

OPPREDNINGSLABORATORIET

Rapportnummer:

26/86

RAPPORT

Tilgjengelighet:

Confidential

7034 TRONDHEIM - NTH

Tlf.: (07) 59 49 10

Folldal Verk

2661 HJERKINN

RAPPORTENS TITTEL Preliminary beneficiation study of Biggejavre davidite ore.	Dato Oct. 9, 1986
	Ant. sider og bilag 8 + 10
Saksbehandler/forf. L. Özmerih	Ansv. sign. <i>Dr. Digne</i>
	Prosjektnr. 07/86
Oppdragsgiver Folldal Verk v/J.G. Heim og I. Killi	Oppdr. givers ref.

Ekstrakt:

A sample of the ore, a davidite-containing albite fels, has been tested in our laboratory. A mineralogical study by dr. T. Malvik revealed that a major part of the davidite was finely disseminated in the gangue minerals. A grind fineness of 80% minus about 90 micrometers was found necessary for reasonable liberation of the davidite. By wet high-intensity magnetic separation (HIWMS) we obtained a primary concentrate with 500-600 ppm Scandium from an ore feed with 130 ppm Sc. The Sc recovery then ranged from 75 to 70%. By separating a magnet concentrate in heavy liquids it could be upgraded to 1100-1200 ppm Sc, but at a loss of about half of the Scandium content.

3 stikkord:

Davidite ore

Beneficiation study

Scandium recovery

OPPREDNINGSLABORATORIET - NTH

PRELIMINARY BENEFICIATION STUDY OF
BIGGEJAVRI DAVIDITE ORE

TRONDHEIM , OCTOBER 1986

CONTENTS

Page No:

1. SUMMARY

2. SAMPLE MATERIAL

1

3. SAMPLE PREPARATION

2

4. BENEFICIATION STUDIES

3

5. CONCLUSIONS

8

APPENDICES

1 . SUMMARY

This study covers the tests and evaluation on the sample material from Biggejavri Deposit, which was sent to us in April 1986 for investigating the possibility of upgrading the scandium content.

The mineralogical examination on this ore indicated that the main scandium source davidite was very fine sized and scattered among the host rock albite. Preliminary tests with heavy liquid separation and high-intensity wet magnetic separation with an ore sample ground to 80% minus 350 micrometer confirmed the mineralogical observations.

Based on these facts a much finer grind was found essential if a reasonable enrichment with a high recovery is aimed. Accordingly, for the further tests we used a grind fineness of 80% minus 90 micrometers.

High intensity wet magnetic separation gave satisfactory selective separation results, yielding concentrates of about 500-600 ppm scandium at 75 to 70 % recovery.

If higher scandium grades are required, then a combination of high intensity wet magnetic and gravity separation is a possibility.

By these applications it was possible to upgrade primary scandium concentrates of about 325 ppm Sc grade with 85% recovery to about 1200 ppm Sc with 40% recovery, from a raw material of 130 ppm Sc content on average.

2 . SAMPLE MATERIAL

Approximately 150 kg of sample material from the Biggejavri Deposit was sent to our laboratories for investigating the possibility of upgrading the scandium content which was mainly bound in the davidite mineral. Our semiquantitative XRF assay gave about 130 ppm Sc, 3200 ppm U and 430 ppm Y .

The sample was in the form of rock pieces, mostly being in the size range of 150 to 250 mm.

A former mineralogical study (S.Olerud, NGU Rap.nr.: 85.159) on various samples from the same deposit indicates that this material is composed of mainly albite (>90%), davidite, limestone, muscovite, chromite, rutile and minor amounts of some other accessory minerals.

The high content of scandium (average value for three samples which were analysed by XRF are given as 122 ppm) was mainly found to be due to davidite content as well as to brannerite, rutile and thortveitite inclusions in minor amounts. In this former mineralogical study, the crystal sizes of davidite are reported to be rather coarse, going up to 3 mm .

In a later study report (Dr.T.Malvik, SINTEF Rap.nr.: STF 36 F86041) the davidite particle sizes were observed to be very fine and always associated with rutile and/or other unidentified phases. According to this study, which was carried out on the sample material used in our investigation, a very fine grinding will be necessary if a high value of liberation is required. As an example, if 80% of davidite minerals are wanted as free particles, then the material should be ground down to less than 35-40 micron size (400 mesh).

3 . SAMPLE PREPARATION

A representative part of the sample material was crushed and prepared for the beneficiation study in the following order ;

Approximately 40 kg of the sample was selected from the sample lots and primarily crushed through a jaw crusher down to a maximum size of about 80 mm. The hand samples for the later mineralogical study were taken out from this coarse crushed lot. Following an intermediate crushing through a smaller jaw crusher down to -25 mm, the sample material was finally reduced down to -5 mm through a gyratory crusher, in closed circuit with a screen.

This fine crushed material was blended a few times and split into smaller representative amounts for the further grinding and upgrading studies.

Based on the findings of the previous mineralogical study from NGU, the ore was initially ground coarse to approximately minus 1.2 mm.

This material was used for the preliminary testing and for the later mineralogical study which was carried out on various size fractions.

4 . BENEFICIATION STUDIES

The preliminary study covers series of gravity separation and high intensity magnetic separation tests which were done on the various size fractions of the coarse grind material. The particle size distribution of this grind and its curve are given in Appendices 1 and 1A.

In order to observe the distribution of scandium content in size fractions, the ground ore was classified in four fractions and analysed through a semi quantitative XRF analyser. The results indicated that, all the size fractions other than the finest one (-200 mesh) contained the same amount of scandium, while there was a slight enrichment in the finest fraction. The weight and scandium distributions of the size fractions and their XRF peak recordings are given in Appendices 2 and 2A.

Throughout the whole study, scandium contents of the products were analysed with the same XRF analyser where the reference base material has been 'BCR-1' having a scandium content of 33 ppm.

Aiming to observe the suitability of gravity separation for this material, the same size fractions of the coarse grind were then treated with a heavy liquid which had a specific weight of 2.85 g/cc. As the main component of this ore was albite (>90%), a gravity separation at this value should eliminate most of the scandium-sterile material in case of a reasonable particle size liberation. But, the analyses and the microscopic observations on the products of this separation showed that most of the heavy minerals which were bearing the scandium content were displaced in the light fractions, due to a poor particle size liberation. The scandium distributions of these products and their XRF peak recordings are given in Appendices 3 and 3A.

In order to determine an optimum liberation size for this ore, the material was screened through various top sizes and then treated through a high intensity magnetic separator which provided a rather sharp separation between the scandium bearing magnetic fractions and the non-magnetic albite components. For this purpose, the coarse grind material was screened as to give the top sizes of 65 mesh (208 micron), 100 mesh (147 micron), 150 mesh (104 micron) and 200 mesh (74 micron). For the magnet separation we used a Carpco MWL-43 model High Intensity Wet Magnetic Separator (HIWMS) with a matrix of 6.2 mm diameter steel balls. This separator was operated in a batch mode. In the tests we regulated the magnetizing current between 5 and 1.6 amps, giving nominal magnetic field strengths from 20000 down to 7000 gauss.

The XRF analyses on the products of these tests indicated that the ore should be ground to at least -100 mesh (-147 micron) if a reasonable particle size liberation is required. The results of these tests are given in Appendix 4.

Together with this conclusion and the findings from the latter mineralogical report, the rest of the investigation was carried out on more finely ground material. The particle size distribution of this grind and its curve are given in Appendices 5 and 5A.

These preliminary tests provided the following information ;

- Grinding should be done to at least -100 mesh ,

- High intensity wet magnetic separation as an initial step will provide a satisfactory enrichment for scandium where a high degree of recovery will be achieved,

- Gravity separation of the magnetic concentrate can give some upgrading, but at the expense of large scandium losses in the finest sizes.

Based on these conclusions, a detailed study on two different flowsheets for high intensity wet magnetic separation and their combinations with heavy liquid separation was carried out with the finer grind sample material.

Both of the magnetic flowsheets started with a rougher and scavenger step. The grind product was fed directly into the Carpc separator through a high intensity field of about 20.000 Gauss (at 5 Ampere setting).

Non-magnetic product from this step was then re-treated through the same field and the magnetic product from that was combined with the magnetic product of the first step, giving a primary concentrate with scandium recovery of about 84% and grade of 320 ppm.

The final non-magnetic product contained about 9% of the total scandium with a grade of 28 ppm.

About 11.5 % of the total feed was collected as slime after separation, which was separated from the tailing slurry. This fine material is practically less than 30 microns size and contains about 6-7 % of the total scandium with a grade of 84 ppm. The particle size distribution of this slime material, which was recorded by a Micromeritics SediGraph is given in Appendix 6.

In the following parts of the flowsheets, the primary magnet concentrate from the first step was treated 3 times each through the Carpc Separator in two different ways ;

In one flowsheet with 3 cleaning steps the field intensity was kept at about maximum (at 5 Ampere setting , 20.000 Gauss), and the primary concentrate was fed through 3 times, where the non-magnetic product from each step was collected separately. The magnetic product from the last step was the final magnetic concentrate.

The flowsheet and the product distribution of this application are given in Appendices 7 and 7A.

In the other flowsheet, the primary magnet concentrate from the rougher and scavenger steps was upgraded by successively applying stronger magnetic fields, taking out 3 separate magnetic products. The final non-magnetics 3. from the last re-separation had quite low scandium content.

The field intensity was varied in the ascending order starting from 7.000 Gauss (1.6 Ampere setting) and increasing this to 14.000 and 20.000 Gauss (3.2 and 5 Amp.) for the 2. and 3. passes. The flowsheet and the product distribution of this application are given in appendices 8 and 8A.

In the final part of this investigation, a combination of magnetic and gravity separation was applied for further upgrading the scandium content. The primary magnetic concentrate from the rougher and scavenger step was treated with heavy liquids having the specific weights of 2.85 and 3.3 g/cc.

This application provided a high grade concentrate of 1200 ppm scandium but with a total recovery of about 40% .

The flowsheet and the product distribution of these tests are given in Appendices 9 and 9A.

When all of these results from the above described magnetic and gravity separation tests are evaluated and correlated together as to give a grade-recovery relation, as in Appendix 10, it can be seen that for a high recovery above 80 % a grade of less than 400 ppm should be expected.

Grinding the material to a finer size distribution may increase the liberation degree but in this case the loss of fine material as slime will also increase. Another negative aspect of this will be the difficulty of treating fine material through the proposed magnetic and gravity separation steps.

In addition to the Sc analyses of various products, some of the magnetic concentrates were also analysed for determining their (U) and (Y) contents, which were reported to be high in the mineralogical report of NGU.

For this purpose, the successive magnetic concentrates 1. , 2. and 3. of Flowsheet 2. (Appendix 8) and the original sample material were analysed semi-quantitatively through the XRF analyser.

The results of these are as follows ;

Product	Weight%	Scandium		Uranium		Yttrium	
		ppm	Dist%	ppm	Dist%	ppm	Dist%
Feed	100.0	145	100.0	3160	100.0	435	100.0
Magnetics 1.	9.9	430	28.7	6200	19.4	915	20.8
Magnetics 2.	9.8	635	41.8	6260	19.4	915	20.8
Magnetics 3.	4.7	278	8.8	4140	6.2	545	5.9
Tailings (Calculated)	75.6	32	20.7	2300	55.0	303	52.7
Magnetics (1.+ 2.)	19.7	530	70.5	6230	38.8	915	41.6
Magnetics (1.+ 2.+ 3.)	24.4	485	79.3	5830	46.0	845	47.5

The relative occurrences of U , Y and Sc in the magnetics are roughly similar to the microprobe analysis of a davidite grain in the NGU report which came out with about 22000 ppm U, 4000 ppm Y and 3000 ppm Sc. It seems that about half of the U and Y contents are in minerals more weakly magnetic than the davidite.

5 . CONCLUSIONS

- Regarding the sample material which was sent to us for this investigation, the primary grind should be done to at least minus 100 mesh (147 micron) top size if an enrichment factor of about 3 (to about 400 ppm Sc) is aimed at a recovery of above 80 % .

At this grind, the amount of -200 mesh (-74 micron) material will be around 80 % by weight.

Grinding to a finer size distribution will increase the degree of liberation but then the loss of fine material as slime will also increase. This will create difficulties in processing the fine material through the proposed beneficiation steps.

- High intensity wet magnetic separation as the initial step provided a satisfactory enrichment for scandium where also a high degree of recovery was achieved.

- A combination of high intensity magnetic treatment with a gravity separation can give an upgrading beyond 500 - 600 ppm but at the expense of high slime losses.

- With these above mentioned applications, it was possible to upgrade scandium concentrates of about 325 ppm Sc grade with a recovery of 85 % to about 1200 ppm Sc with a recovery of 40% , from a raw material containing 130 ppm Sc on average.

Biggejavri - Davidite Ore
Coarse Grinding - Particle Size Distribution

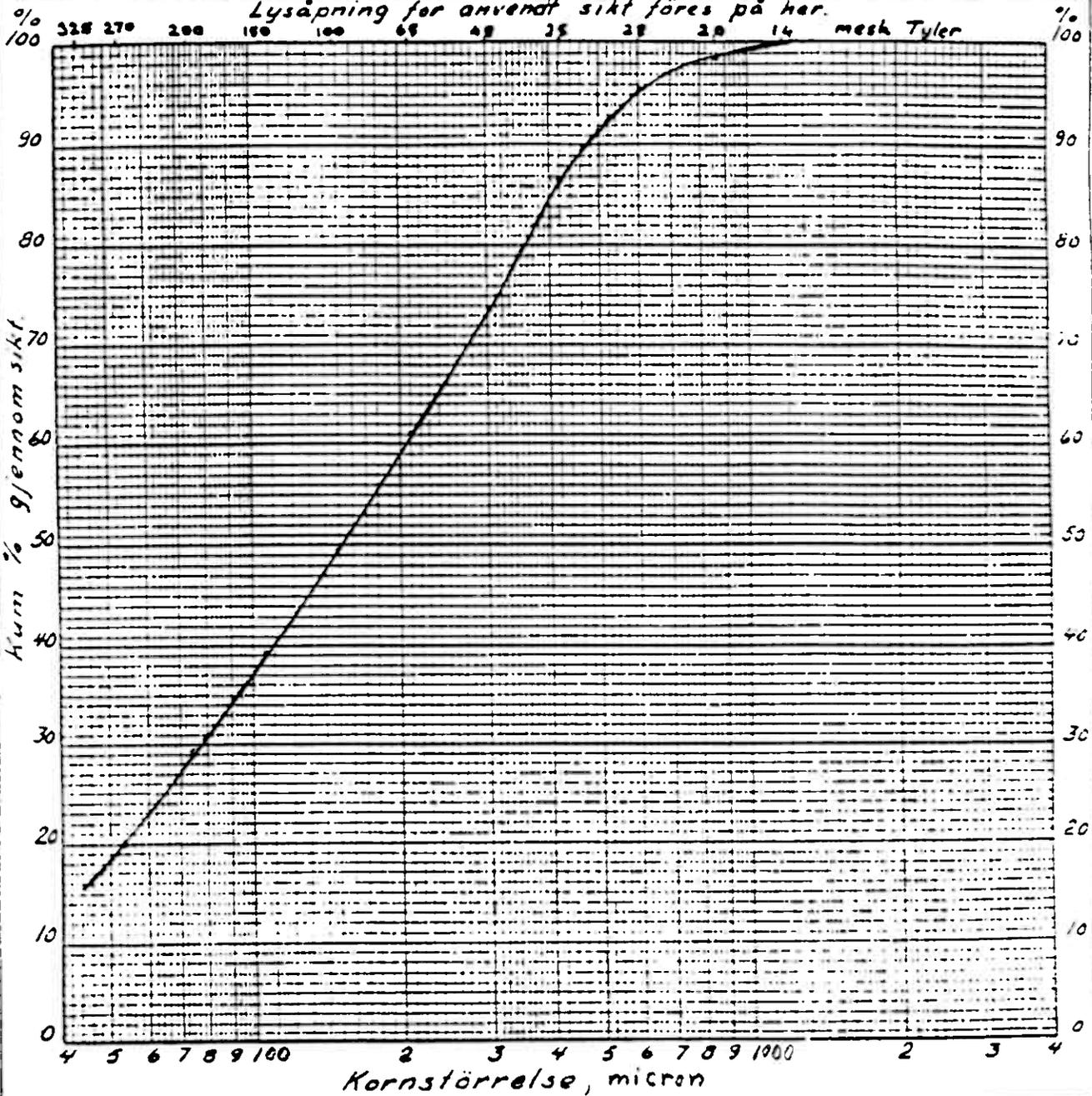
Size fraction (in meshes) -----	Weight % -----	Cumulative passing through (weight %) -----
- + 20	1.45	98.55
- 20 + 28	3.07	95.48
- 28 + 35	8.71	86.77
- 35 + 48	13.45	73.32
- 48 + 65	12.26	61.06
- 65 + 100	11.61	49.45
- 100 + 150	10.22	39.23
- 150 + 200	9.58	29.65
- 200 + 270	9.81	19.84
- 270 + 325	3.97	15.87
- 325	15.87	

	100.00	

Sikteprøve av: Bicarbonate, v.e.i. DAVIDIST. ORE

Utført 30/4 - 1986. Signatur: _____

Lysåpning for anvendt sikt føres på her.



Fraksjon		g	wt %
-	+		
	4	1.76	
	5	2.69	
	6	6.23	
	7	10.16	
	8	16.32	
	9	21.34	
	10	32.27	
	15	44.61	
	20	47.75	
	25	50.76	
	30	53.55	
Differens:			
Total:		100.0	

Biggejavri - Davidite Ore
Scandium Contents Of The Size Fractions

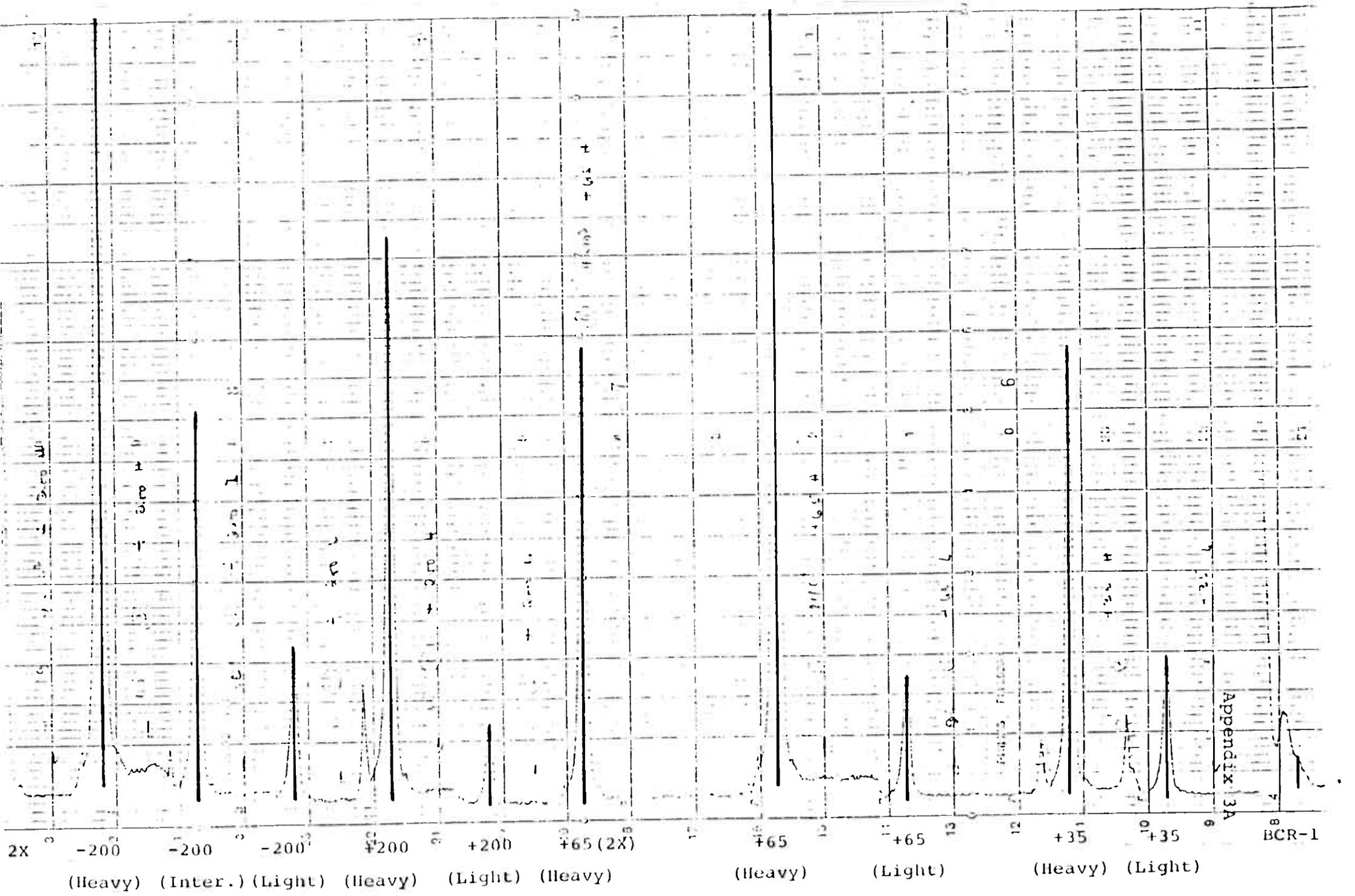
Size fraction (in meshes)	Weight %	Scandium ppm	Scandium Dist. %
+ 35	13.23	120	12.04
- 35 + 65	25.71	120	23.40
- 65 + 200	31.41	120	28.58
- 200	29.65	160	35.98
Total feed	100.00	132	100.00

Biggejavri - Davidite Ore

Scandium Distribution In The Products Of Heavy-Liquid Separation

Specific weight of the heavy liquid : 2.85 g/cc

Product	Wt. % of the feed	Wt. % of fraction	Scandium ppm	Sc Distribution % in the feed
<u>+35 mesh</u>				
Light pr.	11.95	98.71	114	10.41
Heavy pr.	0.16	1.29	365	0.44
	12.11	100.00	117	10.85
<u>-35 +65 mesh</u>				
Light pr.	23.95	96.64	100	18.30
Heavy pr.	0.83	3.36	730	4.63
	24.78	100.00	121	22.93
<u>-65 +200 mesh</u>				
Light pr.	29.56	90.71	65	14.68
Heavy pr.	3.03	9.29	458	10.60
	32.59	100.00	101	25.28
<u>-200 mesh</u>				
Light pr.	25.69	84.20	130	25.51
Intermed.	3.88	12.70	318	9.43
Heavy pr.	0.95	3.10	826	6.00
	30.52	100.00	175	40.94
Total Lights	91.15		99	68.90
" Heavy+Int.	8.85		460	31.10
Total Feed	100.00		131	100.00



Biggejavri - Davidite Ore
 High Intensity Wet Magnetic Tests On Various Top Sizes

Product	Weight %	Scandium ppm	Sc Dist. %
<hr/>			
<u>-65 mesh</u> (61 % of total feed)			
Magnetics	25.29	325	77.0
Non-Mags.	74.71	35	23.0
<hr/>			
	100.00	108	100.0
<hr/>			
<u>-100 mesh</u> (50 % of total feed)			
Magnetics 1.	26.87	408	82.4
Magnetics 2.	4.69	163	5.8
Non-Mags.	68.44	23	11.8
<hr/>			
	100.00	133	100.0
<hr/>			
<u>-150 mesh</u> (39 % of total feed)			
Magnetics 1.	28.24	477	83.8
Magnetics 2.	4.78	189	5.6
Non-Mags.	66.98	25	10.6
<hr/>			
	100.00	160	100.0
<hr/>			
<u>-200 mesh</u> (29 % of total feed)			
Magnetics 1.	16.43	500	76.0
Magnetics 2.	5.57	200	10.2
Non-Mags.	78.00	20	13.8
<hr/>			
	100.00	109	100.0

Biggejavri - Davidite Ore
Fine Grinding - Particle Size Distribution

Size fraction (in meshes)	Weight %	Cumulative passing through (weight %)
-----	-----	-----
+ 65	0.51	99.49
- 65 + 100	3.83	95.66
- 100 + 150	10.57	85.09
- 150 + 200	16.91	68.18
- 200 + 270	26.81	41.37
- 270 + 325	6.13	35.24
- 325	35.24	

	100.00	

SAMPLE IDENTIFICATION *Biggejavri, Slam.*

DATE *12/9-86.*

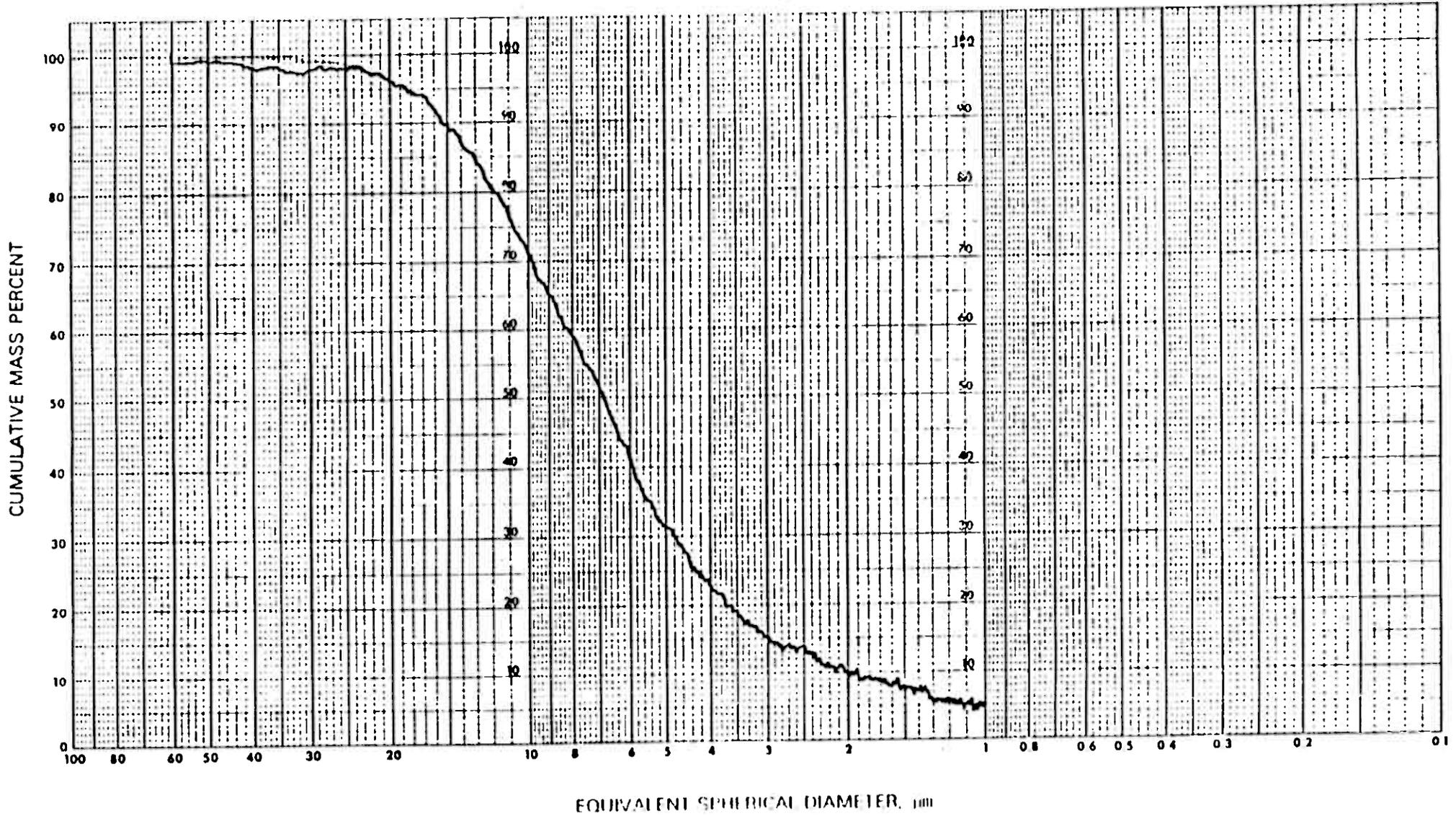
Density *2.75* g cc LIQUID *0.05% Calgon* Density *0.9957* g cc Viscosity *0.8607* cp

BY *T. Skansbo*

Preparation *15 min ultralyd.*

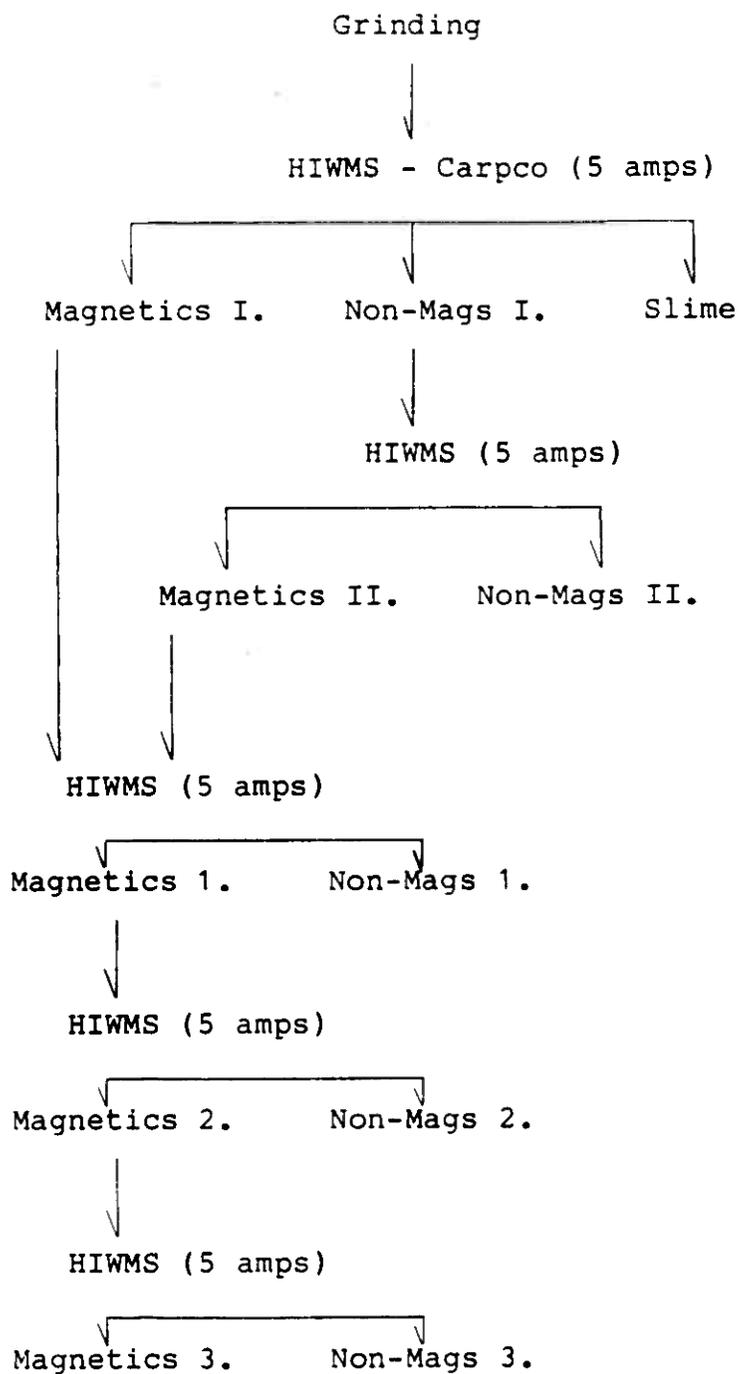
TEMPERATURE *30* °C

RATE *802* START DIA *60* μ m



Biggejavri - Davidite Ore

High Intensity Wet Magnetic Separation - Flowsheet 1.



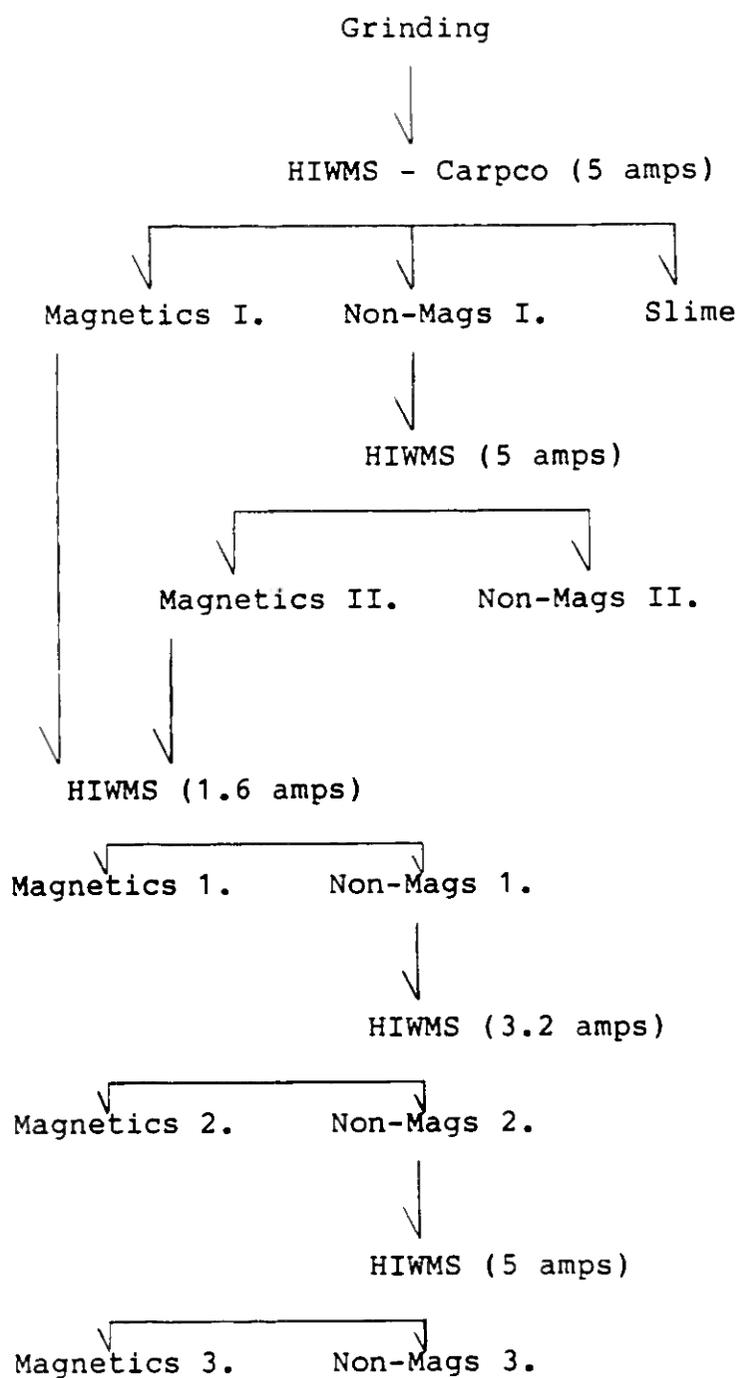
Biggejavri - Davidite Ore

High Intensity Wet Magnetic Separation - Flowsheet 1.

Product	Weight %	Scandium ppm	Sc Distribution % (of total feed)
Magnetics I.	34.5	325	77.0
Non-Mags I.	54.0	44	16.3
Slime	11.5	84	6.7
Feed-Rougher	100.0	145	100.0
Magnetics II.	4.0	270	7.2
Non-Mags II.	50.0	28	9.1
Feed-Scavenger	54.0	46	16.3
Magnetics 1.	24.0	465	75.1
Non-Mags 1.	14.5	95	9.1
Feed-Cleaner 1	38.5	325	84.2
Magnetics 2.	18.0	585	70.9
Non-Mags 2.	6.0	105	4.2
Feed-Cleaner 2	24.0	465	75.1
Magnetics 3.	16.2	635	69.3
Non-Mags 3.	1.8	160	1.6
Feed-Cleaner 3	18.0	585	70.9
Magnetics (I+II)	; Recovery = 84.2%	, Sc grade = 325 ppm	
Magnetics 1.	; Recovery = 75.1%	, Sc grade = 465 ppm	
Magnetics 2.	; Recovery = 70.9%	, Sc grade = 585 ppm	
Magnetics 3.	; Recovery = 69.3%	, Sc grade = 635 ppm	

Biggejavri - Davidite Ore

High Intensity Wet Magnetic Separation - Flowsheet 2.

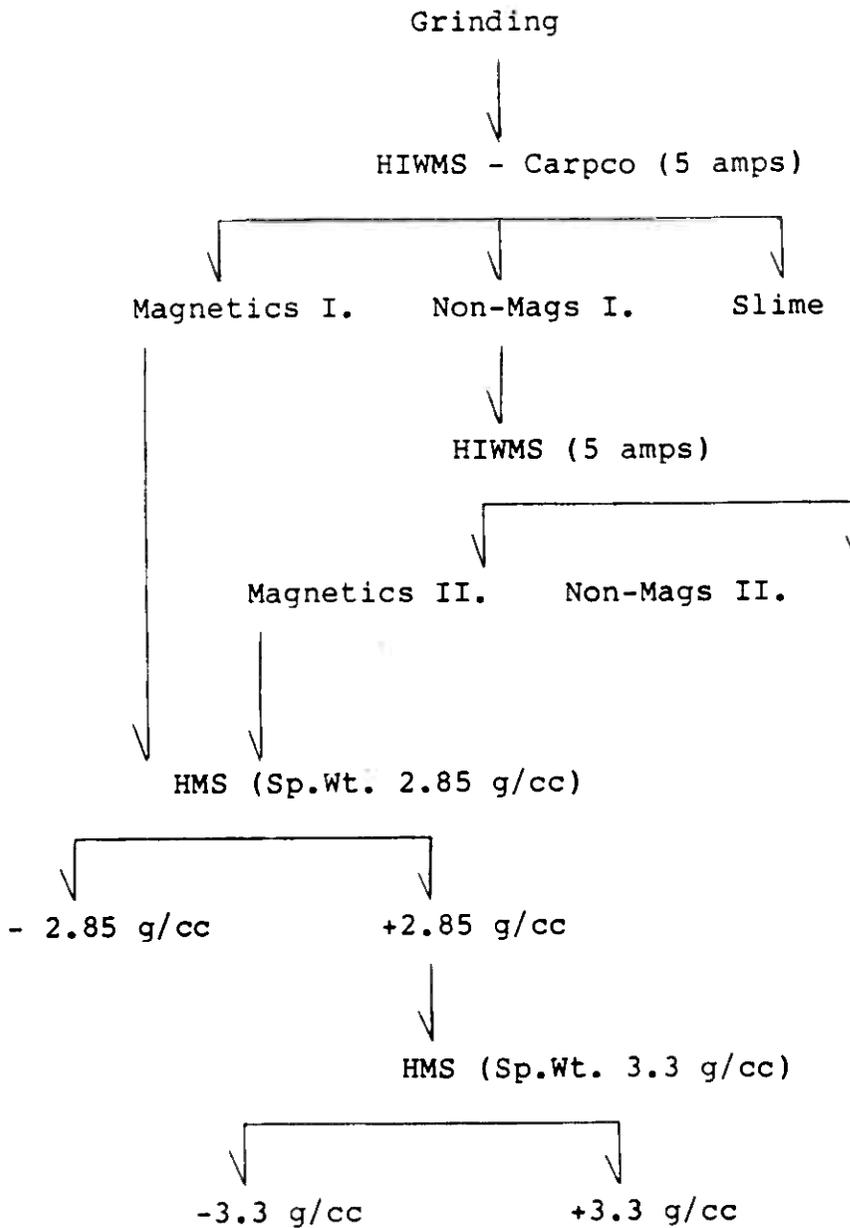


Biggejavri - Davidite Ore

High Intensity Wet Magnetic Separation - Flowsheet 2.

Product	Weight %	Scandium ppm	Sc Distribution % (of total feed)
Magnetics I.	34.5	325	77.0
Non-Mags I.	54.0	44	16.3
Slime	11.5	84	6.7
Feed-Rougher	100.0	145	100.0
Magnetics II.	4.0	270	7.2
Non-Mags II.	50.0	28	9.1
Feed-Scavenger	54.0	46	16.3
Magnetics 1.	9.9	430	28.7
Non-Mags 1.	28.6	288	55.5
Feed-Cleaner 1	38.5	325	84.2
Magnetics 2.	9.8	635	41.8
Non-Mags 2.	18.8	108	13.7
Feed-Resep.1	28.6	288	55.5
Magnetics 3.	4.7	278	8.8
Non-Mags 3.	14.1	51	4.9
Feed-Resep.2	18.8	108	13.7
Magnetics (I+II)		Recovery = 84.2%	Sc grade = 325 ppm
Magnetics (1+2+3)		Recovery = 79.3%	Sc grade = 485 ppm
Magnetics (1+2)		Recovery = 70.5%	Sc grade = 530 ppm

Biggejavri - Davidite Ore
 Flowsheet For HIWMS + Gravity Separation

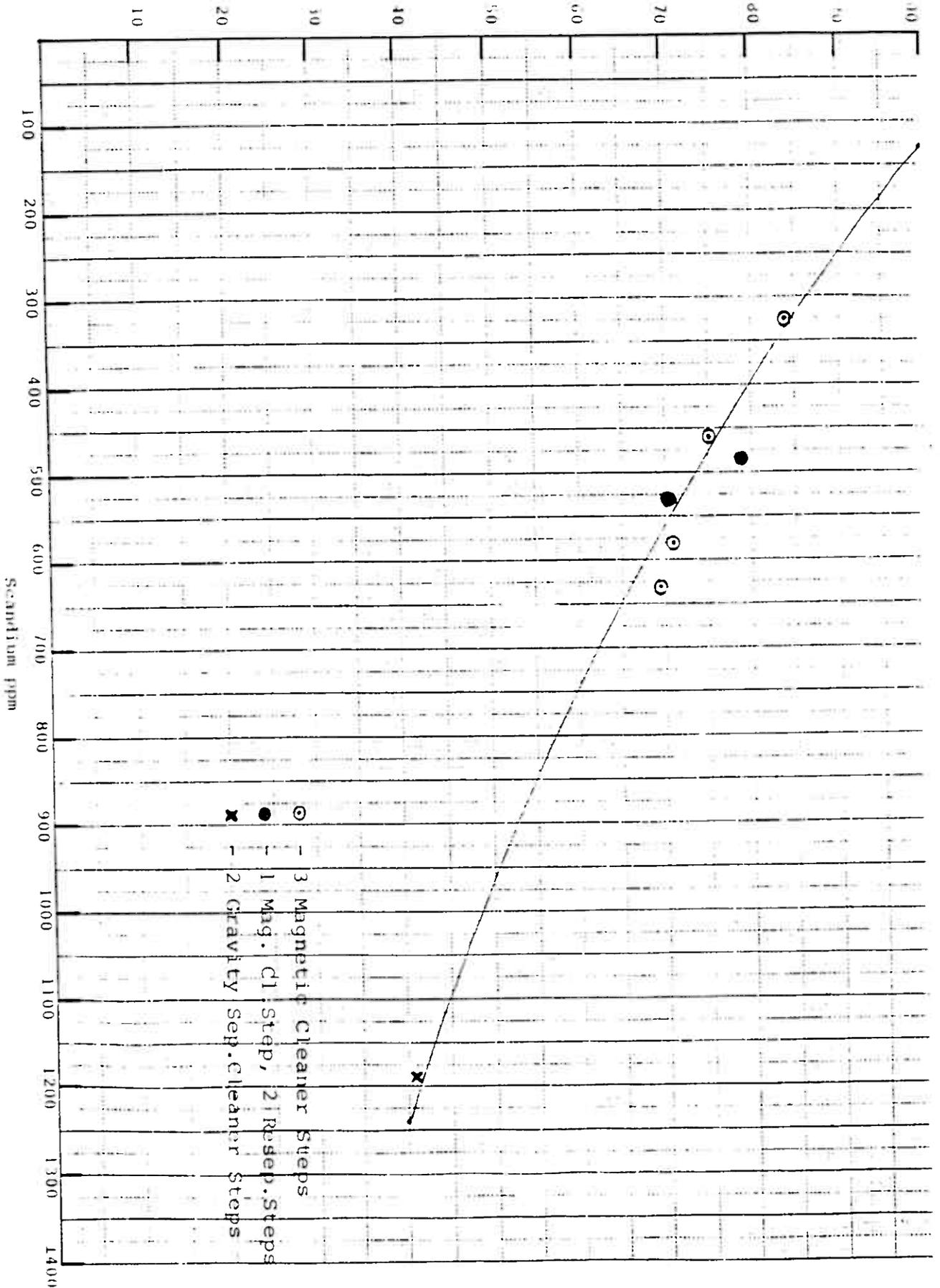


Biggejavri - Davidite Ore

High Intensity Wet Magnetic Separation + Gravity Separation

Product	Weight %	Scandium ppm	Sc Distribution % (of total feed)
Magnetics I.	34.5	325	77.0
Non-Mags I.	54.0	44	16.3
Slime	11.5	84	6.7
Feed-Rougher	100.0	145	100.0
Magnetics II.	4.0	270	7.2
Non-Mags II.	50.0	28	9.1
Feed-Scavenger	54.0	46	16.3
- 2.85 g/cc	33.2	200	43.3
+ 2.85 g/cc	5.3	1190	40.9
Feed-1.Gravity	38.5	335	84.2
-3.3 g/cc	4.0	1240	32.3
+3.3 g/cc	1.3	1020	8.6
Feed-2.Gravity	5.3	1190	40.9

Scandium Recovery %



13 OKT. 1986

OPPREDNINGSLABORATORIET
N-7034 TRONDHEIM-NTH

Vår dato: 09.10.1986

Ref.: MD/eg 143/86

Telefon: (07) 59 49 10
Telex: 55637 NTHAD.N
Telefax: (07) 59 51 03

Deres dato:

Ref.:

Folldal Verk A/S
2661 HJERKINN

BIGGEJAVRI - ORIENTERENDE OPPREDNINGSUNDERSØKELSE

Jfr. Notat fra konferanse med Heim og Killi 16/4-1986.

1. Sammendrag

Vedlagt oversender vi 3 ex av vår rapport 26/86 om våre forsøk med den malmprøve vi mottok i april i år. Videre sender vi 3 ex av dr. Malviks rapport STF36 F86041 om mineralogiske undersøkelser av malmprøven. Ett ex av begge rapporter er sendt geolog Heim i Oslo.

Det fremgår av vår rapport at etter relativt vidtdreven nedmaling kan våt høyintensitet magnetseparering (HI-separering) gi forkonsentrater med opp til 500-600 ppm Sc ved utvinninger på 75-70% av Sc-innholdet. På basis av NGU's davidittanalyser anslår vi at disse gehalter tilsvarer 15-20% daviditt i konsentratet. Det er rimelig å anta at ommaling og videre separering av forkonsentratet bør kunne gi konsentrater med ca. 50% daviditt tilsvarende 1500 ppm Sc uten vesentlige tap av Scandium.

2. Mineralogiske forhold

NGU's rapport 85/159 redegjør for mineralogiske undersøkelser i mikroskop og mikrosonde av forskjellige prøver fra Biggejavri. Det ble da påvist en rekke tungmineraller med daviditt som det klart dominerende når det gjelder innhold av Scandium. Det var stor spredning i mikrosonde-analysene for daviditt, men de indikerer et normalinnhold på ca. 3000 ppm Sc. 4000 ppm Y og

25000 ppm U som er de elementer vi har sett på i vår rapport. Det omtales at daviditten opptrer i store korn, opp til 1-3 mm og vi antok derfor at relativt grov nedmaling ville gi tilfredsstillende frimaling av daviditt.

For den nye prøve som ble tatt i april 1986 benyttet vi først en grov maling til 80% minus ca. 0,35 mm. Dr.ing. T. Malvik ved Geologisk institutt foretok en undersøkelse av frimalingen ved mikroskopering av slip av forskjellige siktefraksjoner. Den viste klart at en vesentlig del av daviditten var intimt sammenvokset med bergarten (vesentlig albitt). Først ved 0,1 mm fant han 50% frimaling, og ved 0,05 mm 70%.

Separeringsforsøk i tung væske (tetthet 2,85) (Appendix 3 og 3A i vår rapport) bekreftet at frimalingen måtte være dårlig i alle fraksjoner over 0,075 mm. Også orienterende forsøk med høyintensitet magnetseparering (Appendix 4 og 4A) med samme maleprodukt indikerte at finere maling var påkrevet.

På den annen side må man ta i betraktning at det relativt sterkt radioaktive davidittmineral har en metamikt struktur som gjør at det lett danner slam ved fin maling. Dette går utover utvinningen, mest med gravitativ separering, mindre ved HI-separering og flotasjon.

Et positivt trekk ved daviditt er den relativt høye Fe-gehalt som gjør at den egner seg bra for HI-separering. Den høye Sc-utvinning ved våre forsøk tyder på at selv bergartskorn med lite innhold av daviditt er magnetiske nok til å utvinnes.

Av de øvrige tungmineraler som er omtalt i NGU-rapporten er det vel bare svovelkis, orthit og brannerit som inneholder nok Fe til å taes ut med HI-separering.

Da daviditten ifølge NGU's rapport også inneholder uran, vanadin og lantanider i kvanta som kan ha økonomisk interesse, har vi analysert noen av produktene fra HI-separeringen semikvantitativt på U og Y, jfr. s. 7 i vår rapport. De viser at ca. 50% av disse

elementer går i davidittkonsentratet. Resten finnes sannsynligvis i svakmagnetiske tungmineraler som kan tenkes utvunnet ved gravitativ separering eller flotasjon. NGU har observert en rekke slike tungmineraler med tettheter fra 4 og oppover. Noen av disse inneholder sannsynligvis noe Scandium, og et slikt opplegg kan da bidra til ytterligere Sc-utvinning.

3. Separeringsresultatene

Ifølge vår XRF-analyse holdt den mottatte malmprøve ca. 130 ppm Sc. Ut fra NGU's davidittanalyse tilsvarer dette ca. 4% daviditt hvis all Sc er bundet i daviditten.

Våre innledende forsøk med separering i tung væske ga dårlig utvinning, og dette ble bekreftet under noen senere forsøk med slik reseparatoring av forkonsentrat (Appendix 9 og 9A).

HI-separeringen har derimot gitt god utvinning av Sc, men ved en nokså beskjeden oppkonsentrering, fra ca. 130 ppm Sc i rågods til 300-350 ppm i forkonsentrat og 500-600 ppm ved rensing av forkonsentrat med HI-separering. De relativt lave Sc-gehalter antar vi skyldes at selv bergartskorn med lite davidittinnhold vil være magnetiske nok til å gå i konsentratet ved HI-separering med høy feltstyrke. Dette er på den annen side hovedårsaken til at HI-separering gir så meget høyere Sc-utvinning enn separering i tung væske.

4. Forslag til videre undersøkelser

Som tidligere anført anslår vi at et konsentrat med 500-600 ppm fører 15-20% daviditt. Det inneholder også litt av andre tungmineraler, og sannsynligvis adskillig bergart med større eller mindre inneslutninger av daviditt. En forsiktig ommaling, etterfulgt av rensing med HI-separering og eventuelt flotasjon

burde kunne gi konsentrater med minst 50% daviditt tilsvarende ca. 1500 ppm Sc. Gravitativ separering kan muligens bidra noe ved oppkonsentrering av den groveste del av forkonsentratet (før ommalingen). Det vil i tilfelle redusere slamtapene av daviditt. På vedlegg har jeg vist utkast til et slikt kombinert flytskjema hvor det tilsiktes høyest mulig Sc-utvinning.

For å klarlegge oppkonsentreringsmulighetene foreslår vi følgende opplegg:

- 1) Mineralogisk undersøkelse av forkonsentrat v/dr. T. Malvik.
- 2) Gravitativ oppkonsentrering av forkonsentrat på Mosley labherd.
- 3) Forsøk med ommaling og ny HI-separering av forkonsentrat.
- 4) Forsøk med ommaling og flotasjon av forkonsentrat.

Det har dessuten interesse å se på om man ved gravitativ separering eller flotasjon kan ta ut ytterligere produkter av økonomisk verdi fra avgangen etter HI-separeringen. Det kan dreie seg om ytterligere utvinning av Scandium, eller om U, V eller lantani-der, jfr. forrige avsnitt.

Vi anser oss ferdig med de orienterende undersøkelser og avventer beskjed fra Dem om det ønskes utført ytterligere undersøkelser på denne malmprøve.

Med beste hilsen



Marcus Digre
fung. instituttstyrer

Gjenpart: Geolog Heim, Folldal Verk, Oslo
Dr. Terje Malvik

Biggejavri daviditt-malm - Utkast til flytskjema

M. Digre 9. okt. 1986

