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Tittel Regional stream sediment and heavy mineral concentrate survey in rhyolittic area SE of Løkken				
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GULF - ORKLA

LØKKEN VENTURE

REPORT NO.: L.V. 3

DATE:

TITLE:

29.12.1981

Regional stream sediment and heavy
mineral concentrate survey in
rhyolittic area SE of Løkken.

ORKLA INDUSTRIER A.S.

MINING SECTION, EXPLORATION

Report no: L.V. (Løkken Venture) 3	Date: 29.12.1981
Title: REGIONAL STREAM SEDIMENT AND HEAVY MINERAL CONCENTRATE SURVEY IN RHYOLITTIC AREA SE OF LØKKEN.	
Prepared by: Kjell B. Carlsen	Areas name: Høgknippen Hårråkletten
Map no., name: 1521 II Høllonda	Coordinates (UTM): 6987-6992, 537 - 547 (Høgknippen) 6998-7000, 558 - 560 (Hårråkletten)
Field work period(s): July, august 1981	Pages: 7 Map enclosures: 25
Summary (purpose, execution, results): A stream sediment geochemical survey was conducted in this areas (100 and 40 sq km). Stream sediment were analysed for Cu, Mn, Ni, Pb and Zn, Heavy mineral concentrates were analysed for Ba, Co, Cu, Mo, Mn, Ni, Pb V and Zn. Three small distinct areas with high stream sediment values indicate the need for follow-up studies. Some of the heavy mineral samples are erratic high. These might be caused by sampling or analysing error.	
Key words: Stream sediments - heavy mineral sampling - rhyolittic area.	
Project initiated (date): June 1981	Report finished (date): December 1981

1. INTRODUCTION

A stream sediment sampling program was carried out in two regions in two rhyolittic areas. (10 - 25 km's SE of Løkken, Fig. 1):

1. 100 sq-km Høgnippen area.
2. 20 sq-km Håråkletten area.

The intention of the program was to get a geochemistry examination of this area. Of specially interest was the more valuable metal deposit described from similar geological conditions. Stream sediments (minus 80-mesh) and heavy mineral fractions were examined. Heavy mineral sampling was a new method for us. We used the method recommended by Norwegian Geological Survey (NGU). The objective of using heavy mineral sampling, was both to test the method and look for heavy minerals which might be interesting in the area.

2. GEOLOGY

The area mainly consist of volcanic sandstones of rhyolittic character and shales. John Walsh (Galeway University) mapped the area partly in 1981. He will continue this work.

3. GEOCHEMISTRY

3.1 Field procedure

The stream sediment samples and the panned concentrates were obtained from the same point. Totally 266 points were sampled. All streams in the area were followed up. The intersection between each sample was 500 meter. There was also taken extra samples after new streams coming in.

3.2 Analytic procedure

Both the stream sediment samples and the heavy mineral samples were sent to Institutt for Energiteknikk.

The stream sediments were digested in HNO_3 and analysed by atomic absorption for Cu, Mn, Ni, Pb and Zn.

The heavy mineral samples were totally digested. The elements Co, Cu, Mn, Ni, V and Zn were analysed on plasma spectrometry. The analysis were completed after about three months. Price per sample was as follows:

- 92,50 NOK (17 US\$) stream sediments
- 169,50 NOK (31 US\$) heavy mineral samples.

Total price was 70.000 NOK (13.000 US\$). For further analysing we have got better bids from foreign laboratories.

3.3 Data preparation

The geochemical data were subjected to statistical analysis. Histograms for cumulative frequency distribution were prepared. From the cumulative frequency, mean and standard deviation can be seen. These curves are represented on the maps for each element. Both the data representation and the map plotting was done with help from the EDB-department at NGU. Elements at the detection limit or lower have got the value to the detection limit. Unfortunately the detection limit are too high for most of the elements to get good statistical representations.

4. RESULTS

4.1 Statistical analysis, stream sediment samples.

Table 2 contains the main statistical figures from the data representation of the elements. These are commented in table 1 together with the results of the logmetrically distribution patterns. Another explanation for the Cu-, Mn- and Zn-distribution patterns might be:

- 1) few analysis (Cu)
- 2) systematically analysis - error (Mn - Zn)

Element	St.dev.	Correlation	% higher than detection lin.	Remarks
Cu	low	Ni(0,69%)	8 %	Two logmetrically distribution patterns. Background until 98%, anomaleous area 98 - 100%
Mn	very high	Ni(0,67%) Zn(0,82%)	93 %	Two logmetrically distribution patterns. Anomaleous area represents 89% of the analysis.
Ni	moderate	Mn(0,67%) Zn(0,75%)	45 %	Logmetrically distribution pattern No anomali.
Pb	moderate		5 %	Unregular distribution.
Zn	low high	Mn(0,82%)	10 %	There might be two logmetrically distribution patterns, and a anomaleous areas from about 98 %.

Table 2. Comments to statistical figures, stream sediment samples.

VARIABLES 5
 OBSERVATIONS 266
 HEADING BEKKESEDIMENTER
 FORMAT (5X,5I5)

NAME	MIN	MAX	MEAN	STD.DEV	NO.OF. NON ZEROS
1 Cu	10.000	27.000	10.425	2.071	266
2 Mn	72.000	21500.000	456.124	1400.479	266
3 Ni	10.000	65.000	13.553	6.114	266
4 Pb	10.000	70.000	10.861	4.594	266
5 Zn	10.000	168.000	13.955	13.936	266

TOTAL EXECUTION TIME : 4.398 SECS

CORRELATION MATRIX

VAR	1	2	3	4	5
1 Cu	1.00000	-.02983	.06930	-.03858	.04929
2 Mn	-.02983	1.00000	.67057	.11629	.81736
3 Ni	.06930	.67057	1.00000	.14759	.75075
4 Pb	-.03858	.11629	.14759	1.00000	.17432
5 Zn	.04929	.81736	.75075	.17432	1.00000

T-VALUE MATRIX

VAR	1	2	3	4	5
1 Cu	.00000	-.48482	1.12863	-.62734	.80192
2 Mn	-.48482	.00000	14.68691	1.90244	23.05159
3 Ni	1.12863	14.68691	.00000	2.42460	18.46552
4 Pb	-.62734	1.90244	2.42460	.00000	2.87640
5 Zn	.80192	23.05159	18.46552	2.87640	.00000

DEGREES OF FREEDOM FOR T-TEST = 264

Table 2. Main statistical figures from the data representation

4.2 Statistical analysis, heavy mineral samples.

Table 4 contains the main statistical figures from the data representation of the heavy mineral samples. These are commented in table 3 together with the results of the logmetrically distribution patterns.

Element	St.dev.	Correlation	% higher than detection lim.	Remarks
Ba (1)	rel.low		30 %	Logmetrically distribution pattern. Unanomalous.
Co (2)	moderate	Zn(54%)	80 %	Two logmetrically distribution patterns. Anomalous area from about 97 %.
Cu (3)	moderate low		65 %	Logmetrically distribution pattern.
Mo (4)				All of the values are below detection limit 50 ppm.
Mn (5)	low		99 %	Two logmetrically distribution patterns. One from 1 - 10 ppm due to sampling error, few values and the rest which represents the background.
Ni (6)	moderate low		89 %	Logmetrically distribution pattern.
Pb (7)	low			
V	rel. high		99 %	Two logmetrically distribution patterns. One from 1 - 5 ppm due to sampling error. The other one represents the background.
Zn	moderate low	Co(54%)		Logmetrically distribution pattern.

Table 3. Comments to statistical figures, heavy mineral samples.

VARIABLES 9
OBSERVATIONS 266
READING MINERALVASKPROVER
FORMAT (SY,F5.2,3IS,F5.2,4IS)

NAME	MIN	MAX	MEAN	STD.DEV	NO.OF. NON ZEROS
1 Ba	.010	.130	.020	.018	266
2 Co	20.000	370.000	42.835	33.083	266
3 Cu	25.000	250.000	35.402	21.801	266
4 Mo	50.000	50.000	50.000	.000	266
5 Mn	.120	5.400	1.655	.864	266
6 Ni	45.000	510.000	91.585	42.281	266
7 Pb	50.000	100.000	50.263	3.298	266
8 V	30.000	665.000	270.947	94.097	266
9 Zn	35.000	305.000	91.682	27.005	266

TOTAL EXECUTION TIME : 5.559 SECS
CORRELATION MATRIX

VAP	1	2	3	4	5	6	7	8	9
1 Ba	1.00000	.02892	-.04940	.00000	.05067	-.05950	.05313	.02454	.09339
2 Co	.02892	1.00000	.04369	.00000	.01780	.43716	-.01136	.12550	.54906
3 Cu	-.04940	.04369	1.00000	.00000	-.18188	.07394	.04314	-.08853	.08691
4 Mo	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000
5 Mn	.05067	.01780	-.18188	.00000	1.00000	-.08034	-.01039	.48012	.30415
6 Ni	-.05950	.43716	.07394	.00000	-.08034	1.00000	-.00193	.01830	.45906
7 Pb	.05313	-.01136	.04314	.00000	-.01039	-.00193	1.00000	-.01906	.02210
8 V	.02454	.12550	-.08853	.00000	.48012	.01830	-.01906	1.00000	.32948
9 Zn	.09339	.54906	.08691	.00000	.30415	.45906	.02210	.32948	1.00000

T-VALUE MATRIX

VAF	1	2	3	4	5	6	7	8	9
1 Ba	.00000	.47007	-.20369	.00000	.82430	-.96851	.86449	.39886	1.52415
2 Co	.47007	.00000	.71050	.00000	.28933	7.89754	-.18462	2.05539	10.67411
3 Cu	-.20369	.71050	.00000	.00000	-3.00525	1.20463	.70153	-1.44413	1.41750
4 Mo	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000
5 Mn	.82430	.28933	-3.00525	.00000	.00000	-1.30953	-.16379	8.89298	5.18756
6 Ni	-.96851	7.89754	1.20463	.00000	-1.30953	.00000	-.03130	.29735	3.39573
7 Pb	.86449	-.18462	.70153	.00000	-.16379	-.03130	.00000	-.30963	.35923
8 V	.39886	2.05539	-1.44413	.00000	8.89298	.29735	-.30963	.00000	5.67010
9 Zn	1.52415	10.67411	1.41750	.00000	5.18756	8.39573	.35923	5.67010	.00000

DEGREES OF FREEDOM FOR T-TEST = 264

Table 4. Main statistical figures, heavy mineral samples.

4.3 Stream sediment maps

Høgknippen_area

In the western part of the investigation area there are some higher Zn-,Ni-values (no. 1-9). These corresponds to high Mn-values. A reason for this might be unnormal pH/Eh - conditions.

On the other side of Bjørnfjell 1 km further west there are a weak Pb-anomali (no. 148). These high value is not influenced by other elements.

In one of the streams going into Messa from south (no. 229) there are some relatively high values with no other influence by other elements.

Hårråkletten_area

In the most northern sampling point (no. 259) there are a Ni-,Zn-anomali corresponding to high Mn-values. Due to the same unnormal pH/Eh - conditions as mentioned under the Høgknippen area this might be a false anomali.

All the stream sediment anomalies should be further investigated.

4.4 Heavy mineral sampling map

Høgknippen_area

In the western part (no. 128) and in the southern part (no. 50) there are two weak Co-anomalies with moderate to high values.

Cu has a relatively high anomaleous values in the Høgknippen mountain area (no. 45 ,no. 95).

Ni has moderate anomaleous values in two streams west of Høgknippen (no. 87, no. 107). Further up in one of these streams (no. 88) there are a high Ba-value.

Zn and V have anomaleous values in streams going into Messa from south. (resp. no. 235 and no. 227).

Hårråkletten_area

Gives no good anomalies.

None of the Pb-values were over the detection limit.

All the heavy mineral concentrate samples are single element values in just one erratic point. This might be caused by sampling or analysing error.

Further investigations to follow up the heavy mineral anomalies are not recommended.

4.5. Remarks

The results of the heavy mineral sampling are occasional and can't be compared with the results of the stream sediment sampling.

As mentioned before there are several element-values below the analysis detection limit. These values are considered as having the detection limit in the statistical analysis. These have of course influence on the statistical values, but as far as we consider no effect on the background or the anomaly. To follow up this we will recalculate the statistical values regarding the detection limit or lower as zero-values.

Enclosure 1: Location of sampling areas.

Concerning enclosures of the other maps of the following elements due to no analysis over detection limit:

Hårråkletten/Høgknippen: Mo (-heavy minerals)

Hårråkletten: Cu, Mo, Pb (-heavy minerals)

Cu (stream sediment sample)

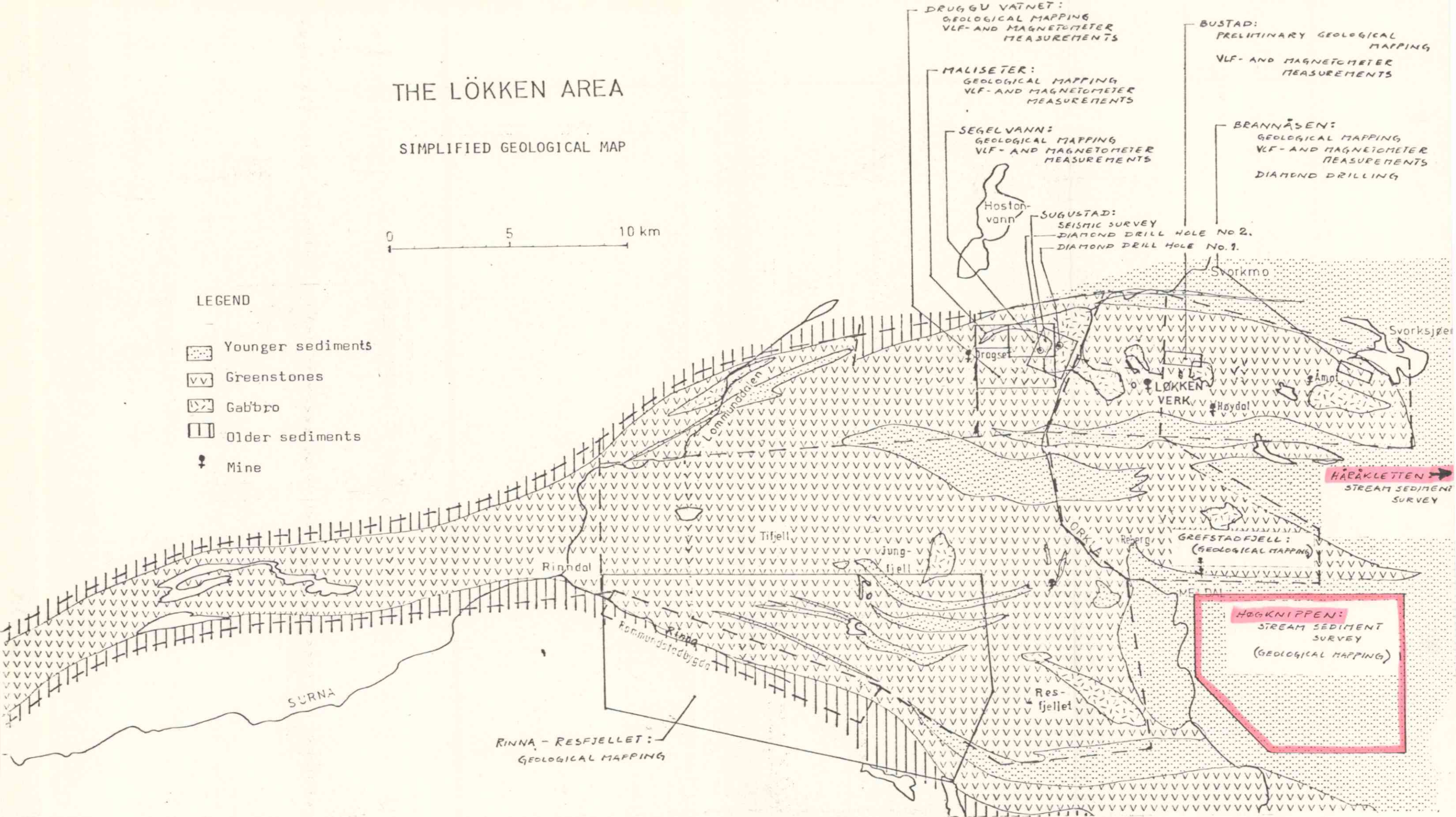
THE LÖKKEN AREA

SIMPLIFIED GEOLOGICAL MAP

0 5 10 km

LEGEND

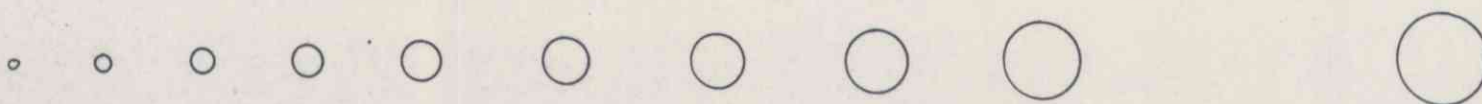
-  Younger sediments
-  Greenstones
-  Gabbro
-  Older sediments
-  Mine

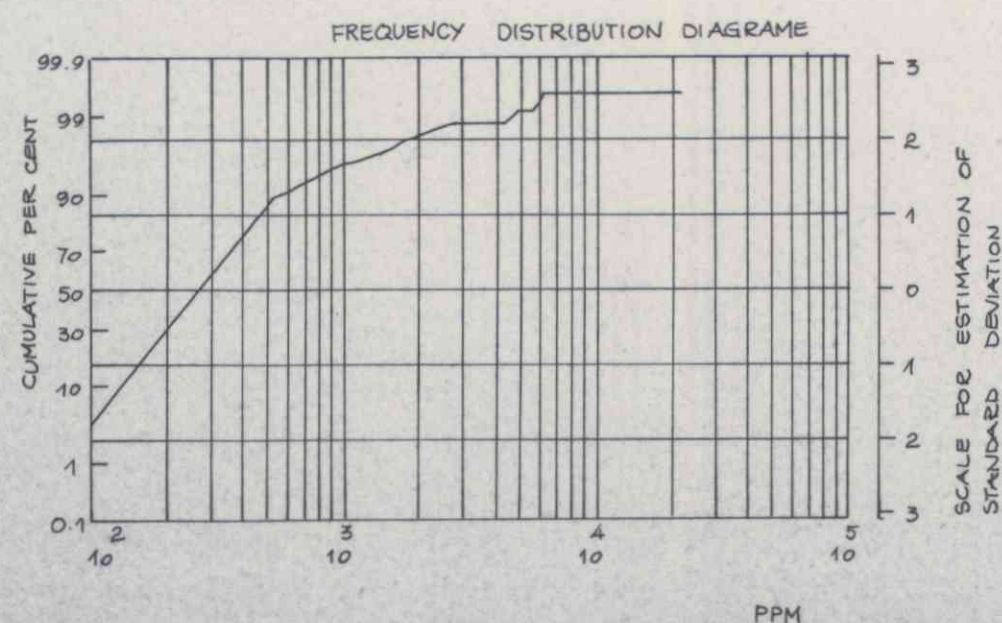




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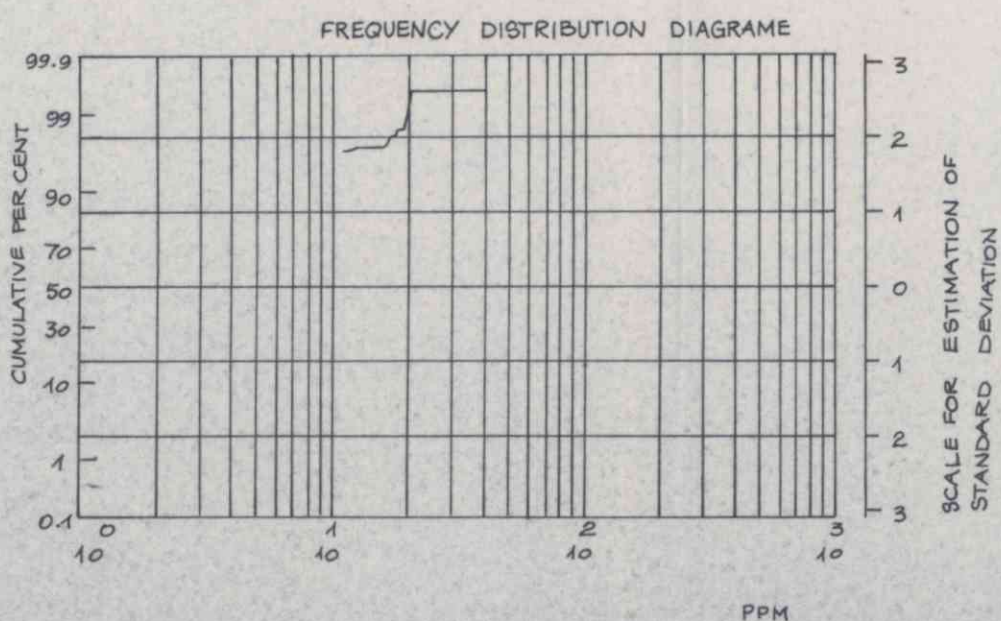


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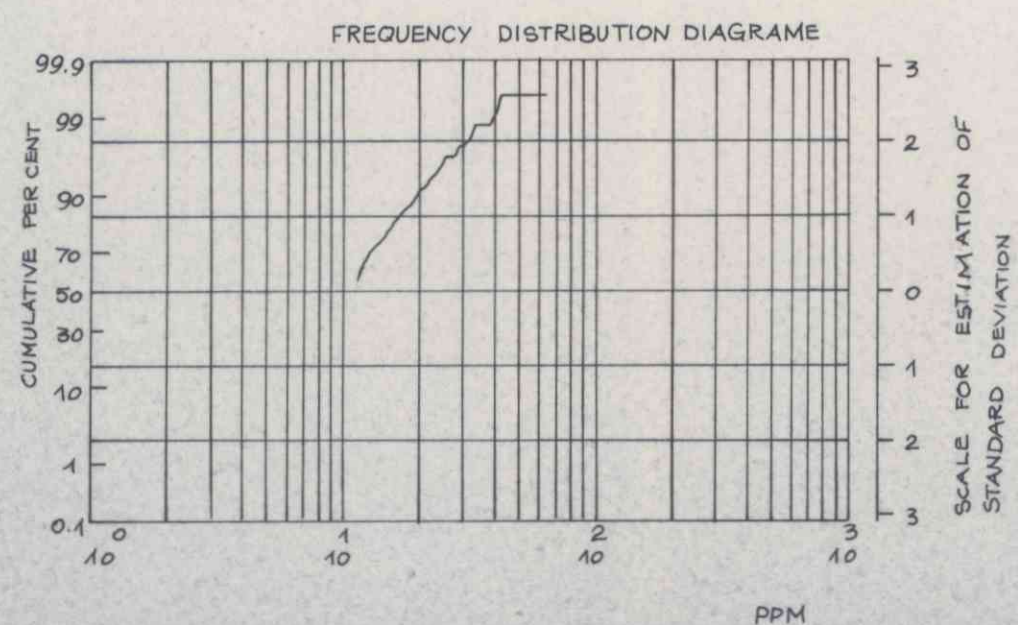
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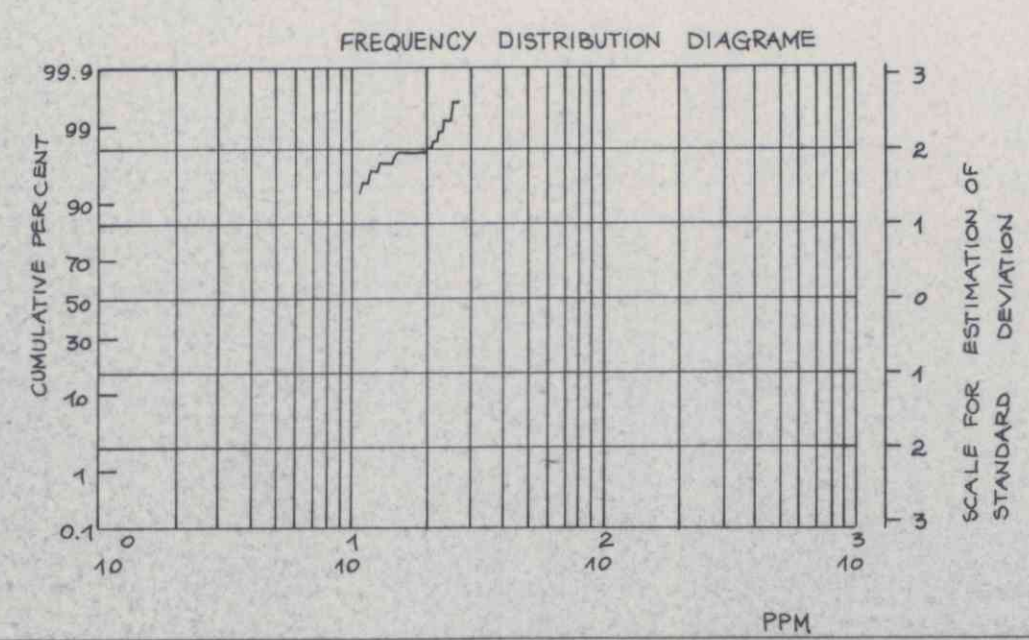


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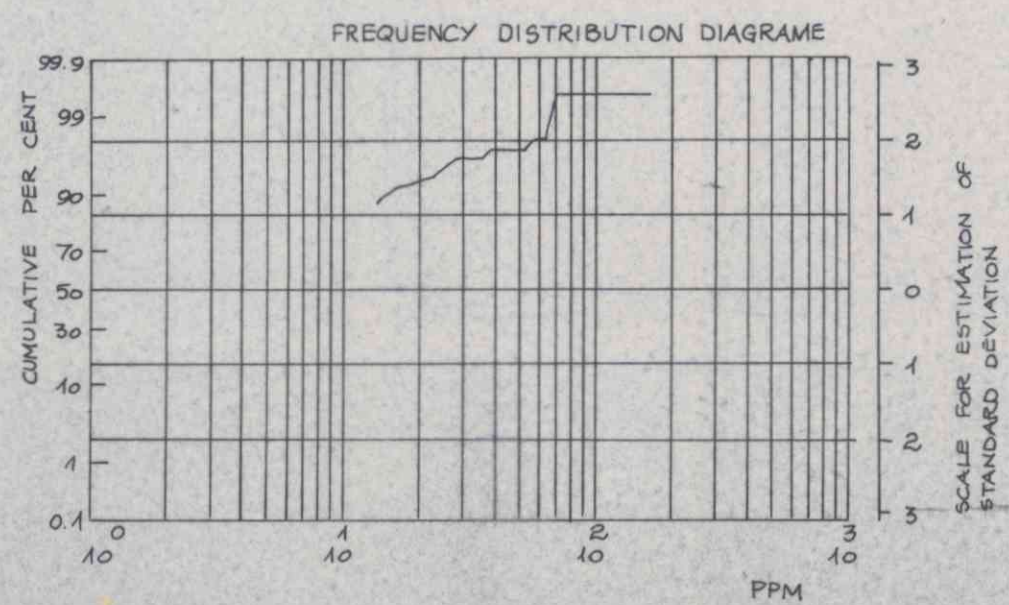
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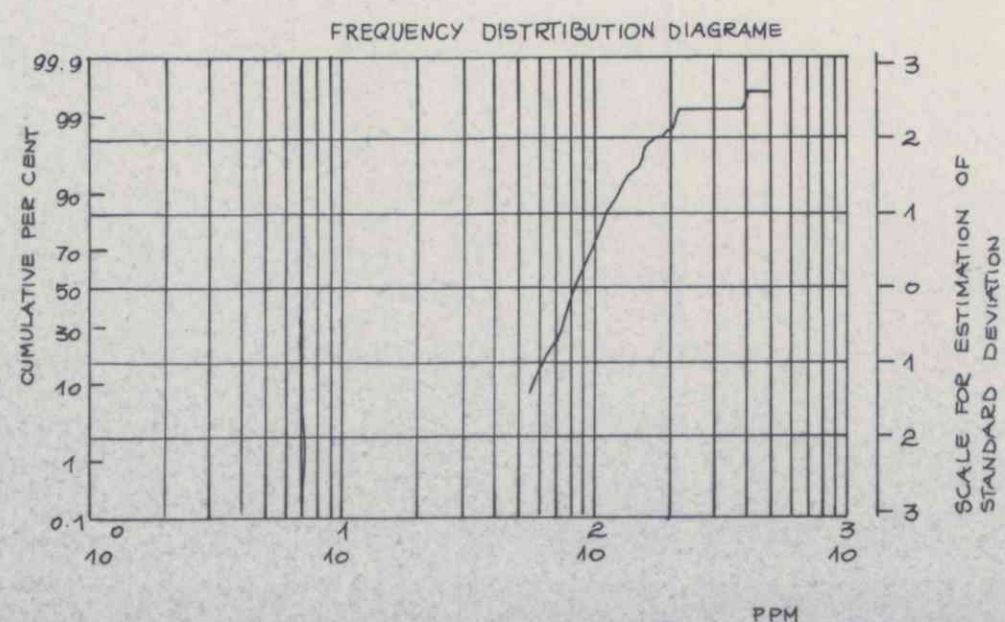


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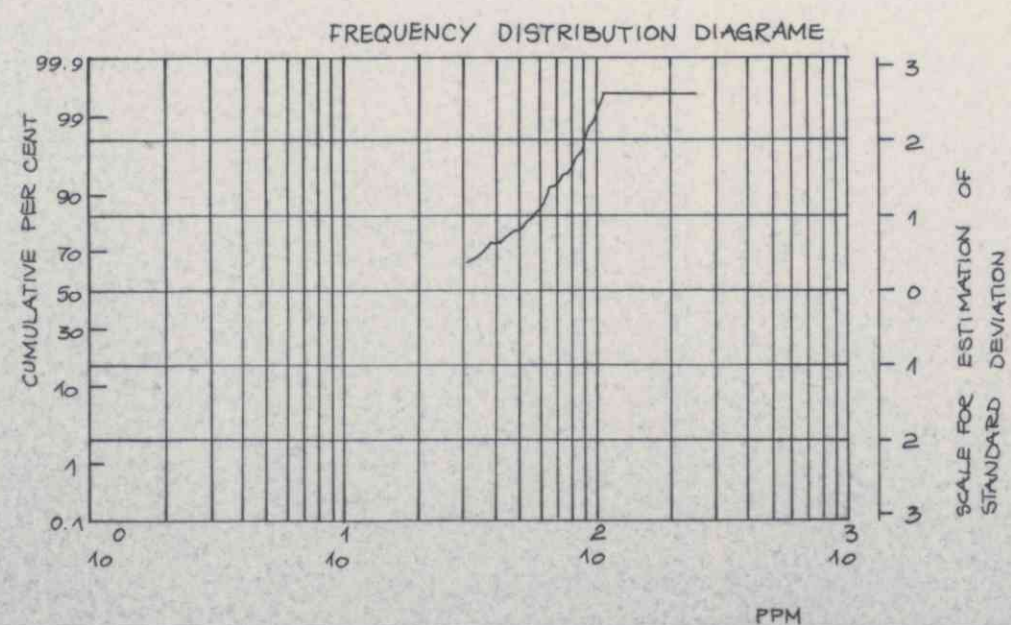


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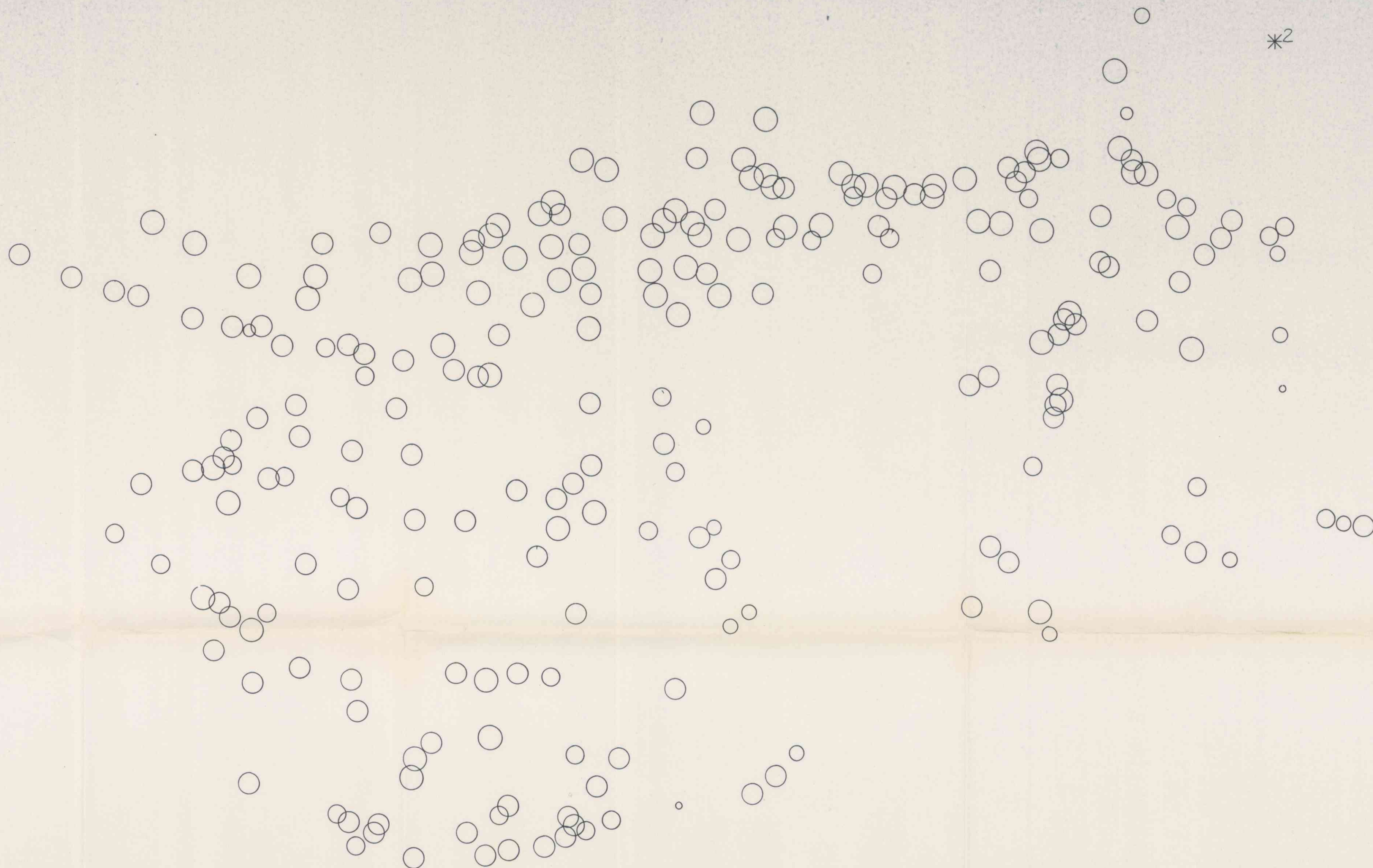


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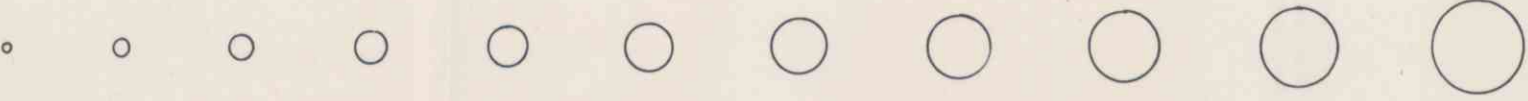


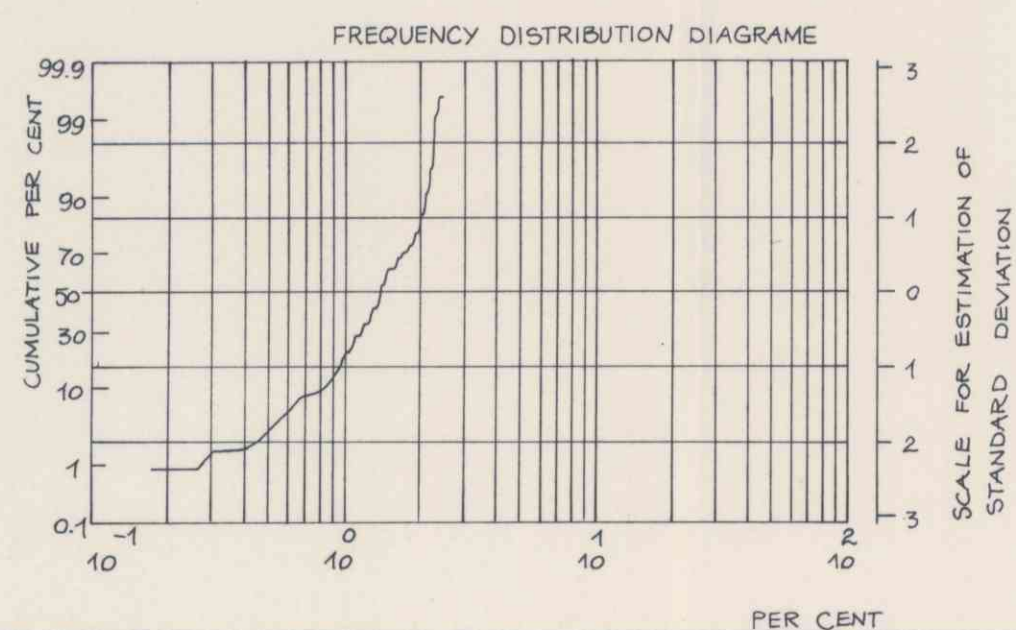
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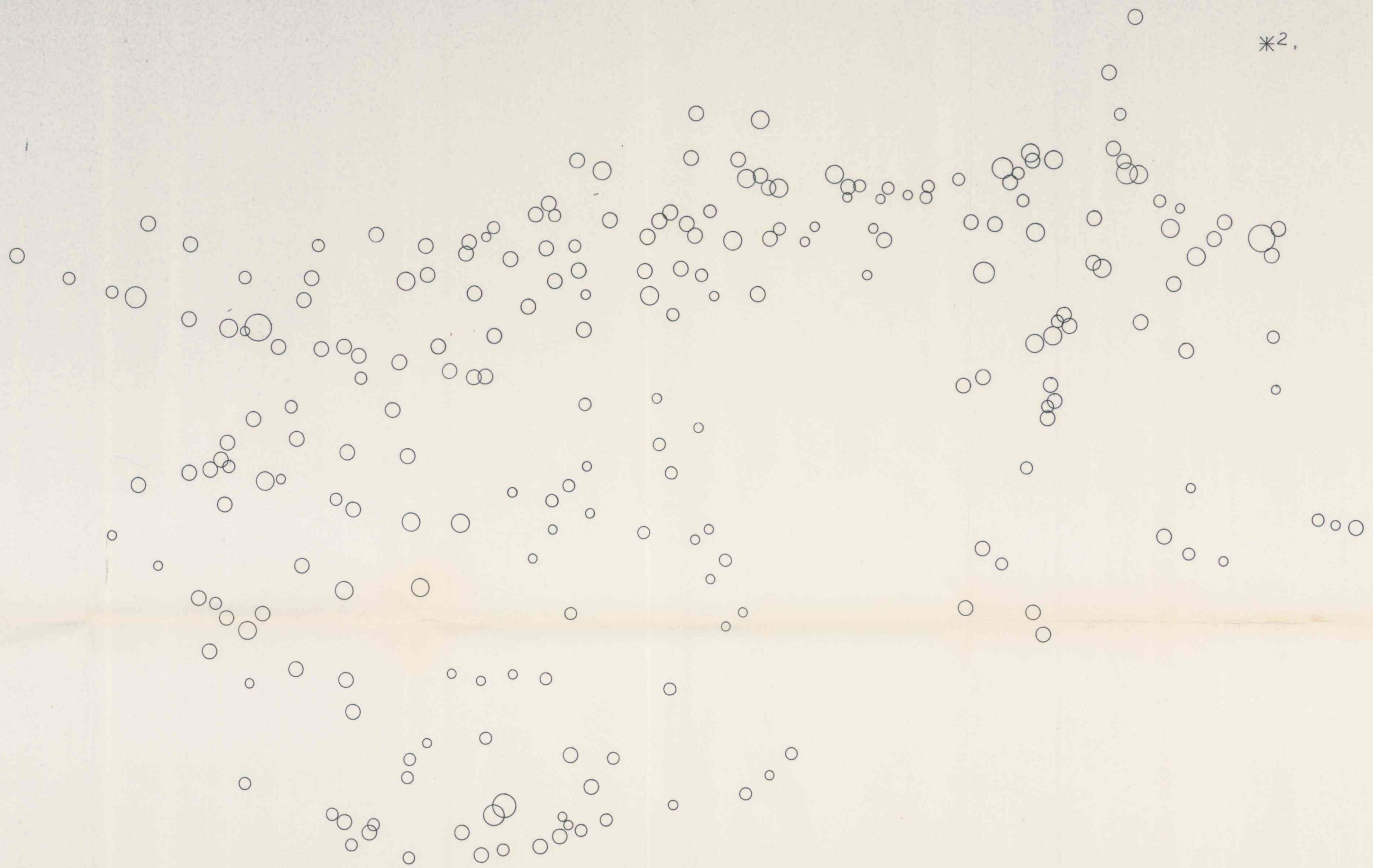
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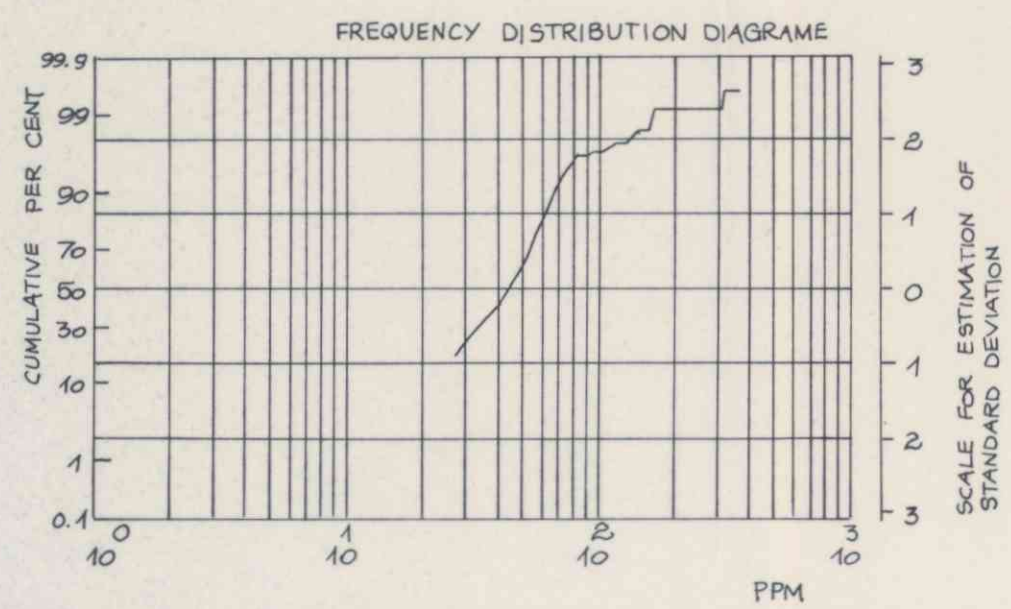
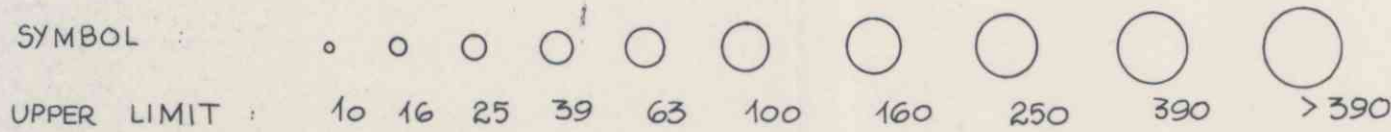


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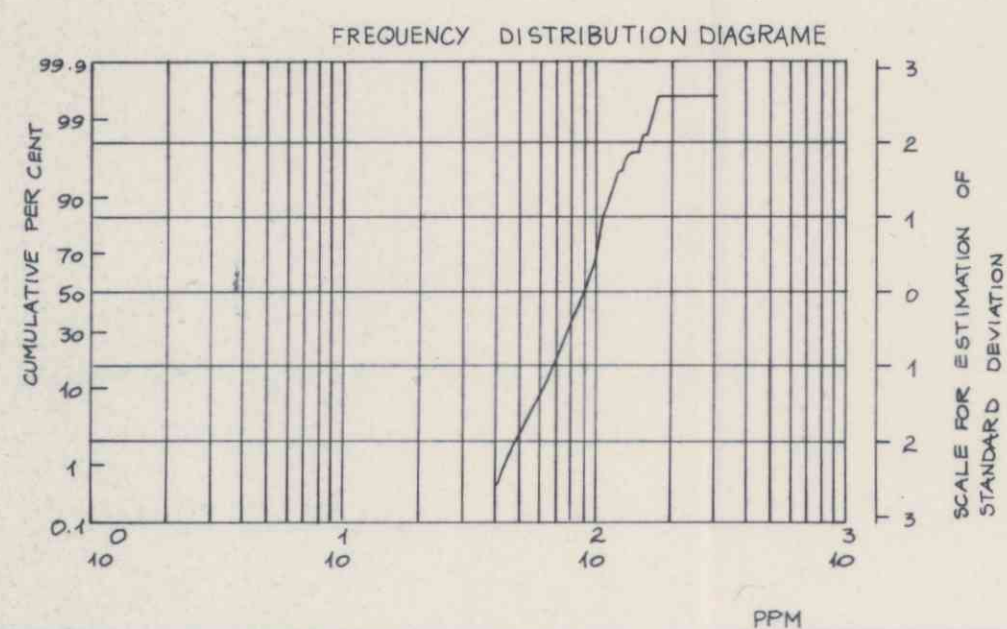
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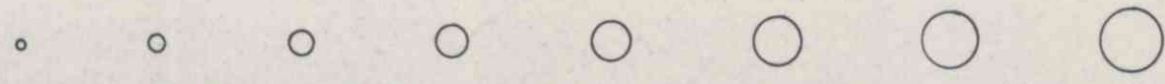
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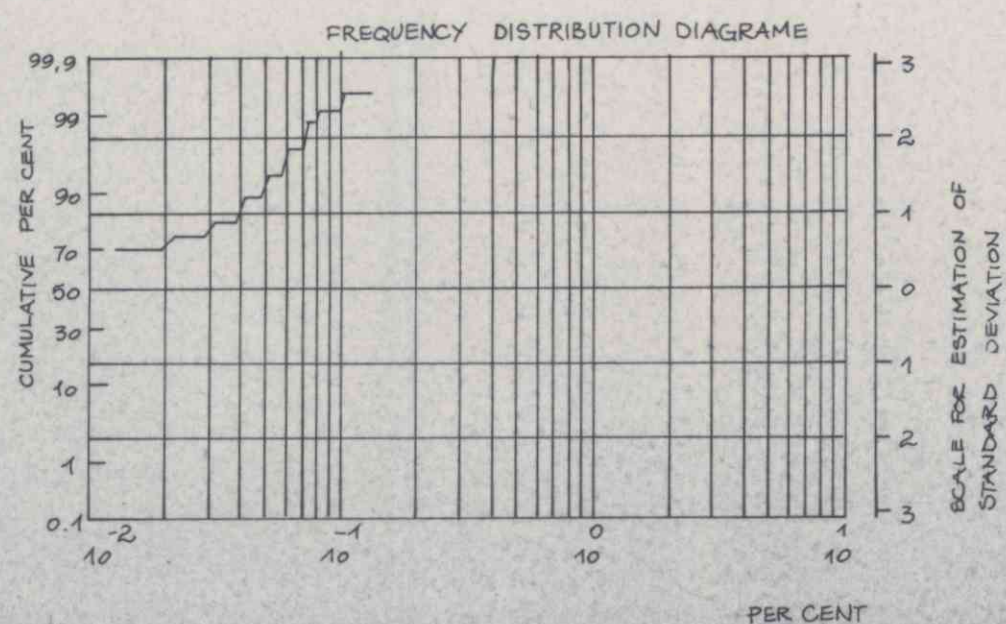


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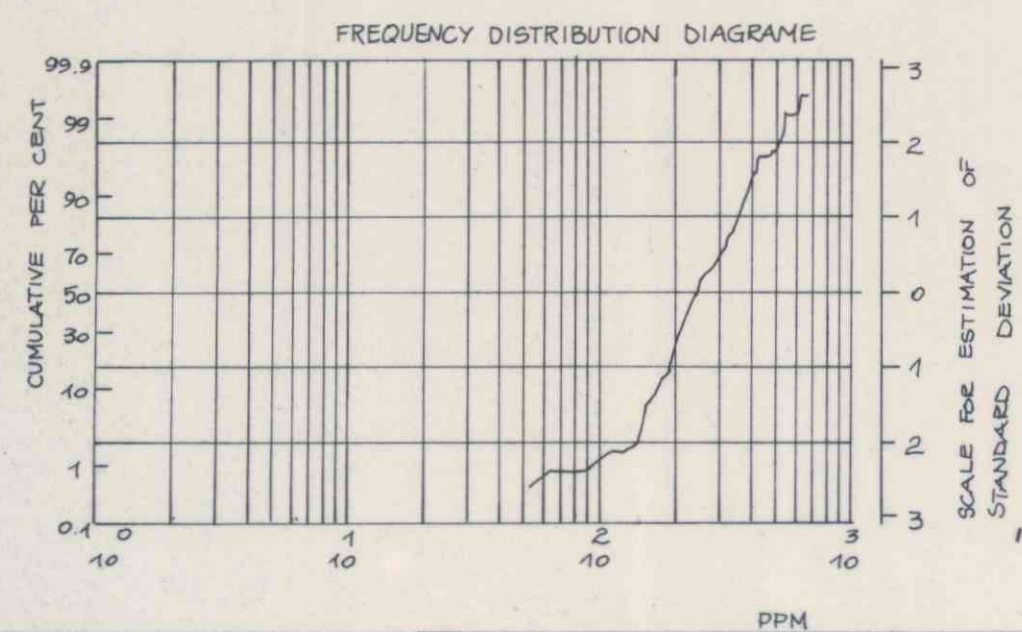
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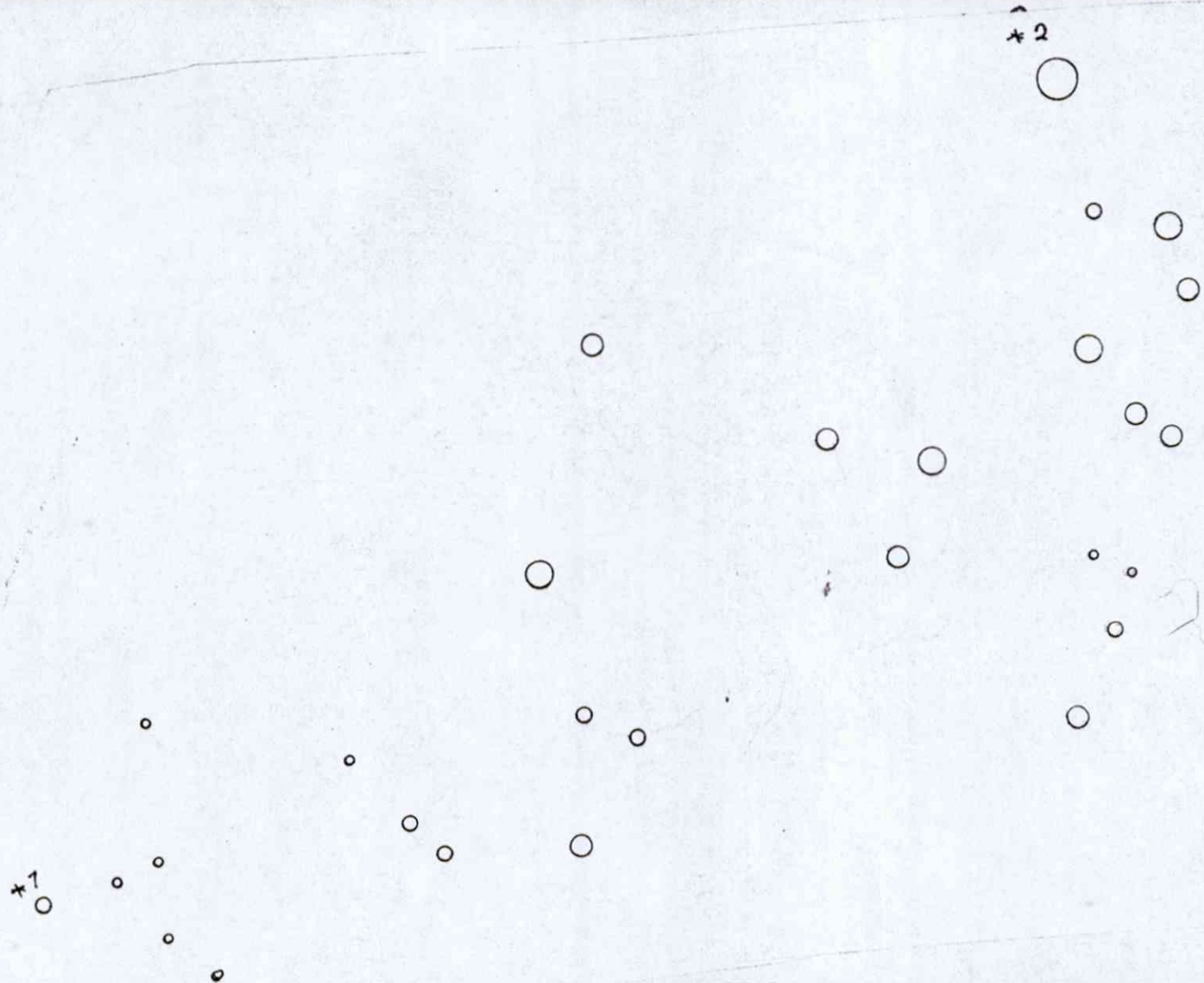
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GULF - ORKLA VENTURE
 7332 LØKKEN VERK
 V. HEAVY MINERAL SAMPLES
 HØGKNIPPEN AREA, SØR-TRØNDELAG

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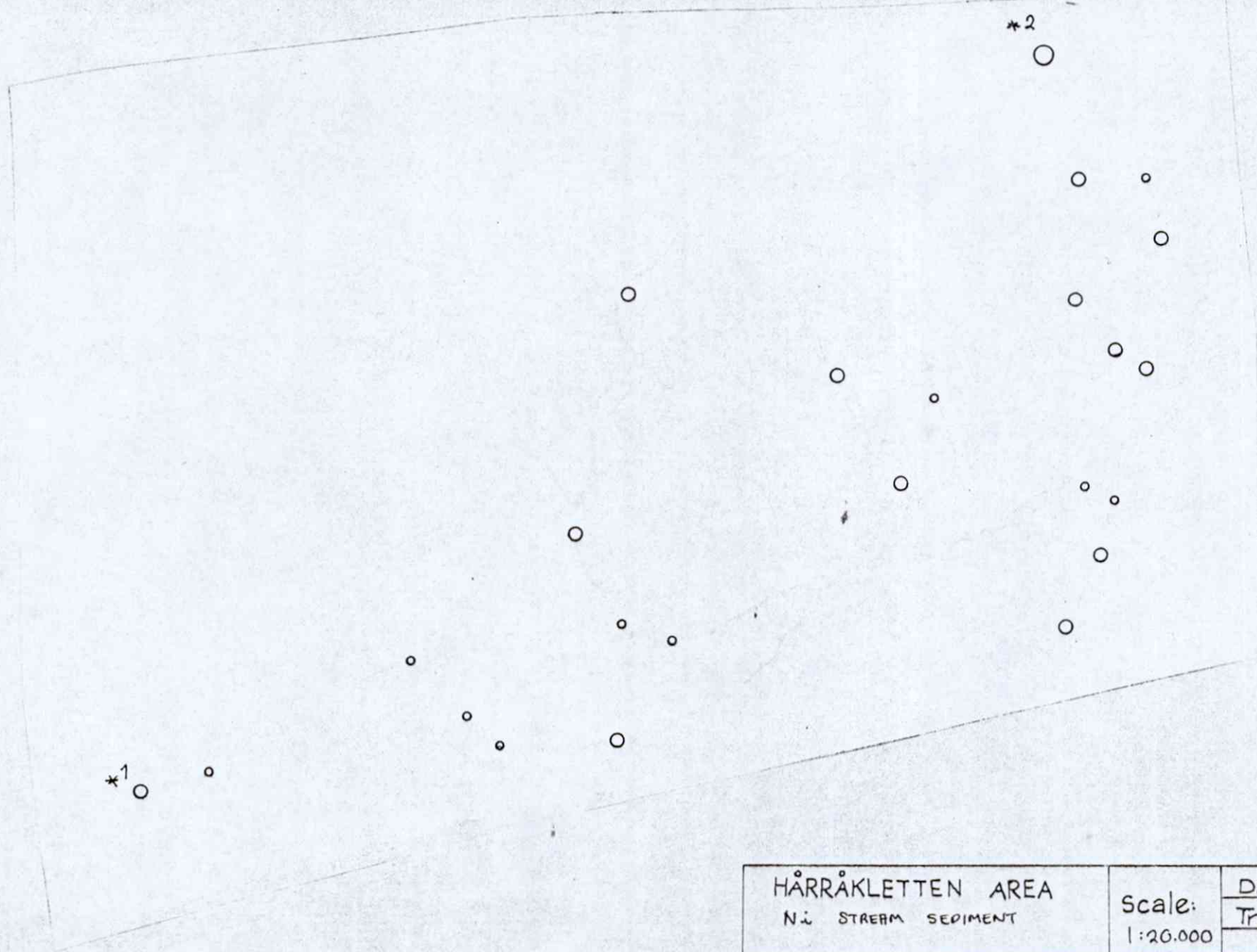
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Orkla Industrier A.s 7332 Løkken Verk Gulf-Orkla Venture	No:		
	DATE: 20.1.82		



HÅRRÅKLETTEN AREA Pls, STREAM SEDIMENT SAMPLE	Scale: 1:20.000	Draw:	KBC
		Trac:	KBC
Orkla Industrier A.s 7332 Løkken Verk Gulf-Orkla Venture	No:		
	DATE: 20.1.81		



HÅRRÅKLETTEN AREA
Ni STREAM SEDIMENT

Scale:
1:20.000

Draw:	KBC
Trac:	KBC
	KBC

Orkla Industrier A.s
7332 Løkken Verk
Gulf-Orkla Venture

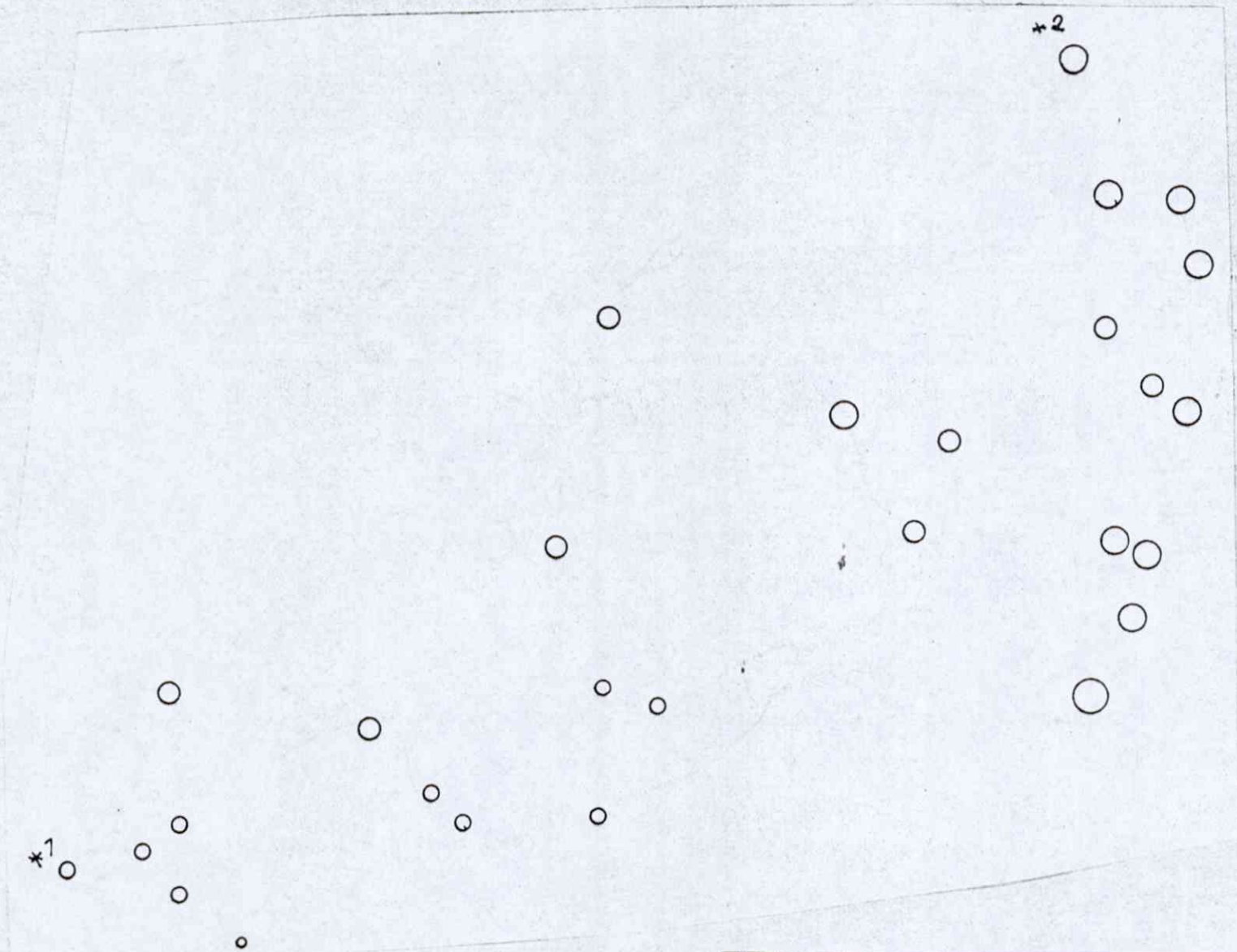
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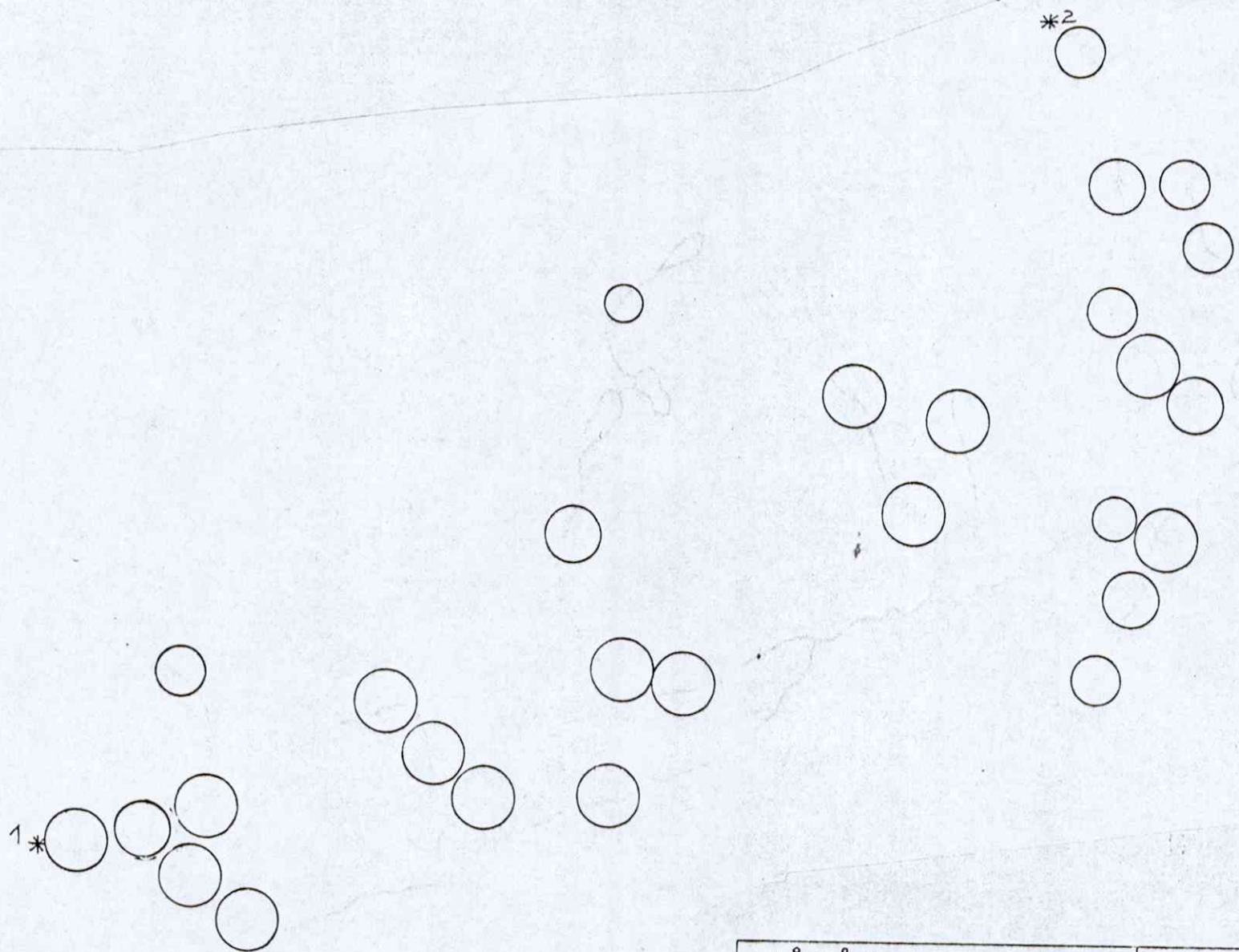
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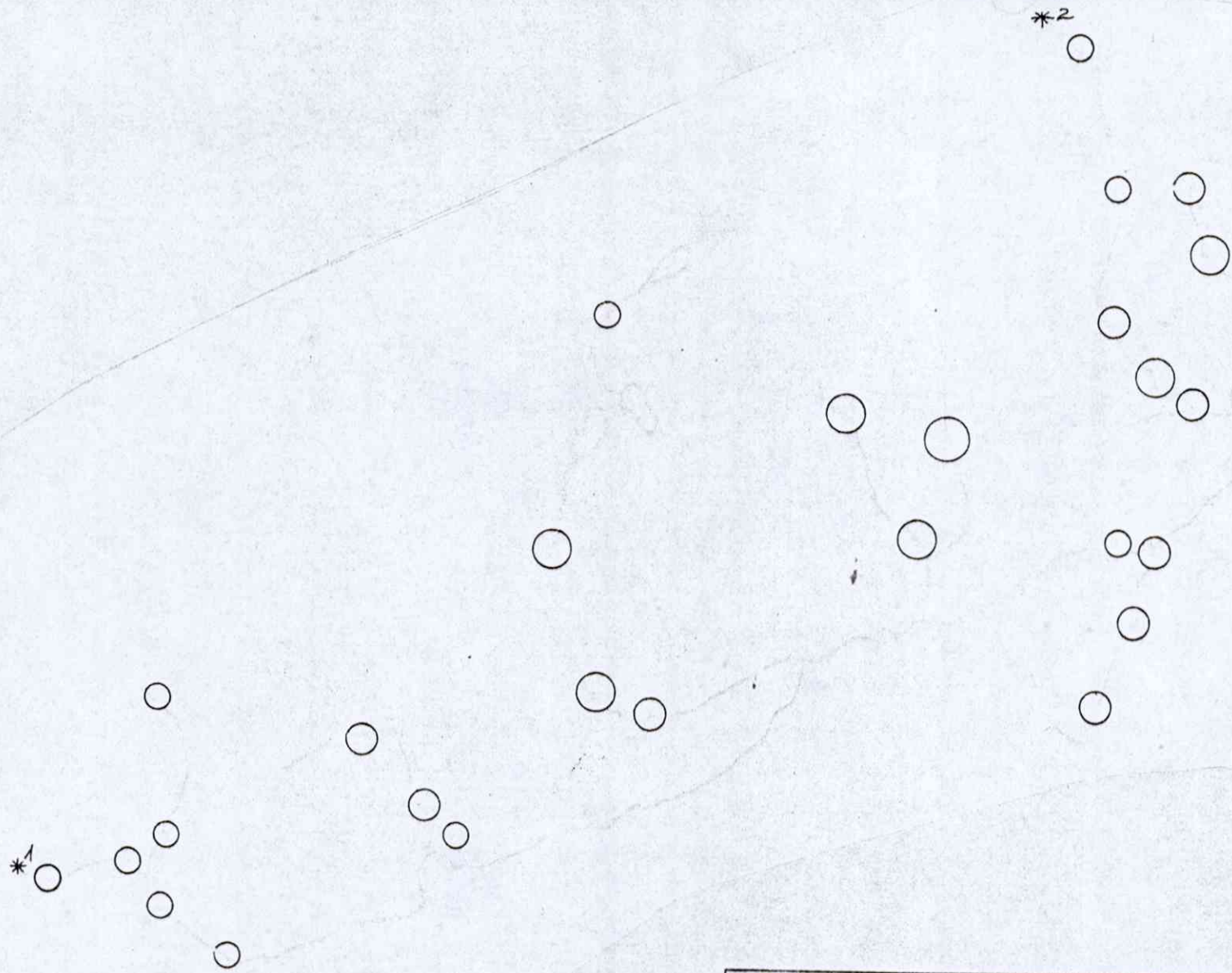
HÅRRÅKLETEN AREA Cu, STREAM SEDIMENT	Scale:	Draw:	KBC
	1:20.000	Trac:	KBC
Orkla Industrier A.s 7332 Løkken Verk Gulf-Orkla Venture			KBC
	No:		
	DATE: 20.1.82		



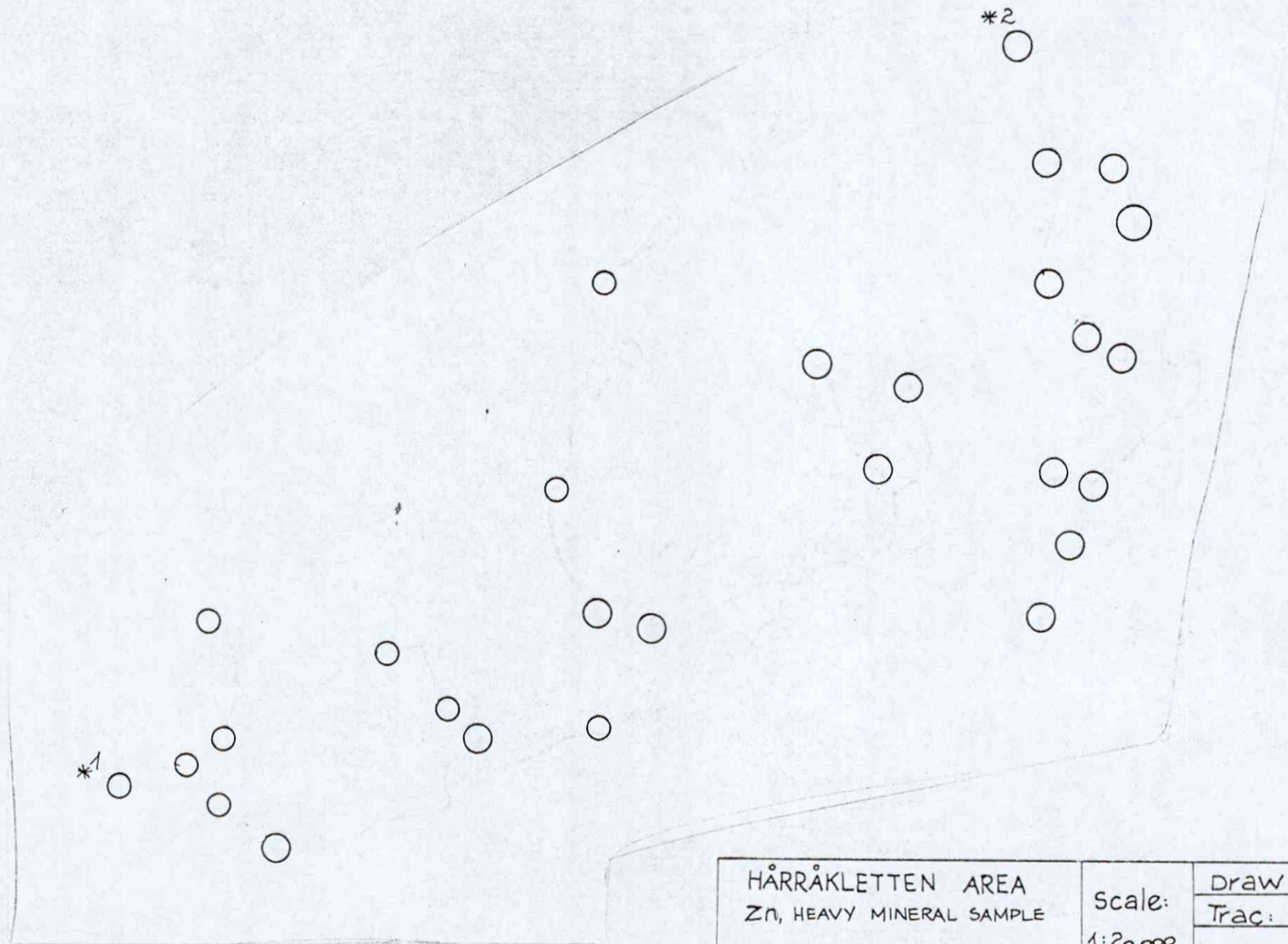
HÅRRÅKLETTEN AREA N.W. HERBY MINERAL SAMPLE	Scale: 1:20,000	Draw:	KBC
		Trac:	KBC
			KBC
Orkla Industrier A.s 7332 Løkken Verk Gulf-Orkla Venture	No:		
	DATE:	21.1.82	



HÅRRÅKLETTEN AREA Mn, HEAVY MINERAL SAMPLE	Scale: 1:20.000	Draw:	AM
		Trac:	AM
			KBC
Orkla Industrier A.s 7332 Løkken Verk Gulf-Orkla Venture	No:		
	DATE: 22.01.82		



HÅRRÅKLETTEN AREA CO, HEAVY MINERAL SAMPLE	Scale: 1:20.000	Draw:	AM
		Trac:	AM
			KBC
Orkla Industrier A.s 7332 Løkken Verk Gulf-Orkla Venture		No.:	
		DATE: 22.01.82	

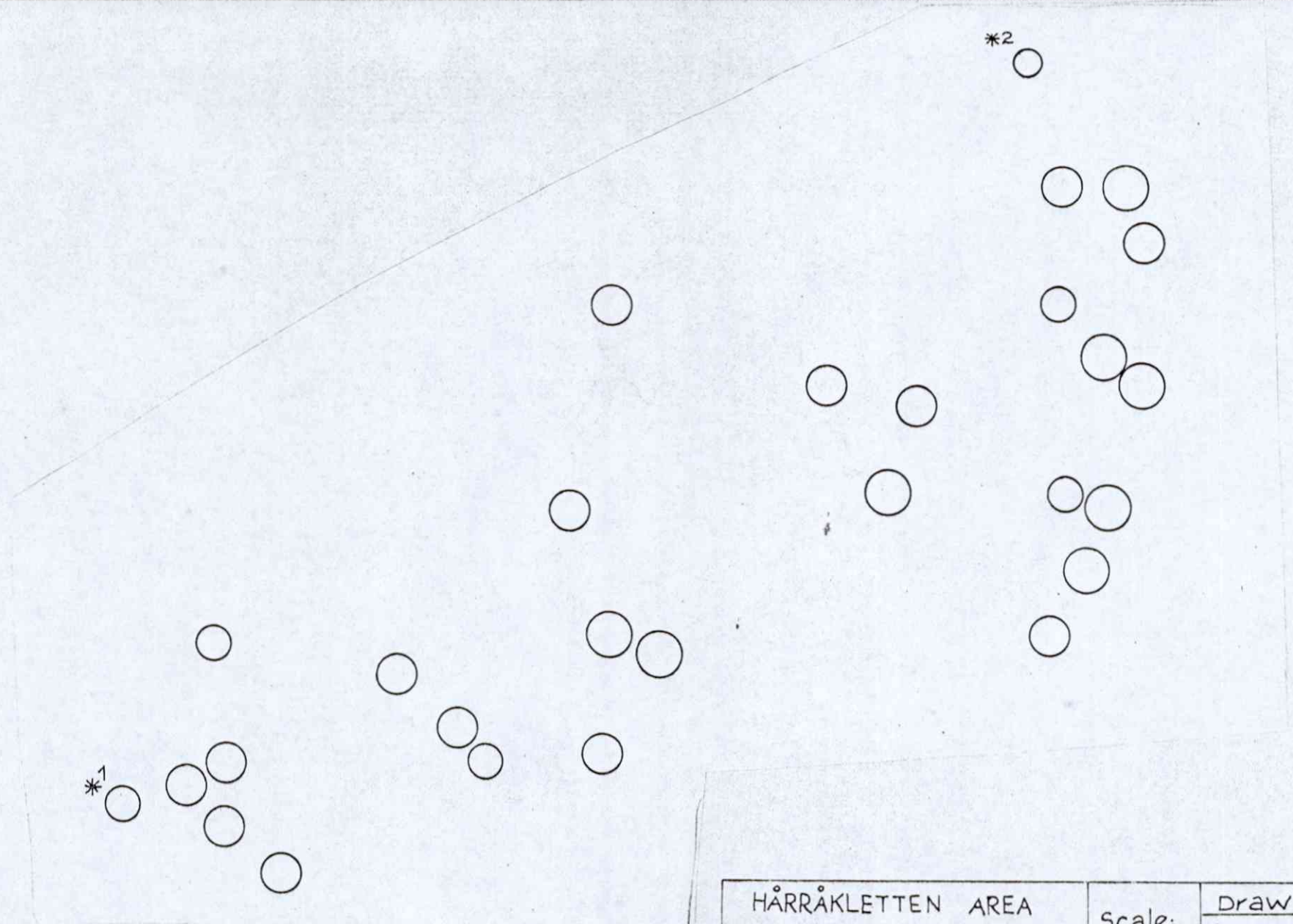


HÅRRÅKLETTEN AREA Zn, HEAVY MINERAL SAMPLE	Scale: 1:20.000	Draw:	AM
		Trac:	AM
			KBC
Orkla Industrier A.s 7332 Løkken Verk Gulf-Orkla Venners	No:		
		Date: 25. 12. 82	

*1

*2

HÅRRÅKLETEN AREA Ba, MERVY MINERAL SAMLE	Scale:	Draw:	KBC
	1:20,000	Trac:	KBC
			KBC
Orkla Industrier A.s 7332 Løkken Verk Gulf-Orkla Venture	No:		
	DATE: 20.1.82		



HÅRRÅKLETTEN AREA V, HEAVY MINERAL SAMPLE	Scale: 1:20.000	Draw:	AM
		Trac:	AM
			KBC
Orkla Industrier A.s 7332 Løkken Verk Gulf-Orkla Venture	No:		
	DATE: 22.1.82		