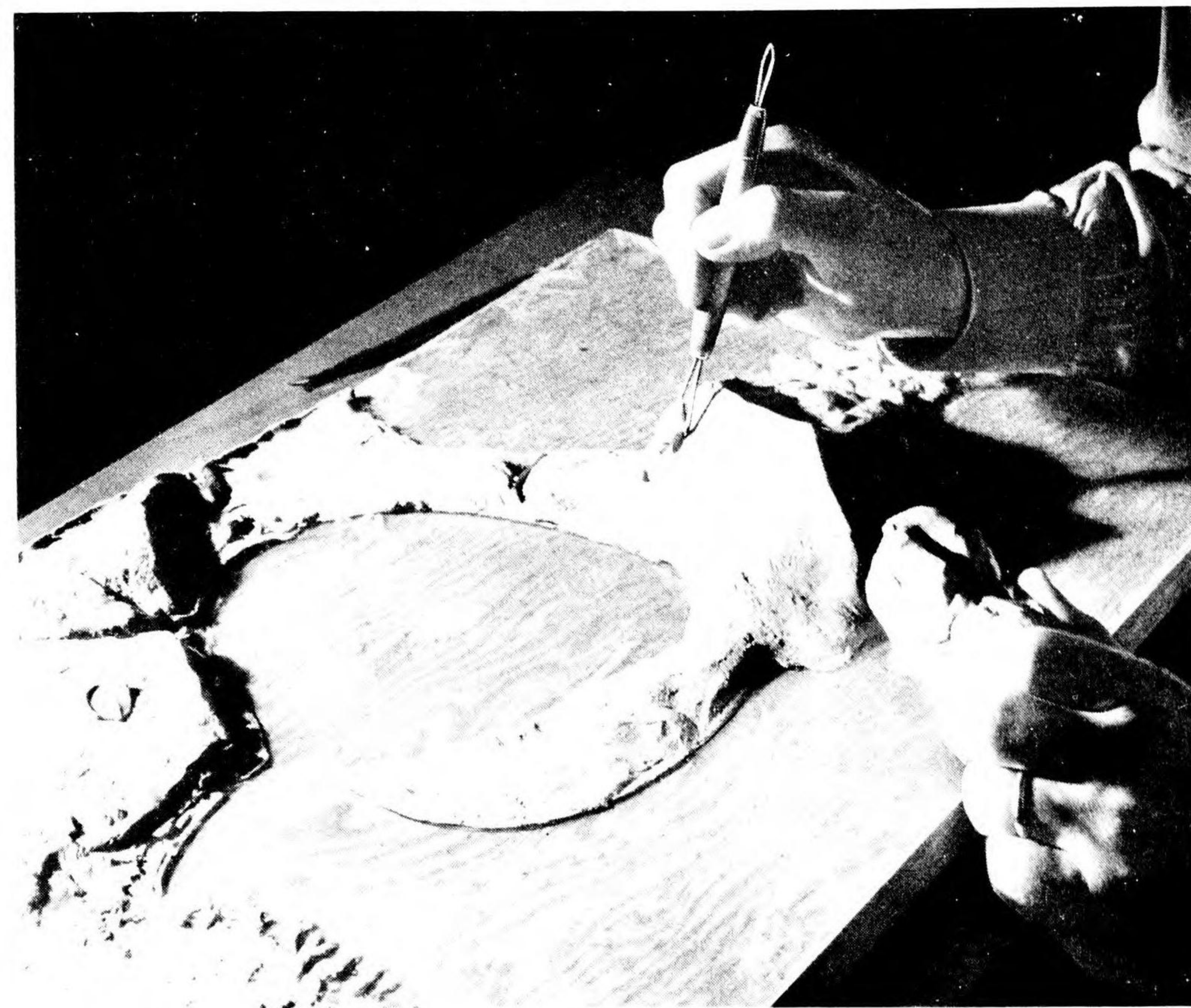
(b) The enlarger is properly adjusted for size, focus, and registration. The two registration marks on the Zero elevation (on the glass) are lined up with the images of those marks from the positive in the enlarger.

(c) When the image from the enlarger falls properly on the model, blocks are tightly taped to the enlarger table around the model's plywood. These blocks hold the model in correct registration during modeling, and are used later to fix position of the paper castings when they are ready for application of the photographic image.

(d) The clay surface is modeled to make it match the image cast upon it. If no standard modeling tools are available, tools may easily be whittled.

(e) As a check on the image from the enlarger, as it appears on the model, the modeler frequently checks with oblique photographs and stereo pairs.

(f) Frequent checking with model-surface illumination is also necessary. Some modelers use a large-size flashlight, made by placing a standard light bulb inside a tin can, to throw a horizontal or vertical beam onto the model. Some snap on ceiling illumination. Others prefer a portable safelight.



*Modeling the clay-covered model under the enlarger, with the image from the positive transparency serving as a guide for accurate modeling of the terrain detail.*

(g) Be certain that the positive transparency in the enlarger does not become too hot. See Section 59.

## 9. The Finishing of the Clay Surface.

(a) Craftsmanship and care determine the accuracy with which the terrain is modeled in clay. The beginner finds this modeling under the enlarger difficult at first, because the enlarger's image makes the roughed-out model appear finished to his inexperienced eye.

(b) With a little experience, the modeler develops a knowledge of general terrain character, and methods of reproducing terrain in clay.

(c) Shadows, for example, usually indicate steep cliffs or hillsides.

(d) Frequently throwing on the model a horizontal or vertical beam of light helps differentiate between true representation and merely plausible representation.

(e) When the true shape of the terrain has been created in clay, the modeler begins texturing. Best texturing tool is a small, stiff-bristle brush (a tooth brush or typewriter brush, for example).

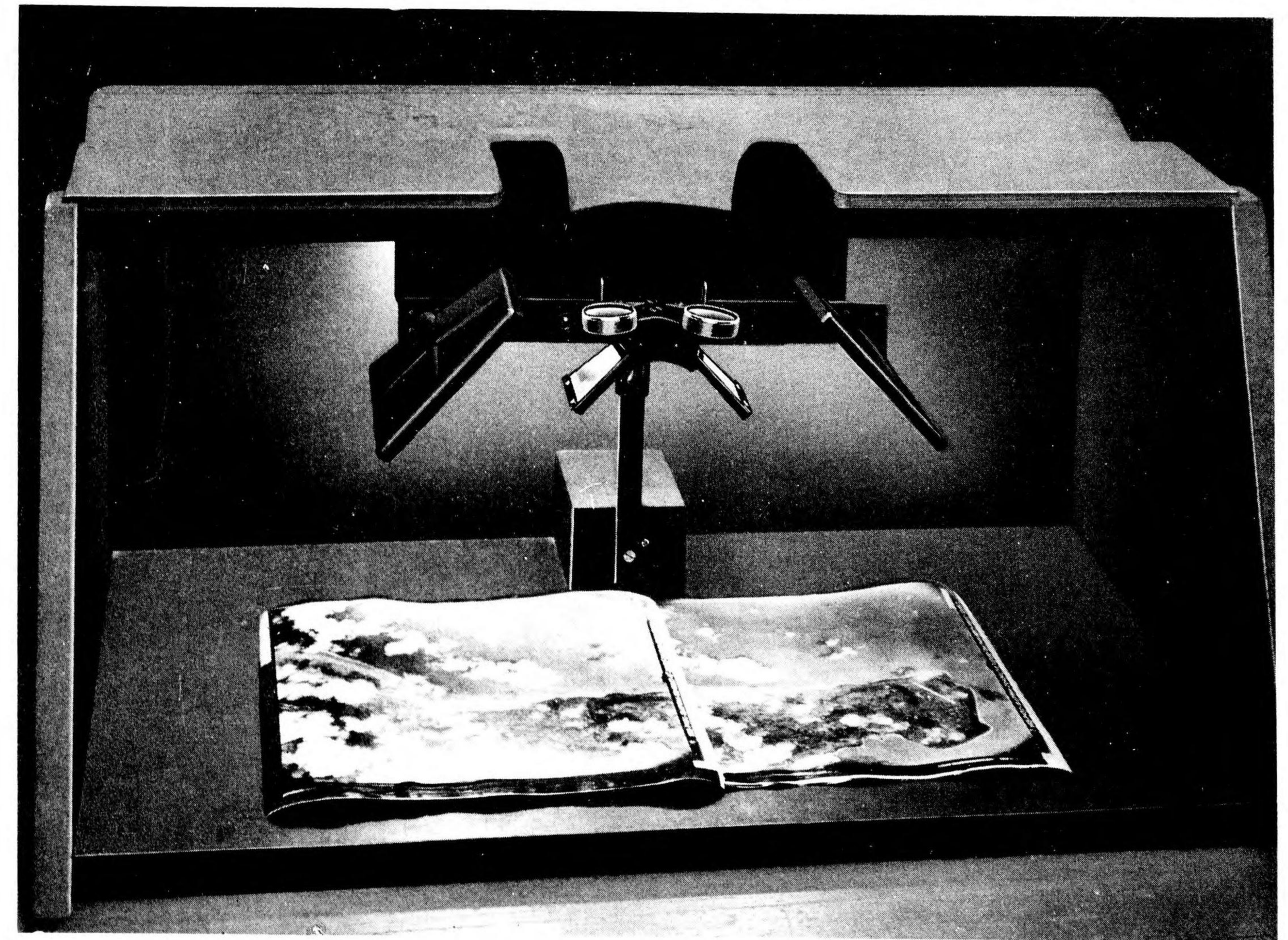
(f) If there is shore line, care is taken to make the edge of the clay on the glass accurately follow the shore line, indicated by the base line originally drawn on the plywood.

(g) When the modeling is completed, the change in registration systems is made. In the clay surface, where the images of the two registration marks at the higher-than-Zero elevation fall, two small holes are made. These holes are concealed in the finished pressed paper model by the photographic image.

(h) The finished clay model is removed from the enlarger.

## 10. Obliques and Stereos.

(a) Frequent checking with whatever other photographic information available is necessary.



*Paragraph 10 (A) describes the box for the stereo pair viewer shown here. A sliding or hinged front permits easy access to the photographs for adjustment of them.*

(b) Oblique photographs are best fastened up above the model, so that the modeler may frequently look up from the model to see them. Dim illumination on the obliques is usually sufficient.

(c) Obliques show terrain character from a viewpoint different from that of the vertical, and serve as a useful double-check.

(d) Obliques, for example, usually show the terrain's silhouette quite clearly.

(e) Stereo pairs are useful. If a stereo pair viewer is used, it should be placed, for sake of convenience, upon the enlarger table or close to it.

(f) Illumination of stereos is simplified through use of a box around the viewer. This box should be built with: (1) An open top. (2) A hinged or sliding front.

(g) Illumination inside. The modeler can look through the viewer's eyepieces. The front is easily opened for adjustment of the photographs. The amount of light leaking from the top is usually insignificant. An off-on switch for the light can be added.

## MAKING THE NEGATIVE MOLD

### 11. The Casting Frame for the Mold.

(a) When the clay surface of the model is completed, the model is ready for production of a Negative Mold. First, however, a casting frame is built around the model.

(b) The frame is roughly made of wood. It is lightly nailed at the four corners, so that it may easily be taken apart.

(c) The frame must be high enough to permit a depth of plaster at least one inch above the highest mountain.

(d) Modeling clay is used to plug leaks at the four corners of the frame and at the joints between frame and model.

(e) When the frame is completed, the modeler pours plaster into it.

### 12. Plaster—in General.

(a) Molding plaster (also known as Plaster of Paris) is a satisfactory material for Negative Mold production.

(b) When available, the form of plaster known as Hydrocal should be used. Hydrocal produces, even in a thinner mixture, a Negative Mold harder than molding plaster.

(c) Before use, any plaster should be tested. Dampness frequently destroys the "active" quality of plaster. To determine if plaster is "active," mix a small quantity with water, and permit it to set. This lump should:

(1) Get warm within 10 to 20 minutes.

(2) Become very hard. Plaster failing the test must not be used.

(d) Sufficient plaster must be made to produce the Negative Mold with one batch.

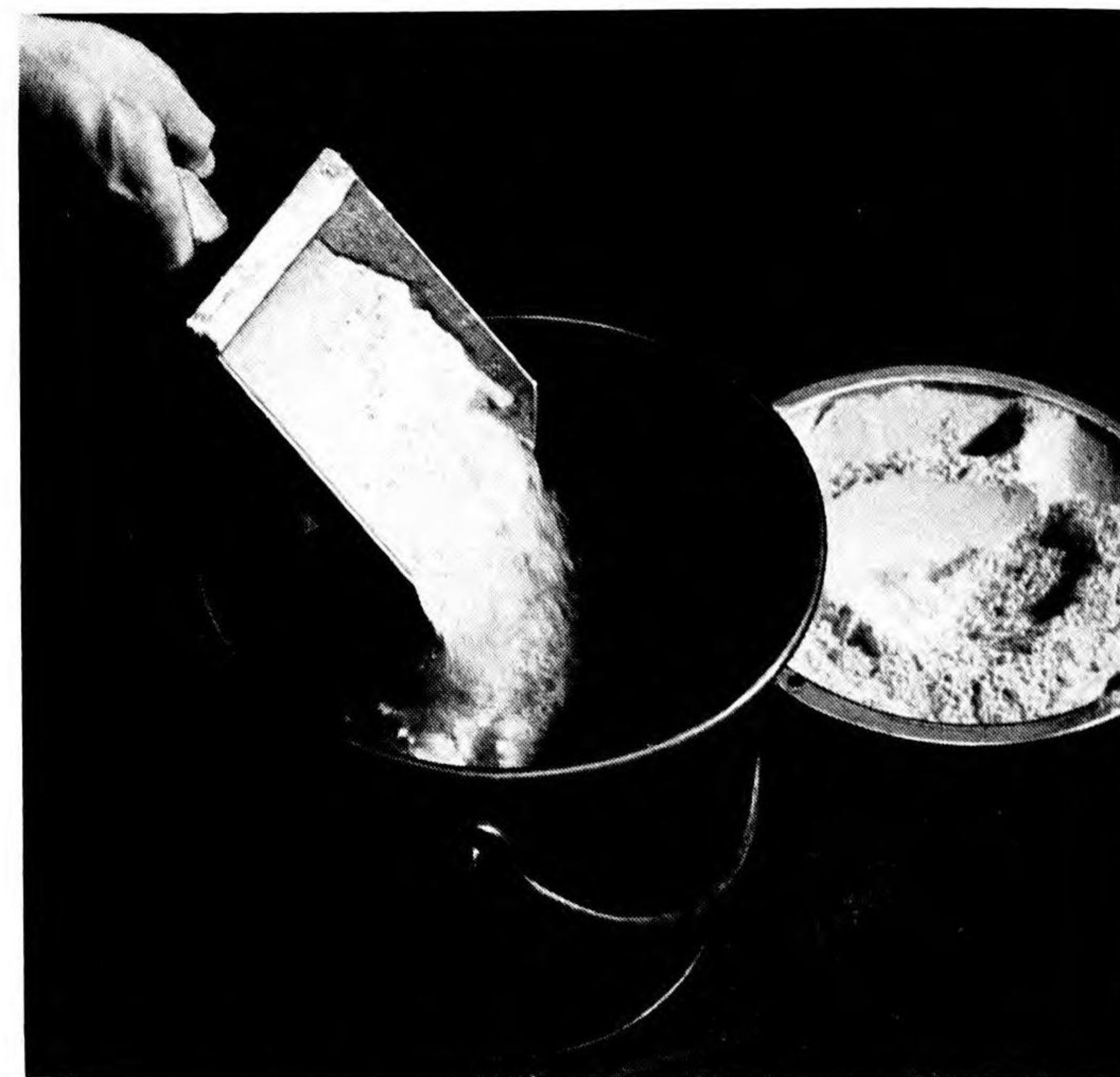
(e) If insufficient plaster has been mixed and if pouring has already begun, rapidly cover the entire surface of clay model with a shell of plaster. After this shell dries, roughen the back of it. Over this roughened back, freshly-mixed plaster is poured to sufficient depth. The shell of the first layer must completely cover the model, so that there will be no joints, between layers of plaster, touching the model. All such joints must be inside the Negative Mold.

(f) A good rule of thumb: Two thirds of a bucket of water will produce one full bucket of plaster.

(g) Do not permit plaster to set up in a bucket or brush. To clean a plaster bucket swab out with the hand; throw the gummy plaster into a trash box; and then wash out with running water. Remember that setting plaster will clog a drain.

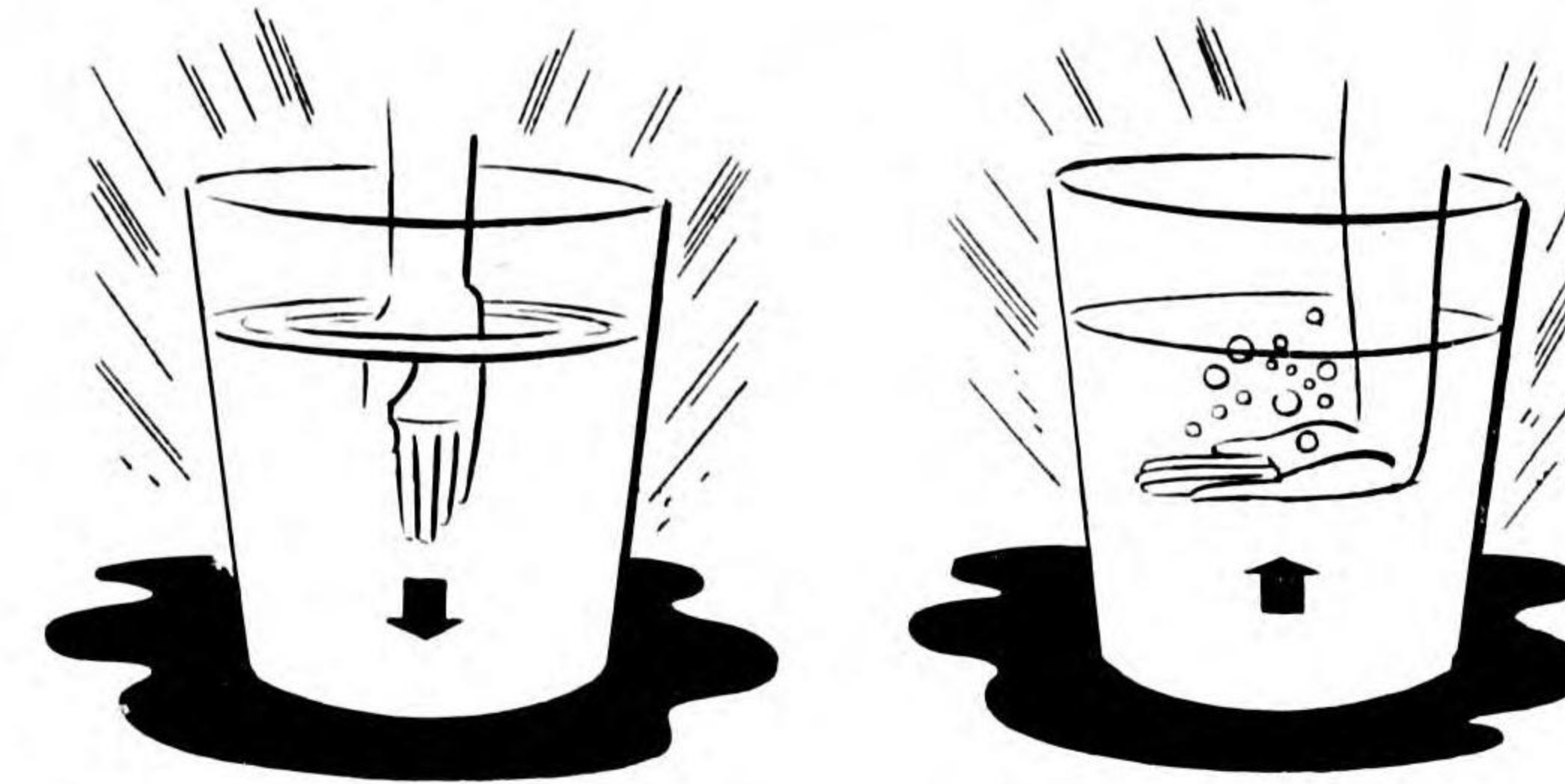
### 13. Steps in Mixing Plaster.

(a) Put desired amount of cool, not warm, water in a bucket. Begin sifting plaster onto the surface of the water. Keep hands out. Do not stir.



Plaster should be sifted into the water, and permitted to settle as described in paragraphs 1. (a) and 13 (b).

(b) Sift fast. Keep sifting until the plaster, building up into a cone from the bottom, forms islands in the middle of the bucket. Then stop sifting.



The two motions of the hand in stirring plaster in water, as described in paragraph 13 (d), to remove bubbles.

(c) Let plaster soak for two or three minutes. Add no more.

(d) Stir in this manner: Holding fingers straight, insert hand into the water as though the hand were a knife blade. At the bottom, turn the hand parallel to the surface of the water, and bring to the top.

(e) Carefully and swiftly, repeat this stirring motion. Do not swirl.

(f) Work the hand around the bottom of the bucket, so that no plaster will stick there.

(g) This stirring should remove all air bubbles.

(h) Continue until plaster begins to set.

(i) Test for setting: As the hand is withdrawn from the bucket, liquid plaster tends to hang or "drag" as it drips off the fingers.

(j) When plaster meets this test, pour.

### 14. Pouring the Plaster.

(a) The model must be perfectly level, on a level table. A bubble level may be used to check.

(b) Modeling clay, kept nearby, is used to patch any leaks which appear.

(c) Plaster is poured in a small, steady stream.

(d) Pour in one place, preferably in a corner.

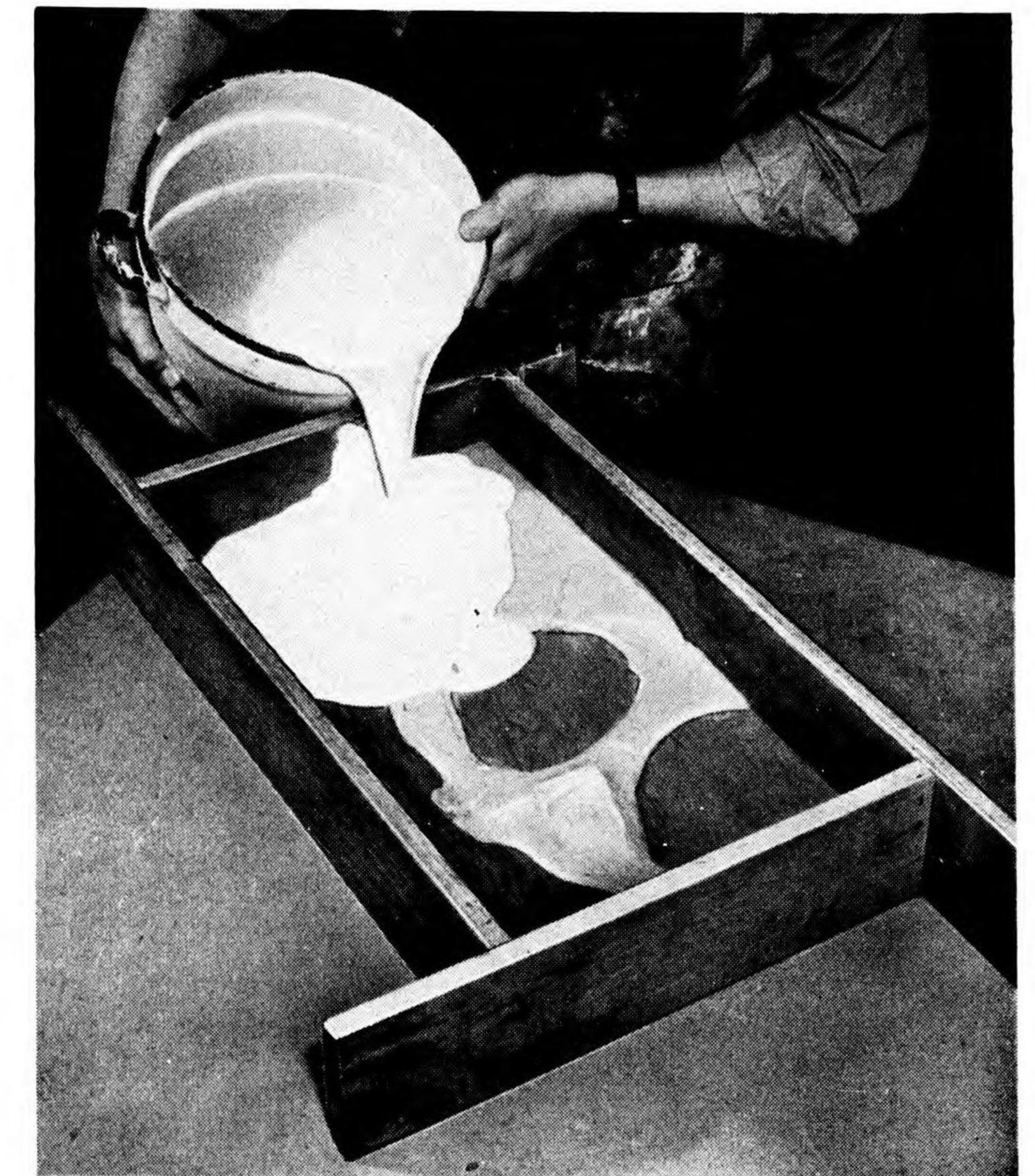
(e) Avoid trapping air.

(f) Make the plaster move slowly across the model's surface as though it were a glacier. In crevices, the plaster should move down one side, and up the other, pushing surface air ahead of it.

(g) After all needed plaster has been poured, dip the finger into the plaster in any of the low points on the model, to release air bubbles.

(h) Shake the table on which the casting stands, to release trapped air, and to level the surface of the plaster.

(i) Let the plaster set. It will get hot. After

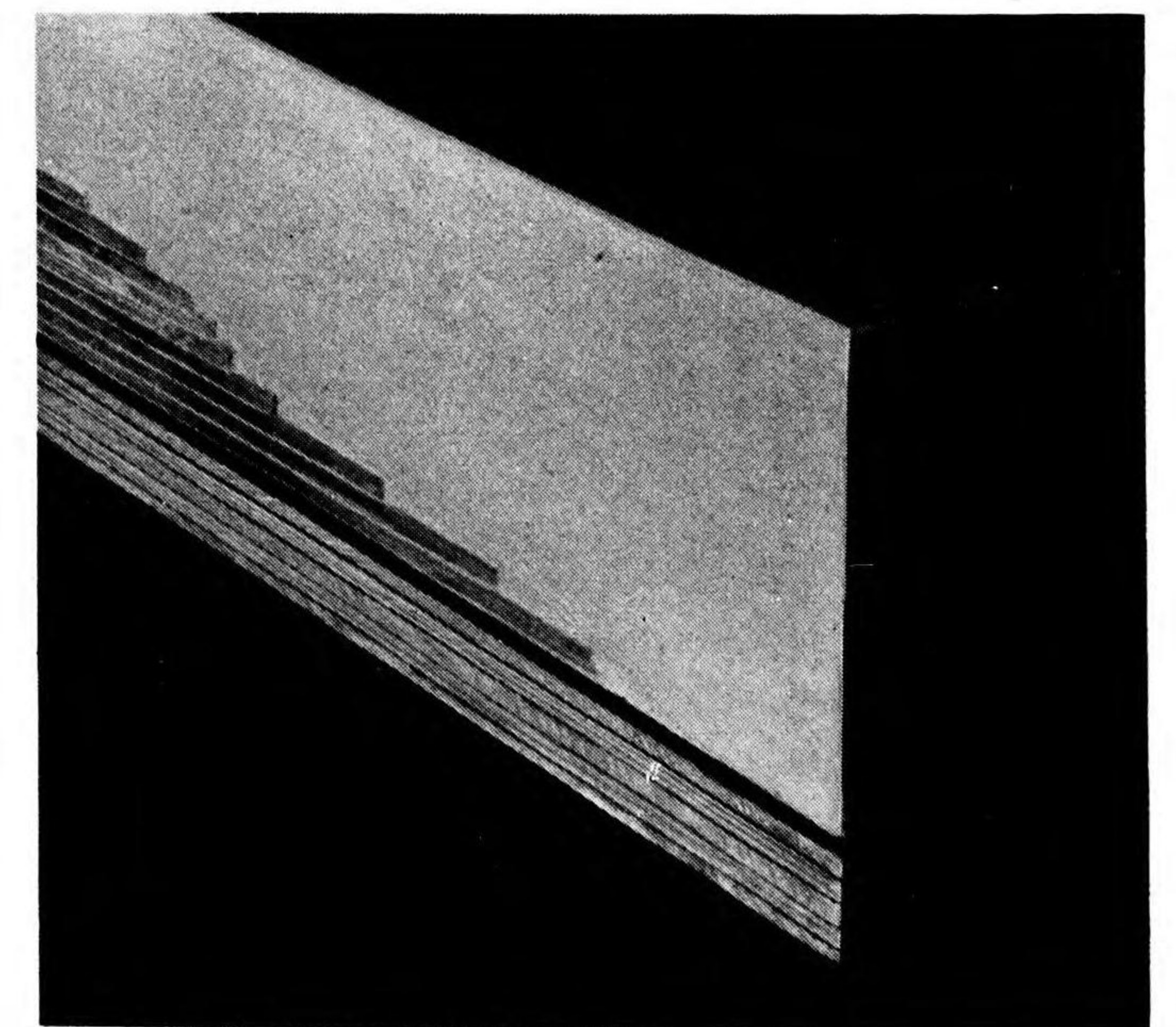


Care must be taken to trap no air bubbles in pouring plaster over the original model. See Section 14.

maximum heat is reached (and cooling has begun), the casting frame is removed.

### 15. Preparing the Negative Mold.

(a) After the plaster has set and frame removed,



Edge view after casting frame is removed, showing the layers of plywood, glass, cardboard, clay, and plaster.

Mold and model may be turned upside down, so that the Negative Mold is on the bottom.

(b) The original model is lifted off. If clay sticks, a bit of clay is dug out of an edge, and water is poured into the hole, to release the model.

(c) Errors in the terrain surface of the Negative Mold may now be corrected.

(1) Cracks. Put water into the crack, and drop plaster into it. Daub and rub with fingers until crack is filled. Excess is rubbed off before it sets. Pits may be touched up in the same manner.

(2) Bumps. Raised bits of plaster are sandpapered or scraped off with a knife.

(3) Sticking Clay. Bits of clinging clay are rubbed off with the fingers or picked up by rubbing with a ball of the same clay.

(d) Now, with its surface clean, the Negative Mold is given two coats of thin shellac. (Formula: At least one part of alcohol to one part of shellac.) Apply on terrain surface only. Do not shellac sides and back—permit escape of interior moisture.

(e) The first coat of shellac should soak quickly into the plaster, with no sheen on it. The second

coat must seal the plaster's surface. But it must not be sticky.

## MAKING THE PRESSED PAPER MODELS

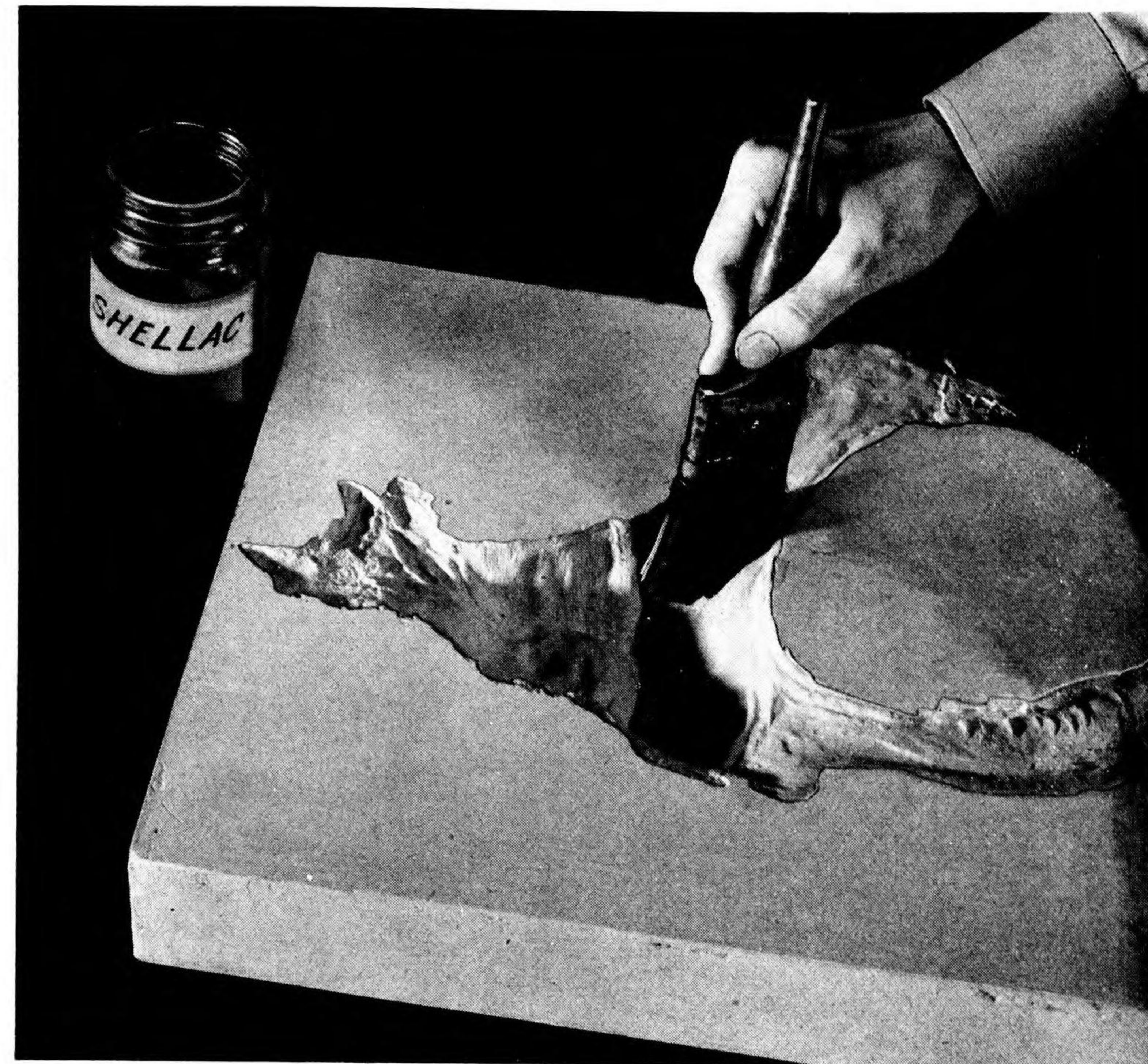
### 16. The Casting Frame.

(a) To produce pressed paper models, the Negative Mold must have around it a four-sided casting frame, forming a five-sided box (with the Mold as the bottom of the box).

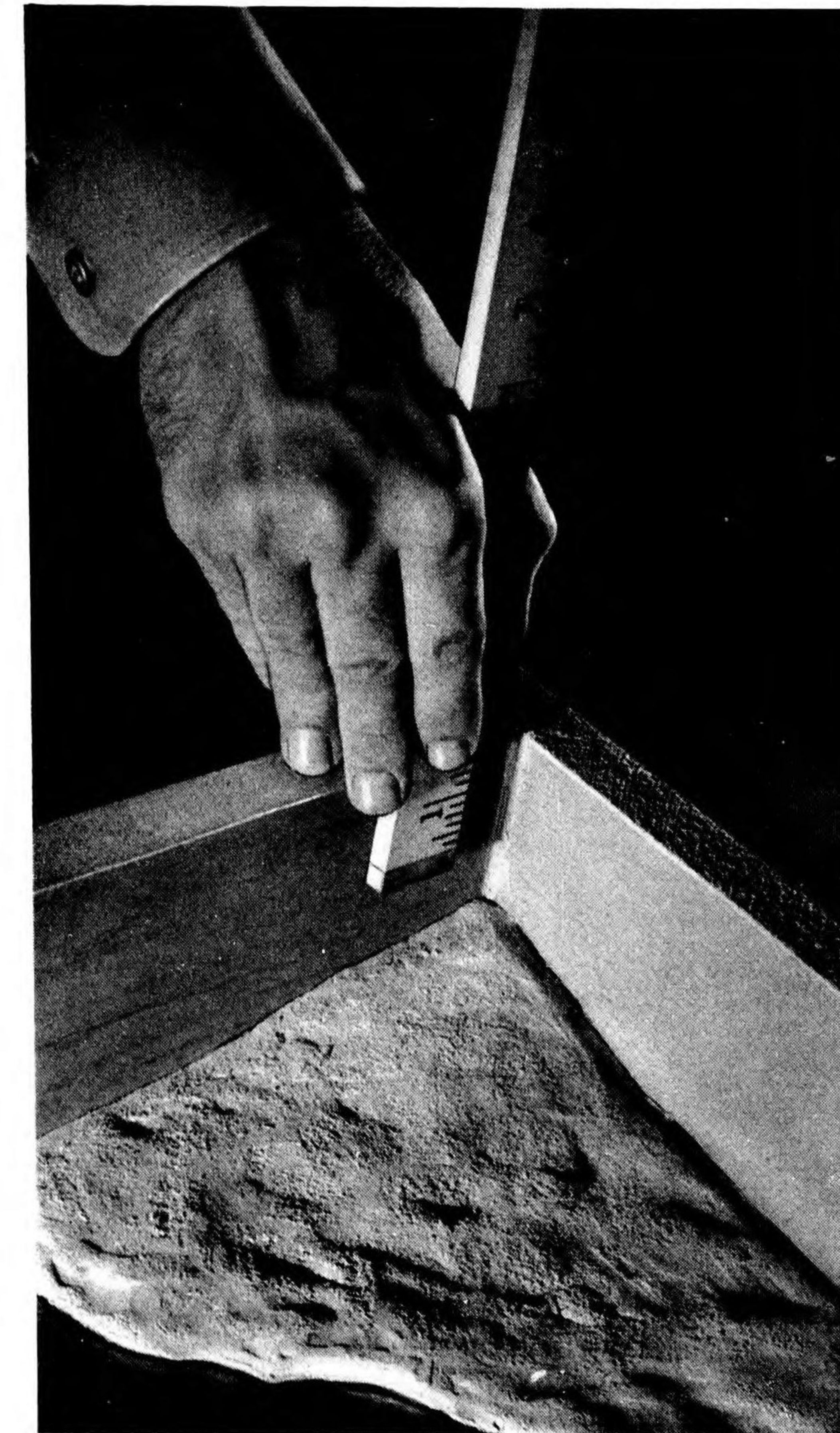
(b) This casting frame must be sturdy, and easily assembled and disassembled.

(c) The frame is made of boards three-quarters to one inch thick. Corners must lap and fit snugly. Boards must be given two coats of thin shellac. (Formula: at least one part of alcohol to one part of shellac.)

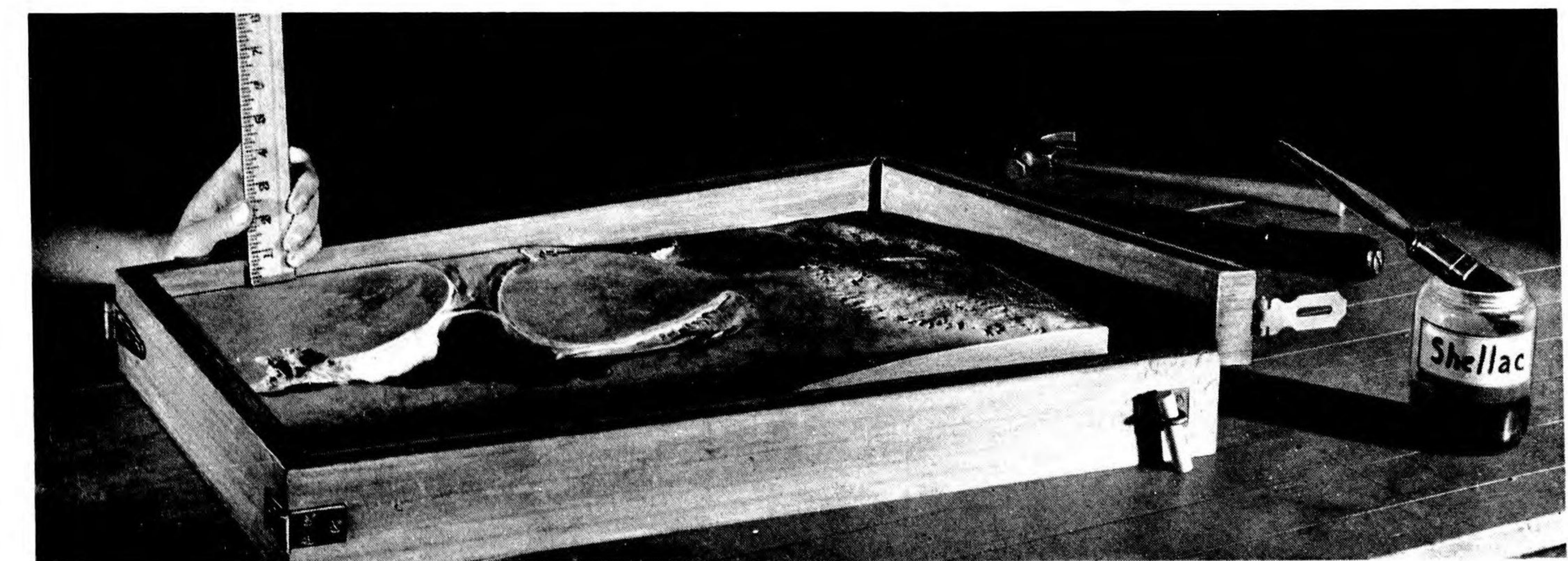
(d) All four boards must be of the same height, that height being determined by the depth of the



The terrain surface of the Negative Mold is given two coats of thin shellac. See 15 (d). But no shellac is applied to the other five sides of the Negative Mold.



The casting frame around the original model must provide sufficient plaster depth. See 11 (c).



The casting frame built around the Negative Mold should provide for a base edge depth of one inch on the paper casting. The casting frame should be easily removed. See Section 16.

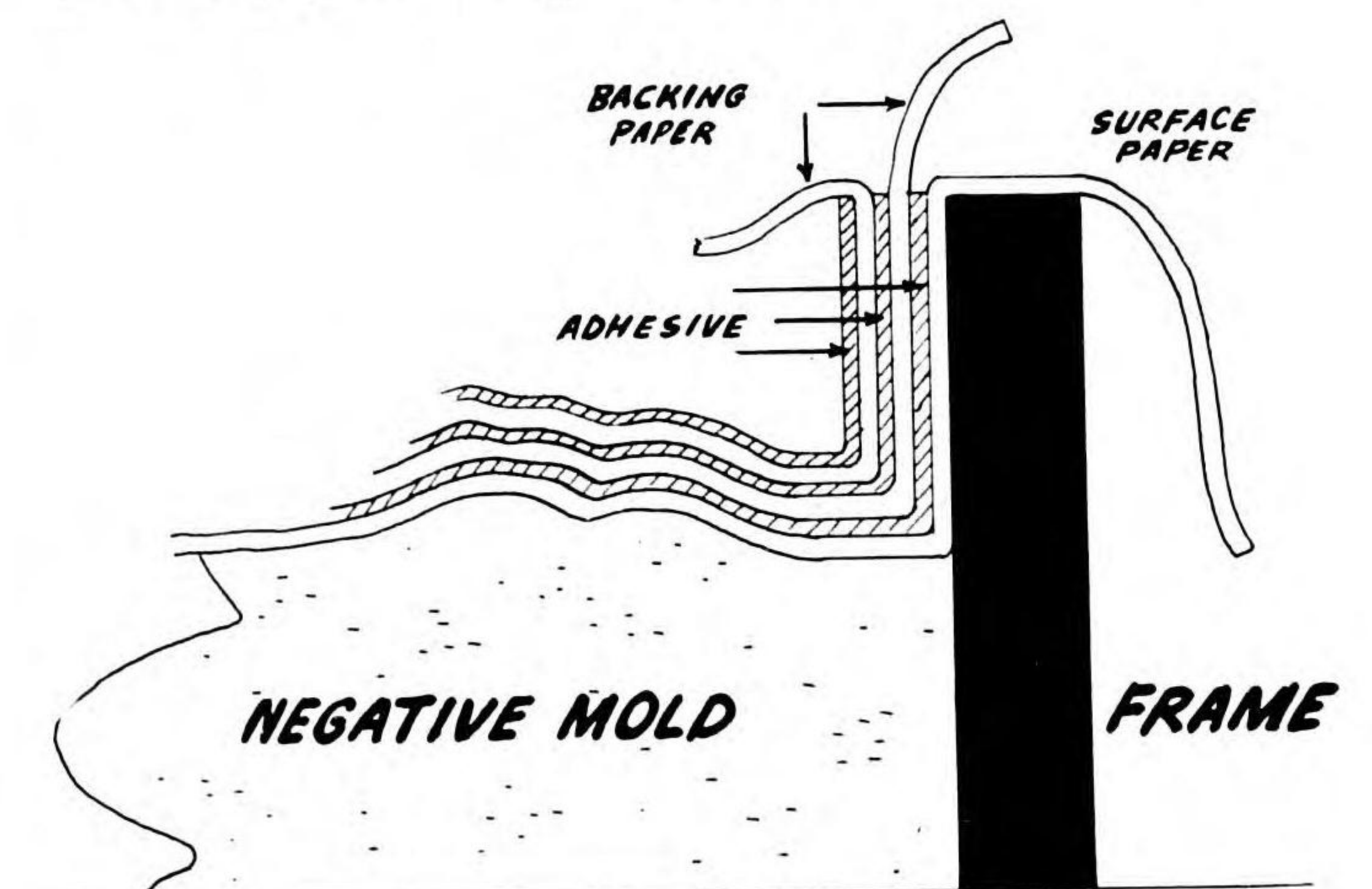
Negative Mold at its highest point (i.e., the lowest point on the original model). This provides a base edge of one inch depth on the finished pressed paper model.

(e) Two screws fasten boards at each corner of the frame. When the boards are wrapped around the Mold (to form the five-sided box), the screws are tightened. This frame is easily put together and taken apart.

(f) A handier frame may be constructed with hinges at three corners, and a hasp at the fourth. This frame is fastened tight with a peg in the hasp. This frame is recommended when a large number of castings is to be produced from a single Negative Mold.

### 17. The Easiest Paper Casting.

(a) With casting frame tightly fastened around Negative Mold, the modeler begins producing a pressed paper casting—a model.



The easiest paper casting provides three layers of paper and three layers of Casting Adhesive.



The model-maker soon learns how to stretch molding paper while tamping to prevent wrinkles. See Section 18.

(b) Several good combinations of papers are possible.

(c) One combination, easy to handle and satisfactory for most terrain, is recommended.

(d) This combination calls for: (1) One layer of Surface Molding Paper, water-soaked. (2) Two layers of Backing Paper, water-soaked. (3) A coating of Casting Adhesive on the back of each of the three sheets.

(e) The Surface Molding paper carries the terrain detail. The Backing Paper forms a support for the Surface Molding Paper. The Casting Adhesive, when set, holds the casting in the desired shape, and provides bond between the sheets of paper.

### 18. The First Layer of Paper.

(a) A sheet of Surface Molding Paper is cut to a size which will (1) cover the Negative Mold, and (2) lap on all four sides by at least two inches. Thus, for a Negative Mold measuring 10 by 10 inches, a sheet of paper 15 by 15 inches is satisfactory.

(b) This sheet is thoroughly water-soaked.

(c) Gently and smoothly, the Surface Paper is pushed and formed against the Negative Mold with the fingers so that it touches at every point.

(d) To press the Paper into the detail, it is tamped down with a stiff-bristle brush. A stencil brush is suitable.

(e) Begin tamping at the center, and work outward, spiral-fashion. Properly done, this prevents trapping of air beneath the paper.

(f) If air bubbles do appear, the paper above them is broken or punctured. The area around the break is then tamped down firmly, to close the break.

(g) Wrinkles are avoided. Wrinkles can be tamped or stretched out.

(h) Tearing is avoided. When tears do occur, they are patched. See (j) below.

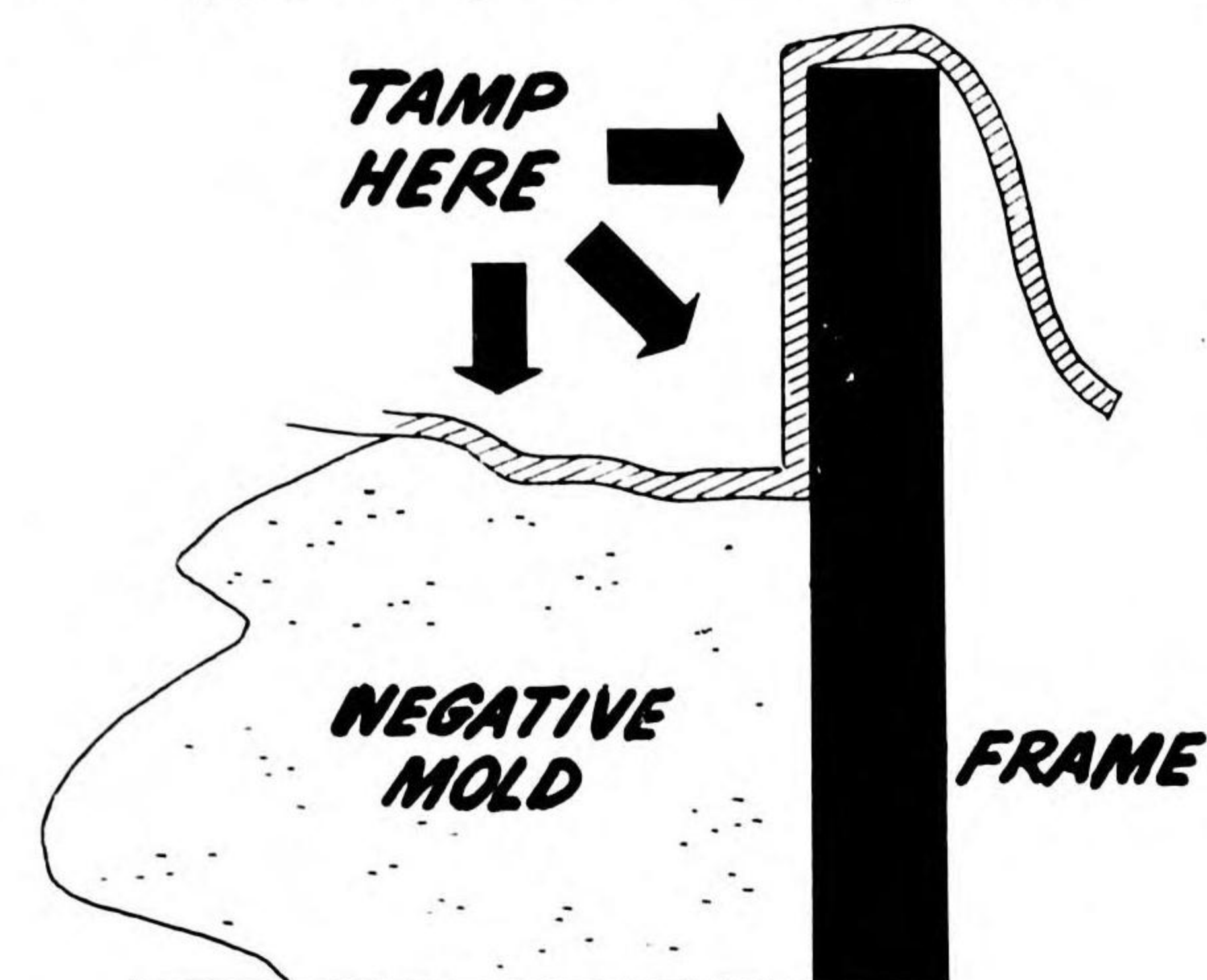
(i) In extra-steep elevations (cliffs, etc.), the unavoidable tears are controlled. When paper has been tamped down all around such a steep area and when



In extra-steep areas, the molding paper is carefully torn, and then patched, as shown here. See 18 (i).

it is apparent that further tamping will produce a tear, the modeler carefully makes the tear with his fingers, where he wants it. Then the tear is patched.

(j) Tears are repaired with patches which have tough, torn edges. They are water-soaked. The paper around the tear is coated with Casting Adhesive. But—no Adhesive is permitted to touch the Mold. Apply the patch, and tamp down firmly.



Molding paper is tamped firmly against the negative mold and against the side of the frame. See 18 (k).

(k) When tamping reaches the four edges of the Negative Mold, special care is taken to tamp the paper into the angle formed by the Mold and the

wood frame. Paper must be tamped firmly against the frame's sides—first step in building up neat, sturdy base edges for the casting.

(l) Trim the paper to form neatly-lapped corners. Tamp into the corners, to form strong, well-sealed 90 degree angles there.

(m) Let excess paper hang down over the frame's outside edges. This excess will later provide reinforcement for the base edge of the finished model.

(n) The modeler soon learns how firmly the brush is tamped against the paper. If too hard, the tamping tears the wet paper or makes it lumpy. If not hard enough, the paper is not forced into the detail of the Negative Mold.

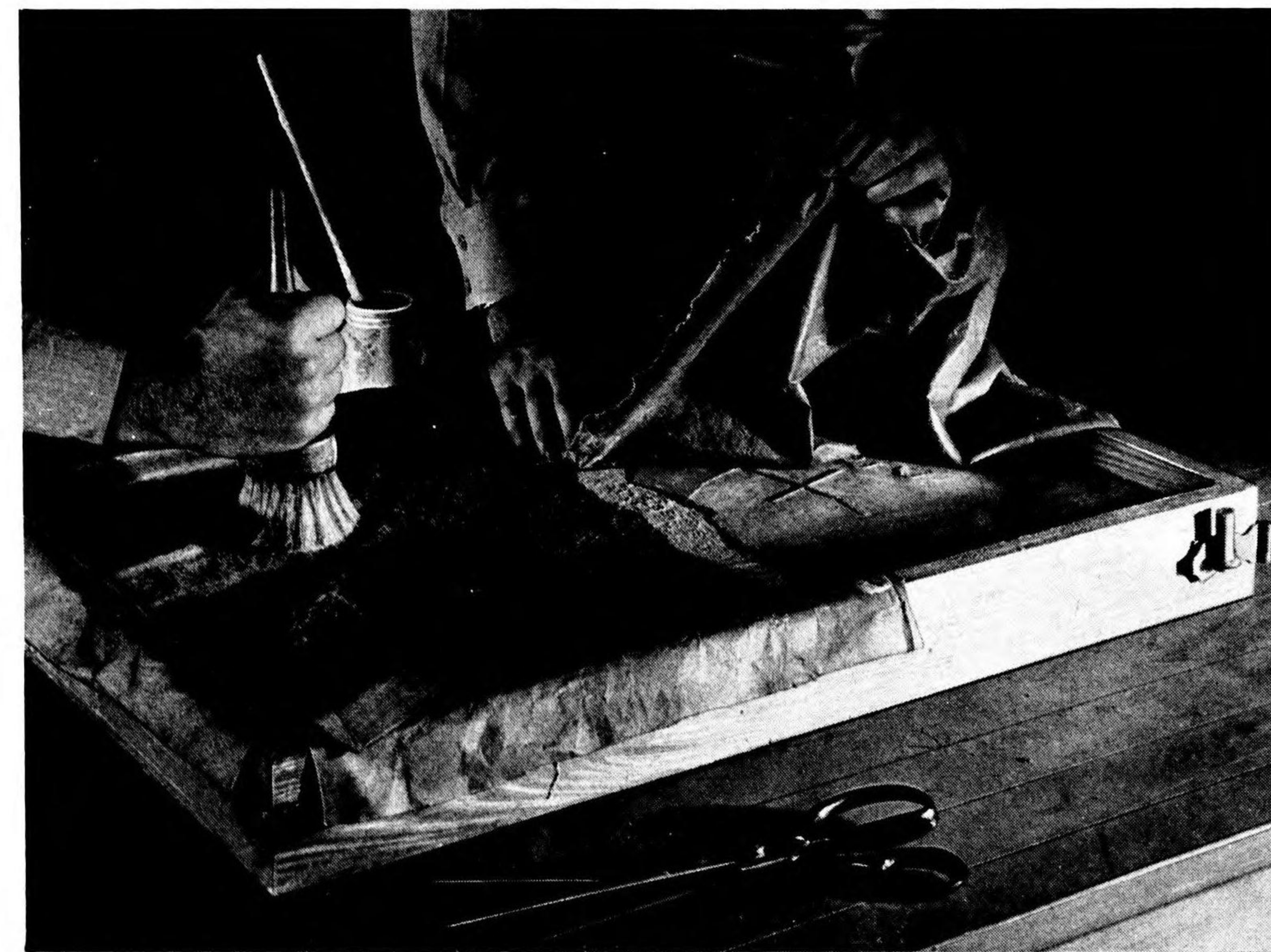
(o) Properly handled, water-soaked sheets of Surface Molding Paper have almost the modeling quality of papier mache.

(p) When tamping is completed, the entire back of the Paper (including the portions tamped against the frame) is coated with Casting Adhesive. But no Adhesive is applied to the overlap.

(q) For instructions on reinforcing extra-large models, see Section 53.

### 19. Applying Casting Adhesive.

(a) Casting Adhesive is made by dissolving one part of PVA-Dextrine Powder in 10 parts of water, and adding plaster. See p. 32.



In models too large for a single sheet of molding paper, lapped joints are made with roughly-torn edges, and joints are sealed with Casting Adhesive. See Section 20.

(b) Casting adhesive will set. Brushes used in it should be washed out immediately after use.

(c) Small batches should be prepared. Adhesive, once it begins to set, should not be used.

(d) Adhesive should be gently brushed over the entire back surface of the Surface Molding Paper clinging to the Negative Mold, in a coating of uniform thickness. It should be brushed also over the paper clinging to the frame, for this paper (against the frame) will build up into the model's base edge.

(e) Beginners should use thick coats. Experience will teach how to cut down on the amount needed.

(f) While the Adhesive is still wet, the first sheet of water-soaked Backing Paper is applied.

(g) No adhesive is applied to the overlapping paper. For this must be kept pliable until it later is formed into reinforcement for the base edges.

## 20. Joints in the First Layer.

(a) If a negative mold is so large that no available sheet of Surface Molding Paper will completely cover it, then two or more jointed sheets are necessary.

(b) Paper at such joints must have ragged, torn edges. Joints must be lapped.



*Overlap of the three sheets of paper is folded back to form strong base edges. Casting Adhesive is spread between the sheets of paper. See Section 22.*

(c) First, tamp down one sheet of Surface Molding Paper, with the ragged edge in the lapped joint position.

(d) Then, lightly coat the edge to be lapped with a band of Casting Adhesive, about one inch wide. Do not permit the Adhesive to touch the Negative Mold.

(e) Place the torn, lapping edge of the other sheet over the Casting Adhesive, and tamp down.

(f) Tamp extra firmly on the lapped joint. The aims: (1) To produce a firm bond at the lap. (2) To pound together the fibers of the two sheets, to make the joint disappear.

(g) The same kind of lapped joint is made, when necessary, on the second and third layers of paper.

## 21. The Two Layers of Backing Paper.

(a) Both sheets of Backing Paper are applied water-soaked. They should be of the same dimensions as the Surface Molding Paper beneath them.

(b) The first sheet is tamped firmly with a stiff-bristle brush.

(c) When tears occur, they are closed with patches of paper soaked in Casting Adhesive, and tamped down firmly.



*Corners are reinforced with wads of paper, soaked in Casting Adhesive and formed with the fingers. Corners must be strong. See Section 22.*

(d) Wrinkles are not so critical in this second layer.

(e) Air bubbles are prevented.

(f) A firm bond between Surface Paper and Backing Paper is produced, all over the terrain surface and against the frame.

(g) Excess paper—not coated with Adhesive—hangs over the sides of the frame.

(h) A coating of Casting Adhesive is applied.

(i) A second sheet of Backing Paper is applied and tamped vigorously.

(j) Wrinkles do no harm. Tears are repaired with patches soaked in Casting Adhesive.

(k) If necessary, mountains and cliffs are reinforced with wads of paper soaked in Adhesive.

(l) When the second sheet of Backing Paper has been tamped down hard, its back is given a coating of Casting Adhesive.

## 22. Reinforcing Edges and Corners

(a) The overlap of the three sheets of paper must be folded back inside the frame, to provide a firm base edge for the finished model.

(b) First, rectangular pieces at the four corners of the overlap must be cut out, so that the overlap may be neatly folded inside the frame without unwieldy lumps in the corners.

(c) Casting Adhesive is spread between the sheets in the overlap, and in other areas where a firm bond is needed.

(d) Base edges are formed with the fingers, and tightly pressed against the frame. Casting Adhesive is generously spread beneath the base edge, to make it stick to the back of the casting's terrain surface.

(e) The base edge must be level with the top of the frame on all four sides.

(f) Corners of the model are reinforced by forcing wads of Backing Paper, soaked in Adhesive, into them.

(g) Care must be taken so that this reinforced base edge, when dry, will make the model stand perfectly level.

## 23. The Backing Board.

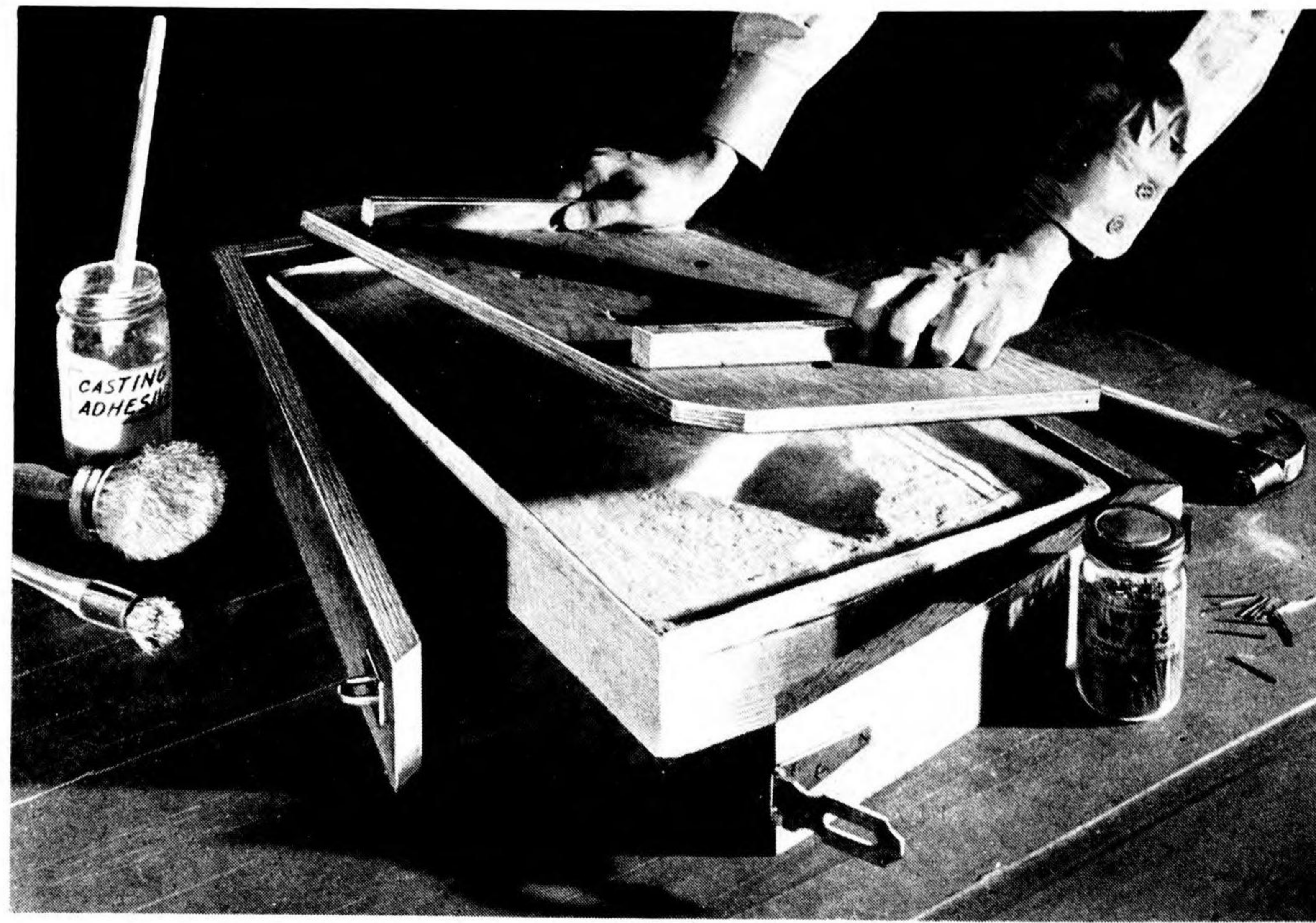
(a) After about 10 minutes of drying, the casting frame is removed.

(b) A Backing Board is then put into the back of the still-wet casting, and nailed into place. See (f) below.

(c) The Backing Board is a sheet of sturdy plywood of length and width to make it fit snugly inside the four base edges of the model. Corners are beveled. To permit the model's drying, the plywood sheet is bored full of holes. The plywood should be shellaced on both sides, to prevent warping.

(d) If no plywood is available, the Board may be made of slats of box lumber.

(e) The plywood sheet has wood cleats which serve as feet. The dried casting, when standing on these cleats, must be perfectly level.



After the casting frame has been removed, a Backing Board is fitted snugly into the back of the still-wet model. See 25 (c).

(f) Nails are driven through the base edges of the model, into the plywood. Nails should stick out on the four sides about one half inch.

(g) The Backing Board remains inside the casting until all other steps in the PSM process (including all photographic steps) are completed.

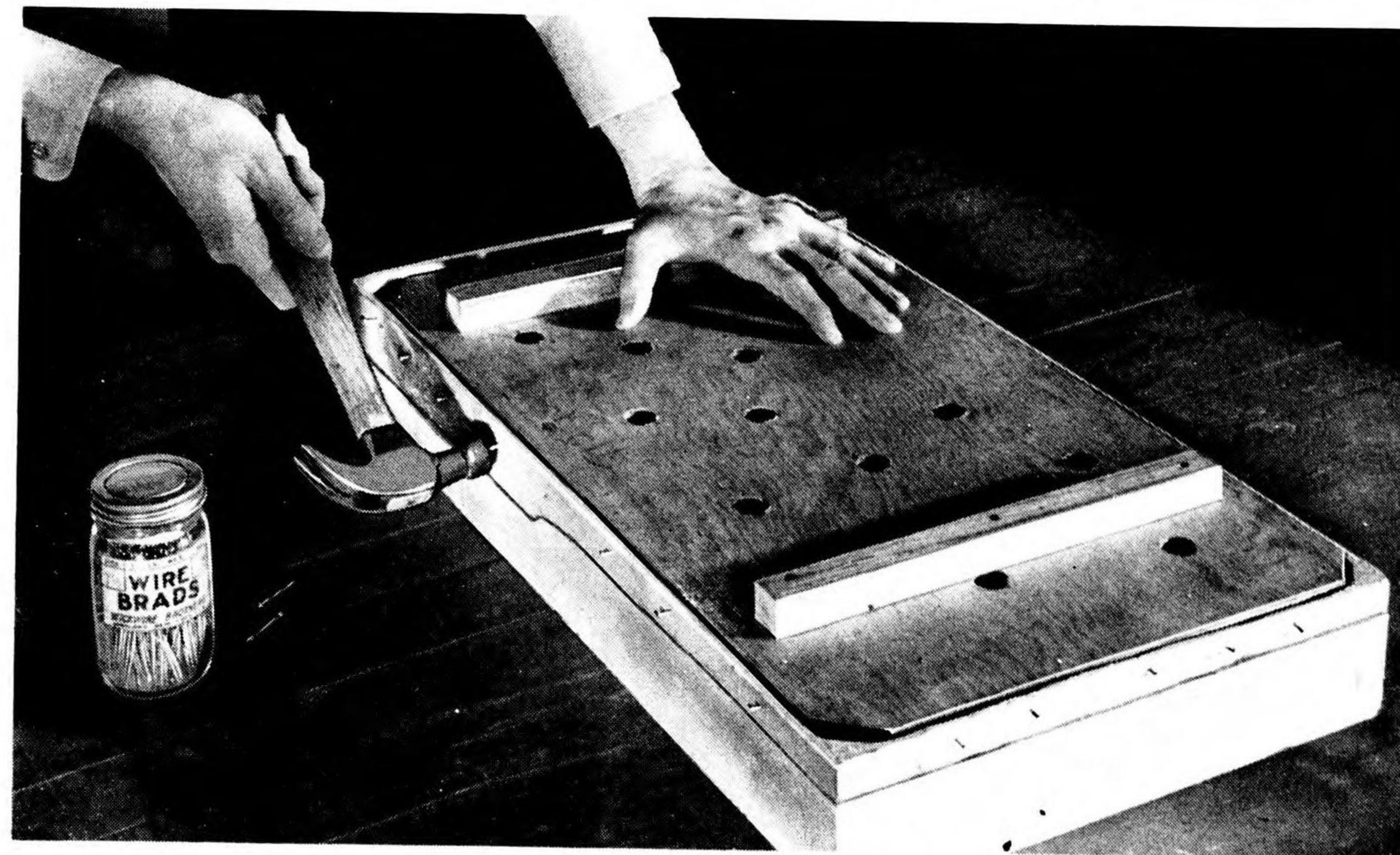
(h) If a number of models are being made from one Negative Mold and are being photo-processed in one operation, then the Backing Boards in all of

them must be uniform, so that all models will stand at a uniform height on the enlarger table.

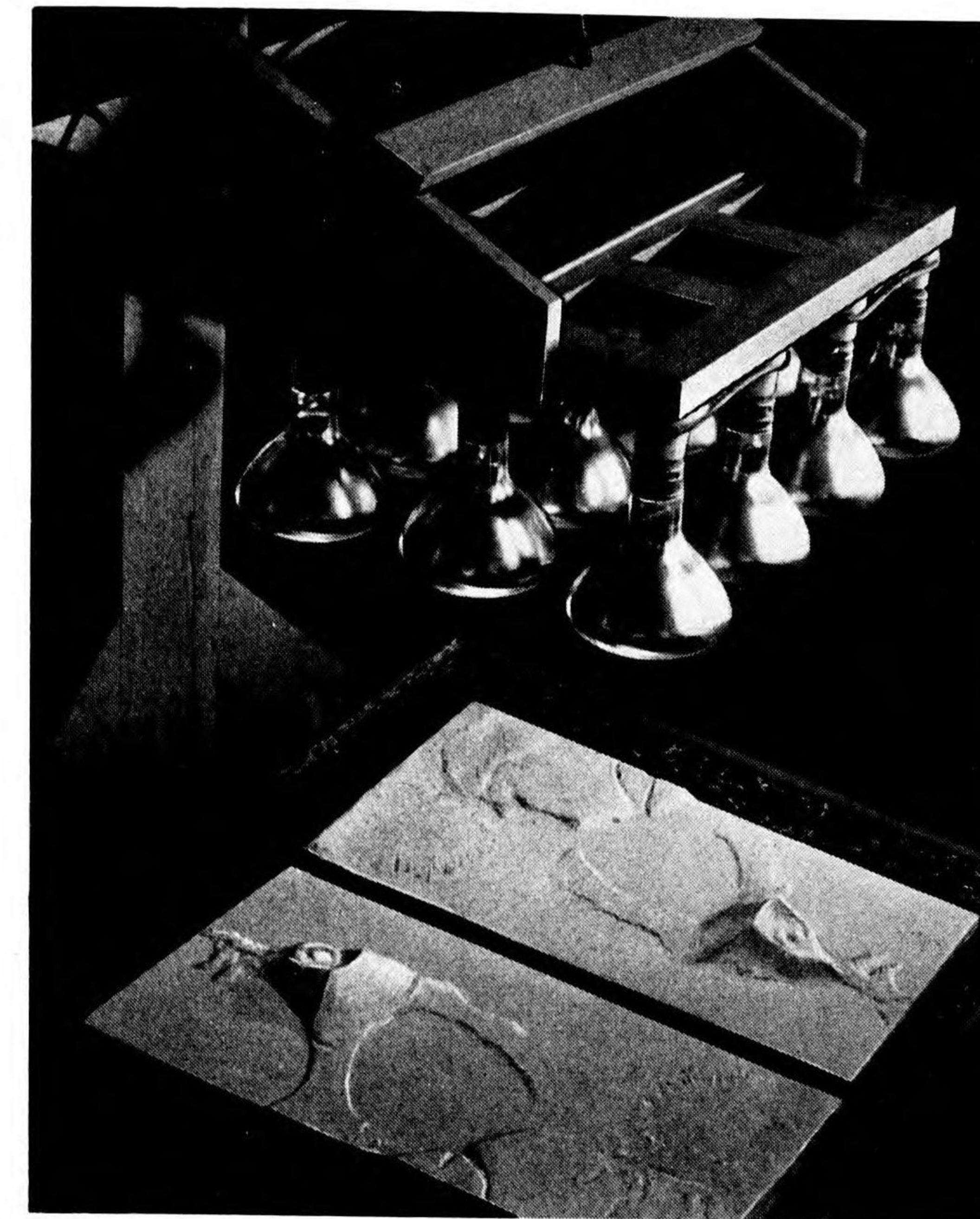
#### 24. The Final Steps.

(a) After about 10 minutes of drying, lift the model gently from the Negative Mold, holding the cleats of the Backing Board in the fingers.

(b) Turn the casting over (with terrain surface upward), standing on its cleats.



Nails driven through the base edge of the model into the Backing Board serve to hold the Backing Board in place, providing strength during later steps.



Infra-red drying lamps power this suggested dryer for models after lifting from the Mold. See 24 (d).

(c) Bits of loose paper on the surface are immediately brushed down flat with a damp brush.

(d) Drying may be speeded in a dryer. Or models may be dried in sunlight.

(e) Minor errors on the terrain surface may be corrected. Fine sandpaper will smooth rough spots. Casting Adhesive will seal down loose spots.

(f) The Negative Mold (its surface wiped clean of traces of Casting Adhesive) may be used again immediately.

#### 25. Pressed Paper Test Sheets.

(a) Length of exposure is determined by test pieces.

(b) Accordingly, for each set of models, a large, pressed paper test sheet is made. It must have exactly the same combination of papers and Adhesive as the models.

(c) A test sheet one by two feet is convenient. It is coated with the same Sealer applied to models.

(d) Later, it is coated with PSM Emulsion, and cut into small pieces for exposure testing under the enlarger.

#### 26. Final Steps in Registration.

(a) Steps are made to insure quick, accurate registration of the paper models with the image from

the negative when the models are put on the enlarger table.

(b) Registration blocks on the enlarger table (same blocks which held the original model in correct position during modeling) are used.

(c) Two registration marks on the higher-than-Zero elevation area (indicated on the paper model by two small holes) are used. They are lined up with the images of these two marks from the negative.

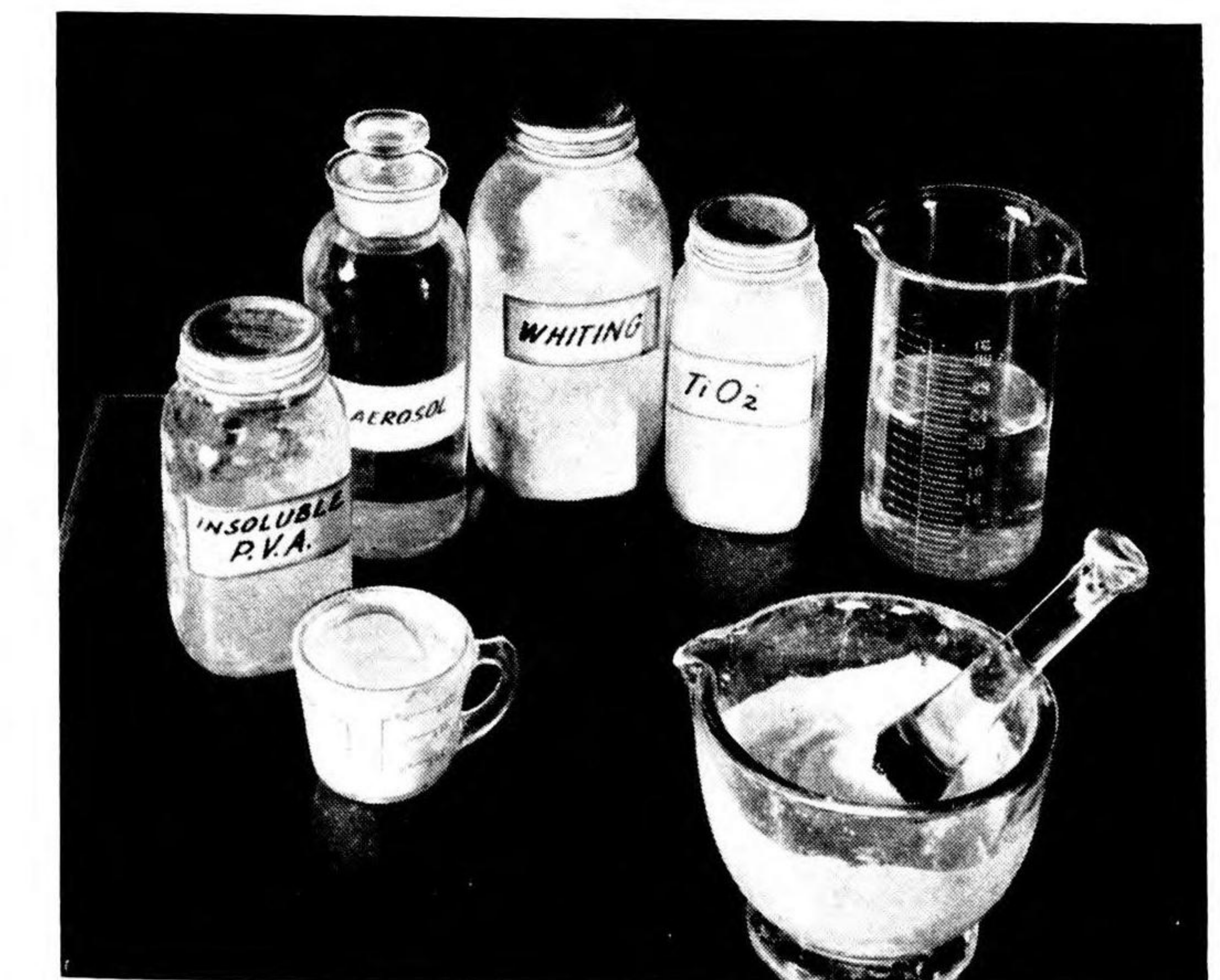
(d) Slight changes in positions of the registration blocks may now be necessary.

(e) Care taken at this time insures a minimum length of time spent later in fixing correct position of each model when put under the enlarger for exposure.

### SEALING THE MODELS

#### 27. Mixing PSM Sealer.

(a) PSM Sealer seals the surfaces of the pressed paper models, so that photographic solutions will not penetrate the surfaces.



Ingredients for the PSM are carefully ground with a mortar and pestle. See Section 27.

(b) Ingredients in the Sealer are: (1) Titanium dioxide ( $TiO_2$ ). (2) Whiting. (3) Insoluble Polyvinol Alcohol. (4) 1 per cent Aerosol.

(c) Place in mortar one cup of titanium dioxide;  $\frac{1}{2}$  cup of whiting; and  $1\frac{1}{2}$  cups of water. Grind with a pestle. At first, the mixture becomes frothy.



Continue grinding until the mixture looks like white cake icing, and has the character of thick cream.

(d) Place one cup of Insoluble PVA and  $\frac{1}{8}$  cup of Aerosol in mortar, and grind with pestle until thoroughly mixed.

(e) These two mixtures are thoroughly mixed together again with the mortar and pestle.

(f) Do not permit this Sealer to dry inside a spray gun. After each use, spray water through the gun to wash out the Sealer.

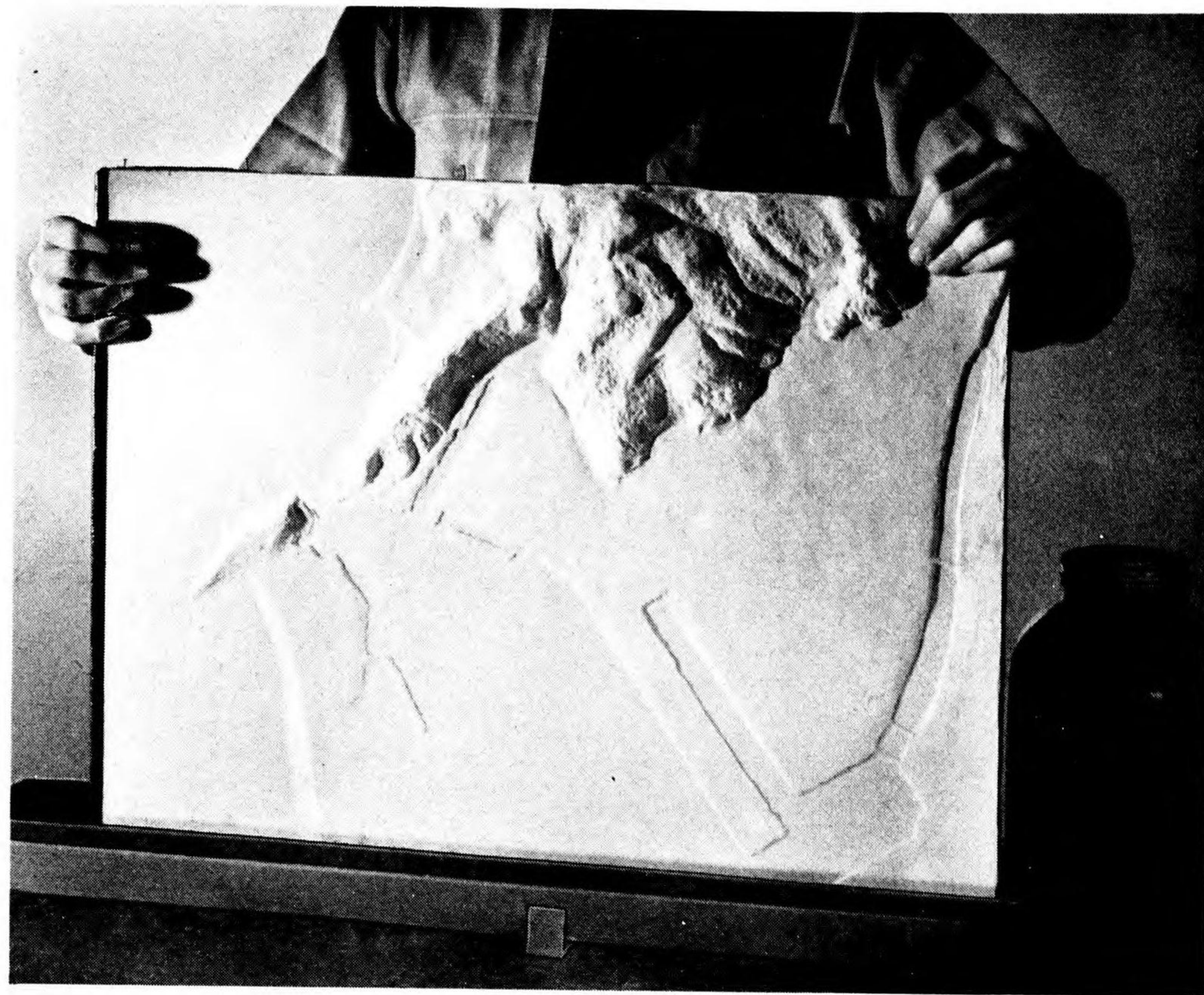
(g) Sealer does not satisfactorily "keep." Mix a fresh batch each time used.

(h) The above Sealer works satisfactorily in a spray gun with a 75 pound pressure. If a lower pressure is necessary, the Sealer may be thinned with water. Small amounts of water should be added—never more than  $\frac{1}{4}$  cup to the mixture described above.

(i) PSM Sealer is dead white. It serves to give a white surface to the models, no matter what the color of the Surface Molding Paper.

### 28. Applying PSM Sealer.

(a) Sealer is applied with any good-quality spray gun. The same type Paasche or Devilbiss gun used for Emulsion may be used for Sealer. But the same gun should not be used for both.



Base edges of the models are sealed by dipping them into a trough of black silk screen lacquer, to provide a one-quarter inch border. See Section 29.

(b) The fan-type spray is used when spraying Sealer.

(c) For sake of convenience, the models may be placed on a spray rack, inside a ventilated hood with a powerful exhaust fan.

(d) If possible, a special rack and hood should be provided for Sealer application, which is likely to be a messy process. Not photo-sensitive, Sealer may be sprayed in a lighted room.

(e) Two uniform coats of Sealer are sprayed onto each model. Models are dried in the convection dryer (temperature 100 to 120 degrees) after each coat.

(f) A thick coat is recommended, for the Sealer shrinks when drying. There must be no pin holes in the Sealer Coat. If there are weak spots in the Sealer coat, photographic chemicals penetrate, and spoil the model. Each tiny pin hole left unsealed is a potential large white spot.

(g) Spray is applied in horizontal strokes, beginning at the top of the model.

(h) Sealer is not permitted to dry inside the gun.

### 29. Sealing the Base Edges.

(a) After the surface of each model is thoroughly sealed and dried, the base edges are sealed.

(b) Recommended base edge sealer is black silk screen lacquer. If this is not available, another good lacquer may be used.

(c) The lacquer may be thinned slightly.

(d) It is applied by dipping the models into it. Lacquer should be placed in long trays or troughs.

(e) The models are dipped so that there will be a lacquer border of about one-quarter inch all around, on the face.

(f) Thus, there will be a thick coating of black lacquer on the face, on the outside of the base edge, and on the inside of the base edge.

(g) One dipping should be sufficient.

(h) When lacquer on the edges is thoroughly dry, Emulsion application may begin.

## PHOTO SENSITIZING AND EXPOSING MODELS

### 30. PSM Emulsion.

(a) PSM Emulsion is a special preparation developed by the Special Devices Division (Design Section) of the Bureau of Aeronautics.

(b) PSM Emulsion must be handled under a yellow-green (OA) safelight. Models coated with it must be treated as photographic printing papers are. They must be stored in light-tight cabinets.

(c) PSM Emulsion, furnished in dehydrated form, must be carefully prepared in accordance with directions in Section 31, and with directions accompanying Emulsion.

(d) Emulsion may safely be held in a melted state for two hours. After two hours, it begins to fog. Emulsion may safely be stored for one week, after melting, provided its temperature is lowered to 65 degrees F, and held there. This may be done by placing the emulsion in light-tight, non-metallic containers, and placing the containers in water at a temperature of 65 degrees. The water jacket of a developing unit will serve.

(e) After coated with an Emulsion, the model is put into convection dryer operating at a temperature of 100 to 120 degrees F. See 60 (c).

(f) Emulsion, after melting, must be stored in containers which are clean, light-tight, and chemically-inactive. Meeting these requirements are plain stoneware jugs, brown bottles, and thermos bottles.

(g) Absolute cleanliness in handling PSM Emulsion is imperative. All containers, thermometers, spray guns, and stirring rods must be kept spotlessly clean.

### 31. Preparing Emulsion.

(a) Specific instructions for preparation of PSM Emulsion accompany every shipment. However, a few general rules for its preparation are listed below.

(b) Complete cleanliness is a first requirement in handling the Emulsion.

(c) No metal—except stainless steel, chrome, or silver—may be permitted to touch the Emulsion.

(d) Emulsion should be stored and handled in containers of glass or of non-porous porcelain. Stirring rods should be glass or plastic. Metallic containers should be of chip-proof enamel.

(e) Temperatures specified in preparation directions must be carefully followed.

(f) Steps specified in directions must be followed—in the order given.

(g) PSM Emulsion gains in speed as it is held in a melted state. After it reaches maximum speed, it begins to fog.

(h) Control of Emulsion to fit special conditions of speed, contrast, hardness, etc., is possible, but is best learned under instruction by an experienced operator.

### 32. The Emulsion Gun.

(a) Emulsion is applied with a specified type of DeVilbiss or Paasche spray gun. See 60 (f) for description.

(b) The spray gun used for Emulsion is never used for other solutions.

(c) The Emulsion Gun must be kept clean. Emulsion dried inside it is impossible to remove, rendering the gun permanently useless.

(d) Satisfactory cleaning solution is made by dissolving a few drops of Aerosol in a beaker of water. After each use of the gun, its feed line is dipped into the beaker, and the water-and-Aerosol solution is sprayed for a few seconds.

(e) A spraying pressure of 90 pounds is recommended.



Without the fan turned on, the Emulsion Gun throws a jet-type stream onto the model. See 32 (h).

(f) The gun nozzle is held 12 to 18 inches from the model while spraying.

(g) The Emulsion Gun's volume adjustment is fixed to suit the wishes (and skill) of the operator.

(h) Without the fan turned on, the Gun throws a round, jet-type stream.



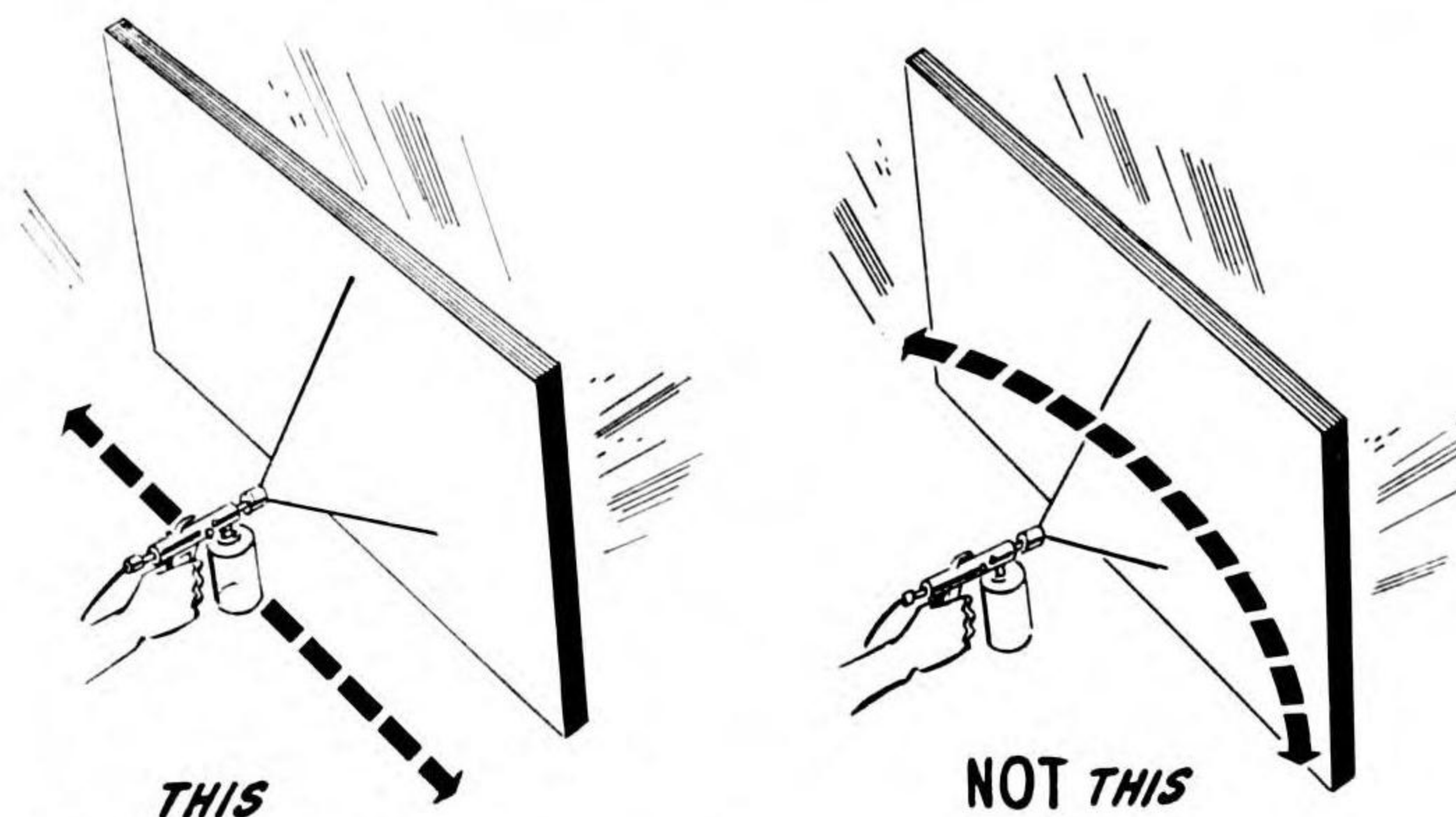
With the fan turned on, the Gun throws a fine flat stream, as though applied with a brush. See 32 (i).

(i) With the fan turned on, the Gun throws fine, flat stream, so that the Emulsion is applied as though applied with a flat brush. Further, the Gun's nozzle may be turned, so that this flat stream may be applied horizontally, vertically, or diagonally.

### 33. General Rules for Spraying Emulsion.

(a) A spray rack is used. See 60 (a).

(b) Emulsion is never applied so thickly that puddles form. No Emulsion should drain off. No runs or streaks are permitted.



The gun is moved as though it were on a horizontal track. Do not move the wrist. See 33 (c) and 33 (d).

(c) The Emulsion Gun is held so that the stream or spray of Emulsion is always perpendicular to the model. Move the gun as though it were on a horizontal track. Do not spray with the Gun held in one place by wrist movement alone.

(d) Do not make partial strokes across the model. Do not hesitate or stop during strokes. The spraying movement must be complete and continuous.

(e) Unless care is taken to prevent it, corners and edges of a model will get less than their share of Emulsion. Be sure the coating is uniform.

(f) The safelight, behind the photographer, must cast its rays over his shoulders, so that he may judge progress by direct reflection from the model's surface.

(g) A heavy coating (thoroughly wet) produces a glossy surface in the safelight's reflection. This gives a glossy surface when dry and the best photographic definition.

(h) A lightly-coated surface (merely damp) produces a semi-glossy surface in the safelight's reflection. Several coats of this surface are required for complete coverage. This gives a semi-matte surface when dry.

### 34. Learning to Spray Emulsion.

(a) Proper spraying of PSM Emulsion demands skill. Before attempting it, the photographer should practice with the Emulsion Gun.

(b) PSM Emulsion is white; it is sprayed onto a white surface; and spraying is done under a yellow-green (OA) safelight.

(c) Practice should be done with a thick mixture of whiting and water, or similar material. It should be sprayed onto white paper, under a safelight.

(d) Practice should be done with a thin, fan-type coat (with fan), and with a jet-type stream (without fan).

(e) Practice should teach application by horizontal movement of the Gun, with a 50 per cent overlap of the strokes, so that final coating is of uniform thickness.

(f) Part of the "feel" of the spray gun is the sound it makes when spraying. An experienced operator can tell by the sound how much emulsion is being thrown, and if emulsion is being thrown smoothly.

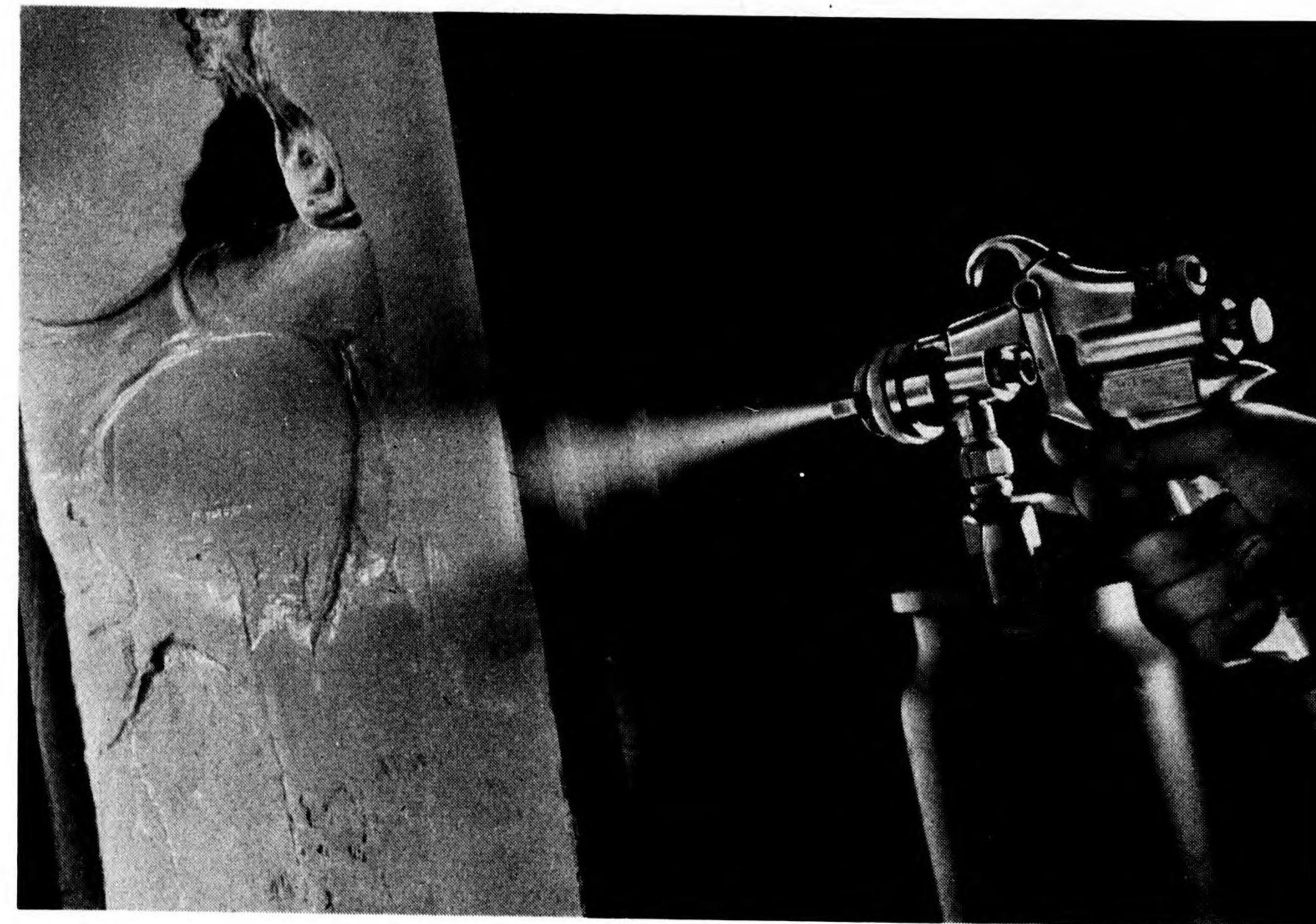
### 35. The First Coat of Emulsion.

(a) Sealer must be thoroughly dry before Emulsion is applied.

(b) The first coat acts as a "tooth" for the second coat.

(c) Precautions in Section 33 are followed.

(d) The first coat is lightly applied, in a fine spray. The Gun's fan is in operation, so that the Emulsion is in a thin, flat plane. It must not be permitted to form droplets. This condition indicates a too heavy coat. Once this condition is produced, the entire area of the model must be thoroughly



This shows how Emulsion should be sprayed onto the model in a thin, flat stream, giving a uniformly light coat on its surface. Runs and pools are avoided.

wetted with emulsion, and a glossy surface will result.

(e) This thin plane of Emulsion must be vertical to the Gun's horizontal movement. Thus, Emulsion is applied as though it were applied by the flat side of a brush.

(f) The coated models are put into a convection dryer, temperature 100 to 120 degrees F.

(g) In quantity production, all models are given a first coat at one time, and then are put into a light-tight cabinet, after drying.

(h) This first coat must dry before the second coat is applied.

### 36. The Second Coat of Emulsion.

(a) The second coat of Emulsion is wetter than the first. Precautions in Section 33 are followed.

(b) The model must be thoroughly coated, with a glossy surface. In the safelight's illumination, it should have a bright uniformly-wet sheen.

(c) The second coat is applied with a jet-type stream. The Gun's fan is not used.

(d) The Gun is moved just as in first coat application, with the stream of Emulsion perpendicular to the model's surface. The gun is held at least 18 inches away from the model's surface.

(e) The second coat must be of uniform thickness. This demands a high degree of skill.

(f) If extra-sharp definition and a glossy print effect on the finished model are desired, exposure may

be made after the second coat is applied and dried.

(g) After application of the second coat, the model is placed in the convection dryer.

### 37. The Third Coat of Emulsion.

(a) The third coat of emulsion is optional. Further, it requires the skill of an experienced spray gun handler.

(b) The third coat is lightly applied, with the Emulsion Gun's fan turned on.

(c) In the safelight's illumination, the third coat should appear without sheen, in a semi-matte effect.

(d) Under the safelight's reflection, the glossy sheen of the dried emulsion vanishes and a semi-matte surface replaces it as the fine fan spray is deposited.

### 38. Emulsion Application Refinements.

(a) Steep cliffs and mountains should be given a heavy coat—a third coat if only two coats are being used, or a fourth coat if only three are used.

(b) This extra coat is necessary, because these steep areas receive less light from the enlarger than flat areas. This is particularly true of steep areas facing away from the center.

(c) The experienced photographer learns how to supply an extra coat on the model on areas which (on the negative) are weak. He first makes a standard flat print of the same dimensions as the models to be produced. He determines, by examination of



Steep cliffs and mountains, particularly those which receive little light from the enlarger during exposure, should be given an extra-heavy coat of emulsion. See 38 (b).

the print, which negative areas are weak. He then applies extra emulsion to the corresponding model areas. This, however, is an advanced technique.

(d) In production, an experienced operator can deposit a single sufficiently heavy and even coating of emulsion to produce good quality results.

### 39. The Test Sheet.

(a) The test sheet (see Section 25) is coated with Emulsion in exactly the same manner as the models.

(b) After the Emulsion-coated test sheet has dried, it is cut into pieces two by six inches.

### 40. After Emulsion Has Been Applied.

(a) Models are dried in the Convection dryer.

(b) In dry climates, Emulsion-coated models may be stored in dry, light-tight cabinets for as long as a week.

(c) In humid climates, it is best to avoid storage periods of longer than a few hours.

### 41. Testing for Length of Exposure.

(a) The three copy negatives originally made are carefully examined, and the best selected for use.

(b) A standard photographic print is made from this negative on medium or number two enlarging paper. Careful study of the print reveals which areas

(if any) require special treatment, such as dodging.

(c) Test pieces are exposed to the Gray Scale. If desired, test pieces may also be exposed to a representative section of the terrain on the negative. These exposed pieces are carried through the development process for PSM—with no short cuts. The pieces are sprayed exactly as the final PSM will be.

(d) It may be necessary to make test pieces with each of the three negatives, to select the negative giving the proper contrast.

(e) Exposure time for the models is determined on a basis of these tests.

(f) One small area of each test piece is left completely unexposed, by covering it during exposure. This unexposed area serves as a check on chemical fog or light fog after development is completed.

(g) The same batches of Emulsion, developer, short stop, and hypo are used for both test pieces and models. This guarantees uniform results.

### 42. Calculating Exposure Time.

(a) The exposure time found satisfactory on test pieces is always increased for the models.

(b) If the terrain on the model is relatively flat, the satisfactory test-piece exposure time is increased by 10 per cent.

(c) If terrain is extremely rugged, exposure time is increased by 25 per cent.

(d) Graduations between 10 and 25 per cent are determined by the terrain's character.

(e) The photographer's judgment determines exposure time. Exposure time varies greatly, because of: (1) character and power of enlarger light source; (2) speed and quality of enlarger lens; (3) density of negative; (4) amount of enlargement; and (5) speed of emulsion.

(f) Greatest possible depth of focus is necessary. Because instead of projecting onto a flat plane (as on standard photographic printing paper), the projection is now onto a surface of varying altitudes. The lens is stopped down until both low and high areas on the model appear acceptably sharp.

### 43. Making the Exposure.

(a) Care with which Backing Boards were made and fitted and the accuracy of the registration blocks are all-important during exposure.

(b) For then: (1) Every model must be exactly the same height above the table. (2) Every model must be exactly parallel with the negative in the enlarger. (3) Every model must fit perfectly into the registration blocks.

(c) A final registration check may be made with the Emulsion-Coated model protected from the enlarger light by a Wratten G filter over the lens.

(d) The exposure is made.

(e) Immediately following exposure, the development process should be carried out. In production of many models, team work is recommended—half the team making exposures, and the other half following through with development and washing.

## THE DEVELOPMENT PROCESS

### 44. The Development Process Spray Gun.

(a) A simple, atomizer-type spray gun is used in applying developer, short stop, and hypo to the models. See 60 (d).

(b) The same gun may be used for all three solutions. Then, the solutions are kept in beakers, and the spray gun's feed line is dipped into each beaker when its solution is sprayed.

(c) Better is the use of three spray guns. To each is attached a glass jar containing the proper solution.

(d) A spraying pressure of about 40 pounds is used for all three solutions.

### 45. Preparing the Developer.

(a) Standard D-72 should be prepared while Emulsion is drying on models, so that it will be ready for use immediately following exposure.

(b) Formula for PSM Developer: Dilute one quart of D-72 Stock Solution in two quarts of distilled water. To this solution add (1) 20 milliliters of 1 per cent Aerosol, and (2) 20 drops of 10 per cent Potassium Bromide.

(c) In ordinary temperatures, the above solution will be satisfactory.

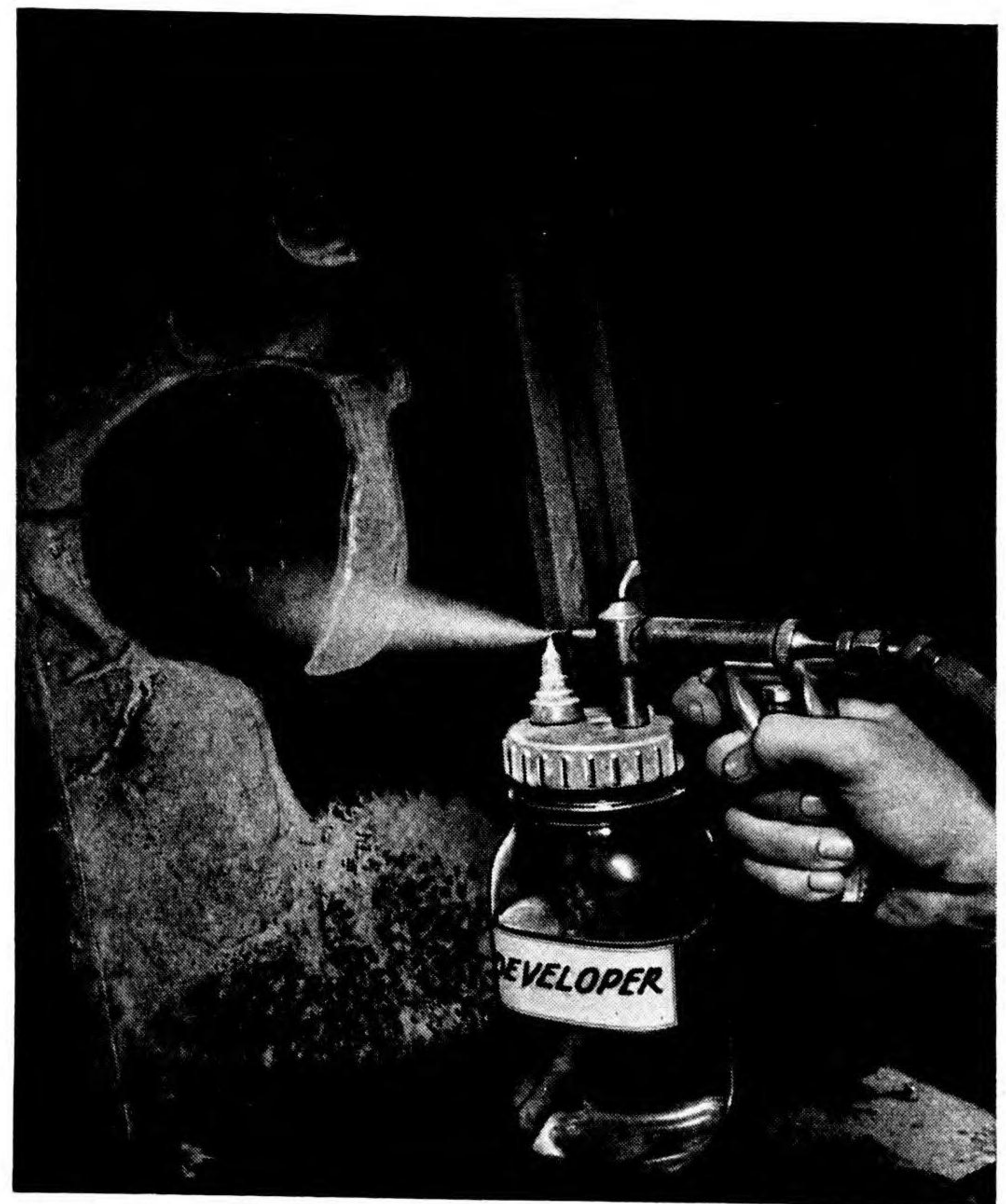
(d) If the laboratory temperature exceeds 80 degrees, add one ounce of Sodium Sulfate ( $\text{NaSO}_4$ ) to each 16 ounces of the above solution, and stir until dissolved.

(e) For directions on altering this developer to suit special conditions, see 56 (g).

(f) Sufficient developer must be prepared so that all test pieces and all models will be developed with the same batch. Otherwise, uniform results cannot be achieved.

### 46. Applying the Developer.

(a) Developer is sprayed with horizontal movement of the gun, beginning at the bottom, so that runs and streaks are prevented.



The model's surface is flooded with developer. Models must not be dipped in developer. See Section 46.

(b) The model's surface is flooded with developer.

(c) Stagnant developer, permitted to gather, produces brown stains in a few seconds' time.

(d) The developer must reach all valleys and cliff sides.

(e) The photographer's judgment determines when development has been carried far enough. Incomplete development produces weak photographic tones. Excessive development produces chemical fog.

(f) Do not attempt dipping models into trays of developer (or other solutions). All efforts at this short cut have failed. Air bubbles are always imprisoned in low areas. Further, no check on development is possible when dipping.

(g) When development is complete, the model's surface is immediately flooded with short stop.

#### 47. Applying the Short Stop.

(a) Short stop is made by mixing one part of 28 per cent acetic acid and 20 parts of water.

(b) The short stop is sprayed onto the model's surface until it is thoroughly and evenly flooded. Short stop must reach all valleys and cliffs.

(c) If the emulsion is soft and fragile to the touch at this stage (as may occur if laboratory temperature is above 80° F.), an alternate short stop can be made by adding one part of 10 per cent formaldehyde solution to each 20 parts of the above short stop.

#### 48. Applying Hypo.

(a) Standard F-5 fixer is used. To accelerate its action, ammonium chloride (NH<sub>4</sub>Cl) is added. The ammonium chloride added should be equal to one-fourth the amount of solid hypo in the solution.

(b) Spraying should reach all valleys, cliffs, etc., on the model when it is flooded with the fixing agent.

(c) After about 30 seconds of hypo fixing, white lights may be turned on. Then, spraying continues for an additional four or five minutes.

(d) Incomplete fixation is indicated by areas of slightly pinkish or yellowish cast. These turn purple when exposed to strong light. There is no remedy for these errors—and they must be avoided by thorough fixation and careful checking under a brilliant white light. It is well to turn off the OA safelights at this stage, because the reflection from the safelight may be mistaken for an unfixated area.

#### 49. Washing and Drying the Finished Model.

(a) When fixing is completed, the model is gently washed with water in a hose spray.

(b) Water must reach all parts of the model. A poorly-washed model will bleach within a few

days. During washing, the model is revolved 90 degrees periodically to insure thoroughness.

(c) After washing, the model is dried in the convection dryer.

(d) A rough-and-ready test for washing of operational models (if they are to be used for only a few weeks) is to taste the surface of the model with the tongue. A slight characteristic taste of hypo indicates incomplete washing.

#### 50. Final Steps in Finishing.

(a) The finished, dried Photo Surface Model is actually a photographic print.

(b) In temperate climates, no further treatment need be given, unless models are given rough use.

(c) If models are given rough use or if used in damp climates, photographic surfaces should be coated with Eastman's Print Lacquer, applied with a spray gun. This lacquer does not change the model's color.

(d) Protection on the models' backs (which is recommended in all climates) is provided with black lacquer, brush-applied or with a hard jet from the gun. See black lacquer directions, Section 29.

### SPECIAL NOTES

#### 51. Refinements in PSM Techniques.

(a) This manual does not attempt to describe all possible techniques which may be used in PSM production. Further, because techniques are so new, many improvements in PSM will be made in months immediately following this manual's publication.

(b) Personnel producing PSM will devise improvements of their own. Large production units will devise special production processes.

(c) Experienced photographers may wish to make such improvements as recreating original geometry of single prints or making controlled mosaics, for the Photo Original.

(d) The possible combinations of papers and adhesives for model production are vast in number.

(e) Photo Surface Models have been successfully used as guides for application of colored, textured surfaces.

(f) When used with proper sealers, undercoats, and control materials, PSM Emulsion can be coated on almost any type of material.

(g) Among improvements in PSM which may become the subject of development for field use are:

(1) Production of original models and photographic images by stereo projection.

(2) Visible indicators of emulsion thickness.

(3) Brush-applied local color toners.

(4) Full, natural-color printing of terrain detail from aerial color film.

(5) Flexible emulsions which can be coated on elastic materials.

(6) Methods of brush-applying emulsions and processing solutions.

(7) Addition of new photographic images, when more complete coverage becomes available, over already-printed Photo Surface Models.

(8) Optical and mechanical devices for producing terrain models directly from stereo photographs.

(9) Use of thermo-plastics, with heated male and female molds, for rapid production of terrain models in large quantities.

#### 52. Making Extra Negative Molds.

(a) If many paper models of a single area are to be produced, several Negative Molds are necessary to permit speedy production.

(b) Then it is necessary to produce one Positive Mold in plaster. This is an exact reproduction of the original clay model. From this Positive as many Negative Molds as necessary are cast.

(c) First, the Negative Mold is given two coats of shellac.

(d) Over the shellac, a thorough coating of soap is applied. Green or soft soap is best. Laundry soap, if soaked in warm water until very soft, is satisfactory.

(e) The soap is applied all over the Negative Mold's surface with a brush. Excess soap is removed from the brush by squeezing the brush dry between the fingers.

(f) Air bubbles are removed from the soapy surface by rubbing gently over it with a clean sponge. Squeeze out the sponge frequently. Never wash the sponge in water.

(g) The soapy surface must be evenly coated. It should have a dull sheen.

(h) A rough wooden frame is built around the soaped model, similar to the frame built around the clay model for the original production of the Negative Mold.

(i) Liquid plaster is gently poured in. Directions for Negative Mold production are followed.

(j) The plaster is permitted to set. Boards of the frame are removed, and the new Positive Mold is lifted off the Negative.

(k) This Positive, which may be used as often as necessary, is shellaced.

(l) Each time the Positive is used, it must be given a fresh coating of soap. Because, when plaster is poured over plaster, there must be (to prevent sticking) a layer of soap between the layers of plaster.

(m) A mold used for paper castings, however, must have a dry-shellaced surface—free of all soap.

#### 53. Size Limits of Models.

(a) There are three limitations on the maximum size of models:

(1) Enlarging capacity of the enlarger.

(2) Size of the spray hood and other equipment.

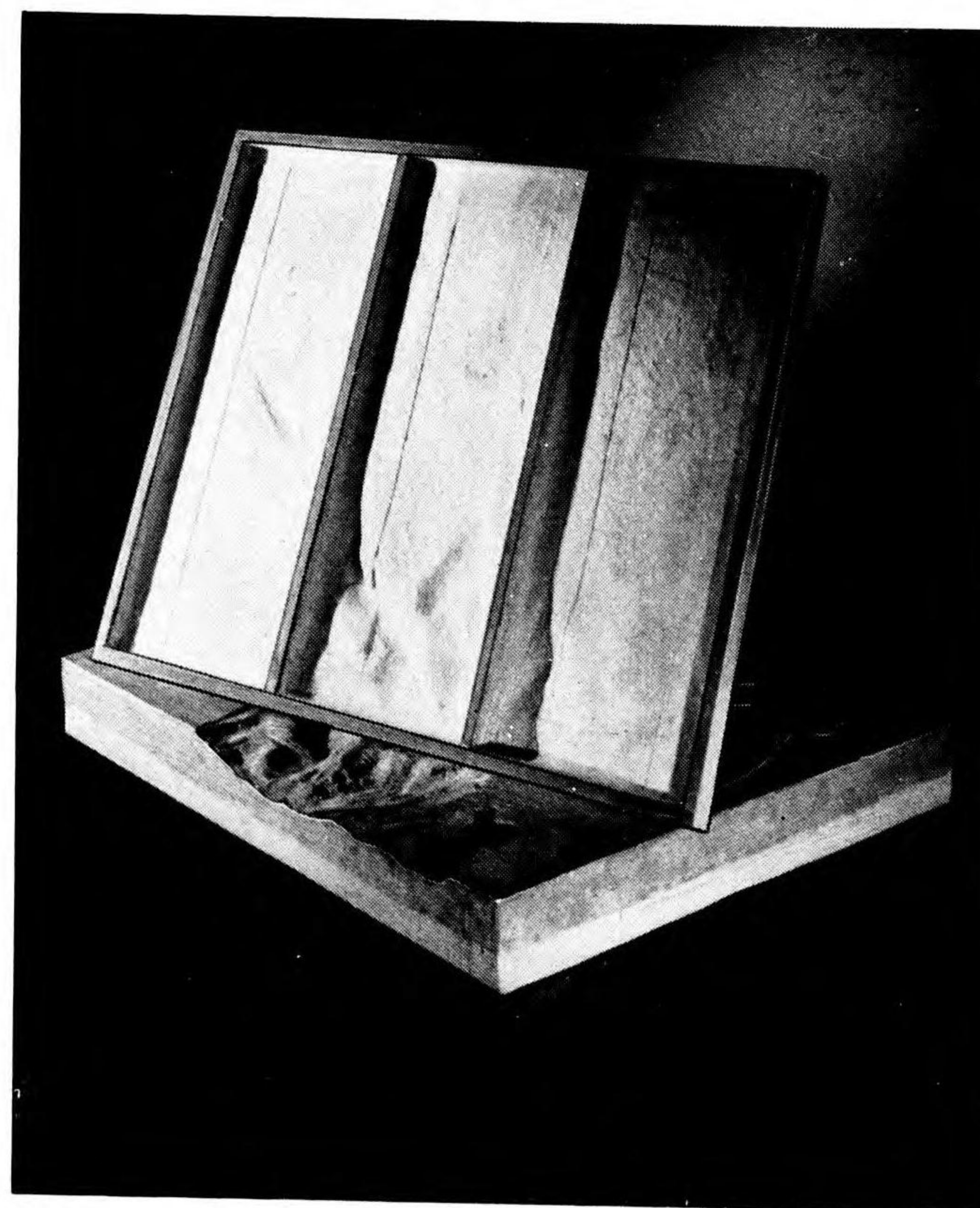
(3) Quality of Photo Original.

(b) Most successful scales for PSM are within the range of 1:5000 to 1:20,000.

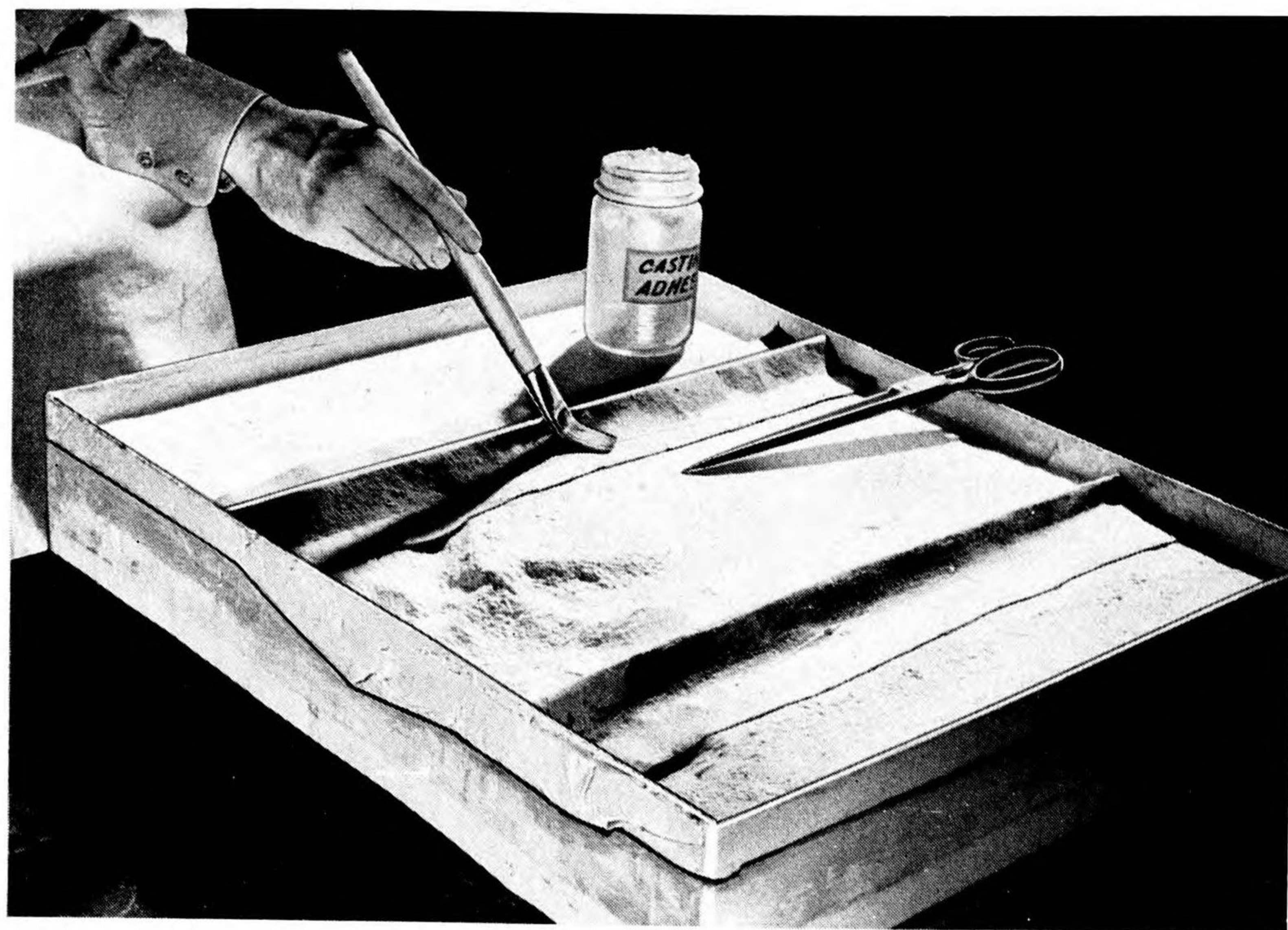
(c) Models longer or wider than 24 inches usually require some extra reinforcement in the backs. Type and amount of reinforcement is determined by the model maker's judgment.

(d) Usually, long strips of Backing Paper, soaked in Casting Adhesive and formed into inverted V-shaped supports, provide sufficient support in the backs of models.

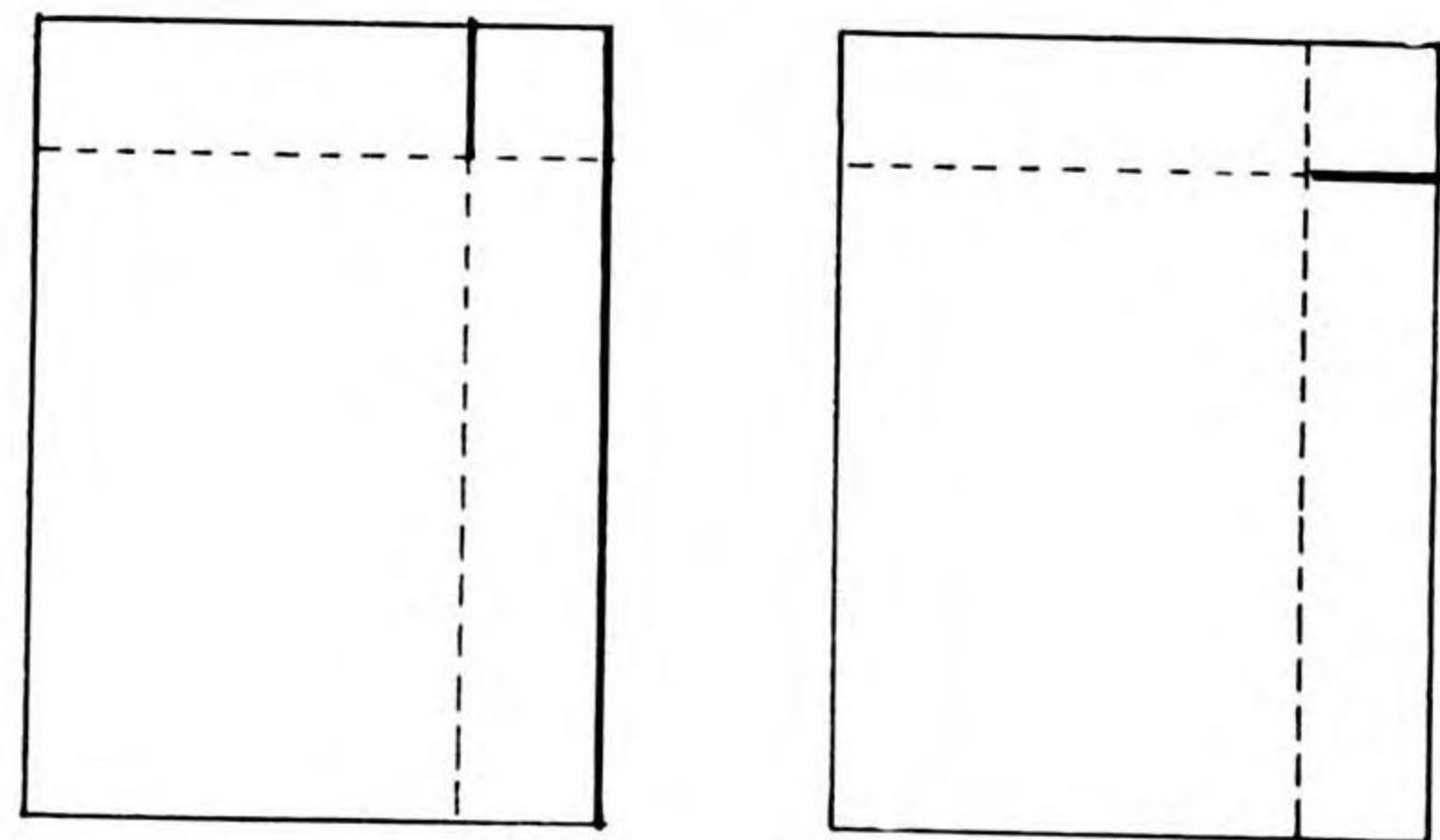
(e) Extra-large models may be reinforced with thin strips of lightweight wood in their backs.



This large model was reinforced in the back with thin strips of wood, a useful method. See 53 (e).



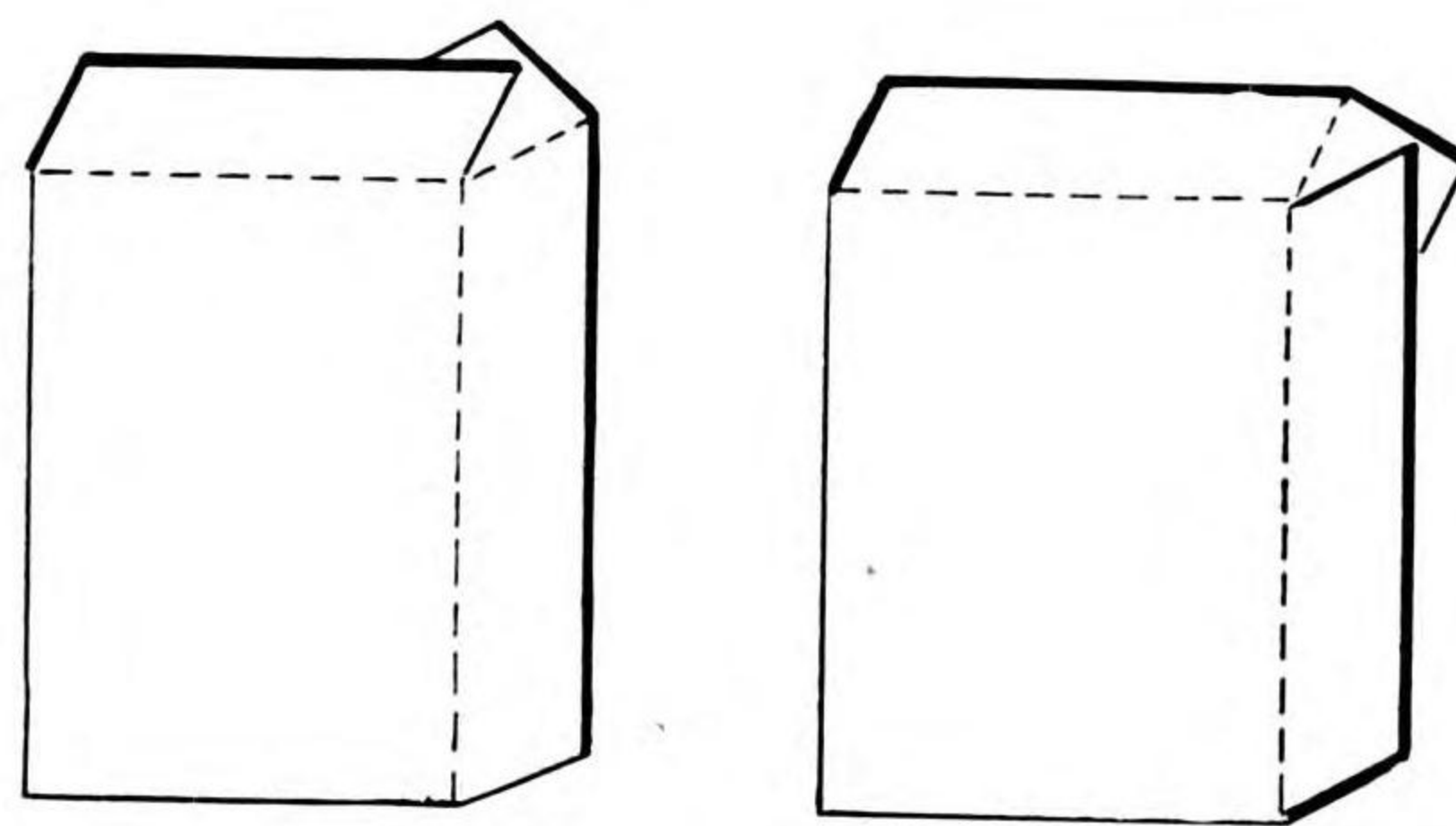
This model is being reinforced with strips of water-soaked paper formed into inverted V-shaped supports. The strips strengthened with Casting Adhesive. See 53 (d).



#### 54. Corners on Models.

(a) Improperly constructed corners on pressed paper models are often a source of trouble.

(b) Corners should be formed after all three layers of paper and all three layers of Casting Adhesive have been applied, at the same time the base edges are formed. Note the accompanying sketches.



#### 55. Mounting Prints.

(a) Single prints are handled by dry mounting.

(b) Mosaics should be laid on tempered Masonite. Extra-large mosaics should be laid on Vehisote.

(c) Insoluble Polyvinol Alcohol is a good non-warp adhesive for mounting mosaics.

(d) The novice should not attempt to lay a mosaic larger than six to eight prints. Errors are cumulative, and large errors which cannot be corrected soon appear.

(e) Adhesive is spread on the backs of prints. The prints are carefully placed in position, and then pushed and stretched to proper register while still wet.

(f) Excess adhesive and air bubbles are squeezed out with a piece of acetate. The acetate should be about two inches square and  $\frac{1}{16}$  inch thick. Its edges and corners should be carefully rounded and smoothed. A little practice makes the photographer proficient in mounting.

(g) If areas of the still-movable prints require



shrinking to match detail, a stream of warm air—from a regulation electric hair dryer—will do the job.

(h) Before it dries, every bit of adhesive on the mosaic's surface must be sponged off.

(i) When the print or mosaic is thoroughly dry, titles, scales, symbols, and desired retouching are added by conventional methods.

#### 56. Trouble Shooting.

(a) If the unexposed white area on the test piece (see 41 (f) for instructions) shows veil or fog, the cause is probably one of the following: (1) improper preparation of emulsion; (2) improper safelights; (3) defective plating of spray gun; (4) contamination of the emulsion; (5) fogging effect of old emulsion in some container or implement; (6) light leaks in the darkroom or dryer; (7) excessively long storage of emulsion, either melted or chilled.

(b) Purple stains on finished models (after exposure to white light) indicate improper fixing.

(c) Slow fading (or bleaching) over a period of several days indicates incomplete washing.

(d) Fast fading (or bleaching) over a period of several hours indicates both incomplete washing and incomplete drying.

(e) In the tropics, models may absorb dampness. Under such conditions, models should be thoroughly dried, and then coated on back and front (see Section 50).

(f) If PSM Emulsion fails to produce rich blacks, the Emulsion needs a few additional minutes of heating—not above 150 degrees F. Or, better, the Emulsion may be permitted to stand overnight at room temperature. Or additional "C" solution may be added to the Emulsion, a few drops at a time, until the desired brilliance is obtained by actual test.

(g) It is sometimes possible to save a batch of models already coated with an emulsion which shows, on the test piece, signs of fogging. This is done by using a special developer. See PSM Anti-fog Developer on p. 32.

### EQUIPMENT AND SUPPLIES

#### 57. Equipment for Model Making.

(a) The model maker producing PSM needs the following hand tools: claw hammer, saw, screw driver, shears, glass cutter, modeling tools, and pocket knife.

(b) If available, a jig saw is useful in cutting cardboard contours.

(c) Stencil brushes, a typewriter brush (with stiff bristles) and miscellaneous paint brushes (for applying Casting Adhesive) are needed.

(d) Hardware requirements are: hinges, hasps, screws and nails.

(e) Containers needed are: a large bucket for mixing plaster, graduates, a mortar and pestle, and miscellaneous tin cans and glass jars.

(f) A tray in which edges of models can be lacquer-dipped is needed. See p. 20.

(g) Any good quality paint spray gun will serve for applying PSM Sealer. See 28 (a).

(h) A supply of lumber, plywood, sandpaper, and single-weight glass is useful.

(i) Useful is a model-dryer for speeding drying of models after their removal from the Negative Mold. See p. 19.

#### 58. General Photographic Equipment.

(a) A well-equipped photographic darkroom is necessary. (See Section 59.)

(b) A good quality, accurate copy camera, with good process lens and lights, is necessary.

(c) For copy negatives, Panatomic X or Isopan is recommended, and for positive transparencies, Contrast Process Ortho.

(d) A Weston Dial-Type thermometer (stainless steel), standard Navy equipment, is best for PSM.

(e) Light-tight, chemically-inert, non-metallic containers are necessary for storing Emulsion.

(f) Several quart or gallon size thermos flasks are needed to hold melted Emulsion during spraying. Emulsion is fed to the Emulsion Gun through rubber tubing.

(g) An electric stirring machine, with plastic beater, operating at 150 to 200 R.P.M., is used for stirring Emulsion.

(h) A temperature-controlled hot plate is necessary.

(i) A Temprite Developing Unit (No. PD-20) is useful for maintaining PSM processing solutions and Emulsion at desired temperatures.

#### 59. Enlarger for PSM.

(a) The enlarger used in PSM production serves two purposes: (1) a guide for the modeler in preparing the clay Original Model, and (2) a standard enlarger in projecting the photographic image on the sensitized paper models.

(b) The size of the enlarger is determined by the negative size used. The 8 x 10 negative is recommended. A 4 x 5 can produce acceptable results.

- (c) The enlarger must retain accurate alignment.
- (d) It must have a fine quality, process lens.
- (e) It must have a powerful light source, with good visual and actinic qualities. Condensers are preferred, because they produce a brilliant illumination.

(f) Most important, the enlarger's cooling system must be sufficient to prevent warping of the positive transparency during long periods of time. For the enlarger must be in operation while the clay Original Model is being made on the enlarger table.

### 60. Spraying Equipment.

(a) A darkroom, with spray booths and a good exhaust fan, to carry off fumes, is necessary for spraying emulsion and processing solutions. The series OA safelights must be placed so that they are behind the operator's head during spraying. Then,

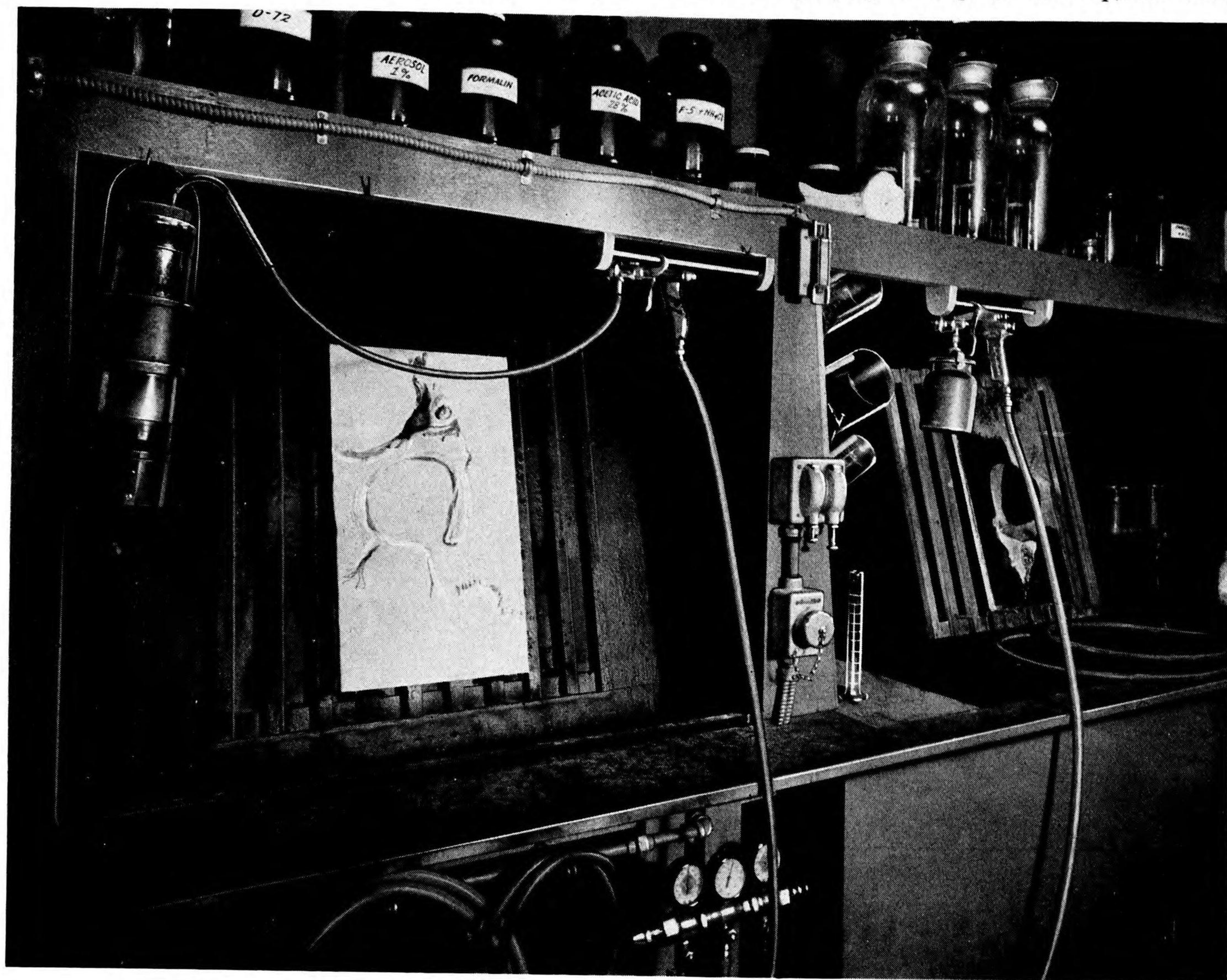
the light from them is reflected off the wet surfaces of the models during spraying, this reflection being the best guide to spraying progress.

(b) Another spray room should be provided for spraying Sealer, print lacquer, and silk screen lacquer.

(c) The convection dryer, providing good circulation of air at 100 to 120 degrees F., should be large enough to accommodate all models being produced at one time. The dryer should be in the darkroom, near the spray booth.

(d) Any good three-horsepower compressor will serve for spraying. Pressure control valves, to reduce compressor pressure to spraying pressure, should be convenient for adjustment by the operator during spraying.

(e) Three simple, atomizer-type spray guns are needed for spraying developer, short stop, and fixer.



This is a spraying room for production of PSM. The control valves for the compressed air are easily reached. Racks provide support for models during spraying. See Section 60.

The guns should have plastic-solution tips, and the tips' openings may, if desired, be enlarged to permit greater capacity. Each gun should be equipped with a glass jar.

(f) The Emulsion Gun may be either the Paasche CUB-PO-12 (manufactured by Paasche Airbrush Co., 1909 Diversey Parkway, Chicago, Ill.) or the DeVilbiss MBCX (manufactured by the DeVilbiss Co., Toledo, Ohio). Interior parts of these guns should be chrome-plated, to prevent the emulsion's coming into contact with other metal. The Emulsion Gun should be used for no other solution.

(g) Any good quality paint spray gun may be used for spraying Sealer, print lacquer, and silk screen lacquer.

### 61. Expendable Materials for PSM Production.

(a) Special PSM materials required are:

- |                                 |                                      |
|---------------------------------|--------------------------------------|
| (1) Surface Molding Paper       | (4) PSM Emulsion                     |
| (2) Backing Paper               | (5) Polyvinol Alcohol (Type B-391-A) |
| (3) Insoluble Polyvinol Alcohol |                                      |

(b) Cardboard for contours may be purchased from an art supply store or from a paper house.

(c) Obtainable in a hardware-and-paint supply store are:

- |                |                                          |
|----------------|------------------------------------------|
| (1) Alcohol    | (9) Titanium dioxide (TiO <sub>2</sub> ) |
| (2) Dextrine   | (10) Whiting                             |
| (3) Glass      | (11) Black silk screen lacquer           |
| (4) Green soap | (12) DuPont 5448 Cement                  |
| (5) Hydrocal   |                                          |
| (6) Plaster    |                                          |
| (7) Plywood    |                                          |
| (8) Shellac    |                                          |

(d) Obtainable in photographic and chemical supply stores are:

- |                             |                         |
|-----------------------------|-------------------------|
| (1) Aerosol Chloride        | (7) Gray Scale Acid     |
| (2) Ammonium Chloride       | (8) Hydrobromic Acid    |
| (3) Benzotriazole           | (9) Neutral Density Dye |
| (4) D-72 Developer          | (10) Potassium Bromide  |
| (5) Eastman's Print Lacquer | (11) Sodium Sulfate     |
| (6) F-5 Fixer Ingredients   |                         |

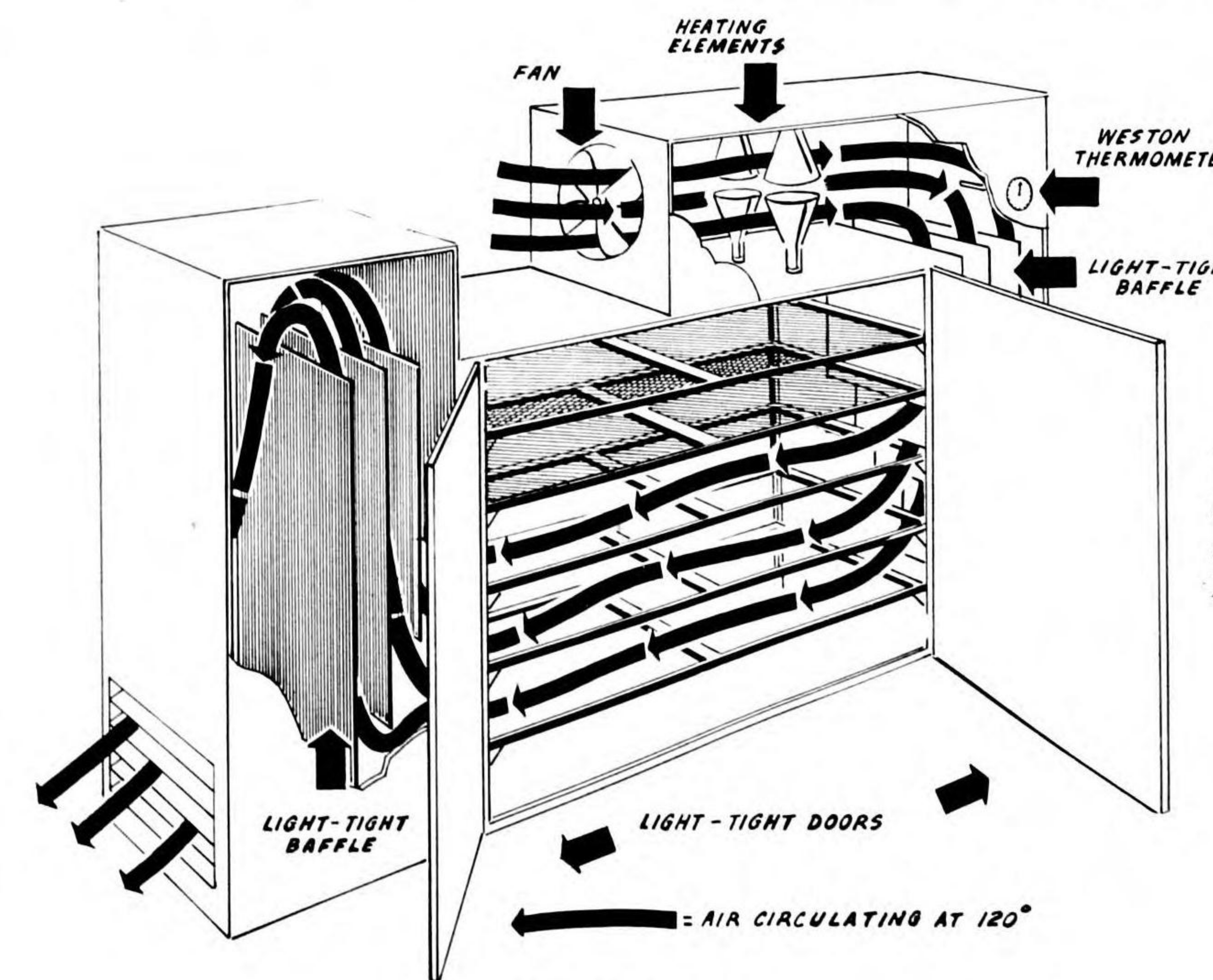
(e) For positive transparencies, Contrast Process Ortho film is recommended. For copy negatives, Panatomic X or Isopan is recommended.

(f) For production of white modeling clay, the following materials are needed: white vaseline, white beeswax, paraffin, kaolin, and titanium dioxide. See p. 33.

### 62. Reference Manuals.

(a) The PSM production unit should have a book on photography. Recommended are *Kodak Reference Book* or *Photographic Chemicals and Solutions*, both published by the Eastman Kodak Co.

(b) Many good manuals on terrain model making are available. Among them are: *Manual of Model Making*, published by the Amphibious Training Command, U. S. Atlantic Fleet, Restricted; *Manual For The Use And Construction of Terrain Models*, published by the Air Intelligence Group, Office of the Chief of Naval Operations, U. S. Navy, Confidential; and *Landfall Relief Models*, published by the Special Devices Division, Bureau of Aeronautics, U. S. Navy, Restricted.



This sketch suggests the type of light-tight convection dryer for models after Emulsion-application and developing. See 60 (c).

## FORMULAS

### Backing Paper.

Because it must provide strength for the cast model, the Backing Paper must be a tough, long-fibre paper which dries stiff. It must be free of chemicals which might inhibit action of photographic chemicals applied.

### Surface Molding Paper.

Because it must carry detail of the terrain, the Surface Molding Paper must be a soft, long-fibre paper which, when wet, acquires the molding quality of papier mache. It must be free of chemicals which interfere with the action of the photographic chemicals applied.

### Short Stop.

28% acetic acid..... 1 part (by volume).  
Distilled water ..... 20 parts.

### PSM Fixer.

Water, about 125 degrees F..... 20 ounces.  
Sodium thiosulfate (hypo)..... 8 ounces.  
Sodium sulfite, dessicated..... 1/2 ounce.  
Acetic acid (28% pure)..... 1 1/2 fluid ounce.  
Boric acid, crystals..... 1/4 ounce.  
Potassium alum ..... 1/2 ounce.  
Ammonium chloride ..... 2 ounces.  
Cold water to make..... 32 ounces.

This is the standard F-5 fixing bath with the addition of the ammonium chloride.

### PVA-Dextrine Powder.

Polyvinol Alcohol (Type B-391-A)... 1 part (by volume).  
Dextrine ..... 1 part.

The above are thoroughly mixed, and stored dry in glass jars. May be kept indefinitely.

### Shellac.

All shellac used in PSM is thin. Mix at least one part of alcohol (by volume) with one part of liquid shellac.

### Plaster, liquid.

See Section 13 for mixing directions.

### Casting Adhesive.

PVA-Dextrine Powder ..... 1 part (by volume).  
Water ..... 10 parts.  
Plaster or Hydrocal..... sufficient.

Heat water to 180 degrees F. Continue heating while stirring in Powder until dissolved. Boiling does no harm. Be sure all powder is dissolved. Let cool. Stir in sufficient Hydrocal or plaster to give the consistency of thick cream. Use this Adhesive immediately. Mix in small batches. This Adhesive sets. Mix only in glass jars. Do not permit metal to touch it.

### PSM Developer.

D-72 Stock Solution..... 1 quart.  
Water ..... 2 quarts.  
1% Aerosol ..... 20 milliliters.  
10% Potassium Bromide..... 20 drops.

If laboratory temperature exceeds 80 degrees F., add 1 ounce of Sodium sulfate to each 16 ounces of the above solution.

### D-72 Developer Stock Solution.

Water, about 125 degrees F..... 16 ounces.  
Elon ..... 45 grains.  
Sodium sulfite, dessicated..... 1 1/2 ounces.  
Hydroquinone ..... 175 grains.  
Sodium carbonate, dessicated..... 2 1/4 ounces.  
Potassium bromide ..... 27 grains.  
Water to make..... 32 ounces.

### PSM Anti-fog Developer.

D-72 Stock Solution..... 16 ounces.  
Water ..... 16 ounces.  
10% Potassium Bromide..... 2 ounces.  
2% Benzotriazole ..... 2 ounces.  
10% Hydrobromic Acid..... 1/2 ounce.  
1% Aerosol ..... 2 ounces.  
Sodium sulphocyanate ..... 100 grains.

If laboratory temperature exceeds 80 degrees F., add 1 ounce of sodium sulfate to each 16 ounces of the above solution.

## FORMULAS

### PSM Sealer.

Titanium dioxide ..... 1 cup.  
Water ..... 1 1/2 cups.  
1% Aerosol ..... 1/8 cup.  
Whiting ..... 1/2 cup.  
Insoluble Polyvinol Alcohol..... 1 cup.

With mortar and pestle, grind titanium dioxide, whiting, and water until the mixture looks like cake icing, and has the consistency of cream. Then, add Insoluble PVA and Aerosol. Resume grinding until thoroughly mixed. See Section 27.

### White Modeling Clay.

Refined (white) vaseline..... 5 pounds.  
Refined (white) beeswax..... 1 1/2 pounds.  
Paraffin ..... 1/4 pound.  
Titanium dioxide ..... 1 pound.  
Refined (white) kaolin..... 12-15 pounds.

Melt the vaseline in a double boiler. Stir in beeswax, paraffin, and titanium dioxide. Stir in kaolin. This clay, which may be used repeatedly, improves after aging a few days.

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GAZETTEERS

Gazetteers serve an extremely useful purpose particularly in unfamiliar areas and countries where place-names are transliterations: Following is a selected representation of list of published and to be published gazetteer coverage - with names in English.

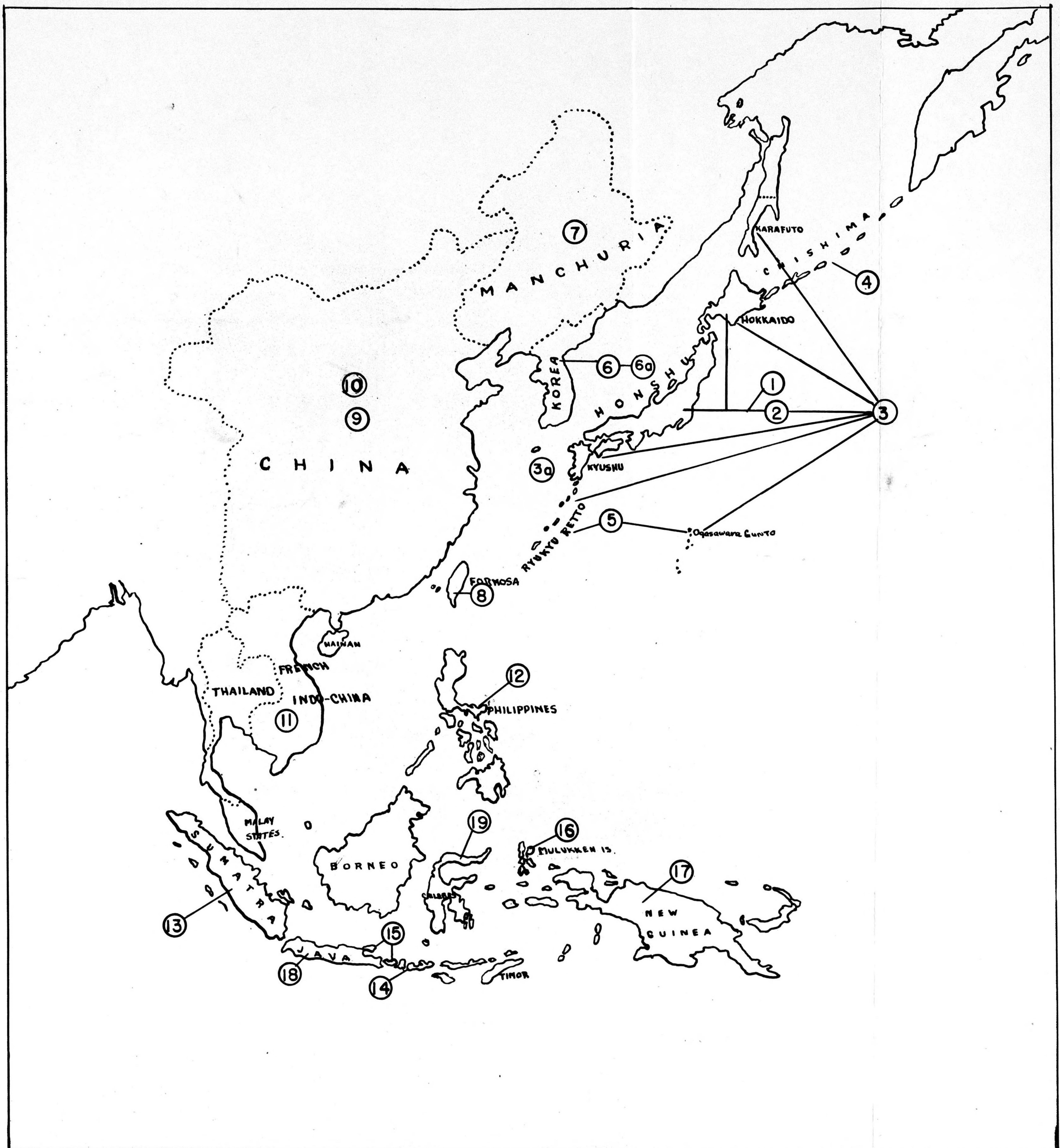
- |                   |     |                                                                                                                                                                         |
|-------------------|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Japan             | 1.  | Gazetteer of Japanese Place Names, Stanley Gerr, Harvard University Press.                                                                                              |
| Japan             | 2.  | Gazetteer of Japanese Empire. H.O. Pub. No. 880.                                                                                                                        |
| Japan             | 3.  | Gazetteer to maps of Japan (based on 1:250,000) AMS 202292.                                                                                                             |
| Japan             | 3a. | Gazetteer to maps of maps of Kyushu (based on 1:50,000) AMS 202325.                                                                                                     |
| Japan             | 4.  | Gazetteer to maps of Chishima-Retto AMS 201057.                                                                                                                         |
| Japan             | 5.  | Gazetteer to maps of Ryukyu-Retto and Ogasawara Gunto AMS 202290.                                                                                                       |
| Korea             | 6.  | Place names Index for Korea (Chosen) AMS 200638.                                                                                                                        |
| Korea             | 6a. | Gazetteer to maps of Korea (based on 1:250,000) AMS 201280.                                                                                                             |
| Manchuria         | 7.  | Manchuria - projected AMS.                                                                                                                                              |
| Formosa           | 8.  | Gazetteer to maps and charts of Formosa (Taiwan) AMS 201543.                                                                                                            |
| China             | 9.  | Gazetteer of Chinese Place Names (Ting Atlas) AMS 201191.                                                                                                               |
| China             | 10. | Gazetteer of Chinese Place Names (1:250,000 series) AMS projected.                                                                                                      |
| French Indo-China | 11. | None                                                                                                                                                                    |
| Philippines       | 12. | Gazetteer of maps of the Philippine Islands AMS 200973.                                                                                                                 |
| Sumatra           | 13. | Gazetteer of maps of Sumatra AMS 201058.                                                                                                                                |
| Lesser Sunda      | 14. | Gazetteer of maps of Lesser Sunda Islands AMS 200930.                                                                                                                   |
| Madura Bali       | 15. | Gazetteer to maps of Madura and Bali AMS 200643.                                                                                                                        |
| Molukken Is.      | 16. | Gazetteer to maps of Molukken Islands AMS 201209.                                                                                                                       |
| New Guinea        | 17. | Gazetteer to maps of New Guinea AMS 200644.                                                                                                                             |
| Java              | 18. | Java and Madura - A.C. of S, G-2, Hq. U.S.A.F. F.E. Directory of Geographic Place Names - Section VI.                                                                   |
| Celebes           | 19. | Gazetteer (no. 5) Celebes - H.O. Pub. No. 885.                                                                                                                          |
|                   | 20. | Though not gazetteers the following four publications are extremely useful in the handling of maps of the Far East Area.<br>a. "Glossary of Selected Map Terms Relative |

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- to Authorities, Dates, Scales, Editions  
and Locations in Foreign Text Maps."  
AMS 200960.
- b. "Symbols appearing on Original Japanese  
Maps of all scales ....", AMS 201542 -  
excellent new publication.
  - c. "Symbols appearing on Original Chinese  
Maps". AMS 200645.
  - d. "Legends for Netherlands Indies Topo-  
graphic." AMS 200529.

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MAP INDICES

1. The ordering, selection and foundation of all map and chart work depends fundamentally upon indices. Indices involve two constant activities viz. the maintenance of them in respect to new sheets in existing sets - the maintenance of them in regard to new sets. In any map work on the Far East there are four fundamental indices:

- a. The Army Map Service Indices of published sheets.
- b. The Aeronautical Chart Service Index
- c. The U.S. Hydrographic Office Index to Aviation Charts and Publications.
- d. The U.S. Hydrographic Office Index to H.O., B.A. and Restricted Charts.

2. Map Indices are never static - they go through a constant cycle of growth, and set maturity to obsolescence with new generations of maps being conceived, having gestation and birth. It is of utmost importance to carefully record these cycles. This can most easily be done by ticking the indices in colors for which an arbitrary Key has been established.

3. The peculiarities of the above mentioned indices follows:

a. Army Map Service Indices -

- (1) All AMS index sheets are the same size 10 $\frac{1}{2}$ " x 20" and can be obtained bound in cardboard covers.
- (2) Under the AMS system the world is divided into Theaters which are designated by letters. These theaters are further broken into numbered sub-divisions.  
Illustration of the Army Map Service numbering system for maps: Central Japan, 1:250,000, AMS L-571 -  
"L" is the main theater area  
"5" means the set is of a scale between 1:255,000 and 1:149,500.  
"7" is the sub theater area  
"1" is the series number used to distinguish sets of the same general scale in the same main area and sub area.
- (3) The most important theater (for this booklet) is theater "L" which embraces Japan - Manchuria, Korea, China, Formosa, French Indo-China, Thailand and The Malay States. All sets in these countries published by AMS will be identified by L. for instance the Japanese 1:250,000 sets are L-561, L-571, etc.
- (4) The Philippines in theater S, Netherlands East Indies T.
- (5) Indices may lag and usually do lag behind map publications.
- (6) The Army Map Service publishes a weekly publication list (confidential) which is necessary to keep indices up to date.
- (7) Indices of all AMS sets are made and are on distribution.
- (8) A.M.S. frequently prints, a series description for the index.
- (9) The sheet key number is printed on the reverse of the index.
- (10) A typical sample AMS index is inclosed.

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b. The Aeronautical Chart Service Index -

- (1) This index which may be secured by requisition from: Headquarters Aeronautical Chart Service, U.S. Army Air Forces, Washington 25, D. C.
- (2) It is frequently revised and is currently in its 5th edition.
- (3) This shows individual sheets and projected coverages ranging from AAF 1:5,000,000 World Planning Charts AIC-1 to AAF Aeronautical Approach Charts 1:250,000 AEC-1.
- (4) In addition various Navigation Charts and Special Charts are listed.
- (5) Sample pages from this index are included.

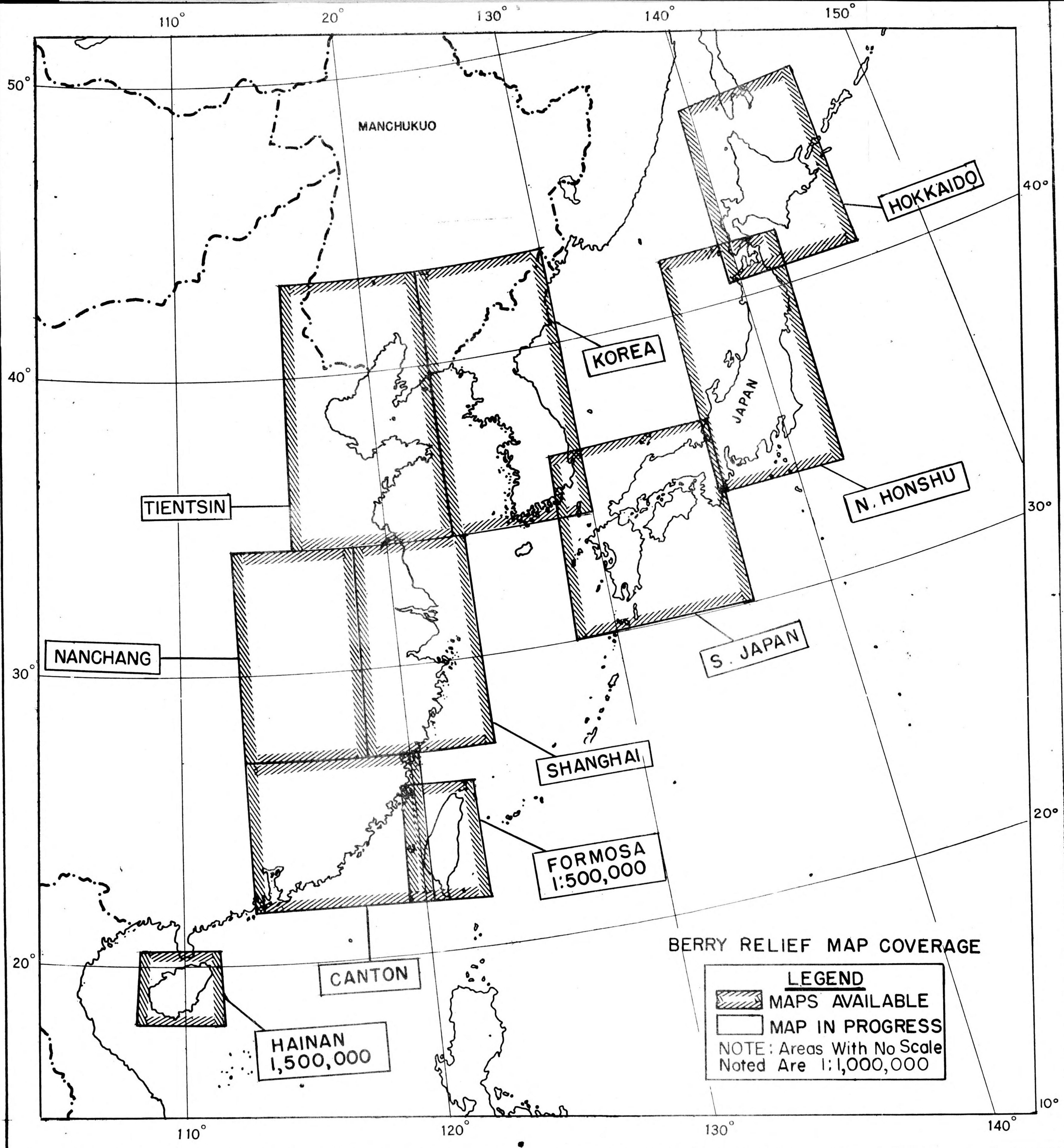
c. Index to Aviation Charts and Publications on Issue by the Hydrographic Office, Navy Department, Washington, D.C. H.O. Pub. No. 1-V (R) -

- (1) This index lists:
  - (a) H.O. Charts and publications
  - (b) AAF Charts and publications
  - (c) Certain other agency air chart publications - GSGS, Canada.
- (2) All H.O. Charts which are air series bear the distinguishing letter "V" in the series number.
- (3) As examples of the Naval Aviation Charts the following series are illustrated: V70, V30, V7, V14, V3, V4 $\frac{1}{2}$ , VPS, VPG, VP30, VL15, VL30, VL70, VRL, LOR (Loran Charts), V-30 sample shown (M-2), V-3 sample shown (M-12).
- (4) Among the publications are:
  - (a) Notice to aviators
  - (b) Naval Air Pilots
  - (c) Aircraft Facilities Directories
  - (d) Weather Summaries
  - (e) Manuals (Navigation)
  - (f) Route Manuals
  - (g) Tables (Navigation), Dead Reckoning, Azimuth, Astronomical Navigation
  - (h) Lists: YG Beacons, and many other miscellaneous publications.

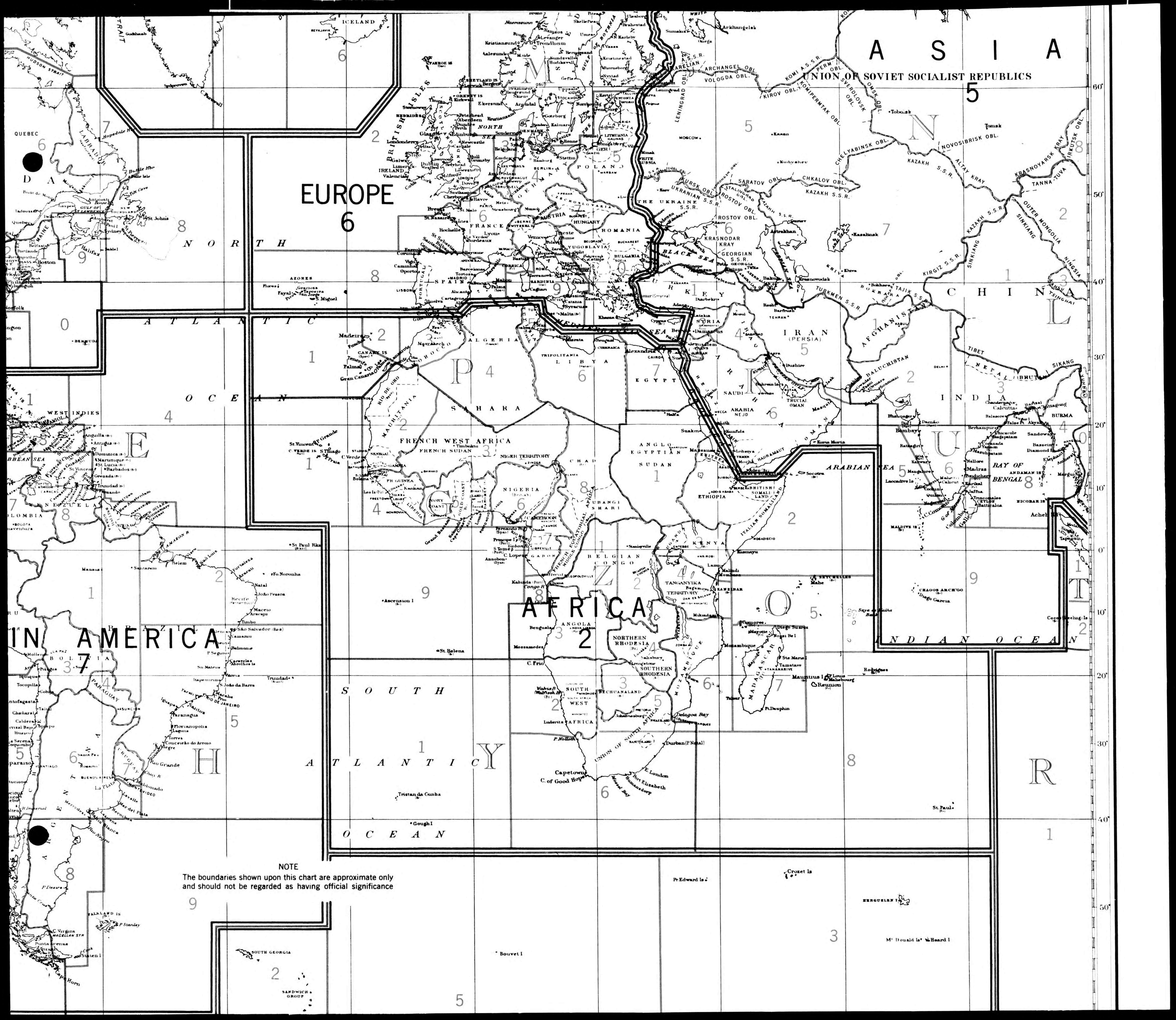
d. Index to H.O., B.A. and Restricted Charts (H.O. Pub. No. 1-R) -

- (1) This index is an exhaustive index listing U.S. Hydrographic and British Admiralty (B.A.), Hydrographic Charts.
- (2) The particular value of this index is its listing of large scale charts - coastal areas, harbors and islands in the Far East which frequently are not represented in similar detail on topographic maps. A sample page is inclosed.

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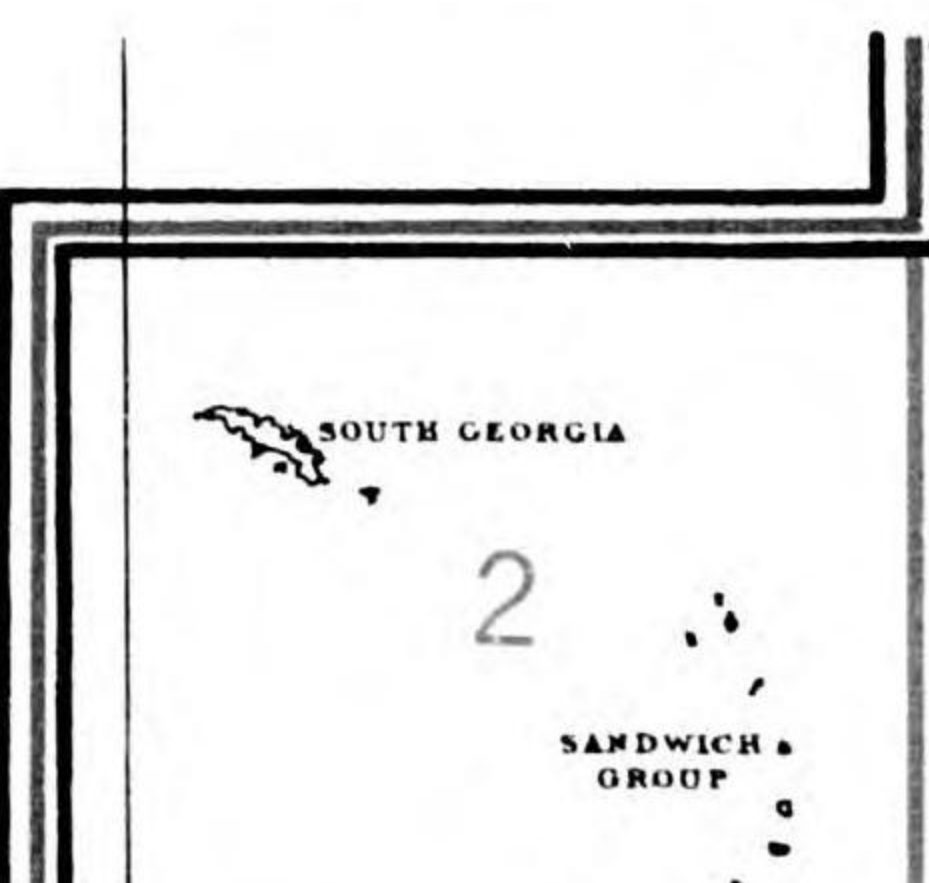
IN AMERICA

SOUTH ATLANTIC OCEAN

INDIAN OCEAN

NOTE  
The boundaries shown upon this chart are approximate only  
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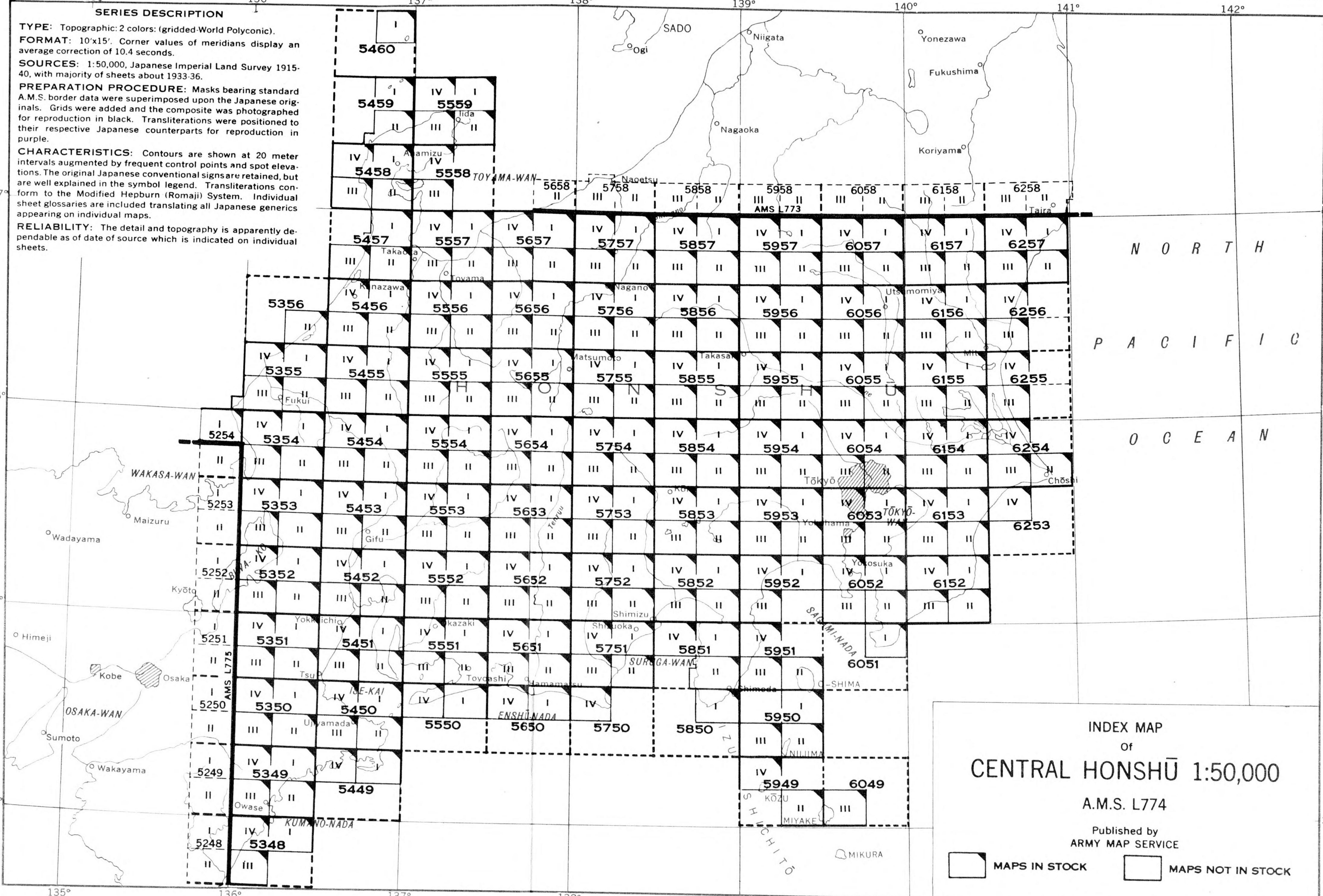
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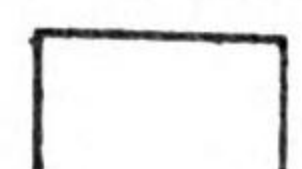
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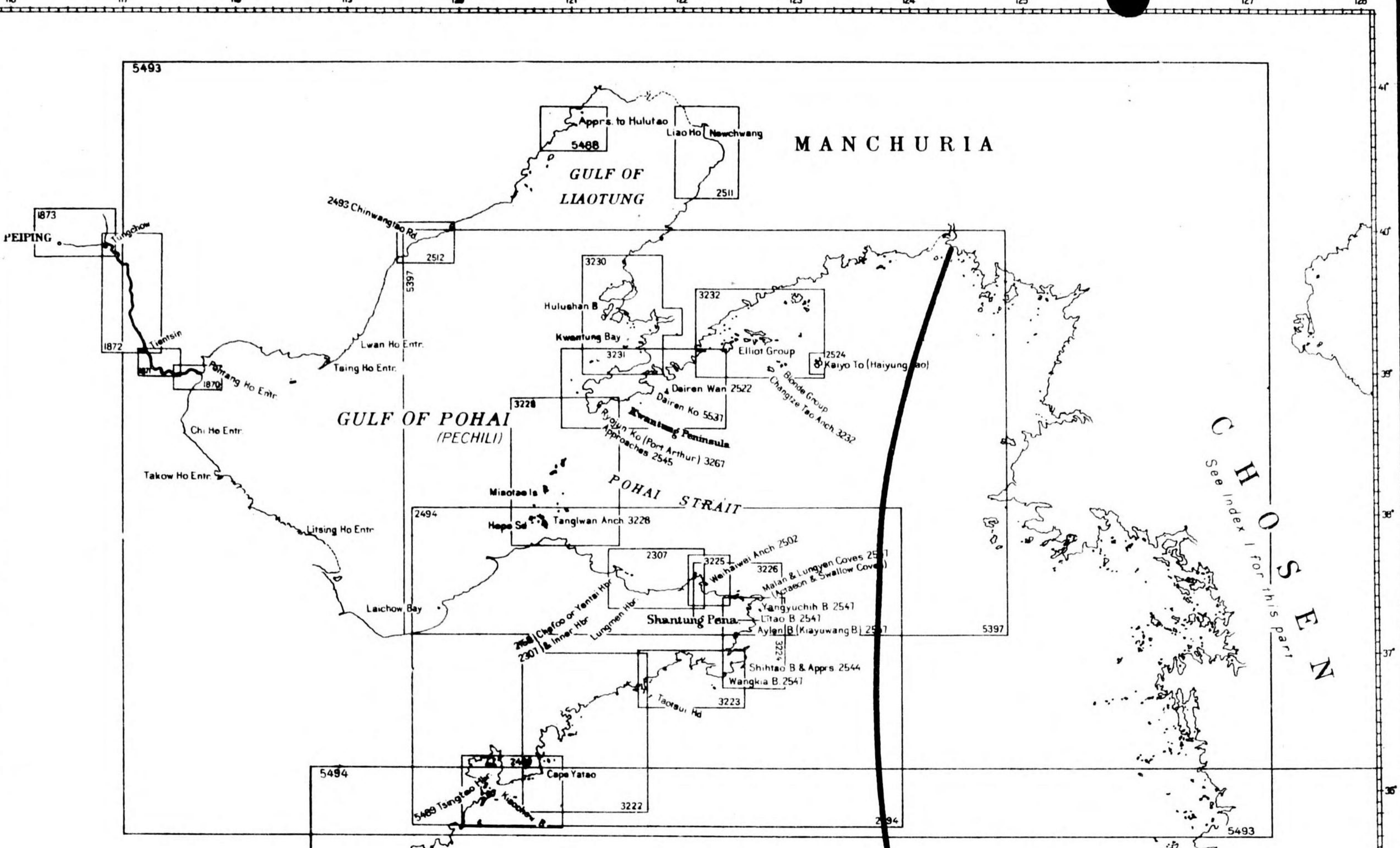
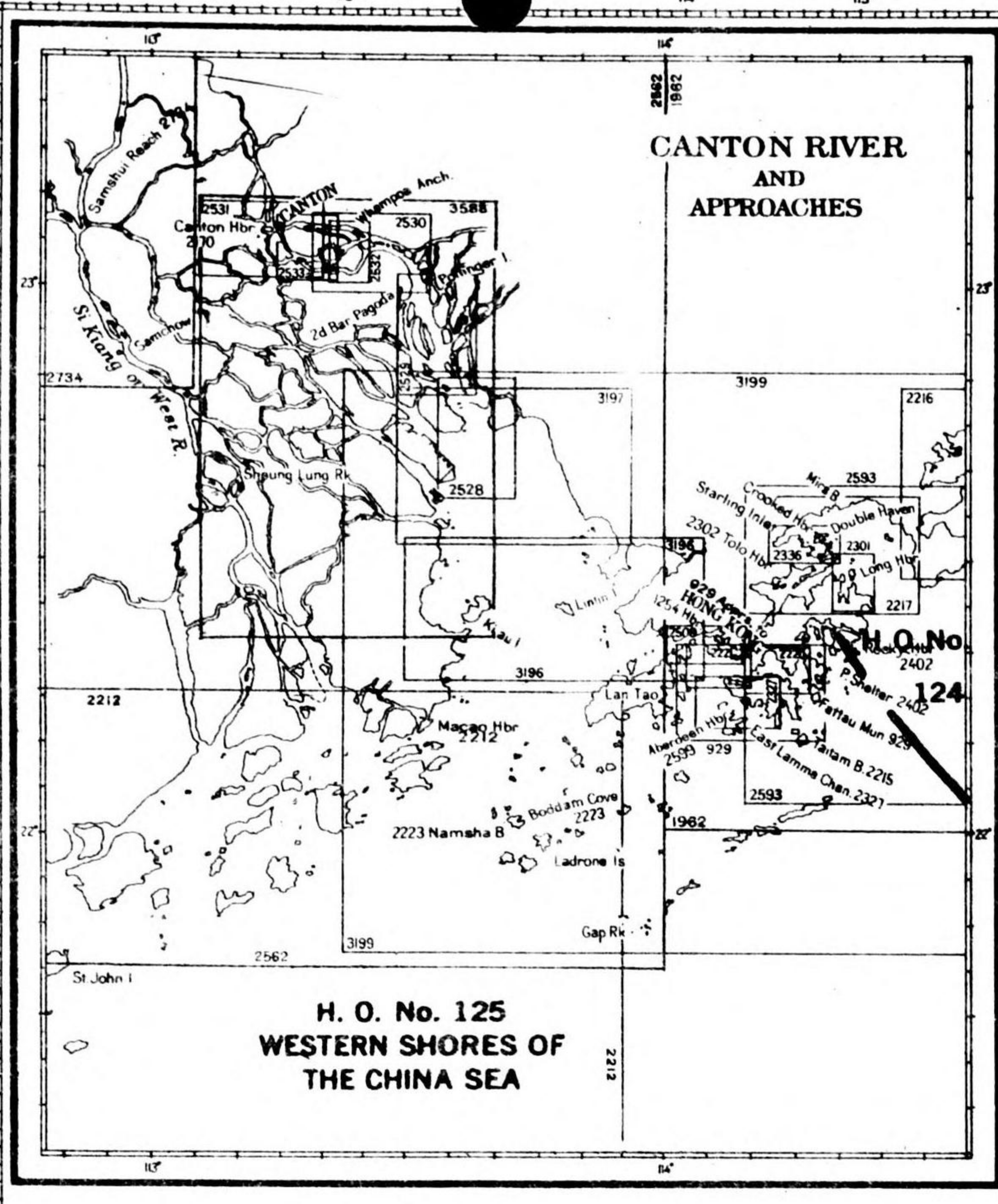


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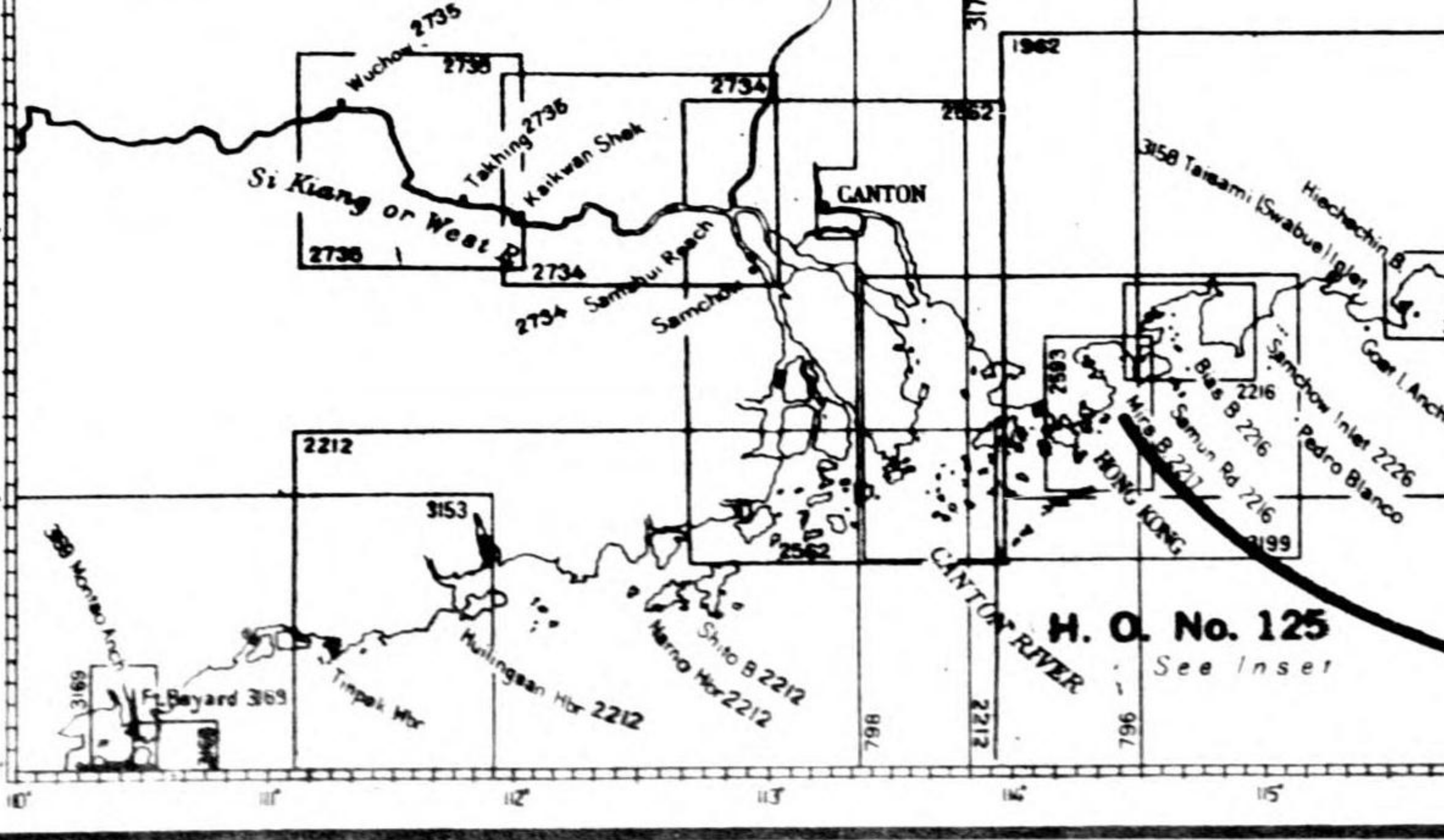
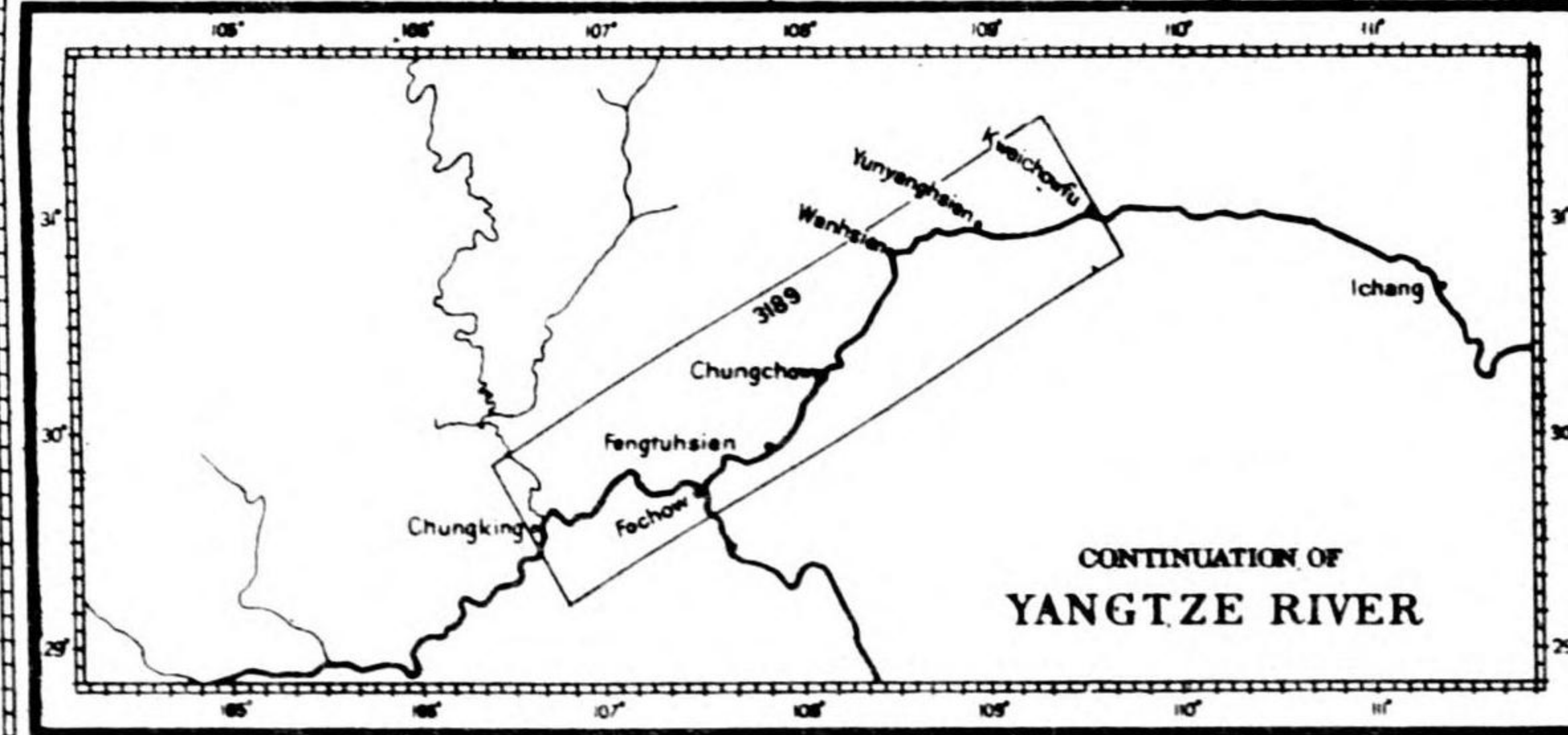
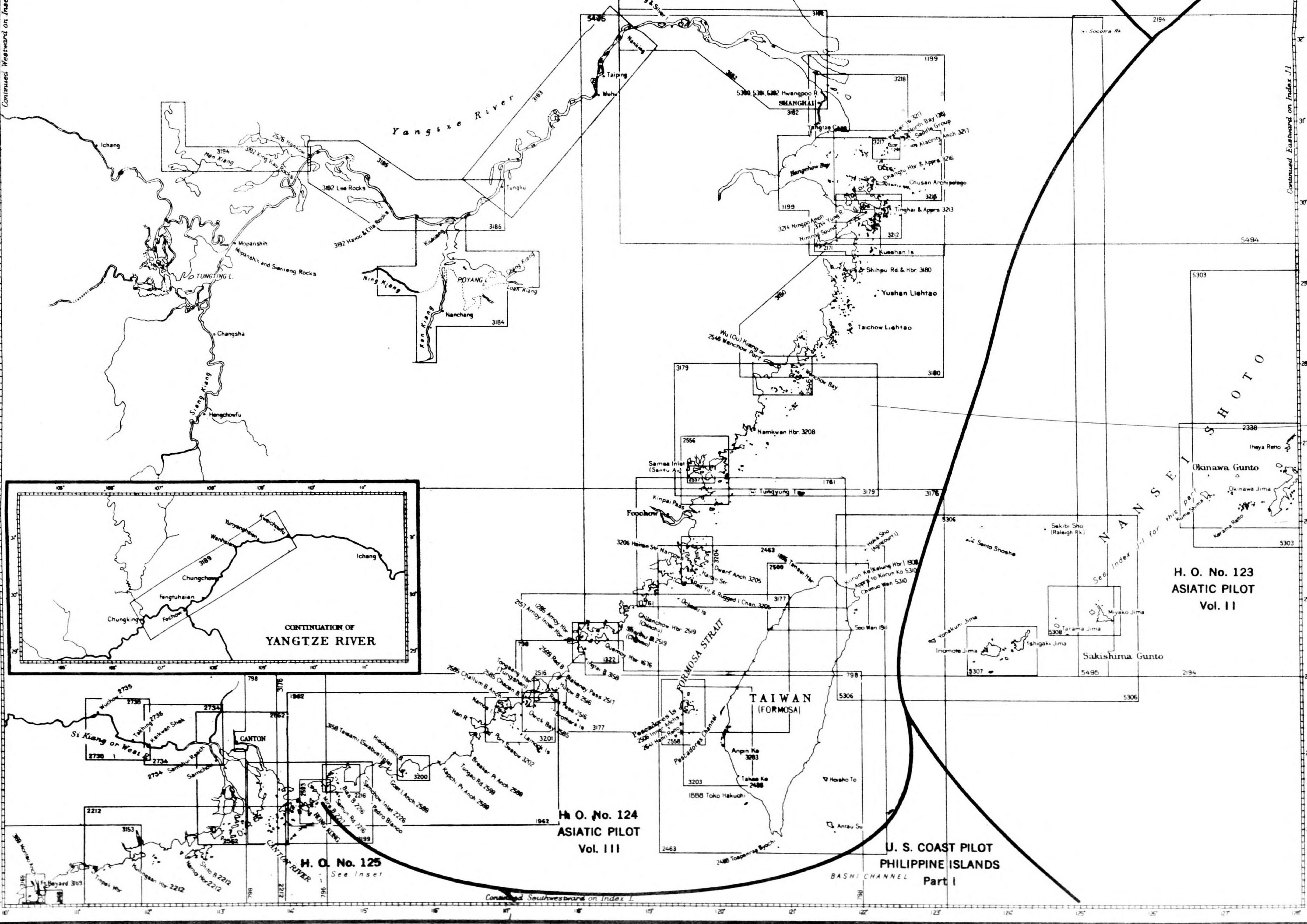
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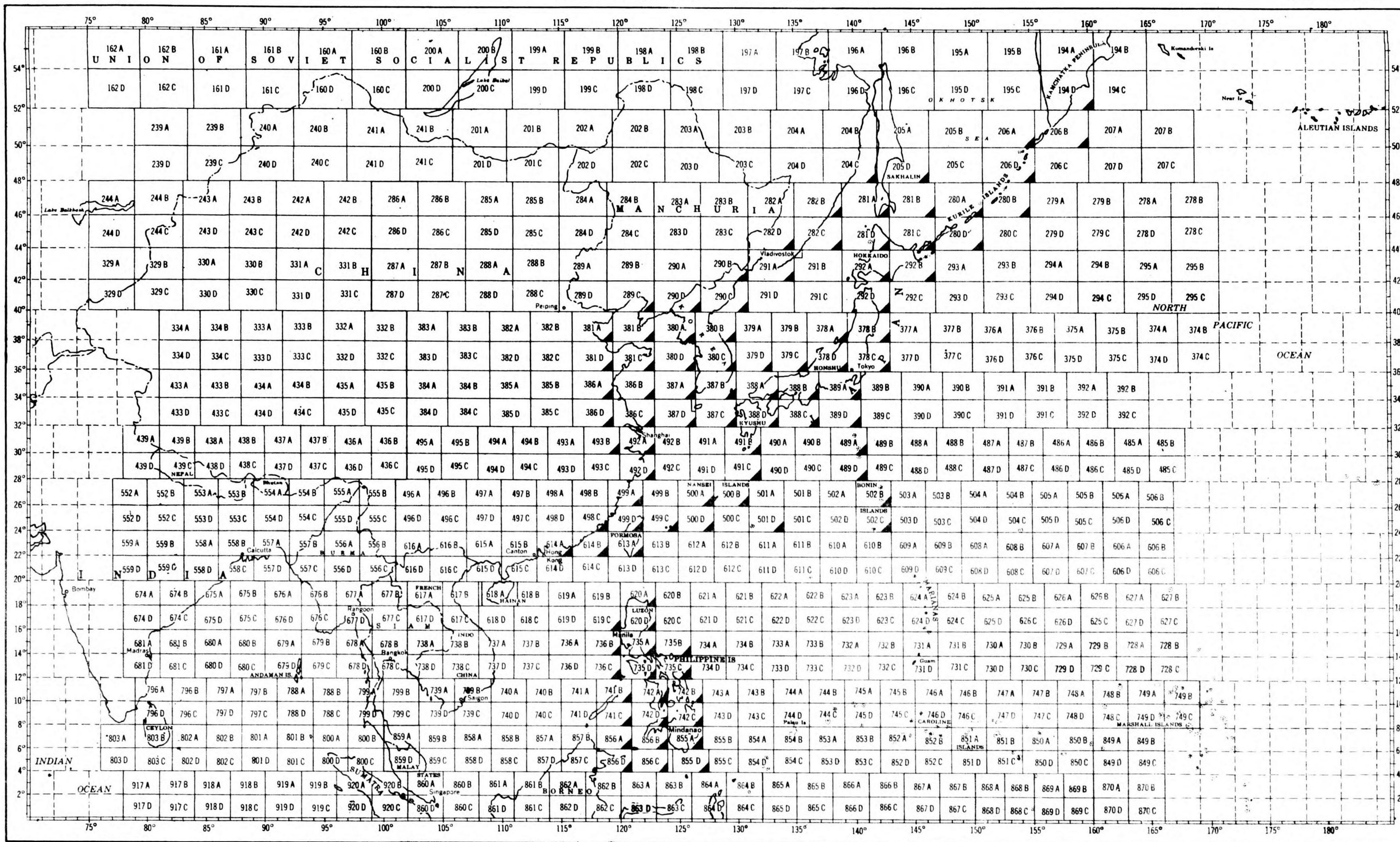
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1. 1:6,336,000 AMS 1102 a. Central and North Pacific, b. India Burma and China. Two new planning maps. Brilliant color. Coverage as name implies. Excellent war room maps and useful for overall Far Eastern picture and rough long distance route measurements. Sample shown (M-1).
2. 1:4,224,000 Japan and adjacent regions. (colors) - centered on Japan - distributed by Aeronautical Chart Service. Good war room map. More place names than 1, above. National Geographic Society authors.
3. 1:4,000,000 AAF Direction Finding Tracking Charts - a projected series of gnomonic charts now in process. China and Japan coverage - possible to plot great circle courses and measurements by straight line.
4. 1:2,000,000 AMS 5207. a. Northern Japan. b. Japan South - Special Strategic Maps - Asia, can be pasted together. Relief hachures. Communications particularly clear. Good place name selection. Good for war room or planning spotting and annotation. Sample shown (M-3).
5. 1:1,000,000 AAF Relief. 3 sheets. a. Hokkaido. b. Northern Honshu. c. Southern Japan. Shows relief by plastic shading (brown) communications fine line black. Spot elevations. Main place names. Best published relief map to date. Can be pasted together. Mercator projection. Useful for general recognition and study of topography, landmarks. Sometimes called Berry Relief Map - AC/AS, Intelligence Physiographic Map. Distributed by Aeronautical Chart Service, also Distribution Sub-section, Joint Target Group. Sample shown (M-6A). Ryukyu and Bonins in process.
6. 1:1,000,000 AMS 5301. Eastern Asia. 17 sheets cover Japan. Type - International Map of the World. 4° x 6°, 4° x 12° - Modified polyconic. Contours, gradient tints. Considered excellent particularly in this area. Very good on place names. Airport information dated. Compass rose over-print and isogonic lines. Excellent background map for Japan. Fits into other sheets of the standard set for Manchuria, China, etc. Sample shown (M-6). Available. These are frequently referred to as IMW's.

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7. 1:500,000 AAF Aeronauticals APC2. 39 sheets (covering all of Japan and adjacent islands. New format and handling of relief - contours and gradient tints. Replace previous edition. Now complete. Lambert Conformal conic projection - partial available. Sample shown (M-8).
8. 1:250,000 AMS L561, AMS L571, AMS L591 and AMS W511 - 135 sheets covering all of Japan and adjacent islands viz. Kuriles, Karafuto, Ogasawara - Gunto, Ryukyu Retto; AMS L571 covers Honshu, Shikoku and Kyushu. Topographic, polyconic. Colored, 10,000 yd. - World Polyconic Grid. 1° x 1°. Probably most useful and used standard set on Japan. Complete coverage. Second editions appearing currently. Excellent coverage, both topographic and place name. Weakest data is airfield. A gazetteer of place names has been completed. This is an extremely useful set for plotting photo coverage and detailed communications study, approach source, radar and operations planning, elevation in meters - glossary. Modified Hepburn transliteration. Some discrepancies on railroad gauges and trackage. Now being corrected in second editions. Available.
9. 1:250,000 AAF Aeronautical AEC-1. No coverage on Japan as yet.
10. 1:218,880 Aviation Charts V3 series - Hydrographic Office, U.S.N. 35 sheets covering Japan and adjacent islands. Contours, gradient tints - railroads - spot elevations. Mercator projections. Large 36" x 54" sheets. Excellent design for air use. New editions have purple overprint of strategic installations. Sample shown (M-12).
11. 1:200,000 Imperial Land Survey Japan. A very fine set never reproduced in color. Originals though dated have remarkable relief and cover presentation. Not on distribution.
12. 1:50,000 AMS L761 - Northern Karafuto 66 sheets.  
 L762 - Southern Karafuto - 55 sheets  
 L763 - Chishima-Retto (Kuriles) - 59 - (Etorofu Is. to Hokkaido. No coverage.)  
 L764 - Hokkaido - 282 sheets.  
 L773 - North Honshu - 240 sheets.  
 L774 - West Honshu - 285 sheets.  
 L775 - South Honshu - 241 sheets.  
 L772 - Kyushu - 160 sheets.  
 L771 - Ogasawara - 21 sheets.  
 L791 - Ryukyu - 84 sheets  
 W511 - S. Jap. Is. - 5 sheets.  
 Approximately 1498 sheets. This is a reprint of the original Japanese Imperial Land Survey 1:50,000 set. It bears purple transliteration overlay. Extremely detailed. Carries grid overlay. One of most detailed topographic sets ever made. Any detailed topographic survey - model making, airfield plotting or source of small place names

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would entail this set. Complete set now reprinted by AMS - Caution. This is dated - 1915 - 1939. The set also bears blank or restricted sheets in key strategic areas - viz: Wakkanai, Hakodate, Ominato, Kure and Hiroshima Bay - Lower Osaka Bay, Maizuru, Nagasaki, Sasebo, Oki Is., Shimonoseki, Lower Tokyo Bay, Yawata. Shorelines - and reclaimed land in almost all larger sea-coast cities is now known to be altered. Some railroad and considerable road changes. This is the great basic set on Japan. The reprint is a straight reprint and bears no compilation of new material. Note the quantity of this set - indiscriminate ordering leads to both much unnecessary bulk and delay. Indices are available and specific sheet ordering is probably advisable. Compilation to cover restricted areas has commenced.

13. 1:25,000

Scattered coverage in Japan in original Japanese sheets. Not on distribution. AMS is starting a 1:25,000 set. AMS L874, L875 - in South and Southwest Honshu. Set only in earliest stages - Not available.

14. 1:12,500,  
1:10,000

Various. AAF City Plans. Most detailed city plans on Japan. Totals 146 - when completed. Most are scale 1:12,500. All key Japanese cities and many small ones which bear targets exhaustively shown. Six colors. Topographic - compilation from all available sources. Installations bear AAF Air Objective Folder names. (AAF Target Charts and Target Area Bases names.) Index attached. As well as regular edition - emergency provisional editions distributed in limited quantity with photo coverage. Plans distributed through Joint Target Group bear soundings and hydrographic data. Sheet sample (M-23).

15. 1:10,000

AMS L096 - Partial coverage, new detailed series from photo sources. (Ryukyus)

16. Miscellaneous Notes and Comments. No attempt has been made to go into hydrographic charts. These are of course available with indices through H.O. It is to be noted that very large quantities of Japanese charts have been captured and emergency reprints made from them and distributed. Reclaimed land particularly bearing industrial expansions are very frequently the case as shown by photography. One should be on the watch for copies - many captured, of Japanese Naval Air Charts 1:500,000, a series reliable only in the Japanese editions and dated past 1940.

All AMS maps of Japan are in the Modified Hepburn System of transliteration. Discrepancies are found from this on U.S. Navy. H.O. publications and charts. A general gazetteer is the Stanley Geer -

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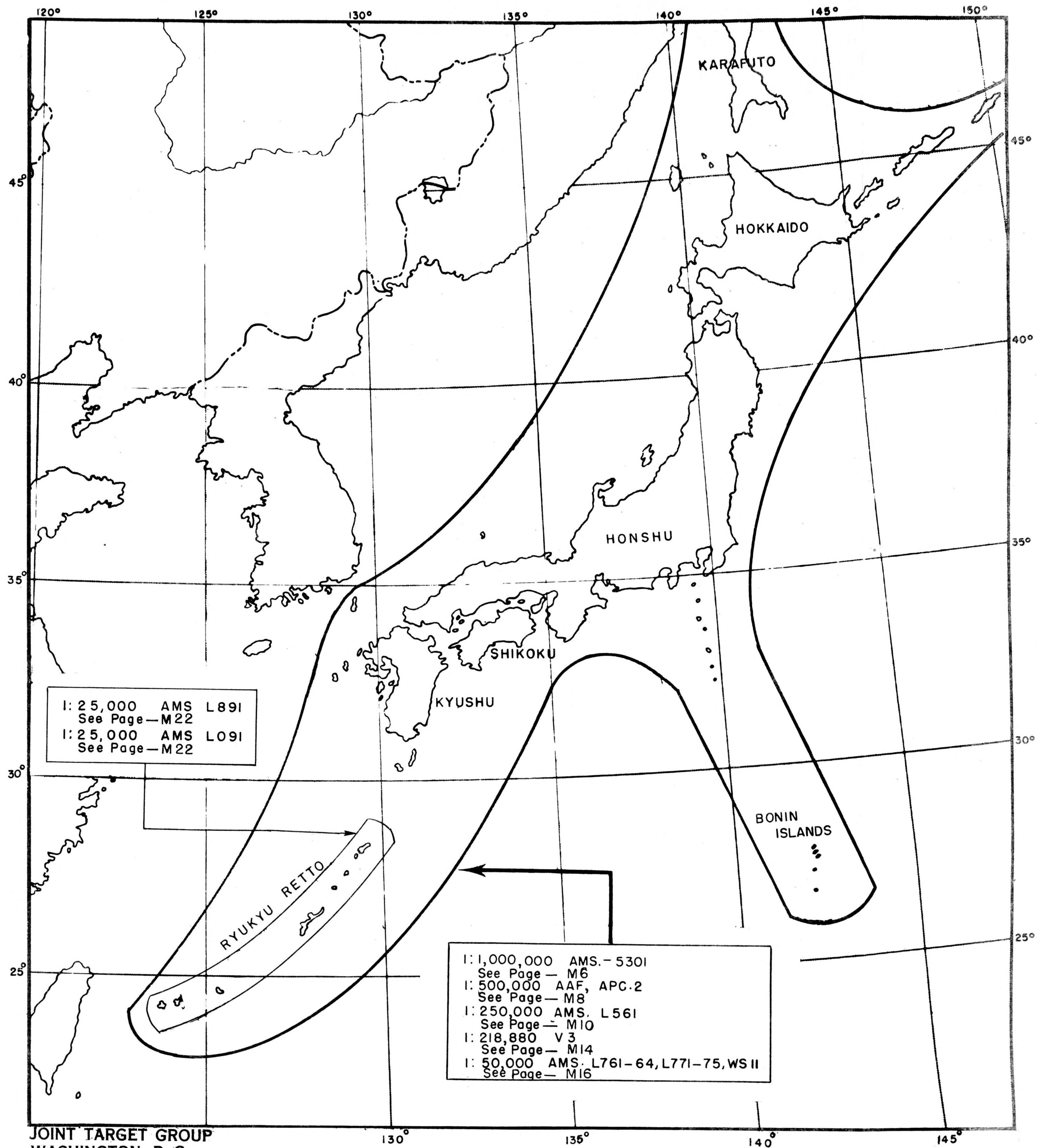


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Gazetteer of Japanese Place Names, Harvard University Press. Excellent but limited in names (Modified Hepburn). The best overall gazetteer now available and on distribution is Gazetteer to Maps of Japan, AMS 202292.

There are 3 more detailed gazetteers covering a. Ryukyu-Retto and Ogasawara-Gunto (Bonins) AMS 202290, b. Chishima-Retto (Kuril Islands) AMS 201057, Gazetteer to Maps of Kyushu AMS 202325.

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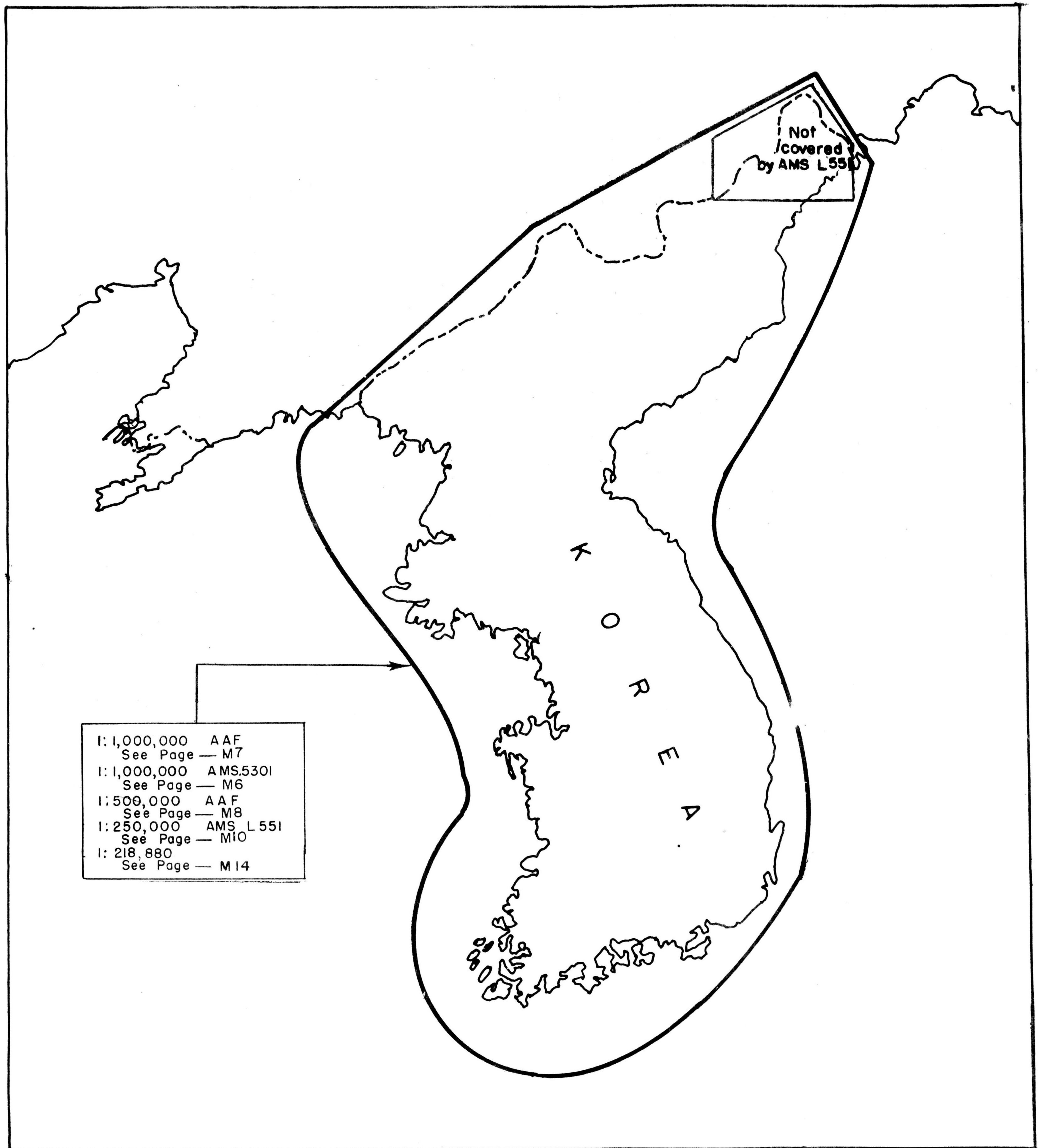
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KOREA (CHOSEN)

1. 1:6,336,000 AMS 1102 - see same items under Japan.
2. 1:4,224,000 Japan and Adjacent Regions - see same items under Japan
3. 1:2,000,000 AMS 5207 - Korea. Special Strategic Map - same comment as item #4, Japan.
4. 1:1,000,000 AAF (Berry) Relief - 1 sheet - most recently published of AAF Relief Map 1:1,000,000 series. Plastic shading in tones of brown. Best published relief map to date on Korea. Major communications, spot elevations - modified polyconic projection. Names - Korean forms with Japanese variants in parentheses.
5. 1:1,000,000 AMS 5301 - 6 sheets cover Korea. Fine basic set, format and type same as comment in item 5, Japan. Communications probably of lower reliability than Japan set. Names in Korean form (McCune Reischauer system) with Japanese forms in parentheses.
6. 1:500,000 AAF Aeronautical - 8 sheets - 1944 editions - gradient tints, contours, spot elevations - Lambert conformal, compass roses, isogonic lines. This is a new edition. Place names Korean form (McCune Reischauer system). Probable deficiencies, airfields. Set now complete.
7. 1:250,000 AMS L-551 - 46 sheets - 4 sheets missing in extreme north. This set is same type as item 7, Japan. Probably will become standard general topographic set for Korea. Uses as in item 8, Japan. Reliability of communications data less than Japan sets. To make full coverage of Korea at or near this scale, use sheets NK52-2 and NK52-3 of set AMS L-401; 1:500,000. Place names, Korean forms - McCune Reischauer transliteration. Japanese variant in parentheses. In using this set, a gazetteer: "Place Name Index for Korea", AMS 200638, is very useful. Newer and more detailed is the "Gazetteer to Maps of Korea, AMS 201280". These are both very good and should be used together. In any map work on Korea, the former gazetteer should be consulted as it gives both Korean and Japanese place names.
8. 1:218,880 Aviation charts V3 series - 10 sheets - U.S. Hydrographic Office comment same as item 10, Japan. Names are Japanese forms though differing from usual Modified Hepburn Japanese forms.
9. 1:50,000 Japanese Imperial Land Survey - Complete coverage. Dated same type as item 11 but this set has never been published in English transliteration. Not available except specific sheet photo copies. Very unreliable in recent cultural developments and detail.
10. 1:12,500, 1:10,000, various. 22 city plans, key cities. Same as comment in item 14, Japan.

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## MANCHURIA

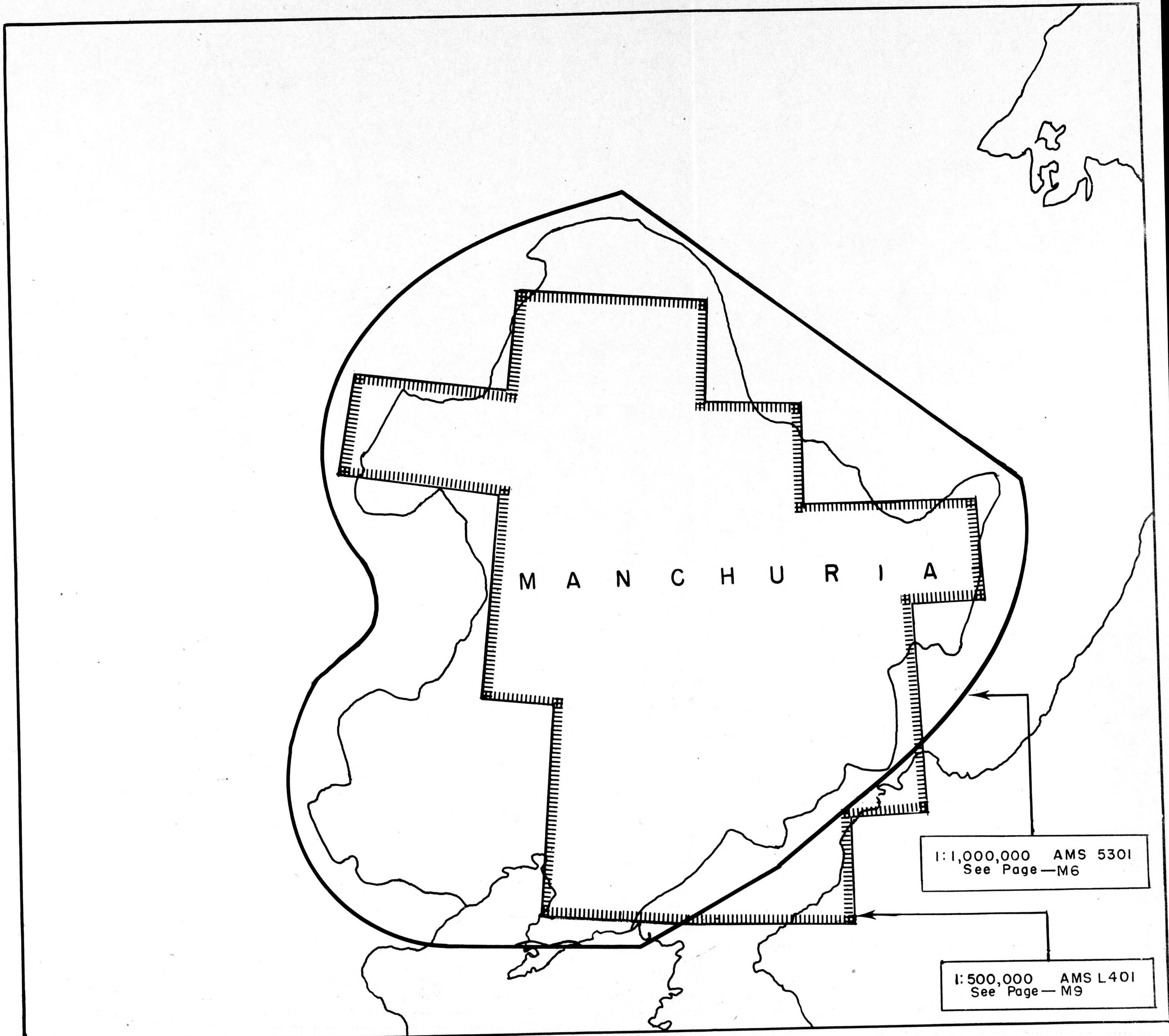
1. 1:6,336,000 AMS 1102 - see comment on item No. 1, Japan.
2. 1:4,224,000 Japan and adjacent regions - see comment item No. 2, Japan.
3. 1:4,000,000 AMS 5207 - Ressian Maritime Provinces - belongs in and of same type as AMS Special Strategic Maps - Asia. Same comment item No. 4, Japan.
4. 1:2,500,000 AMS 5205 Manchuria and adjacent region. Overall war room and planning map - better coverage to south - not as recent as No. 3, above.

NOTE: All overall small scale planning maps will exhibit rail-road and communications discrepancies to the northeast and west. Data is scanty, contradictory and confusing.

5. 1:1,000,000 AMS 5301 14 sheets - total coverage. Comments; type format same as item 5, Japan - except, transliteration more complex - Chinese forms in Wade-Giles with Japanese in parentheses. Less reliable than Japanese coverage due to poorer sources.
6. 1:500,000 AMS L401 29 sheets - supplement with AMS N401 for periphery coverage north and east. Not complete but full coverage except for southwest and lower Kwantung Peninsula. Best available coverage. Same transliteration system as item 5, above. Supplement this set with sheets. 381B, 380A. AAF Aeronautical Chart. Sheet sample (M-9).
7. 1:500,000 AAF Aeronautical Charts: revised coverage incomplete. AAF, APC2.
8. 1:500,000 Twentieth Bomber Command has published certain approach chart strips - which have most recent communication and A/F data - these are confined to strategic target approaches.
9. 1:12,500 and various AC/AS City Plans - 14 being published on key strategic cities. 4 compiled from photography.

10. Some comments on map background. The large scale map coverage of Manchuria is extremely variable. 1906 - 1:84,000 Russian maps for the north - 1:100,000, scattered 1:50,000, 1:25,000 Japanese Imperial Land Survey to south, east and west - some original survey - some copied from Chinese sources. Extremely variable - even to coordinates. None of these are available in English. There is an extremely difficult transliteration problem in this country with names in characters from Chinese, Mongol, Russian, Tungus, Korean, Japanese sources. No available gazetteer covering all place names exists. Extensive gazetteer is projected by AMS and Board on Geographic Names. AMS names as appearing on 1:100,000 and 1:500,000 probably will become standard. Many of small scale maps have Japanese forms of names. No sets probably show accurate extensions of railroads under Japanese occupation on airfields.

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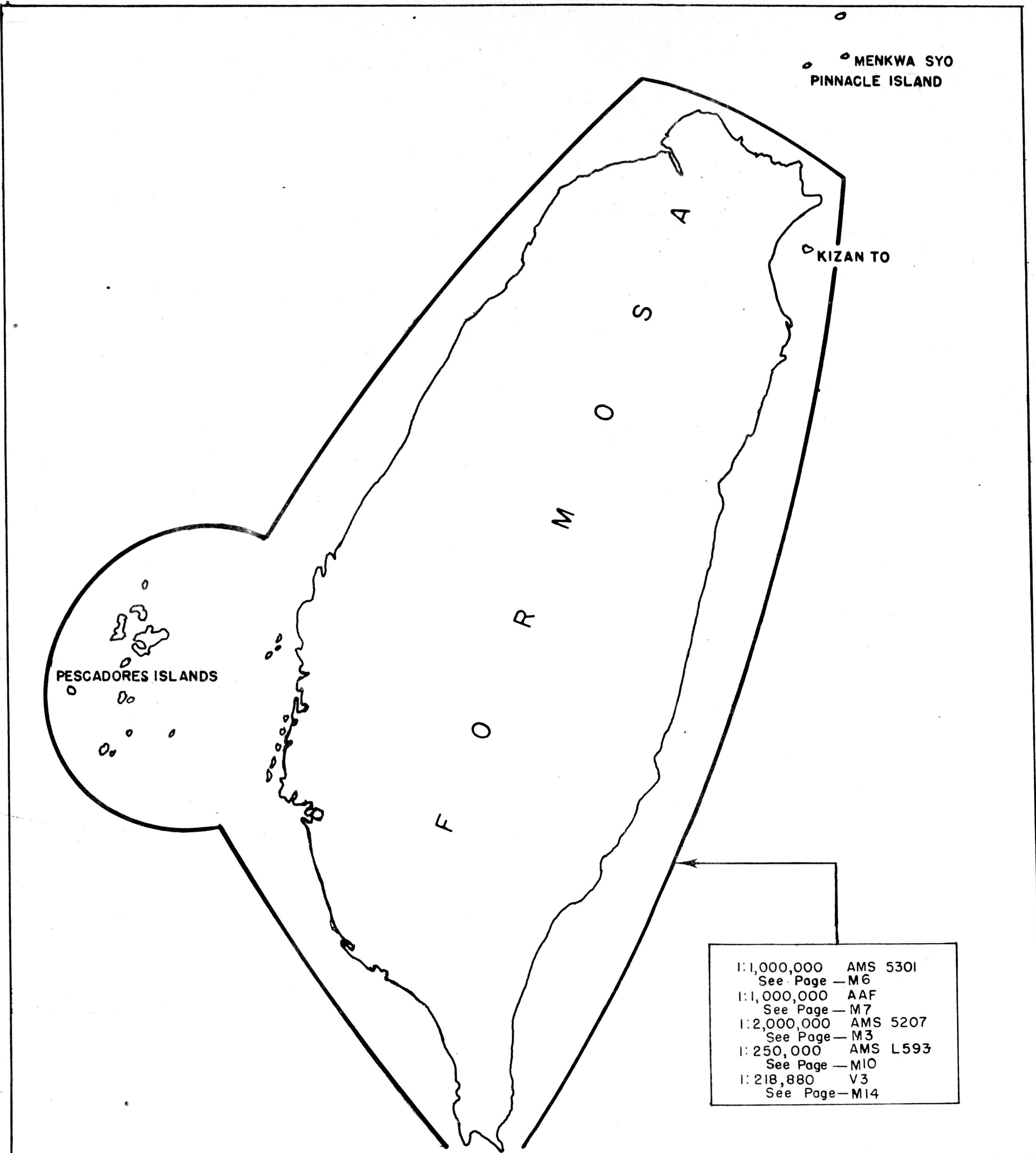
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FORMOSA (TAIWAN)

1. 1:6,336,000 AMS 1102 - see item #1 Japan (India-Burma China sheet)
2. 1:4,224,000 Japan and Adjacent regions - item #2 Japan
3. 1:2,000,000 AMS 5207 Formosa - Special Strategic - item #4 Japan.
4. 1:1,000,000 AMS 5301 3 sheets - see #6 Japan.
5. 1:1,000,000 AAF Aeronauticals 2 sheets - conventional AAF Aeronauticals. AAF, APC1 M-7
6. 1:500,000 AAF Aeronauticals 2 sheets - revised - gradient tints see item #7 Japan. AAF, APC2
7. 1:500,000 AC/AS Relief: same type as 1:1,000,000 Relief - brown plastic shading; spot elevations, communications. 1 sheet. Use similar to item 4 Japan.
8. 1:250,000 AMS L593. 12 sheets - complete coverage similar to item #7 Japan. This set was distributed with Chinese (Amoy) place-name transliteration. Recalled and superseded by set with Japanese transliteration.
9. 1:218,880 Aviation charts V3 series. U.S. Hydrographic Office. Same as item #10, Japan.
10. 1:50,000 AMS L792 - 118 sheets. Variable topographic set. Excellent detail from photo coverage on west coast and extremely careful drafting of detail. Some sheets in mountainous interior - have blank unsurveyed area. Some emergency sheets in black and white reprint of Japanese originals with place name overprint. These latter should be regarded with caution - some sheets overprinted with 1,000 yards world polyconic grid. Polyconic projection. Set still in process 12/21/44 but many sheets released - all of east and west coasts. M-17
11. 1:25,000 AMS L892 - approximate 245 planned. 142 complete at this time - sheets appearing constantly. This is an extremely detailed topographic series. West coast and considerable distance inland from photo coverage. Some sheets bear 1,000 yards world polyconic grid with 200 yards target grid overlay. New sheets bear photo-map back-up. M-20
12. 1:12,500 City Plans AMS L991 - 30 plans of strategic cities drafted from photo coverage. M-23
13. Miscellaneous Notes: One gazetteer is now distributed keyed to the AMS 1:250,000 set, "Gazetteer to maps and charts of Formosa" AMS 201545. All coverages apply equally to Pescadores.

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MENKWA SYO  
PINNACLE ISLAND

KIZAN TO

PESCADORES ISLANDS

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1:1,000,000 AMS 5301  
See Page - M6  
1:1,000,000 AAF  
See Page - M7  
1:2,000,000 AMS 5207  
See Page - M3  
1:250,000 AMS L593  
See Page - M10  
1:218,880 V3  
See Page - M14

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CHINA

This area offers both the most incomplete as well as confusing coverage pictures in the entire Far East.

1. 1:6,336,000 AMS 1102 - India, Burma and China Sheet. See Item No. 1, Japan.
  2. 1:4,000,000 AMS 5207 - China Sheet. Special Strategic Series. See Item No. 4, Japan - Communications less reliable than rest of series. Complete coverage China proper.
  3. 1:2,000,000 AMS 5201 - Asia Transportation, 4 sheets. Coverage, all but extreme North and N.W. China - Planimetric - Lambert conformal conic - Reliability only fair - but effort to solve confusing and complex transportation and route classification.
  4. 1:1,500,000 AMS 5304. 14 sheets coverage, western and northern China east to Hankow. These are copies of Soviet maps 1939-1940. Relief by shading with spot elevations. Excellent desert detail - overprint air data. Only coverage at or near this scale for the western and northwestern area. Fully transliterated. M-4.
  5. 1:1,000,000 AMS 5301 - 9 sheets - (4 sheets in G.S.G.S. 2555 set tie into this set). Coverage of eastern China from Pei-p'ing south to Hong Kong. See Item No. 5, Japan. Same type and use. Reliability in all categories less because of poorer source material, changing communications in Japanese occupied areas - and also seasonal hydrographic changes. For complete coverage of China, a combination must be made of AMS 5301, G.S.G.S. 2555 and AMS 5304.
  6. 1:1,000,000 AAF Flight Charts - Aeronautical Strip Maps - Luchow-Chengt'u - Kuming to India.
  7. 1:500,000 AAF Aeronautical Charts - partial coverage - coastal areas, AAF, APC-2. M-8
  8. 1:300,000 Chinese Military Survey Office. This set covers south, central and southeastern China east of 100°E. Dated in mid '30's. Not reliable. Not on distribution.
  9. 1:250,000 AMS L-531, (China Proper NE), AMS L-532 (China Proper NW), AMS L-581, (China Proper SE), and AMS L-582, (China Proper SW). These sets, a compilation of all available source material, are designed to cover China roughly east of 108°. At the present time 12/21/44 only AMS L-581 has been partially published. These maps, the best topographic set published in English, are at the mercy of various conflicting sources. Work is progressing rapidly. M-11
- IMPORTANT NOTE: ALL MAPS PUBLISHED BY AMS ON CHINA ARE TRANSLITERATED IN THE WADE-GILES SYSTEM WITH THE LARGER CITIES HAVING VARIANTS IN PARENTHESIS.
10. 1:250,000 AAF Aeronautical Charts: Limited coverage - new sheets in southwestern China bear a plastic shading relief representation which is a new presentation for AAF Aeronautical Charts. AEC-1, M-13
  11. 1:100,000 Chinese General Staff Land Survey: This immense set running to almost 1500 sheets covers most of China east of Cheng-tu. It is not on distribution in this country though photographic copies of the set exist. It is an extremely difficult and unreliable set to

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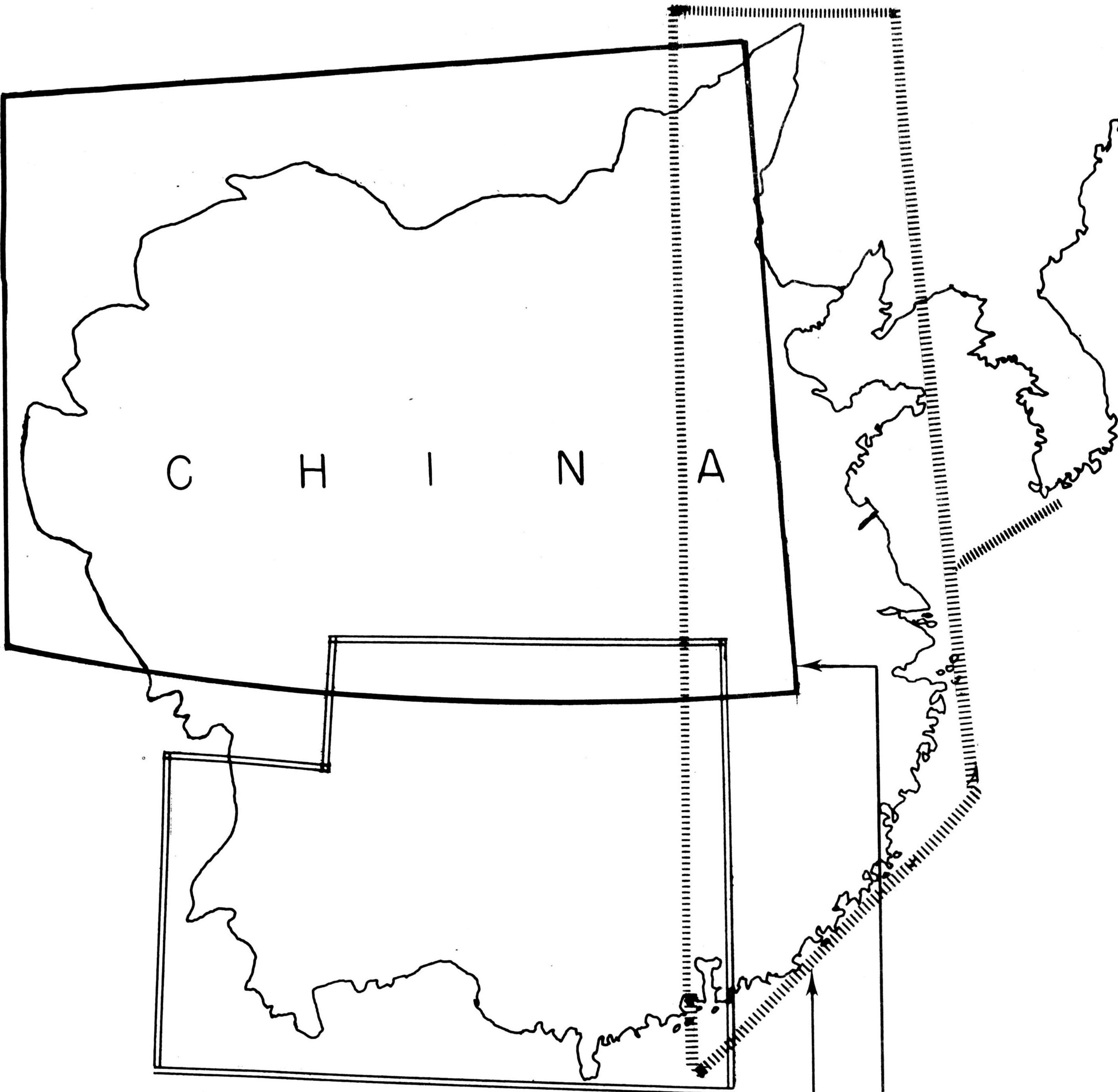
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use. Some sheets do - others do not - have coordinates - horizontal control is very poor. Vertical control is nearly absent. It is entirely in Chinese.

12. Notes and  
Comments:

China. The above summary does not by any means list all known coverage on China. There are innumerable spot and local area coverages of a great range in dates. Probably some of the best maps, covering certain tactical areas have and are being prepared by the Fourteenth Air Force from photography. These are not available for large distribution at present. The office of Strategic Services has prepared some city plans - cities particularly on the east coast. One of the outstanding problems is nomenclature. The Army Map Service and U.S. Board of Geographic Names employ the Wade-Giles System and transliteration. Many (particularly small-scale maps) use the Chinese Postal Atlas System. In general the shift is toward Wade-Giles for all maps and charts now in process with one or two exceptions.

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1:1,500,000 AMS 5304  
See Page—M4

1:1,000,000 AMS 5301  
See Page—M6

1:1,000,000 GSGS 2555  
See Page—M6

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## PHILIPPINE ISLANDS

1. 1:6,336,000 AMS 1102 - see item #1 Japan.
2. 1:4,224,000 Japan and adjacent Regions - see item #2 Japan.
3. 1:2,000,000 AMS 5207, 2 sheets Philippines North, South - see item #4 Japan.
4. 1:1,500,000 AMS 139472 - one sheet complete coverage. This is the most recent single map of Philippines. In IMW style gradient tints revised communications, airfields - good place name coverage. Probably best planning and overall - as well as war room map now extent of this area. See sample (M-5).
5. 1:1,000,000 AMS 5301 - 7 sheets complete coverage - same as item #6 Japan, reliability good. However except for more detailed study item #4 above is sufficient.
6. 1:500,000 AMS S401 - 32 sheets - complete coverage 1944 edition. Topo set colored 50,000 and 10,000 grids 2°x2°. Much revision over previous sets - coverage diagrams for varying reliability. Good coastal detail - bears air data. Polyconic.
7. 1:500,000 AAF Aeronautical Charts - 20 sheets. Lambert Conformal Conic. Gradient tints revised series. Complete coverage. AAF APC2. See sample (M-8)
8. 1:250,000 A.A.F. Aeronautical Approach Charts - 46 sheets complete coverage. Standard AAF Aeronautical. Same as sample sheet (M-13).
9. 1:200,000 AMS 511 - (originally U.S. Coast & Geodetic Survey) incomplete and dated coverage.
10. 1:100,000 AMS S631, AMS 651 - projected sets - western Mindanao published to cover Central Philippines and Mindanao.
11. 1:50,000\* AMS S712 Luzon coverage 347 projected sheets. Topographic set. Key areas covered and published. Exhaustive research background for best data on an area very poorly mapped. Best maps available at this scale.  
AMS S731 - Central Philippines - full coverage 9°N to 13°N projected.  
AMS S751 - Mindanao complete coverage projected  
AMS S741 - Sulu Archipelago complete coverage-completed 69 sheets. See sample (M-18)
12. 1:25,000\* AMS S812 - Luzon selected coverage. 194 sheets-detailed topographic sheets appearing currently.  
AMS S831 - Central Philippines (Samoa and Leyte) 67 sheets published 12/21/44 - full coverage plotted.  
AMS S021 - Palawan-Busuanga - (Photo maps) full coverage plotted - incomplete published coverage.

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AMS S851 - Mindanao full coverage plotted - strategic areas covered and published (primarily shore line sheets).

AMS S841 - Sulu Archipelago - partial coverage published.

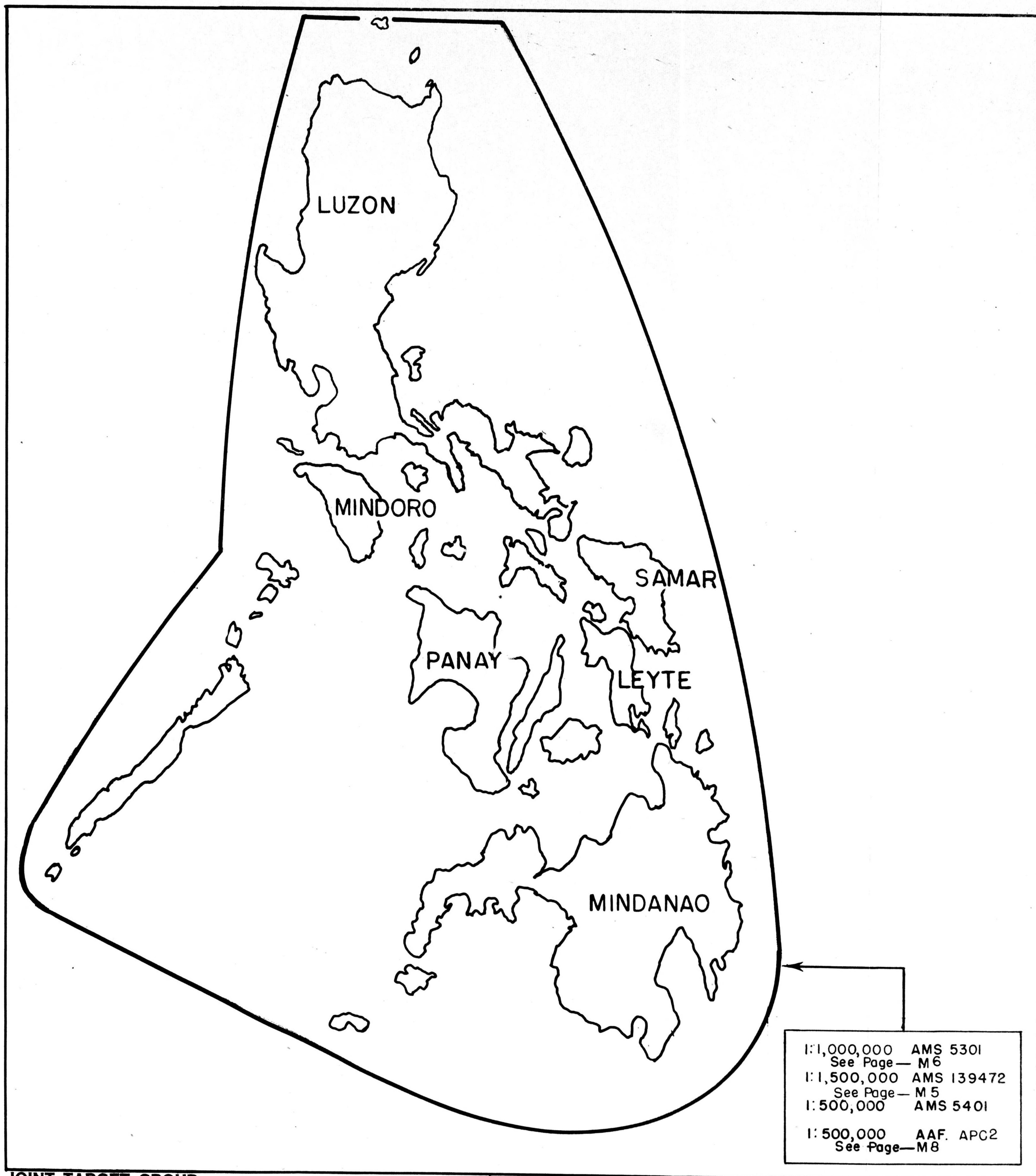
AMS S011, S031, S041 - are photo map series for above coverages. See samples (M-21 and M-21A).

13. 1:40,000 to  
1:5,000

AMS S901 - 50 key cities - some published.

\*Excellent reprints with corrections as well as photo-compilation sheets within these scales have been published under the direction of the Chief Engineer, GHQ, SWPA.

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## FRENCH INDO-CHINA

1. 1:6,336,000 AMS 1102 - India, Burma and China Sheet. See Item No. 1, Japan.
2. 1:4,224,000 Japan and Adjacent Regions. See Item No. 2, Japan.
3. 1:3,000,000 AMS 5207 - Special Strategic Maps - French Indo-China. and Thailand. See Item No. 4, Japan.
4. 1:2,500,000 Chief of Engineers - U. S. Geological Survey - Terrain Diagram French Indo-China. This is a physiographic diagram. One of the finest general representations of topographic features of French Indo-China. Published for Engineers Terrain study. This does not have as wide distribution as its merit and usefulness warrants. Reprinted and published in AAF Air Objective Folder 85.2.
5. 1:1,000,000 G.S.G.S. 2555 (reprint by AMS) 8 sheets. Reprint from French editions. Rather dated series - some older sheets without layer tints - white background.
6. 1:500,000 AAF Aeronautical Charts. No coverage.
7. 1:500,000 G.S.G.S. 4221 - 25 sheets. Originally compiled and produced under French authority. Parts of this set have had British reprint. Not available in large quantity in this country, sheets of the set might well be watched for closer to the point of origin.
8. 1:250,000 AAF Aeronautical Approach Charts - 68 sheets - Complete coverage. Standard AAF Aeronautical. APC-3
9. 1:100,000 AMS L601 - 230 sheets - Incomplete and somewhat erratic coverage. Survey of India publications - Available in limited quantities original French surveys and grad system - detailed topography and cover. Some sheets very dated. See sample, M-15
10. Comment: If one uses original French maps or reprints of these the coordinate system is very likely (particularly on large-scale maps) to be in grads. In this case the prime meridian is Paris - (2° 20' 14" E) and the grad .9 of a degree.

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THAILAND

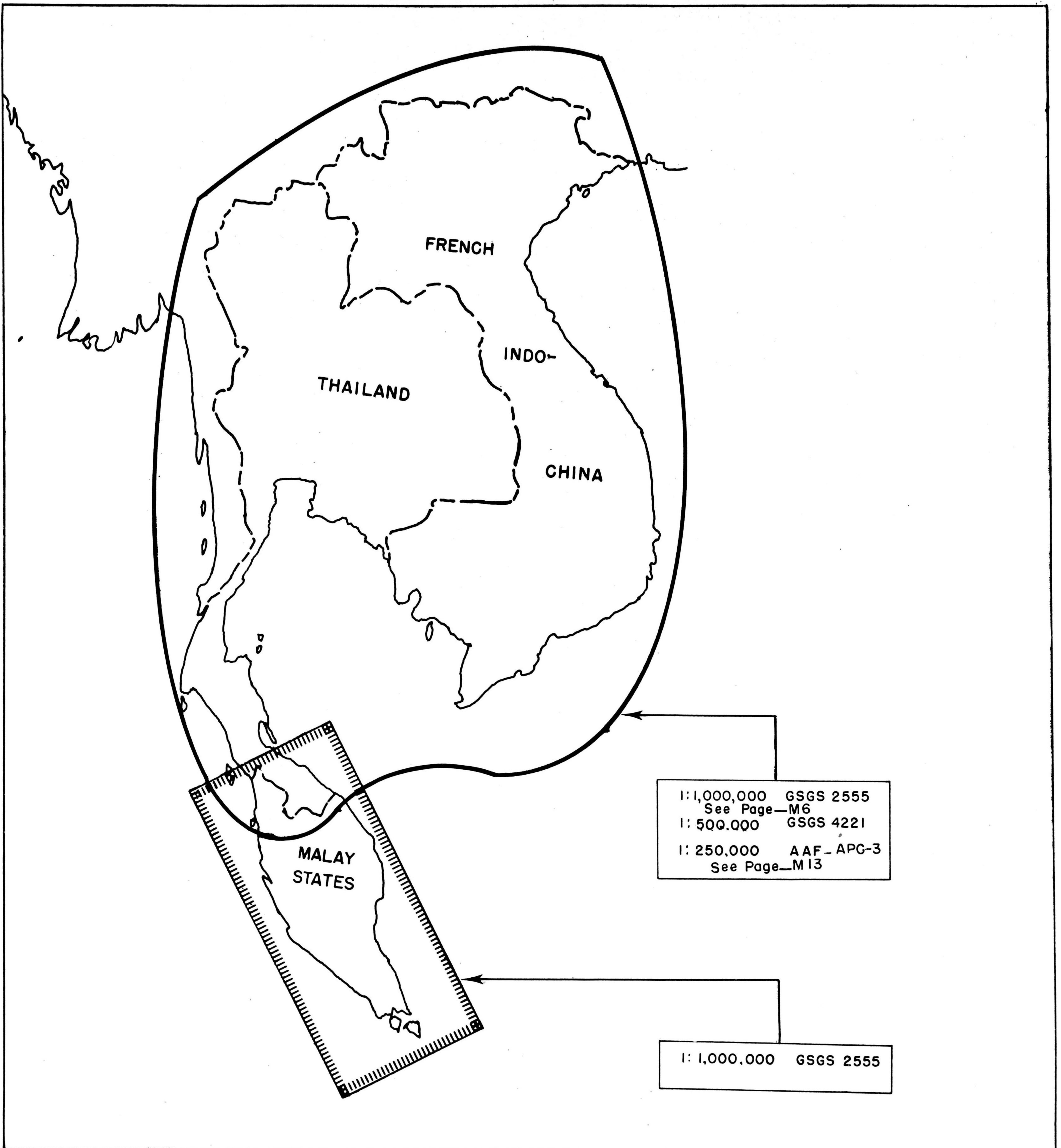
1. Situation almost identical to French Indo-China throughout except for 1:100,000 series item #9 French Indo-China substitute 1:126,720 Survey of India. (AMS L-603) and all sets and sheets less in number due to smaller area covered. Omit French Indo-China item #3.

MALAYA

1. Item #1 through 8 French Indo-China for type of coverage and scales.  
Item #3 1:3,000,000 Malay Peninsula AMS S-207 Special Strategic.  
Item #9 1:63,360 - GSGS 4203 - 120 sheets. Limited quantities available through AMS. Coverage incomplete, follows west coast and blankets lower peninsula. Various larger scale spot coverages - GSGS No. 3772 - Singapore 1:25,000. Various 1:10,800 to 1:2,000 Malay City Plans. GSGS 4476.

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NETHERLANDS EAST INDIES

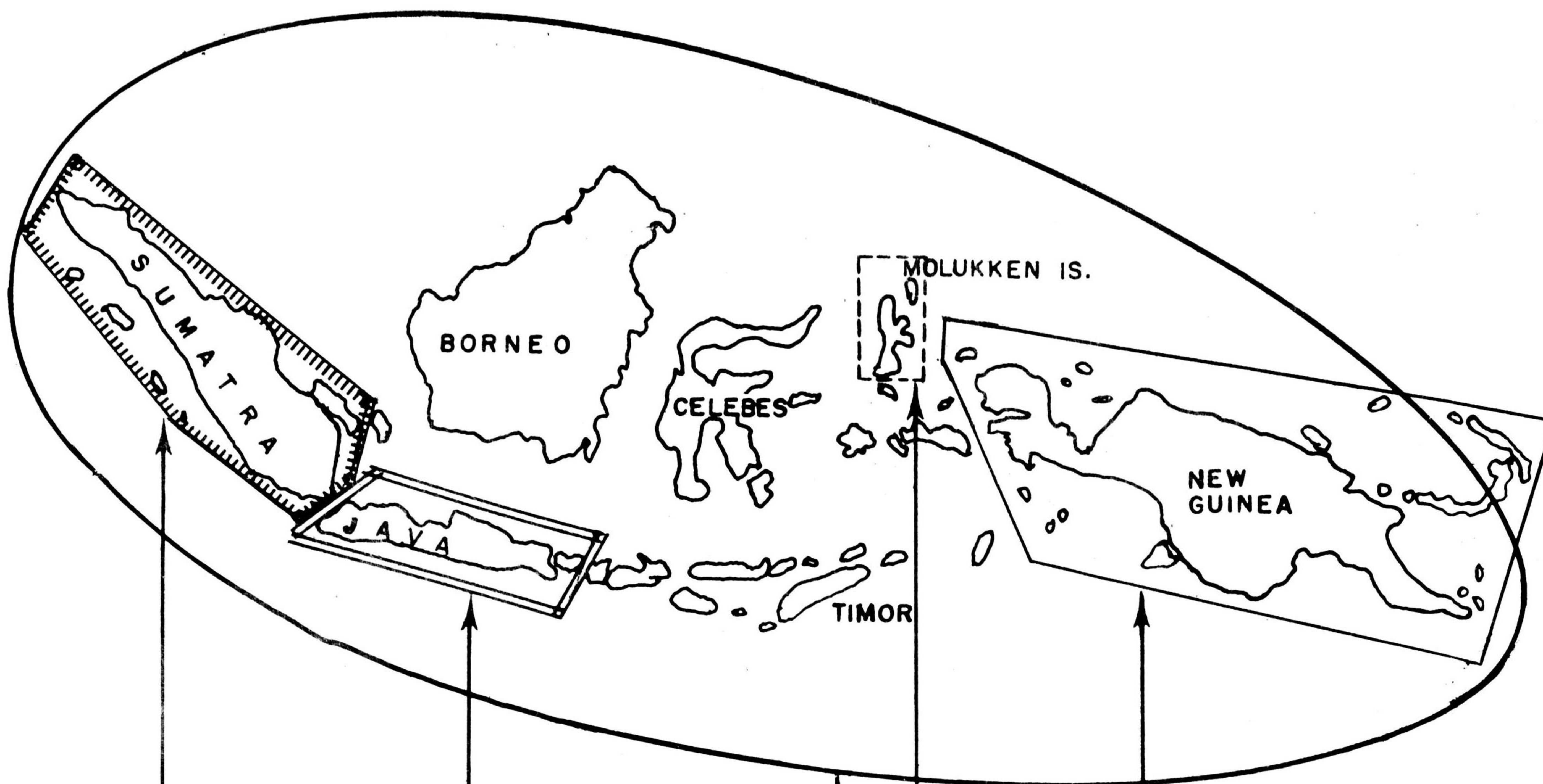
1. 1:6,336,000 AMS 1102 - India, Burma and China sheet also Australasia Sheet.
2. 1:4,000,000 GSGS 3860 - 2 sheets.
3. 1:2,000,000 AMS 9101 - Special Strategic Maps. Sheets by name: Sumatra North, Southern Sumatra, Borneo, Celebes, Sulu Seas, Celebes, Java, Soenda Islands, Timor-Moluccas, Western New Guinea.
4. 1:1,000,000 AMS 9306 (GSGS 4204) - published jointly Army Map Service and G.S.G.S. 29 sheets. 2 sheets from G.S.G.S. 2555 one from AMS 5301 necessary to have full coverage. Previous IMW comments apply here. Various Australian sheets in this area. Format similar but with frequent added air addenda.
5. 1:750,000 GSGS 4184. 10 sheets full coverage. Sumatra. Dated (1934-35)
6. 1:500,000 AMS T401 - 49 sheets covering all of New Guinea. Most recent and only full coverage at this scale. Topographic - gridded. Polyconic.
7. 1:250,000 AMS T511 - Topographic - compilation from sources to 1943. 70 sheets full coverage Sumatra.
8. 1:380,160 GSGS 4311 - 2 sheets Northern Borneo.
9. 1:250,000 AMS T521 - 19 sheets full coverage Java, Madura, Bali.
10. 1:50,000 GSGS 4202 and AMS Extension - joint publication. 381 sheets approximately. For almost all uses complete coverage - Java (actually some scattered missing sheets). Reprints from Dutch Series of same scale - (Topografische Dienst) one of the finest original sets ever compiled. Necessarily dated on some communication and possibly air-field data but a remarkable topographic set. See sample (M-19).
11. 1:50,000 AMS T721. 21 sheets - coverage of most important areas of Bali. Similar to item above.
12. 1:200,000 AMS T531. Projected coverage of Dutch Borneo. 51 sheets published covering Southwestern Borneo. Pontianok area 2 sheets, G.S.G.S. -4215.
13. 1:100,000 AMS T631 - small coverage Southeastern Borneo. 25 sheets. There are other spot coverages at 1:50,000 for Borneo.
14. 1:50,000, 1:40,000. Scattered coverages occur at these scales for Sumatra under AMS T712, T714, T715, T711, T713. They are erratic in coverage and the areas are too small to list. Consultation of AMS indices is necessary for determining coverages. As reprints from Dutch sources they are dated.
15. 1:100,000 GSGS 4201 - broken set coverage parts of Java.

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16. 1:250,000 AMS T543, isolated coverage SE Celebes.
17. 1:200,000 AMS T541 - 14 sheets Northern Celebes.
18. 1:125,000 AMS T641 - 19 sheets Southwestern Celebes.
19. 1:50,000 AMS T441 - 41 sheets Southwestern Celebes.
20. 1:500,000 GSGS 4271 - Timor
21. 1:250,000 AMS T551 - Lesser Sunda Islands. 20 sheets. Similar to Item No. 8.
22. 1:100,000 AMS T654 - Soemba. 11 sheets.  
1:300,000 AMS T655 - coverage Dutch Timor. 20 sheets.
23. 1:250,000 AMS T561 - Molukken Islands. 2 sheets.
24. 1:300,000 AMS T461 - Halmahere 2 sheets.
25. 1:500,000 AMS T402 - Ceram. 1 sheet full coverage.
26. 1:100,000 AMS T663 - Ceram. 13 sheets - only 3 published.
27. 1:100,000 AMS T662 - 43 sheets published - complete coverage Molukken Is. Dutch originals - 4 symbols. Topographic - much of data 1933. Meridians on Batavia.
28. 1:63,360 AMS T771 - reprint from Base Map Plant U.S. Army. G.H.Q., S.W.P.A. Scattered coverage along the north coast of Dutch New Guinea.
29. There are various spot coverages on the New Guinea coast and islands to the north originally published under authorities as item 28 above. These are not listed as tactical events to some degree remove them from the purpose of this summary.
30. Maps of Dutch origin or reprints of Dutch originals usually are based on the prime meridian being that of Batavia which is 106° 48' 38" E. Some of the Sumatra sheets are based on a prime meridian at Zuid Sumatra 103° 33' 27" E. The third but more occasional meridian used is Padang - 100° 22' E.

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I: 750,000 GSGS 4184  
I: 250,000 AMS T511

I: 250,000 AMS T521  
I: 50,000 GSGS 4202  
See Page—M19

I: 500,000 AMS T401

I: 100,000 AMS T662

I: 1,000,000 AMS9306 (GSGS 4204)

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AAF CITY PLANS

City plans on urban areas of the Main Japanese Islands, Korea and Manchuria, are being prepared for use with Air Objective Folders. Plans are printed in six colors at large scale (1:12,500 in most cases) and show topography, hydrography, cover and detailed culture.

<u>Name of City</u>	<u>Objective Area No.</u>	<u>Scale</u>
Akashi	90.25	1:12,500
Akita#	90.6	1:12,500
Amagasaki#	90.25	1:12,500
Aomori#	90.5	1:12,500
Asahigawa	90.2	1:12,500
Chiba	90.14	1:12,500
Daishoji	90.15	1:12,500
Chofu*	90.14	1:12,500
Denenchofu*	90.14	1:12,500
Fukui	90.15	1:12,500
Fukuoka	90.35	1:12,500
Fukushima#	90.10	1:12,500
Fukuyama	90.29	1:12,500
Fushiki#	90.11	1:12,500
Gifu	90.20	1:12,500
Habu	90.29	1:12,500
Hachinohe #	90.7	1:20,000
Hagi#	90.32	1:10,000
Hakodate	90.4	1:12,500
Hamamatsu	90.21	1:12,500
Hanshin Area	90.25	1:75,000
Higashi-Iwase#	90.11	1:12,500
Himeji	90.27	1:12,500
Hiro	90.30	1:12,500
Hirohata - see Shikama	90.27	1:12,500
Hirakata	90.25	1:12,500
Hiratsuka	90.17	1:12,500
Hitachi	90.14	1:12,500
Hirosaki#	90.5	1:12,500
Honjo*	90.17	1:12,500
Hiroshima	90.30	1:12,500
Ichinomya	90.20	1:12,500
Iizuka#	90.35	1:15,000
Isahaya#	90.35	1:10,000
Itabashi*	90.17	1:12,500
Kagamigahara Area	90.20	1:12,500
Kagoshima#	90.38	1:12,500
Kamaishi#	90.8	1:12,500
Kammon Area	90.34	1:50,000
Kanazawa	90.11	1:12,500
Kanda	90.34	1:12,500
Karatsu#	90.36	1:20,000
Kariya	90.20	1:12,500
Kashiwazaki#	90.9	1:12,500
Kawaguchi*	90.17	1:12,500
Kawasaki*	90.17	1:12,500
Kobe#	90.25	1:12,500
Kochi	90.28	1:12,500
Kofu	90.16	1:12,500

\* Indicates plan is one of 22 sheets covering Tokyo and Environs

# Indicates plan is printed and distributed as of 20 Feb 1945

⊕ Indicates plan is published on one sheet "Plans in the Maizuru Area"

## Indicates plan is published in black and white emergency provisional edition.

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Name of City	Objective Area No.	Scale
Koishikawa*	90.17	1:12,500
Kokura##	90.34	1:12,500
Komatsu	90.15	1:12,500
Komatsushima	90.27	1:12,500
Koriyama#	90.10	1:15,000
Koromo	90.20	1:12,500
Kudamatsu#	90.32	1:10,000
Kumamoto#	90.35	1:12,500
Kure#	90.30	1:12,500
Kurume#	90.35	1:12,500
Kushiro	90.2	1:12,500
Kuwana	90.20	1:12,500
Kyoto (2) - No.# & So.#	90.23	1:12,500
Maebashi#	90.13	1:12,500
Maizuru #	90.22	1:12,500
Matsudo*	90.17	1:12,500
Matsue	90.26	1:12,500
Mihara and Itozaki	90.29	1:12,500
Minamata	90.37	1:12,500
Miyakonojo	90.38	1:12,500
Miyazu #	90.22	1:12,500
Morioka#	90.7	1:12,500
Muroran#	90.3	1:12,500
Nagano#	90.12	1:12,500
Nagaoka#	90.9	1:12,500
Nagasaki	90.36	1:12,500
Nagoya (4) NE#, NW#, SE#, and SW#	90.20	1:12,500
Nakano*	90.17	1:12,500
Nanao	90.11	1:12,500
Negishi Bay*	90.17	1:12,500
Naoetsu#	90.9	1:12,500
Nihombashi*	90.17	1:12,500
Niigata#	90.9	1:12,500
Niihama#	90.29	1:12,500
Niiko and Kiyotaki	90.13	1:12,500
Niitsu#	90.9	1:12,500
Nishinomiya#	90.25	1:12,500
Nobeoka#	90.33	1:12,500
Nogata & Environs#	90.35	1:25,000
Numazu	90.18	1:12,500
Od Harima Shipyard	90.27	1:12,500
Ogaki#	90.20	1:12,500
Oita#	90.33	1:12,500
Okayama	90.27	1:12,500
Okegawa	90.17	1:12,500
Omachi#	90.12	1:25,000
Omiya*	90.17	1:12,500
Ominato Naval Base #	90.5	1:12,500
Omori*	90.17	1:12,500
Omura	90.36	1:12,500
Omuta#	90.35	1:10,000
Onoda#	90.32	1:10,000
Osaka (3) - No#, So.#, and Harbor#	90.25	1:12,500
Otake-Iwakuni#	90.30	1:25,000
Ota-Koizumi	90.13	1:25,000
Otaru	90.3	1:12,500
Otsu-Seta	90.23	1:12,500
Rumoi	90.2	1:12,500
Saga	90.35	1:10,000
Saeki	90.33	1:12,500

\* Indicates plan is one of 22 sheets covering Tokyo and Environs

# Indicates plan is printed and distributed as of 20 Feb 1946

/ Indicates plan is published on one sheet "Plans in the Maizuru Area"

## Indicates plan is published in black and white emergency provisional edition.

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<u>Name of City</u>	<u>Objective Area No.</u>	<u>Scale</u>
Sakai	90.25	1:12,500
Sakai	90.26	1:12,500
Sakata#	90.6	1:12,500
Sapporo	90.3	1:12,500
Sasebo	90.36	1:12,500
Sendai#	90.10	1:12,500
Setagawa*	90.17	1:12,500
Shikama, Hirohata & Abashi#	90.27	1:12,500
Shin-Maizuru # ϕ	90.22	1:12,500
Shimizu	90.18	1:12,500
Shimonoseki-Moji##	90.34	1:12,500
Shizuoka	90.18	1:12,500
Suita	90.25	1:12,500
Sunamachi*	90.17	1:12,500
Tachikawa*	90.17	1:12,500
Takamatsu	90.27	1:12,500
Takaoka	90.11	1:12,500
Takasaki#	90.13	1:12,500
Takasago and Befu	90.25	1:12,500
Takada #	90.9	1:12,500
Toba	90.24	1:12,500
Takayama	90.15	1:12,500
Tanashi*	90.17	1:12,500
Tokorozawa*	90.17	1:12,500
Tokushima	90.27	1:12,500
Tokuyama#	90.32	1:10,000
Tokyo and Environs (22)*	90.17	1:12,500
Toyokawa	90.21	1:12,500
Tottori#	90.26	1:12,500
Toyama#	90.11	1:12,500
Toyohashi	90.21	1:12,500
Tsuehizaki#	90.6	1:12,500
Tsuruga#	90.22	1:12,500
Tsurumi*	90.17	1:12,500
Tsuyama	90.26	1:12,500
Ube#	90.32	1:10,000
Uno , Tama and Hibi	90.27	1:12,500
Uraga*	90.17	1:12,500
Uotsu#	90.11	1:12,500
Utsonomiya	90.13	1:12,500
Wakamatsu#	90.10	1:12,500
Wakayama	90.25	1:12,500
Yamagata	90.10	1:12,500
Yamaguchi	90.32	1:10,000
Yatsushiro	90.37	1:12,500
Yawata-Tobata-Wakamatsu##	90.34	1:12,500
Yokkaichi#	90.20	1:12,500
Yokohama*	90.17	1:12,500
Yokosuka*	90.17	1:12,500
Yonago #	90.26	1:12,500
Zentsuji#	90.27	1:12,500
An-shan	93.3	1:12,500
Antung-Shingishu	93.2	1:12,500
Ch'ang-sh'un (Rsinking)	93.3	1:12,500
Ch'i-lin (Kirin)	93.2	1:12,500
Dairen	93.5	1:12,500
Dairen & Env.	93.5	1:25,000
Fu-shun-East & West	93.3	1:12,500
Harbin (Pin-chiang)	93.2	1:12,500

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# Indicates plan is printed and distributed as of 20 Feb 1945

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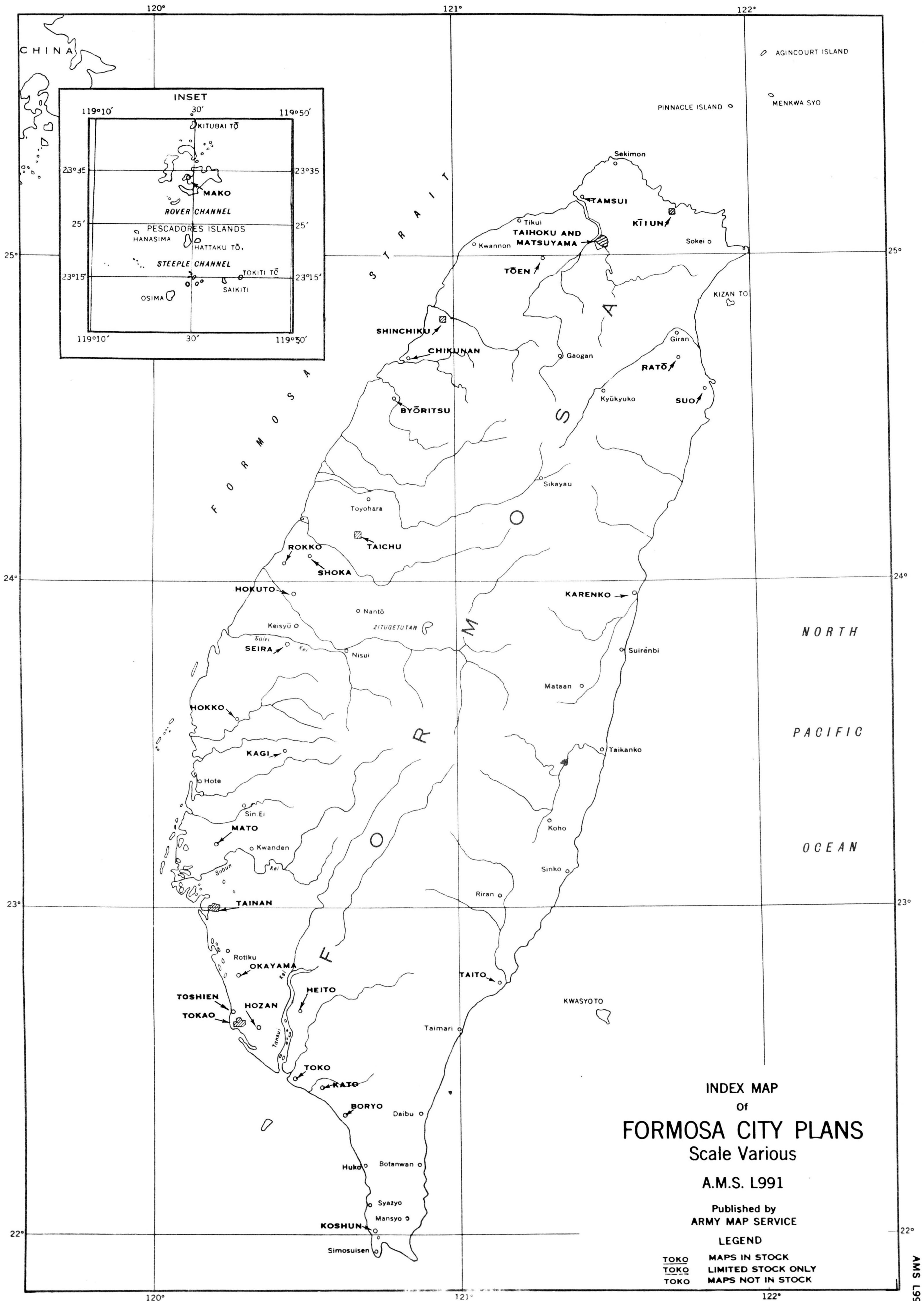
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Name of City	Objective Area No.	Scale
Kyomip'o (Kenjiho)	84.3	1:12,500
Mukden (4) - NE, NW, SE, SW	93.3	1:12,500
Pen-chi-hu	93.3	1:12,500
Ryojun (Pt. Arthur)	93.5	1:12,500
Ssupingchieh	93.3	1:12,500
Sui'-fen-ho###	93.2	1:12,500
Tsitsihar (Lung-chiang)#	93.1	1:12,500
Yalu River Area	93.2	1:75,000
Yingk'ou#(Newchwang)#	93.3	1:12,500
Chinhae (Chinkai)#	84.7	1:12,500
Chinnamp'o (Chinnampo)#	84.3	1:10,500
Ch'ongjin (Seishin)	84.1	1:12,500
Fusen-Choshin	84.2	1:100,000
Haeju (Kaishu)#	84.3	1:12,500
Hamhung (Kanko)	84.2	1:10,000
Hungnam (Konan)	84.2	1:10,000
Kunsan (Gungsan)	84.8	1:12,500
Inch'on (Jinsen)	84.6	1:10,000
Keijo-Jinsen Industrial Area#	84.3	1:10,000
Kyomip'o (Kenjiho)	84.3	1:10,000
Kyongsong (Keijo)	84.6	1:12,500
Masan	84.7	1:12,500
Mok'po (Moppo)	84.6	1:12,500
Musan (Mosan)	84.1	1:50,000
Najin (Rashin)#	84.1	1:20,000
Pusan (Fusan)	84.7	1:12,500
P'yong-yang (Heijo)	84.3	1:12,500
Songjin (Joshin)	84.1	1:12,500
Unggi (Yuki)	84.1	1:12,500
Wosan (Genzan)#	84.4	1:12,500
Yosu (Reisui)	84.8	1:12,500

- \* Indicates plan is one of 22 sheets covering Tokyo and Environs
- # Indicates plan is printed and distributed as of 20 Feb 1945
- ⌘ Indicates plan is published on one sheet "Plans in the Maizuru Area"
- ### Indicates Plan is published in black and white emergency provisional edition.

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INDEX MAP  
 Of  
**FORMOSA CITY PLANS**  
 Scale Various

A.M.S. L991

Published by  
**ARMY MAP SERVICE**

**LEGEND**

- TOKO** MAPS IN STOCK
- TOKO** LIMITED STOCK ONLY
- TOKO** MAPS NOT IN STOCK

FORMOSA CITY PLANS  
SCALE VARIOUS  
A.M.S. L991

SHEET NAME	KEY NUMBER
BORYO	138887
BYORITSU	138888
CHIKUNAN	138889
HAITO	138890
HOKKO	138891
HOKUTO	138892
HOZAN	138893
KAGI	138894
KARENKO	138895
KATO	138896
KIIRUN	138897
KOSHUN	138898
MAKO	138899
MATO	138900
OKAYAMA	138901
RATO	138902
ROKKO	138903
SEIRA	138904
SHINCHIKU	138905
SHOKA	138906
SUO	138907
TAICHU	138908
TAIHOKU&MATSUYAMA	138909
TAINAN	138910
TAITO	138911
TAMSUI	138912
TOEN	138913
TOKO	138914
TOKAO	138915
TOSHIEH	139012

## PORT SHIPPING PLOTS

This is a series of plotting charts of enemy-held Far Eastern ports. They are designed for locating and fixing the position of individual enemy ships of all types. They are large scale (1:12,500) so that annotation, size and type of vessels as well as position in regard to docks, wharves, estuaries and similar mooring locations may be plotted exactly either from reconnaissance photography or report.

They are issued in two formats, viz. chart size 10" x 14" or 18" x 21" adapted for inclusion in the Air Target System folders, (Joint Target Group, Washington, D.C.).

They are similar to the Port Shipping Plots used in the U.K. and the Mediterranean for tracking enemy shipping.

All ports appearing on the AAF City Plans list will be covered by Port Shipping Plots and also all ports appearing in the Air Target System folder Japanese Shipping.

Where adequate photo cover exists, the chart will be in the form of a gridded photo mosaic with interpolated soundings.

The plots bear a 1" (and tenths of an inch marginal divisions) grid overlay with simple H (horizontal) and V (vertical) readings similar to the marginal grid used on target illustrations as issued by the Joint Target Group, Washington, D.C.

First plots are to be distributed in March 1945.

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## SOME HINTS IN HANDLING AND USING MAPS

The following are homely hints for handling and using maps of the Far Eastern Area. They are merely suggestions which are no doubt in constant practice:


1. It is particularly valuable to bind together at least one complete set which becomes the master set for annotations or corrections. Any suitable semi-flexible material can be cut to size for covers and a two or three hole punch made in sheets with a string binding quite satisfactory. String-binding is less destructive to the sheets than metal.

2. Plotting, such as flight and recon tracks, is particularly adapted to colored zip-a-tone which is transparent. Orange or yellow are the best colors on most sets. Zip-a-tone can be secured in large sheets and is quickly adhesive by simply burnishing or rubbing.

3. When a set is bound - always paste an index to left hand cover inside.

4. For quick, ready and rough coordinate plotting it is very handy to make a template on acetate with divisions in minutes all the way across the template. If the country covered by the map set extends principally east and west within a comparatively narrow band of latitude one template is sufficient on conic projections. Select a representative middle sheet for the drawing of the template. This can then be superimposed on any sheet for ready, quick reprints. A new template or set of templates must be made for each set of bound maps. Keep in inside cover attached with masking tape.

5. Hints in working with Japanese maps particularly the 1:50,000 series.

- a. All Japanese elevations and depths are in meters and tenths of meters.
- b. All Japanese metric figures use a comma instead of a decimal point.
- c. All Japanese depths are in meters rather than fathoms.
- d. The Japanese Ri measurement equals 3.44 miles.
- e. Frequently Japanese Imperial Land Survey sheets are off 10.4 seconds from full degree and minutes of longitude however the sheets bear this correction.
- f. Watch that certain symbols do not appear as cultural features particularly the symbol  for Prefectural Seat.
- g. The most important feature of Japanese rivers in flat areas is the very fine dike symbols. These rivers are extremely variable in flow and the true boundary is more times than not the dikes. In general from the air Japanese rivers are more prominent and appear larger than the 1:50,000 maps would suggest.
- h. In comparing aerial photos and the 1:50,000 map (AMS L-761 thru L-764, L-771 thru L-775, L-791, W-511) pay particular attention to the true symbols. The cover has proved remarkably accurate on these maps.
- i. Photo-cover has demonstrated 3 primary cultural changes on Japanese maps: (1) Changes in shore-lines in the form of reclaimed land; (2) Straightening of or new primary highways; (3) New airfields and expanded old ones.
- j. The Japanese symbol for a power plant (a toothed

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circle with extended prongs) signifies either a steam power plant, a hydro-electric plant or a mere transformer or substation.

- k. The use of a diagonal hatched block-like form in built up areas does not necessarily indicate individual buildings but rather a dense built up area.
  - l. A careful study will often show that villages are very constant reference points. This is useful in plotting airfields. The shape of these villages follows the cross-hatch shape on the maps.
  - m. Vegetation - rice, etc. also seems to bear remarkable agreement with photography.
  - n. The high-tension lines shown on the Japanese maps are rarely visible on photography.
  - o. In a general way everything on a Japanese 50 will be found on a comparable air photo but obviously the case is not true in its converse.
  - p. All sheets which have a flat foreshore and particularly if rivers enter the sea are open to caution because of the enormous amount of work in such areas that has been done in Japan since the map dates.
6. Some general hints on individual maps:
- a. Always be suspicious of maps without listed sources.
  - b. Always examine sources immediately particularly as regards date.
  - c. Remember that there has been no aerial reconnaissance over Japan, Korea or Manchuria prior to 1943.
  - d. Remember that a map's intelligence may date back from its published date anywhere from four months to several years.
  - e. Remember that overprints on maps though perhaps spoiling their aesthetic value are made to add information.
  - f. Maps are made with specific use range as to scale, so location of objects should be taken from the largest scale maps possible.
  - g. Maps are inanimate and when you know you are right change them.
  - h. Until proved wrong the map is always right.

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## MISCELLANEOUS ADDENDA

In the assembling and collating a booklet of this sort the time interval involved is necessarily so great as to allow certain new or projected map sets and map relative materials to appear:

- a. 1:25,000 Japan - Central Honshu AMS L874
- b. 1:25,000 Japan - Southern Japan AMS L875 both of these sets have begun to appear.
- c. Japan City Plans - AMS L902
- d. Korea City Plans - AMS L951
- e. Manchuria City Plans - AMS L941 all of these have a similar format and coverage to the AAF City Plans. First AMS editions in some cases are reprints of AAF City Plans with addition of military grid. Some editions will be re-compilations from photography on AAF City Plan type base. Some of these have begun to appear (3/23/45).
- f. 1:250,000 Manchuria - AMS has commenced compilation on this set.
- g. Directions for the Treatment of Geographical Names in Manchuria, Board on Geographical Names, Washington 25, D.C. This pamphlet though primarily a source for the handling of transliteration directly from foreign language sources also lists approximately 200 Manchurian place names with their numerous variants. In view of the extremely sparse and complicated material on Manchurian place names this has particular value.
- h. Target Chart Perspectives - A new type of perspective has been developed by the XX Bomber Command. The view point is represented at 25,000' fifteen miles from the objective. Approach mileage lines are concentric ellipses. Fixed points are shown with tangency values appearing on the face of the perspective.
- i. 1:1,000,000 - Northern Honshu (AAF Relief)
- j. 1:1,000,000 - Southern Japan (AAF Relief)
- k. 1:1,000,000 - Korea (AAF Relief) all of these are in process of reprint by the AMS with overprint of new transportation (rail and highway) data.
- l. Manual for the use and construction of Terrain Models - OPNAV-16-V #S56, 1 May 1944. Air Intelligence Group, Division of Naval Intelligence, Office of the Chief of Naval Operations, Navy Department, Washington, D.C. Very detailed and thorough treatise - valuable technical advise and tables.

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## TABLE OF MAP TYPE SAMPLES

- M-1 Planning Maps, scale 1:6,336,000, China, Burma and India AMS 1102.
- M-2 Naval Air Navigation Charts, scale 1:2,188,800 - HO V30 series.
- M-3 Special Strategic Maps, scales various; AMS 5207, 9101.
- M-4 Asia, scale, 1:1,500,000; AMS 5304
- M-5 Philippine Islands; scale 1:1,500,000; AMS 5305
- M-6 I.M.W's; scale, 1:1,000,000; AMS 5301, 5302, 9306, & G.S.G.S. 2555.
- M-6A A.A.F. (Berry) Relief Maps - 1:1,000,000 and 1:500,000.
- M-7 Air Pilotage Chart; scale 1:1,000,000; AAF APC-1.
- M-8 Air Pilotage Chart; scale 1:500,000; A.A.F. APC-2.
- M-9 Manchuria; scale 1:500,000; A.M.S. L-401.
- M-10 Japan, Formosa, Korea; scale 1:250,000; A.M.S. L-551, L-561, L-571, L-591 & L-592.
- M-11 China; scale 1:250,000; A.M.S. L-531 & L-581.
- M-12 Aero. Approach Chart; scale 1:250,000; A.A.F. APC-3
- M-13 Aero. Approach Chart; Relief, scale 1:250,000, A.A.F. APC-3
- M-14 Aviation Charts (Navy); scale 1:218,880; H.O. V-3 series.
- M-15 French Indo-China; scale 1:100,000; A.M.S. L-601.
- M-16 Japan and Japanese Islands; scale 1:50,000; A.M.S. L-761 L-762, L-763, L-764, L-771, L-772, L-773, L-774, L-775 & L-791.
- M-17 Formosa; scale 1:50,000; A.M.S. L-792
- M-17A Ryukyu-Retto 1:50,000 A.M.S. L-791.
- M-18 Philippines; scale 1:50,000; A.M.S. S-712, S-731, S-741, & S-751.
- M-19 Netherlands East Indies; 1:50,000; G.S.G.S. 4202.
- M-20 Formosa; scale 1:25,000; A.M.S. L-892 (Photo on reverse side of map A.M.S. L-092)
- M-21 Philippines; scale 1:25,000; A.M.S. S-812, S-831, & S-851.
- M-21A Philippines; scale 1:25,000; A.M.S. S-011 (Photo Map)
- M-22 Ryukyu-Retto; scale 1:25,000; A.M.S. L-391
- M-22A Ryukyu Retto; scale 1:25,000; A.M.S. L-091 (Photo Map)
- M-23 A.A.F. City Plan

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JAPAN

SEA

PO HAI WAN  
(Gulf of Chihli)

YELLOW SEA  
(Huang Hai)

EAST CHINA SEA  
(Tung Hai)

NANSEI-SHOTO  
(RYUKYU ISLANDS)  
(JAPAN)

KOREA

FUKUOKA

KYUSHU

TSUSHIMA

HIROSHIMA

YAWATA

OSAKA

KAGOSHIMA

TOKARA-GUNTŌ

AMAMI-GUNTŌ

OKINAWA-GUNTŌ

Okinawa-shima

Okinawa-jima

Naha

Matsue

Tottori

Okayama

Kobe

Osaka

Kyoto

Wakayama

Tokushima

Miyazaki

Kagoshima

Osumi-kaikyō

Tanega-shima

Yaku-shima

Nakano-shima

Suwanose-shima

Tokara-shima

Amami-shima

Tokuno-shima

Okino-Erabu-shima

Daitō-shima (JAPAN)

Okino daitō-shima (JAPAN)

Nishi-Chōsen-wan

Chinnamp'o

Heiju

Inch'ŏn

Kapsong

Kyongsong

Ch'ungju

Ch'ŏnju

Iri

Kwanju

Masan

Such'ŏn

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PLANNING MAPS  
SCALE 1:6,336,000

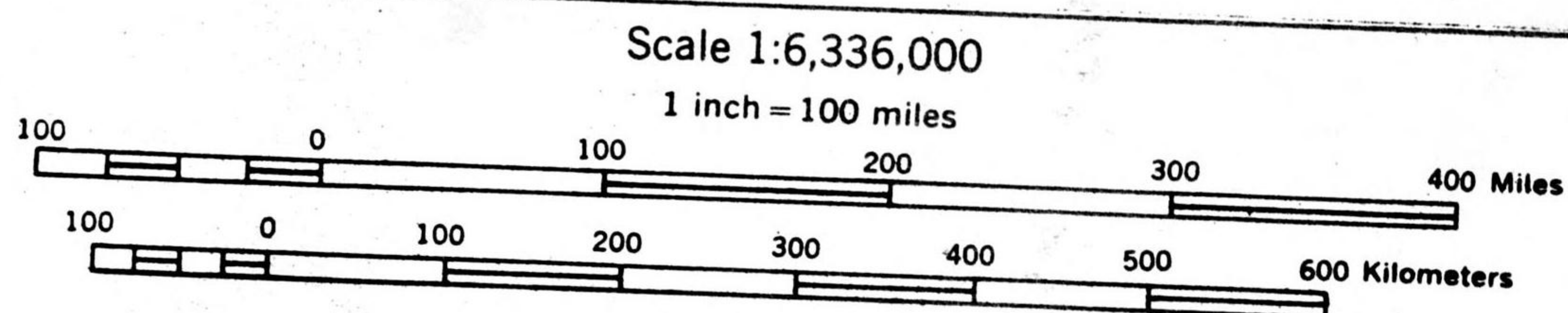
CHINA, BURMA  
AND  
INDIA

A.M.S. 1102

FIRST EDITION-AMS 1

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Not for sale or distribution

ARMY MAP SERVICE, U. S. ARMY, WASHINGTON, D. C., 134190  
10/44 ST 1944

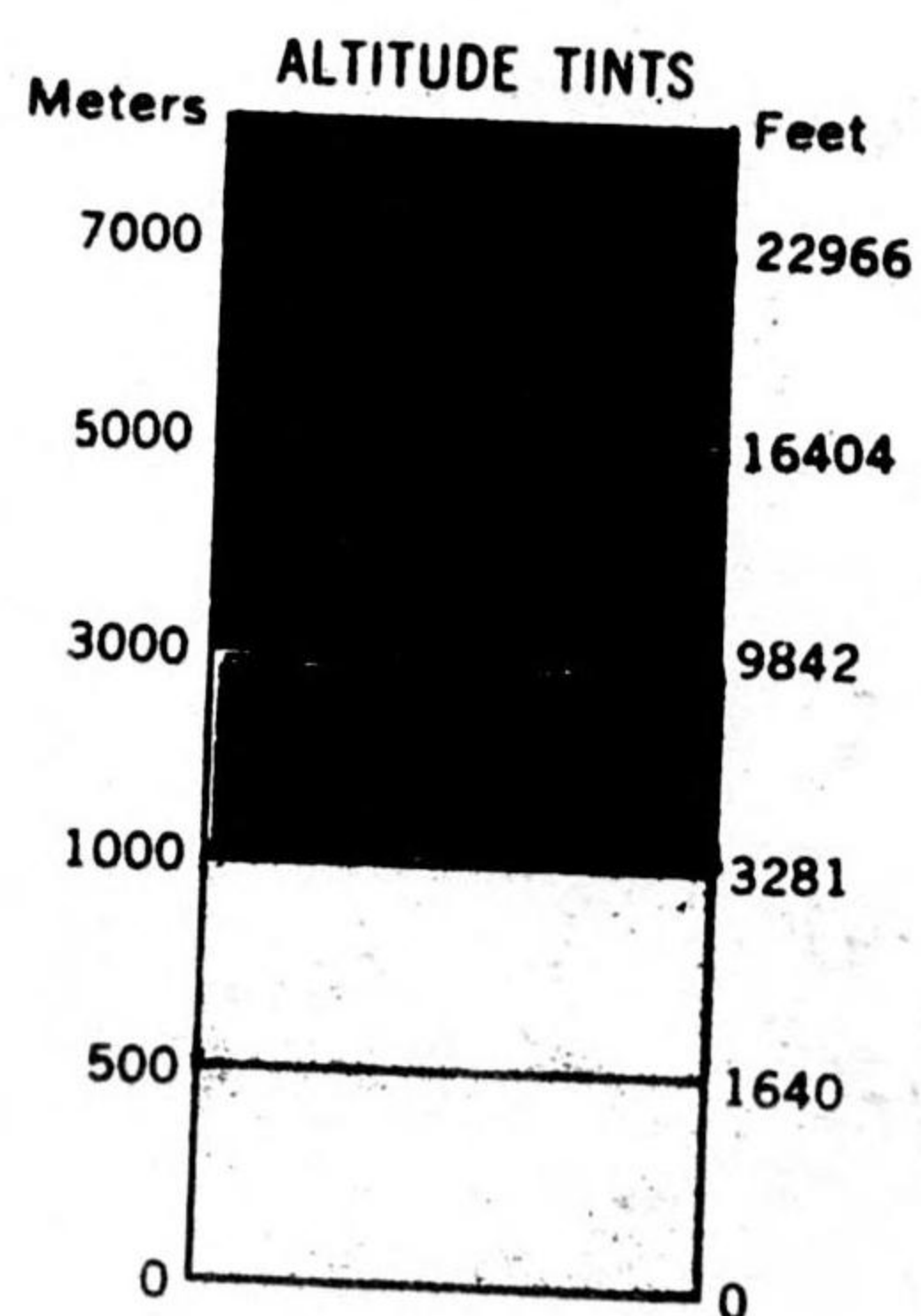


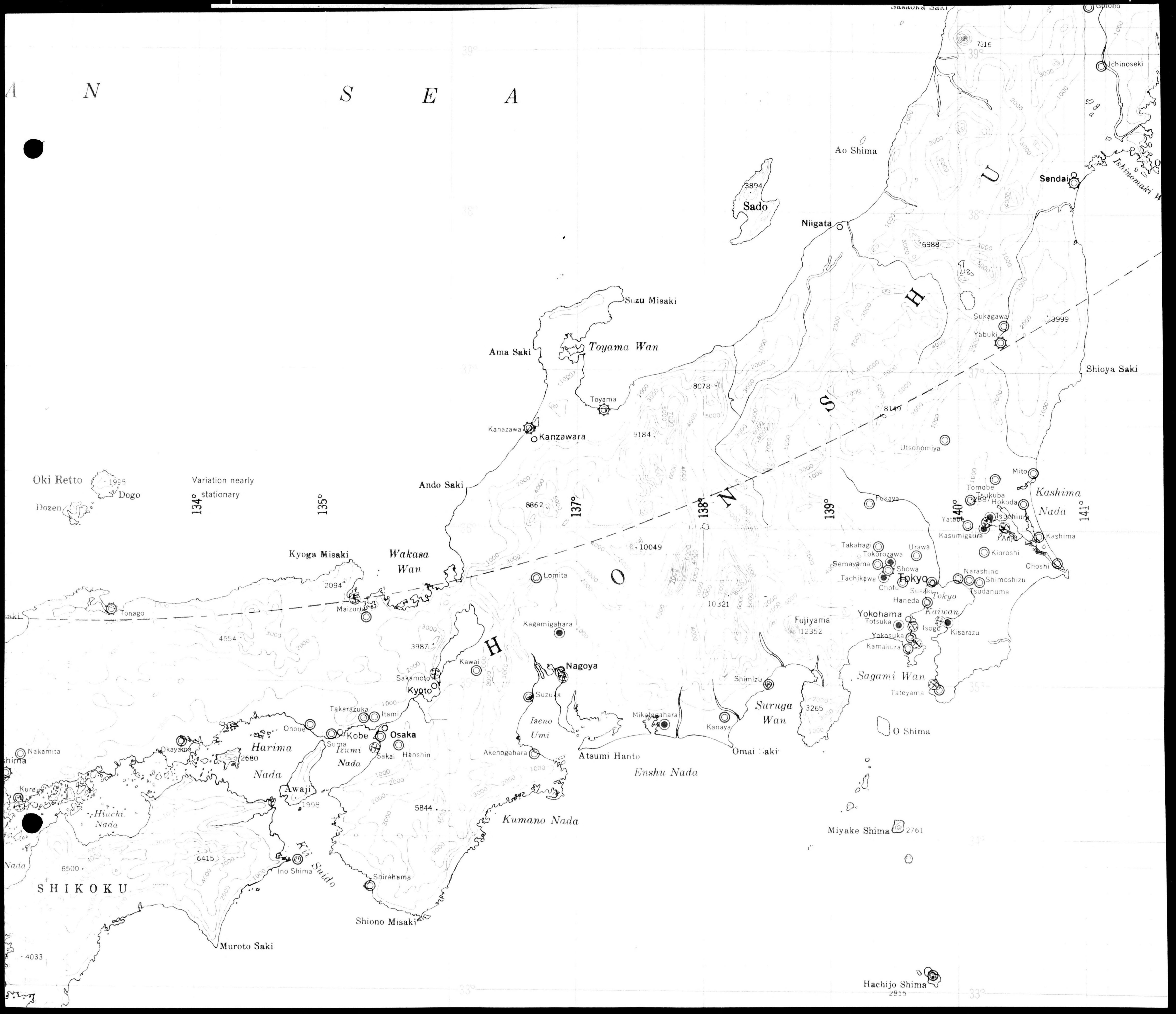
Azimuthal Equidistant Projection  
Projection Center 20°N and 115°E  
HEIGHTS IN METERS

LEGEND

- |                            |   |           |           |
|----------------------------|---|-----------|-----------|
| Towns of First Importance  | ■ | Railroads | —+—+—+—+— |
| Towns of Second Importance | ● | Roads     | —+—+—+—+— |
| Towns of Third Importance  | ○ | Trails    | —+—+—+—+— |
| International Boundaries   | ▨ |           | —+—+—+—+— |

Prepared under the direction of the Chief of Engineers, U. S. Army, by the Army Map Service (AM-LU), U. S. Army, Washington, D. C., 1944. Compiled from:  
Asia, 1:4,000,000, GSGS 2957, 1931-1939.  
Asia, 1:2,000,000, MIS, sheets NW, NE, SW, SE, 1943.  
Australasia, 1:6,336,000, AMS, 1943.  
U.S.H.O. Charts 5591 (1933), 5592 (1934), 5593 (1942).  
USSR, 1:5,000,000, Chief Administration of Geodesy & Cartography, 1940.  
Formosa, 1:2,000,000, AMS, 1943.  
Korea, 1:2,000,000, AMS, 1943.  
Japan (North), 1:2,000,000, AMS, 1943.  
Japan (South), 1:2,000,000, AMS, 1943.  
Russian Maritime Provinces, 1:4,000,000, AMS, 1943.  
Eastern Asia, 1:1,000,000, AMS, sheets NK-55, NL-55, NL-56, 1943.  
East Indies, 1:4,000,000, GSGS 3860, 1928.  
Japanese H.O. Charts 48, 2103, and intelligence data.





A N S E A

Variation nearly stationary  
134°

Oki Retto  
Dozen  
Dogo  
1995

SHIKOKU

Hachijo Shima  
2815

# AIR NAVIGATION CHART

Published at the Hydrographic Office, Washington, D. C., June 1948  
under the authority of the SECRETARY OF THE NAVY











MERCATOR PROJECTION

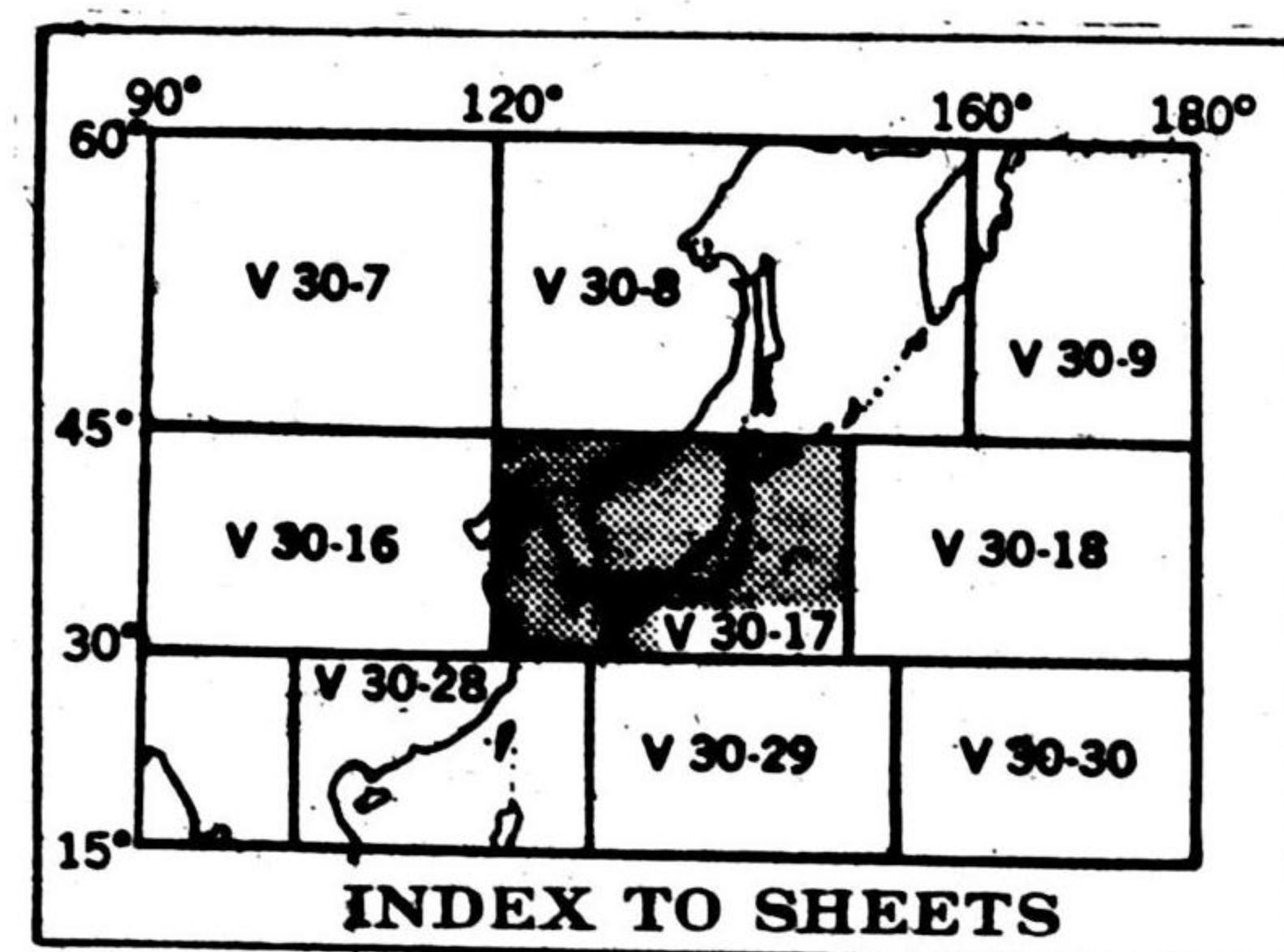
Scale 1"=30 Nautical Miles (1:2,188,800) at Lat. 37°30'

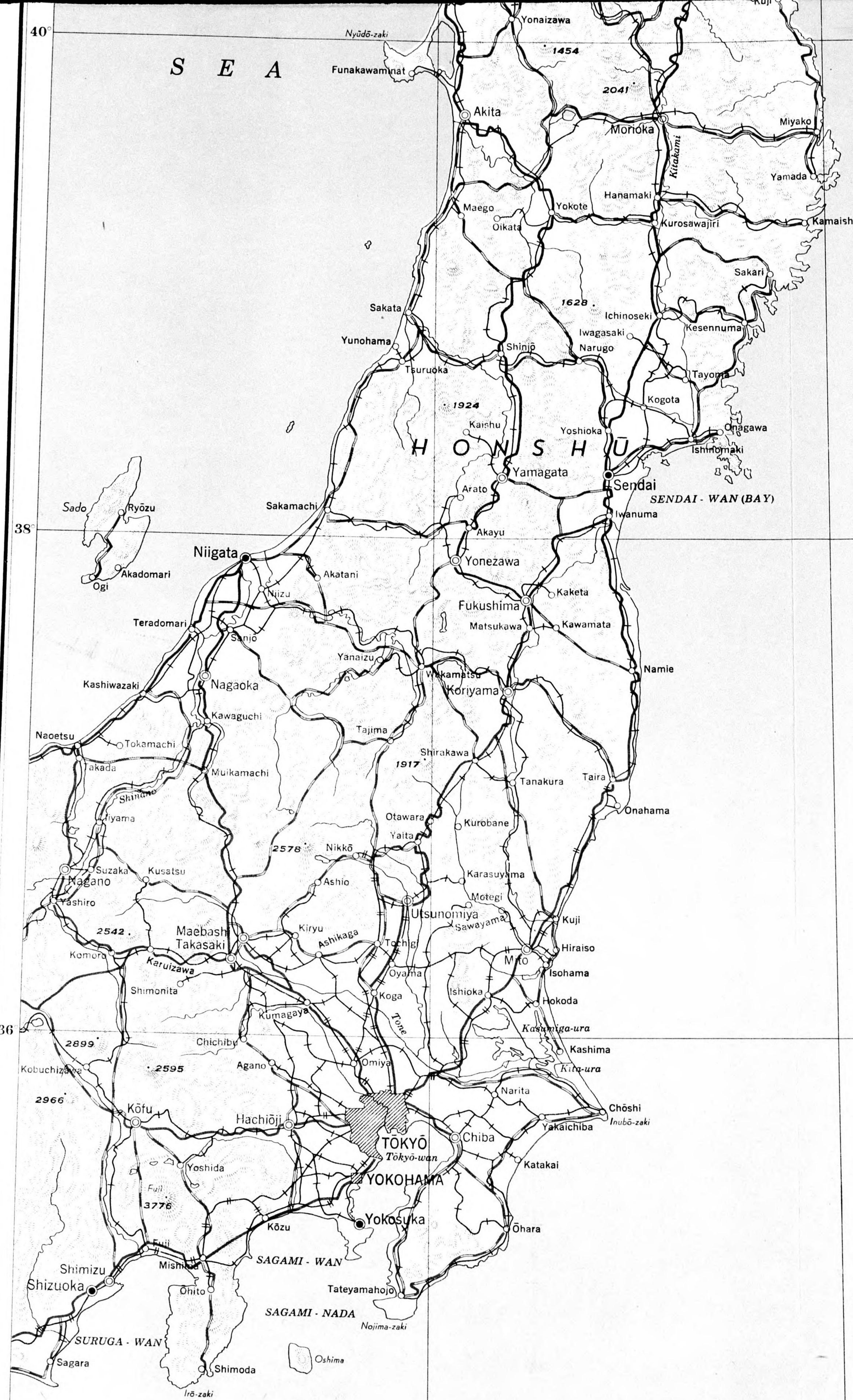
HEIGHTS IN FEET

Form line interval 1000 feet

## LEGEND

- Landplane Base—Military. Complete facilities.....
- Landplane Base—Commercial. Complete facilities.....
- Landplane Airport—Military. Refueling and limited repair facilities.....
- Landplane Airport—Commercial. Refueling and limited repair facilities.....
- Air Navigation Light Beacon.....
- Seaplane Base—Military. Complete facilities.....
- Seaplane Base—Commercial. Complete facilities.....
- Seaplane Airport—Military. Refueling and limited repair facilities.....
- Seaplane Airport—Commercial. Refueling and limited repair facilities.....
- Radio facility and identification.....





S E A

N O R T H

P A C I F I C

O C E A N

**JAPAN (NORTH)**  
**SPECIAL STRATEGIC MAP**  
 Scale 1:2,000,000

20 0 20 40 60 80  
 20 0 20 40 60 80 100 120 140

Polyconic Projection  
 HEIGHTS IN METERS

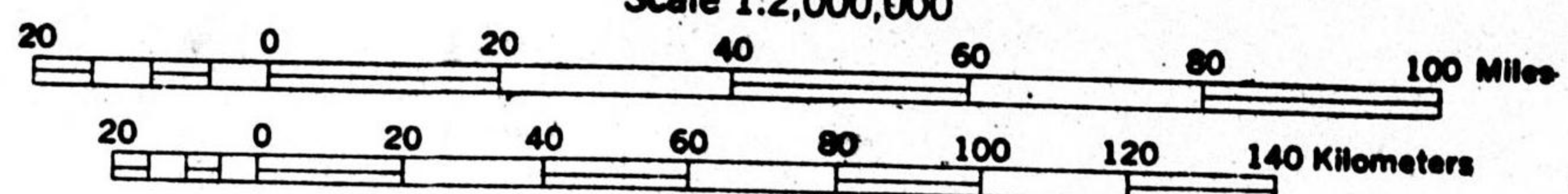
LEGEND

MAP - 3

# JAPAN (NORTH)

## SPECIAL STRATEGIC MAP

Scale 1:2,000,000



Polyconic Projection

HEIGHTS IN METERS

### LEGEND

Towns of First Importance.....	▣	Primary Roads.....	—
" " Second ".....	⊙	Secondary Roads.....	- - -
" " Third ".....	⊙	Railroads: Double Track	—+—
" " Fourth ".....	○	3'6" Gauge	—+—

Prepared under the direction of the Chief of Engineers, U. S. Army, Washington, D. C.  
Compiled by the Army Map Service, May 1943, from the following sources:  
Japan 1:2,000,000 Society for International Cultural Relations, 1937.  
International Map of the World 1:1,000,000. Sheets:  
NJ 53 1927, NJ 54 1932, NK 54 1933, NK 55 1932, NL 54 1936, NL 55 1936.  
**AMS 5207.**  
First Edition (AMS 1), 1943.



ASIA 1:1,500,000

MAP - 4

ULAN-BATOR, M. P. R.  
N4200-E9900/600x900

Copied from a U.S.S.R. Map dated 1940

Map compilation based on all data available as of March, 1939. Original map: Chief of Division, Engineer Bulkin; Chief of Cartographic Section, Major Khukhorev; Military Commissar of the section, Political Supervisor Golovinov. Edited by Engineer-Cartographer Kostritz.

Gauss Conformal Conic projection, with tangent parallel at 51°.  
Transliterated from Russian according to the modified 1942 P. C. G. N. System.

A. M. S. 5304

LEGEND

ULAN-BATOR

Capital of State

TSETSERLIG

Capital of Aymak and Province

KHENTEY SOMON

Capital of Permanent and Nomadic Tribes

Dabusun sume

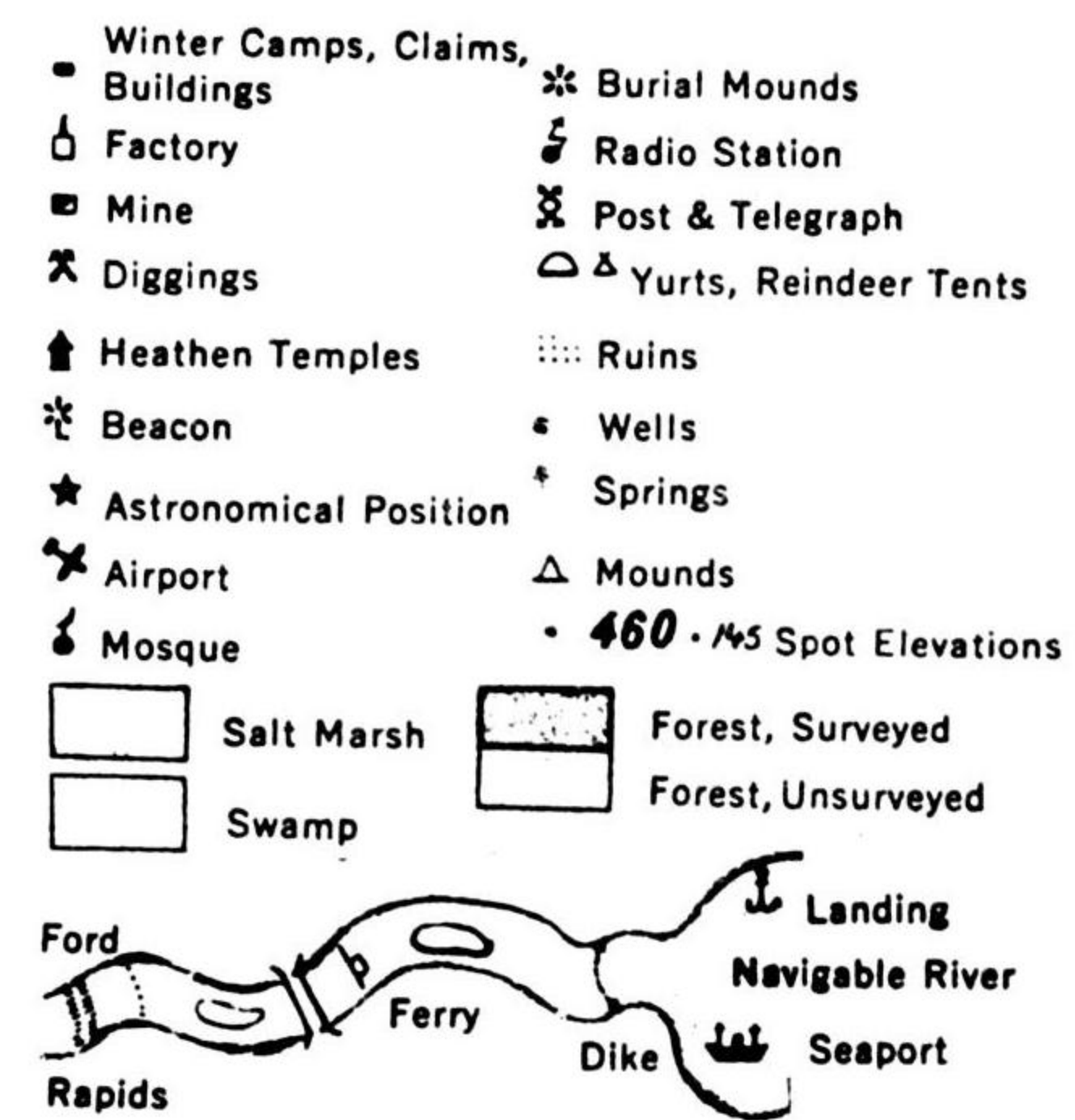
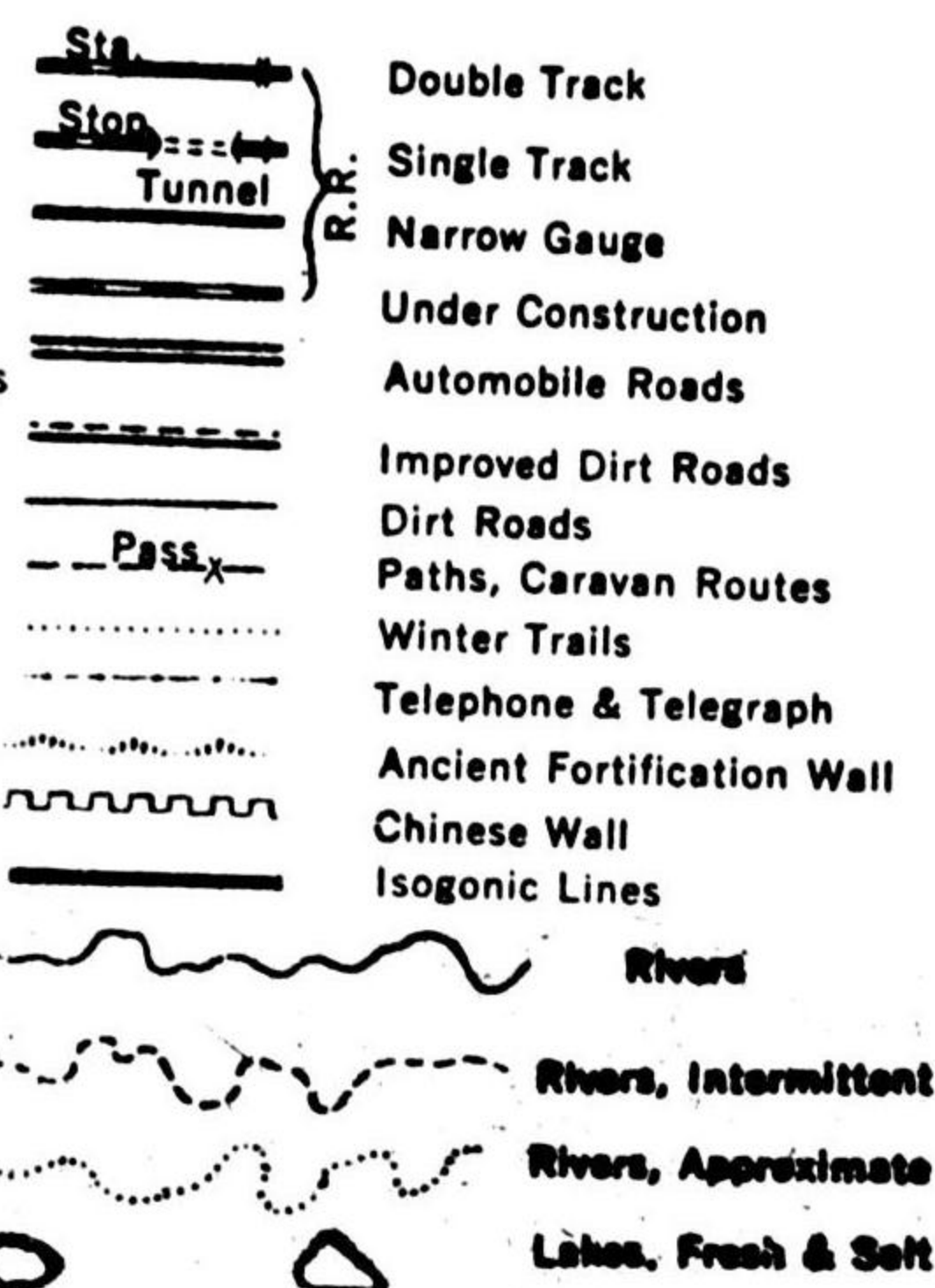
Small Cities; Large Monasteries

Gurbaniy urto

Tribal Headquarters

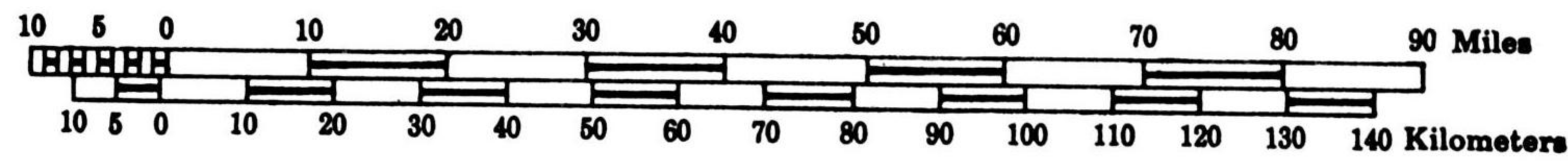
Aletu

Other Settlements



HEIGHTS IN METERS

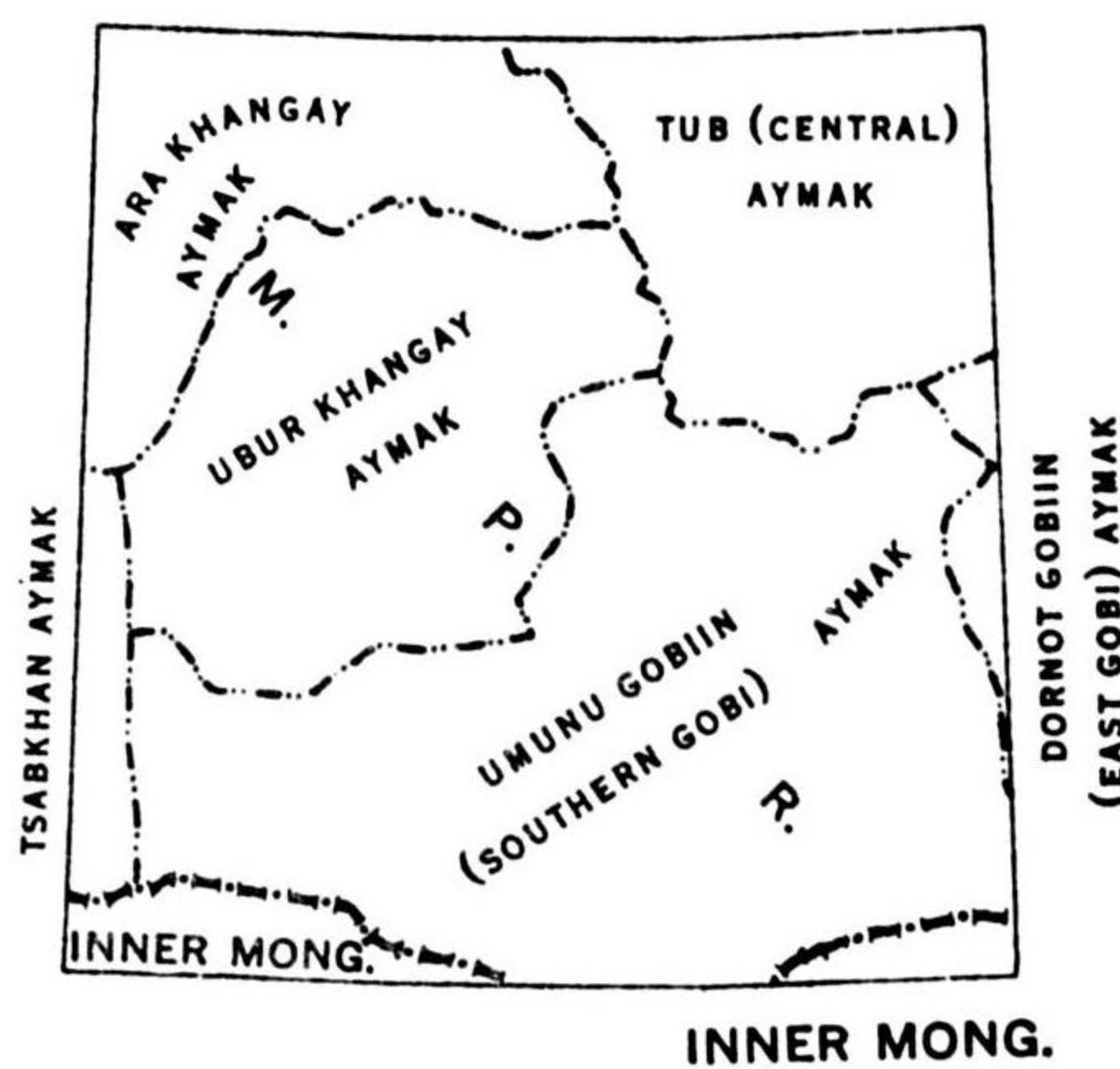
Scale 1:1,500,000



INDEX TO ADJOINING SHEETS

VII-11 MINUSINSK	VII-12 IRKUTSK	VII-13 CHITA
VIII-11 CHZHIB-KHALANTU	VIII-12 ULAN-BATOR	VIII-13 DOLONNOR
IX-11 TSAIDAM	IX-12 KAO-LAN (LAN-CHOU)	IX-13 PEI-P'ING

INDEX TO BOUNDARIES



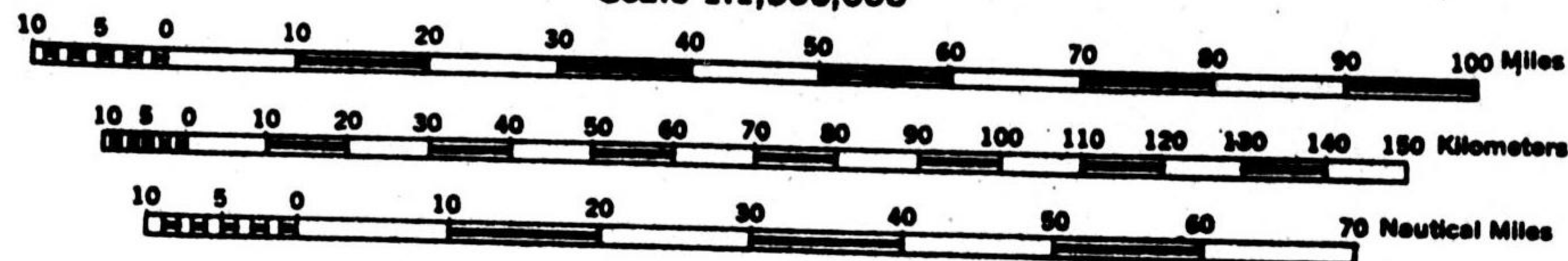




# PHILIPPINE ISLANDS

MAP - 5

Scale 1:1,500,000



POLYCONIC PROJECTION

N400-E11600/1600x1200

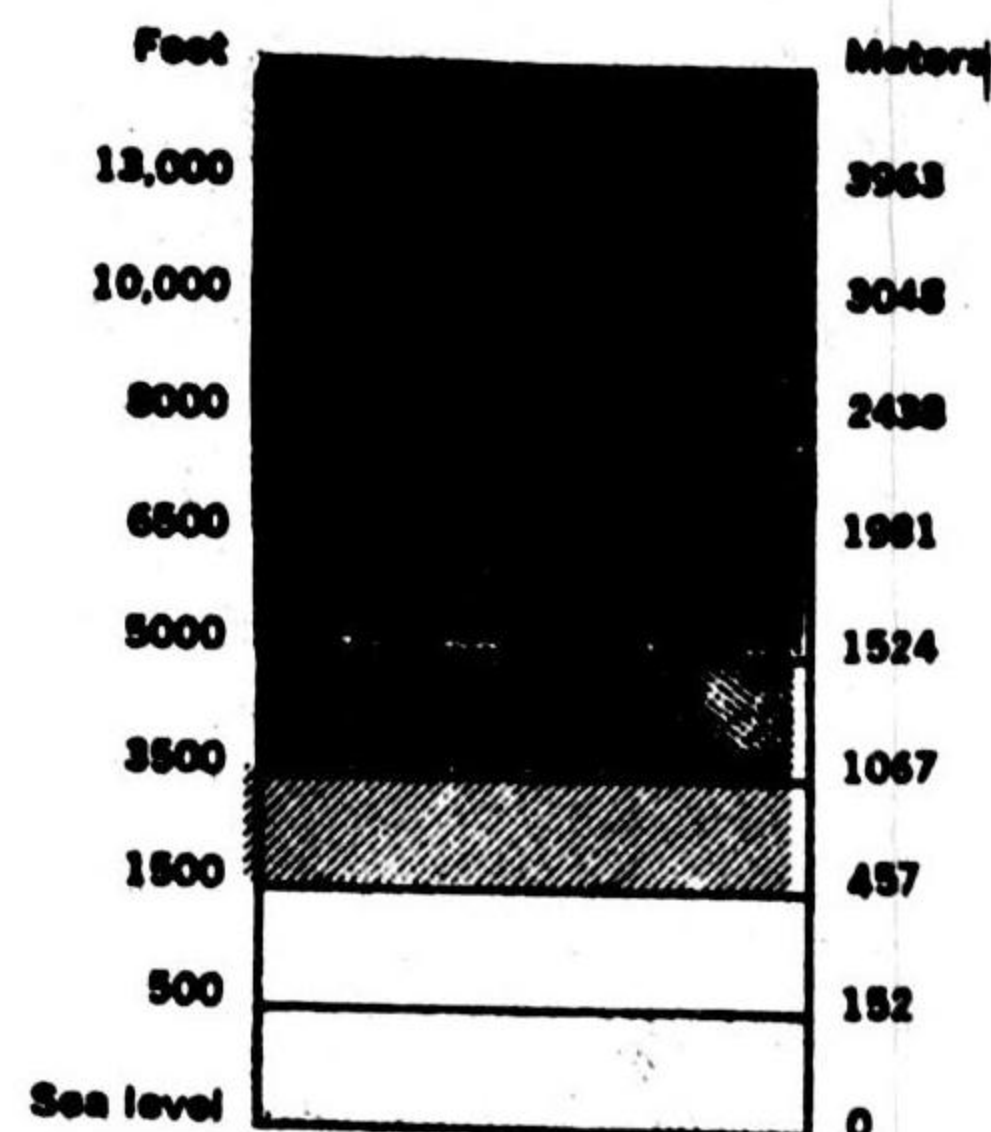
Prepared under the direction of the Chief of Engineers, by the Army Map Service (AM), U. S. Army, Washington, D. C., 1944. Compiled from Eastern Asia, AMS 5301. 1:1,000,000, 1944. Sheets NB 50, NB 51, NB 52, NC 50, NC 51, NC 52, ND 50, ND 51, NE 50, NE 51. U. S. C. & G. S. Chart 4205.

A.M.S. 5305 S  
First Edition (AMS 1) 1944

## LEGEND

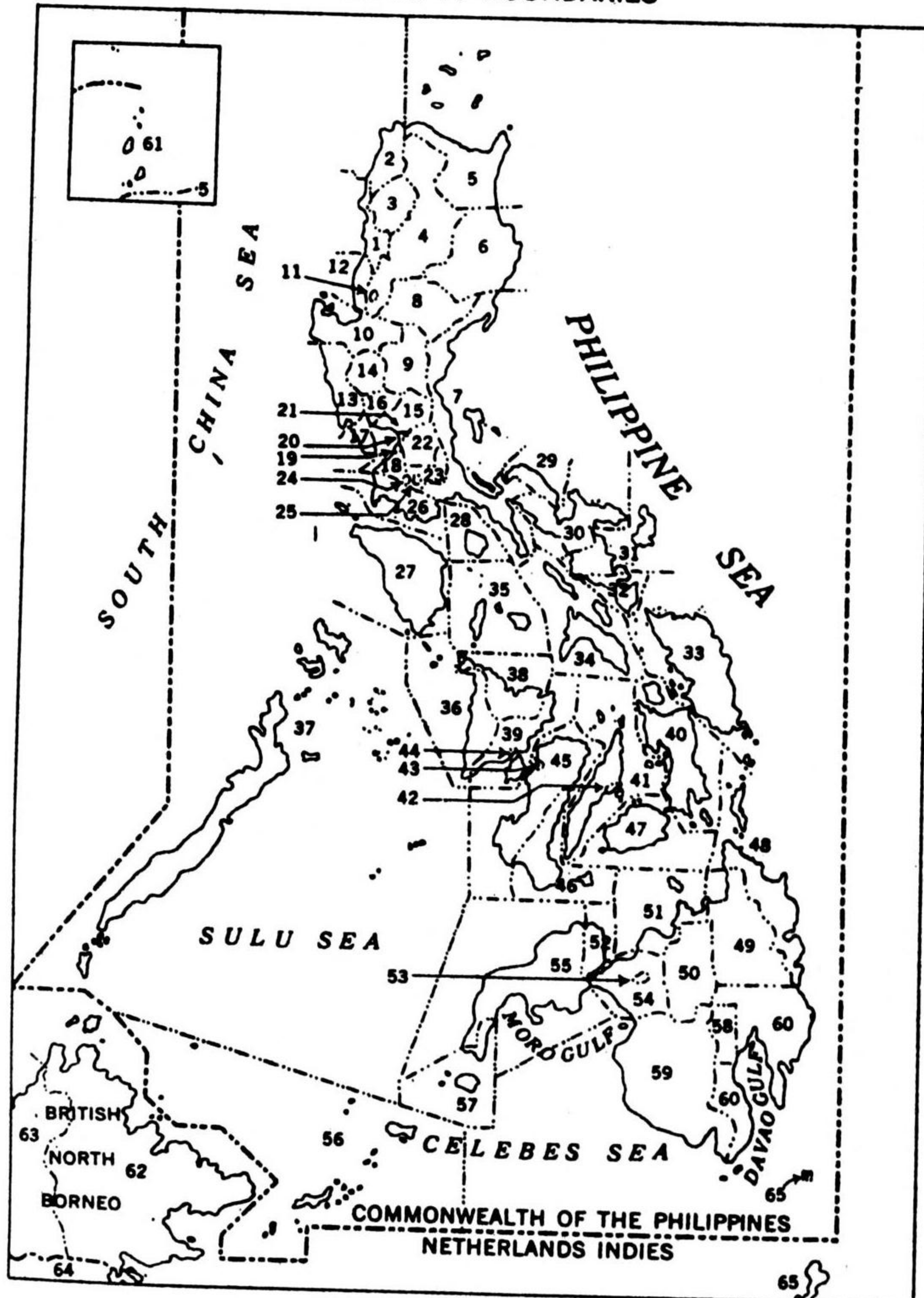
City (1st Importance).....	<b>MANILA</b> ●	Main Road.....	—————
City (2nd Importance).....	<b>CANIDAD</b> ○	Secondary Road.....	—————
Town.....	Montalban ○	Track or Trail.....	- - - - -
Village or Settlement.....	Pilapala ○	Road under Construction, 1941.....	- · - · -
International Treaty Limits.....		Ferry.....	~~~~~
Boundary: Province or Chartered City.....		Telephone and Telegraph Line.....	TTTTTTTT
Boundary in Borneo Residency.....		Power Transmission Line.....	—————
Railroads, 3'6" Gauge: with station.....		Marsh.....	
Railroads, Less than 3'6" Gauge.....		Mud or Tidal Flat.....	
Railroad, Electric.....		Height (in feet).....	743
Contour.....	500	Mine.....	⊕
Approximate Contour.....	500	Rock Awash.....	⊕
Sand.....		Limiting Danger Line.....	⊕
Principal Navigation Light.....	★		

## ALTITUDE TINTS



## HEIGHTS IN FEET

## INDEX TO BOUNDARIES

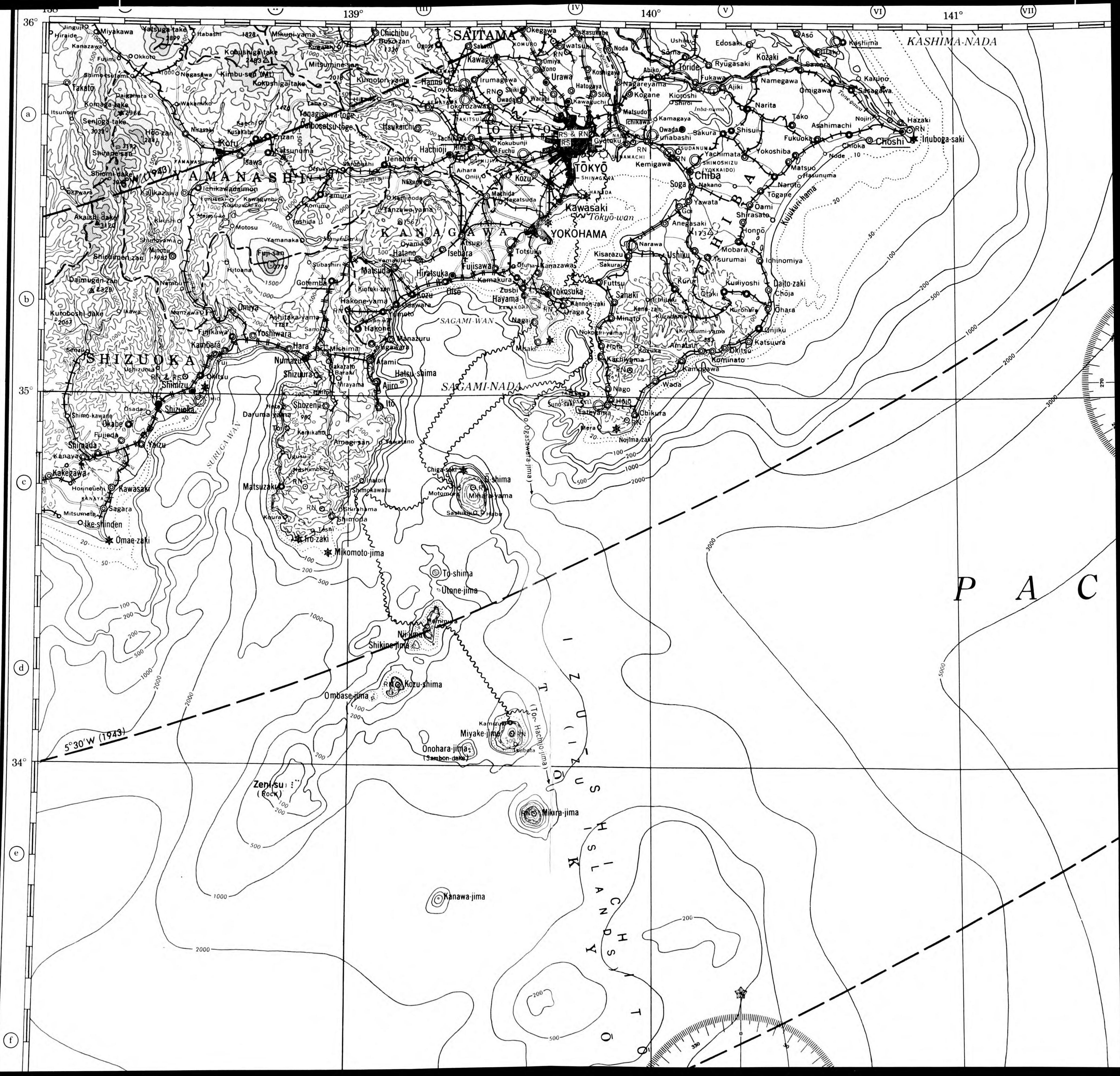
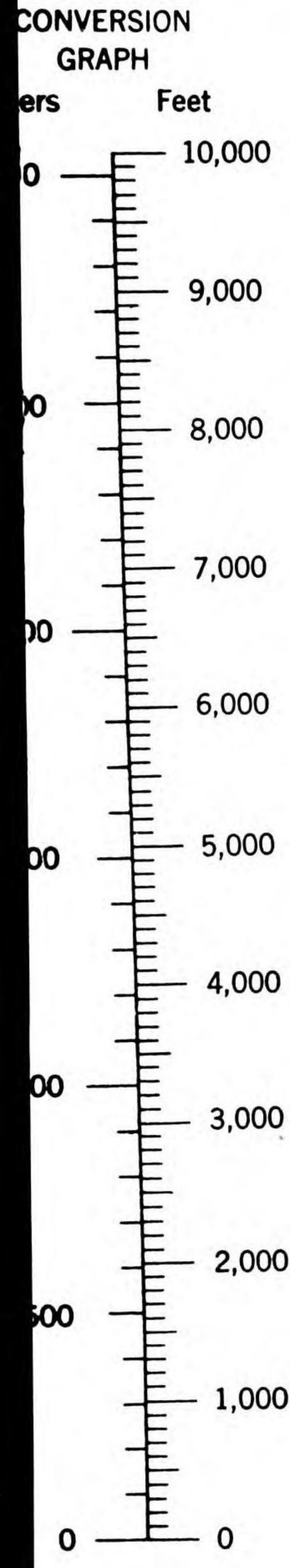


## COMMONWEALTH OF THE PHILIPPINES PROVINCES

- |                       |                                  |
|-----------------------|----------------------------------|
| 1. ILOCOS SUR         | 36. ANTIQUE                      |
| 2. ILOCOS NORTE       | 37. PALAWAN                      |
| 3. ABRA               | 38. CAPIZ                        |
| 4. MOUNTAIN PROVINCE  | 39. ILOILO                       |
| 5. CAGAYAN            | 40. LEYTE                        |
| 6. ISABELA            | 41. CEBU                         |
| 7. TAYABAS            | 42. CITY OF CEBU                 |
| 8. NUEVA VIZCAYA      | 43. CITY OF BACOLOD              |
| 9. NUEVA ECIIJA       | 44. CITY OF ILOILO               |
| 10. PANGASINAN        | 45. NEGROS OCCIDENTAL            |
| 11. CITY OF BAGUIO    | 46. NEGROS ORIENTAL              |
| 12. LA UNION          | 47. BOHOL                        |
| 13. ZAMBALES          | 48. SURIGAO                      |
| 14. TARLAC            | 49. AGUSAN                       |
| 15. BULACAN           | 50. BUKIDNON                     |
| 16. PAMPANGA          | 51. MISAMIS ORIENTAL             |
| 17. BATAAN            | 52. MISAMIS OCCIDENTAL           |
| 18. CAVITE            | 53. CITY OF DALSALAN             |
| 19. CITY OF CAVITE    | 54. LANAO                        |
| 20. CITY OF MANILA    | 55. ZAMBOANGA                    |
| 21. QUEZON CITY       | 56. SULU                         |
| 22. RIZAL             | 57. CITY OF ZAMBOANGA            |
| 23. LAGUNA            | 58. CITY OF DAVAO                |
| 24. CITY OF TAGAYTAY  | 59. COTABATO                     |
| 25. CITY OF SAN PABLO | 60. DAVAO                        |
| 26. BATANGAS          | 61. BATANES                      |
| 27. MINDORO           |                                  |
| 28. MARINDUQUE        | BRITISH NORTH BORNEO             |
| 29. CAMARINES NORTE   | 62. EAST COAST RESIDENCY         |
| 30. CAMARINES SUR     | 63. WEST COAST RESIDENCY         |
| 31. ALBAY             |                                  |
| 32. SORSOGON          | GOV. GROOTE OOST, N. I.          |
| 33. SAMAR             | 64. RESIDENTIE Z. & O. AFDEELING |
| 34. MASBATE           | 65. RESIDENTIE MANADO            |
| 35. ROMBLON           |                                  |

## GLOSSARY

- Boekit: Bkt, Bt ..... mountain  
 Deleng: Dg ..... mountain  
 Goanoeng, Gunong: Gg, G ..... mountain  
 Kampong, Kampoeng: Kg ..... village  
 Loemban: L ..... village  
 Poelau, Poelo, Pulau: P ..... island  
 Soengai, Sungai: S ..... river  
 Tandjoeng, Tanjong: Tg ..... cape, point



a  
b  
c  
d  
e  
f

36°  
35°  
34°

138° 139° 140° 141° 142°

138° 139° 140° 141° 142°

P A C I F I C O C E A N

I Z U S I M A R U I S L A N D S

5°30' W (1943)

Zenisu (Rock)

Kanawa-jima

Ombase-jima

Kozu-shima

Shikine-jima

Nirajima

Utone-jima

To-shima

Mikomoto-jima

Matsuzaki

Shizuoka

Numazu

Hara

Mishima

Hakone

Hakone-yama

Yamanaka

Yamanaka

Yamanaka

Yamanaka

Yamanaka

Yamanaka

Yamanaka

Yamanaka

Yamanaka

Yamanaka

Yamanaka

Yamanaka

Yamanaka

Yamanaka

Yamanaka

Yamanaka

Yamanaka

Yamanaka

# EASTERN ASIA 1,100,000

MAP - 6

## KANAZAWA, JAPAN

N3600 · E13200/400x600

9 hr.  
L.M.T. ahead of G.M.T.

Scale 1:1,000,000


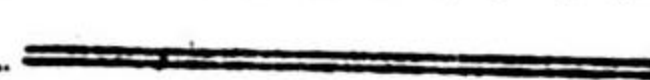








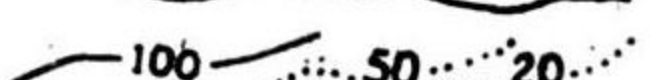

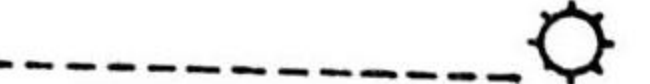



Modified Polyconic Projection

A.M.S. 5301

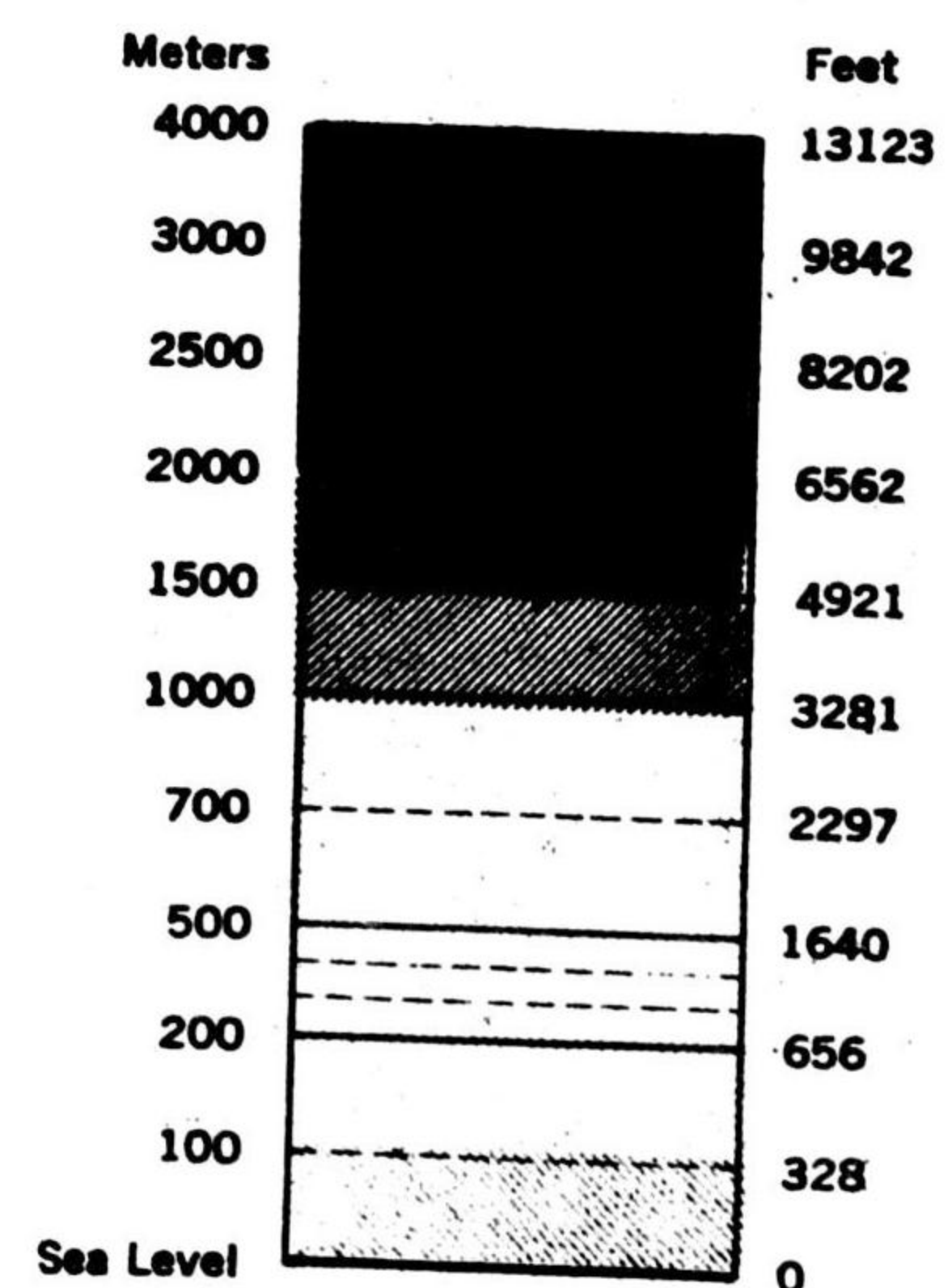
First Edition 1943

Prepared under the direction of the Chief of Engineers,  
U.S. Army, Washington, D. C., 1943. Compiled by the  
Army Map Service, Washington, D. C. Drafted by the  
Pittsburgh Unit. Compiled from Japanese Lands  
and Survey maps 1:200,000 and 1:500,000 1927,  
and Japanese Admiralty H. O. Chart  
Japanese names corrected to the Modified  
Hepburn (Romaji) System

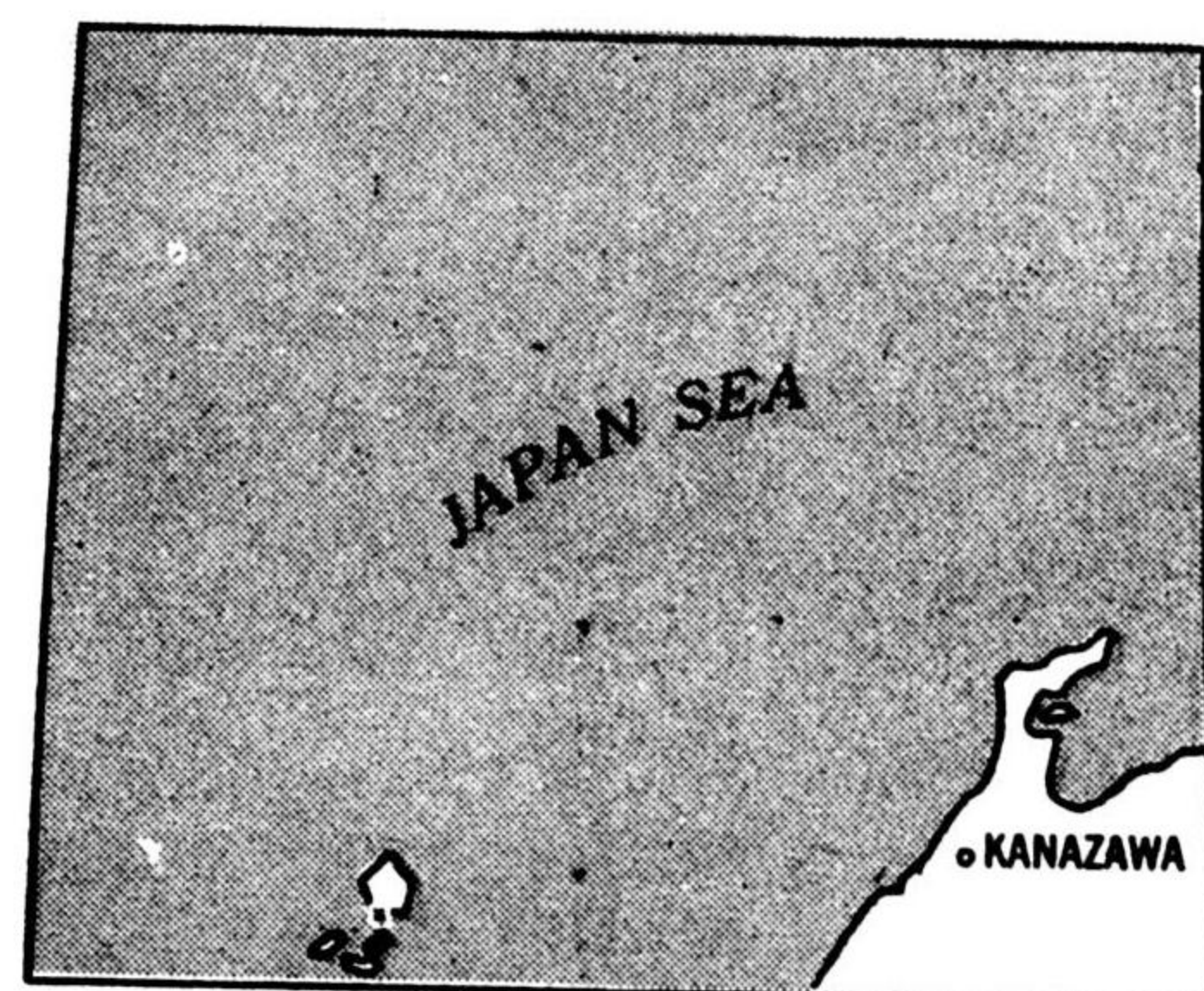
### LEGEND

- Railroads: Standard Gauge 
- Roads: 2nd Class 
- Roads: 3rd Class 
- Trails 
- Cities with population below 400,000 
- Towns 
- Villages with population above 5,000 
- Villages with population below 5,000 
- Lighthouse 
- Radio Station  RN & RS
- Heights (in meters)  1427
- Rivers 
- Depth contours (meters)  100 50 20
- Contours  100 200
- Civil Airport 
- Emergency Airport 

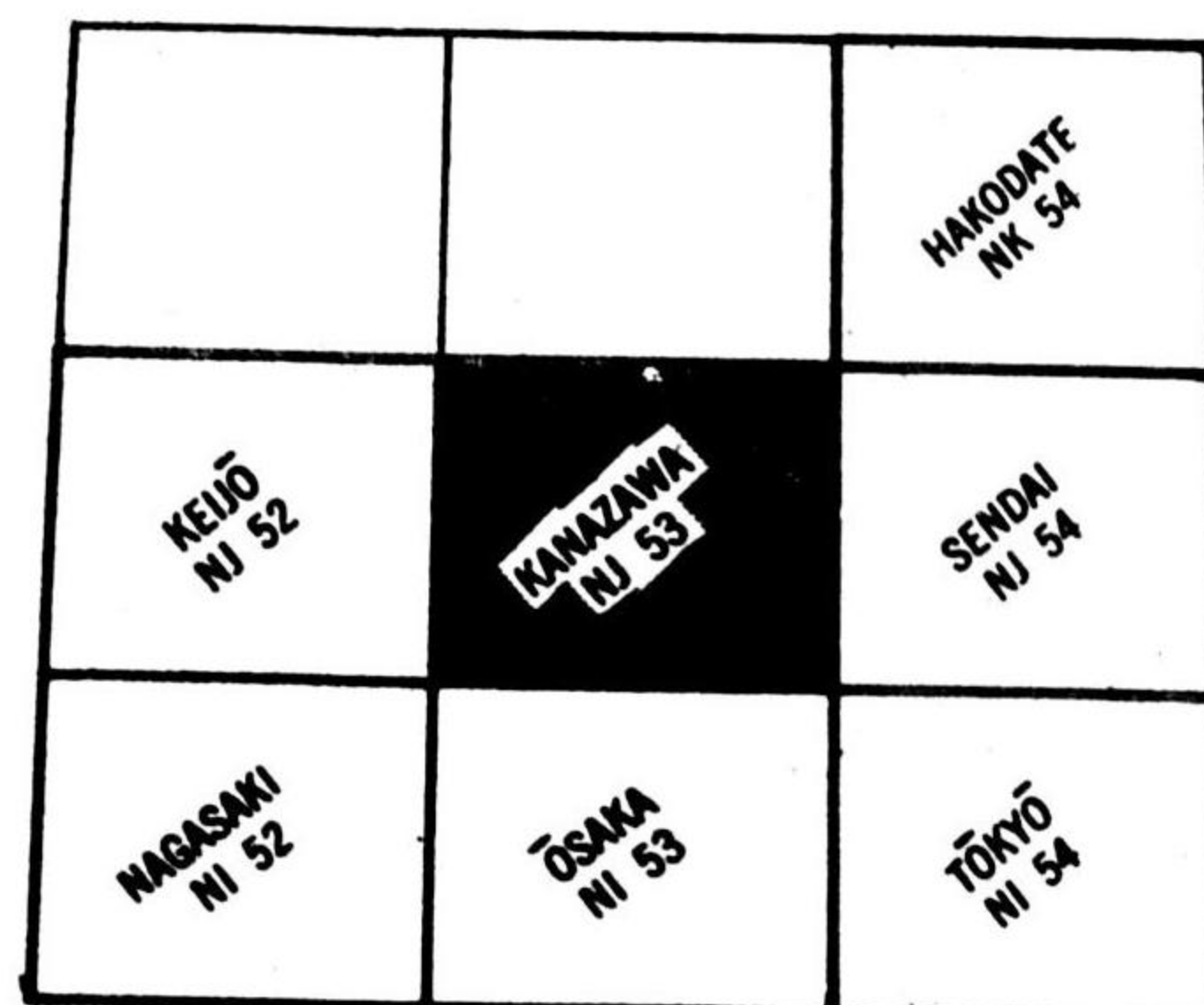
### ALTITUDE TINTS



### INDEX TO BOUNDARIES



### INDEX TO ADJOINING SHEETS



### GLOSSARY

- San..... Mountain, Peak, Hill
- Zan..... Mountain, Peak, Hill
- Yama..... Mountain, Peak, Hill
- Dake..... Mountain, Peak, Hill
- Take..... Mountain, Peak, Hill
- Toge..... Pass
- Wan..... Gulf Bay
- Gata..... Beach
- Kawa..... River, Stream
- Gawa..... River, Stream
- Shima..... Island
- Jima..... Island
- Zaki..... Cape
- Misaki..... Cape

HEIGHTS AND DEPTHS IN METERS

