

Johnson & Johnson

F-111
NEW BRUNSWICK, N. J.

July 8, 1971

R. Schaffner, Ph.D.
Director, Office Product Technology
Bureau of Foods
Food and Drug Administration
200 C Street
Washington, D. C.

Subject: JOHNSON'S Baby Powder

Dear Dr. Schaffner:

As we discussed, we are providing herewith the following reports of analyses of JOHNSON'S Baby Powder and various samples of Vermont Talc used in JOHNSON'S Baby Powder.

1. June 24, 1971, Report on Particle Size and Shape Distributions of Grantham, Italian, and Vermont Talc Final Products for Johnson & Johnson by Colorado School of Mines Research Institute.
2. July 7, 1971, X-ray analyses report on JOHNSON'S Baby Powder sample 344-L, and six samples of Vermont Talc by Colorado School of Mines Research Institute.
3. June 28, 1971, Report of x-ray examination of Talc Products by Dr. R. C. Reynolds, Jr., Geology Dept., Dartmouth College, Hanover, New Hampshire.

We will be pleased to answer any questions regarding the data and methods used in the analyses during our meeting with you today.

It should be noted that the information and data submitted herein contains trade secrets, commercial or financial information or privileged or confidential information, and the Food and Drug Administration is not authorized to make it public without written permission from the company.

Very truly yours,

JOHNSON & JOHNSON

W. Nashed

by: W. Nashed

Director of Science Information

WN:dw

Submitted in triplicate

Johnson-Johnson

New Brunswick, N. J.
July 6, 1971

Subject: JOHNSON'S Baby Powder
Lot #344L

Dr. W. Nashed

The above lot of regular production Baby Powder was compounded into finished goods for sale on the second shift of December 10, 1970, at our Eastern Surgical Dressing Plant.

W. Ashton

W. Ashton

rap

Golden, Colorado 80401

Report On

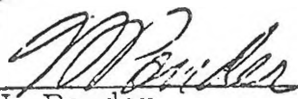
Particle Size and Shape
Distributions of Grantham,
Italian, and Vermont Talc
Final Products

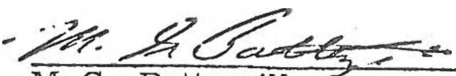
Johnson & Johnson

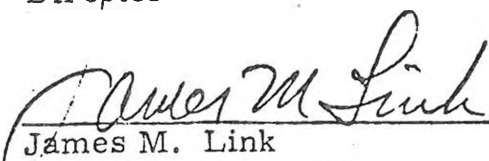
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Mineralogical Type		
	344-L	Ital. O. S.
Platy talc and/or chlorite	0.002765	0.001750
Free diamond- shaped particles	0.000030	-
Free carbonates	0.000265	0.000707
Free quartz	0.000404	0.000026
Free talc shards	0.000353	0.000205
Free nontalc needles	0.000027	0.000021
Free talc needles	0.000022	0.000029
Free other	0.000013	0.000005
Granular particles	-	-
Dark opaque	0.000215	0.000207

TABLE 3

Average sq mm Size of Particles in Each

Ital. U. S.	Lot No. 2 Grantham	Percent of Grains C	
		July 1970	Sept 1970
0.002190	0.000996	0.002661	0.001
-	-	0.000024	0.0001
0.000877	0.000591	0.000047	0.0001
0.000024	-	0.000051	0.0001
0.000363	0.000130	0.000343	0.0001
0.000030	0.000024	0.000036	0.0000
0.000030	0.000068	0.000033	0.0000
0.000004	0.000004	0.000007	0.0000
-	-	-	-
-	0.000081	-	0.0001

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INTRODUCTION

Mr. Wm. Ashton of Johnson & Johnson requested that we do detailed size, shape, and mineralogical analyses on the following samples:

1. 344-L (a representative final Vermont product)
2. Italian O. S. (an Italian final product ground overseas)
3. Italian U. S. (an Italian final product ground in the United States)
4. Lot No. 2 Grantham (a representative sample of the 19 acceptable barrels from the continuous pilot plant run at CSMRI)
5. Vermont, July 1970^{1/}
6. Vermont, September 1970^{1/}
7. Vermont, November 1970^{1/}
8. Vermont, January 1971^{1/}
9. Vermont, March 1971^{1/}
10. Vermont, May 1971^{1/}

^{1/} These were grab samples from the Vermont plant during the various months.

Point counts were made on 500 grains from each sample at 500X.

The mineral type and maximum and minimum dimensions were determined for each grain.

RESULTS AND CONCLUSIONS

Platy Phase

Within the size range of <0.001343 sq mm to 0.025531 sq mm, the following were noted:

1. The Grantham Lot No. 2 sample appeared to have the smallest particle size.
2. The Vermont products appeared to have the largest particle size.
3. The Italian products appeared intermediate in size between the Grantham and Vermont products.

Within the size range of <0.0001 sq mm to 0.001343 sq mm, the following were noted:

1. The 344-L representative Vermont sample showed the smallest amount of platy material in the <0.0001 sq mm range, and the Lot No. 2 Grantham sample had the largest amount of platy material in the 0.0005 to 0.001 sq mm range.
2. The Italian samples had the largest amount of platy material in the <0.0001 sq mm range.

The following were noted relative to length/width ratio.

1. The Vermont and Italian samples showed a major portion of platy particles in the 1.1 to 1.5 length/width ratio range.
2. The Lot No. 2 Grantham product showed a maximum amount of platy particles in the 1.6-2.0 length/width ratio range.

Talc Shards

The most significant trend noted in regard to talc shards was that the Italian O. S. product possessed shards that fell within a more restricted size range than the Italian U. S. sample. This could possibly indicate different grinding techniques.

Talc Needles

The 344-L Vermont sample had the largest number of talc needles, but the shortest needle lengths.

Nontalc Needles

The Grantham Lot No. 2 sample had the largest number of nontalc needles but the shortest nontalc needle length.

Quartz

The 344-L sample had the most quartz and the Lot No. 2 Grantham sample had essentially no quartz.

Carbonate

No significant trends were noted in regard to carbonate content between the various samples.

"Other" Particles

The 344-L Vermont sample had the largest number of, and the largest sized, "other" particles.

DISCUSSION

General Results of Grain Counts

Each sample was point counted to determine the occurrences of mineral types and their average size in sq mm. The following table shows the percentages of mineral types in each sample based on the number of grains counted:

TABLE 1

Percent of Grains in Each Category on a Grain Count Basis

Mineralogical Type	Percent of Grains Counted									
	344-L	Ital. O. S.	Ital. U. S.	Lot No. 2 Grantham	July 1970	Sept 1970	Nov 1970	Jan 1971	Mar 1971	May 1971
Platy talc and/or chlorite	87.3	90.2	89.4	92.6	89.2	86.8	90.4	89.2	86.0	87.0
Free diamond-shaped particles	1.0	-	-	-	0.2	0.4	0.2	0.6	0.4	0.6
Free carbonates	1.4	0.4	2.2	0.2	1.0	1.2	1.4	2.2	2.0	0.4
Free quartz	1.6	0.4	0.2	-	1.0	2.0	0.8	0.2	0.6	1.2
Free talc shards	2.8	4.8	5.2	3.0	2.8	2.2	1.4	1.6	3.8	1.6
Free nontalc needles	0.6	0.4	0.4	1.0	1.0	0.8	0.4	0.8	1.0	0.8
Free talc needles	2.2	1.4	0.8	1.2	0.8	1.4	0.6	1.0	1.8	2.2
Free other	2.8	2.0	1.8	1.8	4.0	4.6	4.8	4.4	4.2	5.6
Granular particles	-	-	-	-	-	-	-	-	-	0.6
Dark opaque	0.2	0.4	-	0.2	-	0.6	-	-	0.2	-

Following are explanations for the above terms.

1. The platy talc and/or chlorite particles usually had nonopaque inclusions of various types and sizes. As per your instructions these were not counted separately.
2. The "diamond shaped particles" were tentatively identified as pyroxene and/or carbonate.

3. The "carbonates" noted may include magnesite, dolomite or calcite.
4. The "quartz" noted was identified using interference figures where possible. Where not possible, due to size, conchoidal fractures relief and interference colors were used for identification.
5. The "talc shards" noted were thin pieces that could clearly be defined as being broken off of plates.
6. The "talc" and "nontalc" needles noted were definite needle-like particles and not shards. The two types were defined by differences in extinction angles.
7. The "other particles" noted were nonopaque particles, usually of a very small size and not readily identifiable optically. They invariably exhibited higher relief than the 1.600 oil used and higher interference colors than talc.
8. The "granular particles" noted were nondescript masses of very fine grains. The individual grains were almost submicroscopic and could not be positively identified. Brucite or granular talc are possibilities.
9. The "dark opaque" are particles that do not transmit light.

Table 2 shows the percentage of mineral types in each sample on a total sq mm basis, and Table 3 shows the average sq mm size of particles in each mineralogical category.

TABLE 2

Percent of Particles in Each Category on a Total sq mm Basis

Mineralogical Type	Percent of Grains Counted									
	344-L	Ital. O. S.	Ital. U. S.	Lot No. 2 Grantham	July 1970	Sept 1970	Nov 1970	Jan 1971	Mar 1971	May 1971
Platy talc and/or chlorite	99.100	99.110	98.067	99.314	99.515	99.226	99.936	99.400	99.1012	99.230
Free diamond- shaped particles	0.010	-	-	-	0.002	0.002	0.001	0.001	0.0012	0.010
Free carbonates	0.150	0.178	0.966	0.127	0.020	0.256	0.228	0.290	0.0881	0.010
Free quartz	0.270	0.006	0.002	-	0.021	0.156	0.023	0.020	0.0215	0.030
Free talc shards	0.410	0.617	0.944	0.420	0.404	0.283	0.792	0.150	0.7311	0.450
Free nontalc needles	0.010	0.005	0.006	0.026	0.015	0.006	0.005	0.020	0.0119	0.020
Free talc needles	0.020	0.026	0.012	0.084	0.011	0.022	0.004	0.050	0.0295	0.030
Free other	0.010	0.006	0.003	0.008	0.012	0.013	0.001	0.060	0.0150	0.020
Granular particles	-	-	-	-	-	-	-	-	-	0.020
Dark opaque	0.020	0.052	-	0.017	-	0.036	-	-	0.0003	-

As may be noted from the above data:

1. The percentage of plates on a grain count basis is considerably less than the percentage of plates on a total sq mm basis.
2. The percentage of nontalc constituents, talc needles and talc shards is considerably higher on a grain count basis than on a cumulative sq mm basis.
3. The average plate size is smallest in the Lot No. 2 Grantham products, intermediate in the Italian products and largest in the Vermont products.
4. No free diamond-shaped particles were noted in the Lot No. 2 Grantham or the Italian products.
5. The Lot No. 2 Grantham ore was the only one showing no quartz.
6. The Lot No. 2 Grantham showed the highest percent of plates on a grain count basis.

The "granular particles" noted in the May 1971 sample were irregular gelatineous masses of very fine grains that could not be positively identified. These particles were not noted in any of the other samples.

Detailed Results of Grain Counts

To better define the particle shape and size in each sample, plots were made involving length/width ratios and/or size distribution of the various components in each sample. Following are the results of these analyses:

Platy Talc and/or Chlorite

Figures 1 through 20 show plots of the ratio of length to width and the size distribution in sq mm of the platy components of each sample.

PLOT OF LENGTH/WIDTH RATIOS FOR THE PLATY PHASE OF SAMPLE 344-L

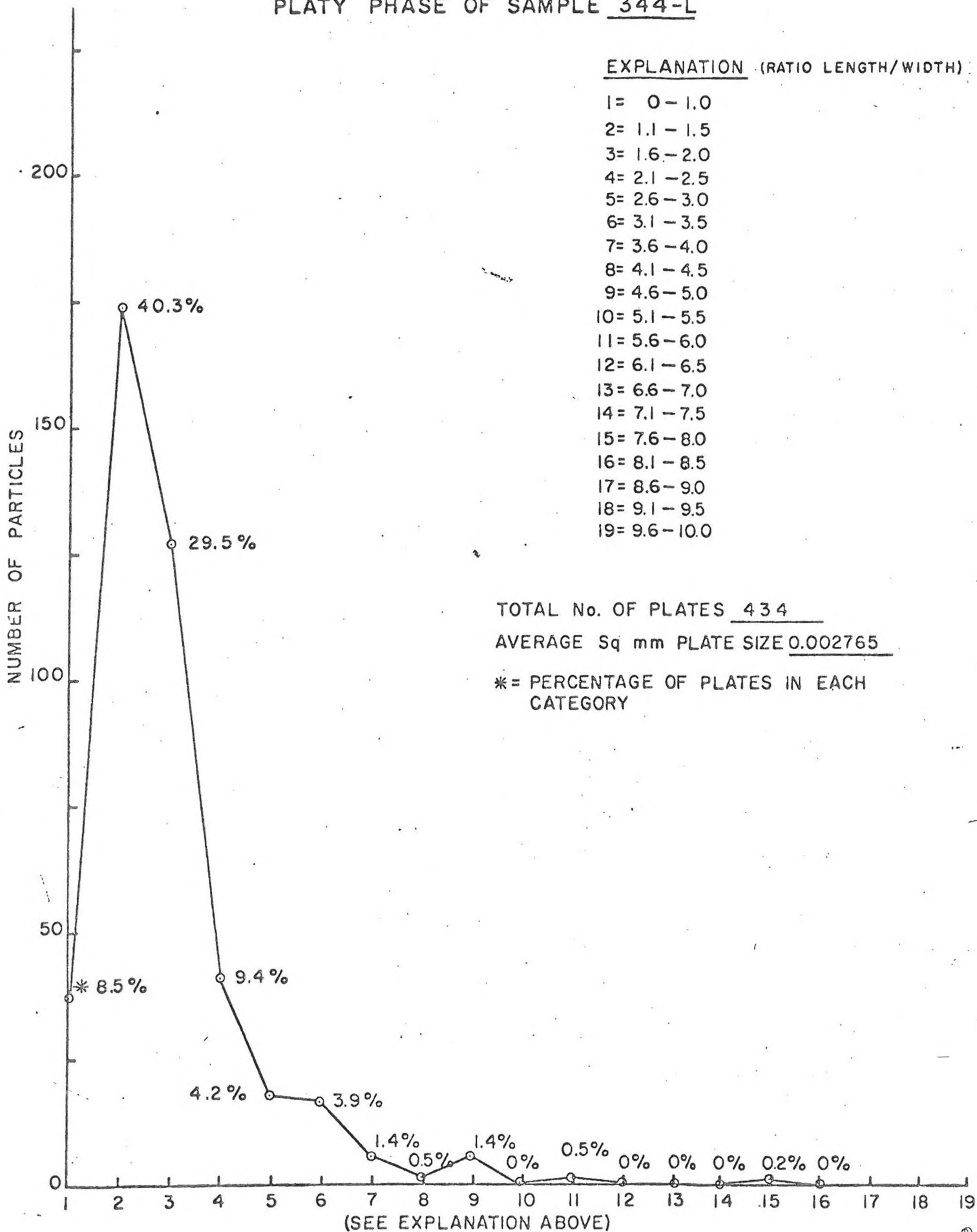
EXPLANATION (RATIO LENGTH/WIDTH)

- 1= 0 - 1.0
- 2= 1.1 - 1.5
- 3= 1.6 - 2.0
- 4= 2.1 - 2.5
- 5= 2.6 - 3.0
- 6= 3.1 - 3.5
- 7= 3.6 - 4.0
- 8= 4.1 - 4.5
- 9= 4.6 - 5.0
- 10= 5.1 - 5.5
- 11= 5.6 - 6.0
- 12= 6.1 - 6.5
- 13= 6.6 - 7.0
- 14= 7.1 - 7.5
- 15= 7.6 - 8.0
- 16= 8.1 - 8.5
- 17= 8.6 - 9.0
- 18= 9.1 - 9.5
- 19= 9.6 - 10.0

TOTAL No. OF PLATES 434

AVERAGE Sq mm PLATE SIZE 0.002765

* = PERCENTAGE OF PLATES IN EACH CATEGORY



**PLOT OF SIZE DISTRIBUTION (Sq mm) OF THE
PLATY PHASE OF SAMPLE 344-L**

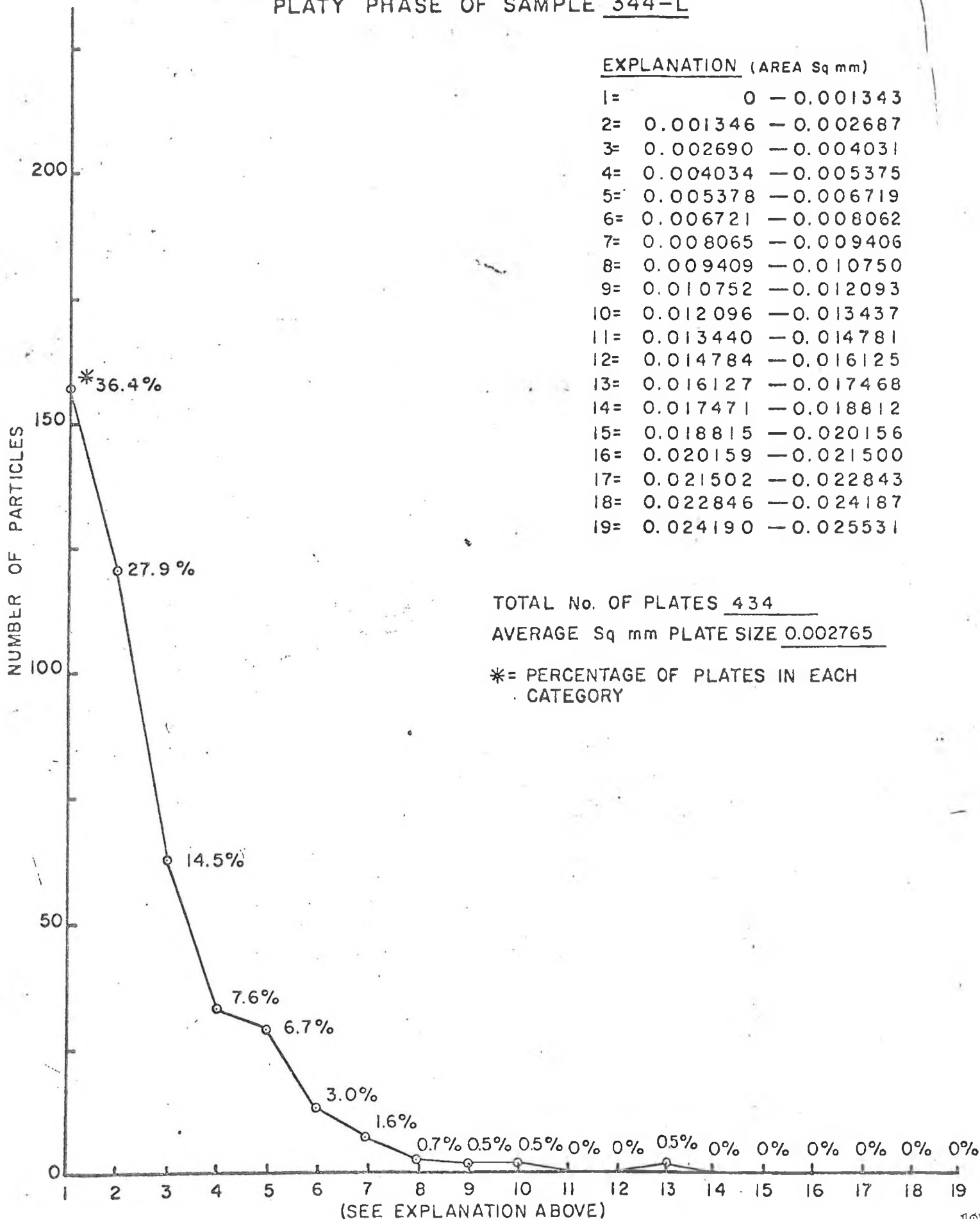
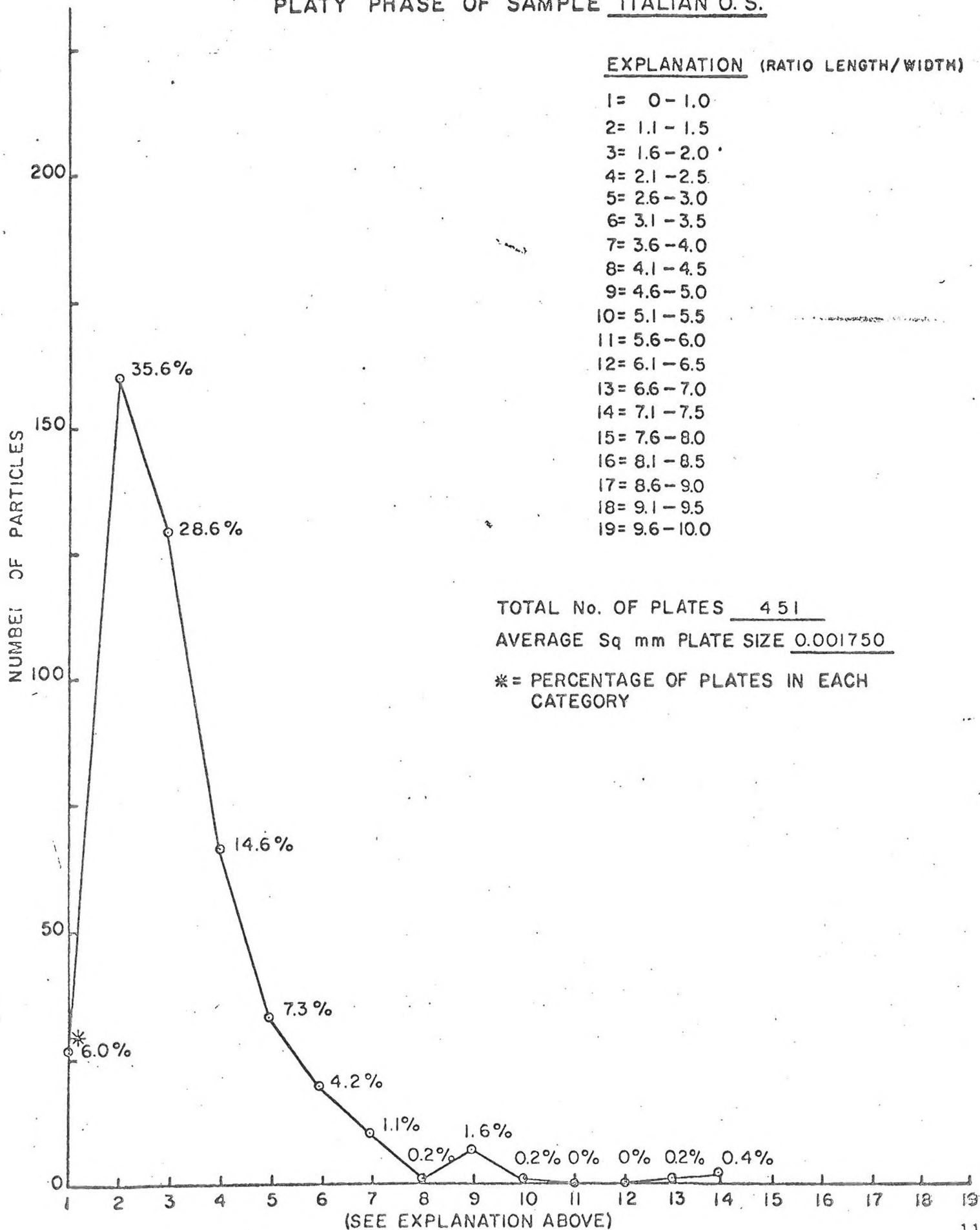
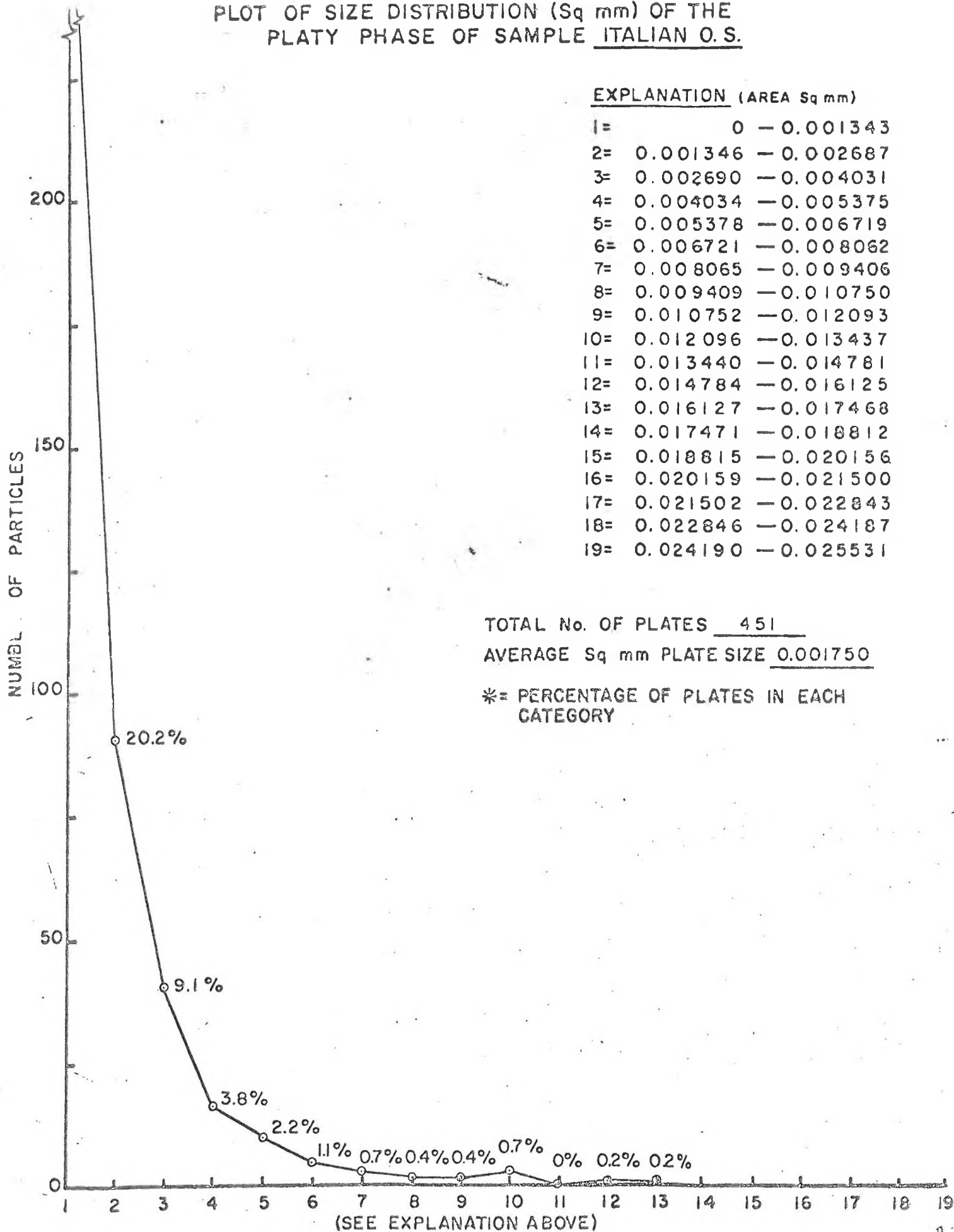


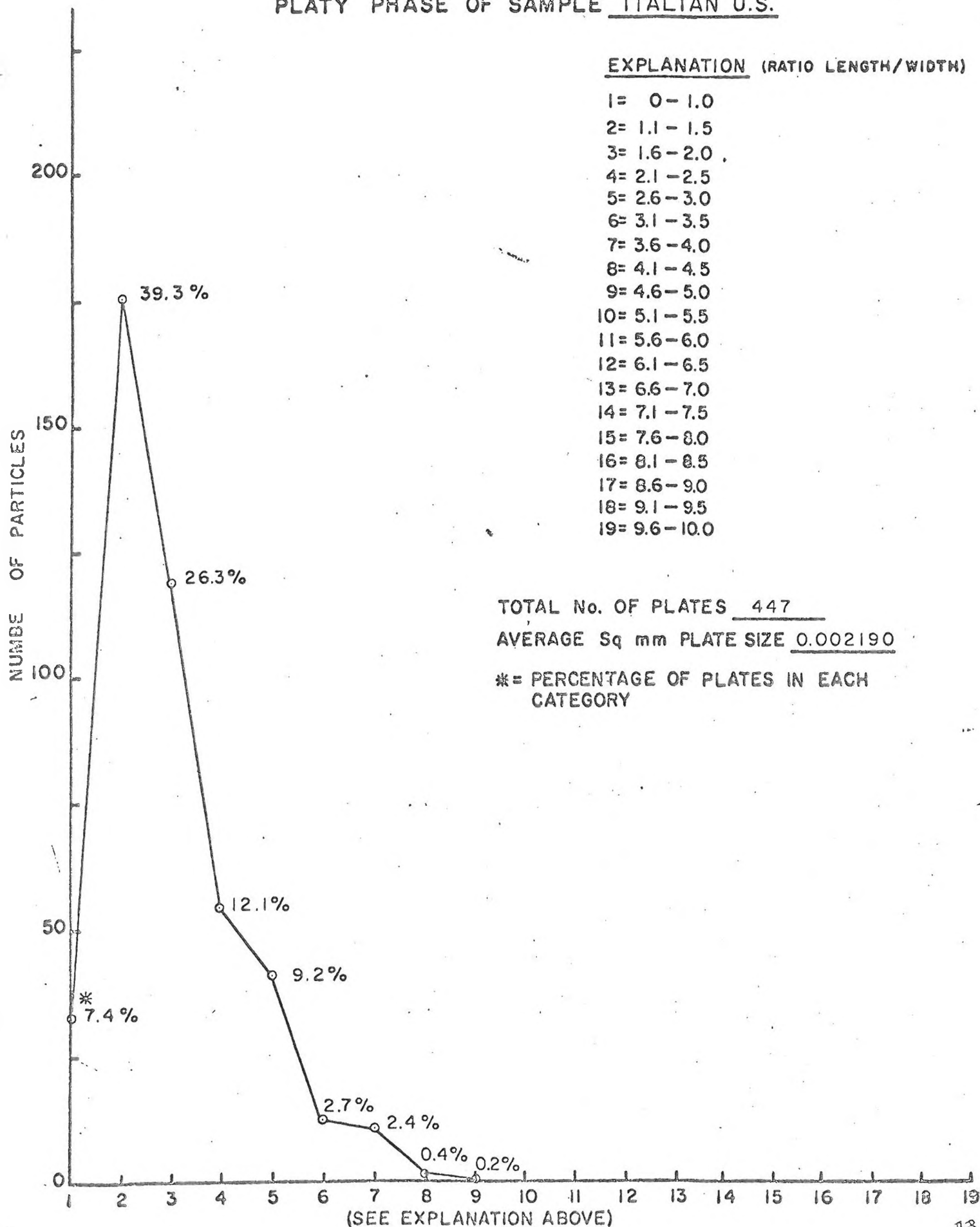
FIGURE 3
PLOT OF LENGTH/WIDTH RATIOS FOR THE
PLATY PHASE OF SAMPLE ITALIAN O. S.



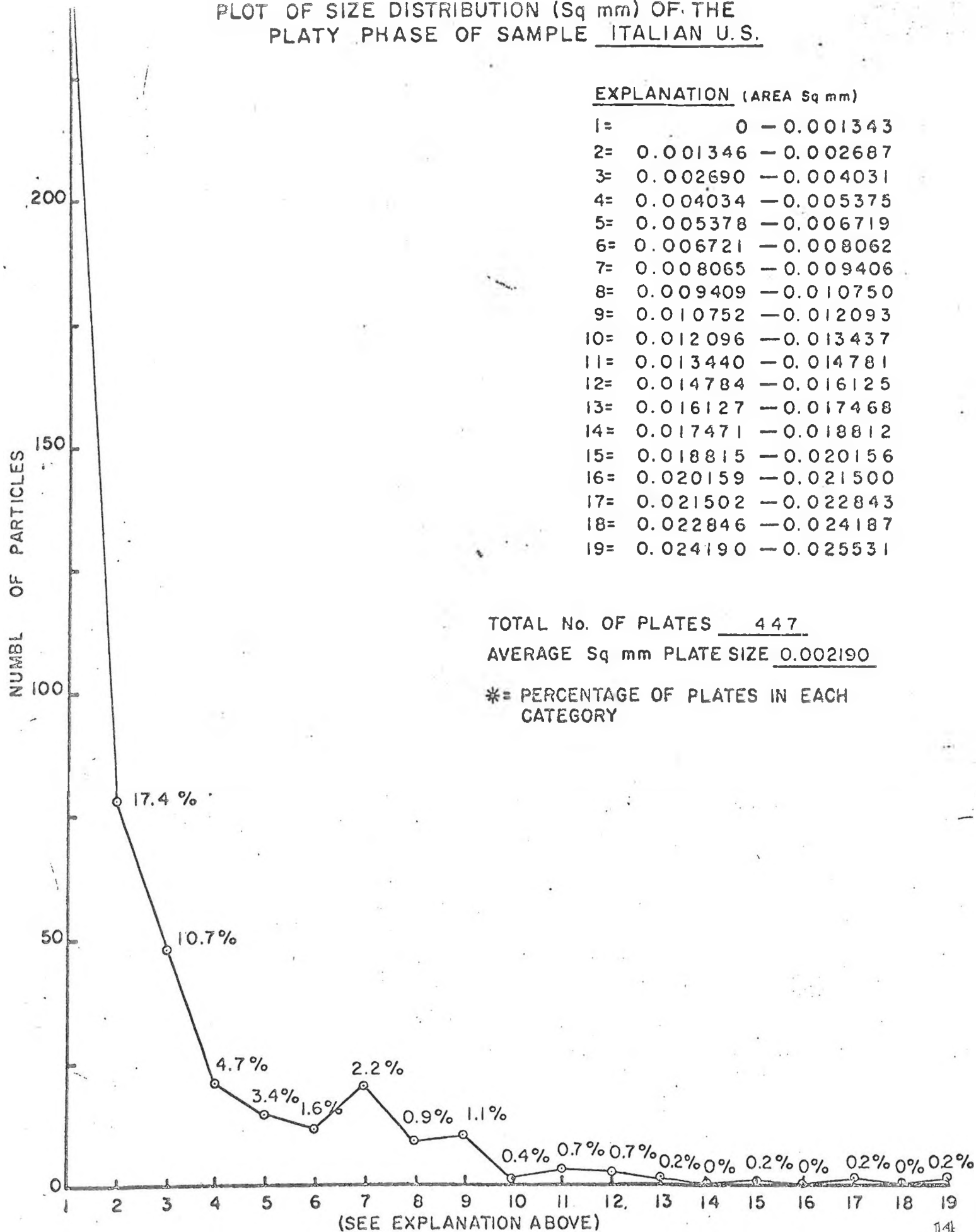
PLOT OF SIZE DISTRIBUTION (Sq mm) OF THE
PLATY PHASE OF SAMPLE ITALIAN O.S.



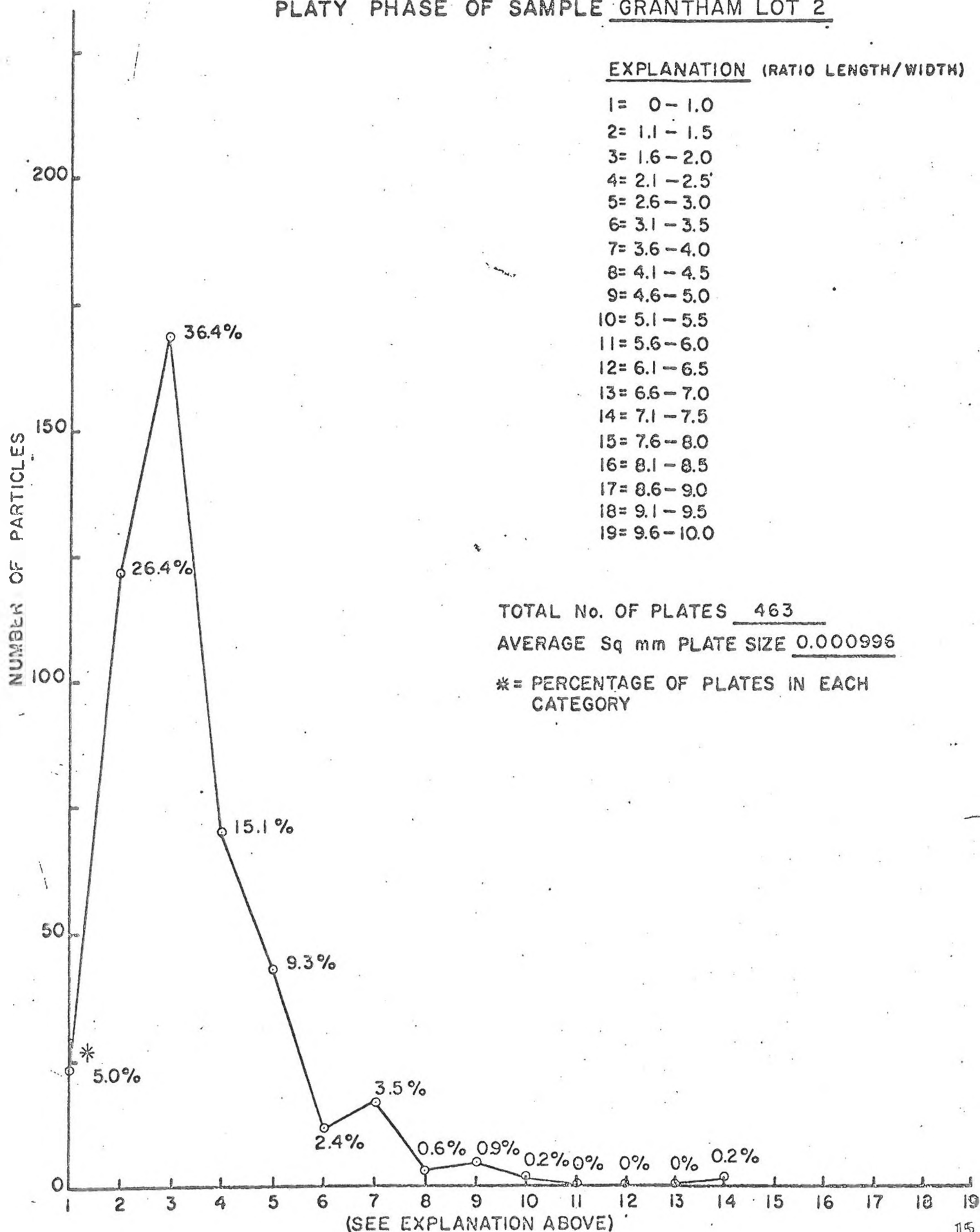
PLOT OF LENGTH/WIDTH RATIOS FOR THE
PLATY PHASE OF SAMPLE ITALIAN U.S.



PLOT OF SIZE DISTRIBUTION (Sq mm) OF THE
PLATY PHASE OF SAMPLE ITALIAN U.S.



PLOT OF LENGTH/WIDTH RATIOS FOR THE
PLATY PHASE OF SAMPLE GRANTHAM LOT 2



PLOT OF SIZE DISTRIBUTION (Sq mm) OF THE
PLATY PHASE OF SAMPLE GRANTHAM LOT 2

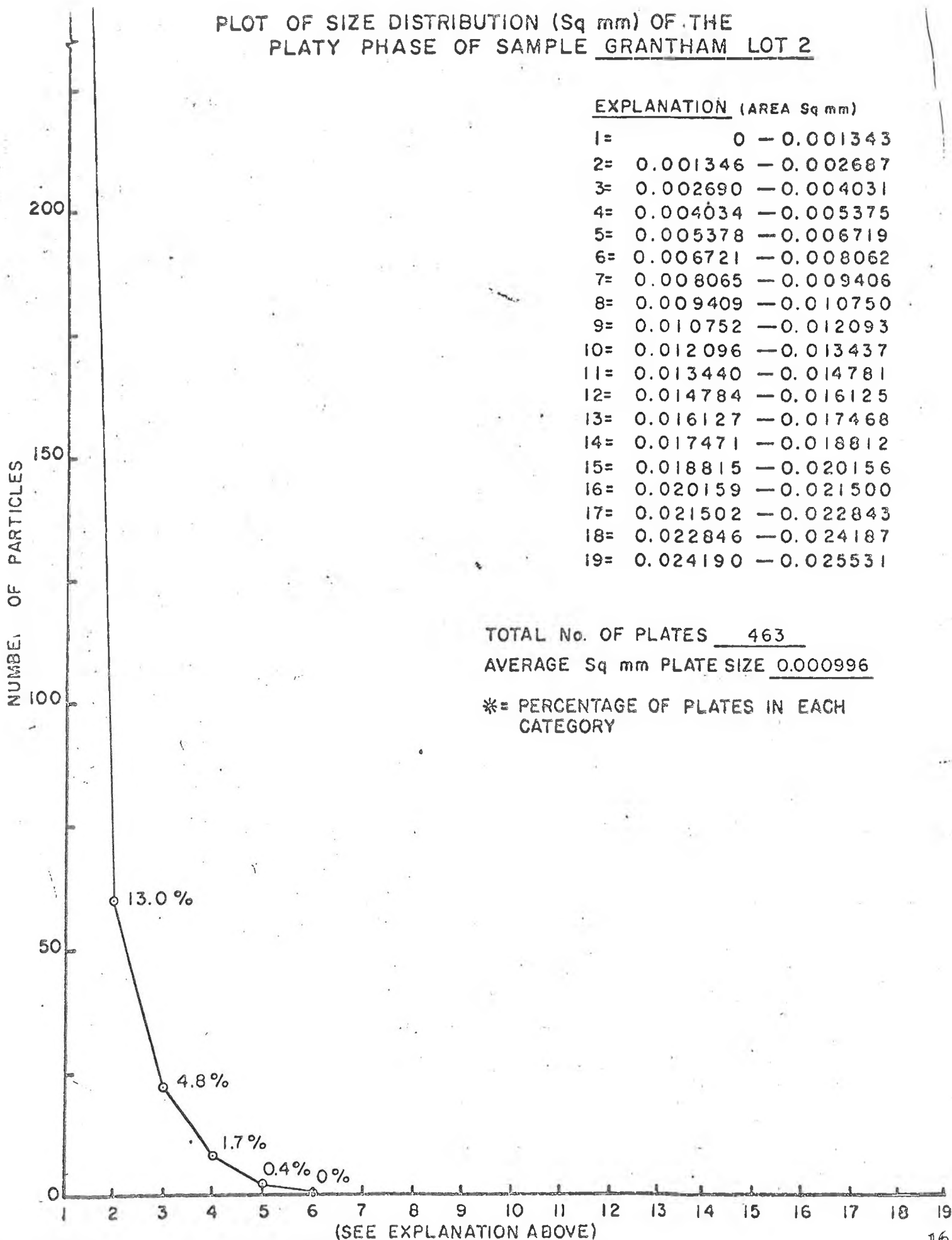


FIGURE 3
 PLOT OF LENGTH/WIDTH RATIOS FOR THE
 PLATY PHASE OF SAMPLE VERMONT - JULY, 1970

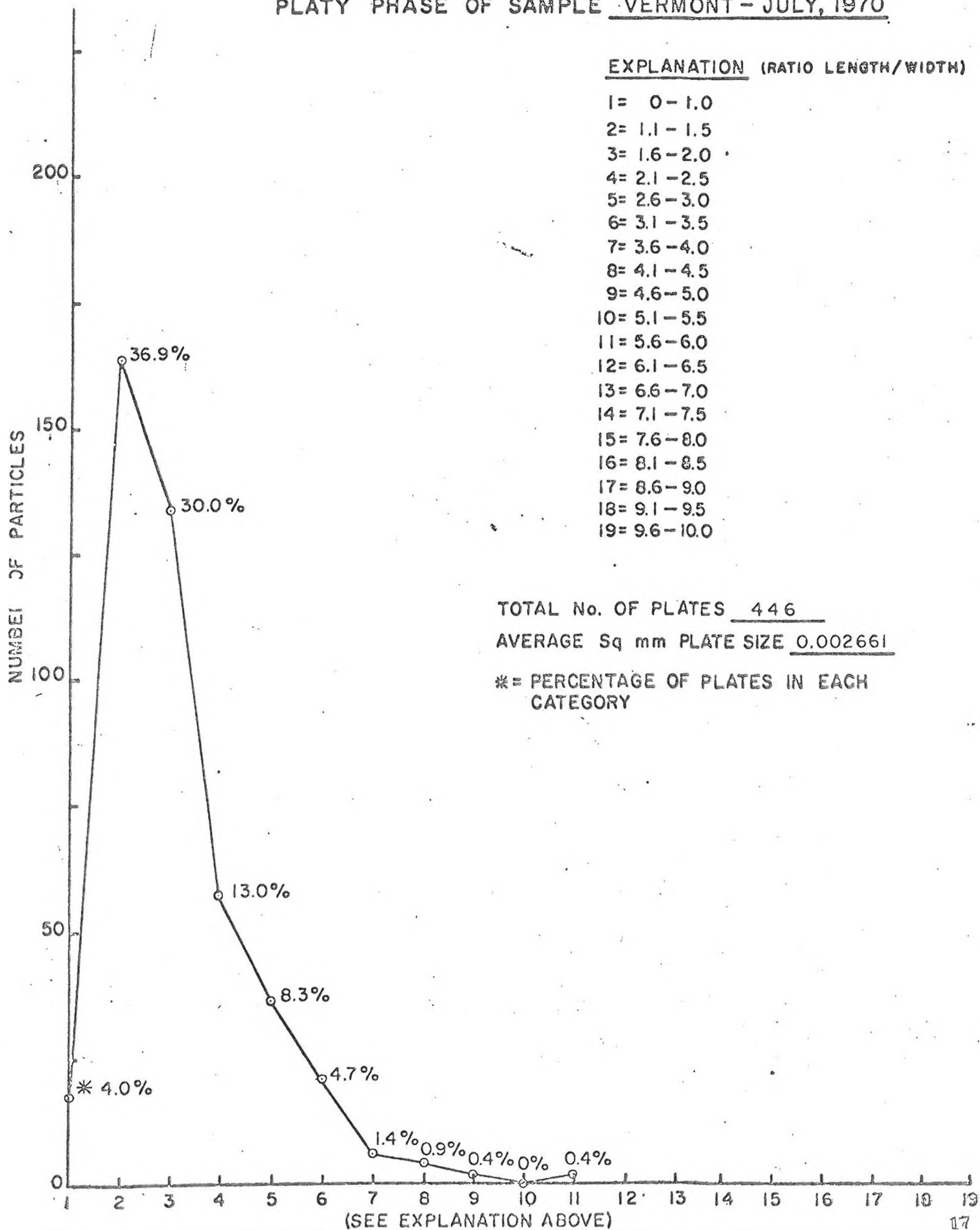
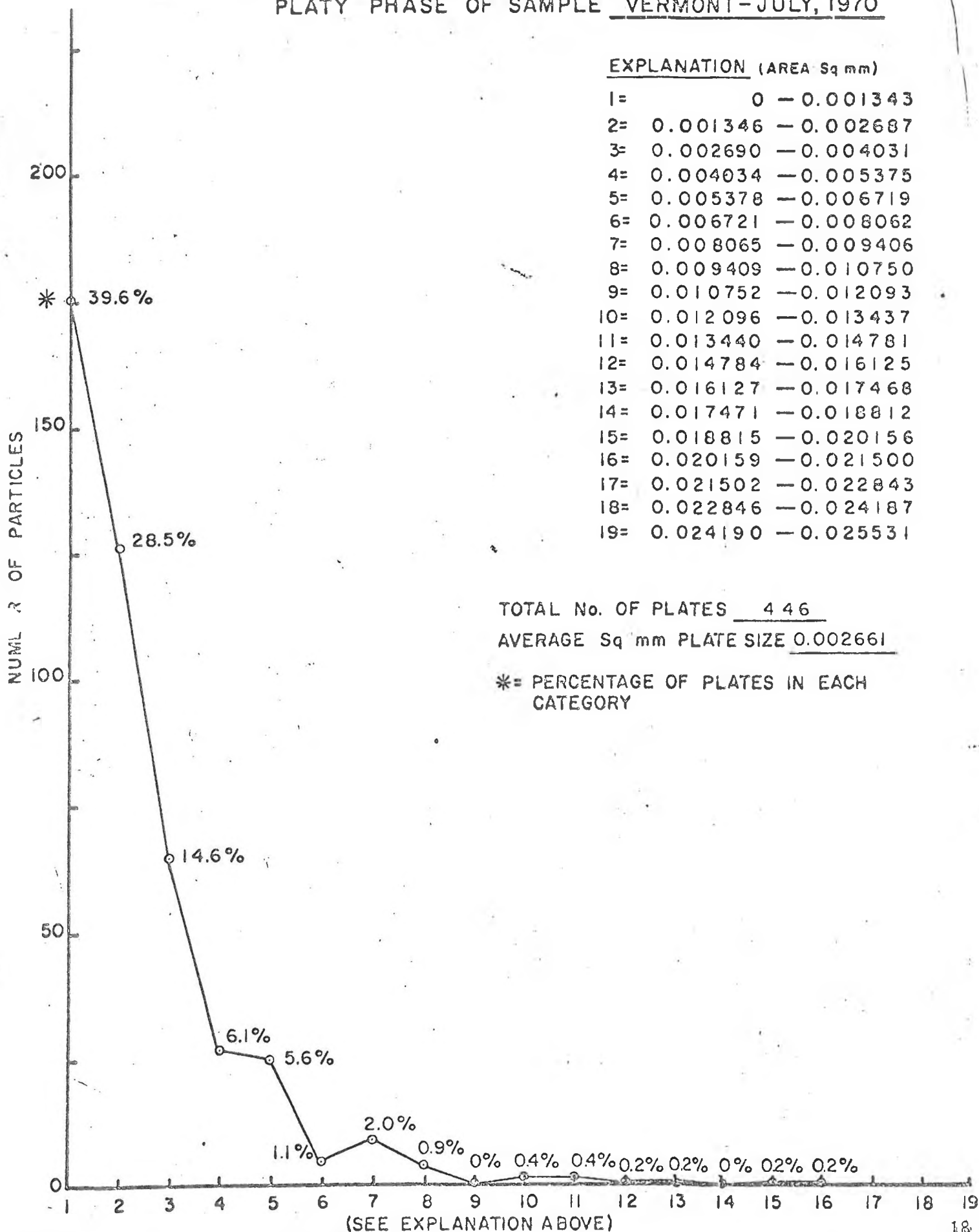


FIG. 1. SIZE DISTRIBUTION (Sq mm) OF THE
PLATY PHASE OF SAMPLE VERMONT-JULY, 1970

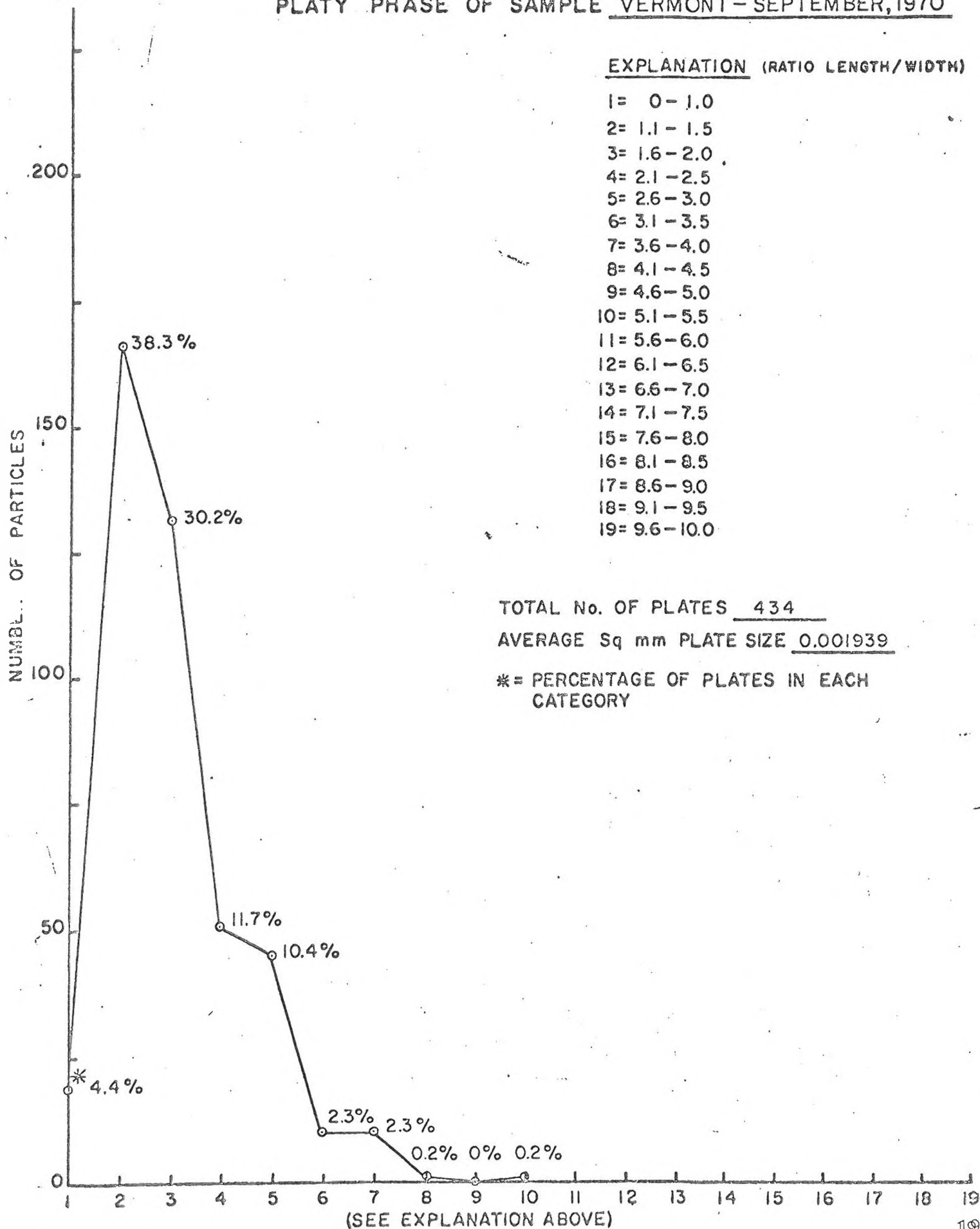


TOTAL No. OF PLATES 446

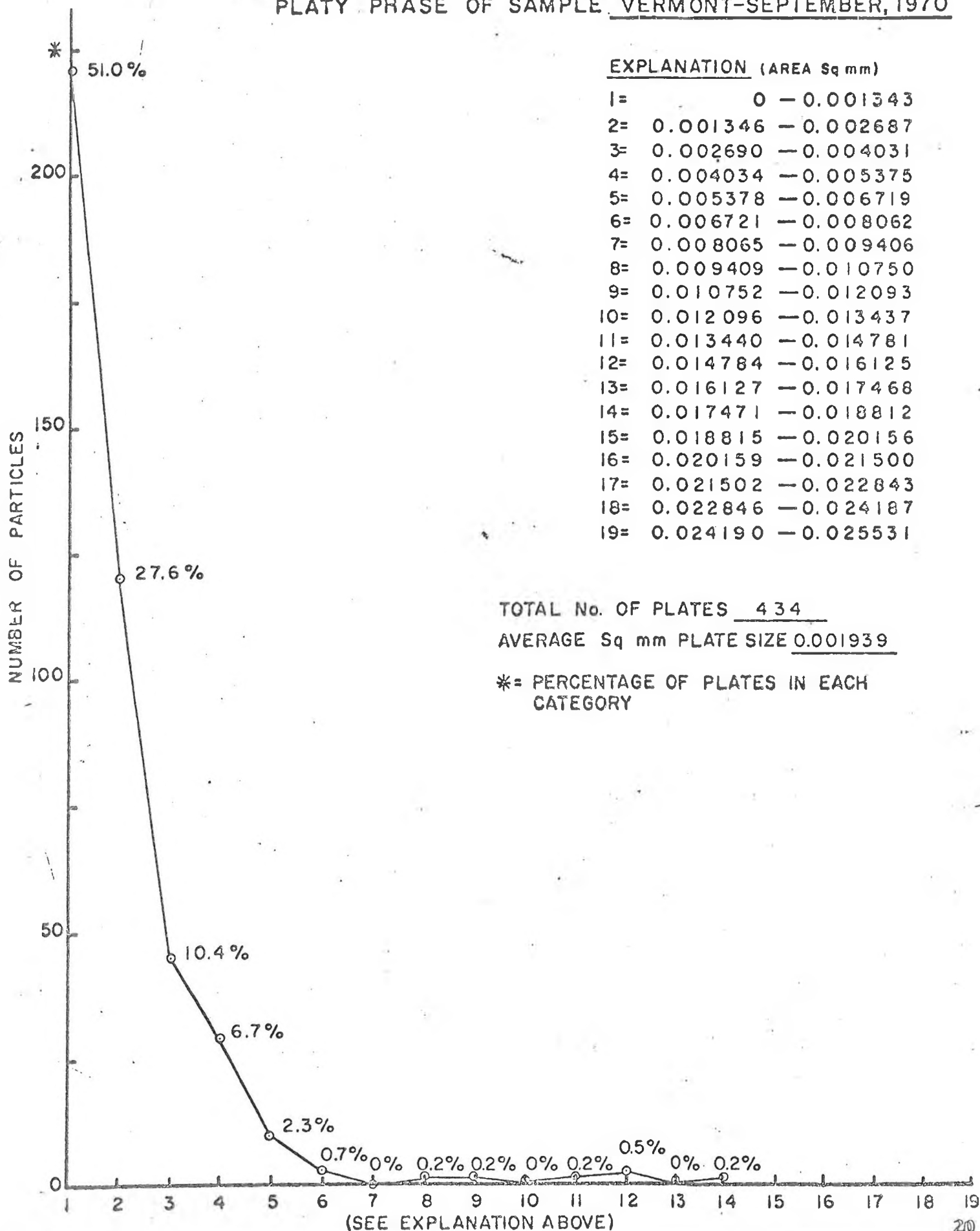
AVERAGE Sq mm PLATE SIZE 0.002661

*= PERCENTAGE OF PLATES IN EACH
CATEGORY

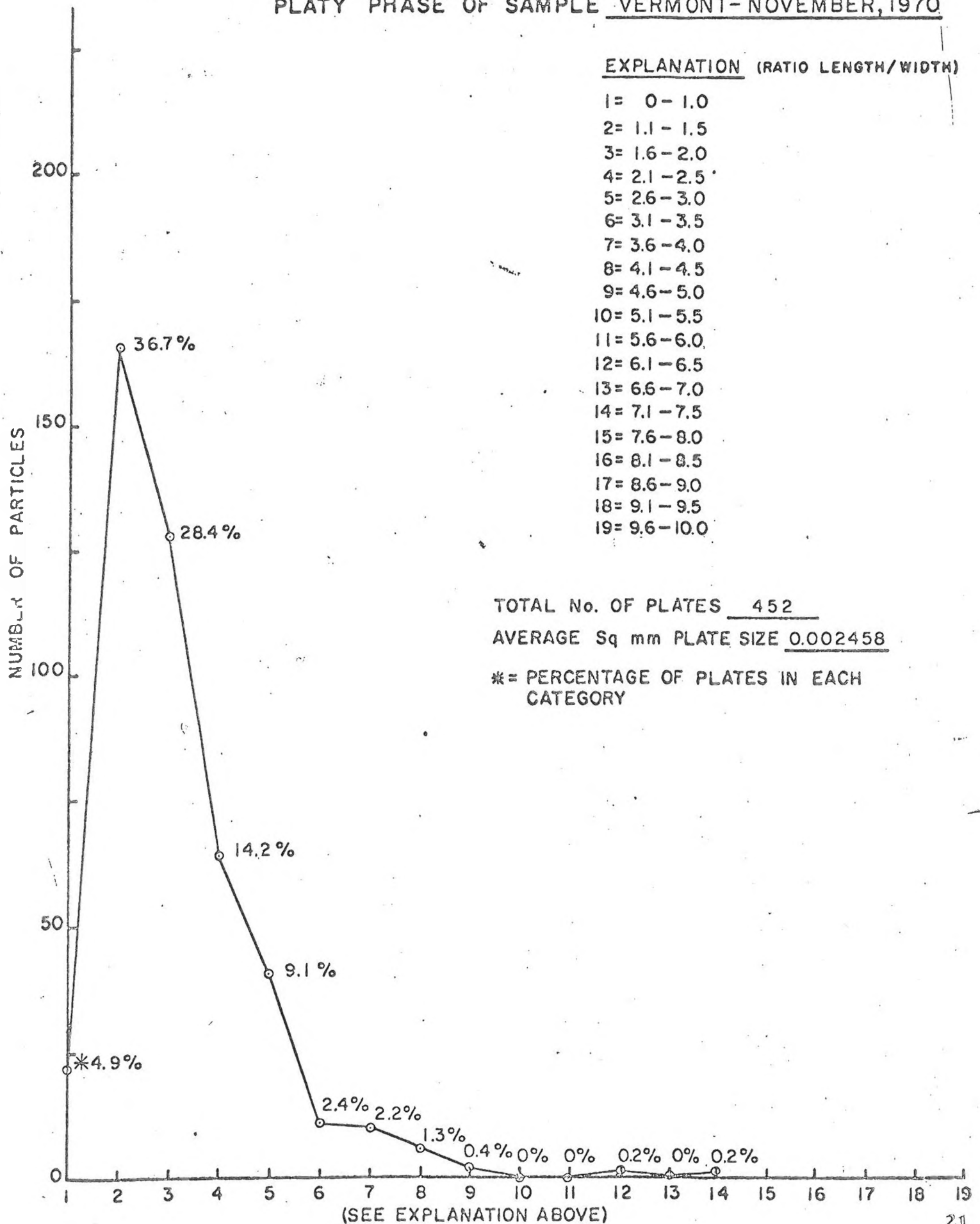
PLOT OF LENGTH/WIDTH RATIOS FOR THE
PLATY PHASE OF SAMPLE VERMONT-SEPTEMBER, 1970



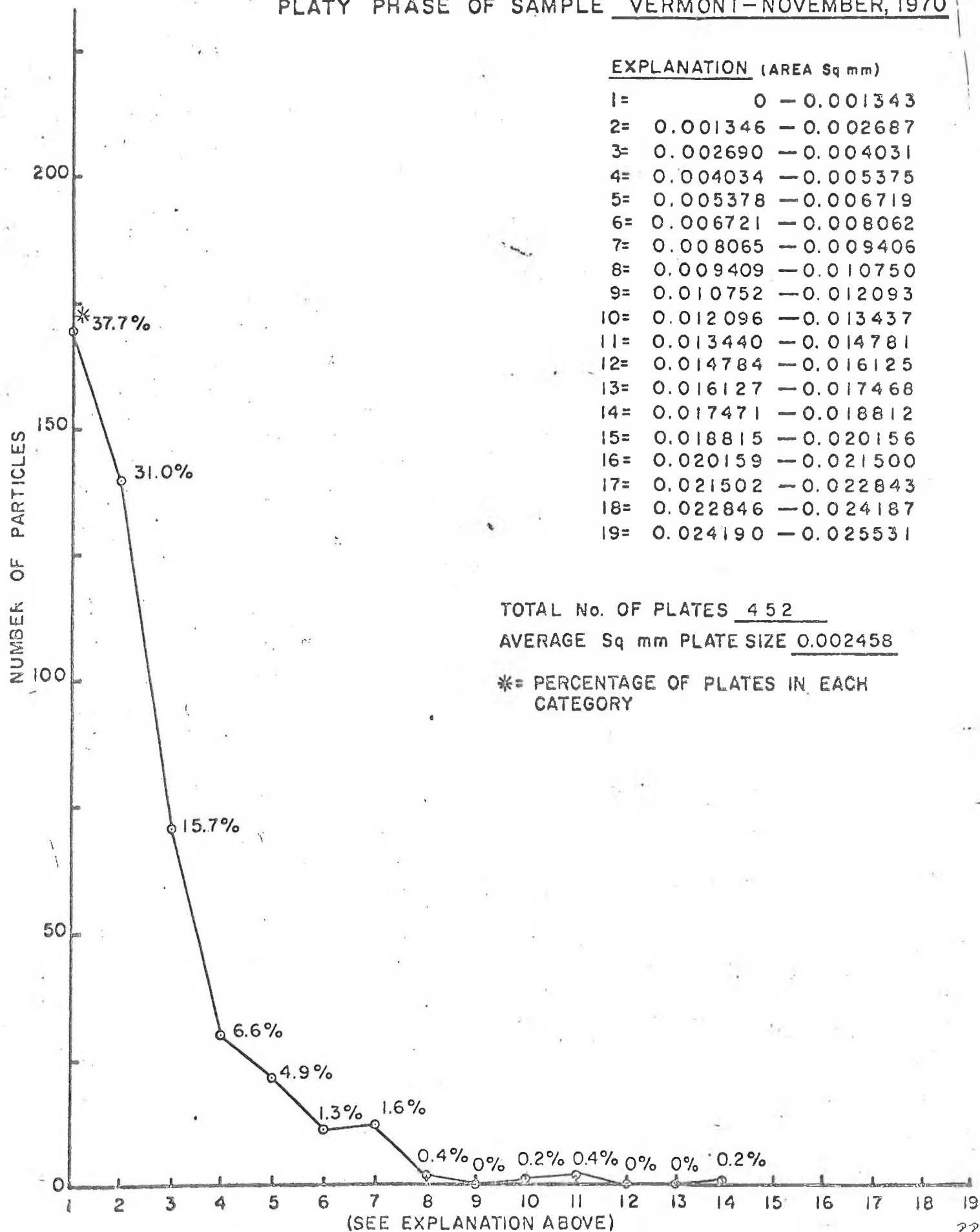
**PLOT OF SIZE DISTRIBUTION (Sq mm) OF THE
PLATY PHASE OF SAMPLE VERMONT-SEPTEMBER, 1970**



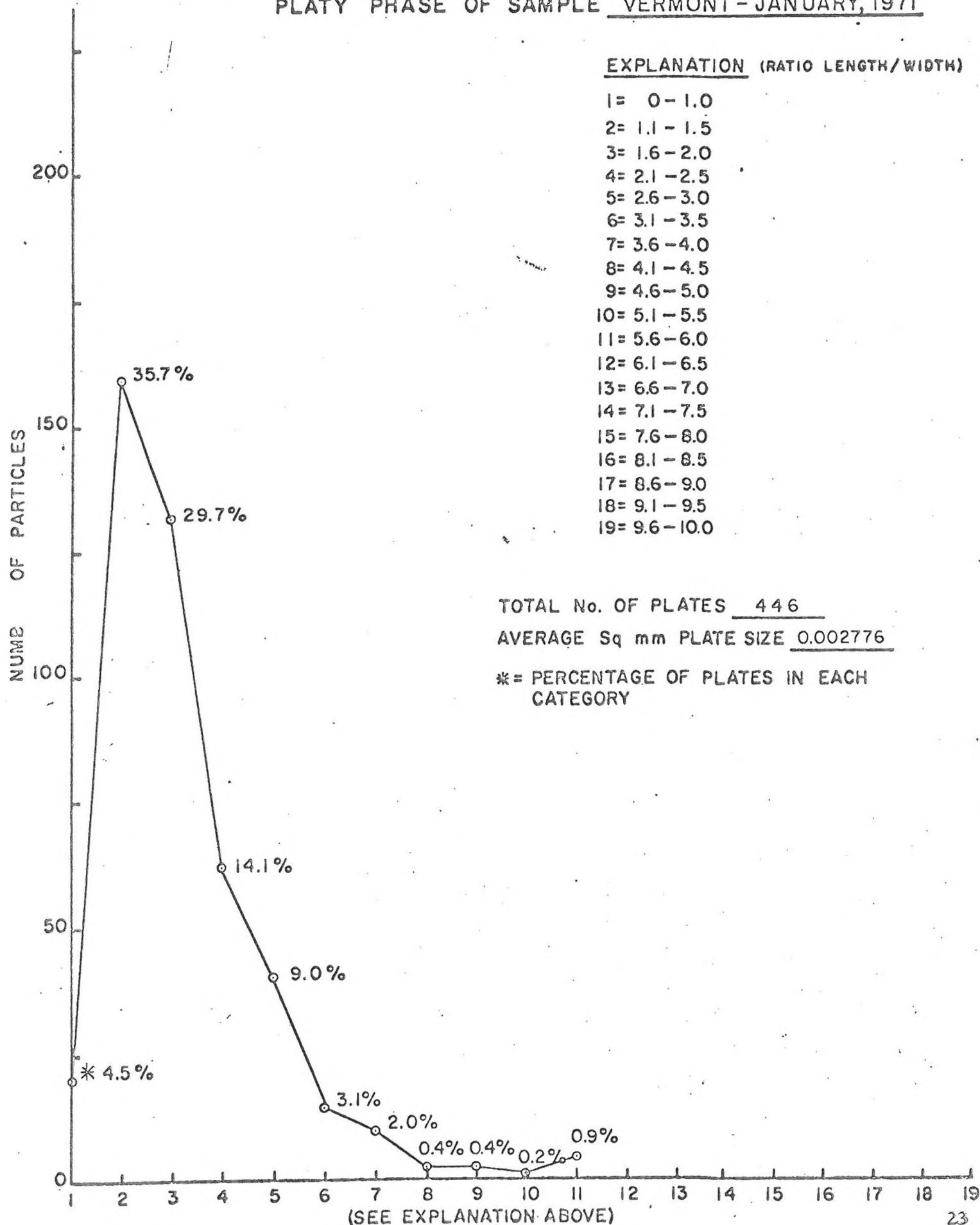
PLOT OF LENGTH/WIDTH RATIOS FOR THE
PLATY PHASE OF SAMPLE VERMONT-NOVEMBER, 1970

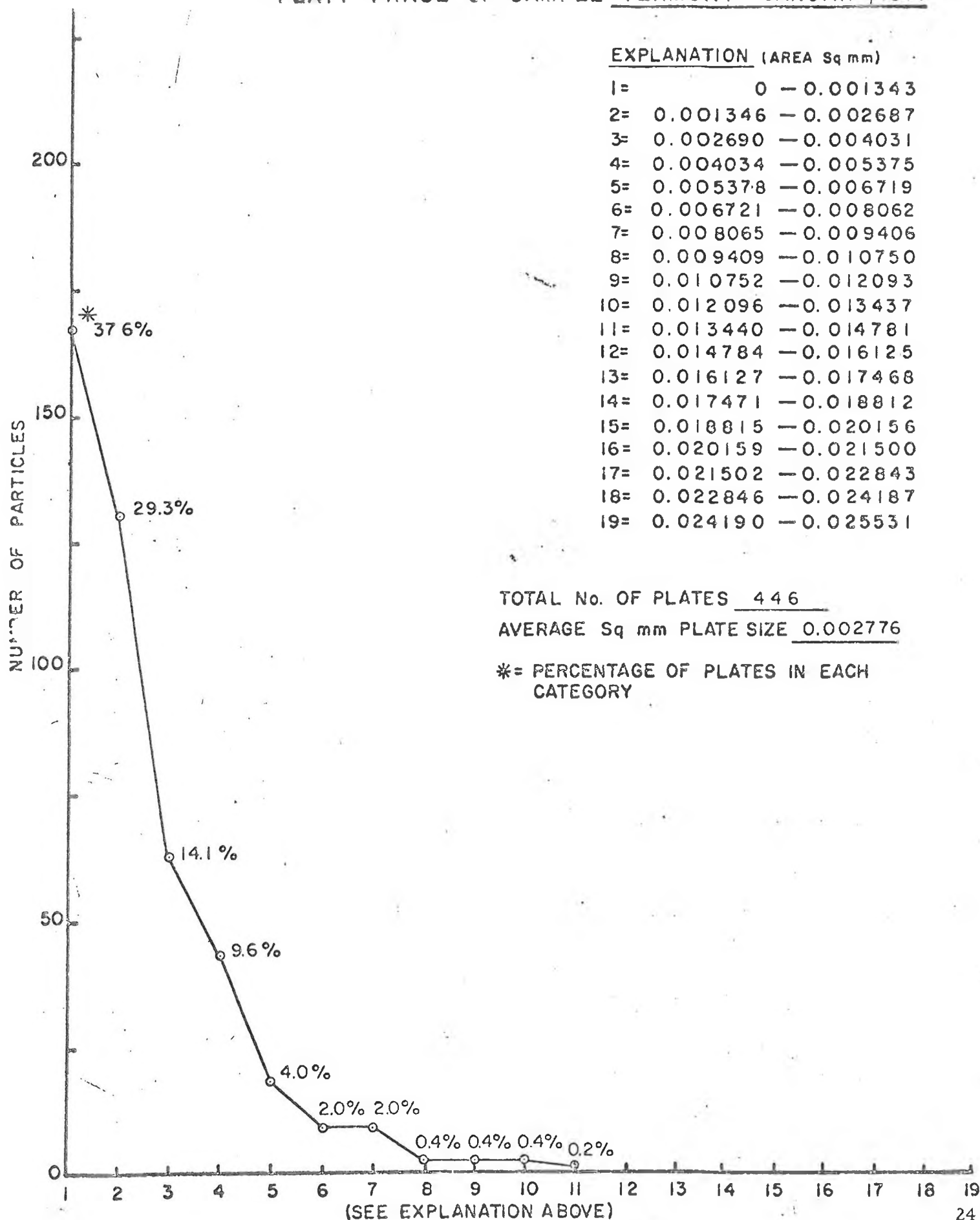


PLOT OF SIZE DISTRIBUTION (Sq mm) OF THE
PLATY PHASE OF SAMPLE VERMONT-NOVEMBER, 1970



PLOT OF LENGTH/WIDTH RATIOS FOR THE
PLATY PHASE OF SAMPLE VERMONT - JANUARY, 1971





PLOT OF LENGTH/WIDTH RATIOS FOR THE
PLATY PHASE OF SAMPLE VERMONT-MARCH, 1971

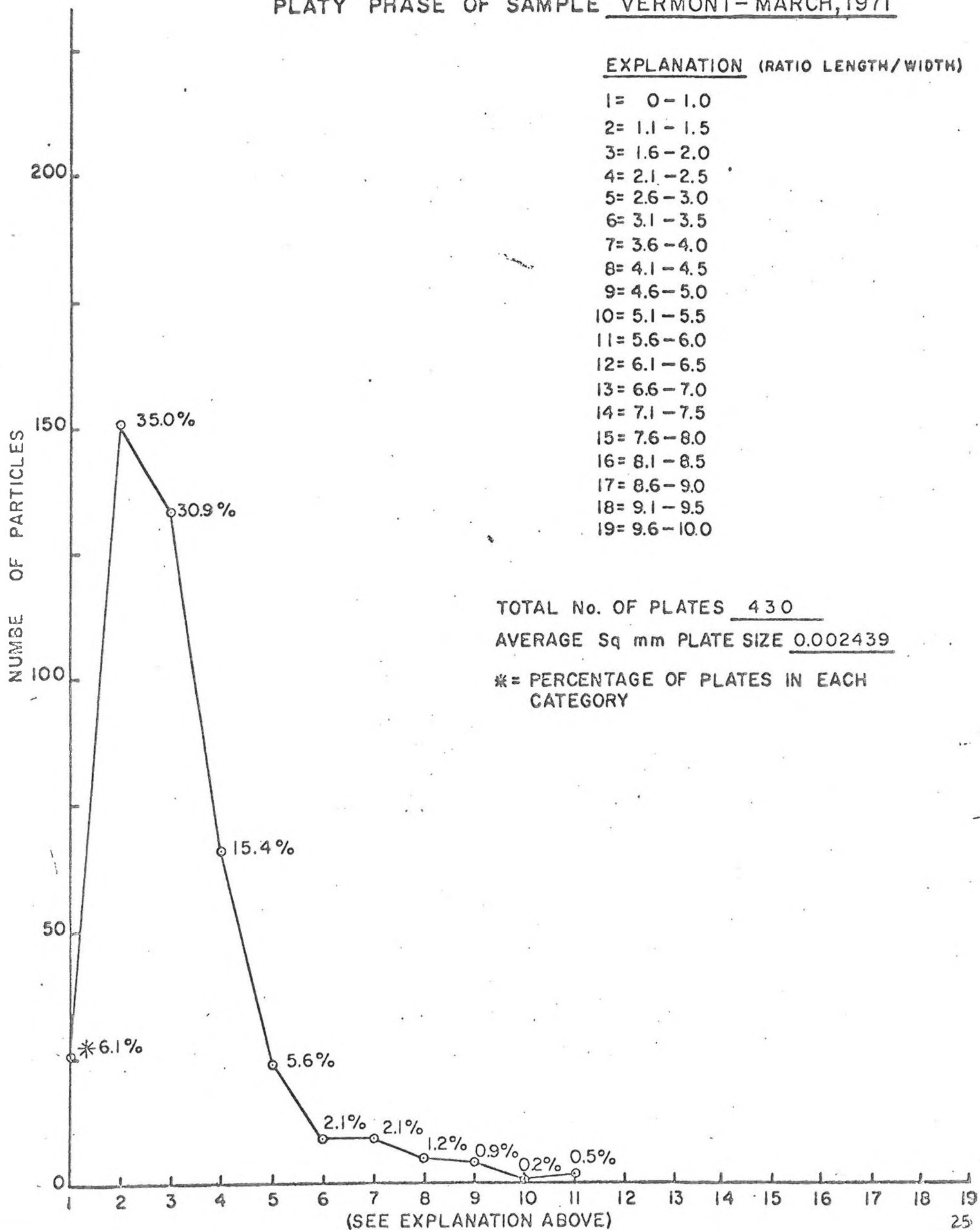
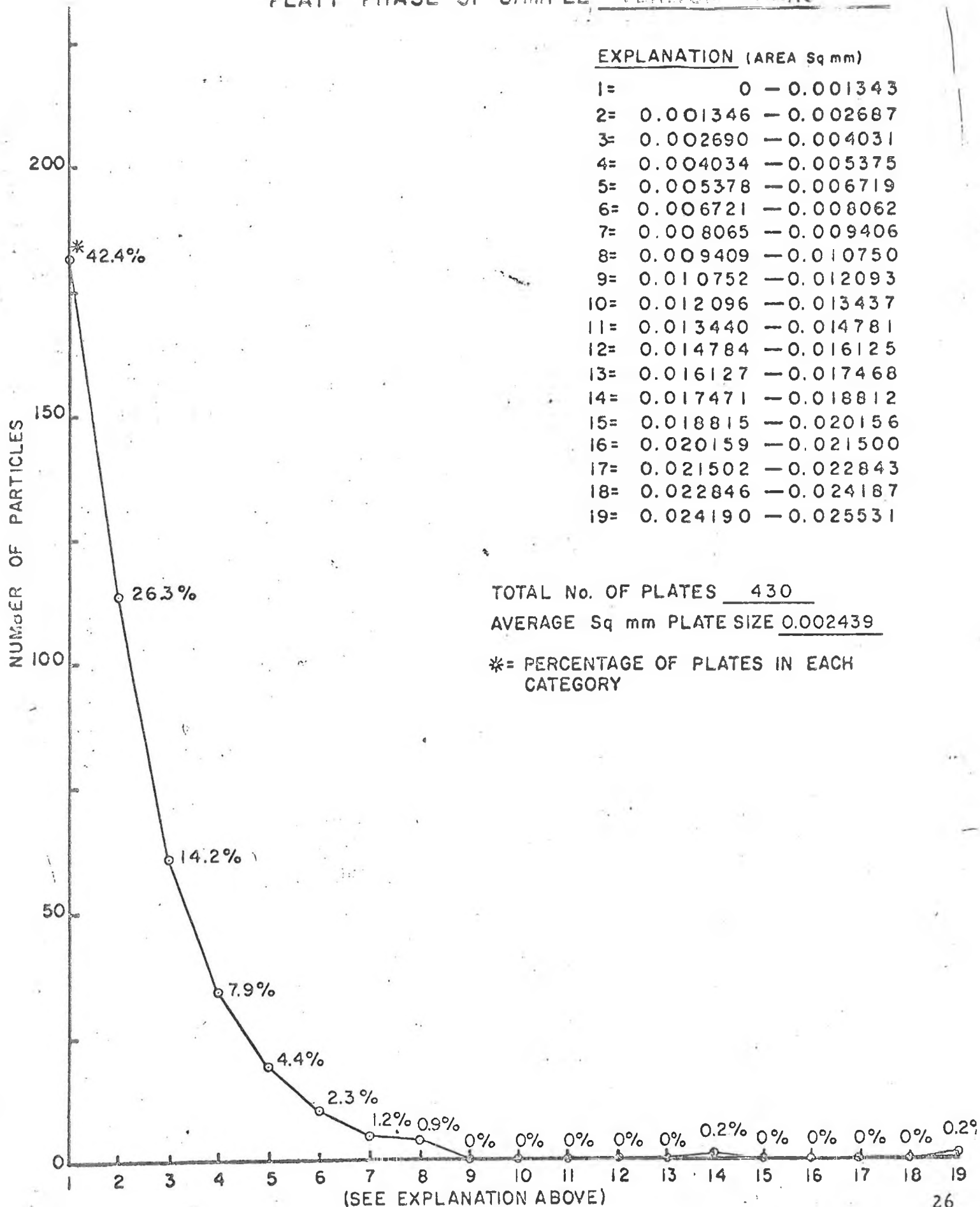
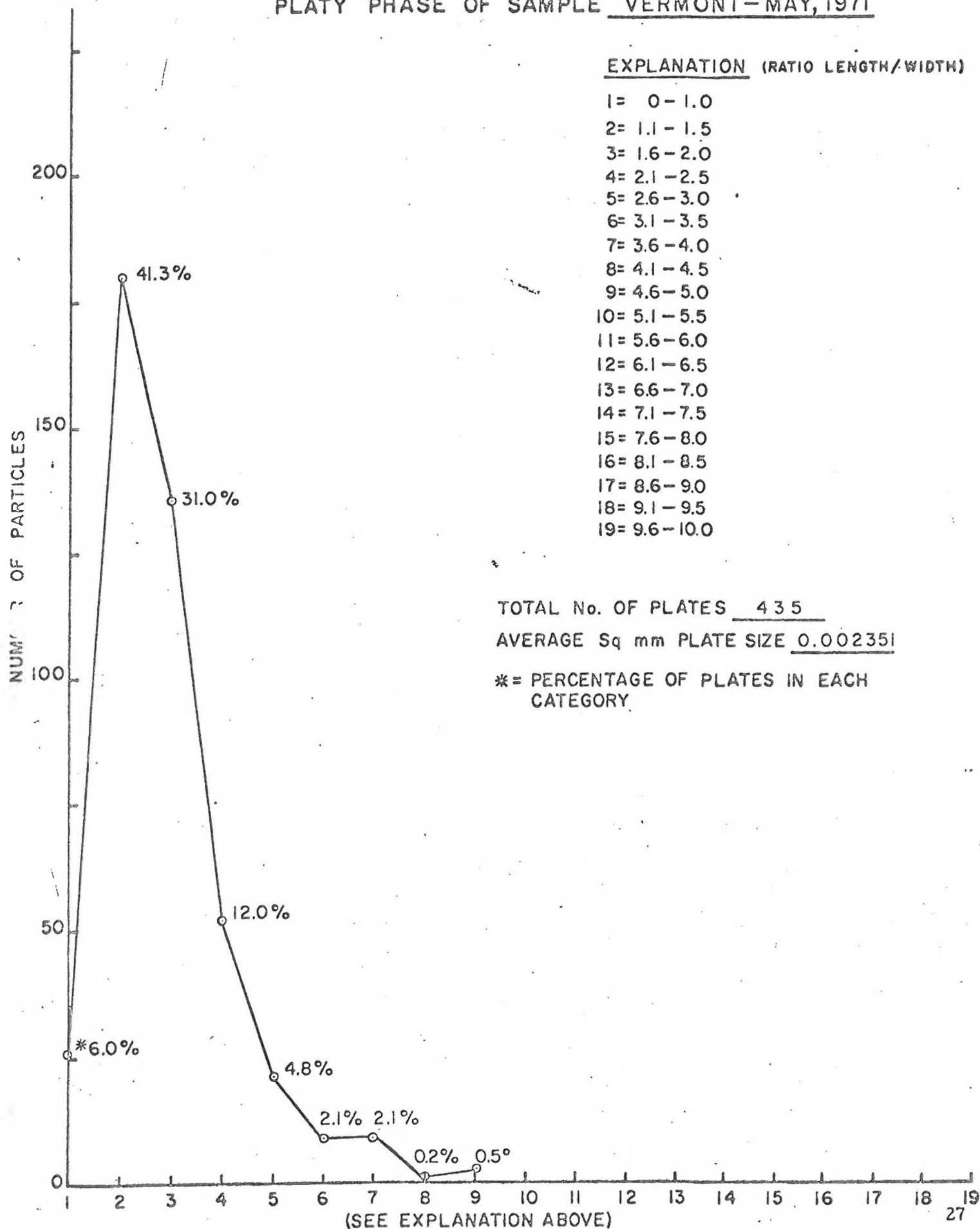


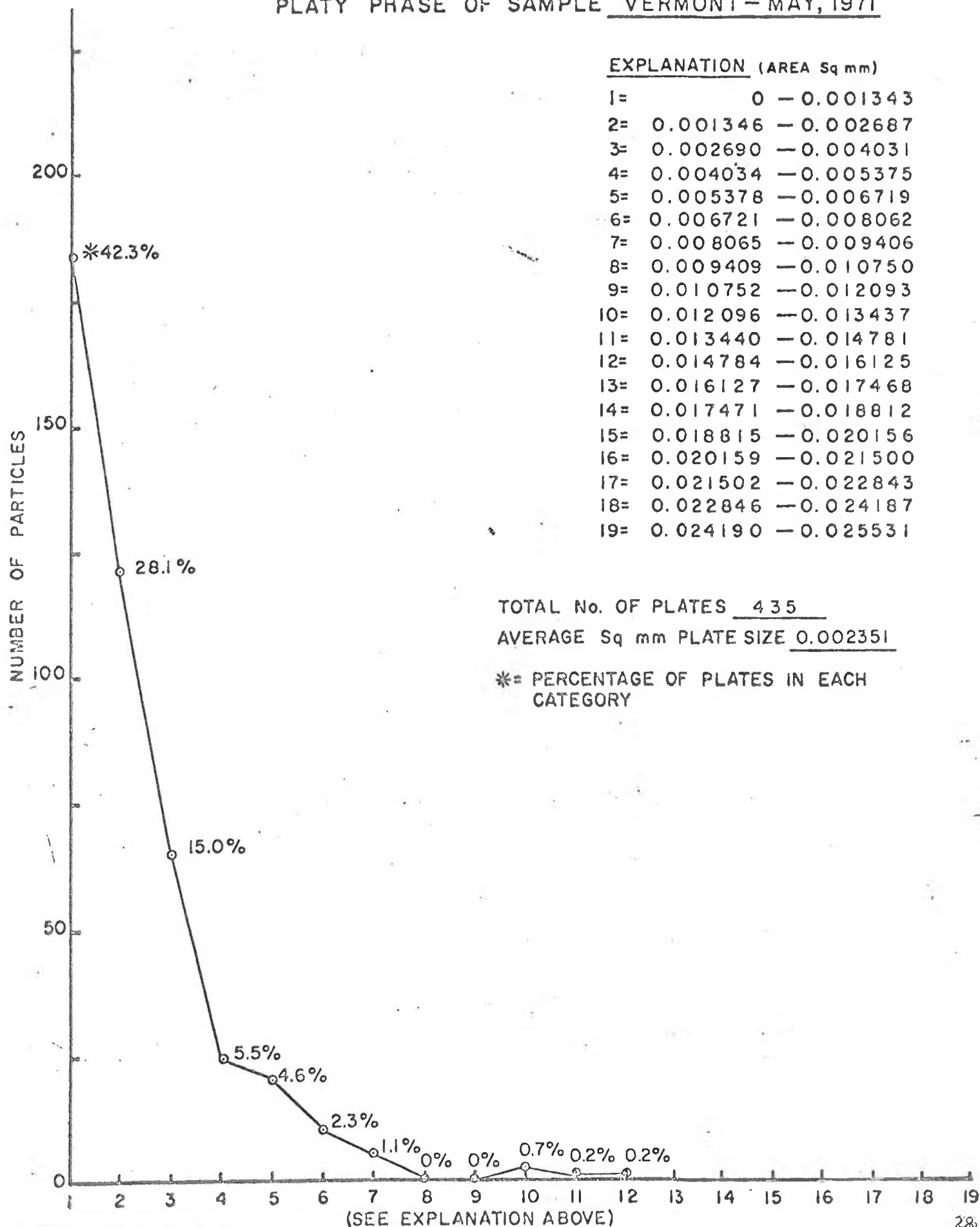
PLATE PHASE OF SAMPLE



PLOT OF LENGTH/WIDTH RATIOS FOR THE
 PLATY PHASE OF SAMPLE VERMONT-MAY, 1971



**PLOT OF SIZE DISTRIBUTION (Sq mm) OF THE
PLATY PHASE OF SAMPLE VERMONT - MAY, 1971**



These plots show:

1. The size distribution curves show that the Lot No. 2 Grantham product possesses the largest amount of fine material and the Vermont products the smallest amount of fine material.
2. The ratio curves show the Italian and Vermont products to be comparable in particle shape, and the Lot No. 2 Grantham to be slightly more elongate.

The distribution of platy particles below 0.001343 sq mm in the 344-L, Italian O. S., Italian U. S., and the Lot No. 2 Grantham samples were then determined to more closely define the superfine portion of each sample. Following are the results of that study:

TABLE 4

Percent of Plates in Categories Below 0.001343 sq mm

Sample	% on a total sample basis (sq mm)			
	<0.0001	0.0001-0.0005	0.0005-0.0010	0.0010-0.001343
344-L	1.4	7.2	13.1	10.1
Ital. U. S.	6.8	25.4	12.8	4.8
Ital. O. S.	7.0	23.4	18.4	6.2
Lot No. 2 Grantham	5.6	34.8	23.8	10.0

These results show that the 344-L sample had the smallest percentage of particles below 0.0001 sq mm in size, and the Italian samples had the largest percentage of particles below 0.0001 sq mm in size. The Lot No. 2 Grantham and the Italian samples showed the largest percentage of

particles in the 0.0001-0.0005 sq mm size range. The Lot No. 2 Grantham sample showed the largest percentage of particles in the 0.0005-0.0010 sq mm size range.

Talc Shards

Length/width ratio and size distribution data were procured on the particles identified as talc shards in samples 344-L, Italian U.S., Italian O.S., and Lot No. 2 Grantham. Following are the results of that study:

TABLE 5

Number of Talc Shard Particles Falling Into Length/Width Ratio Categories

Sample	Ratio Length/Width												
	0- 2	2- 4	4- 6	6- 8	8- 10	10- 12	12- 14	14- 16	16- 18	18- 20	20- 22	22- 24	24- 26
344-L	3	9	5	6	1	1	1	0	0	0	0	0	0
Ital. U.S.	0	0	7	6	4	3	2	2	0	0	0	1	1
Ital. O.S.	0	0	2	12	8	2	0	0	0	0	0	0	0
Lot No. 2 Grantham	3	6	6	0	0	0	0	0	0	0	0	0	0

The most significant trend noted from these data was that the Italian O.S. product had shards falling within a rather restricted length/width ratio range, i. e, 4-12, while the Italian U.S. product had shards that ranged in length/width ratio from 4-26. It is possible that this could indicate different grinding procedures.

TABLE 6

Number of Talc Shard Particles Falling Into Size Categories

Sample	Size (sq mm)			
	0-0.0001	0.0001-0.0005	0.0005-0.0010	0.0010-0.0015
344-L	4	6	4	0
Ital. U.S.	9	12	5	0
Ital. O.S.	9	12	3	0
Lot No. 2 Grantham	7	8	0	0

These data show the talc shards in Italian products to be essentially identical in regard to particle size. The Lot No. 2 Grantham talc shards are concentrated near the finer size end.

Talc Needles

Since most of the needles in the samples had a width of 0.00164 mm, it was decided to examine only the relationship of needle length. The following table shows the comparison of talc needle length in each sample:

TABLE 7

Number of Talc Needles in Each Length Range

Sample	Needle Length (mm)					
	0- 0.0082	0.0082- 0.0164	0.0164- 0.0246	0.0246- 0.0328	0.0328- 0.0410	0.0410- 0.0492
344-L	3	6	1	0	1	0
Ital. U.S.	1	2	3	1	0	0
Ital. O.S.	1	1	1	1	0	0
Lot No. 2 Grantham	1	2	2	1	0	0

These data show that the 344-L sample has the greatest number of talc needles, the majority of which fall in the 0.0082-0.0164 mm length range. The other samples show no trends other than the needle lengths all fall below 0.0328 mm.

Nontalc Needles

As in the talc needle category, all of the nontalc needles had a rather uniform width of about 0.00164 mm, therefore the needle length relationships were examined. The following table outlines the nontalc needle lengths in each sample.

TABLE 8

Number of Nontalc Needles in Each Length Range

Sample	Needle Length (mm)					
	0- 0.0082	0.0082- 0.0164	0.0164- 0.0246	0.0246- 0.0328	0.0328- 0.0410	0.0410- 0.0492
344-L	0	1	2	0	0	0
Ital. U.S.	0	1	1	0	0	0
Ital. O.S.	1	0	1	0	0	0
Lot No. 2 Grantham	2	2	0	1	0	0

These data show the Lot No. 2 Grantham to have the greatest amount of nontalc needles. The majority of the needles in all of the samples fall in size ranges below 0.0246 mm.

Quartz

Most of the quartz particles were nearly equidimensional, therefore it was decided to examine the relationships of area in sq mm between samples. The following table shows the relationship of quartz particle size in each sample:

TABLE 9

Number of Quartz Particles Falling Into Size Ranges

Sample	sq mm				
	0- 0.00001	0.00001- 0.00005	0.00005- 0.00010	0.00010- 0.00050	0.00050- 0.00100
344-L	0	3	1	3	2
Ital. U. S.	0	1	0	0	0
Ital. O. S.	0	2	0	0	0
Lot No. 2 Grantham	0	0	0	0	0

These data indicate that the 344-L sample contains the most quartz, and that a majority of the sample has areas ranging from 0.00001-0.0005 sq mm. Very little quartz was noted in the Italian samples; the particles that were noted fell into the 0.00001-0.00005 sq mm range. No quartz was noted in the Lot No. 2 Grantham sample.

Carbonate

Again, as in the case of the quartz grains, most of the carbonate grains were nearly equidimensional, therefore, a comparison of their areas in sq mm was made. The following table outlines the results of that study:

TABLE 10

Number of Carbonate Particles in Each Size Range

Sample	sq mm						
	0- 0.00001	0.00001- 0.00005	0.00005- 0.00010	0.00010- 0.00050	0.00050- 0.00100	0.00100- 0.00500	0.00500 0.01000
344-L	0	0	4	2	0	1	0
Ital. U. S.	0	5	1	2	1	1	1
Ital. O. S.	0	0	0	1	0	1	0
Lot No. 2 Grantham	0	0	0	0	1	0	0

These data show the Italian U. S. samples to have the largest number of carbonate particles and also to have the largest number in the smallest size range.

"Other" Particles

Particles classified as "other" were generally very small and generally equidimensional. Because of the equidimensional aspect, the areas in sq mm, of these particles in each sample were compared. The following table outlines the results of that study:

TABLE 11

Number of "Other" Particles in Each Size Range

Sample	sq mm				
	0- 0.000001	0.000001- 0.000005	0.000005- 0.000010	0.000010- 0.000050	0.000050- 0.000100
344-L	1	6	3	5	0
Ital. U. S.	0	6	1	1	0
Ital. O. S.	0	9	0	1	0
Lot No. 2 Grantham	0	7	1	1	0

As may be noted from these data, a majority of the "other" particles in the Italian and Lot No. 2 Grantham samples fall into the 0.000001-0.000005 sq mm range. In the 344-L sample the majority of the particles fall in the 0.000001 to 0.000050 sq mm range.

COLORADO SCHOOL OF MINES RESEARCH INSTITUTE

P.O. Box 112

GOLDEN, COLORADO 80401

July 7, 1971

Mr. Wm. H. Ashton
Johnson & Johnson
Research Center
Research and Development
New Brunswick, NJ 08901

390517

Dear Mr. Ashton:

Following are the results of the x-ray analyses on the 344-L Vermont talc product and the six monthly Vermont talc product samples.

Summary and Conclusions

Semiquantitative x-ray diffraction analyses of the Vermont products and standard mineral samples indicate that essentially no anthophyllite and only minor amounts (below 1%), of tremolite and actinolite were detected. Other nontalc phases noted in the Vermont talc samples were small amounts of mica, chlorite, magnesite, dolomite, and minor to trace amounts of quartz.

Discussion

Figure 1 shows tracings of x-ray diffractograms of the 344-L Vermont talc product and 6 monthly Vermont talc products. The column at the left of the tracings indicate the positions of the diffraction peaks of each noted mineral type. As may be noted from these tracings only very minor tremolite-actinolite and no recognizable anthophyllite peaks are present.

The following table shows the relative peak heights of the major peak of each mineral species identified.

TABLE 1

Relative Peak Heights

<u>Sample</u>	<u>Talc</u>	<u>Relative Peak Heights</u>						
		<u>Trem. - Act.</u>	<u>Antho- phyllite</u>	<u>Mica</u>	<u>Chlorite</u>	<u>Magnesite</u>	<u>Dolomite</u>	<u>Quartz</u>
344-L	major	trace	-	5.0	4.0	4.0	2.0	2.0
May 71	"	trace	-	10.5	7.0	5.5	-	2.0
Mar 71	"	-	-	18.0	15.5	7.0	5.0	2.0
Jan 71	"	3	-	10.0	6.5	6.5	3.0	2.5
Nov 71	"	trace	-	5.0	4.5	5.0	-	3.0
Sept 71	"	3	-	6.5	6.5	5.5	2.0	1.0
July 71	"	trace	-	13.0	9.5	6.5	3.0	-

It must be remembered that peak heights of different mineral species cannot be compared, i. e., mica vs chlorite, etc. Peak heights of the same mineral species can be compared in a relative manner. Also the peak heights themselves in no way indicate percent.

The following table gives the peak heights of standard samples of tremolite, actinolite, anthophyllite and quartz.

TABLE 2

Peak Heights of Standard Samples

	<u>Peak Height</u>
Tremolite	180
Actinolite	280
Anthophyllite	250
Quartz	500

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The peak heights noted in Table 1 can be compared to these standard peak heights to produce a semiquantitative estimate of percentages. By comparing the peaks noted in Table 1 with the peak heights of the standards in Table 2, it is evident that the quartz, tremolite-actinolite and anthophyllite phase all appear to fall well below the 1% range.

Table 2 shows the results of x-ray diffraction analysis on a 344-L sample to which 1% of the tremolite standard had been added:

TABLE 3

Relative Peak Heights of a 344-L Sample
With 1% Tremolite Standard Added

<u>Talc</u>	<u>Trem. - Act.</u>	<u>Antho- phyllite</u>	<u>Mica</u>	<u>Chlorite</u>	<u>Magnesite</u>	<u>Dolomite</u>	<u>Quartz</u>
major	4.0	-	5.0	4.0	4.0	2.0	2.0

Sincerely,



M. G. Pattengill
Project Engineer
Mining Division

/laj
Attach. Figure 1