

NOTA 706

12 oktober 1972

Instituut voor Cultuurtechniek en Waterhuishouding
Wageningen

ALTERRA,
Wageningen Universiteit & Research centre
Omgevingswetenschappen
Centrum Water & Klimaat
Team Integraal Waterbeheer

GEO-ELEKTRISCHE METINGEN IN MIDDEN-WEST-NEDERLAND

M. Wijnsma

Nota's van het Instituut zijn in principe interne communicatiemiddelen, dus geen officiële publikaties.

Hun inhoud varieert sterk en kan zowel betrekking hebben op een eenvoudige weergave van cijferreeksen, als op een concluderende discussie van onderzoeksresultaten. In de meeste gevallen zullen de conclusies echter van voorlopige aard zijn omdat het onderzoek nog niet is afgesloten.

Bepaalde nota's komen niet voor verspreiding buiten het Instituut in aanmerking

INLEIDING

Een facet van de hydrologische onderzoeken door het I.C.W. in Midden-West-Nederland was het verkrijgen van gegevens omtrent de chemische samenstelling van het grondwater en in het bijzonder het chloridegehalte.

Door middel van in het veld uitgevoerde elektrische weerstands-metingen, (WIT, WIJNSMA, 1970) aangevuld met analyseresultaten van aan ter plaatse aangebrachte filters onttrokken watermonsters werd een overzicht verkregen van de gehalten aan chloride in het grondwater tot een diepte van 10 m beneden maaiveld. De elektrische weerstands metingen zijn tot een diepte van 10 m beneden maaiveld uitgevoerd. Het aantal waarnemings punten bedraagt 93, waarbij tevens de filters zijn geplaatst op 1,5 en 4,5 m beneden maaiveld, waaruit voornoemde watermonsters zijn onttrokken.

Het chloridegehalte van deze monsters is in het eigen laboratorium bepaald volgens de titratiemethode, terwijl tevens de elektrische geleidbaarheid is vastgesteld.

VERWERKING VAN DE GEGEVENS

De in het veld gemeten elektrische weerstand bestaat uit de volgende componenten:

- a. de weerstand van het bodemskelet (P_s)
- b. de weerstand van het bodemvocht (P_v)

De weerstand P_s is niet alleen afhankelijk van de granulaire samenstelling van de grond en het poriënvolume, maar mede van de aan kleimineralen geadsorbeerde ionen. De weerstand P_v is afhankelijk van de totale ionen concentratie. De verhouding tussen de weerstand

P_s en de weerstand P_v wordt als formatie factor (F) aangeduid. Gegevens betreffende de formatie factor kunnen verkregen worden uit in het veld gemeten weerstanden op een diepte van 1,5 en 4,5 m beneden maaiveld en de elektrische weerstand van bovengenoemde watermonsters op die diepten. Daaruit verrichte boringen en genomen grondmonsters gegevens zijn verkregen omtrent de lithologische eigenschappen van het profiel, was het mogelijk de volgende indeling te maken.

Tabel I

Grondsoort	Slibgehalte %	Formatie factor
Klei	15 - 40	1,4
Oppervlakte veen		1,1
Afgedekt veen		1,2
U 80 - 120	5 - 10	2,2
U 80 - 120	2 - 5	2,3
U 50 - 80	5 - 10	3,2
U 50 - 80	2 - 5	3,3
U 50 - 80	0 - 2	3,4

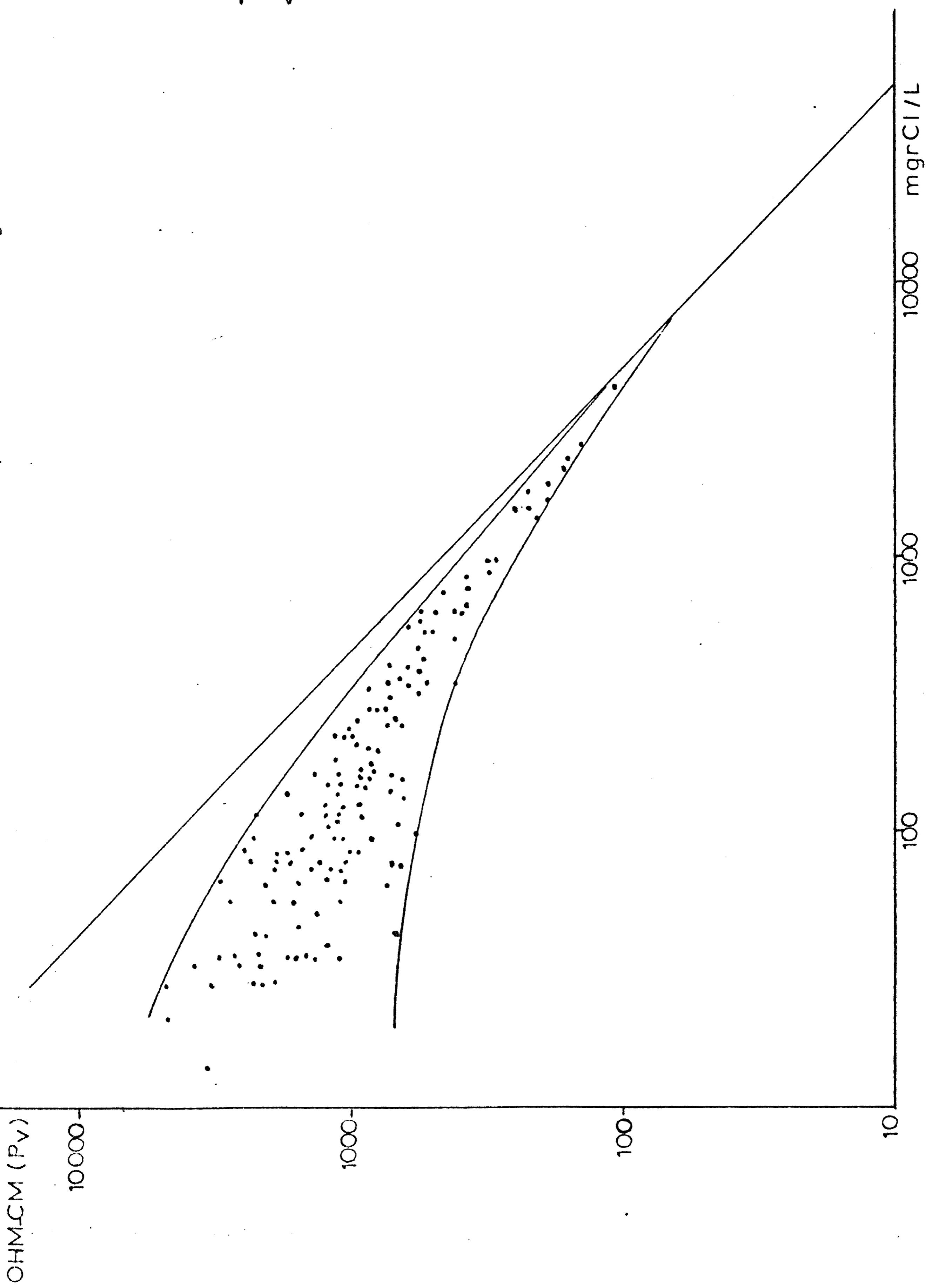
In fig. 1 is het gehalte aan chloride in mg/l tegen de weerstand P_v (ohm cm) uitgezet voor alle 93 waarnemings punten van de diepten 1,5 en 4,5 m-mv.

Naarmate het chloridegehalte af- en het gehalte van andere ionen relatief toeneemt wordt de spreiding in het verband tussen het chloride gehalte en P_v groter.

Om uit fig. 1 en de uit in het veld gemeten waarden het chloridegehalte af te leiden is de volgende procedure gevuld: Van alle metingen is P_s omgerekend naar P_v door gebruik te maken van de formatie factor uit tabel I. Verder is uit fig. 1 een indeling gemaakt die in tabel II is gegeven.

Het verband tussen specifieke weerstand P_V en net chloride gehalte

fig. 1



Tabel II

Weerstand ohm cm (P_v)	mg Cl / l
1500	0 - 200
700 - 1500	0 - 500
400 - 700	0 - 1000
220 - 400	400 - 2000
95 - 220	1300 - 5000
95	5000

Uit tabel II blijkt dat er een vrij grote spreiding ontstaat tussen het minimum en het maximum betreffende het chloride gehalte. Het is dan ook niet mogelijk exact het chloride gehalte met deze methode vast te stellen, er wordt een globale indruk verkregen.

Op de lokaties 1 t/m 93 is de linker figuur de uit de metingen berekende weerstand (P_s) uitgezet tegen de diepte, daarnaast is een profiel getekend waarin het aangegeven U-cijfer en het slibgehalte geschatte waarden zijn. In de rechter figuur is het chloride gehalte uitgezet tegen de diepte volgens tabel II. De onderbroken lijn geeft het waarschijnlijke chloridegehalte weer.

Met behulp van deze figuren zijn kaarten samengesteld van de isohalinen op 1,5; 5 en 10 m-m.v.; respectievelijk fig. 2, 3 en 4. Tevens is een kaart gemaakt van het chloride gehalte op 8 - 12 m. NAP (fig. 5). Deze kaart sluit aan op kaarten, die van lagere niveaus zijn gemaakt (VAN REES VELLINGA, TOUSSAINT en H.M. VAN GILS; 1972).

SAMENVATTING

Door elektrische weerstands metingen uitgevoerd op 93 lokaties en metingen verricht in watermonsters zijn gegevens verkregen omtrent het chloride gehalte van het grondwater tot een diepte van 10 m - mv.

In isohalinen kaarten, samengesteld van de diepten 1,5; 5 en 10 m - m.v. en van de diepte 8 - 12 m - NAP zijn de verkregen gegevens weergegeven.

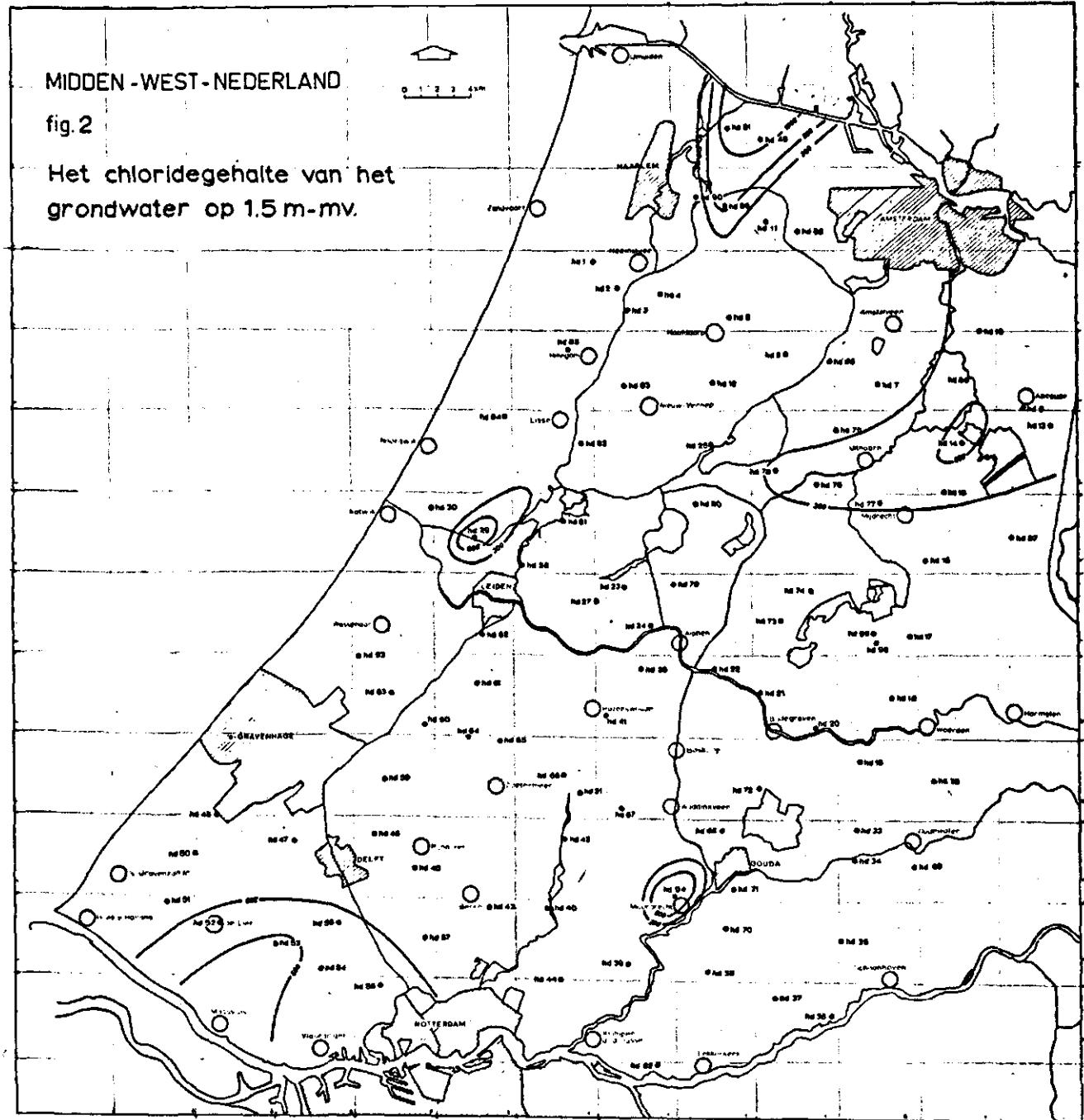
LITERATUUR

- DIJKSTRA, J. en A. VOLKER, 1957. Geo-elektrisch onderzoek op het IJselmeer. Mededelingen betreffende de Dienst der Zuidzeewerken, nr. 6.
- REES VELLINGA, E. VAN, C.G. TOUSSAINT en J.B.H.M. VAN GILS, 1972. Chloridegehalten van het grondwater in Midden-West-Nederland, concept nota, I.C.W.
- WIT, K.E. en M. WIJNSMA, 1970. Bepaling van de specifieke weerstand in situ. nota I.C.W. 559.

MIDDEN - WEST - NEDERLAND

fig. 2

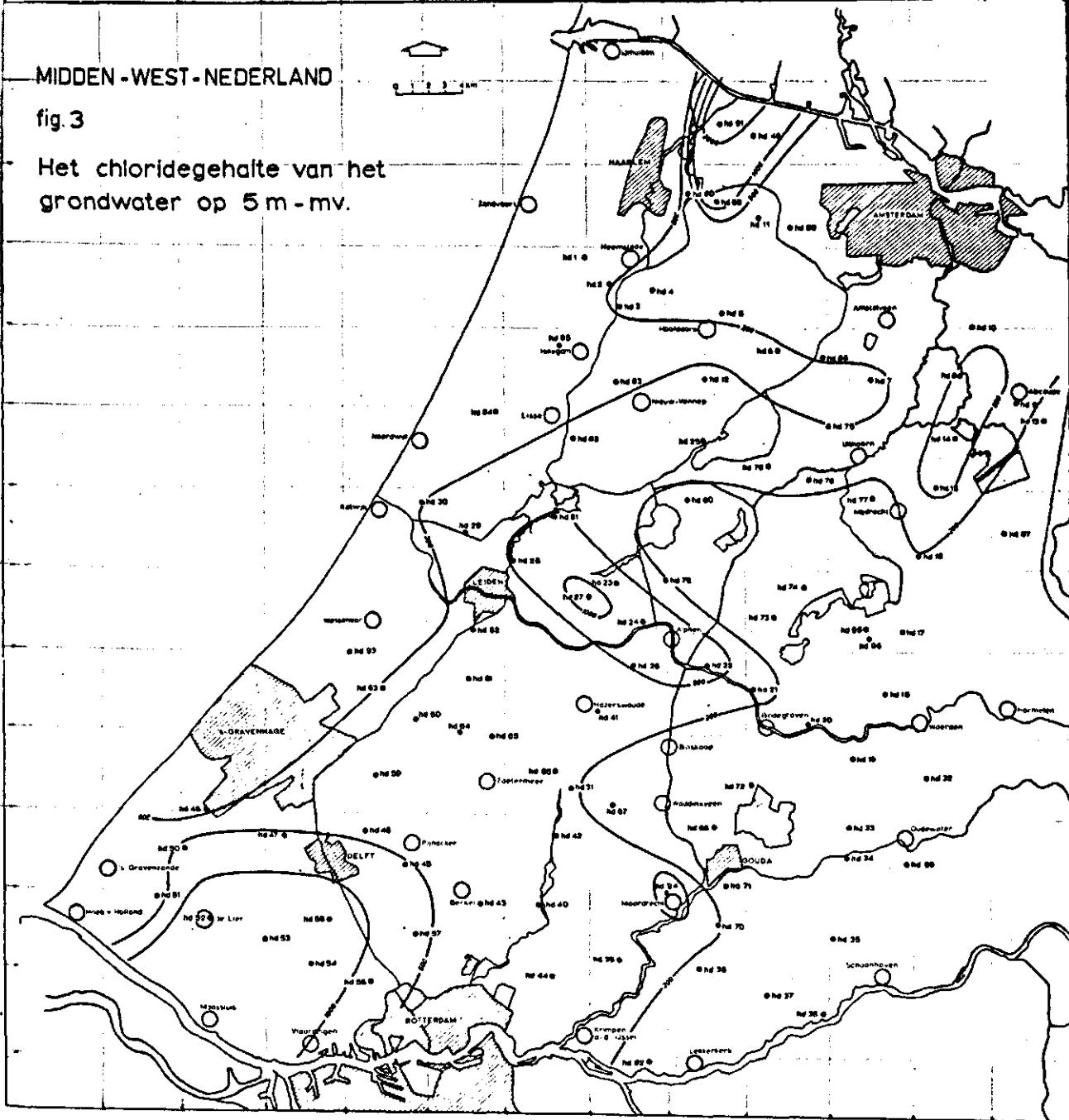
Het chloridegehalte van het grondwater op 1.5 m-mv.



MIDDEN - WEST - NEDERLAND

fig. 3

Het chloridegehalte van het grondwater op 5 m - mv.



MIDDEN - WEST - NEDERLAND

0 1 2 3 km
N

fig. 4

Het chloridegehalte van het grondwater op 10 m-mv.

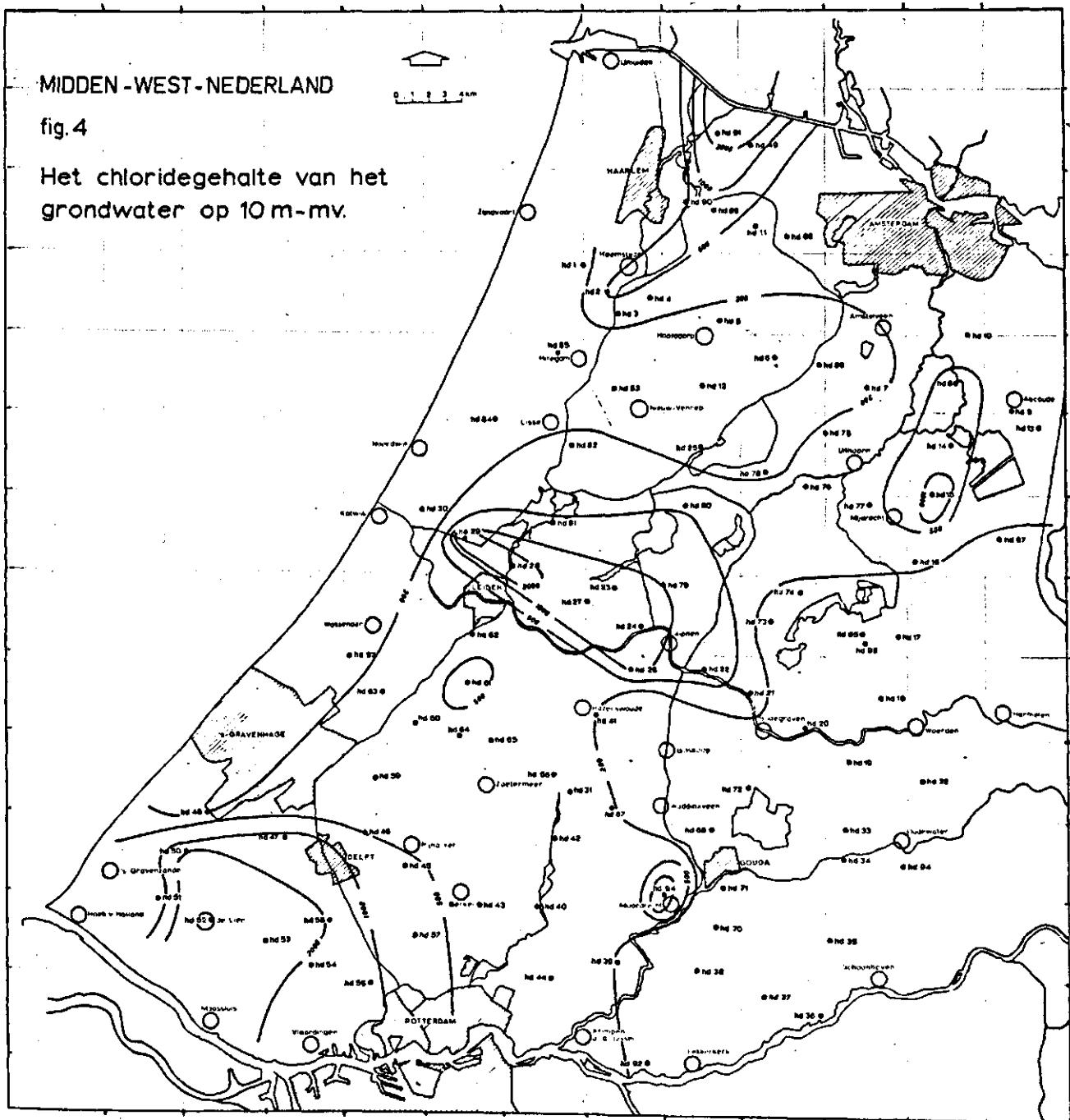
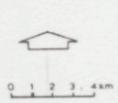


fig. 5

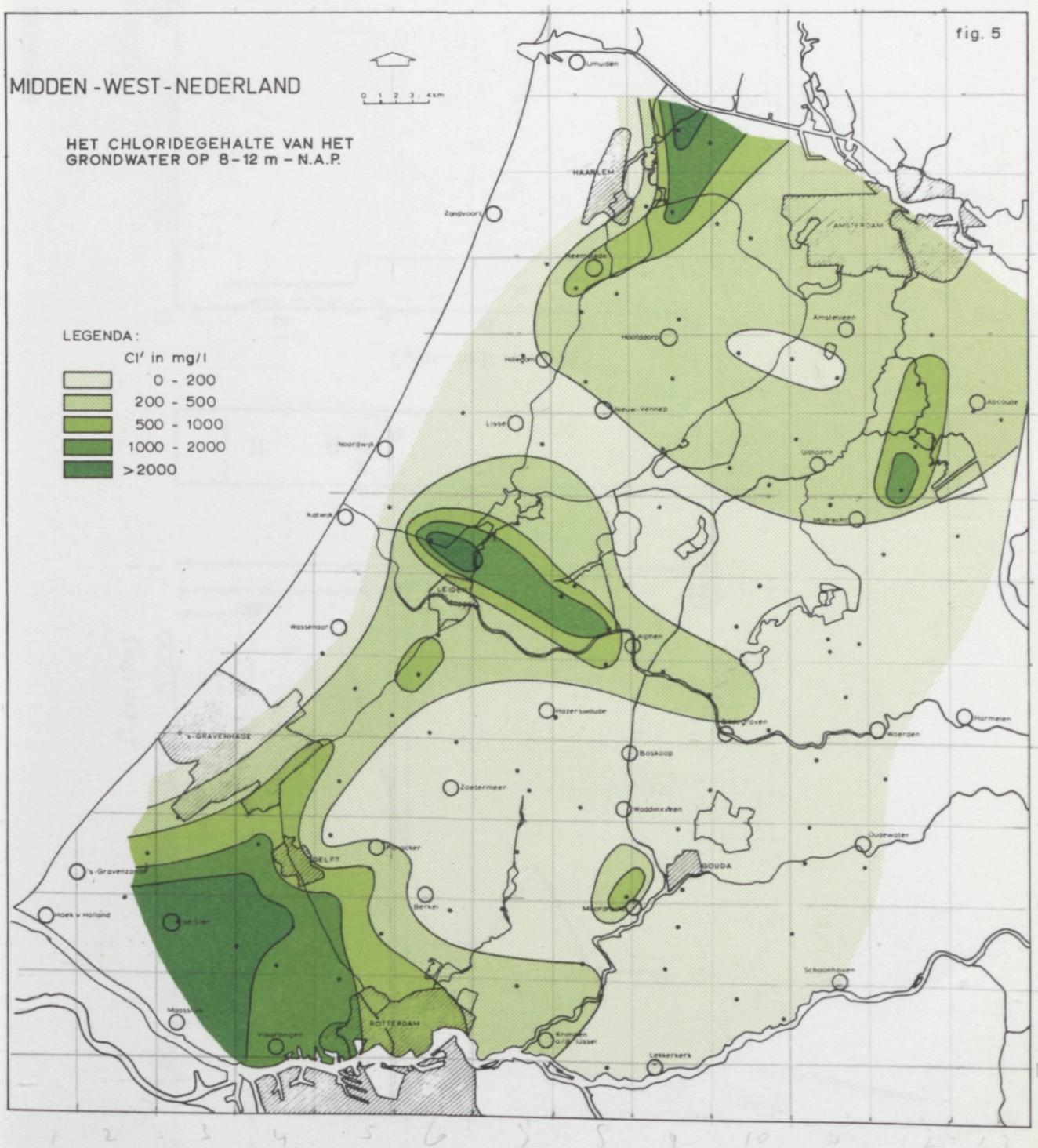
MIDDEN - WEST - NEDERLAND



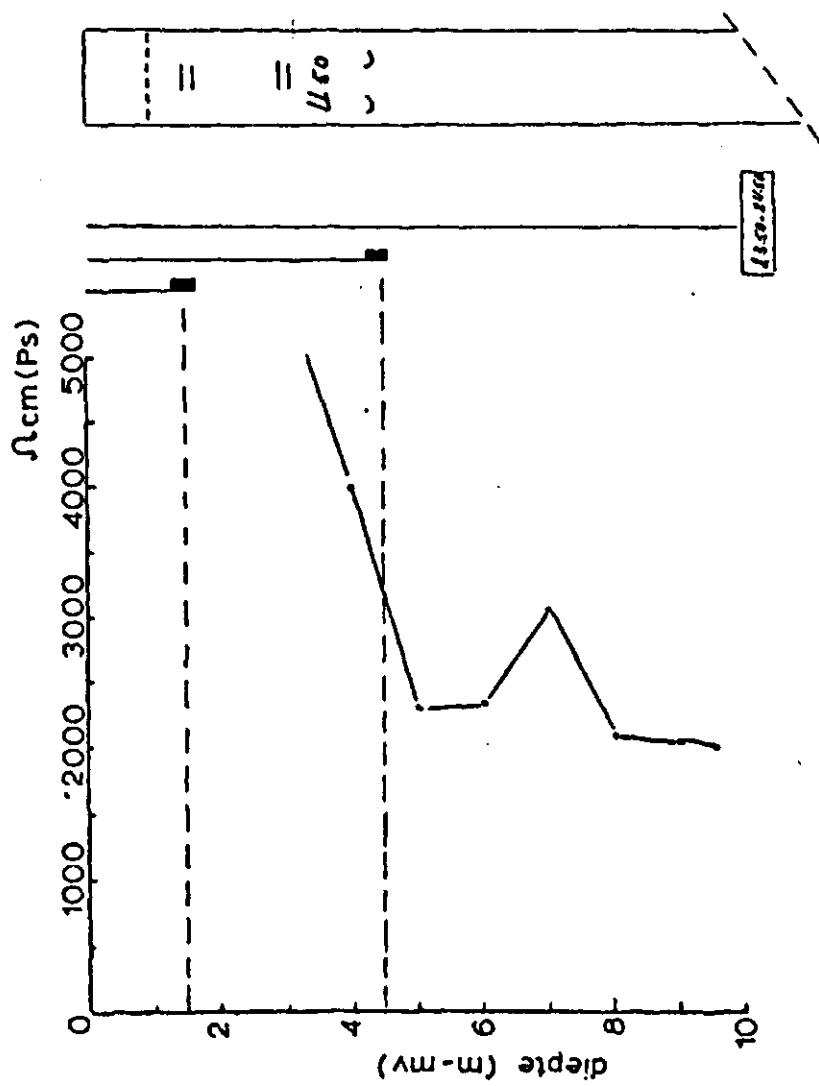
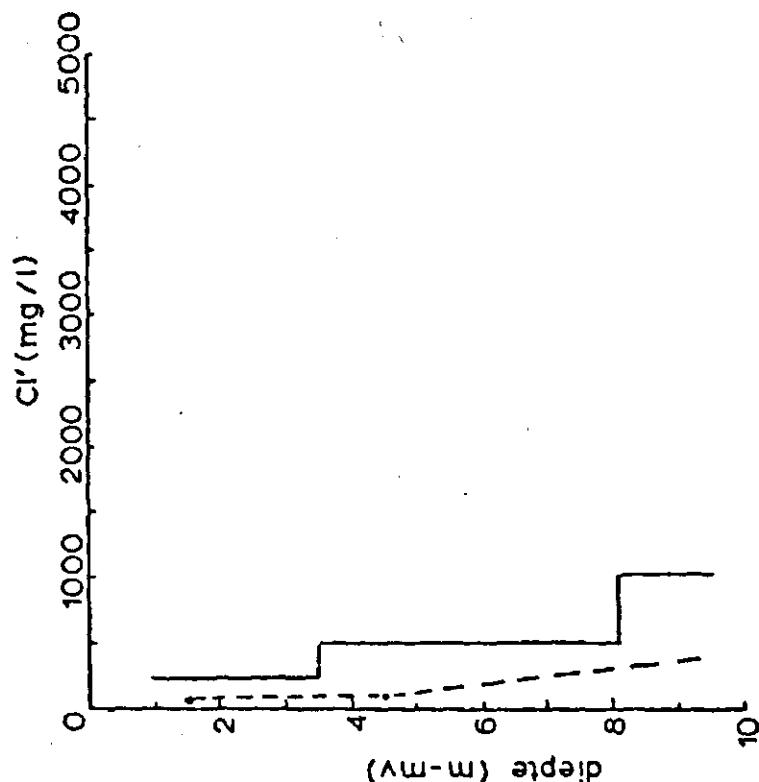
HET CHLORIDEGEHALTE VAN HET
GRONDWATER OP 8-12 m - N.A.P.

LEGENDA:

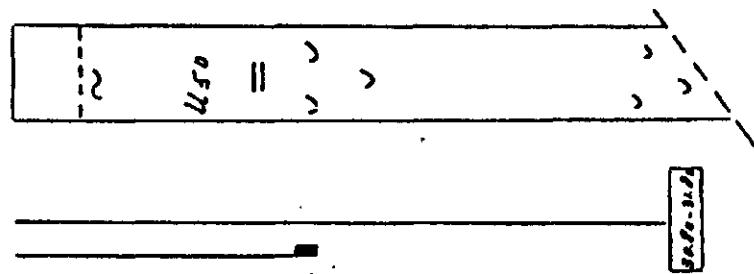
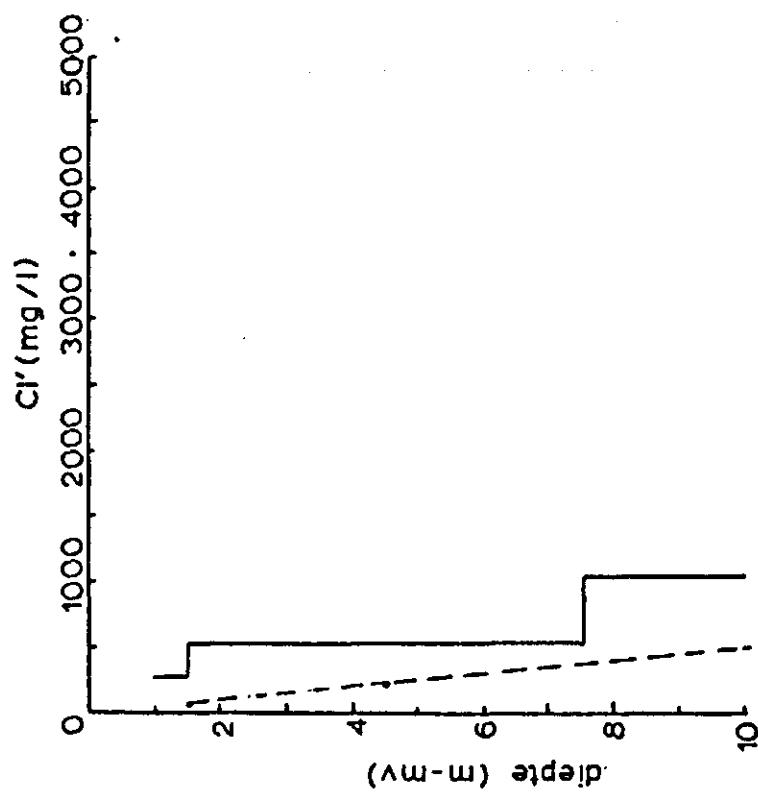
Cl' in mg/l
0 - 200
200 - 500
500 - 1000
1000 - 2000
>2000



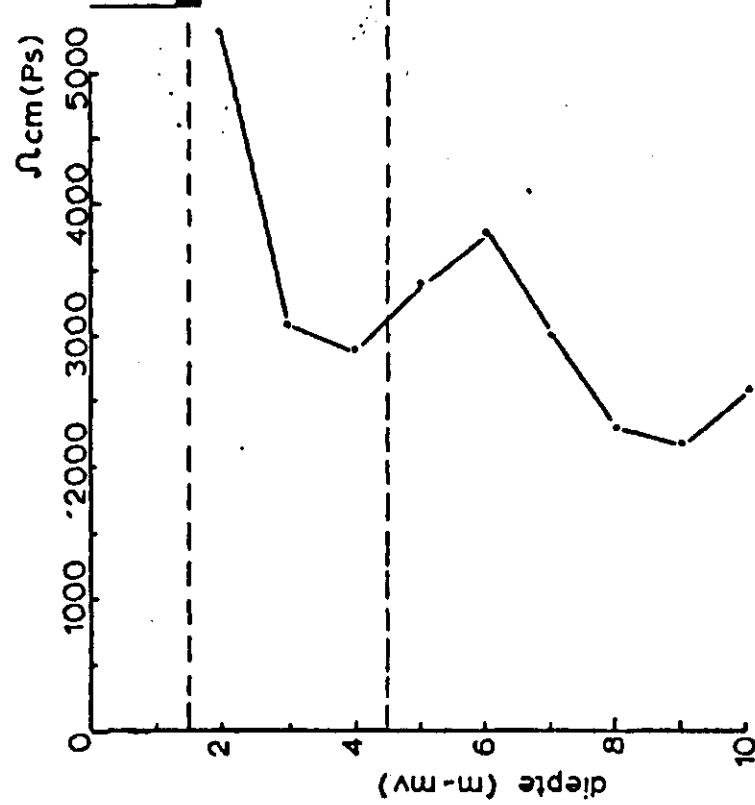
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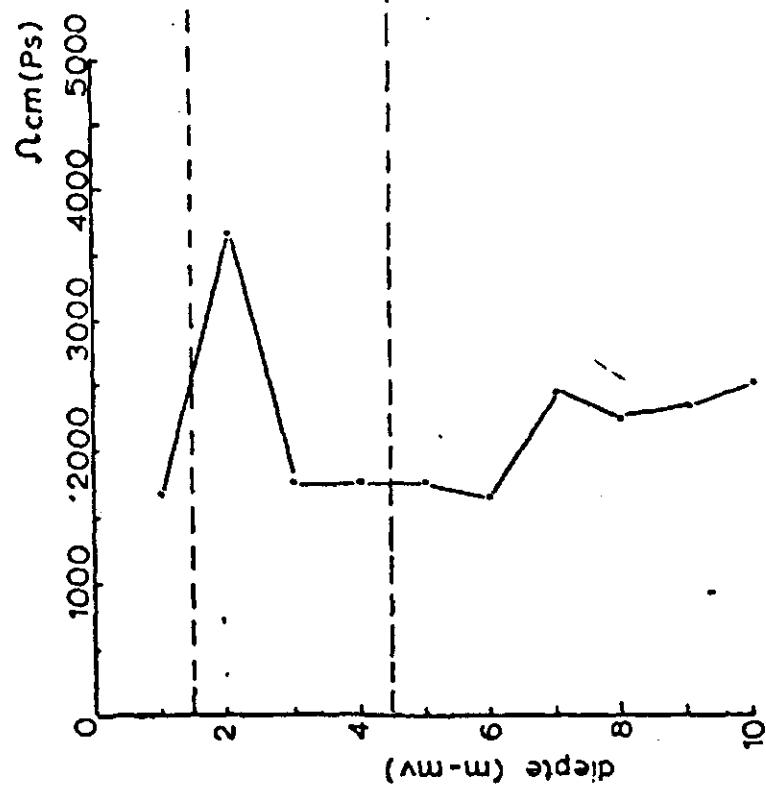
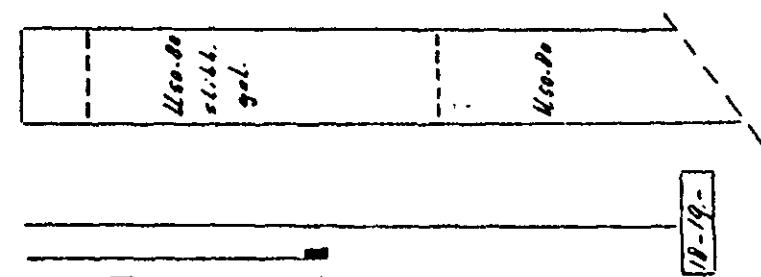
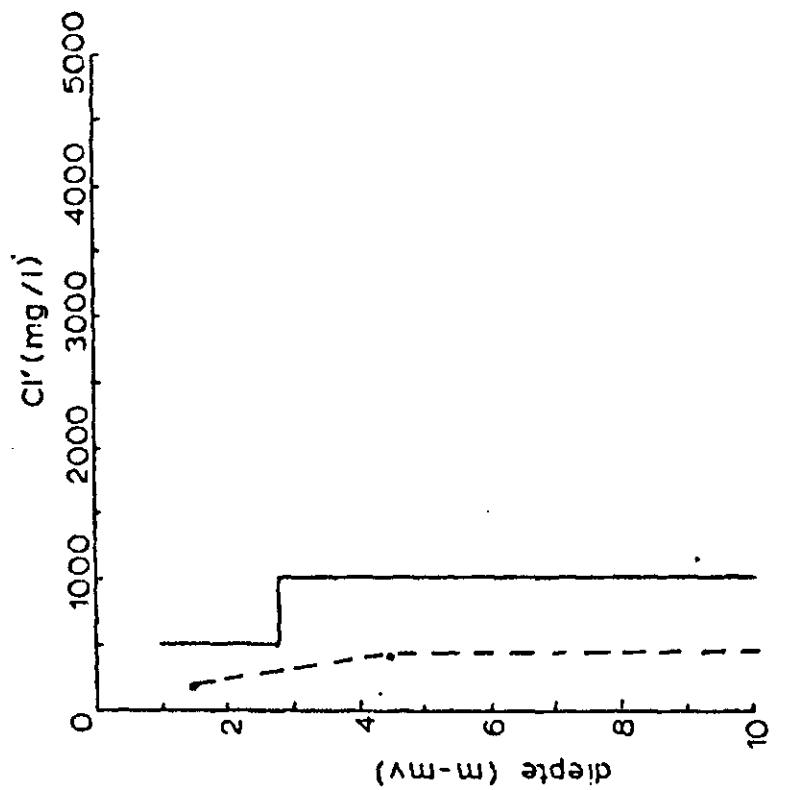


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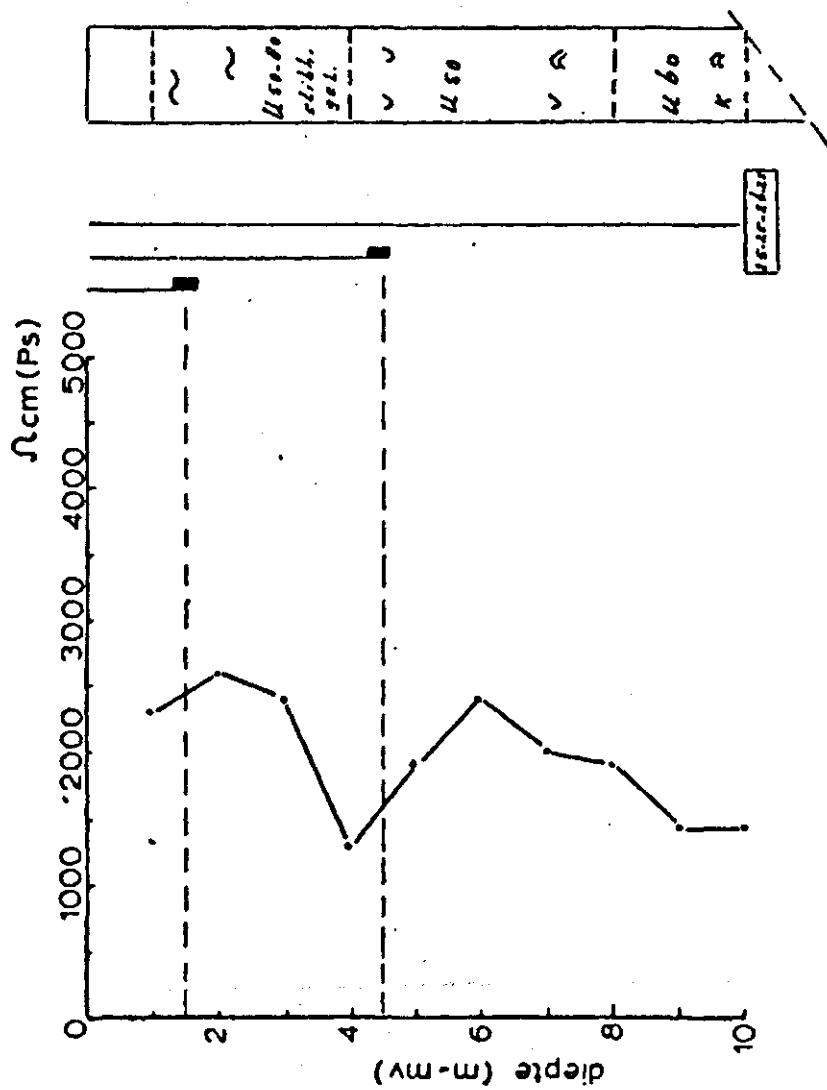
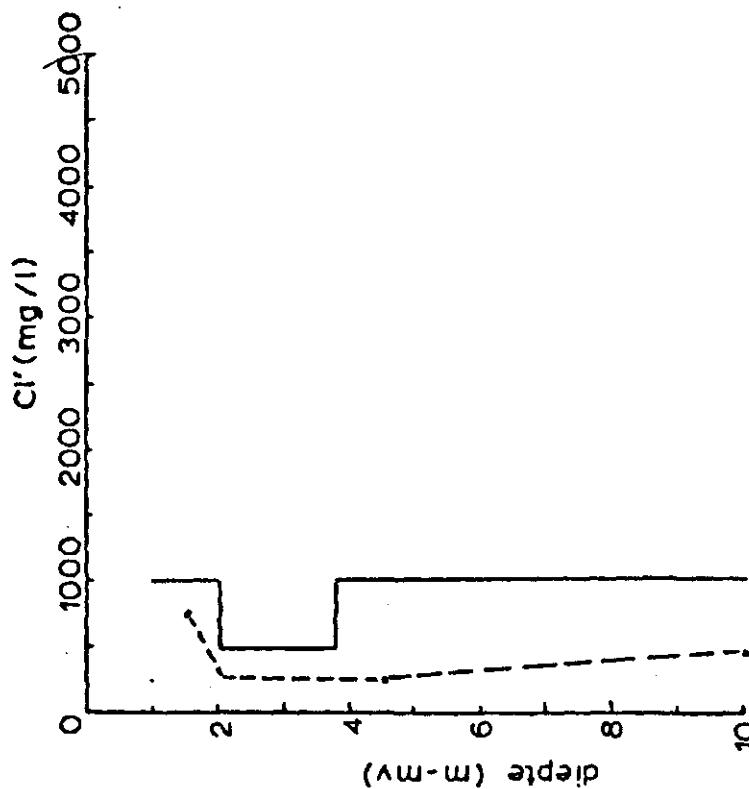


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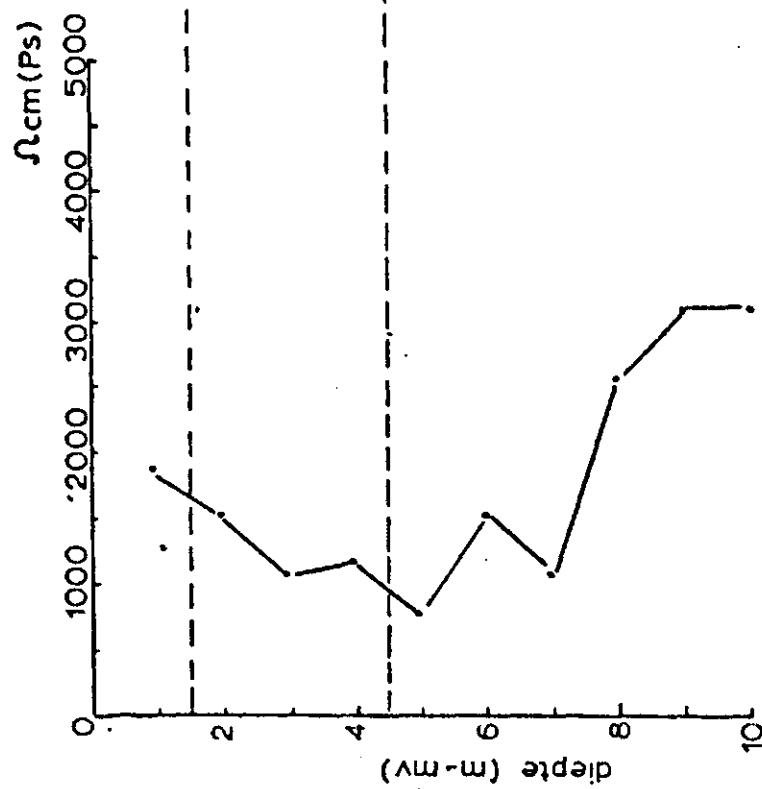
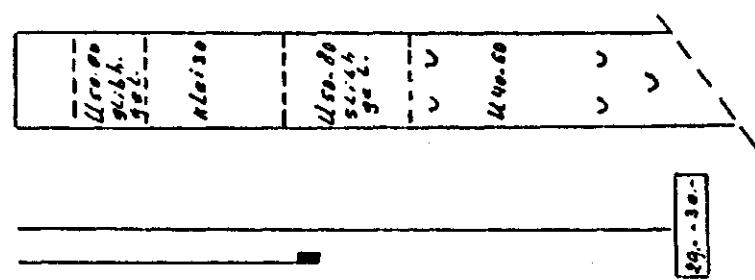
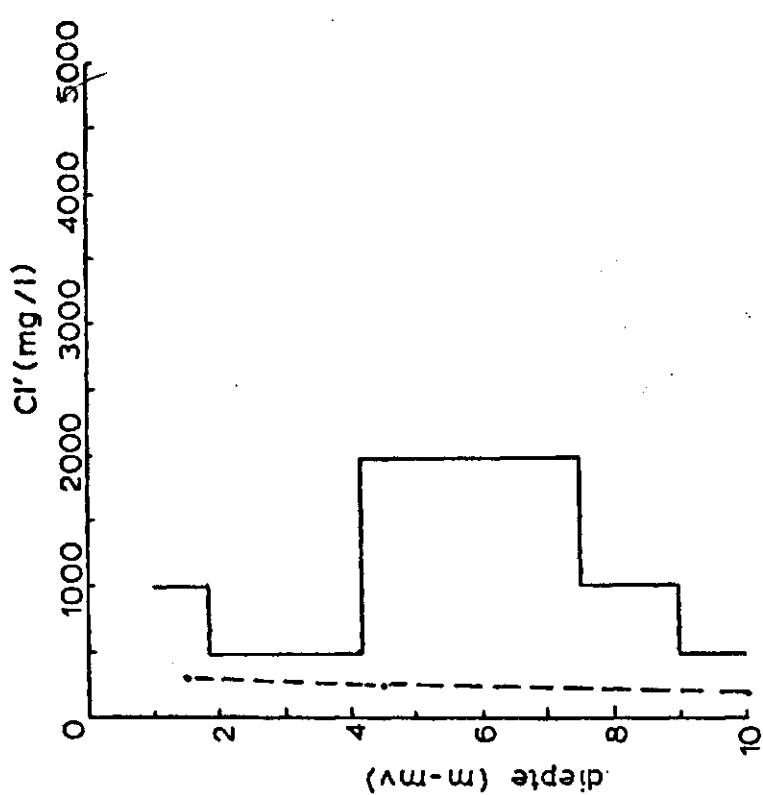




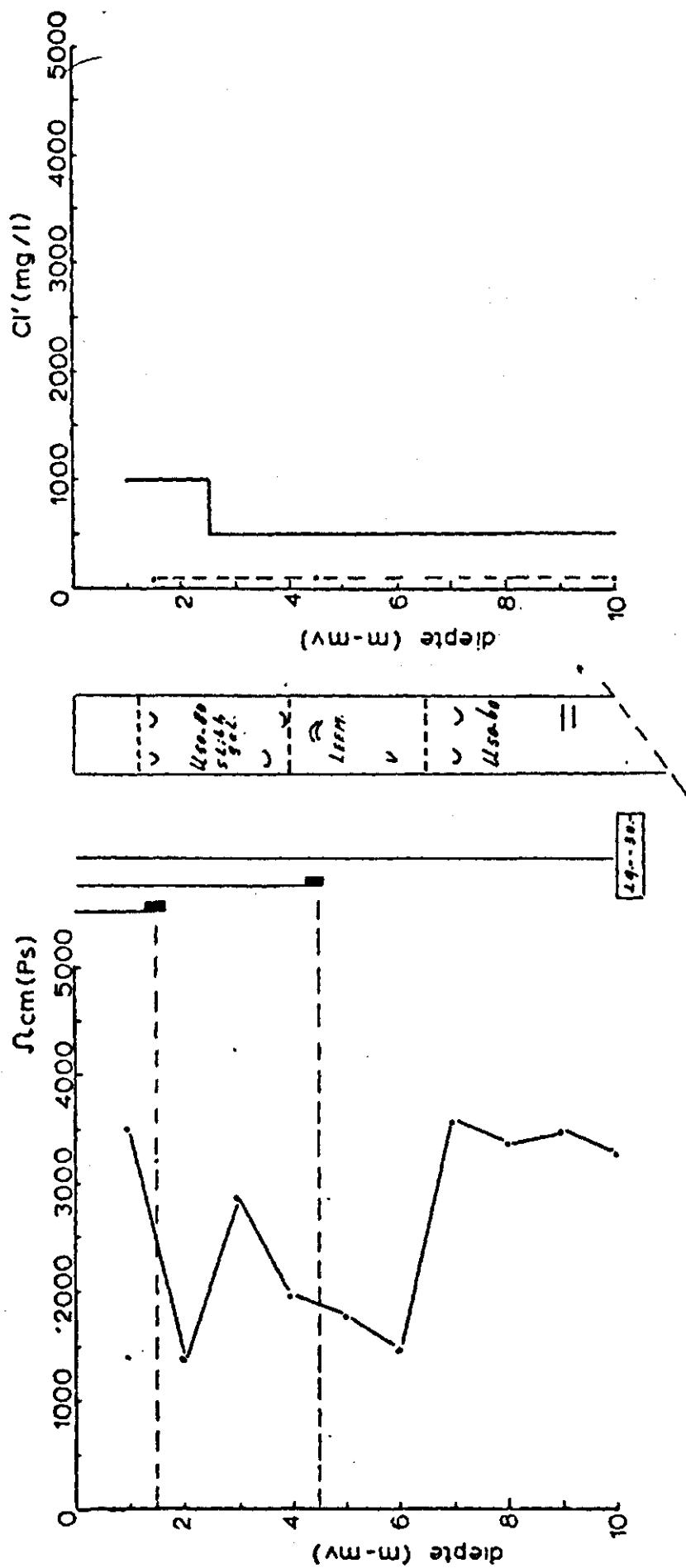
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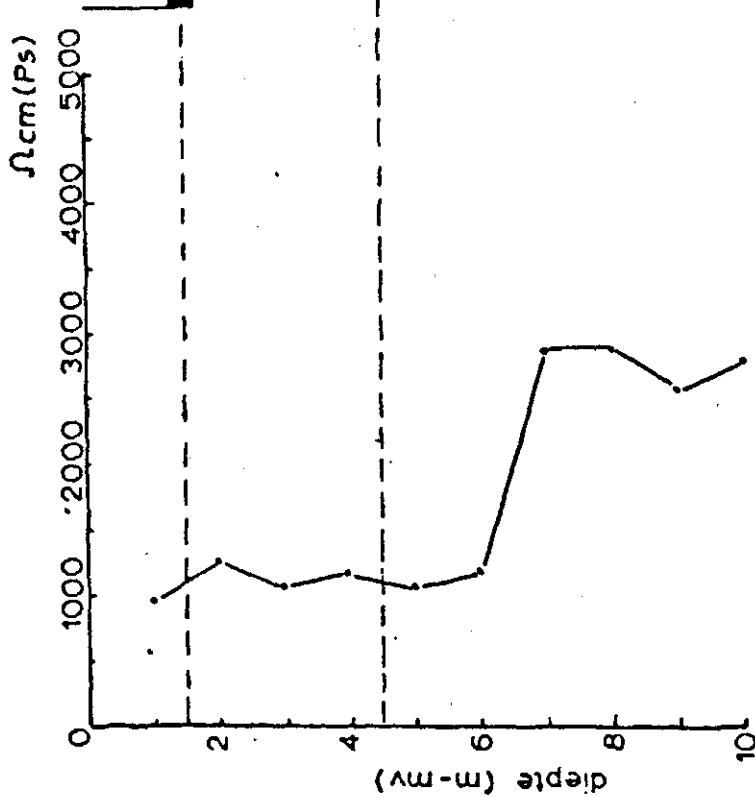
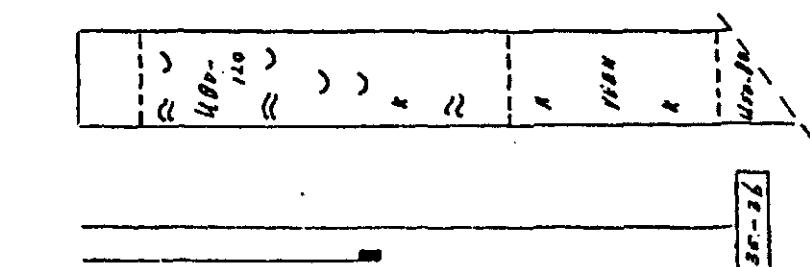
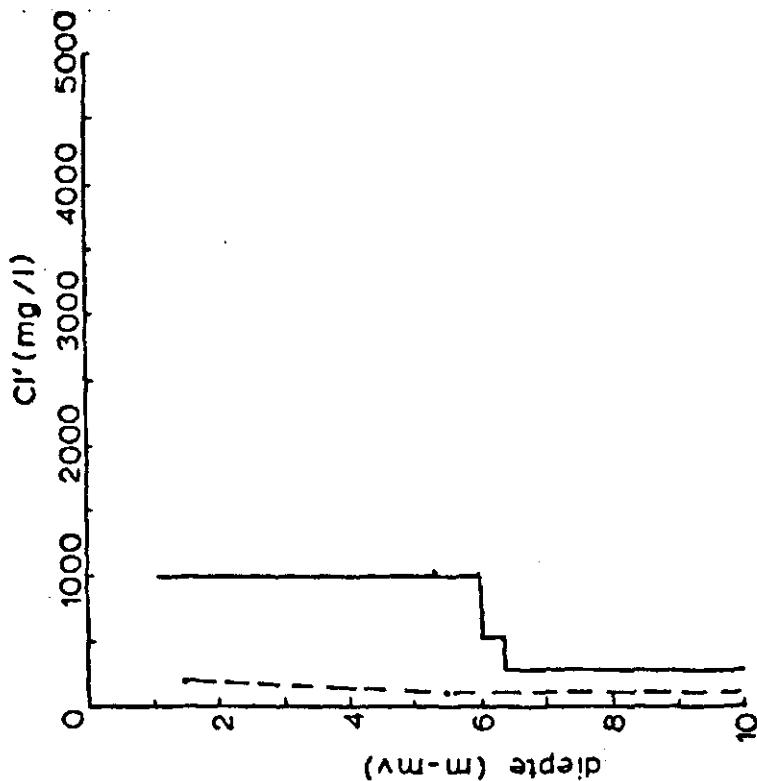
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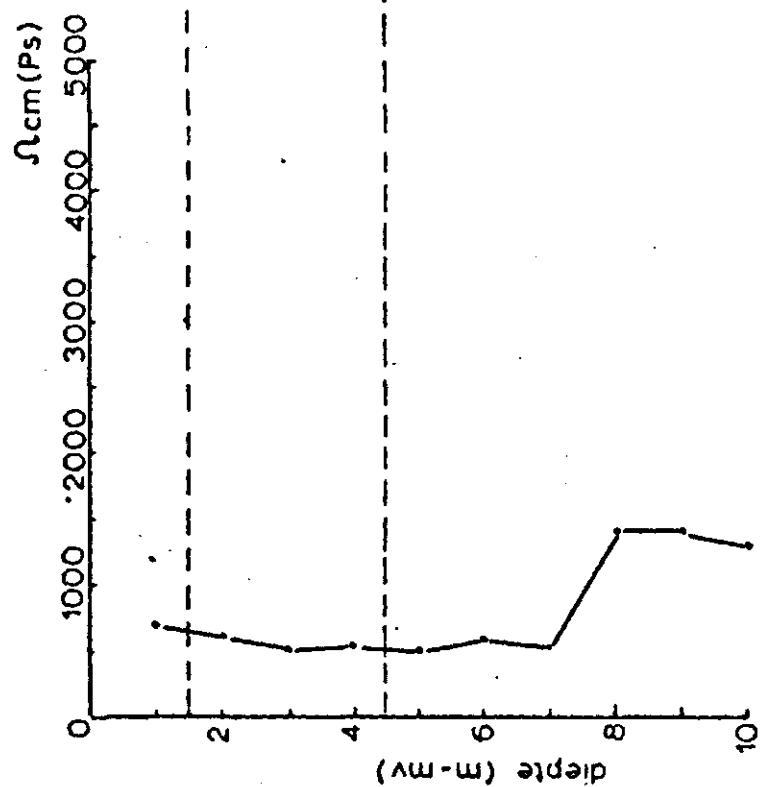
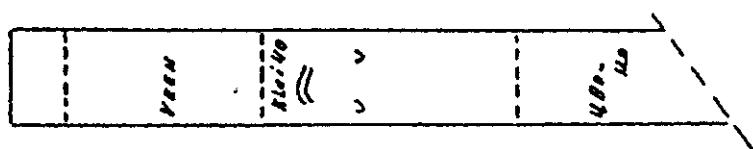
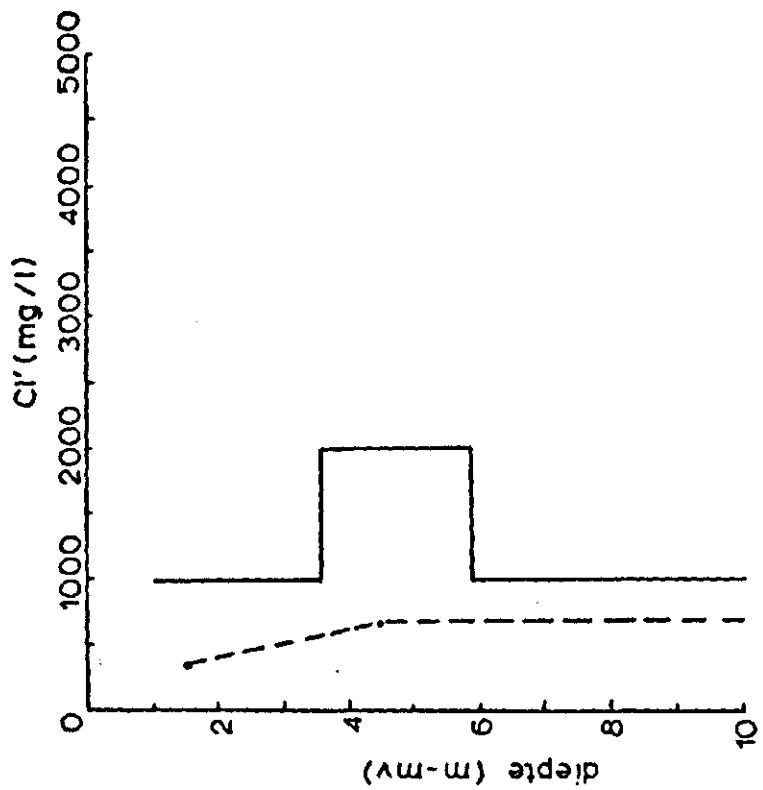
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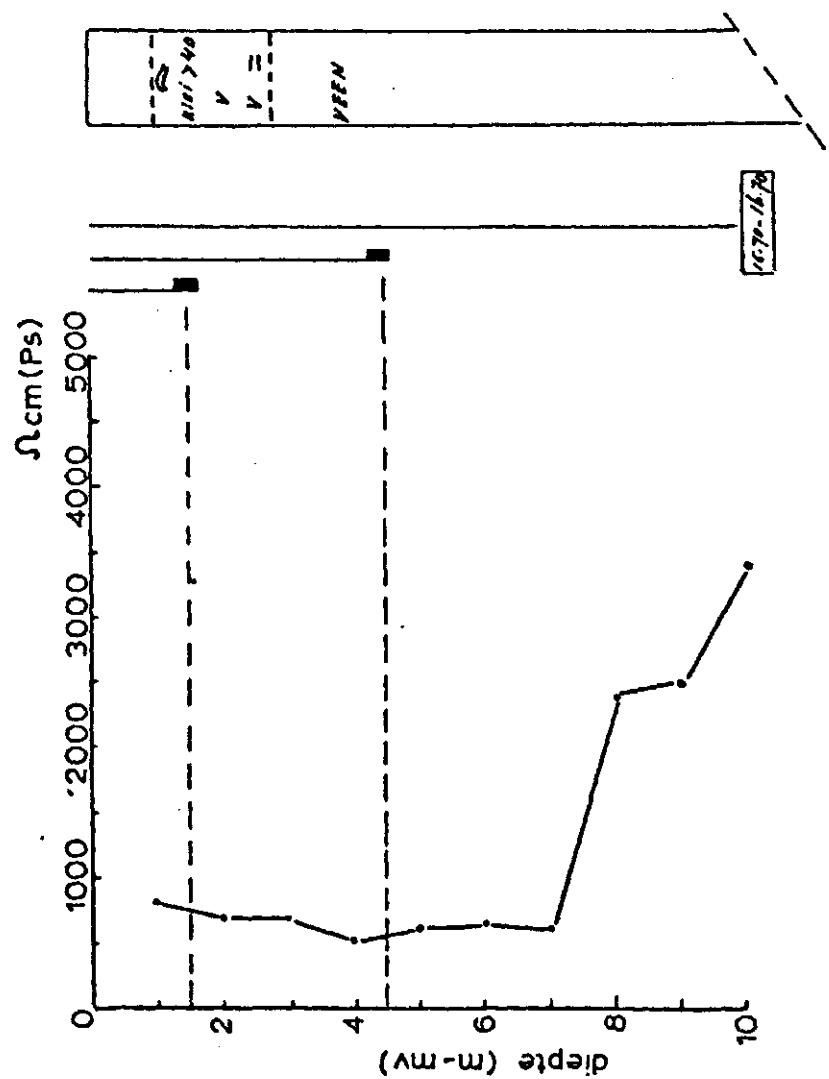
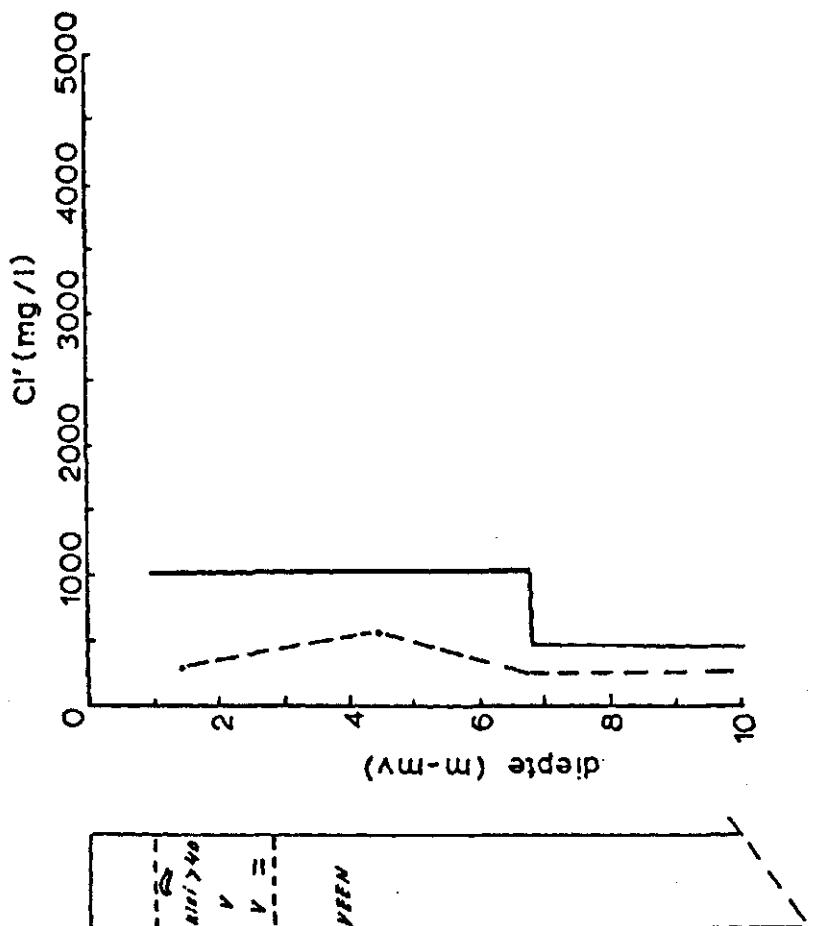
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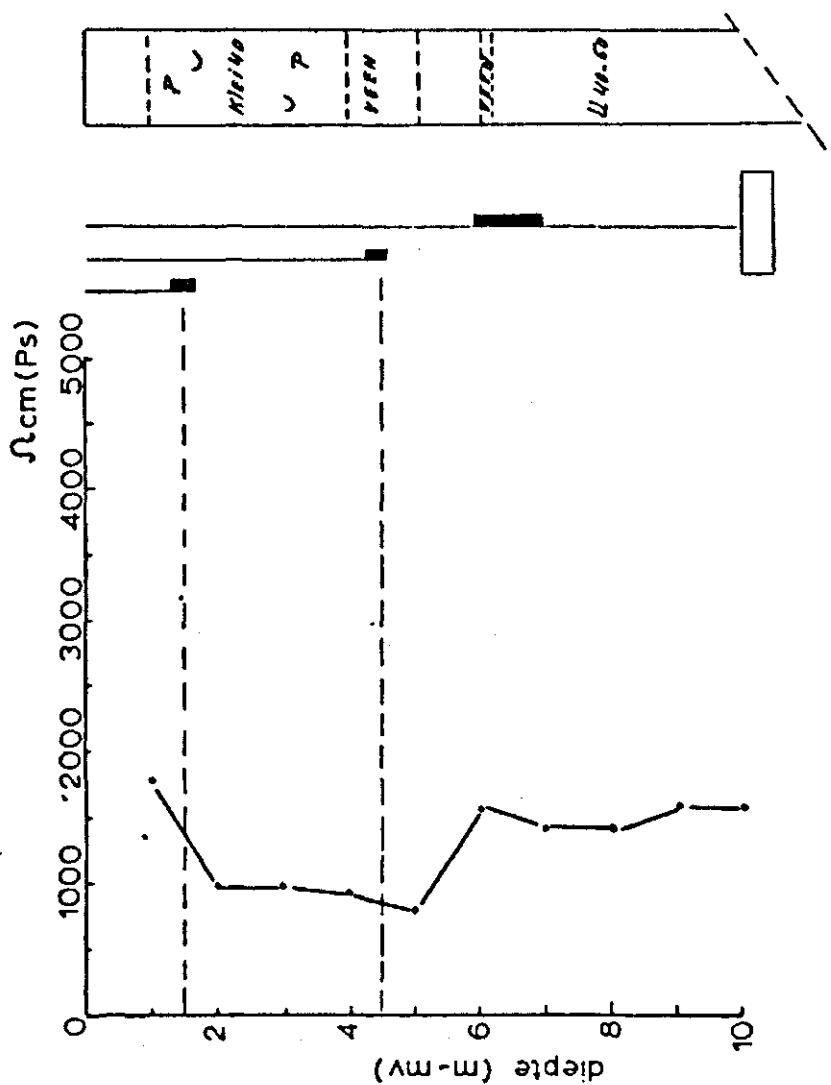
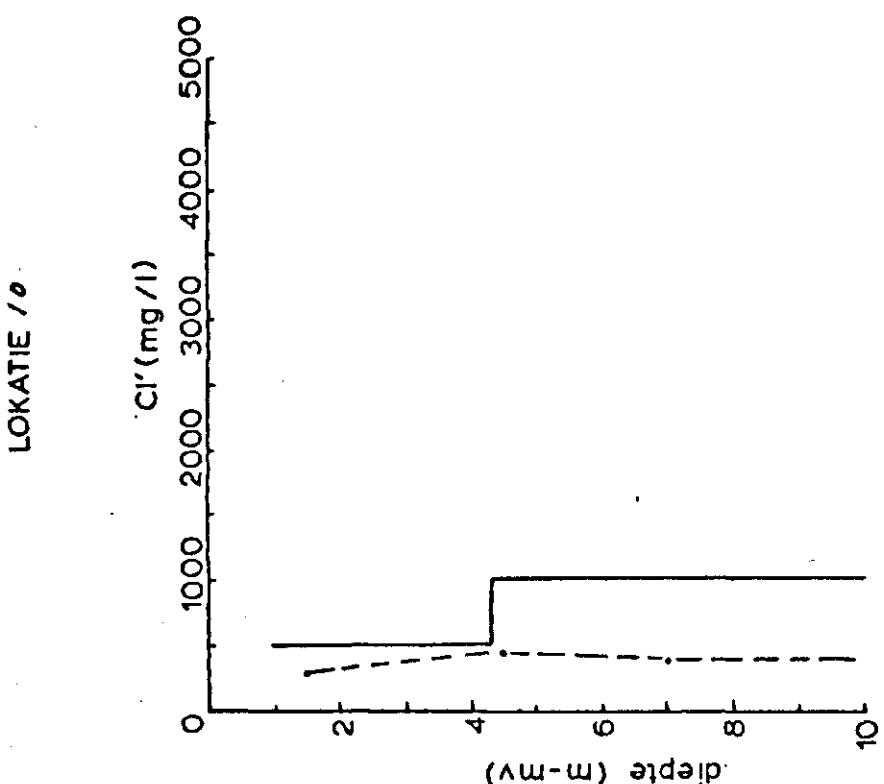


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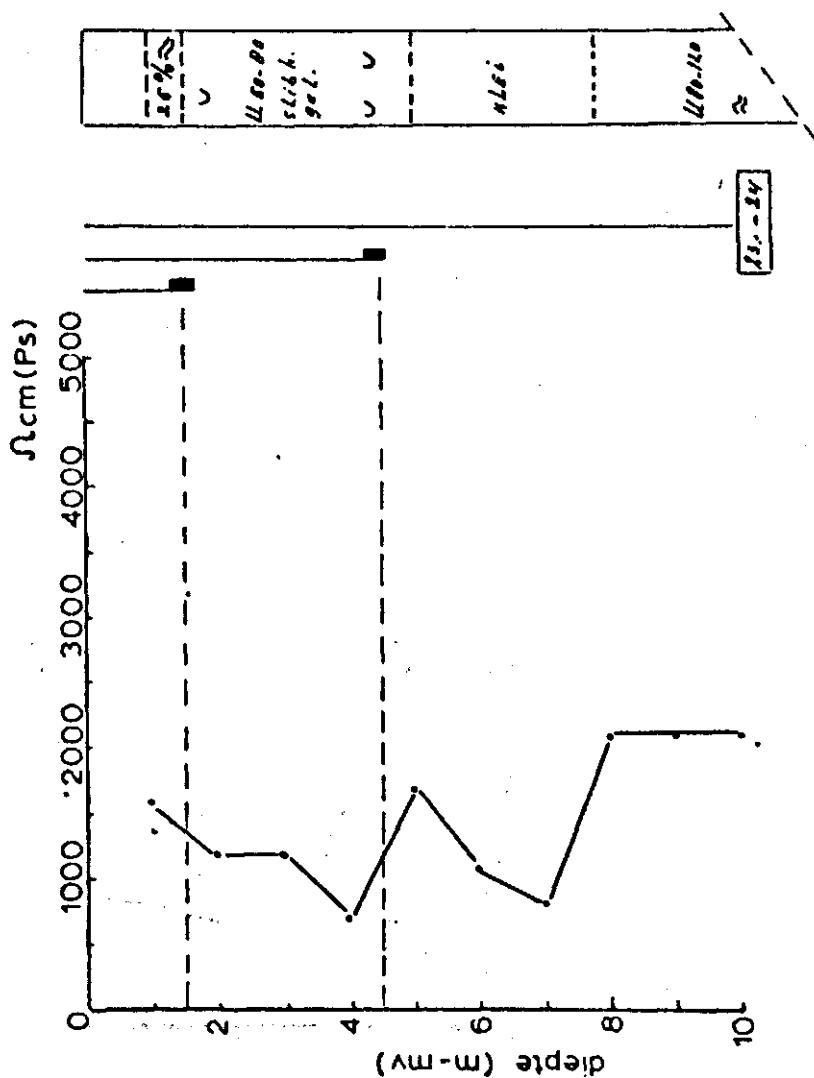
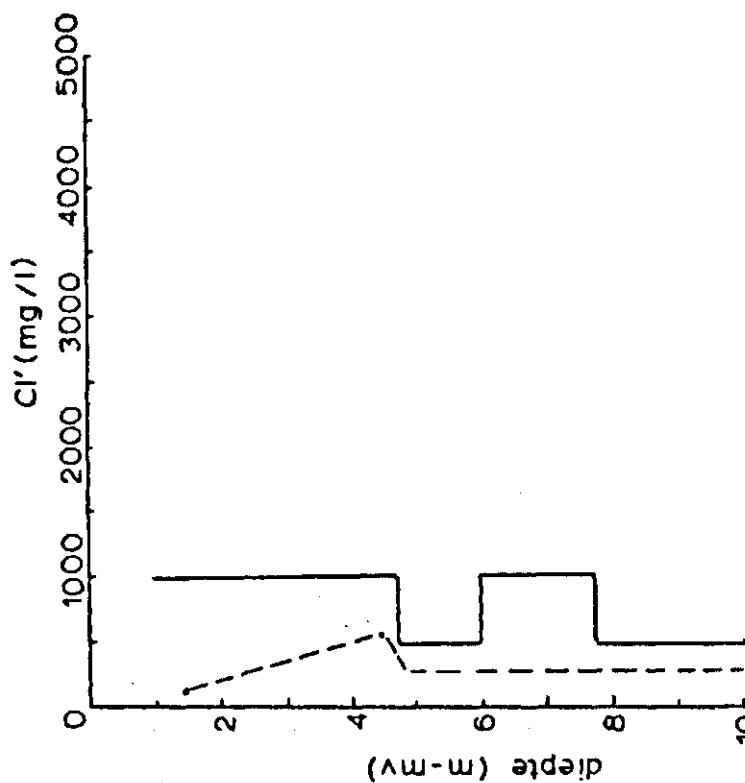


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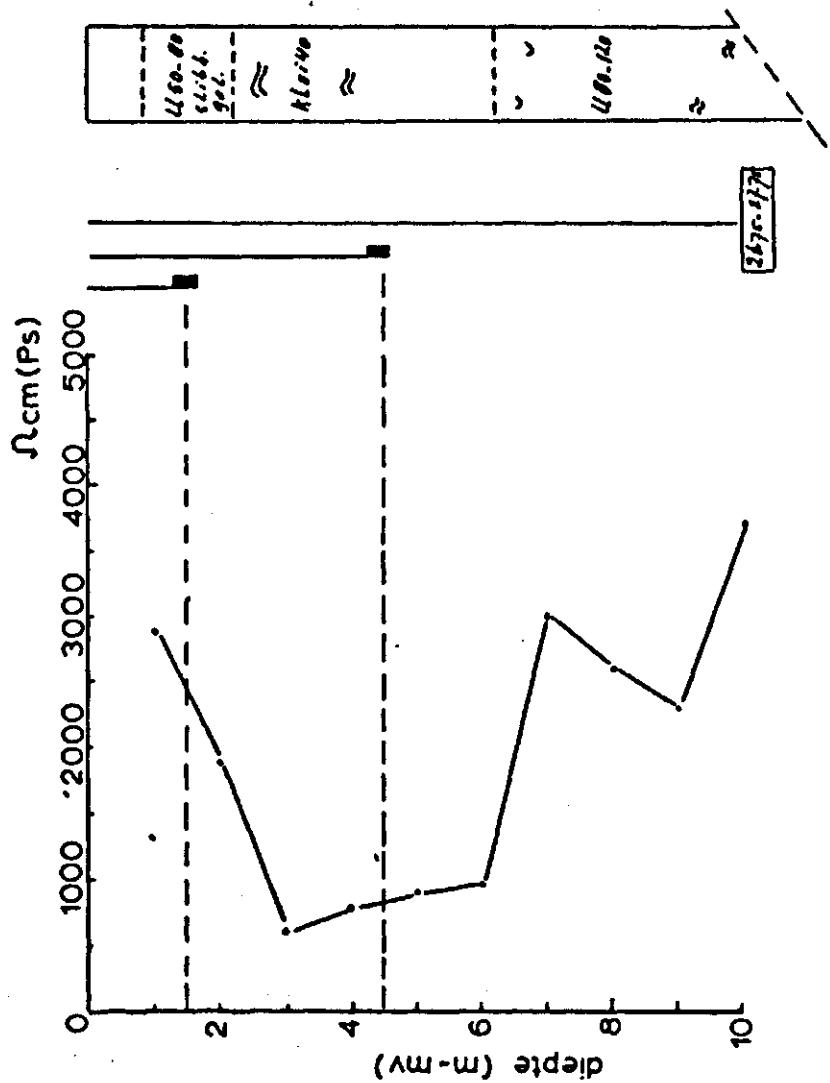
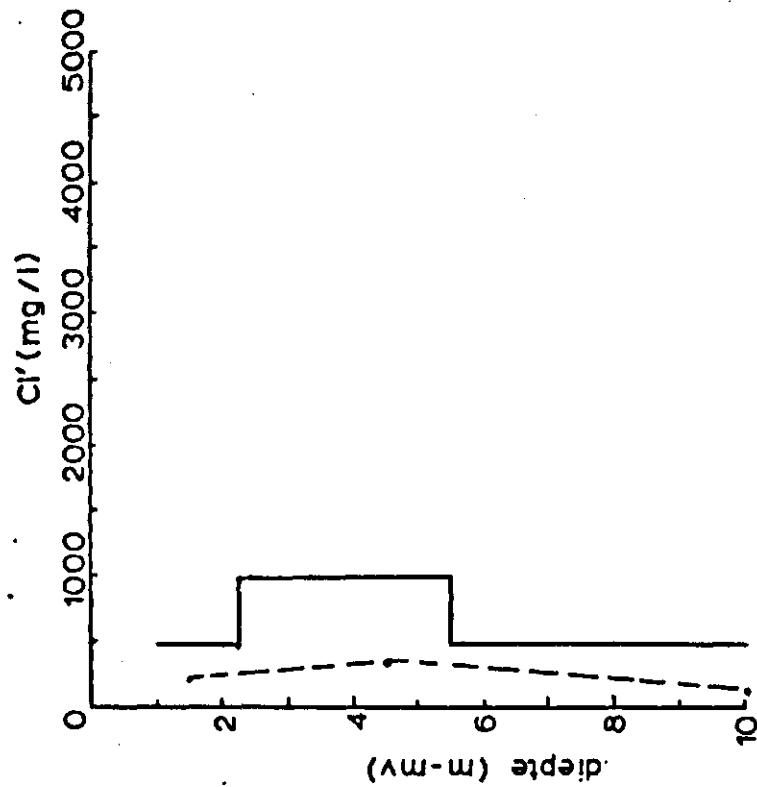




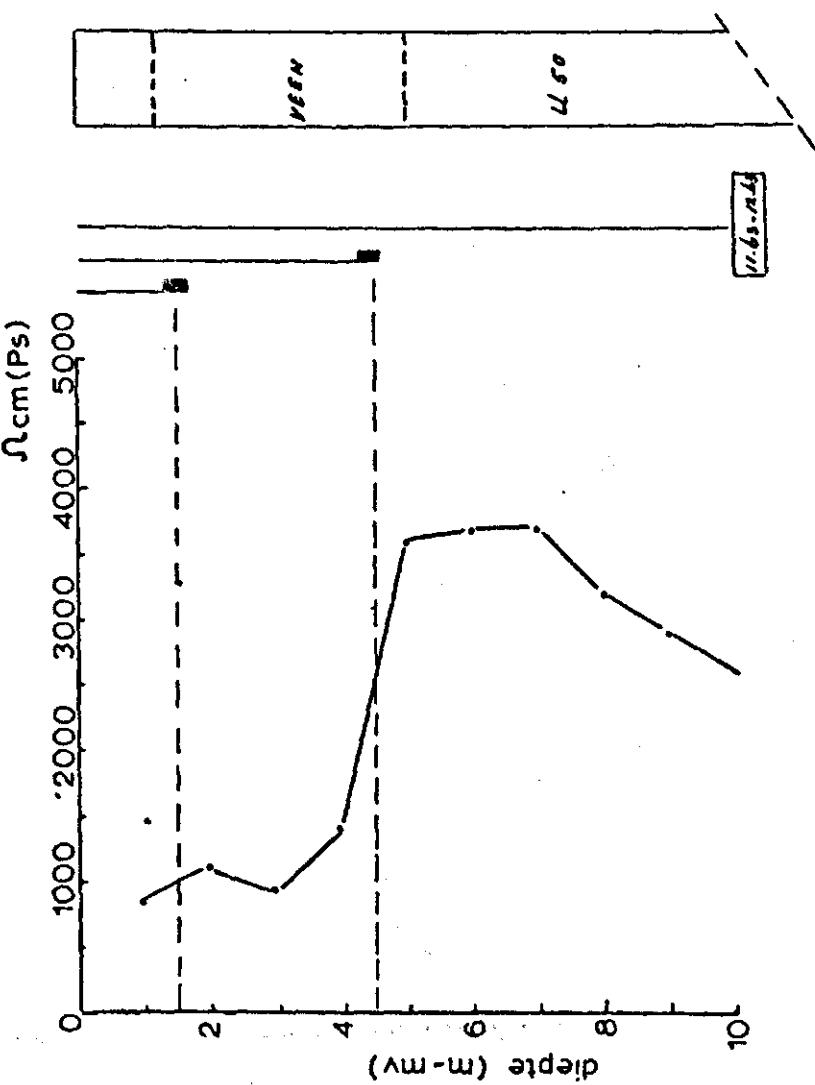
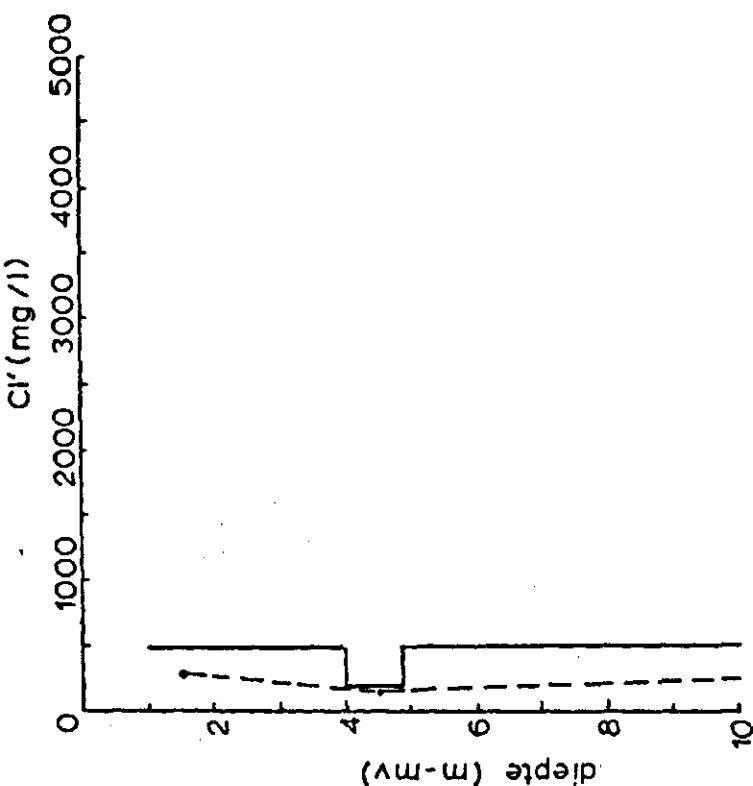
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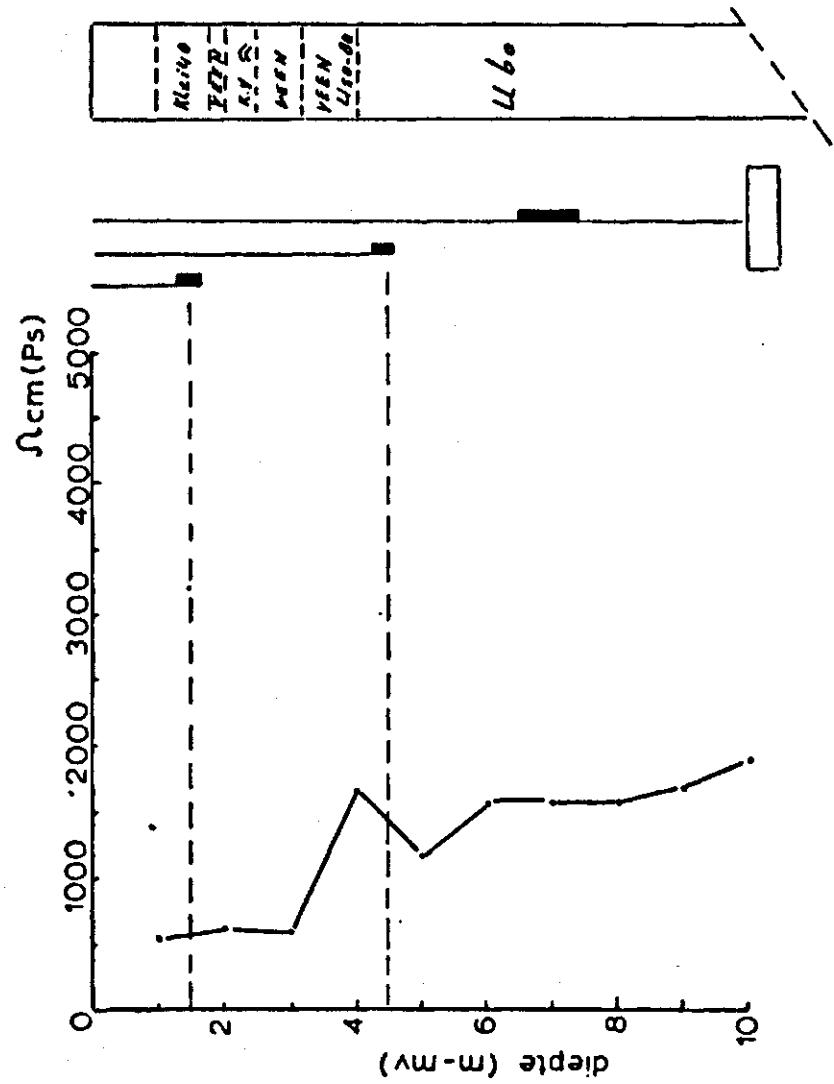
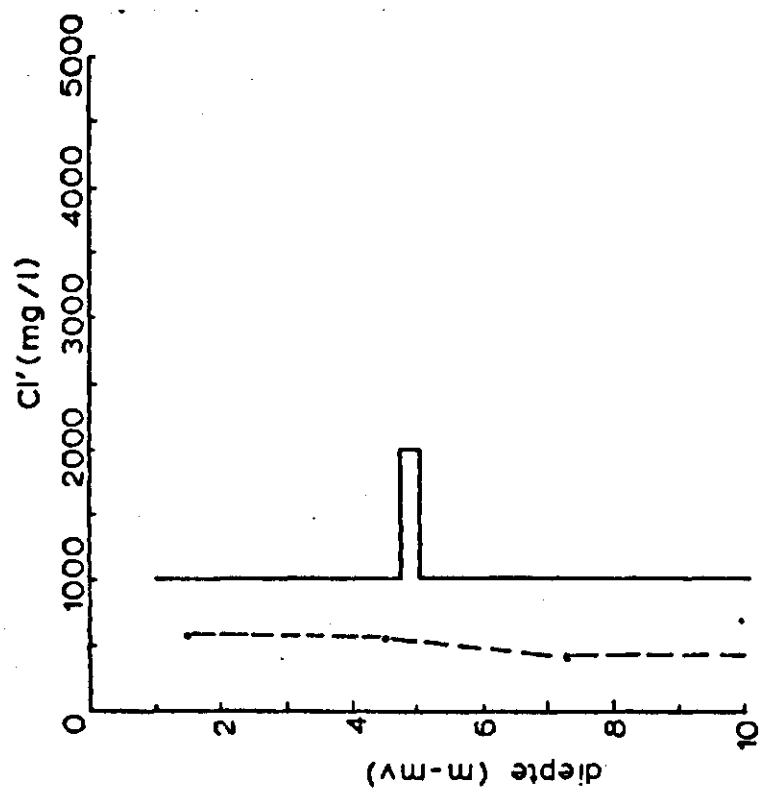
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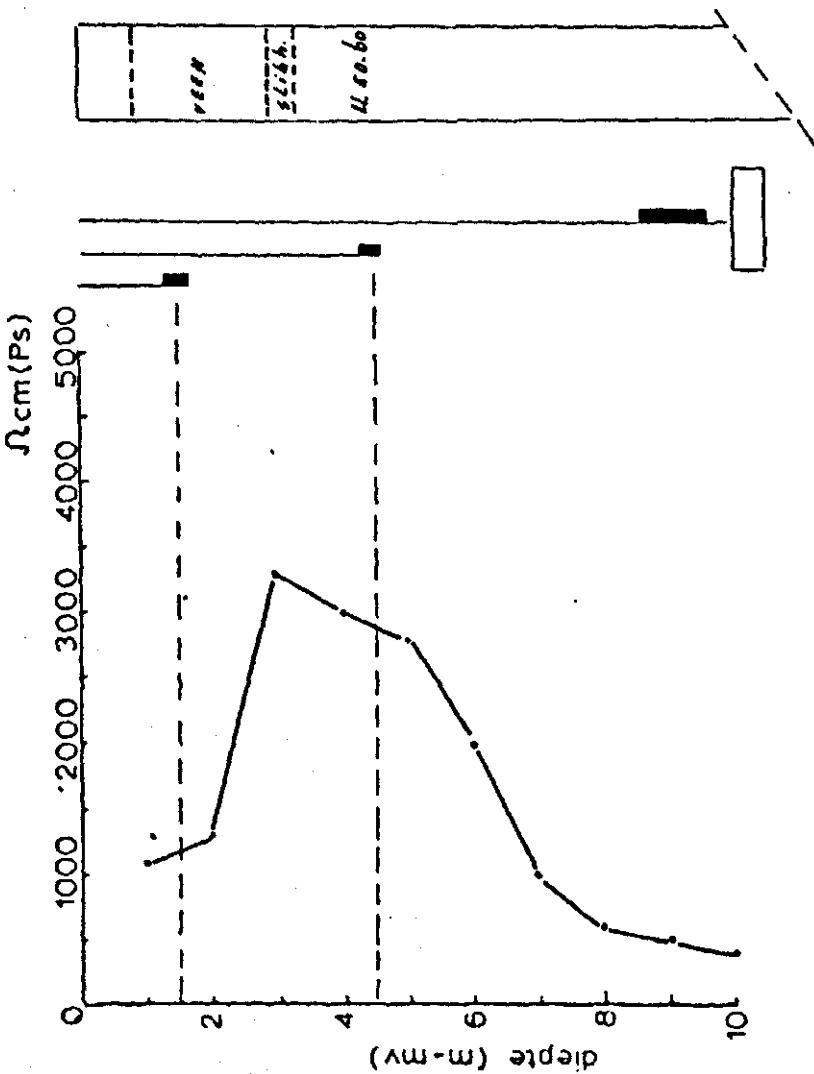
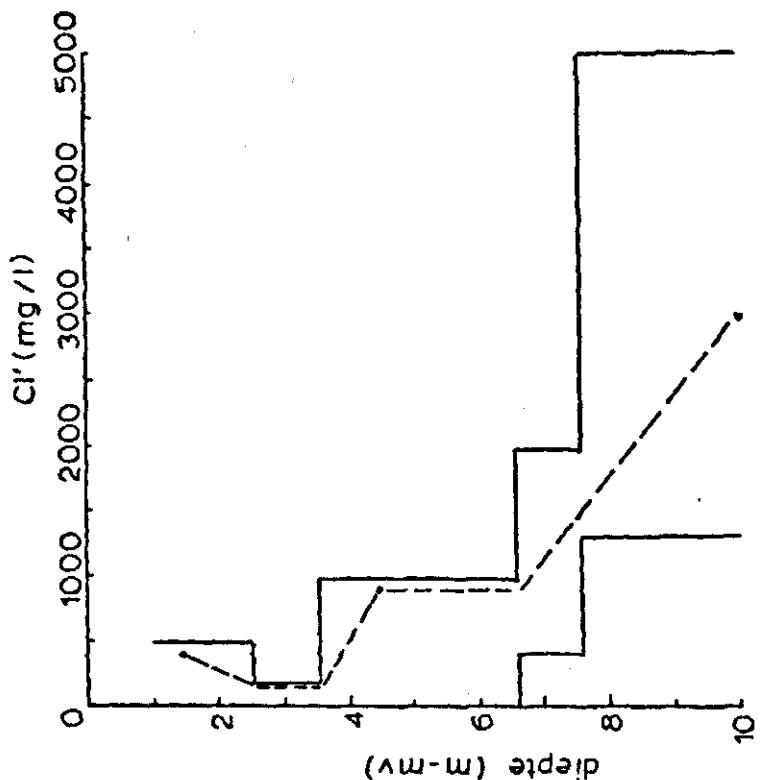
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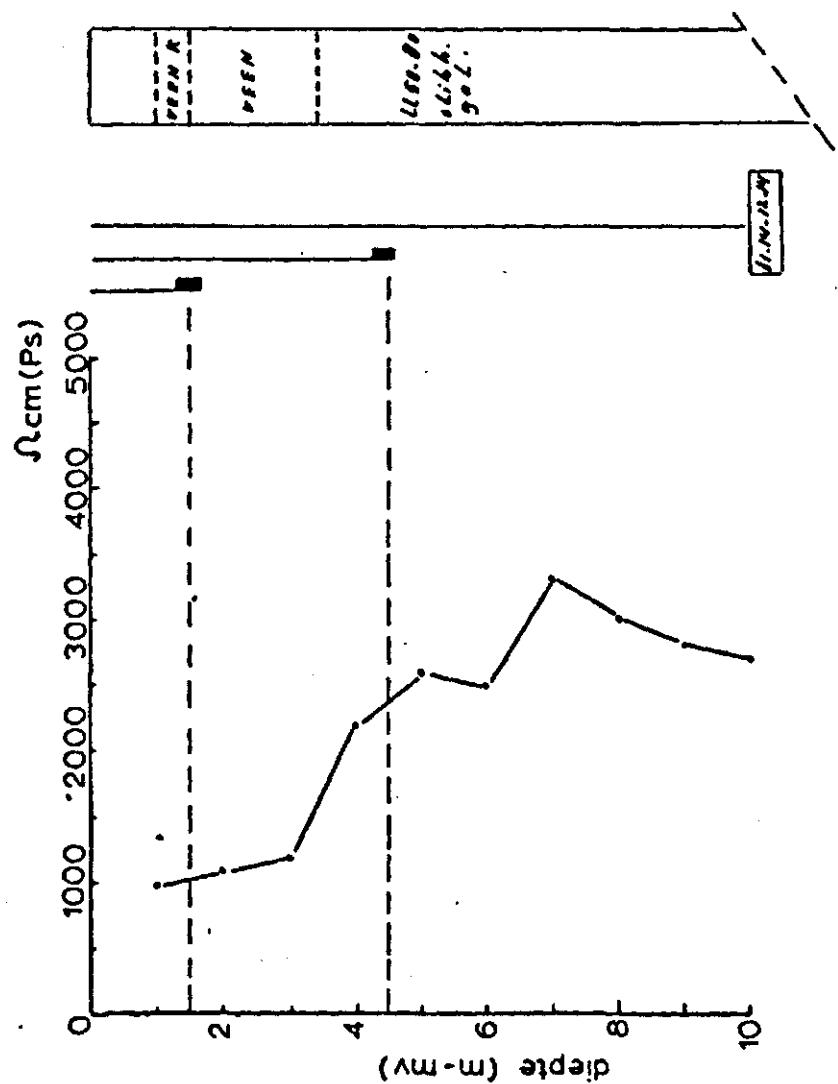
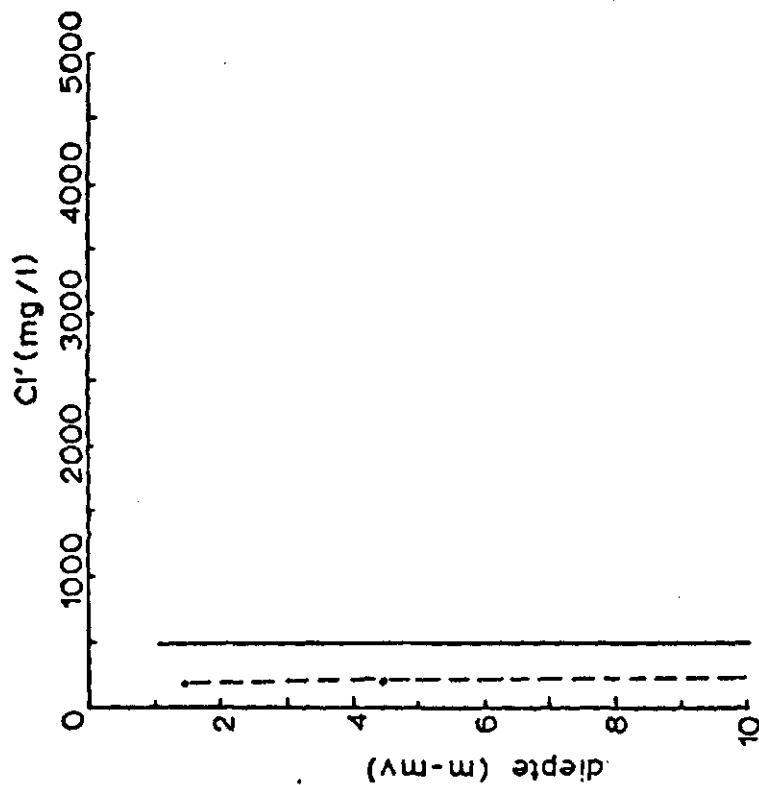
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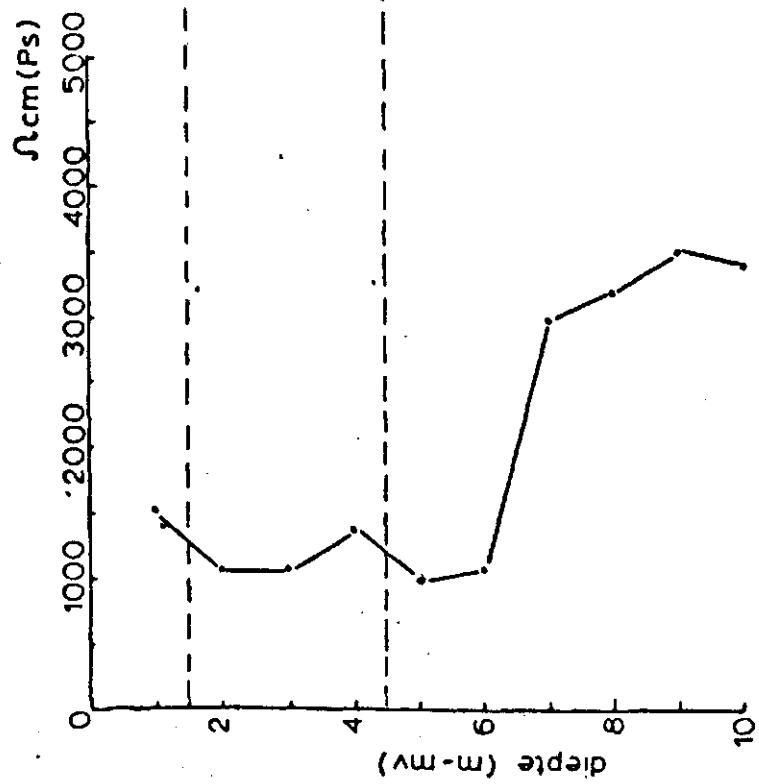
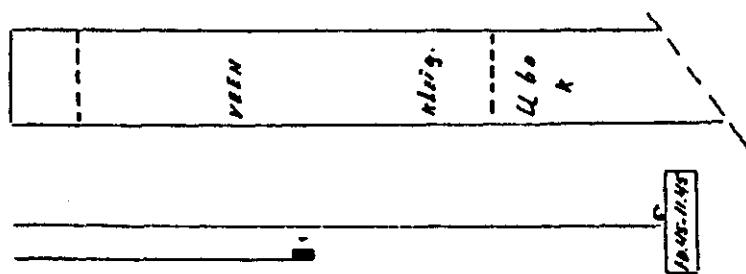
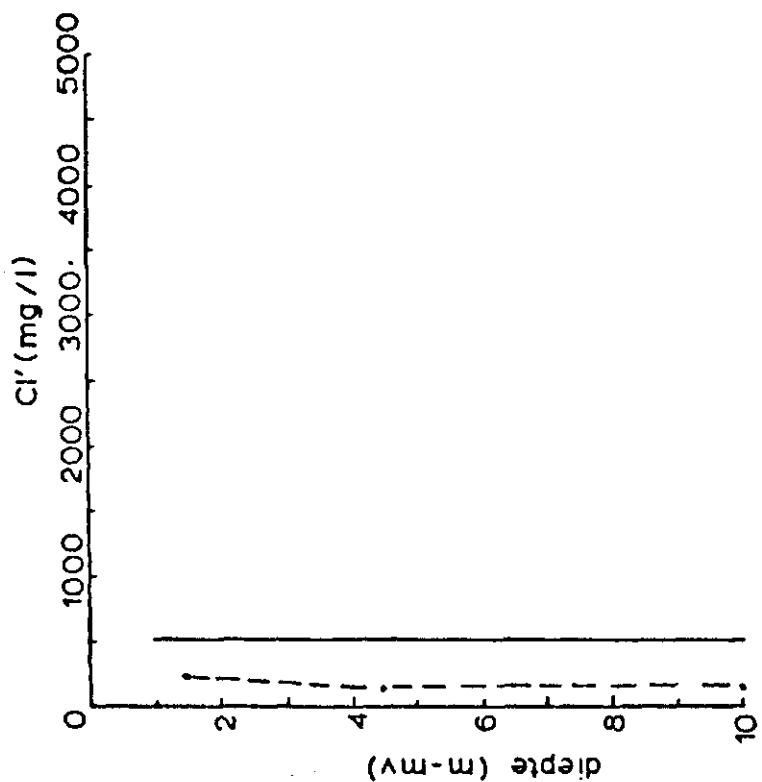
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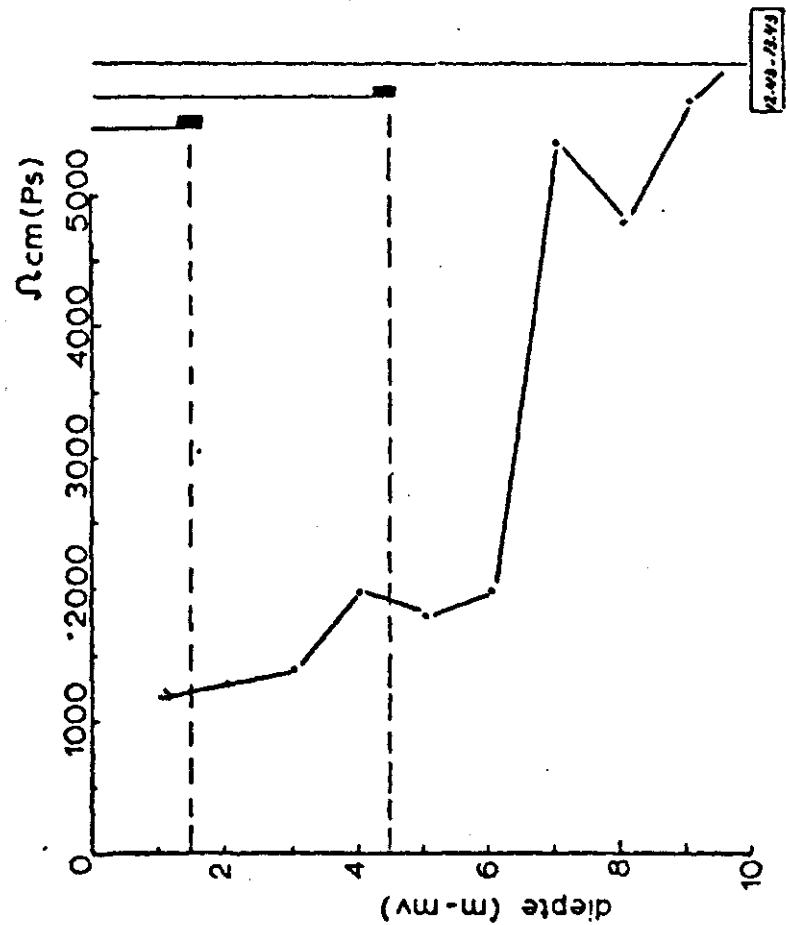
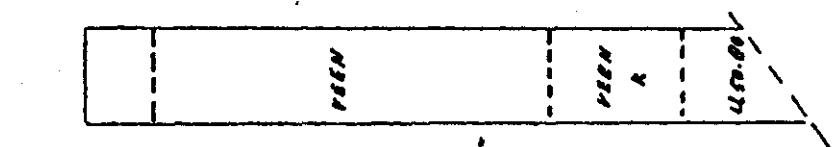
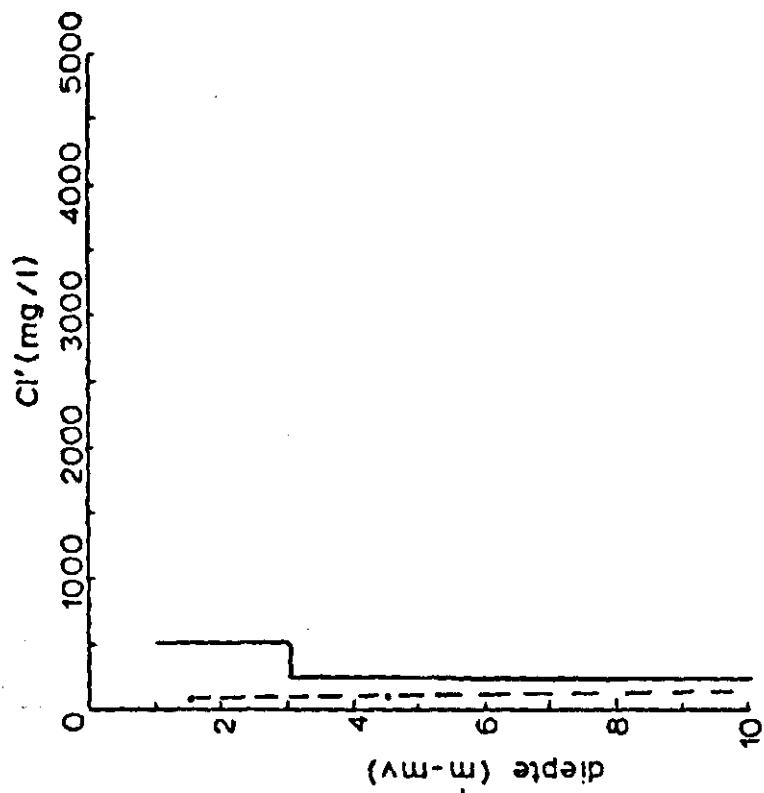
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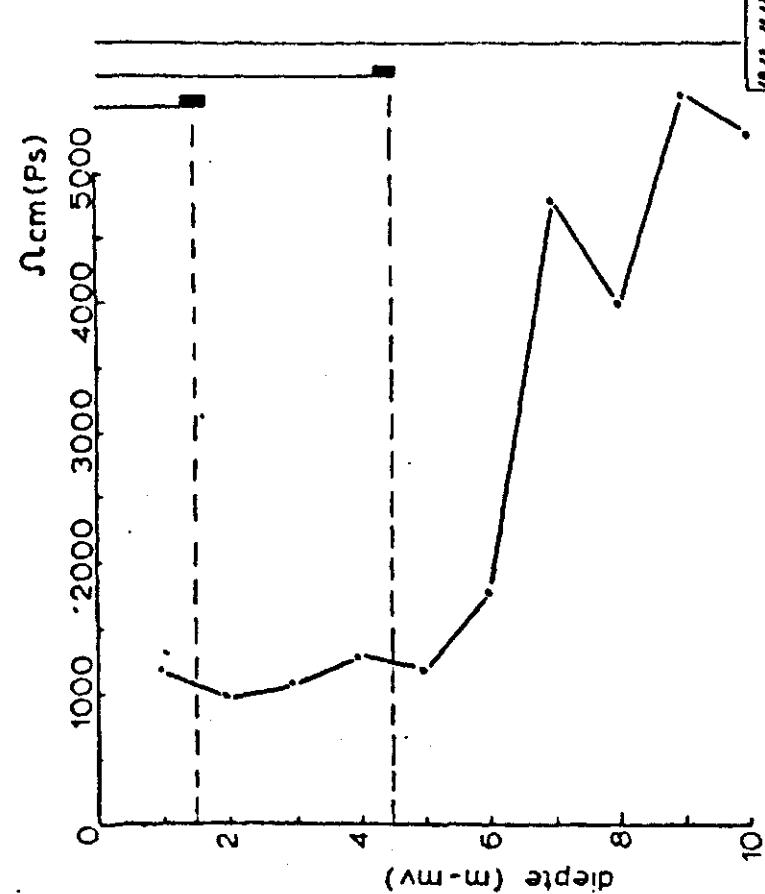
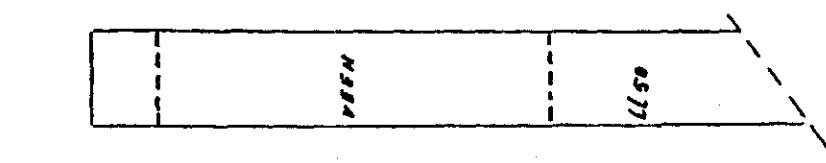
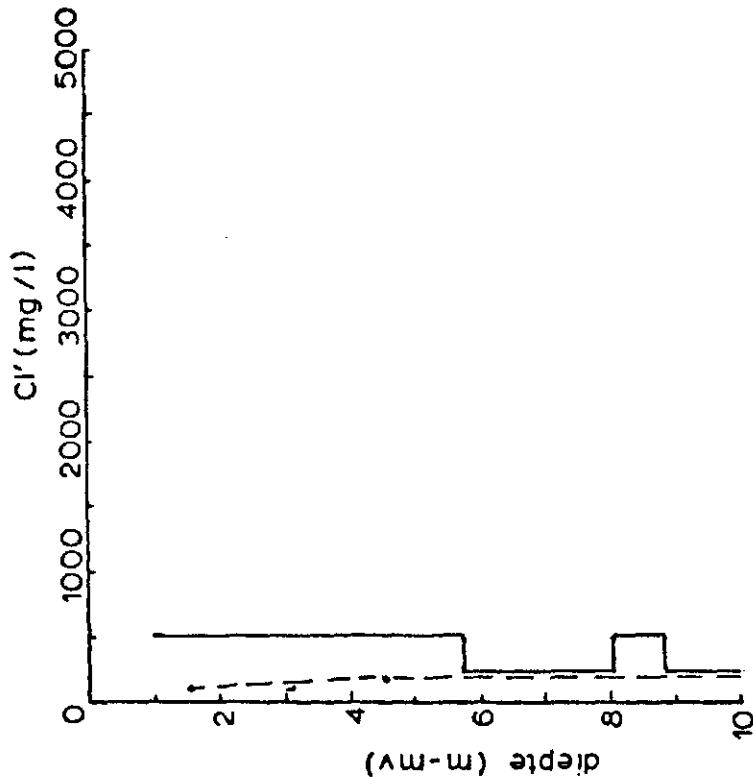
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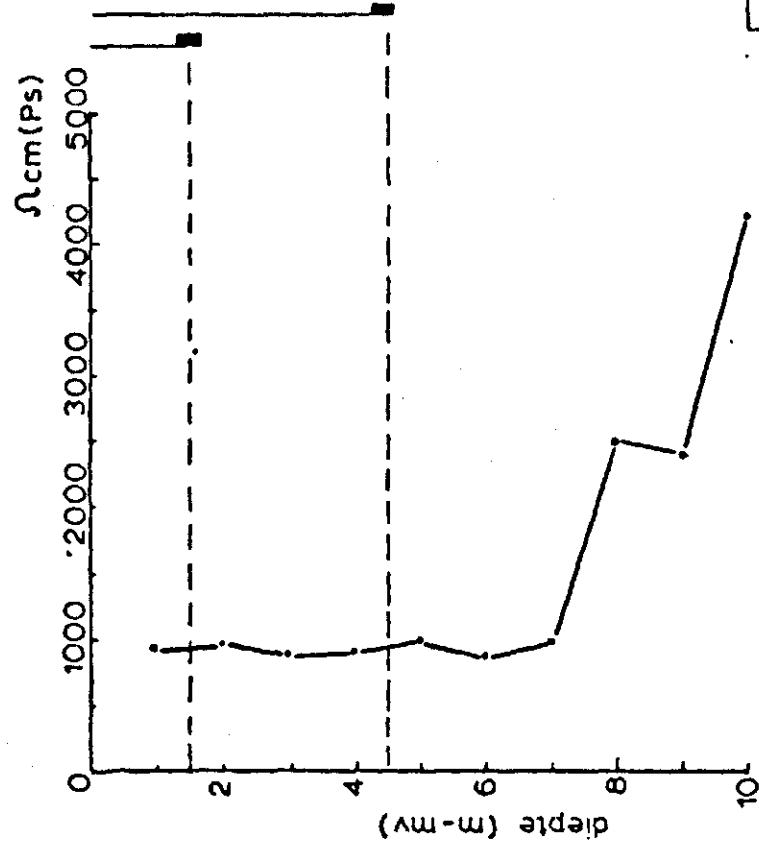
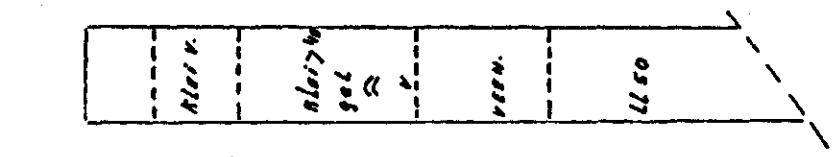
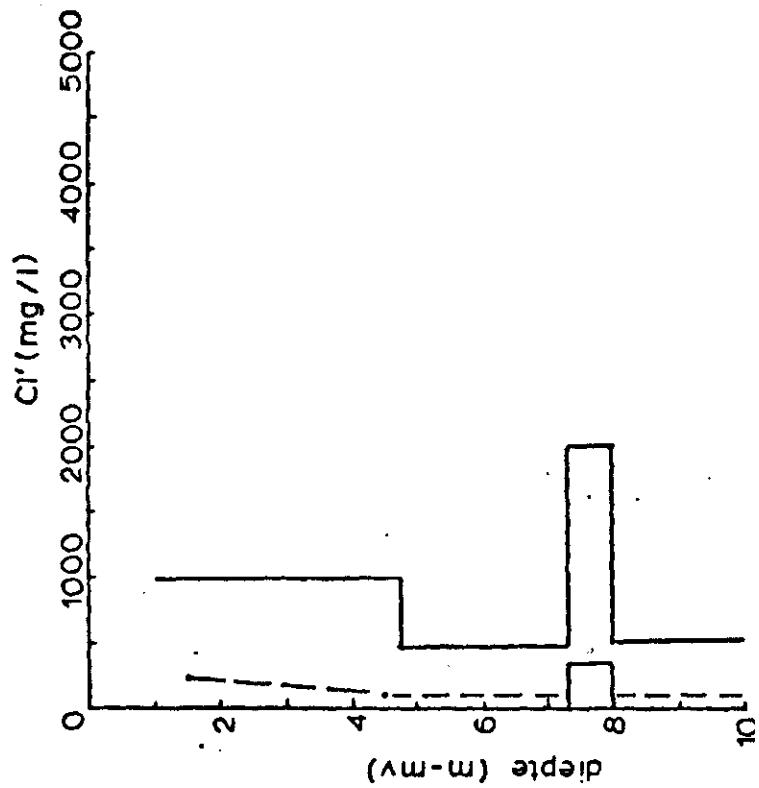
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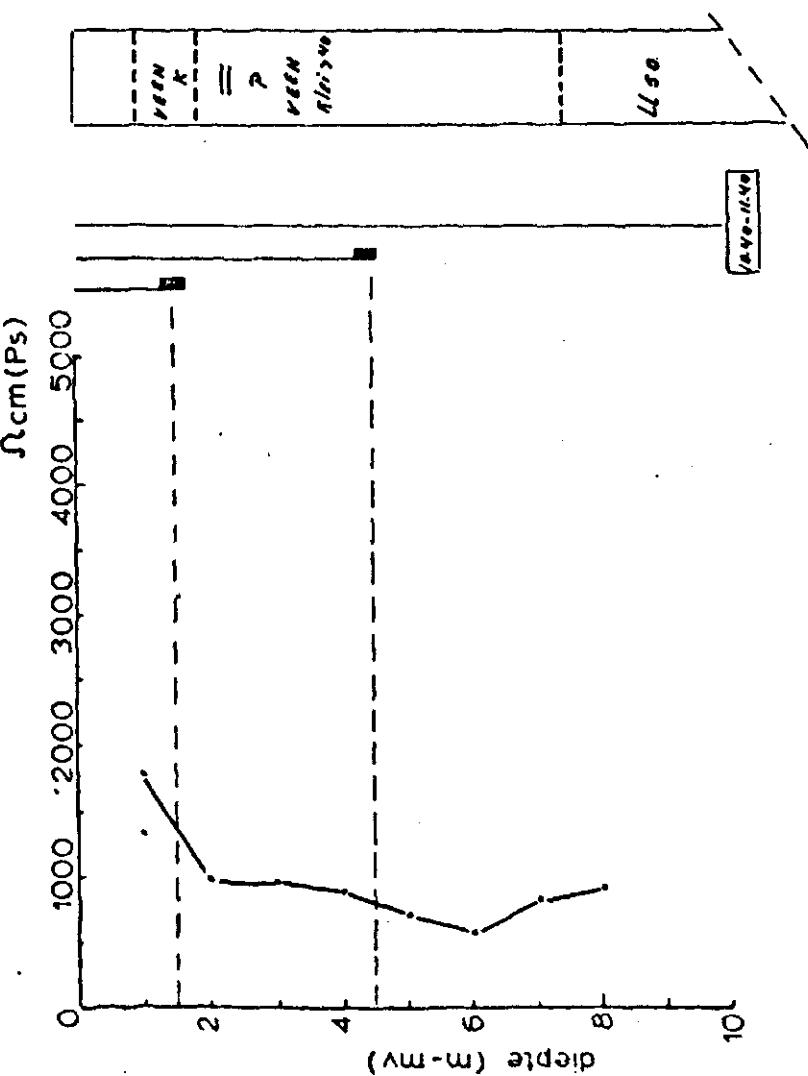
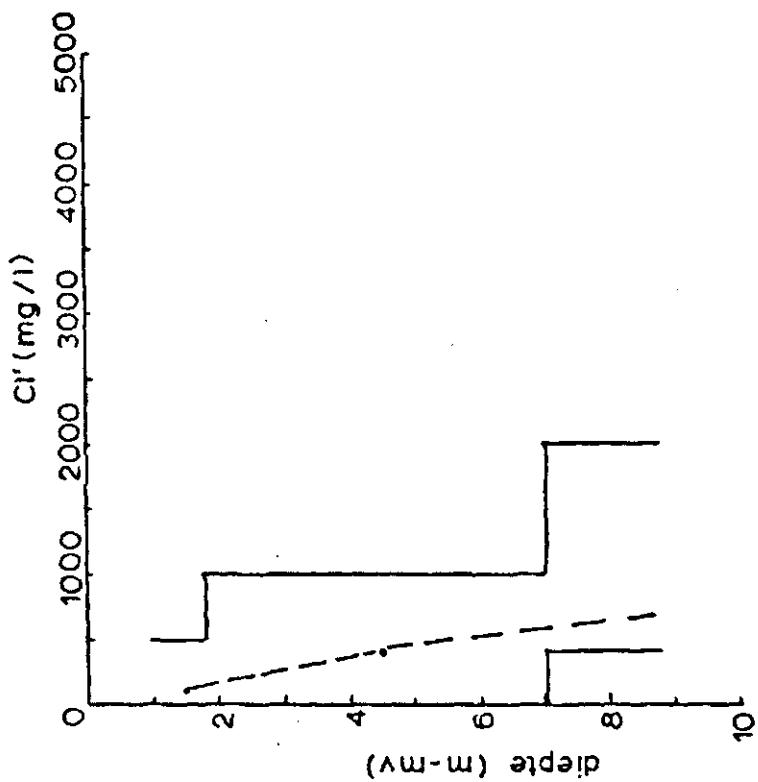
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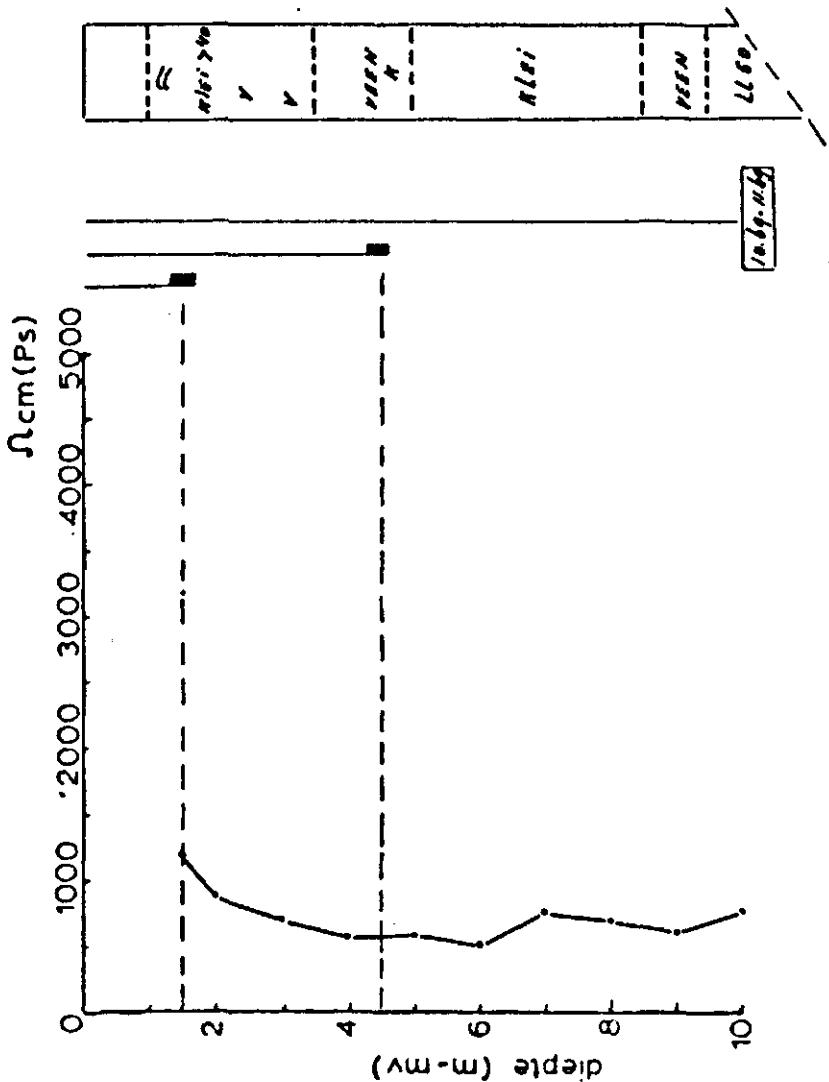
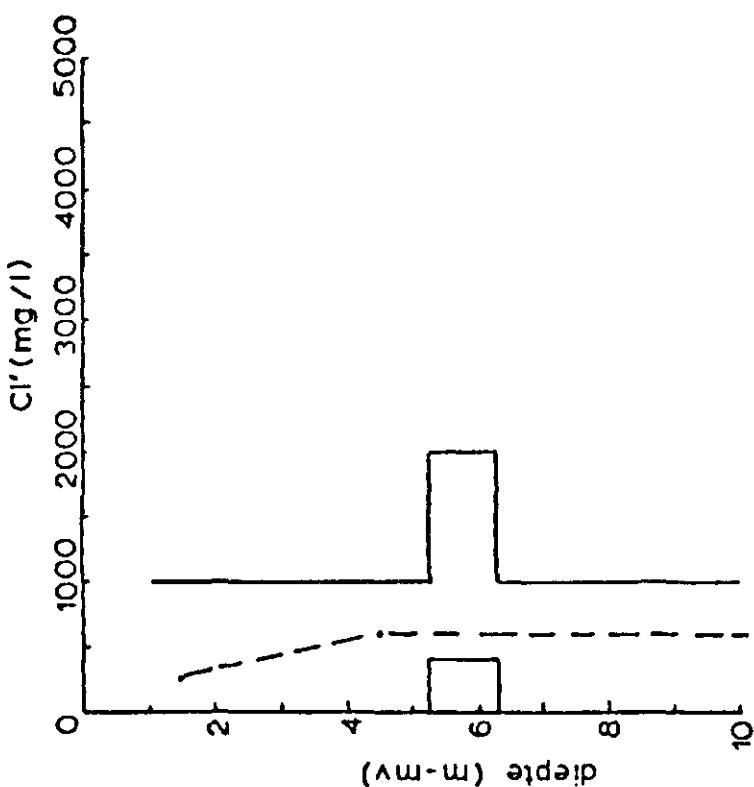
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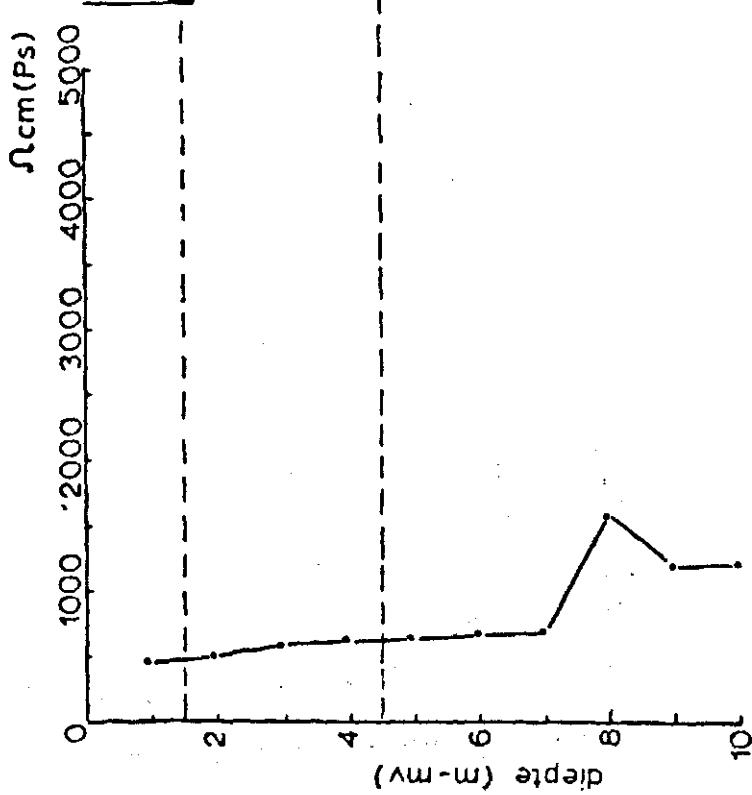
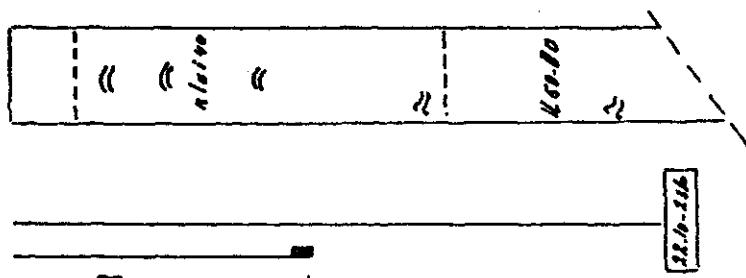
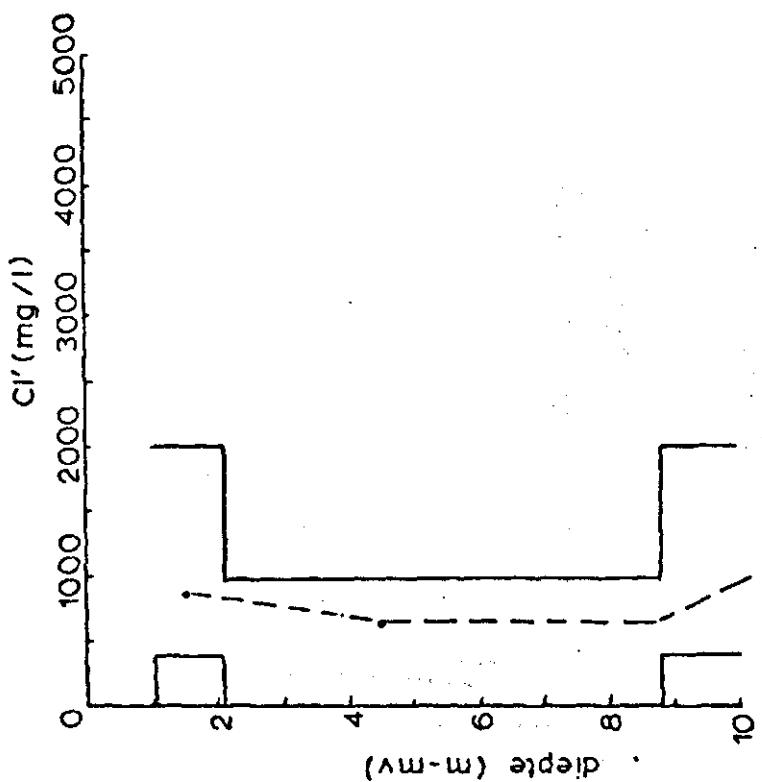
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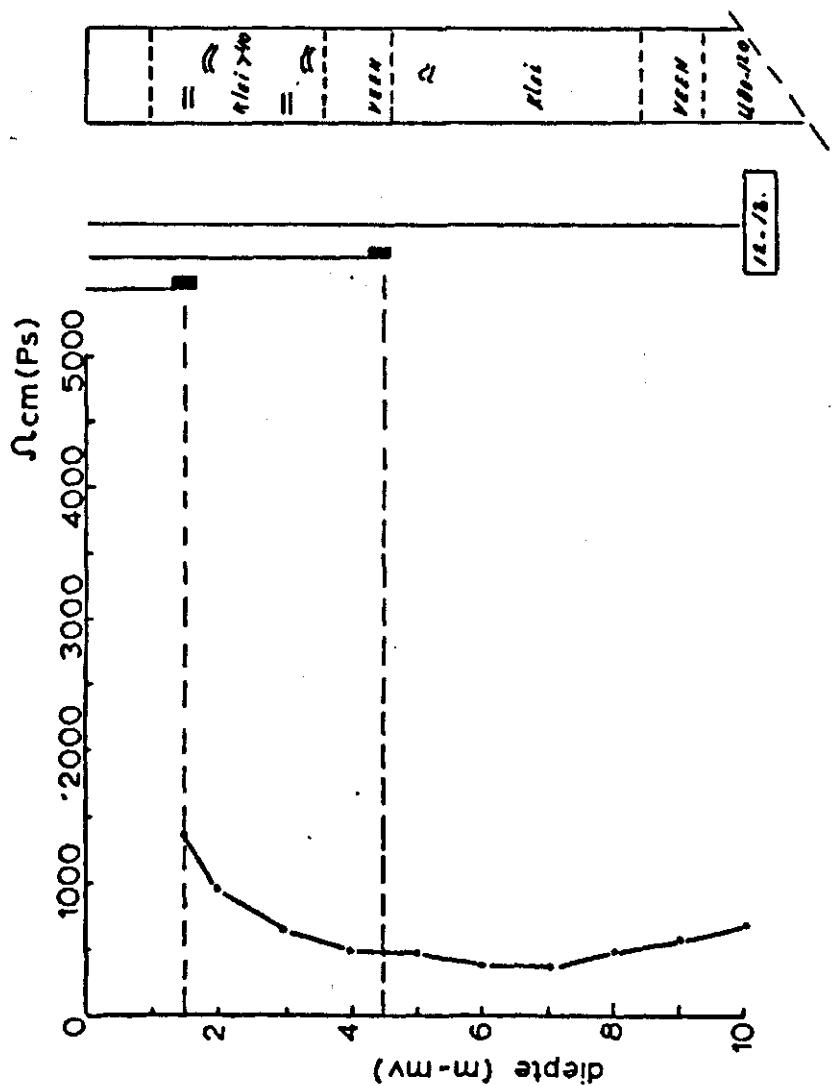
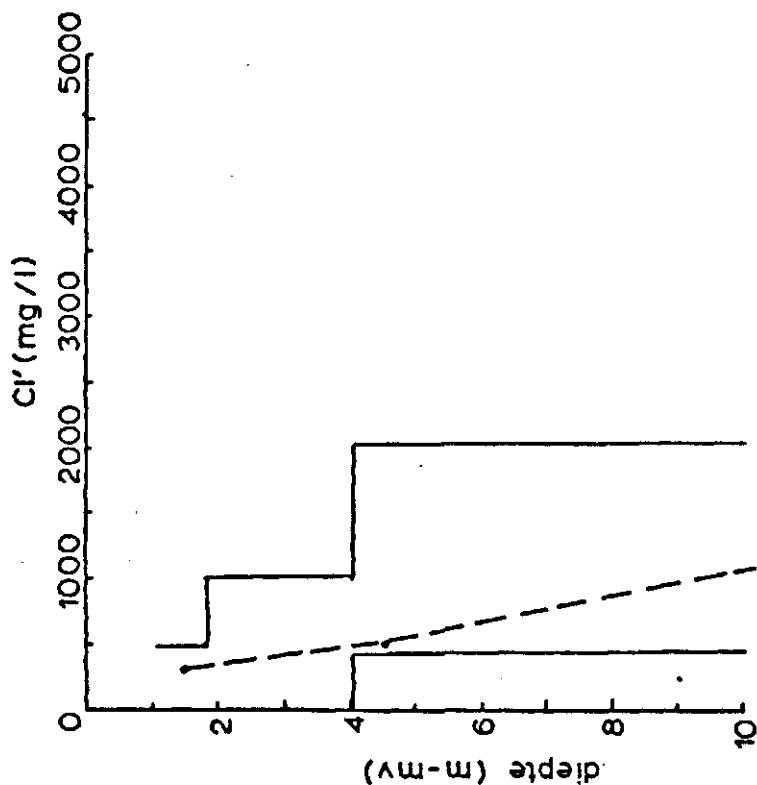
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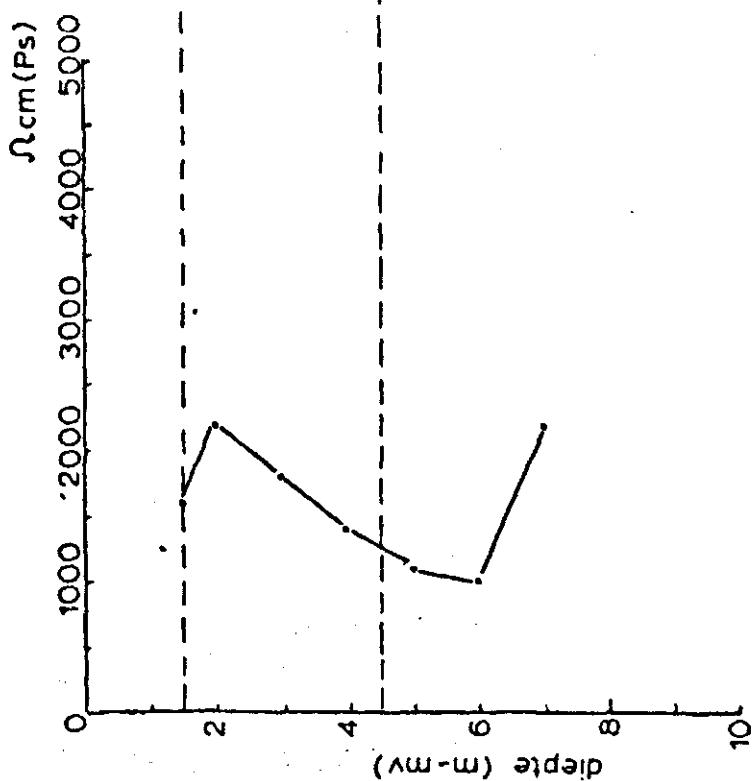
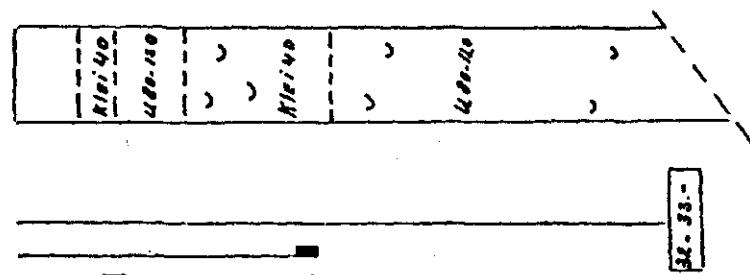
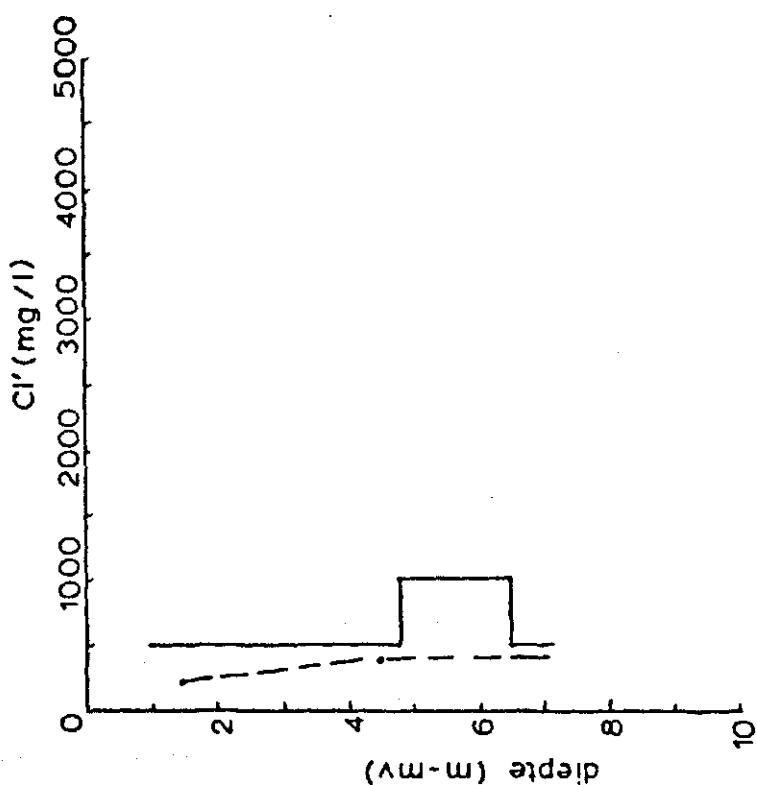
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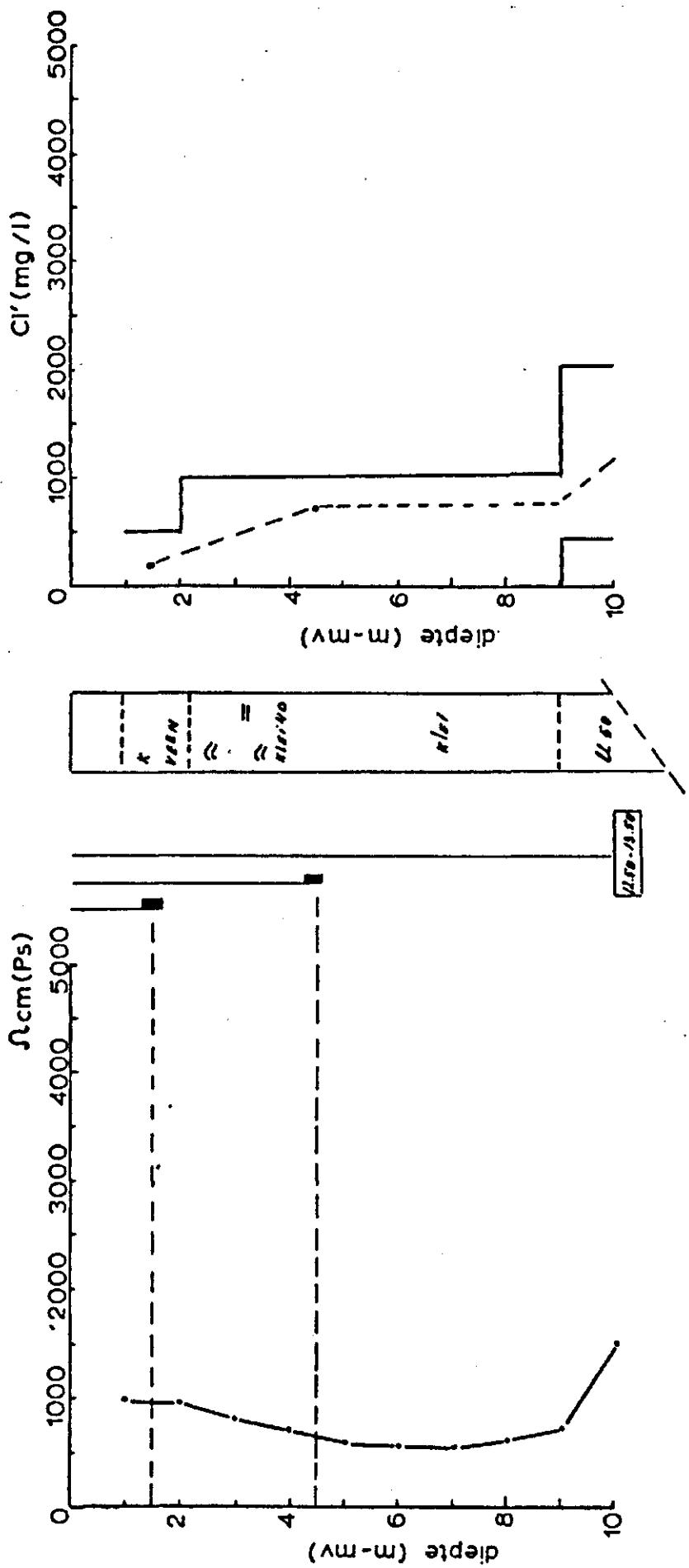
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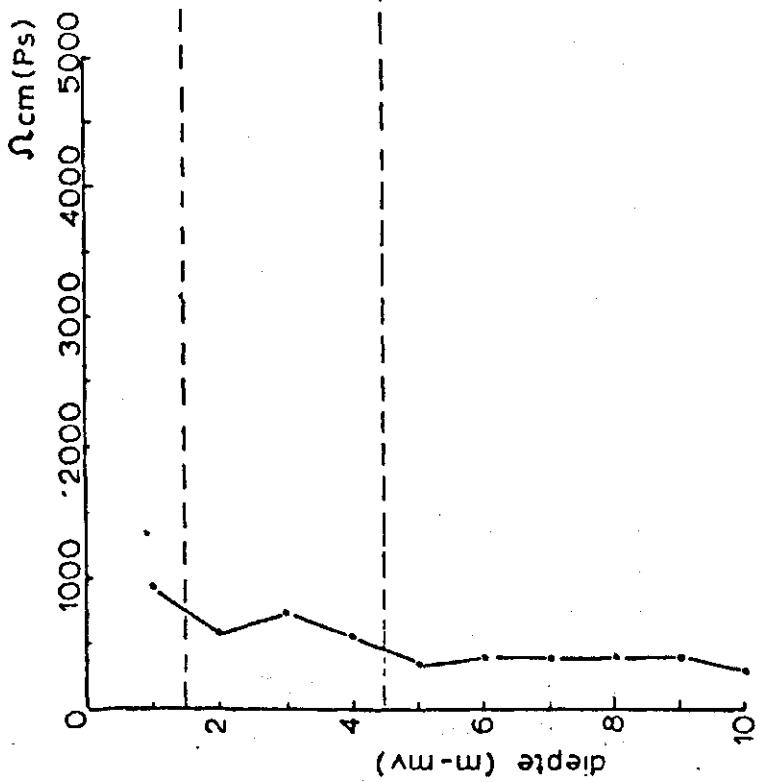
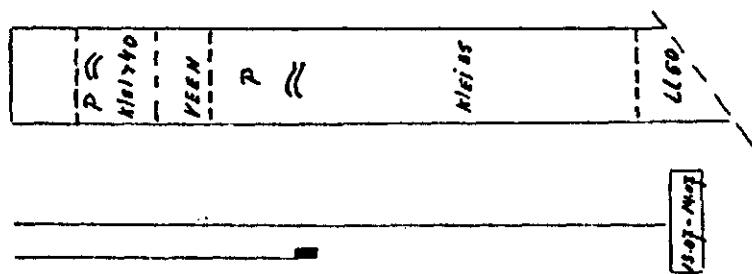
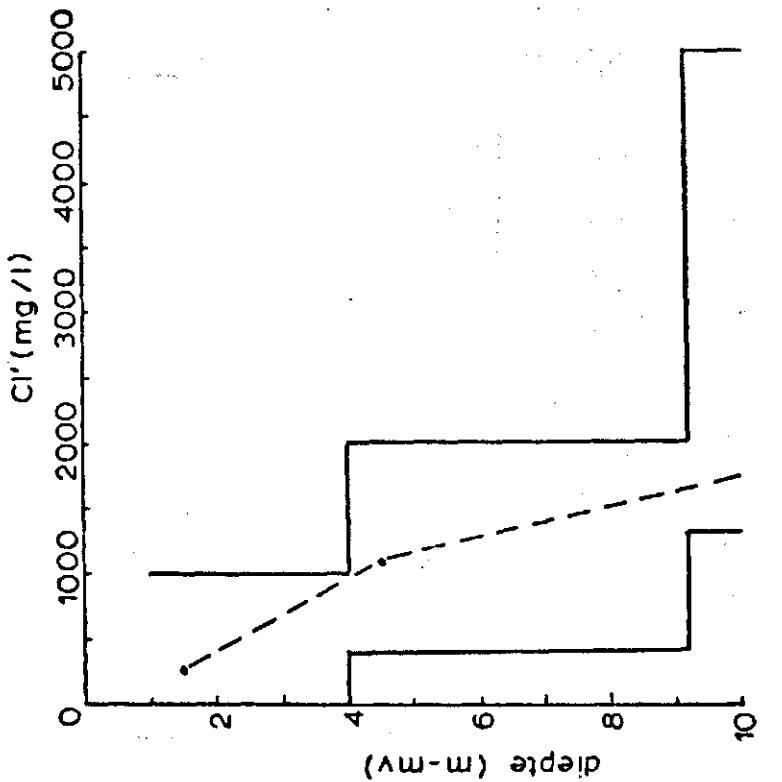
LOKATIE 26



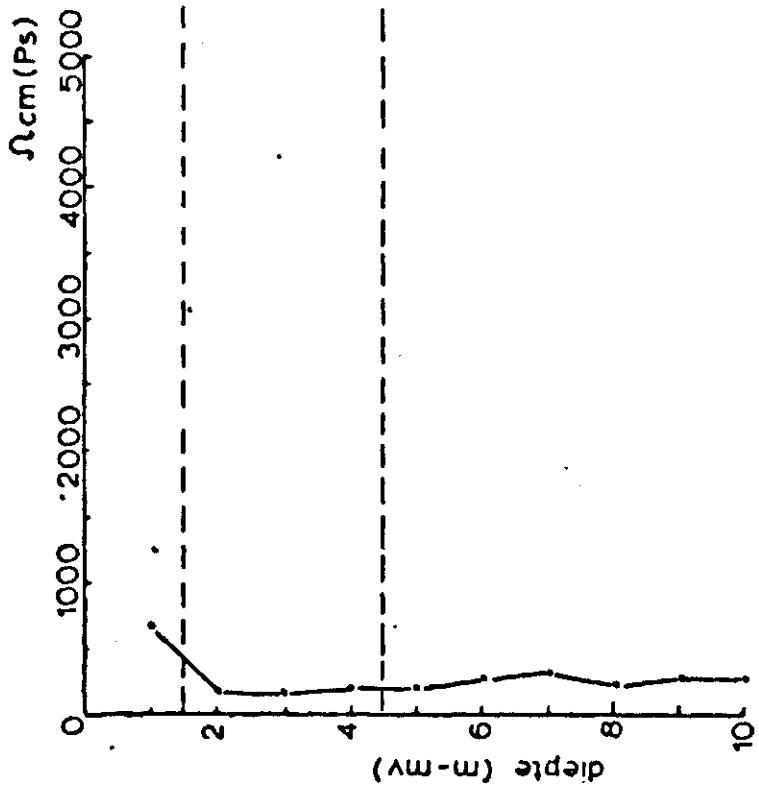
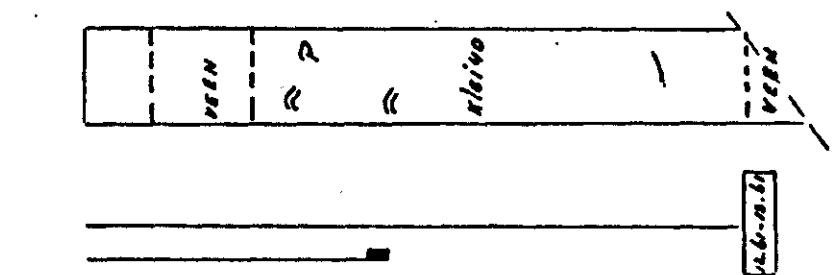
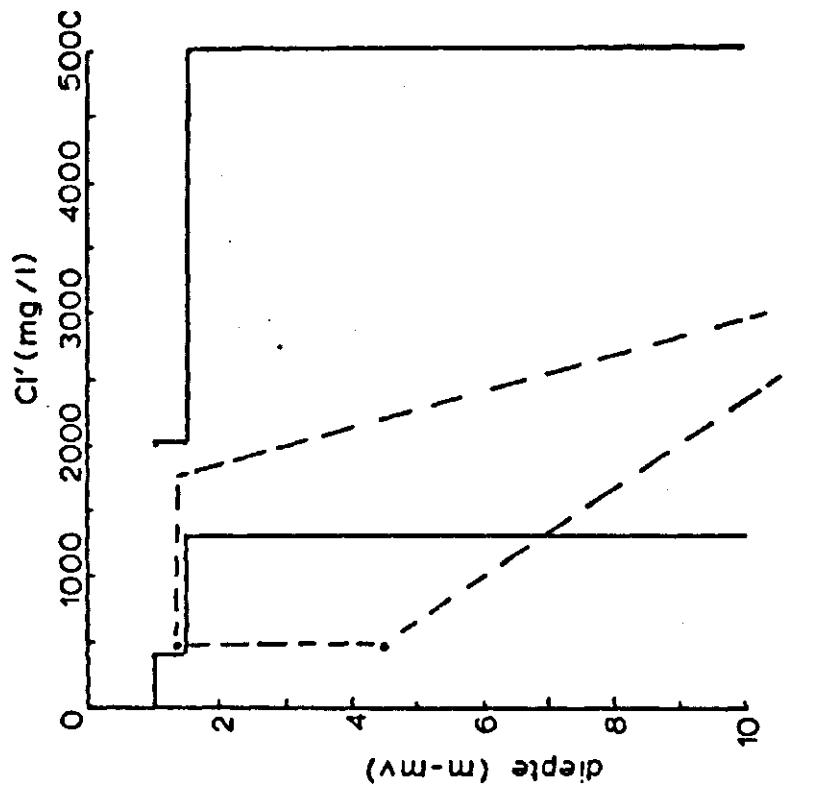
LOKATIE 26



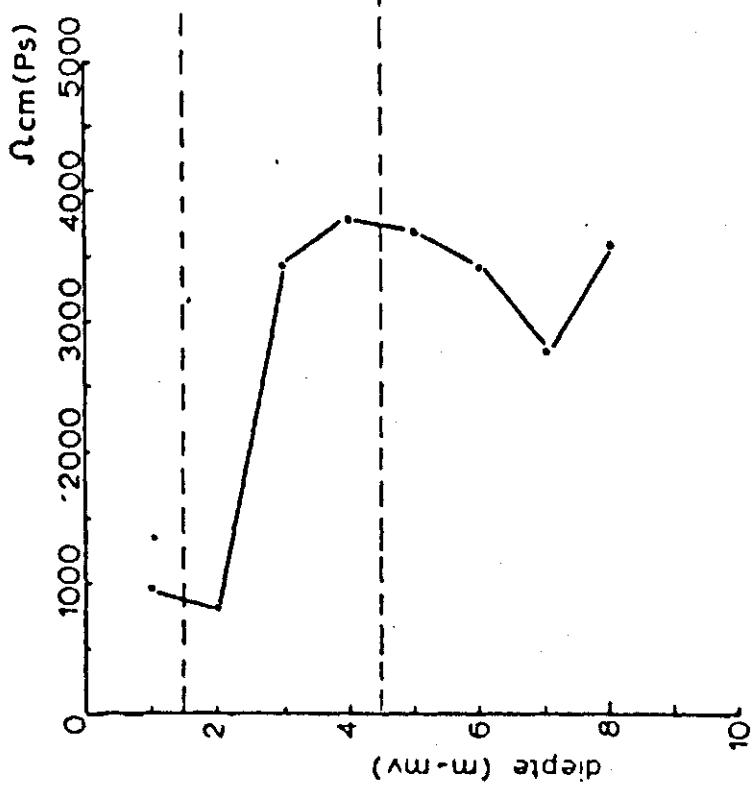
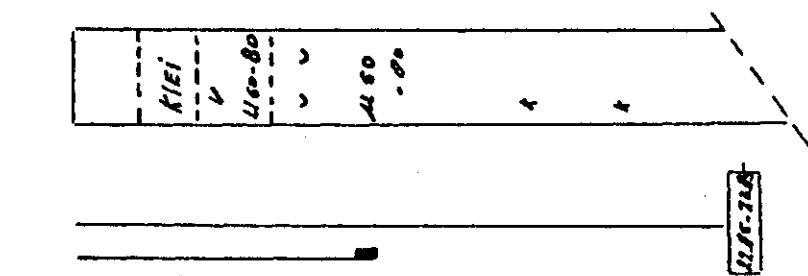
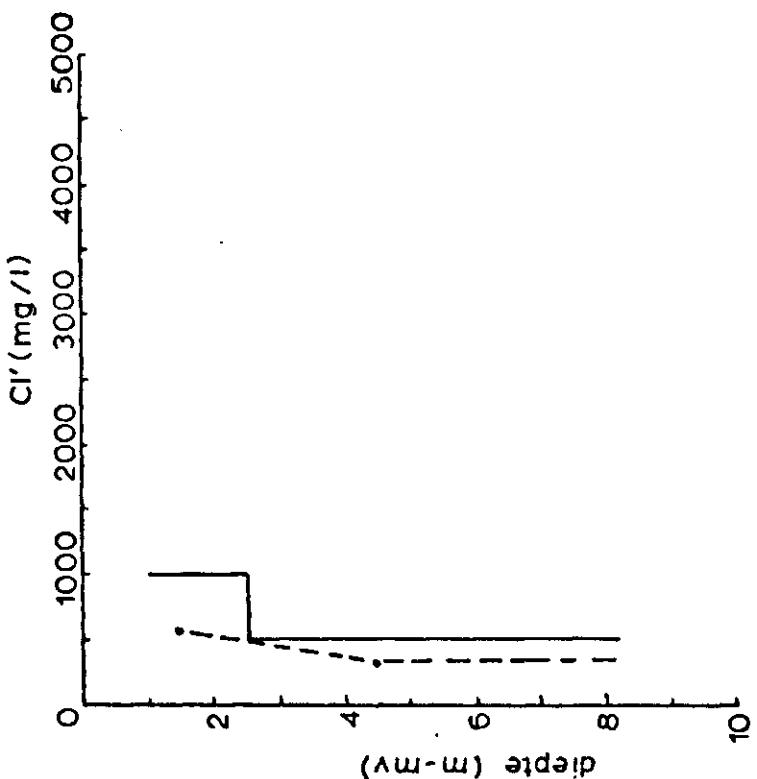
LOKATIE 47



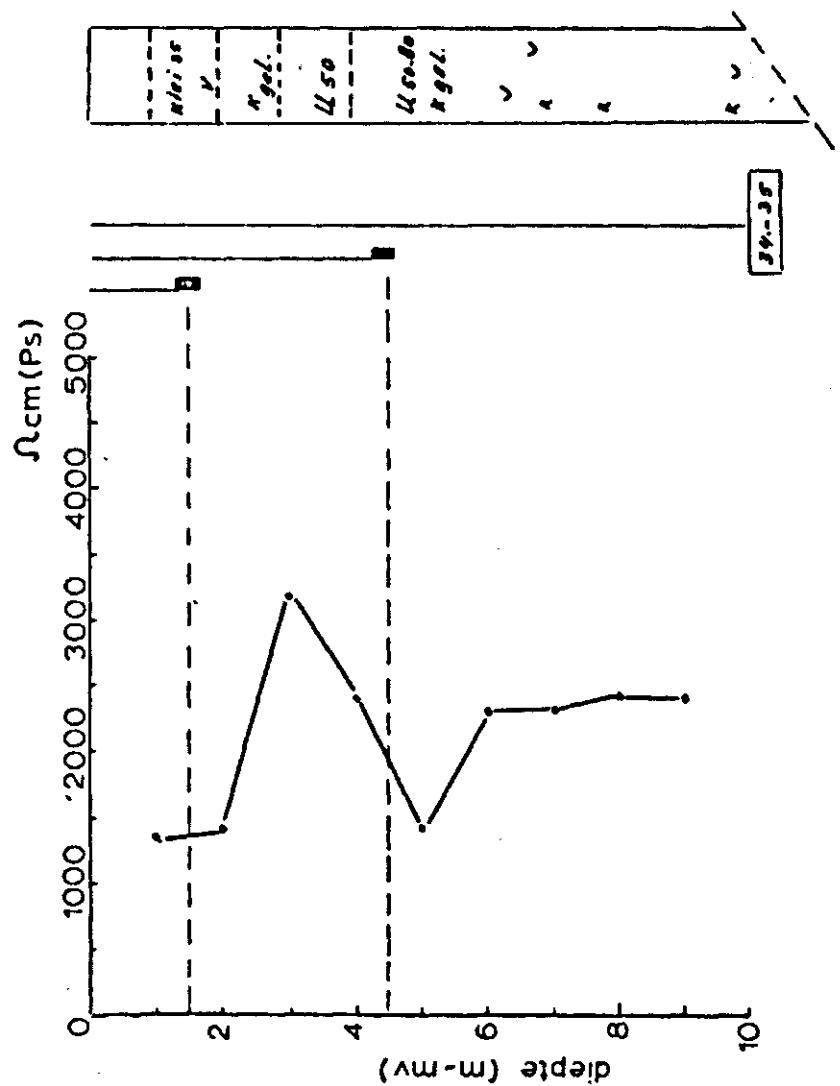
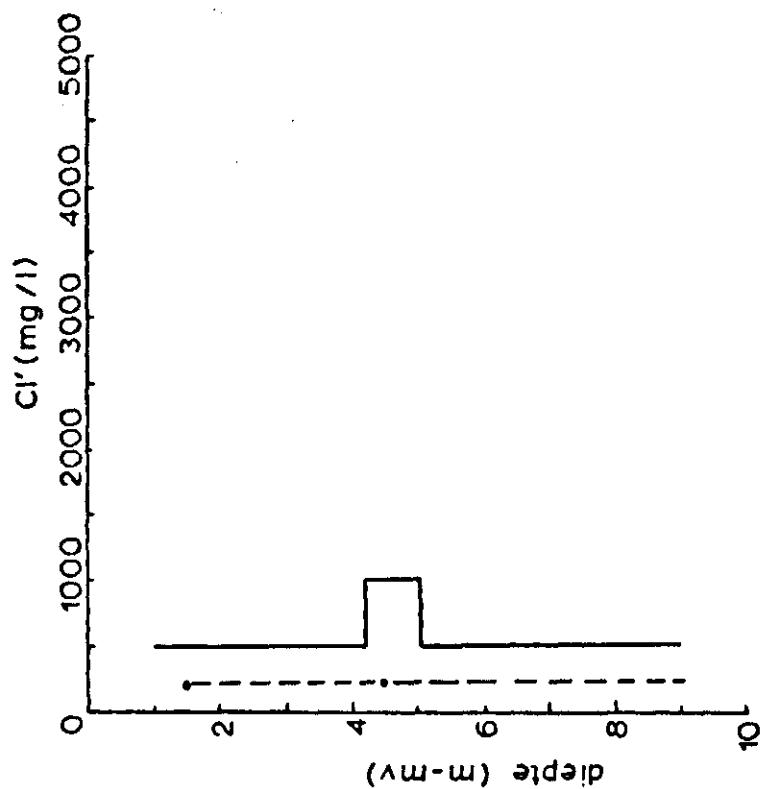
LOKATIE 20



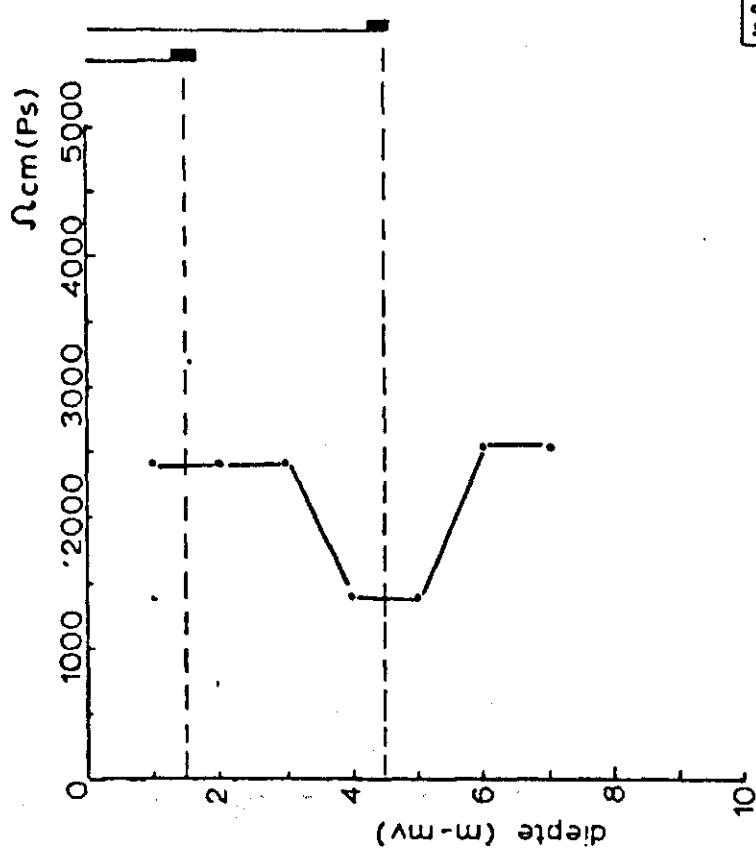
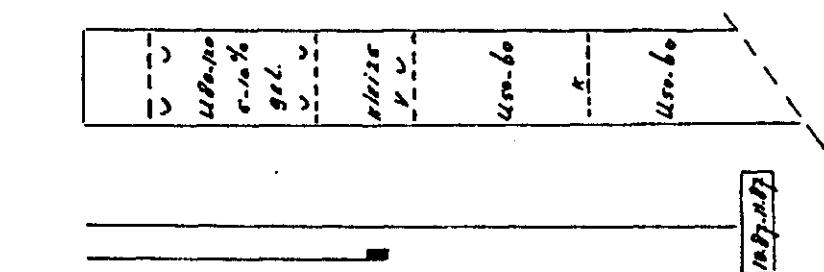
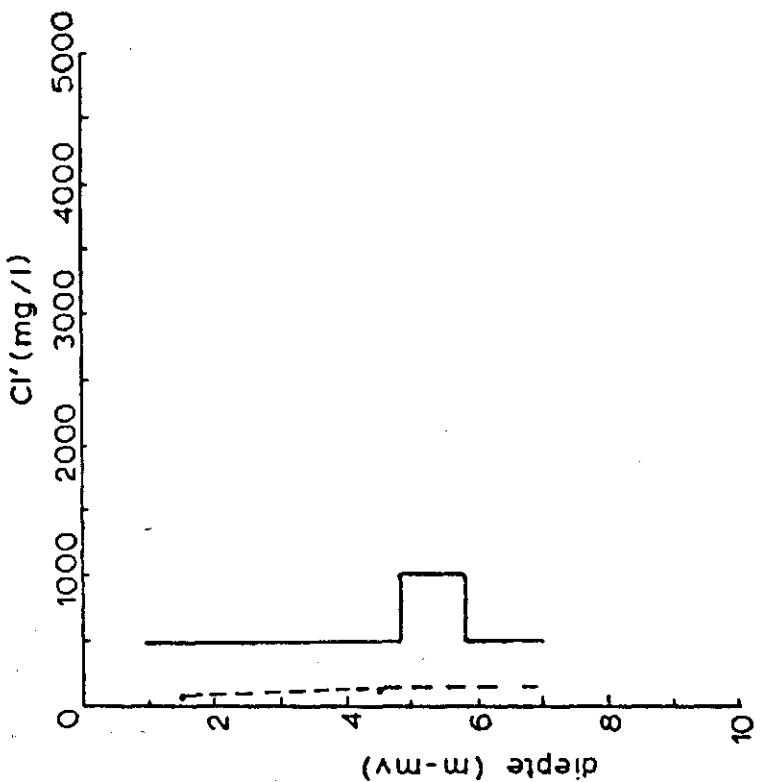
LOKATIE 49



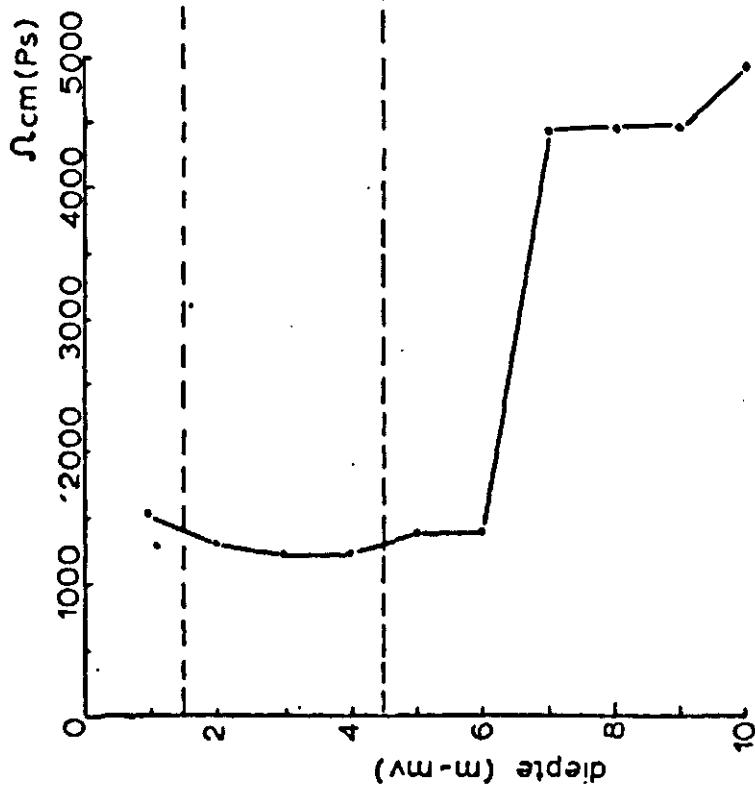
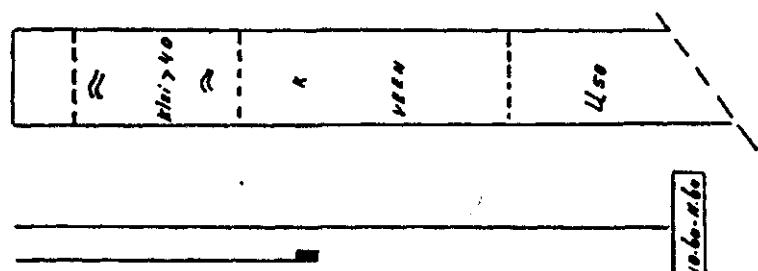
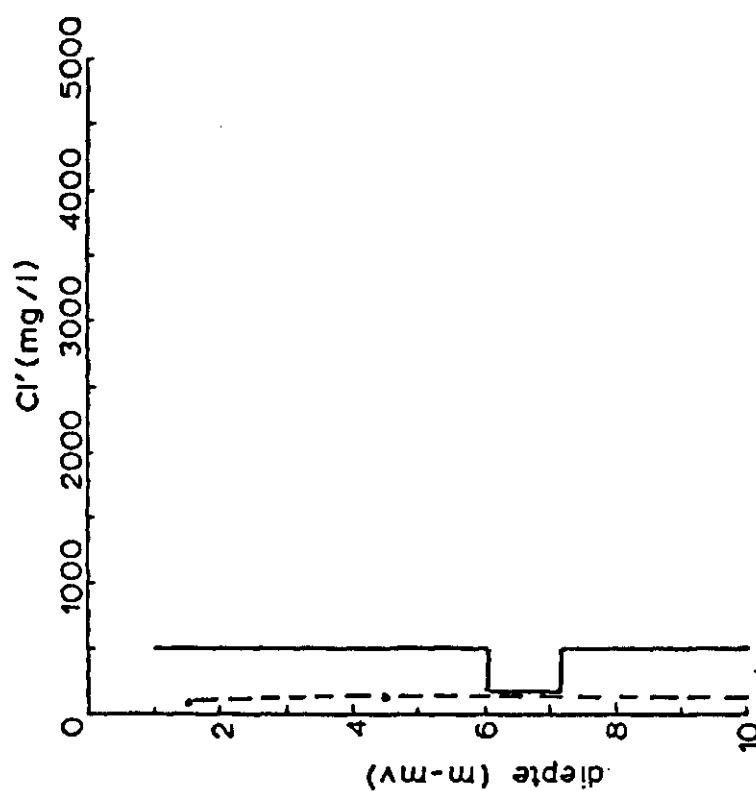
LOKATIE 30



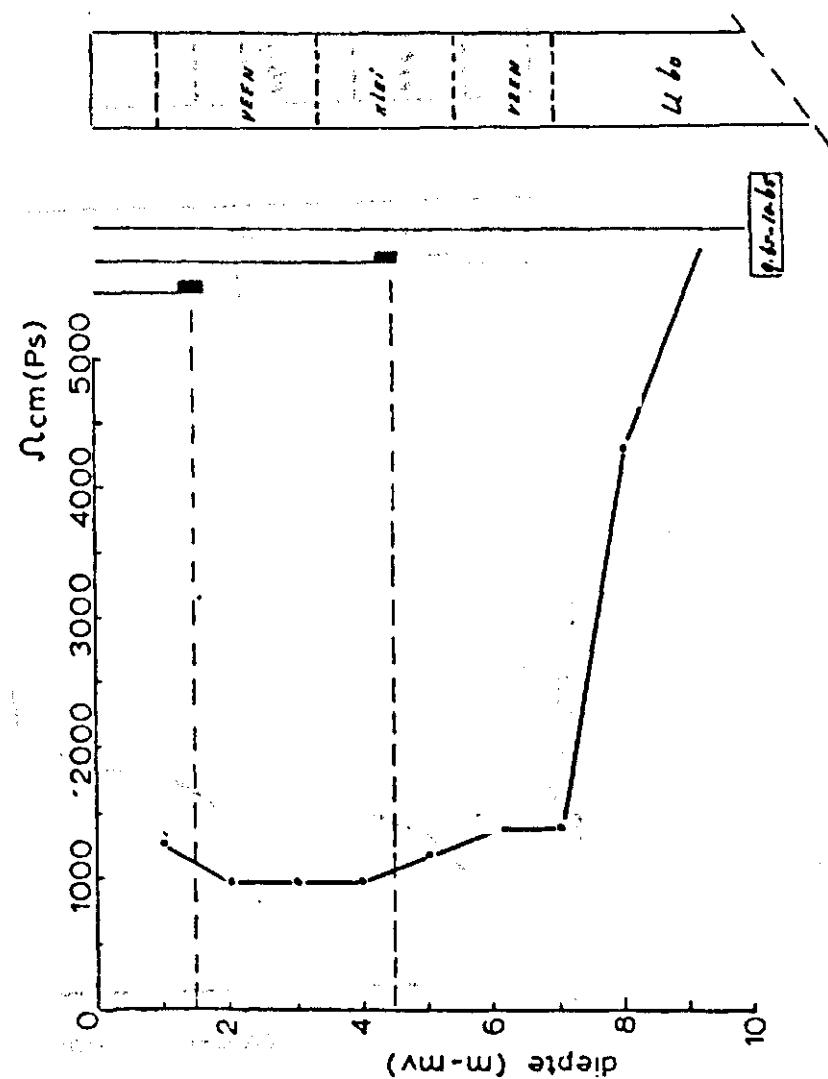
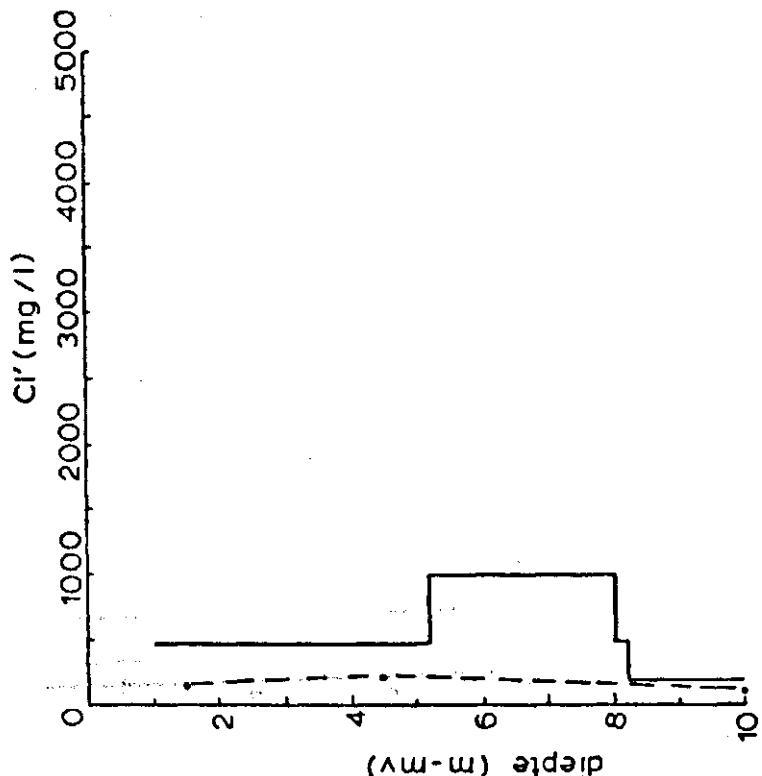
LOKATIE 3/



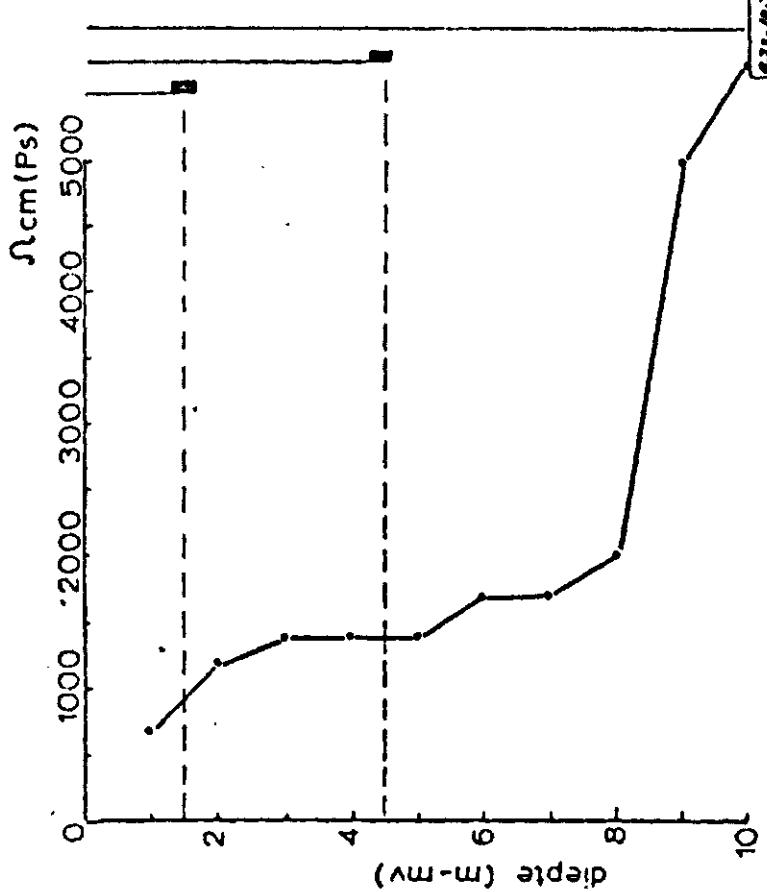
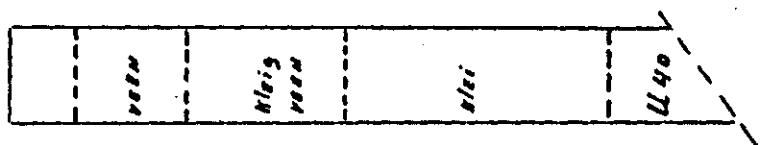
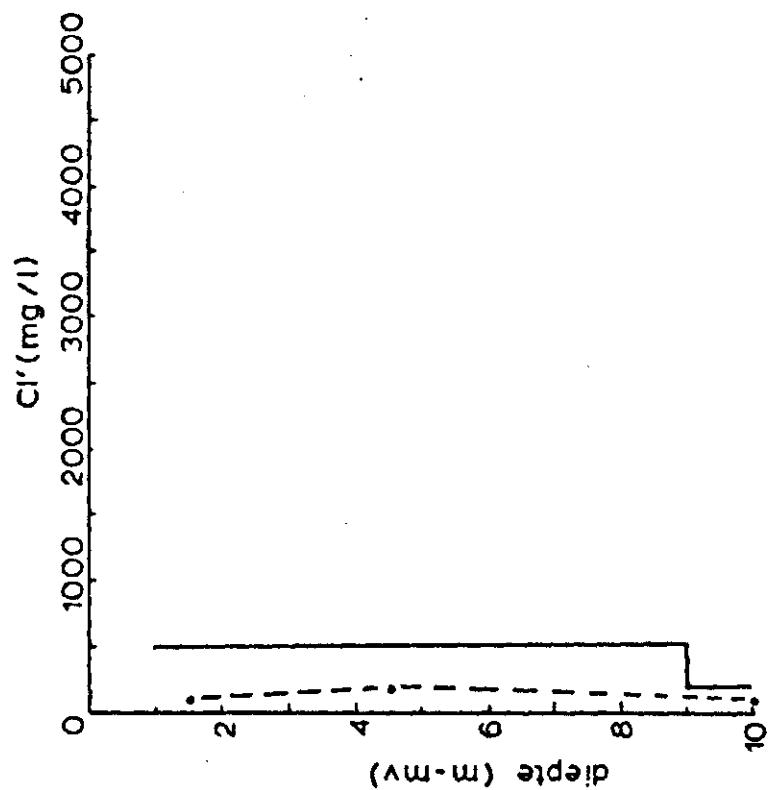
LOKATIE 2



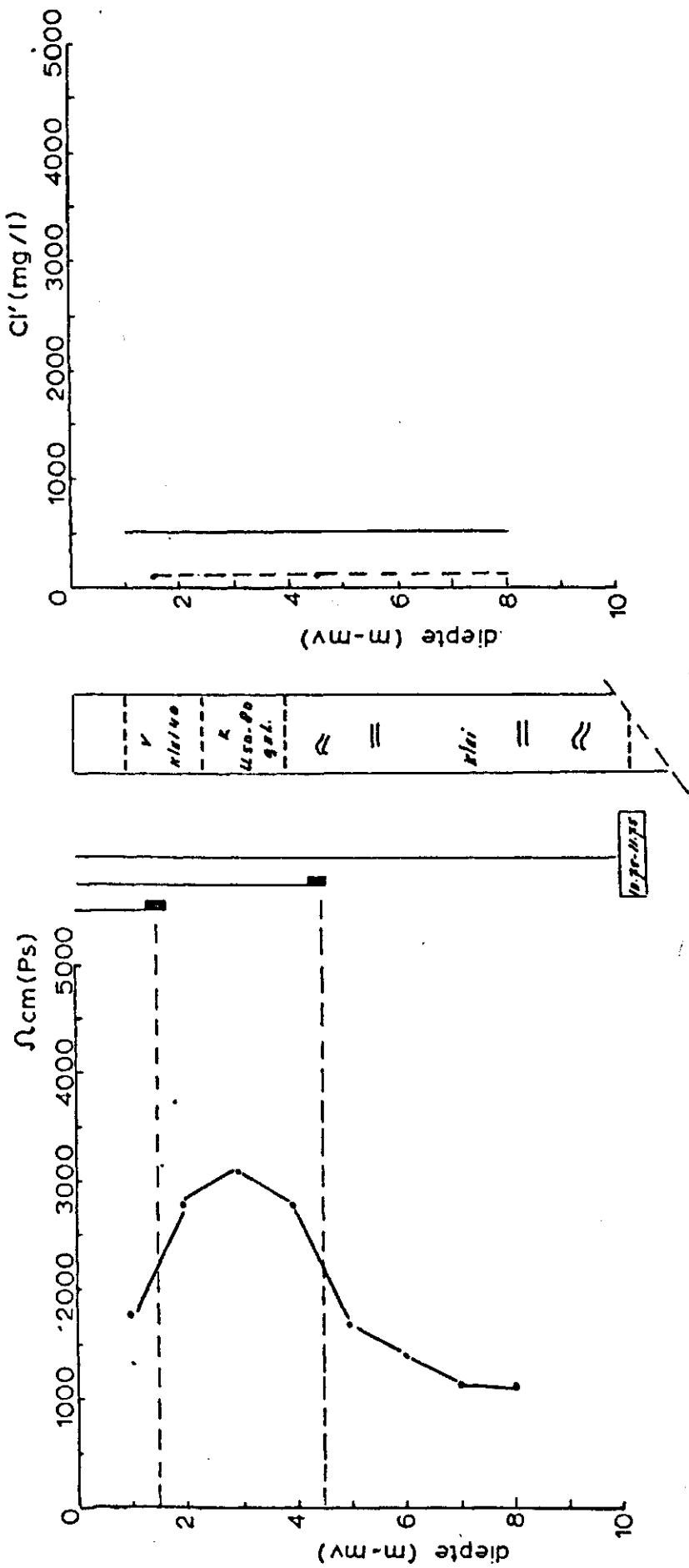
LOKATIE 93



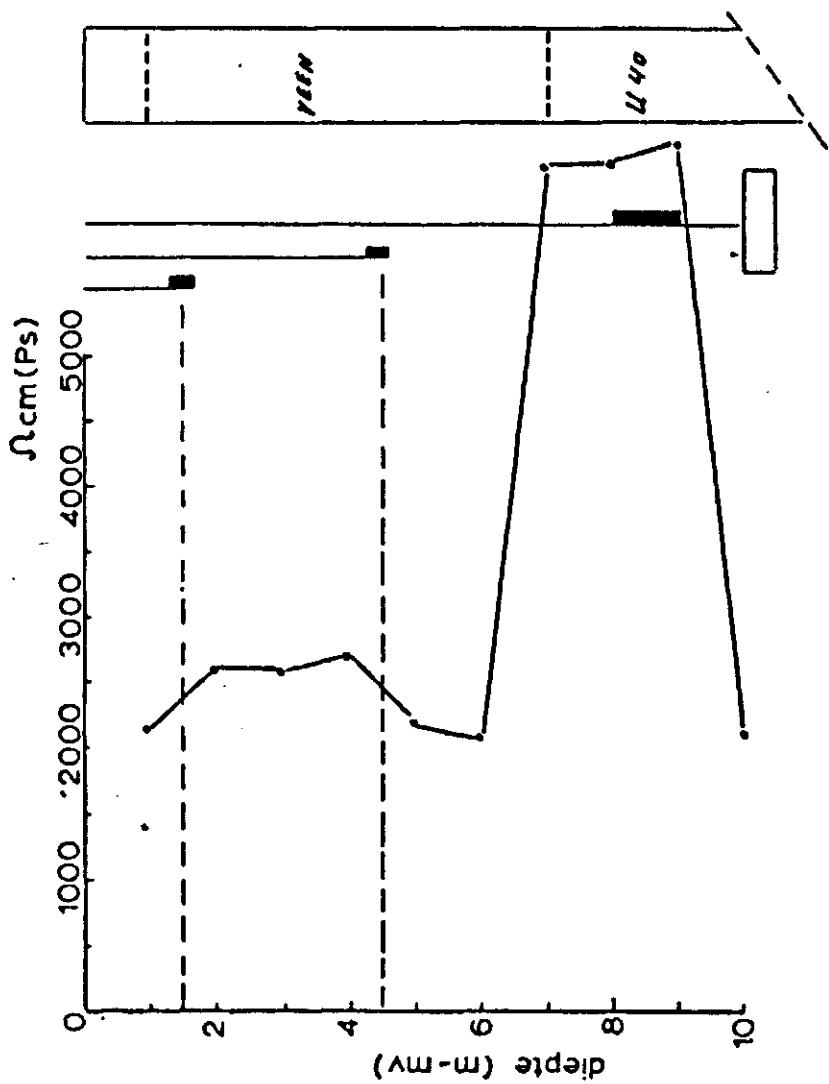
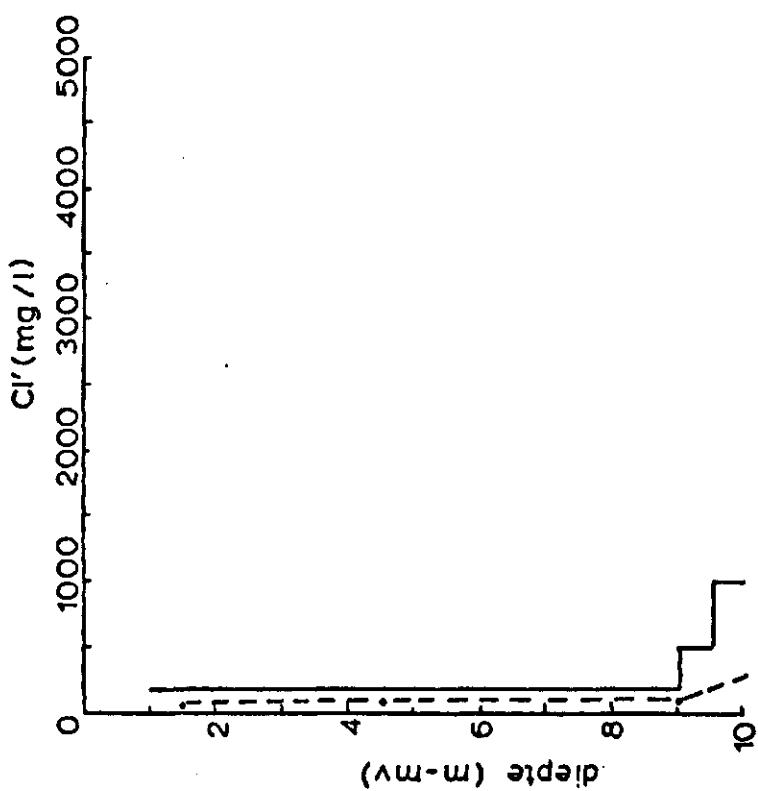
LOKATIE 34



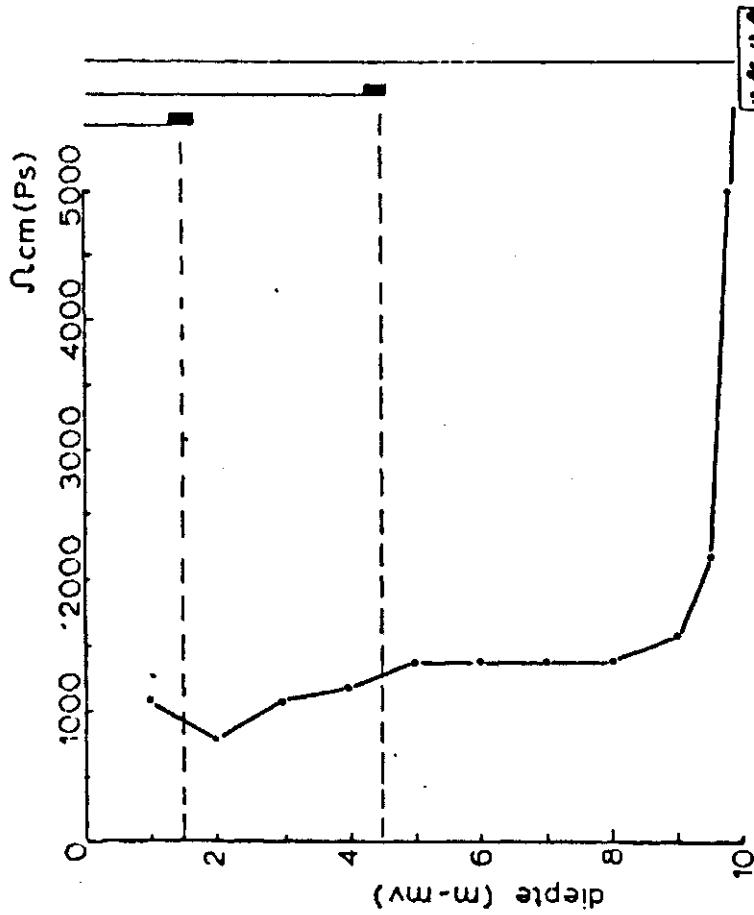
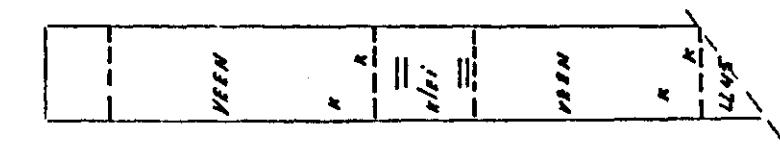
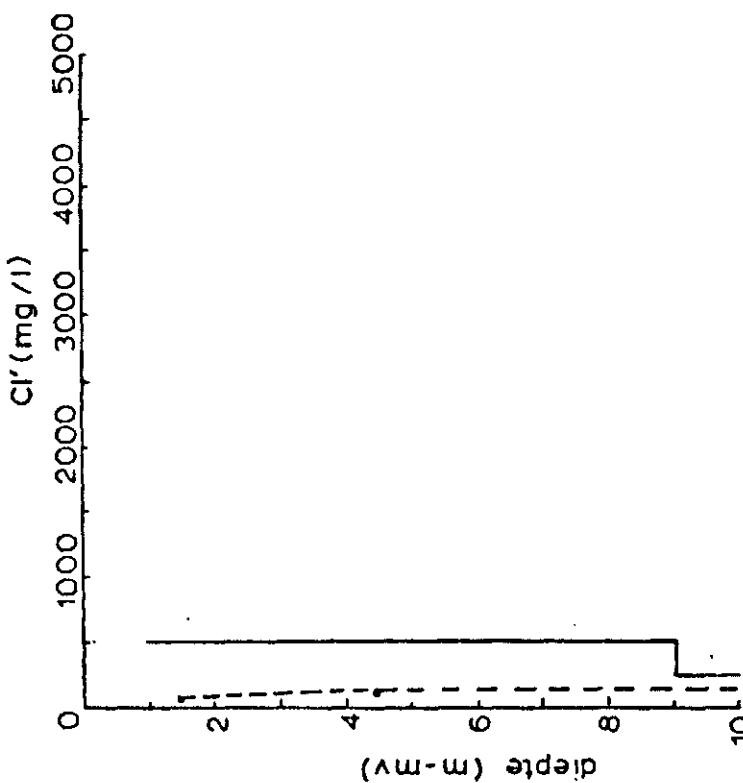
LOKATIE 35



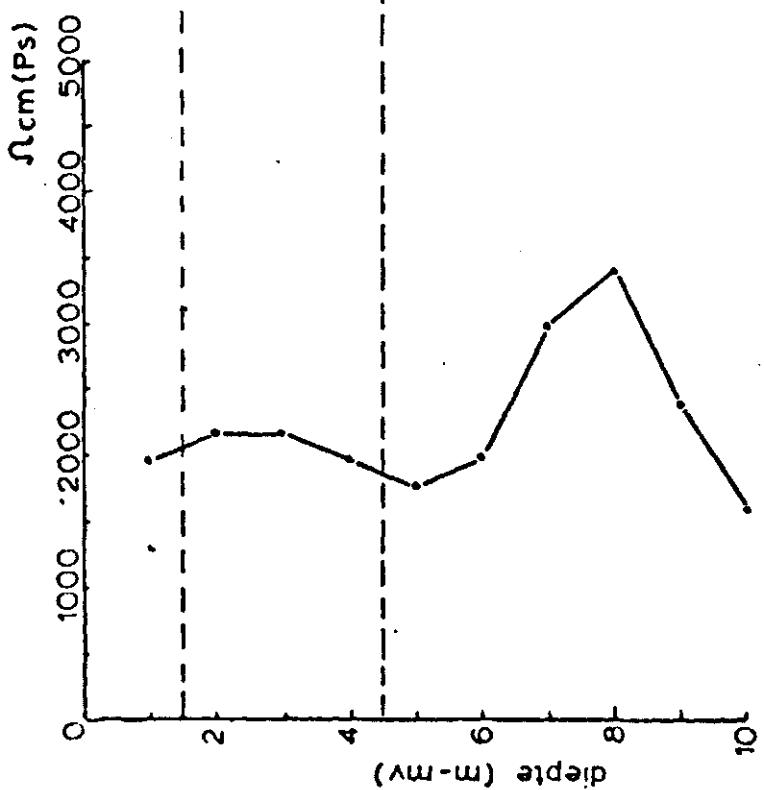
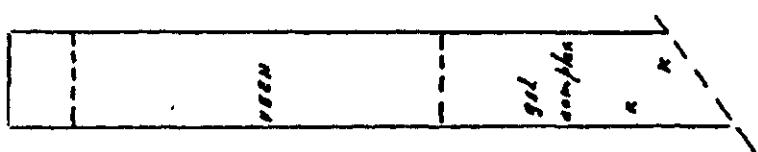
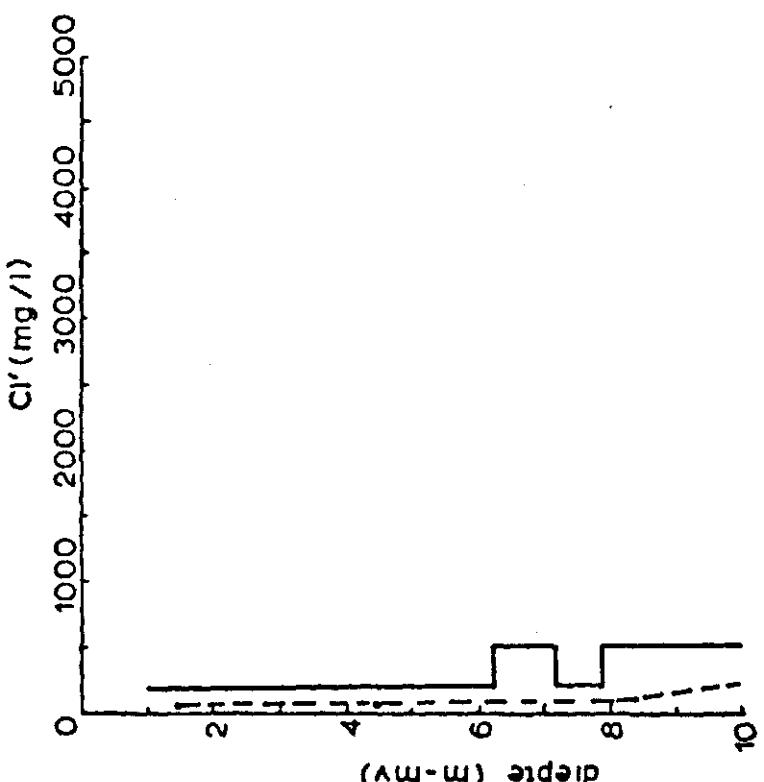
LOKATIE 36



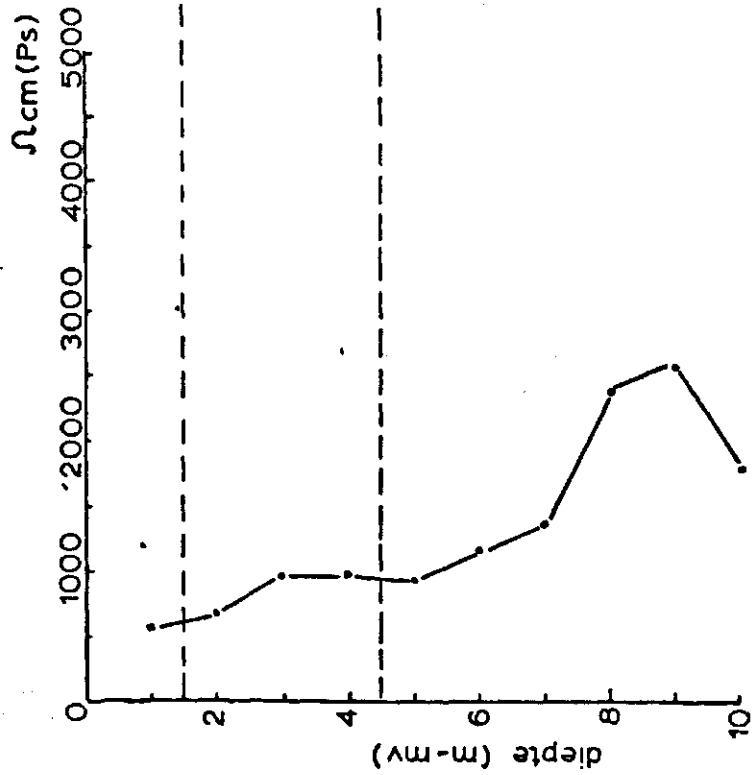
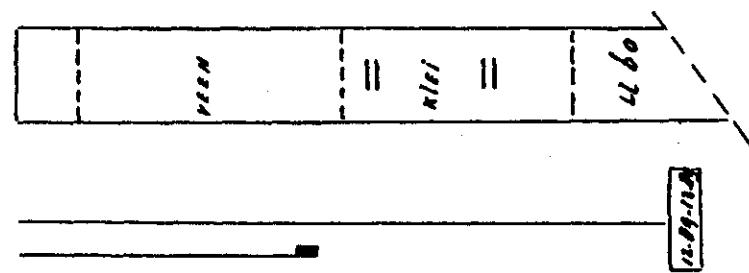
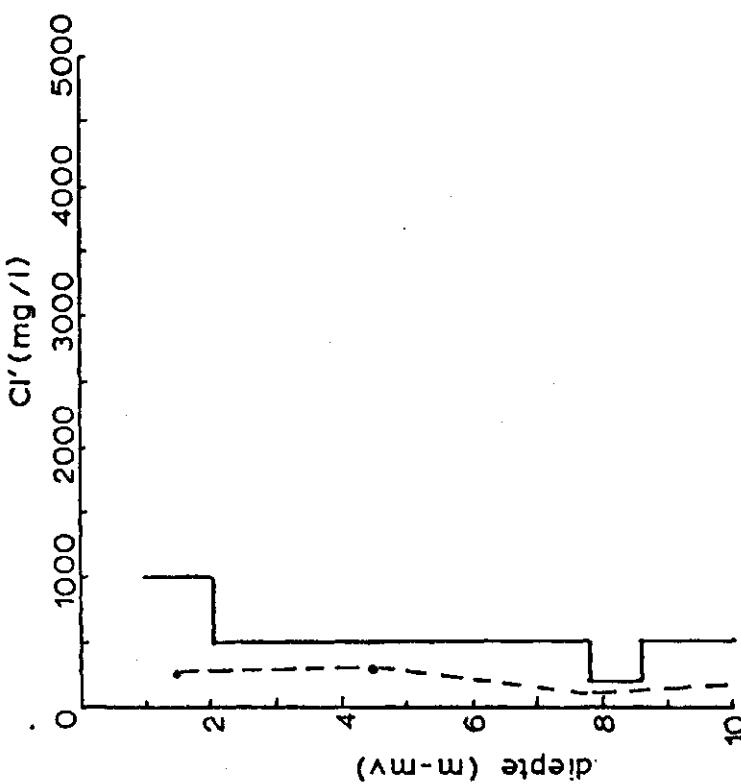
LOKATIE 37



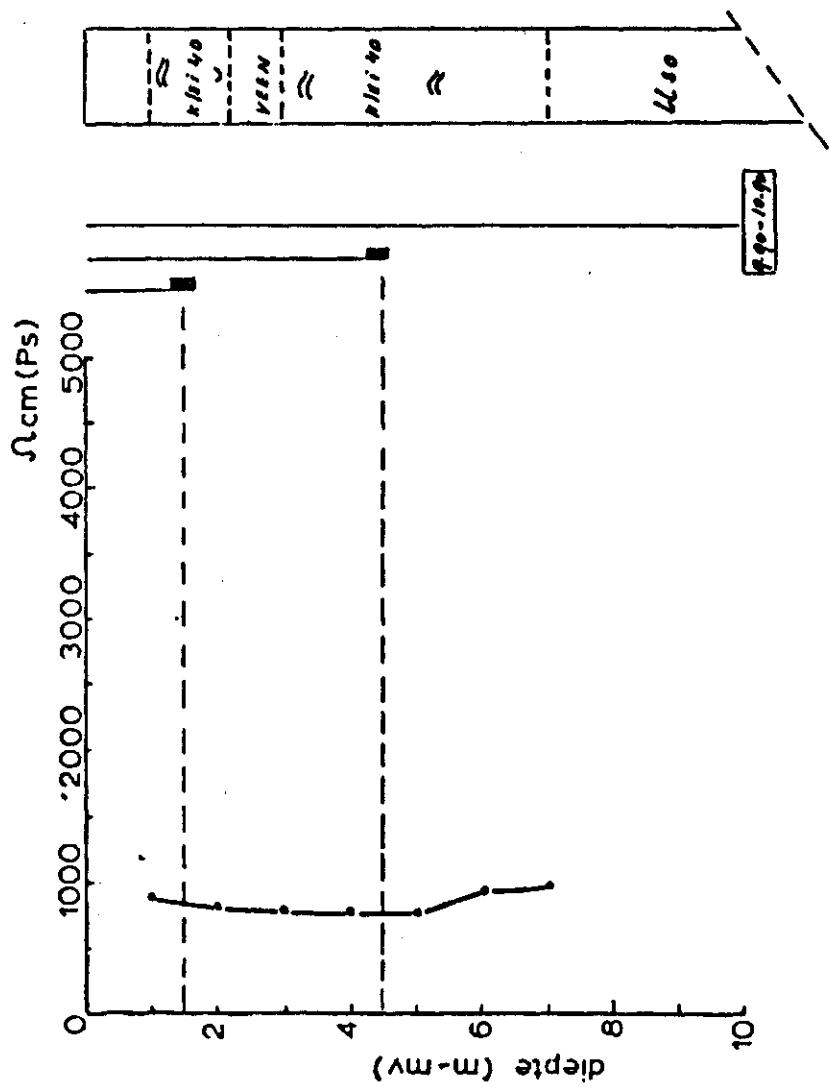
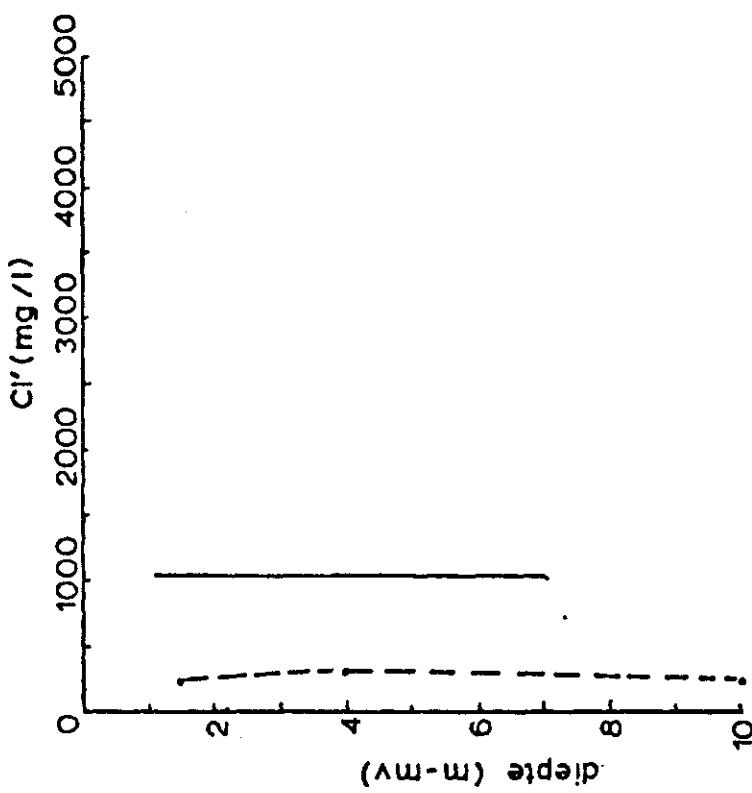
LOKATIE 3P



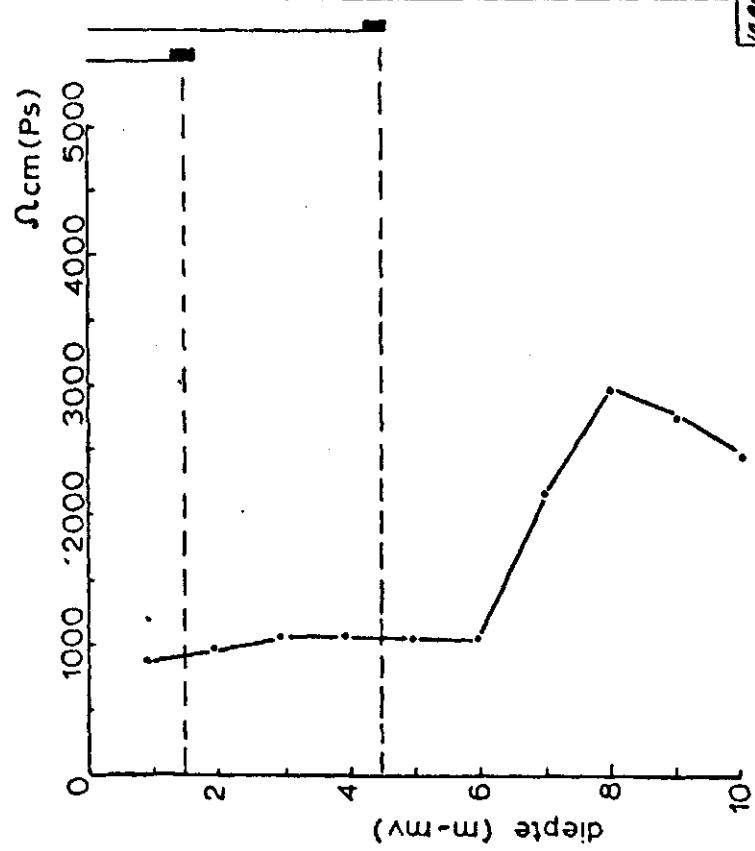
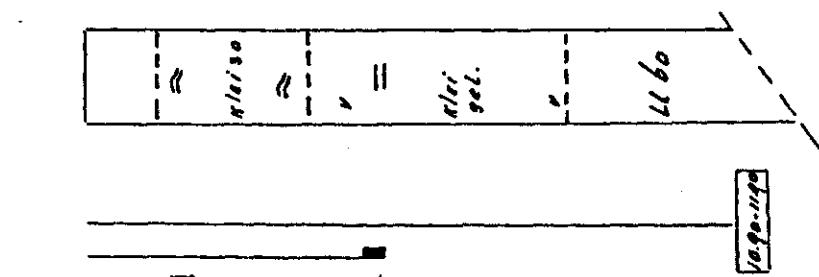
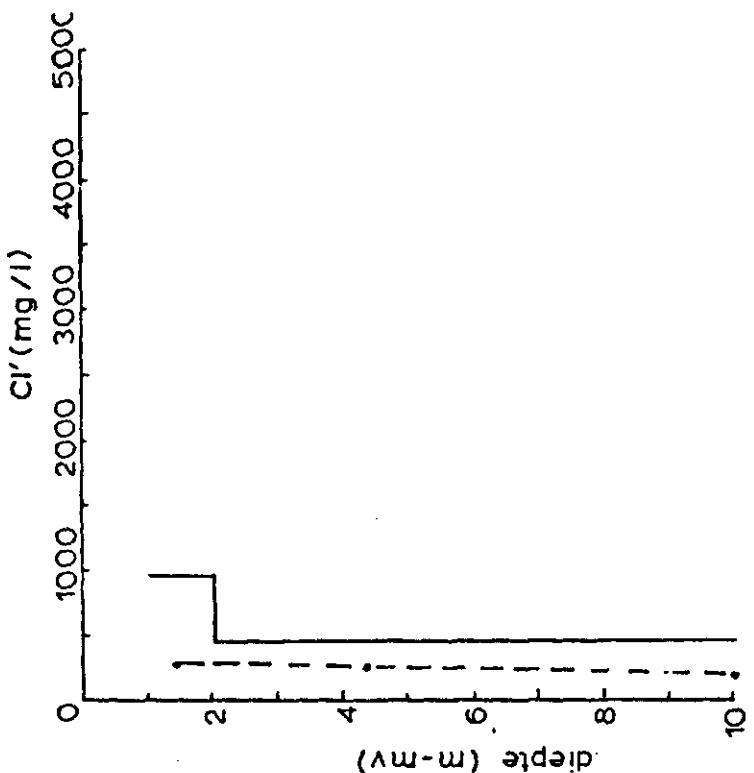
LOKATIE 39



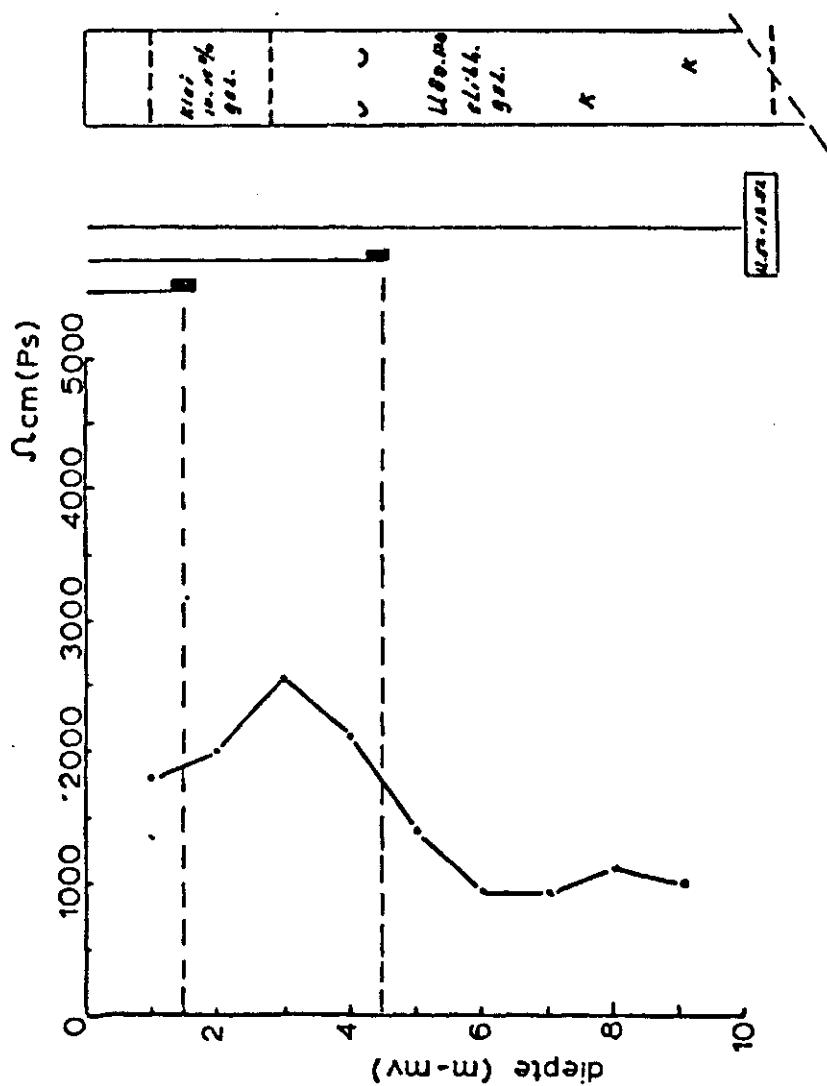
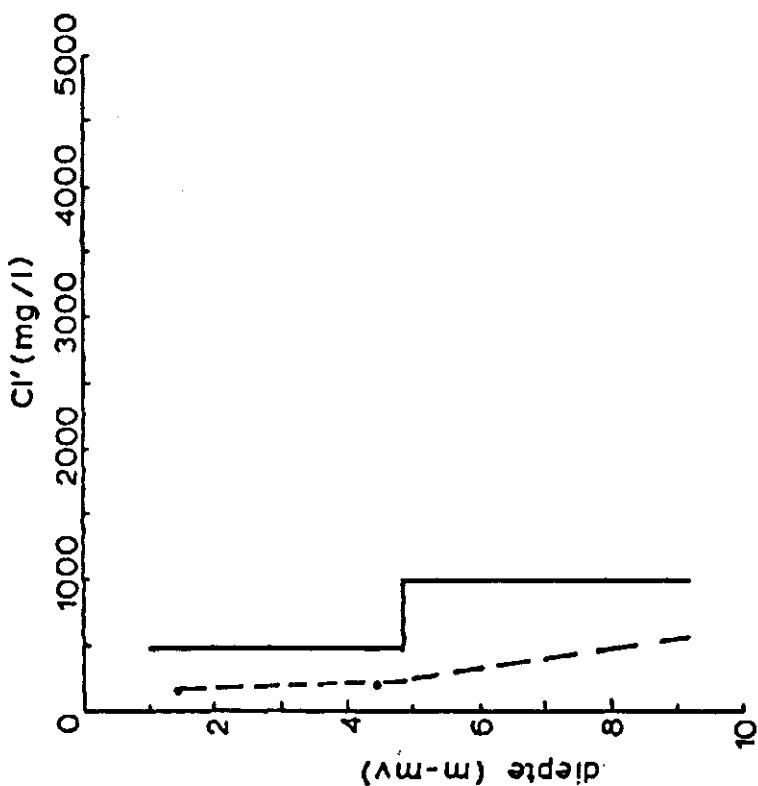
LOKATIE 49



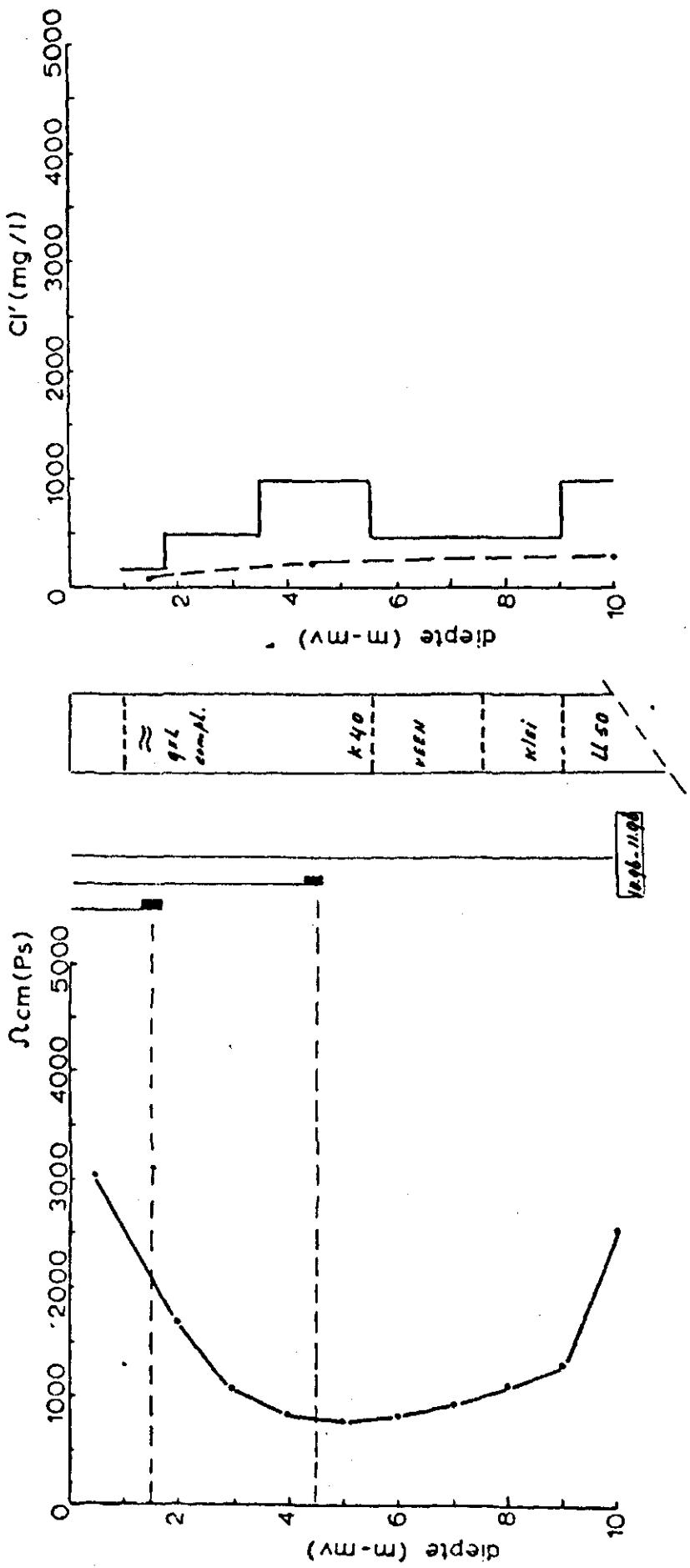
LOKATIE 4/



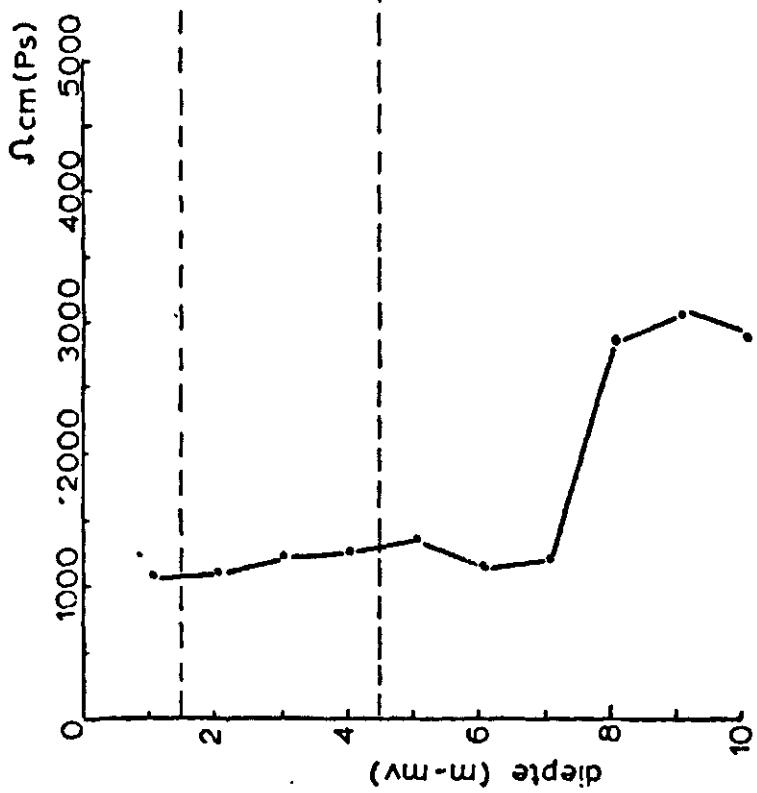
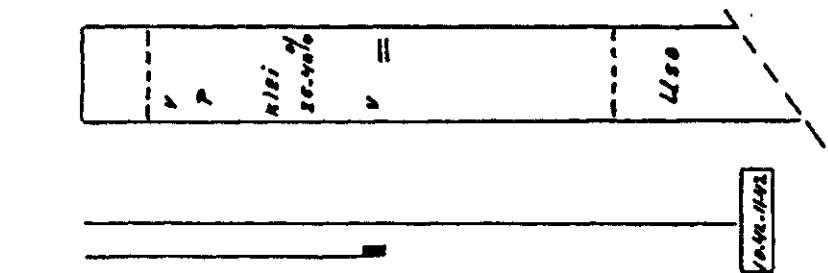
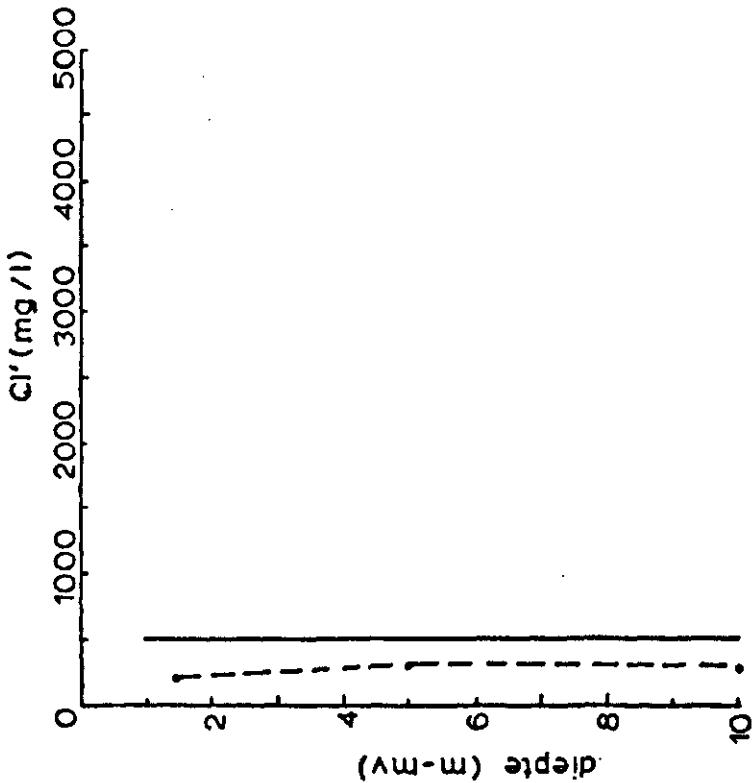
LOKATIE 4x



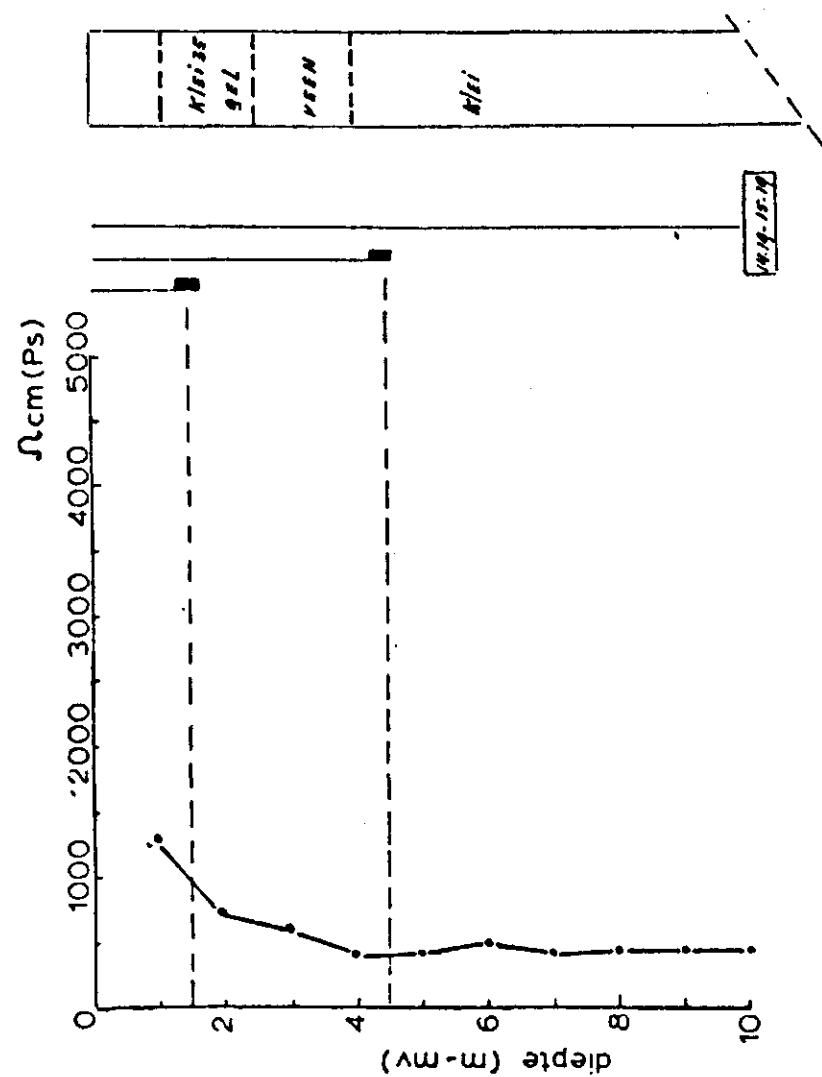
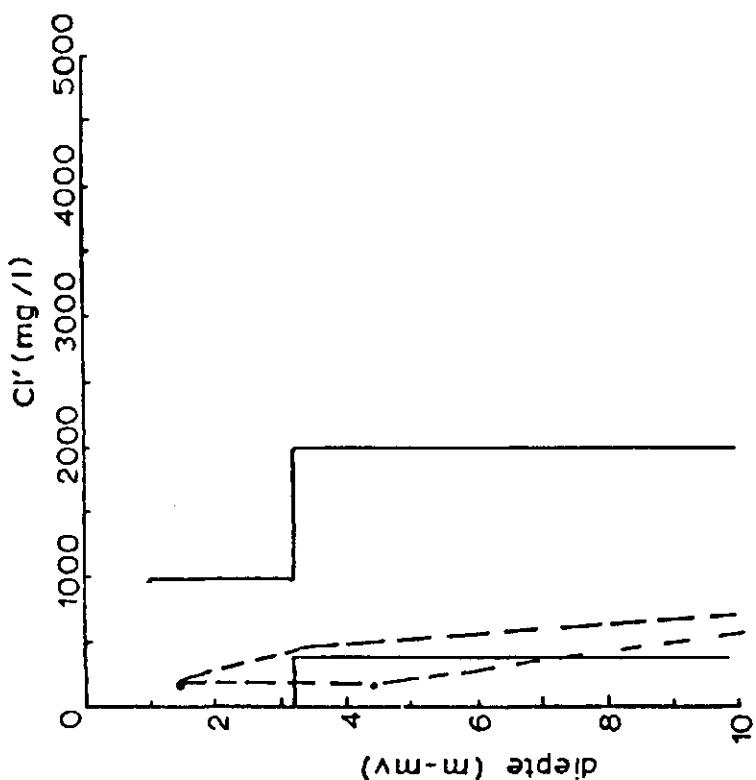
LOKATIE 43



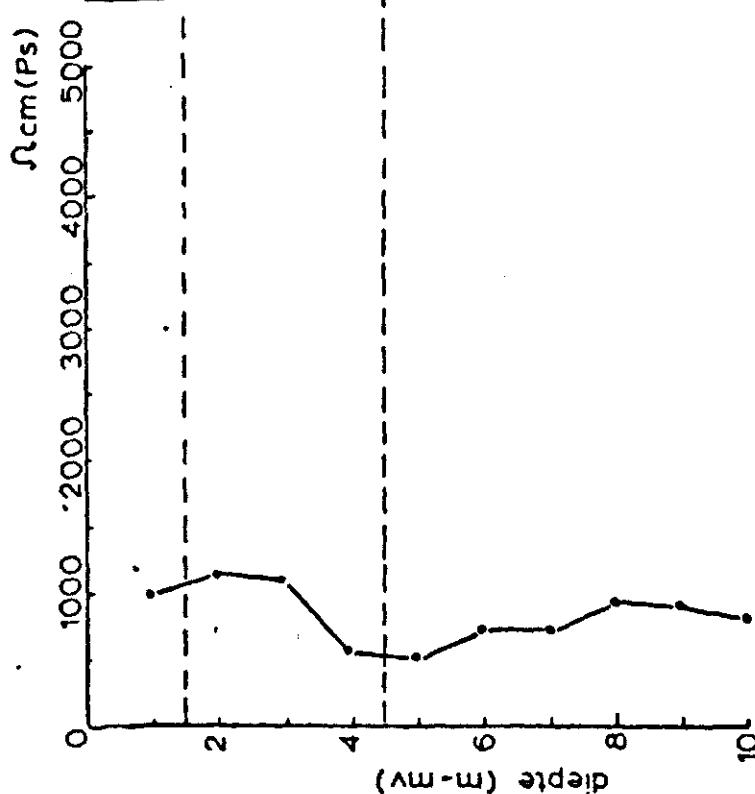
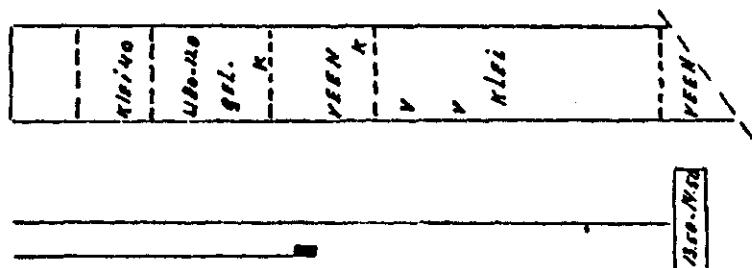
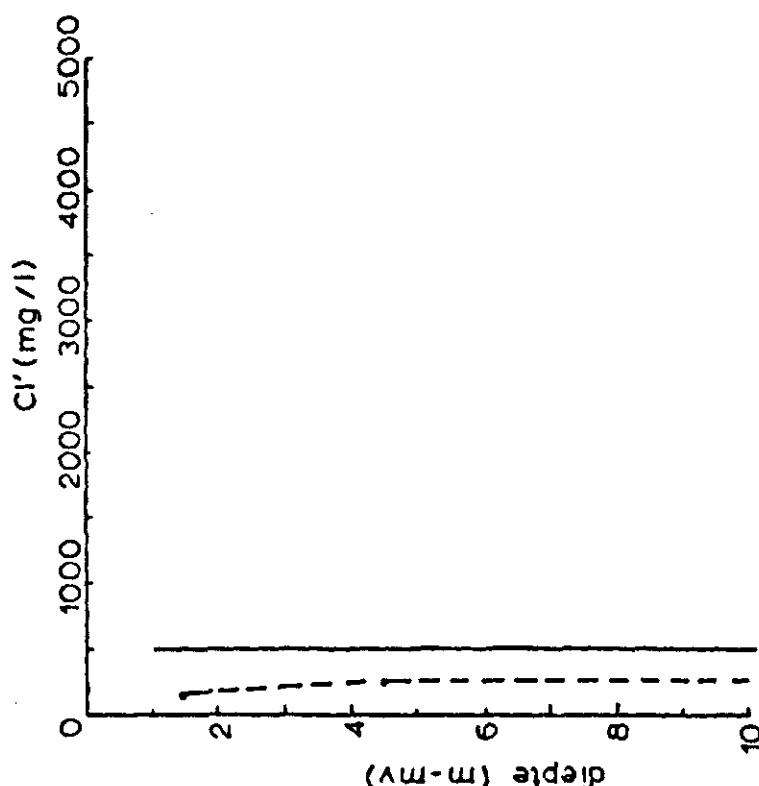
LOKATIE 44



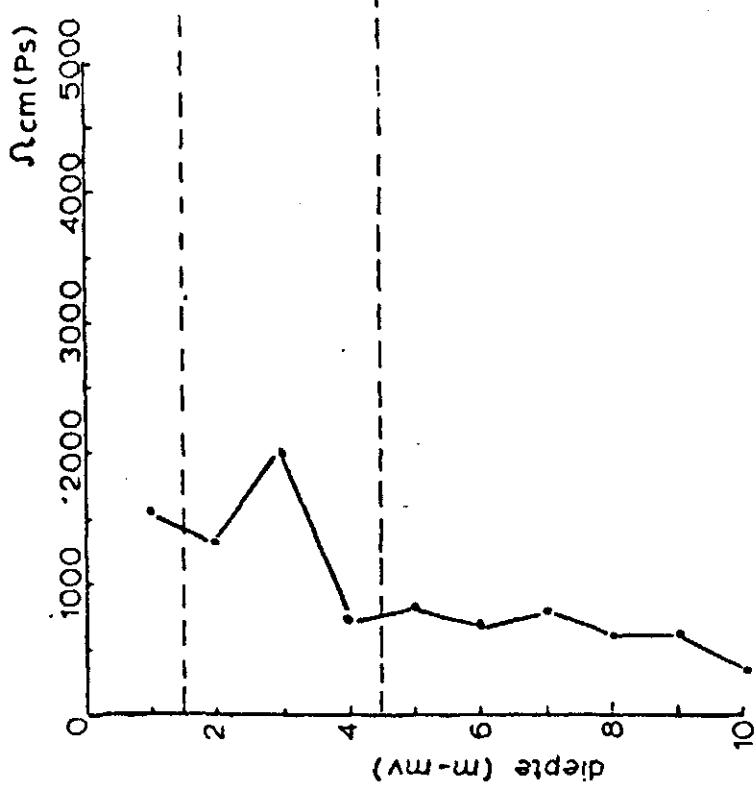
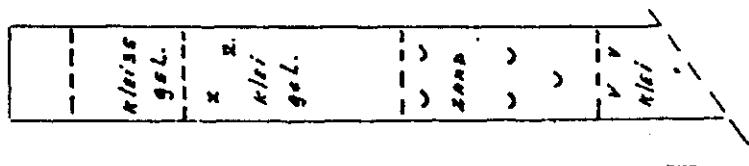
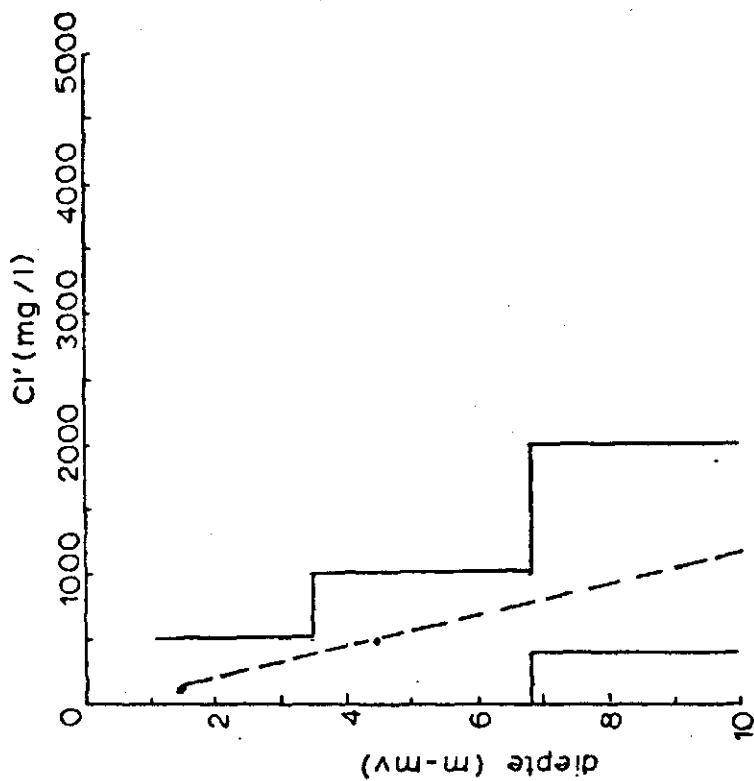
LOKATIE 45



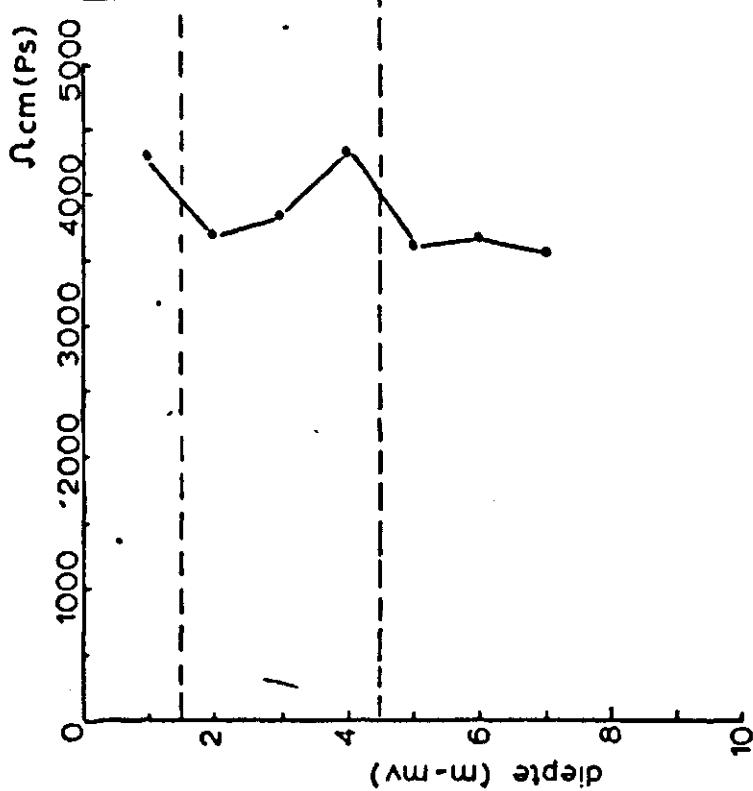
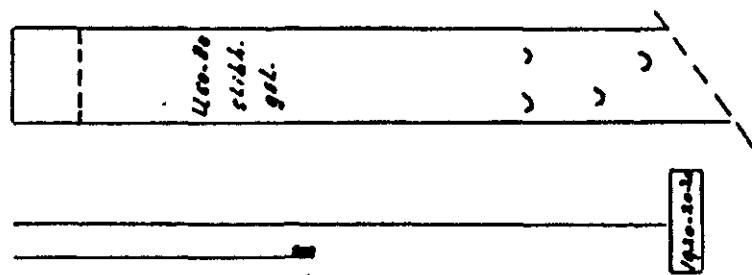
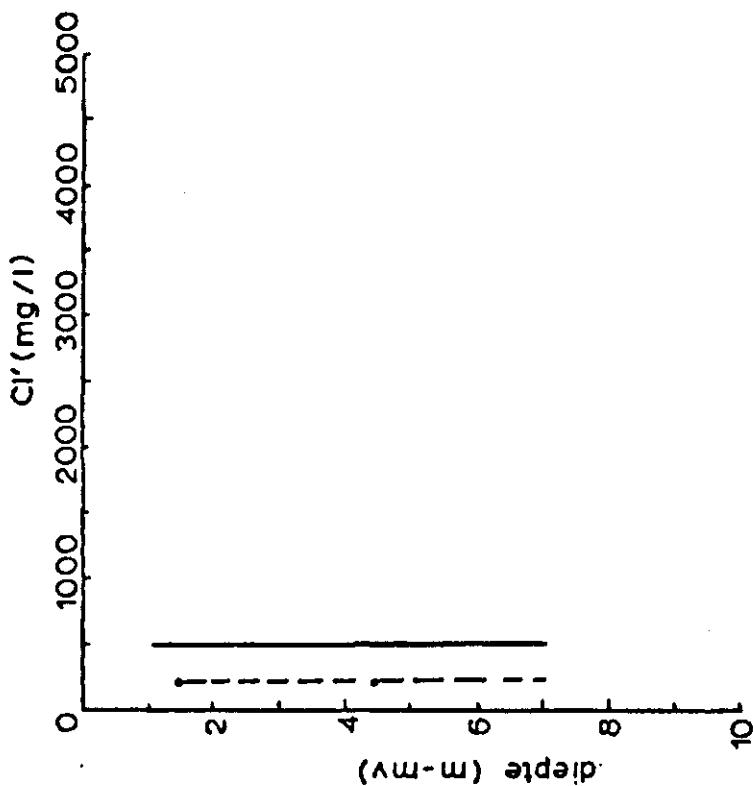
LOKATIE 46



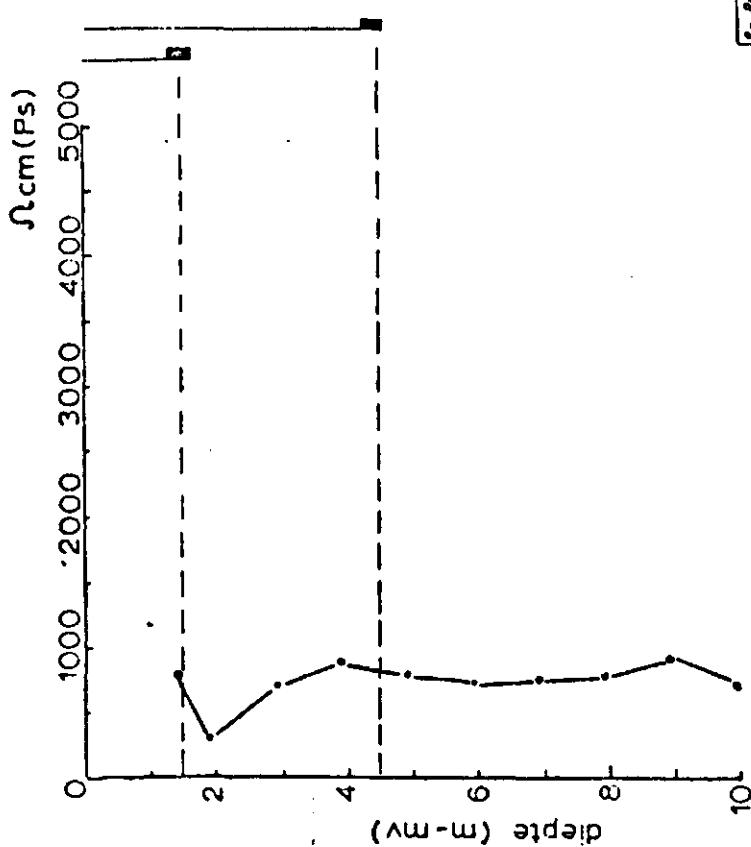
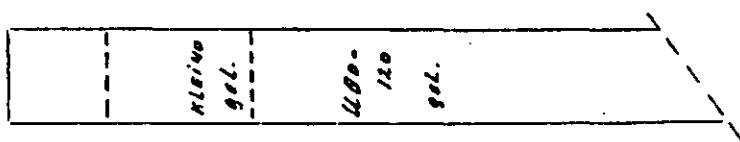
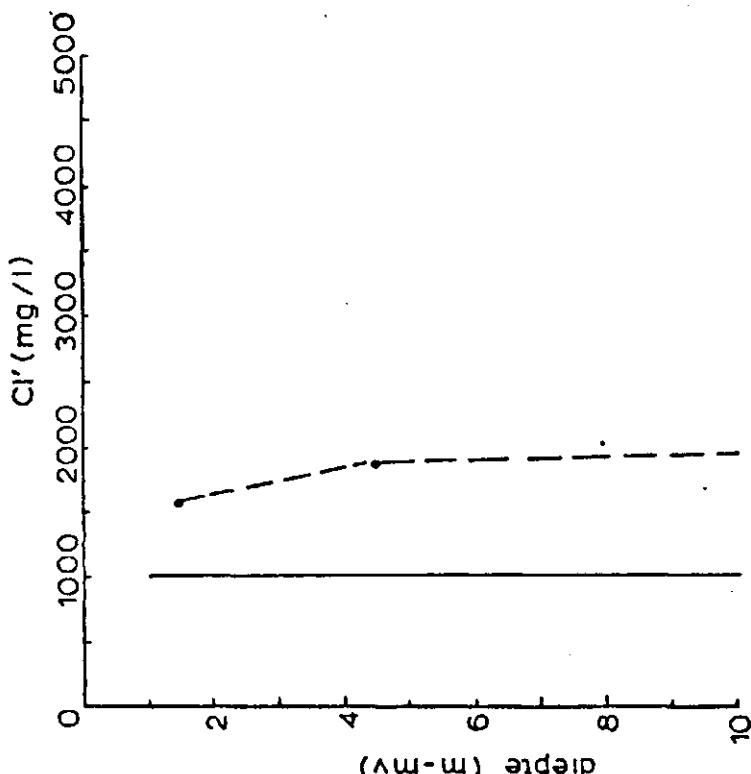
LOKATIE #7.



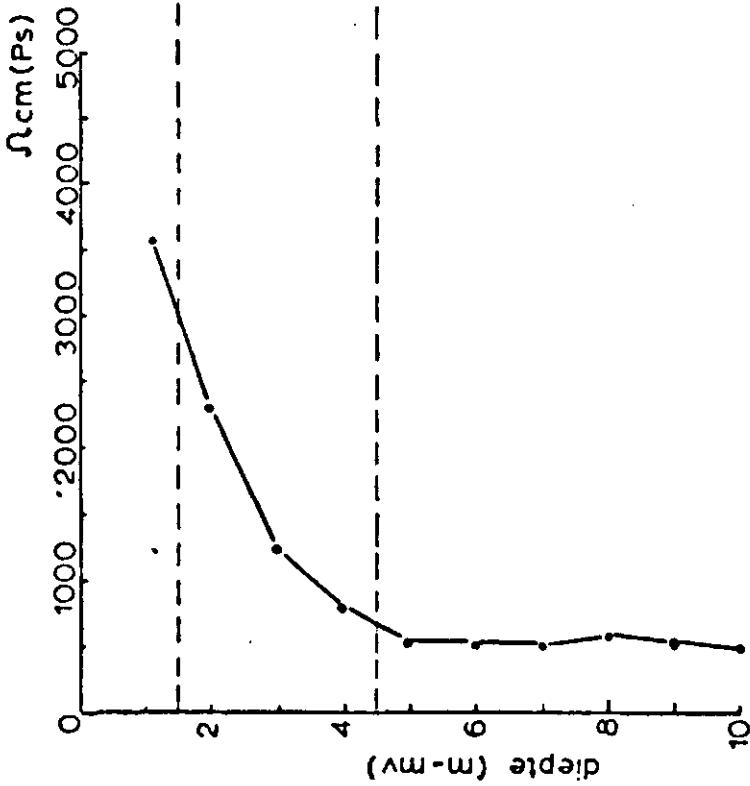
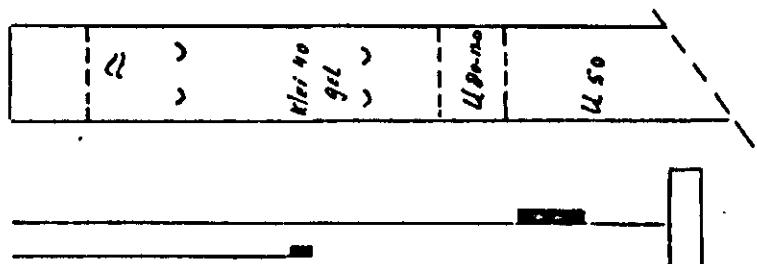
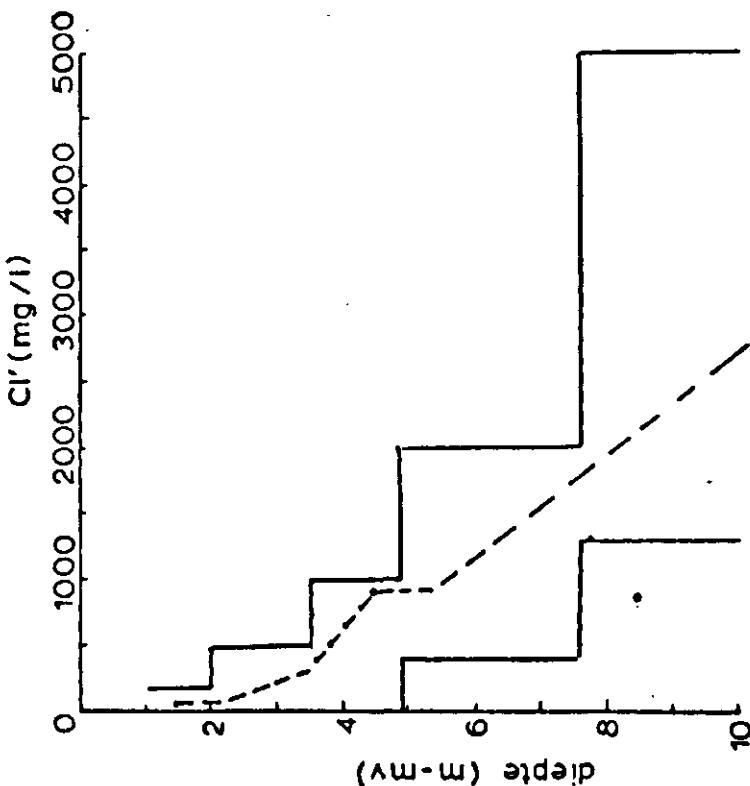
LOKATIE 48



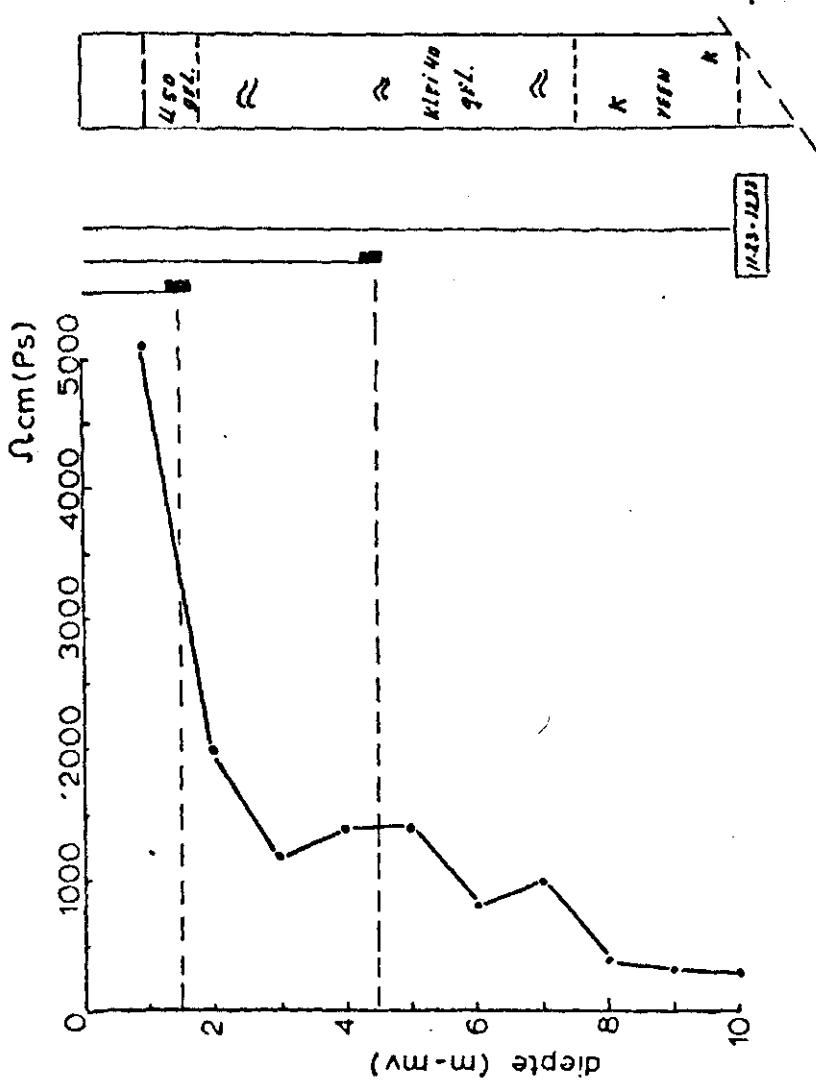
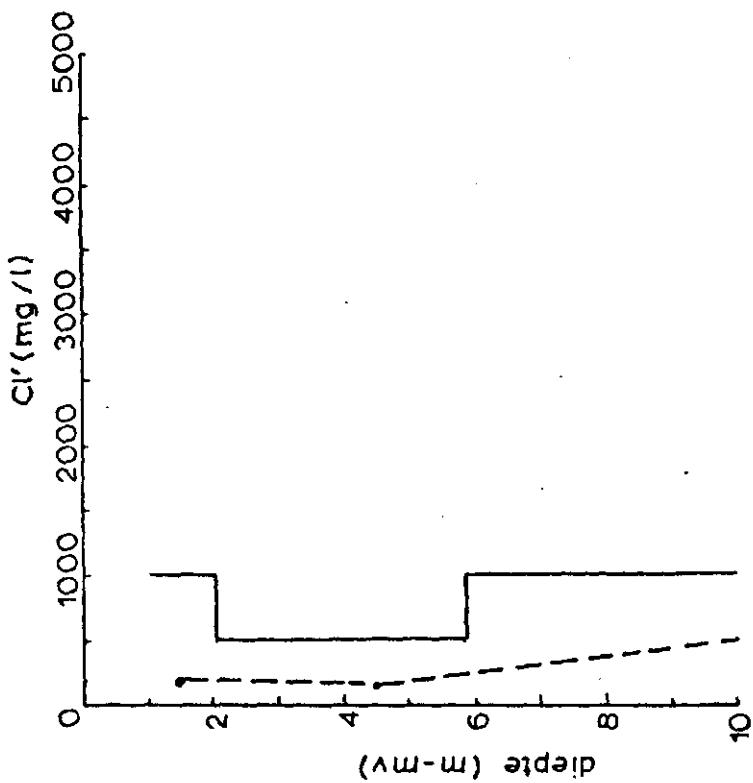
LOKATIE 49



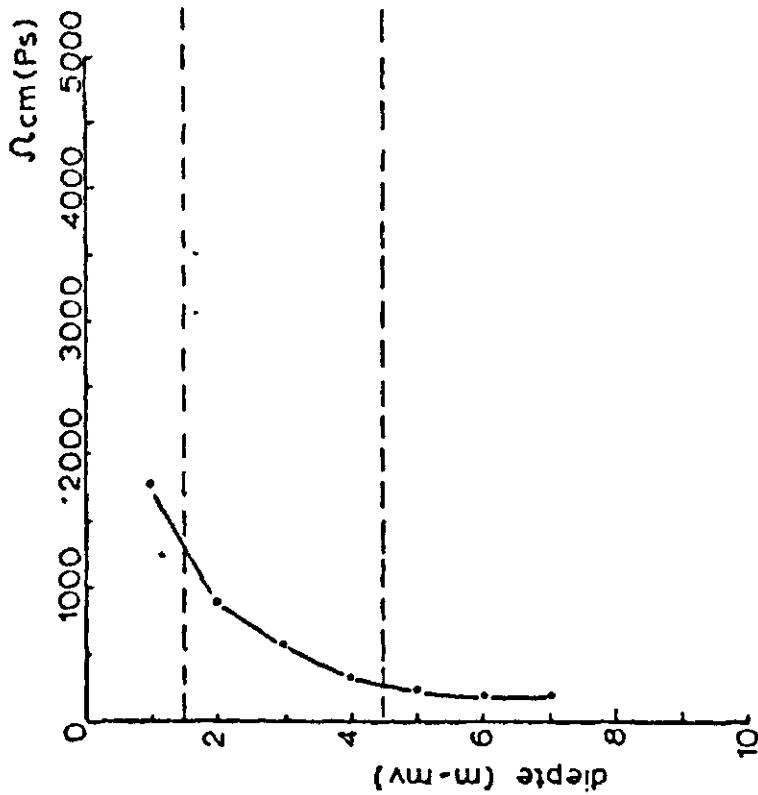
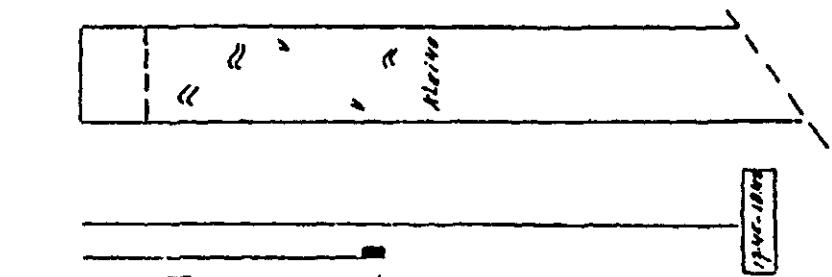
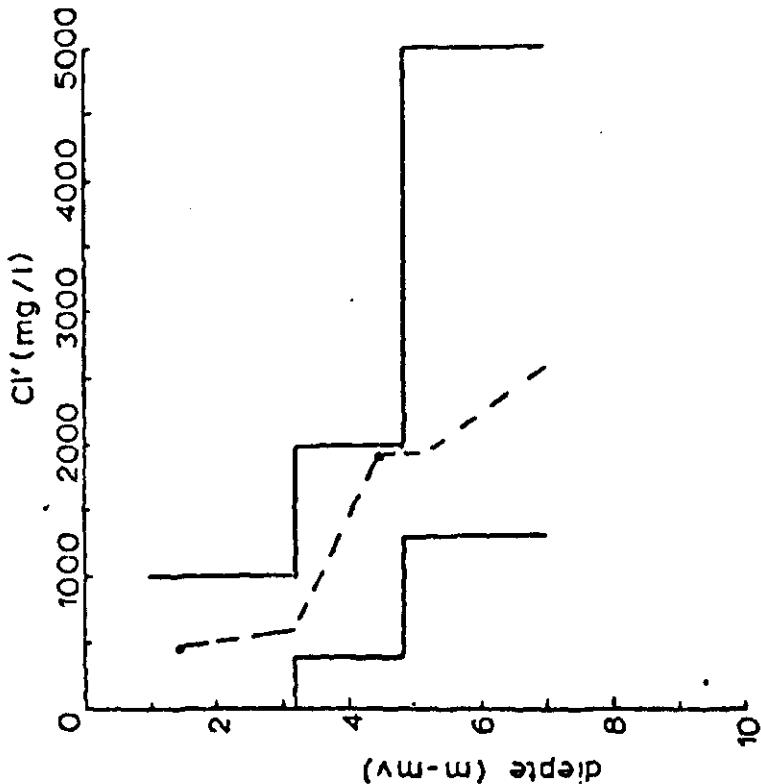
LOKATIE 50



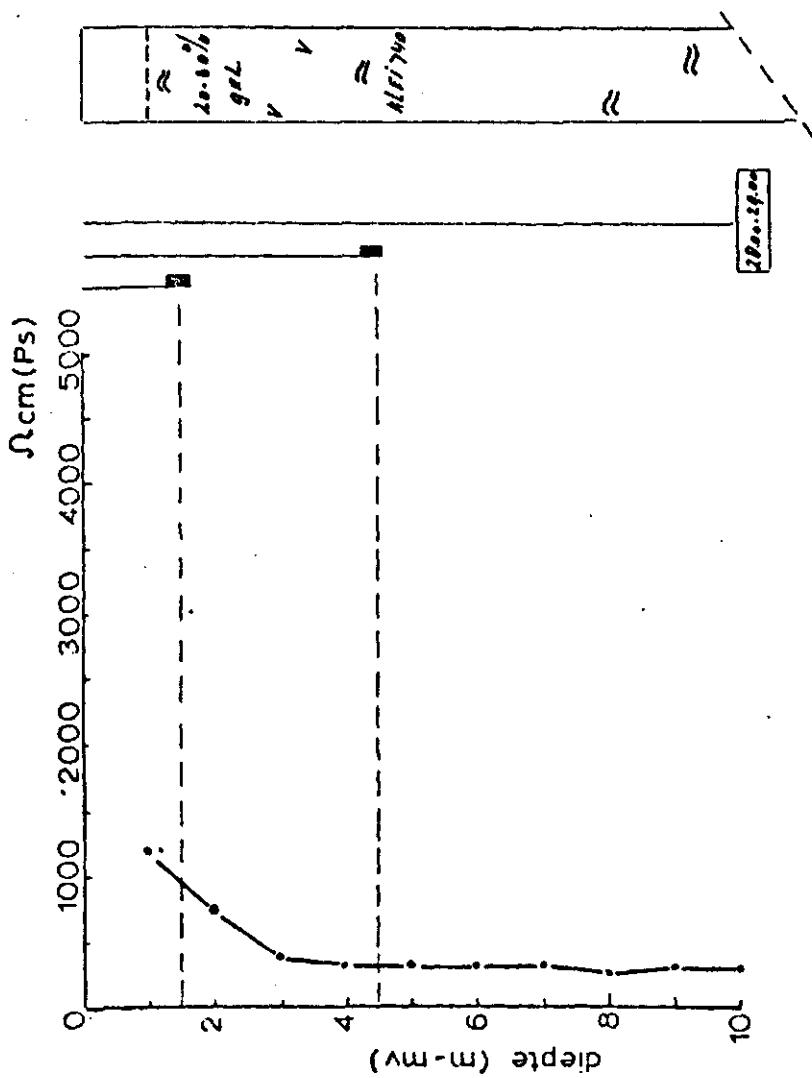
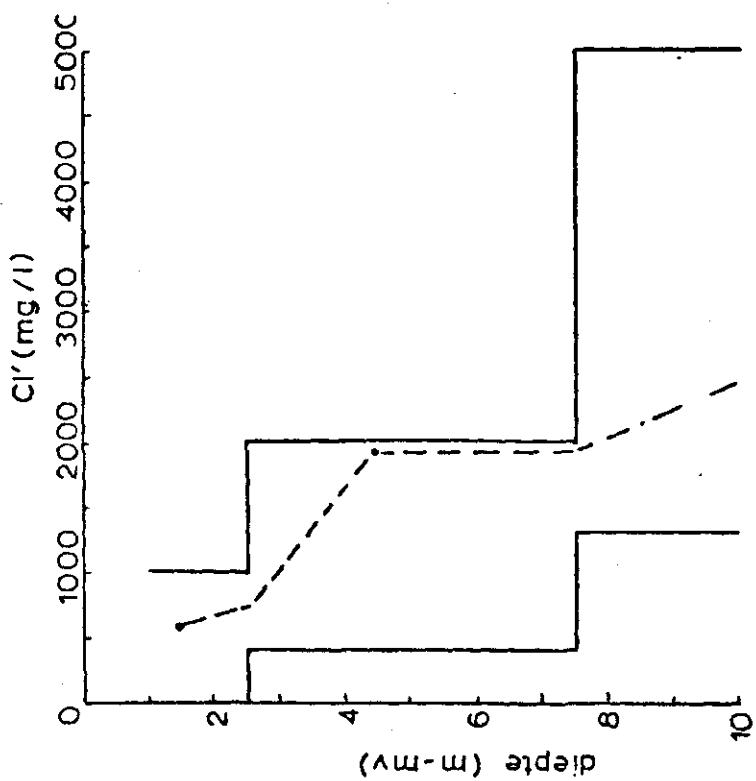
LOKATIE 51



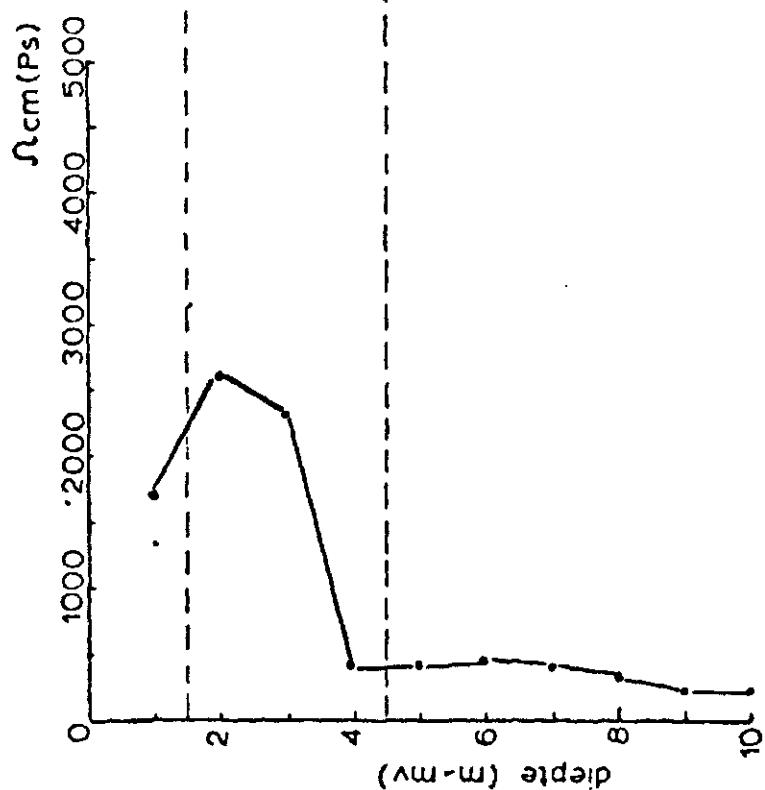
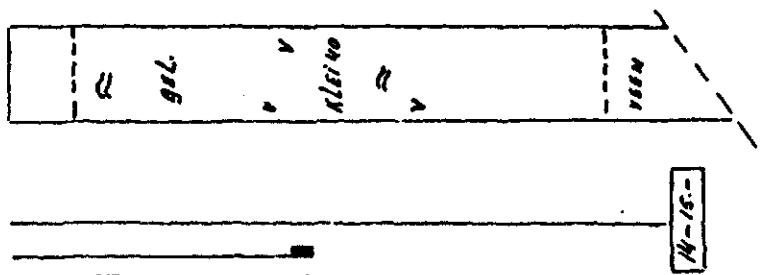
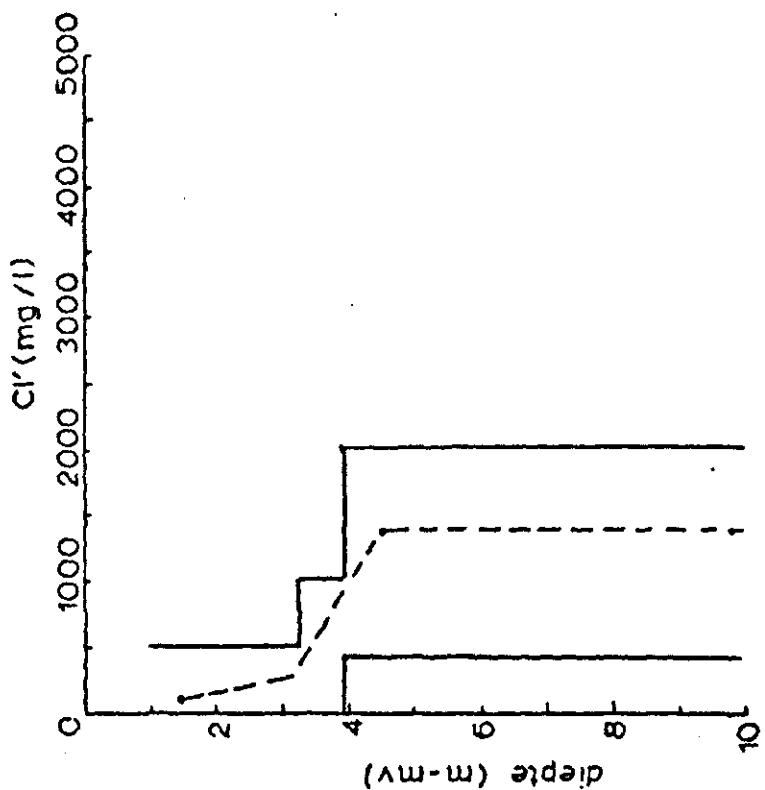
LOKATIE 52



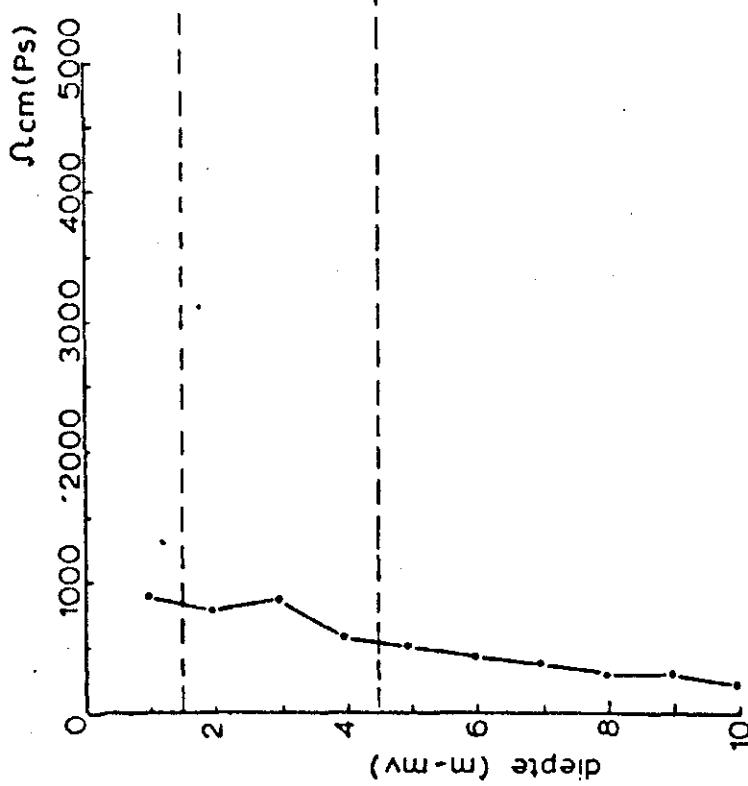
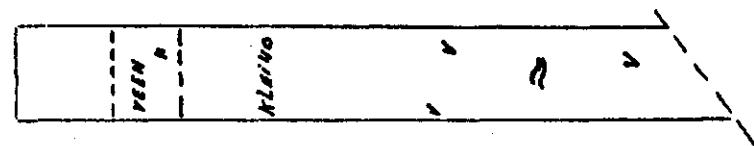
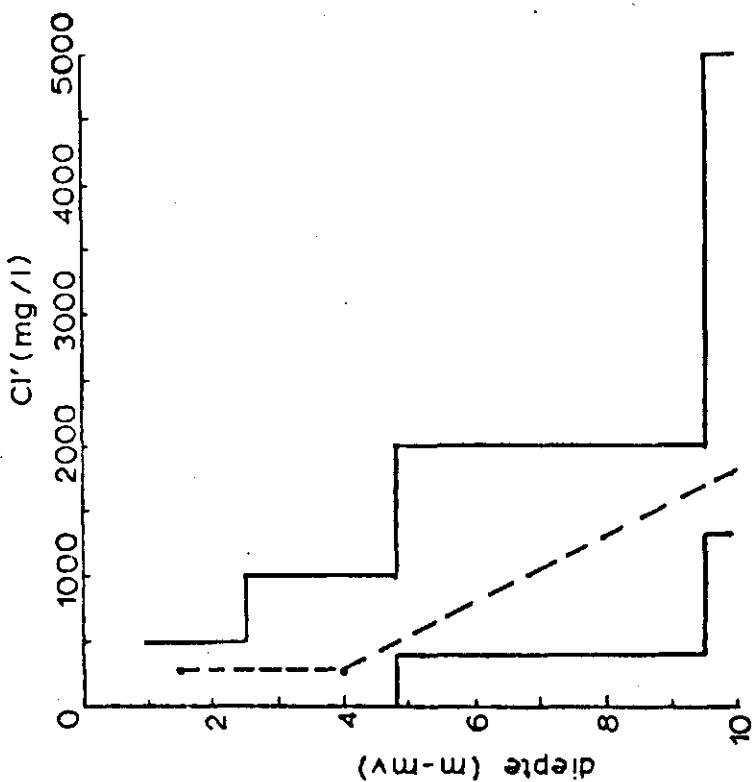
LOKATIE #3



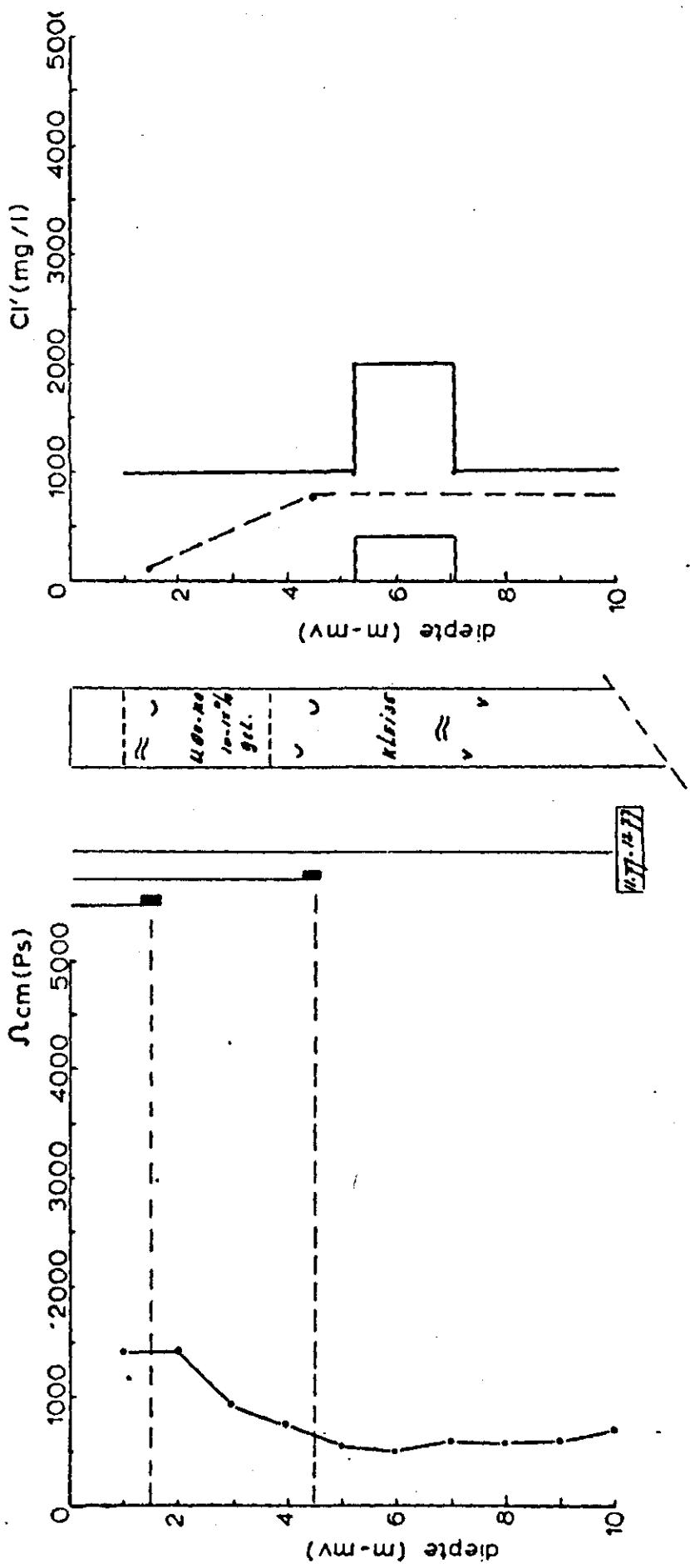
LOKATIE 54



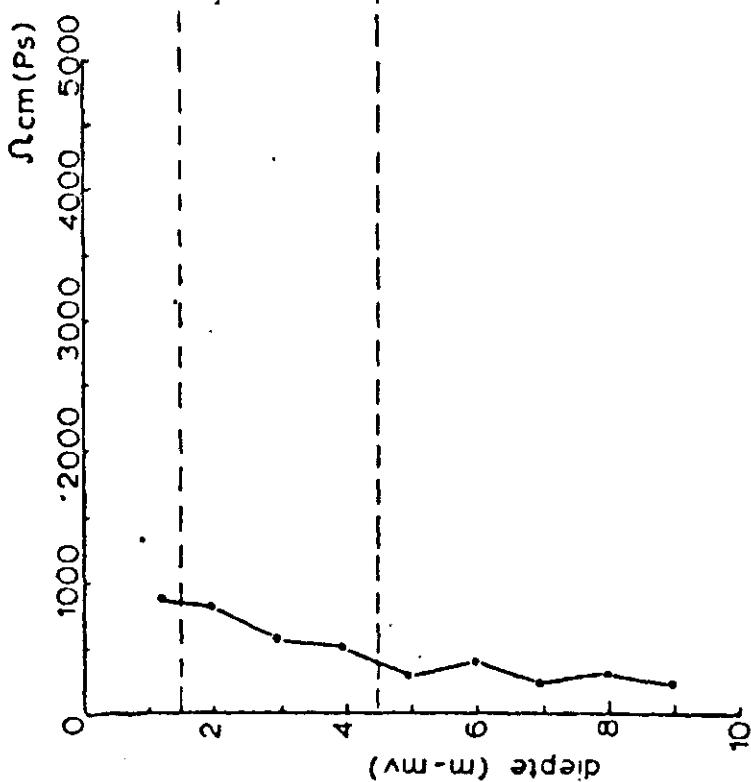
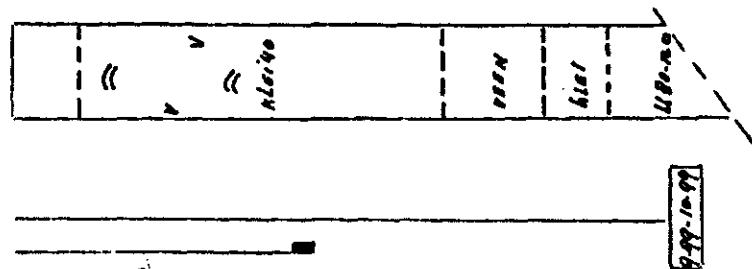
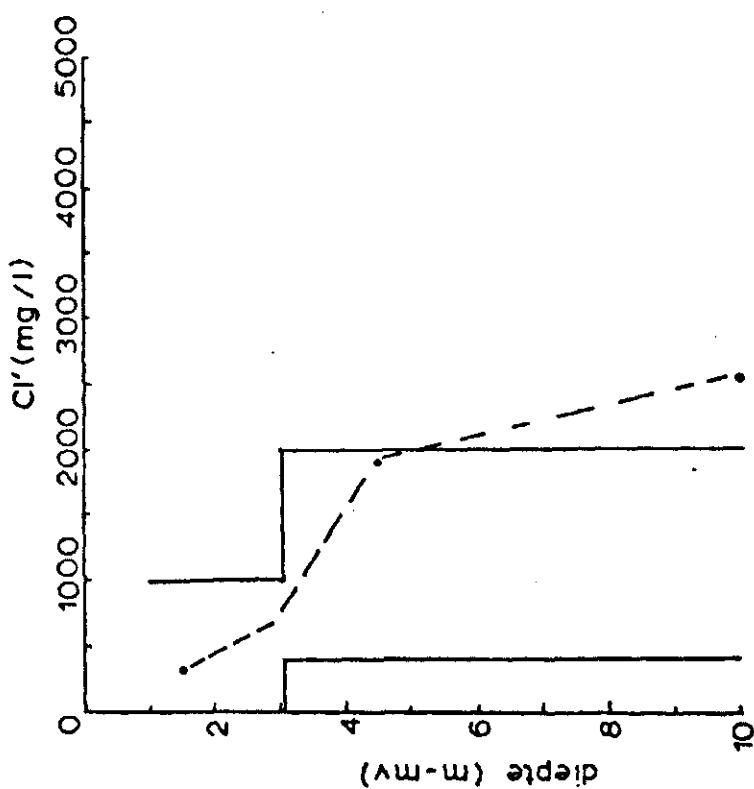
LOKATIE 56



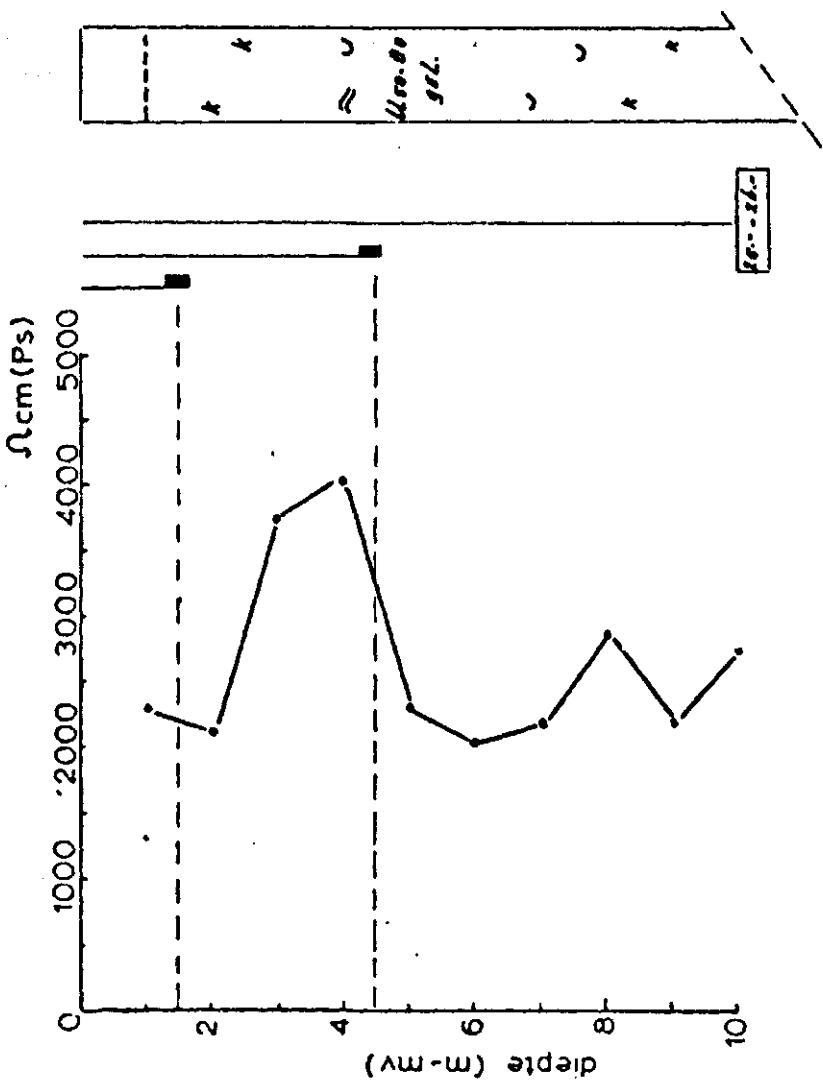
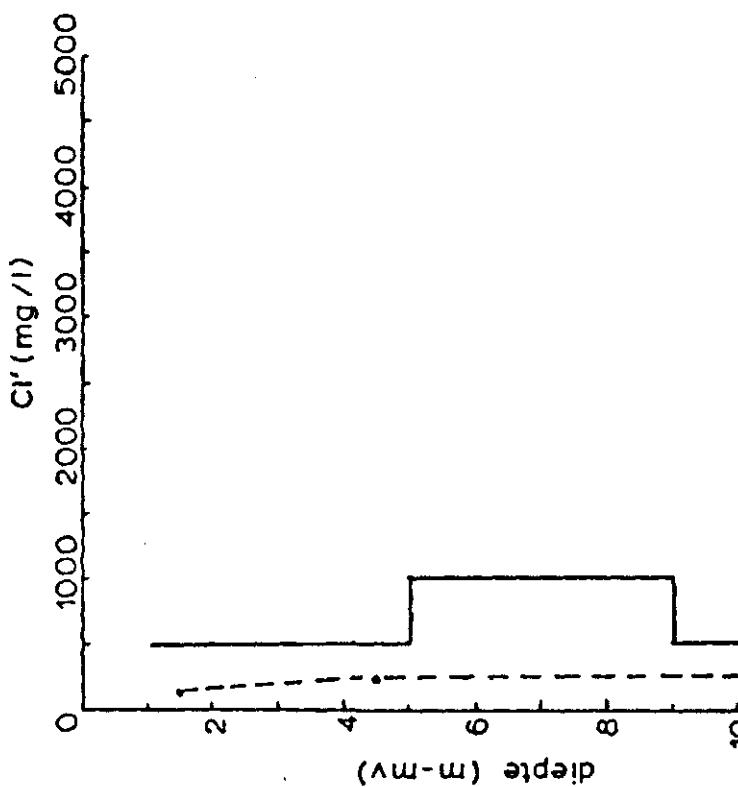
LOKATIE 57



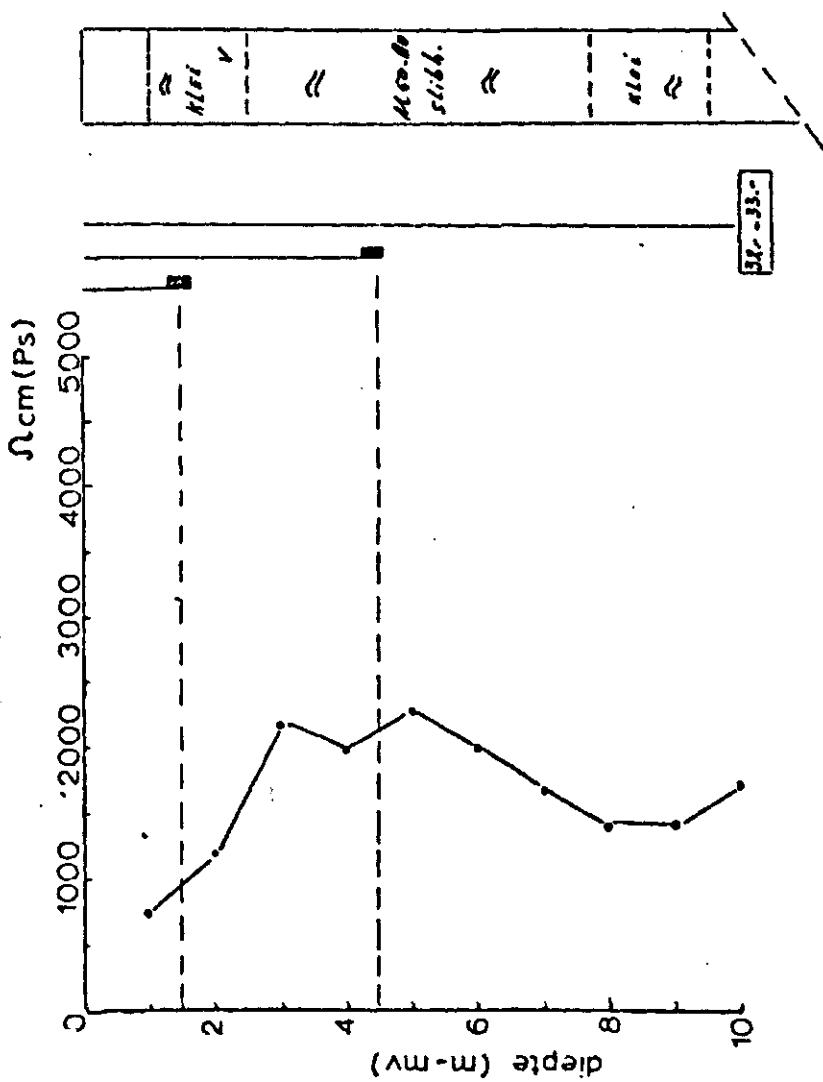
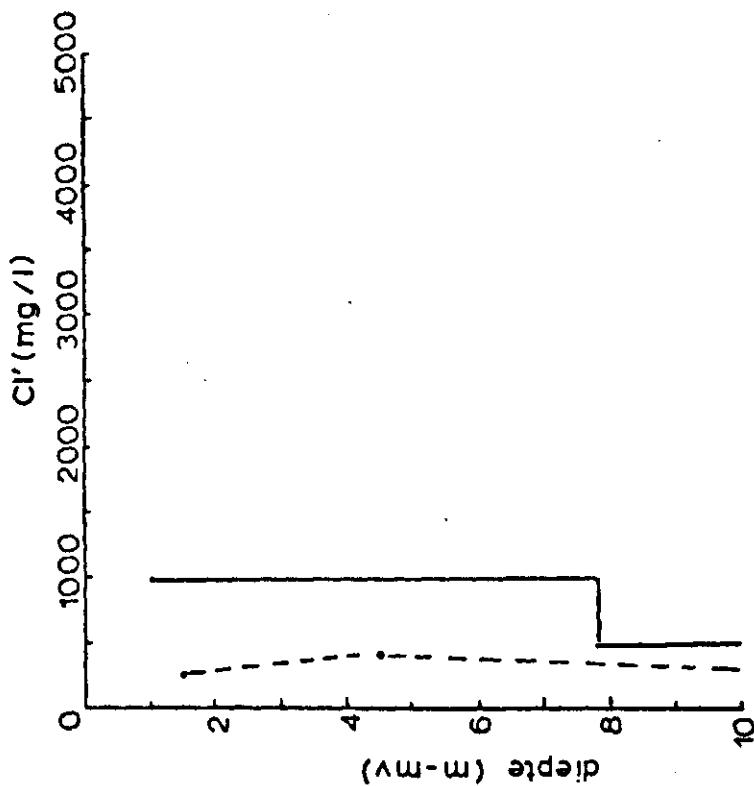
LOKATIE 68



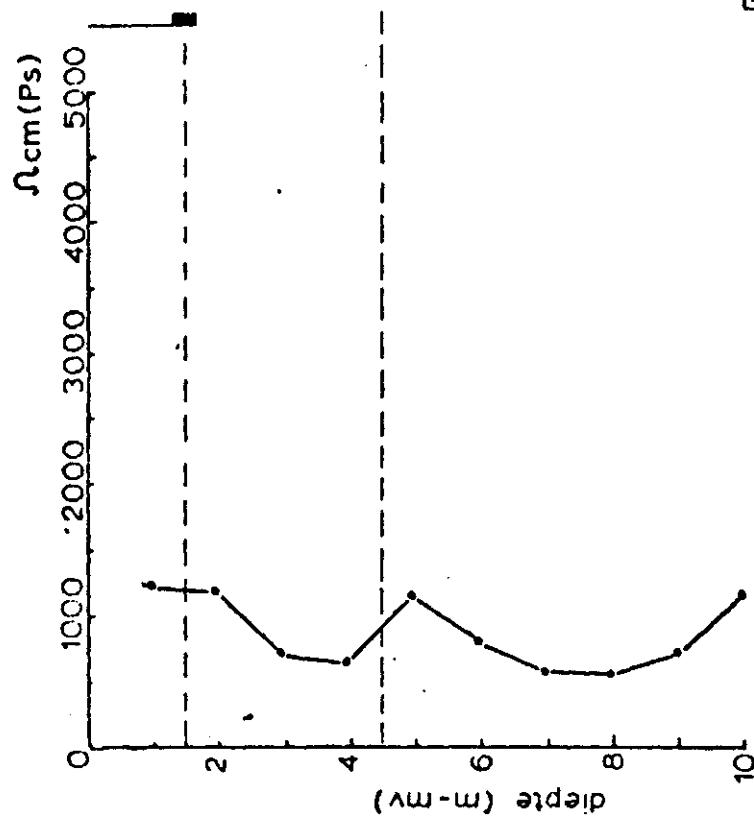
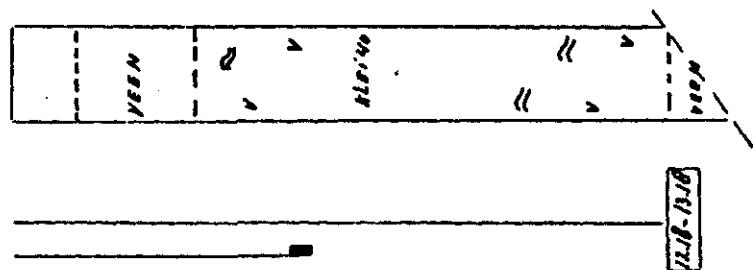
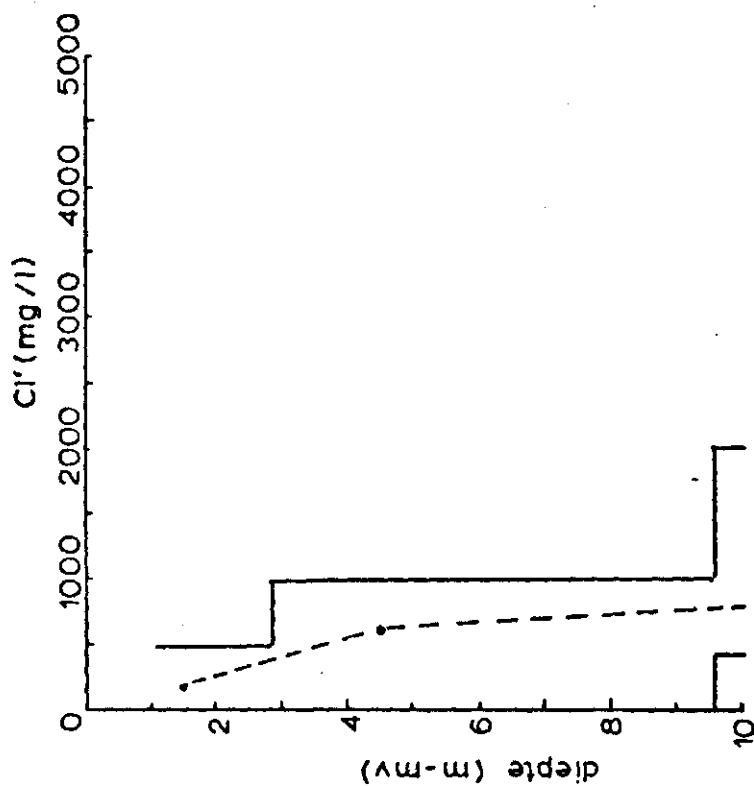
LOKATIE 59



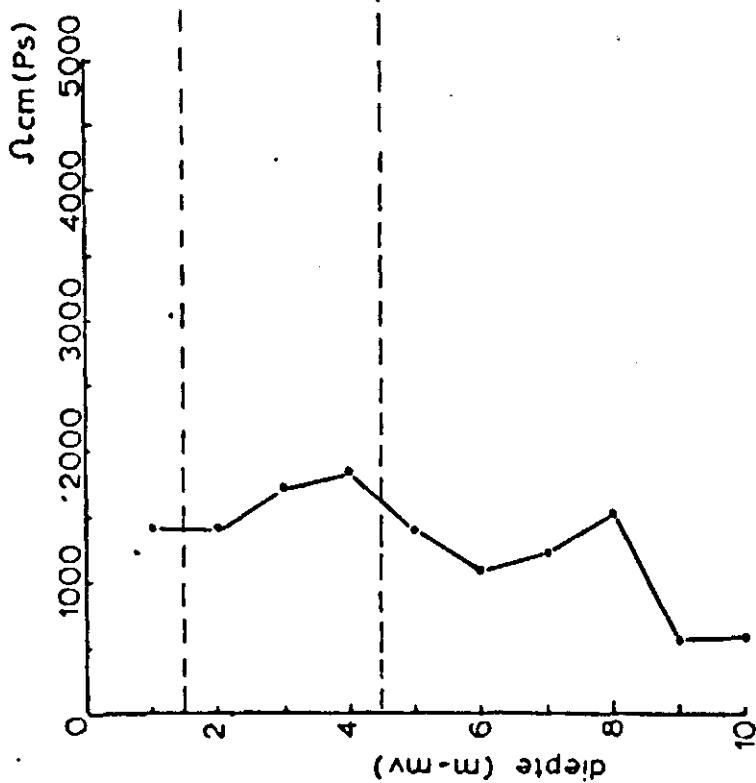
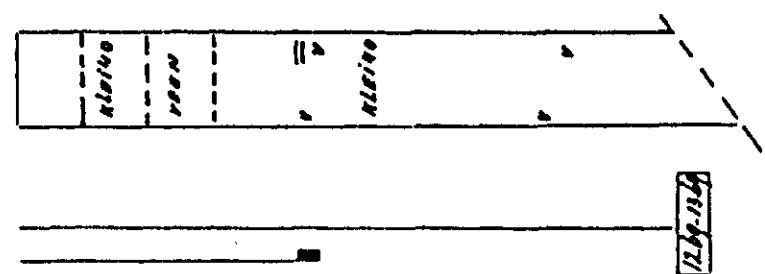
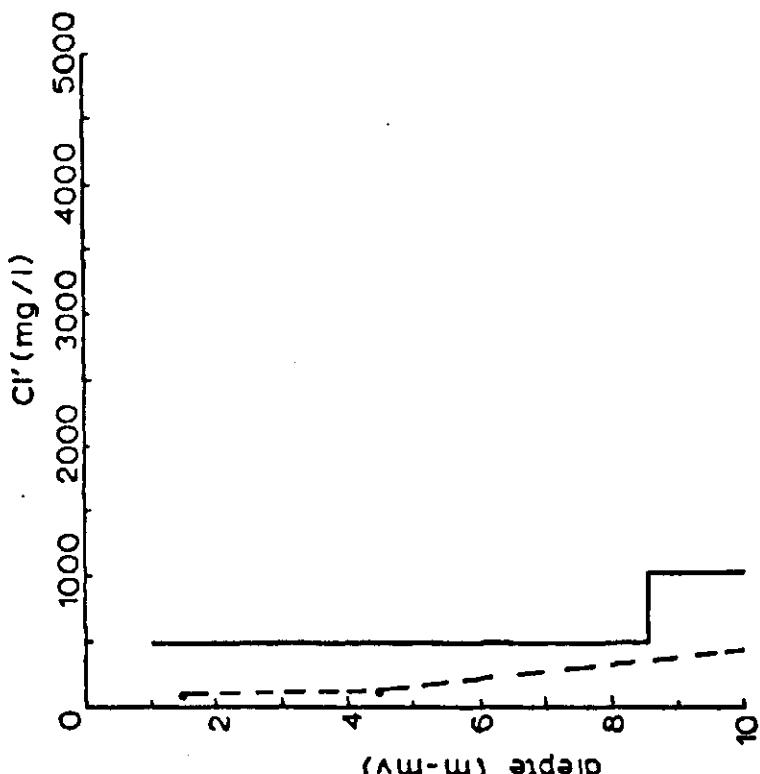
LOKATIE 60



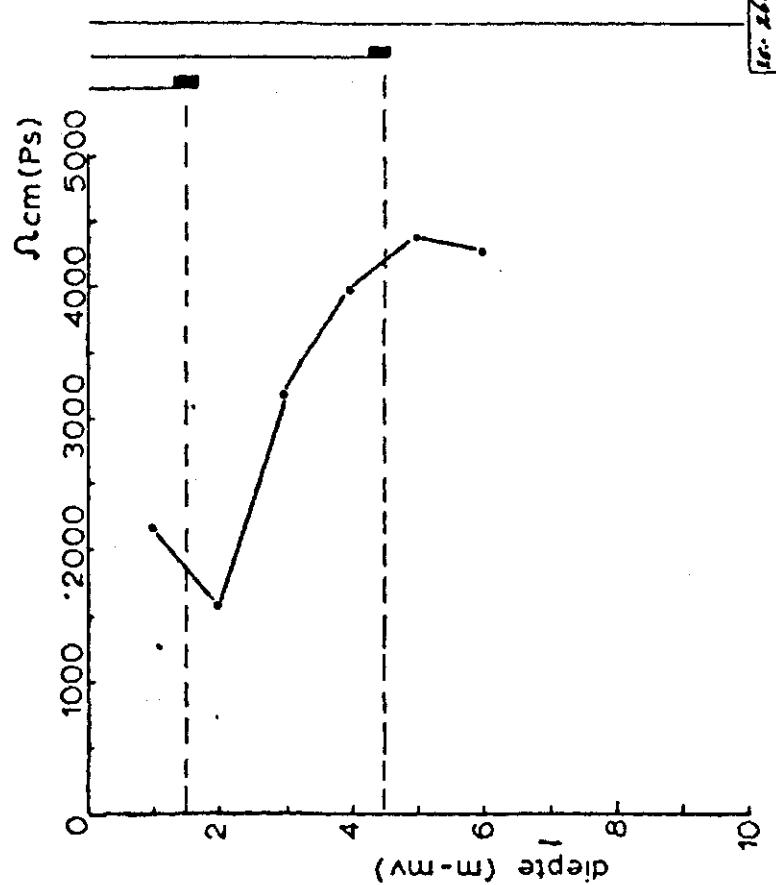
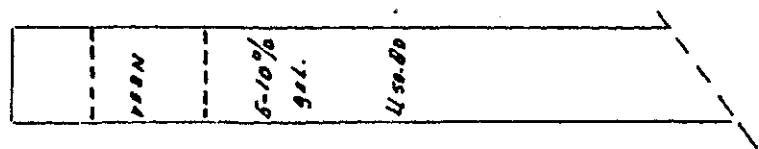
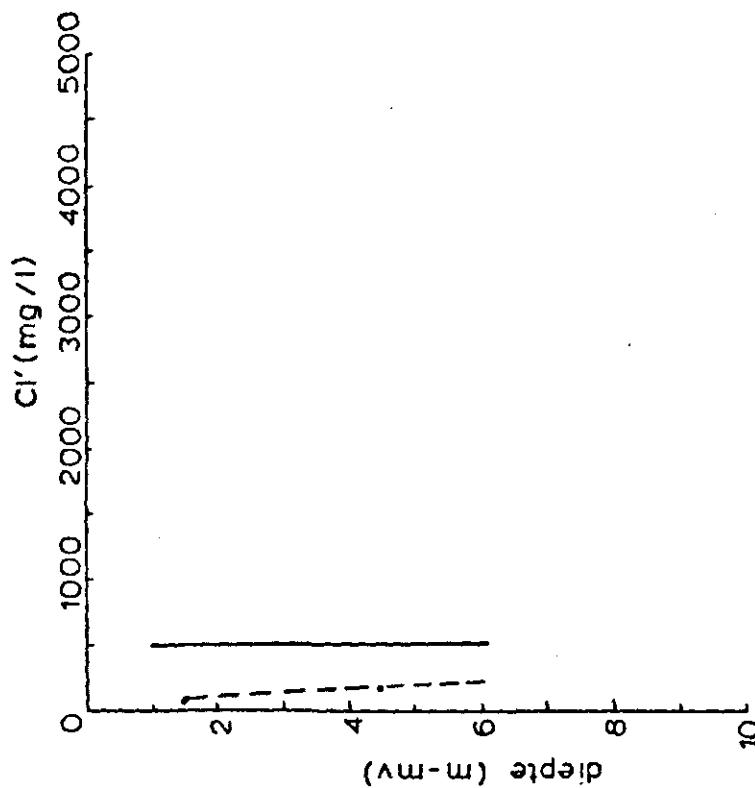
LOKATIE 61



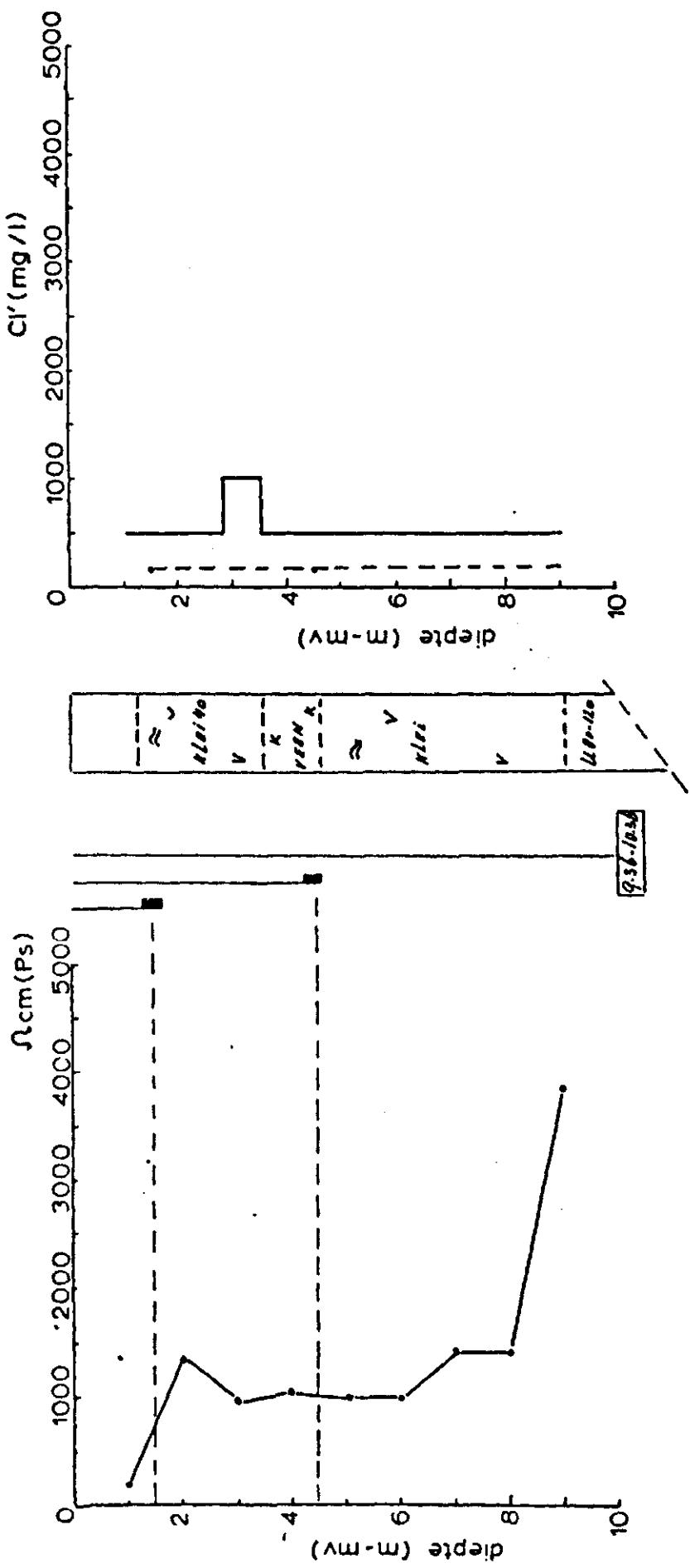
LOKATIE 62



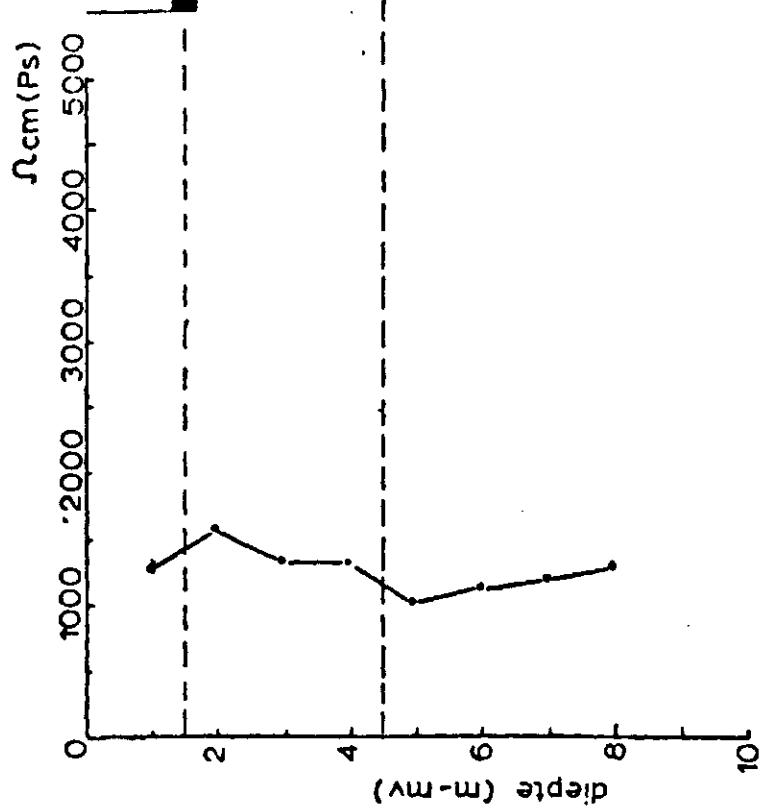
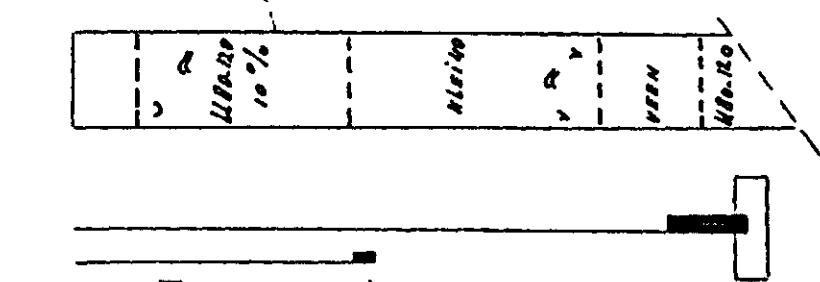
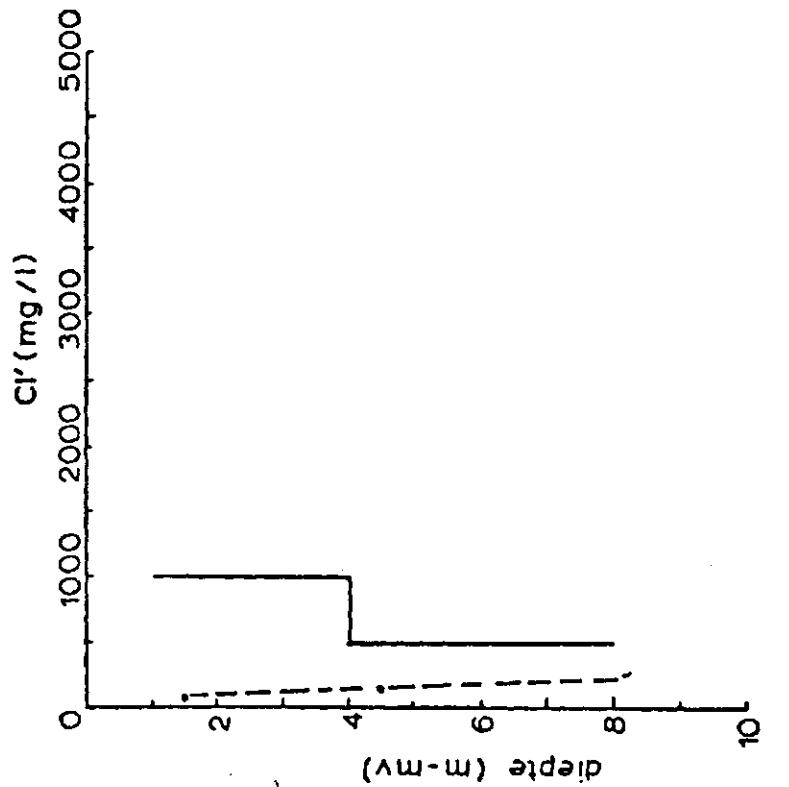
LOKATIE 63



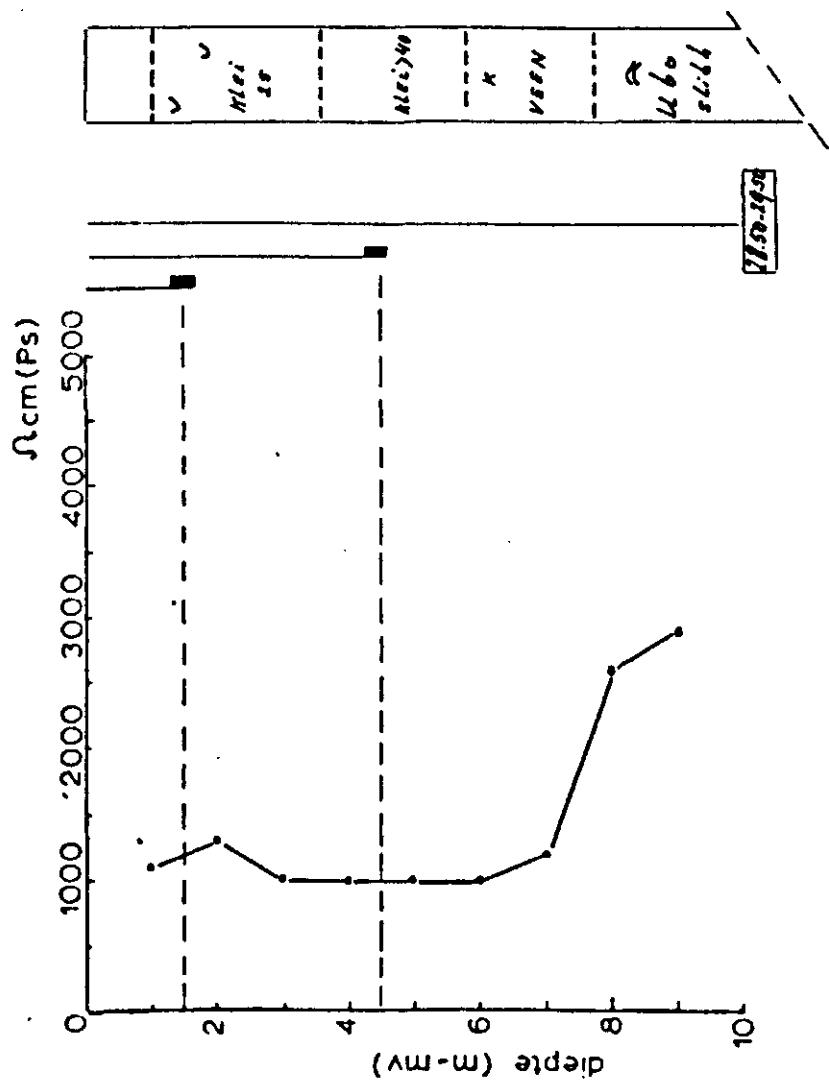
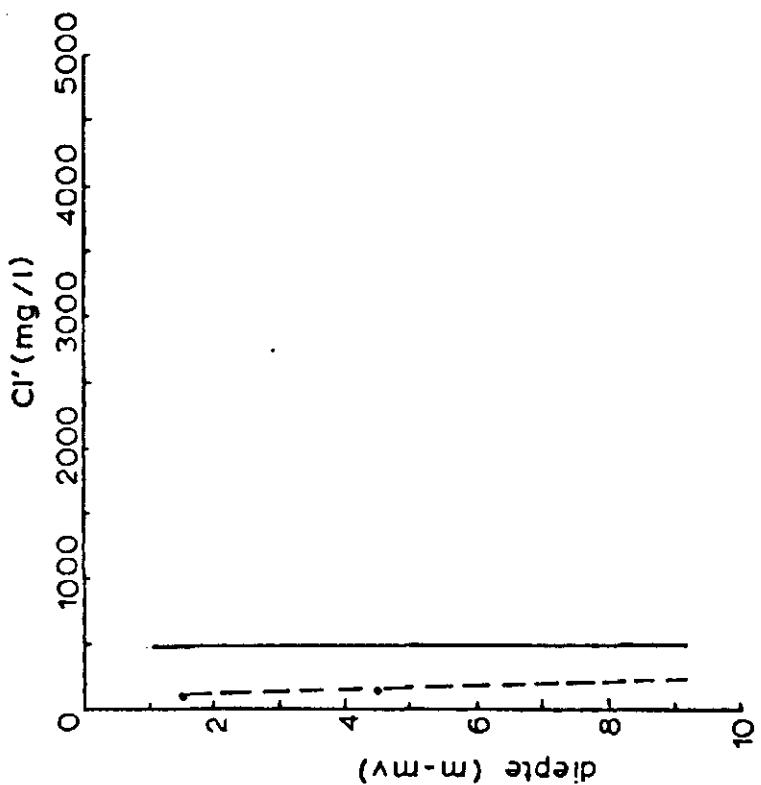
LOKATIE 64



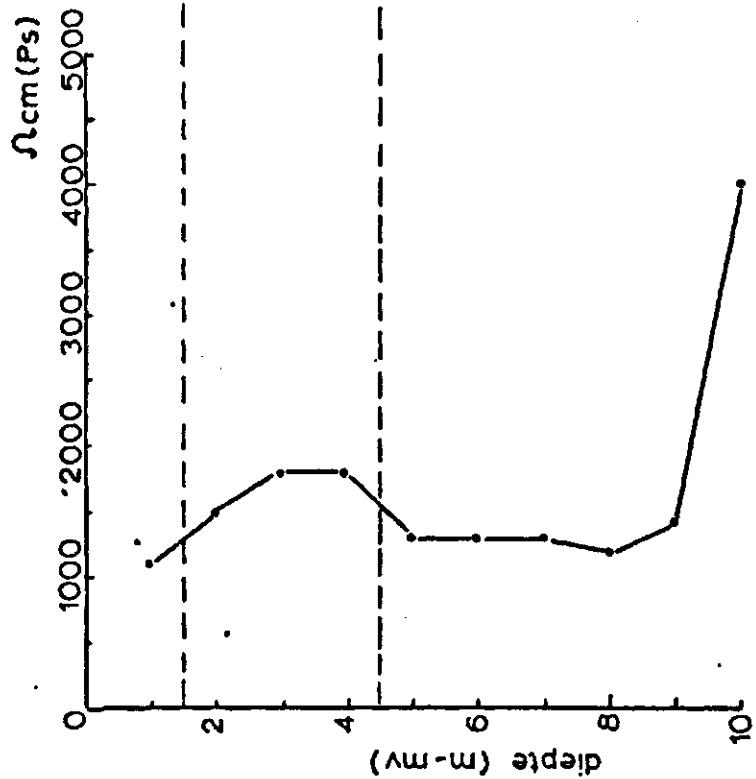
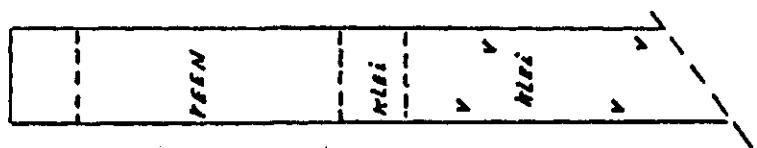
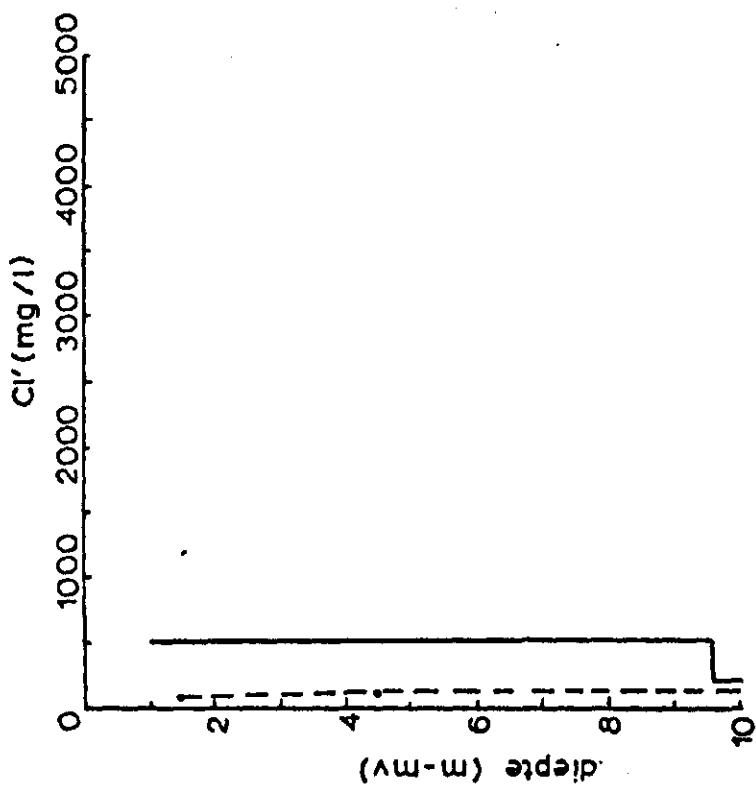
LOKATIE 66



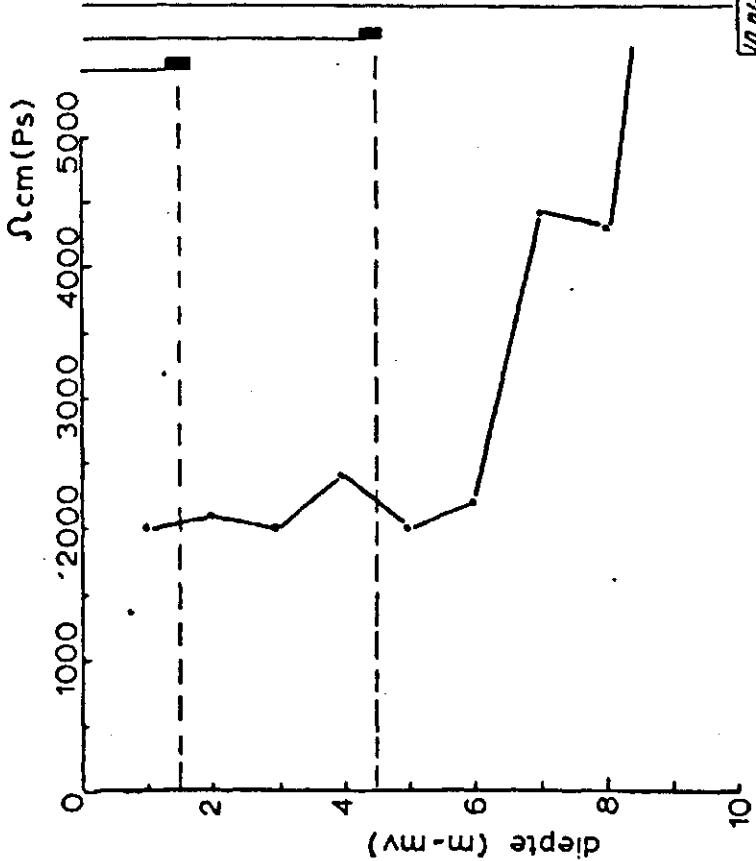
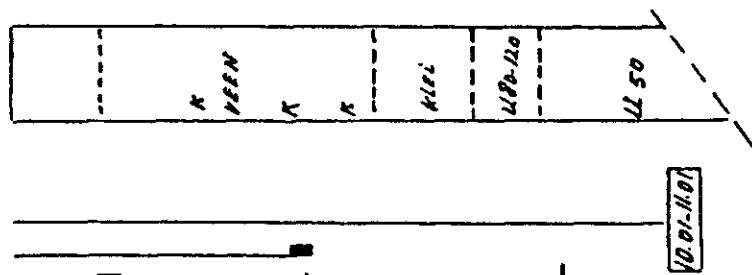
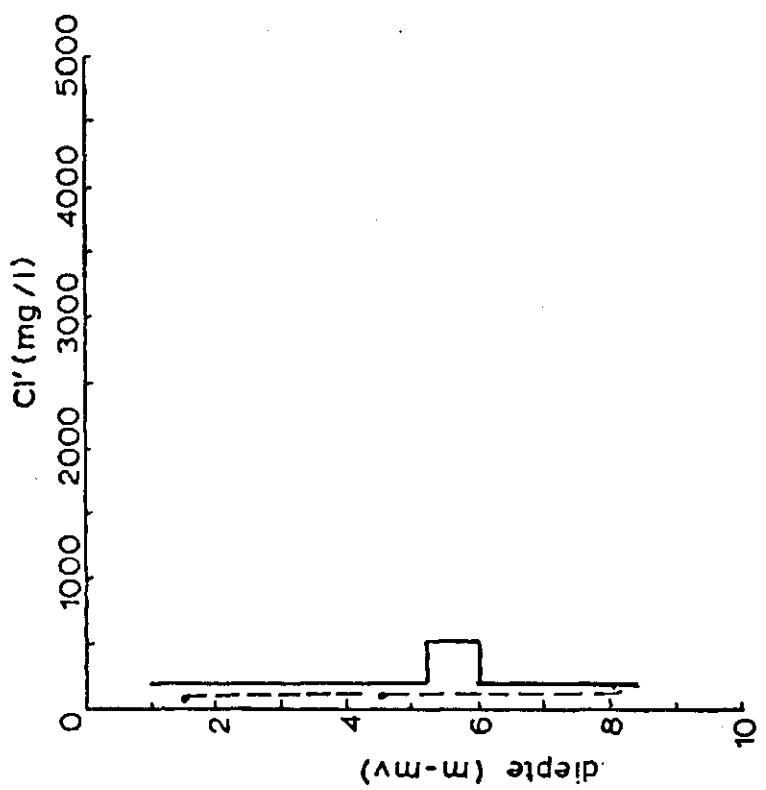
LOKATIE 67



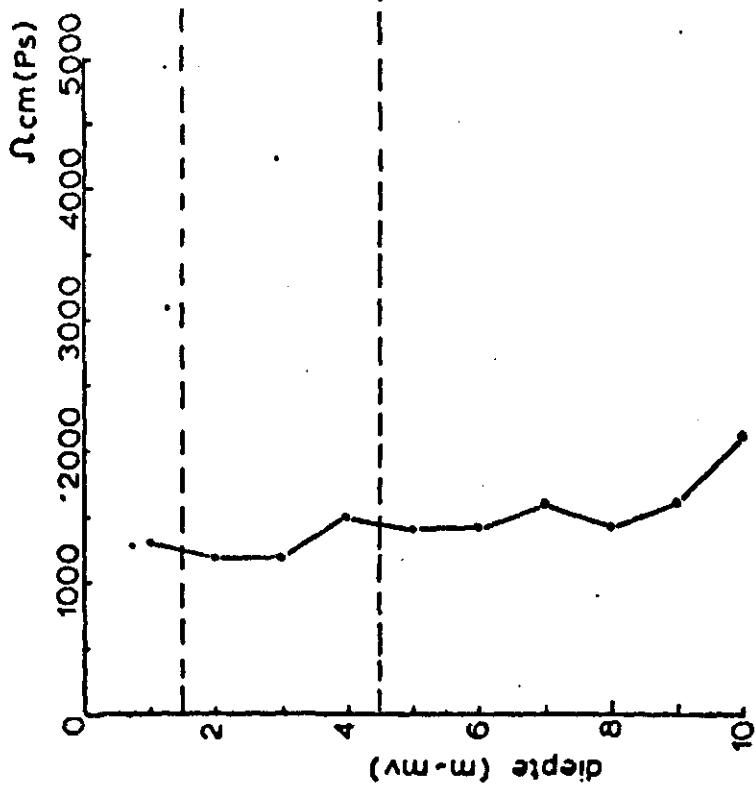
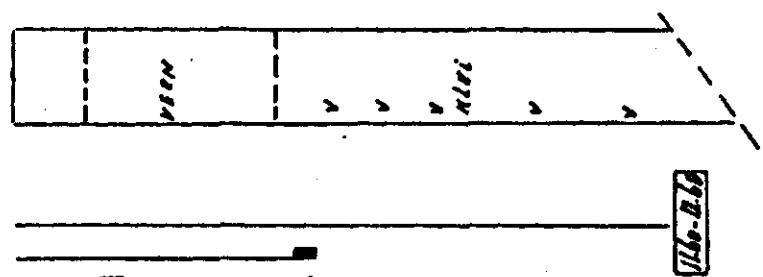
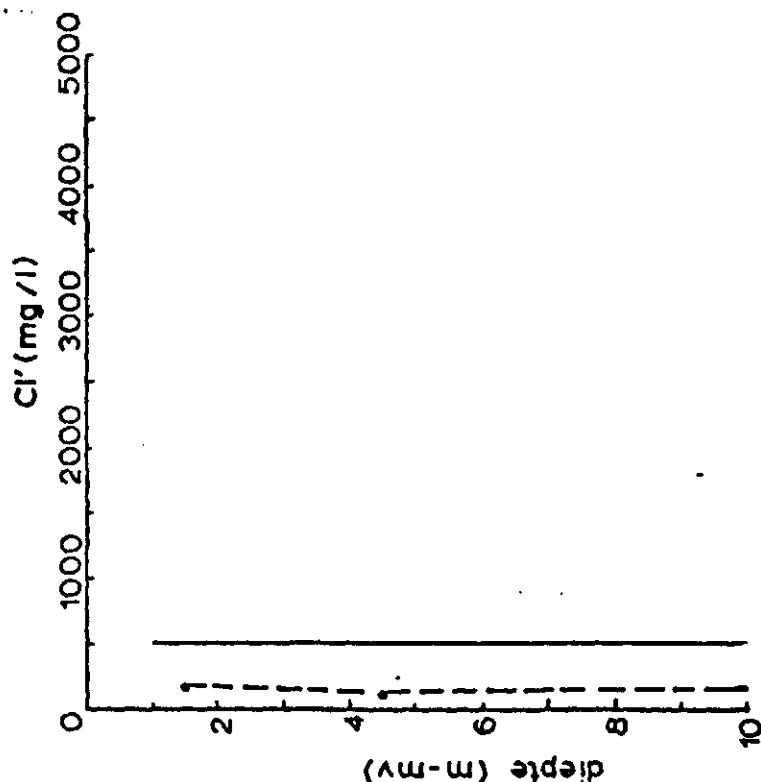
LOKATIE 68



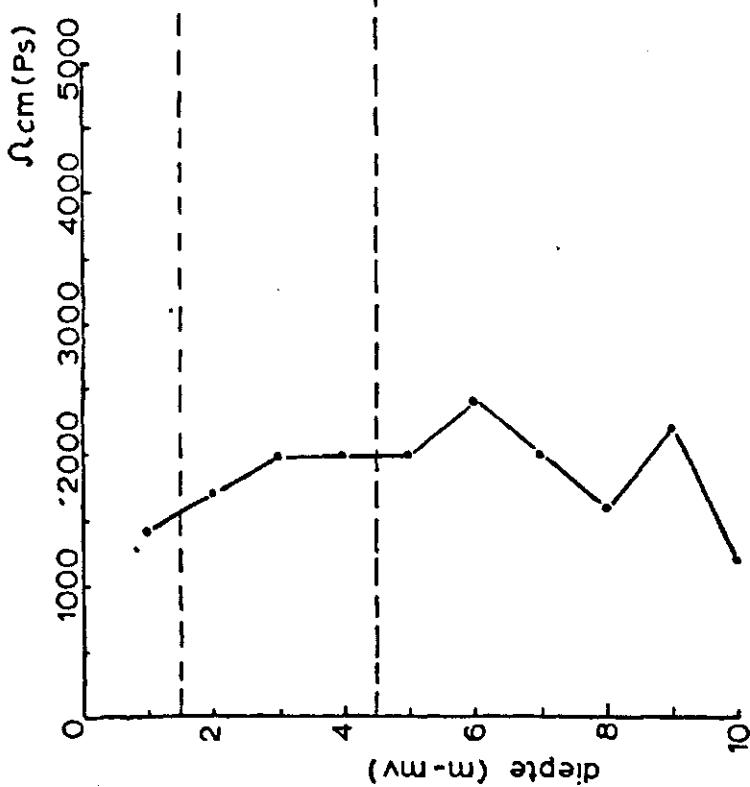
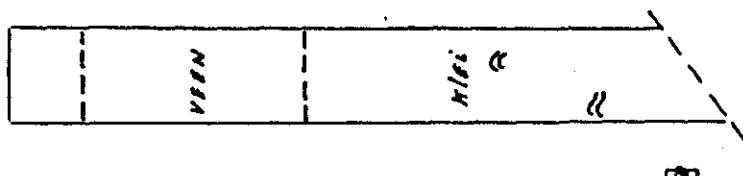
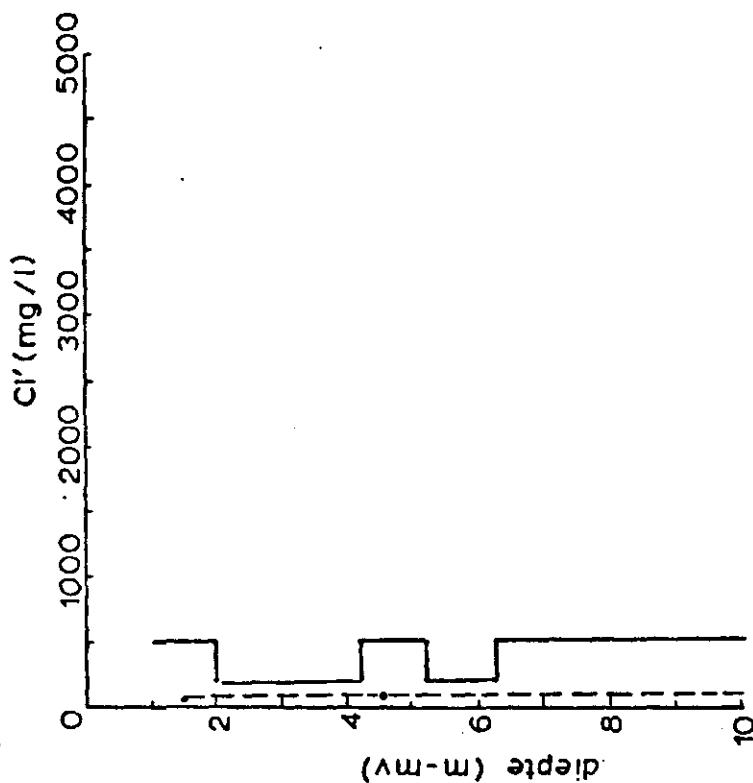
LOKATIE 69



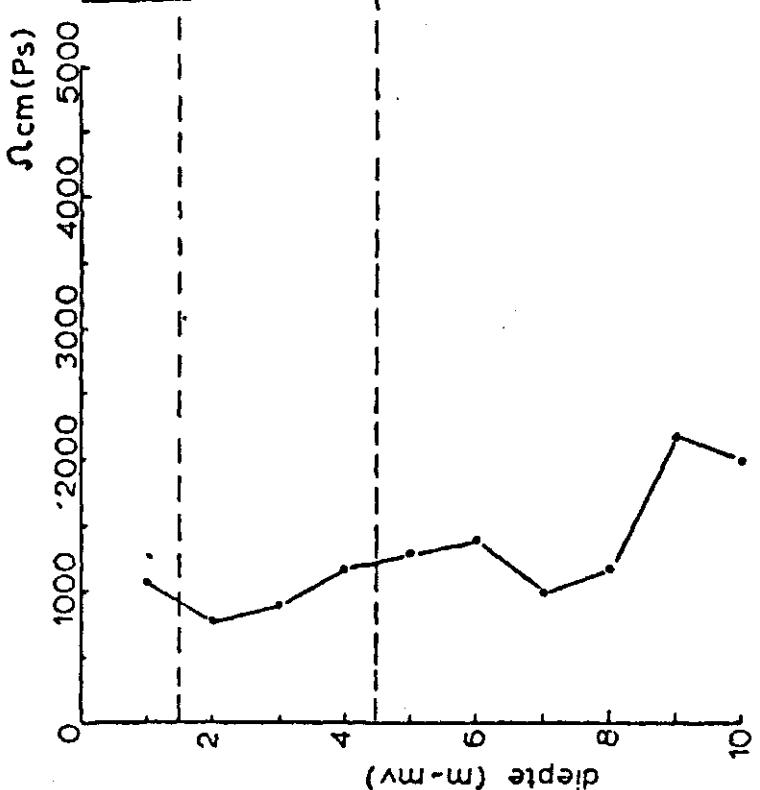
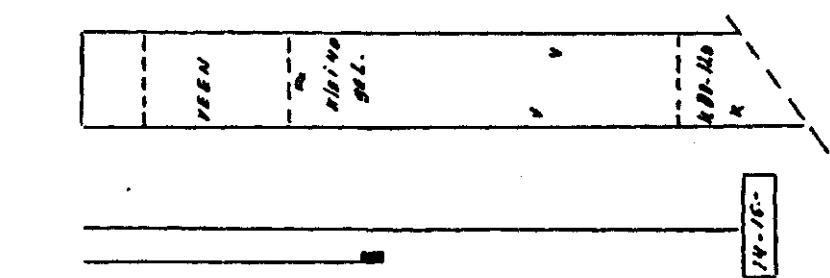
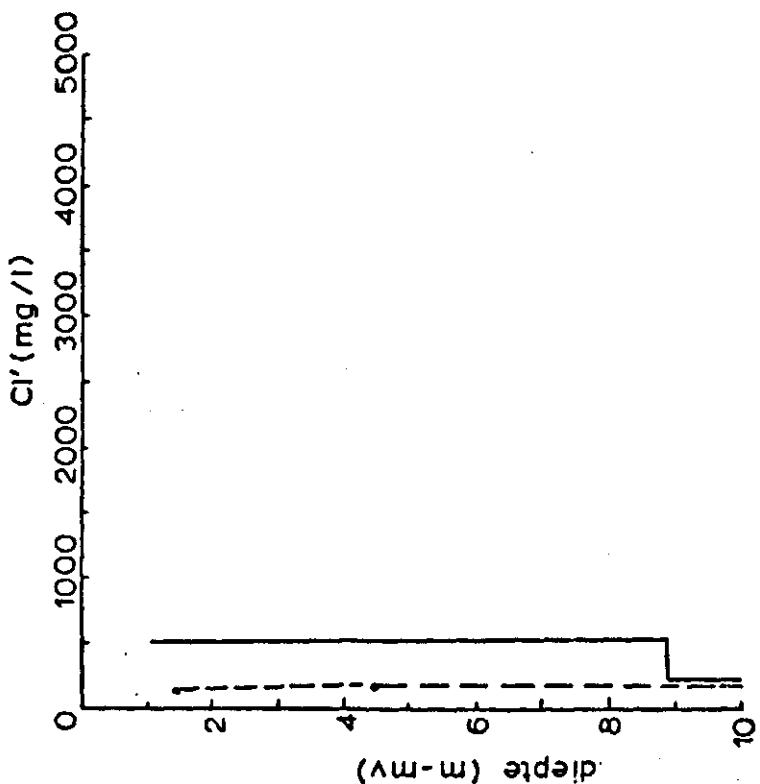
LOKATIE 30



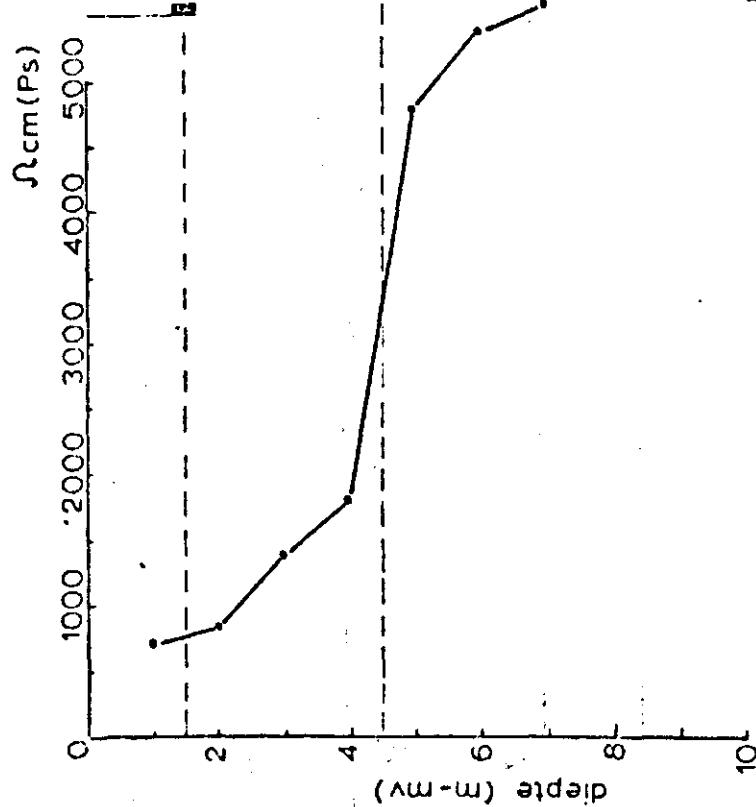
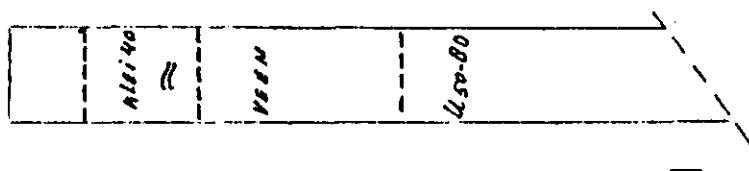
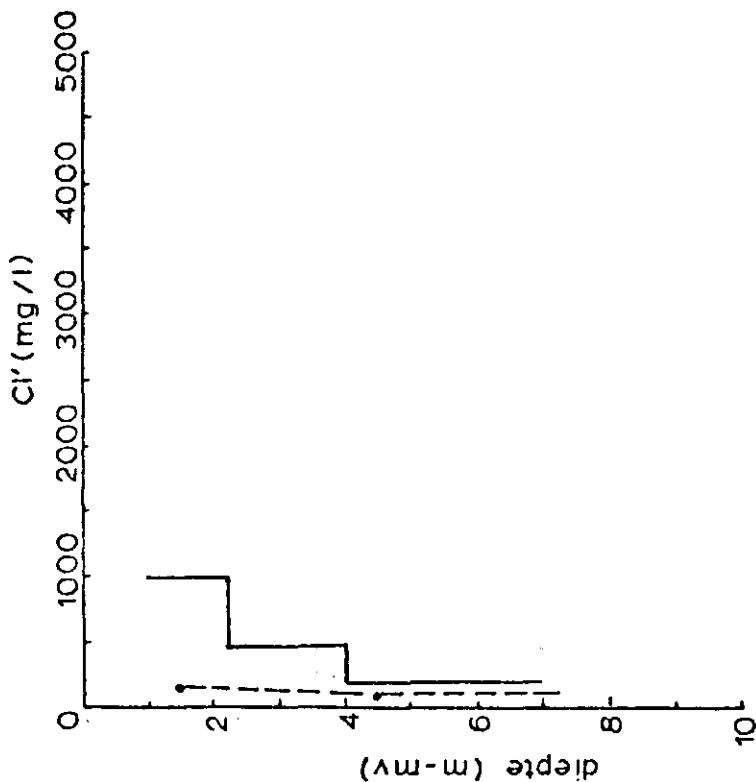
LOKATIE 7'



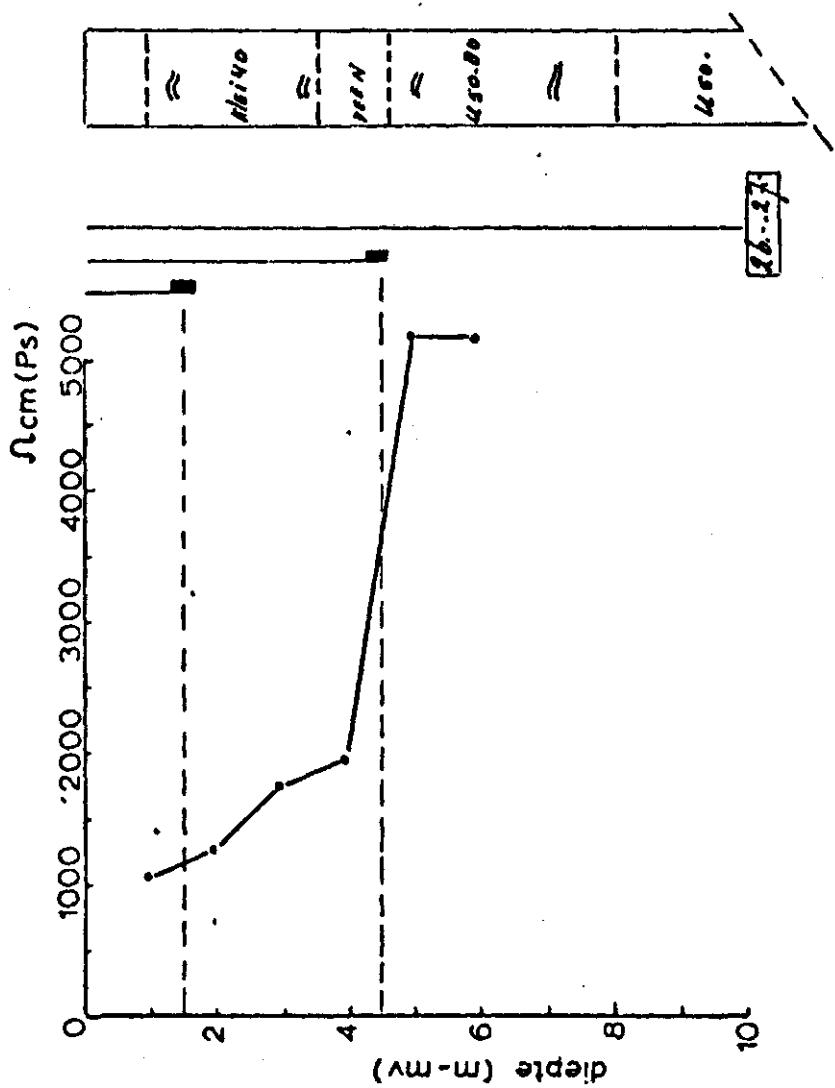
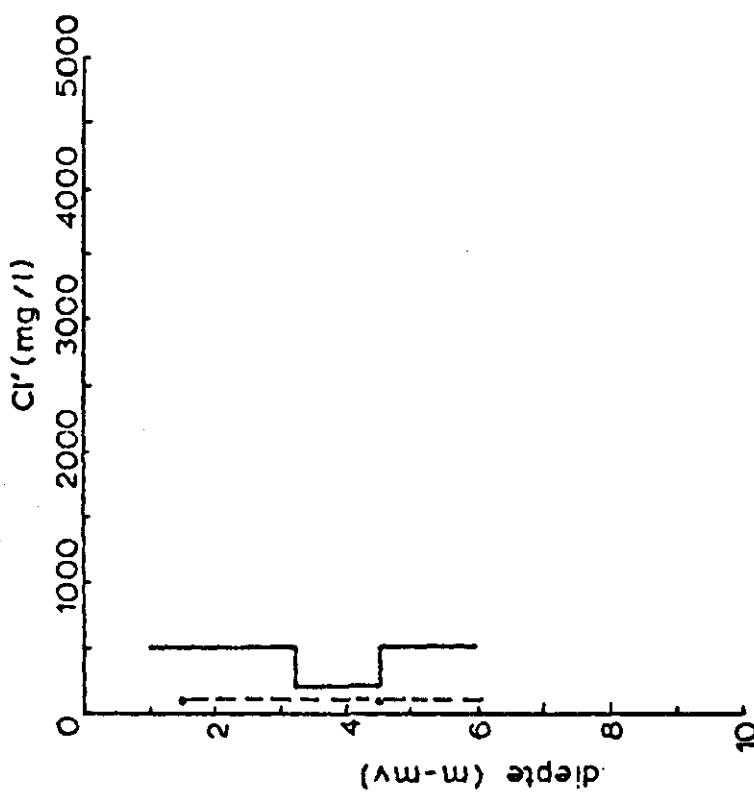
LOKATIE 72



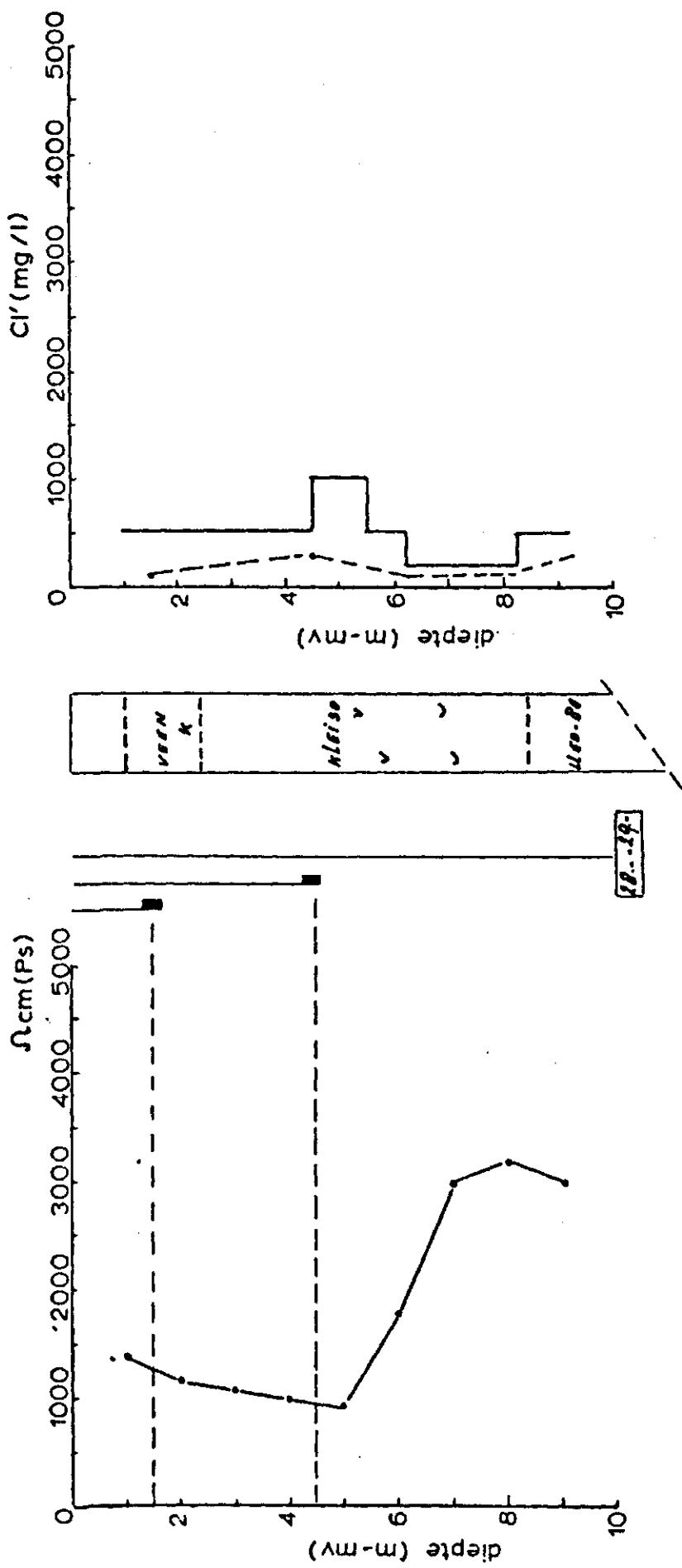
LOKATIE 73



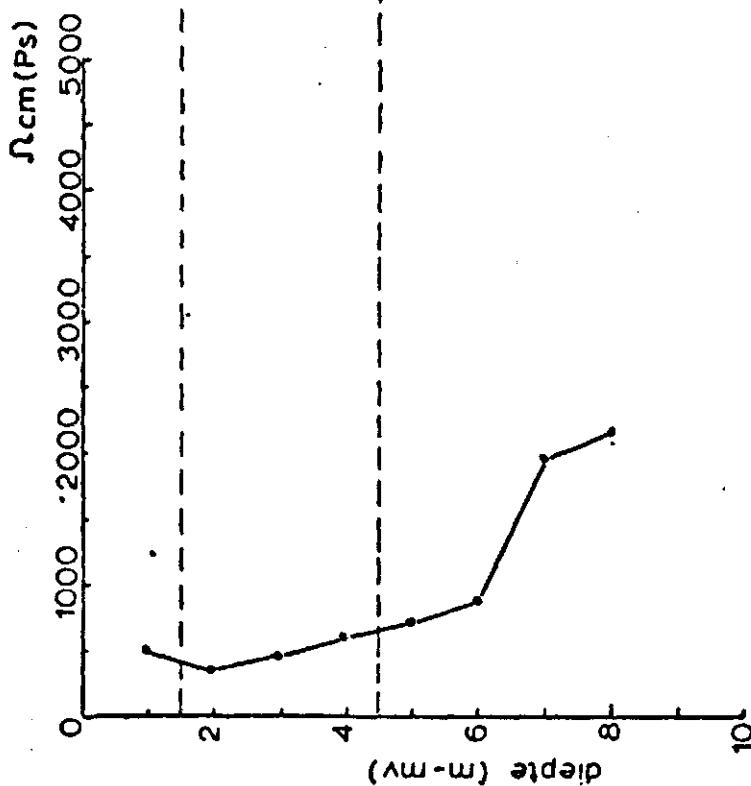
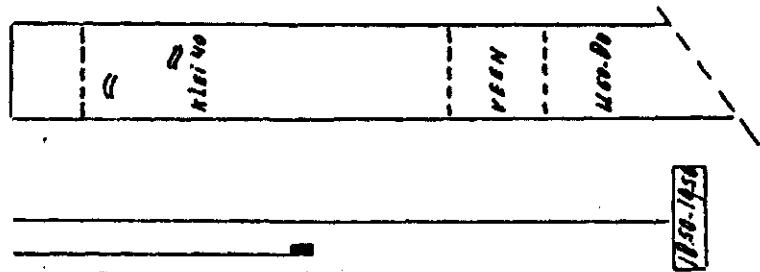
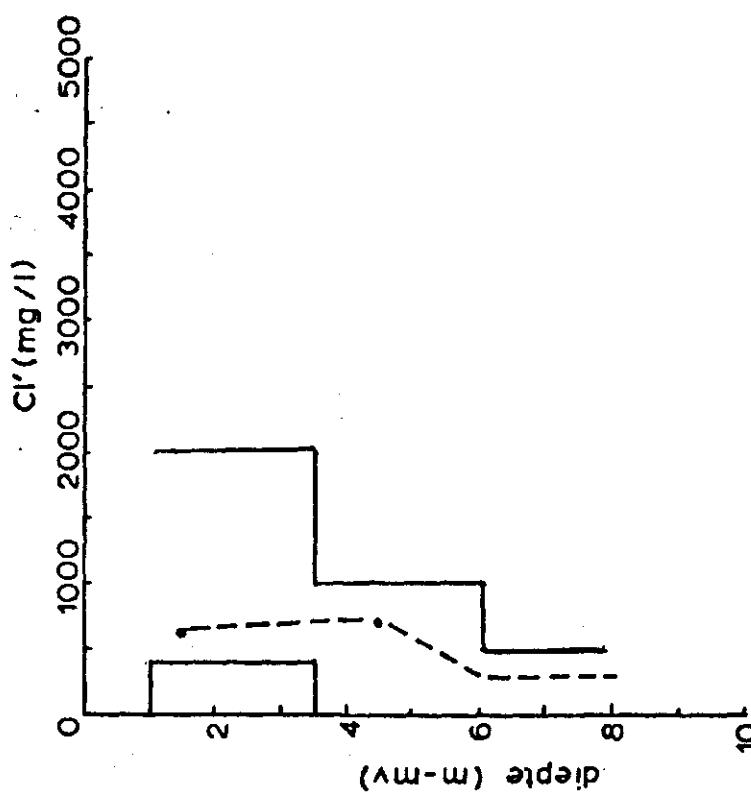
LOKATIE 74



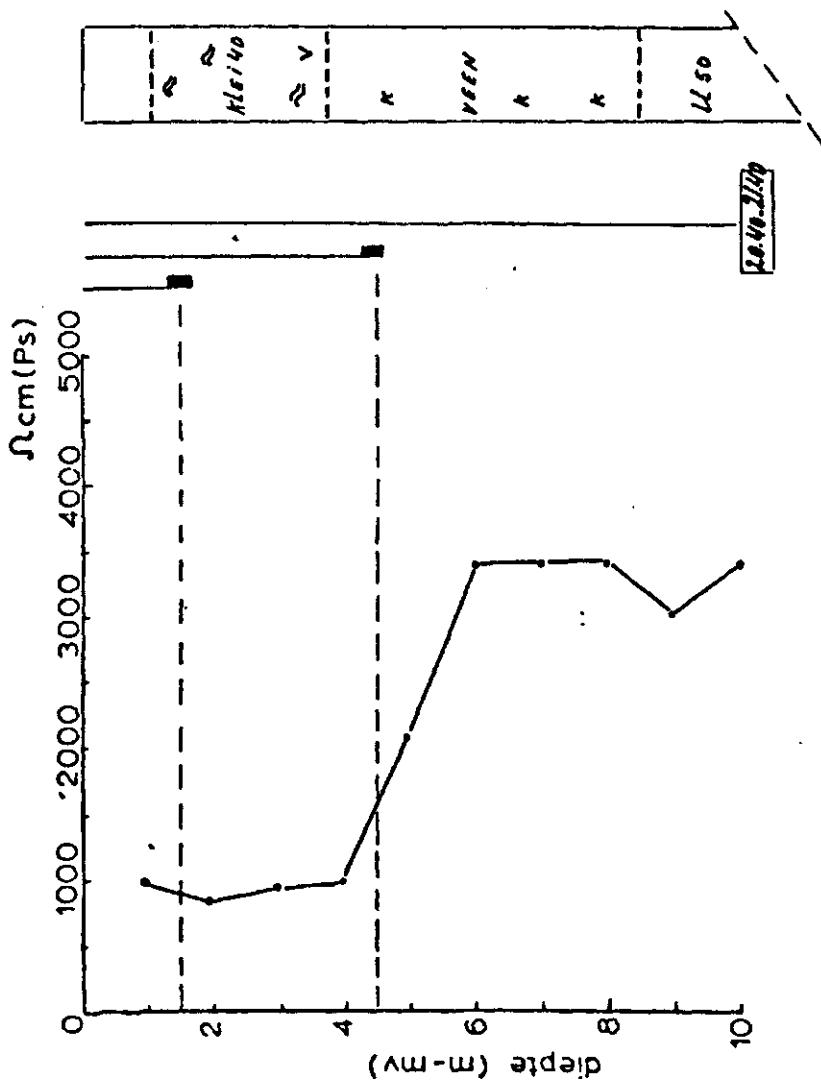
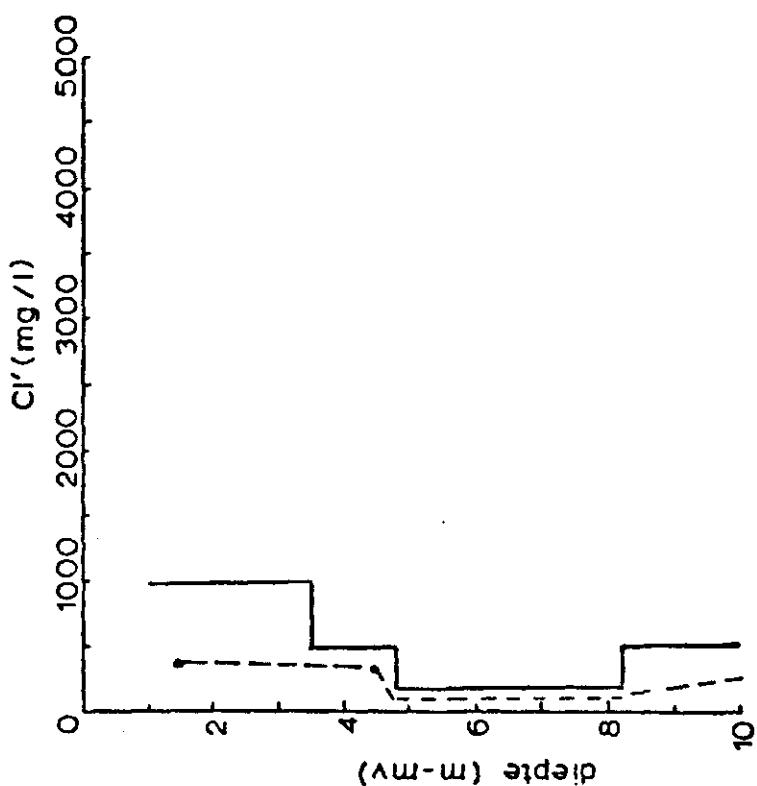
LOKATIE 75



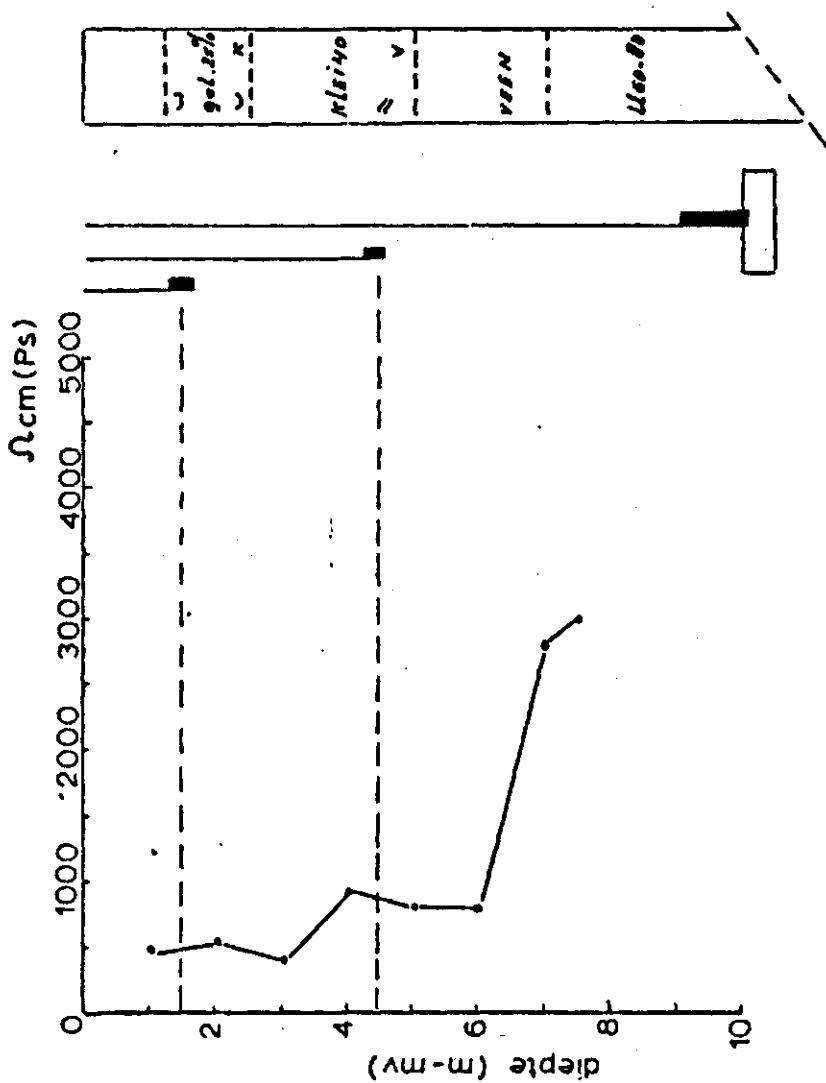
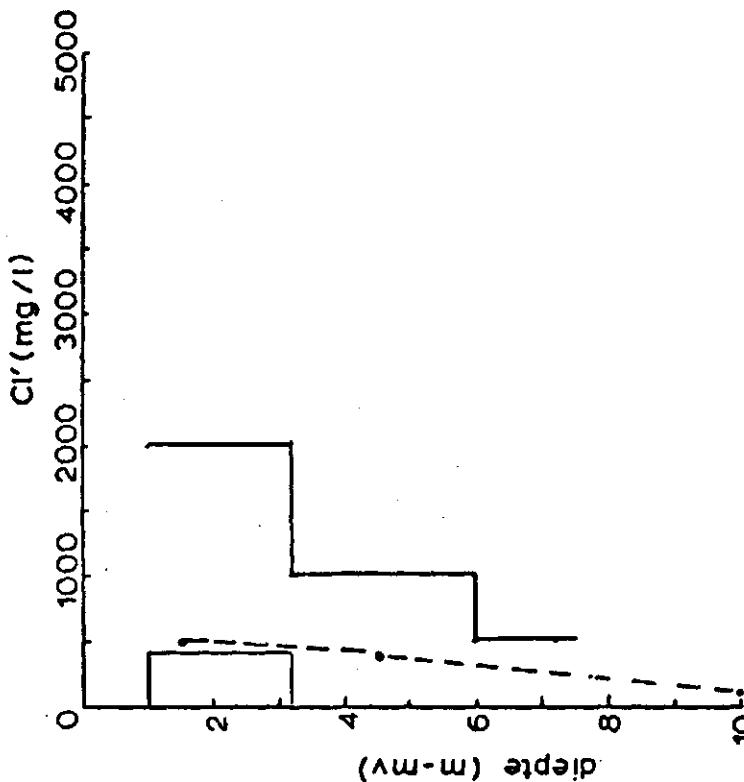
LOKATIE 76



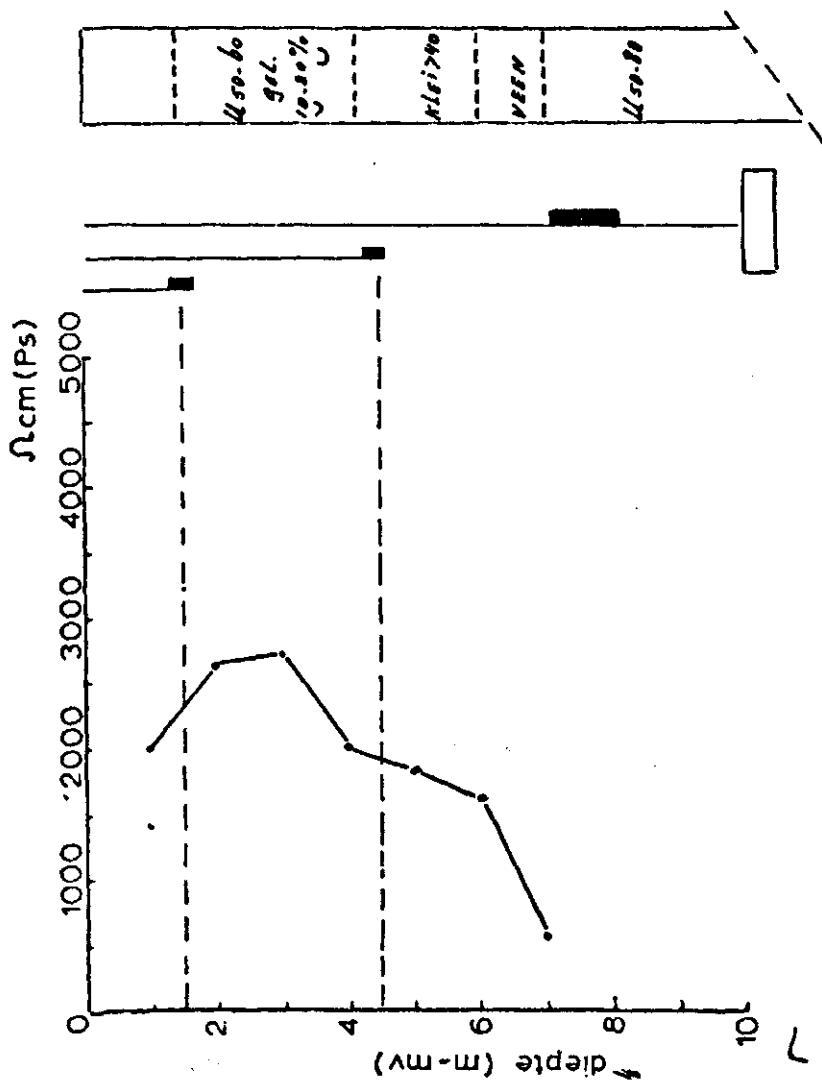
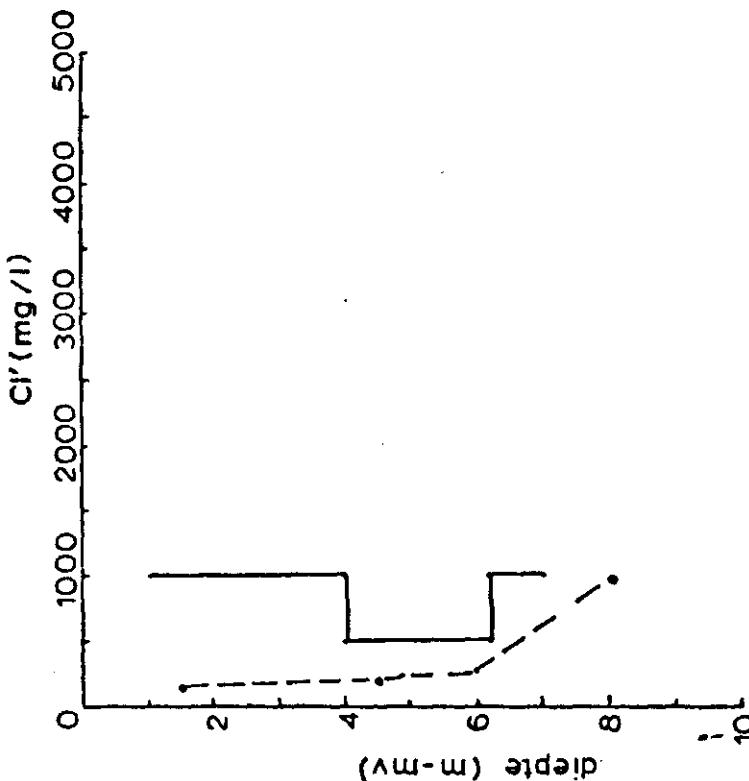
LOKATIE 77



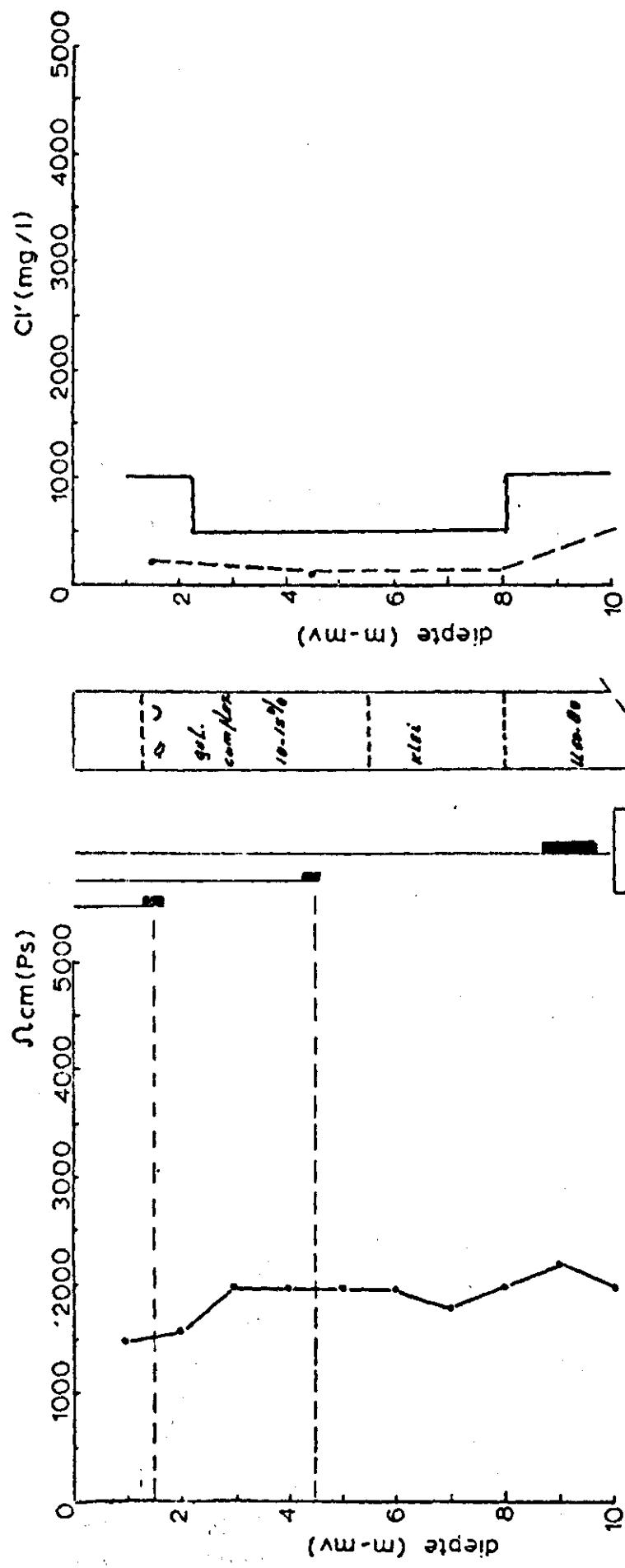
LOKATIE 70



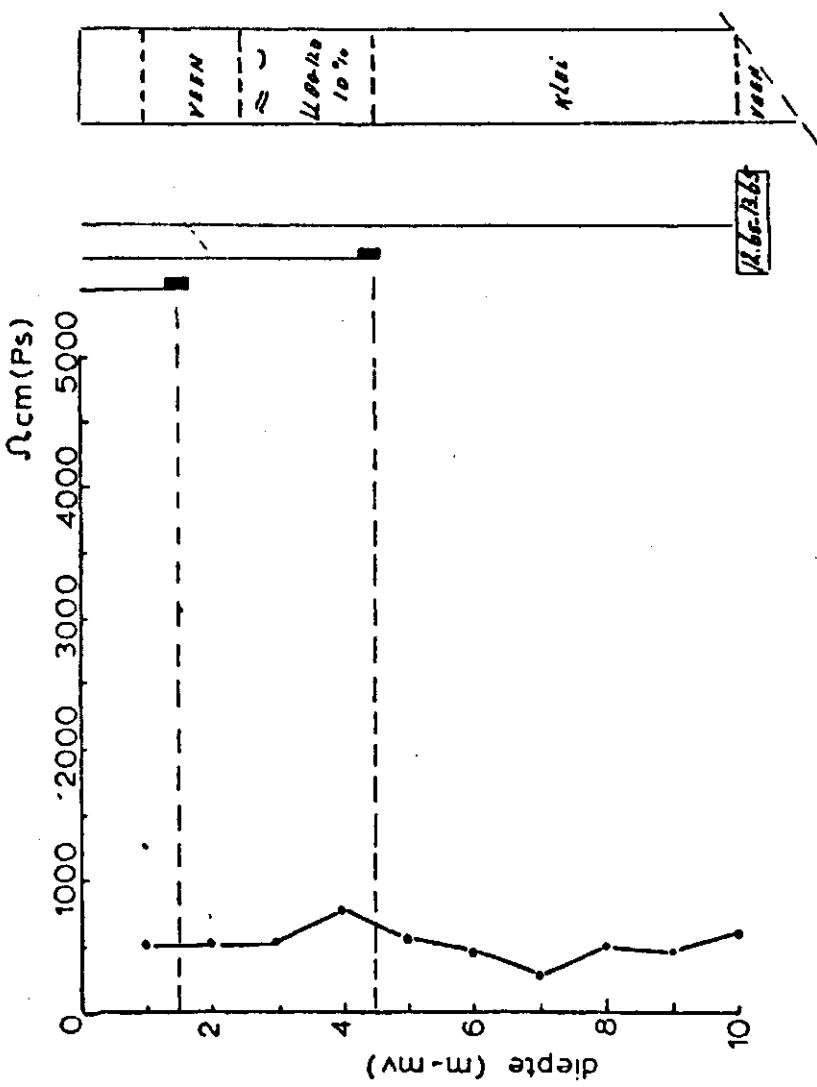
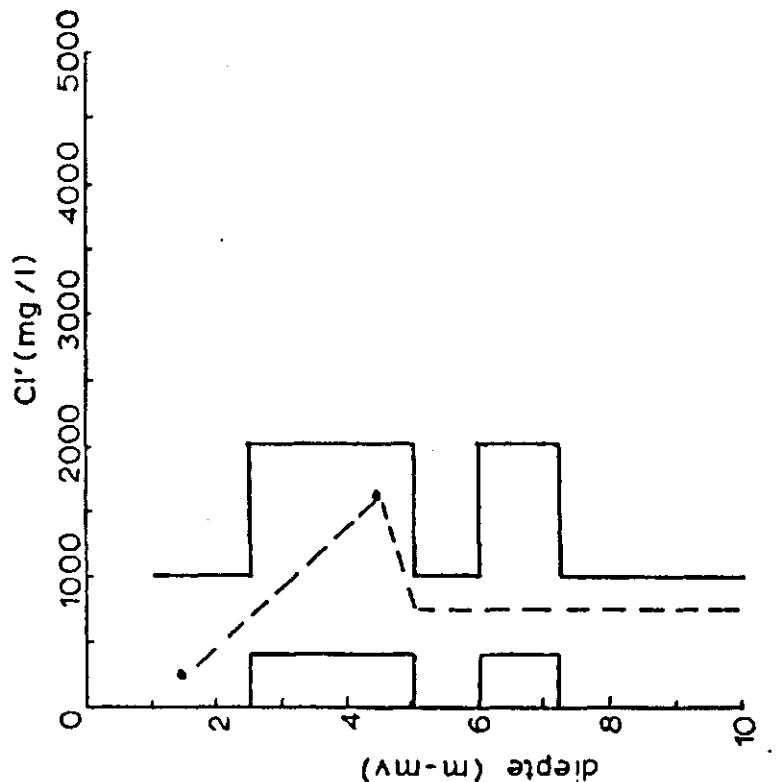
LOKATIE 79



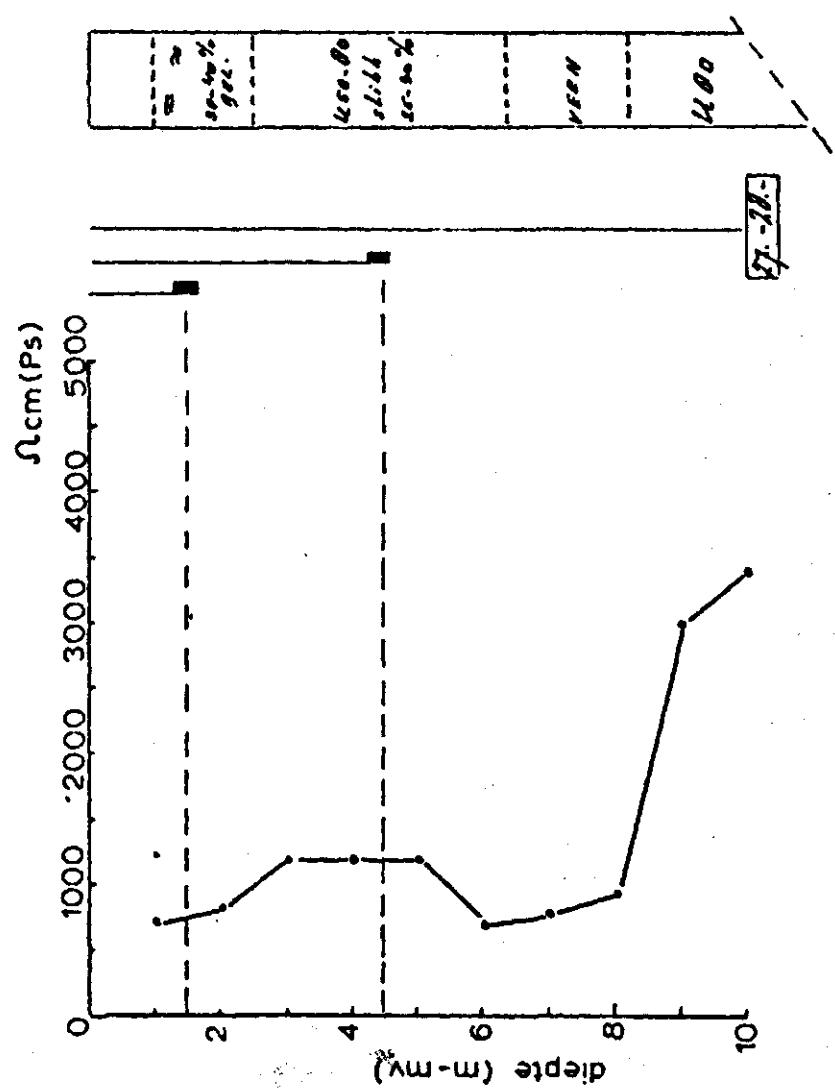
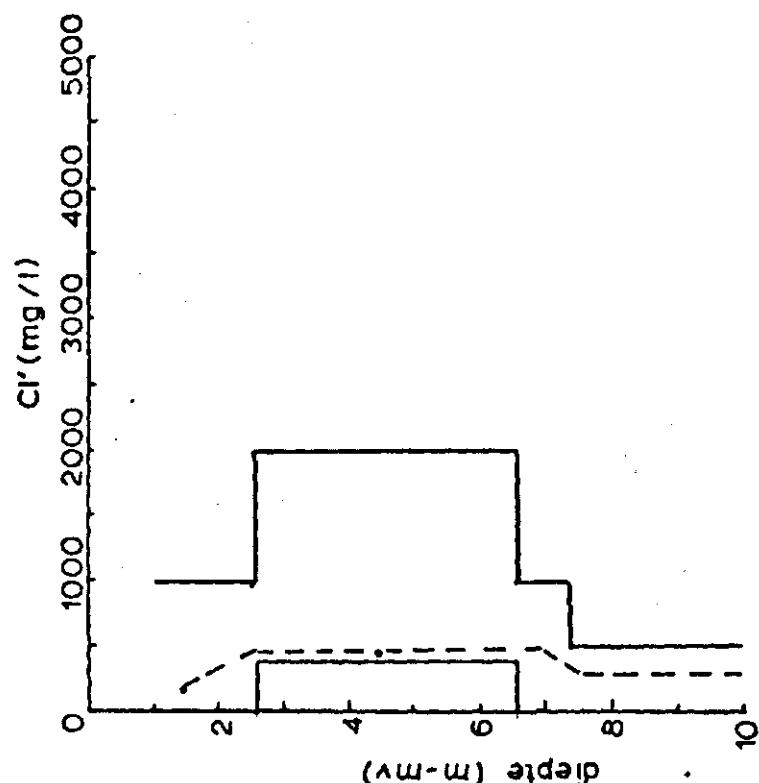
LOKATIE 00



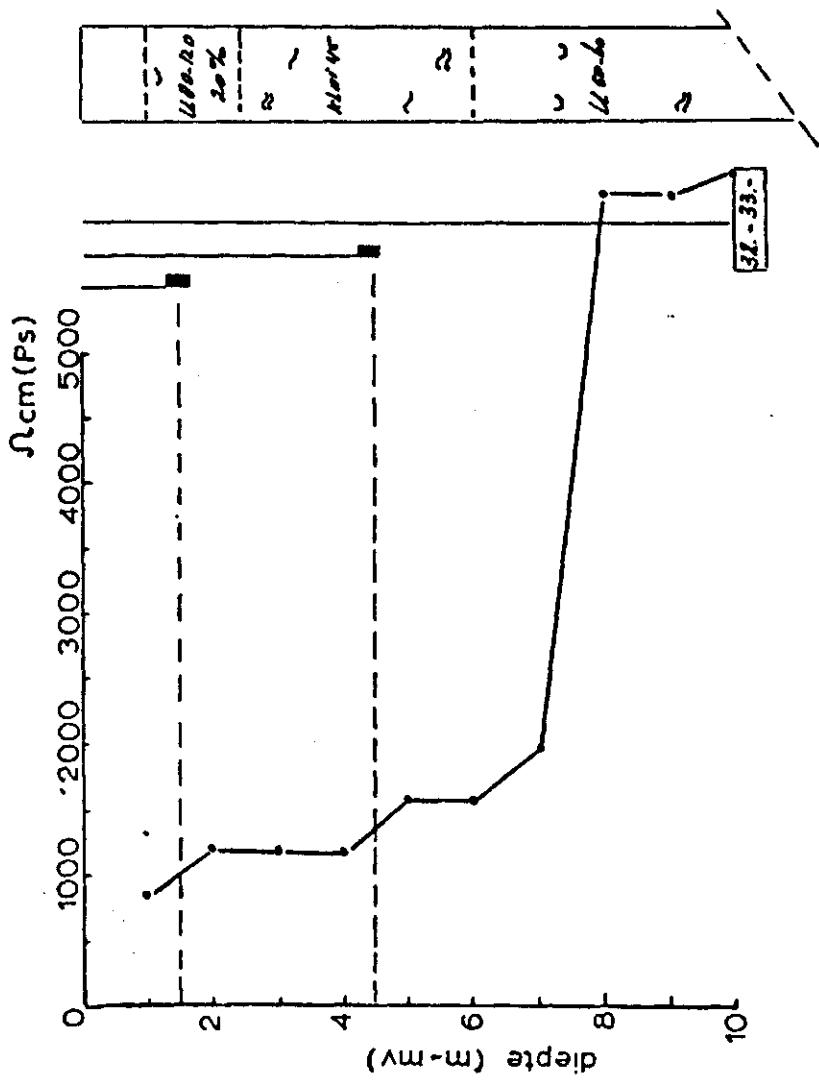
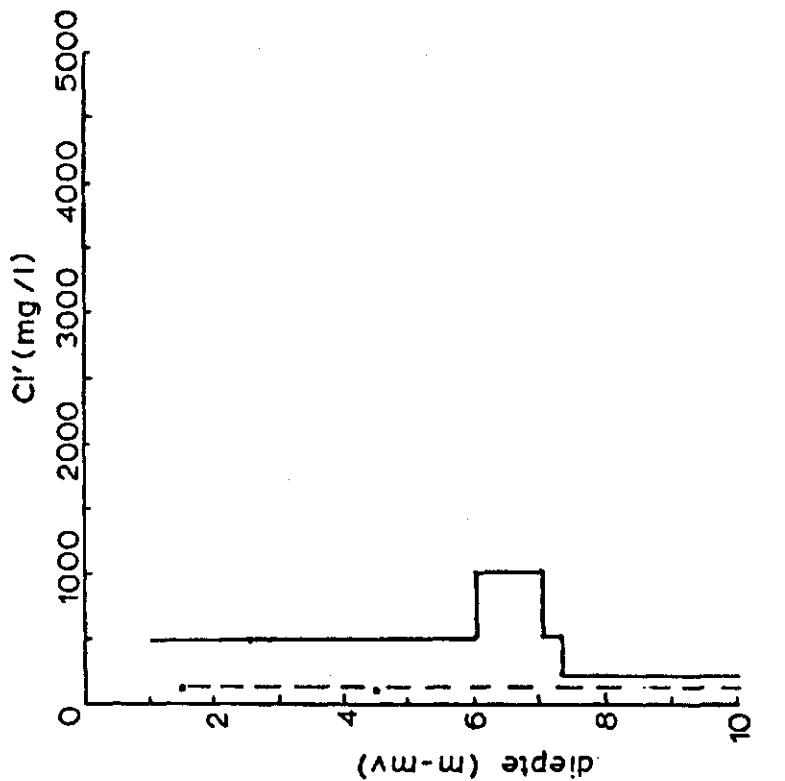
LOKATIE Ø1



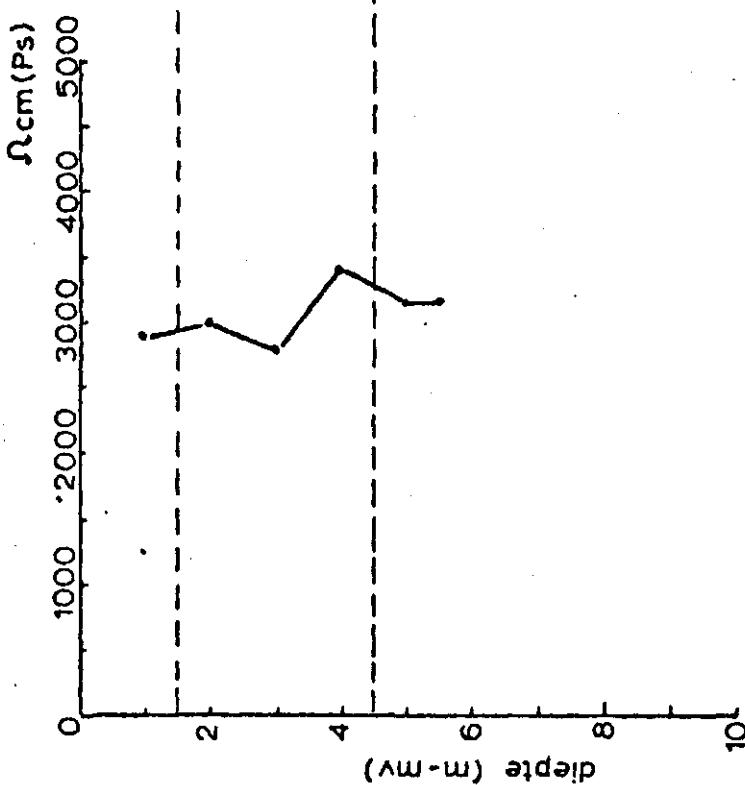
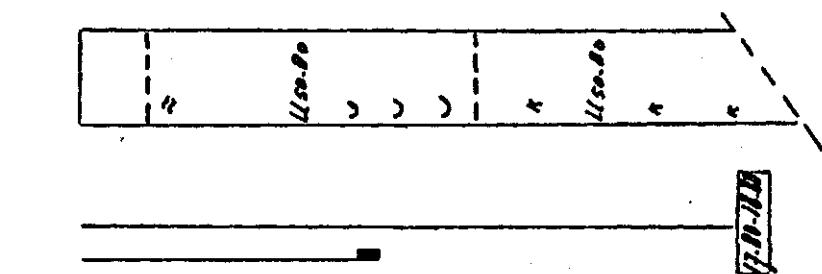
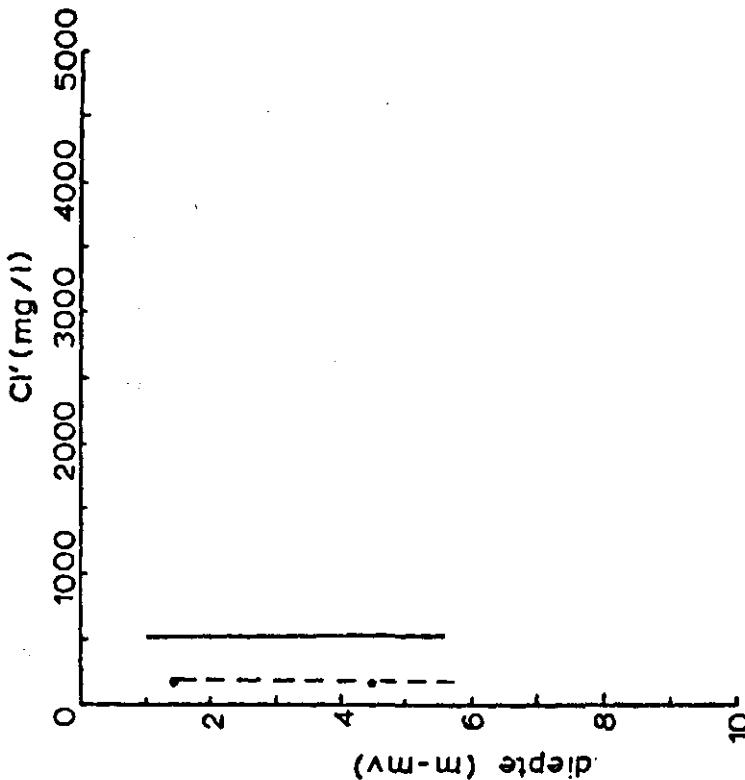
LOKATIE #1



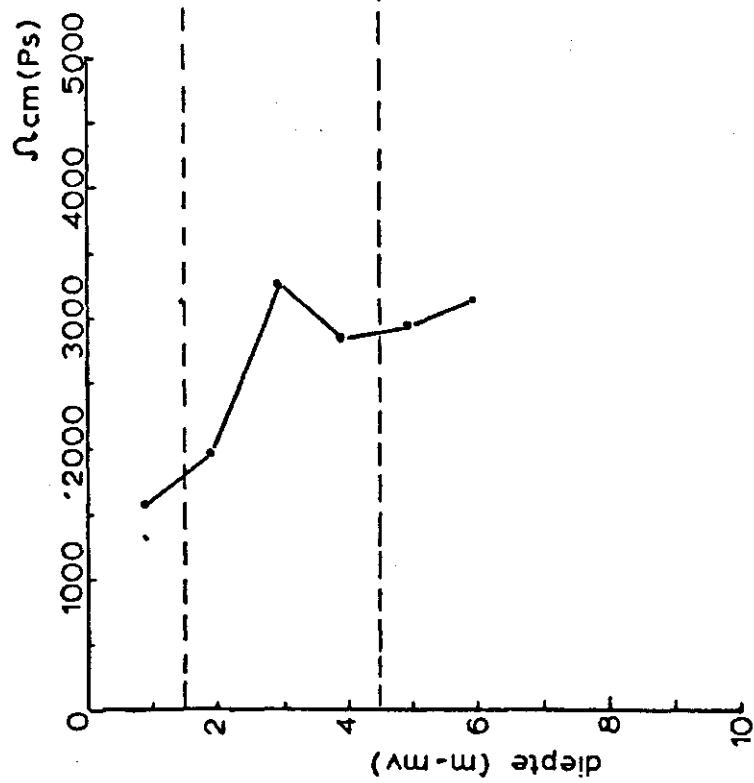
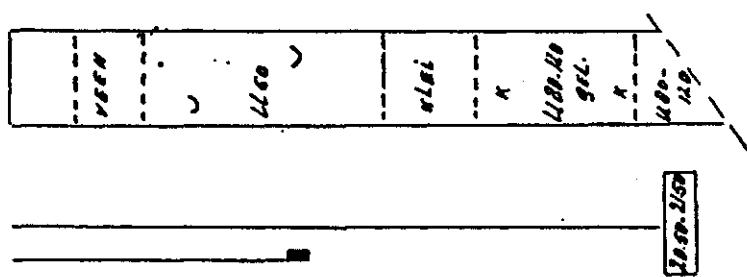
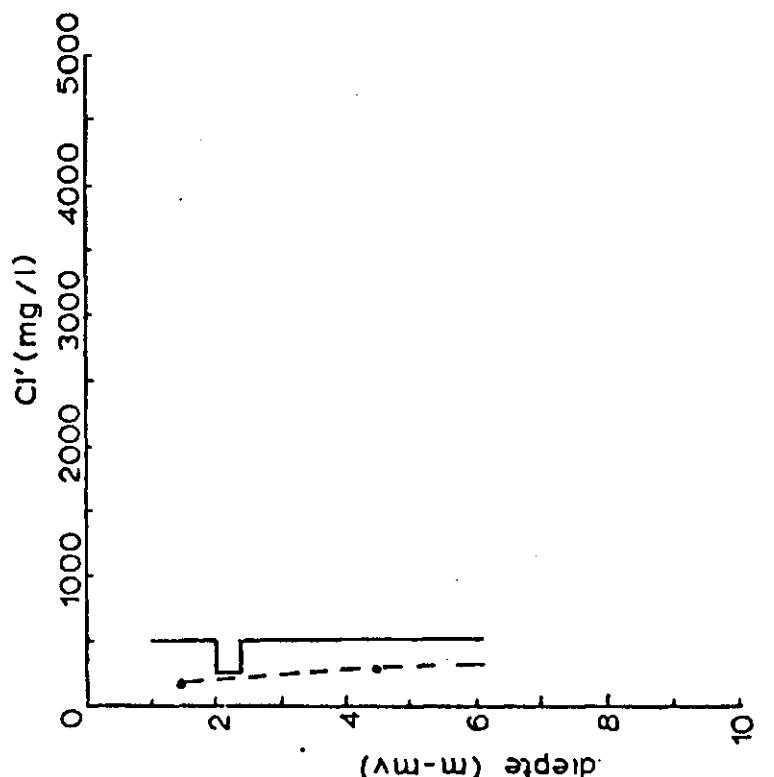
LOKATIE Ø3



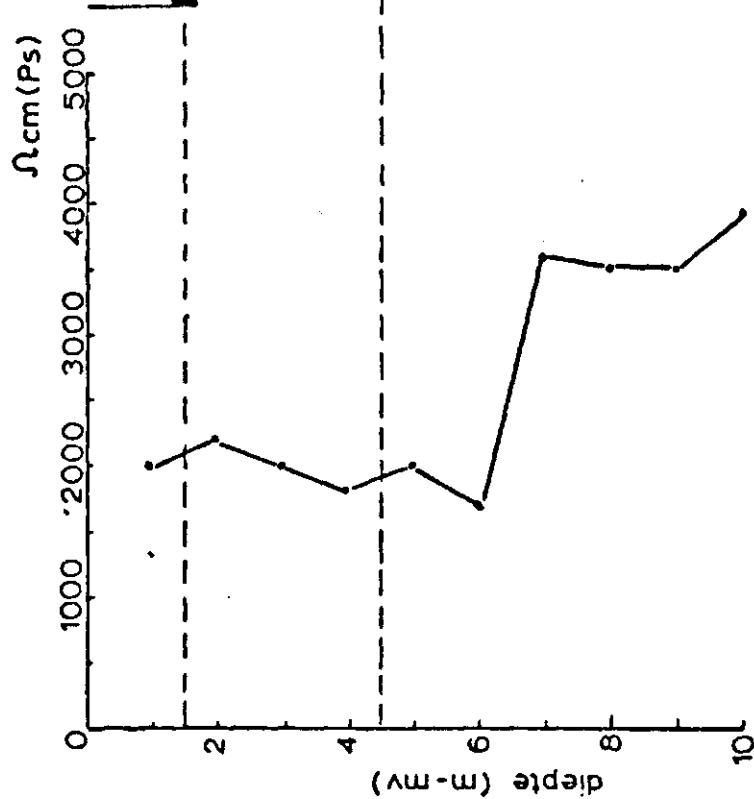
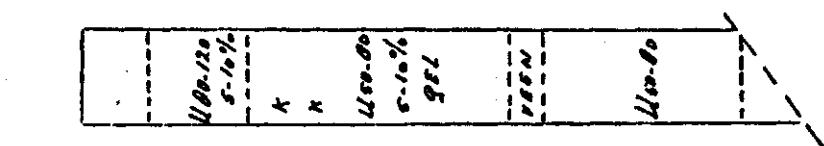
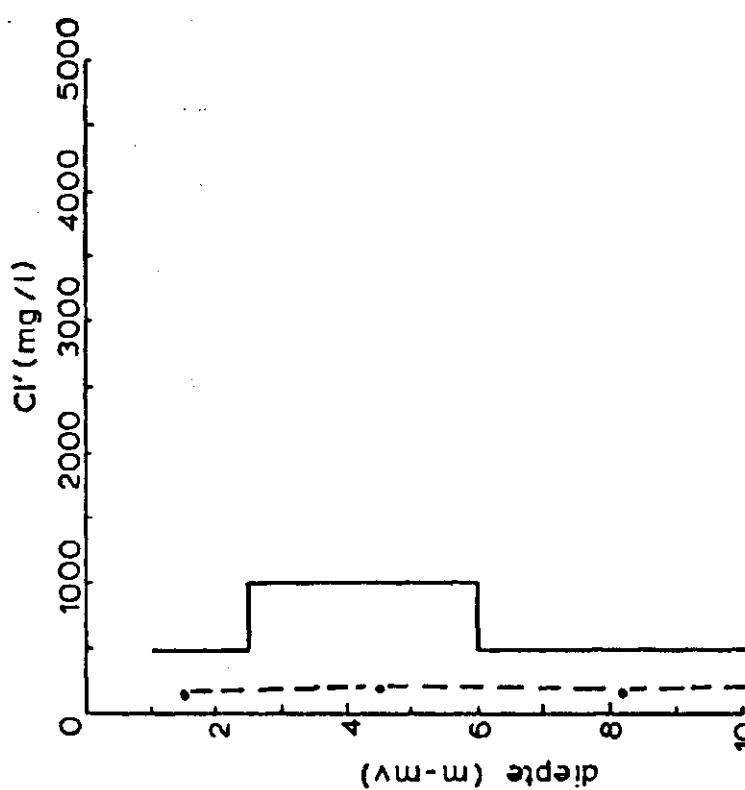
LOKATIE #4



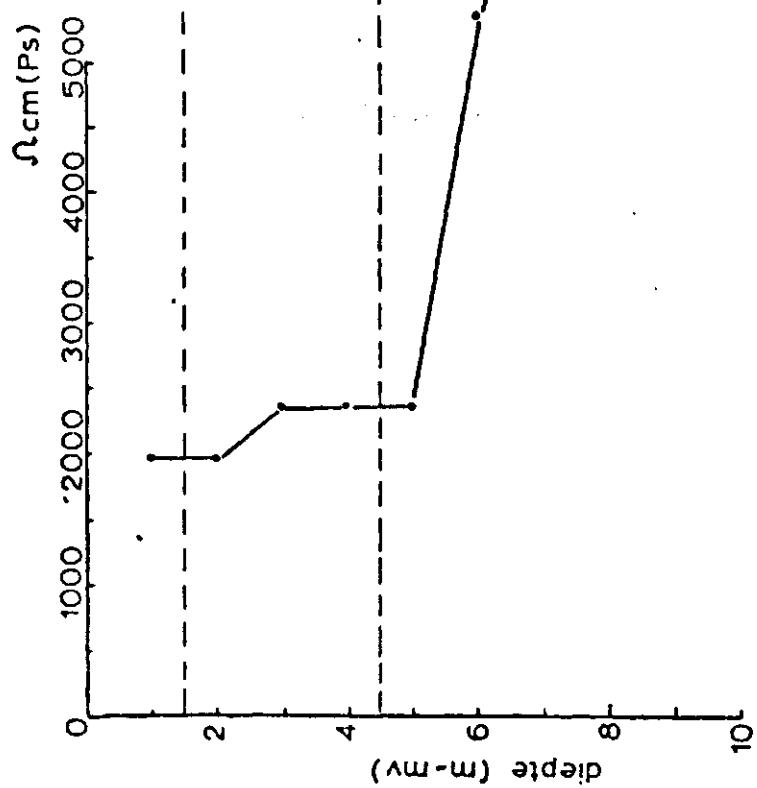
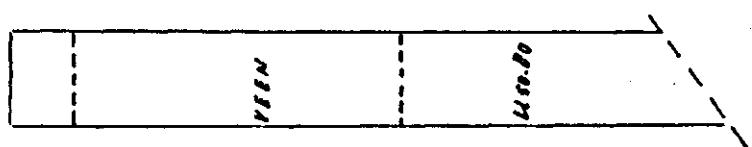
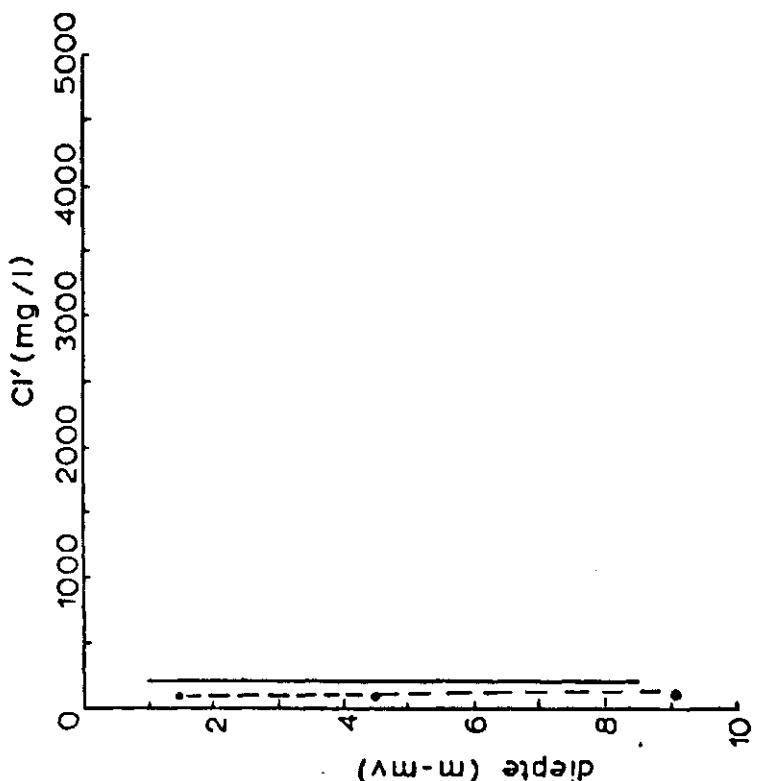
LOKATIE 6



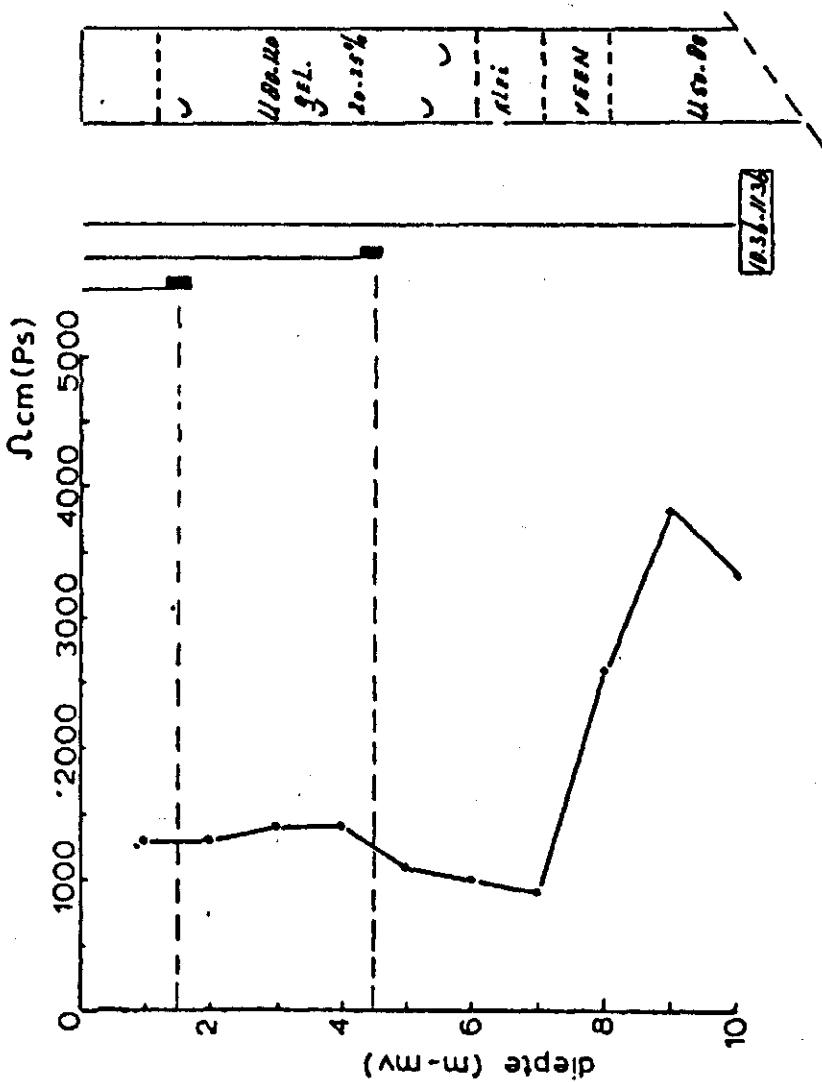
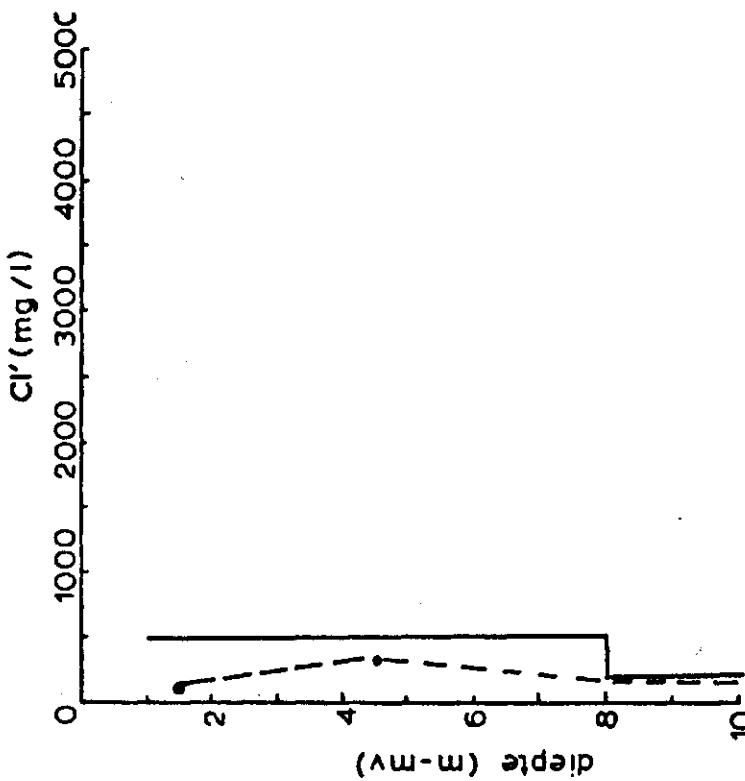
LOKATIE 06



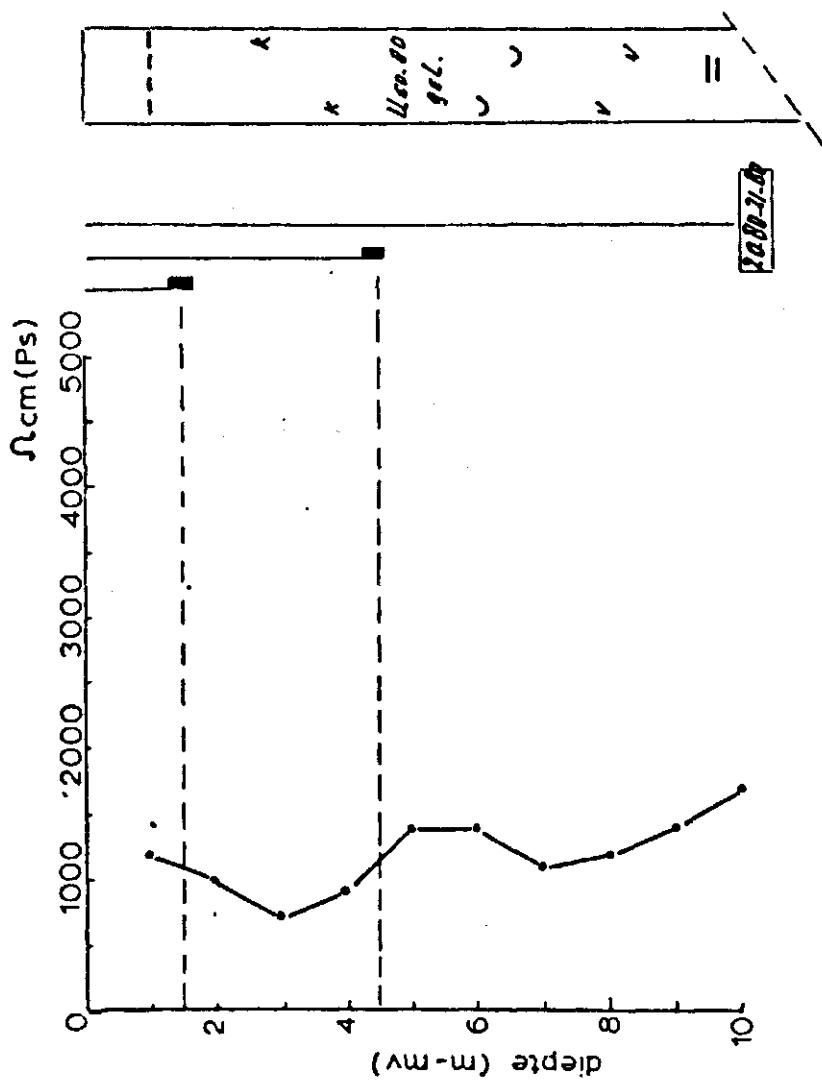
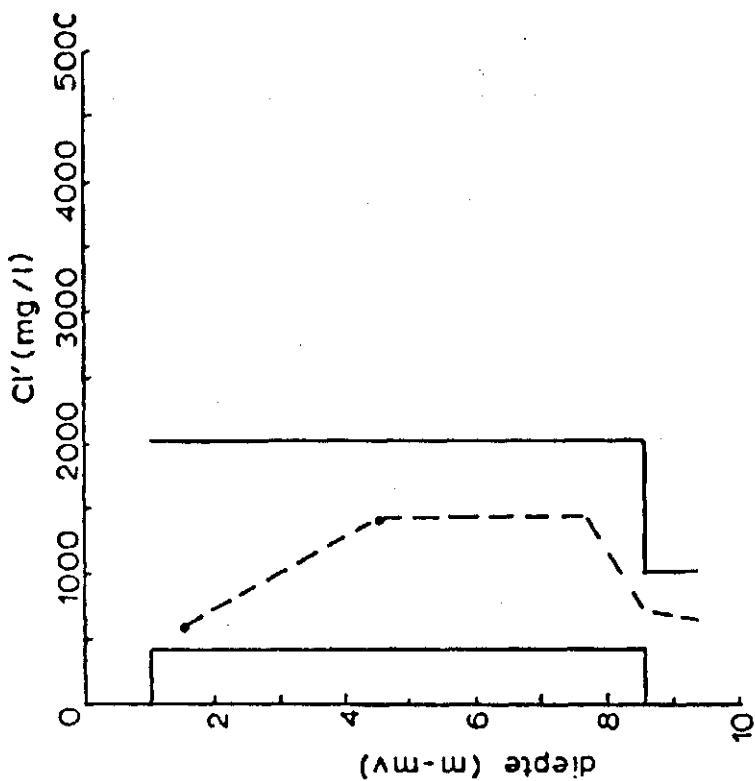
LOKATIE 17



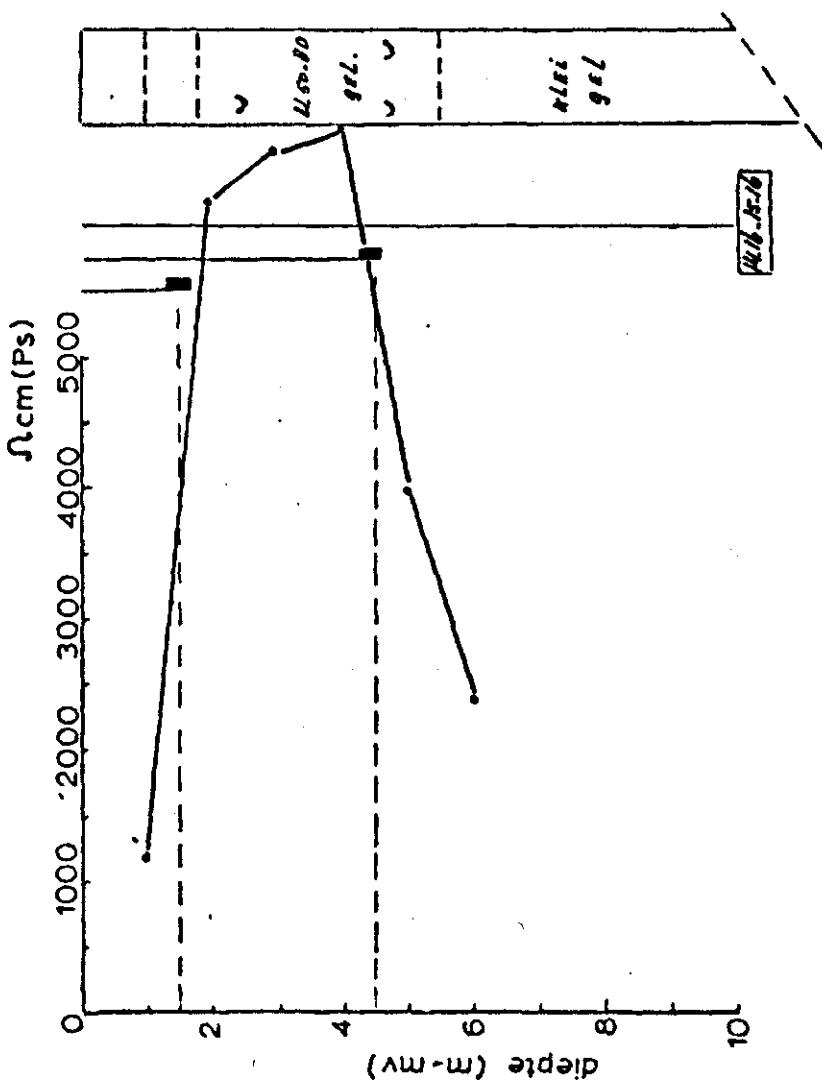
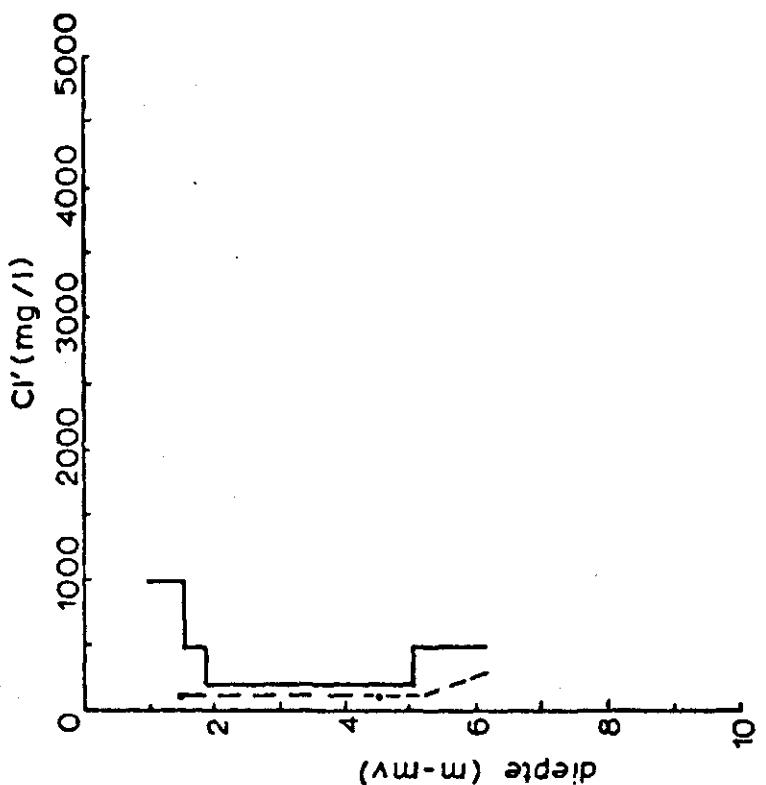
LOKATIE 01



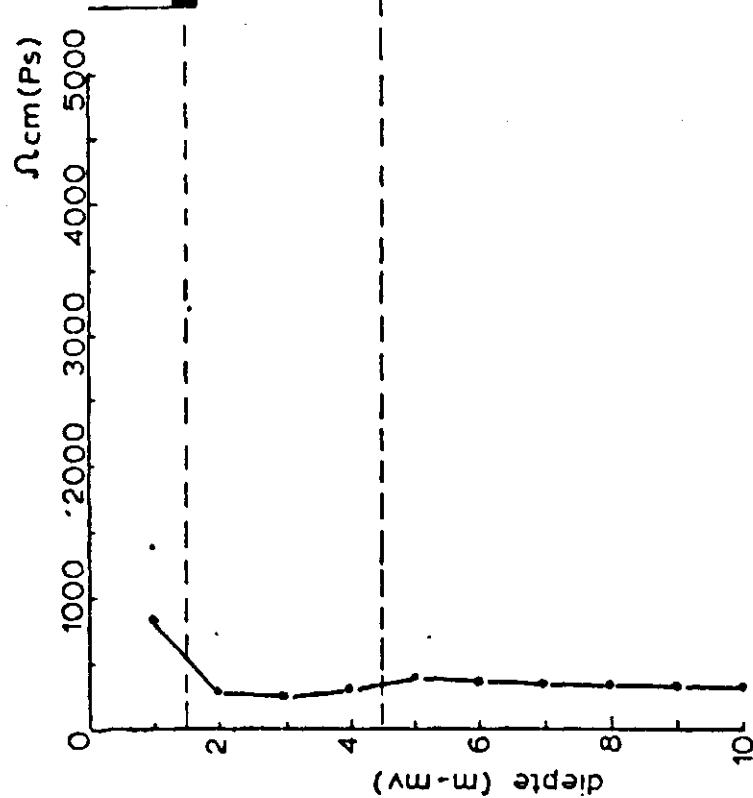
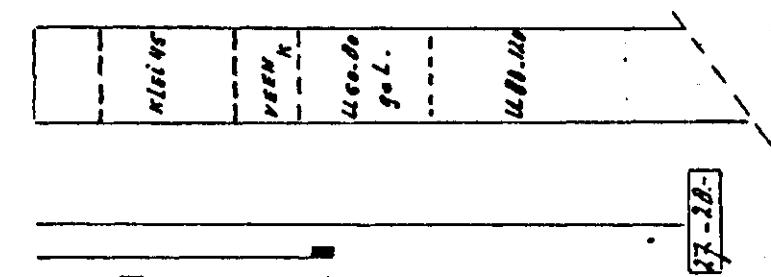
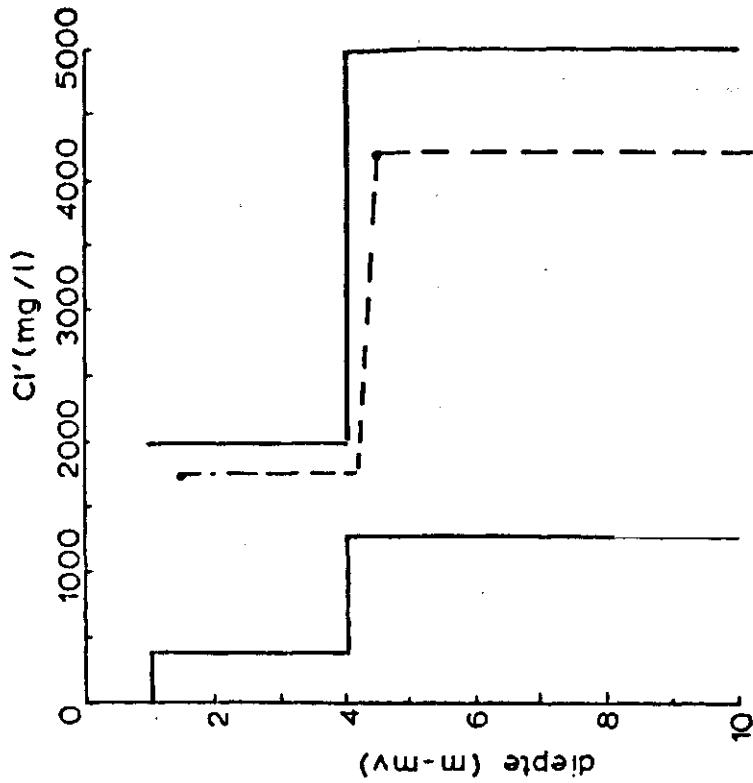
LOKATIE Ø9



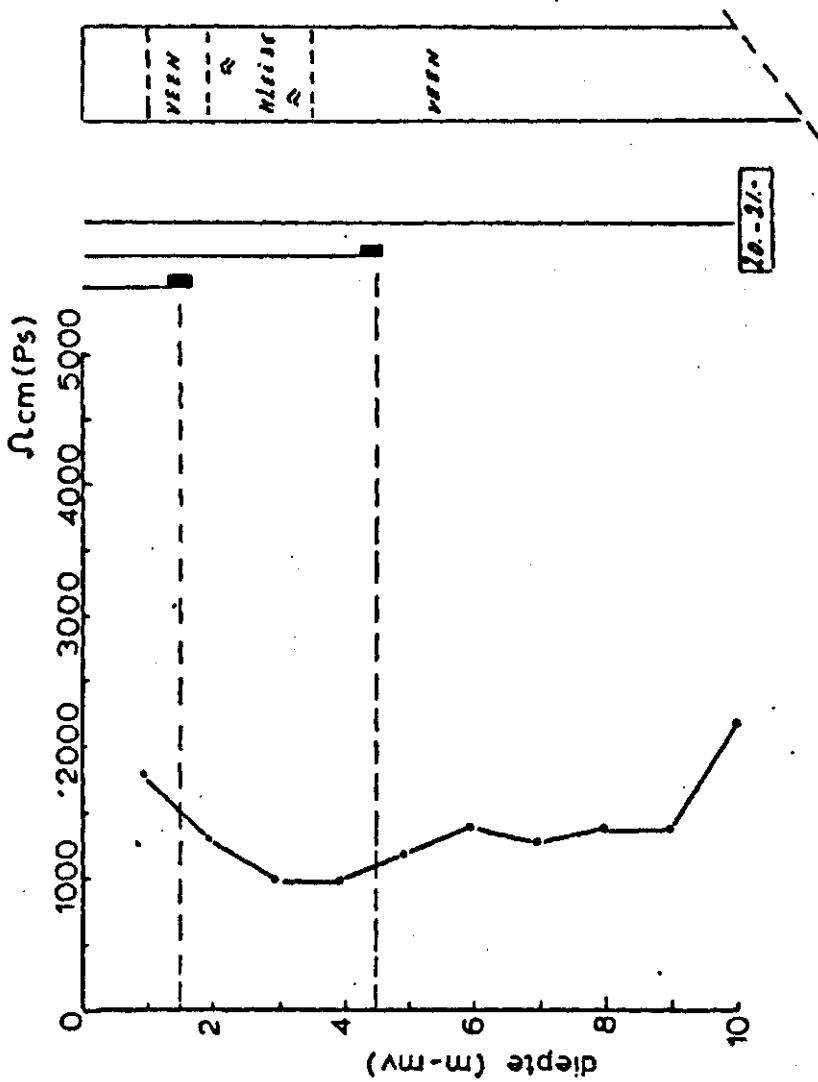
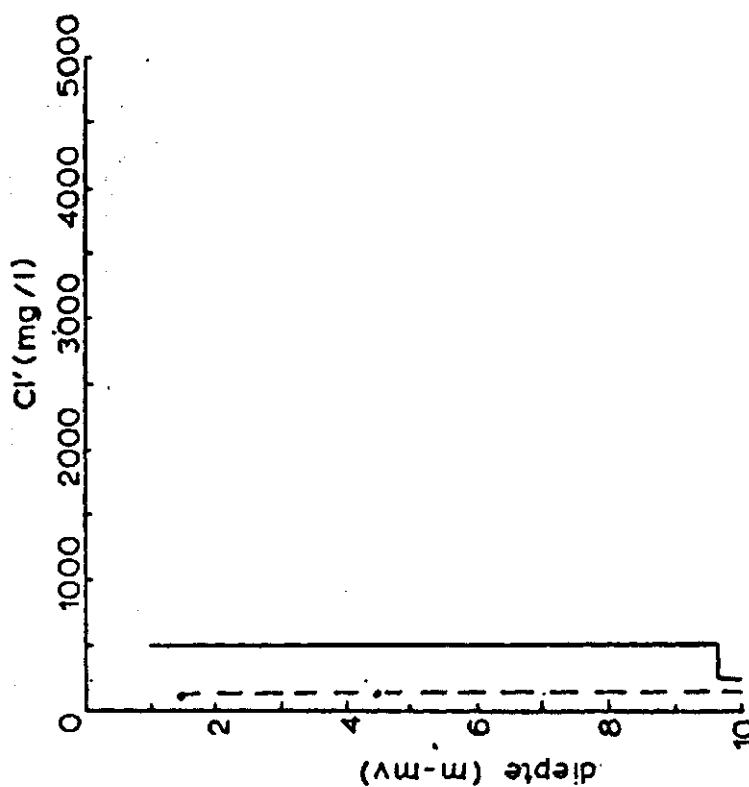
LOKATIE 90



LOKATIE 9'



LOKATIE 92



LOKATIE 93

