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NORWESTLANT survey: German report

Plankton:- Phytoplankton

International Commission for the Northwest Atlantic Fisheries.

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NORWESTLANT survey: German National Report

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E. Plankton

b) Phytoplankton

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It should be the best way to start the description of the phytoplankton during the three NORWESTLANT cruises by means of simple mean values (Fig. 1). We have the three cruises I (April), II (May/June) and III (July), and I have subdivided the area under investigation in four regions:

NW:	northerly from 60° N westerly from 45° W
SW:	southerly from 60° N westerly from 45° W
SE:	southerly from 60° N easterly from 45° W
NE:	northerly from 60° N easterly from 45° W

The common point of this four regions is near Cape Farewell. Now we can see an interesting phenomenon if we compare the surface mean values (0 to 20 m). Whilst on the east coast of Greenland the quantity of the phytoplankton is increasing during the time of the investigation, the maximum is over on the west side. But in the latter region the warming of the water in the spring starts earlier than in the other. In this way there is also earlier a good stabilisation of the water column to allow the begin of a phytoplankton bloom. This means that also at high northern latitudes (at least up to the polar circle) the plankton bloom can start as early as March if the stability of the water masses is high enough. The southern regions show the typical curves with a maximum. The value from the SW region cruise II should have the right tendency but too high a value. There were only some measurements near Cape Farewell. This should be the reason.

Fig. 2 shows the development of the small zooplankton catched with the water bottle. All regions have a steady increase in zooplankton. The development of the zooplankton is much slower than that of the phytoplankton. Therefore it can't follow directly the phytoplankton. The southern region indicates better conditions of growth (more phytoplankton and lower respiration because the temperature is also low?). The zooplankton of the NW region doesn't start growing earlier than the other regions. We may expect that the water was too cold earlier in the year.

There are also organic particles in the samples (fig. 3). I have counted them and I have tried to convert this numbers to carbon. Such a method can't have any high accuracy, and I don't know, where this substances are coming from. I believe they represent destroyed plankton or sometimes naked forms which I can't determine. In the moment I can't explain the maximum during the second cruise in the eastern regions, but I hope later on this will be possible.

Fig. 4 gives the mean vertical distribution of phytoplankton, zooplankton and organic particles during the three cruises divided in N (northerly than 60° N) and S (southerly than 60° N). The values at the surface and the gradients to the depth are greater in the region N than in the region S. The organic particles have the same range than the phytoplankton, whilst the zooplankton quantity near the surface is only one quarter of the former values.

This situation is better seen on fig. 5. Here you can observe the logarithmic decrease of the plankton components from the surface down to 100 m. In this range the correlation between the logarithms of the plankton and the depth is a good one (with exception of the zooplankton S).

Fig. 6 shows the vertical distribution of the biological interesting ammonia determined on board r/v "Anton Dohrn" during NORWESTLANT II (practically region NE). From the surface values some extremely high were not used because they were obviously influenced by the ship or so. We have a similar curve as seen before for the plankton data, but the gradient is steady down to a depth of 200 m.

Better to compare with the plankton values is the vertical curve of the organic substances (dissoved and particulate, also determined on board of r/v "Anton Dohrn" during NORWESTLANT II) and data from the same area in August/September 1958 (IGY). The values near the surface are the same in both cases, below 30 m we find higher data in 1963 than in 1958.

How is this fact to explain? The simplest reason would be that in 1958 the stability of the water masses (the density gradient) was a greater one than in 1963. And indeed this can be observed (fig. 8). The third curve gives the situation in June 1955 in the same region. The difference between 1958 and 1963 is obvious and the reason may be in the first range that in 1958 the measurements were done some months later than in 1963.

But what does the difference between 1955 and 1963 mean? The increase of the phosphate with depth was 1955 much greater than 1963 (fig. 9). As for the oxygen saturation there was the decrease with the depth 1955 greater than 1963. 1963 turbulence was great and in this way we could observe a highly saturated water down to 100 m. The saturation curves from

[illegible] are probably the same. We can therefore expect that the hydrographic differences between [illegible] an 1958 was not so enormous than the differences in the density gradients, which in 1953 we find had a greater turbulence. It may be so that there exists a critical density gradient between the gradients in 1953 and in 1958.

This situation is [illegible] of interest as so far as we should know whether or not our investigations are done during a good, a normal or a bad year in view of the plankton production. And we know that the stability (the density gradient) is a fundamental factor for the plankton growth. We find [illegible] the following situation as we compare the different years:

	[illegible]		[illegible] (region [illegible])		
	[illegible] June	1958 August September	1963 May June	1963 July	
[illegible]	40	15	13	16	µg C/l
[illegible]	9	[illegible]	4	5	µg C/l

Compared to 1953 the year 1963 had bad conditions in view of the [illegible] and low plankton values. A comparison with 1958 is more difficult, because the samples were taken later in the year than during [illegible] III. So it is to expect that the maximum was over and that the values were at least a little higher than 1963. Therefore we can say that the [illegible] and certainly also the production was low in 1963 in the region [illegible] compared with 1958 and especially with 1953.

The situation in each year may be [illegible] of course, if we are drawing charts of the surface (10 m) distribution of the different components. In this case it is necessary to use one degree fields because otherwise you couldn't draw all the isolines [illegible] in the regions with many measurements. So we can see that single values should not be used to construct such charts i.e. we can only get an impression what happens truely, but such a chart can not be right in the details.

As for the phytoplankton the situation is the following one:

[illegible] I: On the west coast of Greenland there are relatively high plankton values from the northern boundary of the investigated area (67° N) to the Cape Farewell with a maximum (>50 µg C/l) at 64° N. It is possible that on the east coast [illegible] is drifted in from the [illegible].

[illegible] II: [illegible] west coast of Greenland we find two maxima (ca. 50 µg C/l) at 62 and 65° N. The isolines run parallel to the coast. On the east side the highest values come in from Greenland, from Iceland and [illegible] from the open sea with values up to more than 100 µg C/l.

[illegible] the [illegible] of [illegible] coming [illegible] the [illegible] where there [illegible] only [illegible] quantity of phytoplankton [illegible] population is shifted [illegible] high mean value [illegible] formation.

[illegible]

[illegible]

Fig. 2, Zooplankton (conditions as in Fig. 1).

Fig. 3, Organic particles (conditions as in Fig. 1).

Fig. 4, Mean vertical distribution [illegible] all three cruises divided in a northern (N) and a southern (S) region.

Phytoplankton: ....

Zooplankton: ----------

Organic particles: -.-.-.-.-.

Fig. 5, [illegible] vertical distributions from all three cruises divided in a northern (N) and a southern (S) region, same signs as in Fig. 4, the quantity is given in a logarithmic scale. For phytoplankton N the mean values (+) are given. r = correlation coefficient.

Fig. 6, Mean values of the vertical distribution of the ammonia during [illegible] II (r/v "Anton Dohrn").

Fig. 7, Mean values of the vertical distribution of the organic carbon (permanganate consumption) during [illegible] (r/v "Anton Dohrn") and during [illegible] (r/v "Anton Dohrn").

Fig. 8, Mean values of the [illegible] differences [illegible] between the [illegible] and [illegible] on the surface of the r/v "Anton Dohrn" in the Irminger Sea:

June 1955: ________;

August/September 1958: - - - - - - and

June 1959: -.-.-.-.-.-.

Fig. 9, Mean values of the vertical distribution of the phosphate content (P) and of the oxygen saturation (O_2%). (Same cruises and signs as in Fig. 8.)

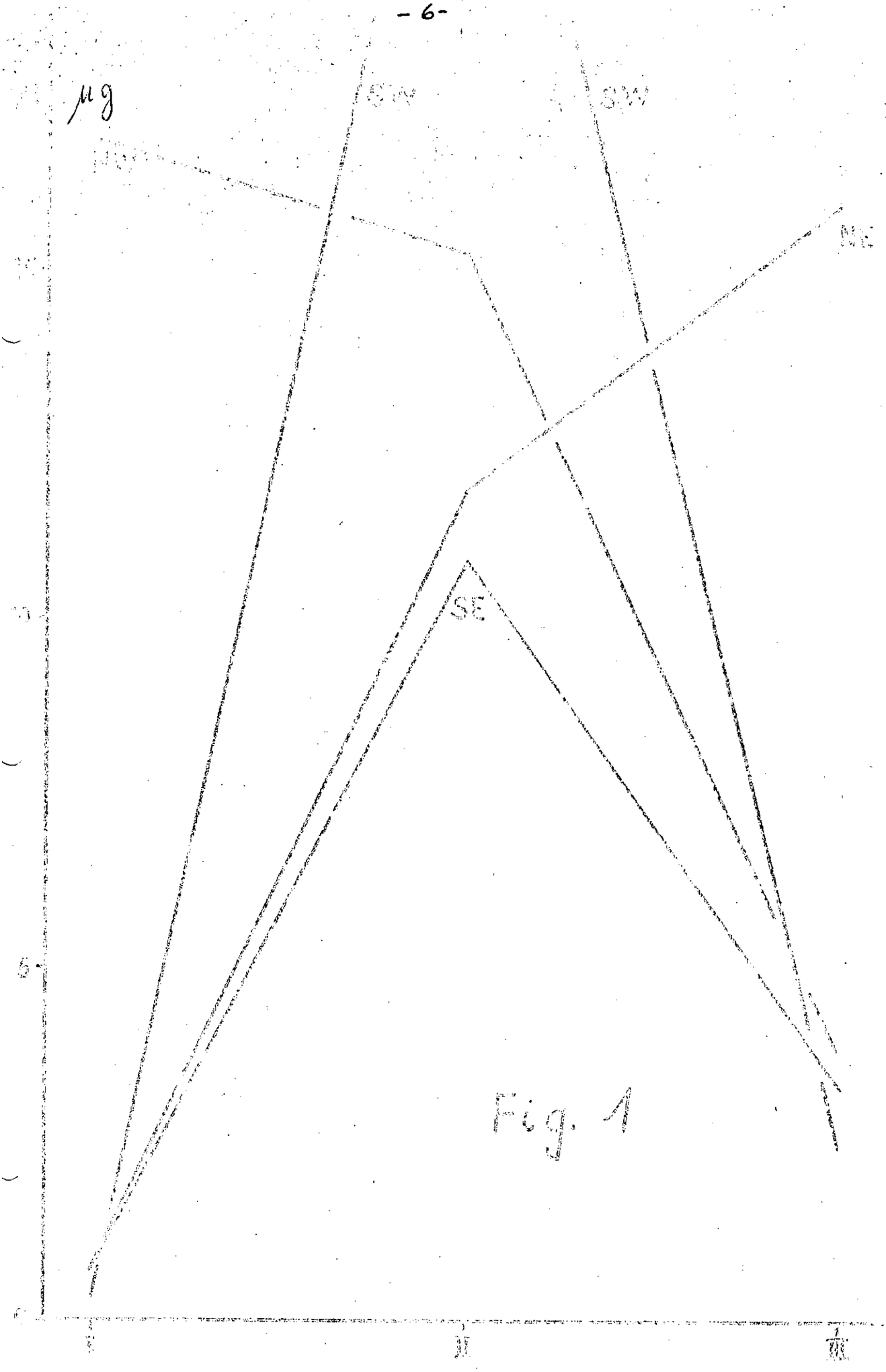


Fig. 1

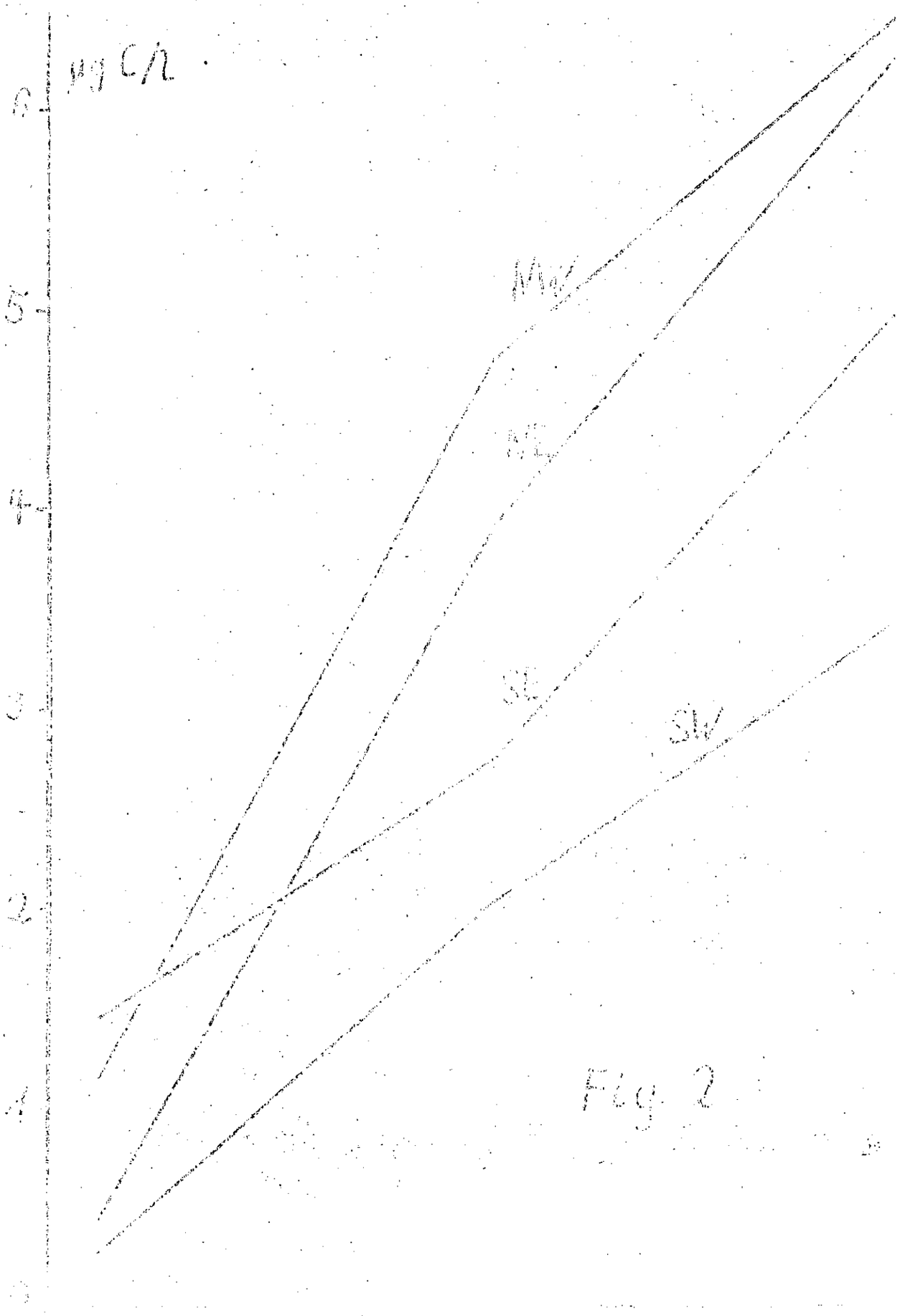


Fig 2

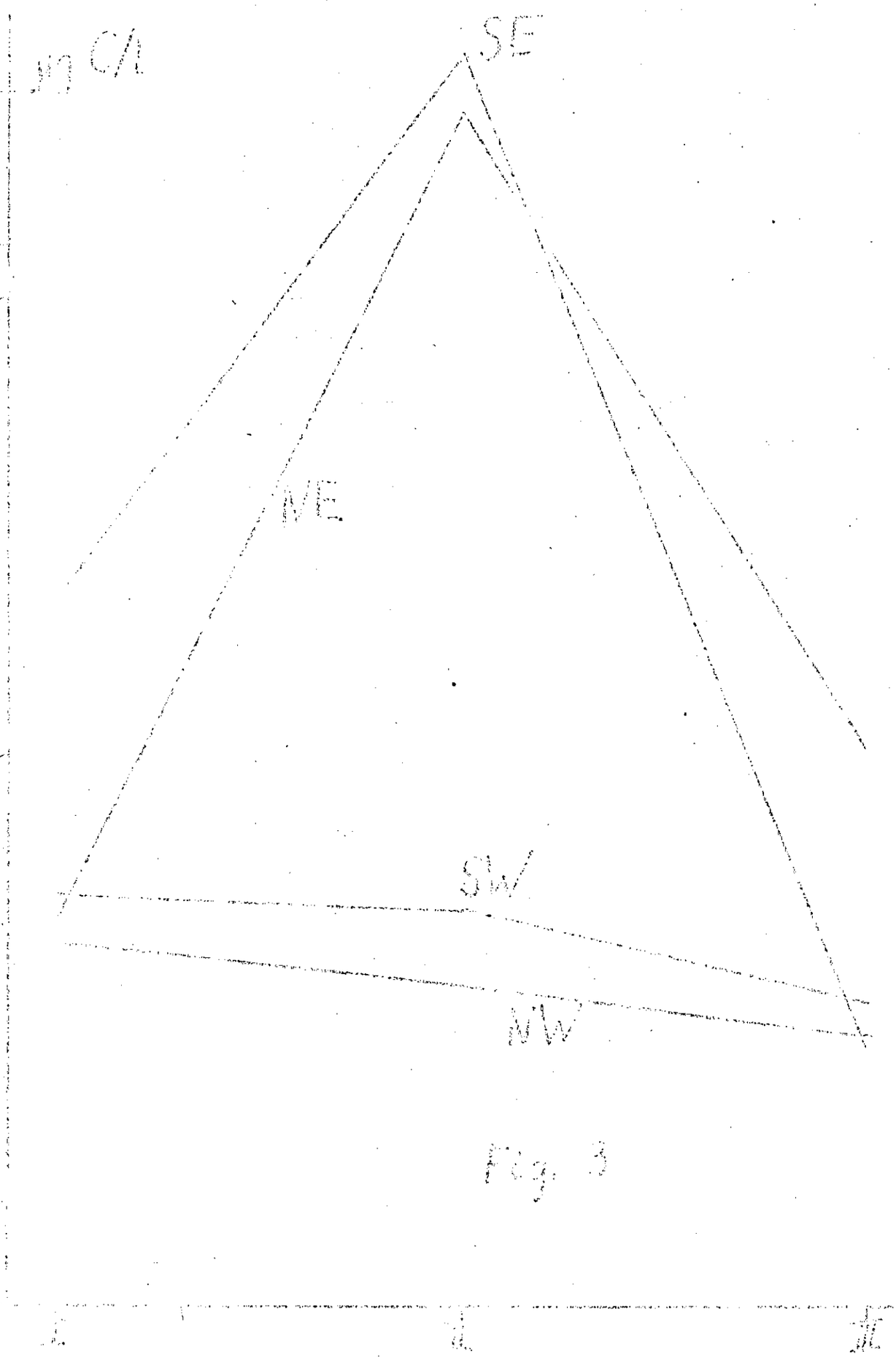


Fig. 3

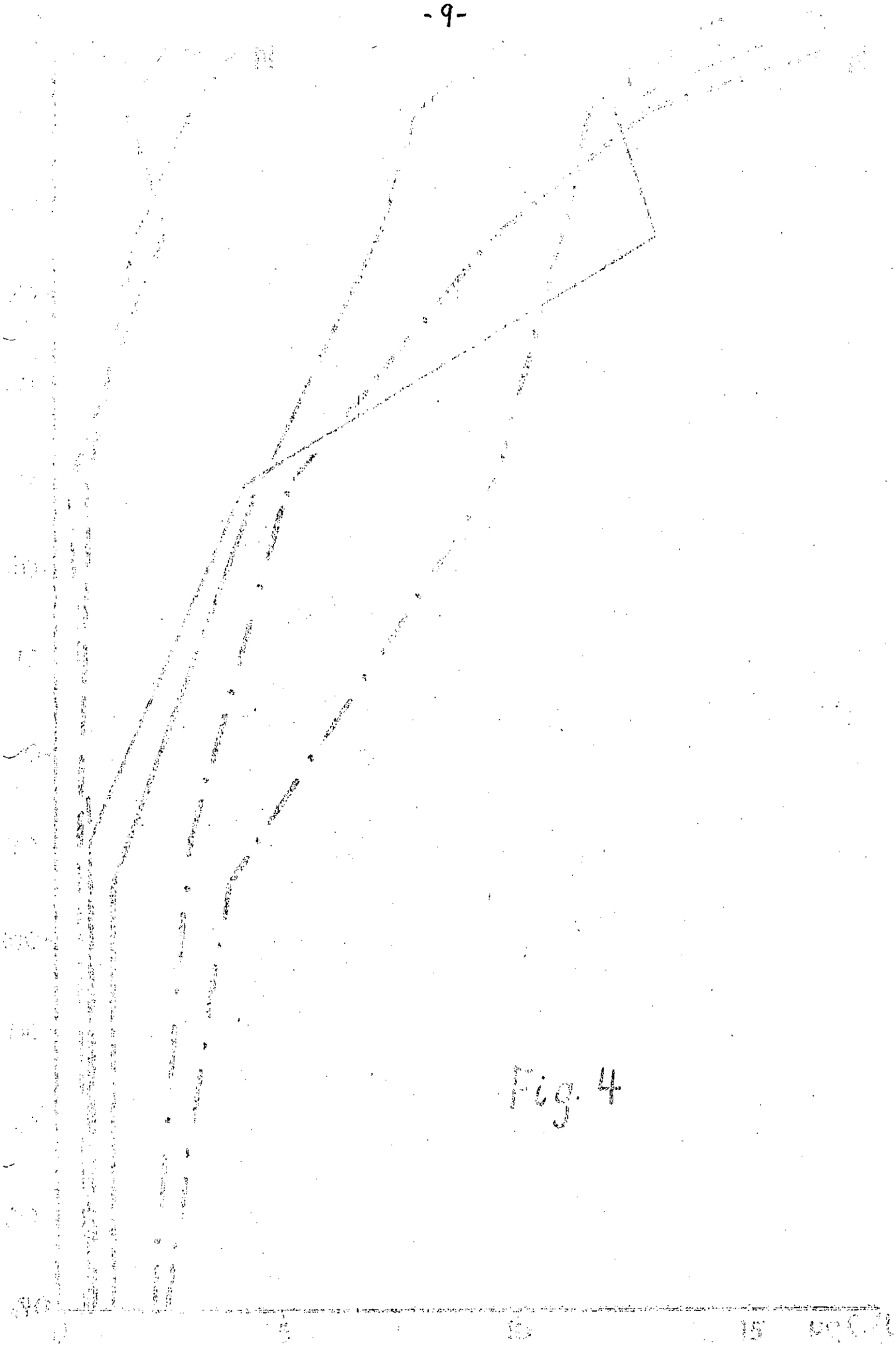


Fig. 4

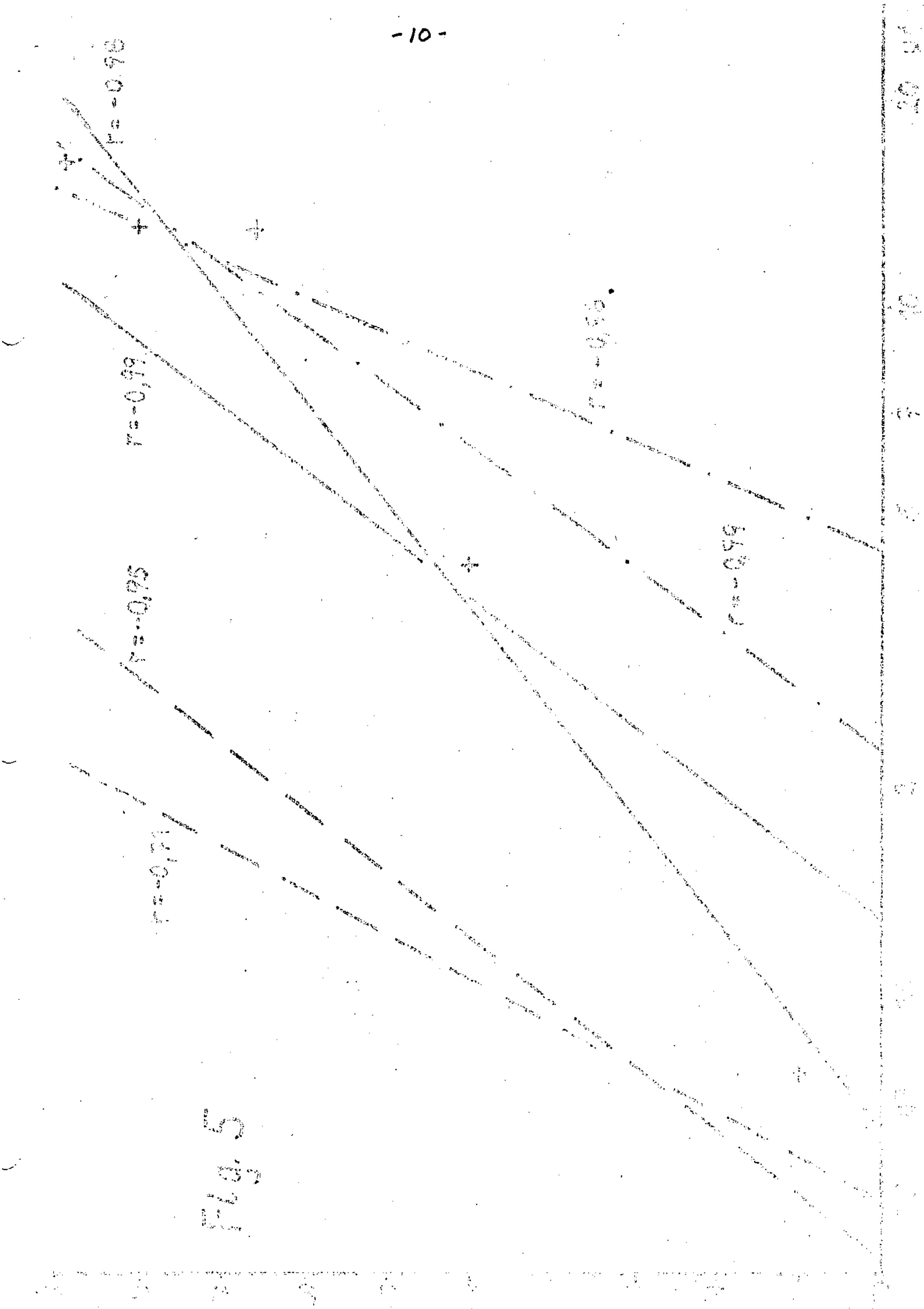


Fig. 5

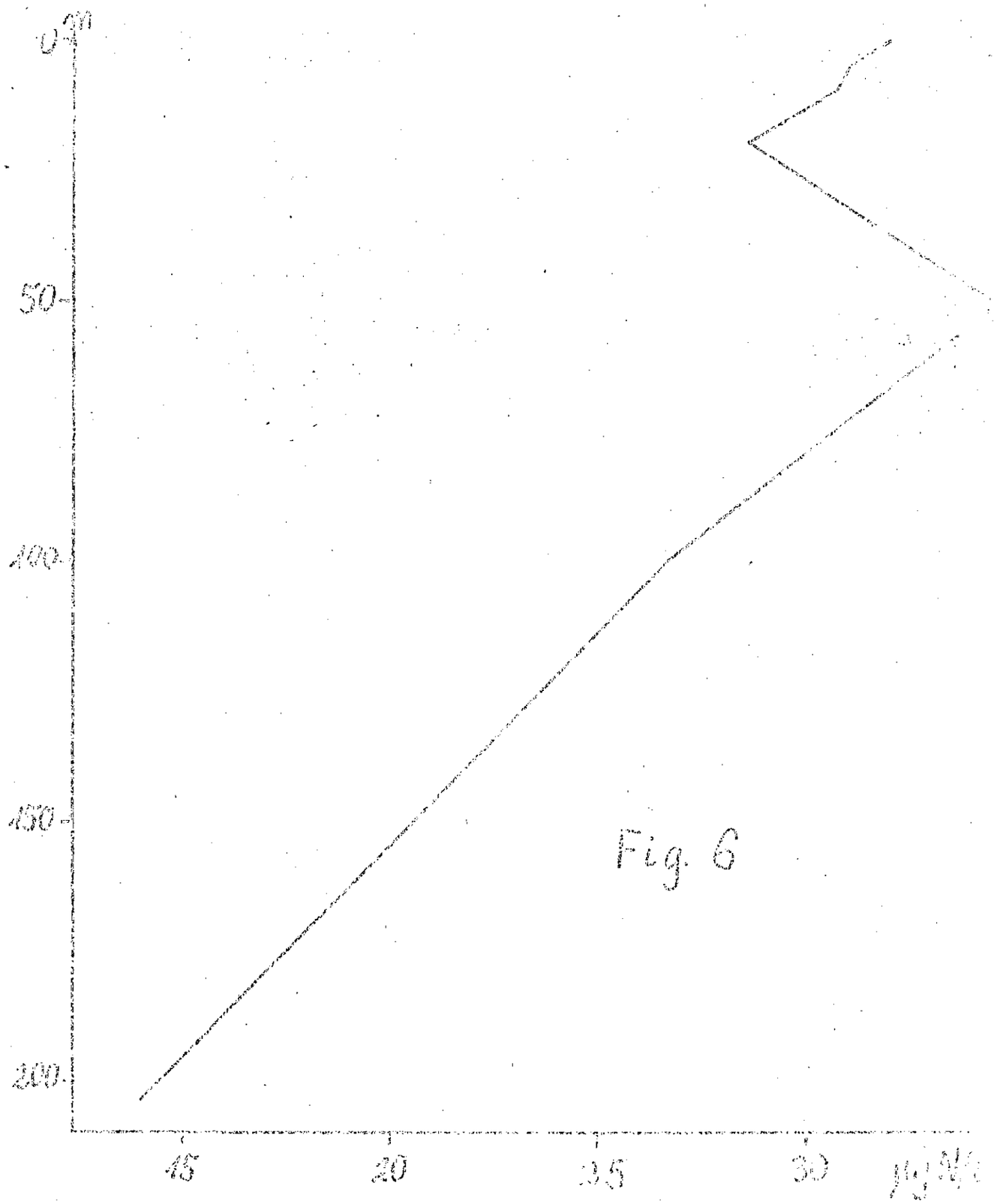


Fig. 6

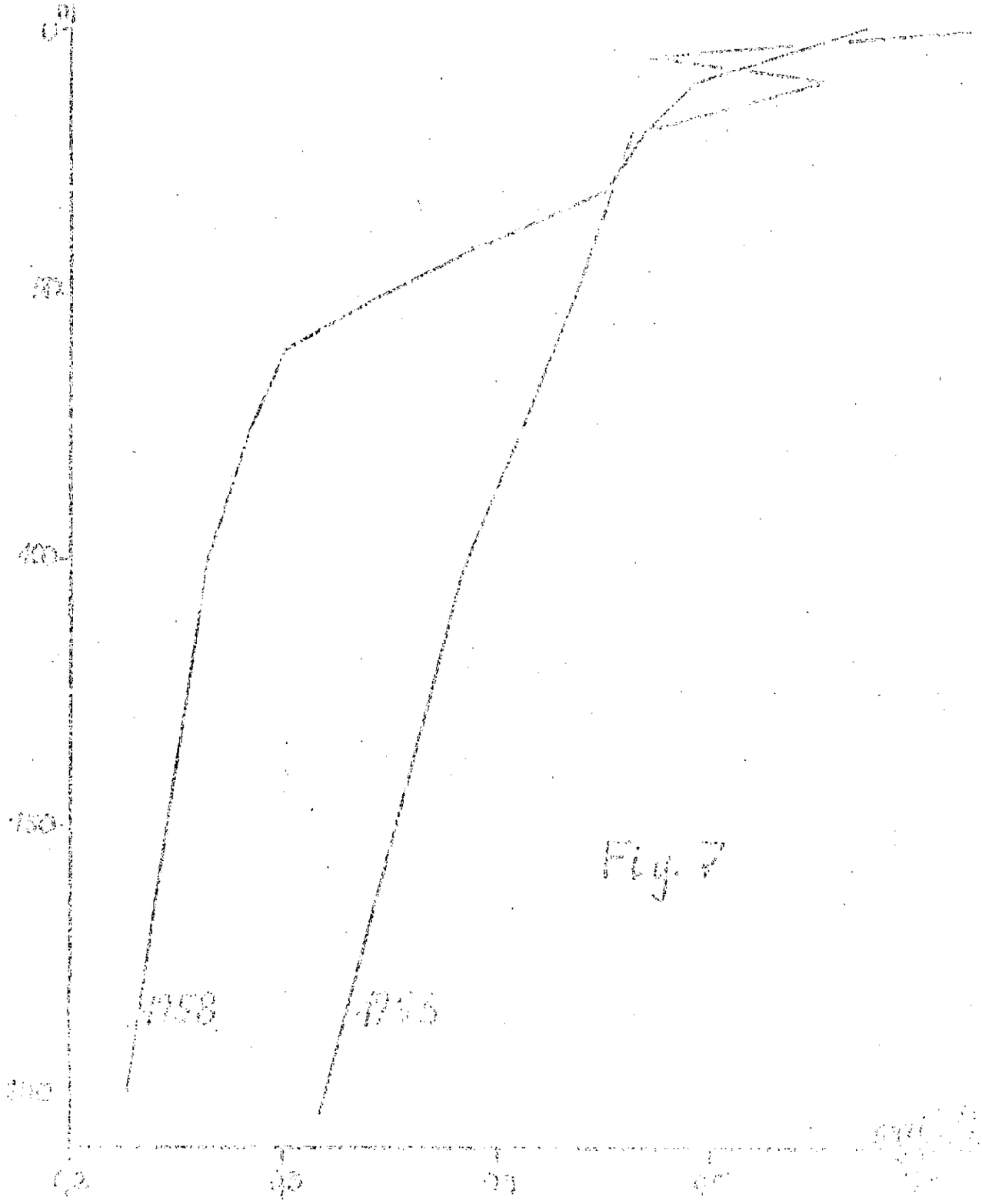
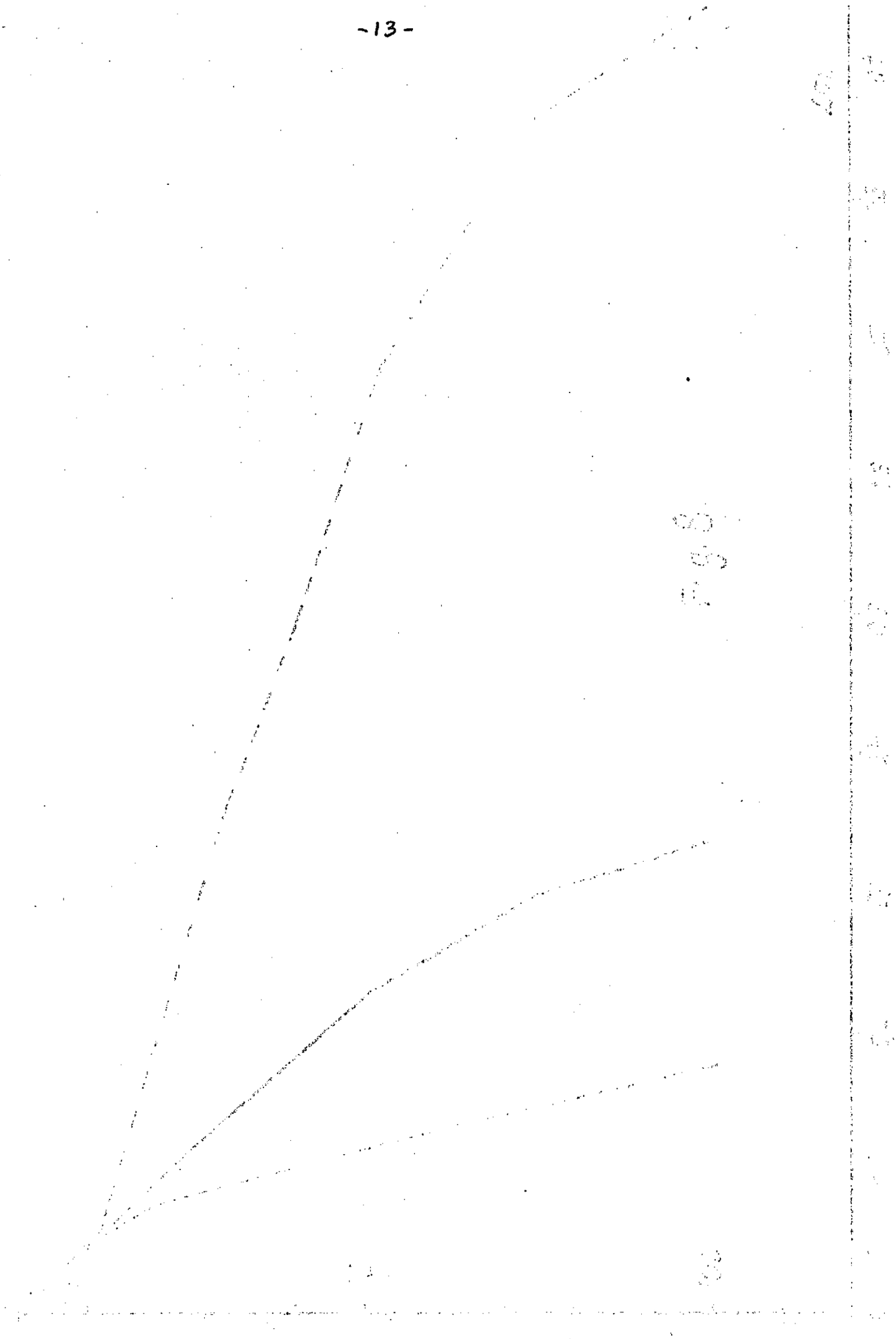
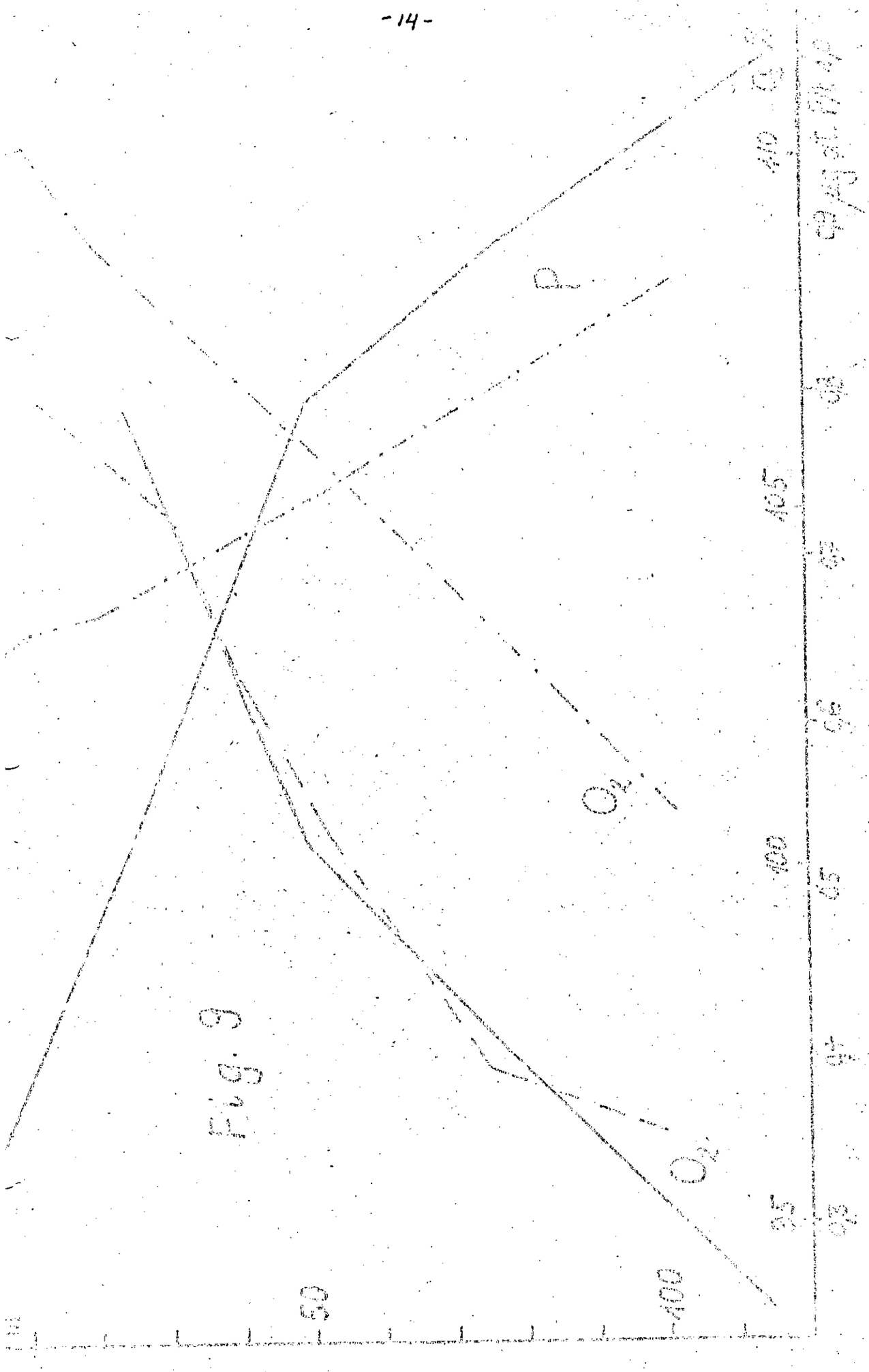


Fig. 7

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