

Verformungen und Beanspruchungen  
dünnwandiger zylindrischer Silozellen  
infolge Teilflächenlasten

**T 2520/2**

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Forschungsvorhaben

Verformungen und Beanspruchungen dünnwandiger zylindrischer Silozellen  
infolge Teilflächenlasten

Anhang

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Fehlende Seiten sind **Leerseiten**,  
die bei Erstellung  
der PDF-Datei für den Download nicht  
berücksichtigt wurden

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## **Anhang**

zu Kap. 3

- Schüttguteigenschaften
- Federsteifigkeit der einzelnen Maßelemente
- Statistische Untersuchungen zu den Meßwerten
- Einzeldarstellung der Versuchsergebnisse

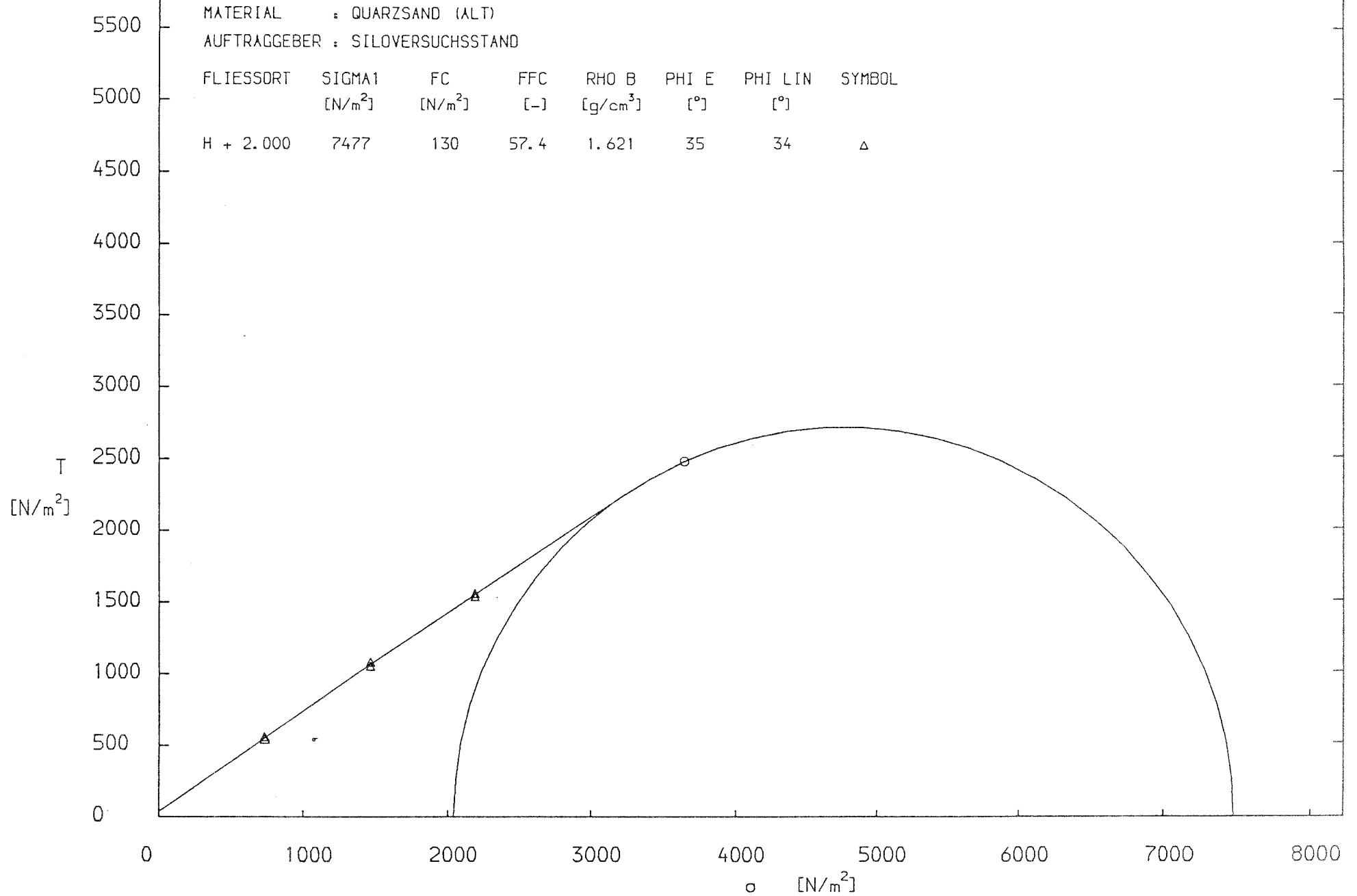


BILD : FLIESSORTE VON QUARZSAND (ALT)

R 3.1

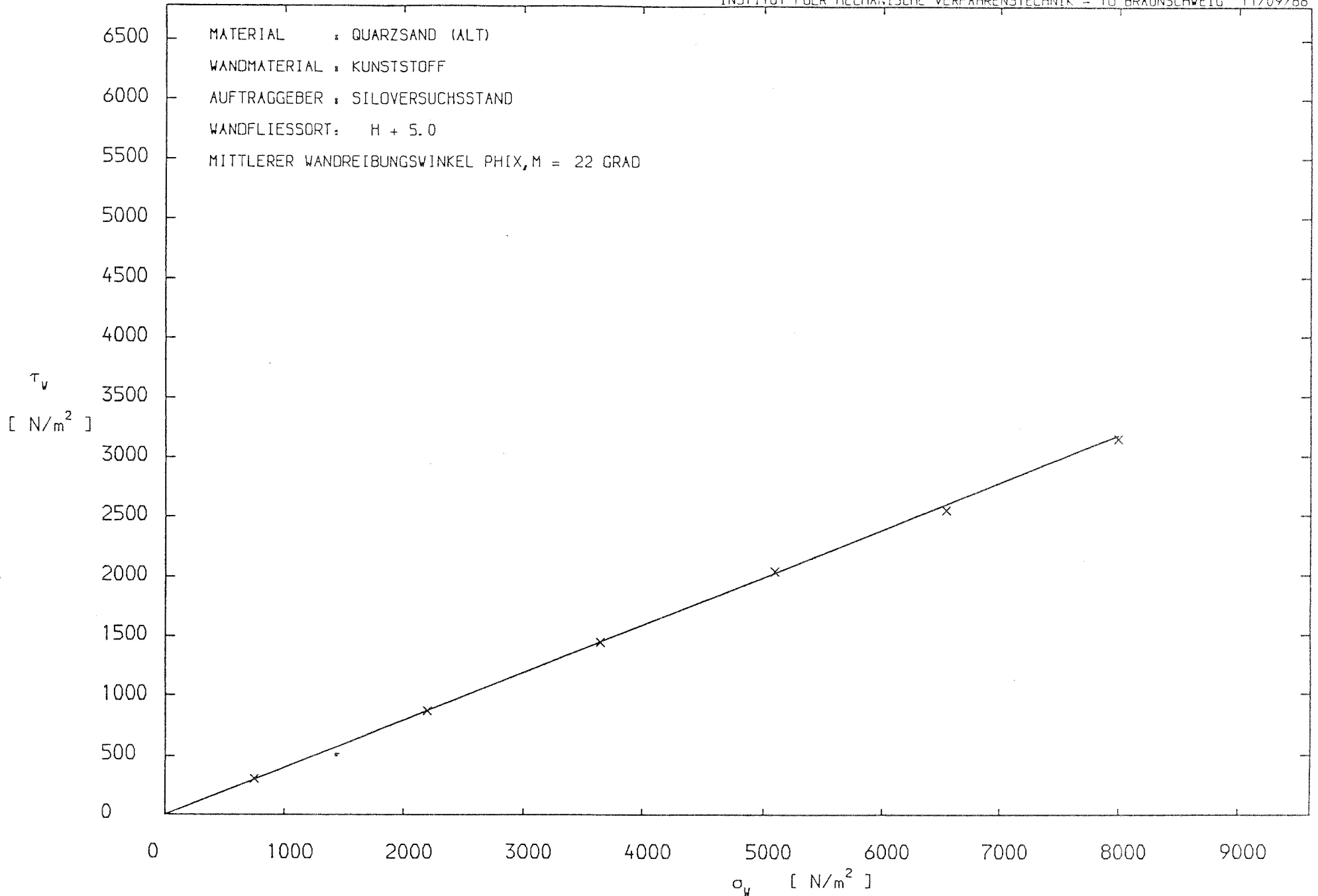


BILD : WANDFLIESSORT FÜR QUARZSAND (ALT) GEGEN KUNSTSTOFF

A 3.2

MATERIAL : QUARZSAND (NEU)

AUFTRAGGEBER : SILOVERSUCHSSTAND

FLIESSORT	SIGMA1 [N/m <sup>2</sup> ]	FC [N/m <sup>2</sup> ]	FFC [-]	RHO B [g/cm <sup>3</sup> ]	PHI E [°]	PHI LIN [°]	SYMBOL
H + 2.000	6212	19	331.0	1.569	33	33	△

T  
[N/m<sup>2</sup>]

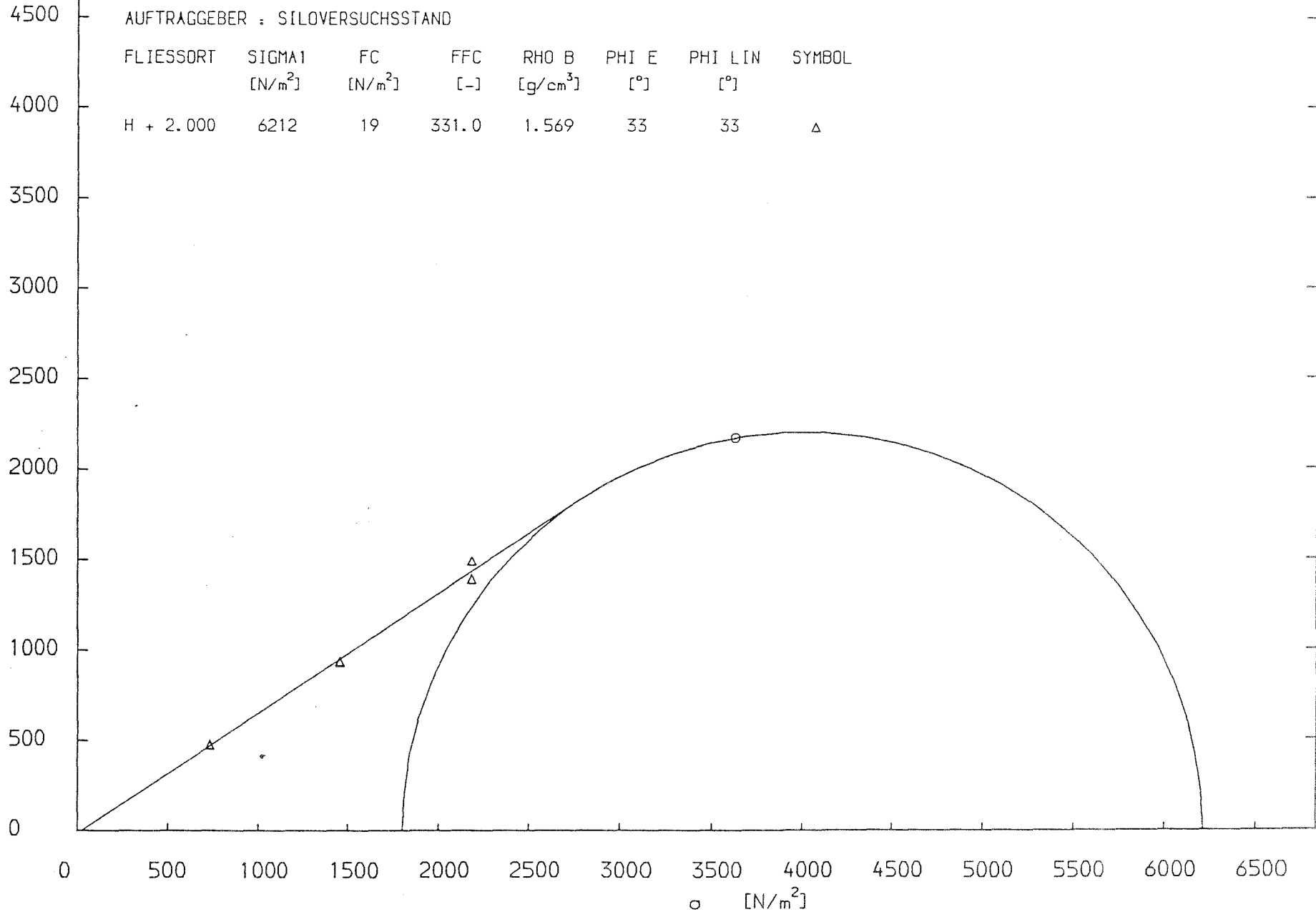


BILD : FLIESSORTE VON QUARZSAND (NEU)

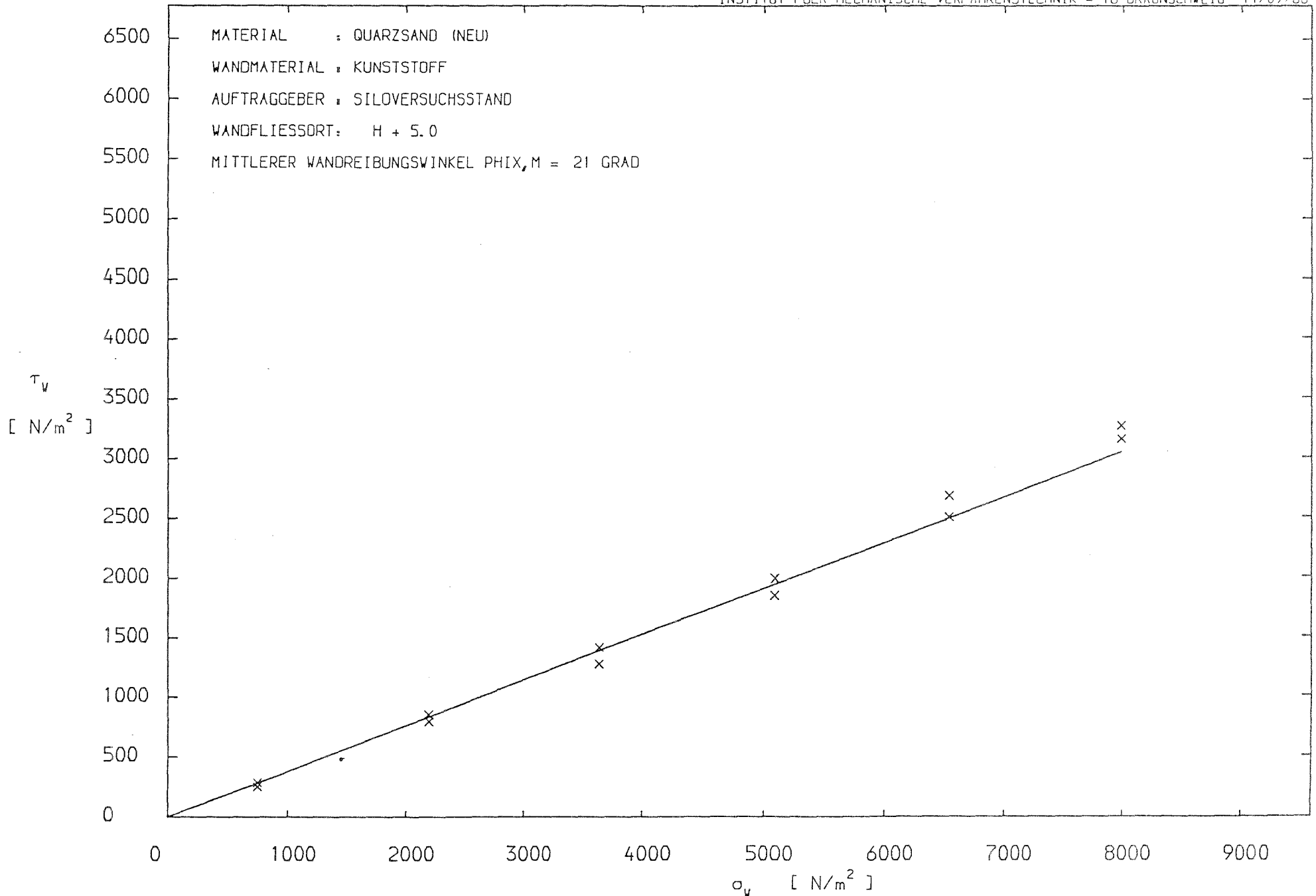


BILD : WANDFLIESSORT FUER QUARZSAND (NEU) GEGEN KUNSTSTOFF

A 3.14

W E G M E S S U N G:

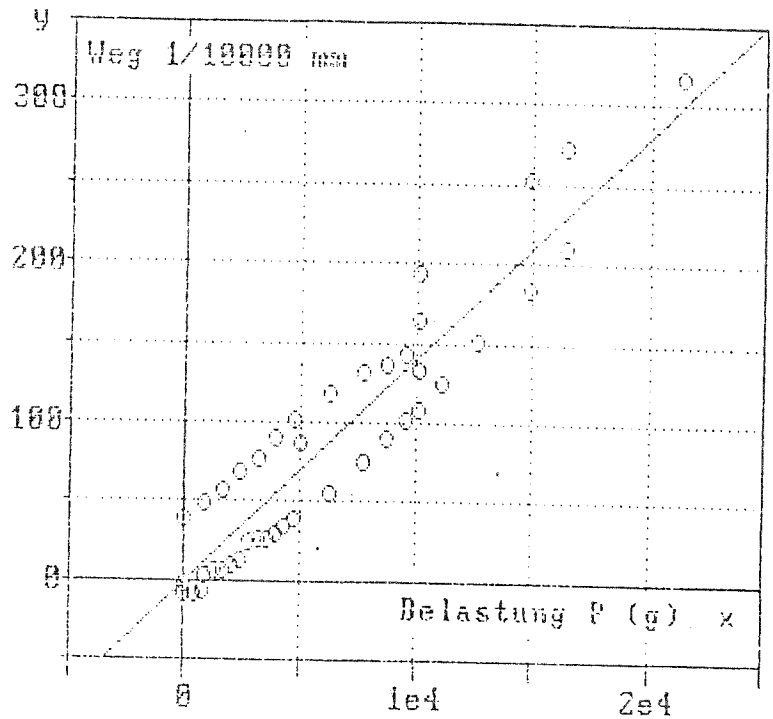
$$y = .0141x + .0004$$

Messhorizont: 1  
 Element.Nr. 0  
 Groesse 16 \* 16

$$c = 7892.2 \text{ kN/m}$$

Bestimmtheitsmaß : .878257

Korrelationskoeff.: .937154



W E G M E S S U N G:

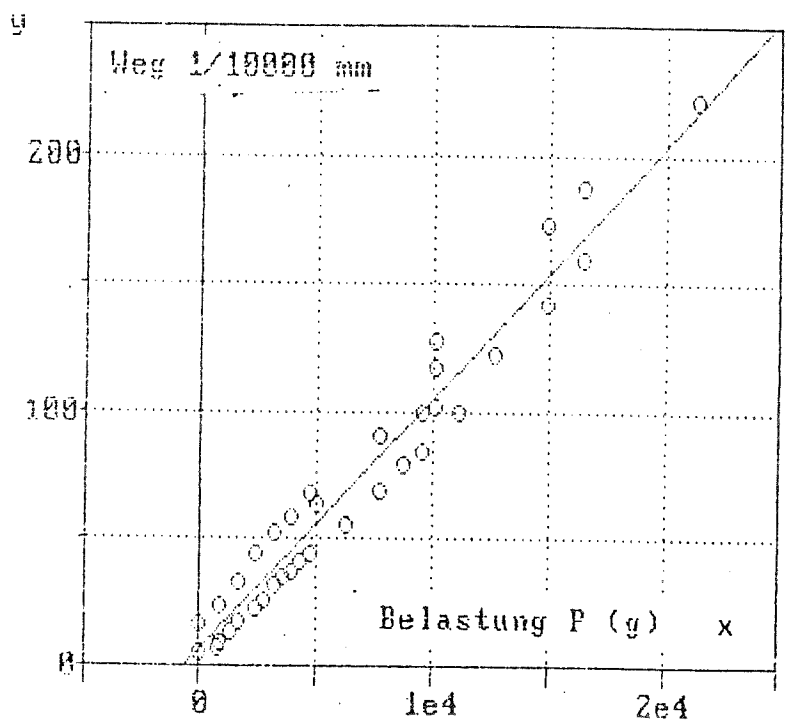
$$y = .0099x + 6.3713$$

Messhorizont: 1  
 Element.Nr. 1  
 Groesse 16 \* 16

$$c = 18181 \text{ kN/m}$$

Bestimmtheitsmaß : .958328

Korrelationskoeff.: .978942



W E G M E S S U N G:

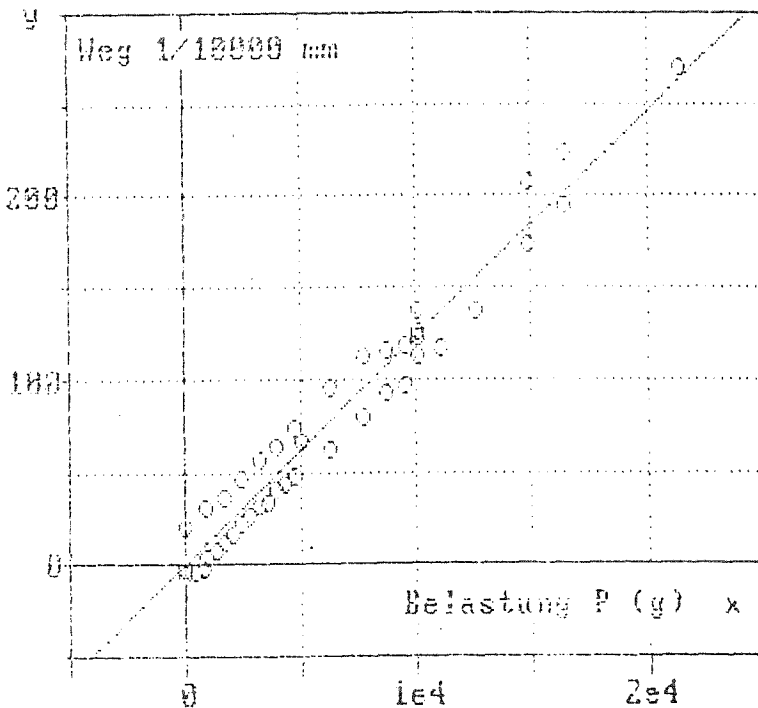
$$y = .0123x + 3233$$

Messhorizont: 1  
 Element.Nr. 2  
 Groesse 16 \* 16

$$c = 6139.1 \text{ MN/m}$$

Bestimmtheitsap : .958486

Korrelationskoeff.: .979823



W E G M E S S U N G:

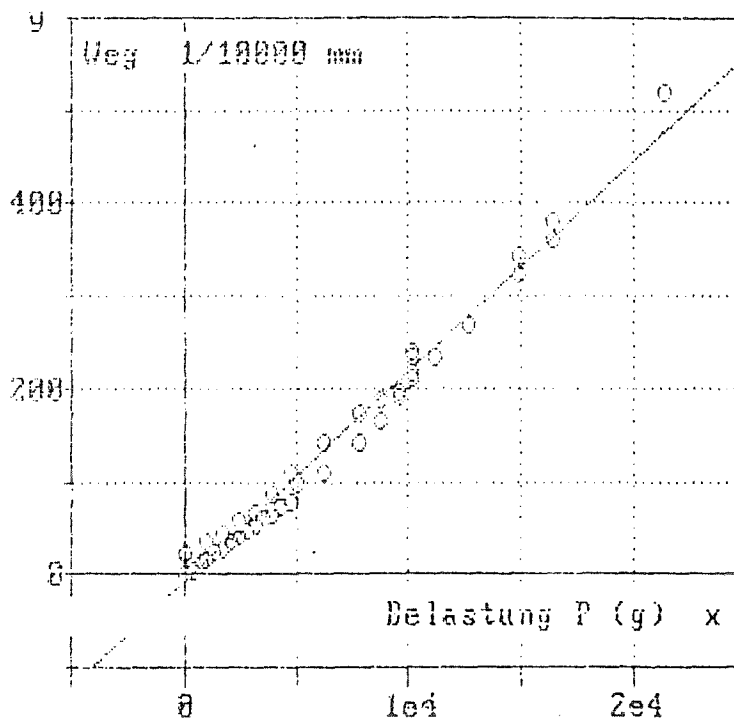
$$y = .0226x - 6.5517$$

Messhorizont: 1  
 Element.Nr. 3  
 Groesse 16 \* 16

$$c = 4424.9 \text{ MN/m}$$

Bestimmtheitsap : .982531

Korrelationskoeff.: .991227



W E G M E S S U N G:

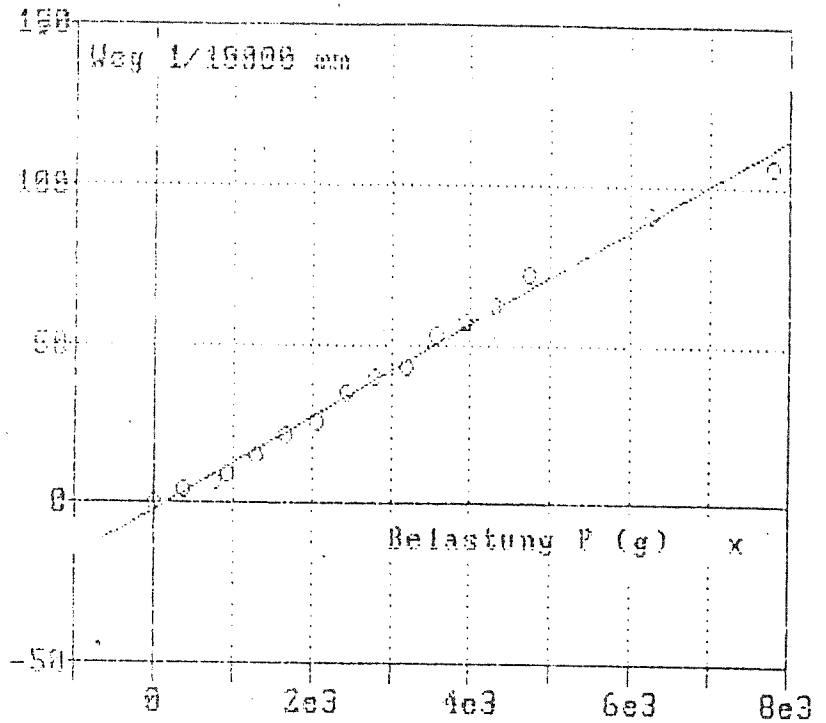
$$y = 0.0146x - 1.6422$$

Messhorizont: 4  
 Element.Nr.: 4  
 Grösse: 8 \* 8

$$c = 6049.3 \text{ kN/m}$$

Bestimmtheitsmap: .99347

Korrelationskoeff.: .99673



W E G M E S S U N G:

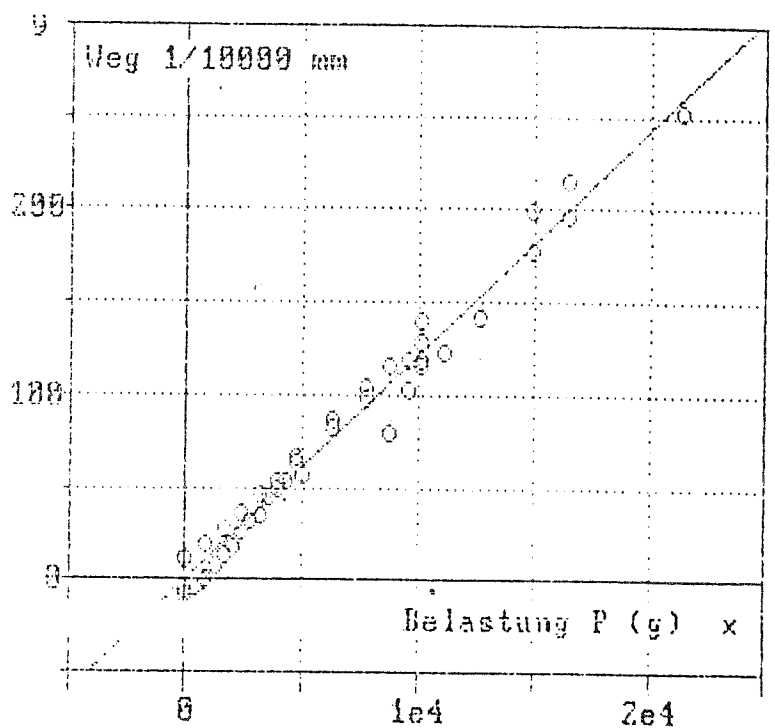
$$y = 0.0122x + 0.495$$

Messhorizont: 1  
 Element.Nr.: 5  
 Grösse: 16 \* 16

$$c = 8195.7 \text{ kN/m}$$

Bestimmtheitsmap: .978433

Korrelationskoeff.: .989158





## W E G M E S S U N G:

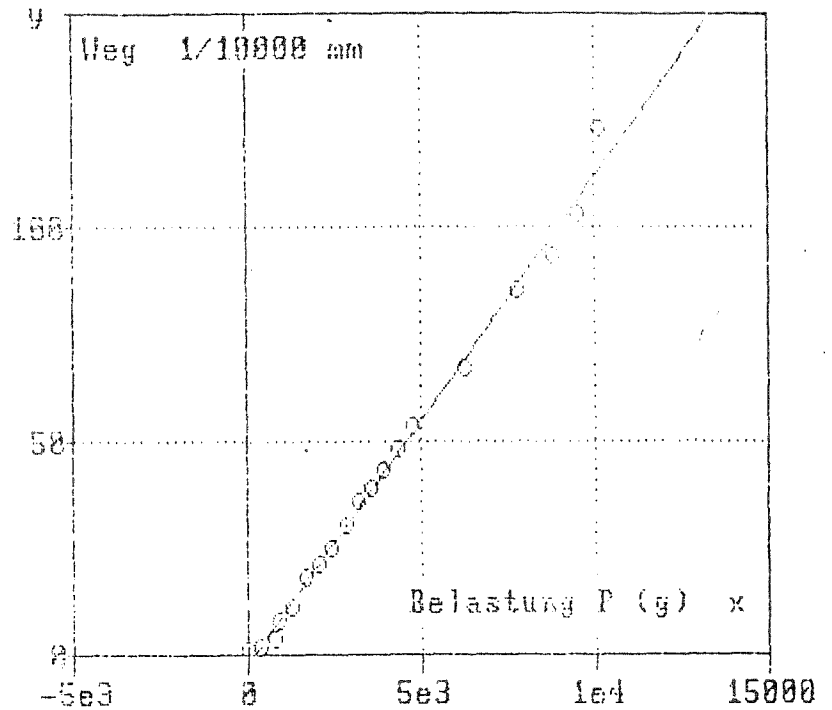
$$y = 0.0114x - 1.7627$$

Messhorizont: 1  
 Element.Nr. 6  
 Grösse: 16 \* 16

$$c = 0771.9 \text{ kN/m}$$

Bestimmtheitsmaß : .999864

Korrelationskoeff. : .996526



## W E G M E S S U N G:

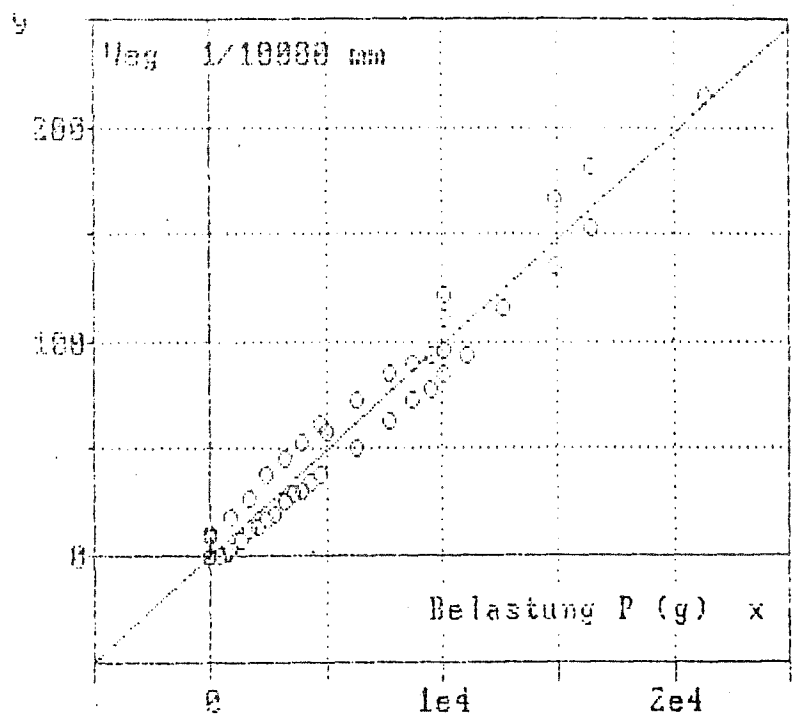
$$y = 0.0092x + 0.001$$

Messhorizont: 1  
 Element.Nr. 7  
 Grösse: 16 \* 16

$$c = 10284 \text{ kN/m}$$

Bestimmtheitsmaß : .958937

Korrelationskoeff. : .979253



W E G M E S S U N G:

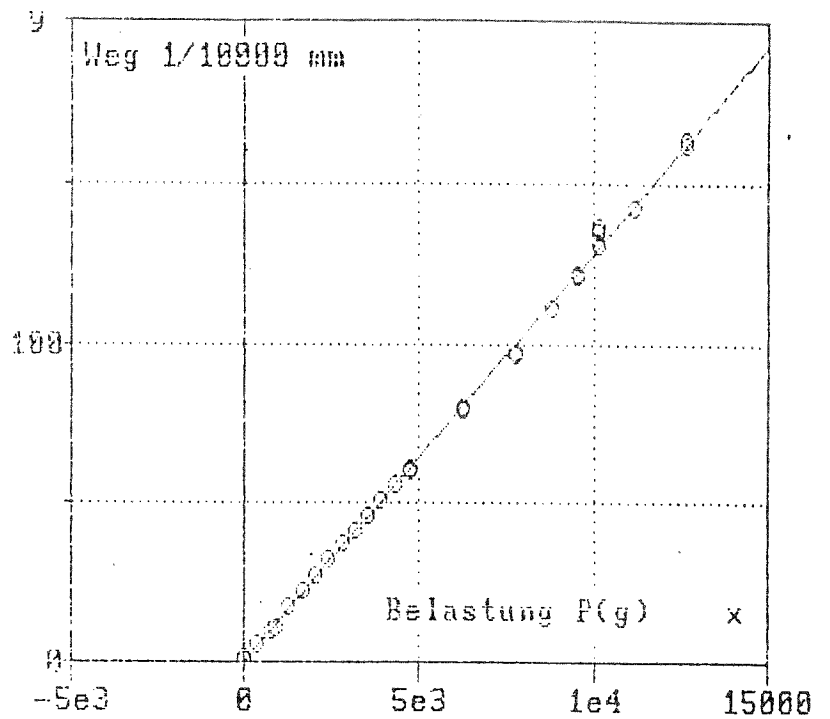
$$y = .0128x + .3168$$

Messhorizont: 2  
 Element.Nr. 0  
 Grösse 12 \* 12

$$c = 7812.5 \text{ kN/m}$$

Bestimmtheitsmaß : .998455

Korrelationskoeff. : .999227



W E G M E S S U N G:

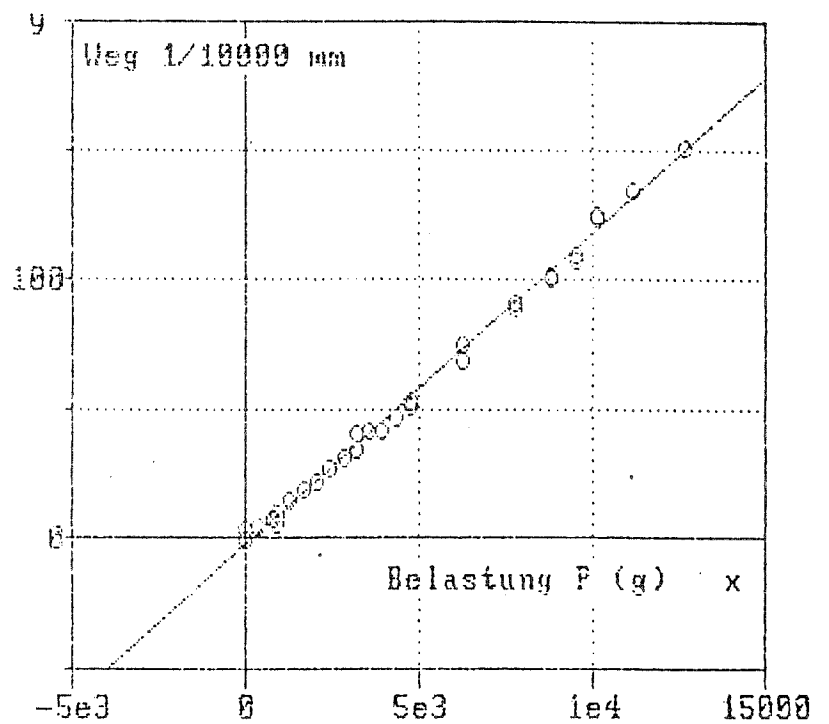
$$y = .012x - 1.973$$

Messhorizont: 2  
 Element.Nr. 1  
 Grösse 12 \* 12

$$c = 8333.3 \text{ kN/m}$$

Bestimmtheitsmaß : .99506

Korrelationskoeff. : .997527



## W E G M E S S U N G:

$$y = .0126x + 14.056$$

Messhorizont: 2

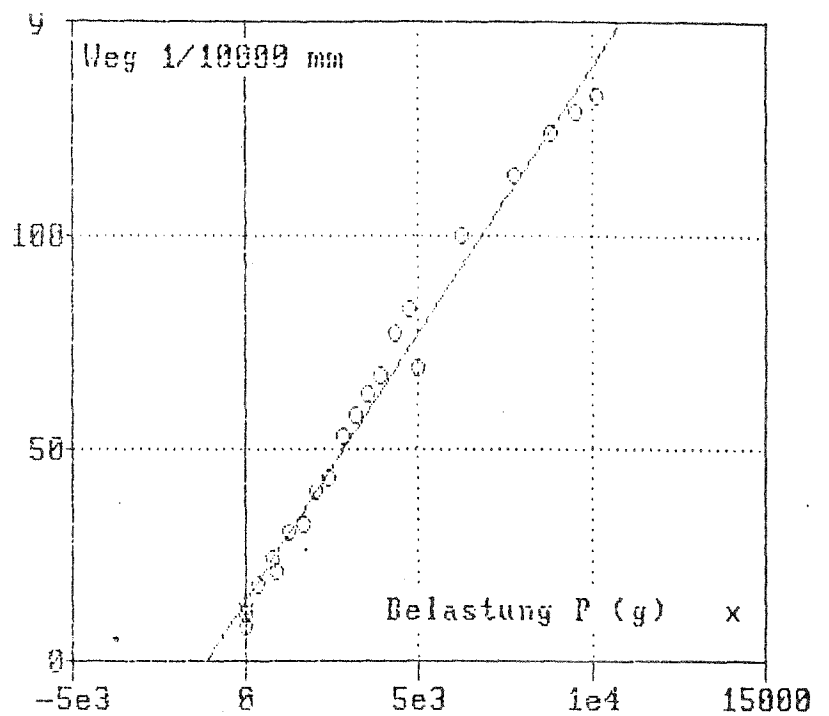
Element.Nr. 2

Grösse 12 \* 12

$$c = 7936.5 \text{ kN/m}$$

Bestimmtheitsmaß : .984552

Korrelationskoeff. : .992246



## W E G M E S S U N G:

$$y = .0125x + .6256$$

Messhorizont: 2

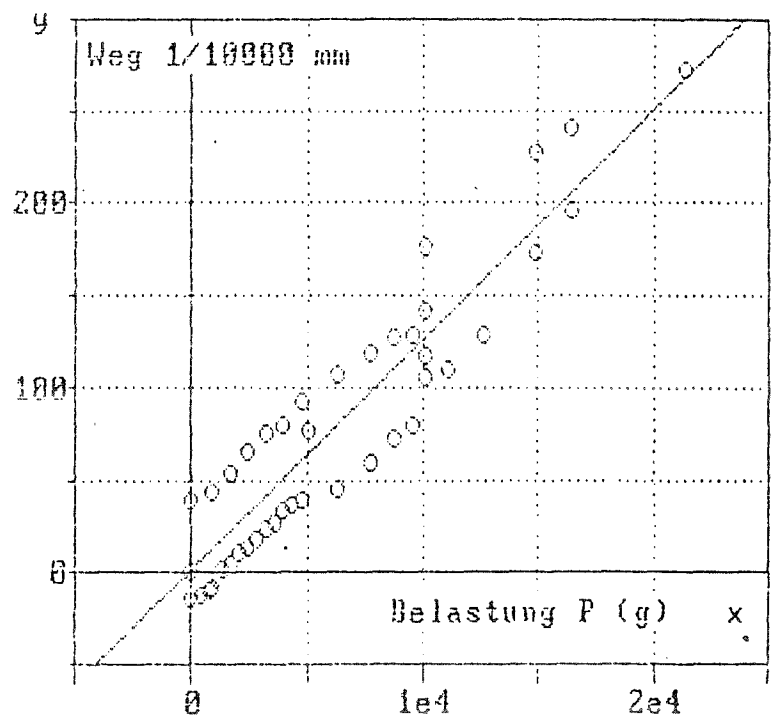
Element.Nr. 3

Grösse 16 \* 16

$$c = 8000.0 \text{ kN/m}$$

Bestimmtheitsmaß : .864145

Korrelationskoeff. : .929594



## W E G M E S S U N G:

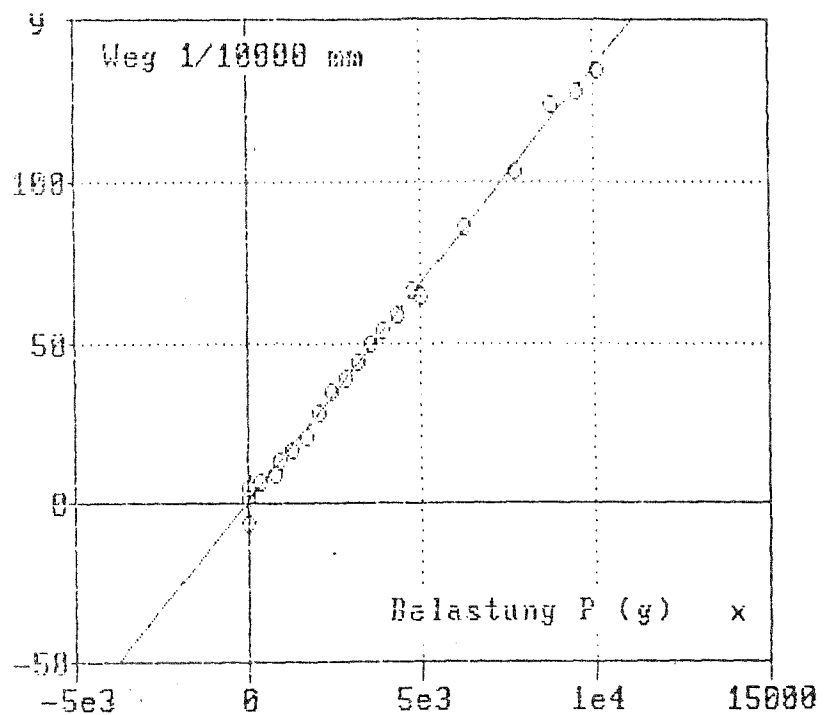
$$y = .0135x + .5261$$

Messhorizont: 2  
 Element.Nr. 4  
 Groesse 8 \* 8

$$c = 7487.4 \text{ kN/m}$$

Bestimmtheitsmaß : .996198

Korrelationskoeff.: .998897



## W E G M E S S U N G:

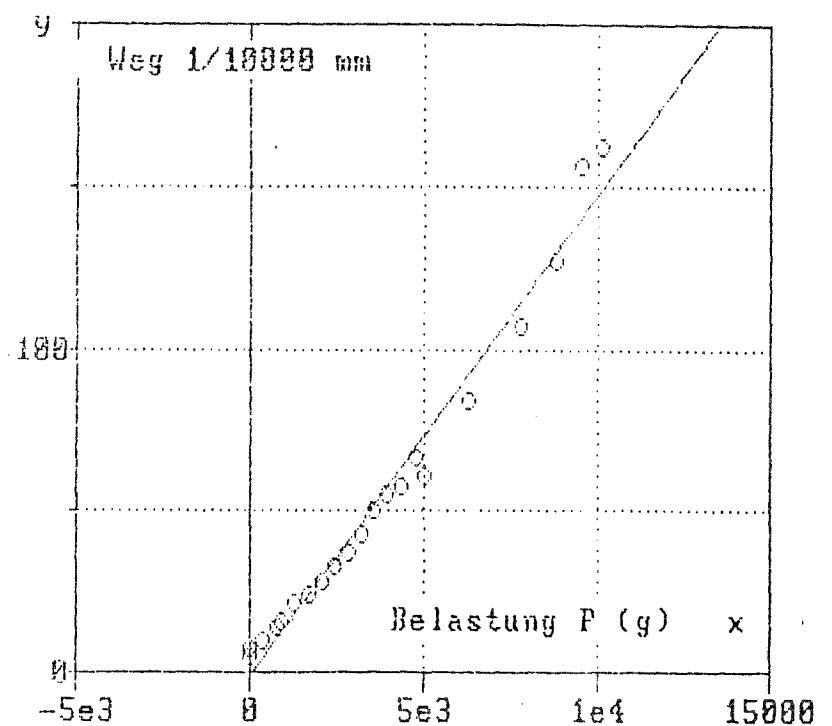
$$y = .0148x - .7235$$

Messhorizont: 2  
 Element.Nr. 5  
 Groesse 12 \* 12

$$c = 6756.8 \text{ kN/m}$$

Bestimmtheitsmaß : .979476

Korrelationskoeff.: .989685



## W E G M E S S U N G:

$$y = .022x + .0243$$

Messhorizont: 2

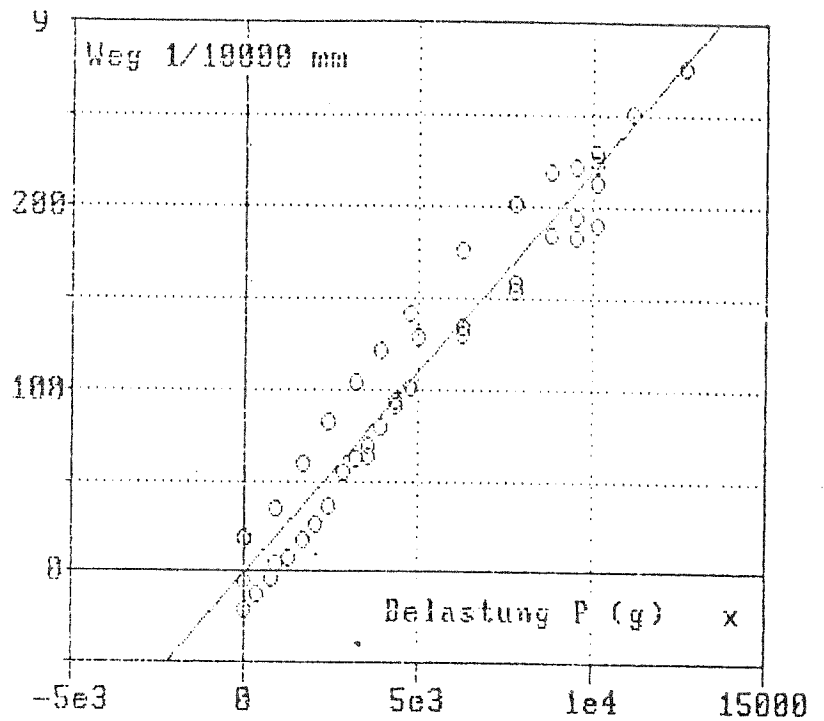
Element.Nr. 6

Grösse 12 \* 12

$$c = 4545.5 \text{ kN/m}$$

Bestimmtheitsmaß : .945933

Korrelationskoeff.: .972591



## W E G M E S S U N G:

$$y = .0122x - .021$$

Messhorizont: 2

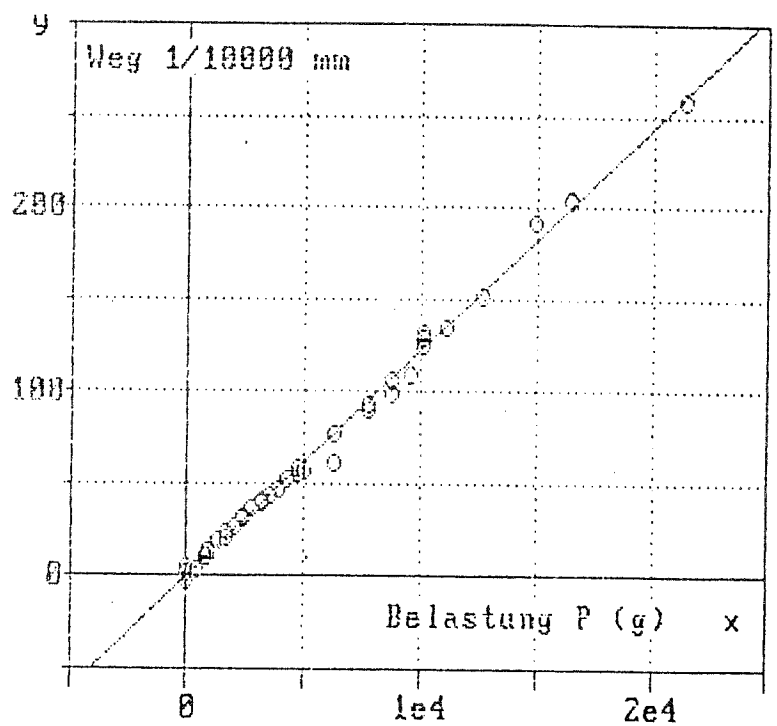
Element.Nr. 7

Grösse 12 \* 12

$$c = 6196.7 \text{ kN/m}$$

Bestimmtheitsmaß : .994571

Korrelationskoeff.: .997282



## W E G M E S S U N G:

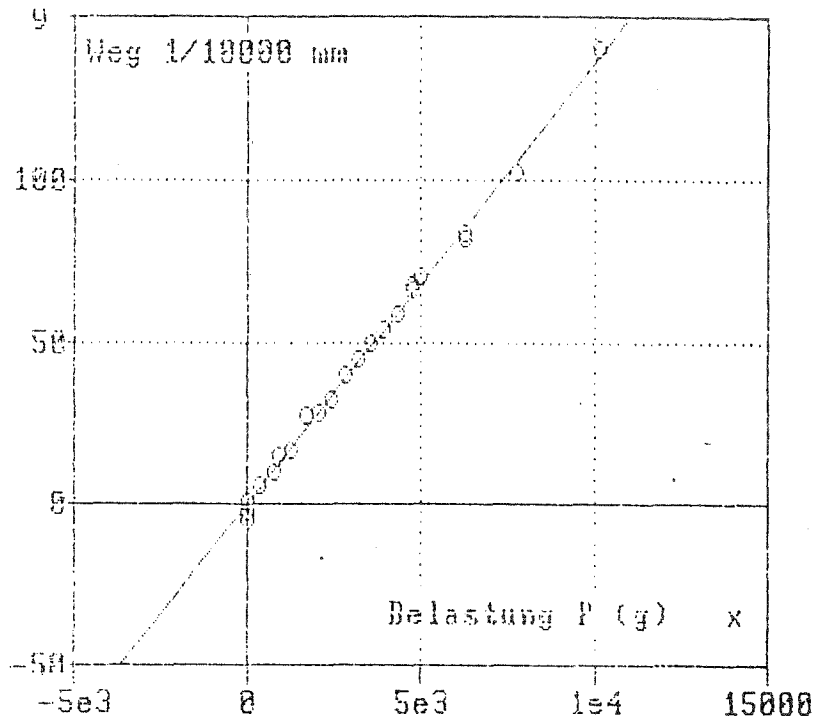
$$y = .0136x + .2538$$

Messhorizont: 3  
 Element.Nr. 0  
 Grösse 8 \* 8

$$c = 7352.9 \text{ kN/m}$$

Bestimmtheitsmas : .995965

Korrelationskoeff.: .997981



## W E G M E S S U N G:

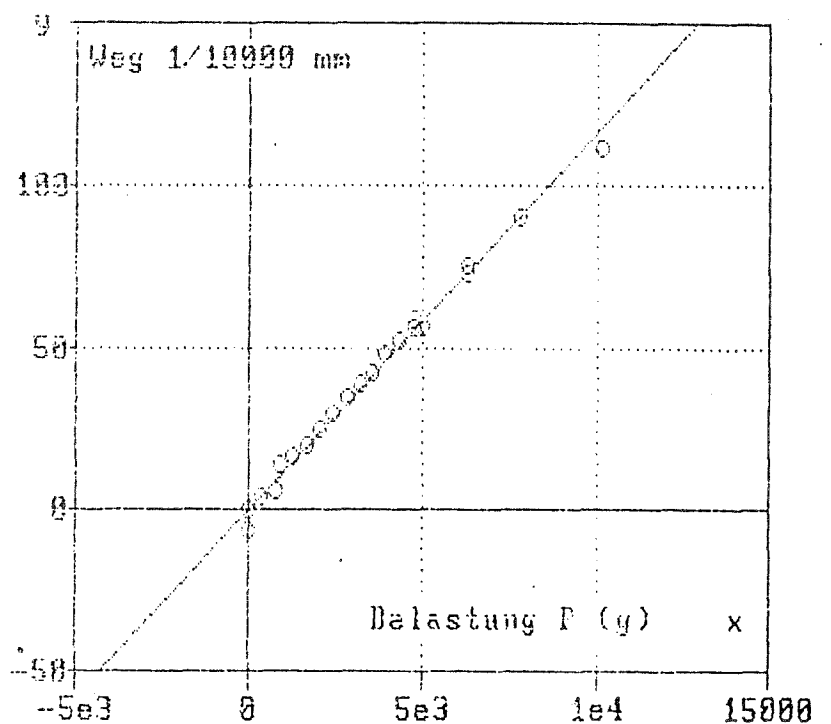
$$y = .0116x + .0929$$

Messhorizont: 3  
 Element.Nr. 1  
 Grösse 8 \* 8

$$c = 8628.7 \text{ kN/m}$$

Bestimmtheitsmas : .990942

Korrelationskoeff.: .995461



W E G M E S S U N G:

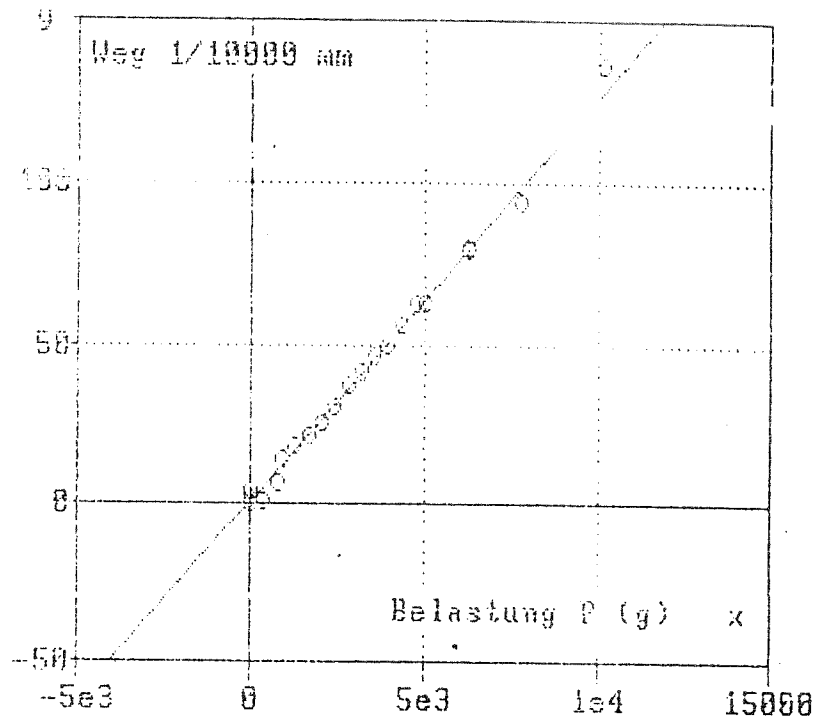
$$y = .0125x + .6656$$

Messhorizont: 3  
 Element.Nr. 2  
 Grösse 8 \* 8

$$c = 7936.5 \text{ MN/m}$$

Bestimmtheitsmaß : .994237

Korrelationskoeff.: .997115



W E G M E S S U N G:

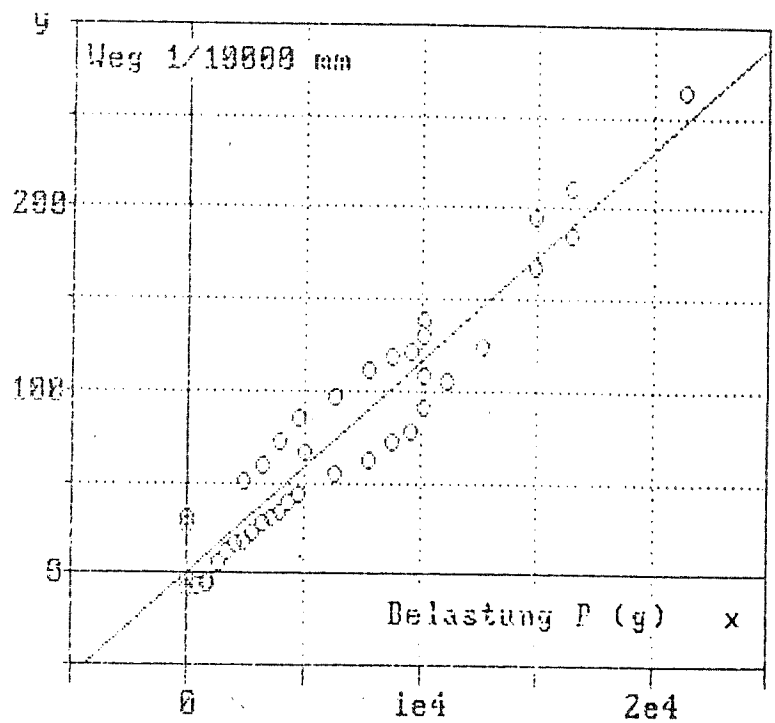
$$y = .0116x + .5043$$

Messhorizont: 3  
 Element.Nr. 3  
 Grösse 16 \* 16

$$c = 8628.7 \text{ kN/m}$$

Bestimmtheitsmaß : .91474

Korrelationskoeff.: .956421



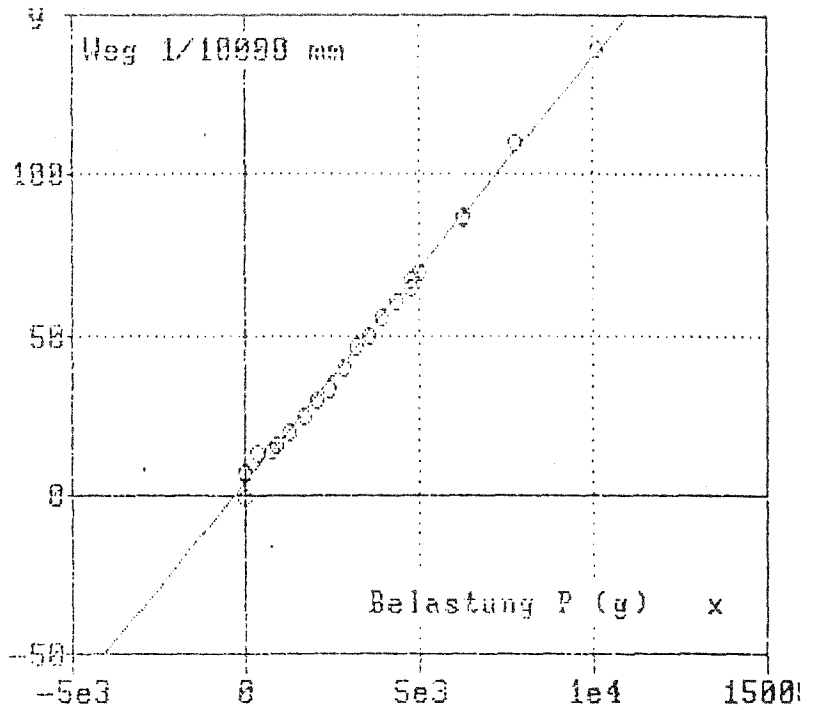
W E G M E S S U N G:

$$y = .0132x + 3.7114$$

Messhorizont: 3  
 Element.Nr. 4  
 Groesse 8 \* 8

Bestimmtheitsmaß : .996223

Korrelationskoeff. : .99811



W E G M E S S U N G:

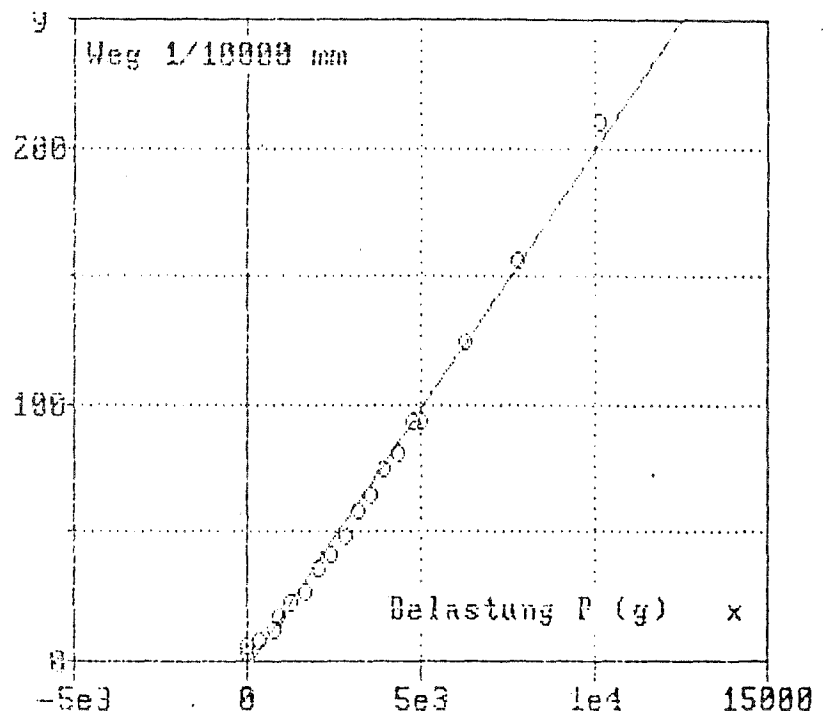
$$y = .0282x - 2.5962$$

Messhorizont: 3  
 Element.Nr. 5  
 Groesse 8 \* 8

c = 4959.5 kN/m

Bestimmtheitsmaß : .994082

Korrelationskoeff. : .997836





## W E G M E S S U N G:

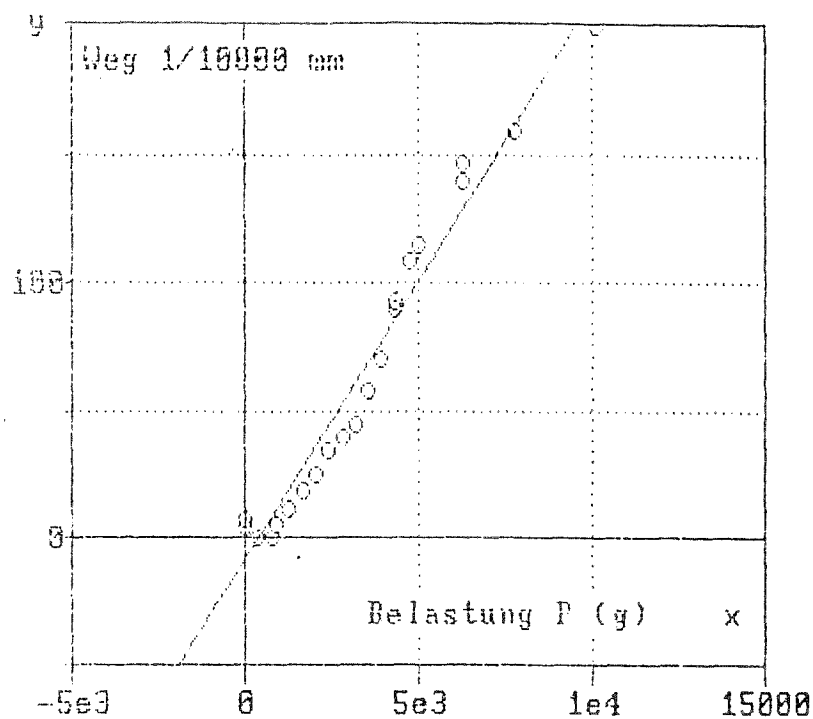
$$y = .0217x - 3.2631$$

Messhorizont: 3  
 Element.Nr. 6  
 Grösse 8 \* 8

$$c = 4688.3 \text{ kN/m}$$

Bestimmtheitsmaß : .963164

Korrelationskoeff.: .981499



## W E G M E S S U N G:

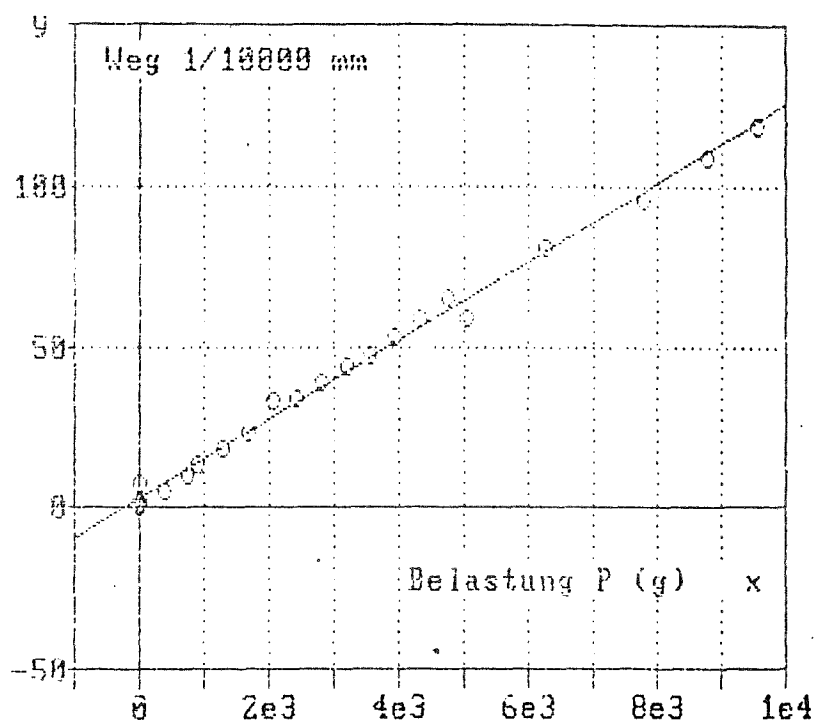
$$y = .0122x + 3.1716$$

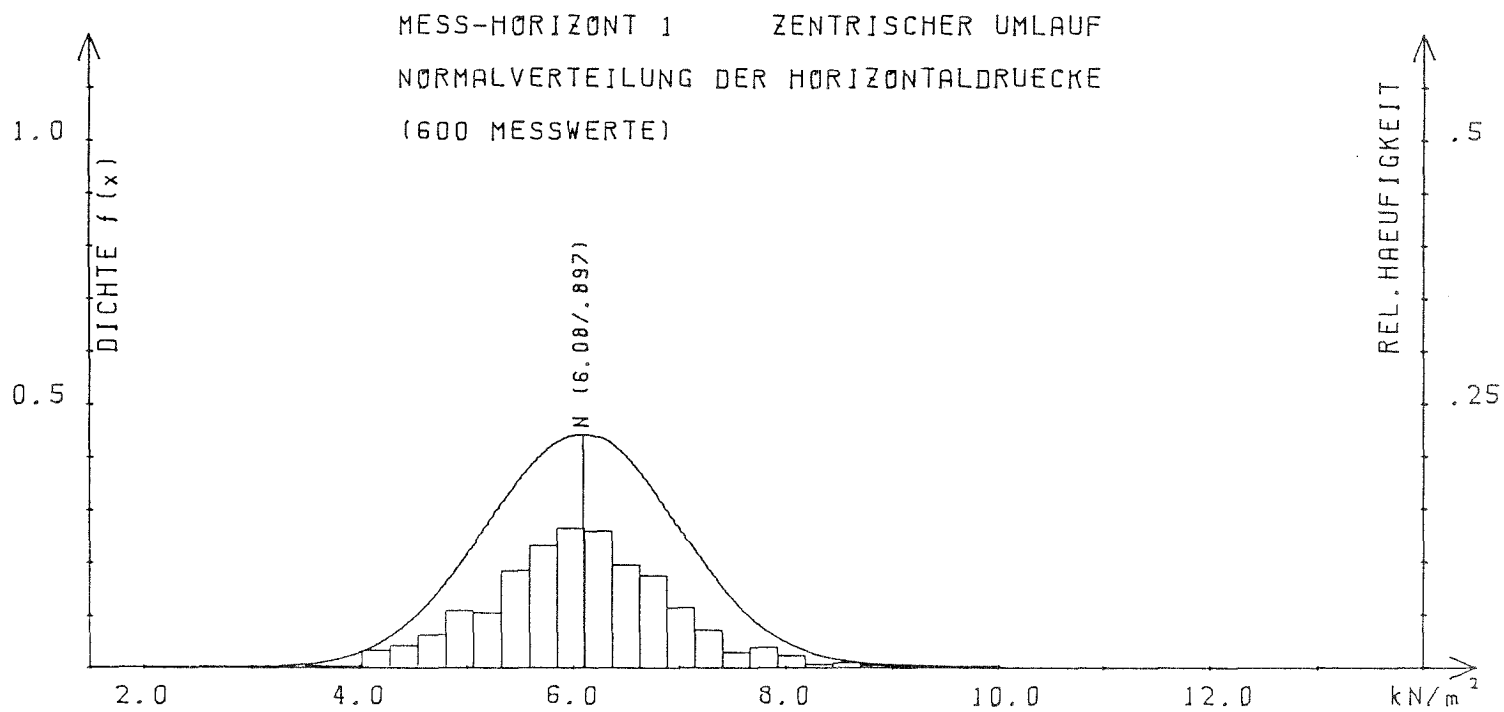
Messhorizont: 3  
 Element.Nr. 7  
 Grösse 8 \* 8

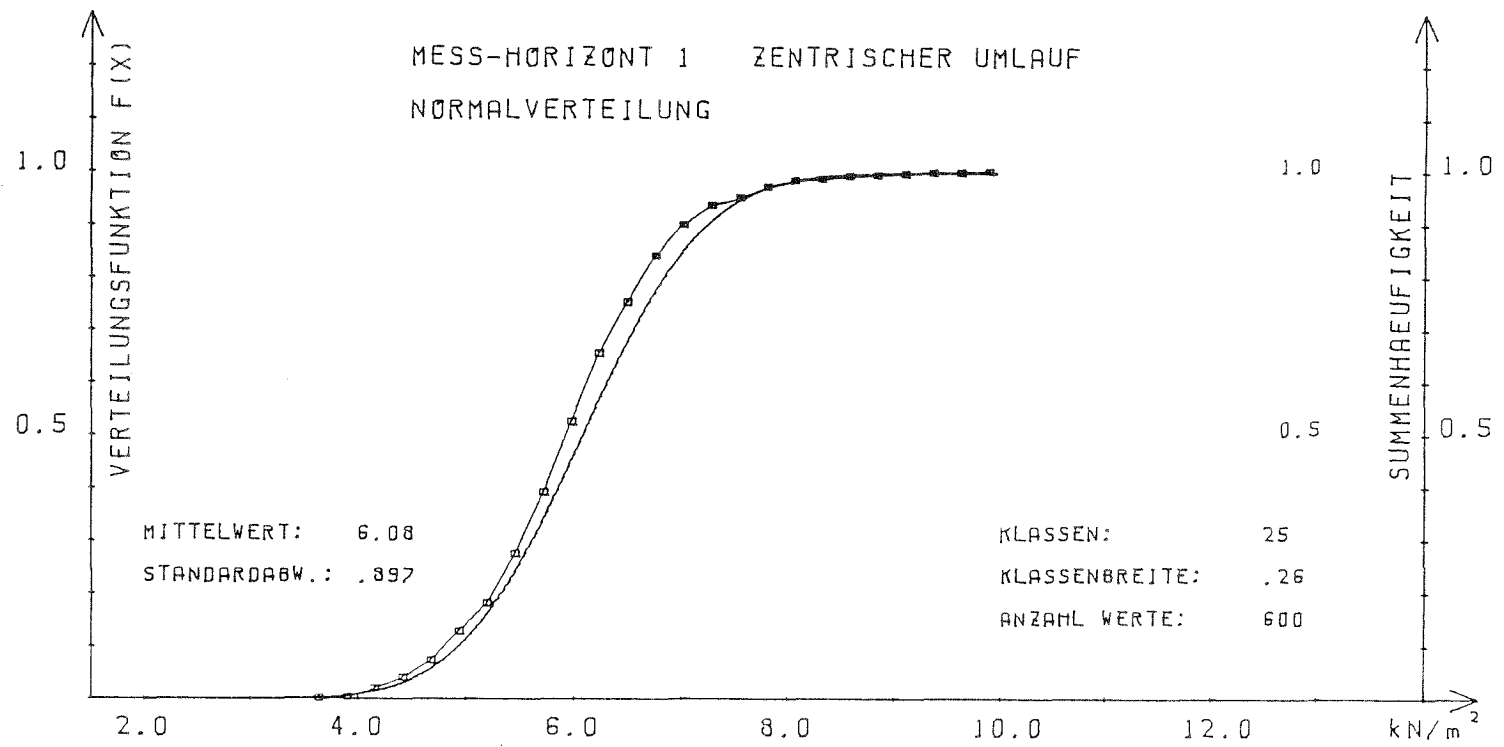
$$c = 8196.7 \text{ kN/m}$$

Bestimmtheitsmaß : .994145

Korrelationskoeff.: .997968

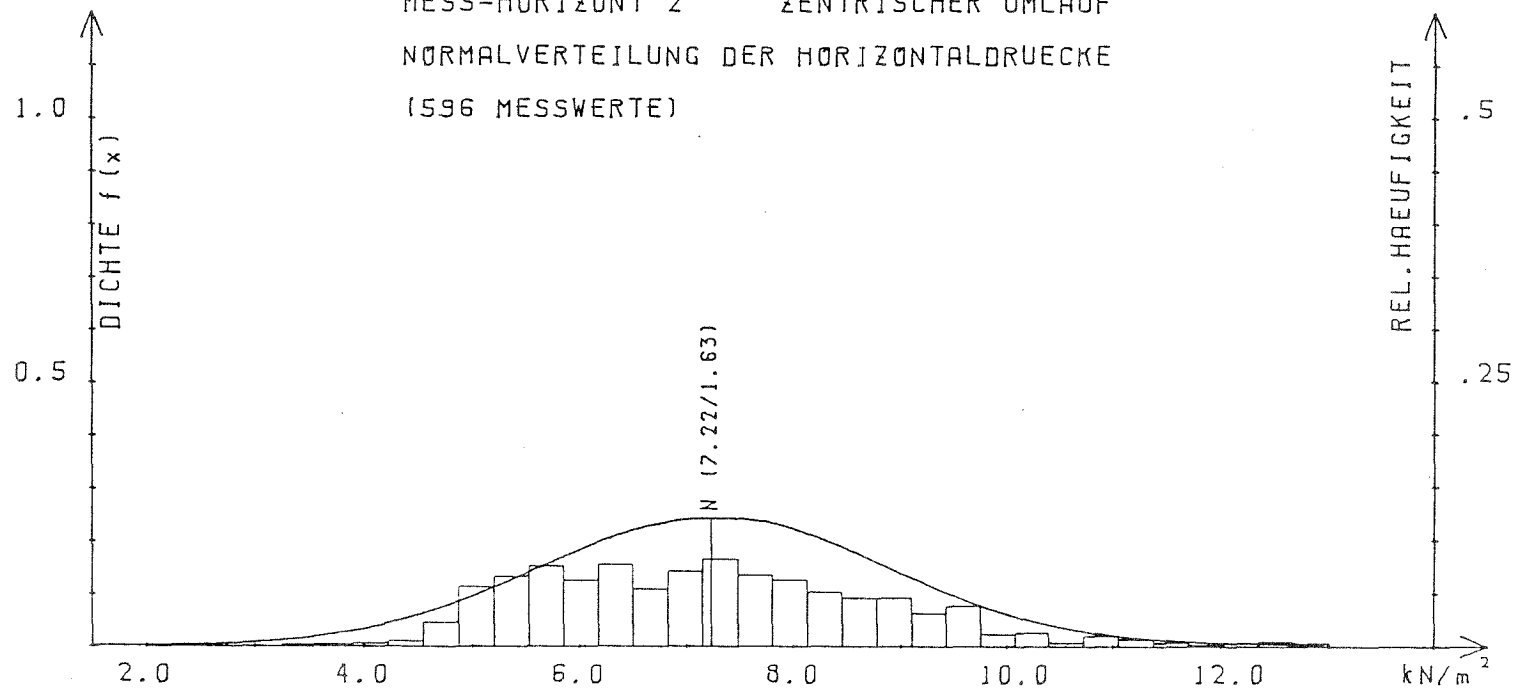




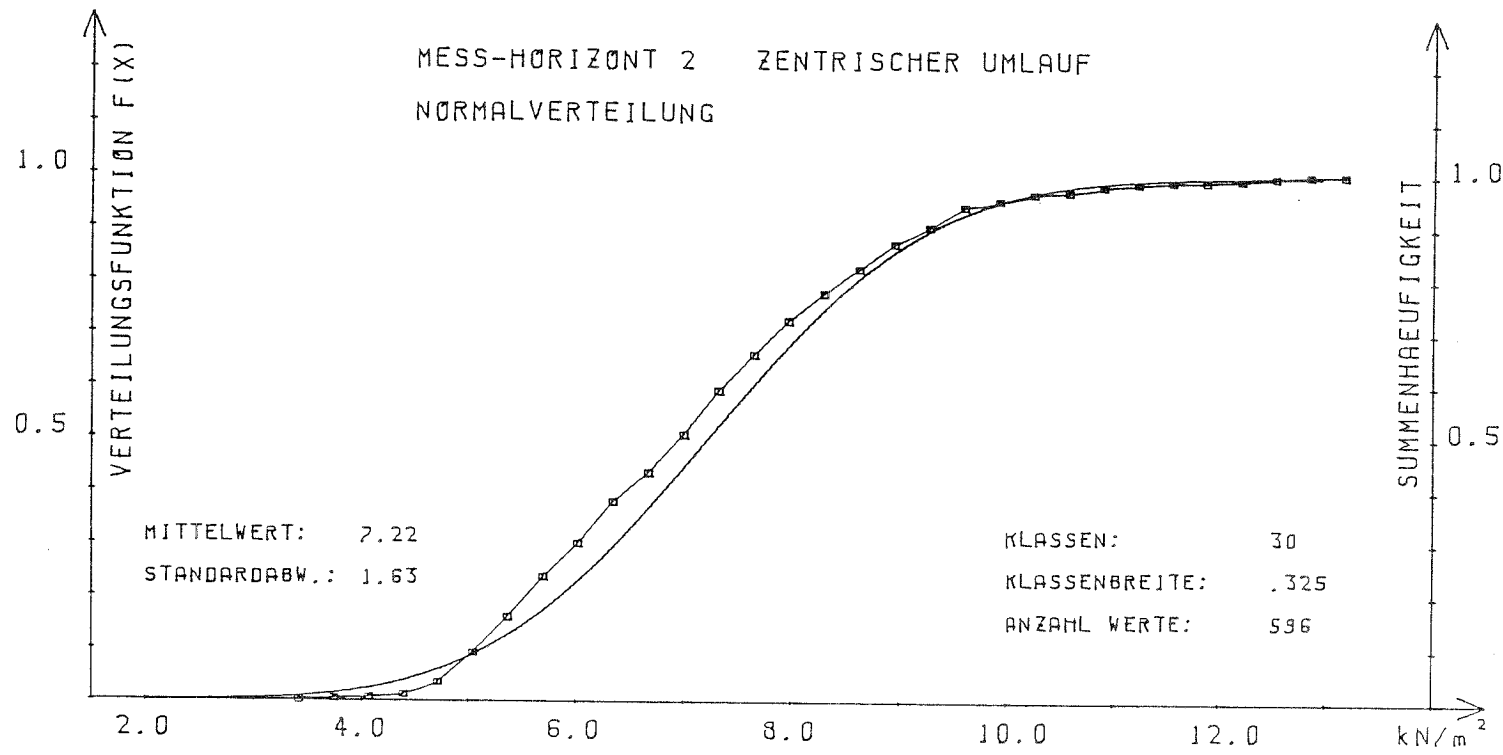


A 3.20

MESS-HORIZONT 2      ZENTRISCHER UMLAUF  
NORMALVERTEILUNG DER HORIZONTALDRUECKE  
(596 MESSWERTE)

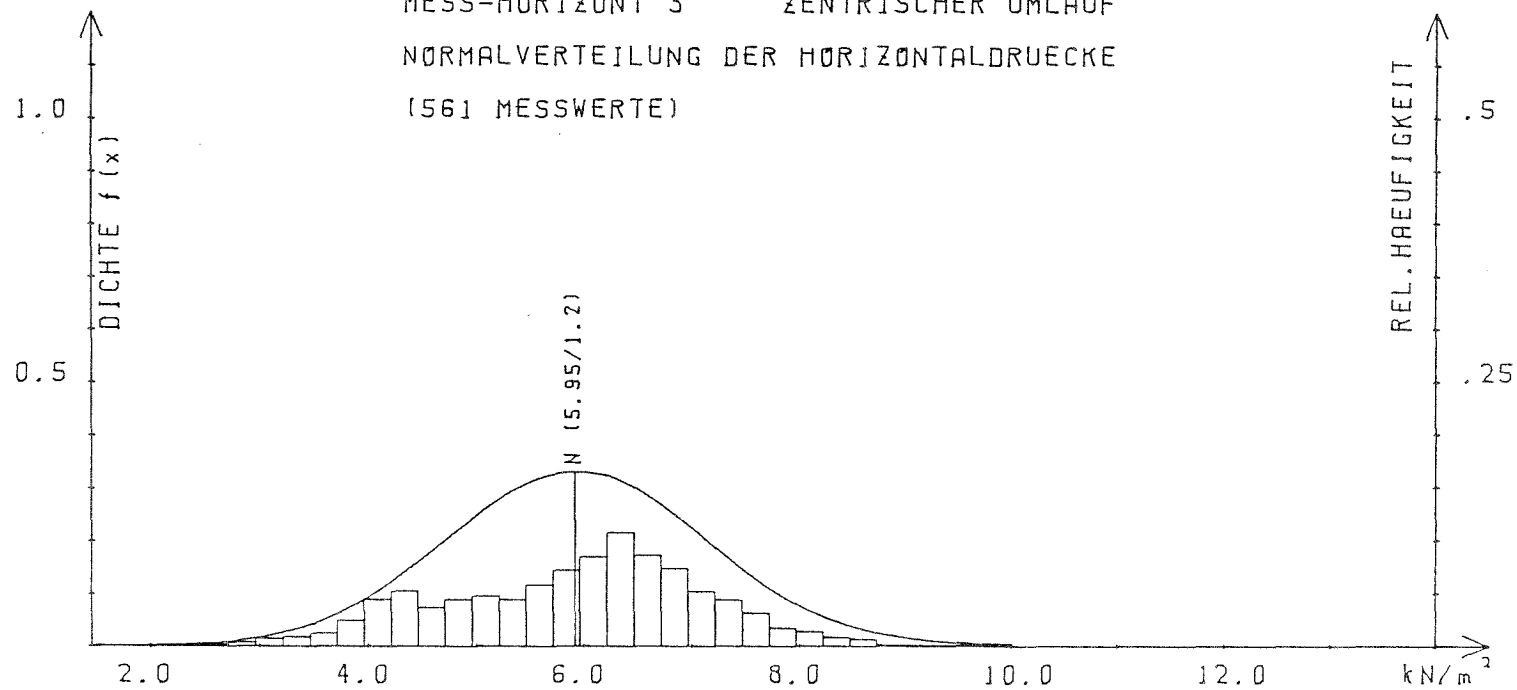


A 3.21

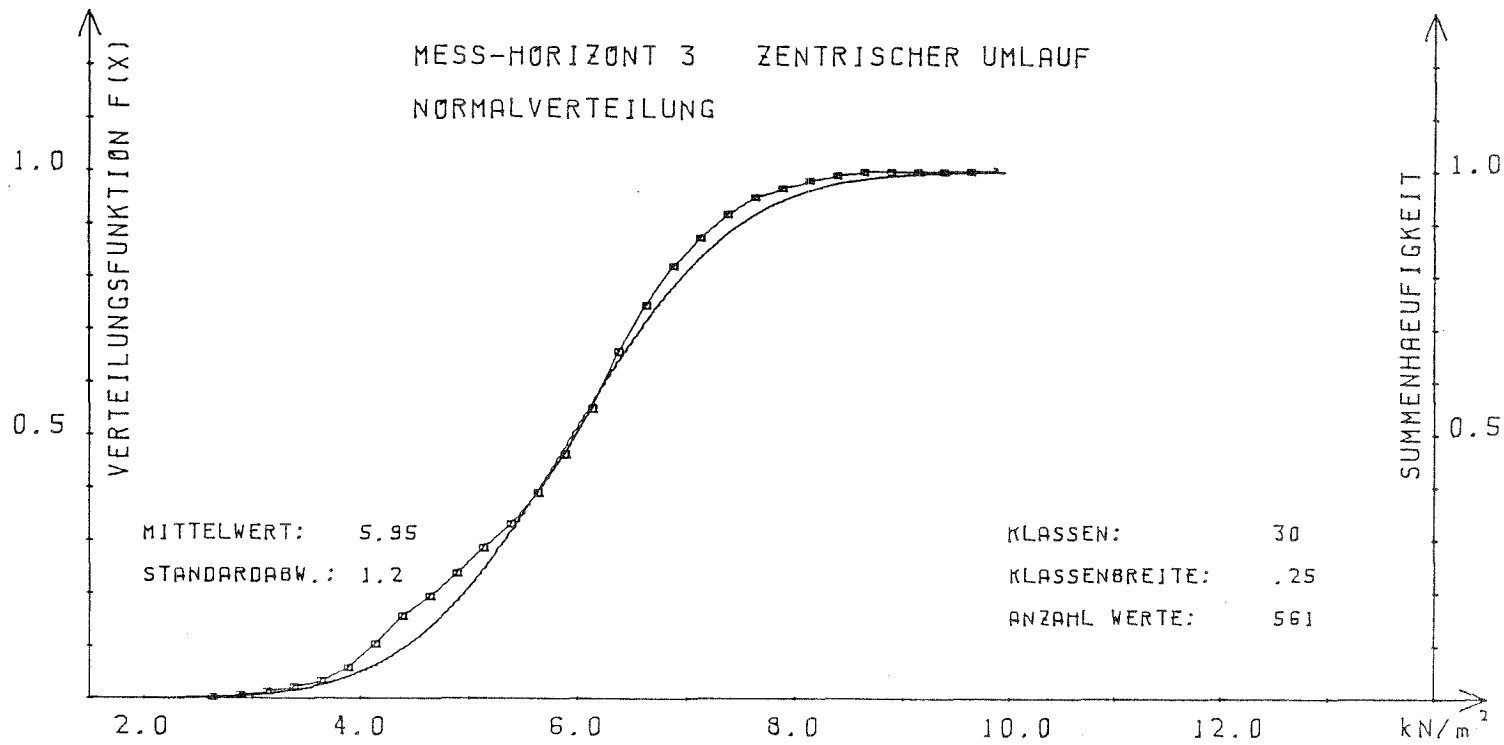


A 3.22

MESS-HORIZONT 3      ZENTRISCHER UMLAUF  
NORMALVERTEILUNG DER HORIZONTALDRUECKE  
(561 MESSWERTE)



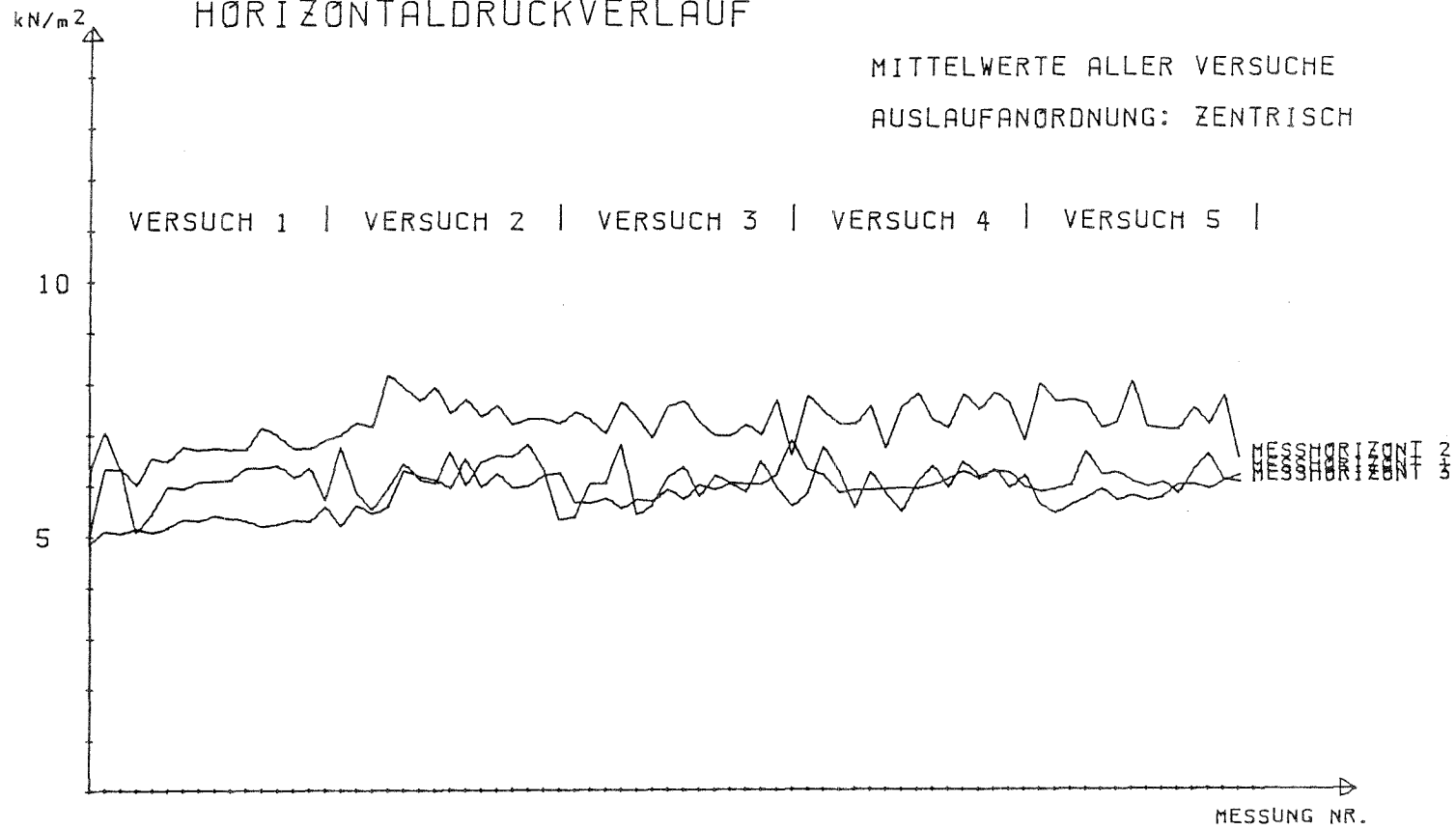
A 3.25



A 3.24

# HORIZONTALDRUCKVERLAUF

MITTELWERTE ALLER VERSUCHE  
AUSLAUFANORDNUNG: ZENTRISCH



A 3-26



kN/m<sup>2</sup>

# HORIZONTALDRUCKVERLAUF

MITTELWERTE ALLER VERSUCHE  
AUSLAUFANORDNUNG: HALBEXZENTRISCH

VERSUCH 1 | VERSUCH 2 | VERSUCH 3 | VERSUCH 4 | VERSUCH 5 |

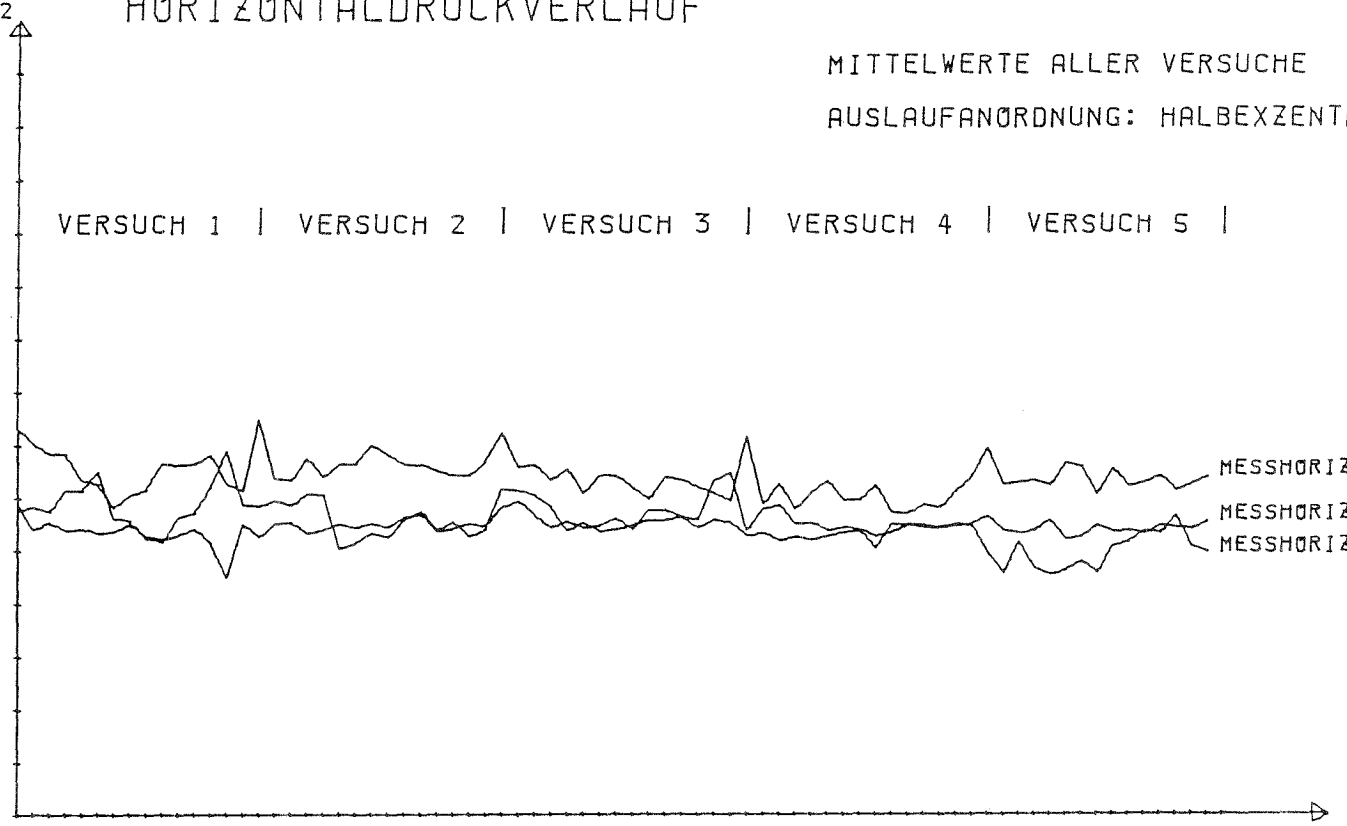
10

5

MESSHORIZONT 2  
MESSHORIZONT 3  
MESSHORIZONT 1

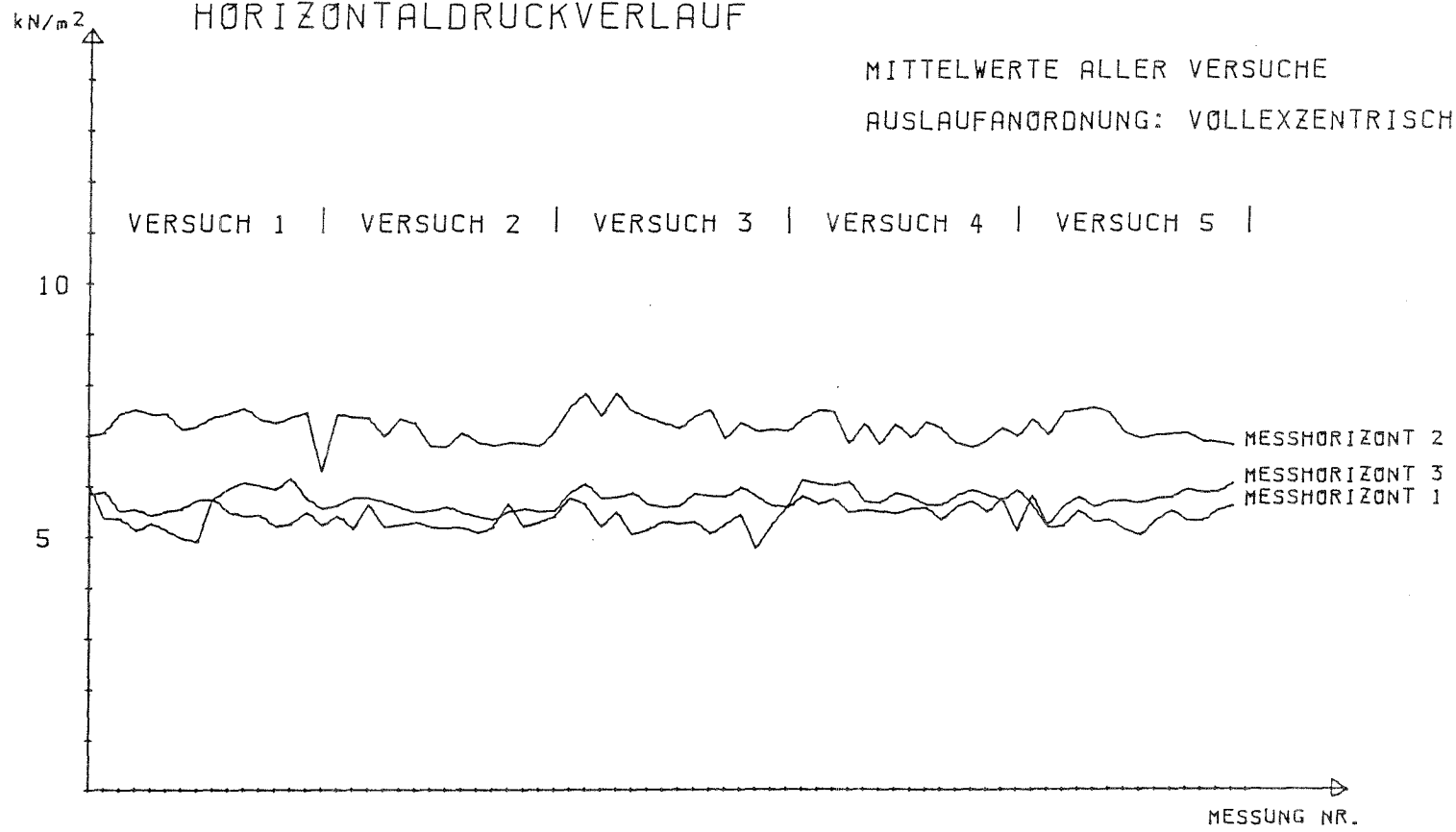
MESSUNG NR.

A 5.27

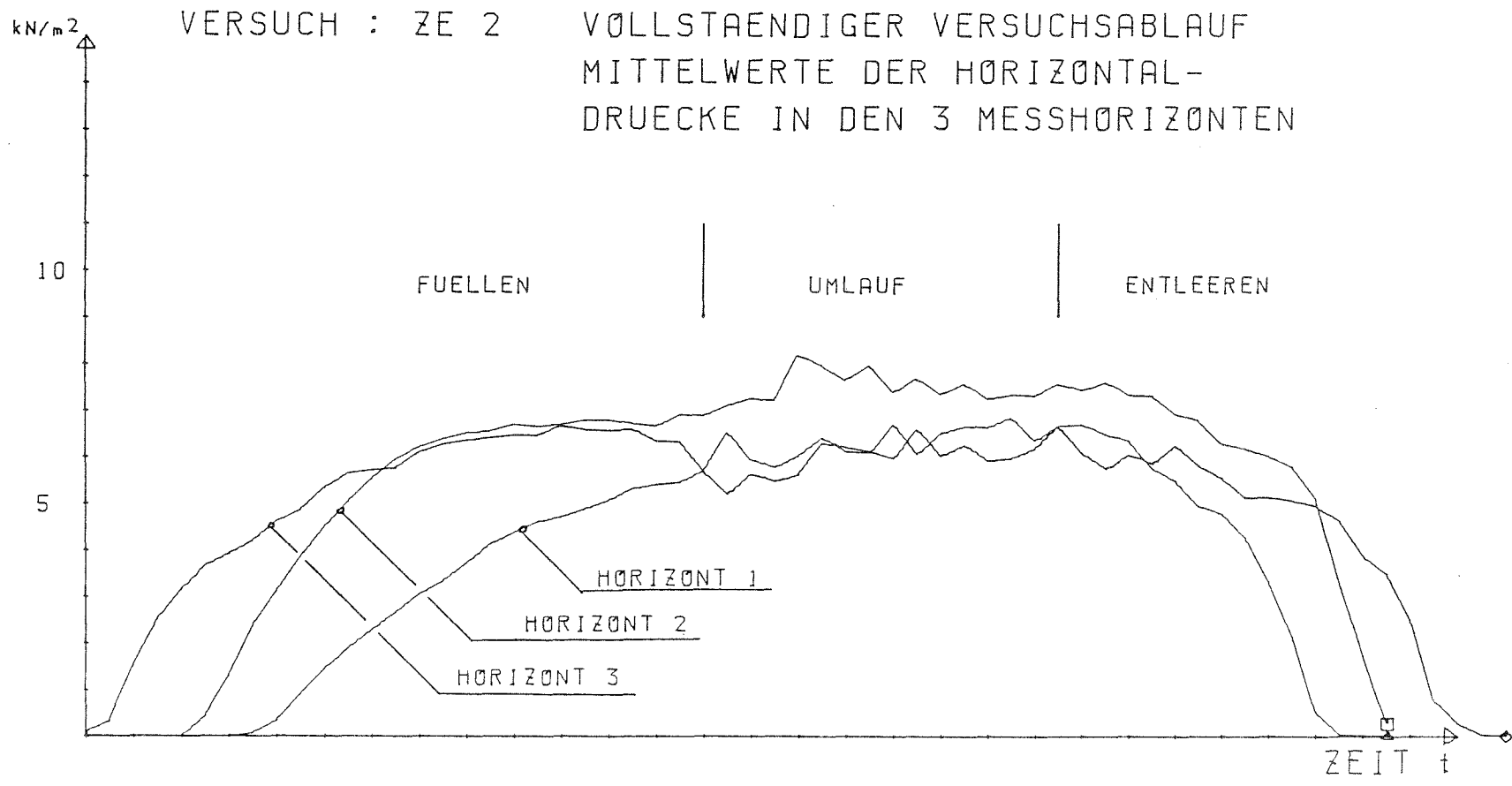


# HORIZONTALDRUCKVERLAUF

MITTELWERTE ALLER VERSUCHE  
AUSLAUFANORDNUNG: VOLLEXZENTRISCH



A 3.28



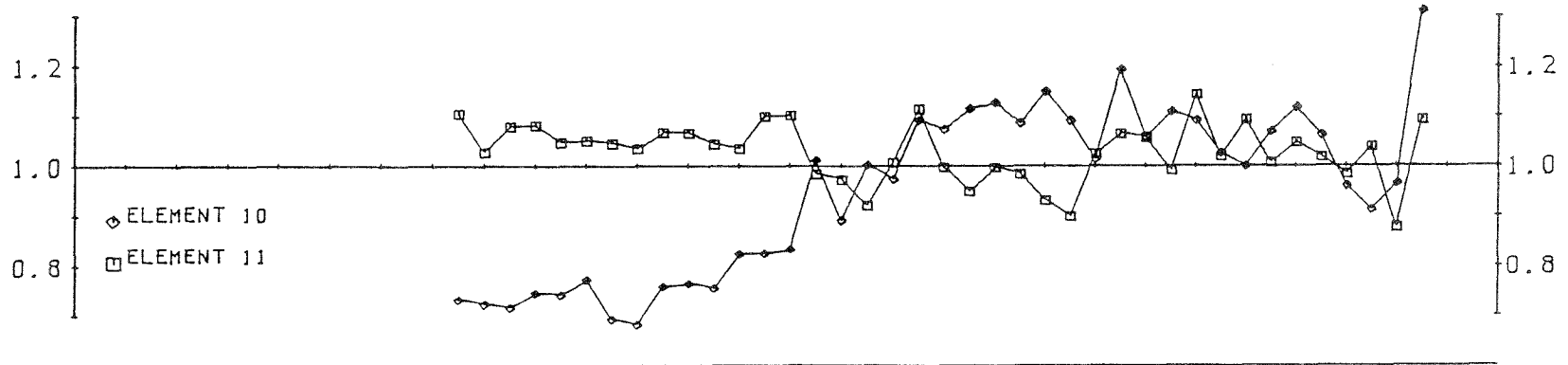
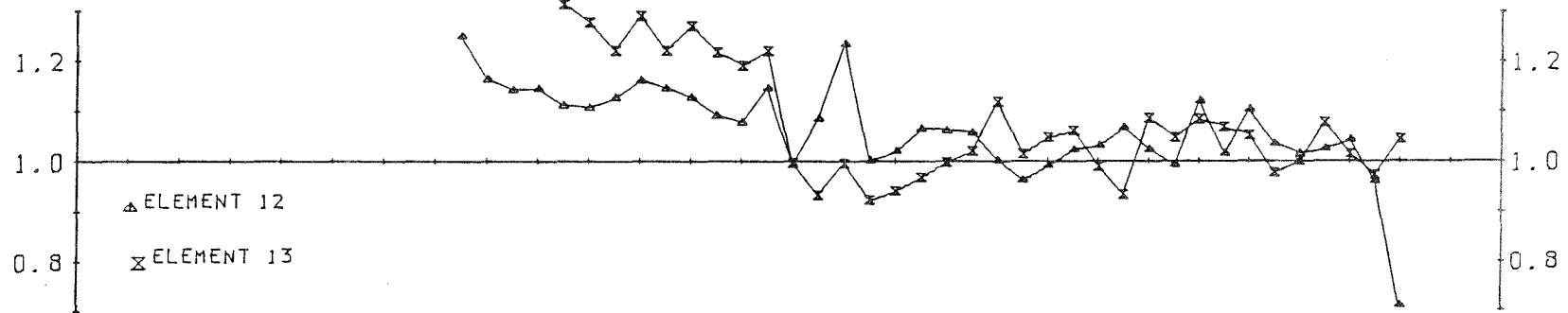
A 3.29

VERSUCH : ZE 2

HORIZONT: 1

VOLLSTÄNDIGER VERSUCHSABLAUF

EINZELMESSWERTE BEZOGEN AUF MITTELWERT



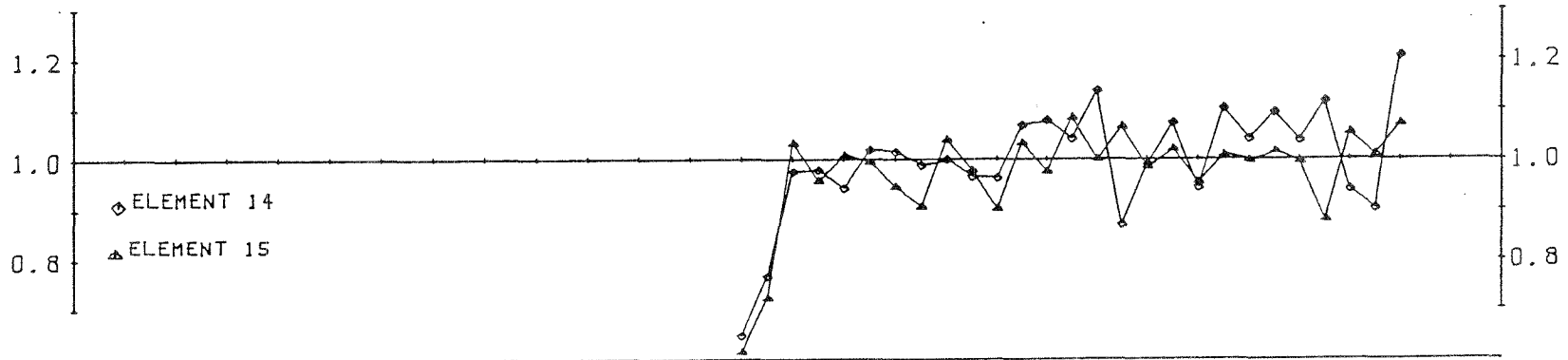
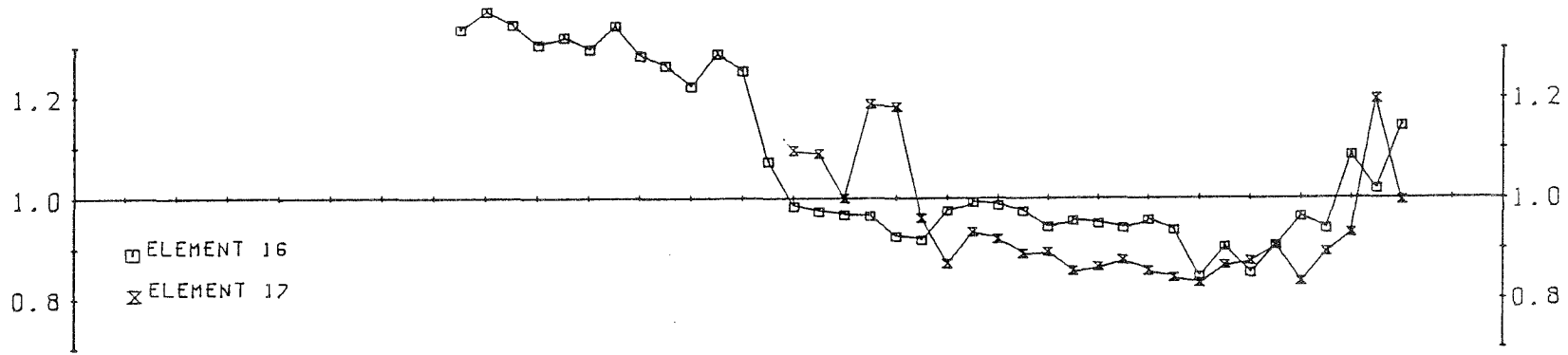
A 3.30

VERSUCH : ZE 2

HORIZONT: 1

VOLLSTÄNDIGER VERSUCHSABLAUF

EINZELMESSWERTE BEZOGEN AUF MITTELWERT



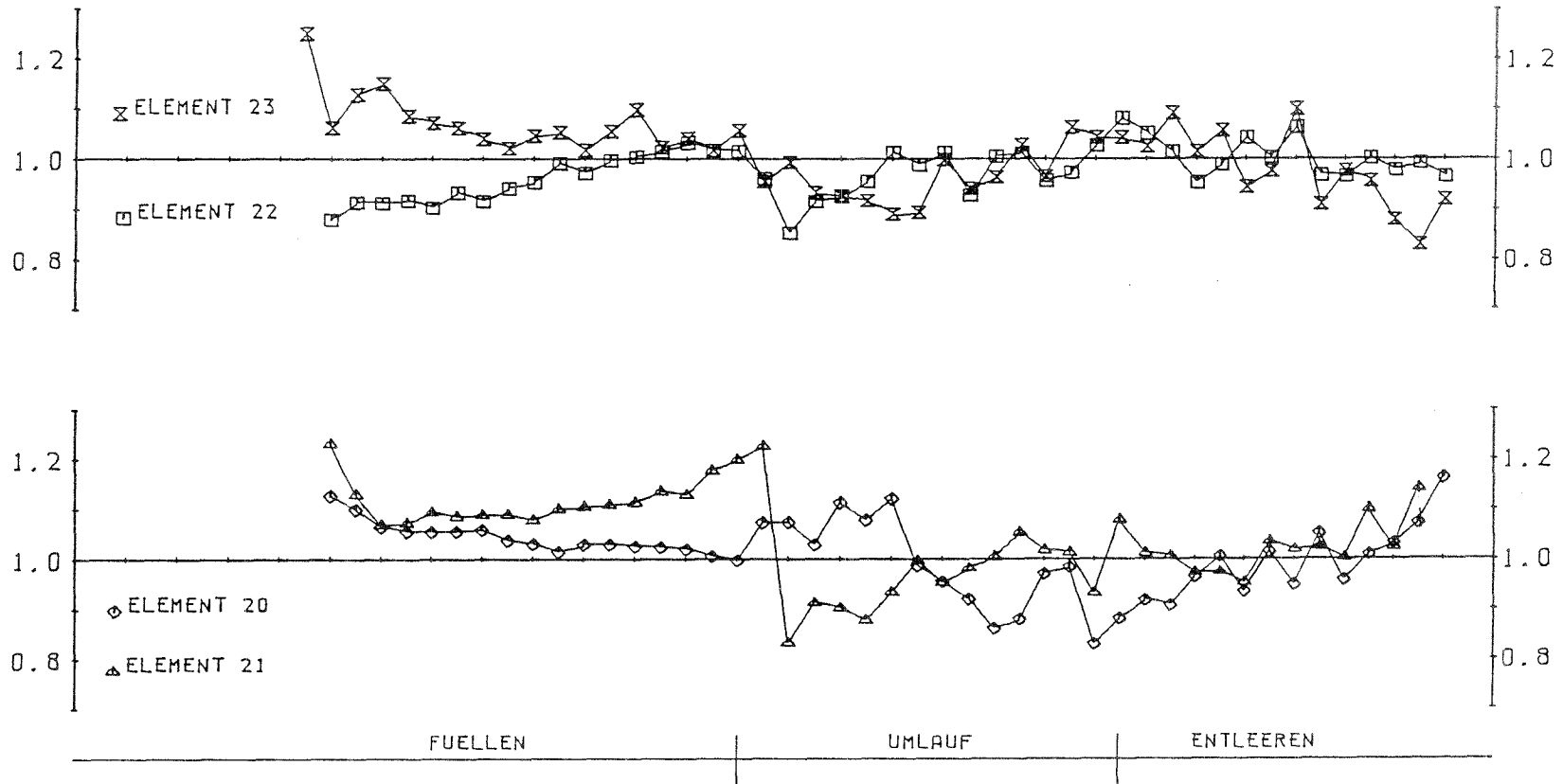
# 3.3A

VERSUCH : ZE 2

HORIZONT: 2

VOLLSTÄNDIGER VERSUCHSABLAUF

EINZELMESSWERTE BEZOGEN AUF MITTELWERT



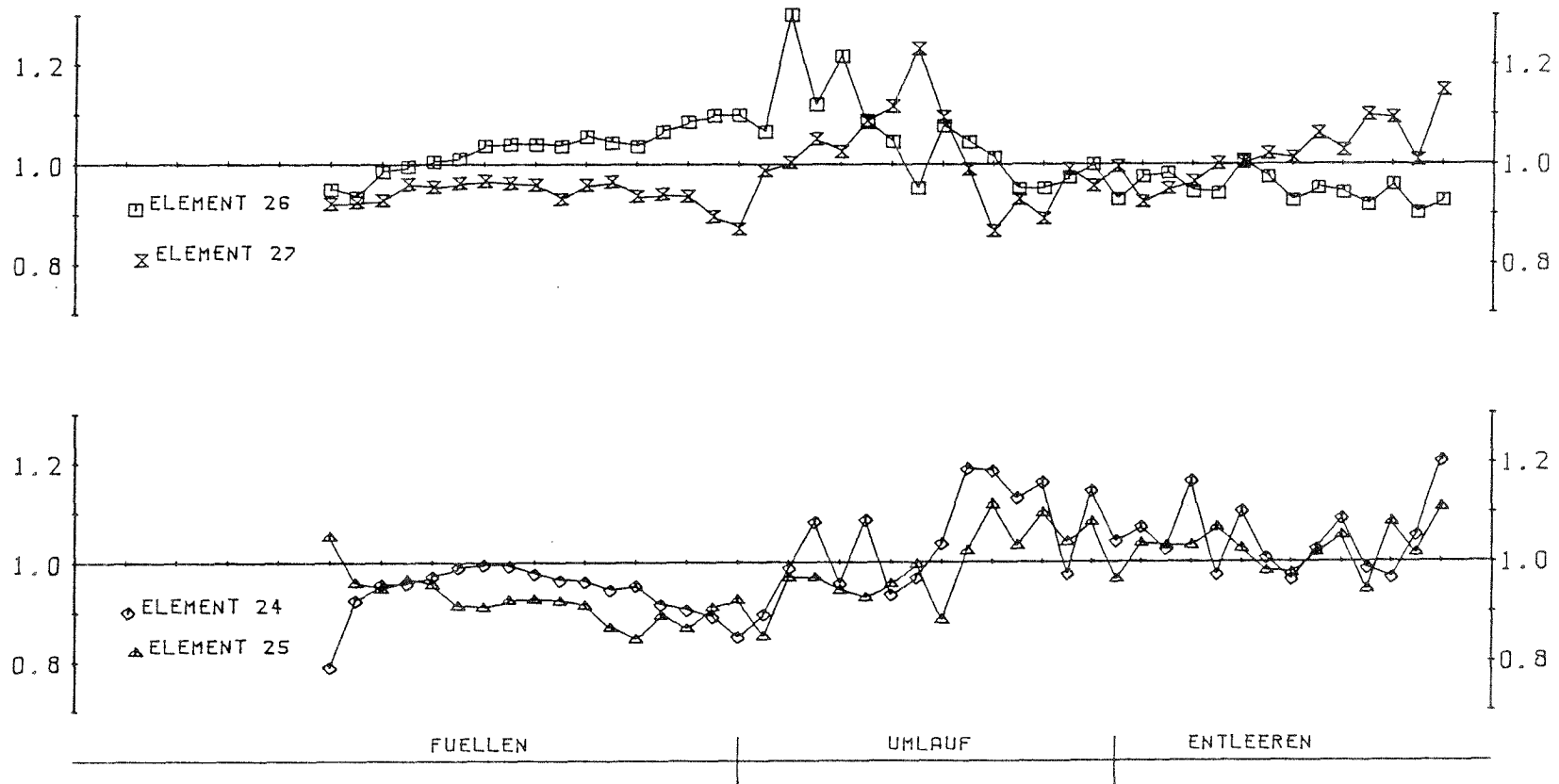
A 3.32

VERSUCH : ZE 2

HORIZONT: 2

VOLLSTÄNDIGER VERSUCHSABLAUF

EINZELMESSWERTE BEZOGEN AUF MITTELWERT



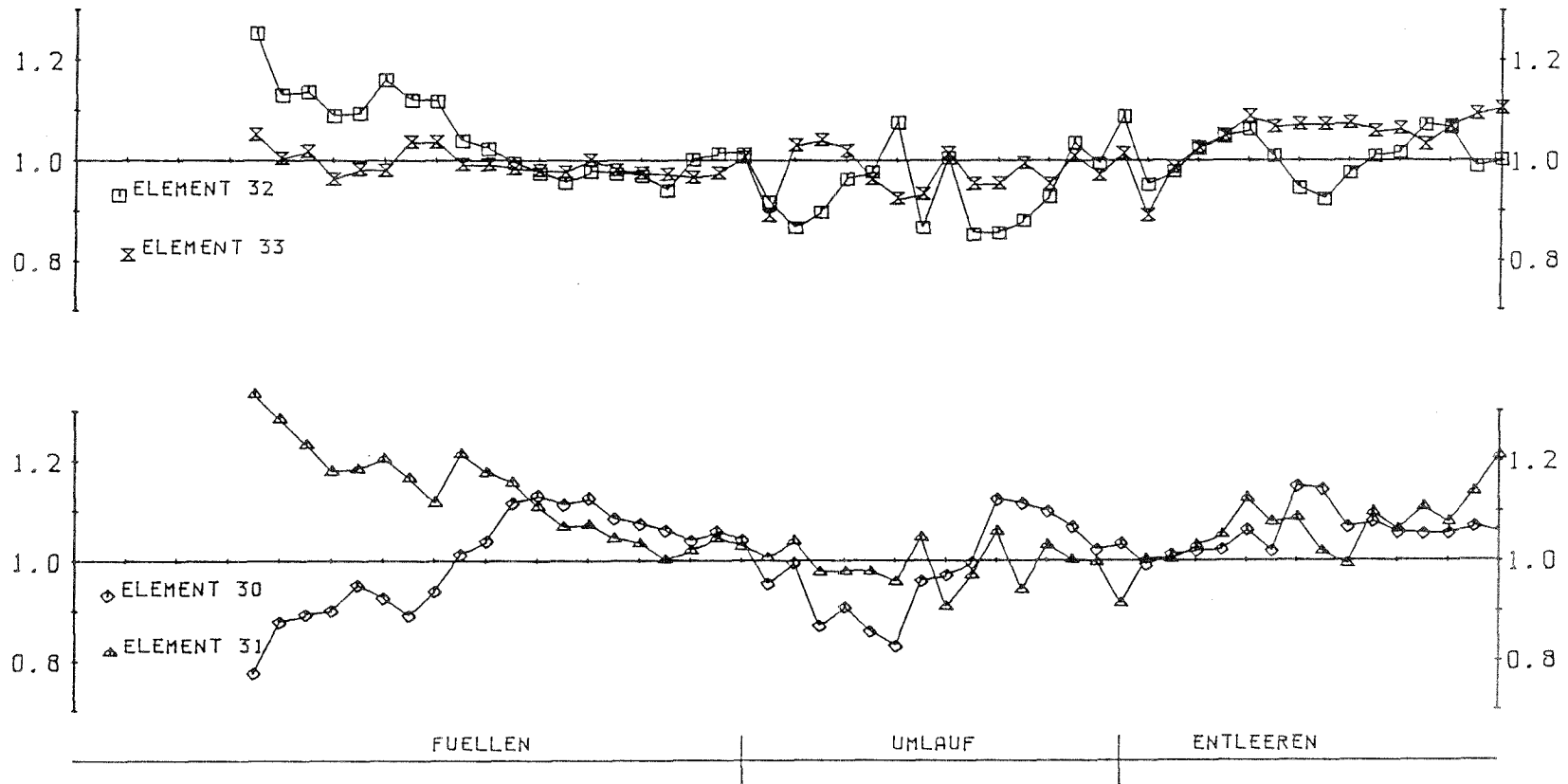
4.3.33

VERSUCH : ZE 2

HORIZONT: 3

VOLLSTÄNDIGER VERSUCHSABLAUF

EINZELMESSWERTE BEZOGEN AUF MITTELWERT



A 5.34

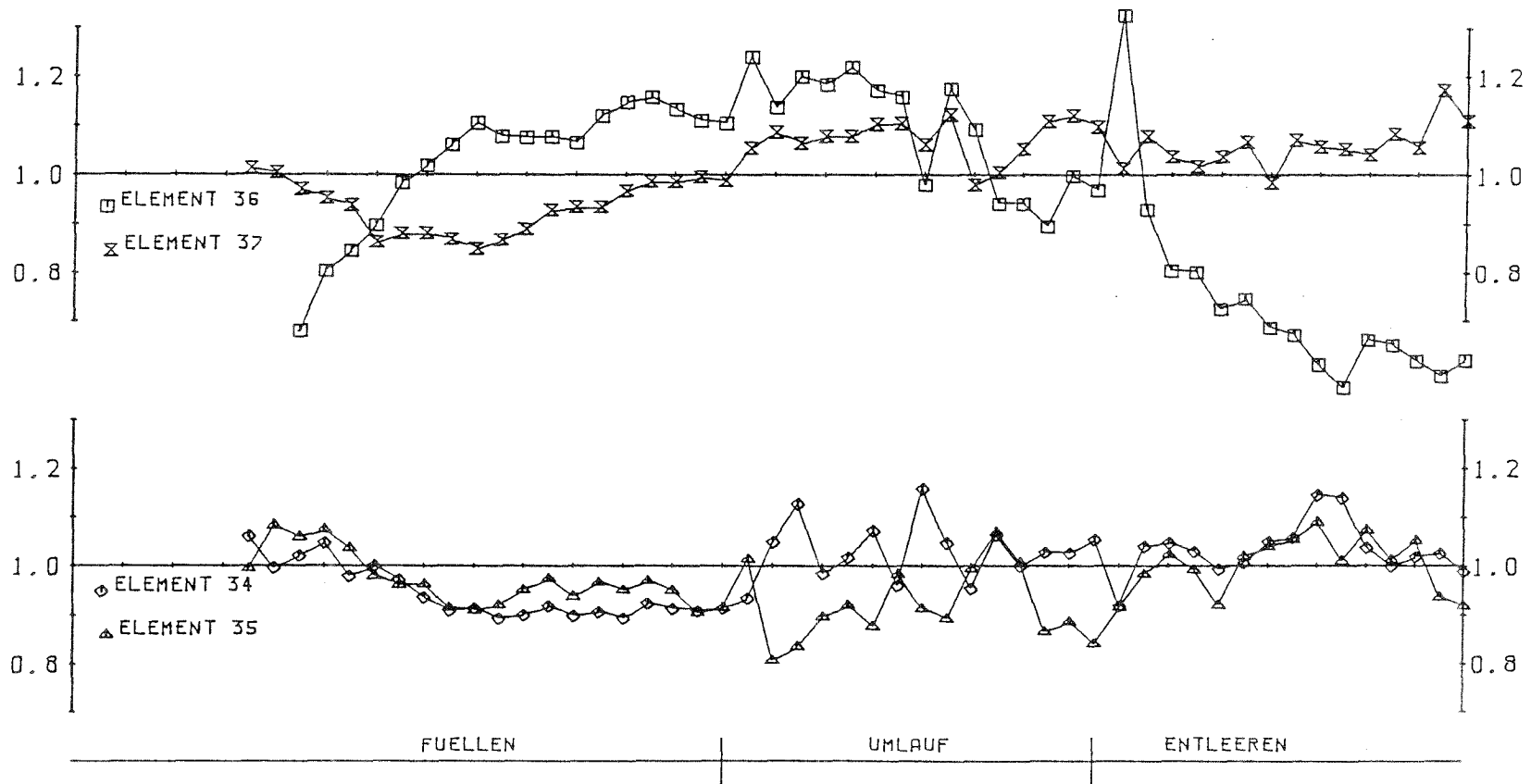


VERSUCH : ZE 2

HORIZONT: 3

VÖLLSTÄNDIGER VERSUCHSABLAUF

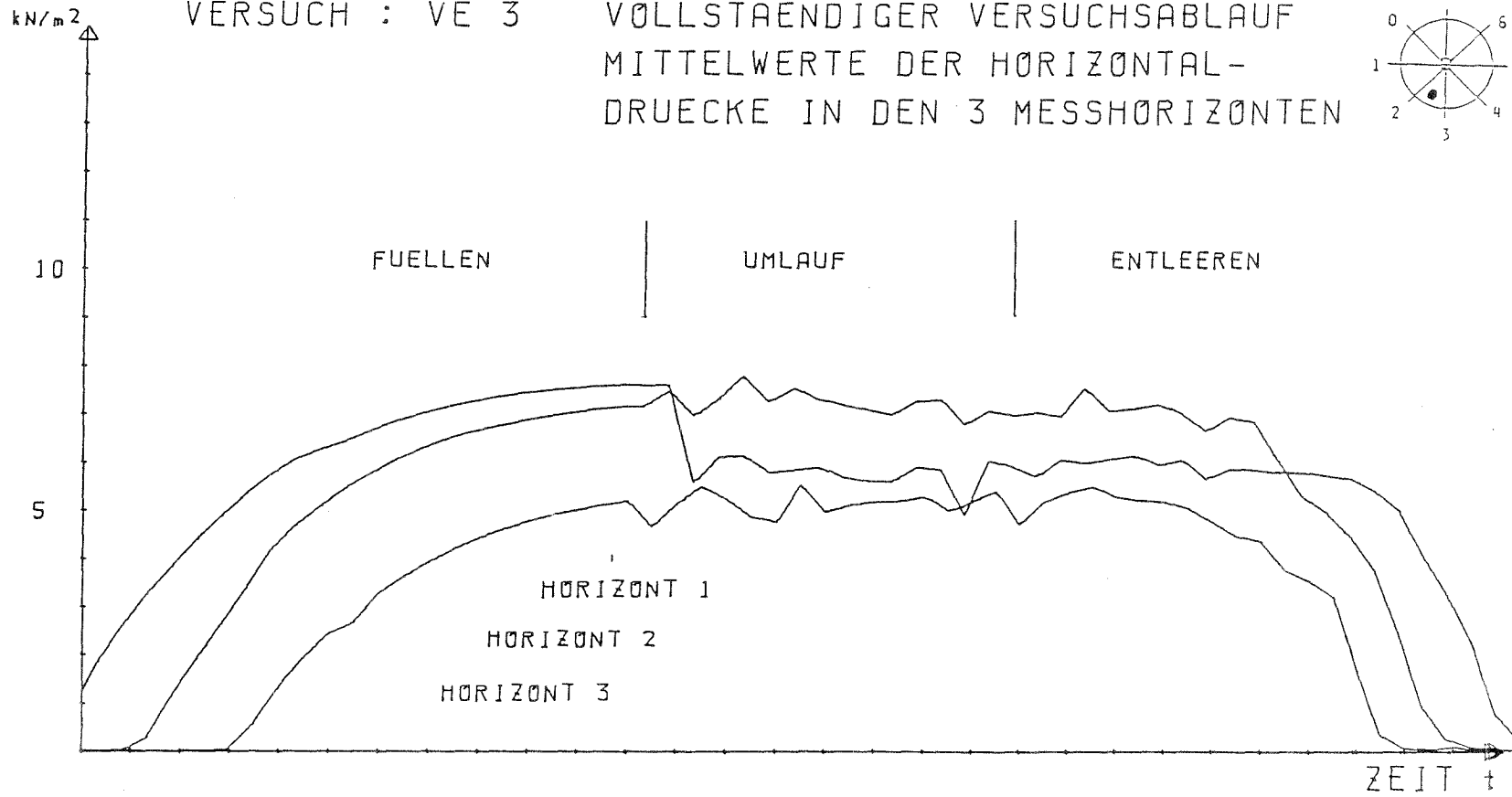
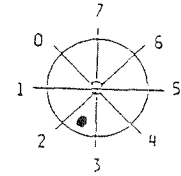
EINZELMESSWERTE BEZOGEN AUF MITTELWERT



17.3.35

HORI

VERSUCH : VE 3 VOLLSTÄNDIGER VERSUCHSABLAUF  
MITTELWERTE DER HORIZONTAL-  
DRUECKE IN DEN 3 MESSHORIZONTEN



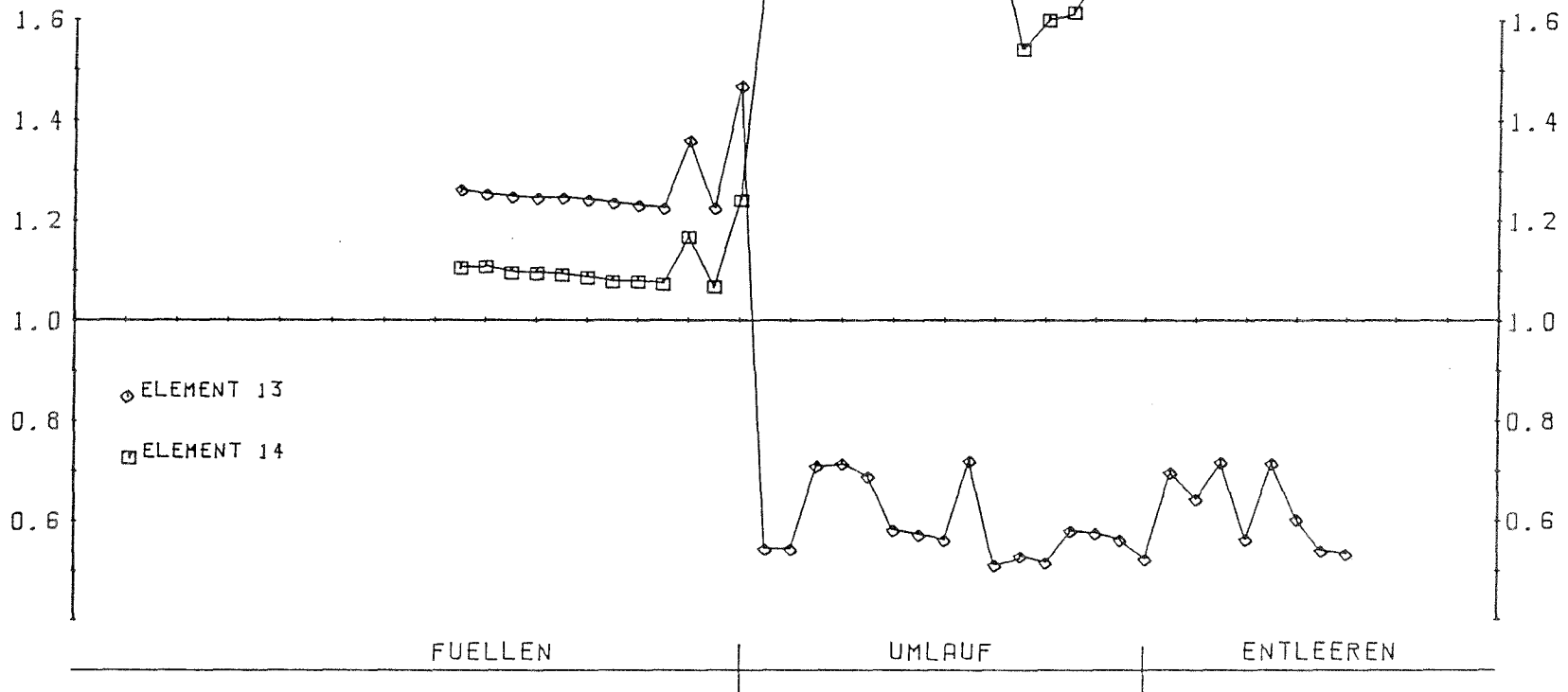
A 3.36

VERSUCH : VE 3

HORIZONT: 1

VOLLSTÄNDIGER VERSUCHSABLAUF

EINZELMESSWERTE BEZOGEN AUF MITTELWERT



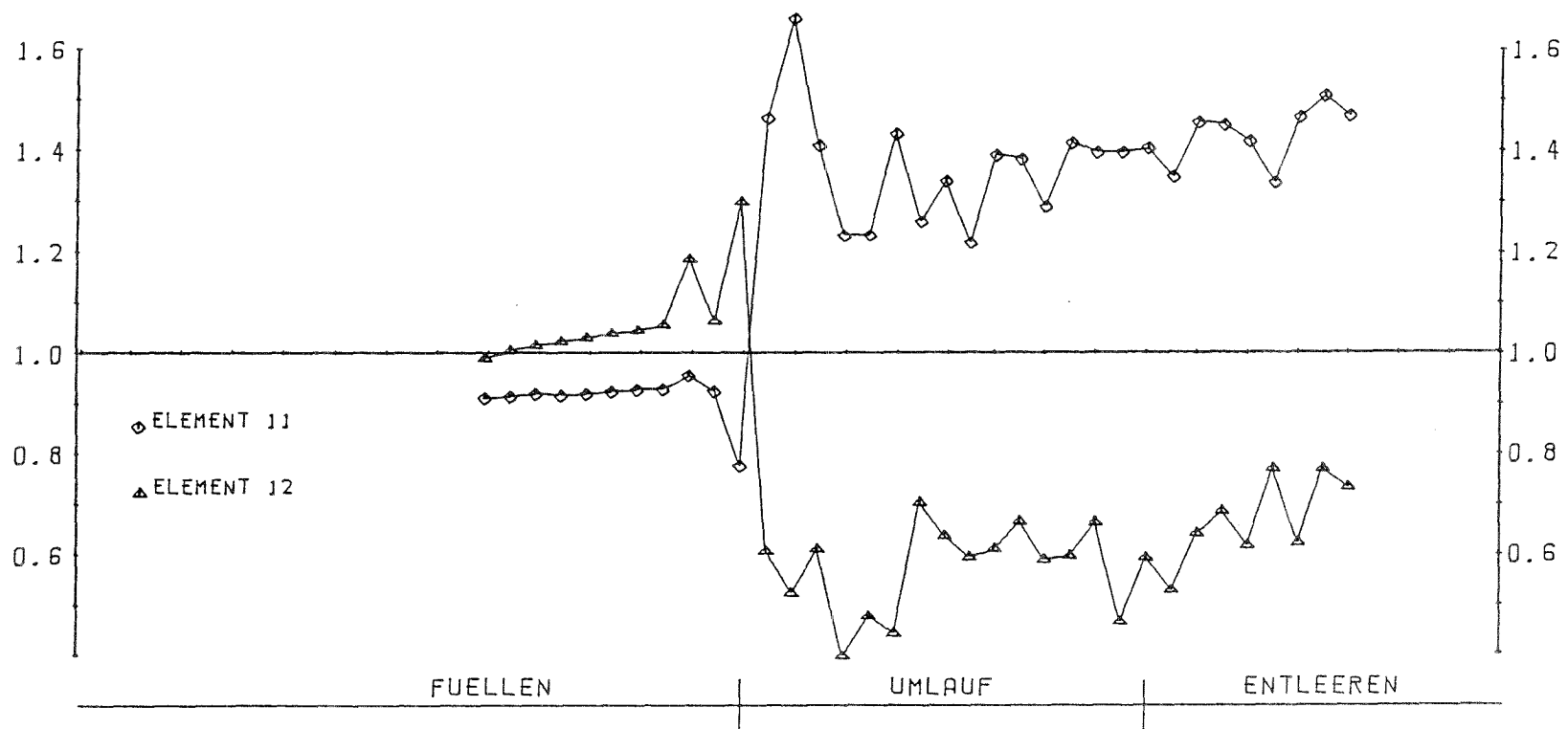
A 3.31

VERSUCH : VE 3

HORIZONT: 1

VOLLSTÄNDIGER VERSUCHSABLAUF

EINZELMESSWERTE BEZOGEN AUF MITTELWERT



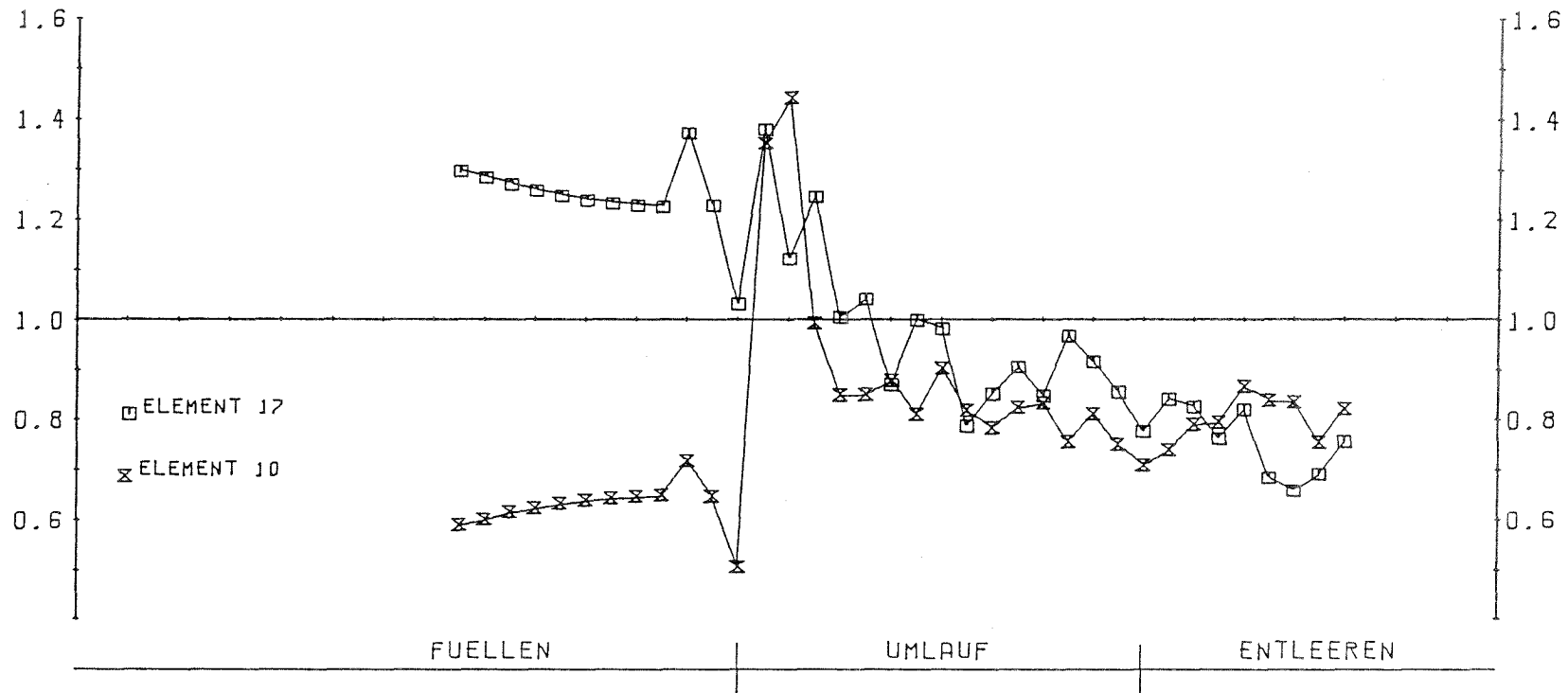
A 3.38

VERSUCH : VE 3

HORIZONT: 1

VOLLSTÄNDIGER VERSUCHSABLAUF

EINZELMESSWERTE BEZOGEN AUF MITTELWERT



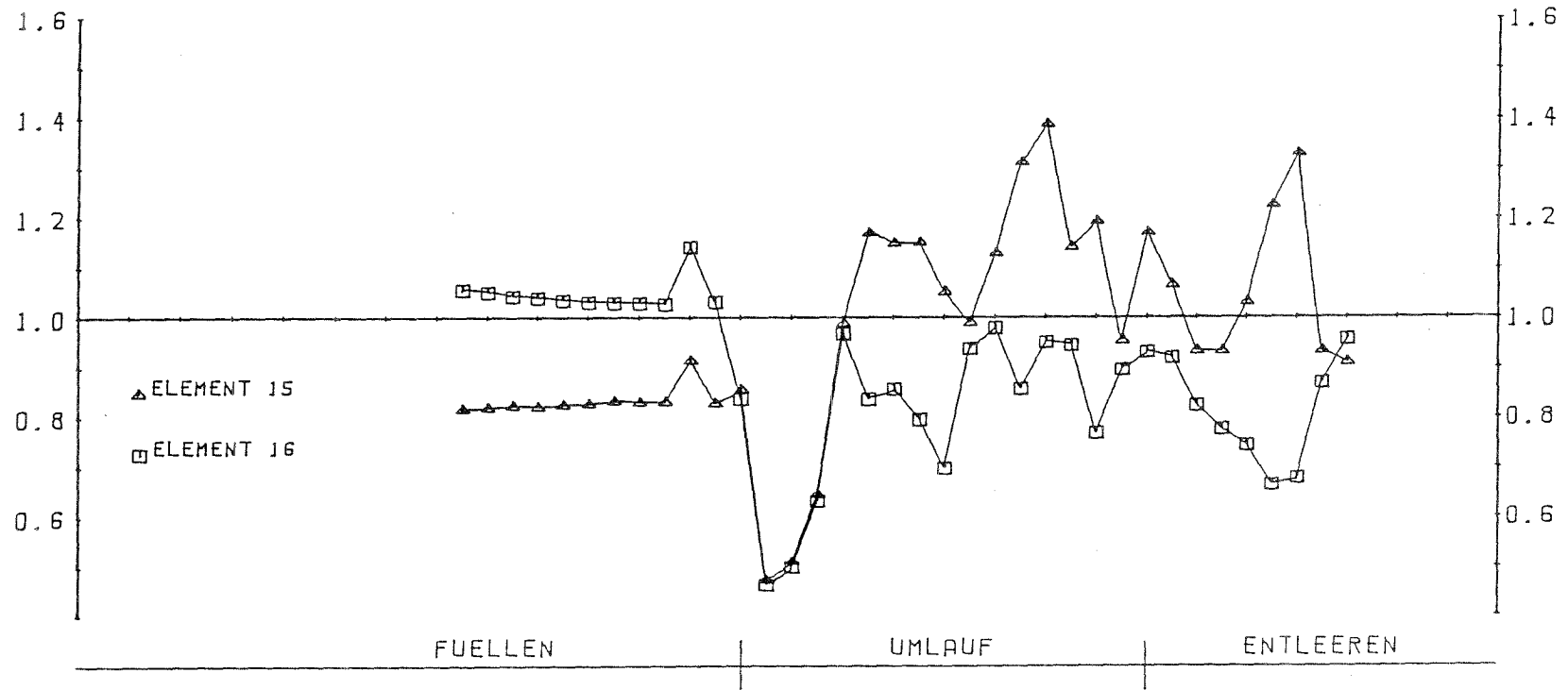
A 3.30

VERSUCH : VE 3

HORIZONT: 1

VÖLLSTAENDIGER VERSUCHSABLAUF

EINZELMESSWERTE BEZOGEN AUF MITTELWERT



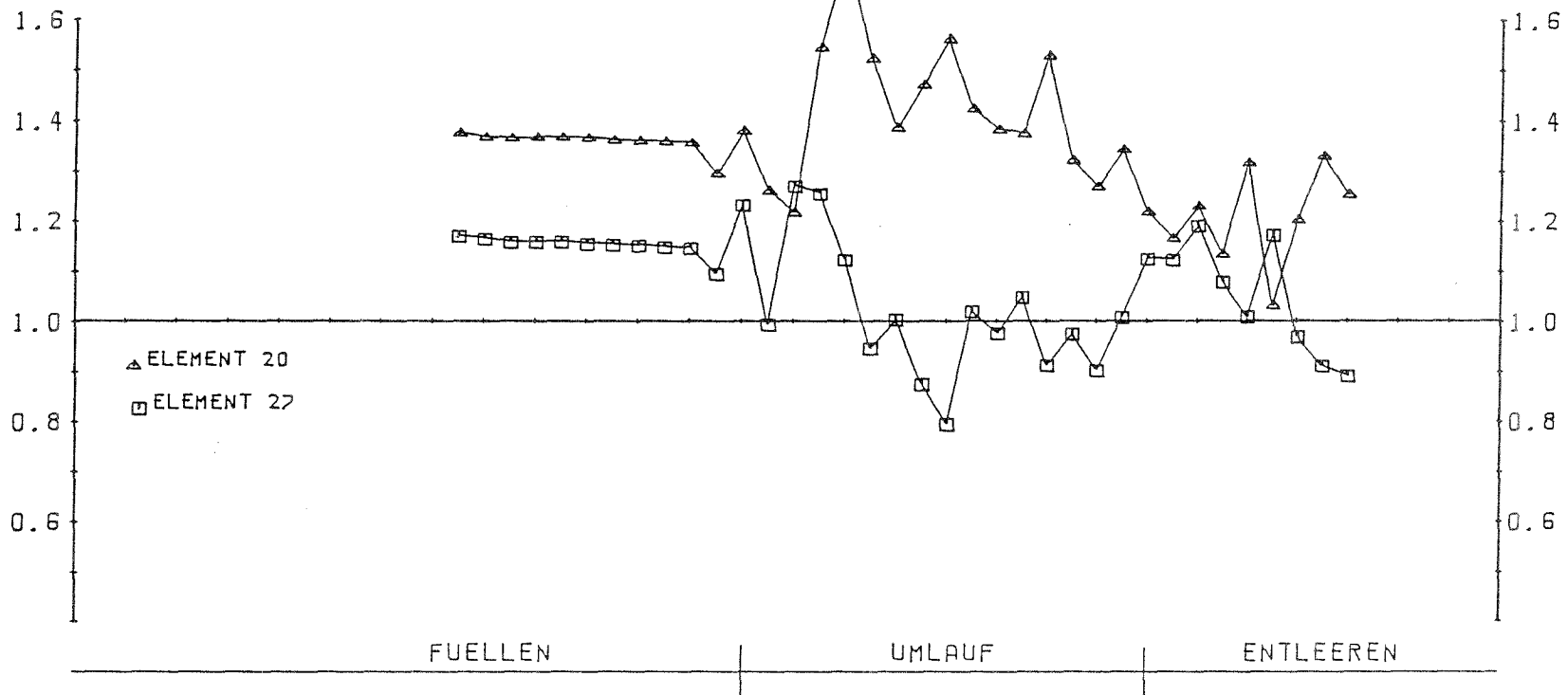
A 3.40

VERSUCH : VE 3

HORIZONT: 2

VÖLLSTÄNDIGER VERSUCHSABLAUF

EINZELMESSWERTE BEZOGEN AUF MITTELWERT



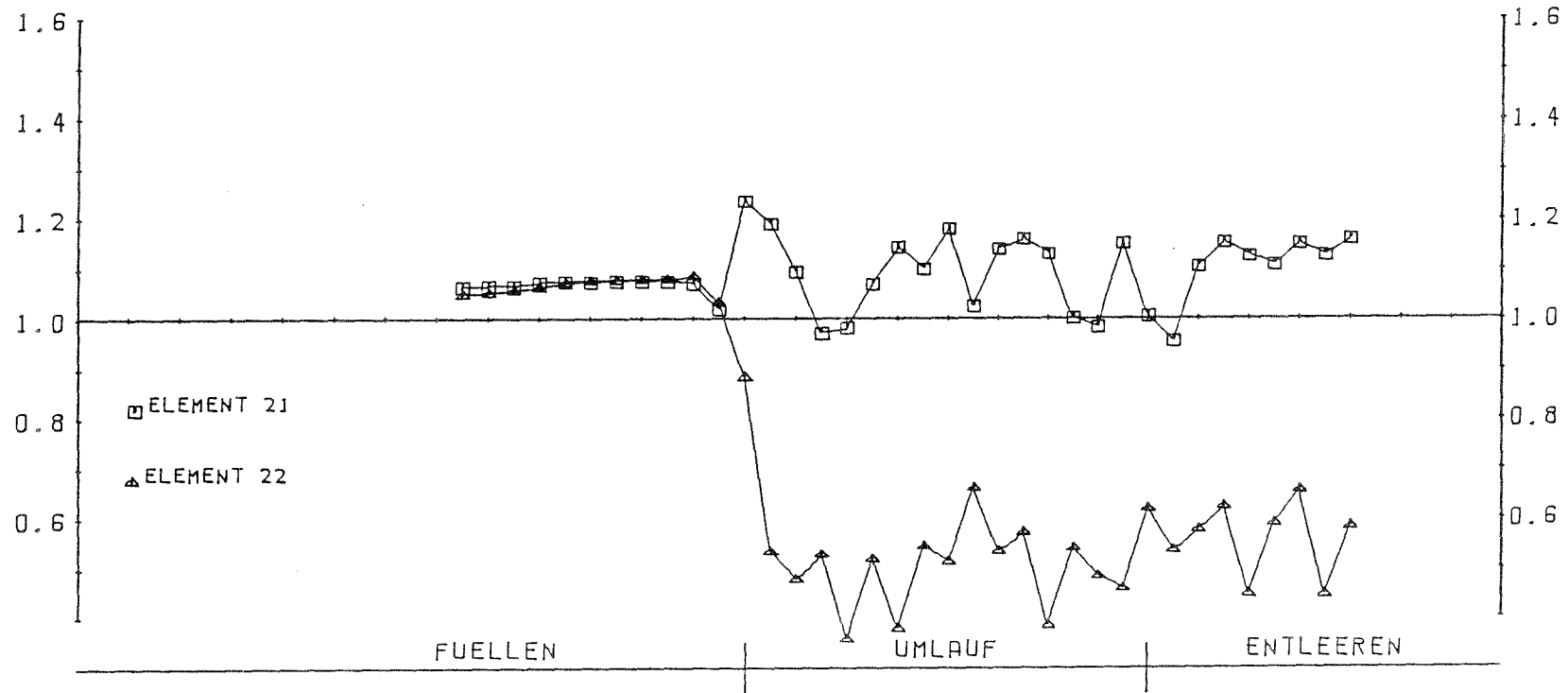
A. 344

VERSUCH : VE 3

HORIZONT: 2

VOLLSTÄNDIGER VERSUCHSABLAUF

EINZELMESSWERTE BEZOGEN AUF MITTELWERT



A 3.42

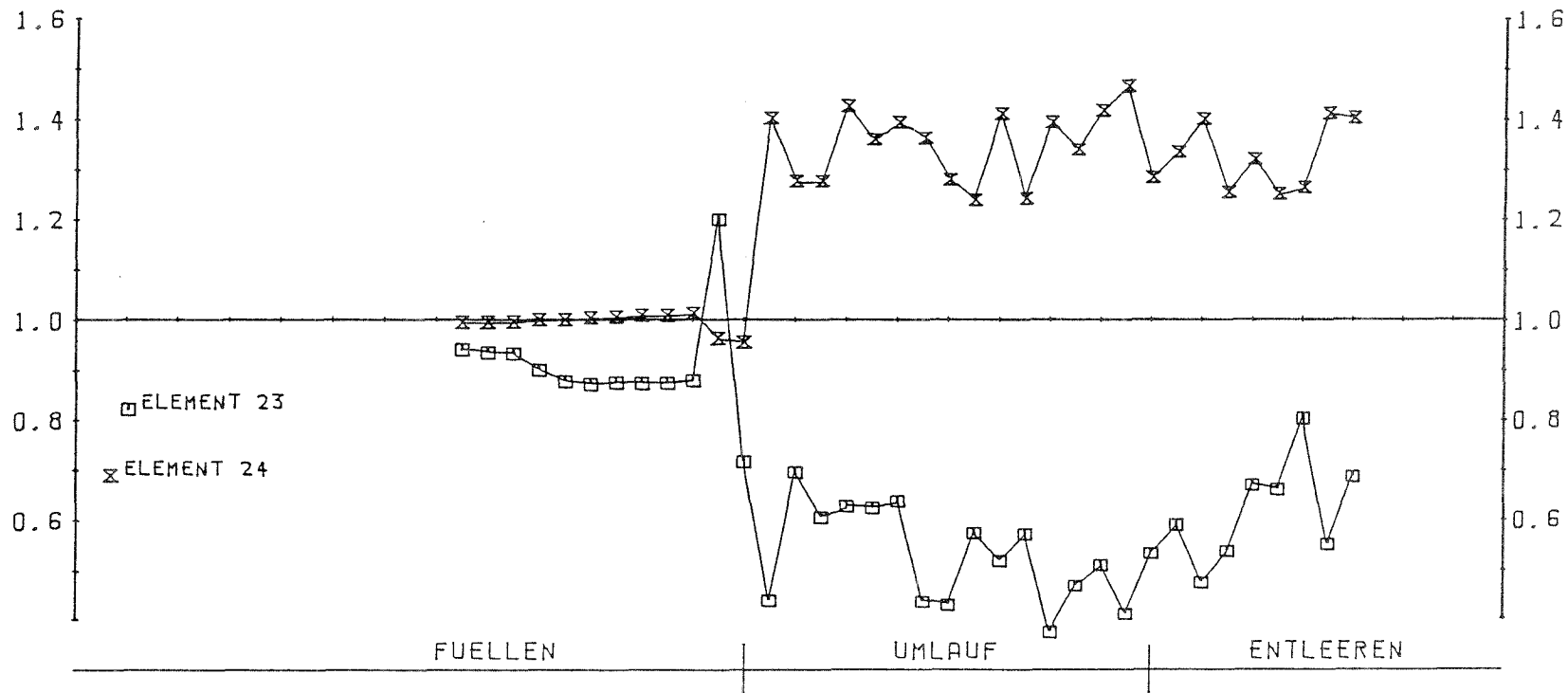


VERSUCH : VE 3

HORIZONT: 2

VOLLSTAENDIGER VERSUCHSABLAUF

EINZELMESSWERTE BEZOGEN AUF MITTELWERT



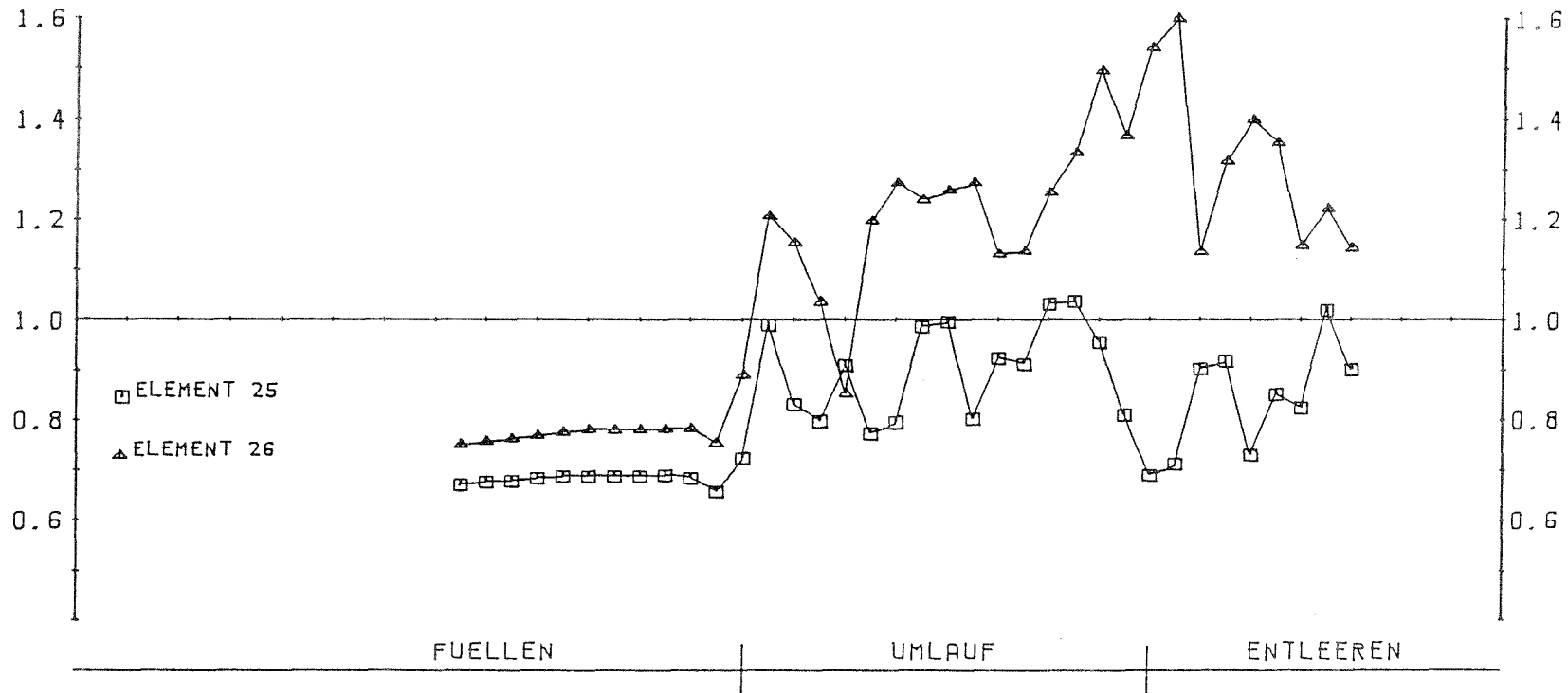
A 3.43

VERSUCH : VE 3

HORIZONT: 2

VÖLLSTÄNDIGER VERSUCHSABLAUF

EINZELMESSWERTE BEZOGEN AUF MITTELWERT



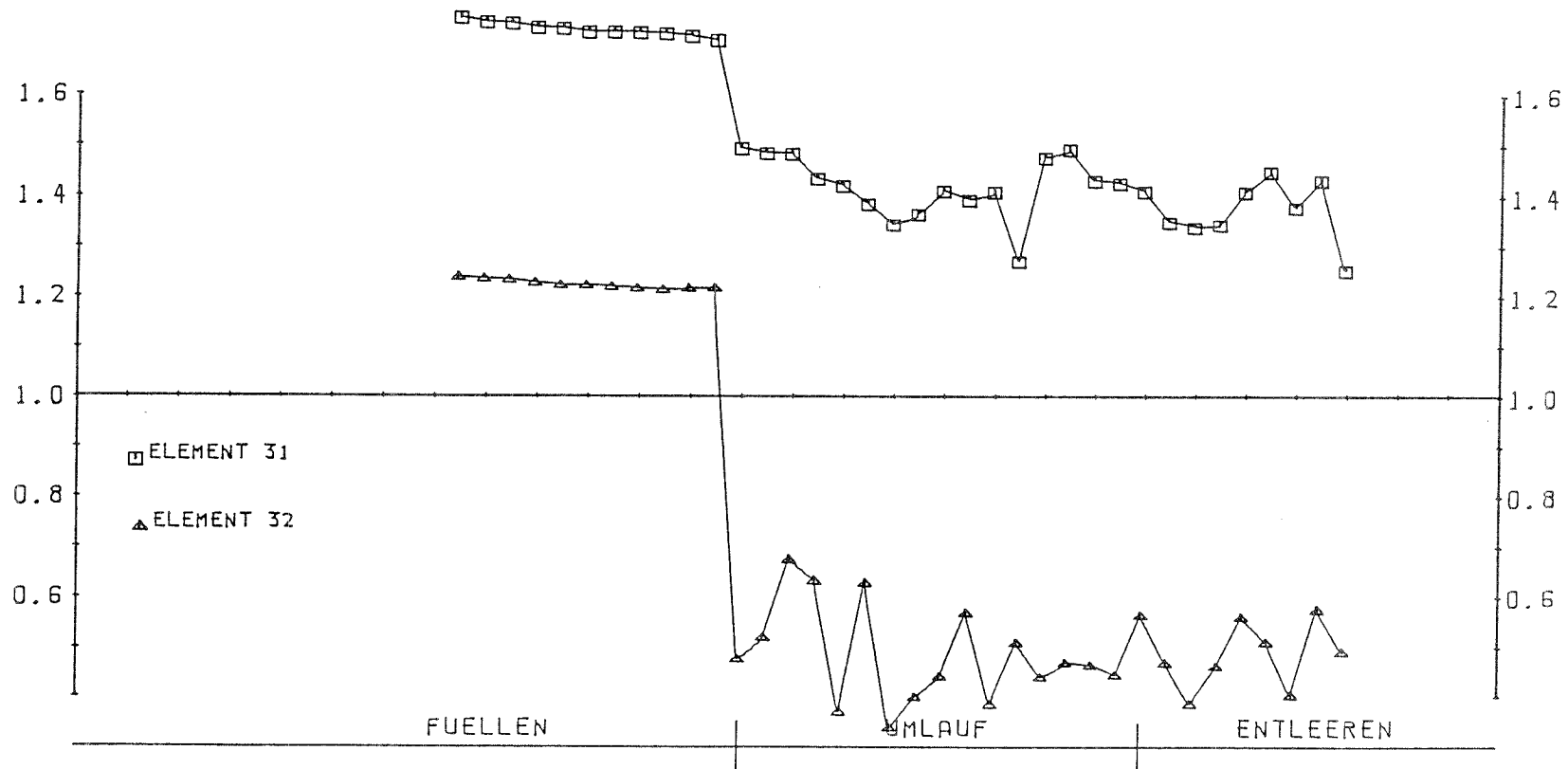
A 3.44

VERSUCH : VE 3

HORIZONT: 3

VOLLSTÄNDIGER VERSUCHSABLAUF

EINZELMESSWERTE BEZOGEN AUF MITTELWERT



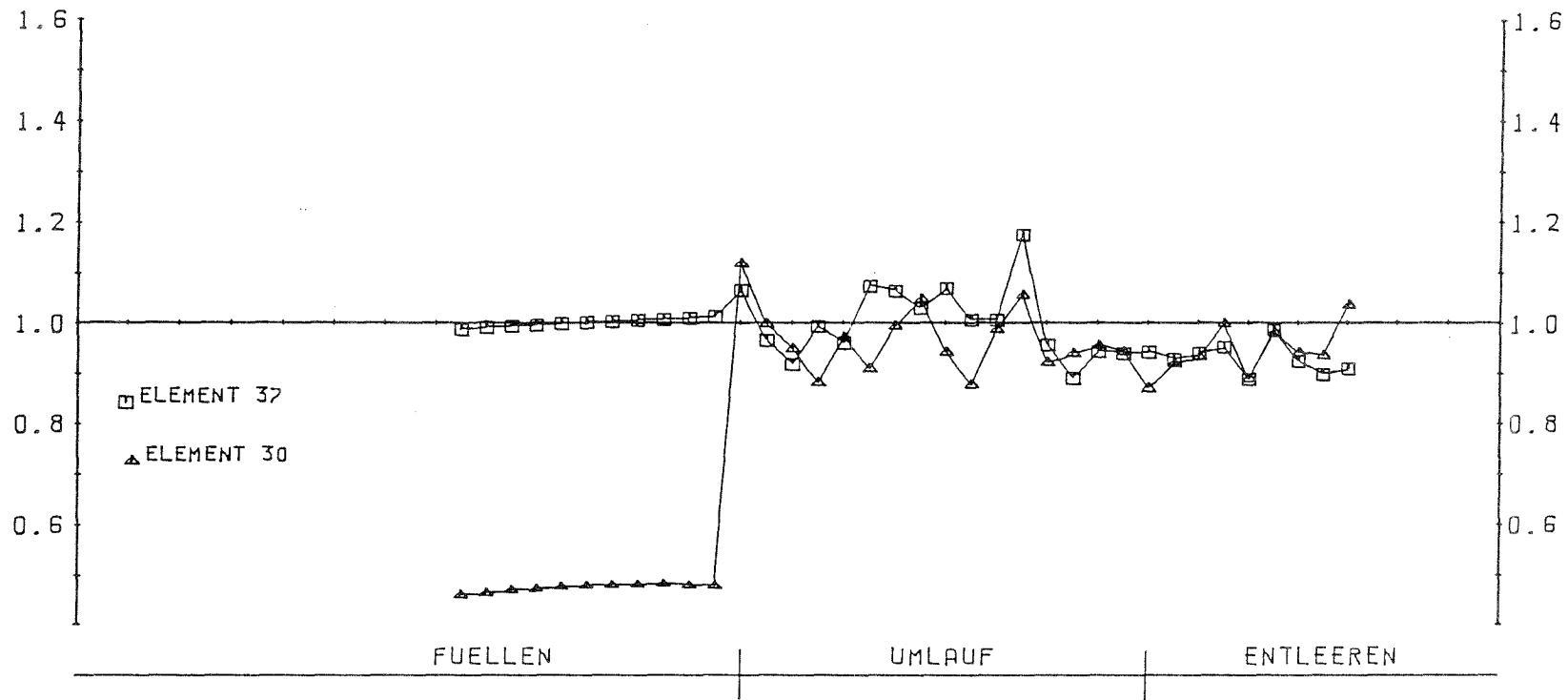
A 3.45

VERSUCH : VE 3

HORIZONT: 3

VOLLSTÄNDIGER VERSUCHSABLAUF

EINZELMESSWERTE BEZOGEN AUF MITTELWERT



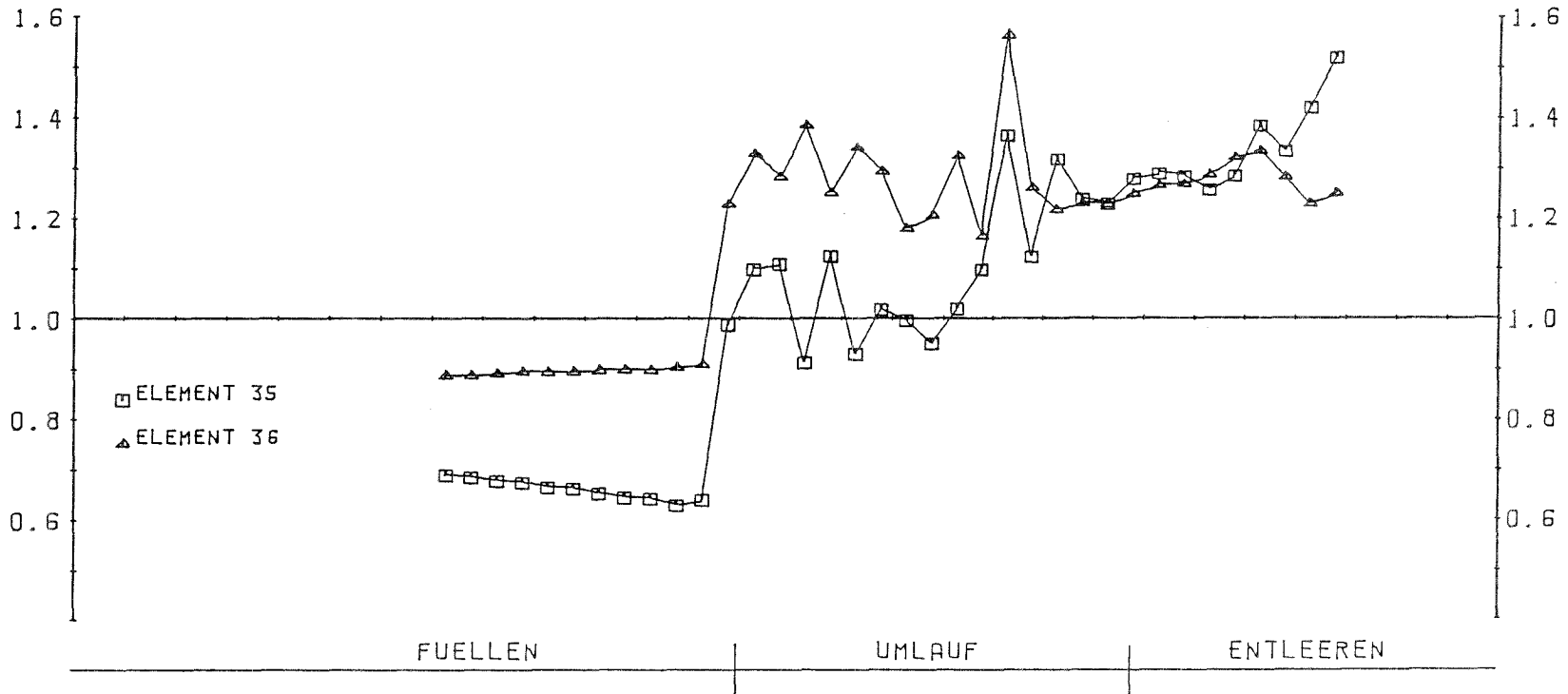
A 3.46

VERSUCH : VE 3

HORIZONT: 3

VOLLSTÄNDIGER VERSUCHSABLAUF

EINZELMESSWERTE BEZOGEN AUF MITTELWERT



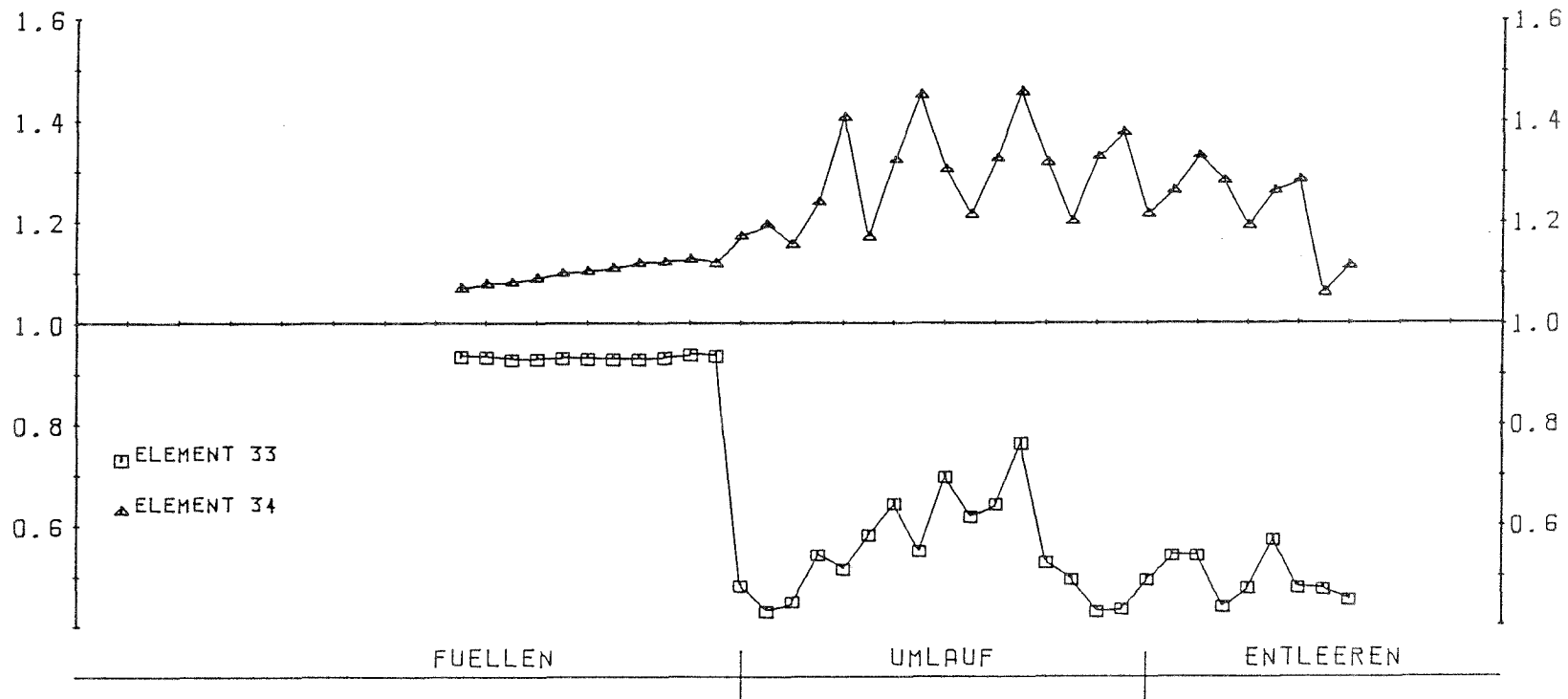
D 3.47

VERSUCH : VE 3

HORIZONT: 3

VOLLSTÄNDIGER VERSUCHSABLAUF

EINZELMESSWERTE BEZOGEN AUF MITTELWERT



A 3.48

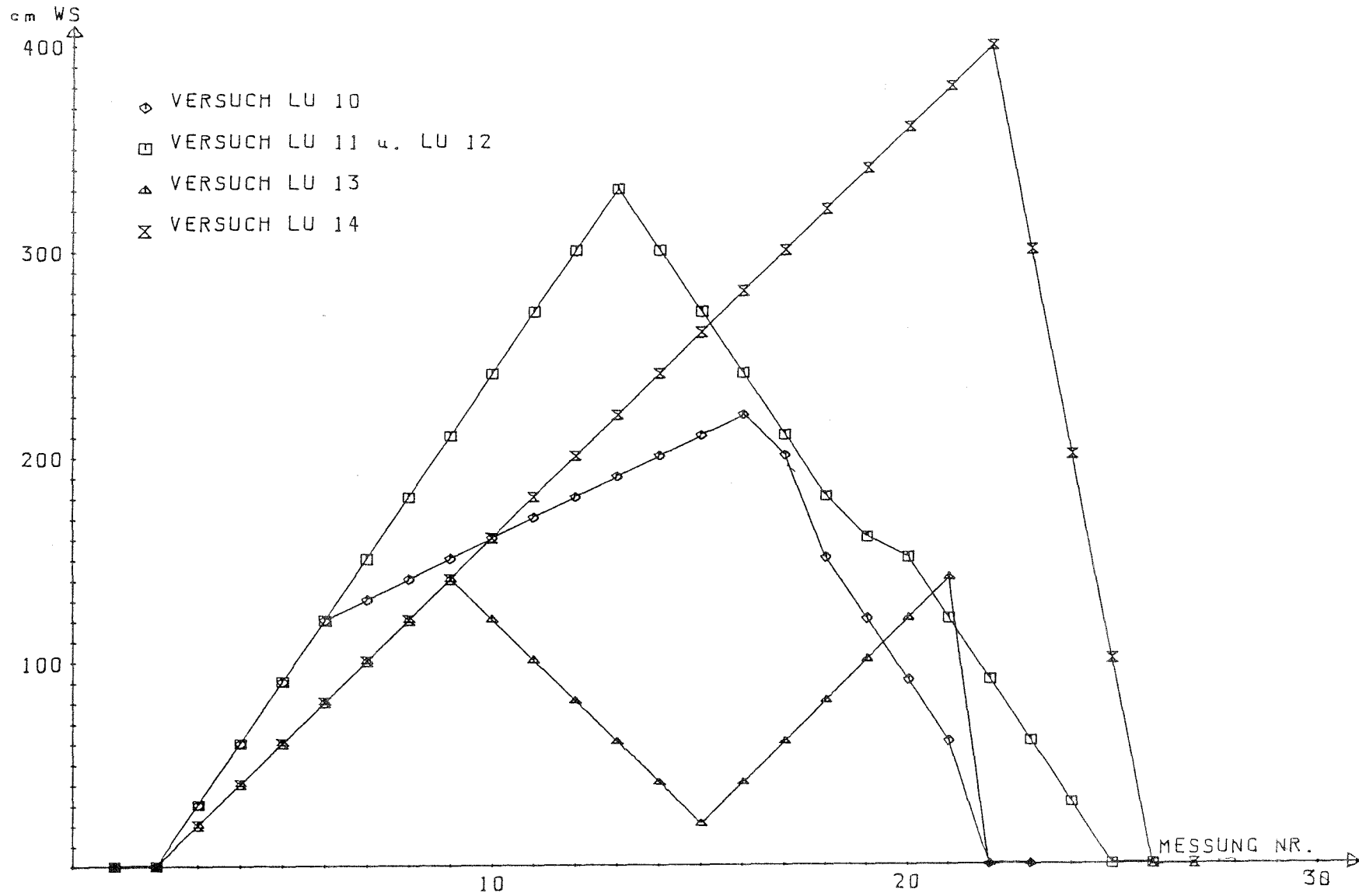
## **Anhang**

zu Kap. 4

- Eichversuche mit gleichmäßig verteilter Belastung
- Eichversuche mit Einzellasten
- Einzeldarstellungen Versuchsreihe M
- Einzeldarstellung Versuchsreihe EZ
- Einzeldarstellung Versuchsreihe EX
- Verlauf der Ringzugkraft über die Höhe
- Verlauf der Ringzugkraft über den Umfang

# EICHVERSUCHE

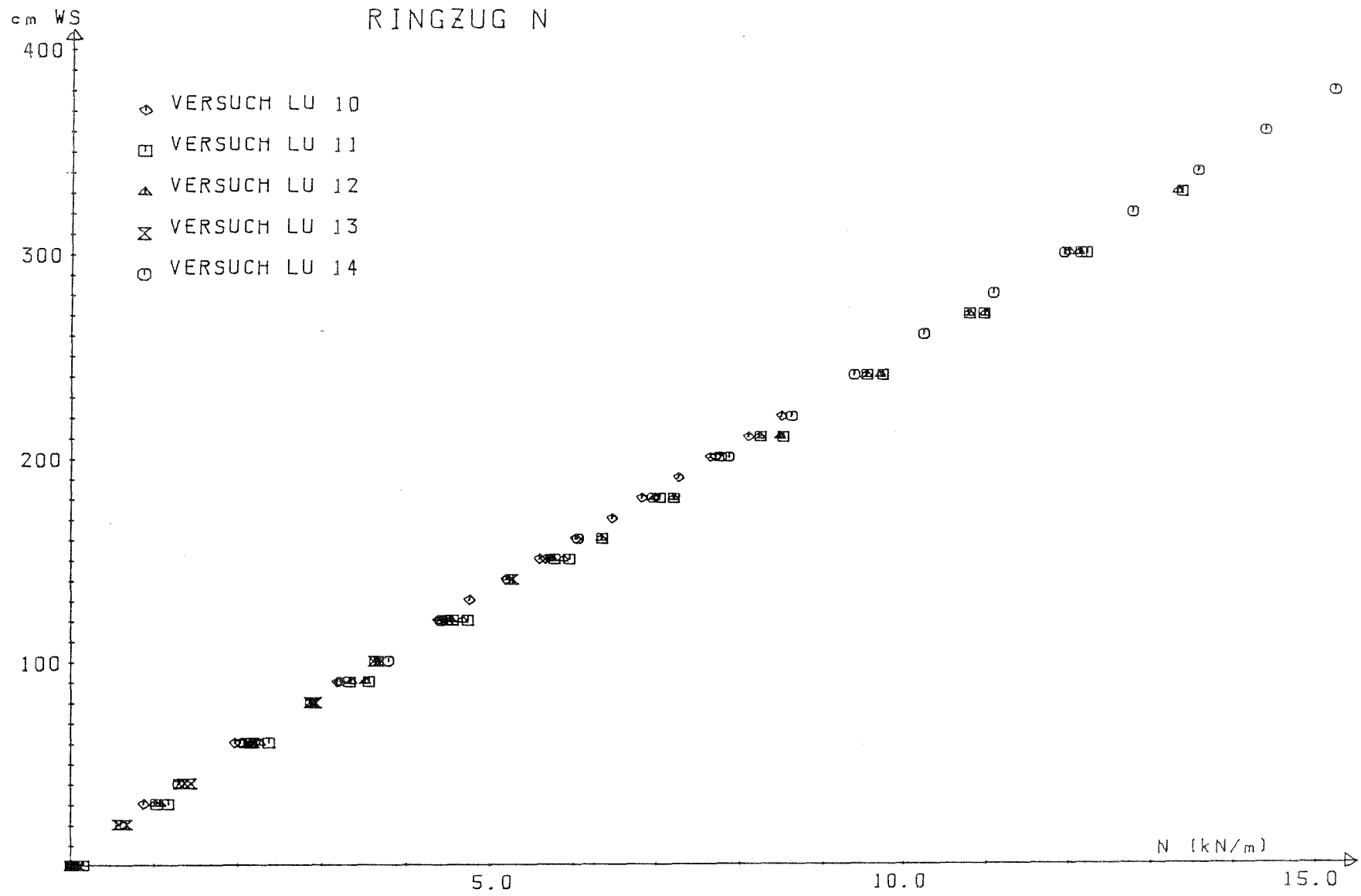
# GANGLINIEN DER DRUCKBELASTUNG



0.4.1

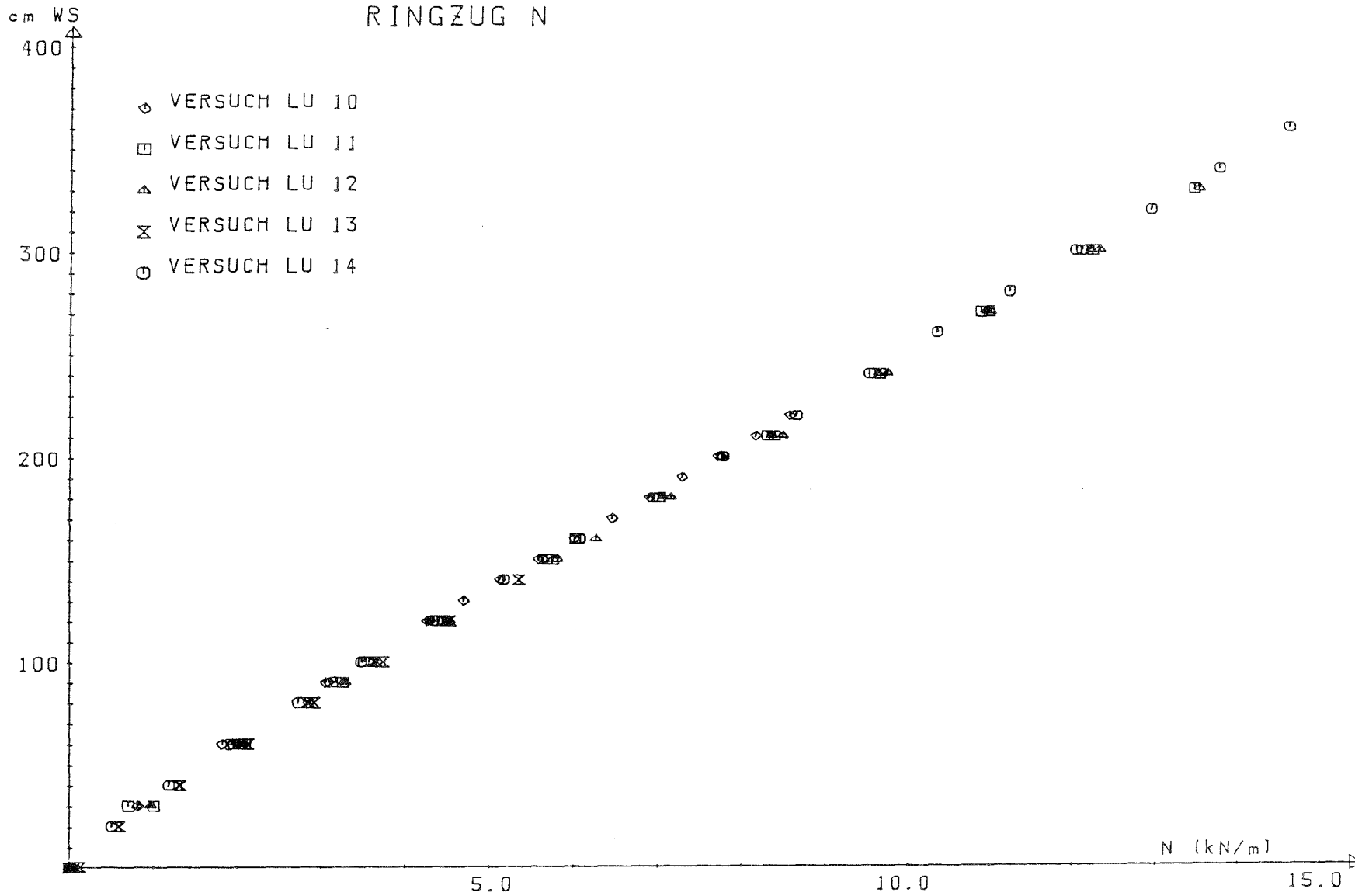


EICHUNG OBERER HORIZONT MESS-STELLE NR. 1  
RINGZUG N



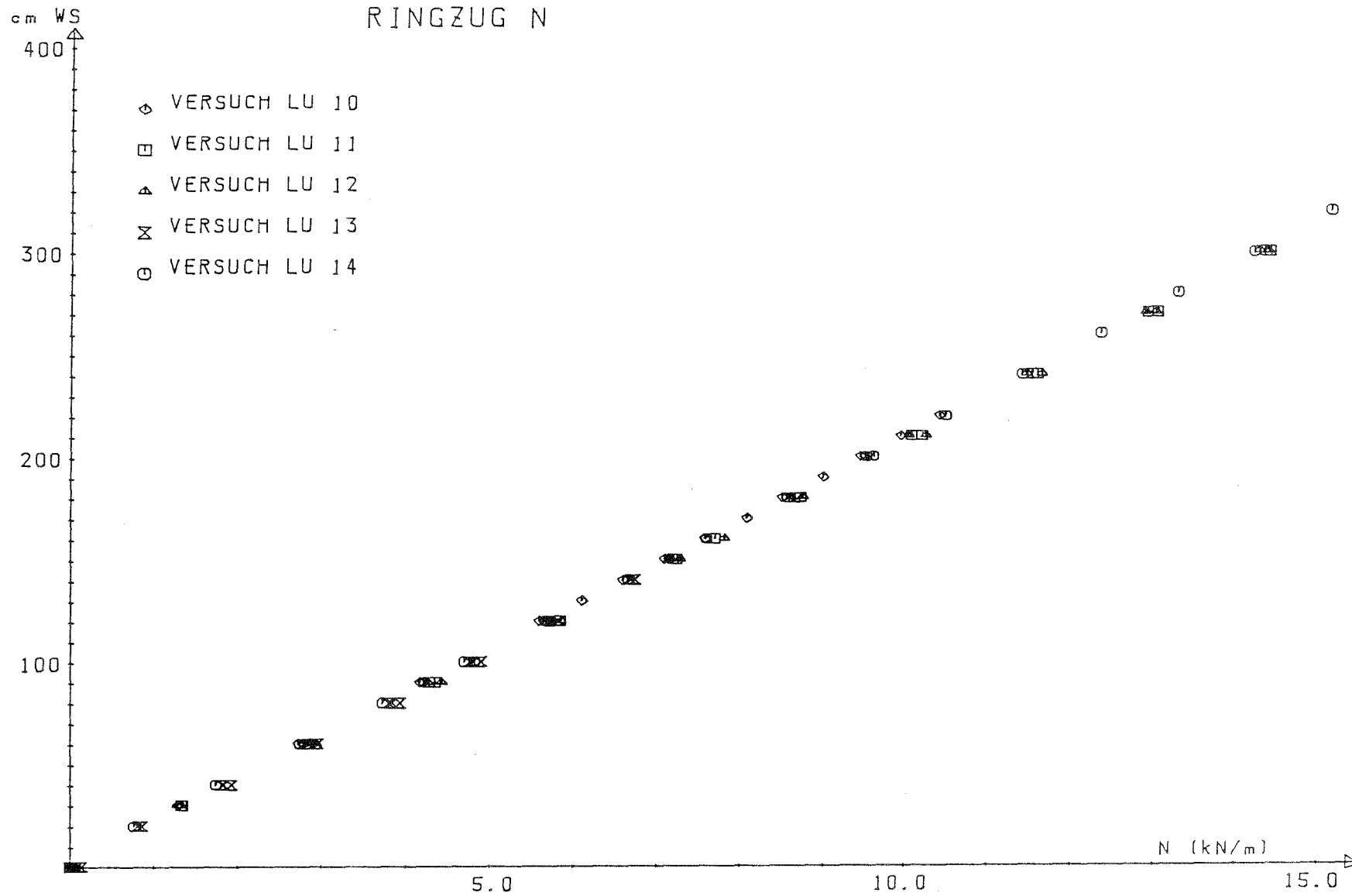
A 4.2

EICHUNG OBERER HORIZONT MESS-STELLE NR. 2  
RINGZUG N



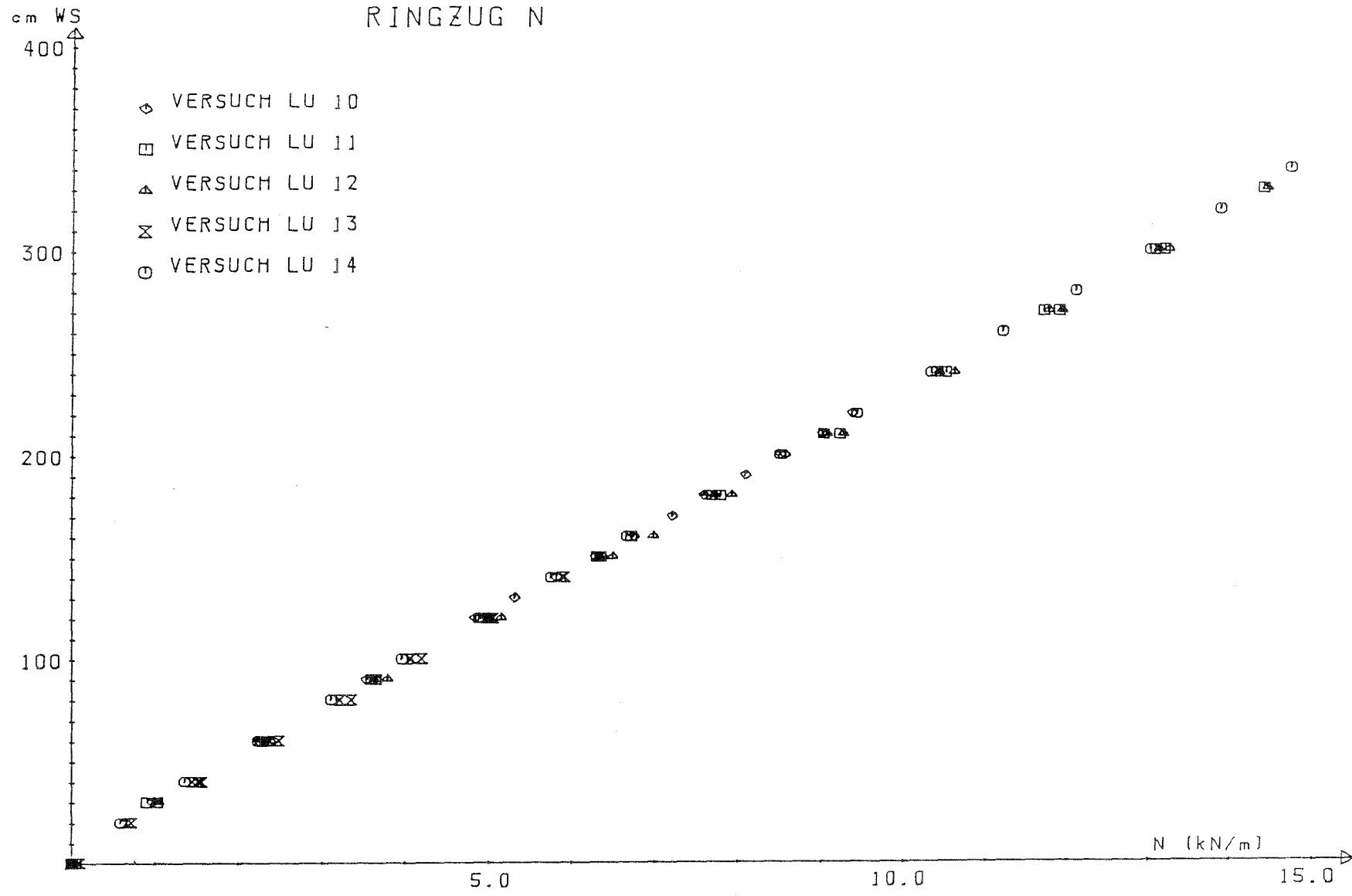
A 4.3

EICHUNG OBERER HORIZONT MESS-STELLE NR. 3  
RINGZUG N



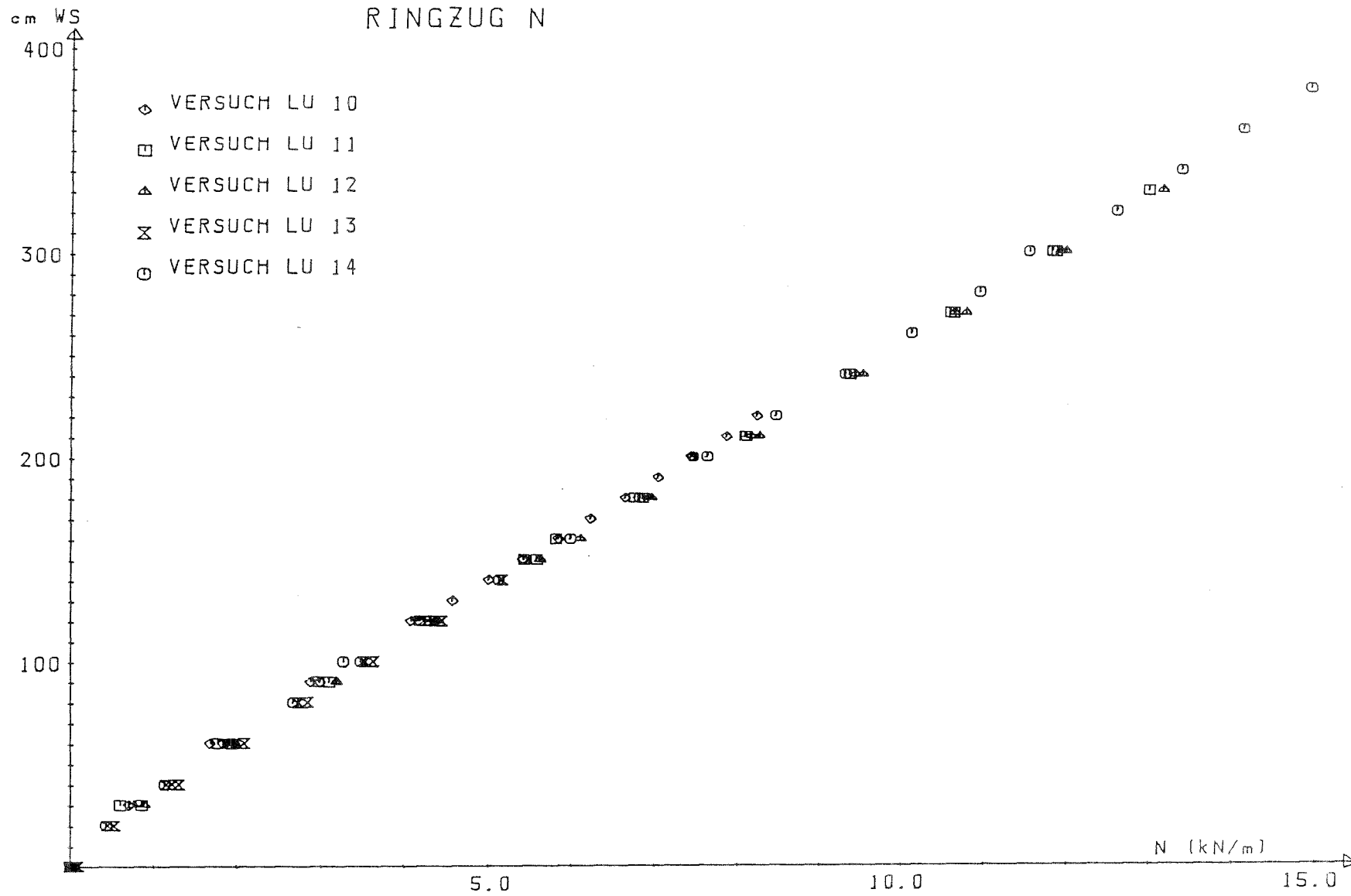
A 4.4

EICHUNG OBERER HORIZONT MESS-STELLE NR. 4  
RINGZUG N

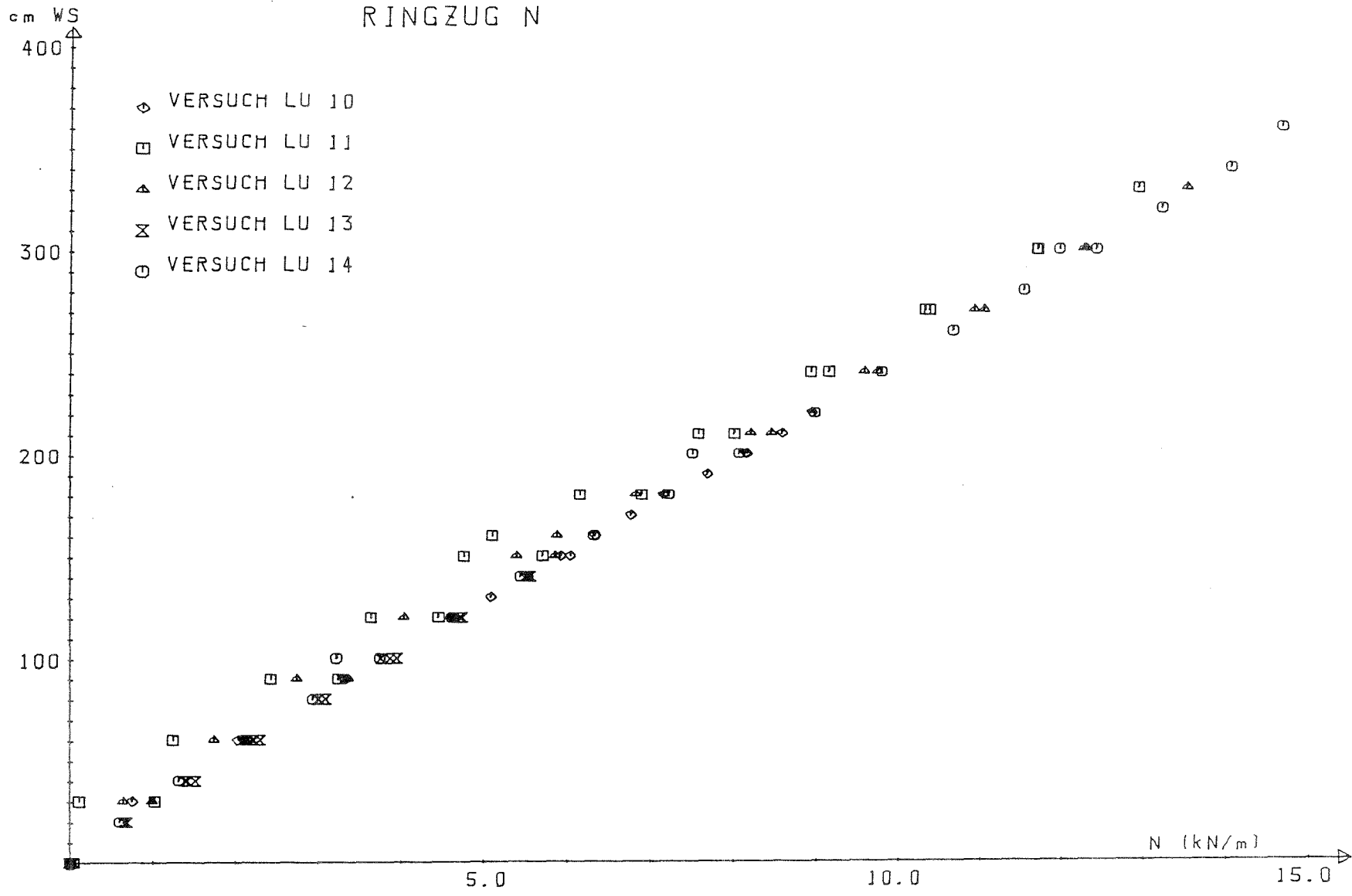


A.F.S

EICHUNG OBERER HORIZONT MESS-STELLE NR. 5  
RINGZUG N

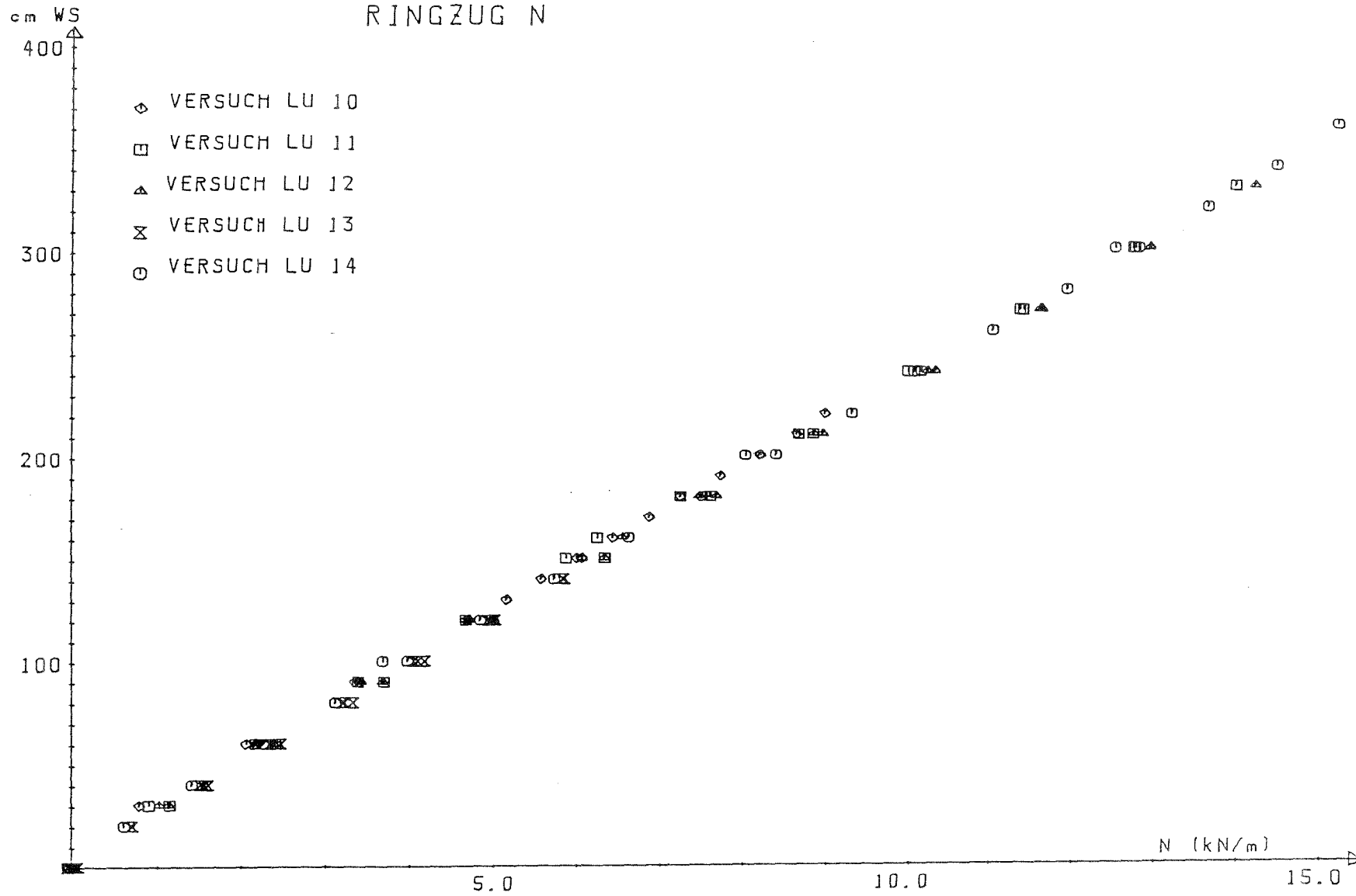


EICHUNG OBERER HORIZONT MESS-STELLE NR. 6  
RINGZUG N



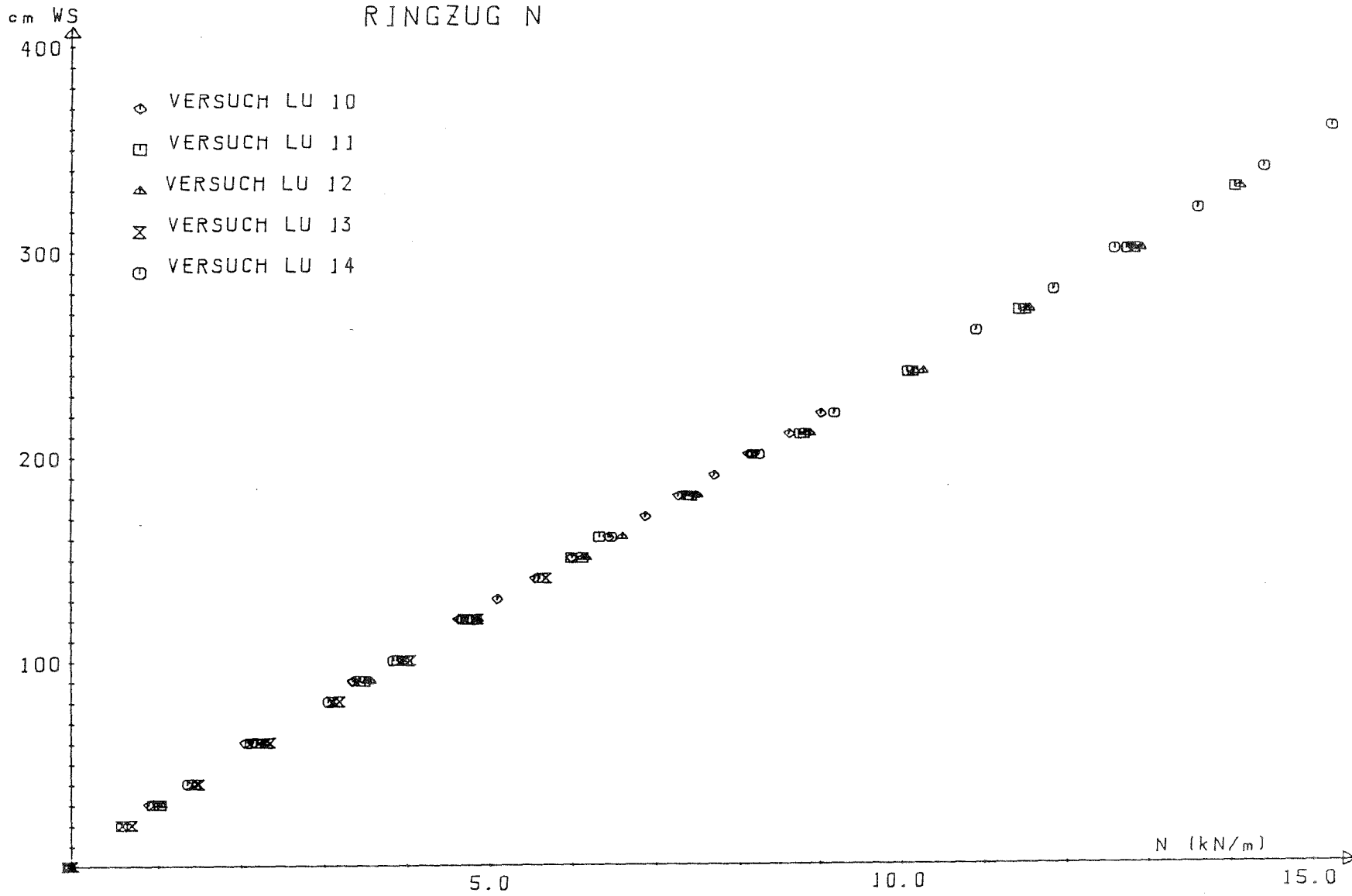
0.4.7

EICHUNG OBERER HORIZONT MESS-STELLE NR. 7  
RINGZUG N



D. 4. 8

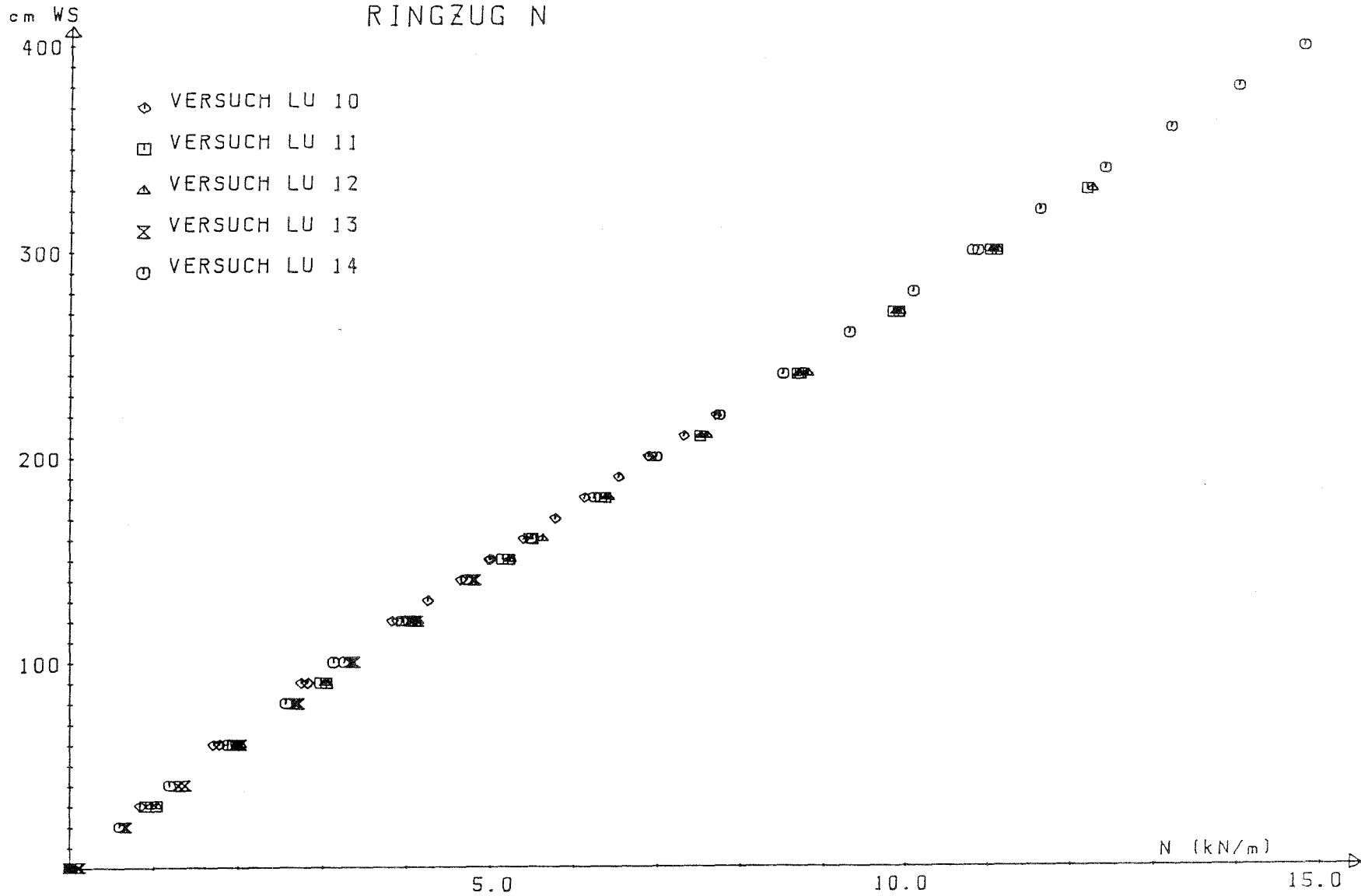
EICHUNG OBERER HORIZONT MESS-STELLE NR. 8  
RINGZUG N



A 4.9

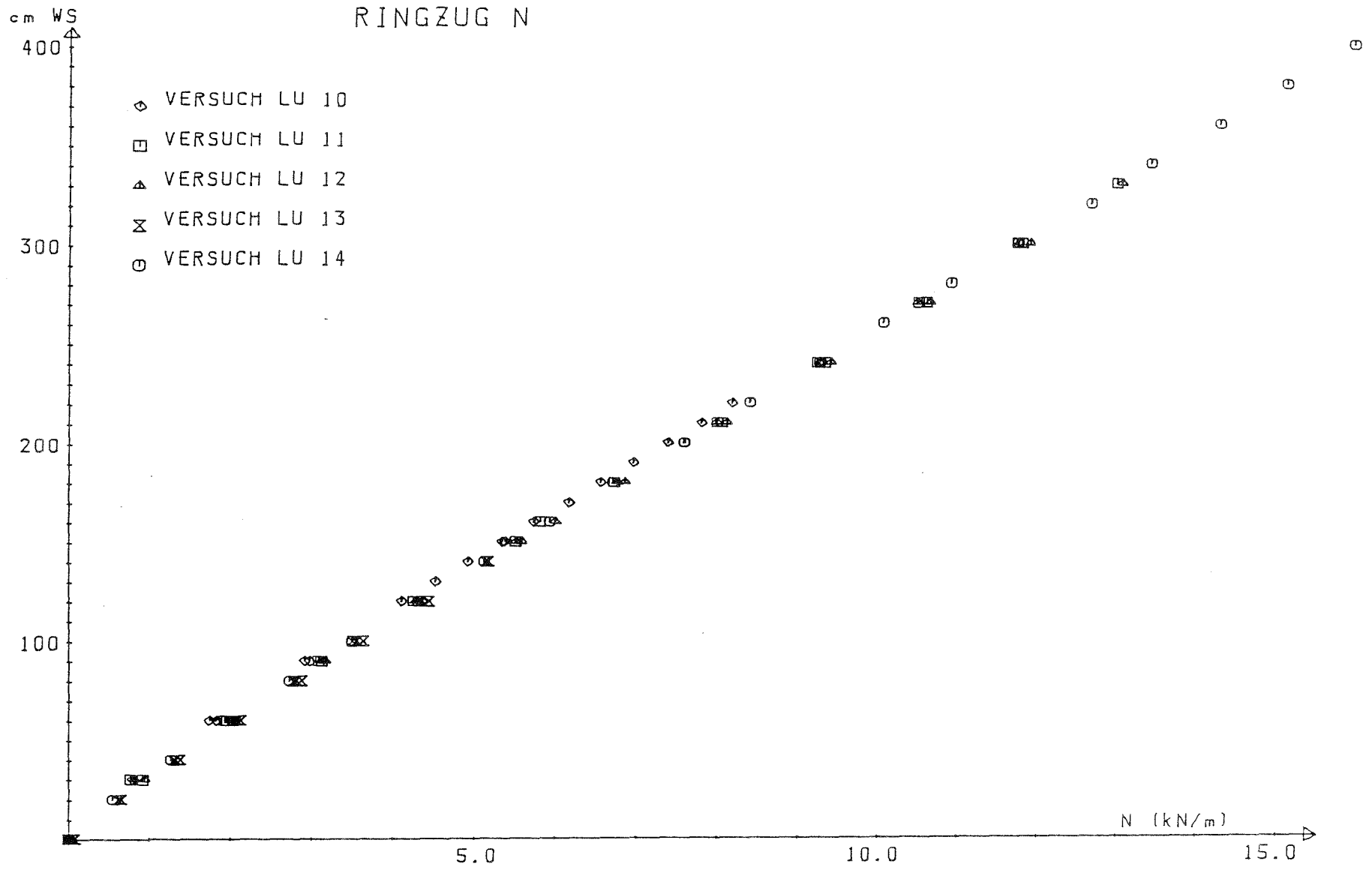


EICHUNG MITTLERER HORIZONT MESS-STELLE NR. 1  
RINGZUG N



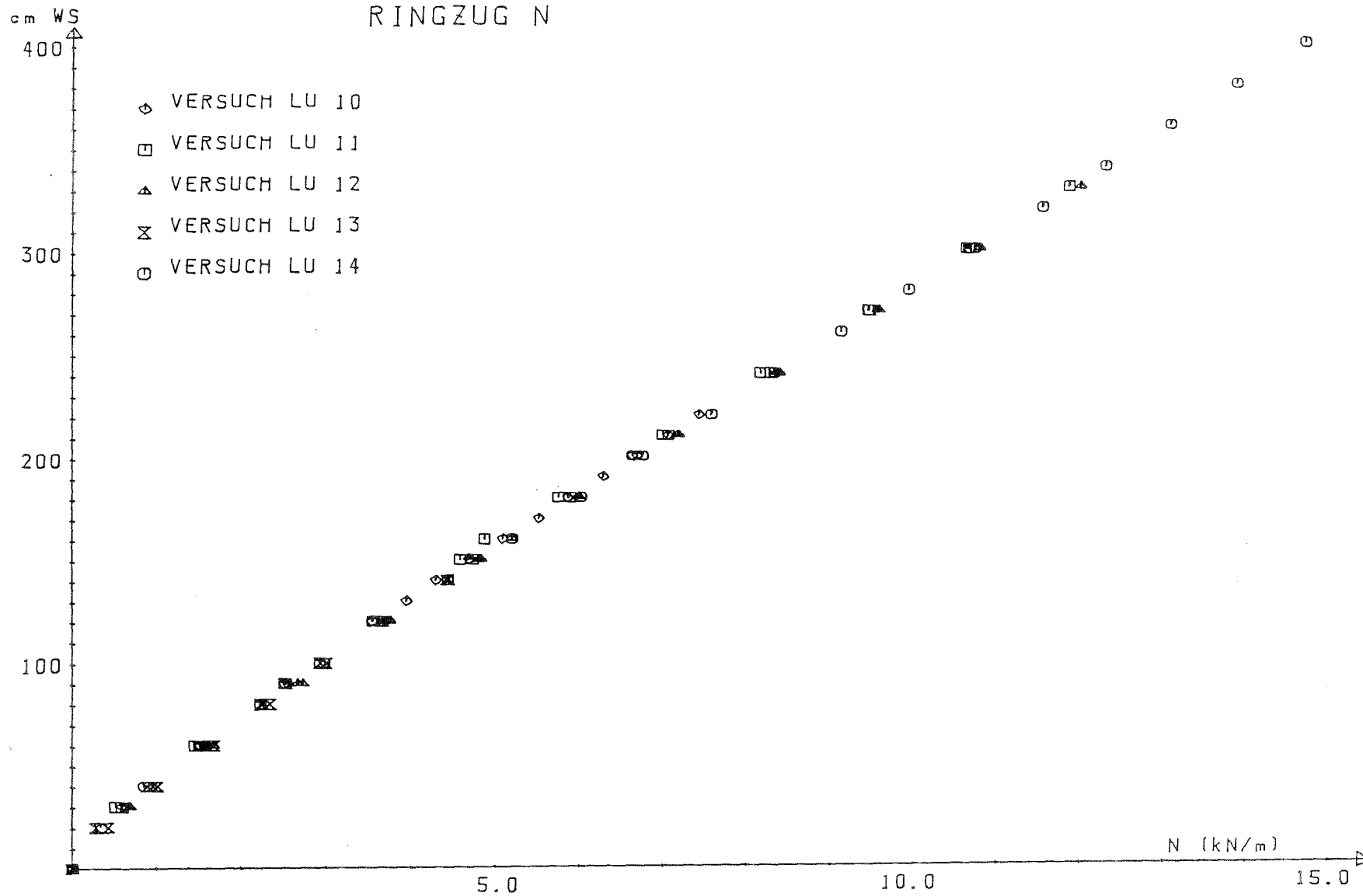
94.10

EICHUNG MITTLERER HORIZONT MESS-STELLE NR. 2  
RINGZUG N

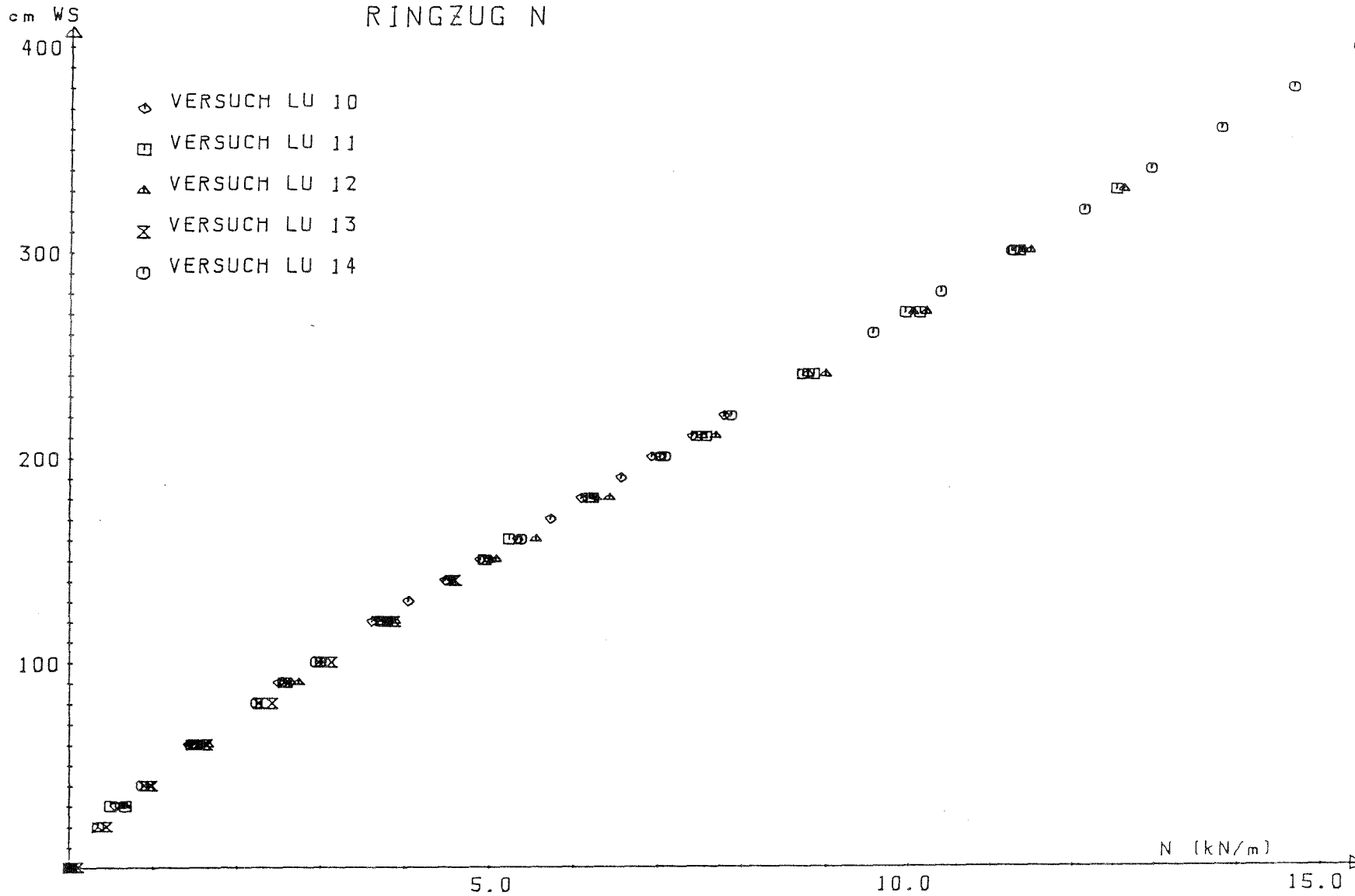


U 4.14  
17.7.71

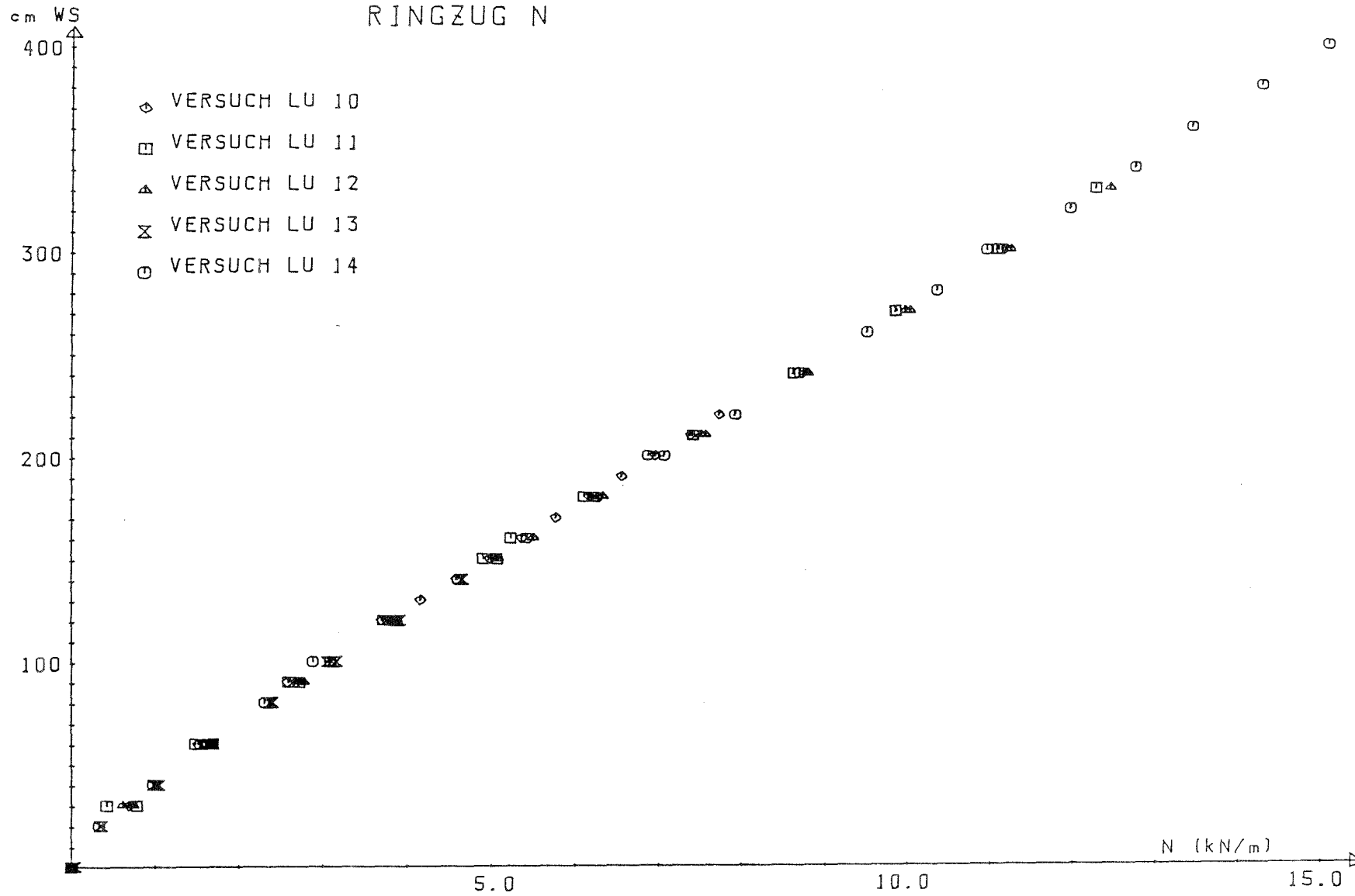
EICHUNG MITTLERER HORIZONT MESS-STELLE NR. 3  
RINGZUG N



EICHUNG MITTLERER HORIZONT MESS-STELLE NR. 4  
RINGZUG N

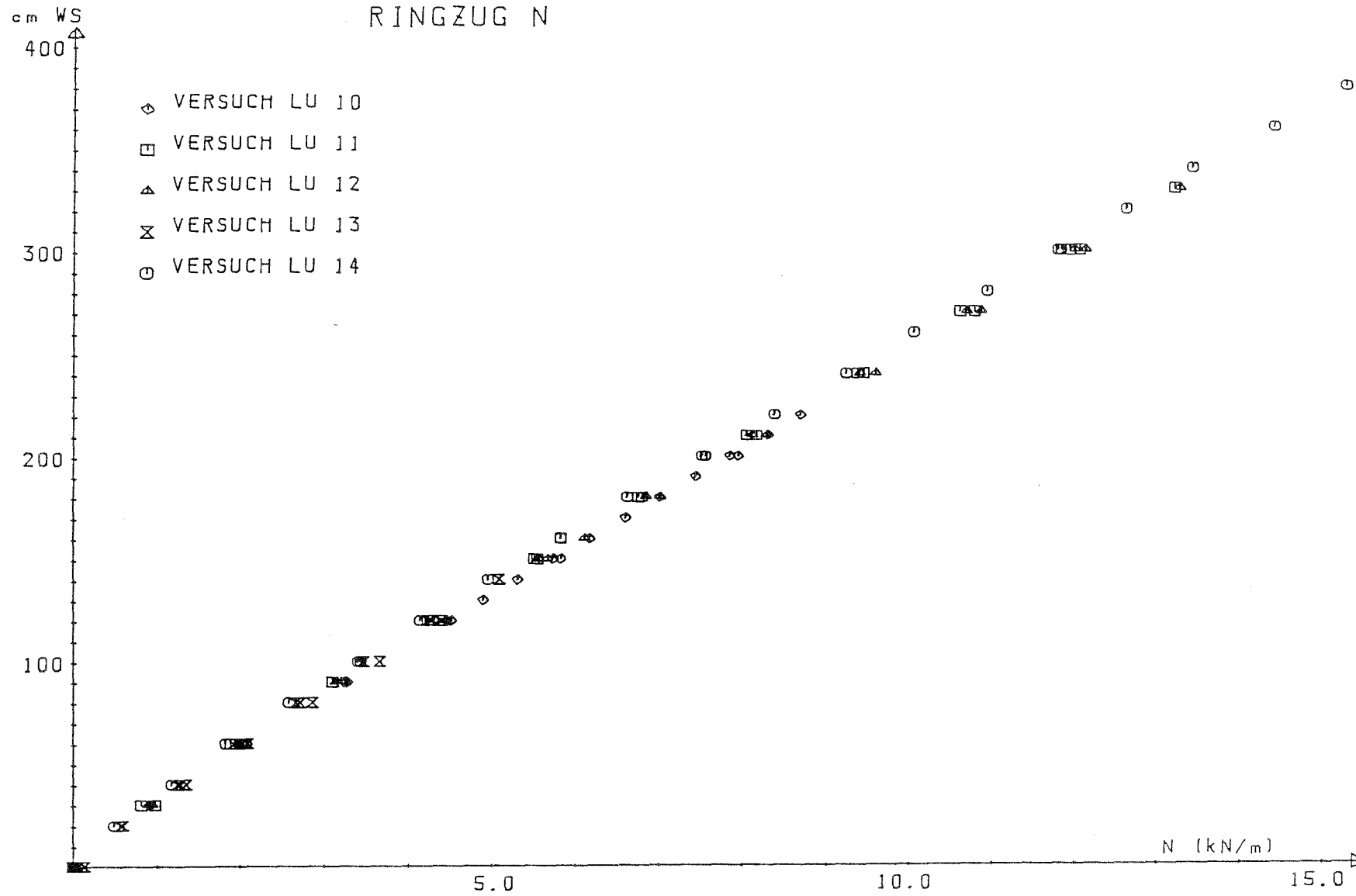


EICHUNG MITTLERER HORIZONT MESS-STELLE NR. 5  
RINGZUG N

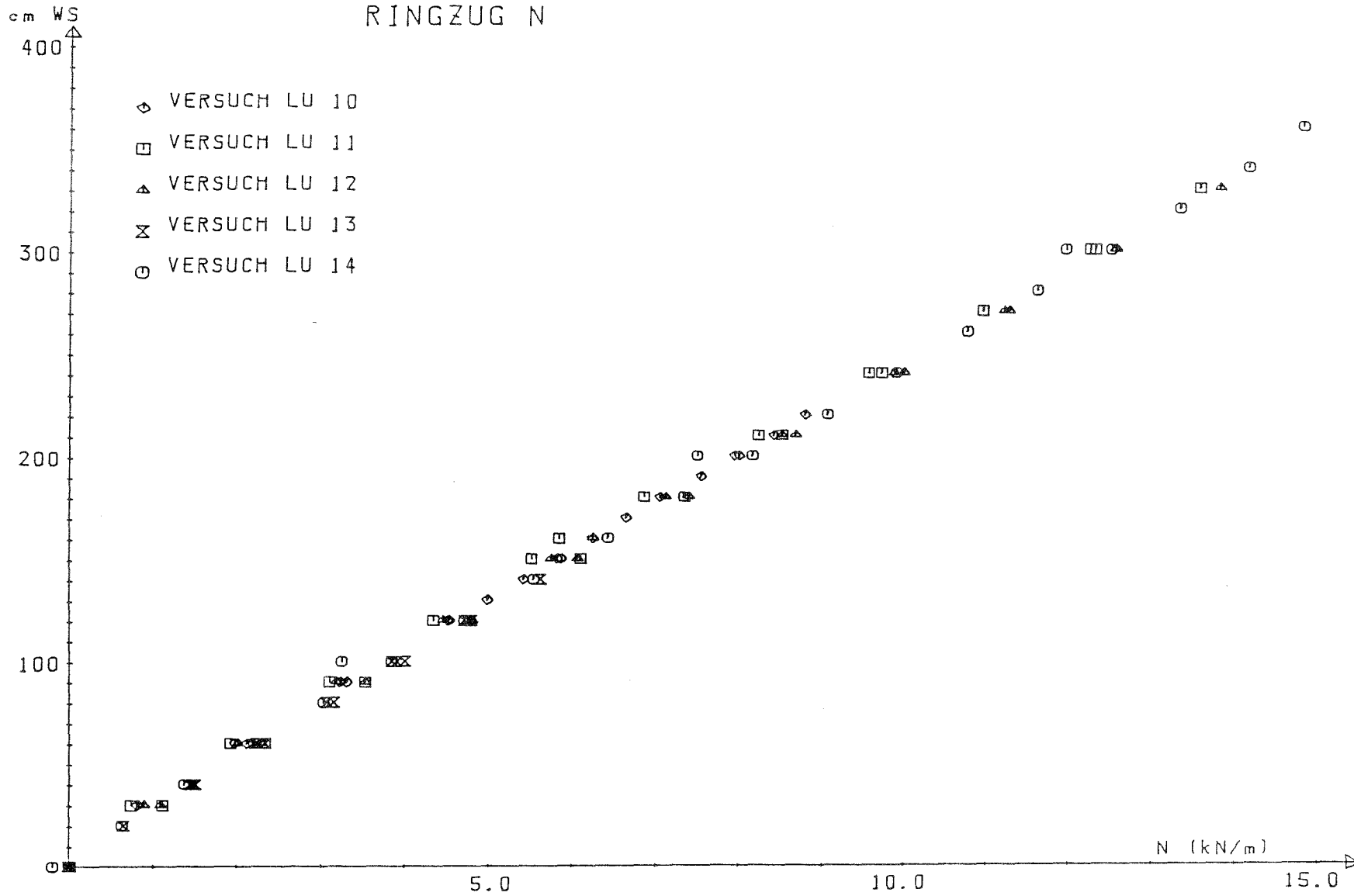


A 4.14

EICHUNG MITTLERER HORIZONT MESS-STELLE NR. 6  
RINGZUG N

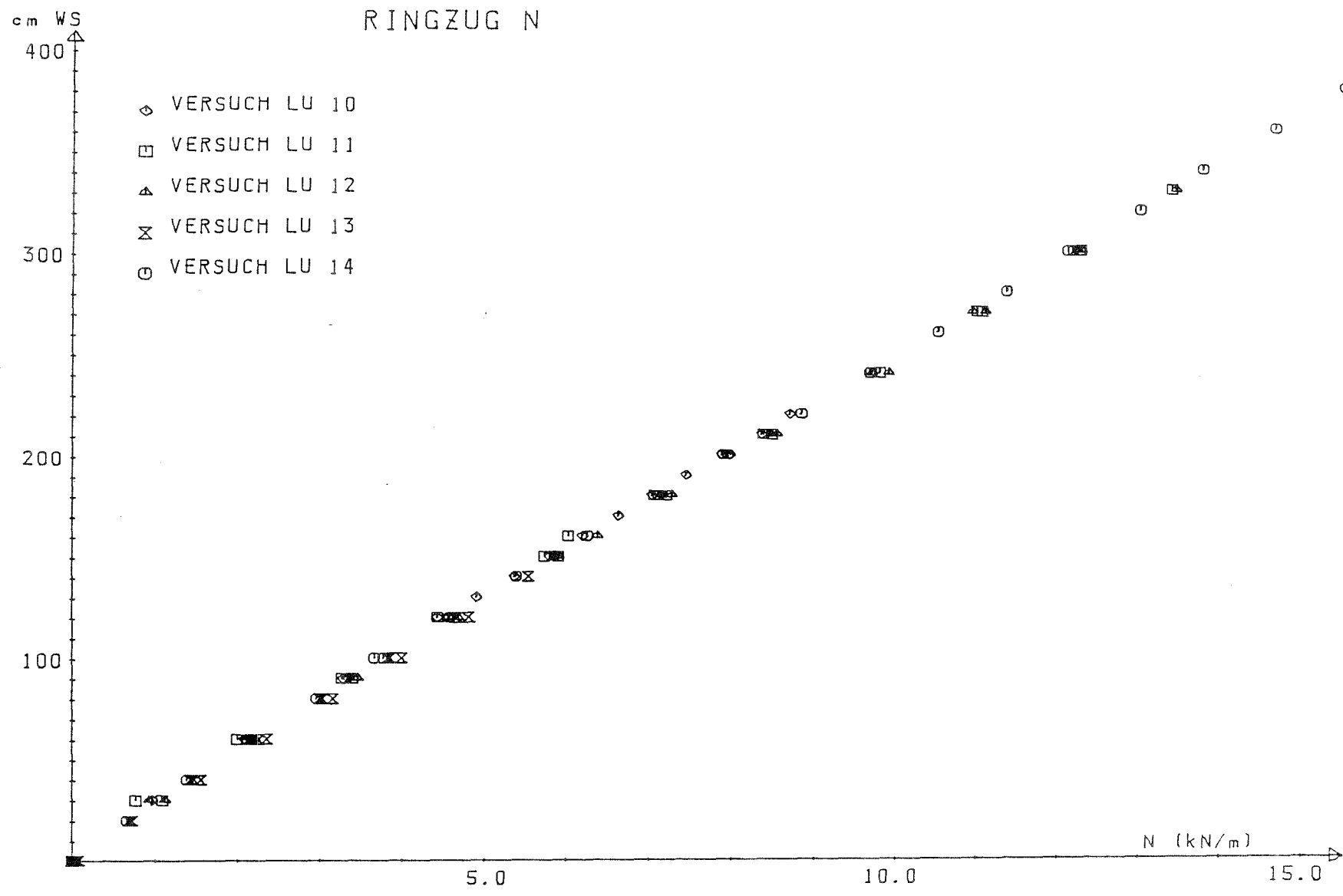


EICHUNG MITTLERER HORIZONT MESS-STELLE NR. 7  
RINGZUG N



A 4.16

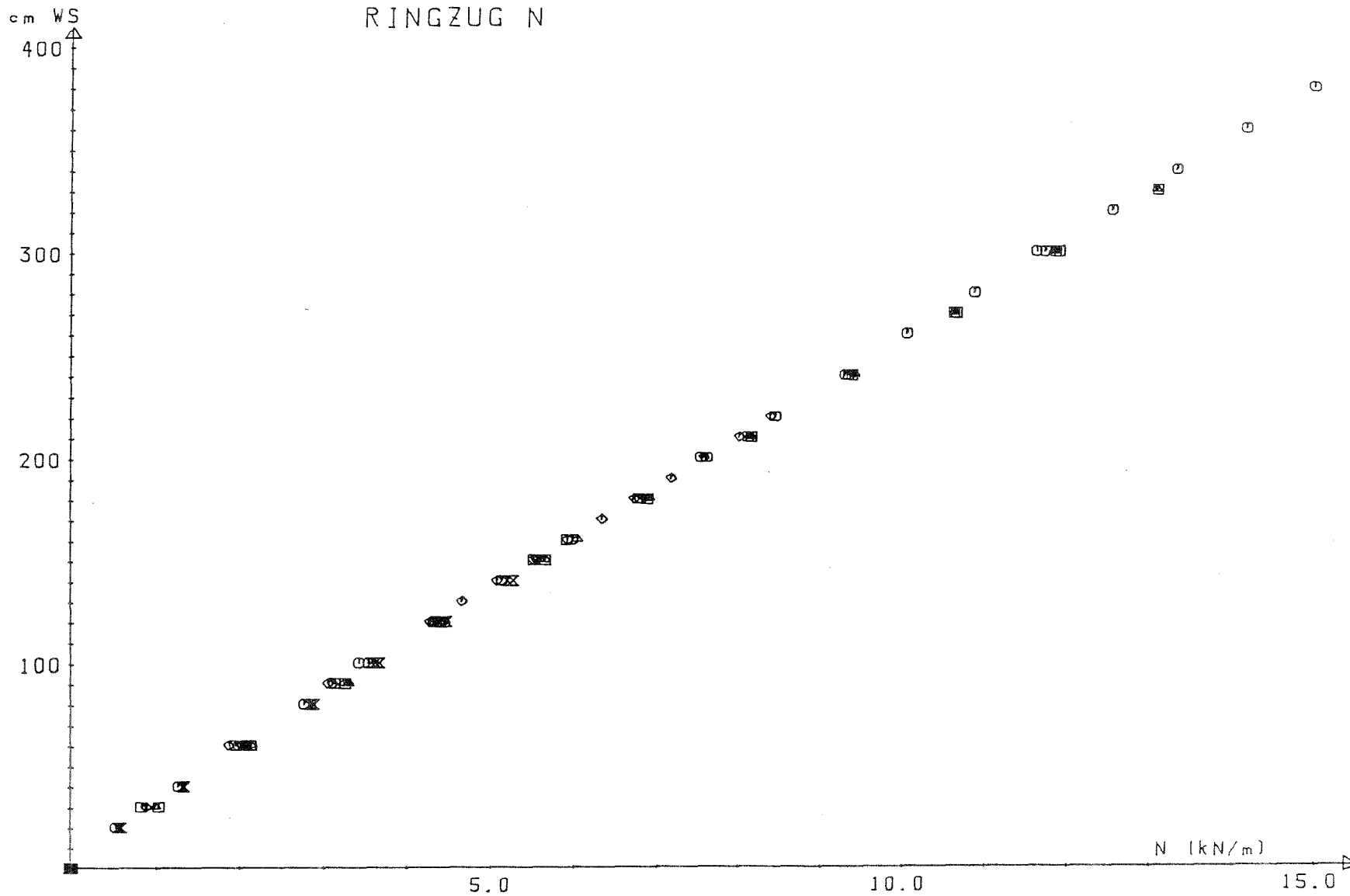
EICHUNG MITTLERER HORIZONT MESS-STELLE NR. 8  
RINGZUG N



A 4.17

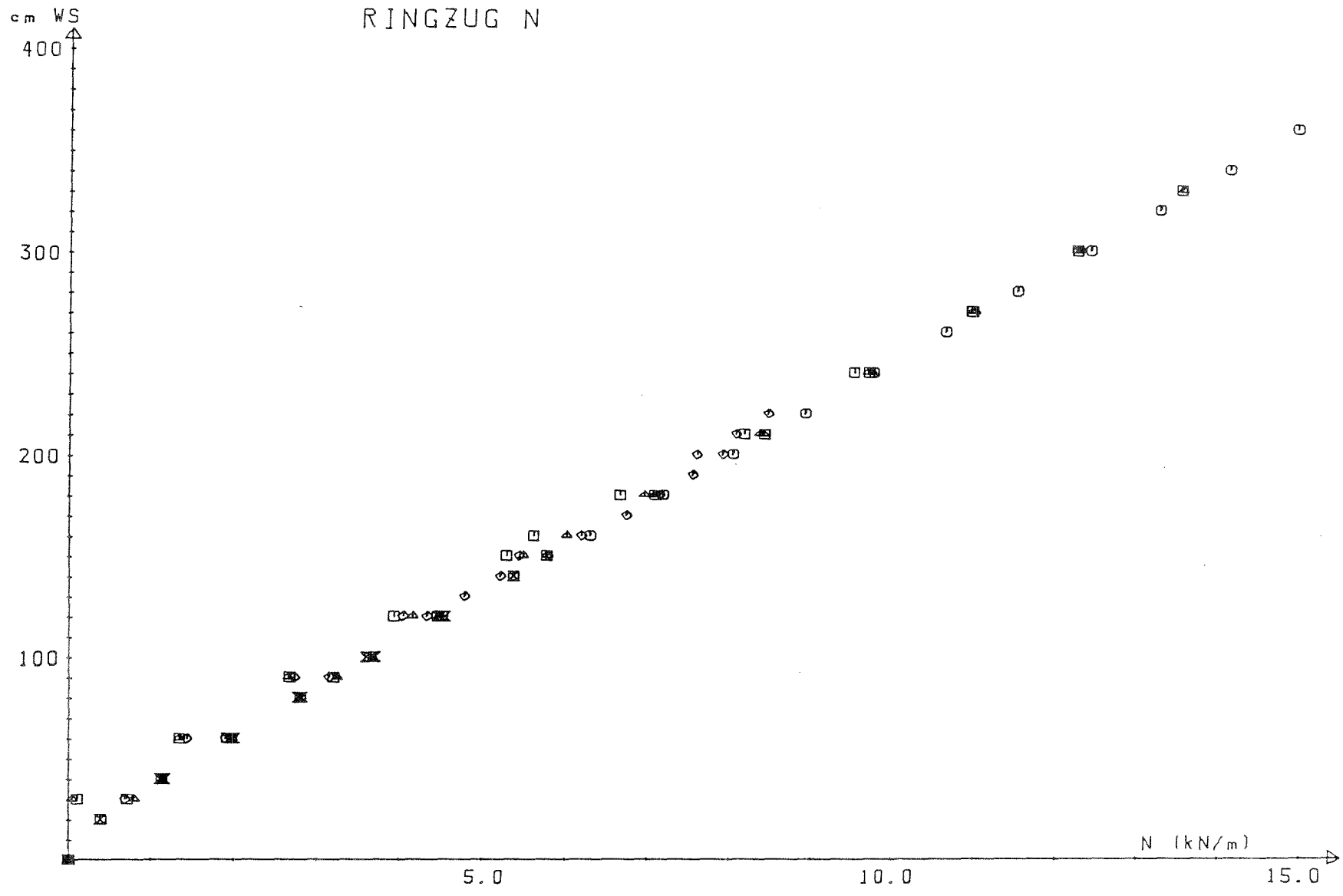


EICHUNG    UNTERER HORIZONT    MESS-STELLE NR. 1  
RINGZUG N



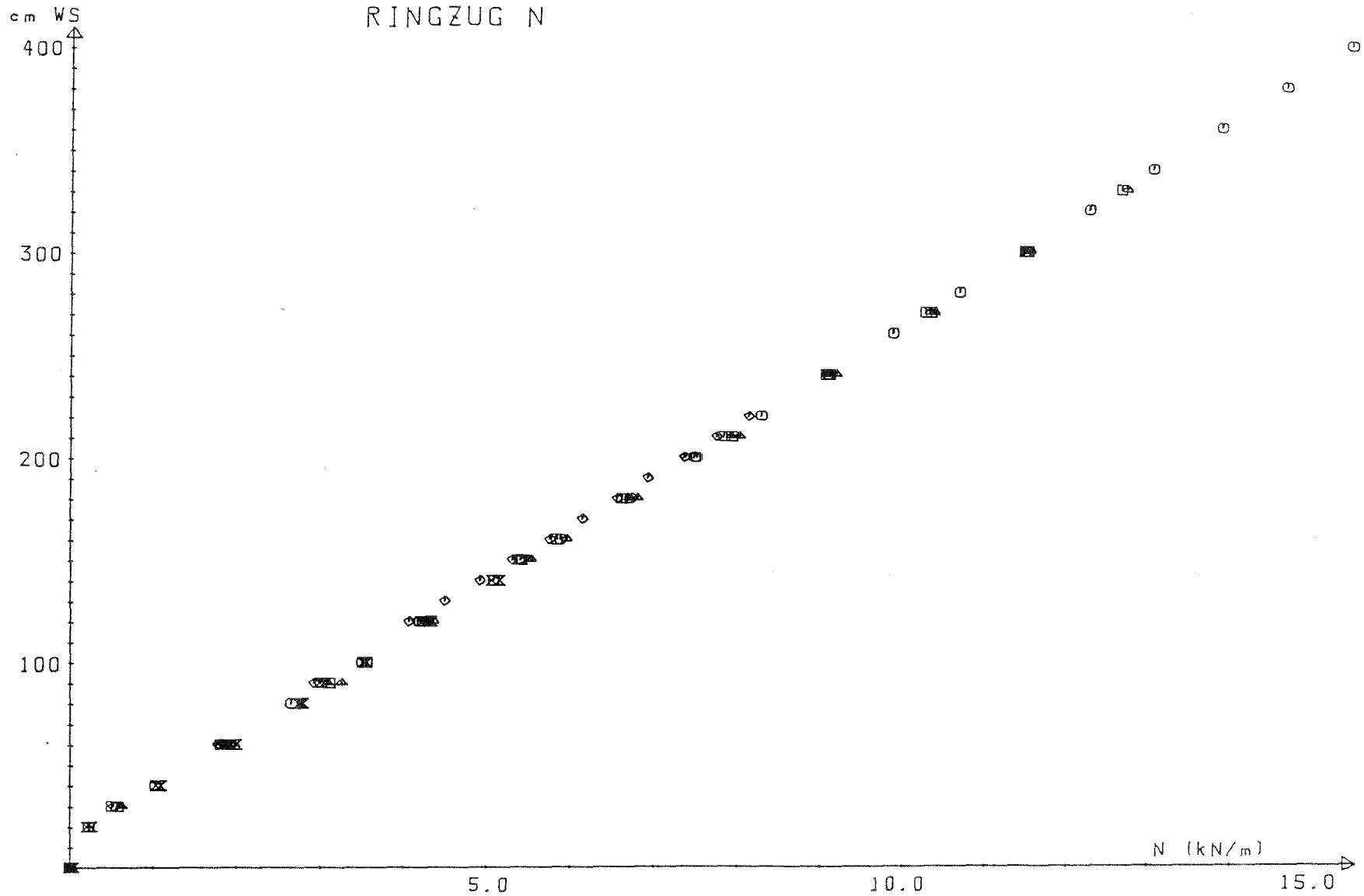
A 4.18

EICHUNG    UNTERER HORIZONT    MESS-STELLE NR. 2  
RINGZUG N



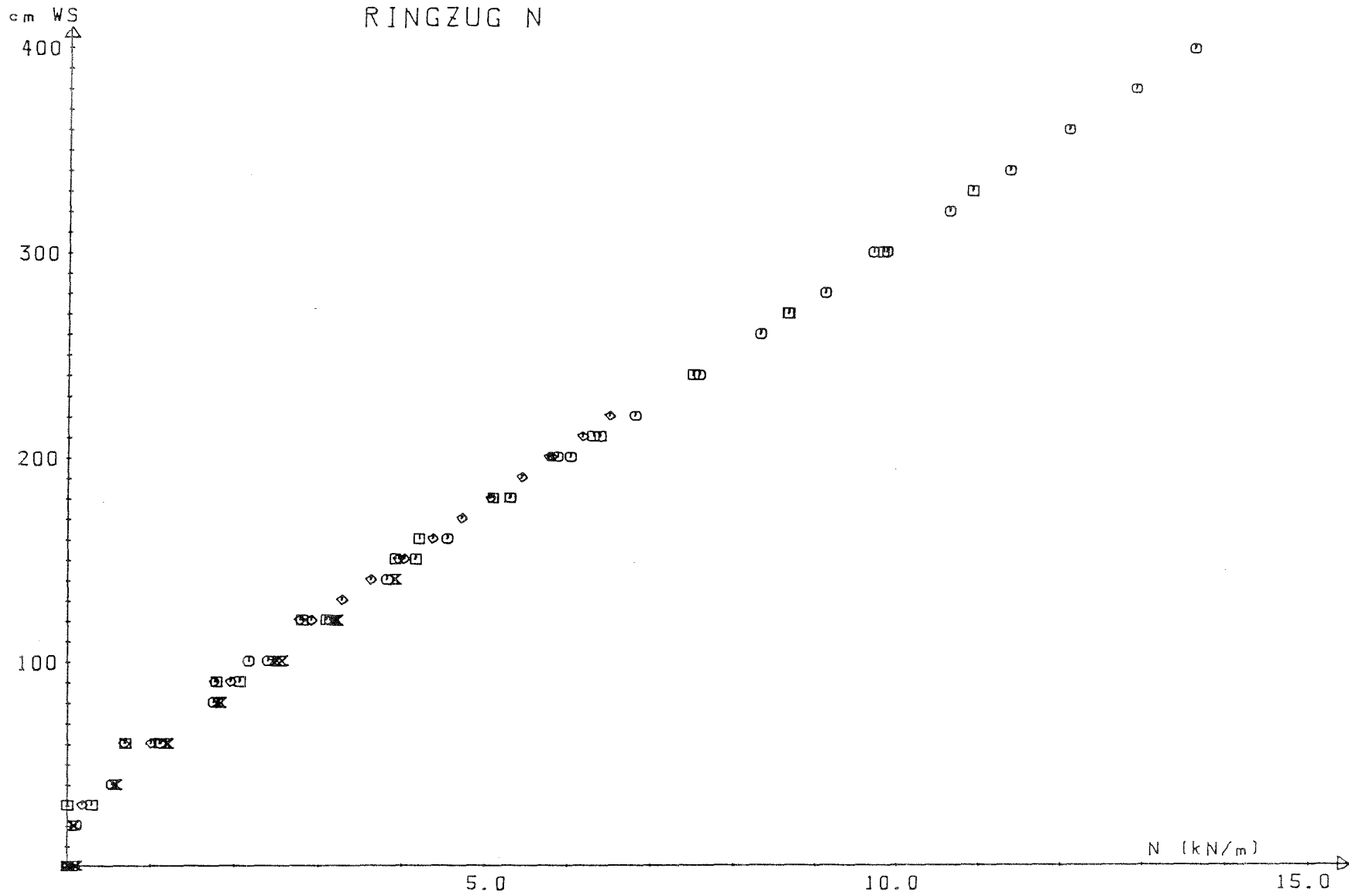
A 4.19

EICHUNG    UNTERER HORIZONT    MESS-STELLE NR. 3  
RINGZUG N



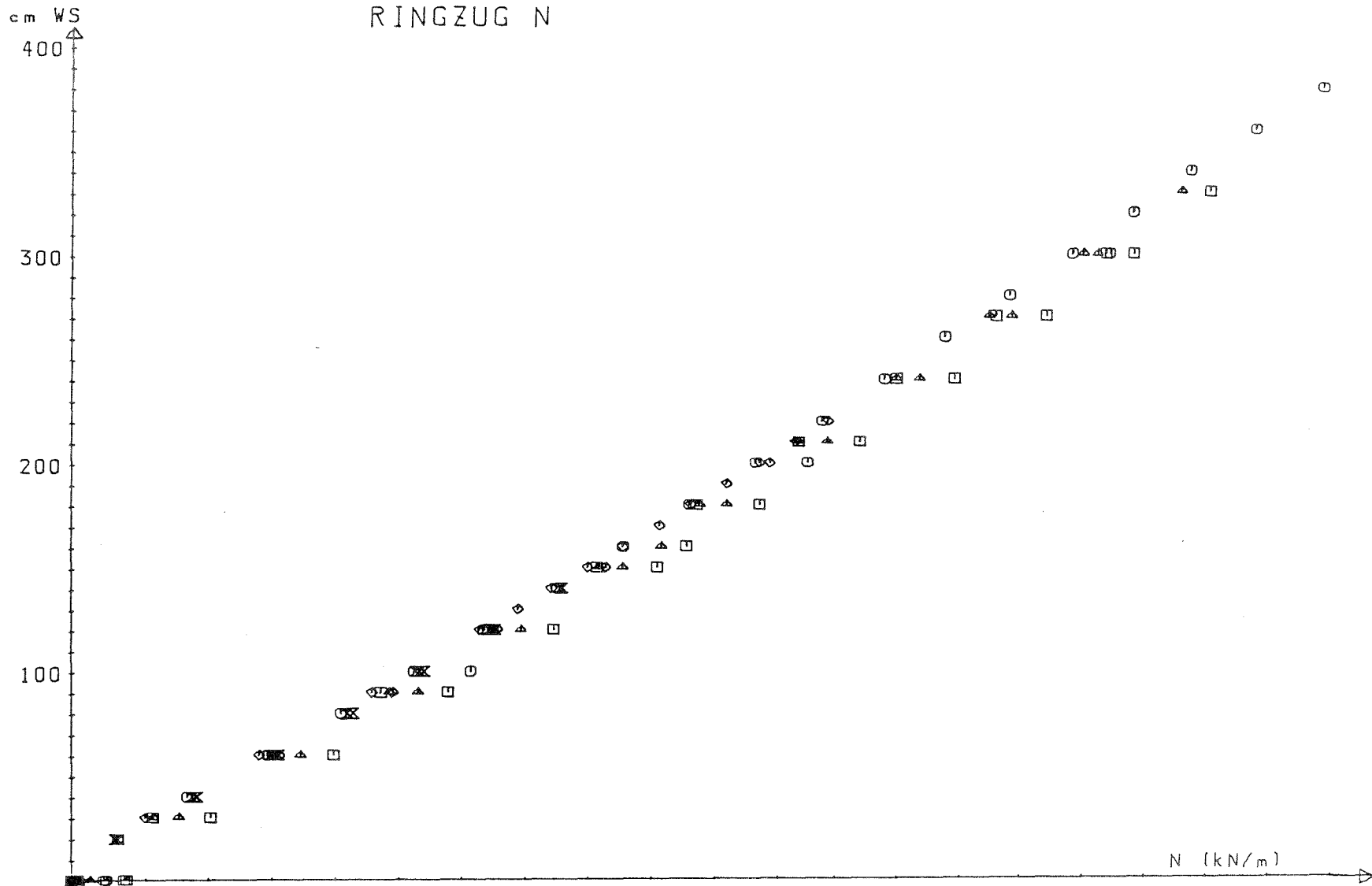
P 4.20

EICHUNG UNTERER HORIZONT MESS-STELLE NR. 4  
RINGZUG N



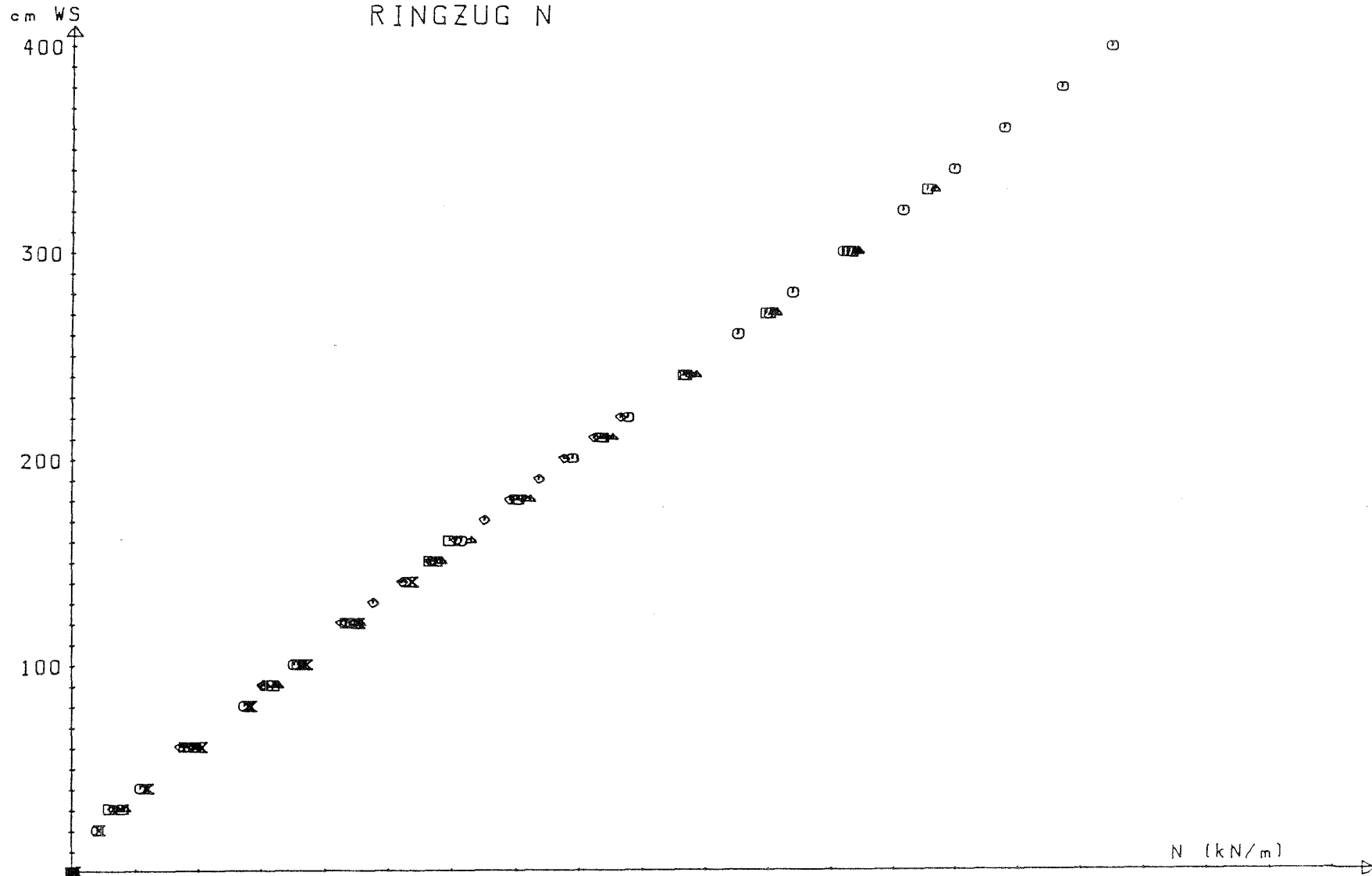
P4.21

EICHUNG UNTERER HORIZONT MESS-STELLE NR. 5  
RINGZUG N



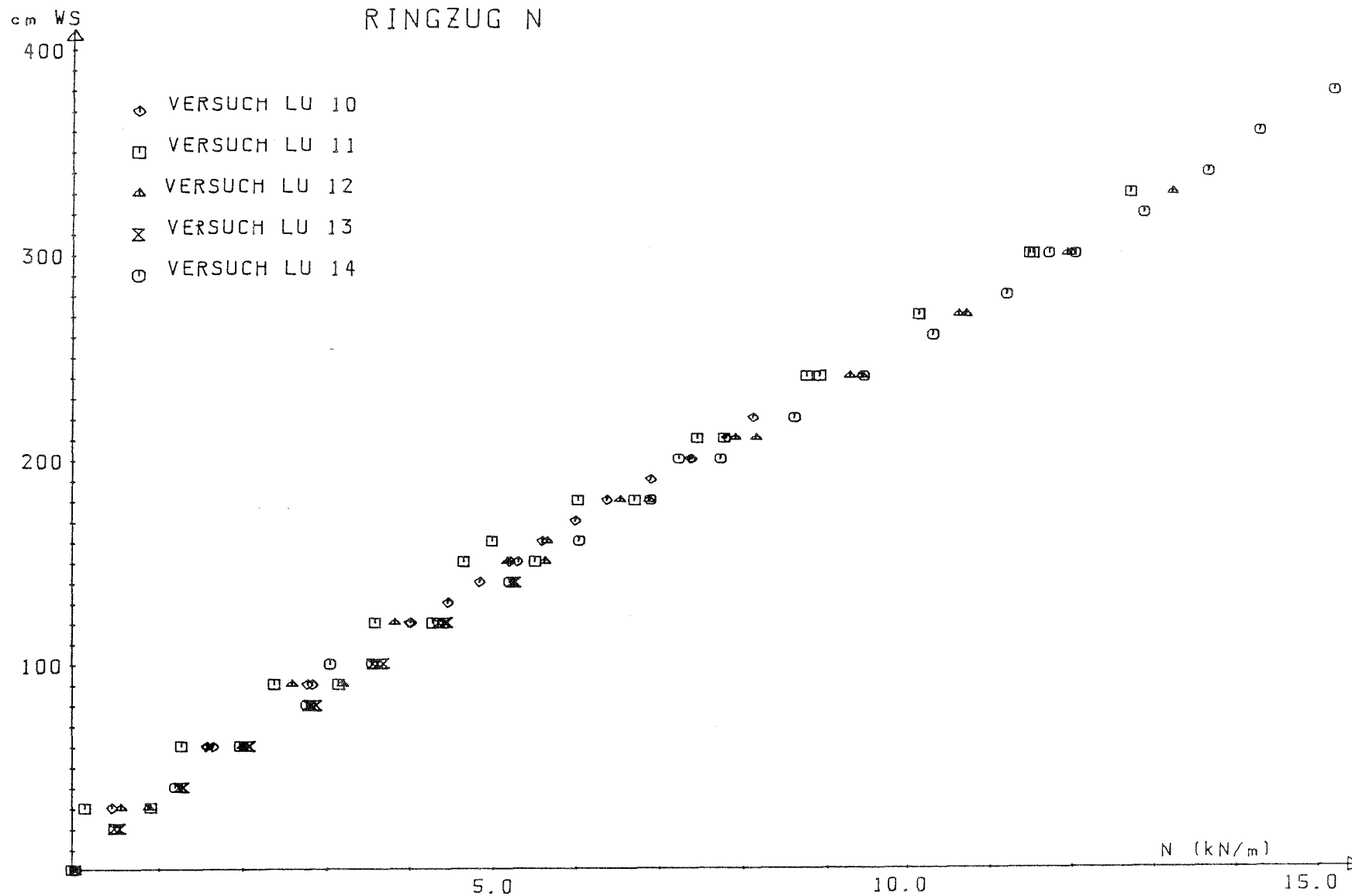
A422

EICHUNG UNTERER HORIZONT MESS-STELLE NR. 6  
RINGZUG N



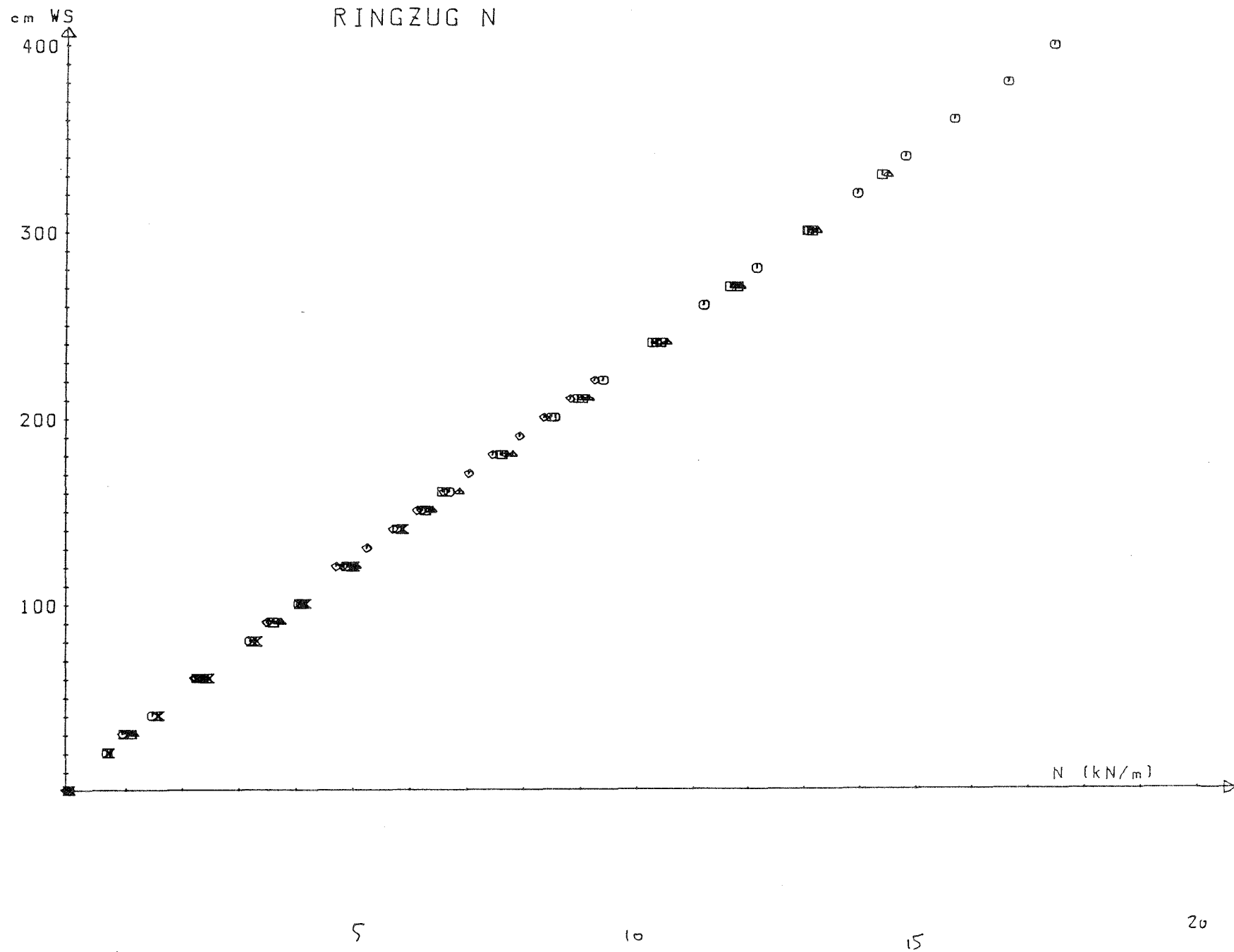
A 4.23

EICHUNG    UNTERER HORIZONT    MESS-STELLE NR. 7  
RINGZUG N



A 4.24

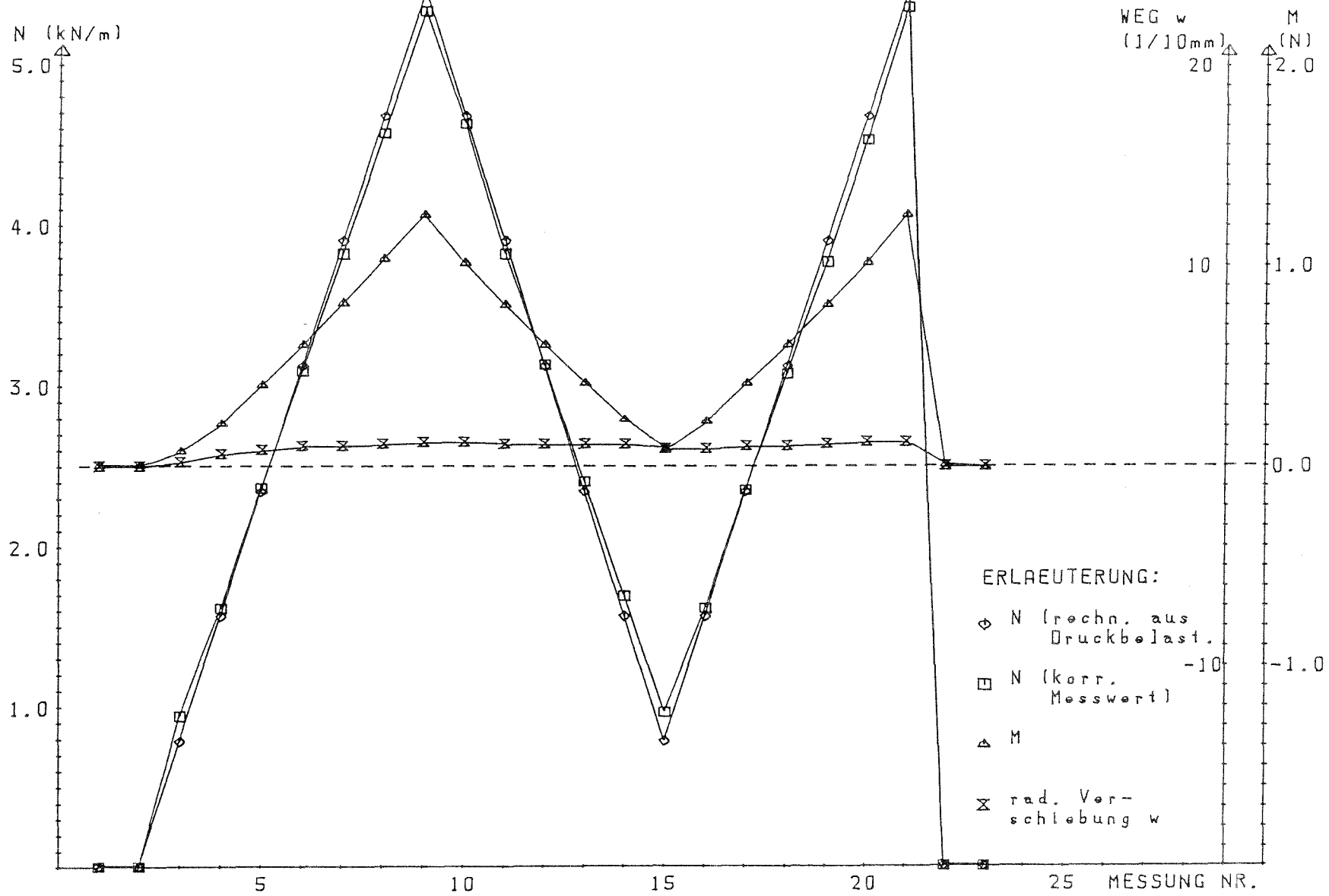
EICHUNG    UNTERER HORIZONT    MESS-STELLE NR. 8  
RINGZUG N



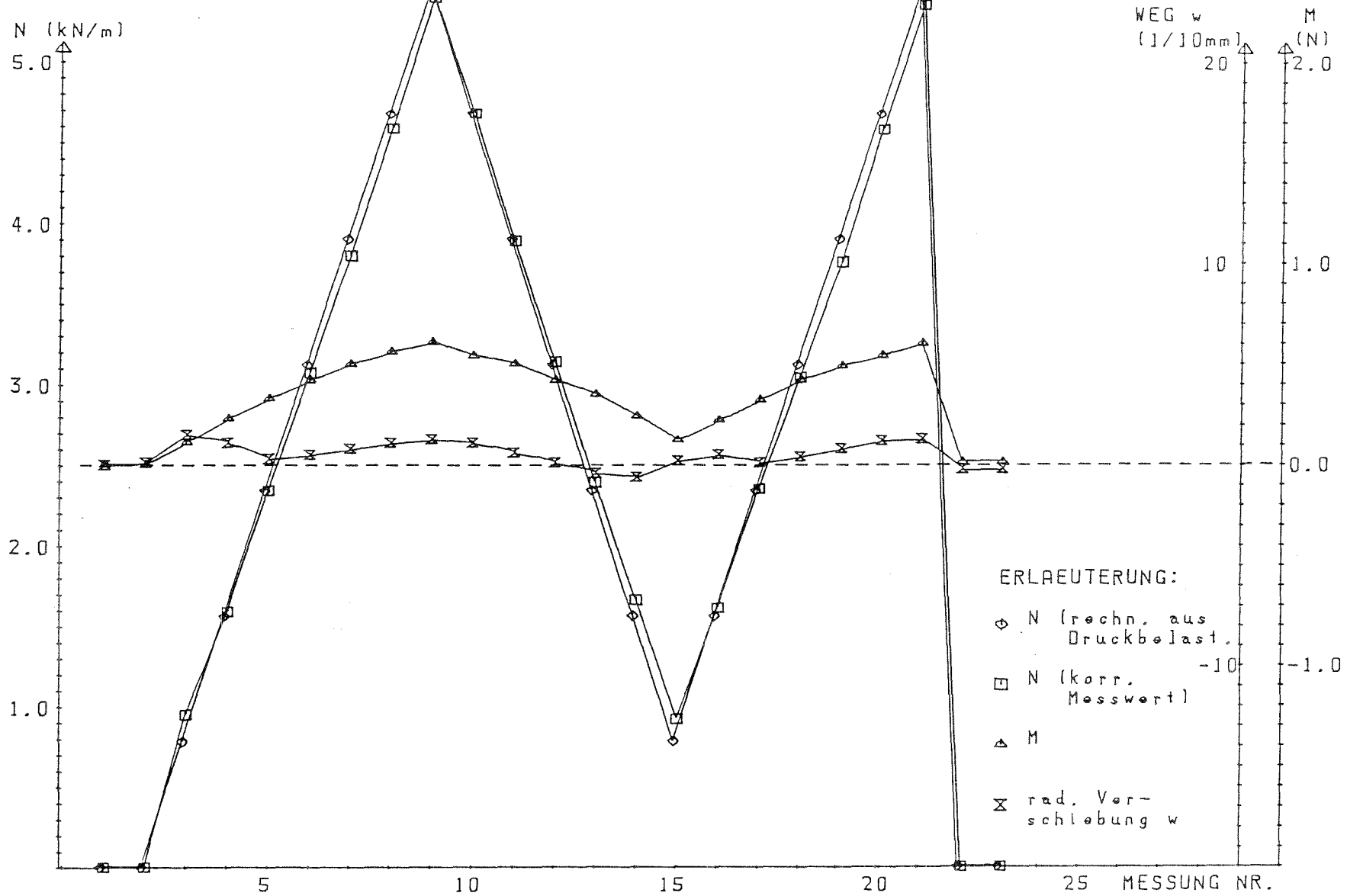
A 4.25



EICHVERSUCH: LU13 MESS-STELLE: 21

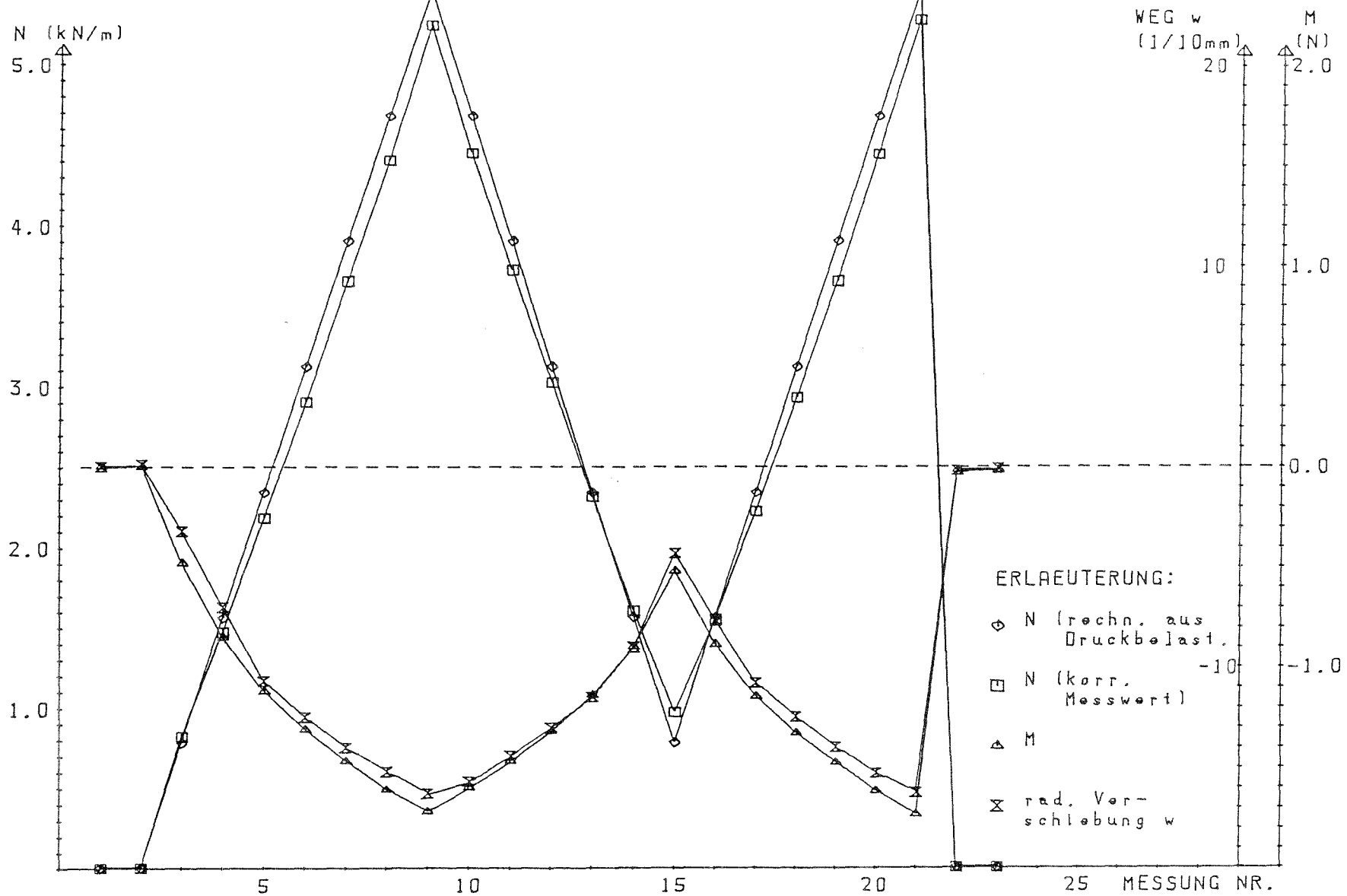


# EICHVERSUCH: LU13 MESS-STELLE: 22



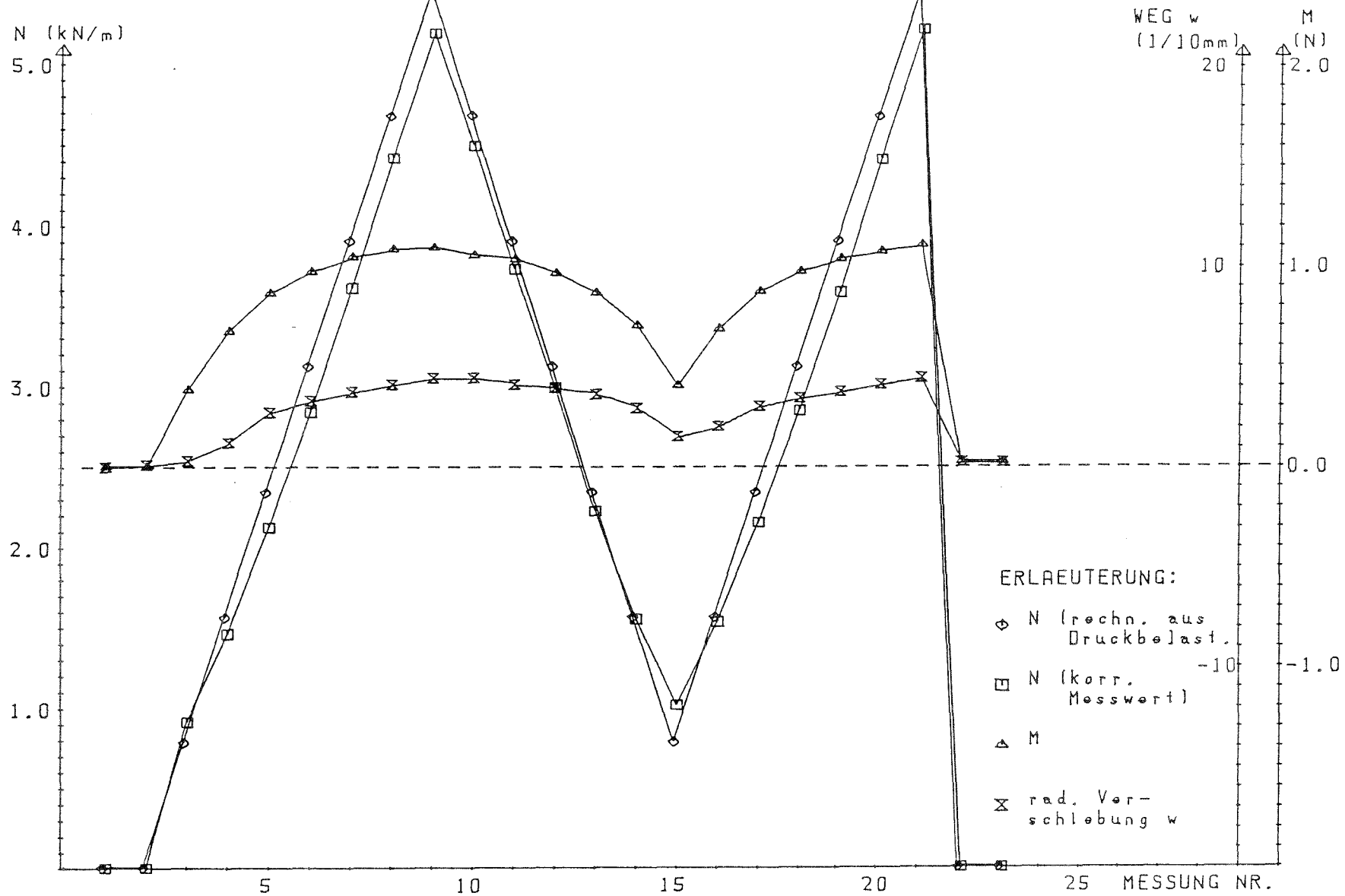
A 4.27

EICHVERSUCH: LU13 MESS-STELLE: 23



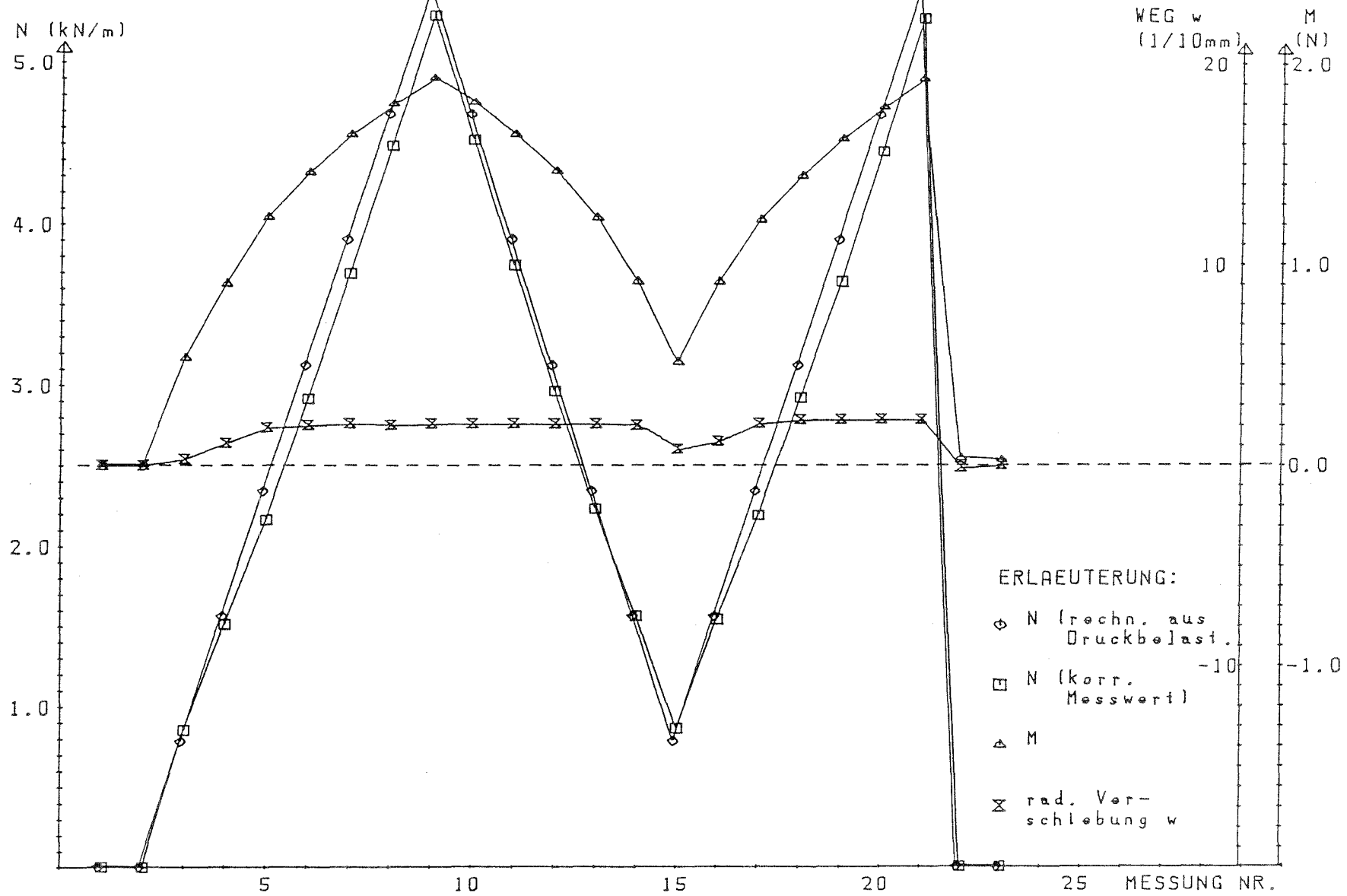
A4.28

EICHVERSUCH: LU13 MESS-STELLE: 24



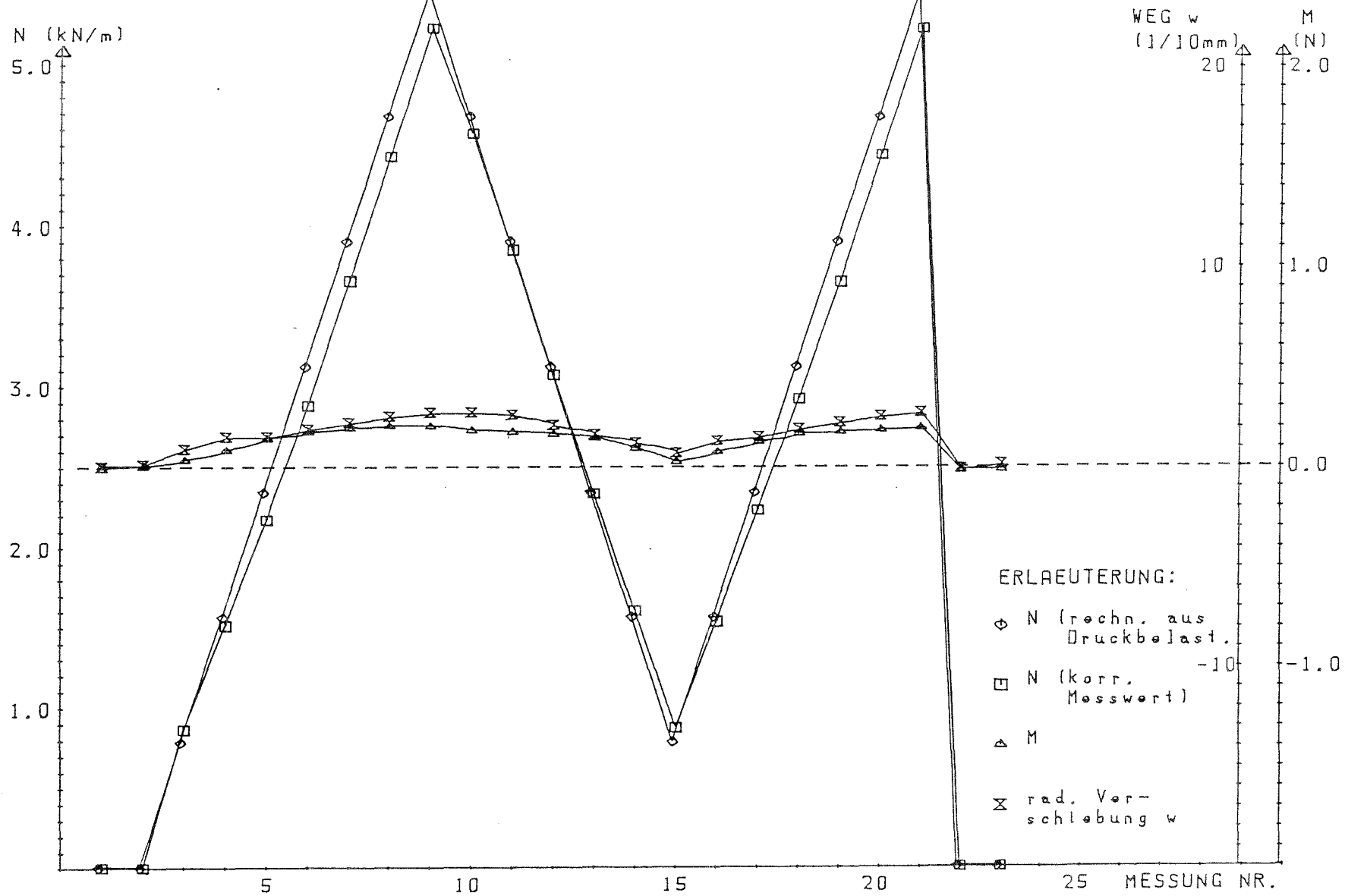
A 4129

# EICHVERSUCH: LU13 MESS-STELLE: 25



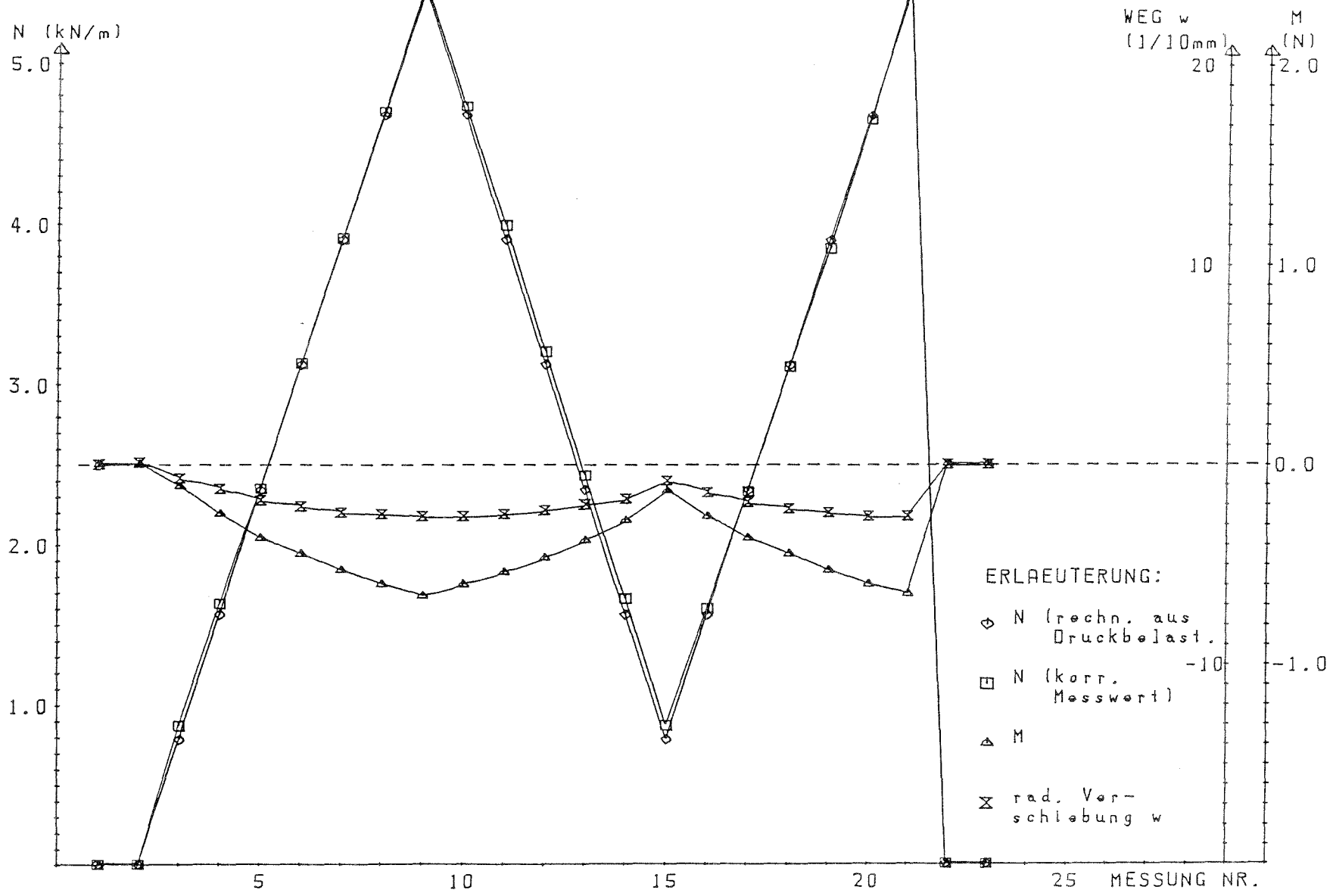
A 4.30

EICHVERSUCH: LU13 MESS-STELLE: 26



A 4.34

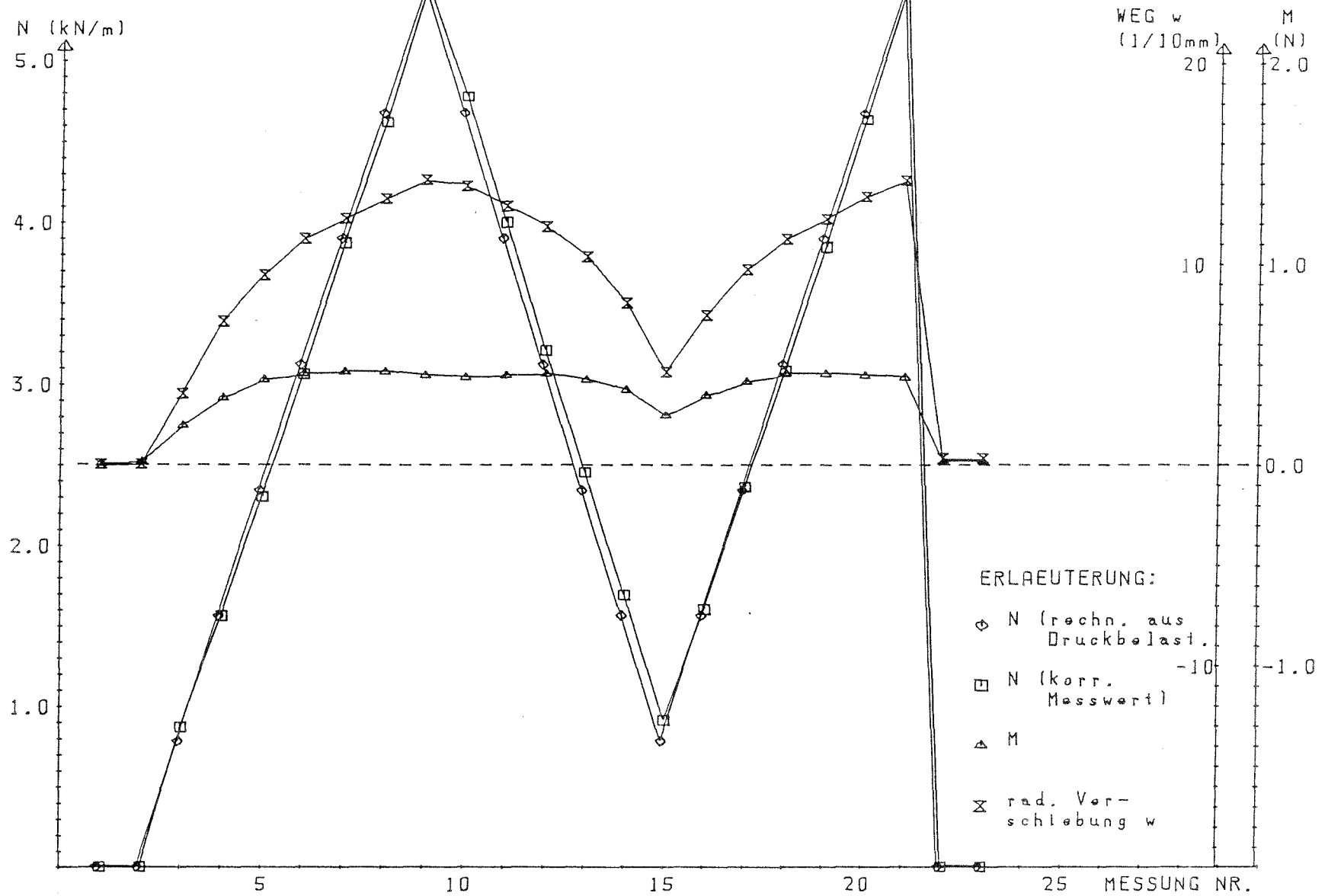
EICHVERSUCH: LU13 MESS-STELLE: 27



ERLAEUTERUNG:  
 ◊  $N$  (rechn. aus Druckbelast.)  
 ◻  $N$  (korr. Messwert)  
 ▲  $M$   
 × rad. Verschiebung  $w$

A4.32

EICHVERSUCH: LU13 MESS-STELLE: 28

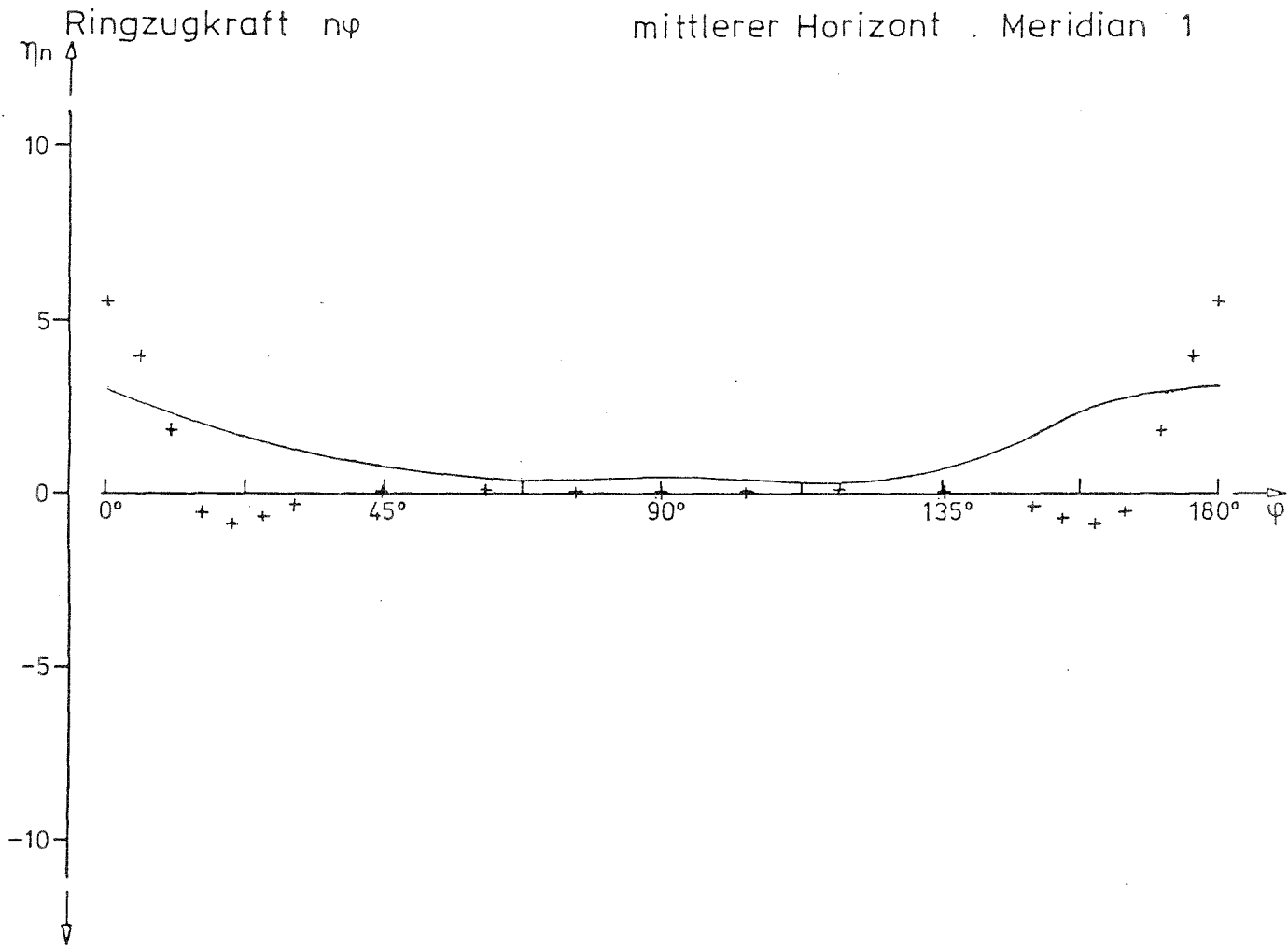


ERLAEUTERUNG:

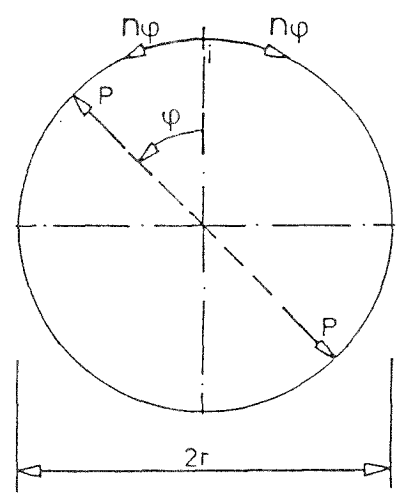
- ◇  $N$  (rechn. aus Druckbelast.)
- $N$  (korr. Messwert)
- △  $M$
- × rad. Verschiebung  $w$

A 4.33

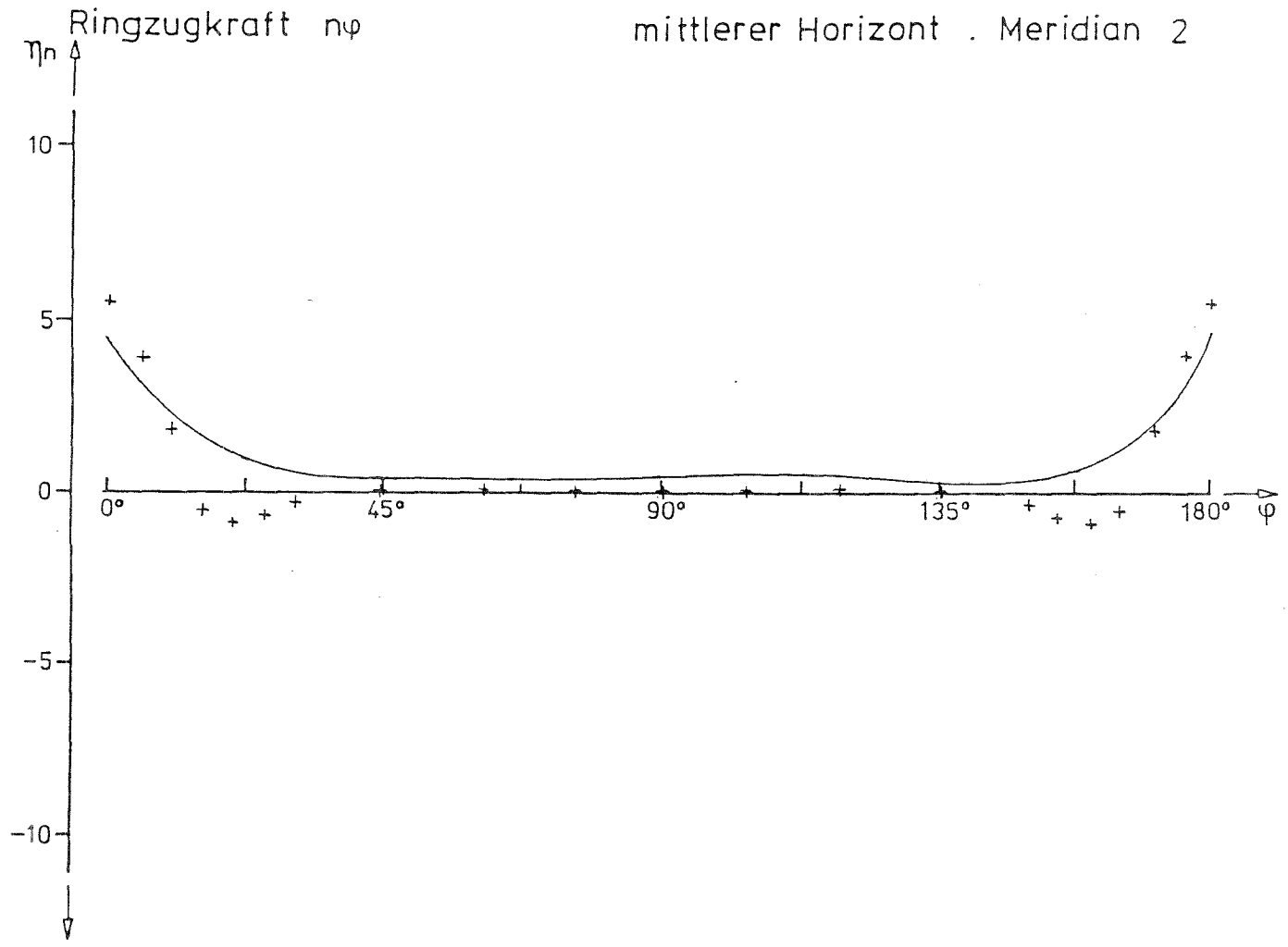




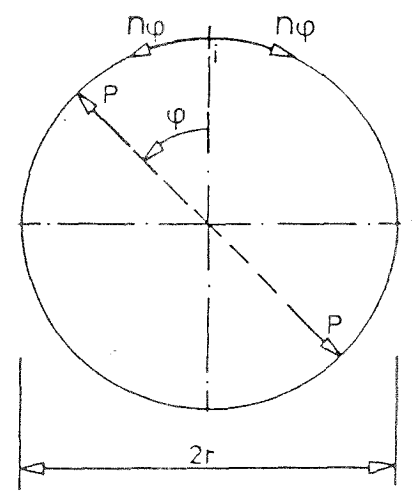
$$\eta_n = \frac{n\varphi \cdot r}{P}$$



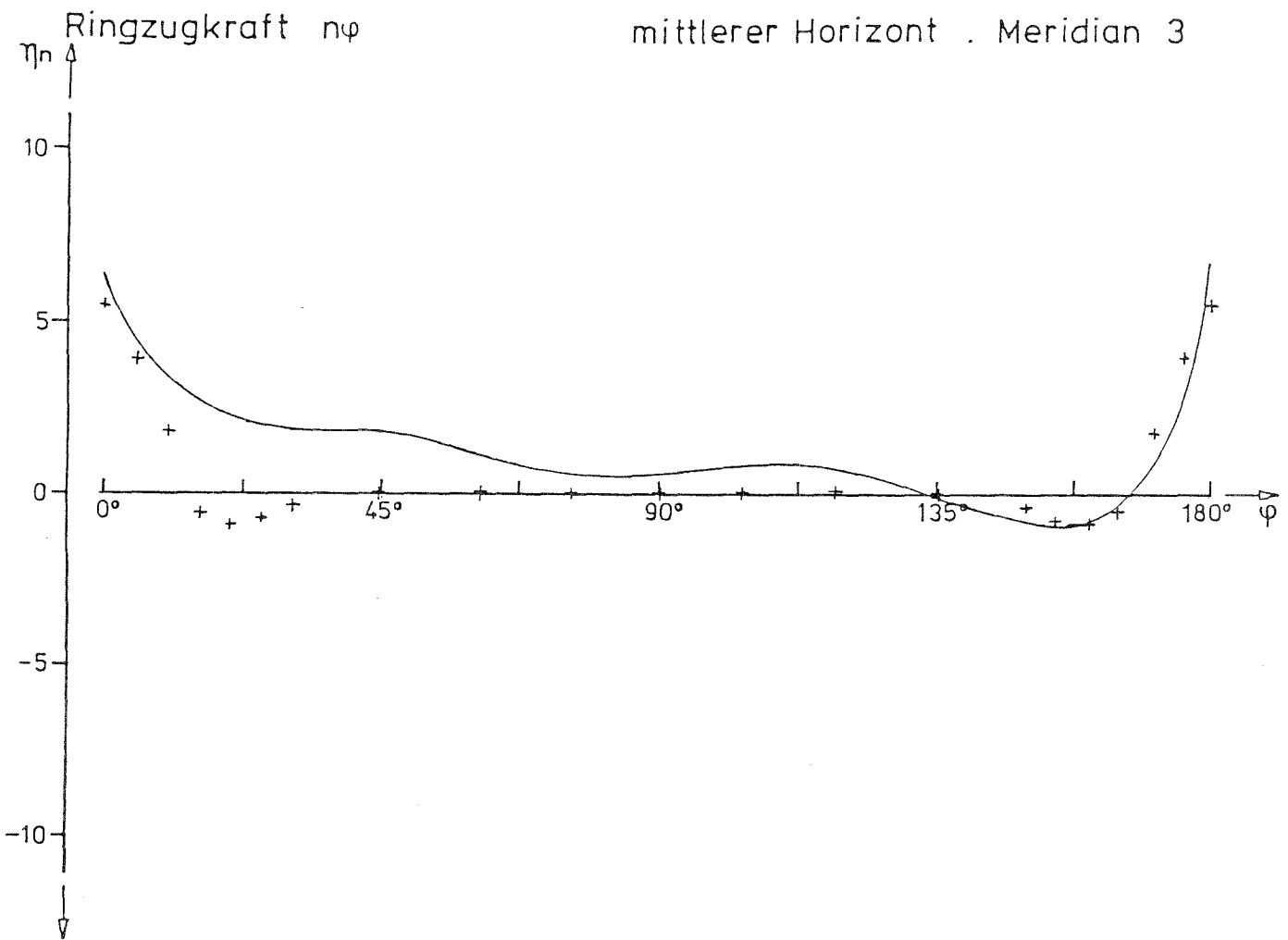
- experimentell
- + FEM-Berechnung



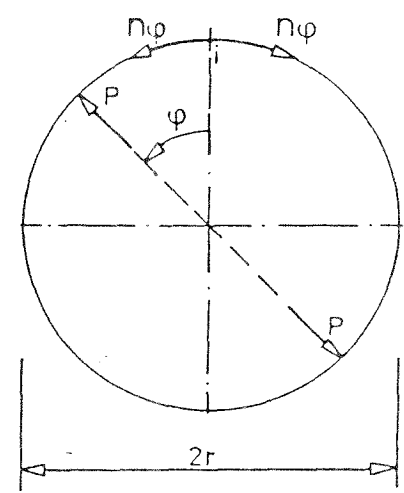
$$\eta_n = \frac{n\varphi \cdot r}{P}$$



- experimentell
- + FEM-Berechnung

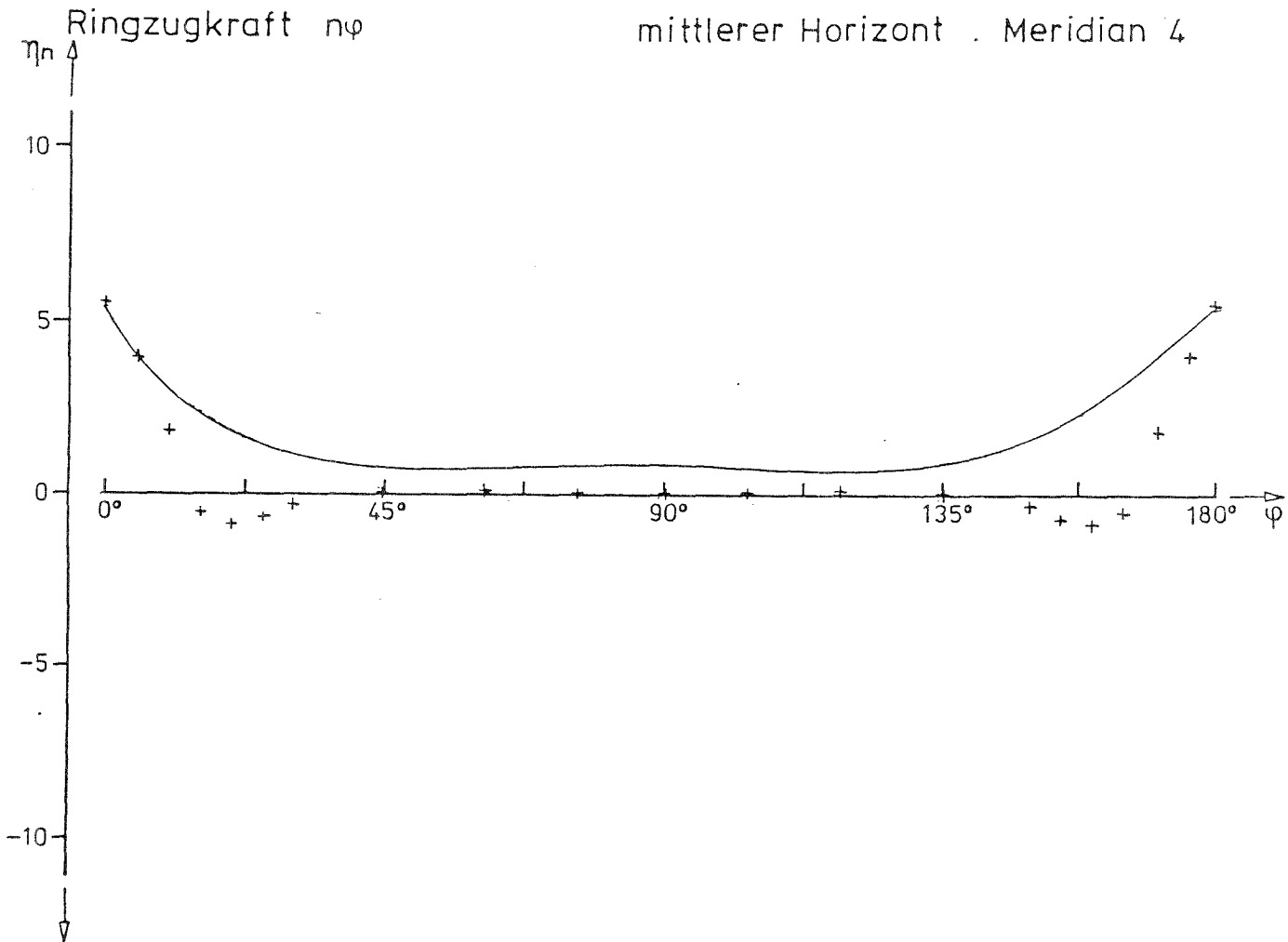


$$\eta_n = \frac{n\varphi \cdot r}{P}$$

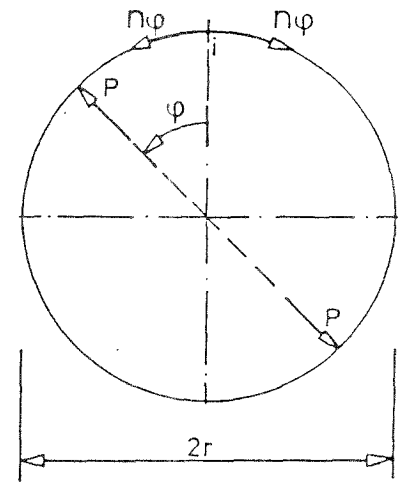


- experimentell
- + FEM-Berechnung

A 4.37

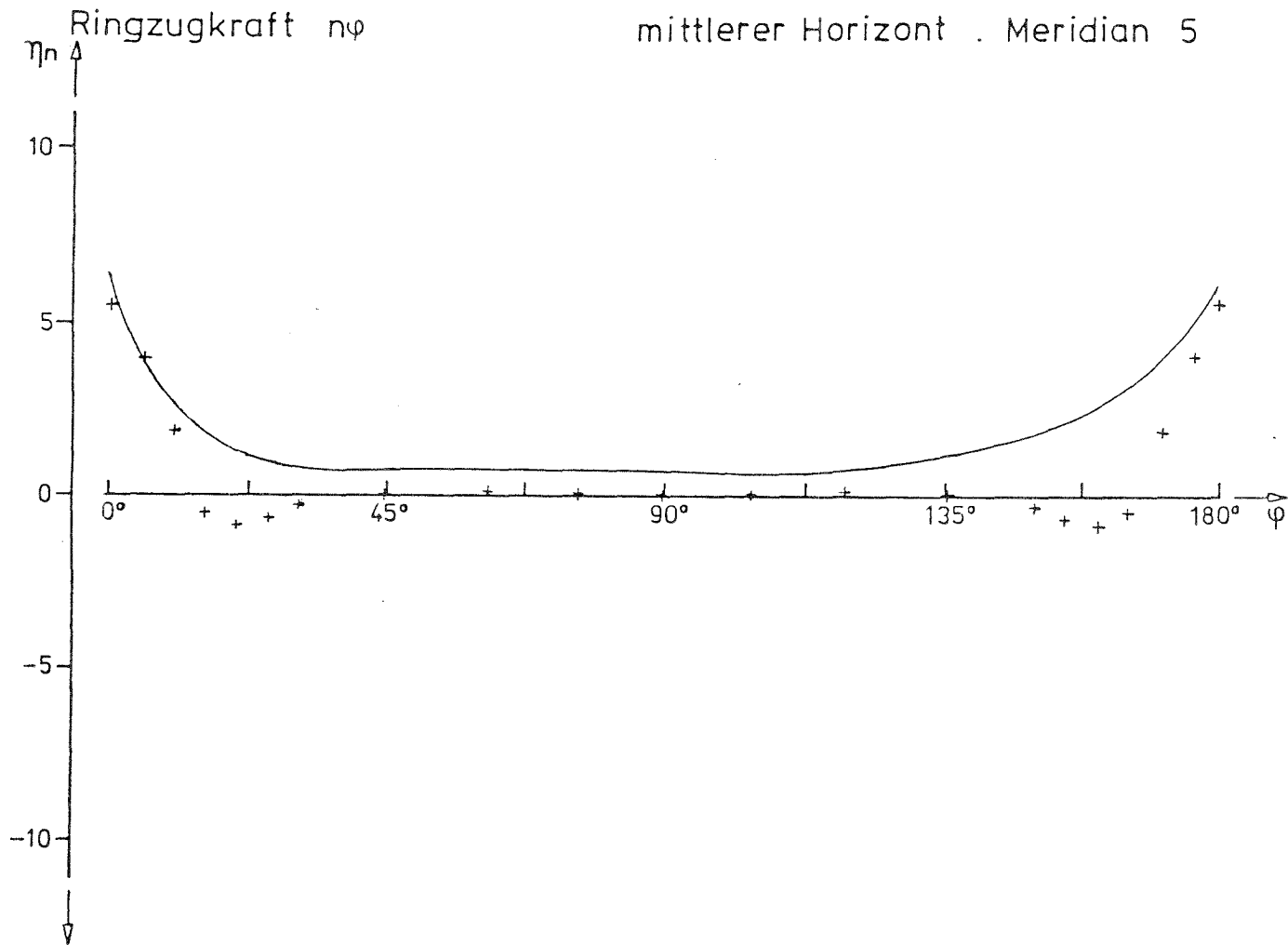


$$\eta_n = \frac{n\varphi \cdot r}{P}$$

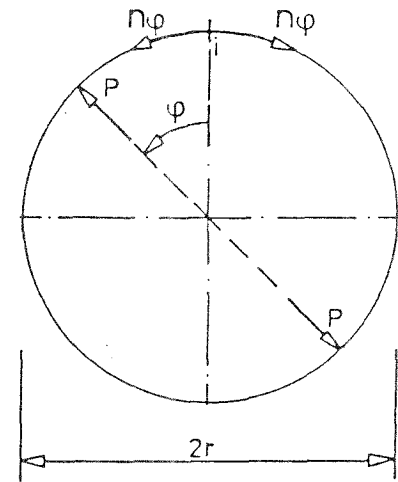


— experimentell  
 + FEM-Berechnung

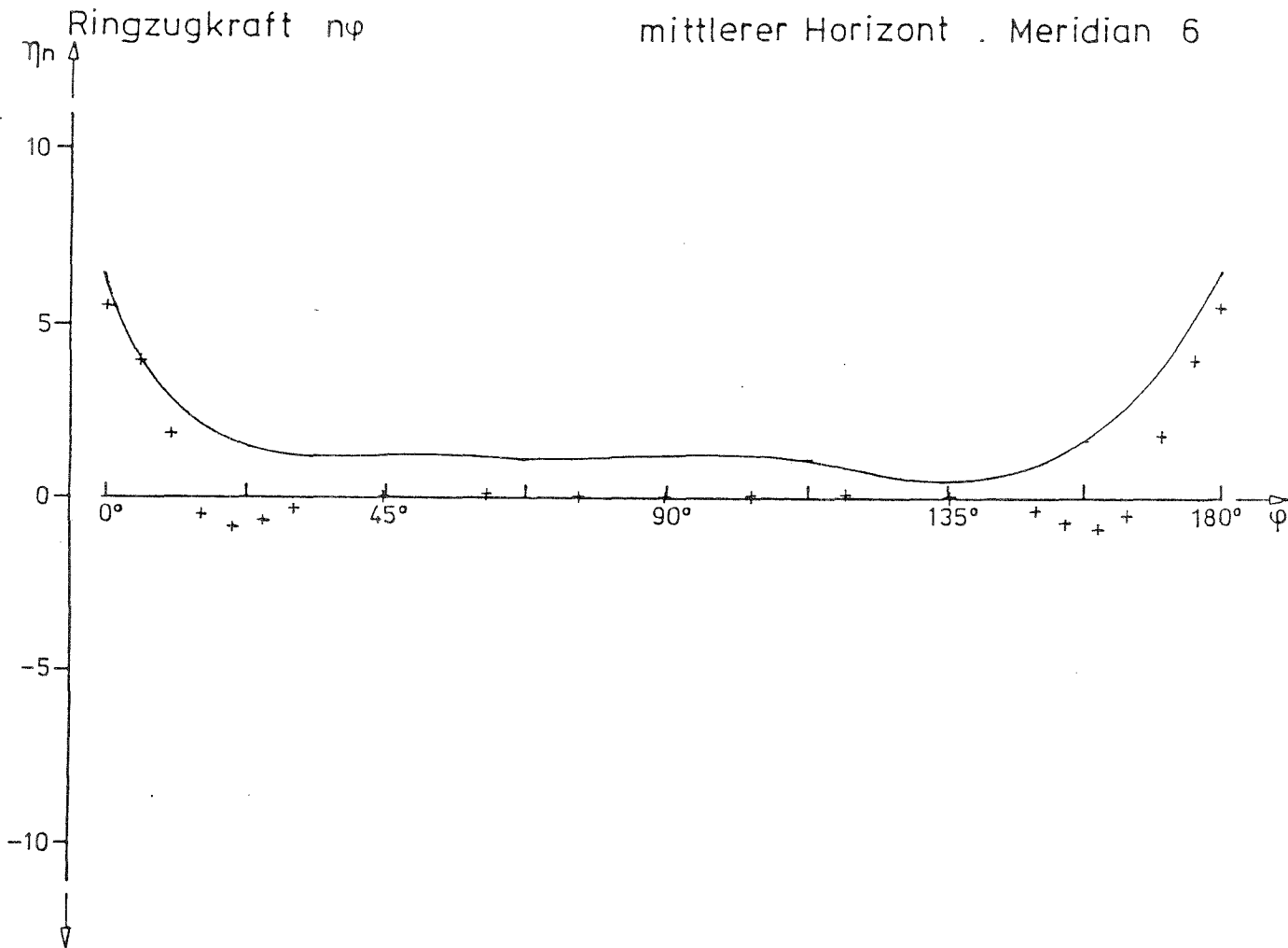
R 4.38



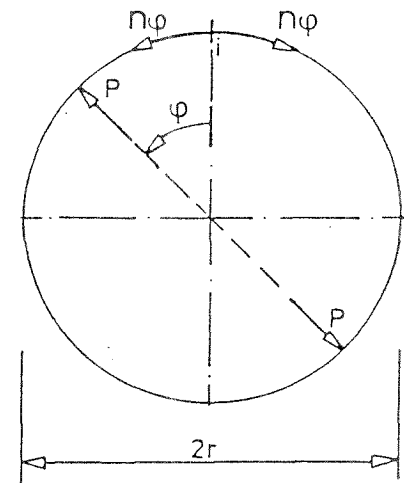
$$\eta_n = \frac{n\varphi \cdot r}{P}$$



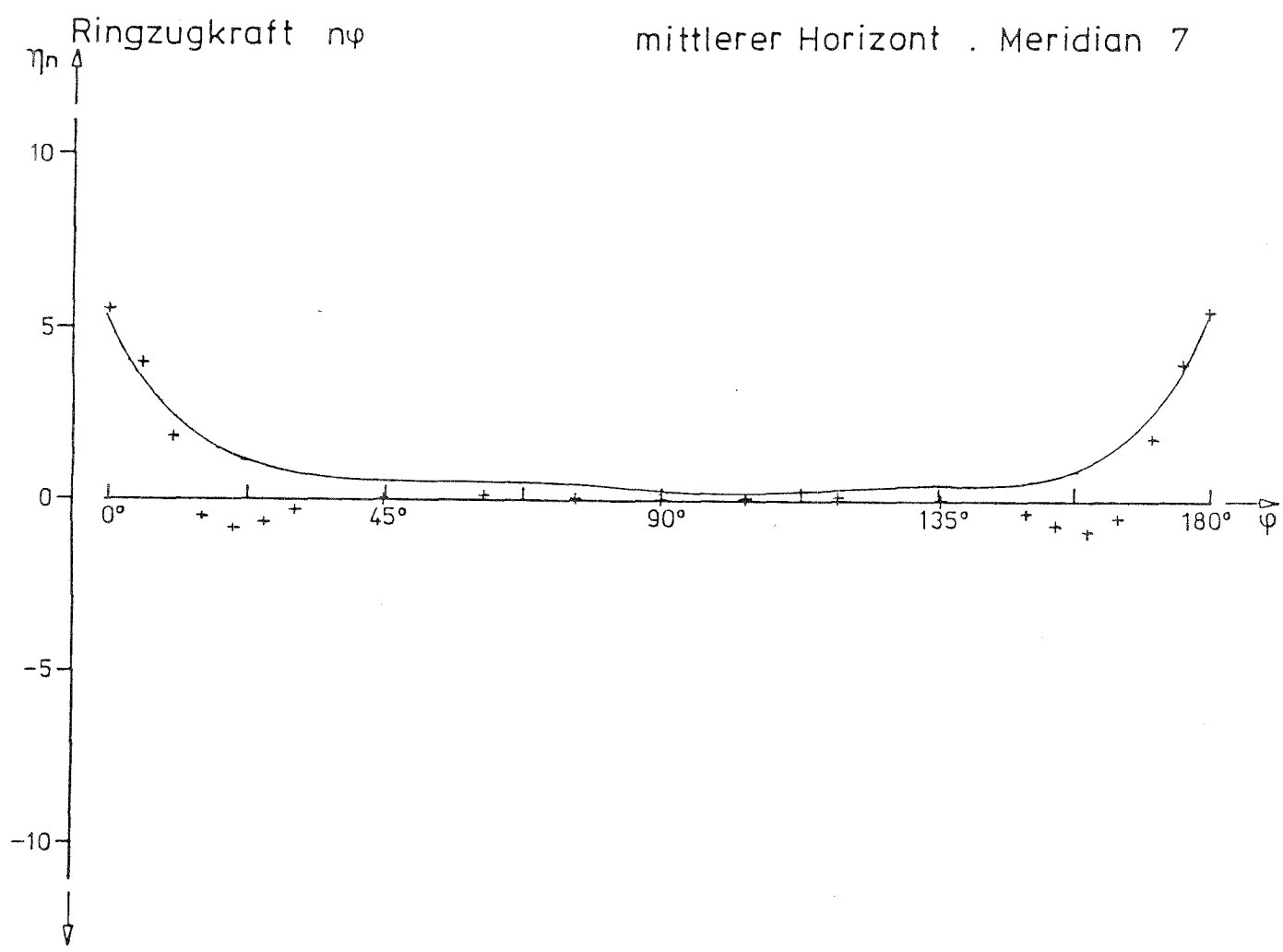
- experimentell
- + FEM-Berechnung



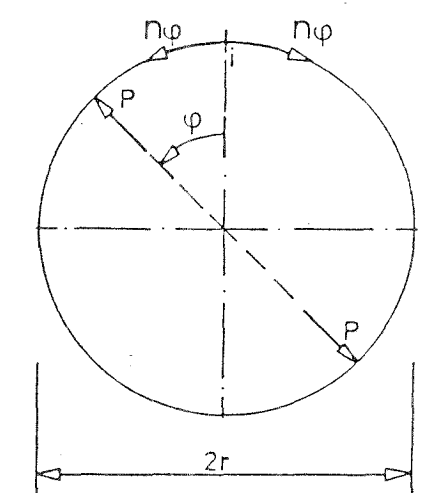
$$\eta_n = \frac{n\varphi \cdot r}{P}$$



- experimentell
- + FEM-Berechnung

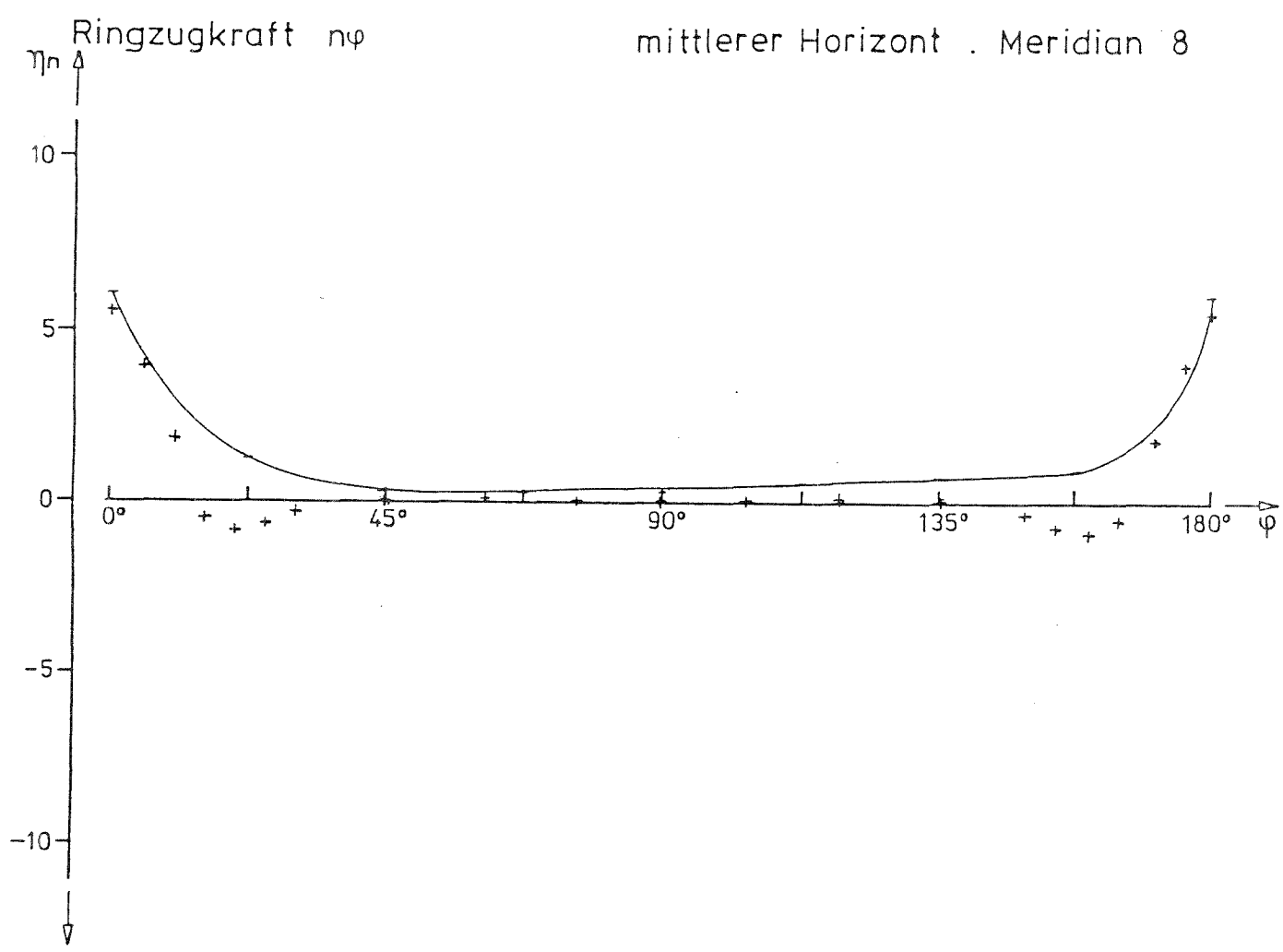


$$\eta_n = \frac{n\varphi \cdot r}{P}$$

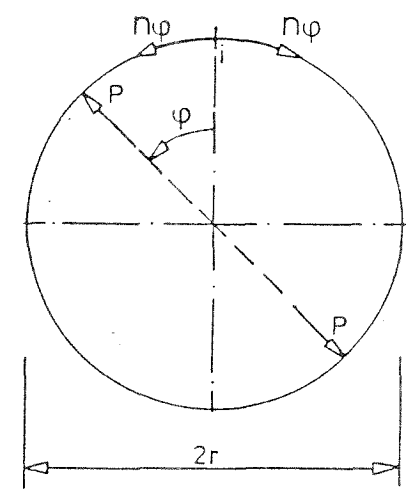


- experimentell
- + FEM-Berechnung

A 4.4.1



$$\eta_n = \frac{n\varphi \cdot r}{P}$$



— experimentell  
 + FEM-Berechnung

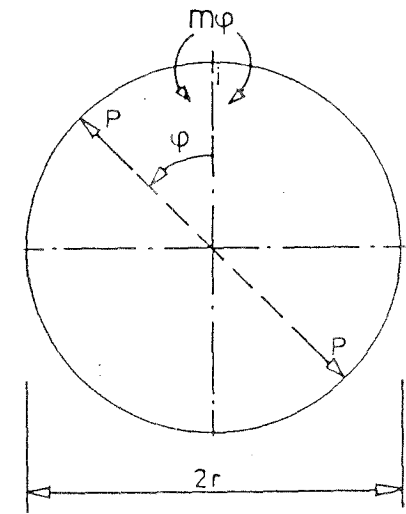
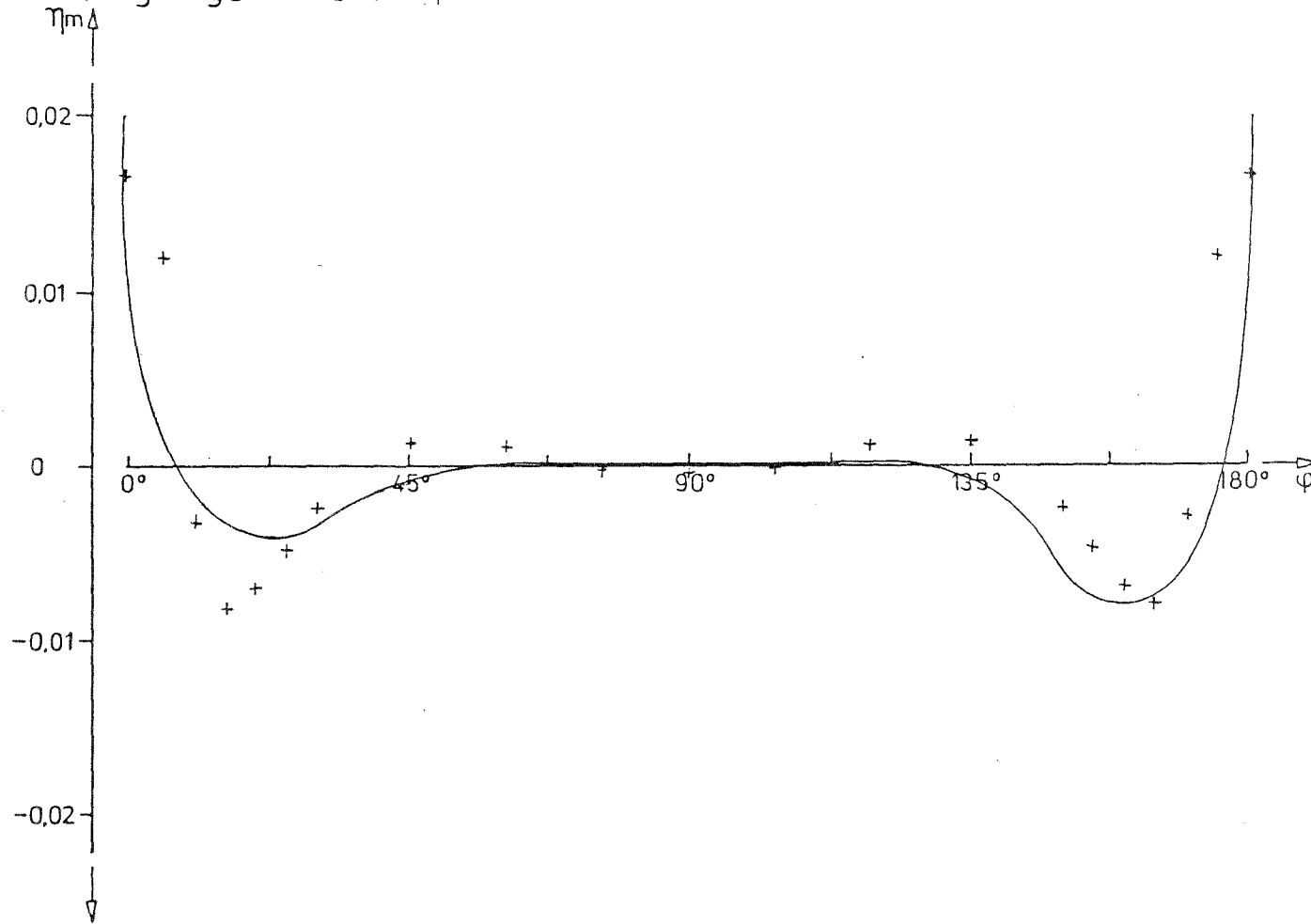
A 4.42



Ringbiegemoment  $m_\varphi$

mittlerer Horizont . Meridian 1

$$\eta_m = \frac{m_\varphi}{P}$$

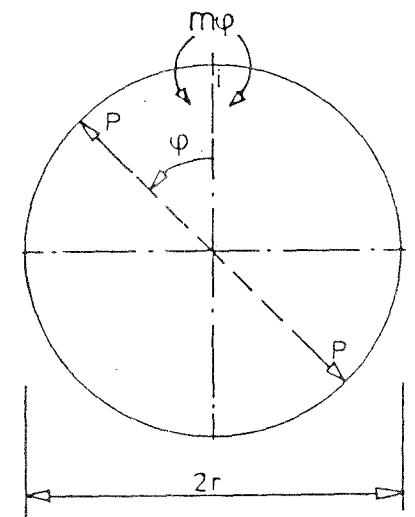
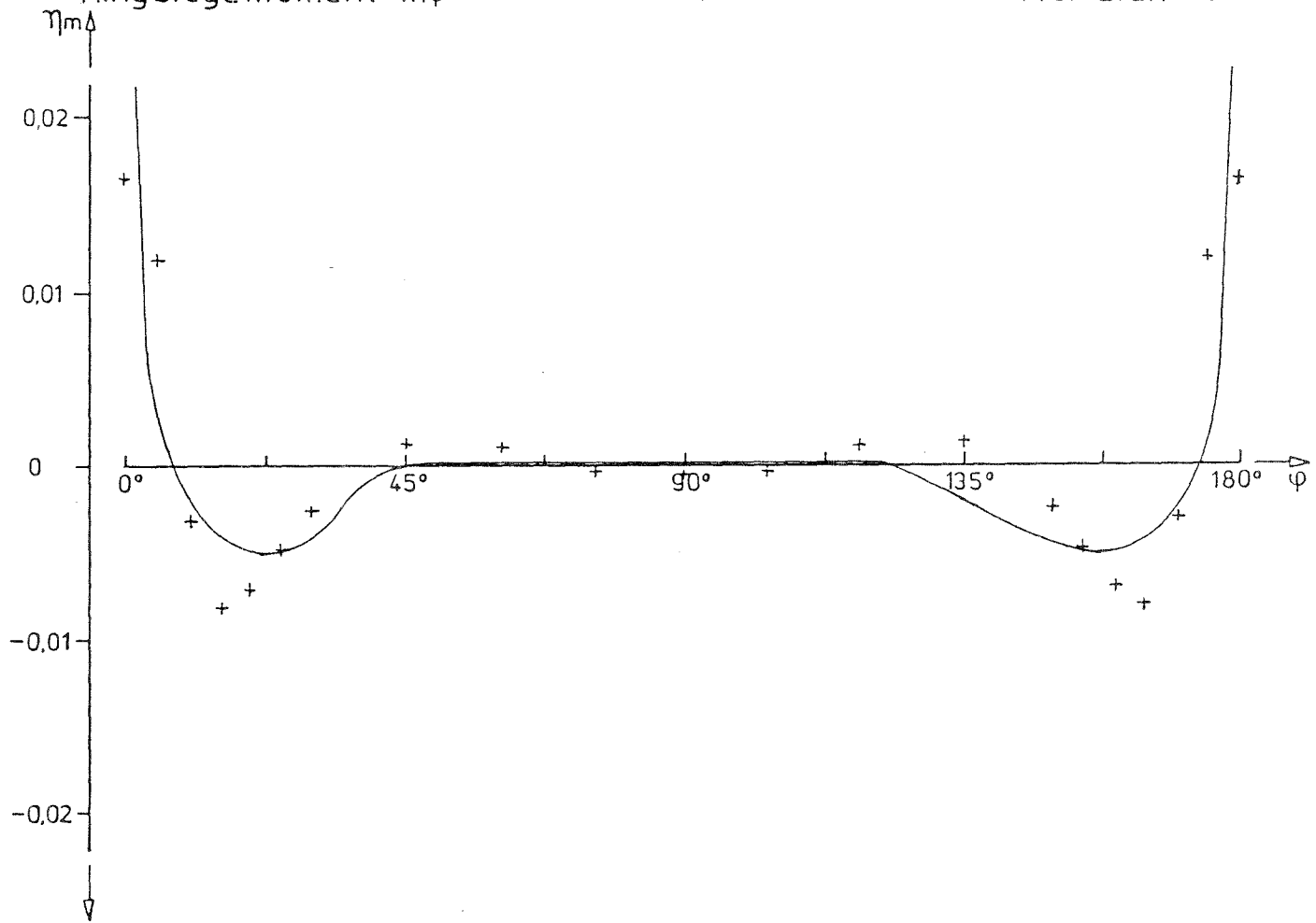


- experimentell
- + FEM-Berechnung

Ringbiegemoment  $m_\varphi$

mittlerer Horizont . Meridian 2

$$\eta_m = \frac{m_\varphi}{P}$$



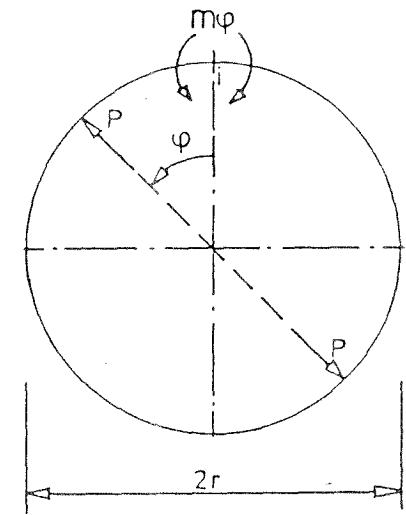
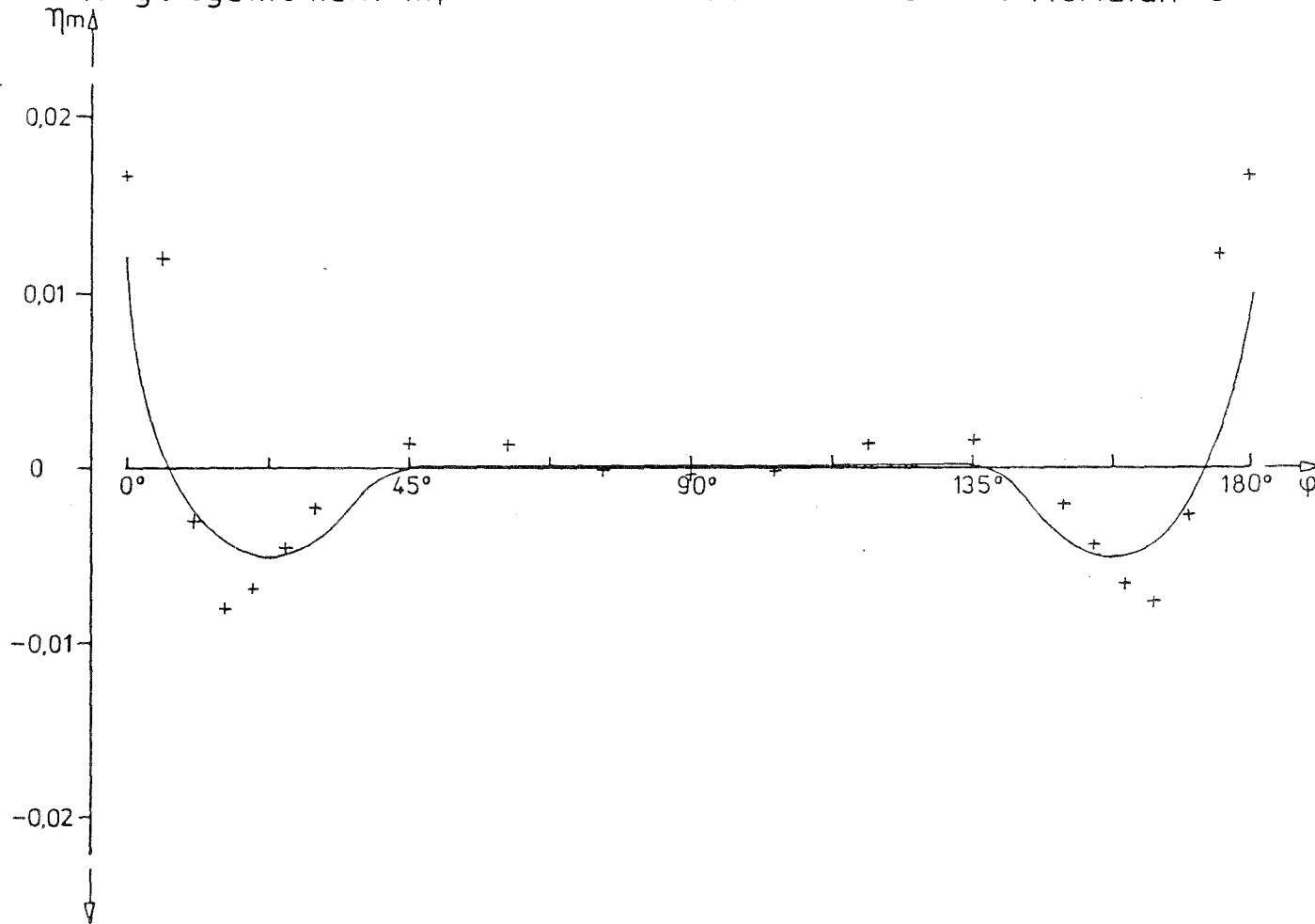
- experimentell
- + FEM-Berechnung

P. 4. 44

Ringbiegemoment  $m_\varphi$

mittlerer Horizont . Meridian 3

$$\eta_m = \frac{m_\varphi}{P}$$

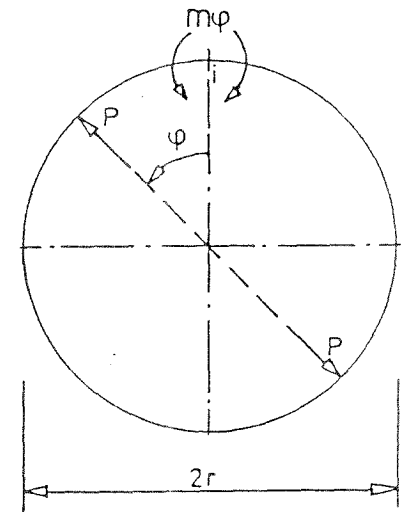
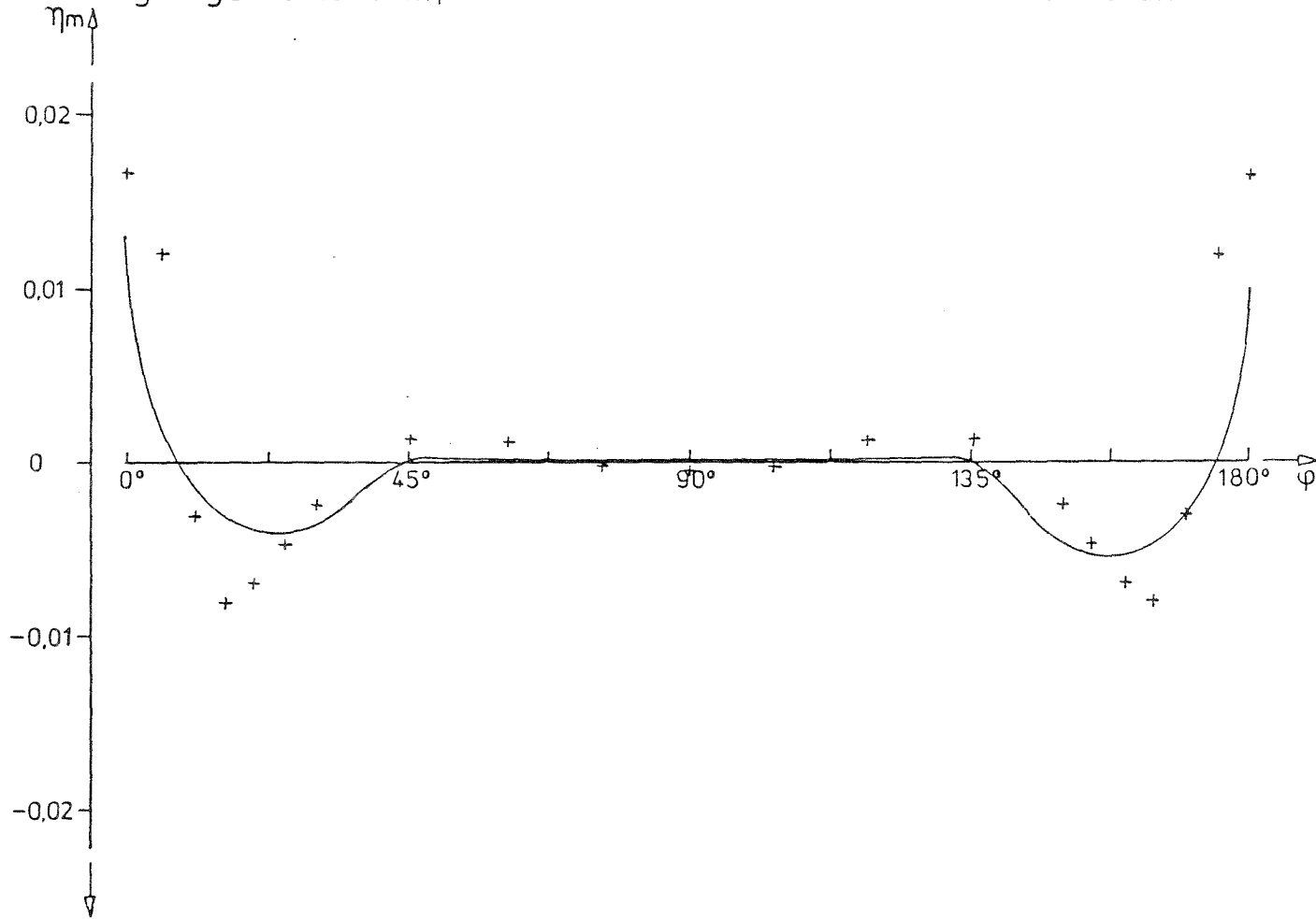


- experimentell
- + FEM-Berechnung

Ringbiegemoment  $m_\varphi$

mittlerer Horizont . Meridian 4

$$\eta_m = \frac{m_\varphi}{P}$$



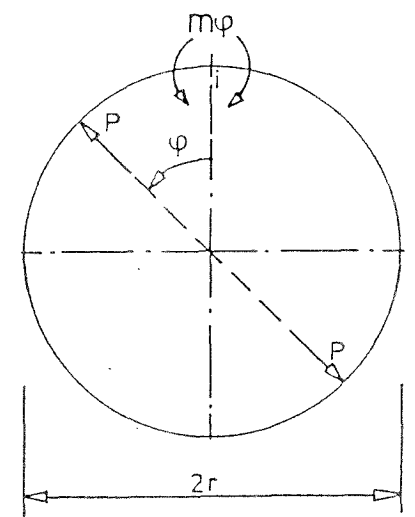
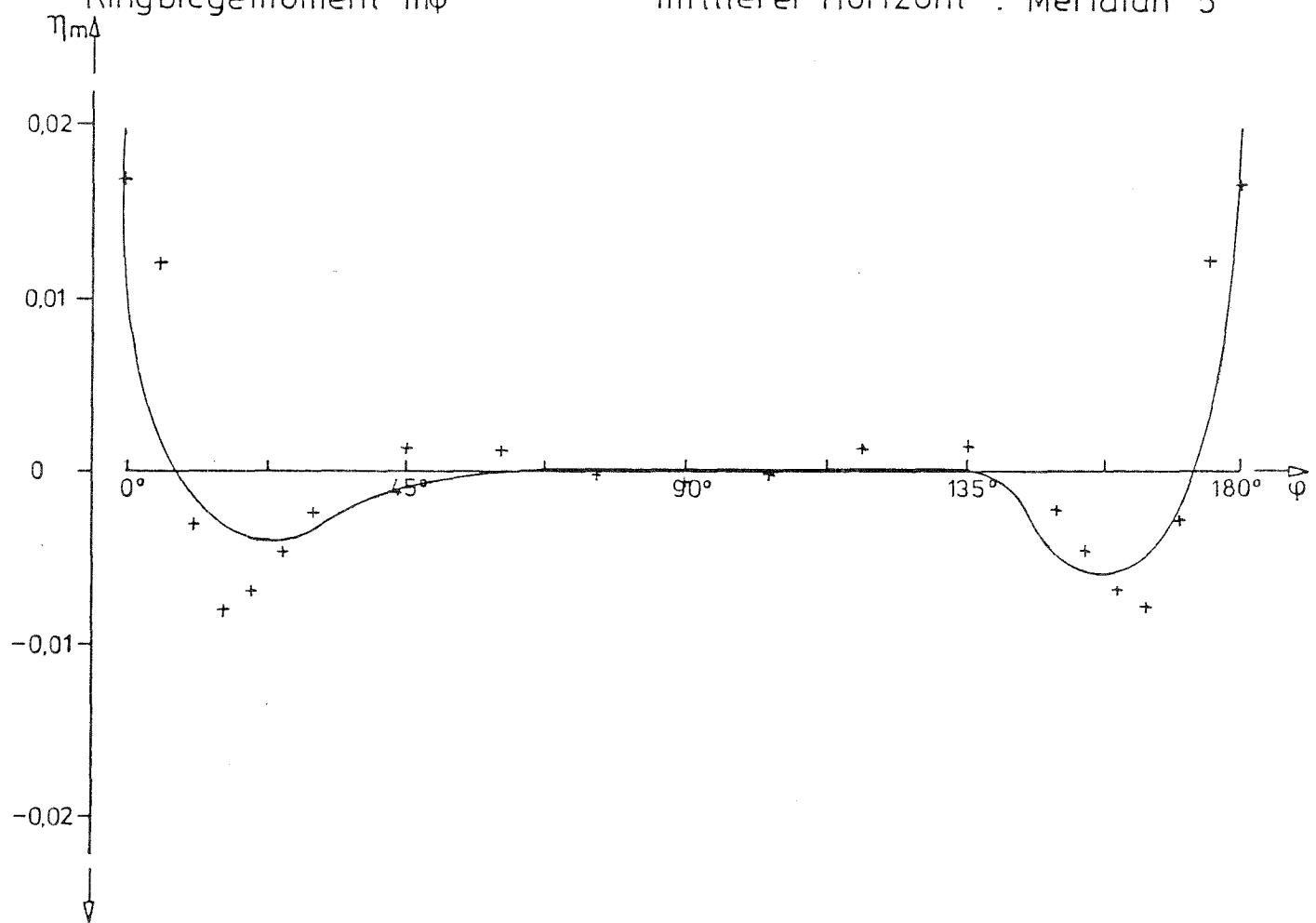
— experimentell  
+ FEM-Berechnung

A 4.46

Ringbiegemoment  $m_\varphi$

mittlerer Horizont . Meridian 5

$$\eta_m = \frac{m_\varphi}{P}$$



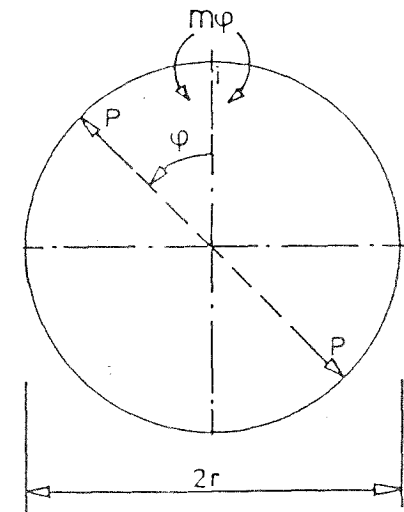
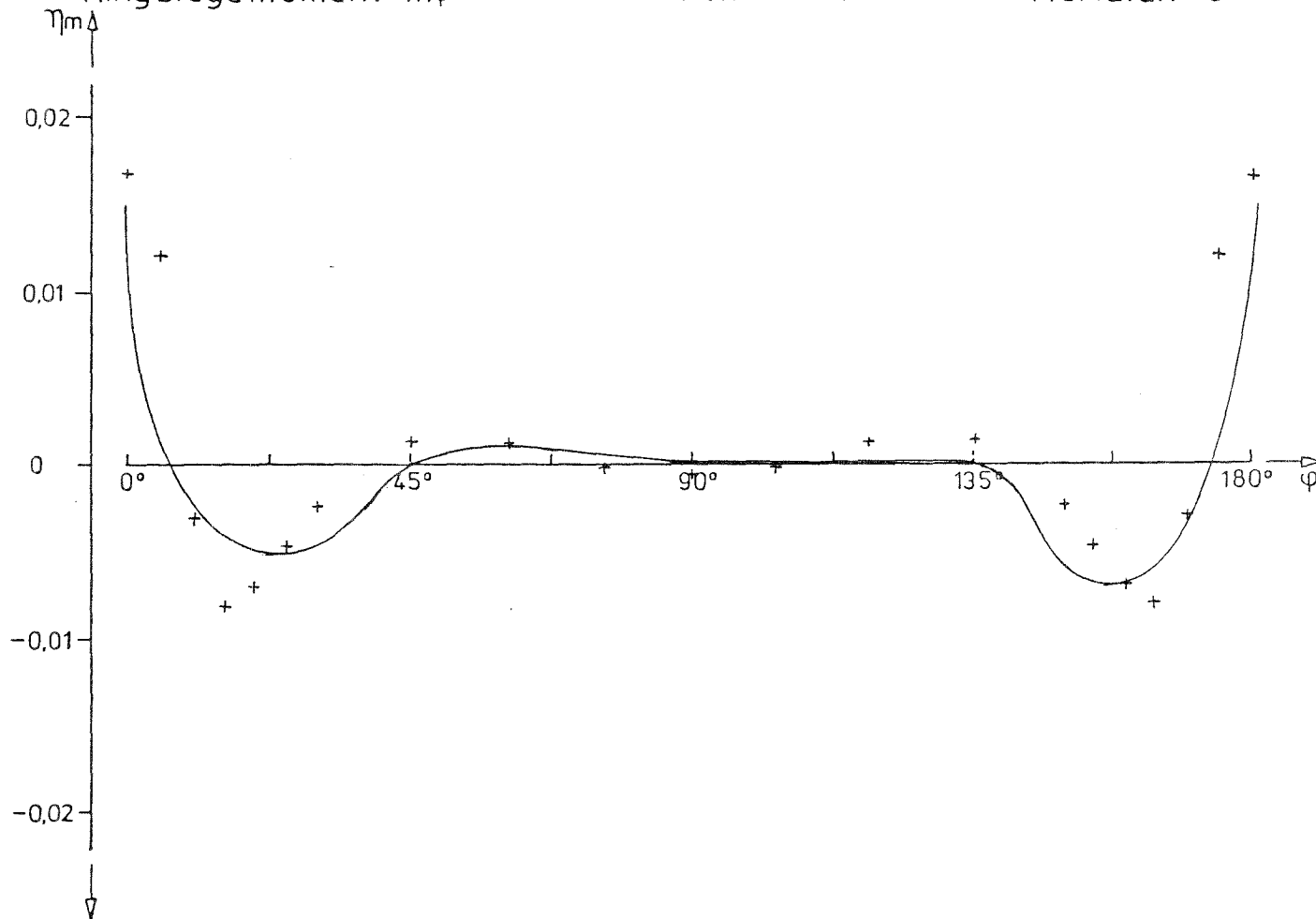
- experimentell
- + FEM-Berechnung

A 4.47

Ringbiegemoment  $m_\varphi$

mittlerer Horizont . Meridian 6

$$\eta_m = \frac{m_\varphi}{P}$$

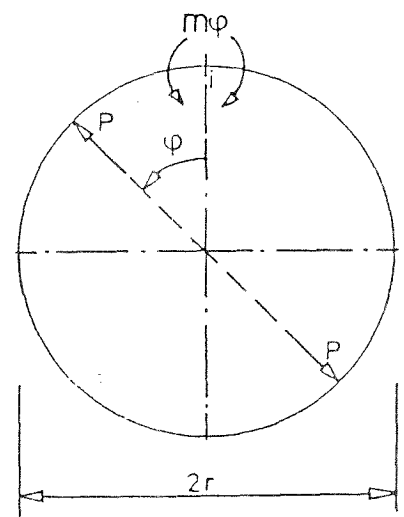
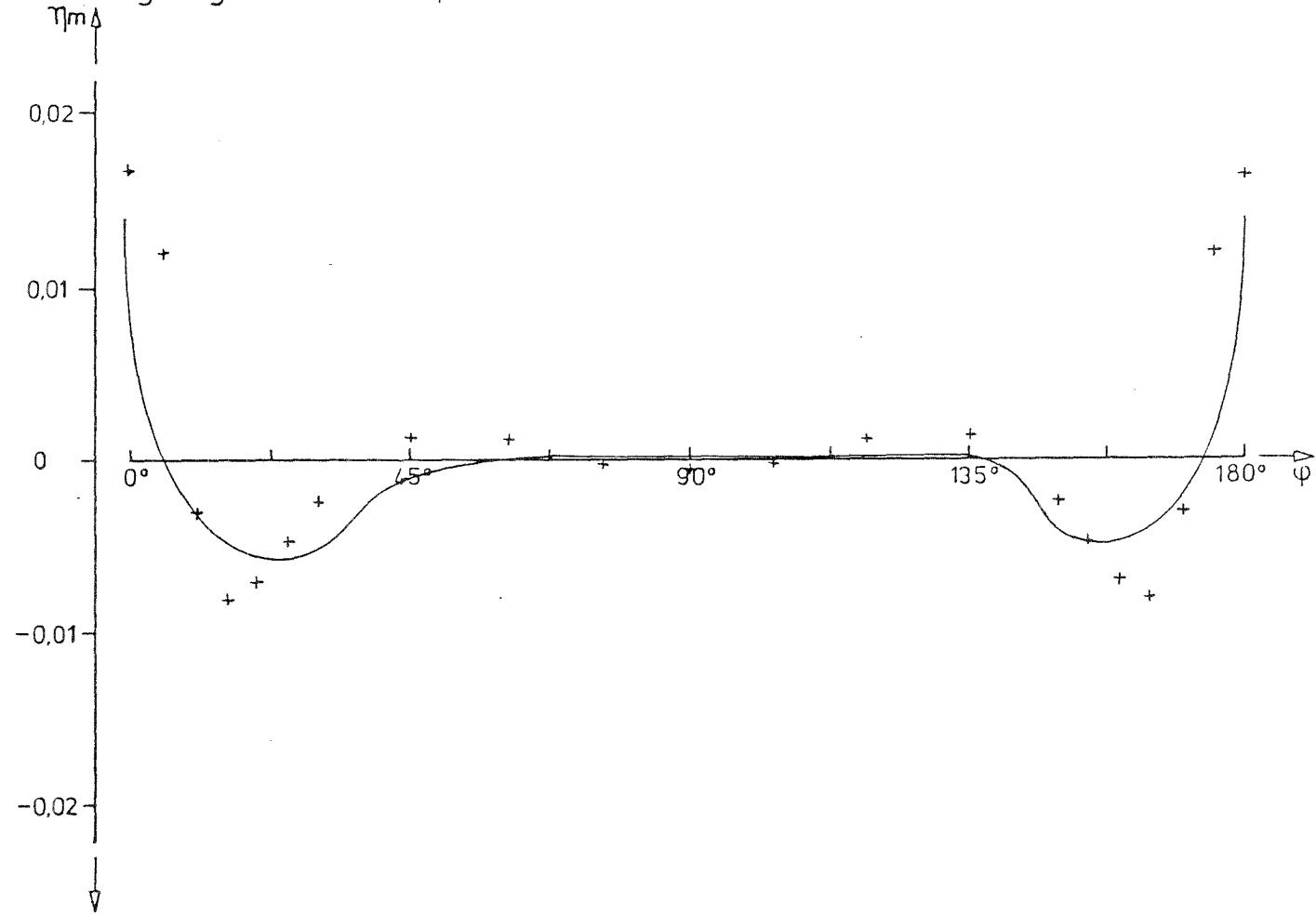


- experimentell
- + FEM-Berechnung

Ringbiegemoment  $m_\varphi$

mittlerer Horizont . Meridian 7

$$\eta_m = \frac{m_\varphi}{P}$$



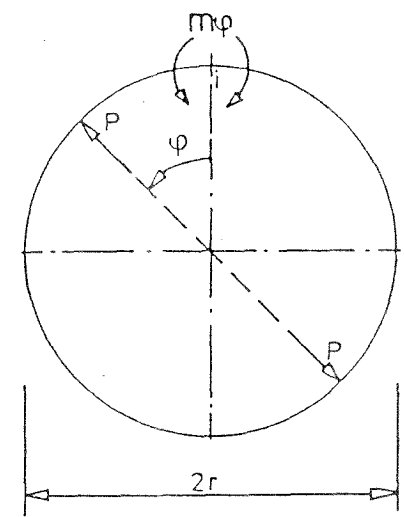
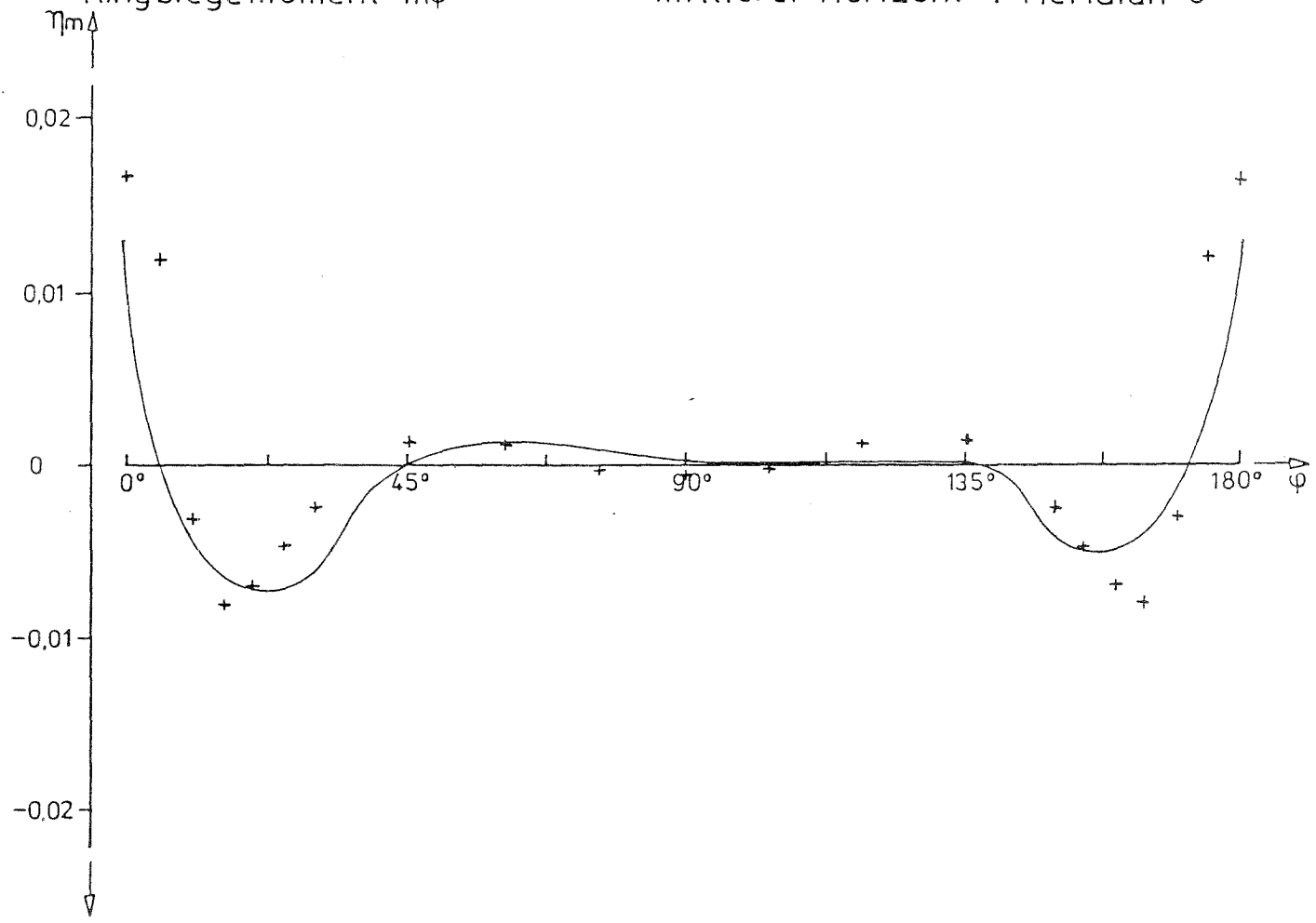
— experimentell  
 + FEM-Berechnung

A 4.49

Ringbiegemoment  $m_\varphi$

mittlerer Horizont . Meridian 8

$$\eta_m = \frac{m_\varphi}{P}$$



- experimentell
- + FEM-Berechnung

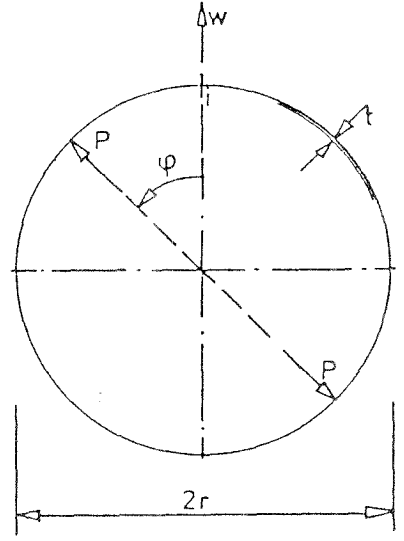
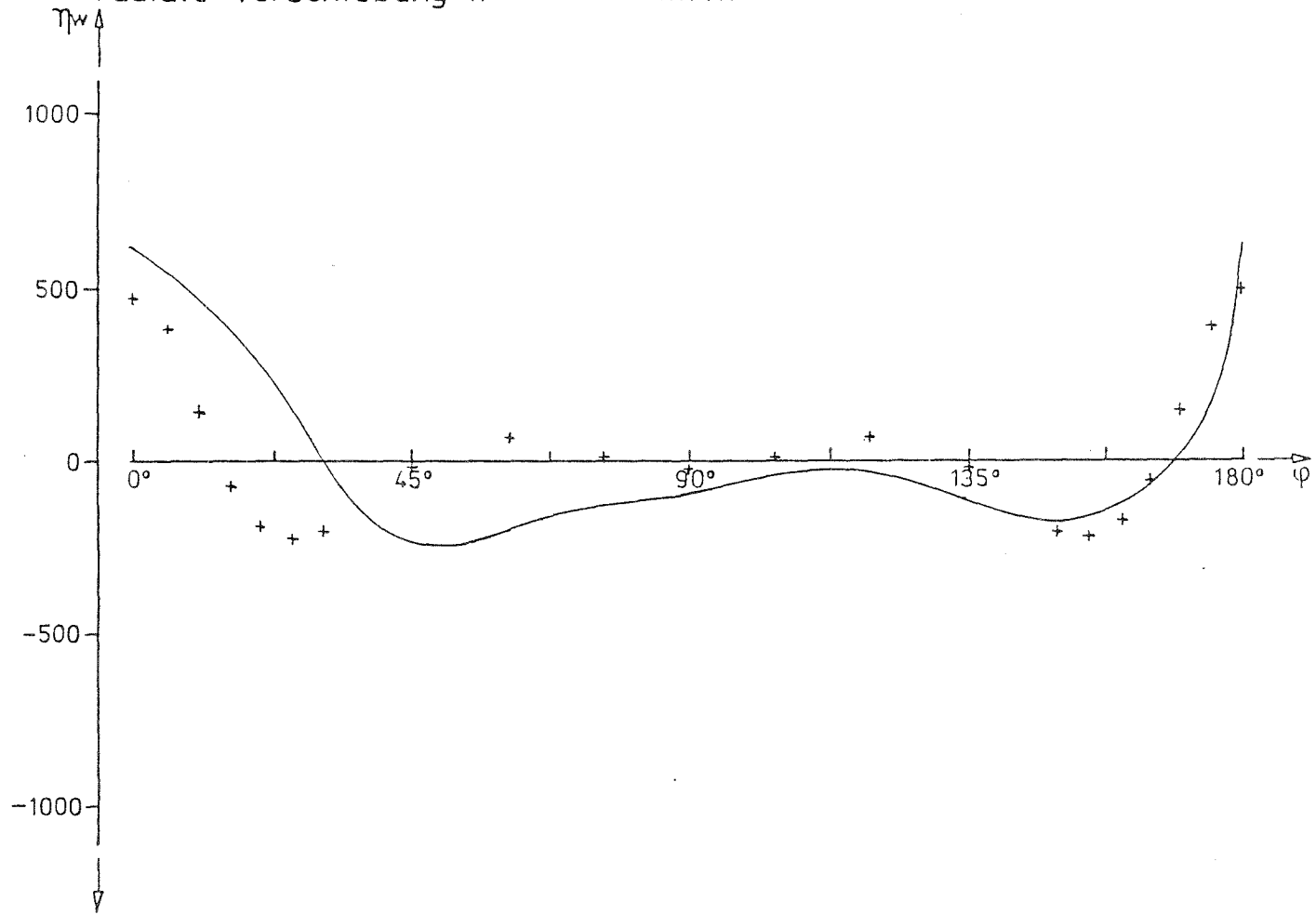
A 4.50



radiale Verschiebung w

mittlerer Horizont . Meridian 1

$$\eta_w = \frac{w \cdot E \cdot t}{P}$$



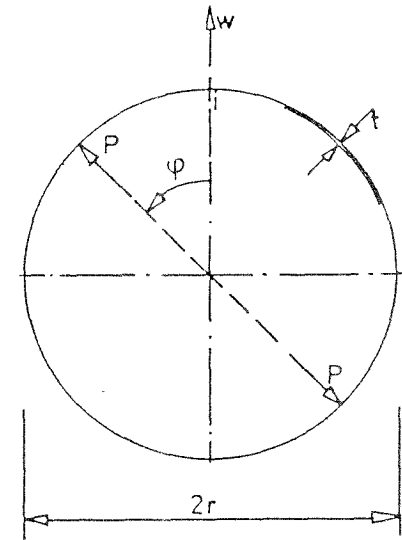
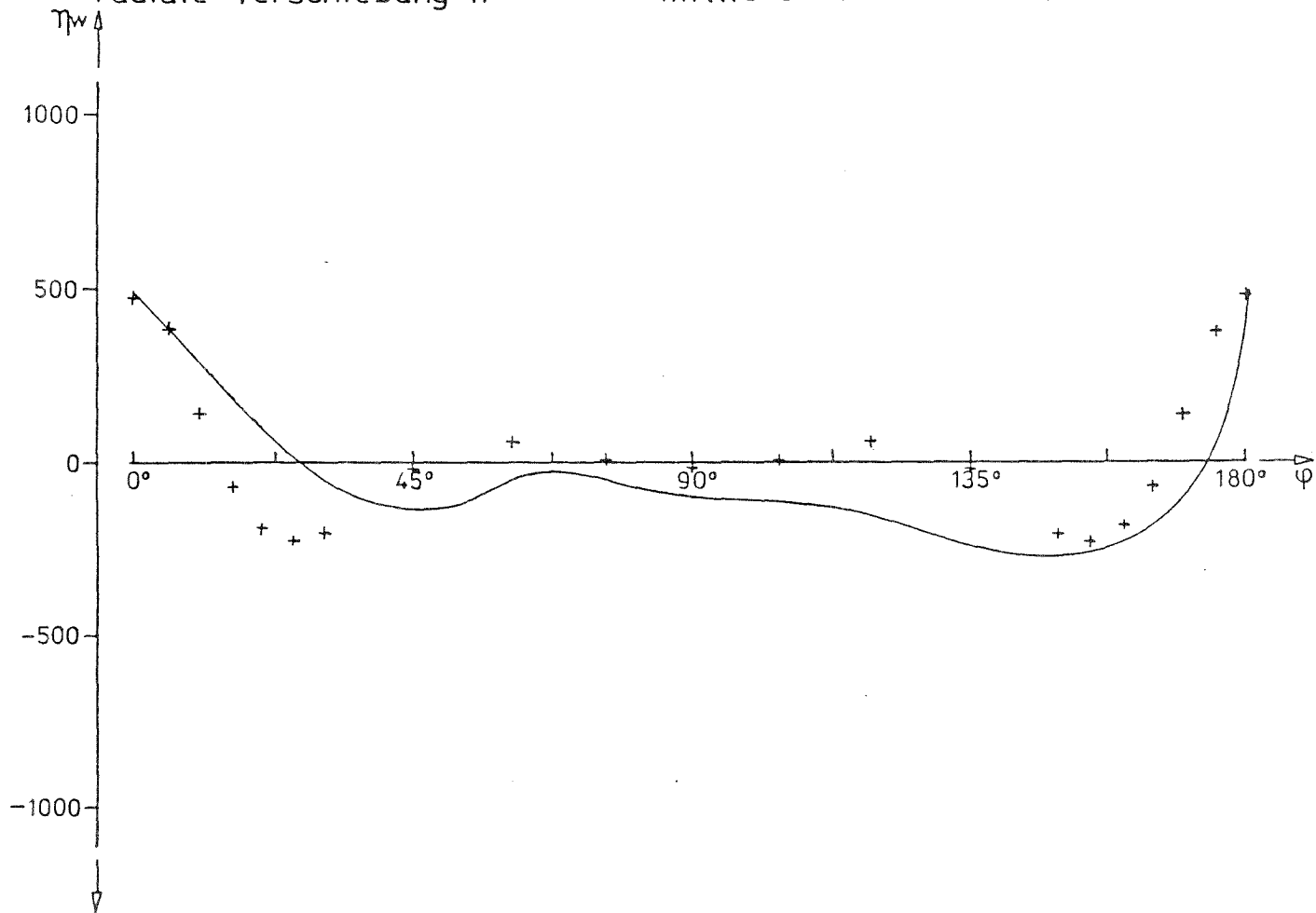
— experimentell  
+ FEM-Berechnung

A4,5A

radiale Verschiebung w

mittlerer Horizont . Meridian 2

$$\eta_w = \frac{w \cdot E \cdot t}{P}$$

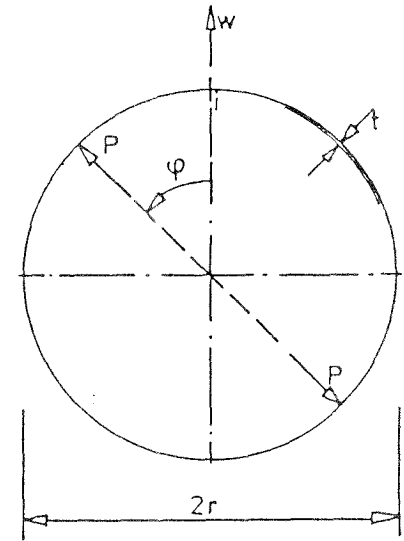
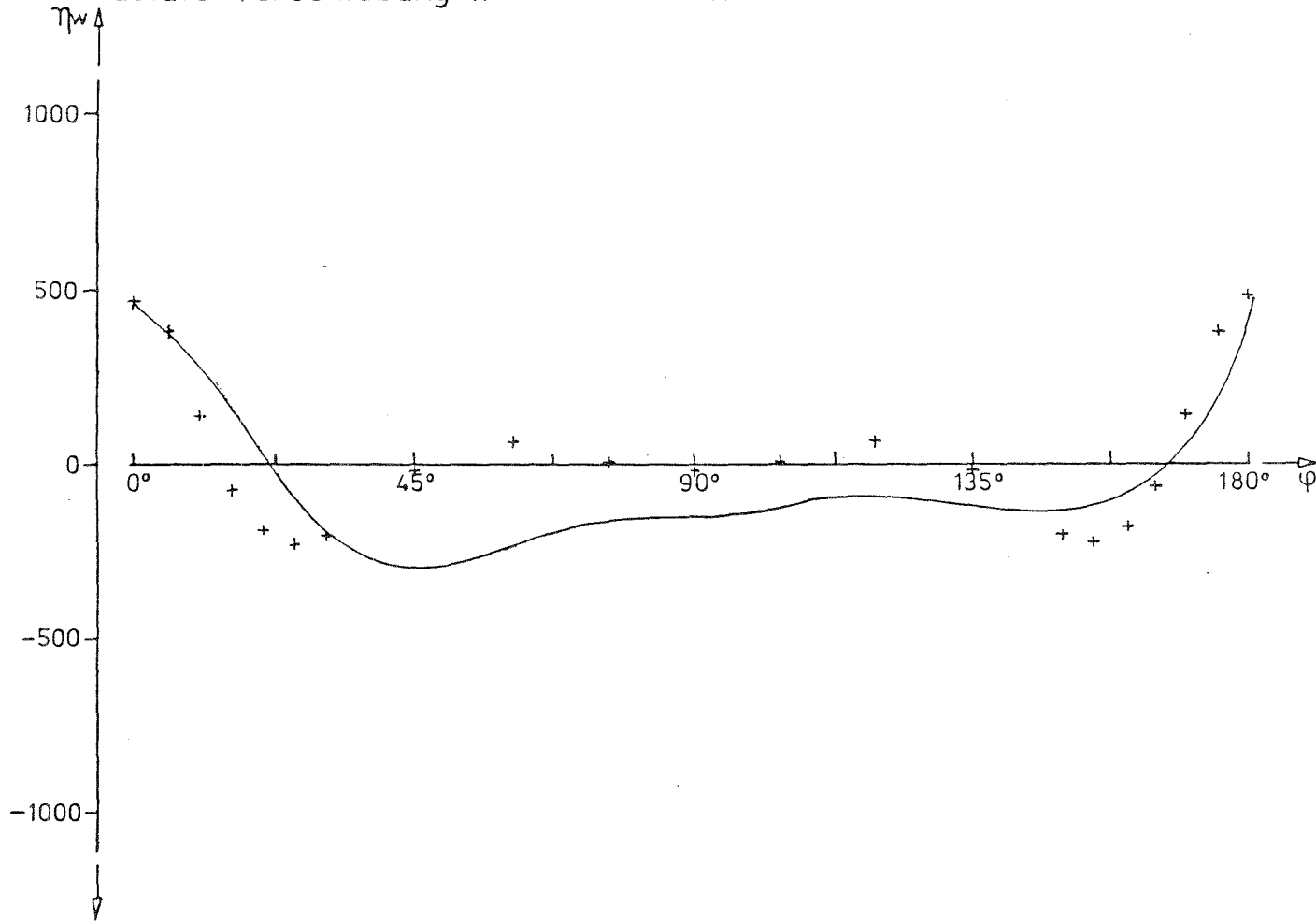


— experimentell  
+ FEM-Berechnung

radiale Verschiebung w

mittlerer Horizont . Meridian 3

$$\eta_w = \frac{w \cdot E \cdot t}{P}$$



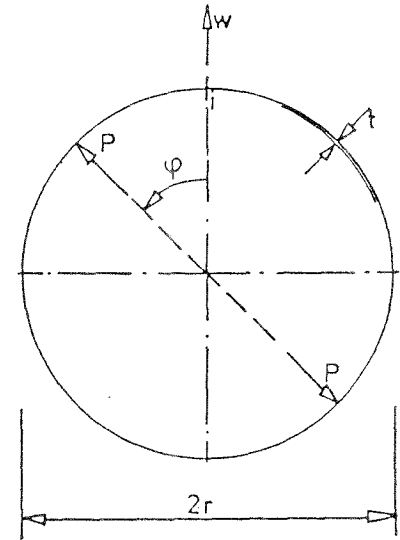
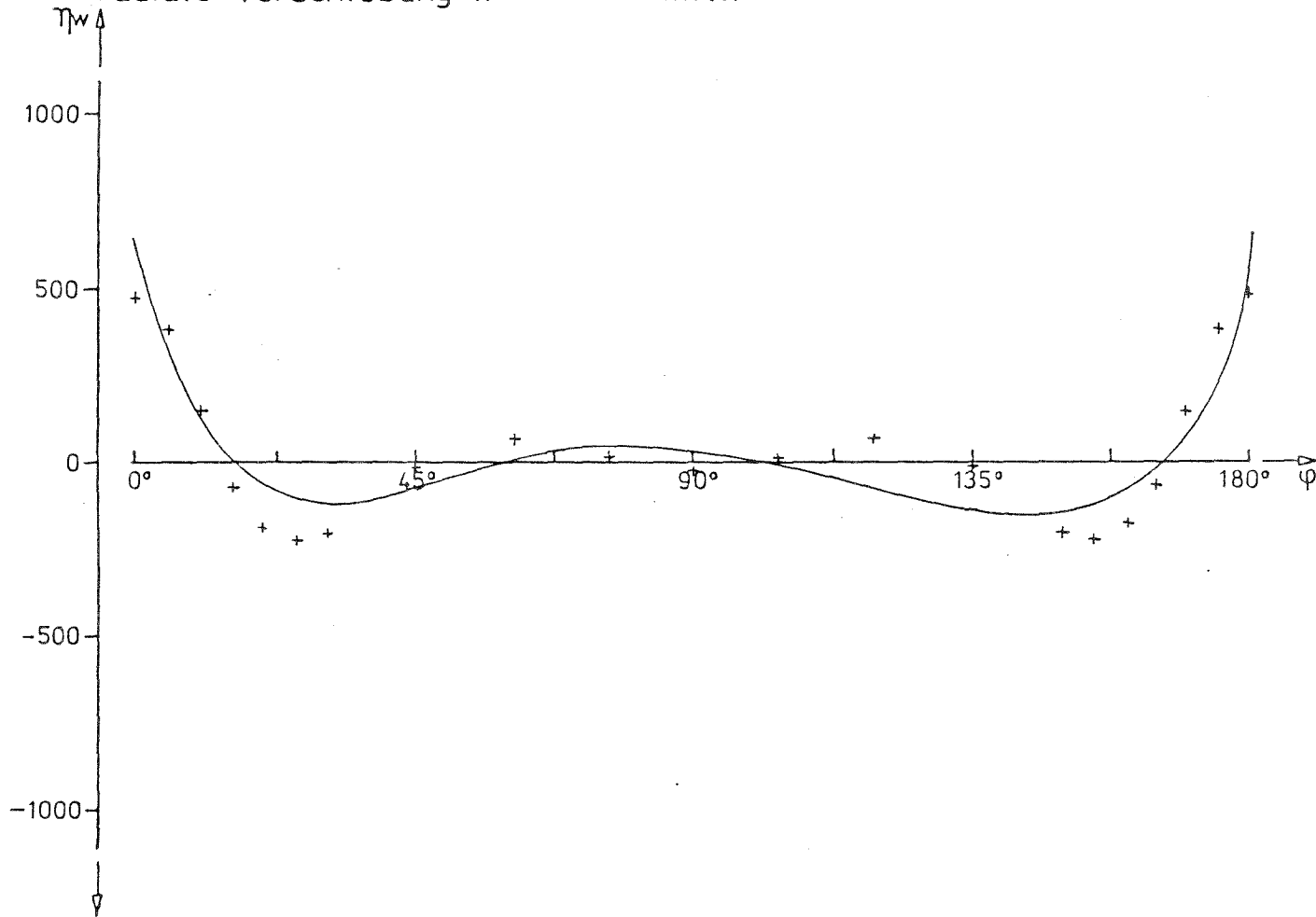
— experimentell  
+ FEM-Berechnung

A4S3

radiale Verschiebung  $w$

mittlerer Horizont . Meridian 4

$$\eta_w = \frac{w \cdot E \cdot t}{P}$$



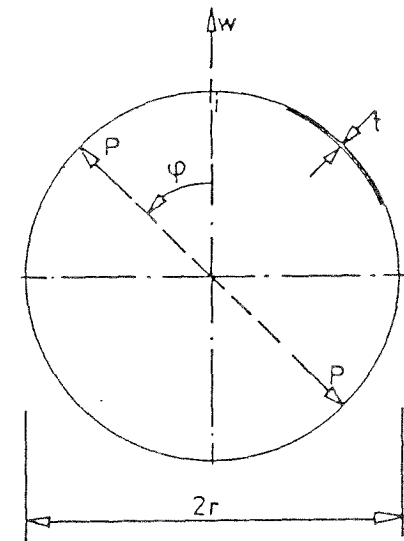
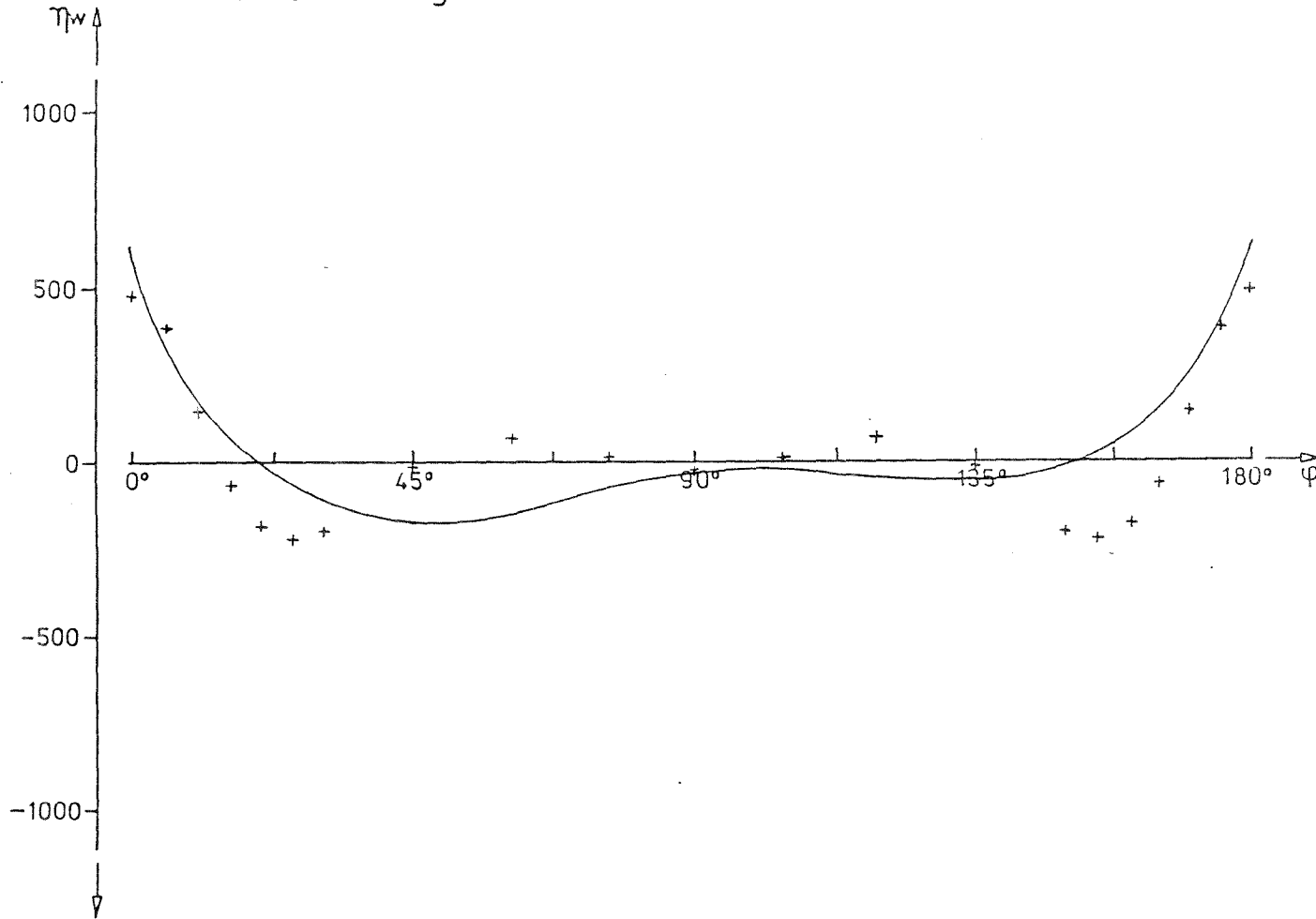
— experimentell  
+ FEM-Berechnung

R4.54

radiale Verschiebung w

mittlerer Horizont . Meridian 5

$$\eta_w = \frac{w \cdot E \cdot t}{P}$$



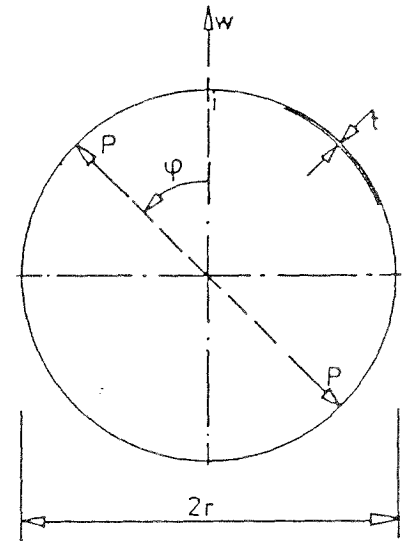
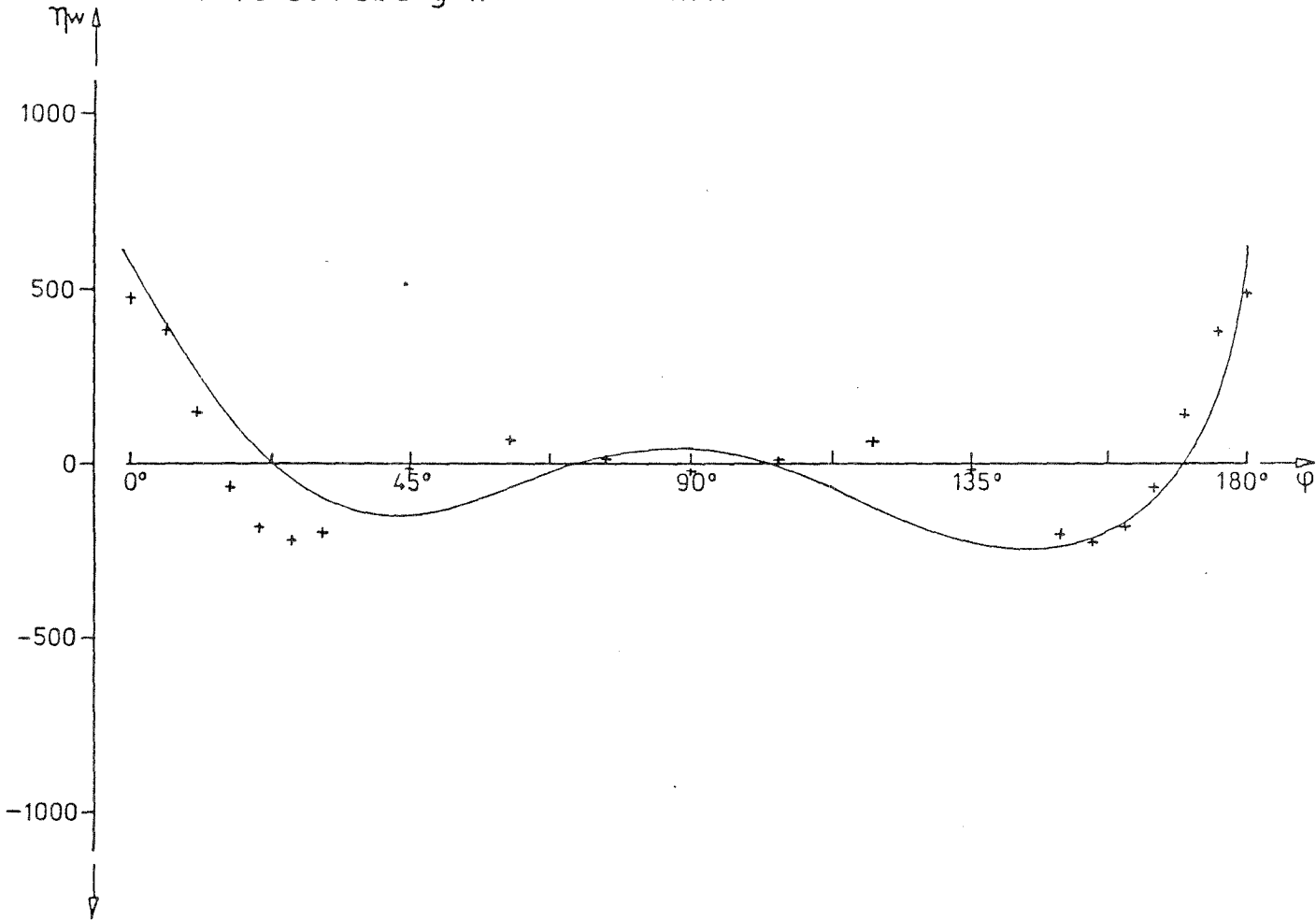
— experimentell  
+ FEM-Berechnung

A 4.55

radiale Verschiebung w

mittlerer Horizont . Meridian 6

$$\eta_w = \frac{w \cdot E \cdot t}{P}$$



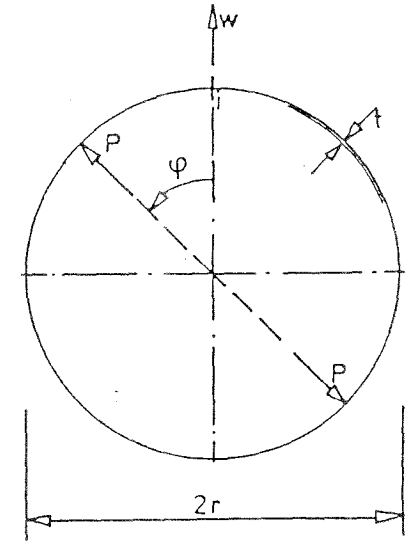
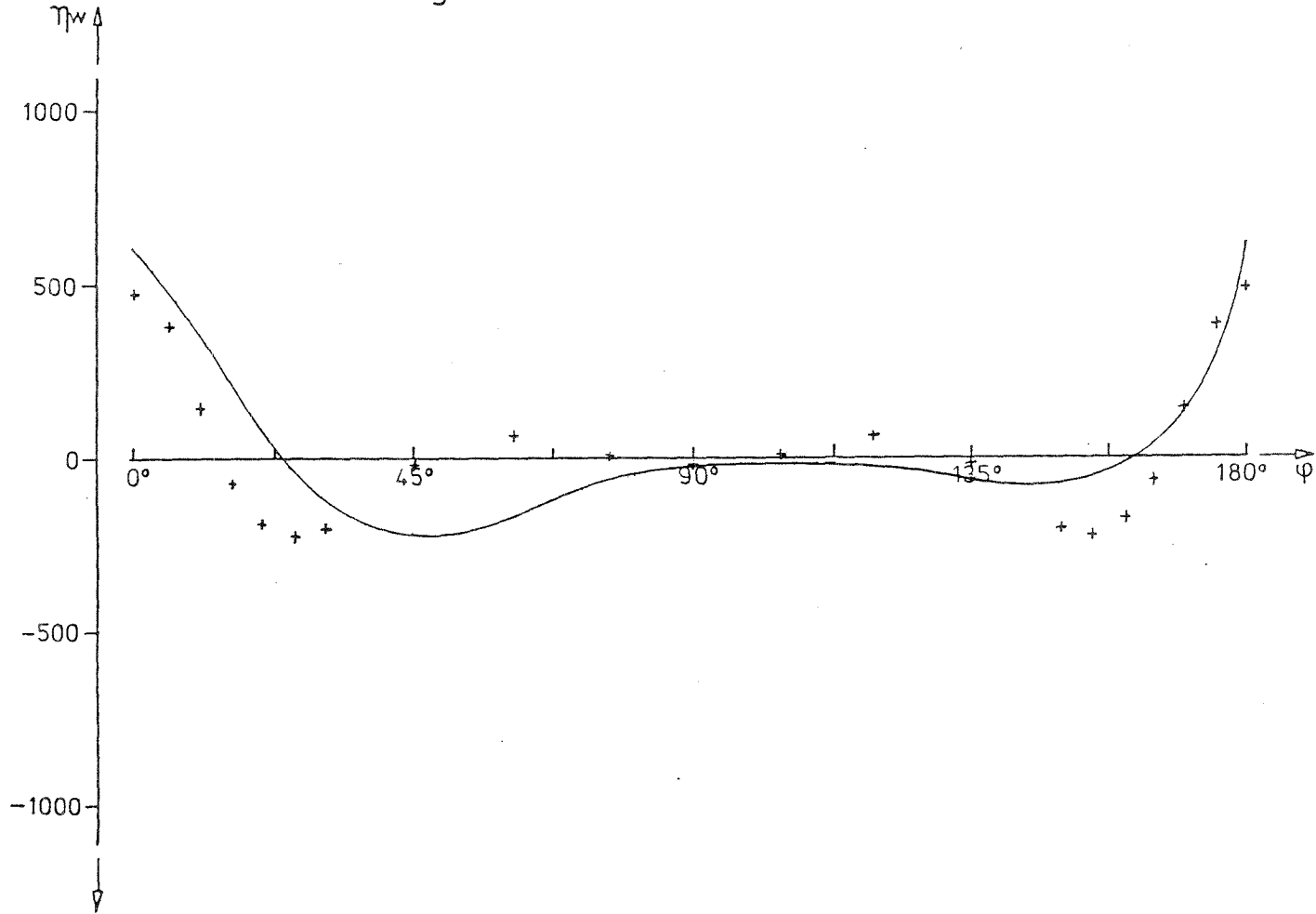
— experimentell  
+ FEM-Berechnung

A4.56

radiale Verschiebung  $w$

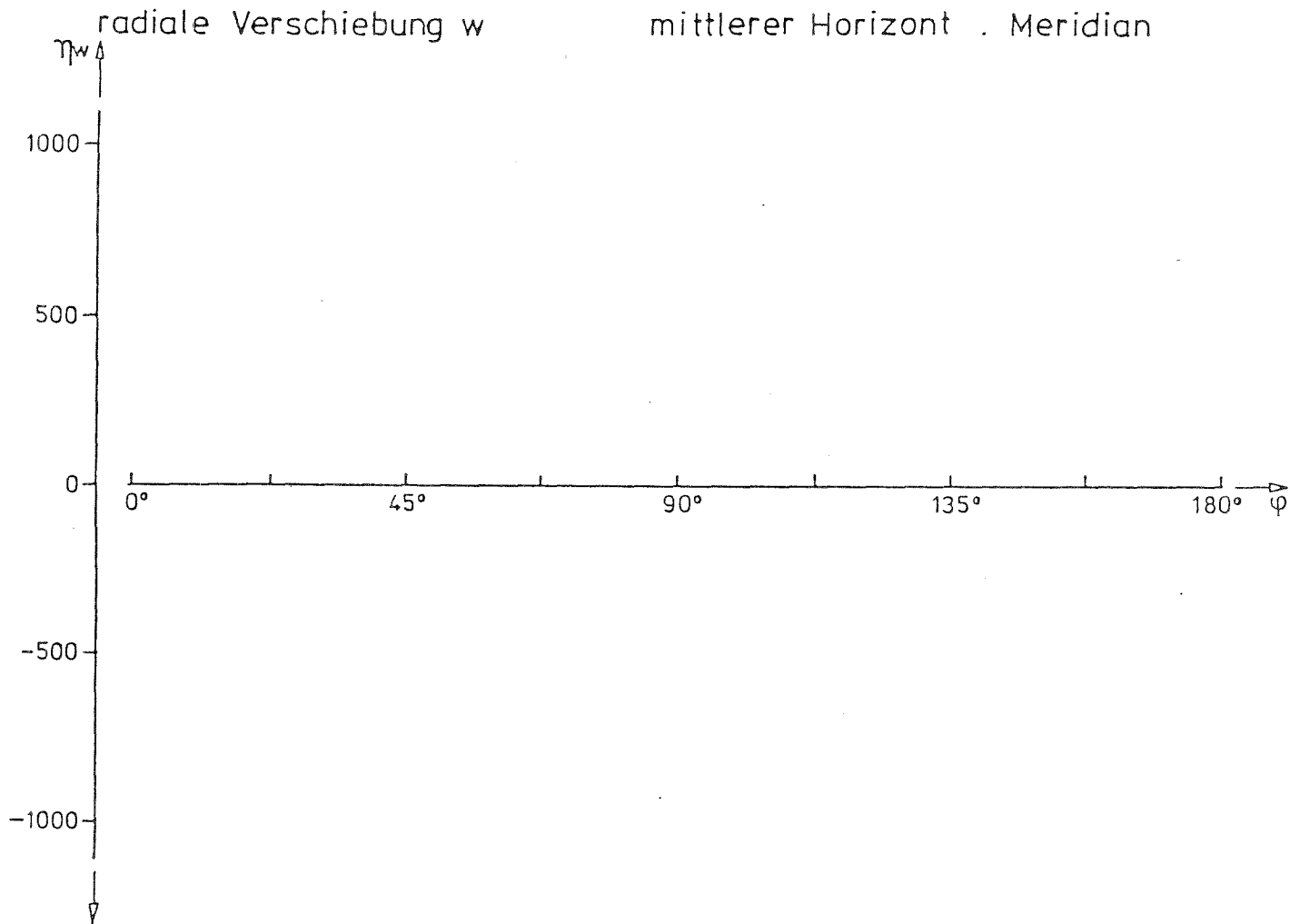
mittlerer Horizont . Meridian 7

$$\eta_w = \frac{w \cdot E \cdot t}{P}$$

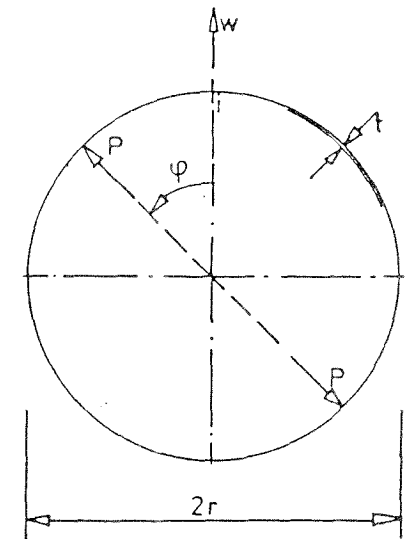


— experimentell  
+ FEM-Berechnung

A4.57



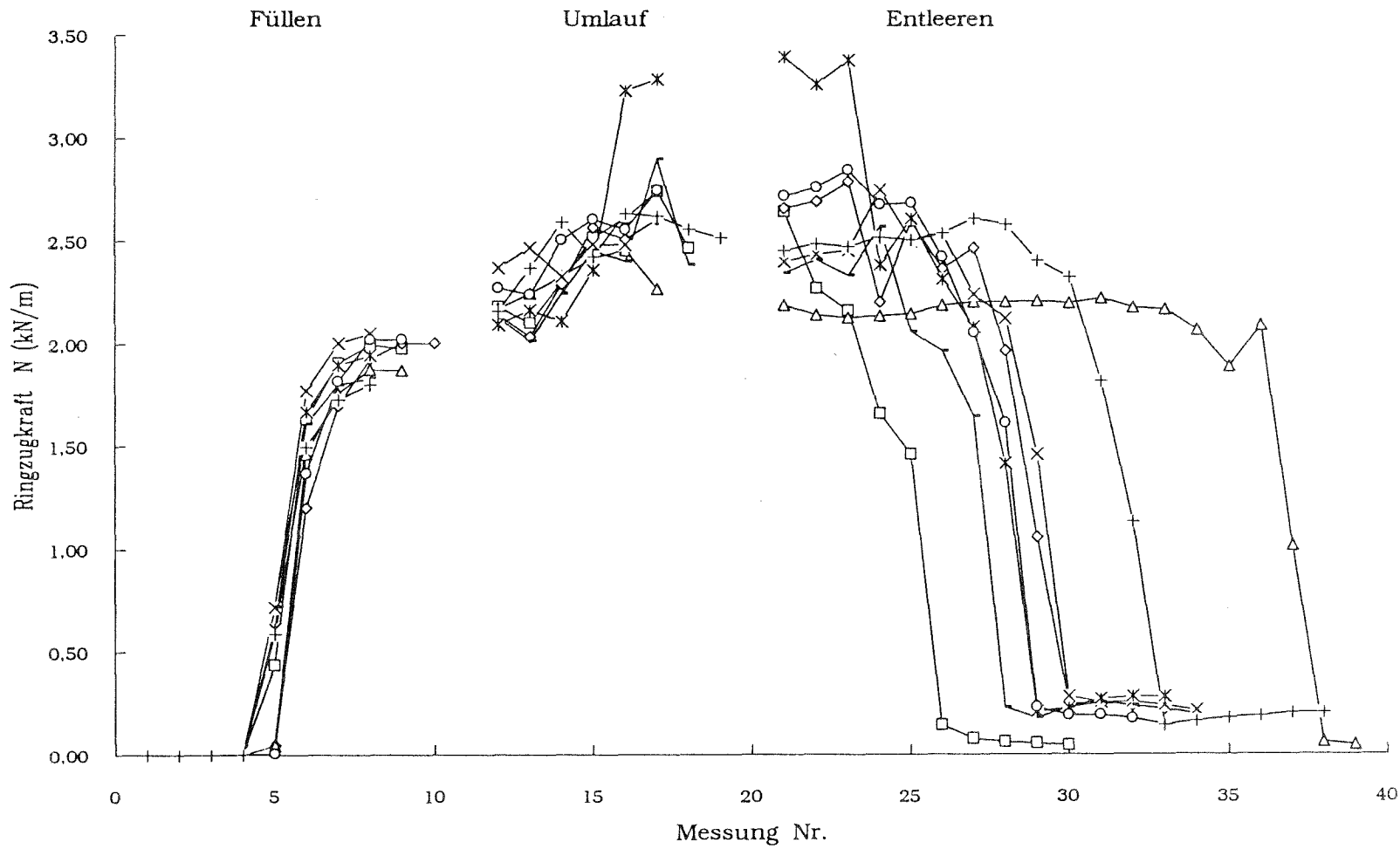
$$\eta_w = \frac{w \cdot E \cdot t}{P}$$



- experimentell
- $\Delta$  FEM-Berechnung
- $\odot$  HENNIG
- $\times$  BS 5500



Mittelwert aus den Versuchen M 1 - M 8 oberer Horizont

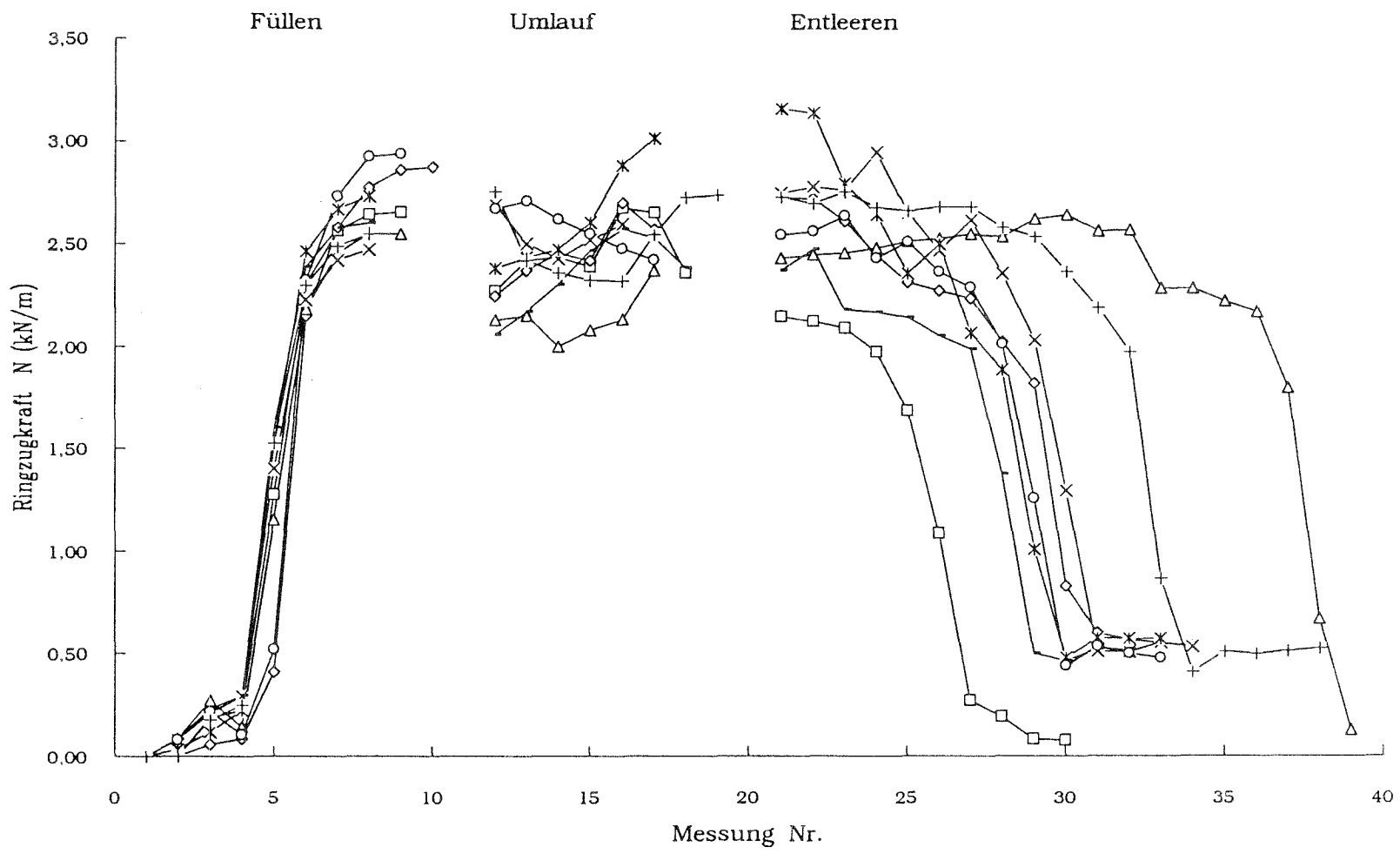


Versuch

□	M 1
◇	M 2
△	M 3
×	M 4
*	M 5
+	M 6
○	M 7
+	M 8

A 4,60

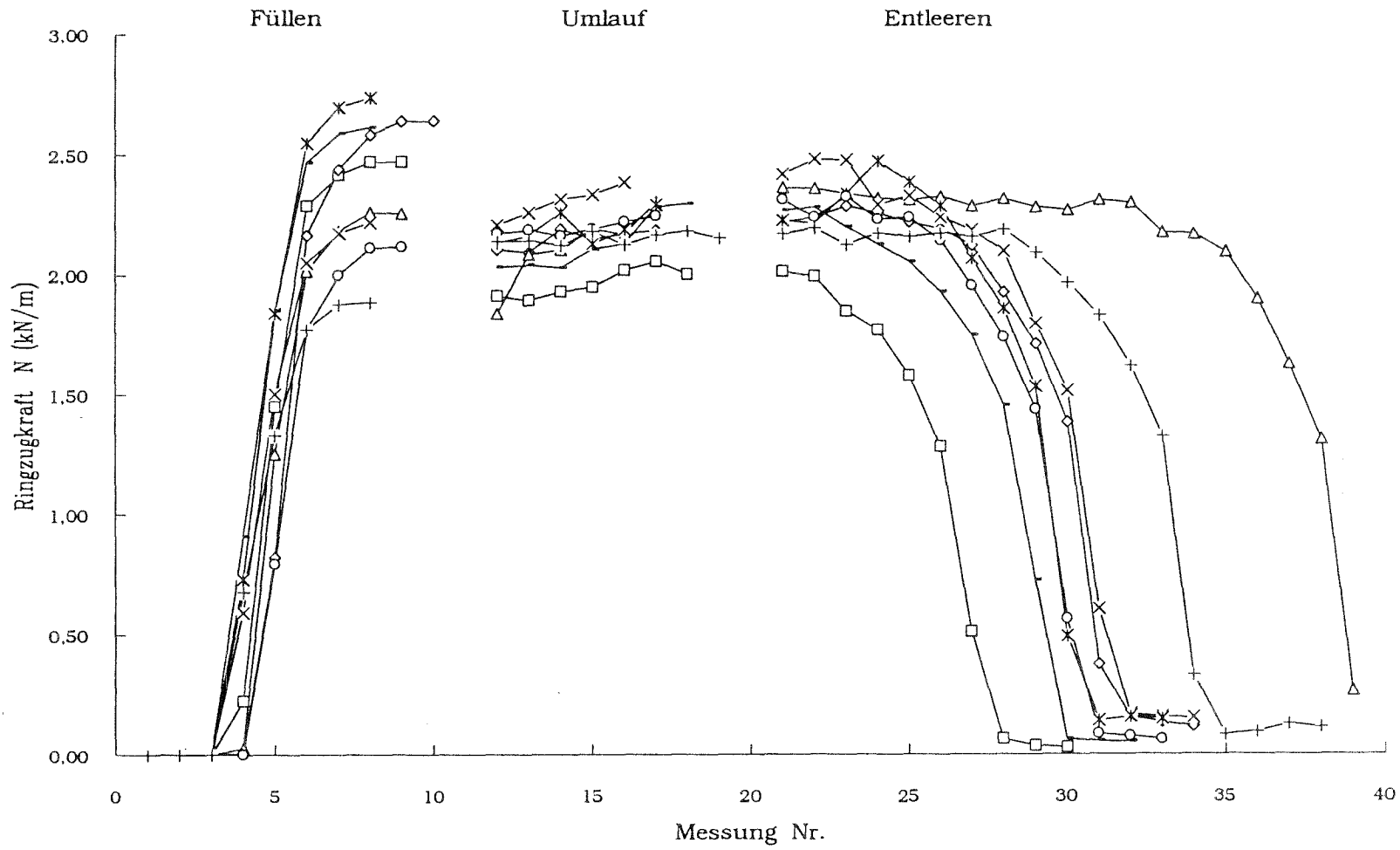
Mittelwert aus den Versuchen M 1 - M 8 mittlerer Horizont



- Versuch
- M 1
  - ◇— M 2
  - △— M 3
  - ×— M 4
  - \*— M 5
  - +— M 6
  - M 7
  - +— M 8

A 4,6 A

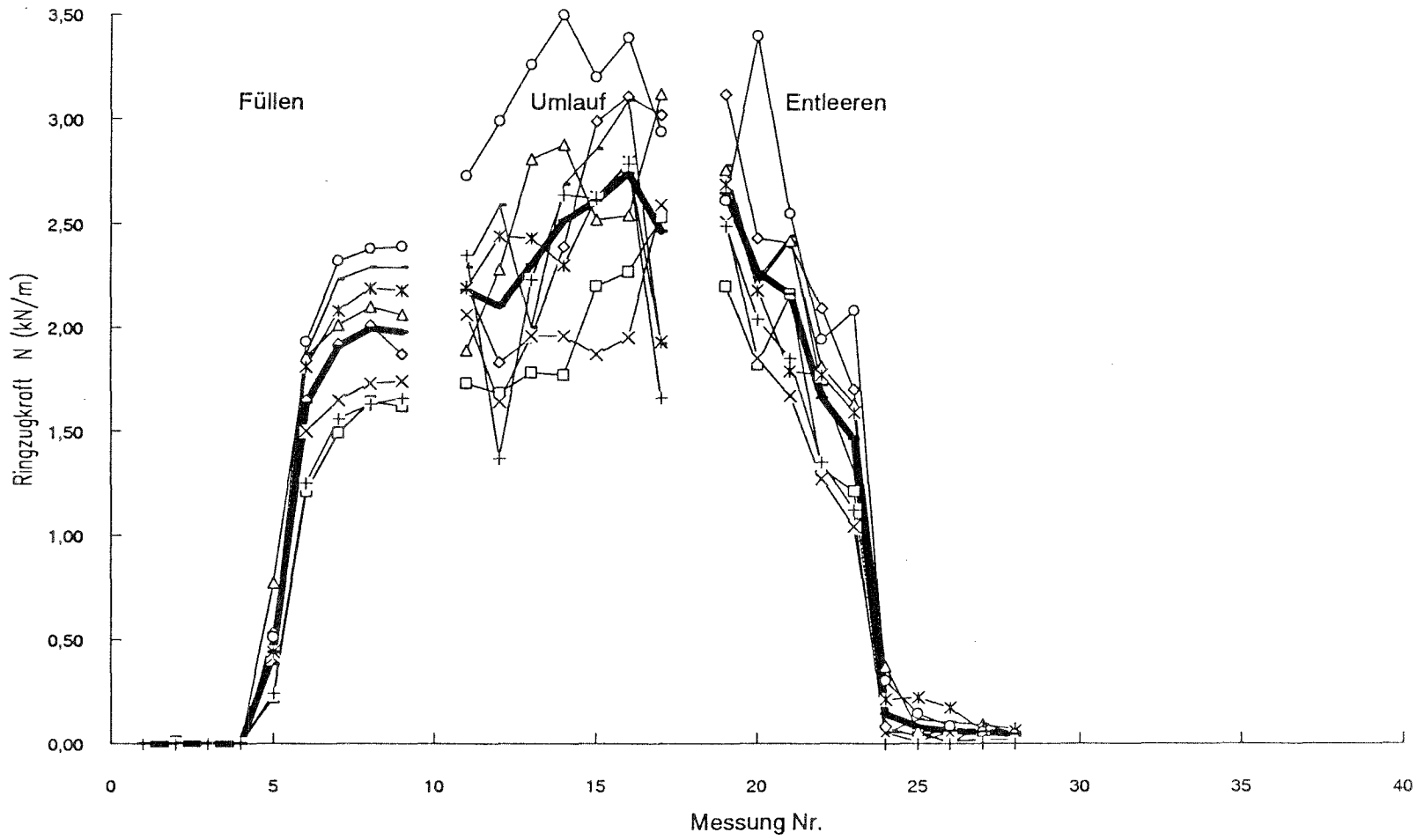
Mittelwert aus den Versuchen M 1 - M 8 unterer Horizont



- Versuch
- M 1
  - ◇— M 2
  - △— M 3
  - ×— M 4
  - \*— M 5
  - +— M 6
  - M 7
  - +— M 8

A4,62

Versuch M 1 oberer Horizont

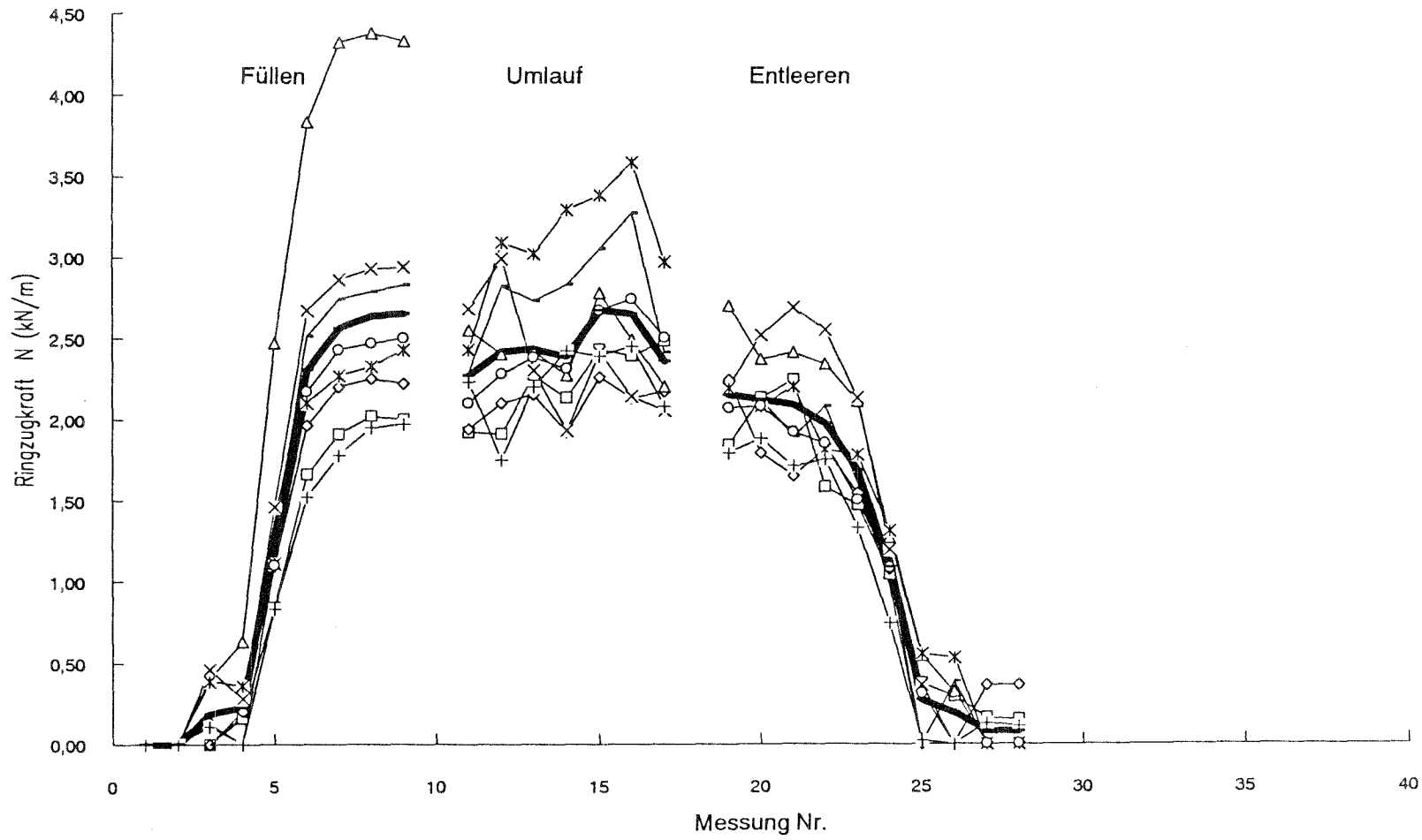


Meridian

- M1
- ◇ M2
- △ M3
- × M4
- \* M5
- M6
- M7
- + M8
- MW

PA 4.63

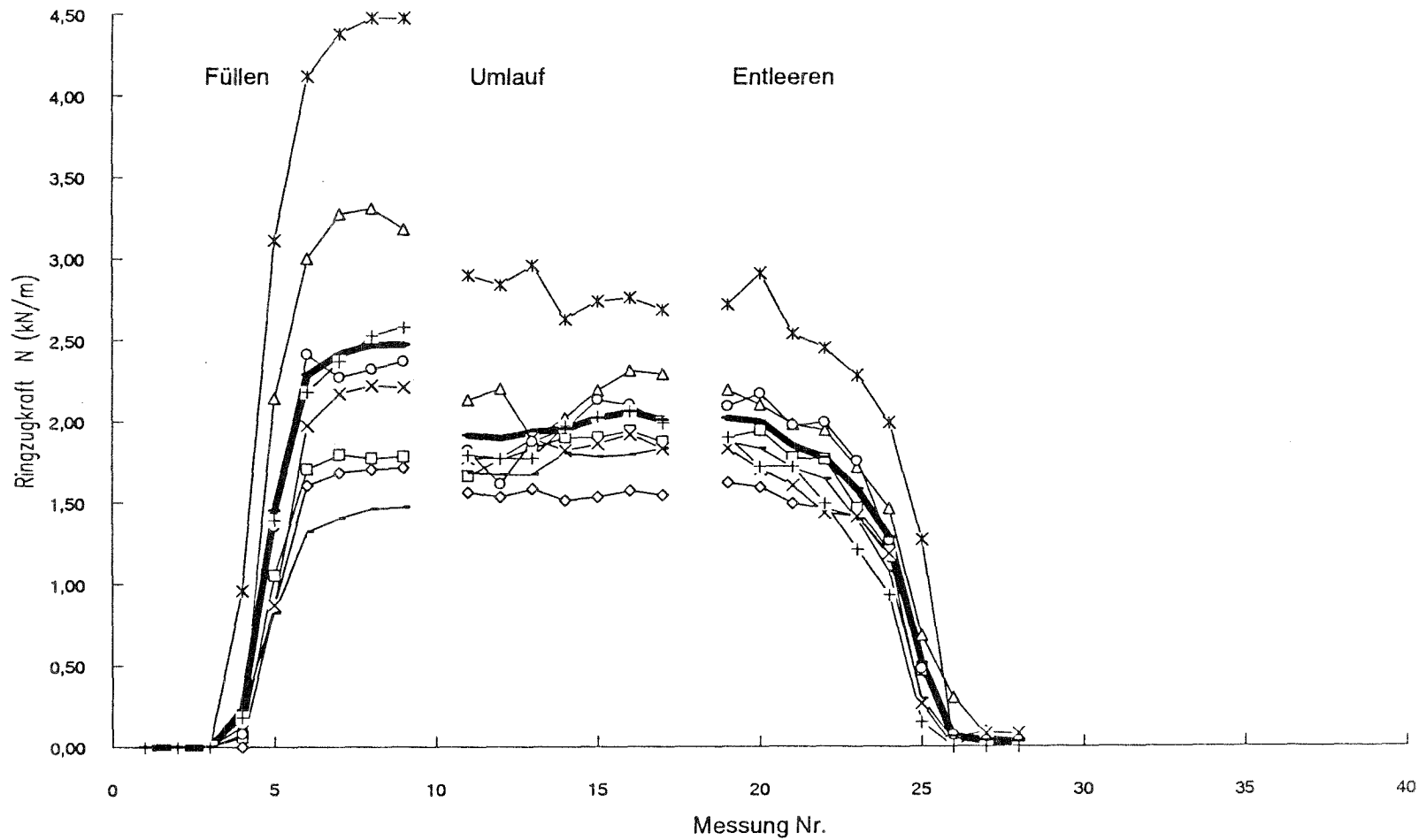
Versuch M 1 mittlerer Horizont



- Meridian
- M1
  - ◇— M2
  - △— M3
  - ×— M4
  - \*— M5
  - +— M6
  - M7
  - +— M8
  - MW

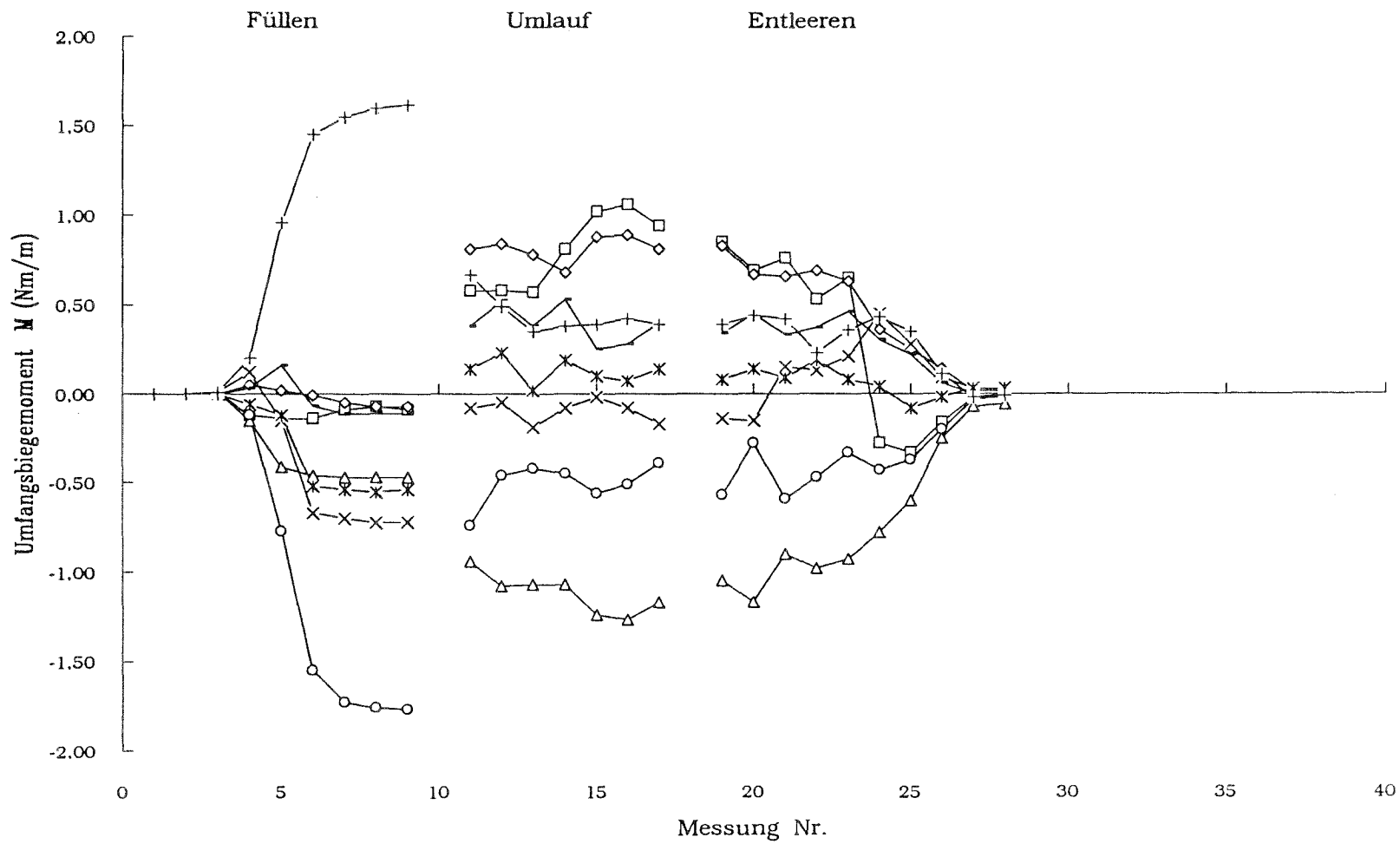
4464

Versuch M 1 unterer Horizont



A 4,65

**Versuch M 1 oberer Horizont**

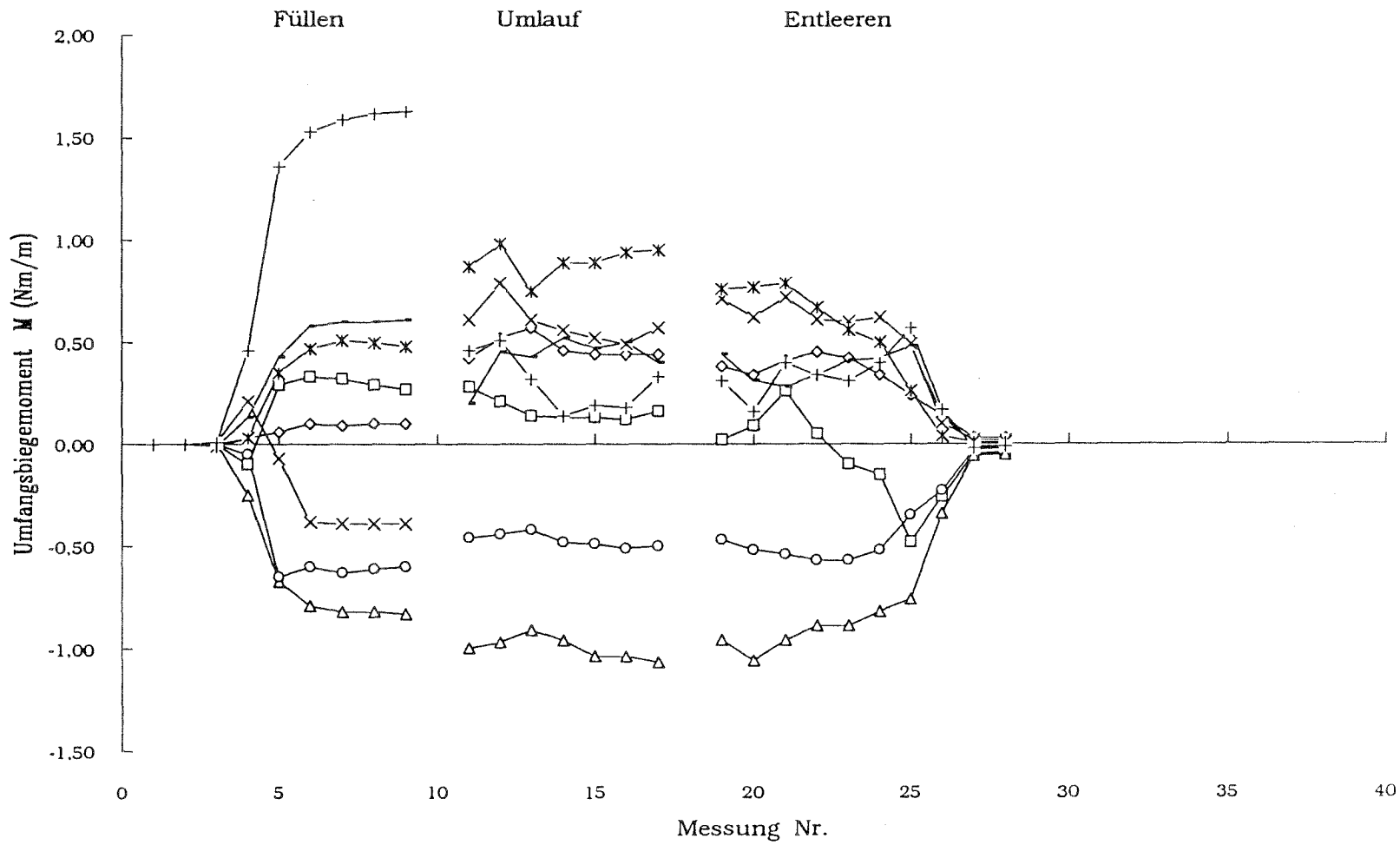


Meridian

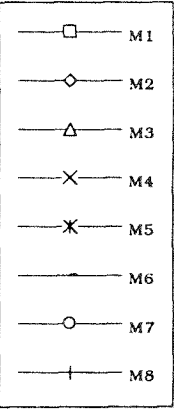
- M1
- ◇— M2
- △— M3
- ×— M4
- \*— M5
- +— M6
- M7
- |— M8

H. 4.66

# Versuch M 1 mittlerer Horizont



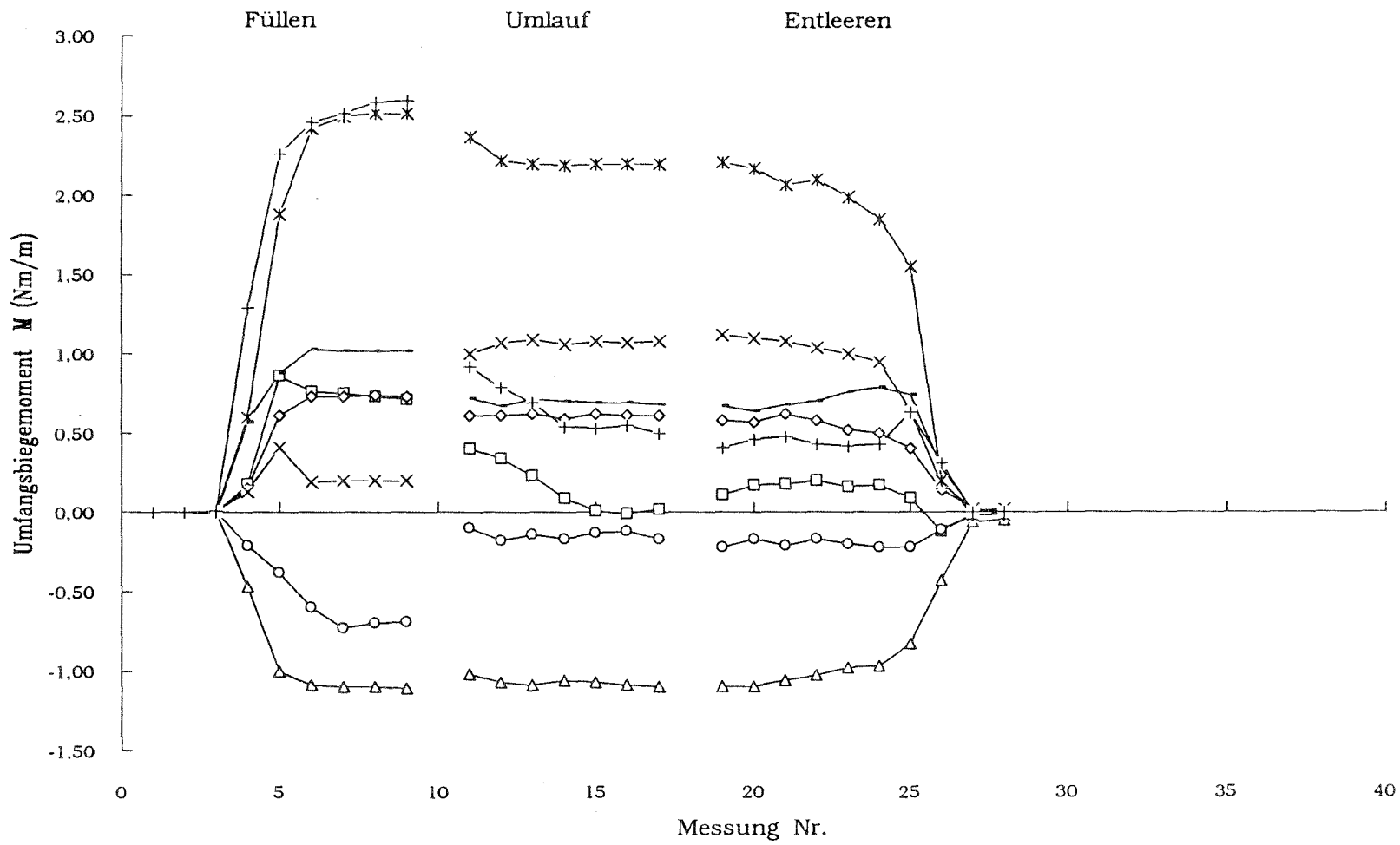
Meridian



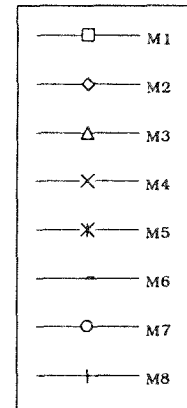
A4,67



### Versuch M 1 unterer Horizont

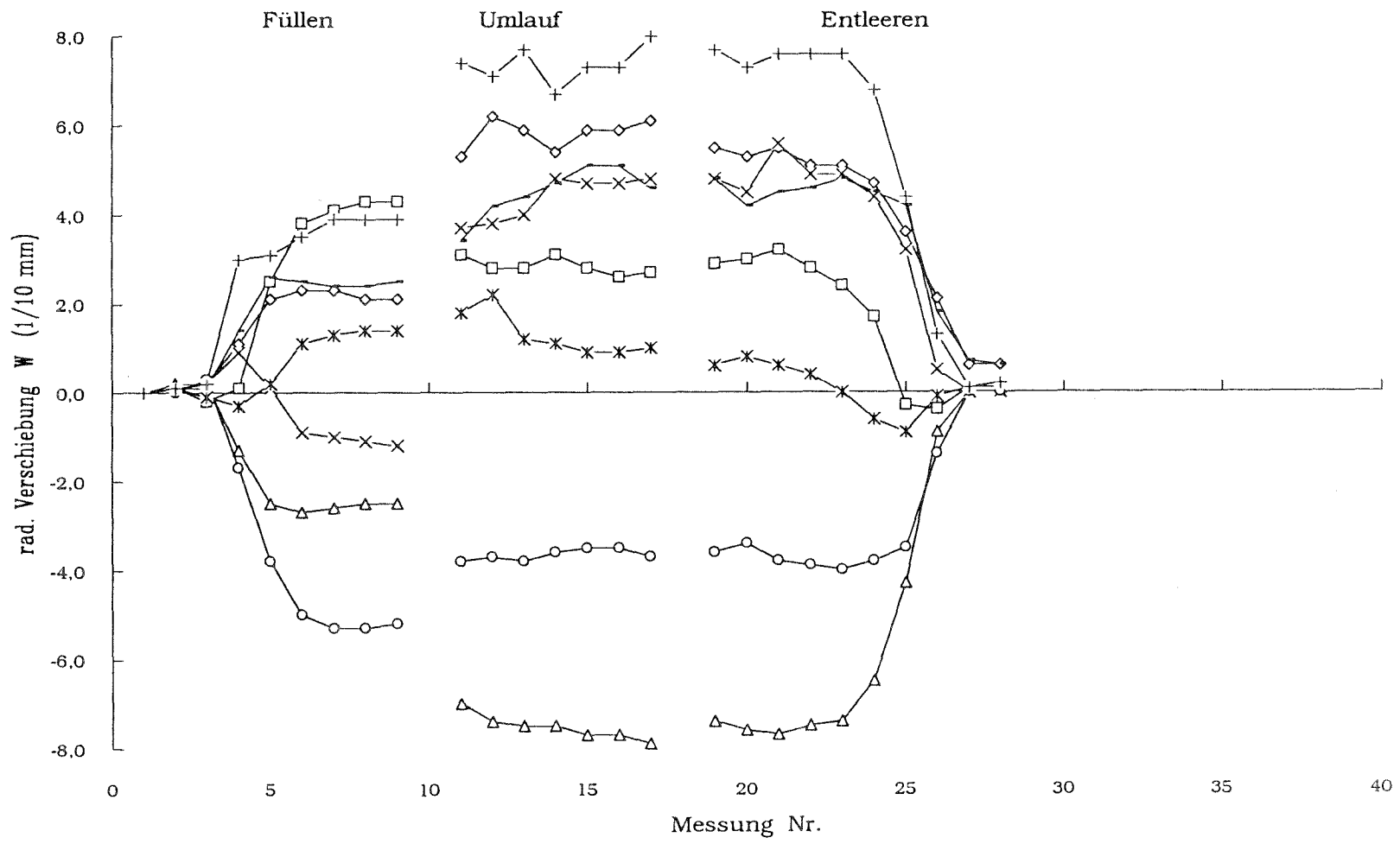


Meridian



A 4.68

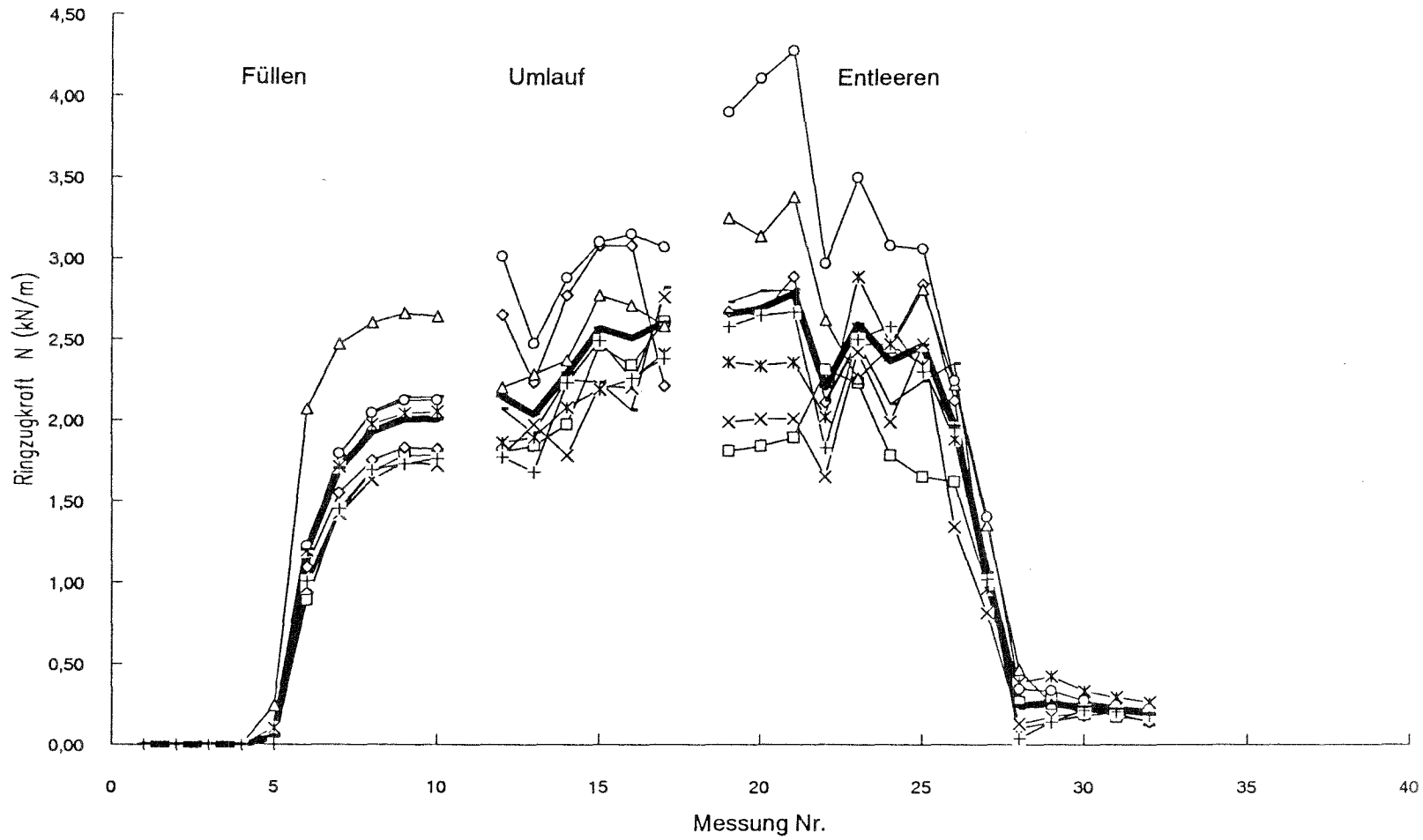
# Versuch M 1 mittlerer Horizont



- Meridian**
- M1
  - ◇— M2
  - △— M3
  - ×— M4
  - \*— M5
  - +— M6
  - M7
  - +— M8

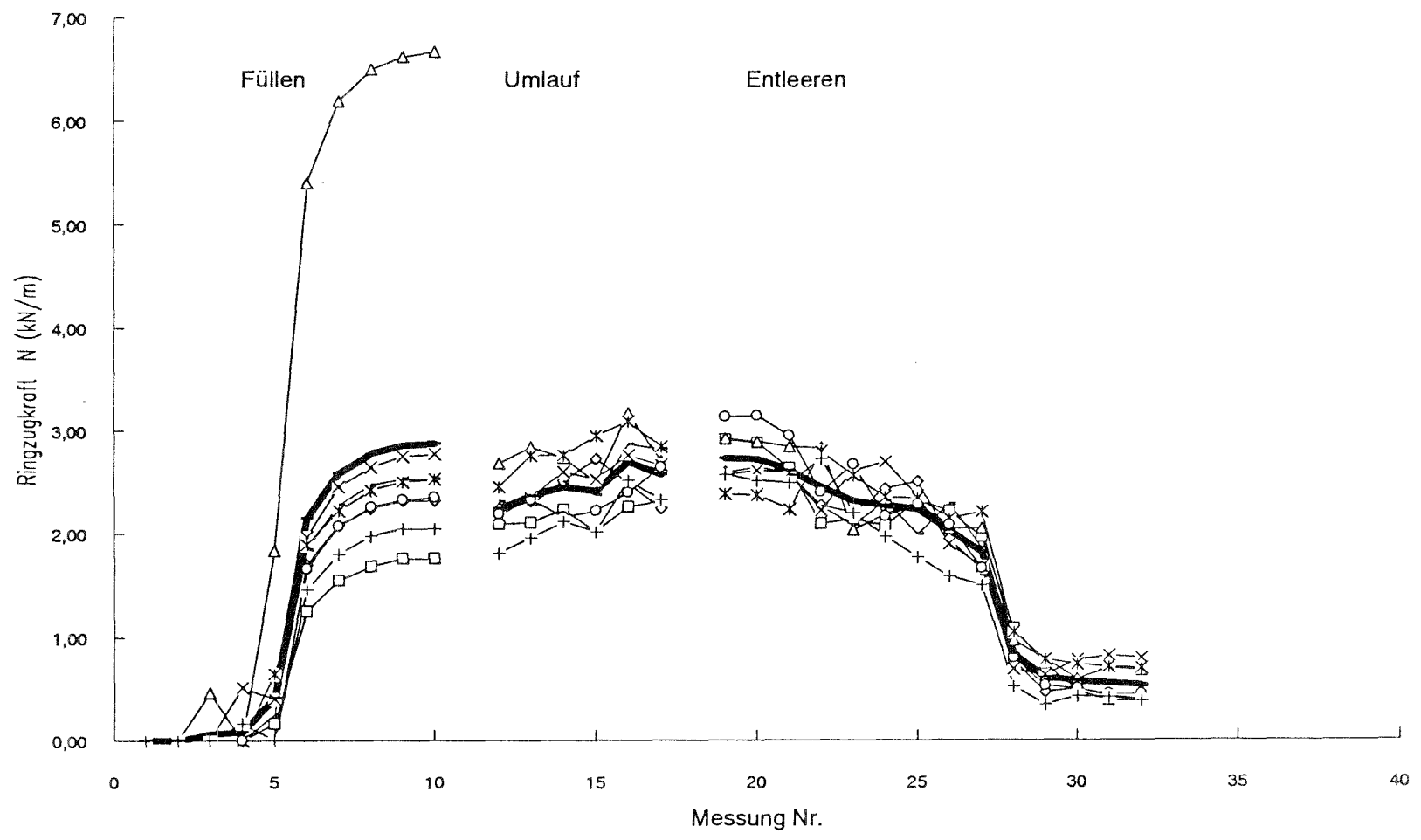
A 4,69

Versuch M 2 oberer Horizont



P 4.70

Versuch M 2 mittlerer Horizont

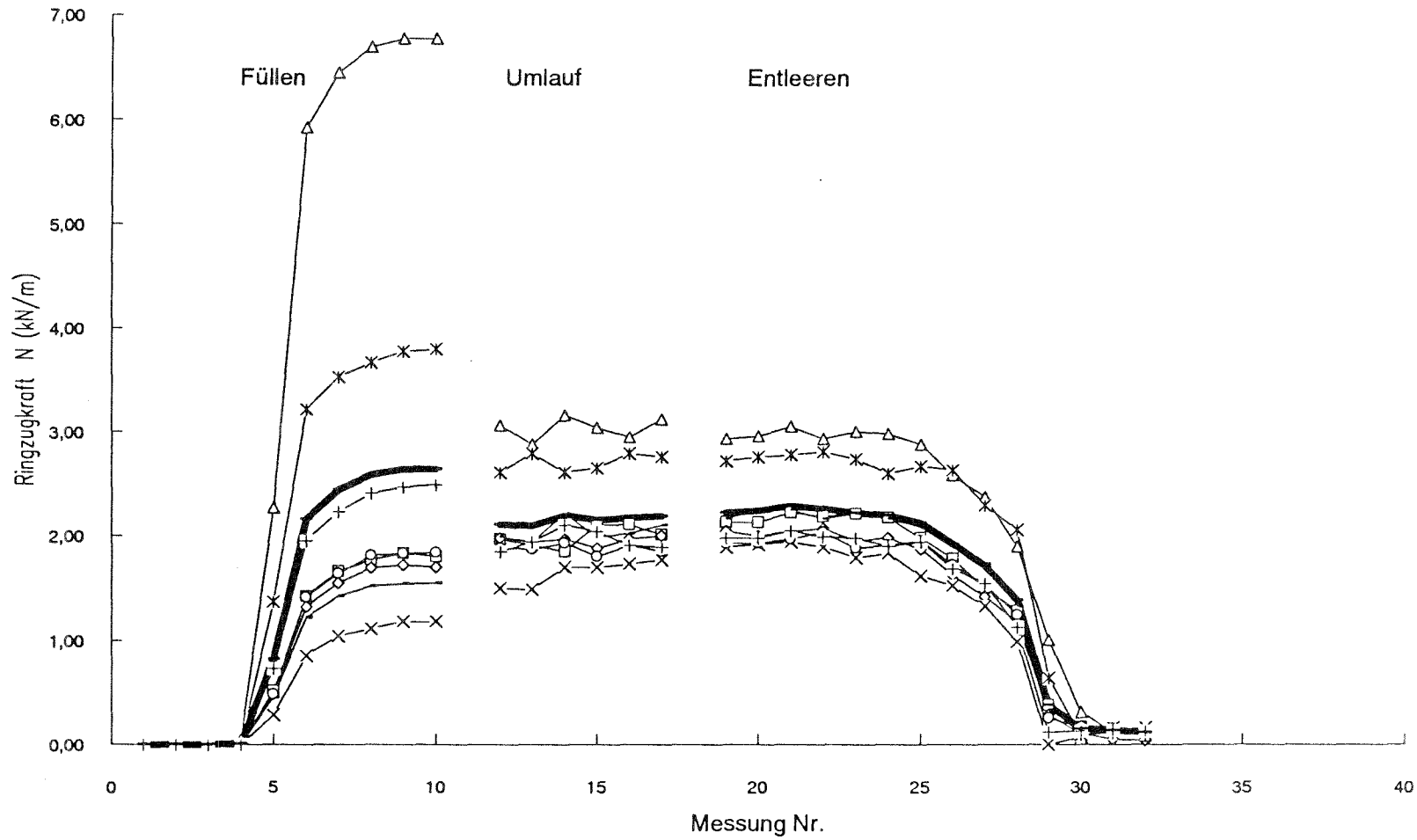


**Meridian**

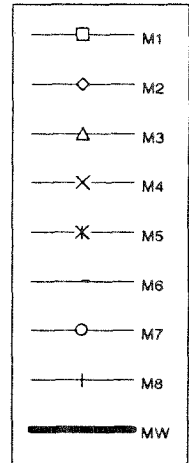
- M1
- ◇— M2
- △— M3
- ×— M4
- \*— M5
- +— M6
- M7
- +— M8
- MW (thick line)

R 4.7A

### Versuch M 2 unterer Horizont

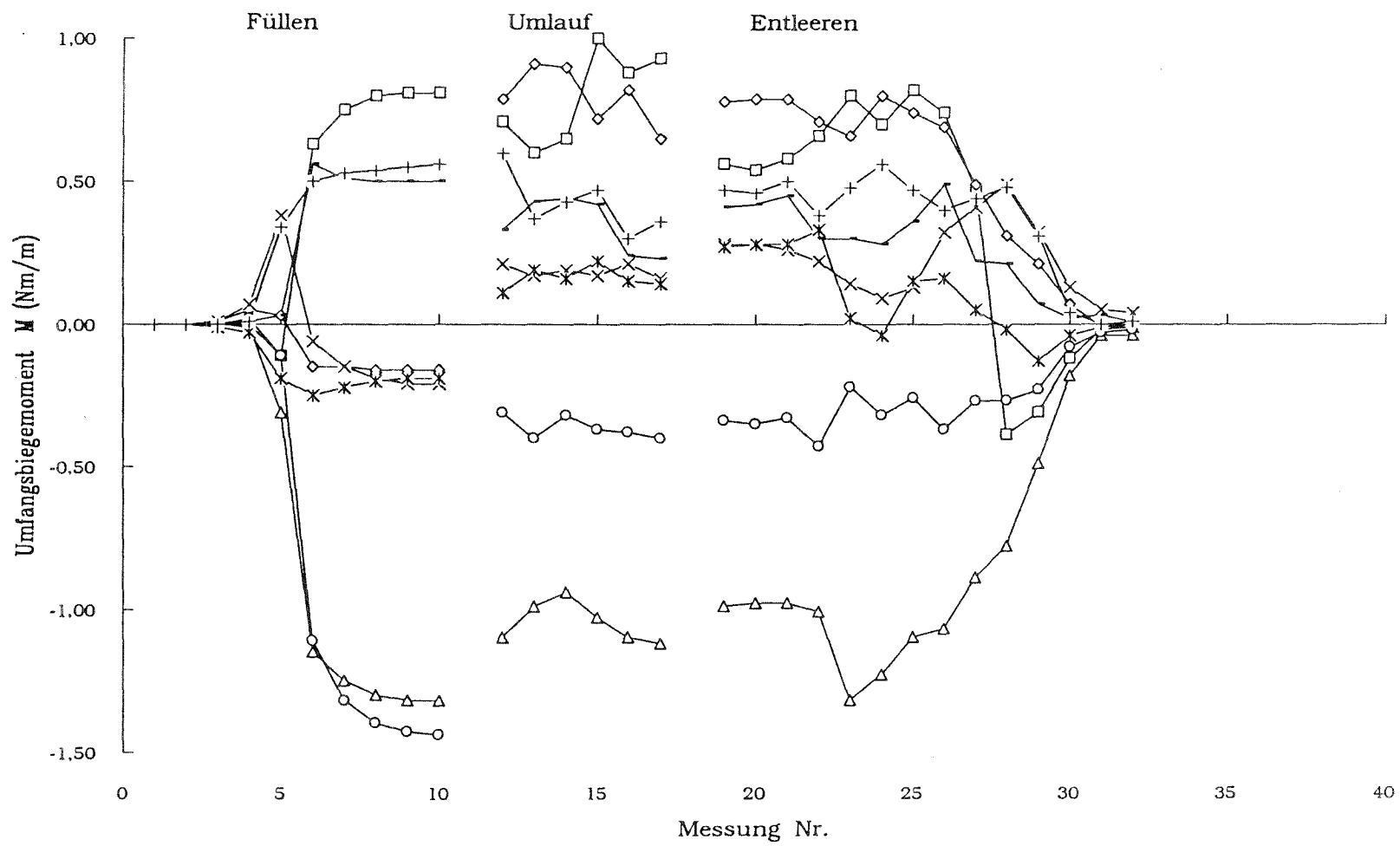


Meridian



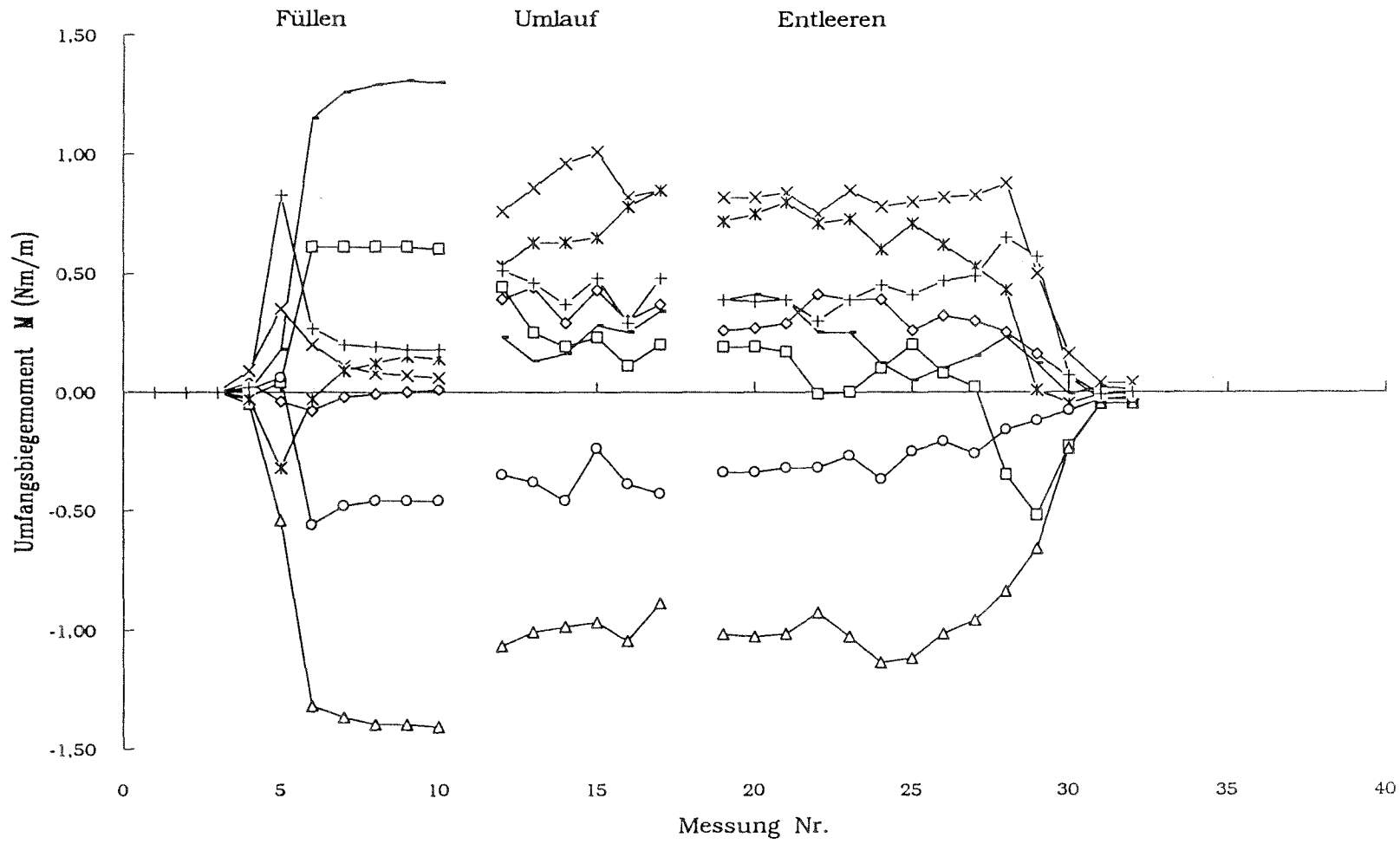
R472

**Versuch M 2 oberer Horizont**



A 4.73

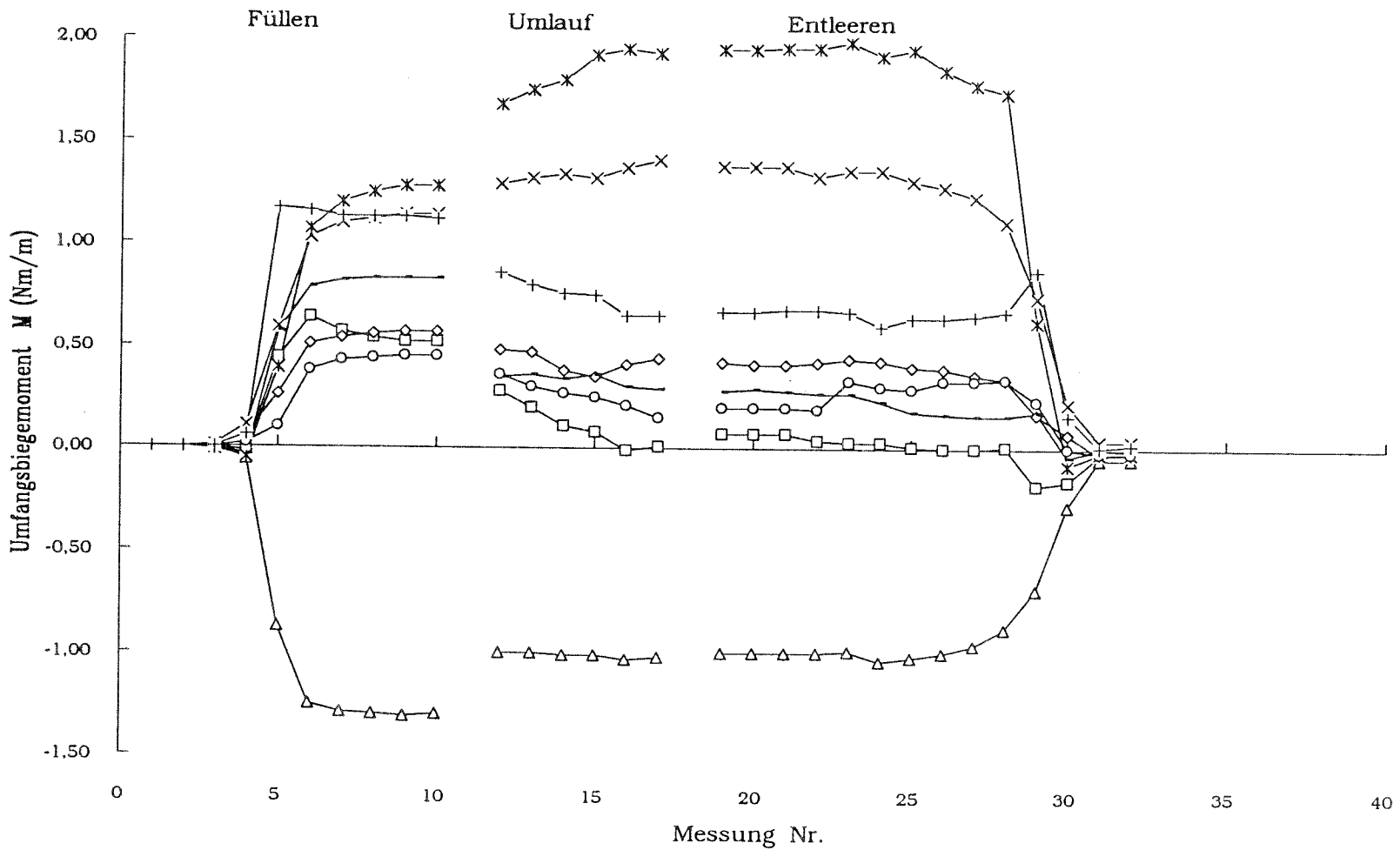
# Versuch M 2 mittlerer Horizont



- Meridian**
- M1
  - ◇— M2
  - △— M3
  - ×— M4
  - \*— M5
  - +— M6
  - M7
  - +— M8

A 4.7.74

# Versuch M 2 unterer Horizont



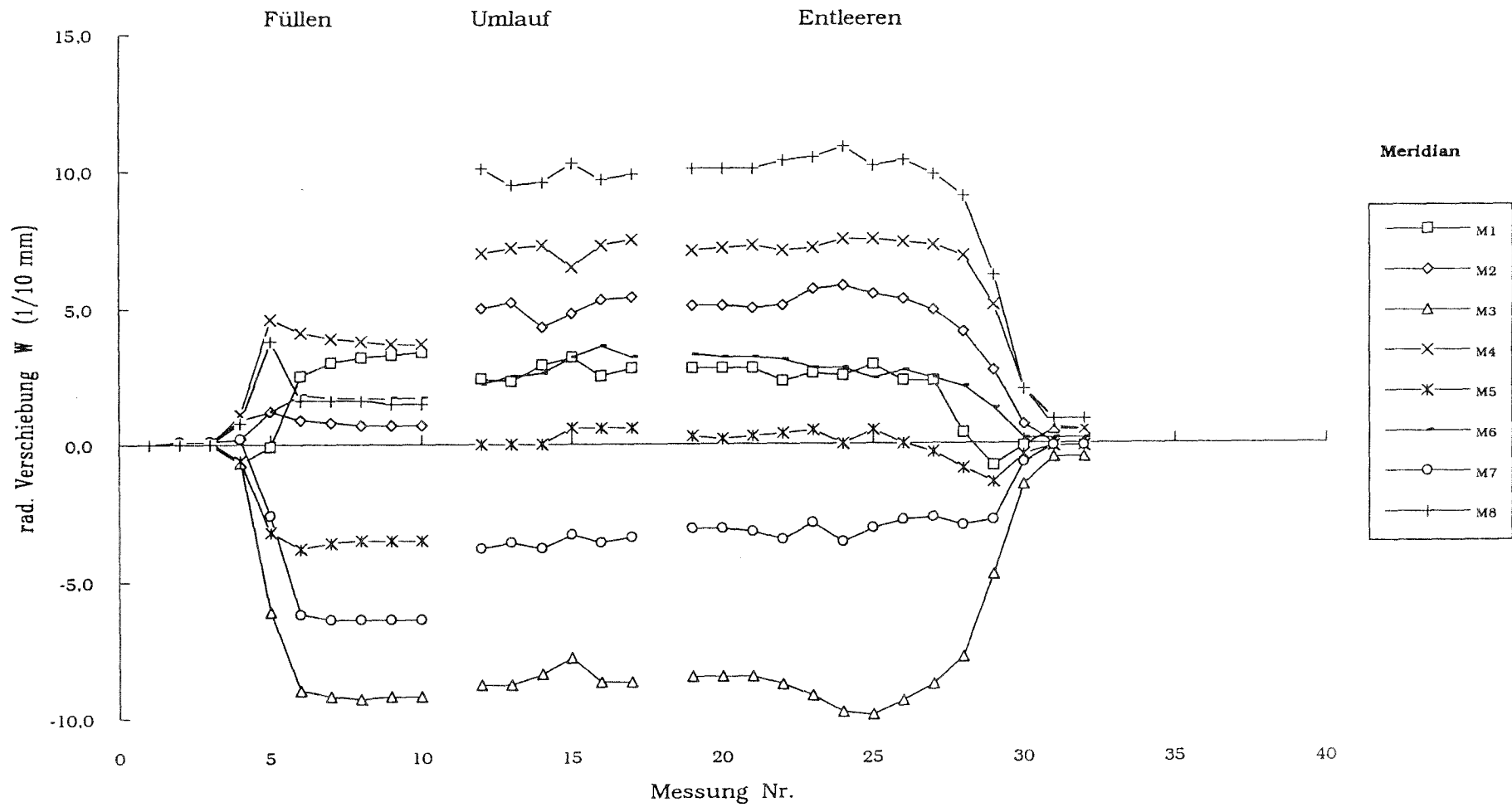
Meridian

- M1
- ◇— M2
- △— M3
- ×— M4
- \*— M5
- +— M6
- M7
- |— M8

A4.75

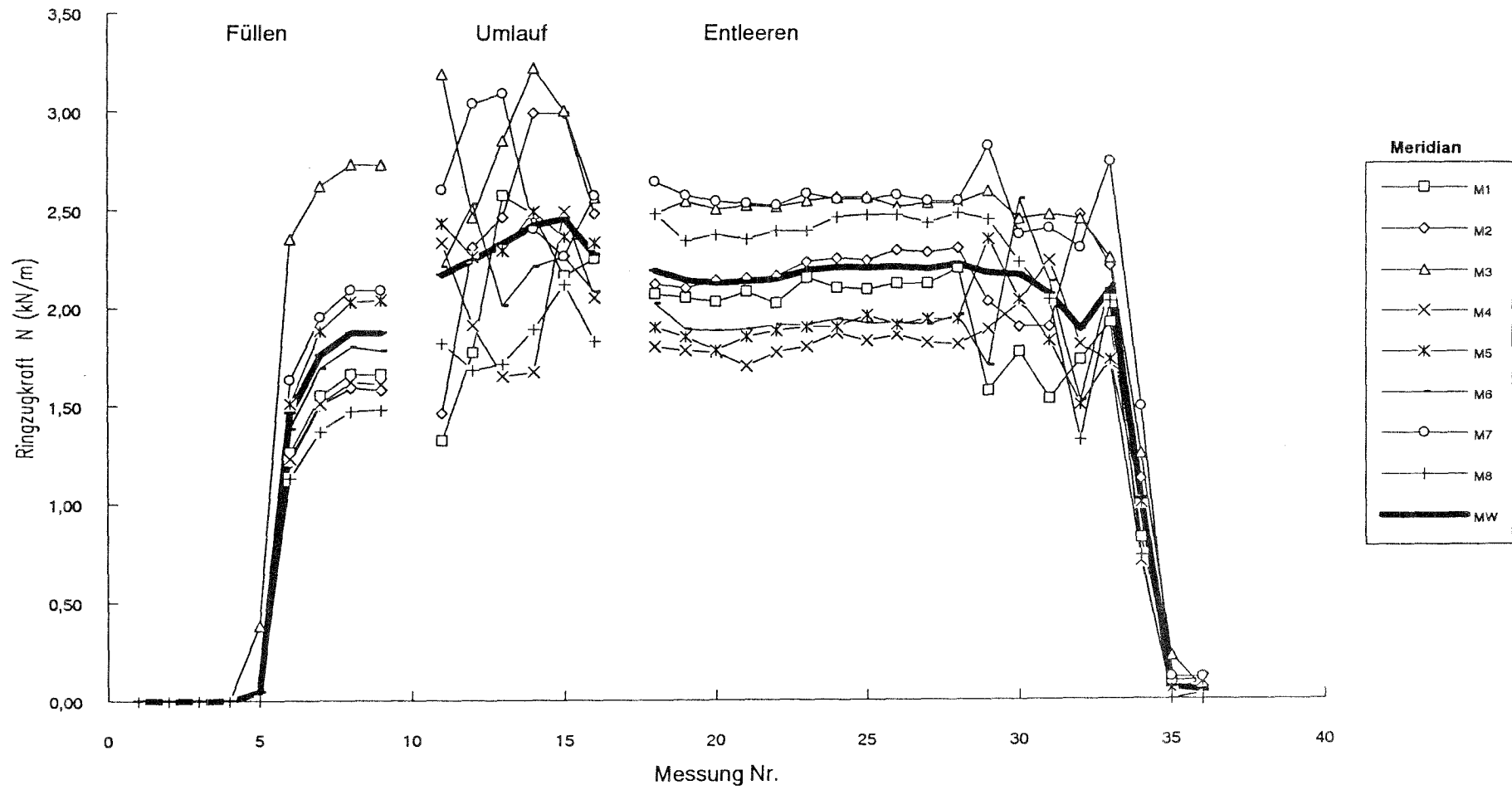


# Versuch M 2 mittlerer Horizont



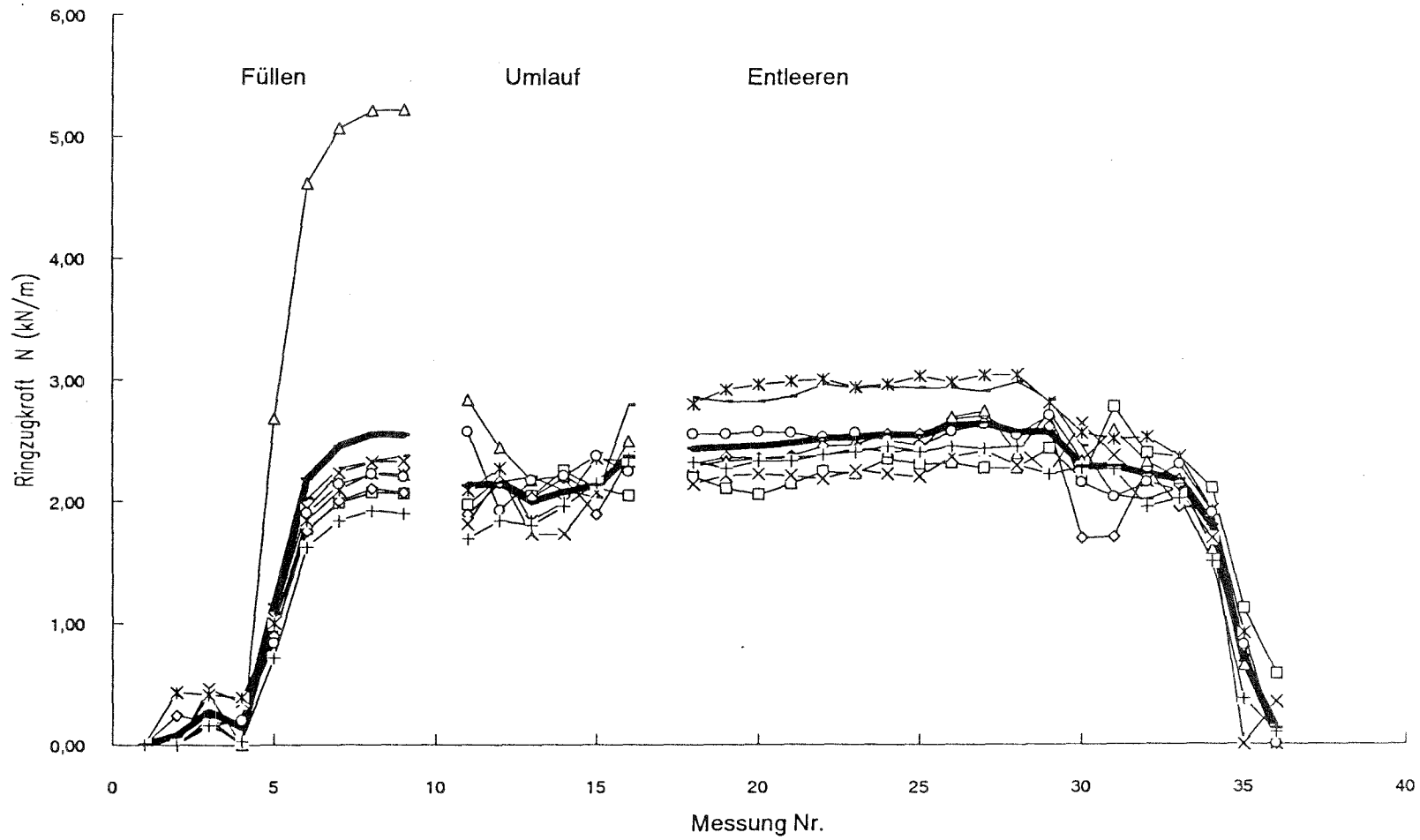
194.76

### Versuch M 3 oberer Horizont



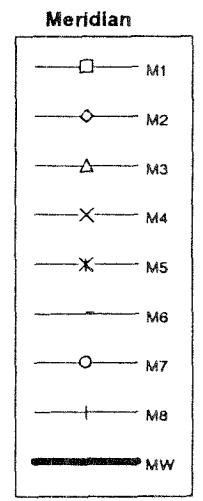
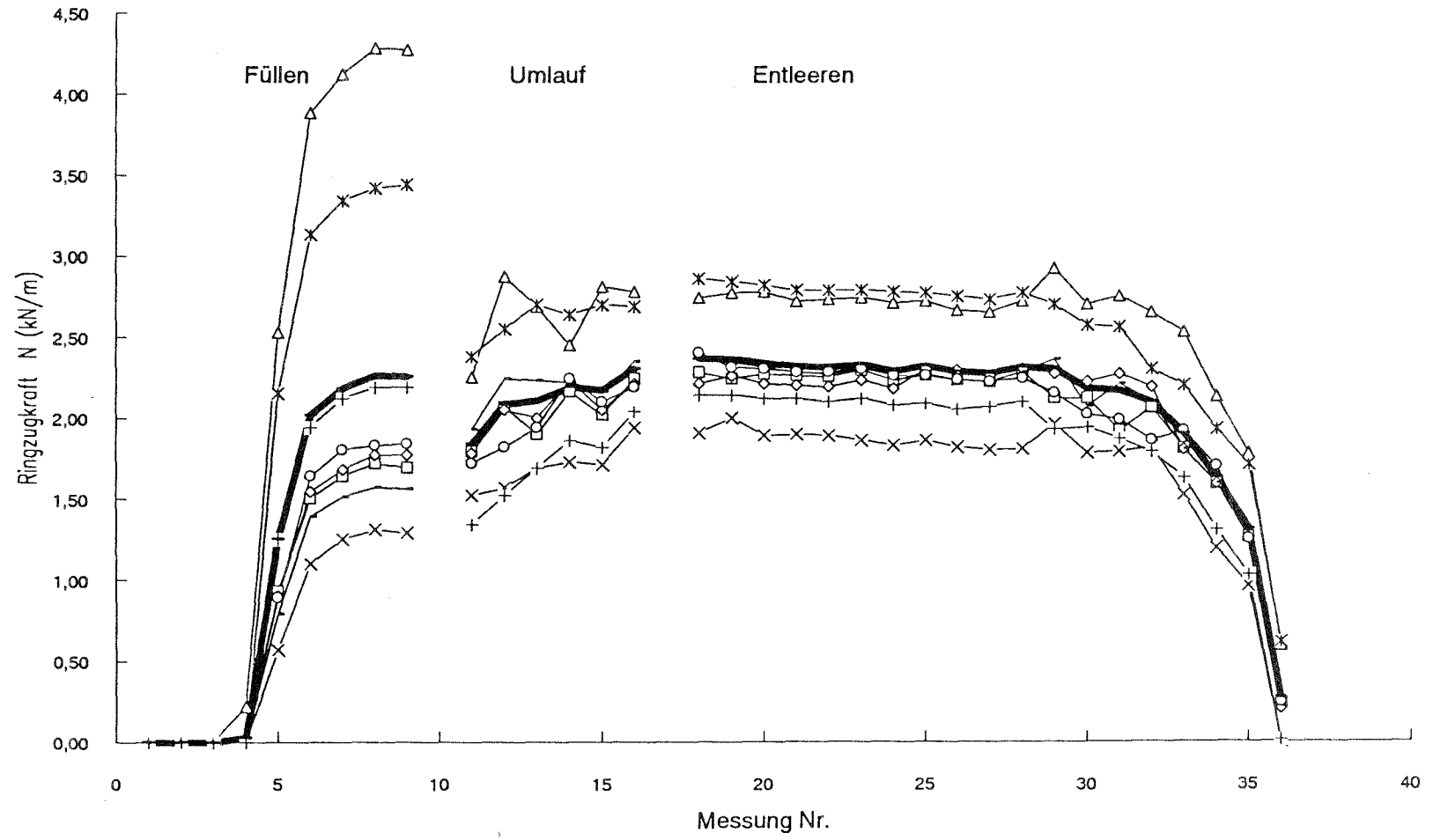
A 4.77

Versuch M 3 mittlerer Horizont



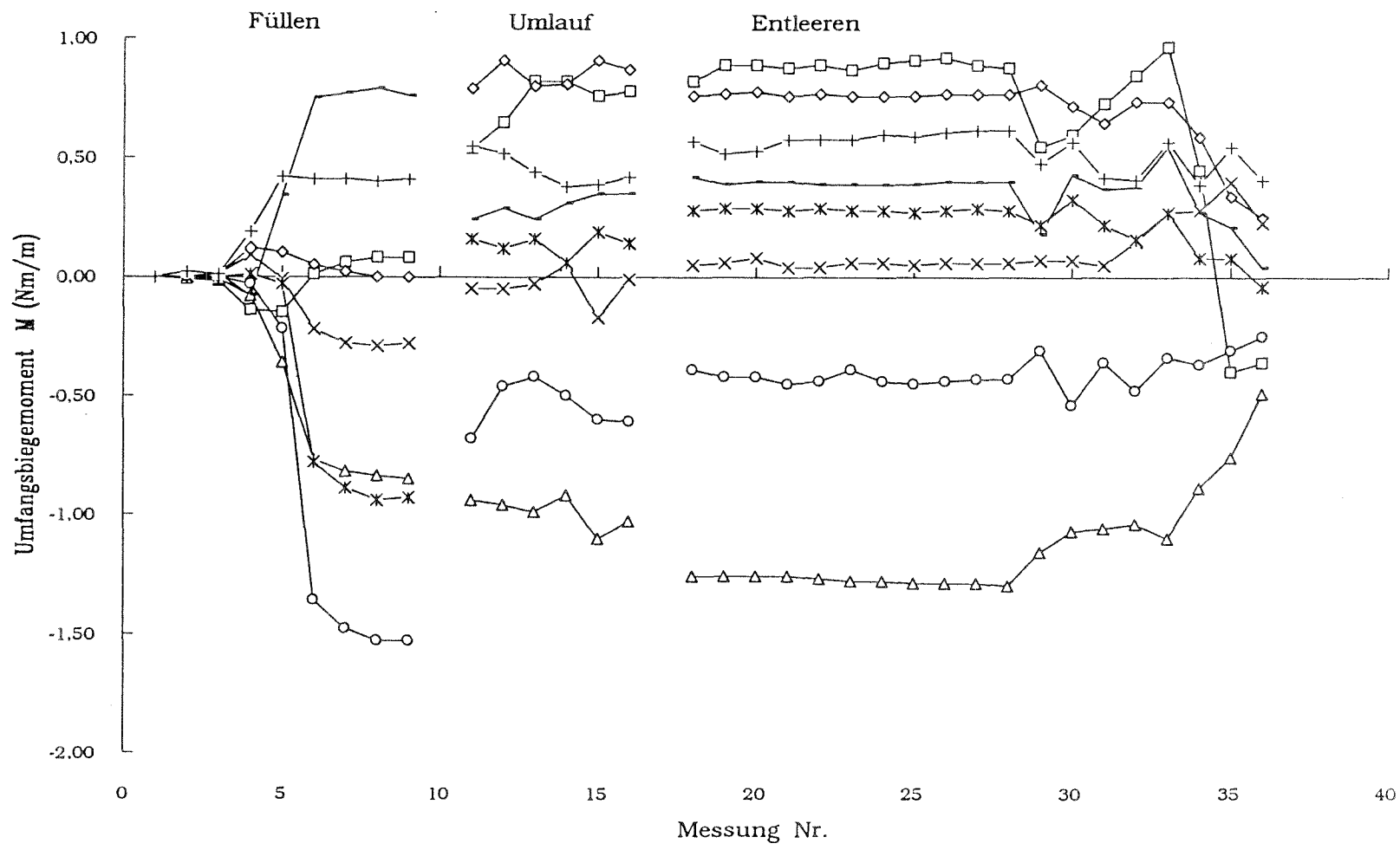
14.78

Versuch M 3 unterer Horizont



1479

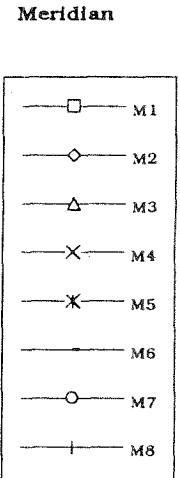
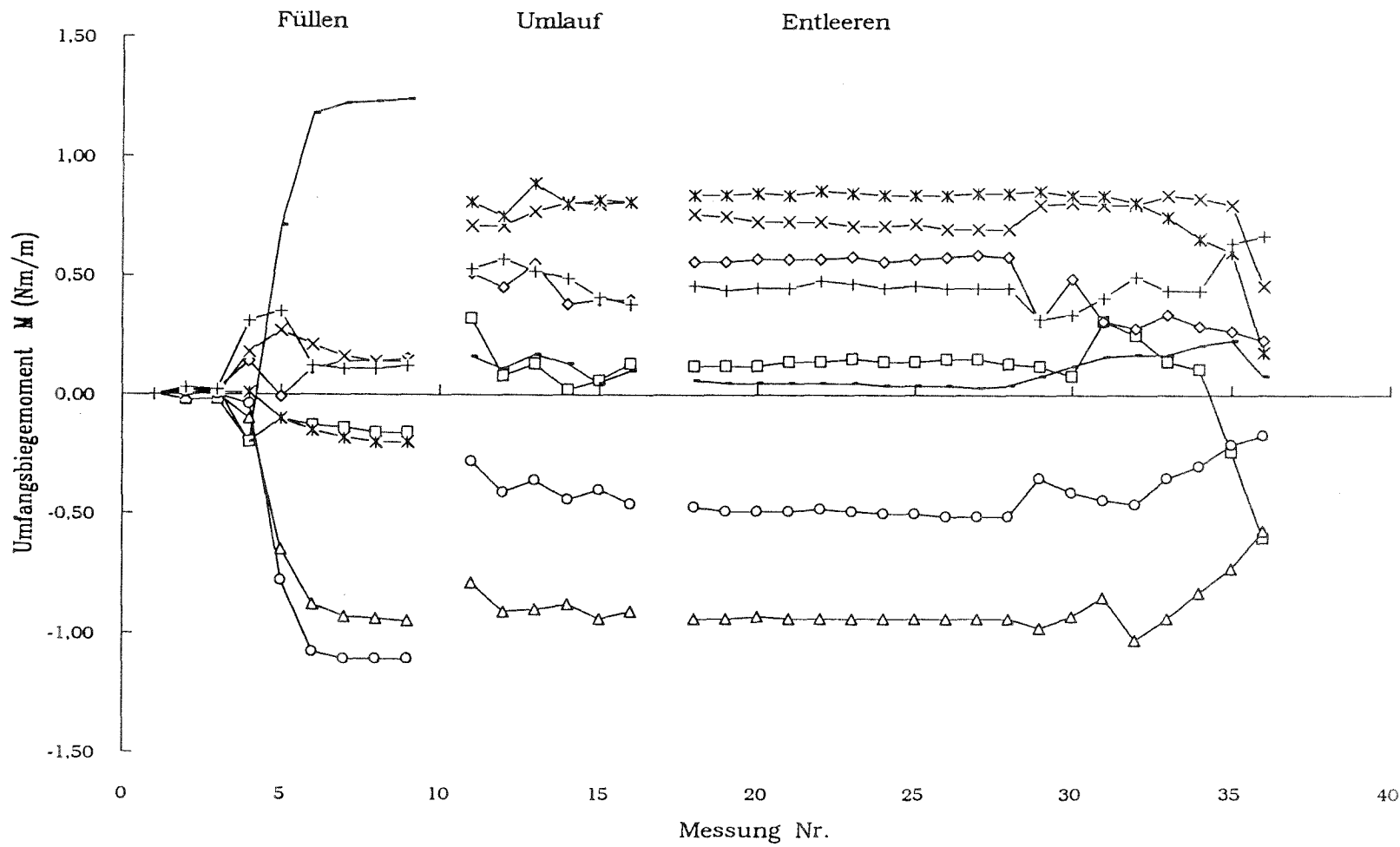
**Versuch M 3 oberer Horizont**



- Meridian**
- M1
  - ◇ M2
  - △ M3
  - × M4
  - \* M5
  - + M6
  - M7
  - + M8

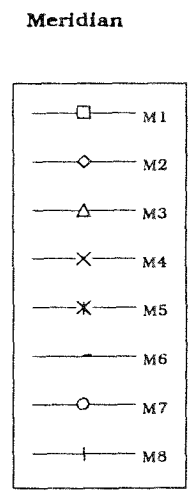
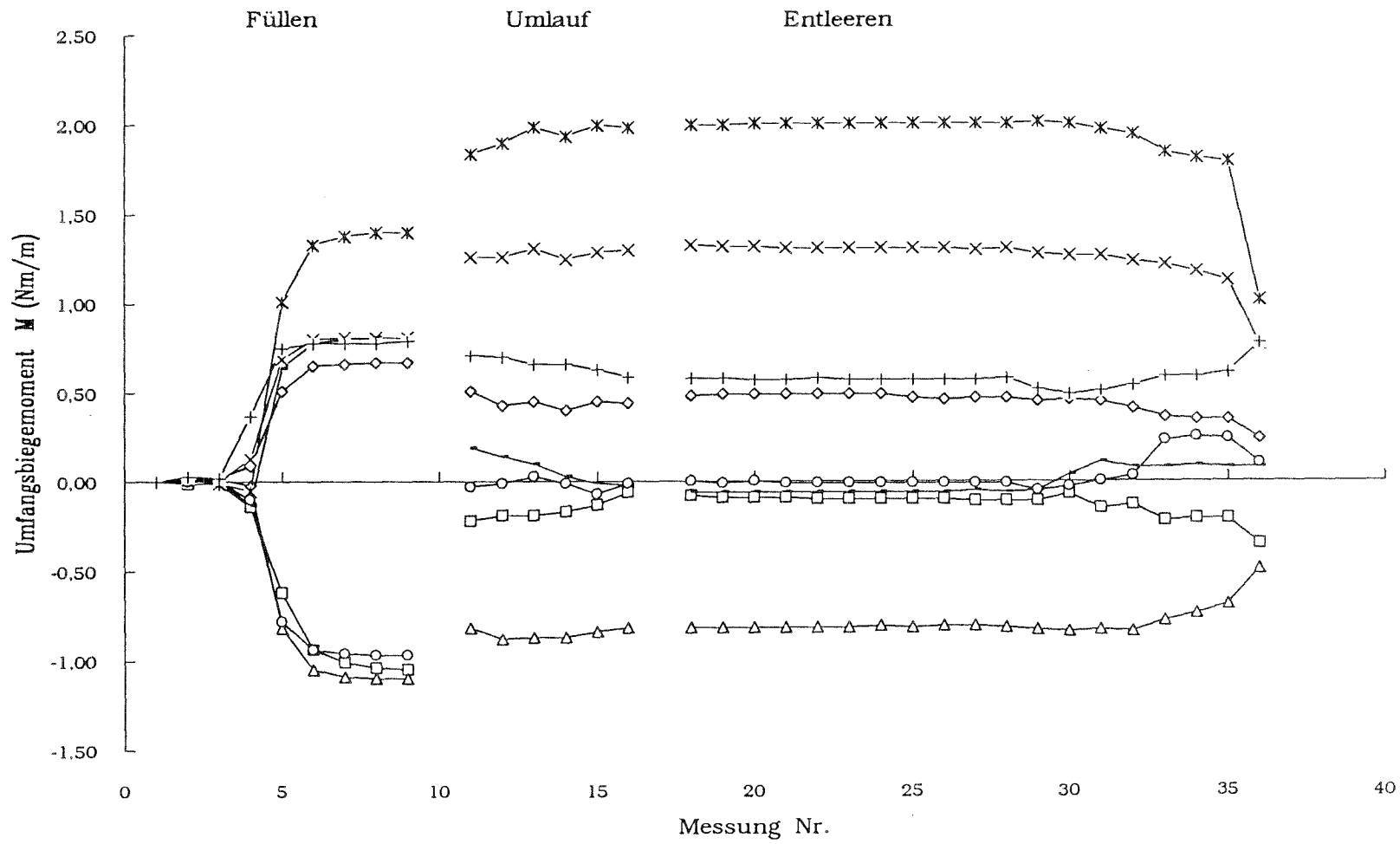
A 4.80

### Versuch M 3 mittlerer Horizont



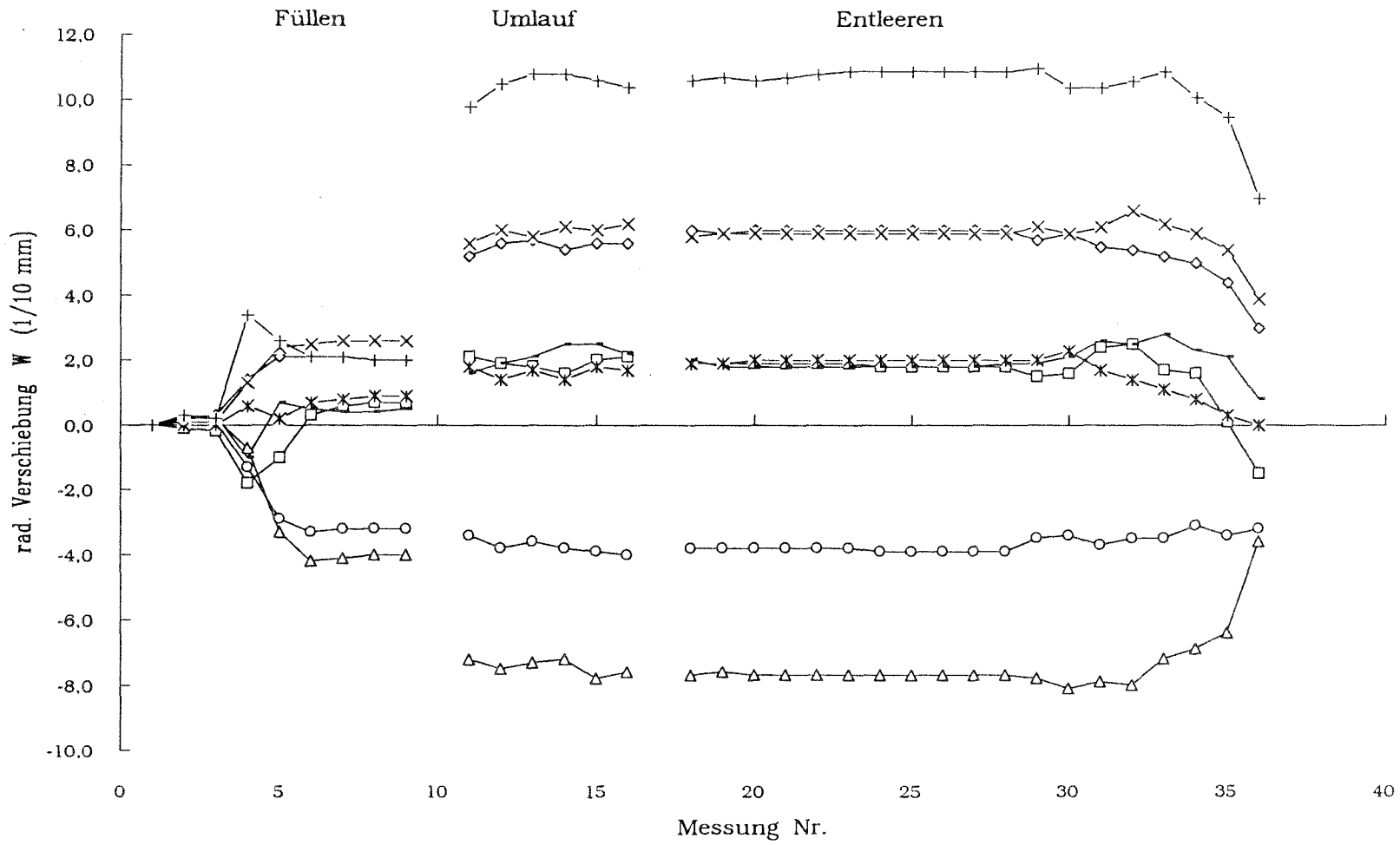
V818A

# Versuch M 3 unterer Horizont



A4.82

### Versuch M 3 mittlerer Horizont

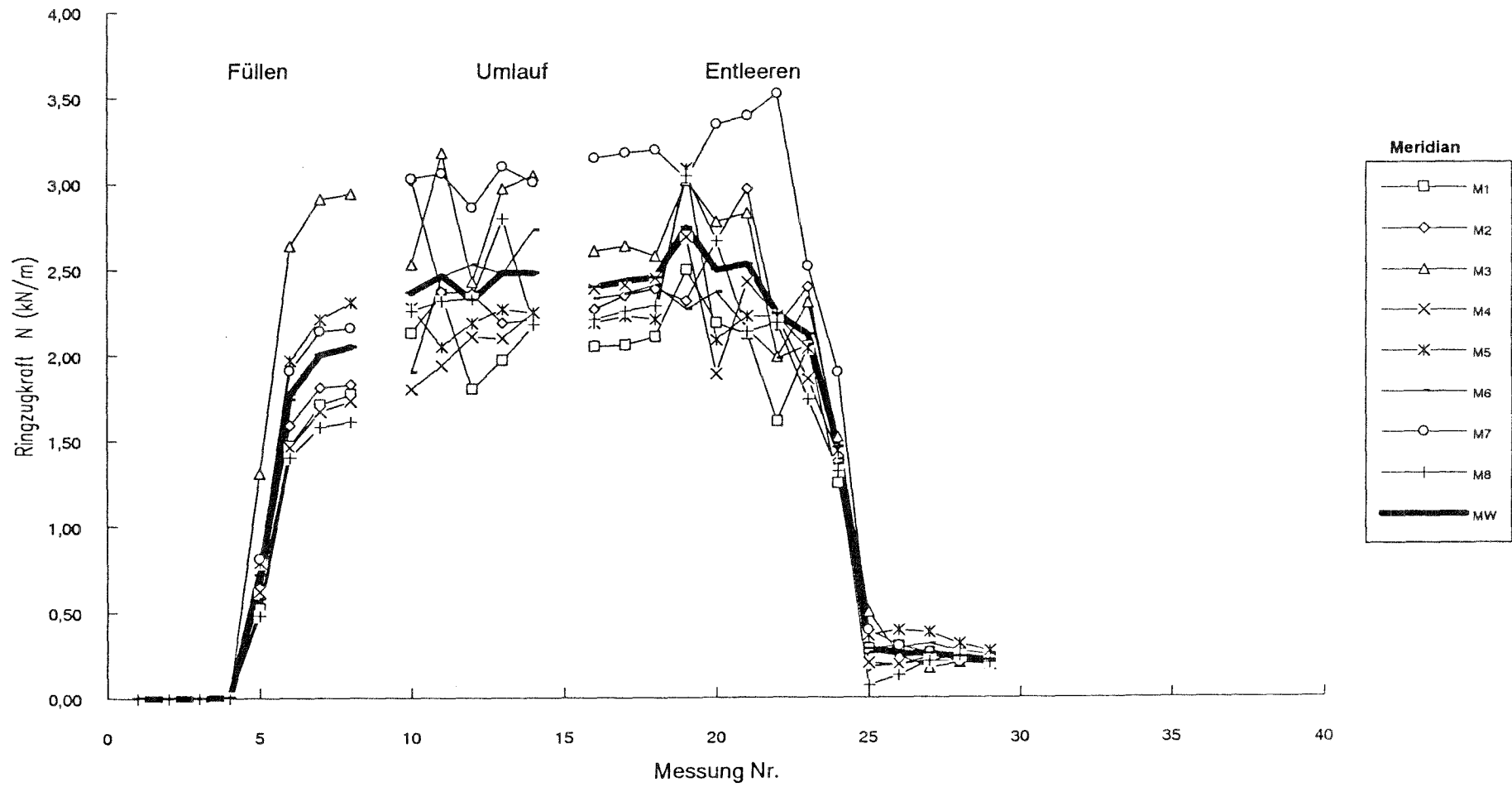


- Meridian**
- M1
  - ◇— M2
  - △— M3
  - ×— M4
  - \*— M5
  - +— M6
  - M7
  - +— M8

A 4.83

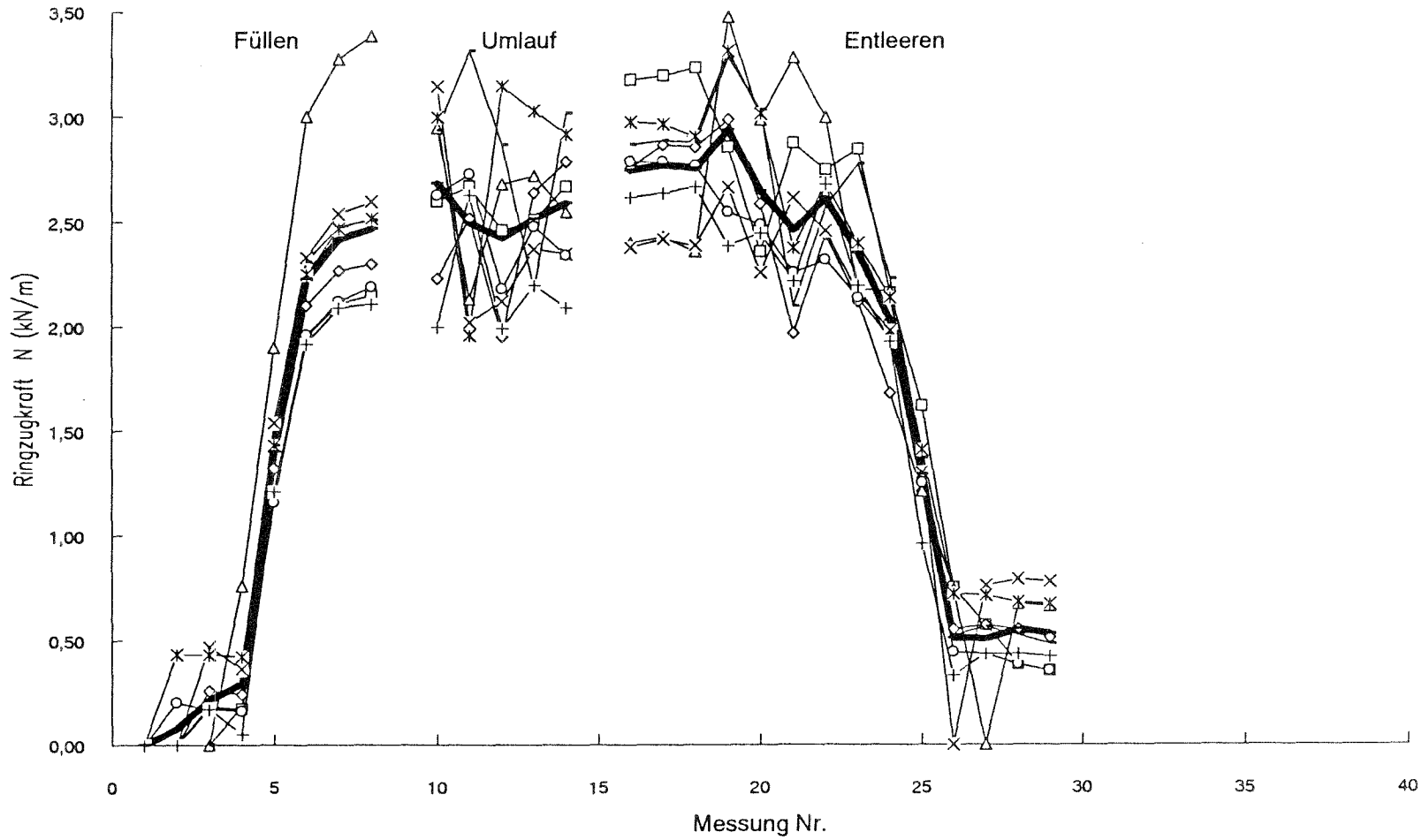


Versuch M 4 oberer Horizont



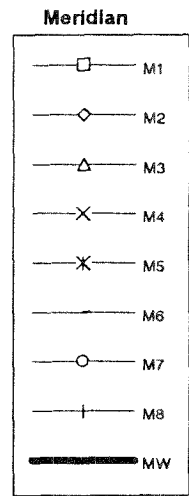
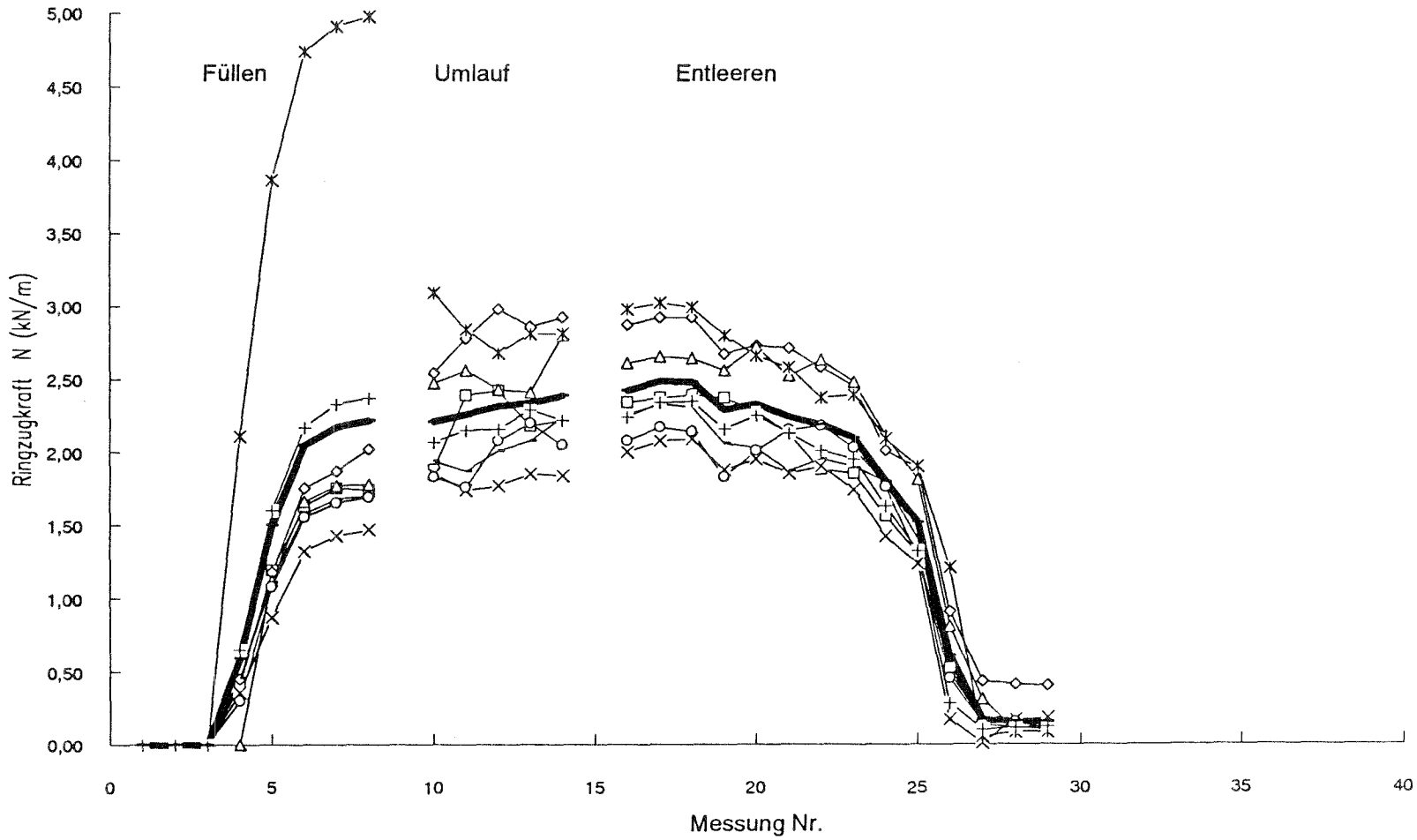
M 4, 04

Versuch M 4 mittlerer Horizont



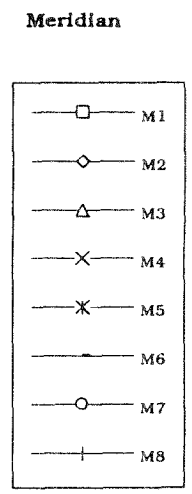
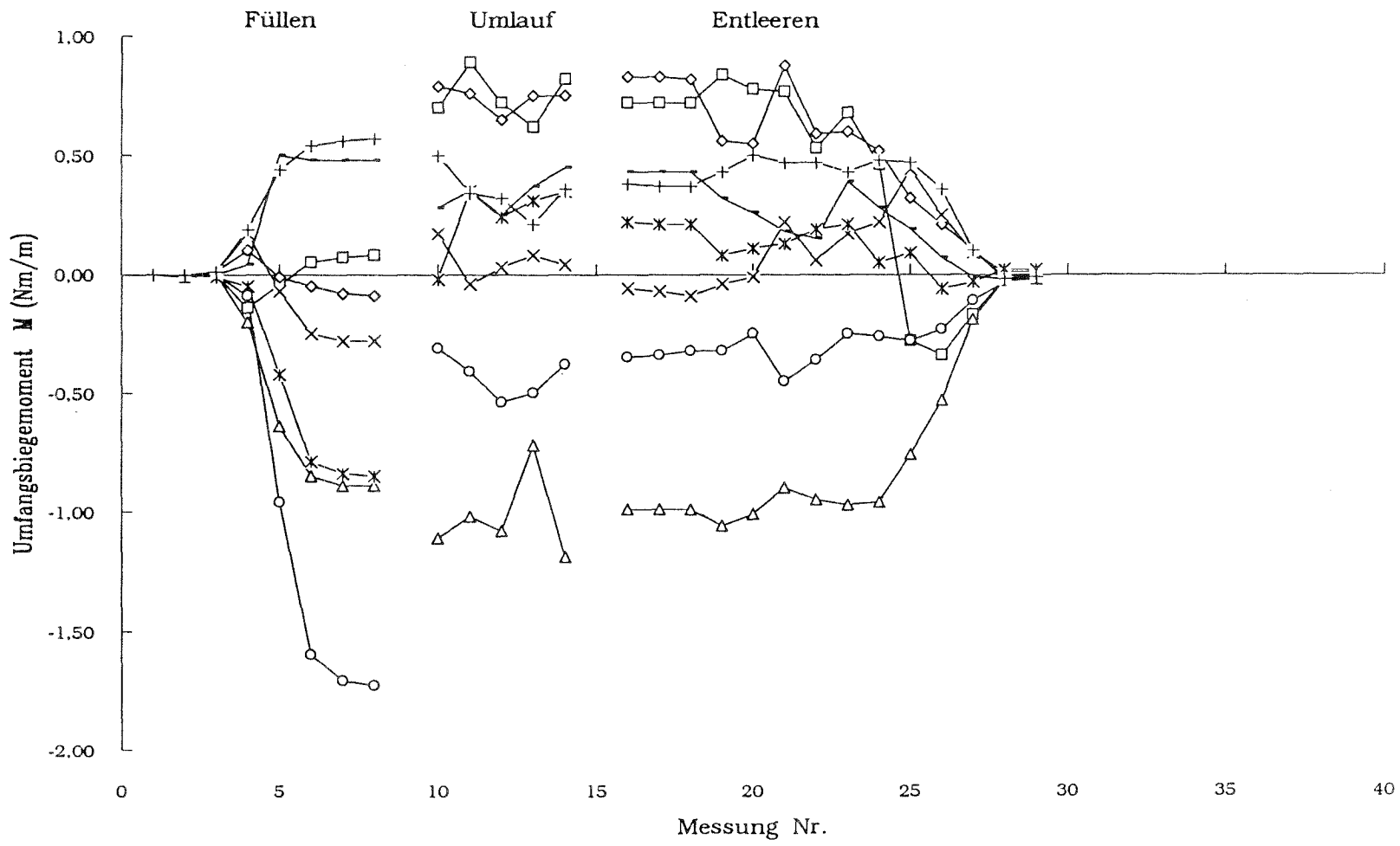
A 4,85

Versuch M 4 unterer Horizont



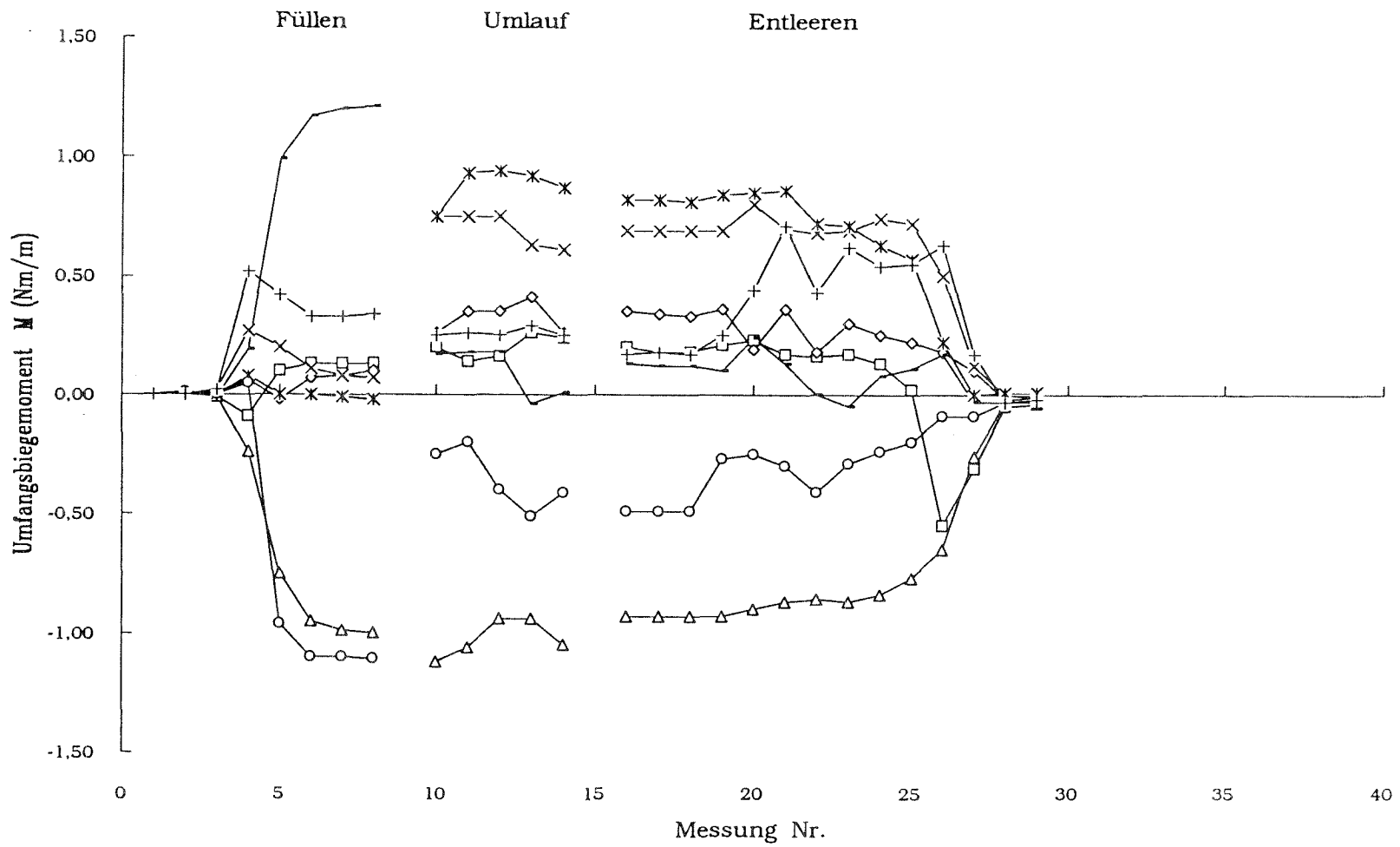
A 4.86

**Versuch M 4 oberer Horizont**



A 4.87

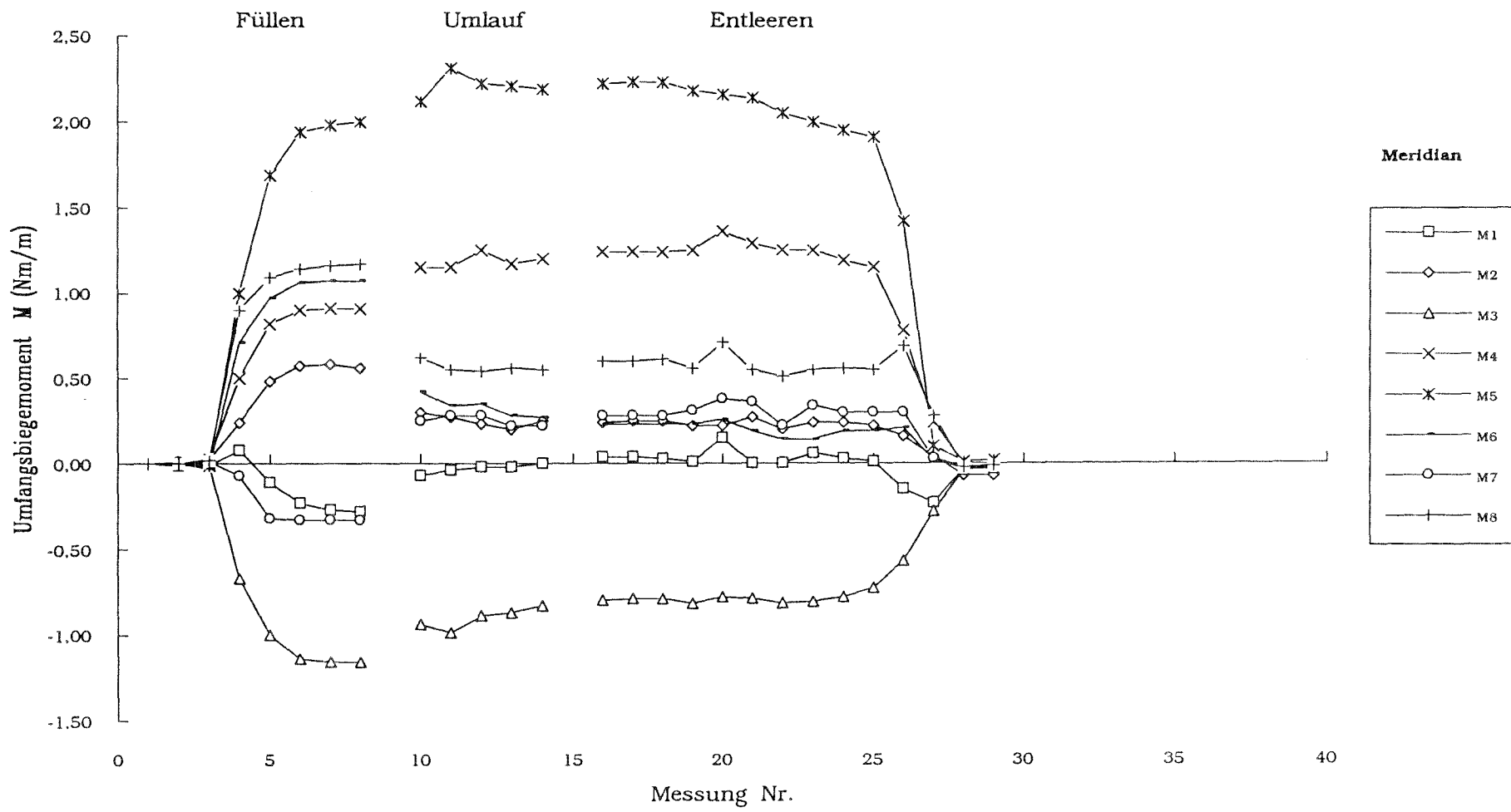
**Versuch M 4 mittlerer Horizont**



- Meridian**
- M1
  - ◇— M2
  - △— M3
  - ×— M4
  - \*— M5
  - M6
  - M7
  - +— M8

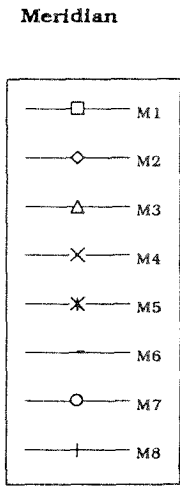
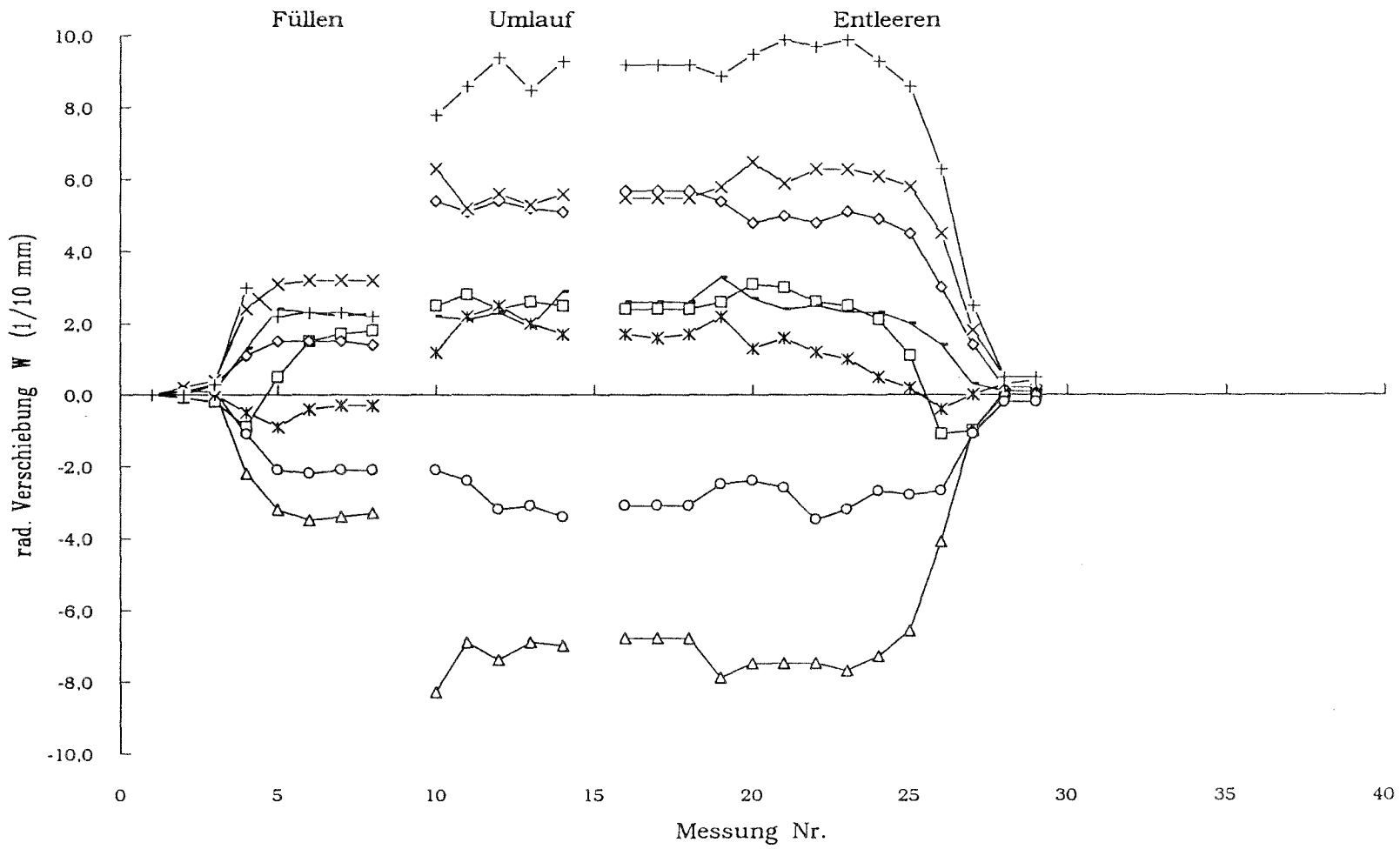
A 4.88

# Versuch M 4 unterer Horizont



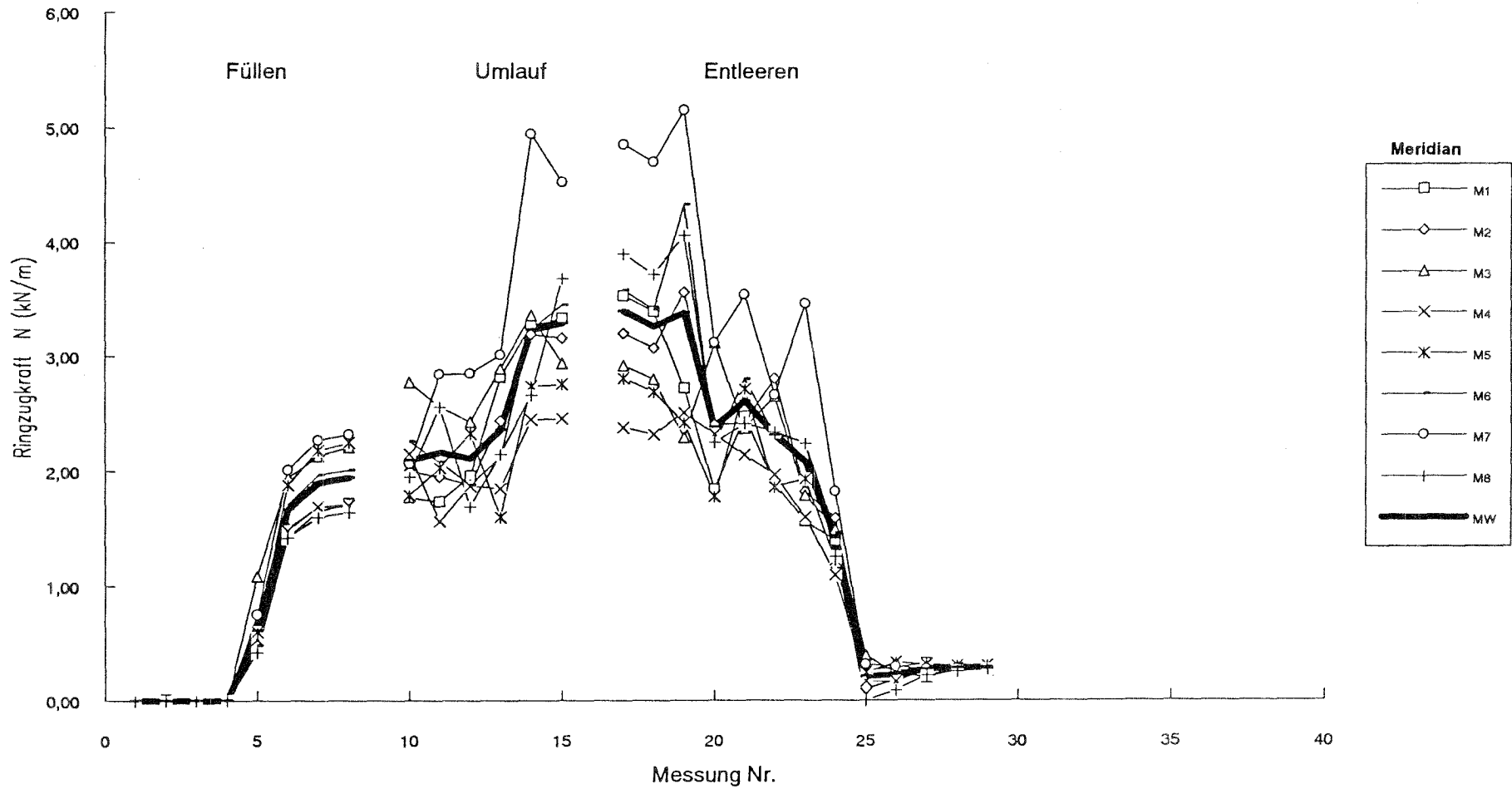
A 4.89

# Versuch M 4 mittlerer Horizont



P 4,90

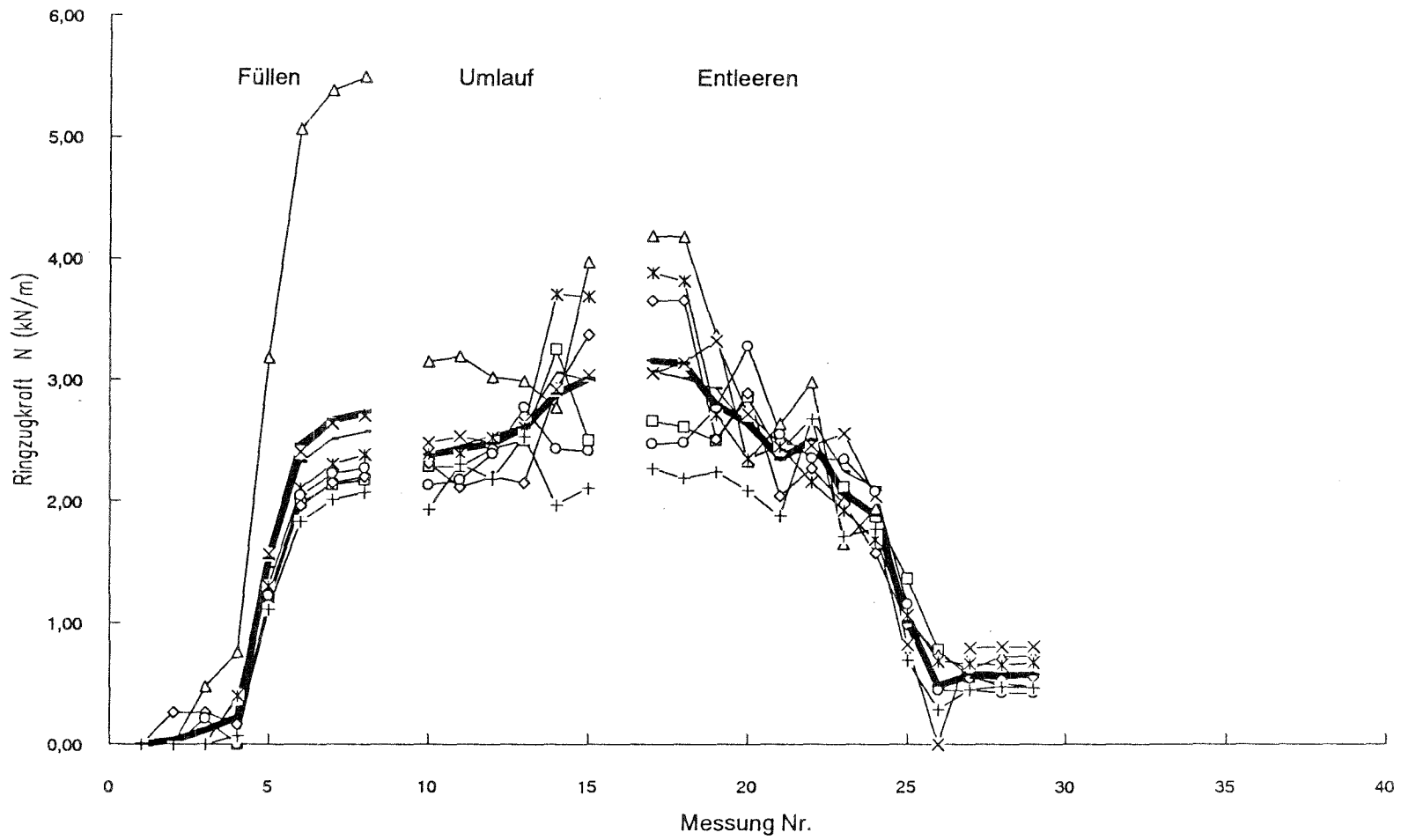
Versuch M 5 oberer Horizont



A 4.91

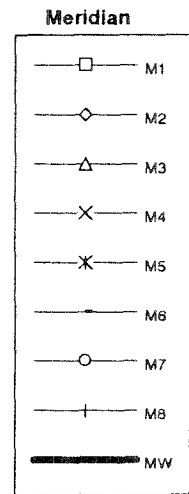
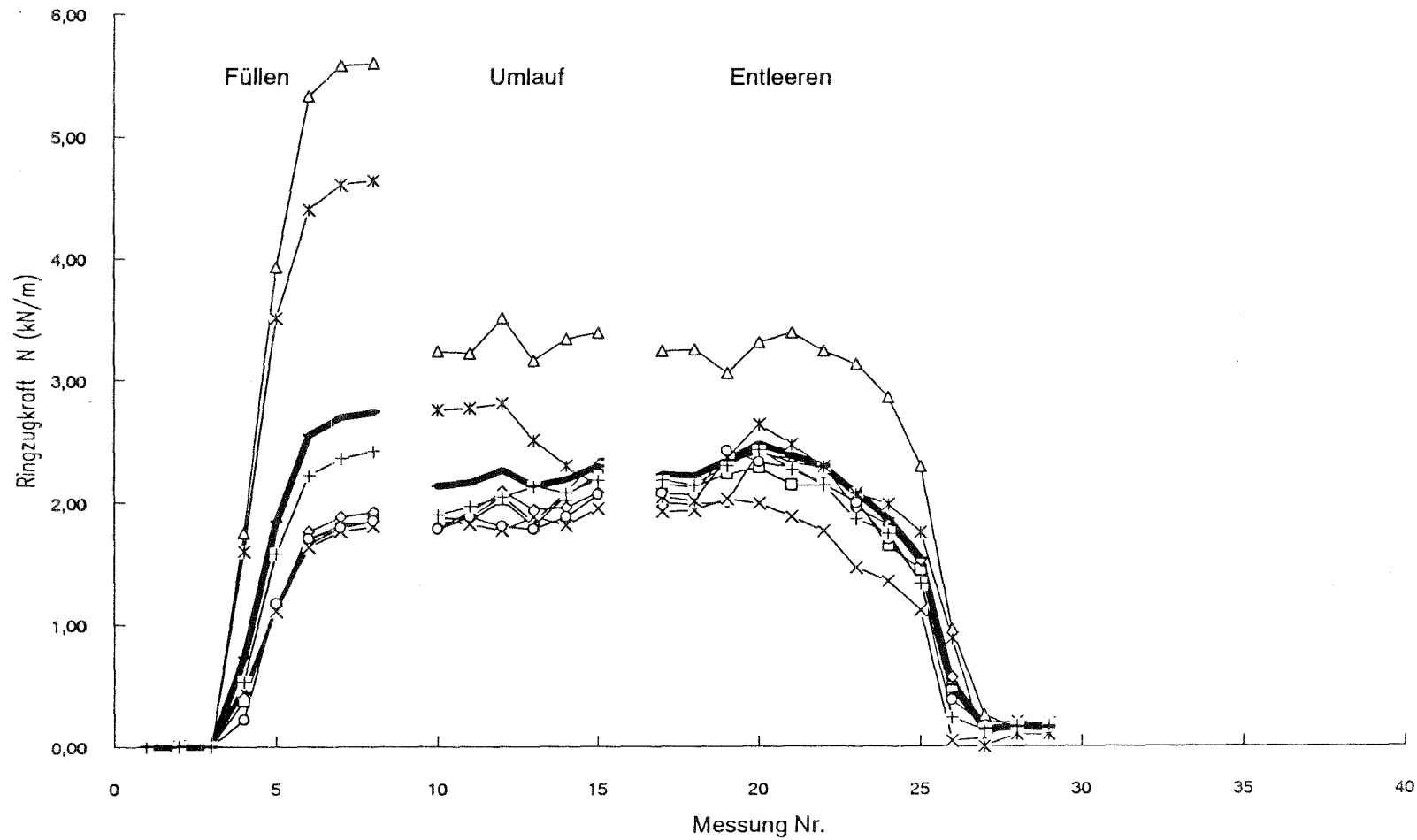


### Versuch M 5 mittlerer Horizont



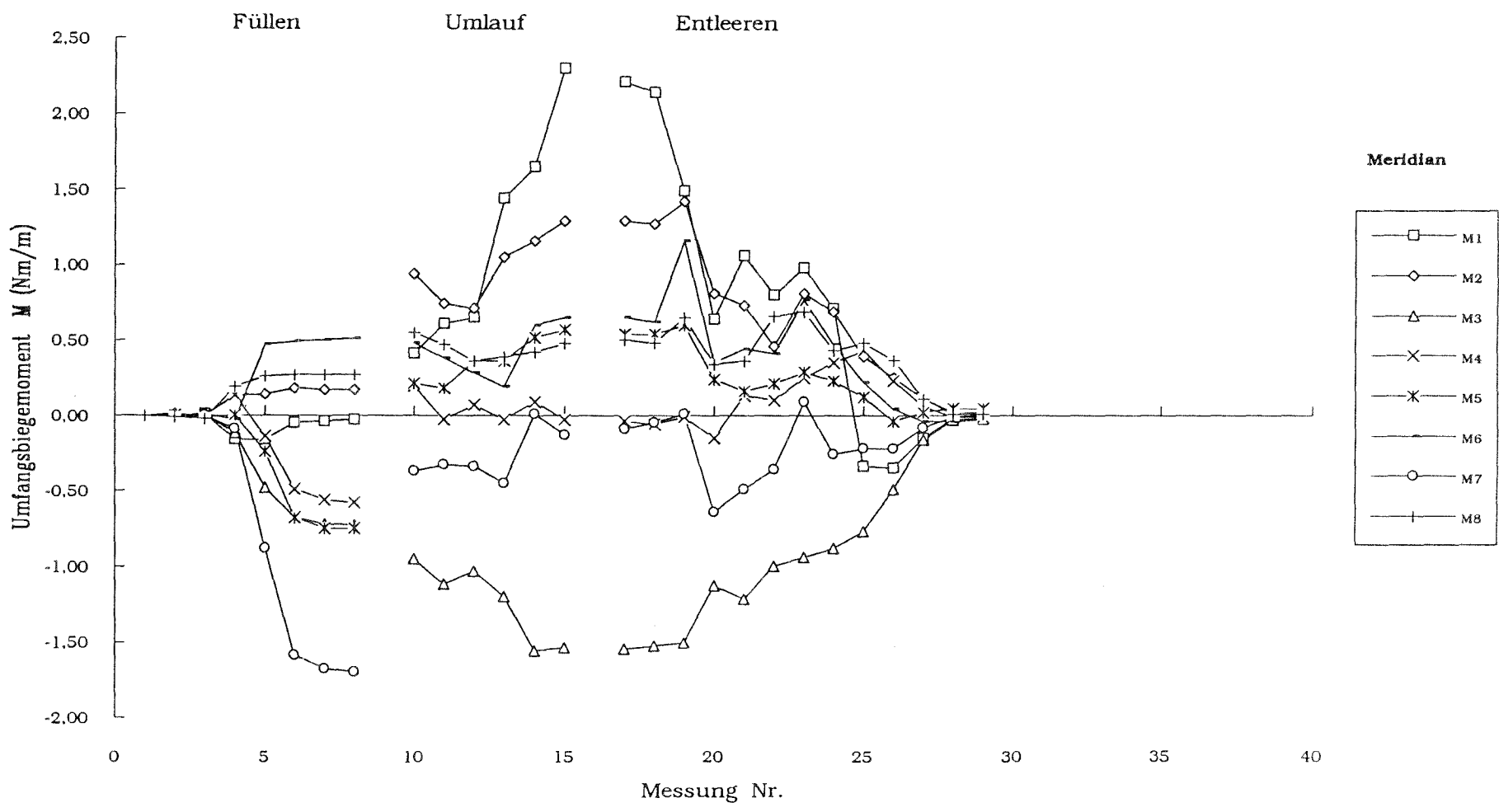
A 4.92

Versuch M 5 unterer Horizont



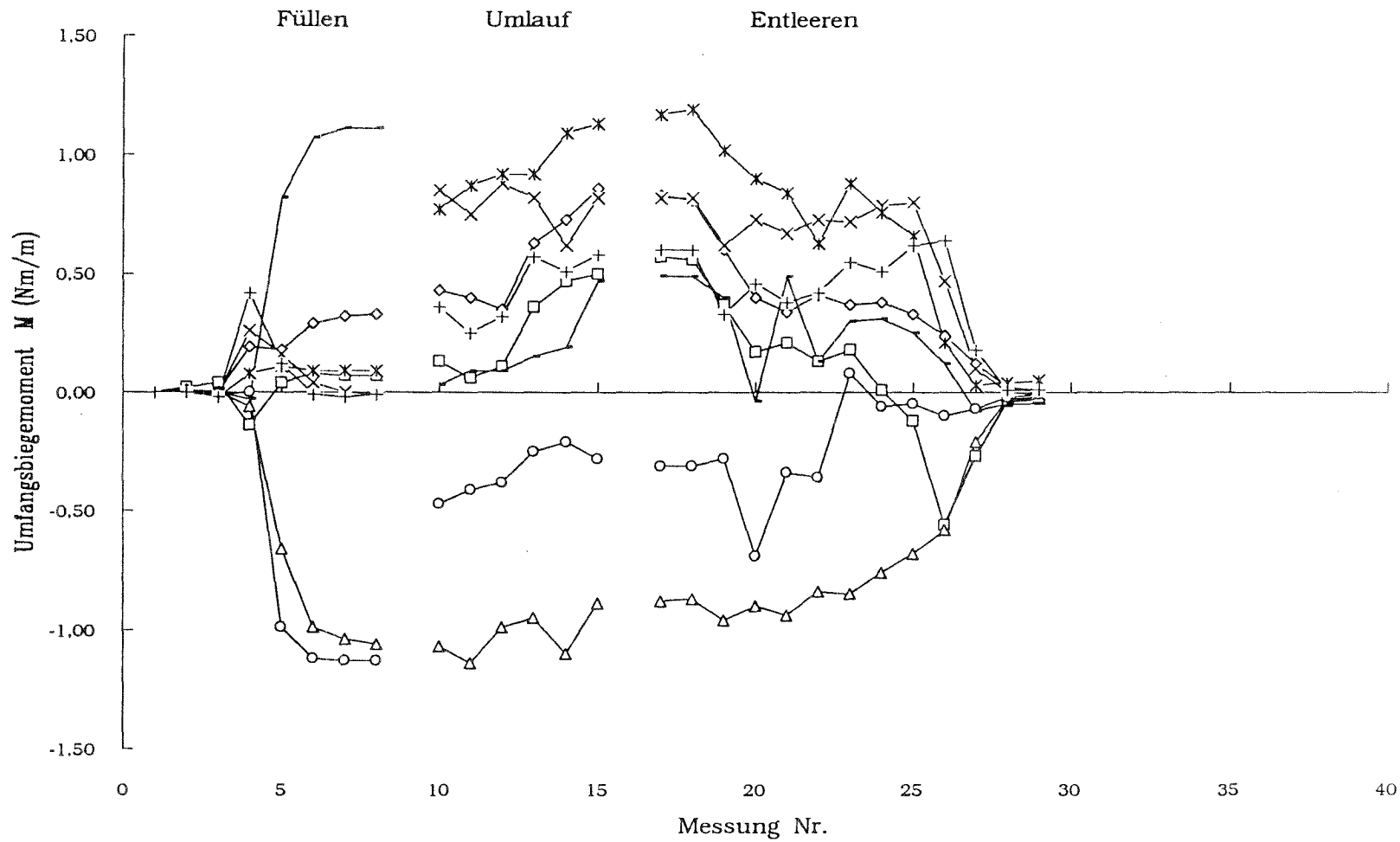
A 4.93

**Versuch M 5 oberer Horizont**

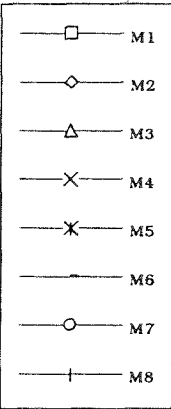


A 4.94

Versuch M 5 mittlerer Horizont

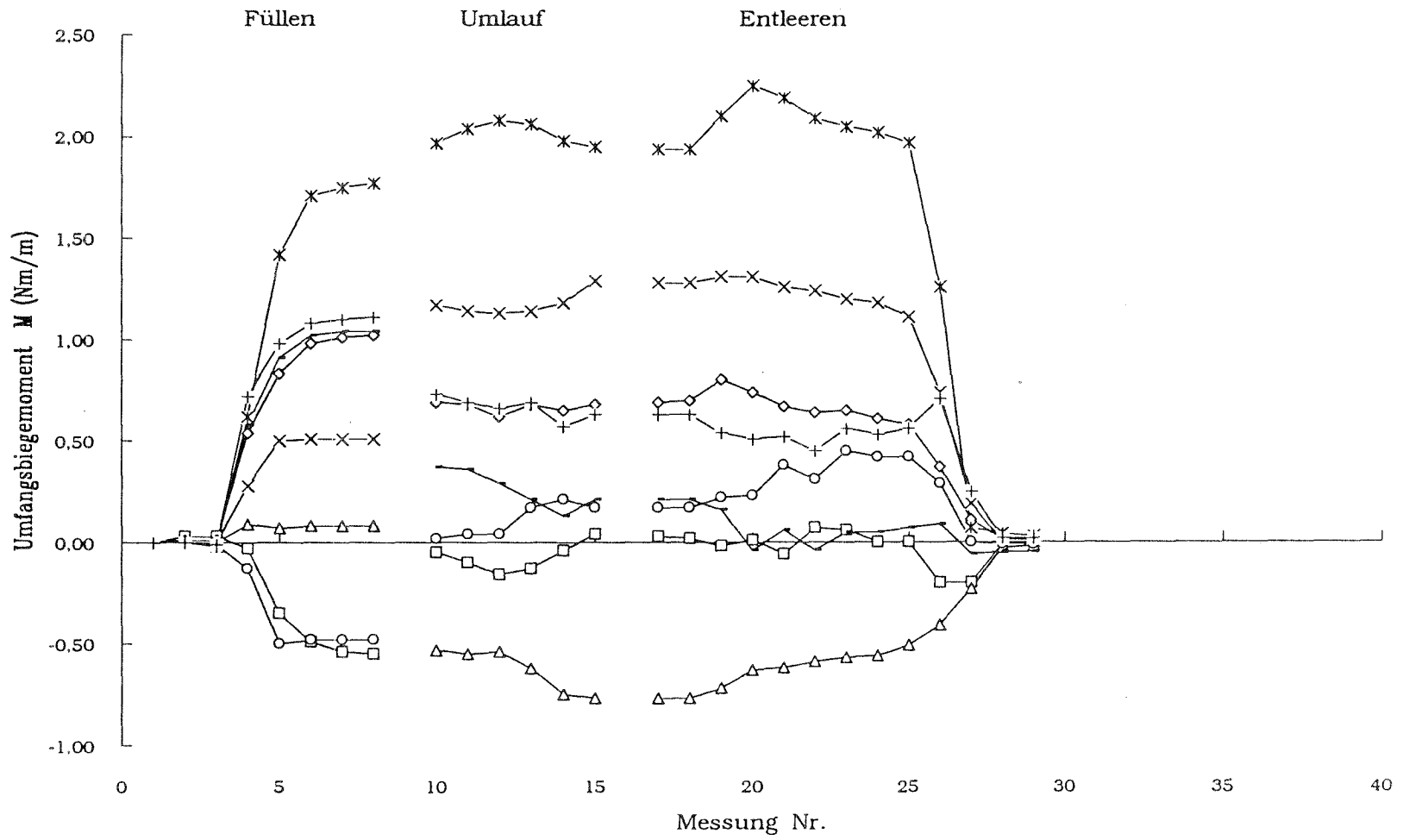


Meridian

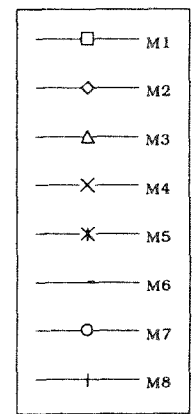


A 4,95

# Versuch M 5 unterer Horizont

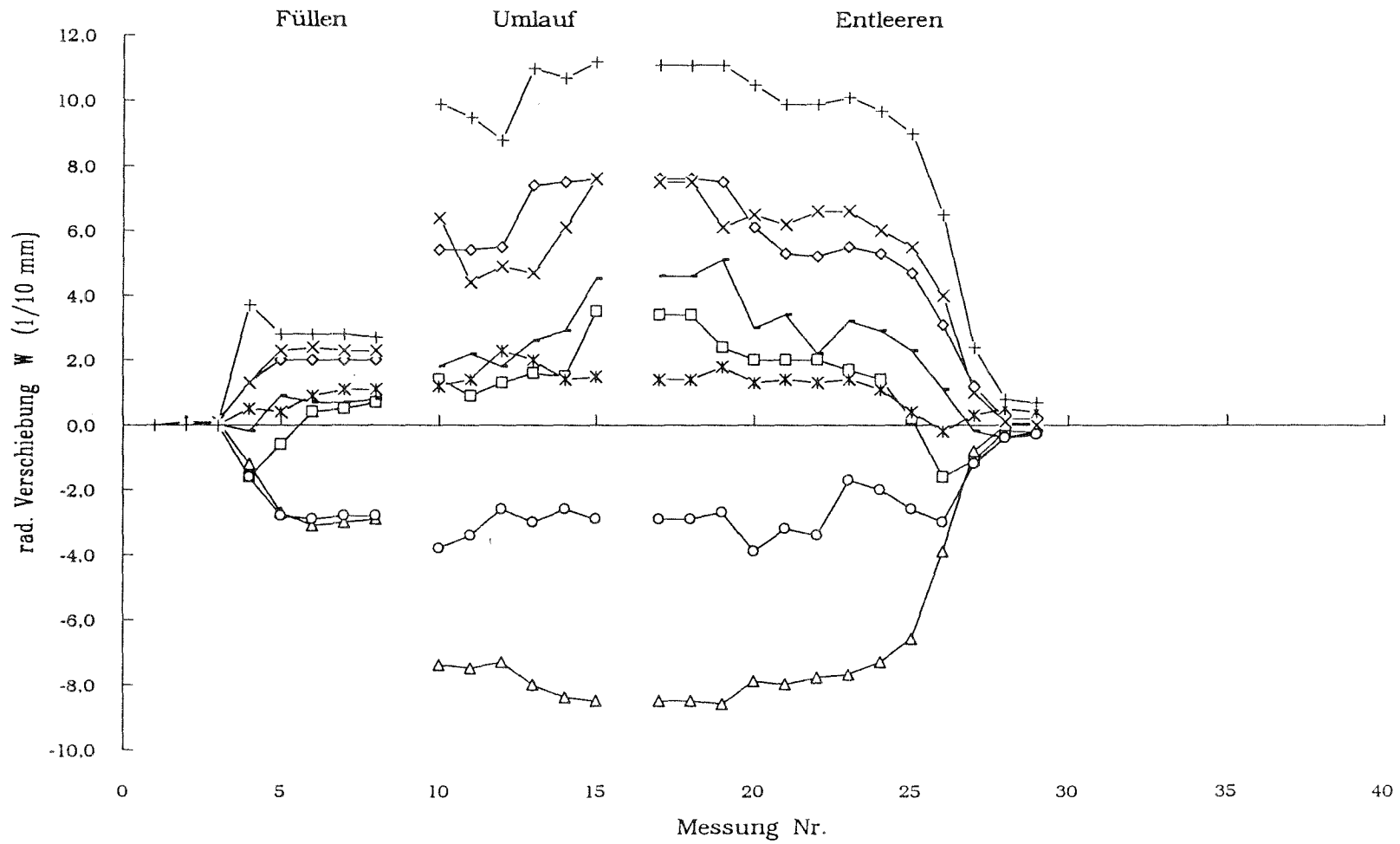


Meridian



A4.96

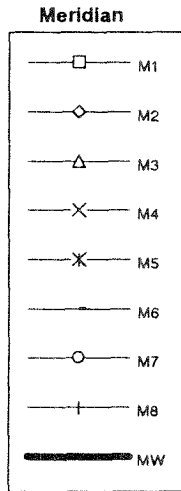
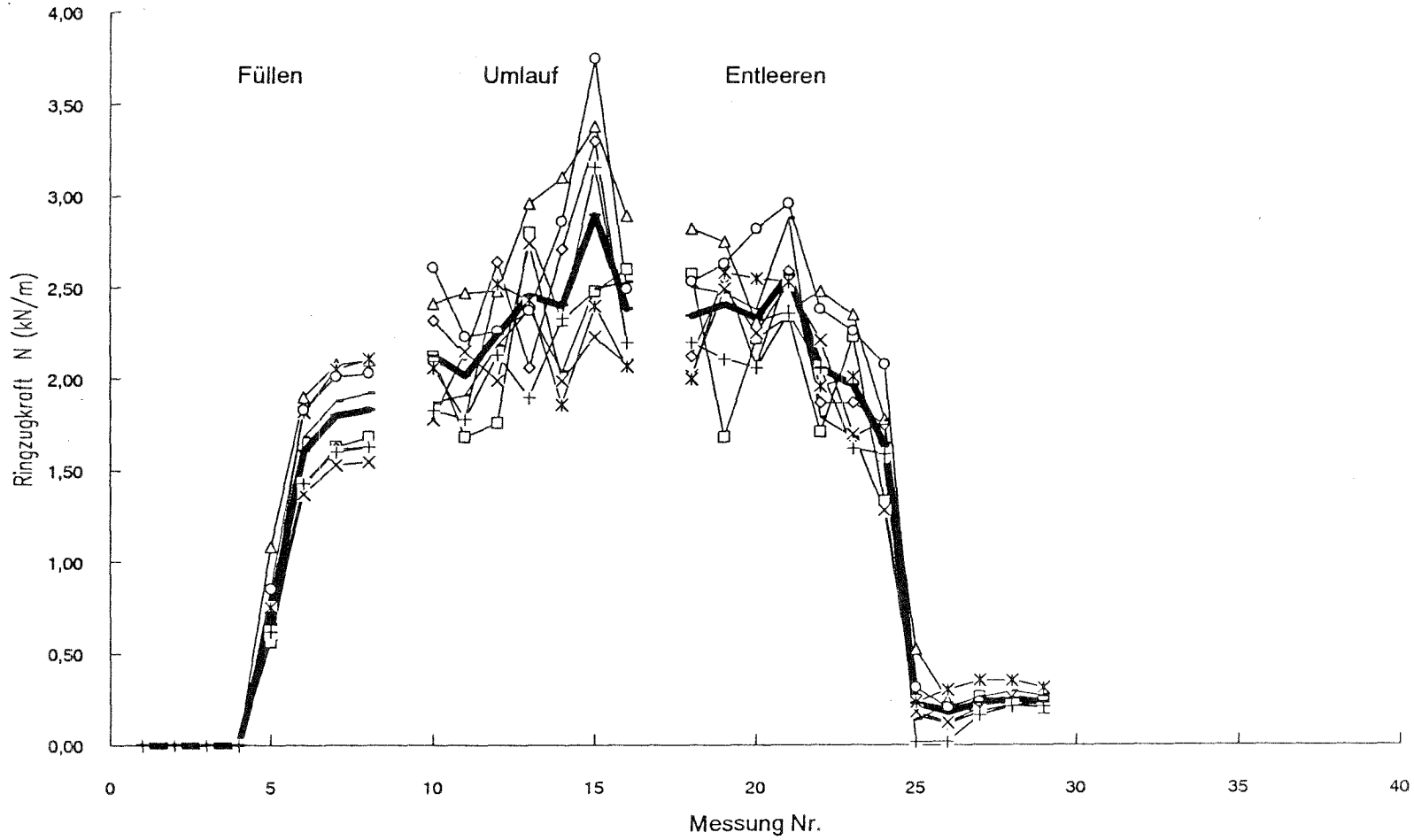
# Versuch M 5 mittlerer Horizont



- Meridian**
- M1
  - ◇— M2
  - △— M3
  - ×— M4
  - \*— M5
  - +— M6
  - M7
  - +— M8

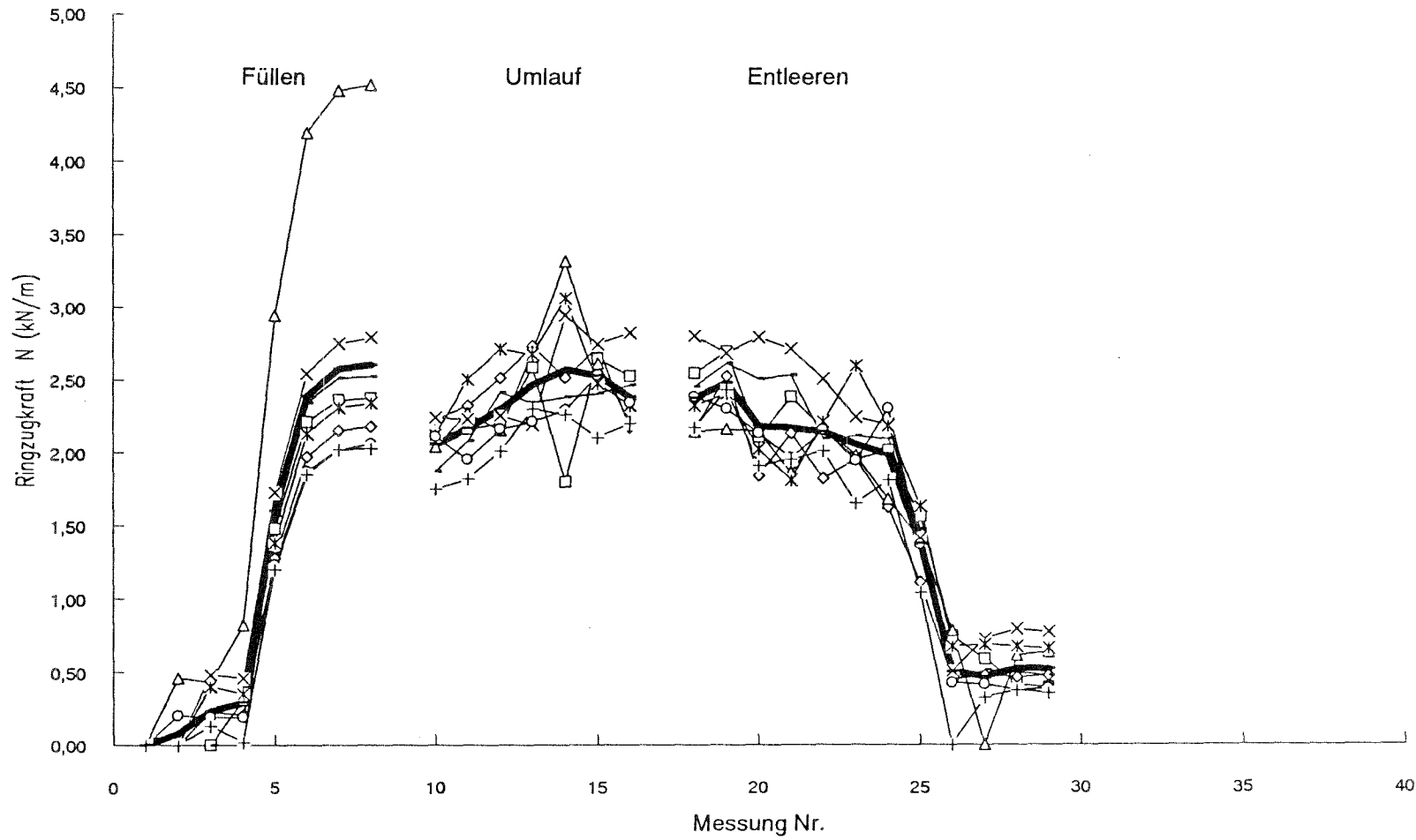
A 4.97

Versuch M 6 oberer Horizont



A 4.98

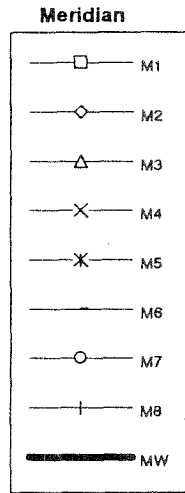
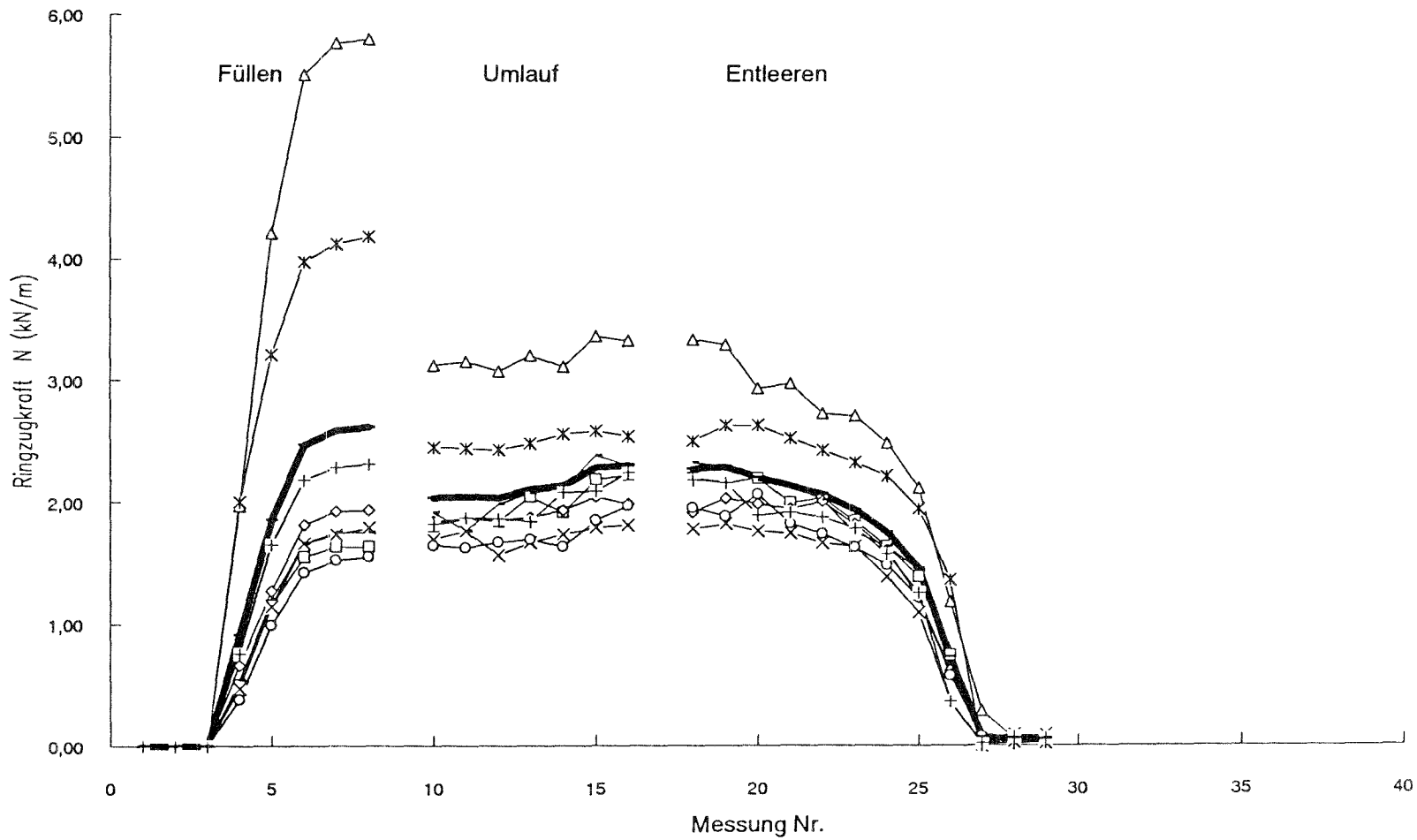
Versuch M 6 mittlerer Horizont



A 4.99

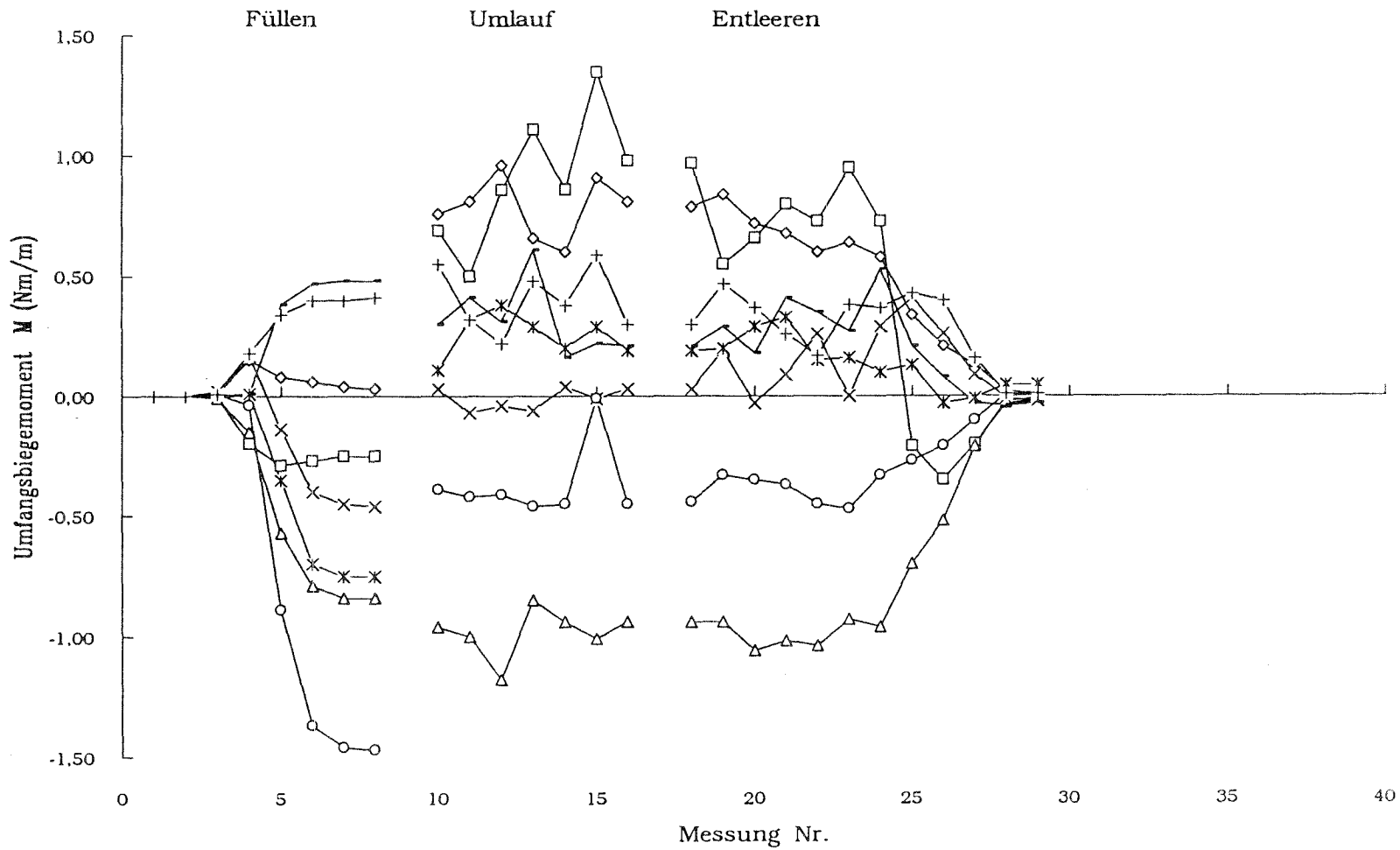


Versuch M 6 unterer Horizont



P. 4.100

**Versuch M 6 oberer Horizont**

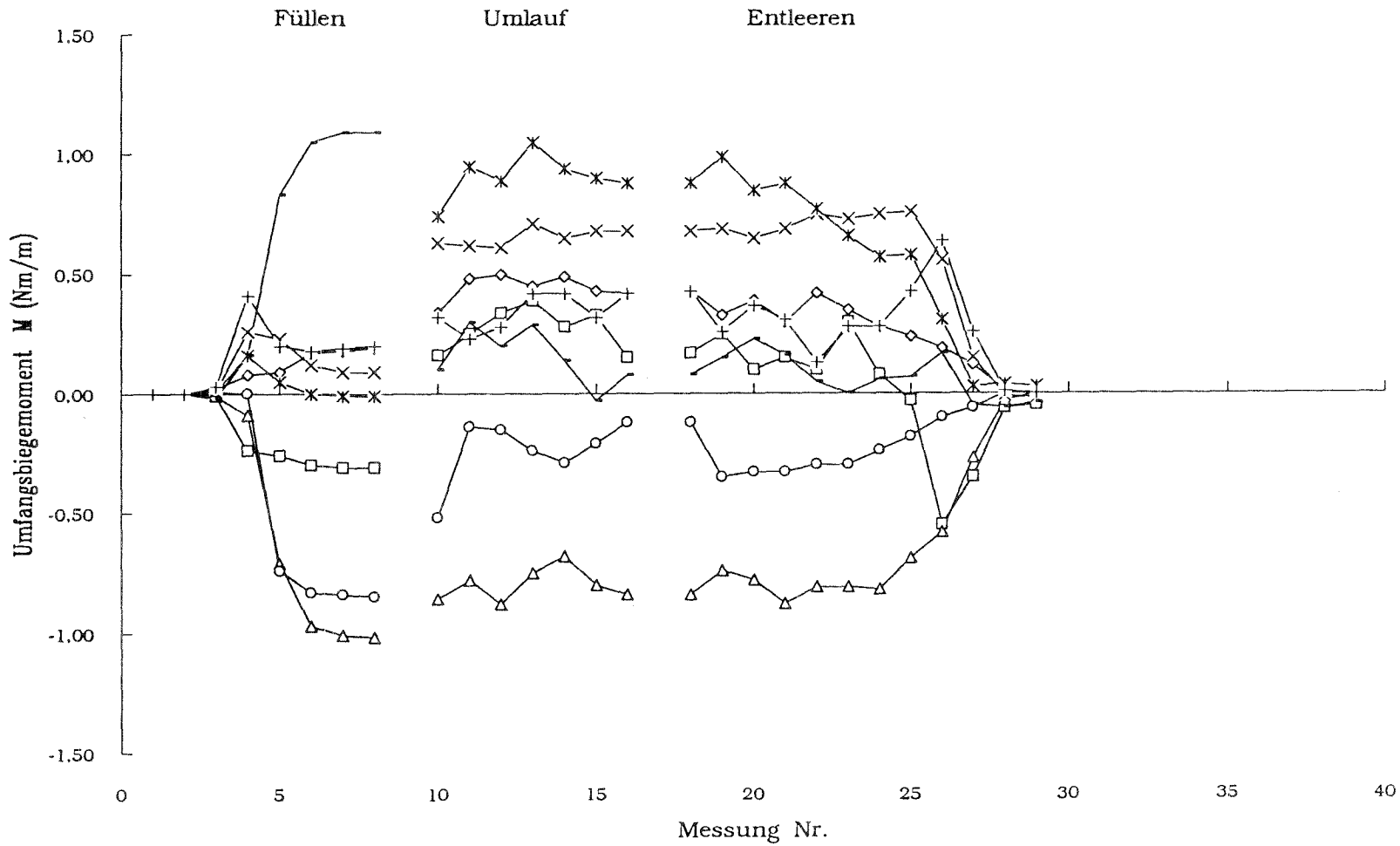


Meridian

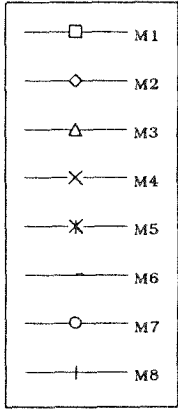
- M1
- ◇— M2
- △— M3
- ×— M4
- \*— M5
- +— M6
- M7
- |— M8

rort A

# Versuch M 6 mittlerer Horizont

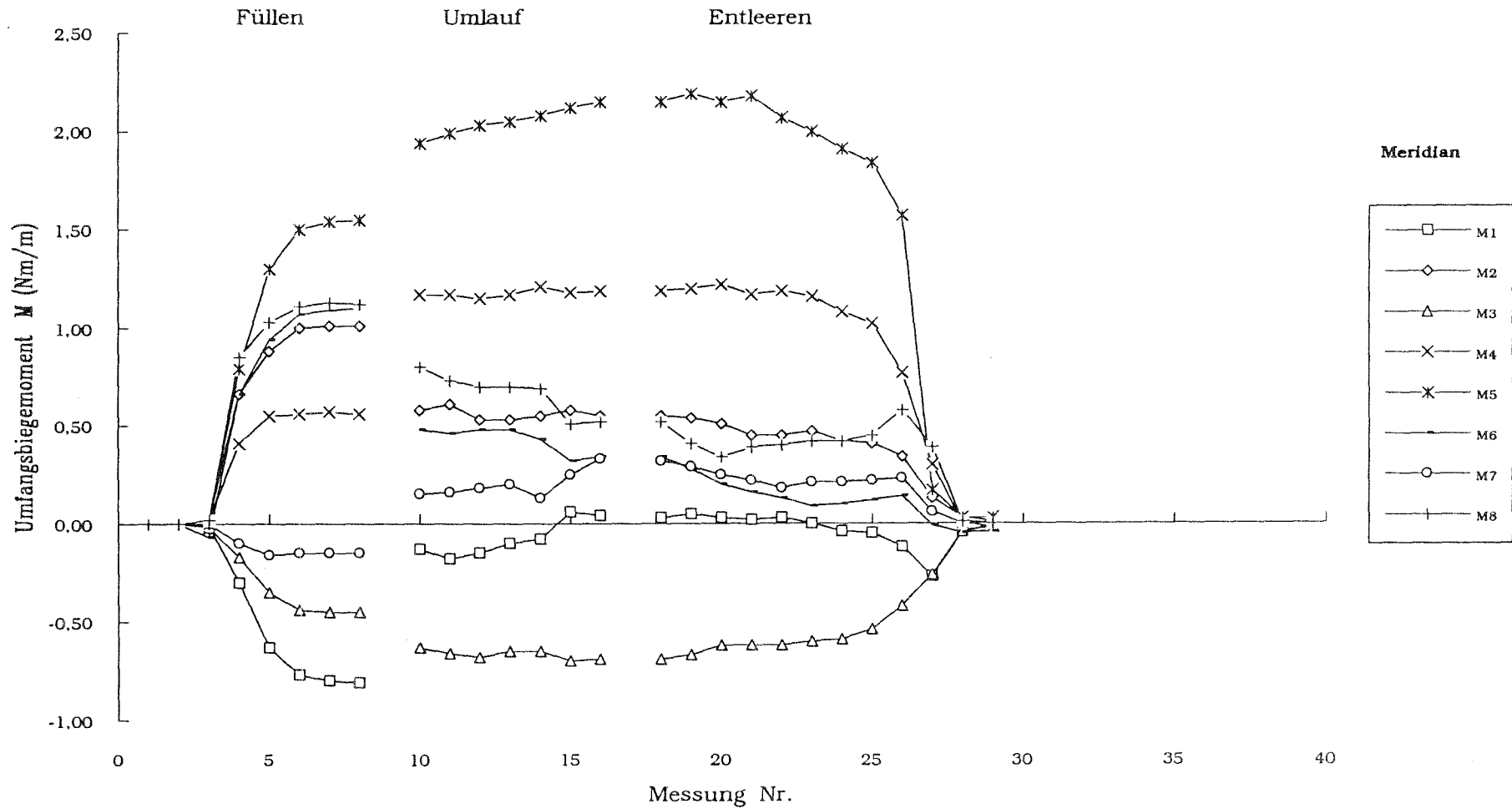


Meridian



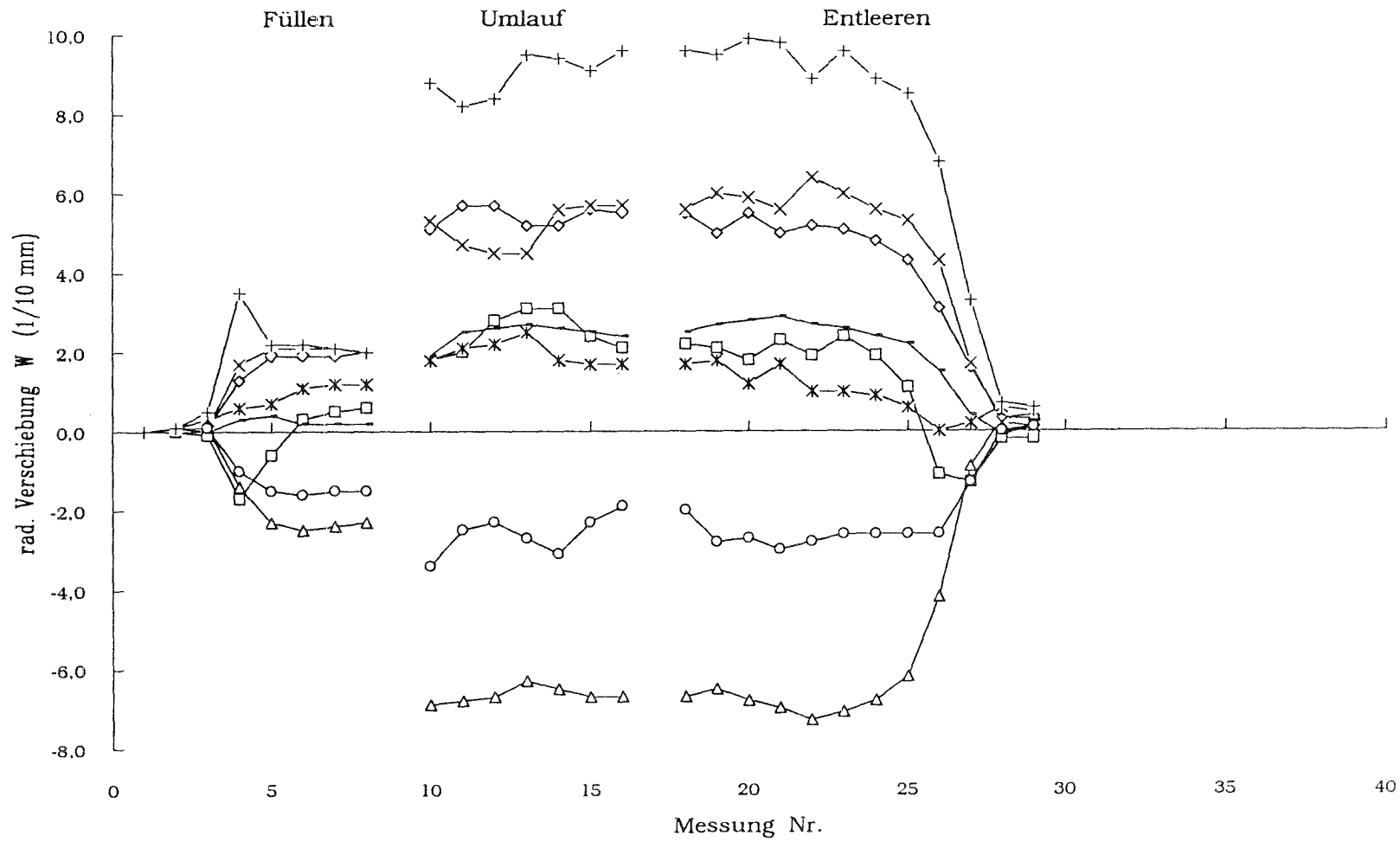
A4.102

# Versuch M 6 unterer Horizont



A 4.103

# Versuch M 6 mittlerer Horizont

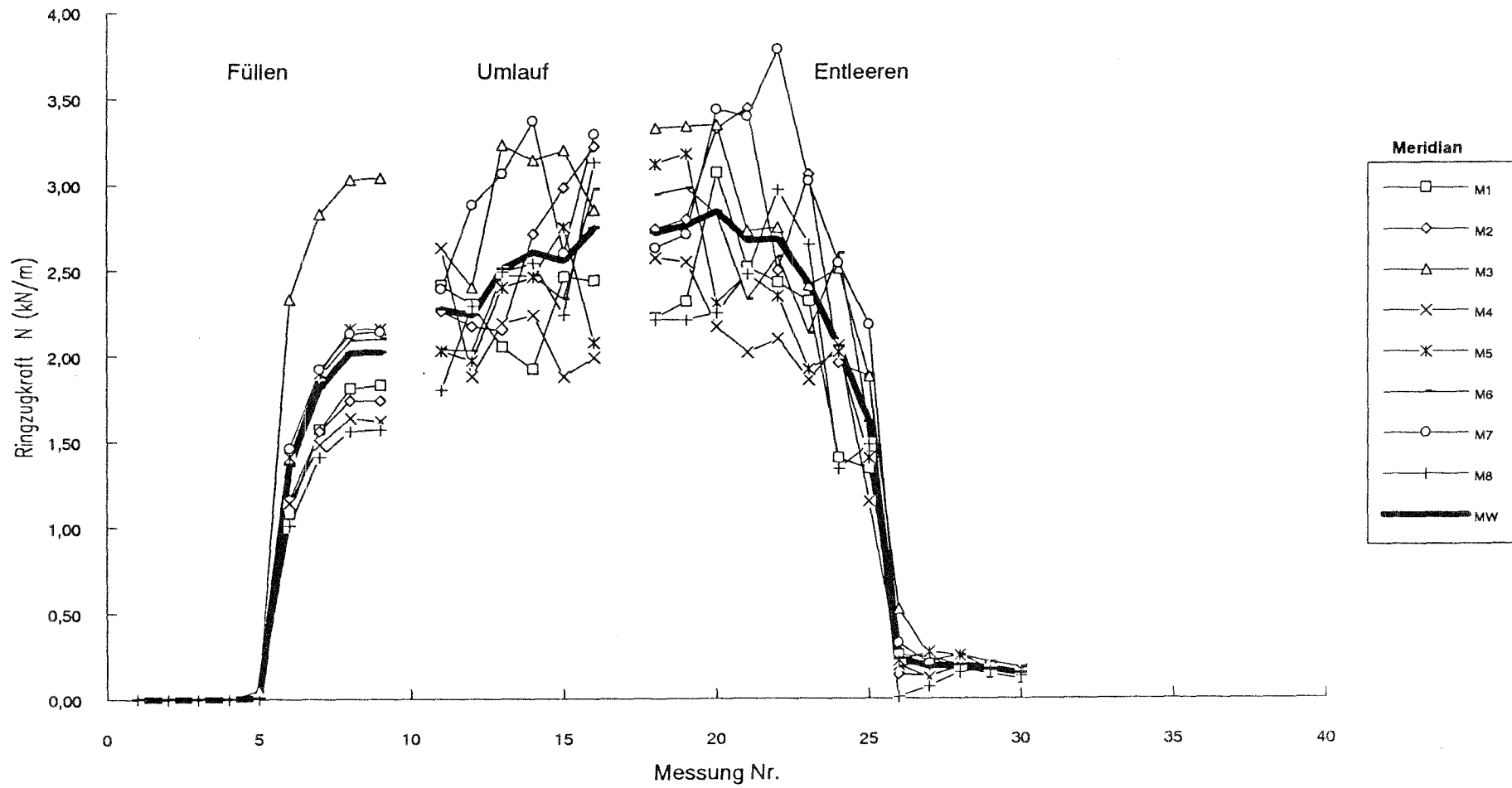


Meridian

- M1
- ◇— M2
- △— M3
- ×— M4
- ×— M5
- M6
- M7
- +— M8

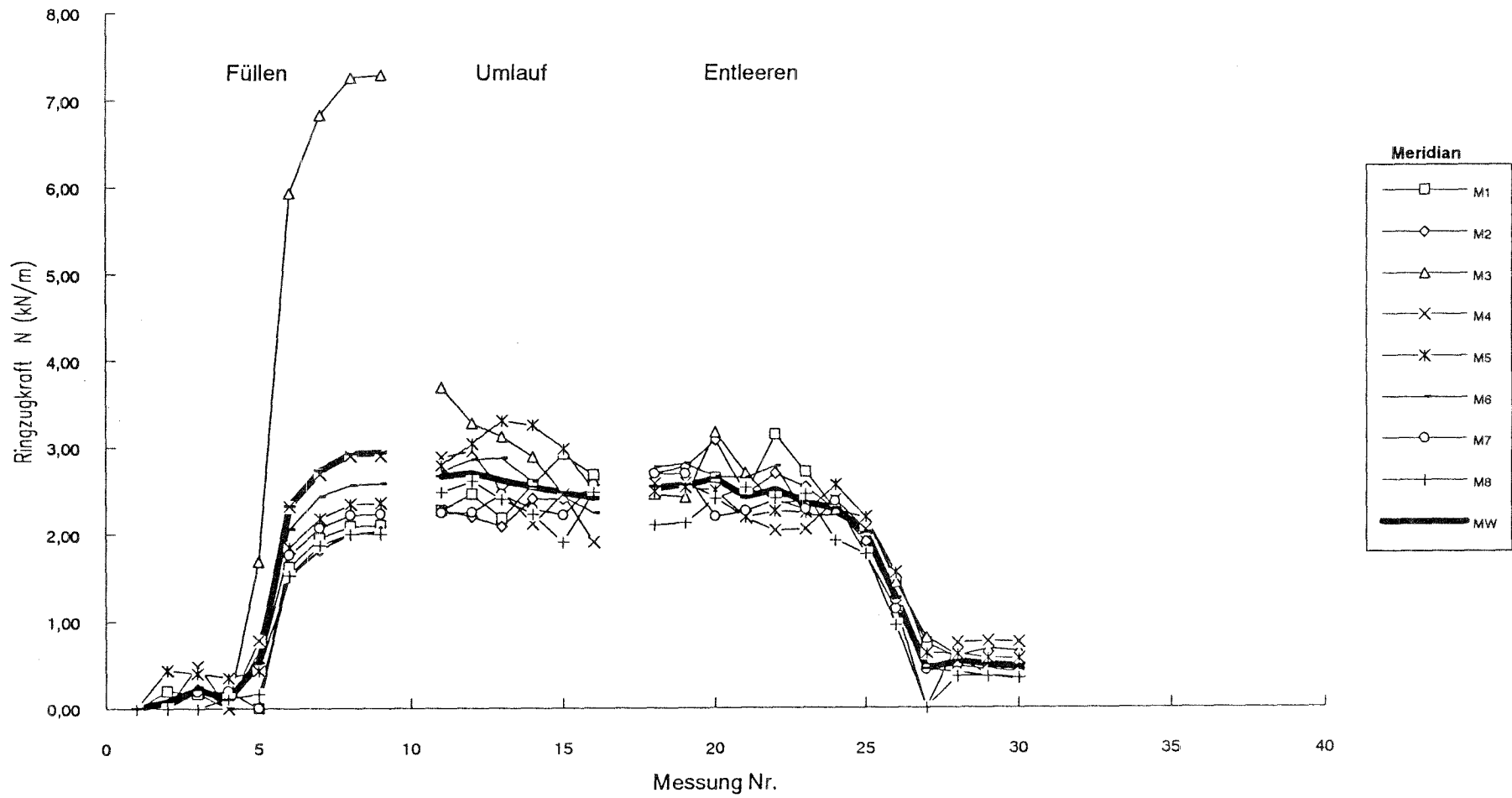
Fu. 104

# Versuch M 7 oberer Horizont



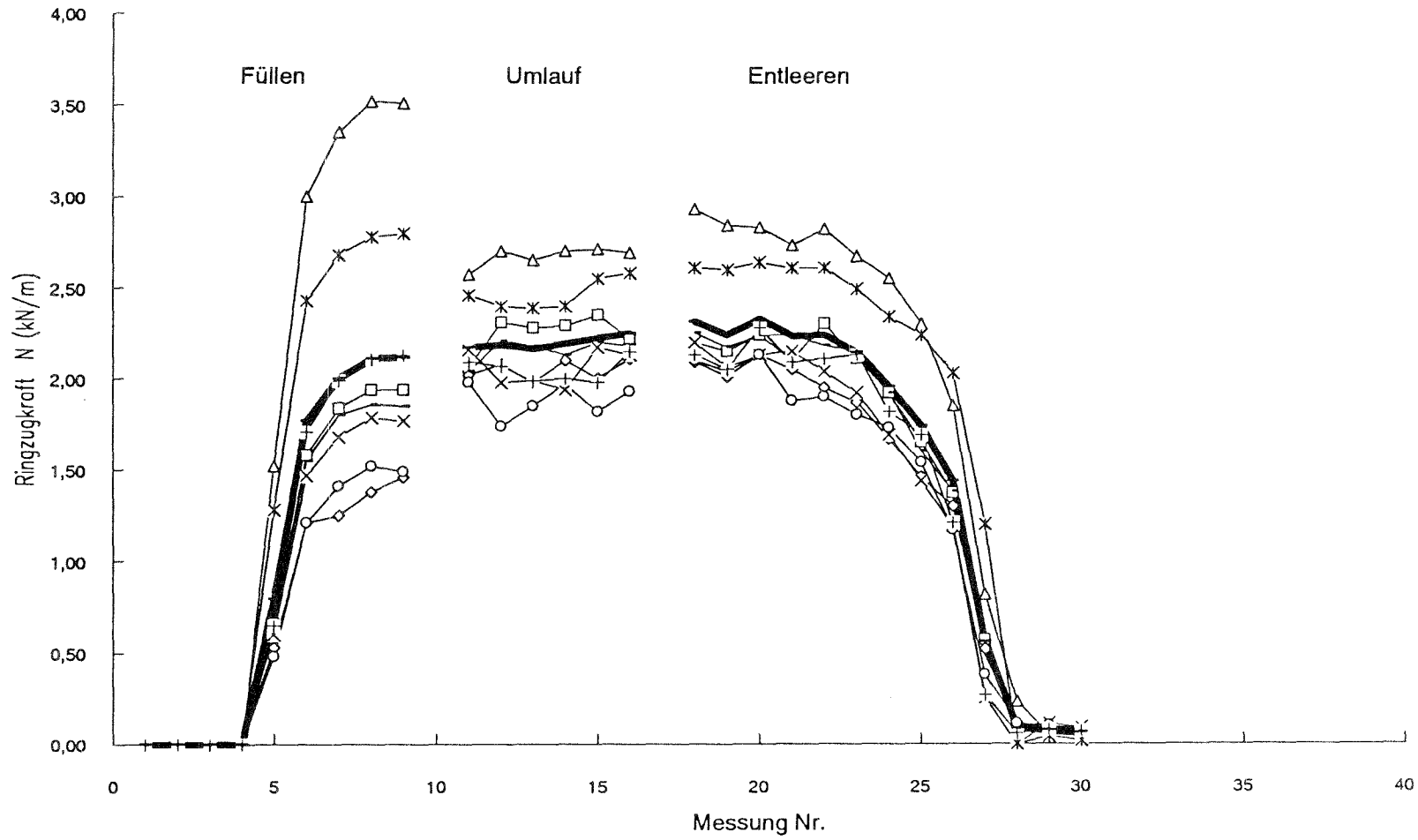
A.4.105

Versuch M 7 mittlerer Horizont



A 4.106

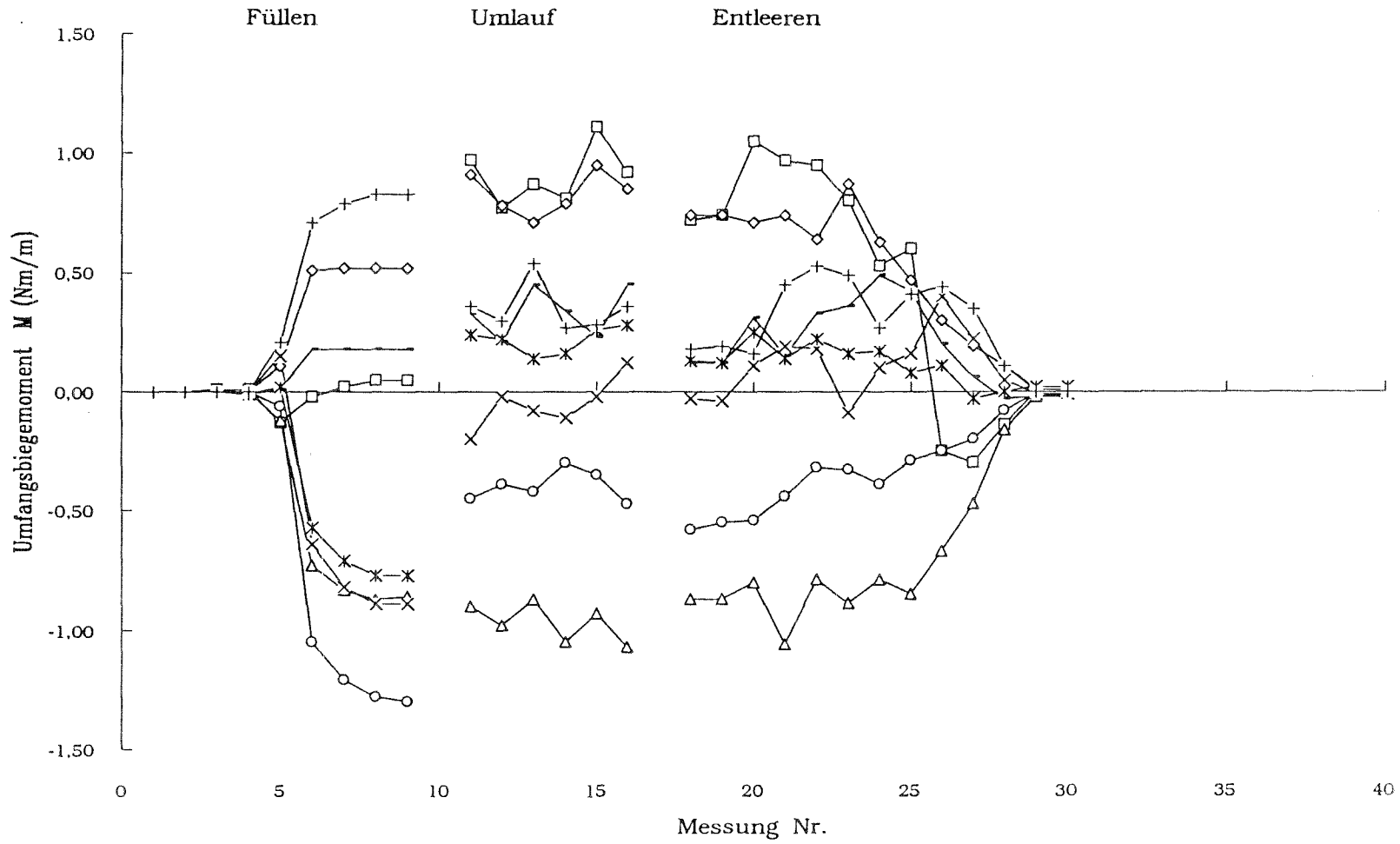
Versuch M 7 unterer Horizont



A 4.107

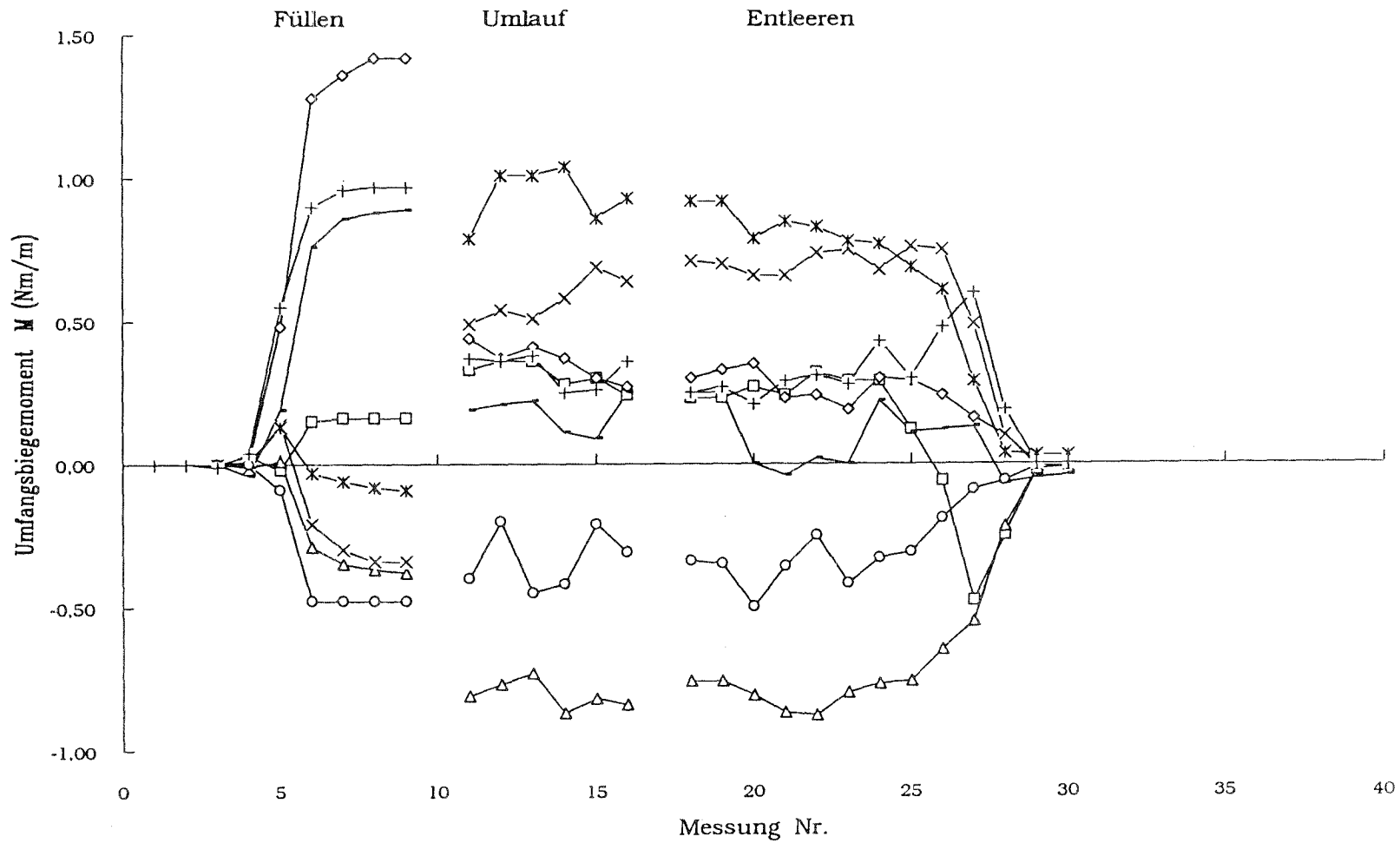


# Versuch M 7 oberer Horizont

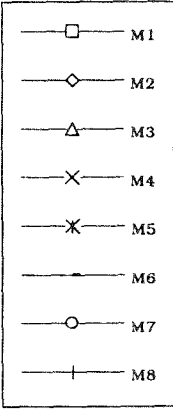


R4.108

# Versuch M 7 mittlerer Horizont

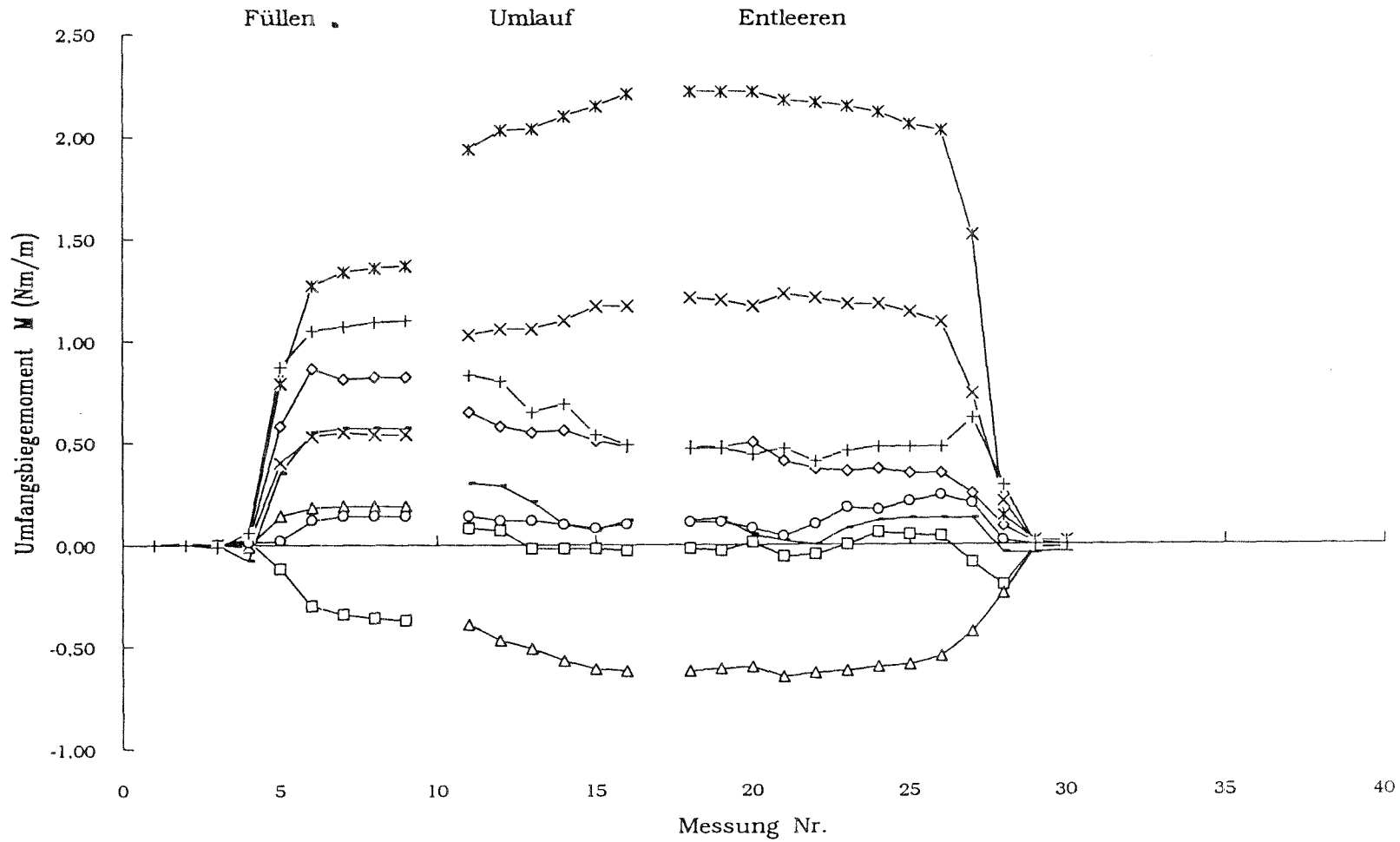


Meridian

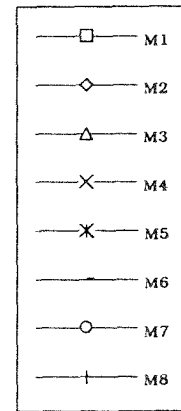


A4.109

# Versuch M 7 unterer Horizont

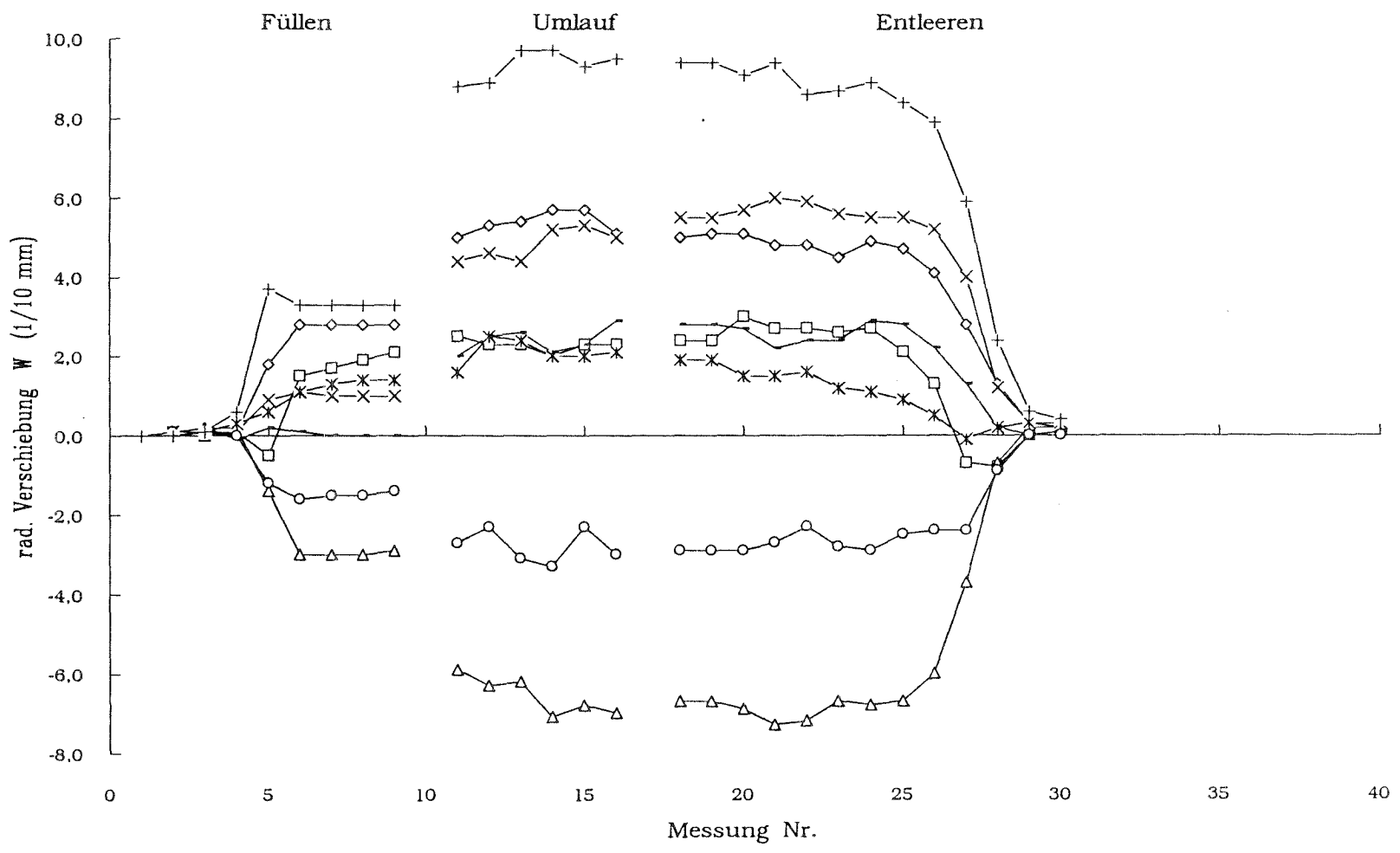


Meridian



017, 10

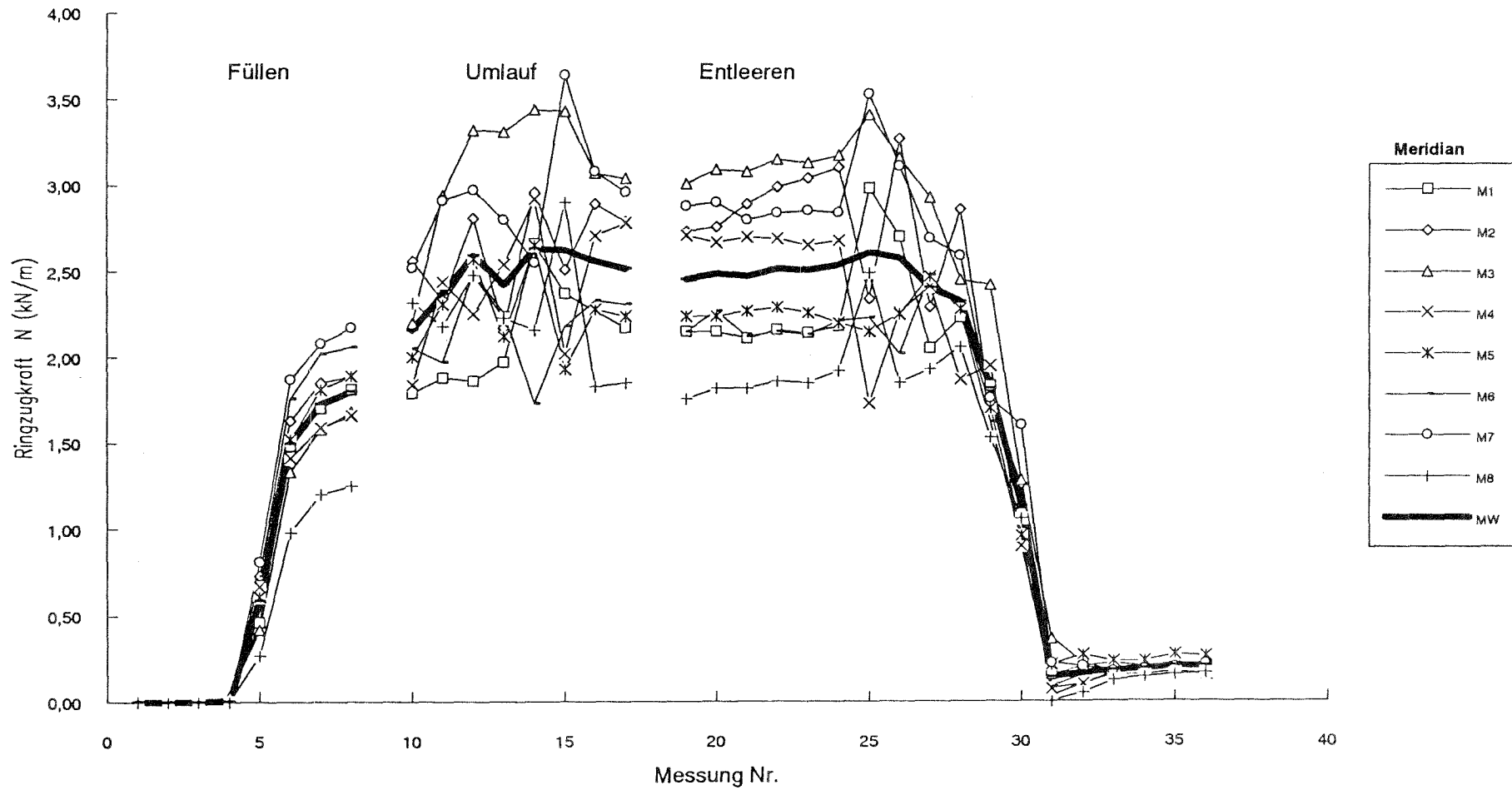
### Versuch M 7 mittlerer Horizont



- Meridian**
- M1
  - ◇— M2
  - △— M3
  - ×— M4
  - \*— M5
  - +— M6
  - M7
  - +— M8

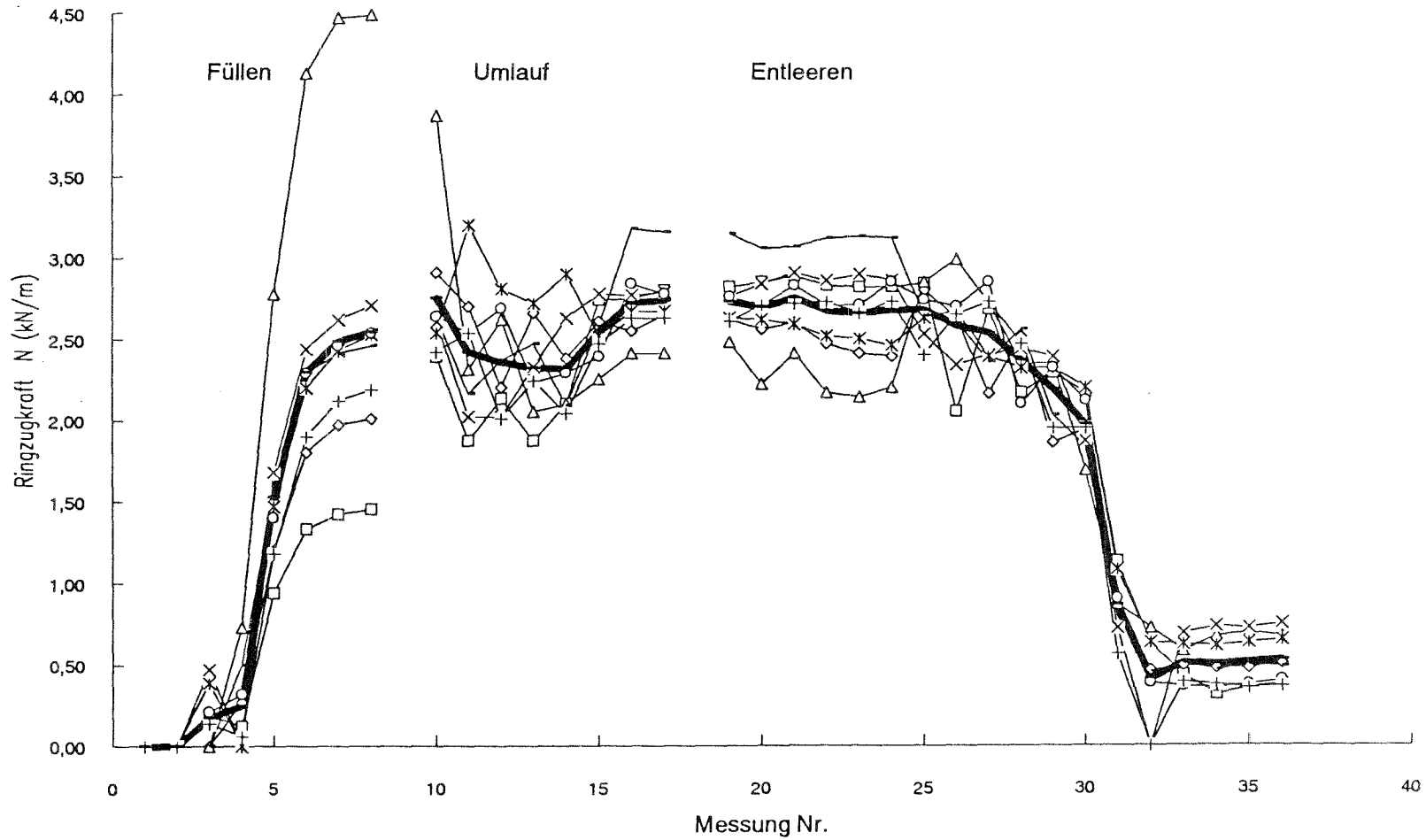
A 4.111

# Versuch M 8 oberer Horizont



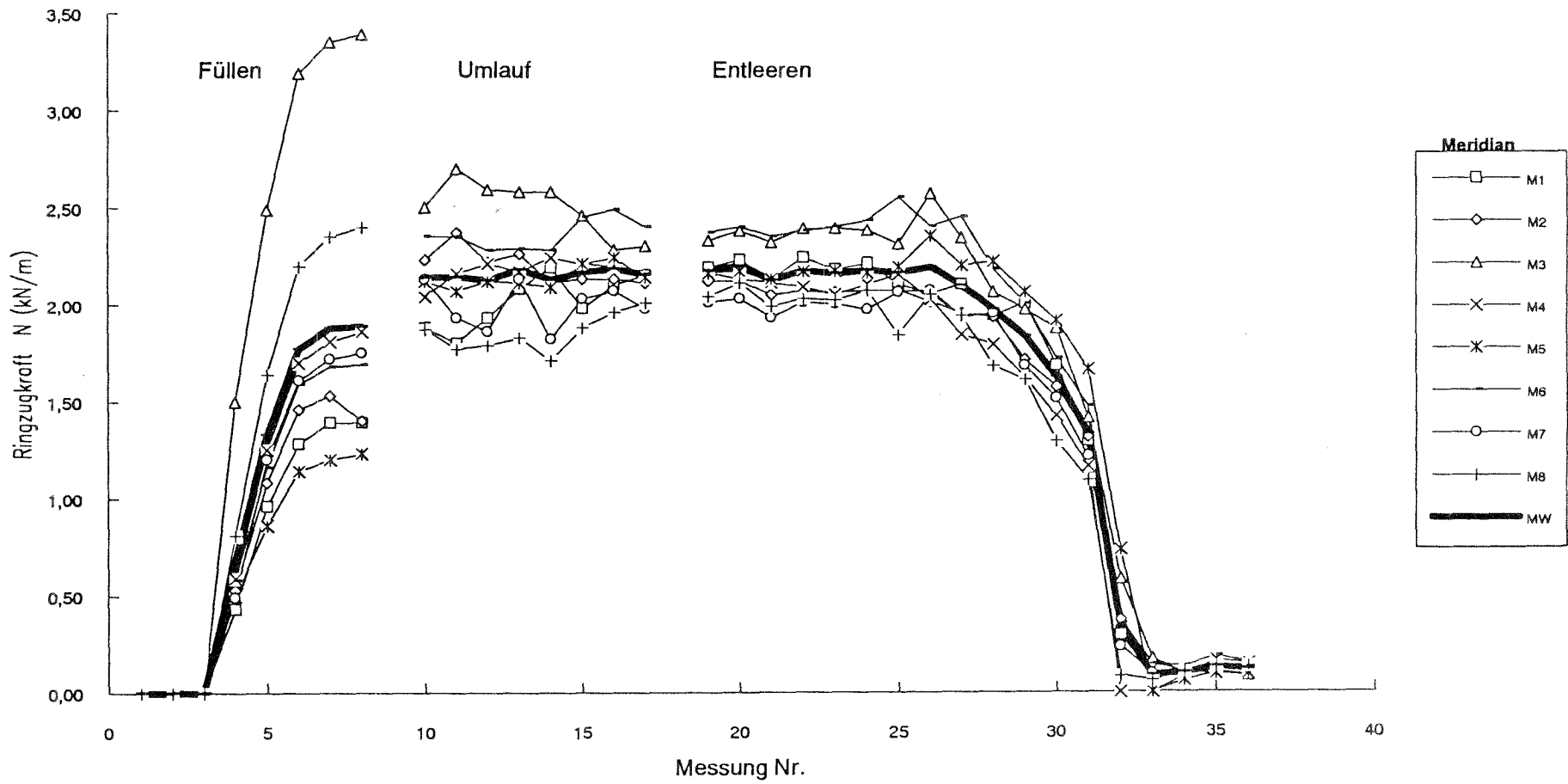
D. U. 112

### Versuch M 8 mittlerer Horizont



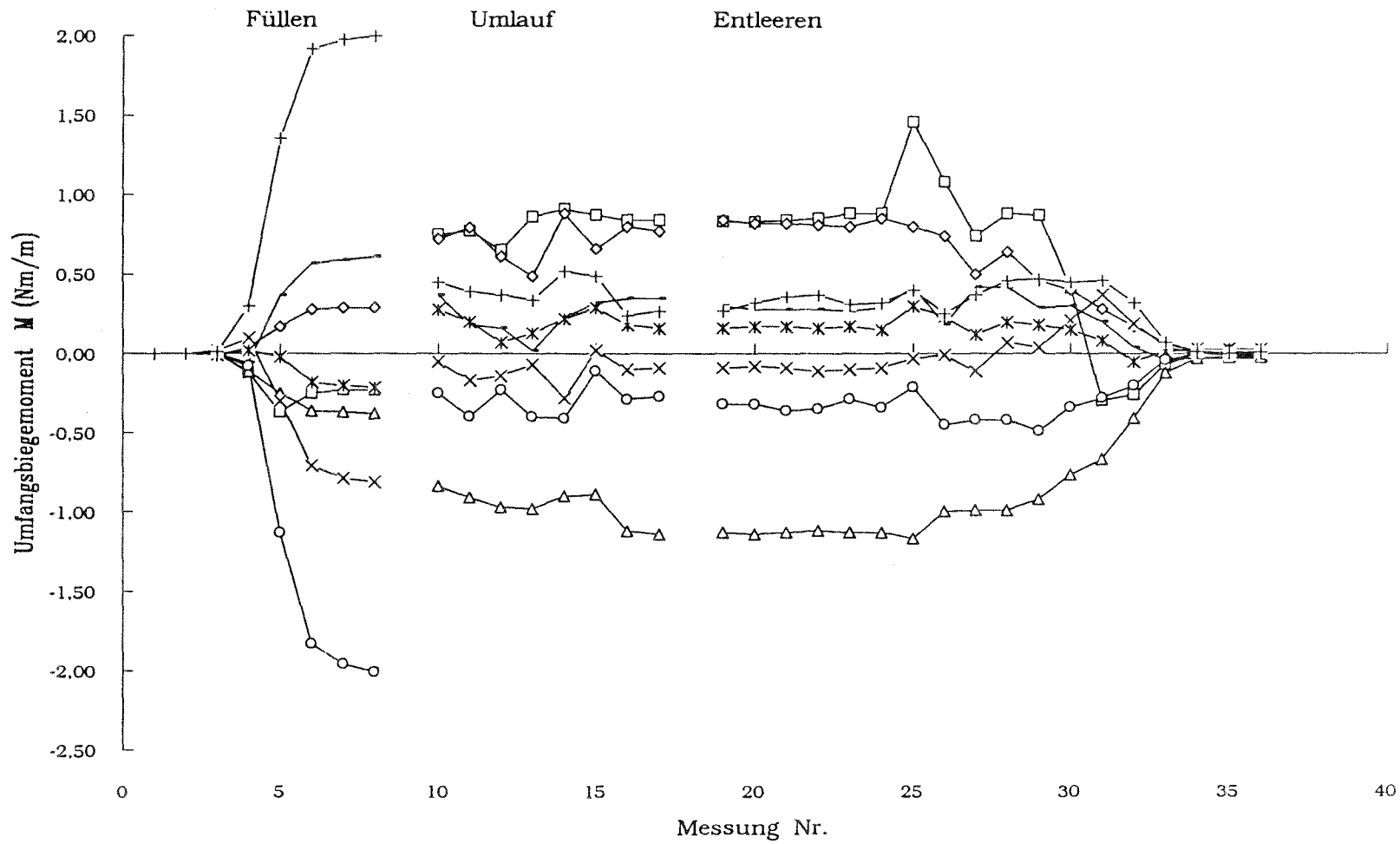
04.13

Versuch M 8 unterer Horizont

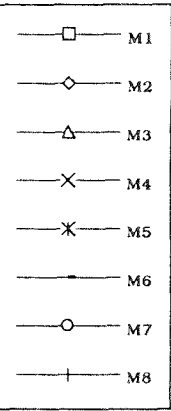


14.11

# Versuch M 8 oberer Horizont



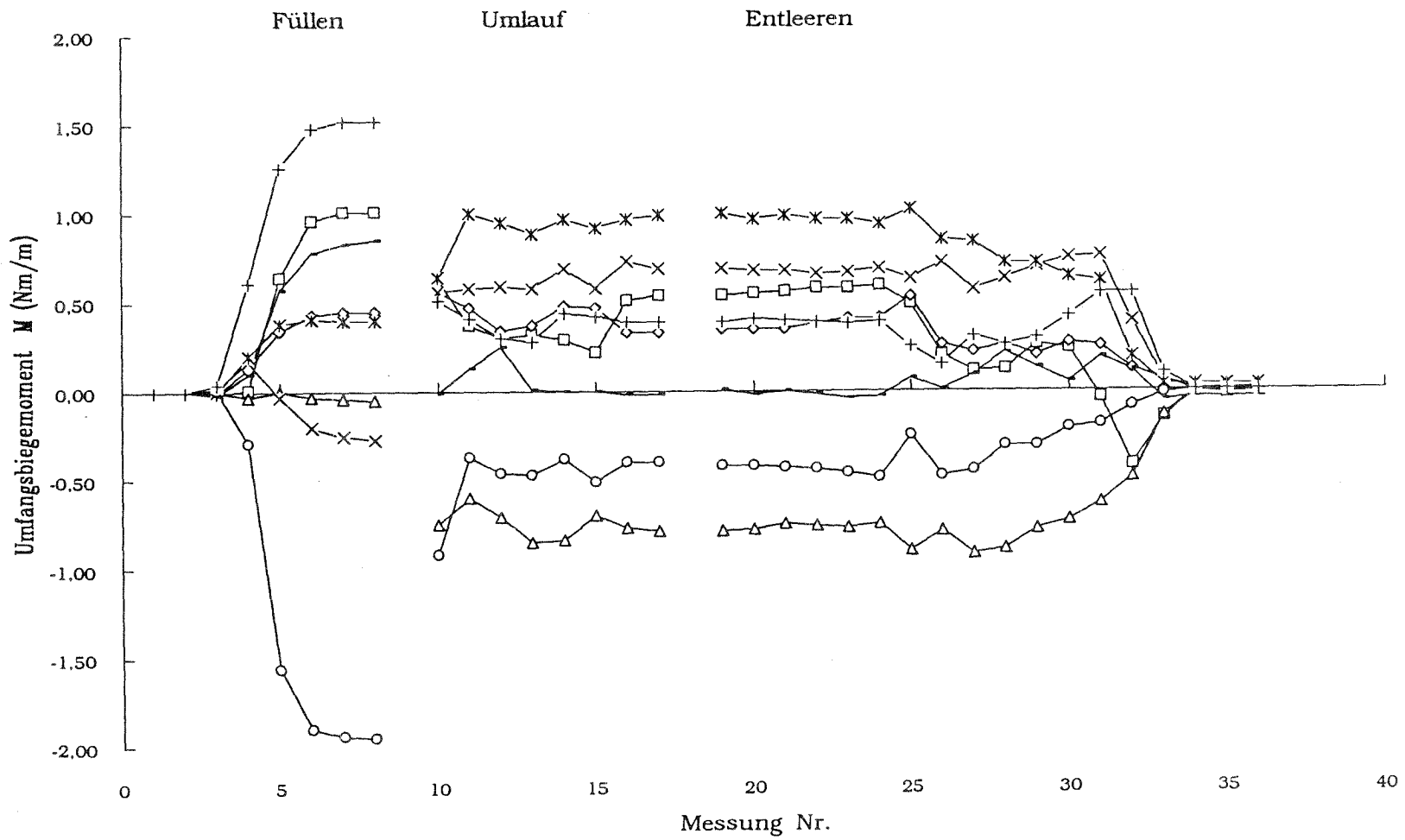
Meridian



R. 4. 1. 15



# Versuch M 8 mittlerer Horizont

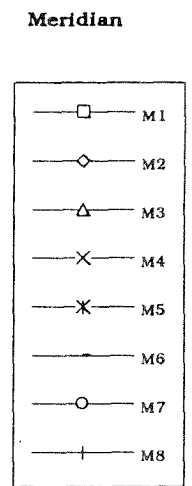
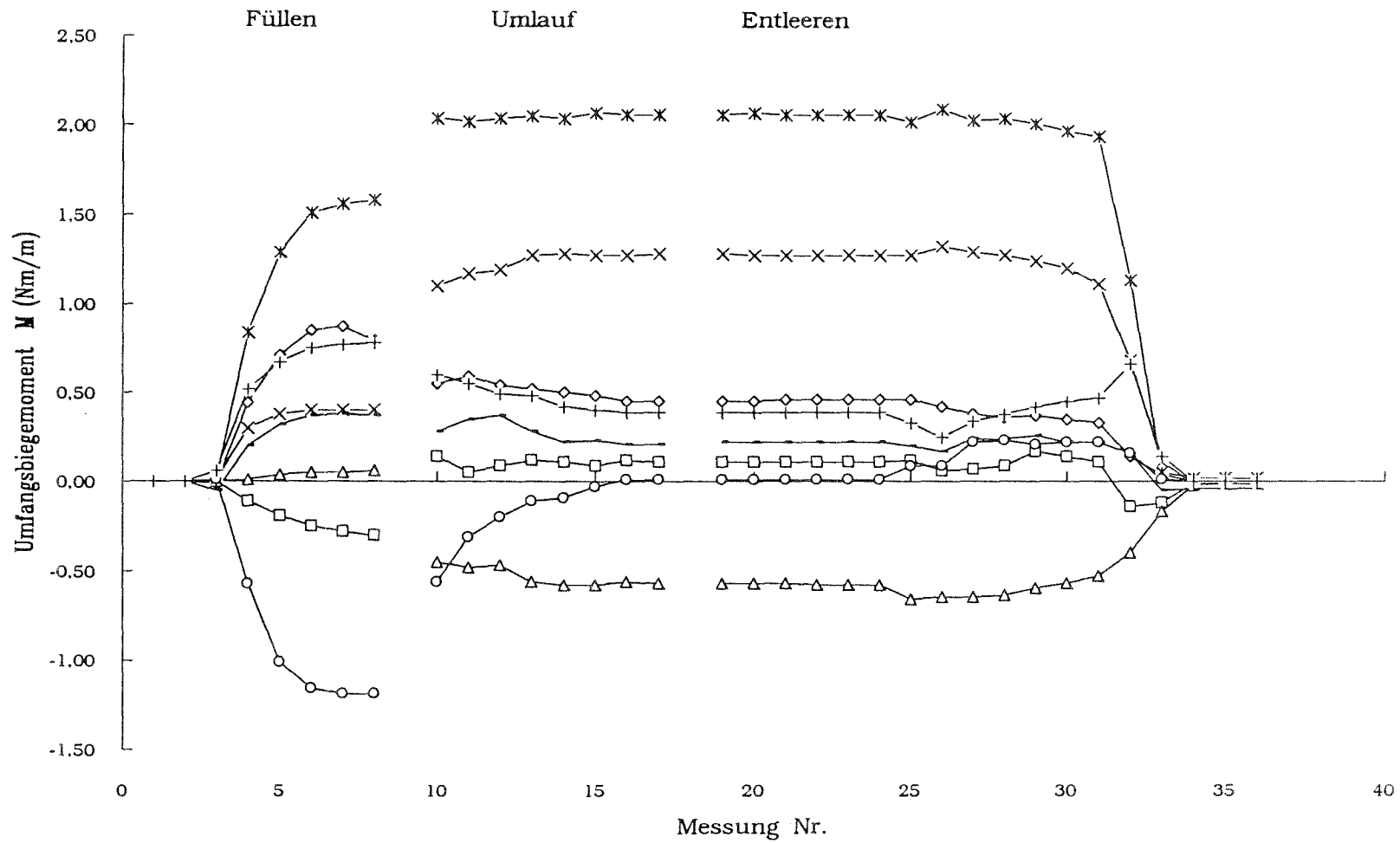


Meridian

- M1
- ◇— M2
- △— M3
- ×— M4
- \*— M5
- +— M6
- M7
- |— M8

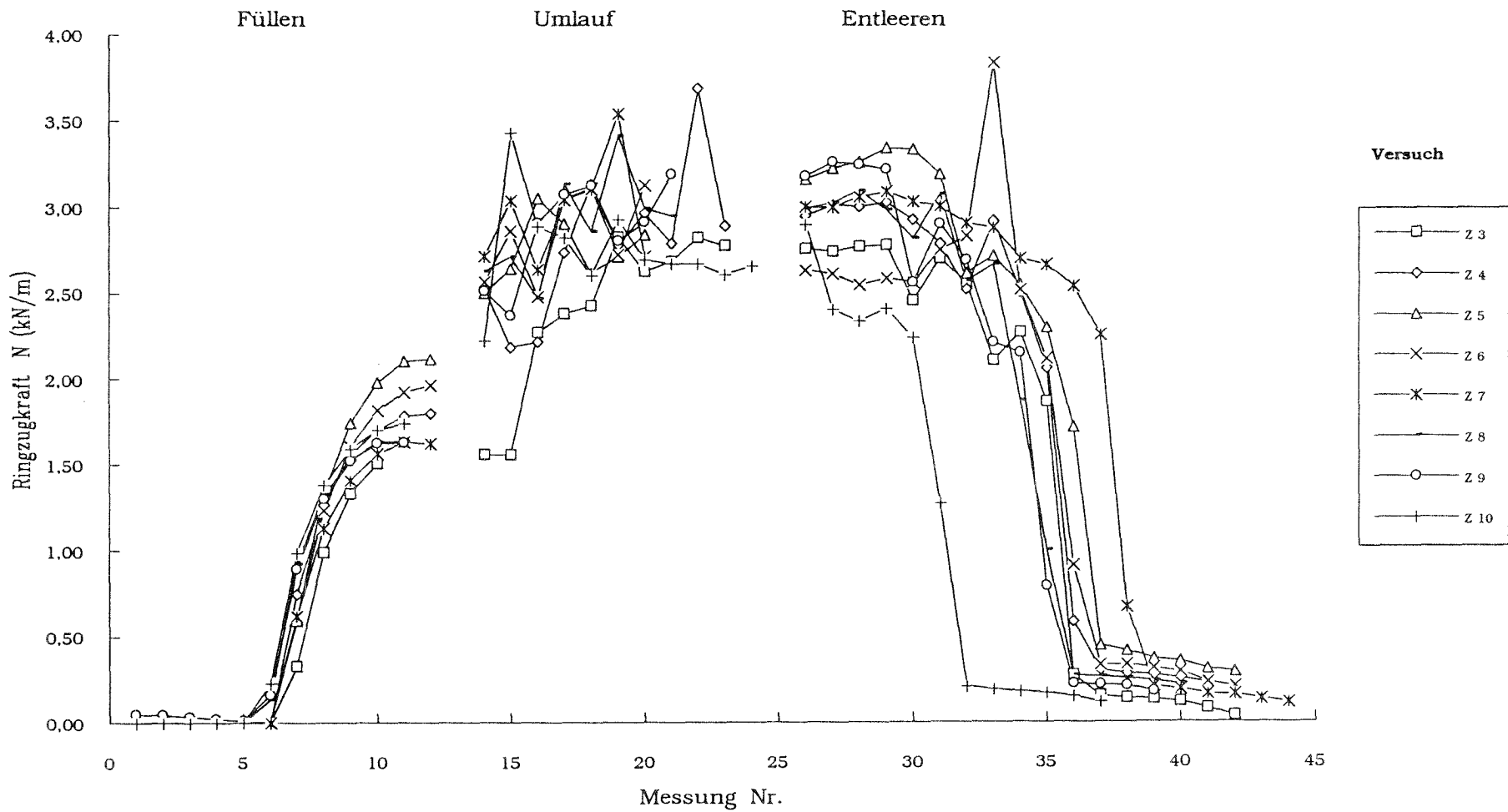
17.4.11.6

# Versuch M 8 unterer Horizont



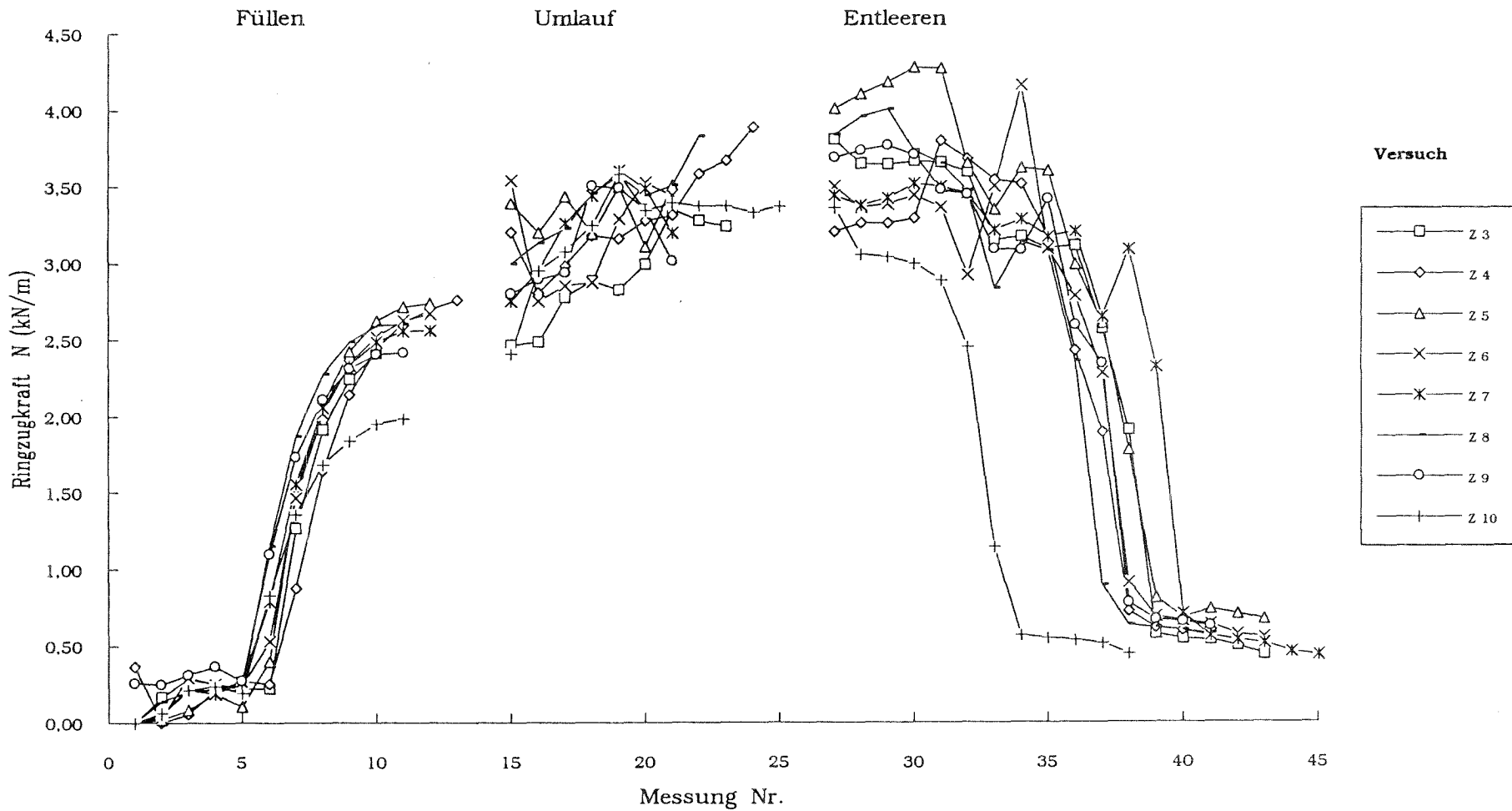
D. U. M. T.

Mittelwert aus den Versuchen Z 3 - Z 10 oberer Horizont



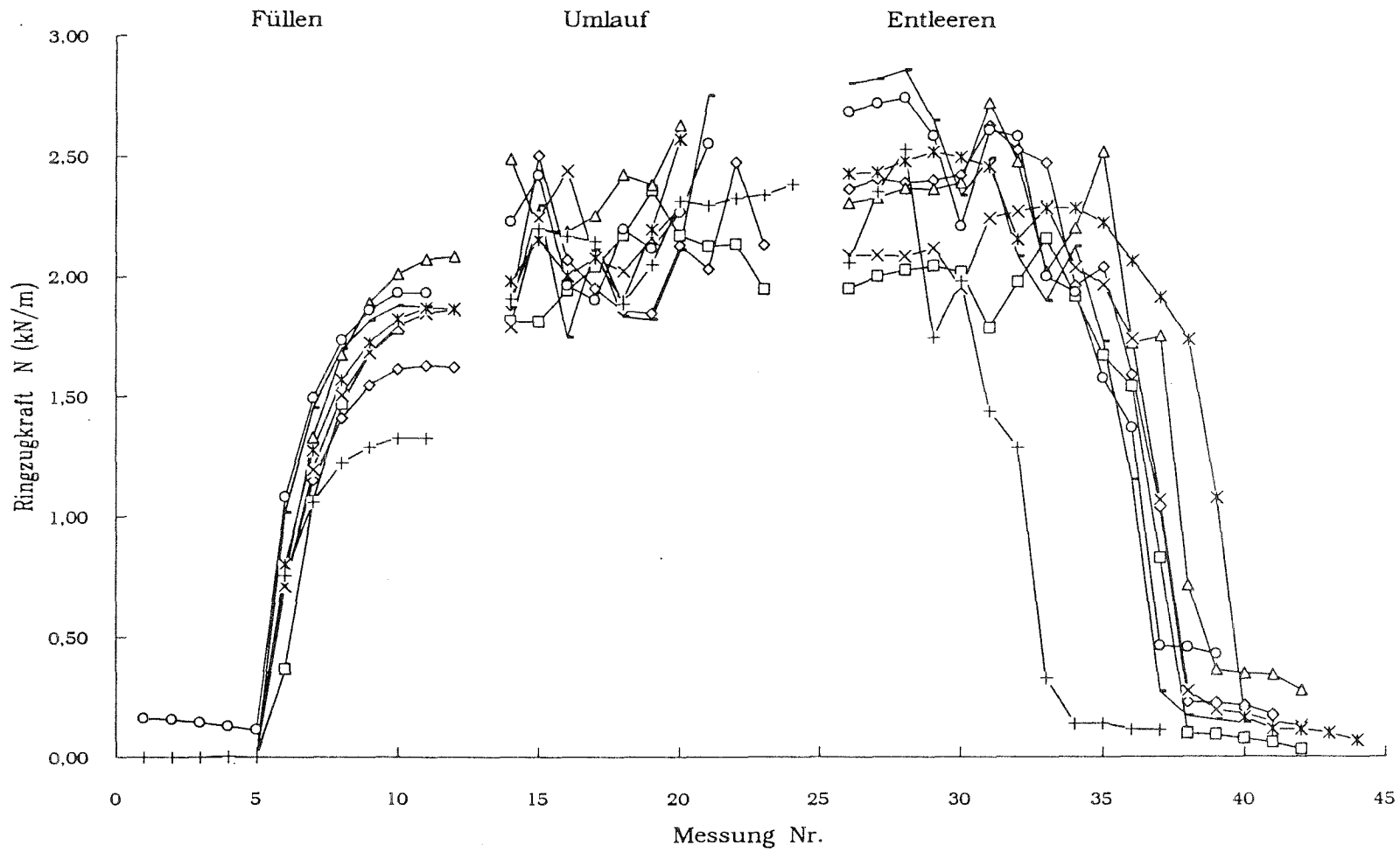
14.189

Mittelwert aus den Versuchen Z 3 - Z 10 mittlerer Horizont



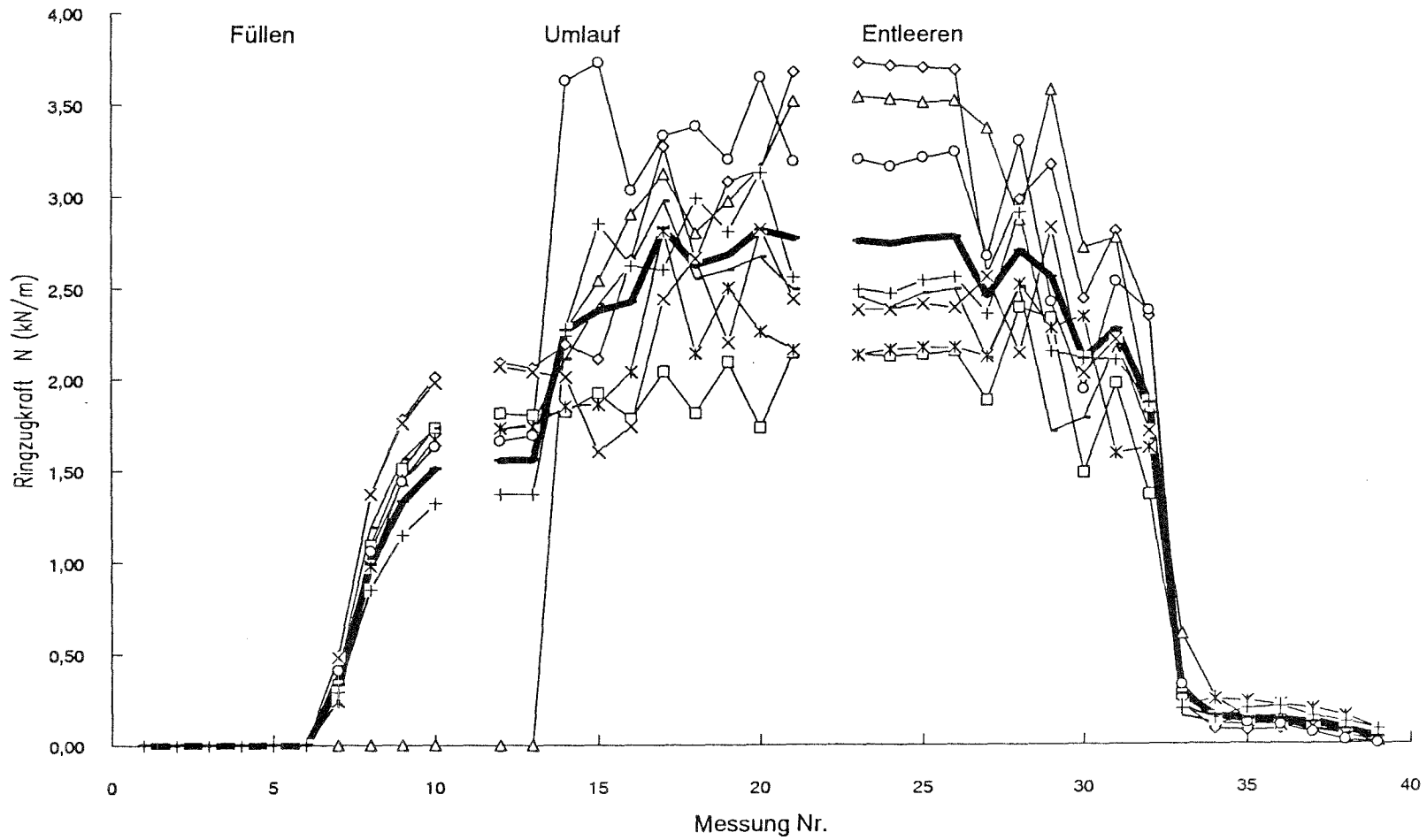
P 4.120

Mittelwert aus den Versuchen Z 3 - Z 10 unterer Horizont



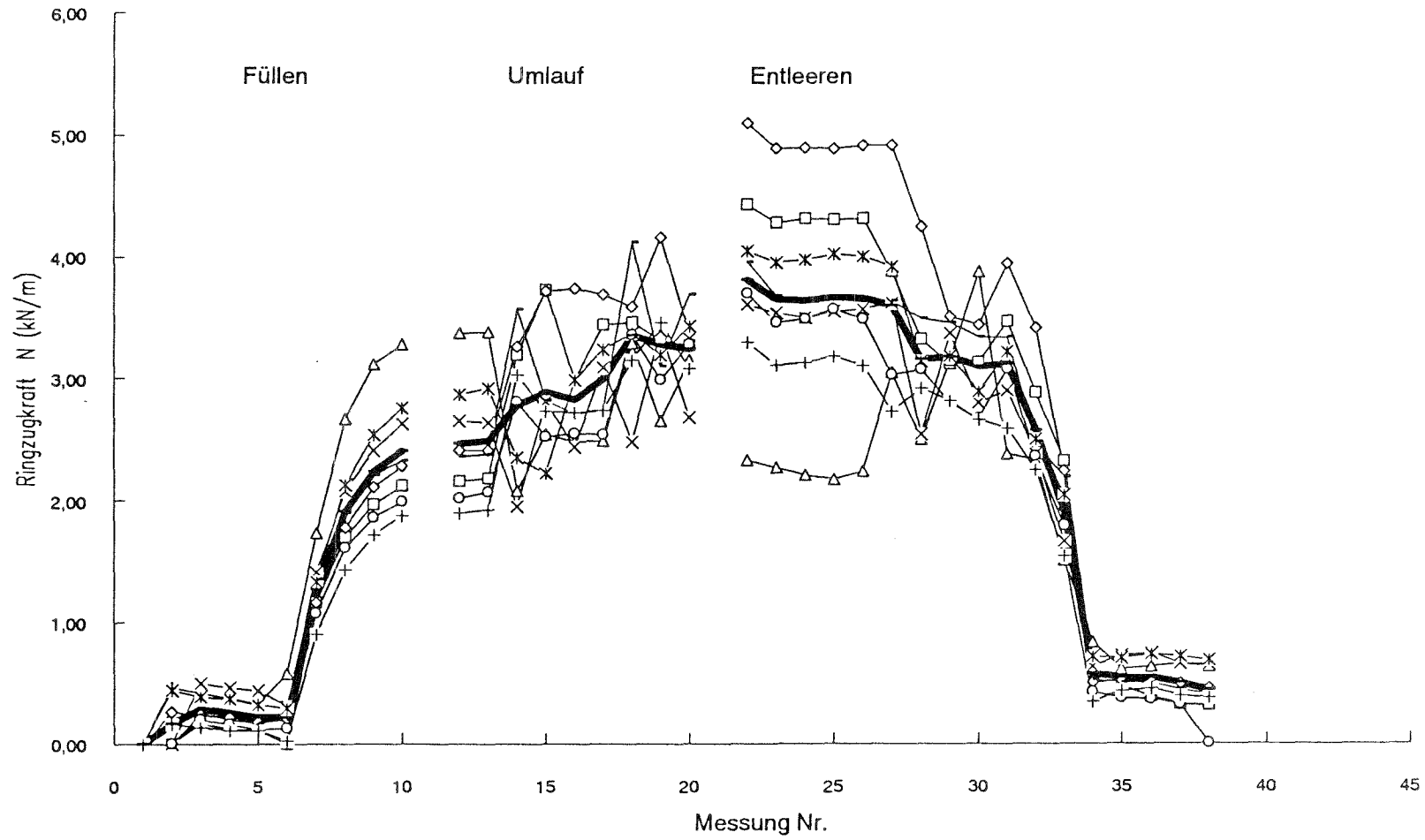
Pl. 121

### Versuch Z 3 oberer Horizont



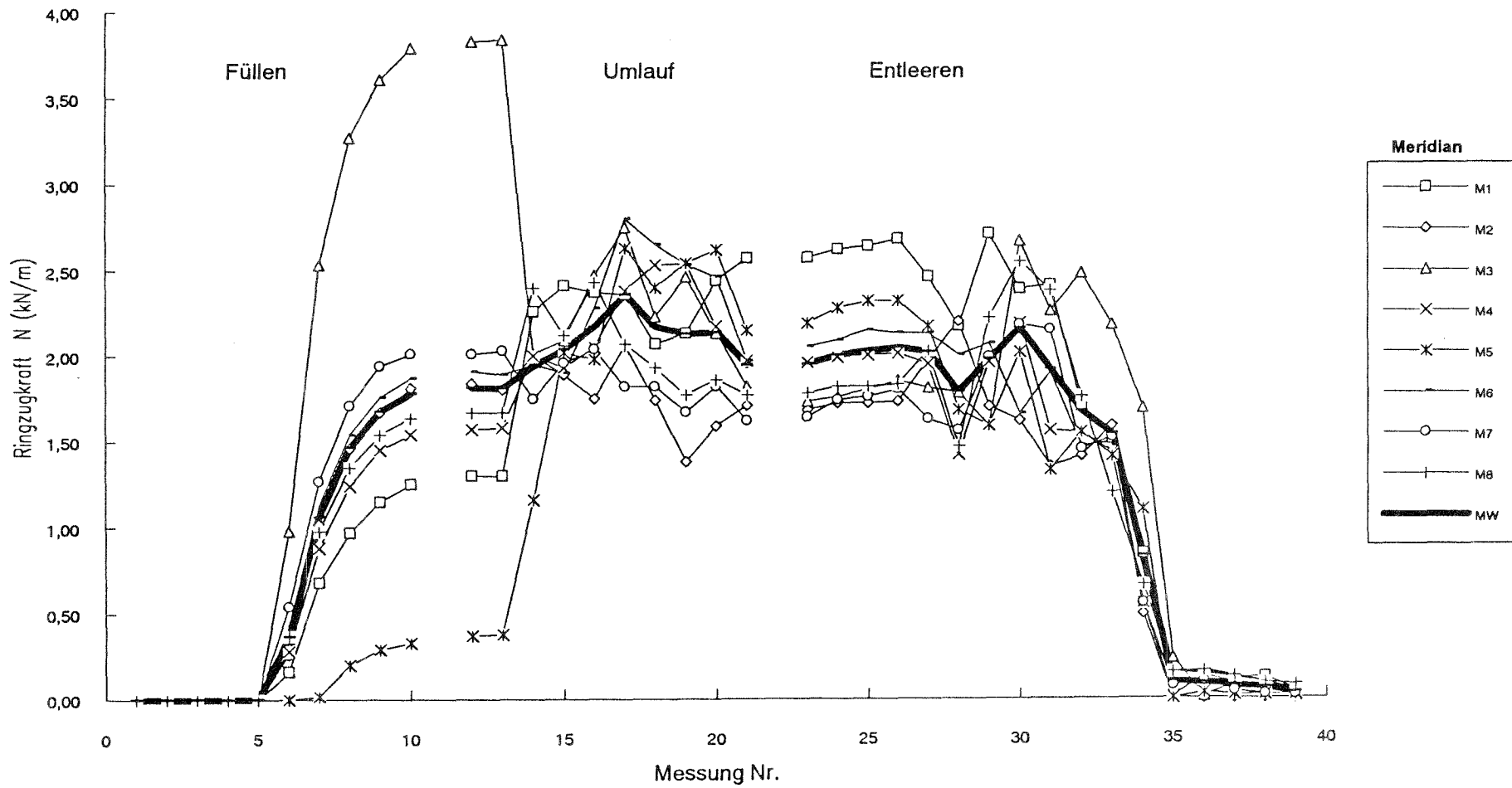
A 4.122

Versuch Z 3 mittlerer Horizont



A 4.123

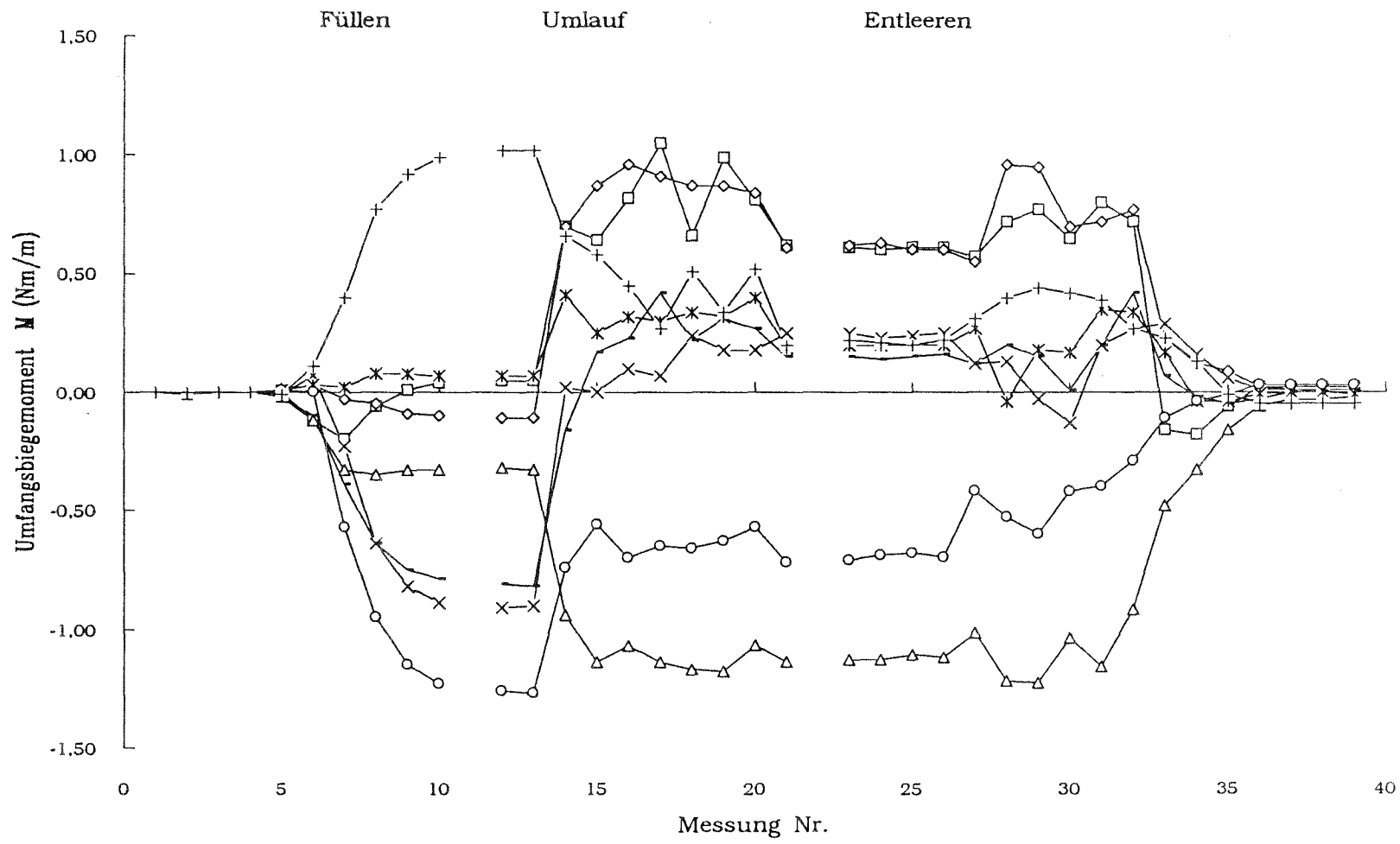
Versuch Z 3 unterer Horizont



12.12.24



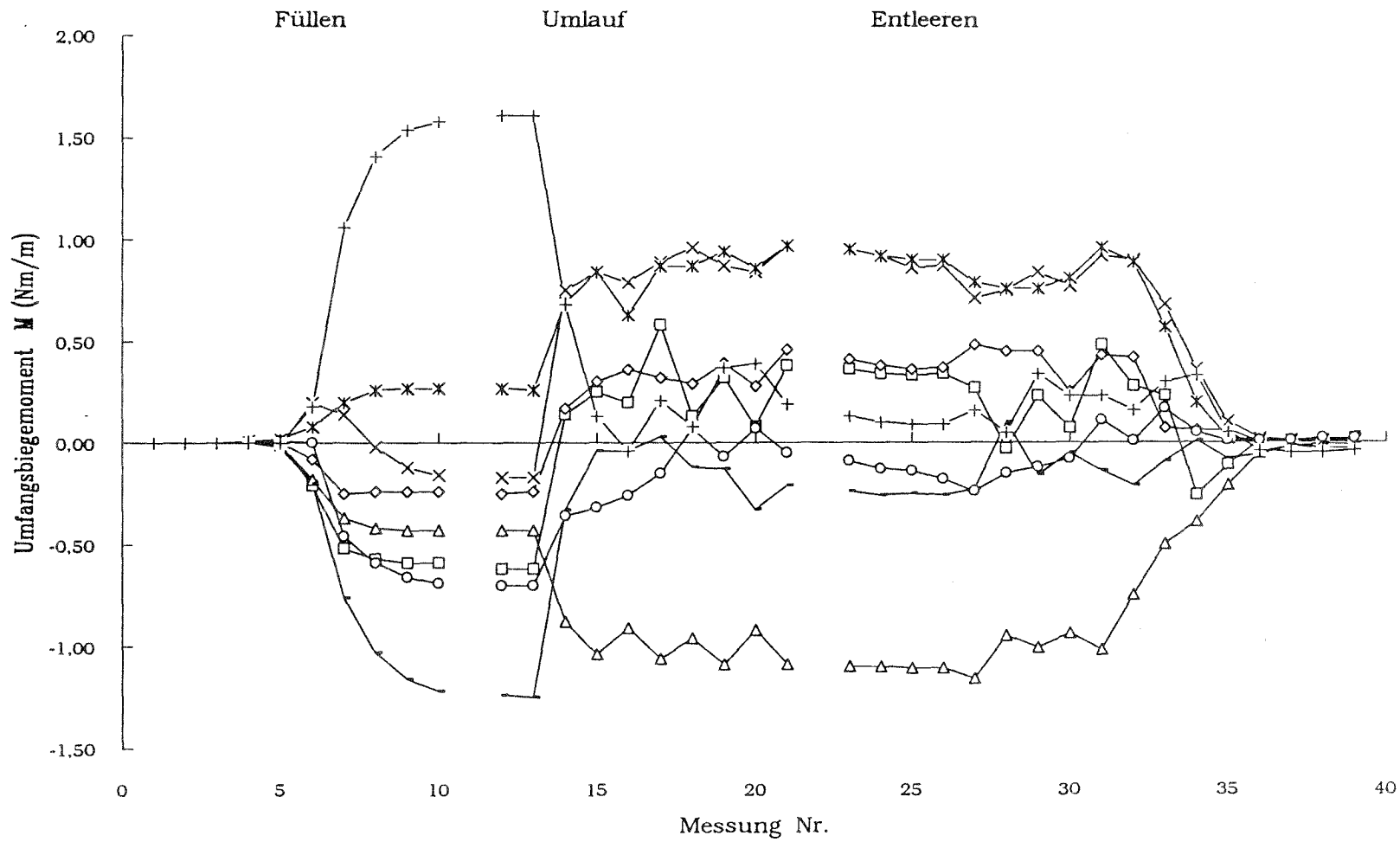
**Versuch Z 3 oberer Horizont**



- Meridian**
- M1
  - ◇— M2
  - △— M3
  - ×— M4
  - \*— M5
  - — M6
  - M7
  - +— M8

A 4.125

# Versuch Z 3 mittlerer Horizont

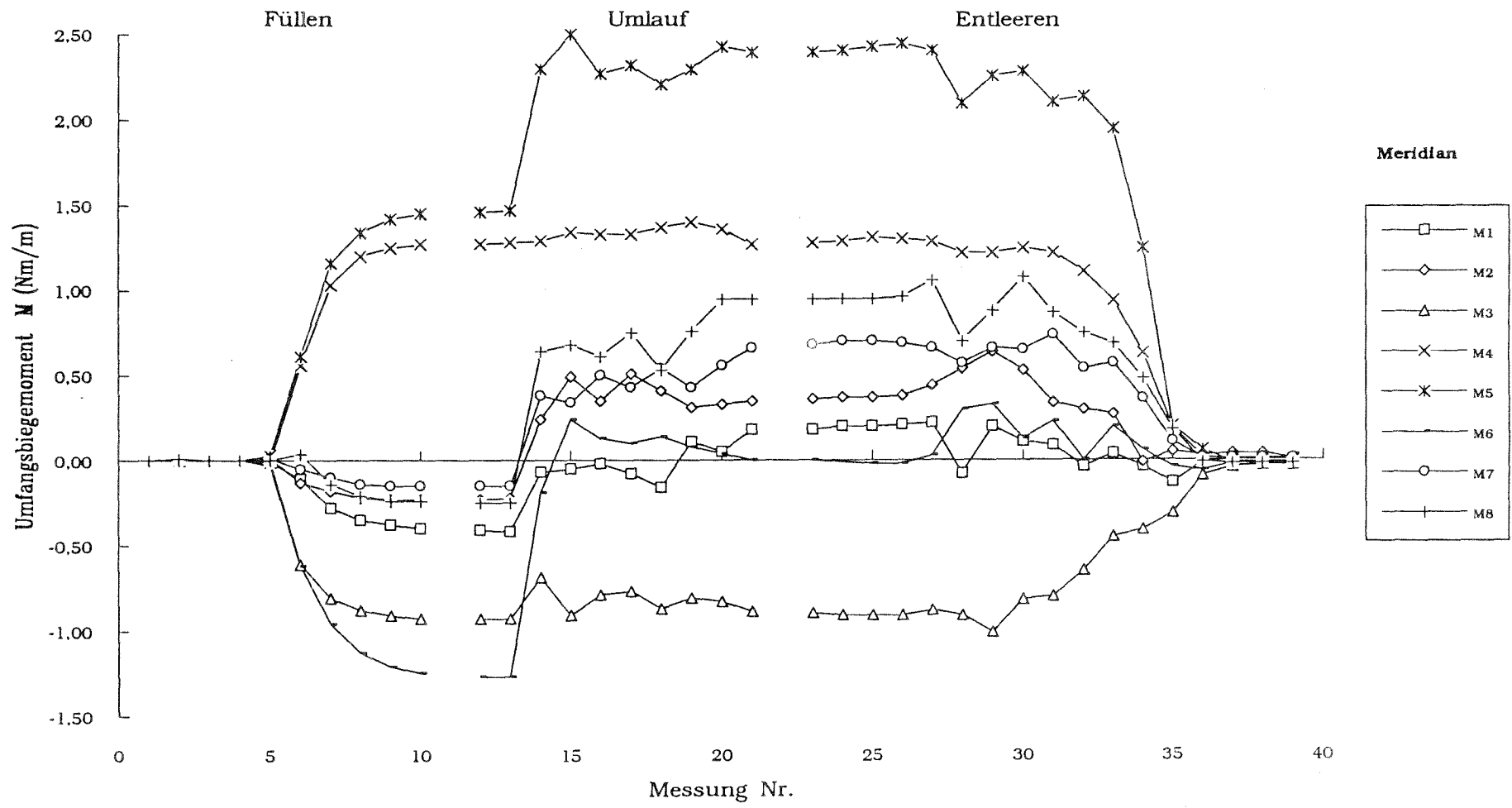


Meridian

- M1
- ◇— M2
- △— M3
- ×— M4
- \*— M5
- M6
- M7
- +— M8

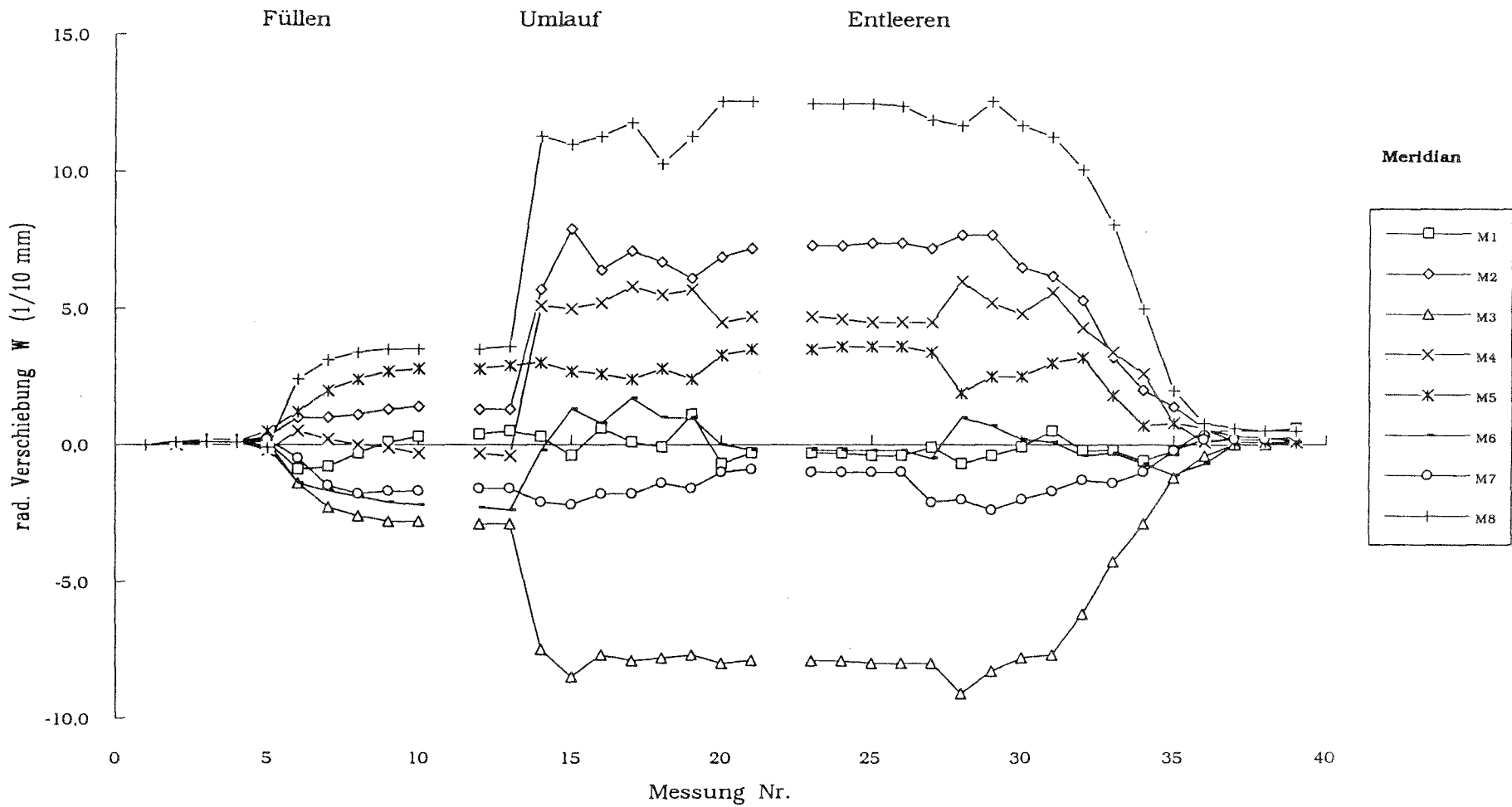
A4.126

# Versuch Z 3 unterer Horizont



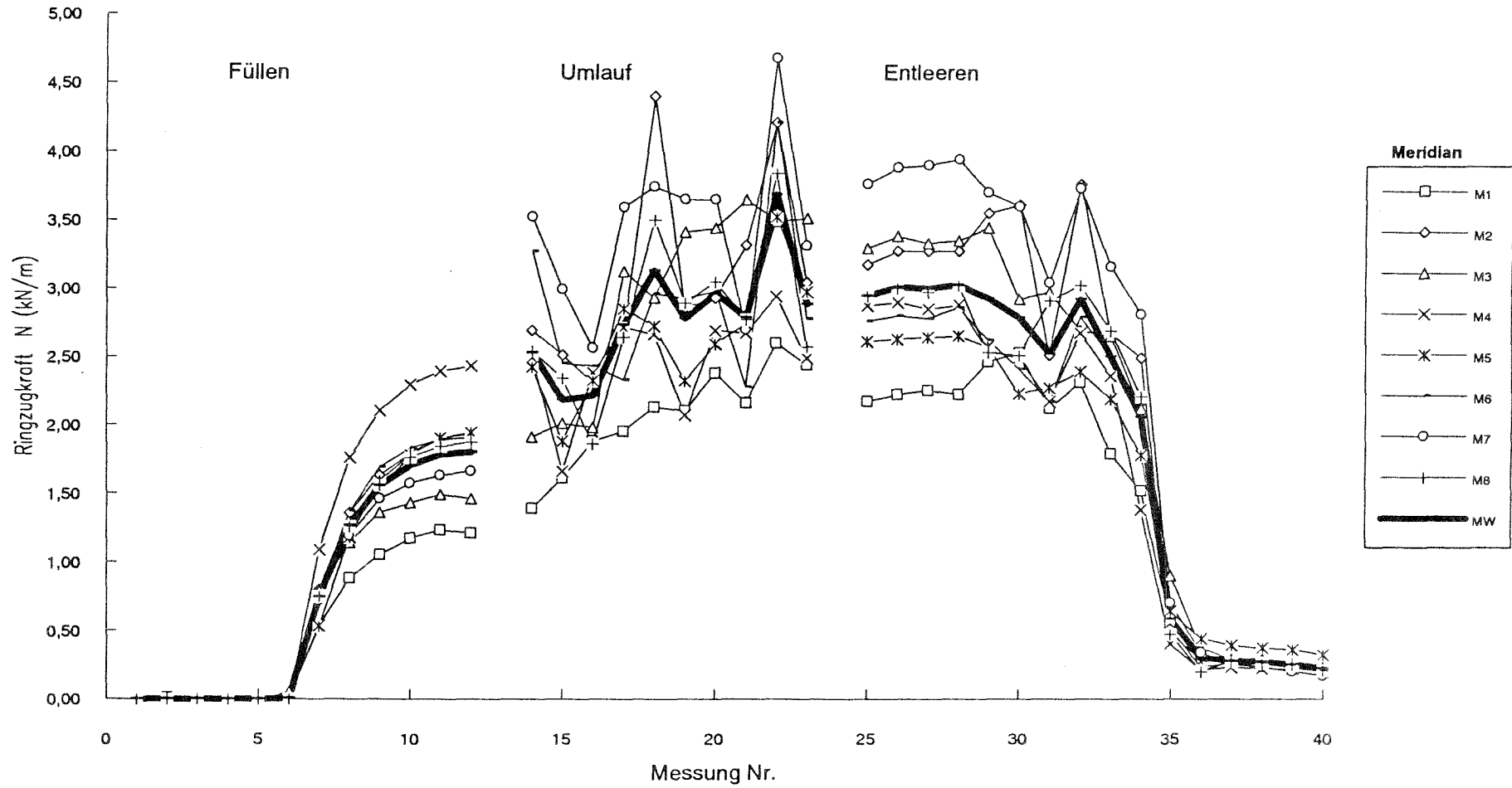
A 4.122

# Versuch Z 3 mittlerer Horizont



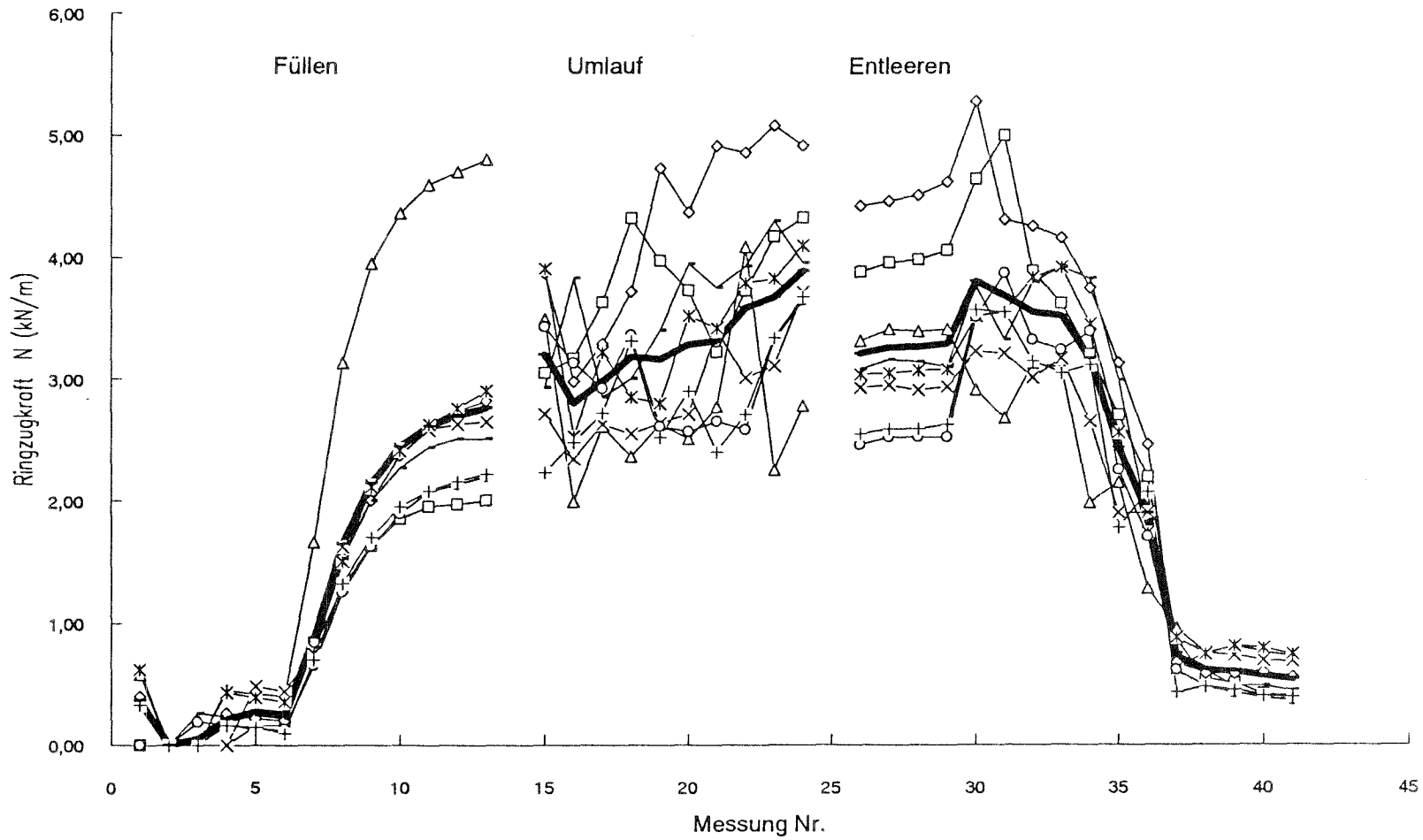
A4.128

Versuch Z 4 oberer Horizont



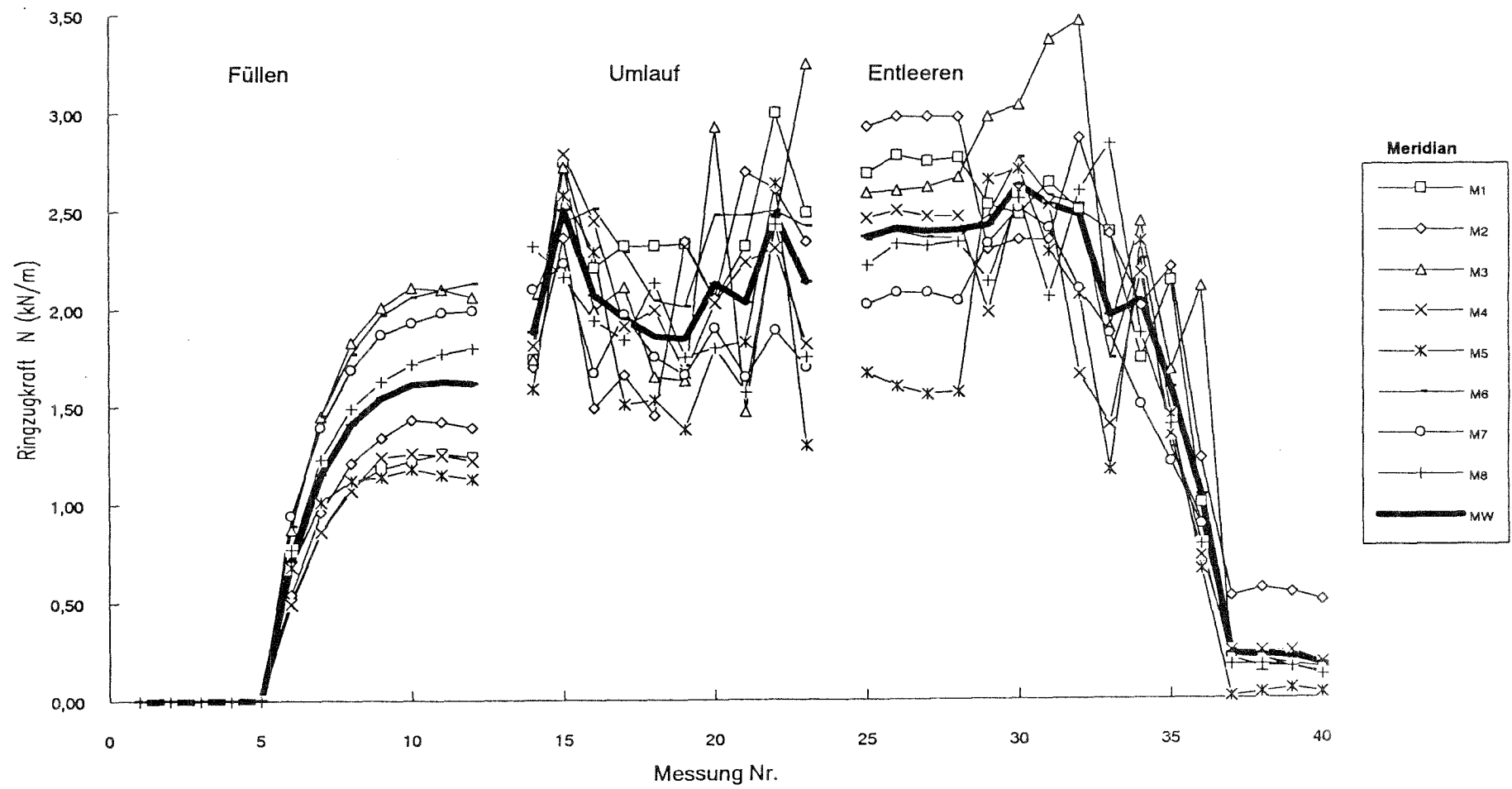
PA 4.1209

Versuch Z 4 mittlerer Horizont



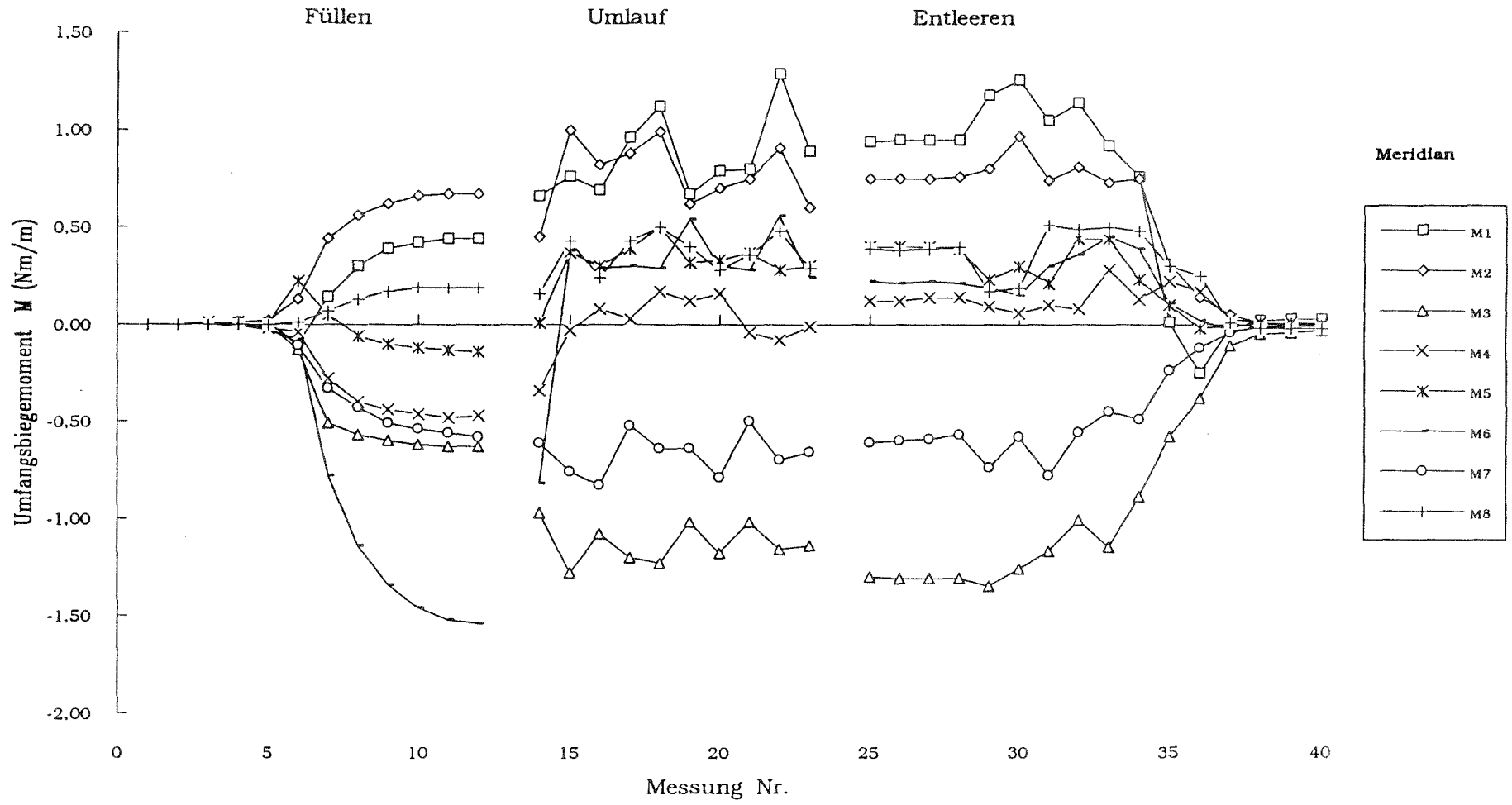
R.U. 130

Versuch Z 4 unterer Horizont



R 4.131

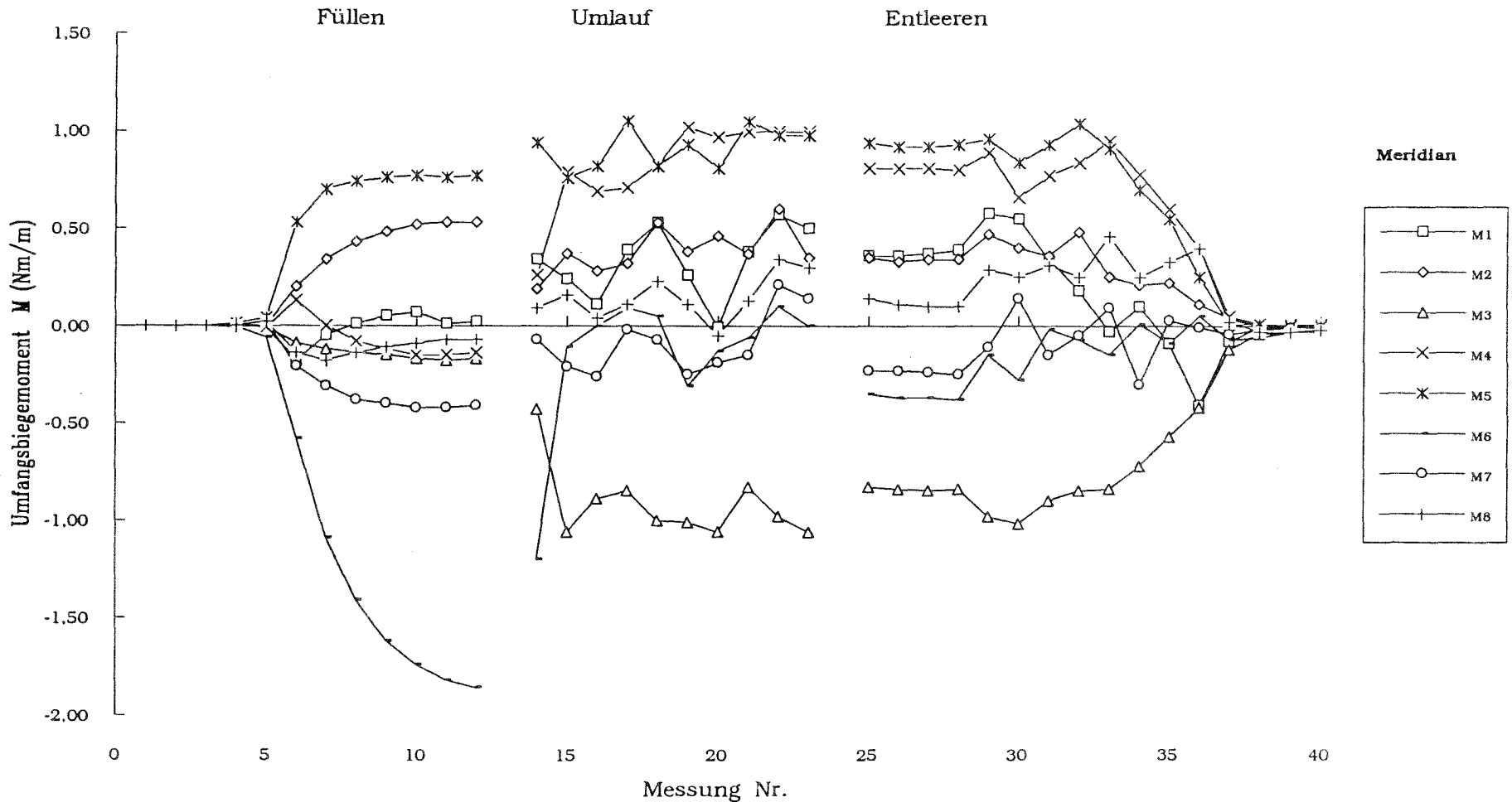
**Versuch Z 4 oberer Horizont**



P 4.132

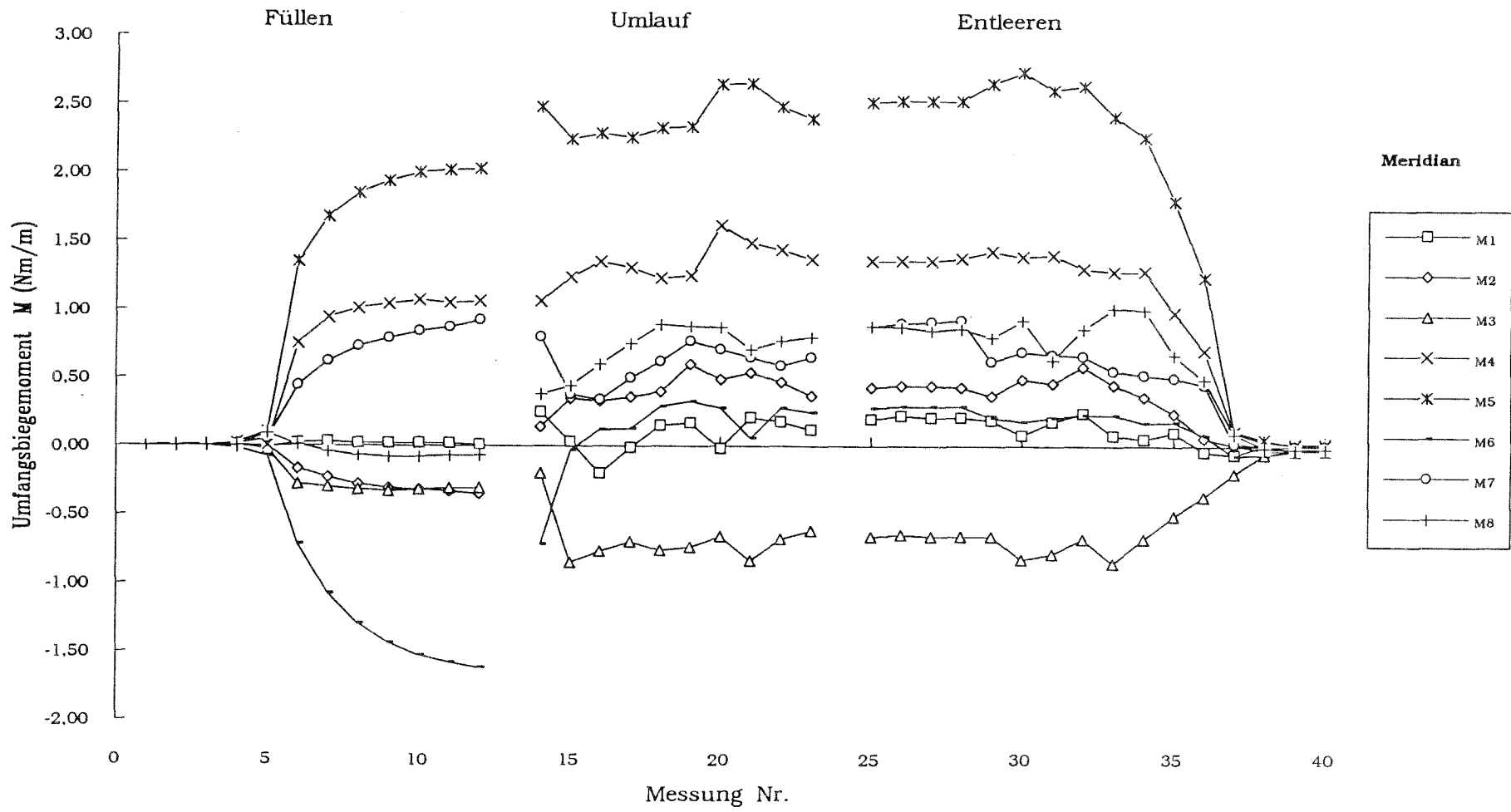


**Versuch Z 4 mittlerer Horizont**



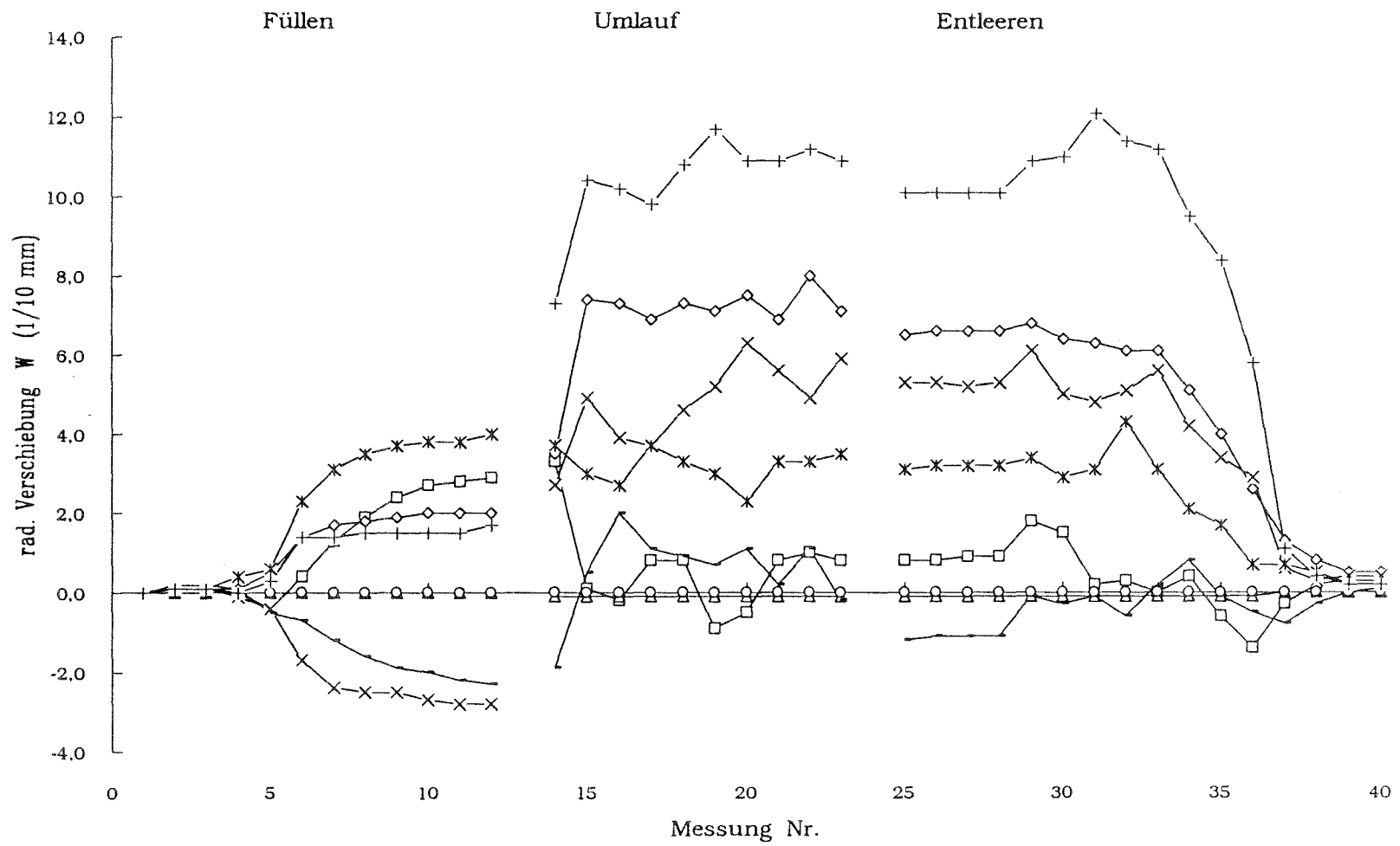
A4.133

# Versuch Z 4 unterer Horizont



A 4.134

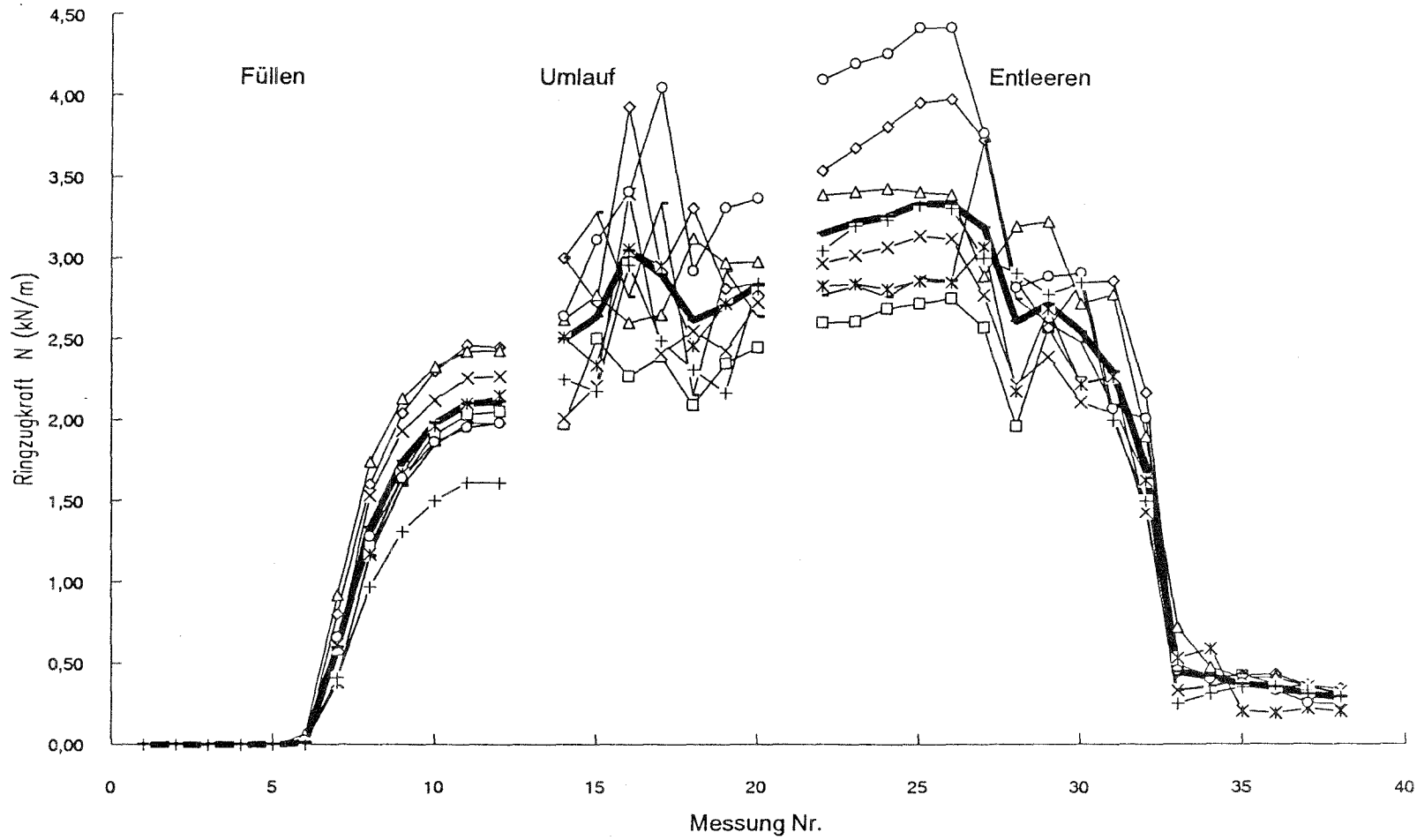
# Versuch Z 4 mittlerer Horizont



- Meridian**
- M1
  - ◇— M2
  - △— M3
  - ×— M4
  - \*— M5
  - +— M6
  - M7
  - +— M8

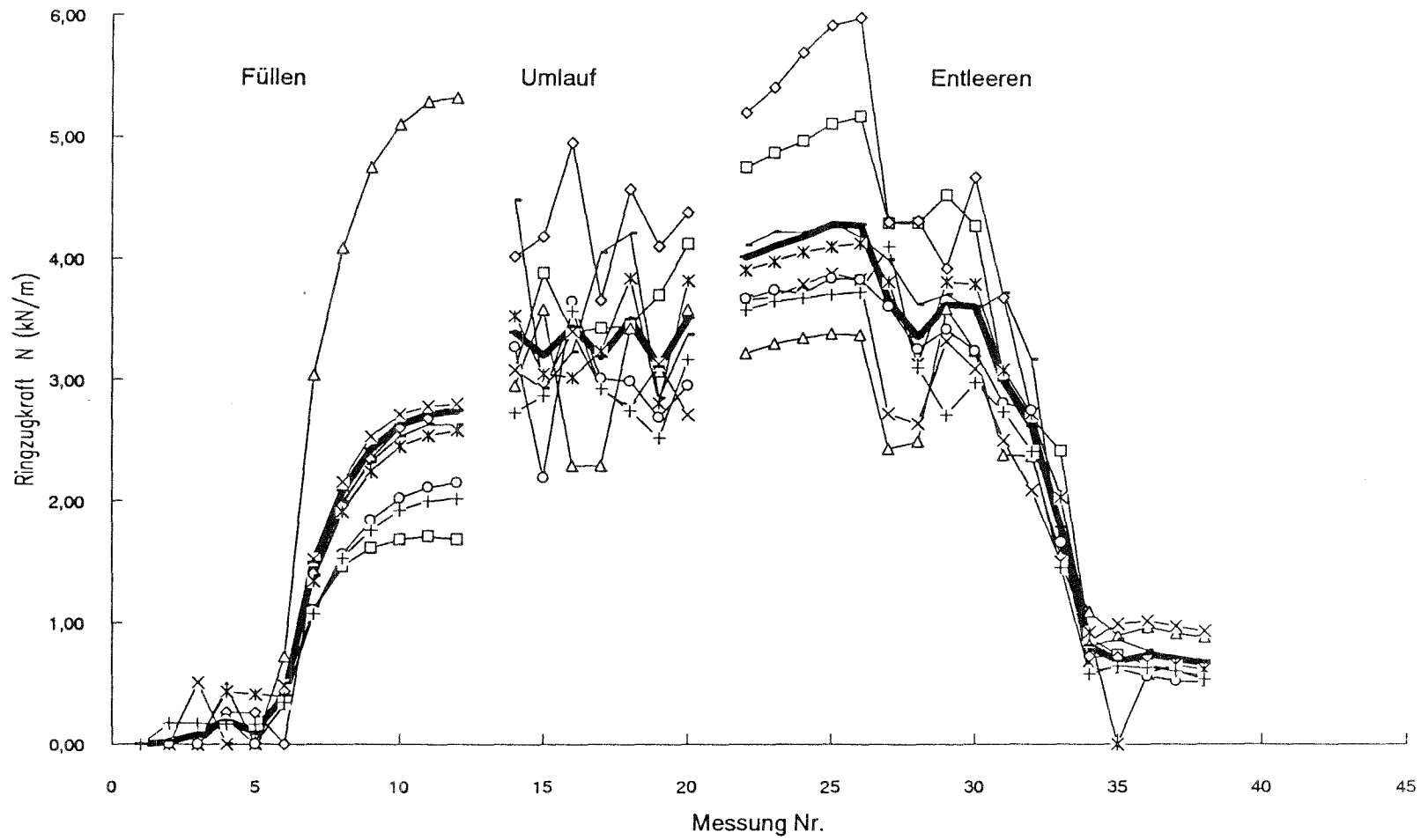
174.135

Versuch Z 5 oberer Horizont



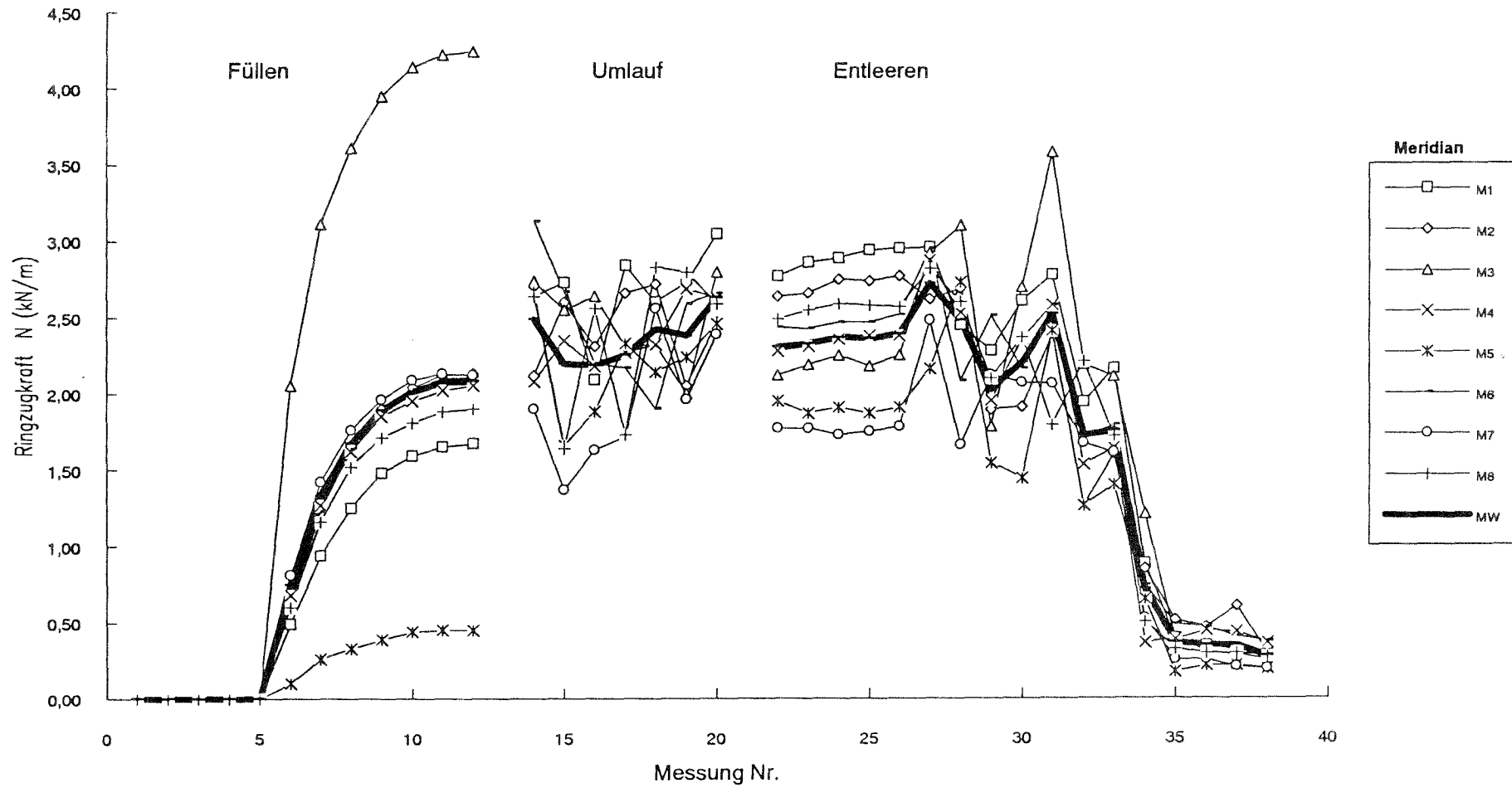
A4.136

Versuch Z 5 mittlerer Horizont



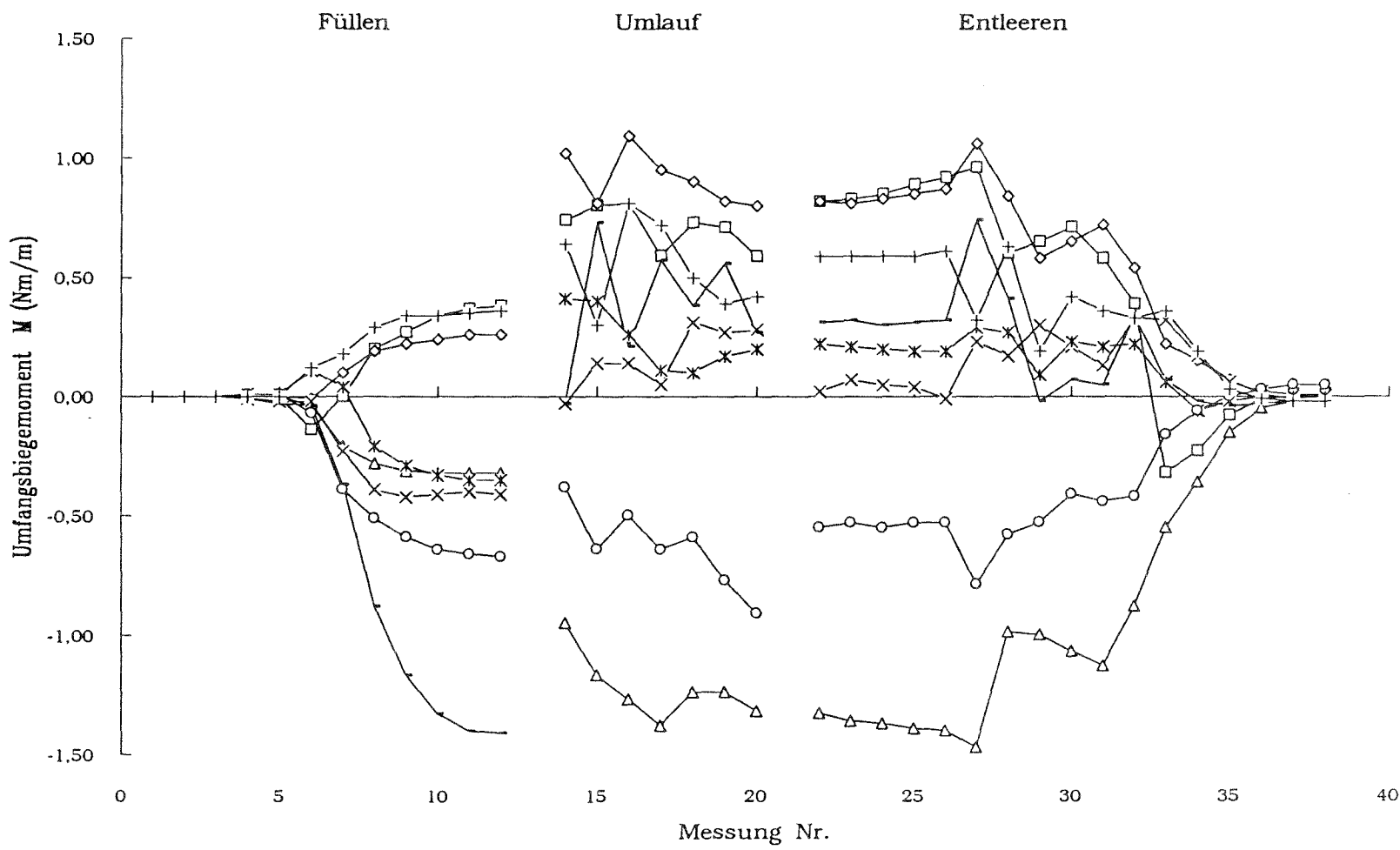
14.137

Versuch Z 5 unterer Horizont



174.158

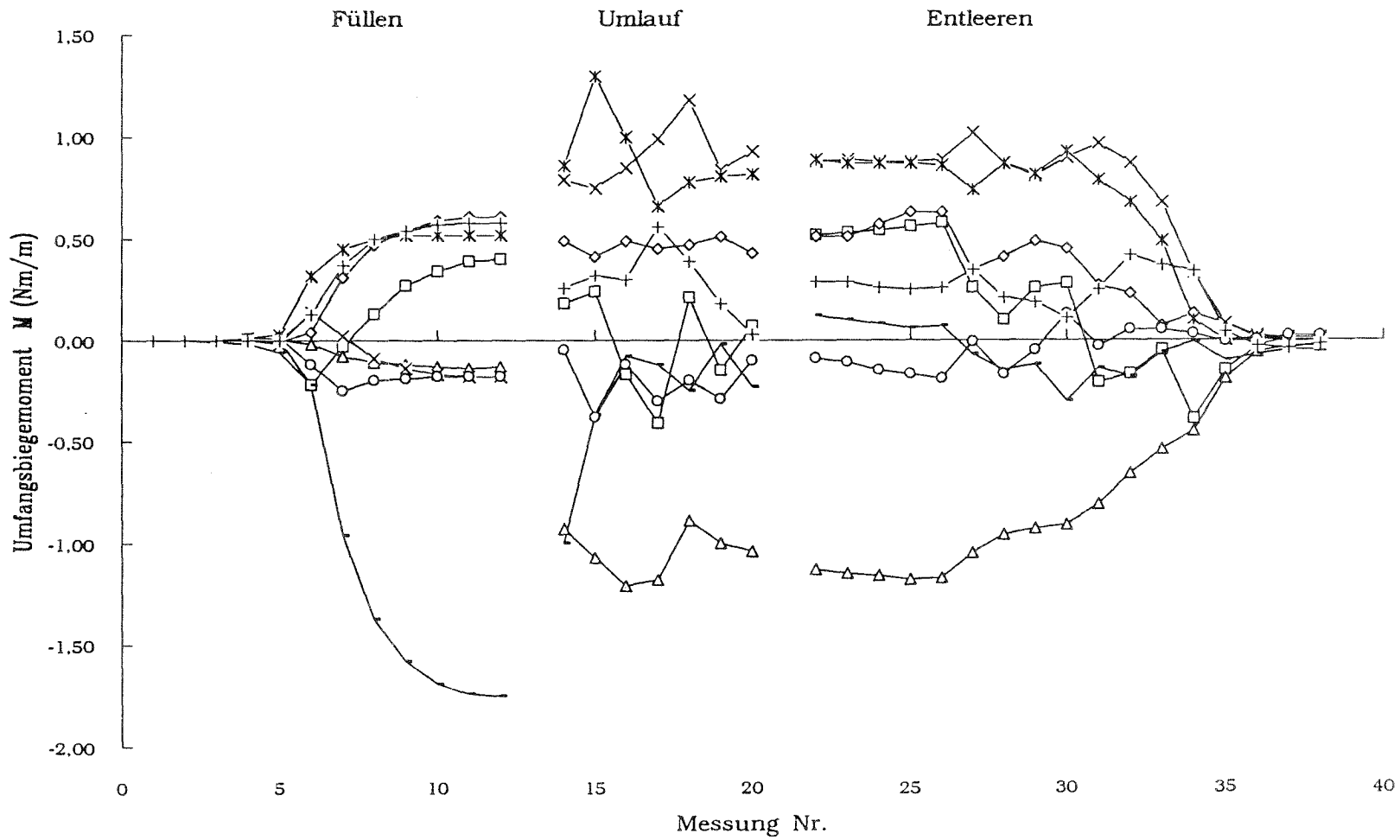
**Versuch Z 5 oberer Horizont**



- Meridian**
- M1
  - ◇— M2
  - △— M3
  - ×— M4
  - \*— M5
  - +— M6
  - M7
  - |— M8

R 4.139

**Versuch Z 5 mittlerer Horizont**

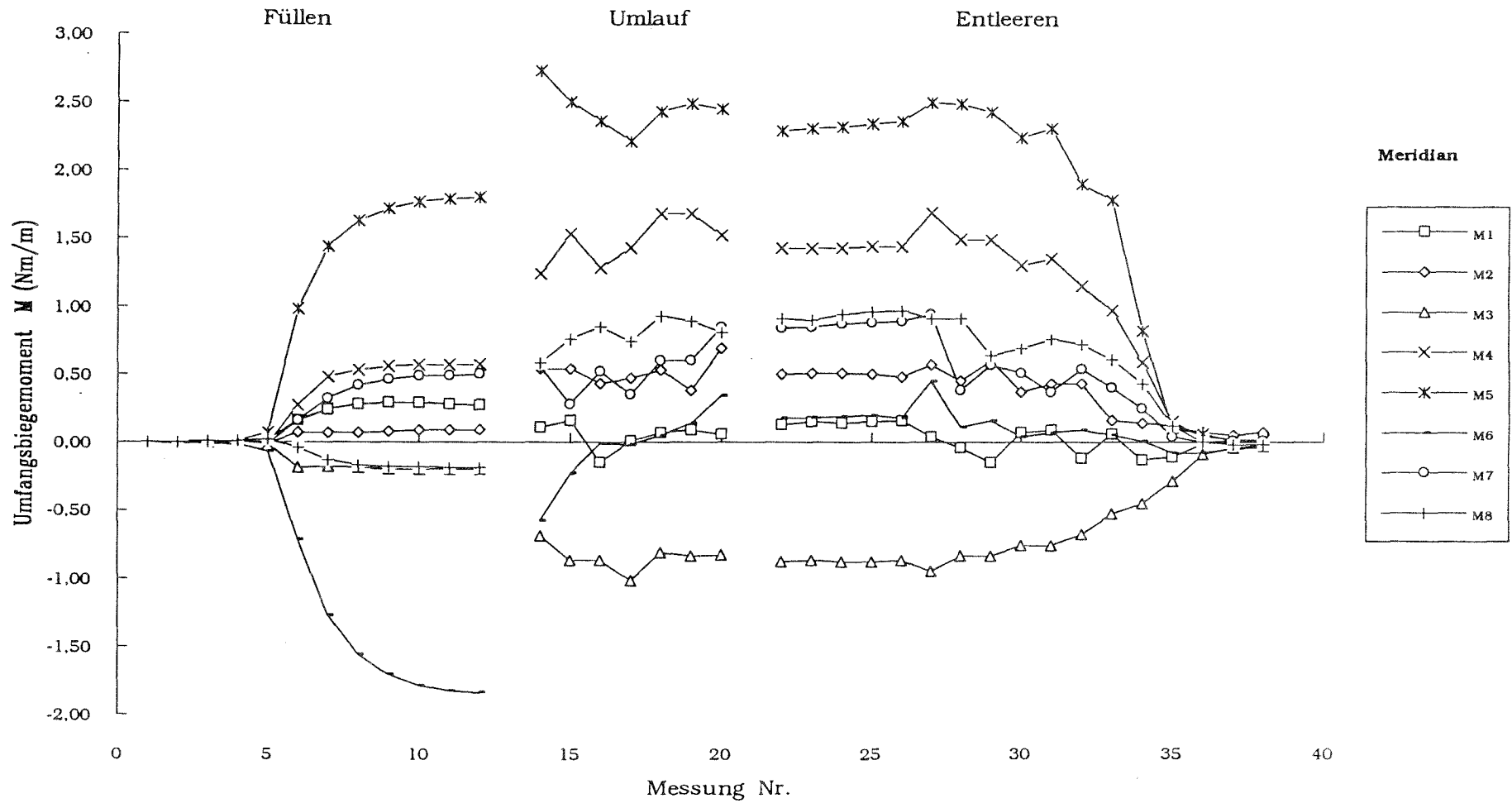


- Meridian**
- M1
  - ◇— M2
  - △— M3
  - ×— M4
  - \*— M5
  - +— M6
  - M7
  - +— M8

04.14.6

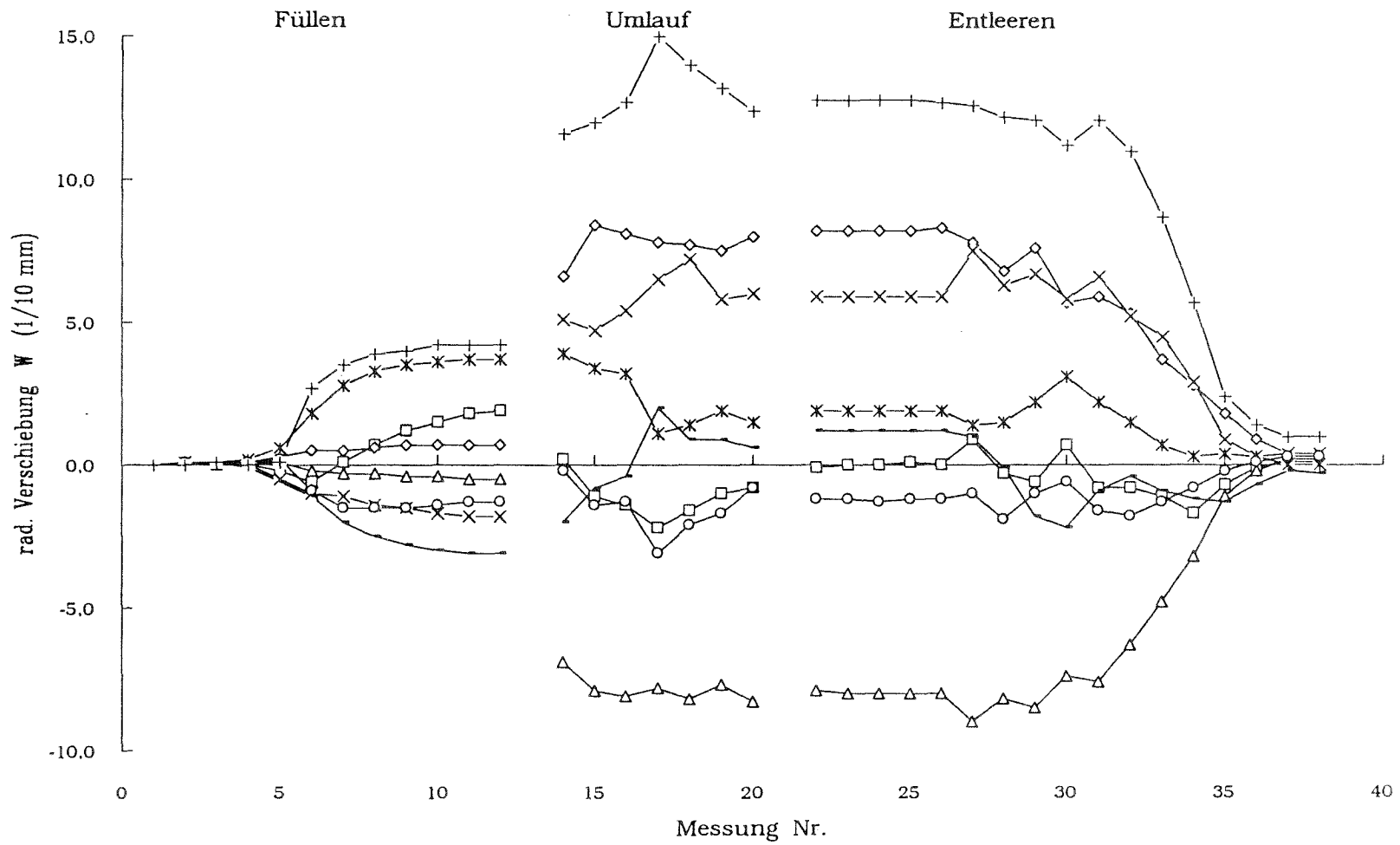


# Versuch Z 5 unterer Horizont



A4.146

# Versuch Z 5 mittlerer Horizont

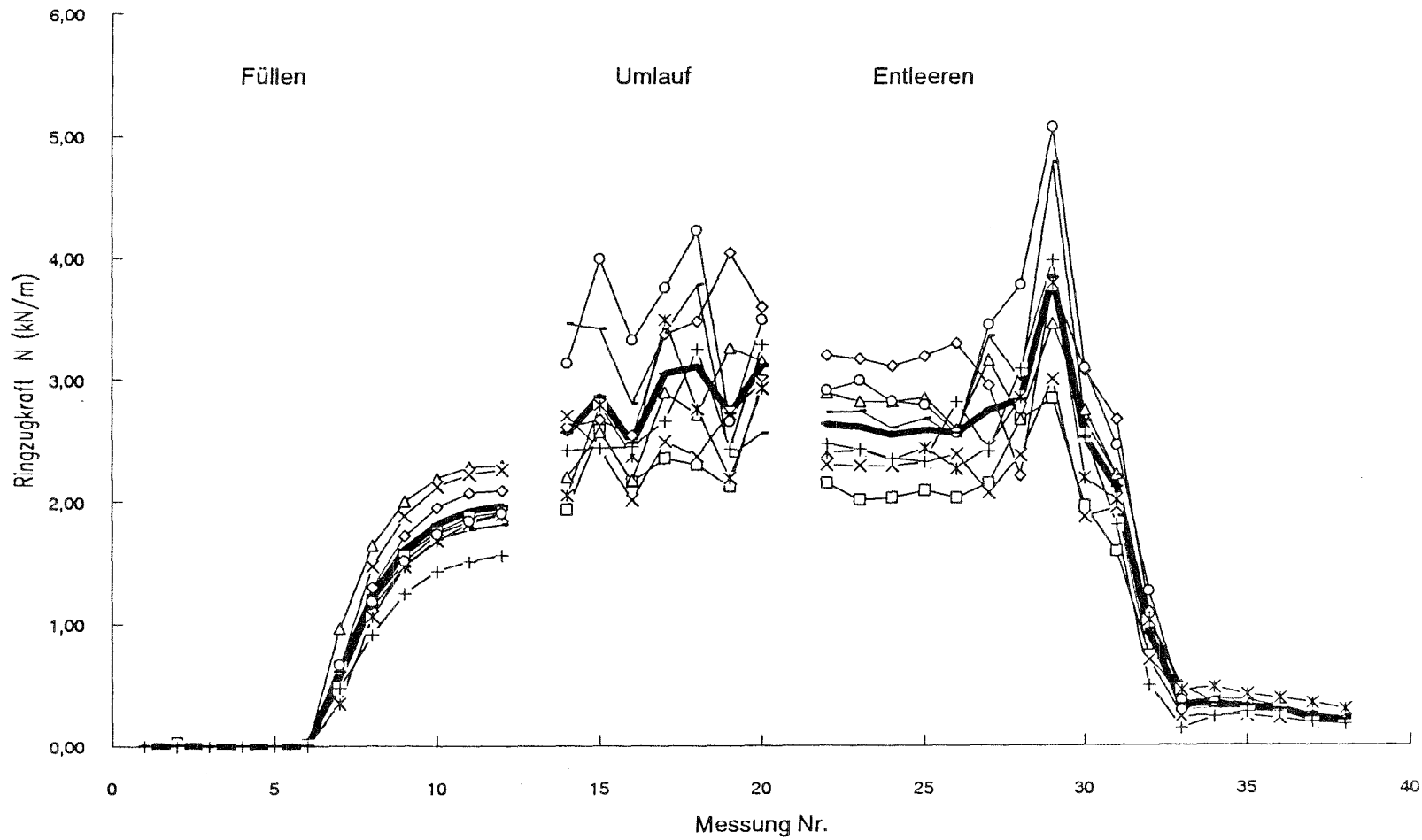


Meridian

- M1
- ◇— M2
- △— M3
- ×— M4
- \*— M5
- +— M6
- M7
- +— M8

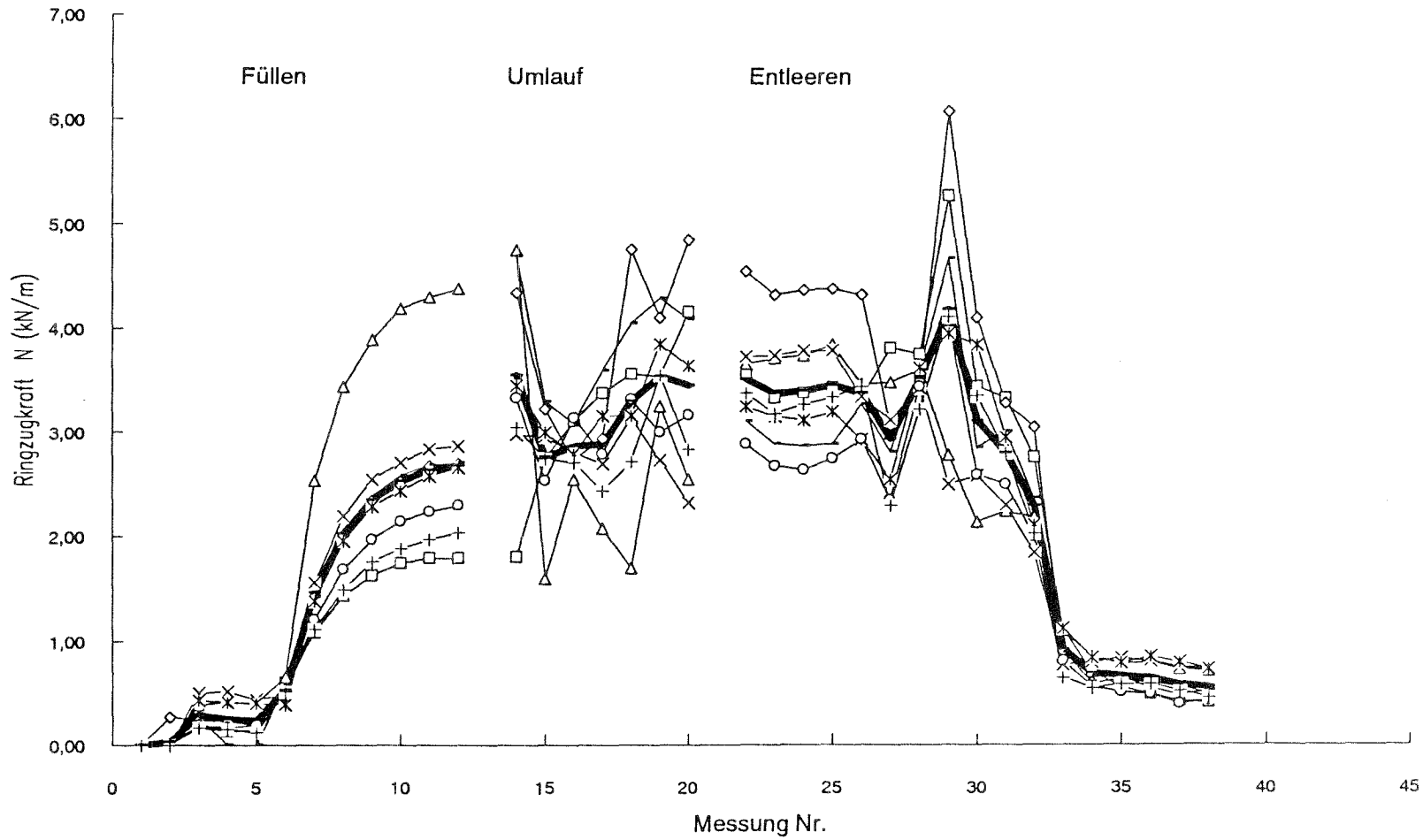
A 4. 147

Versuch Z 6 oberer Horizont



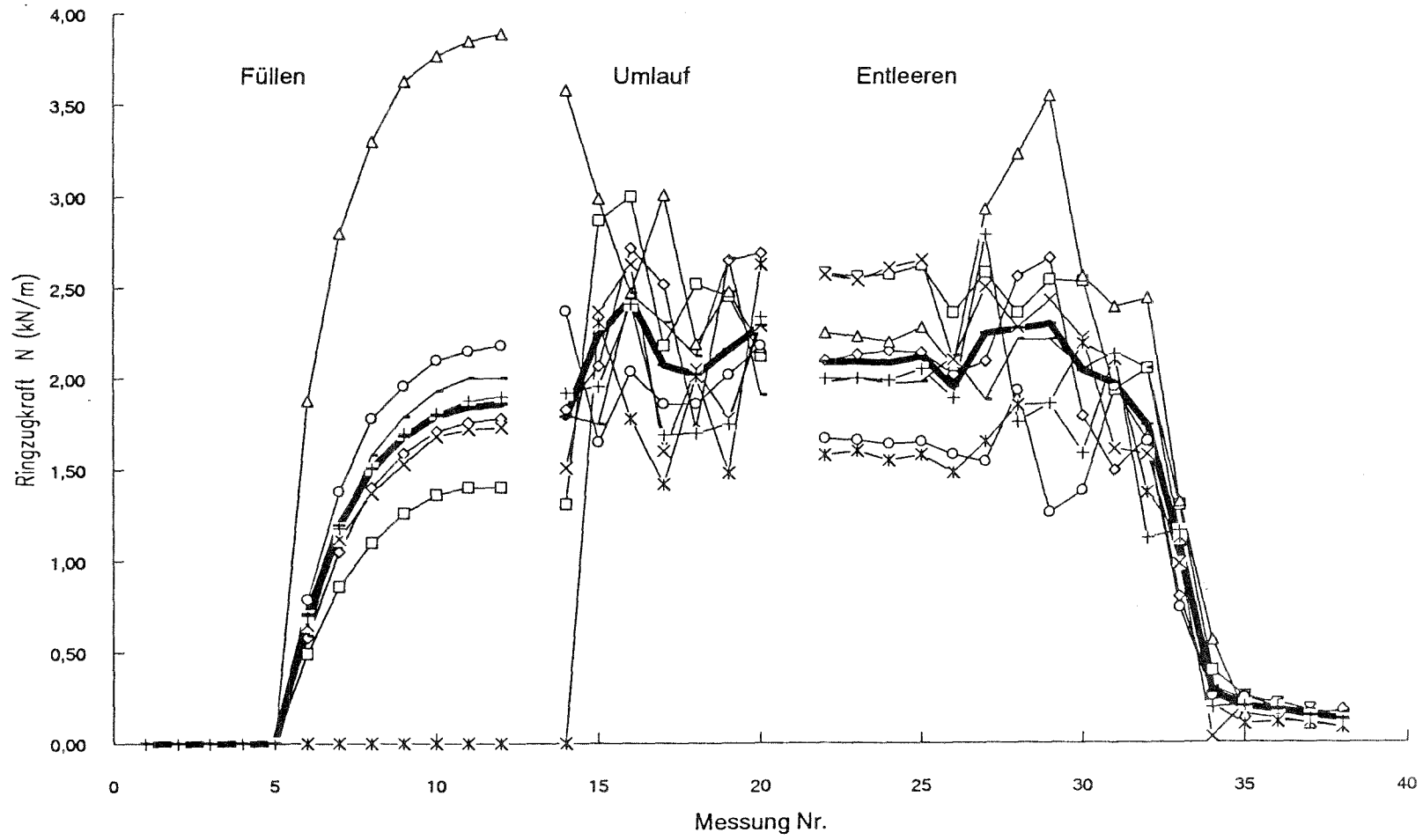
P. 4. 148

Versuch Z 6 mittlerer Horizont



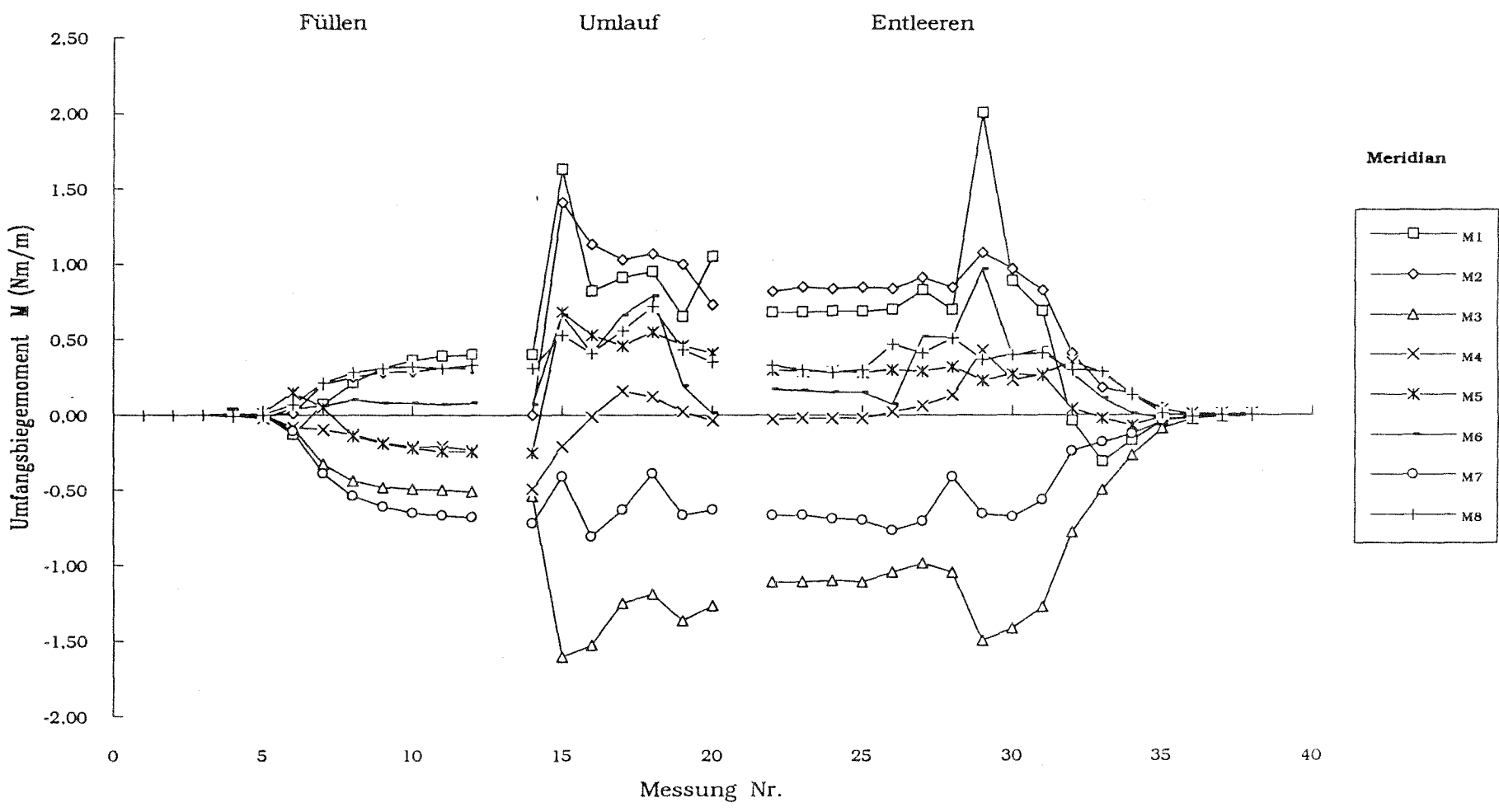
R4.149

# Versuch Z 6 unterer Horizont



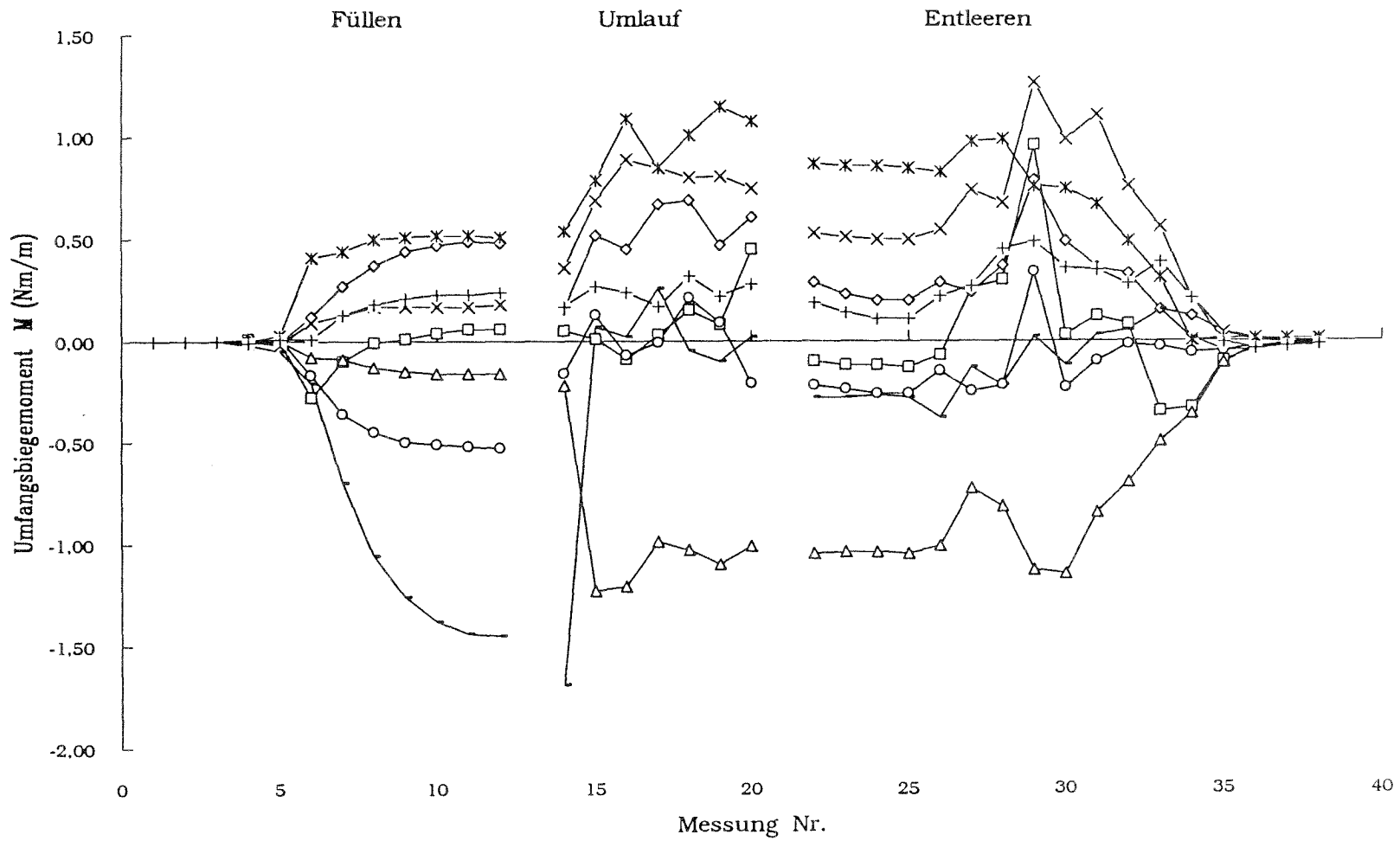
05/1/50

**Versuch Z 6 oberer Horizont**



A 4.151

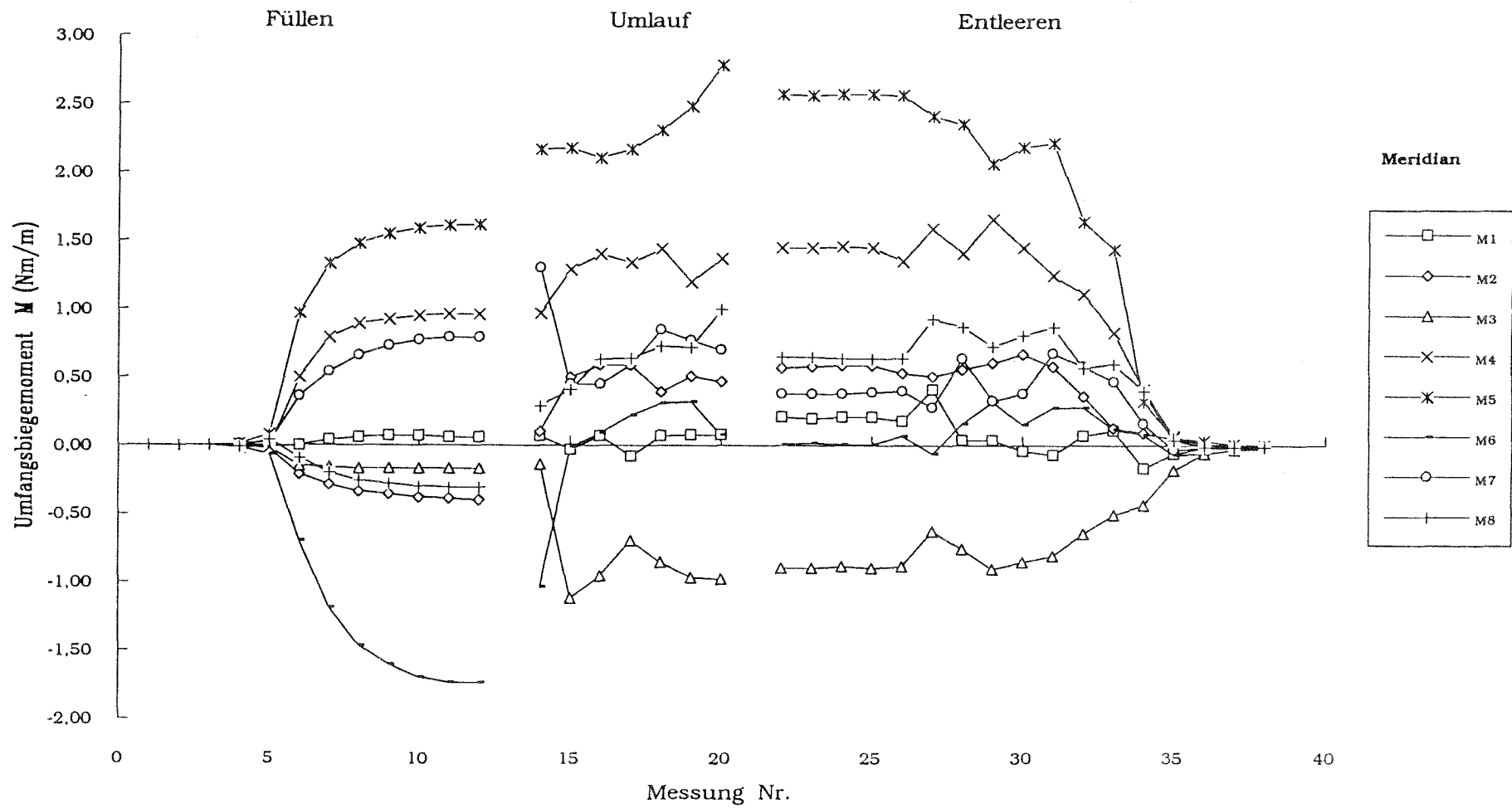
**Versuch Z 6 mittlerer Horizont**



- Meridian**
- M1
  - ◇— M2
  - △— M3
  - ×— M4
  - \*— M5
  - +— M6
  - M7
  - +— M8

A4.152

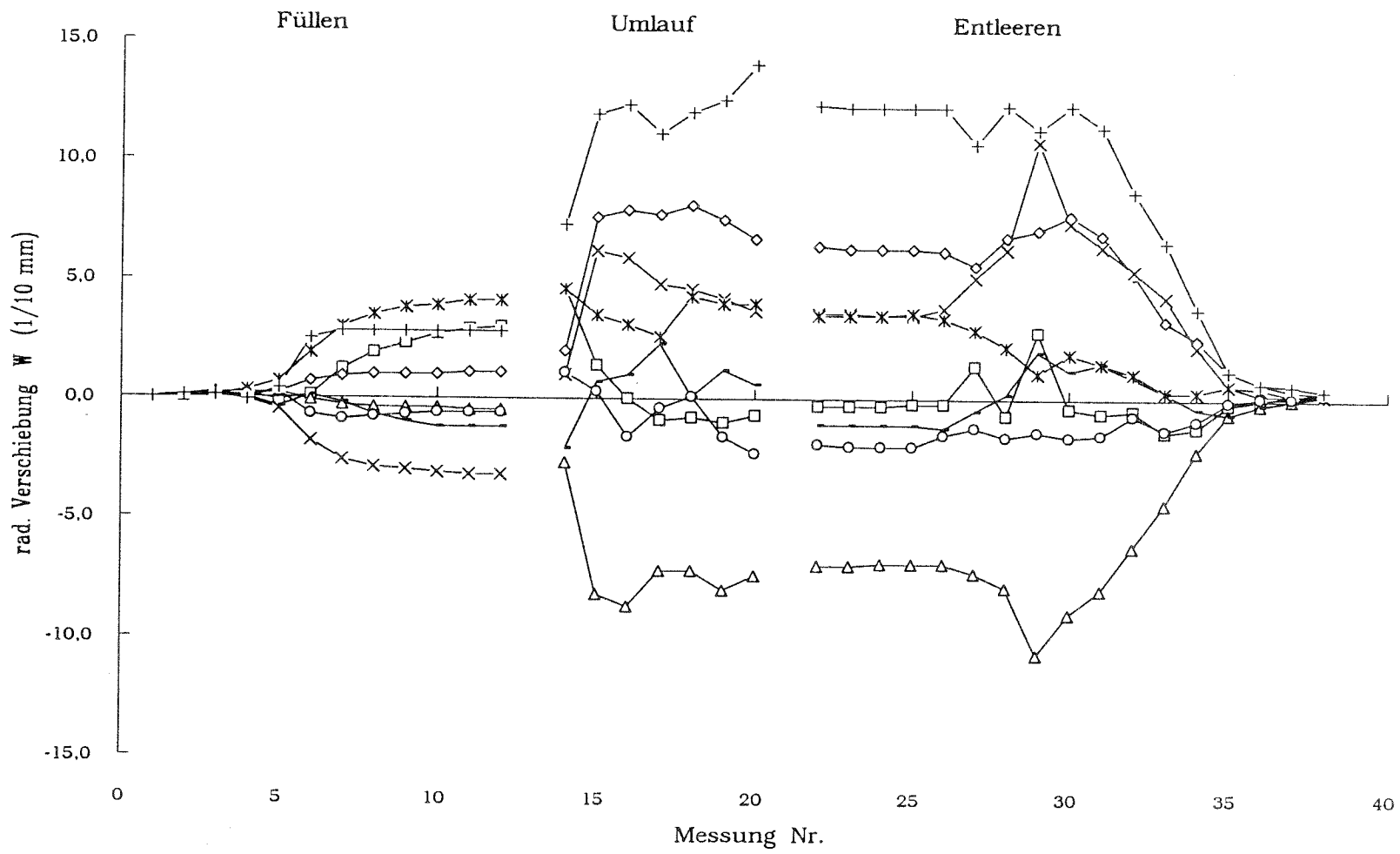
# Versuch Z 6 unterer Horizont



A4.153



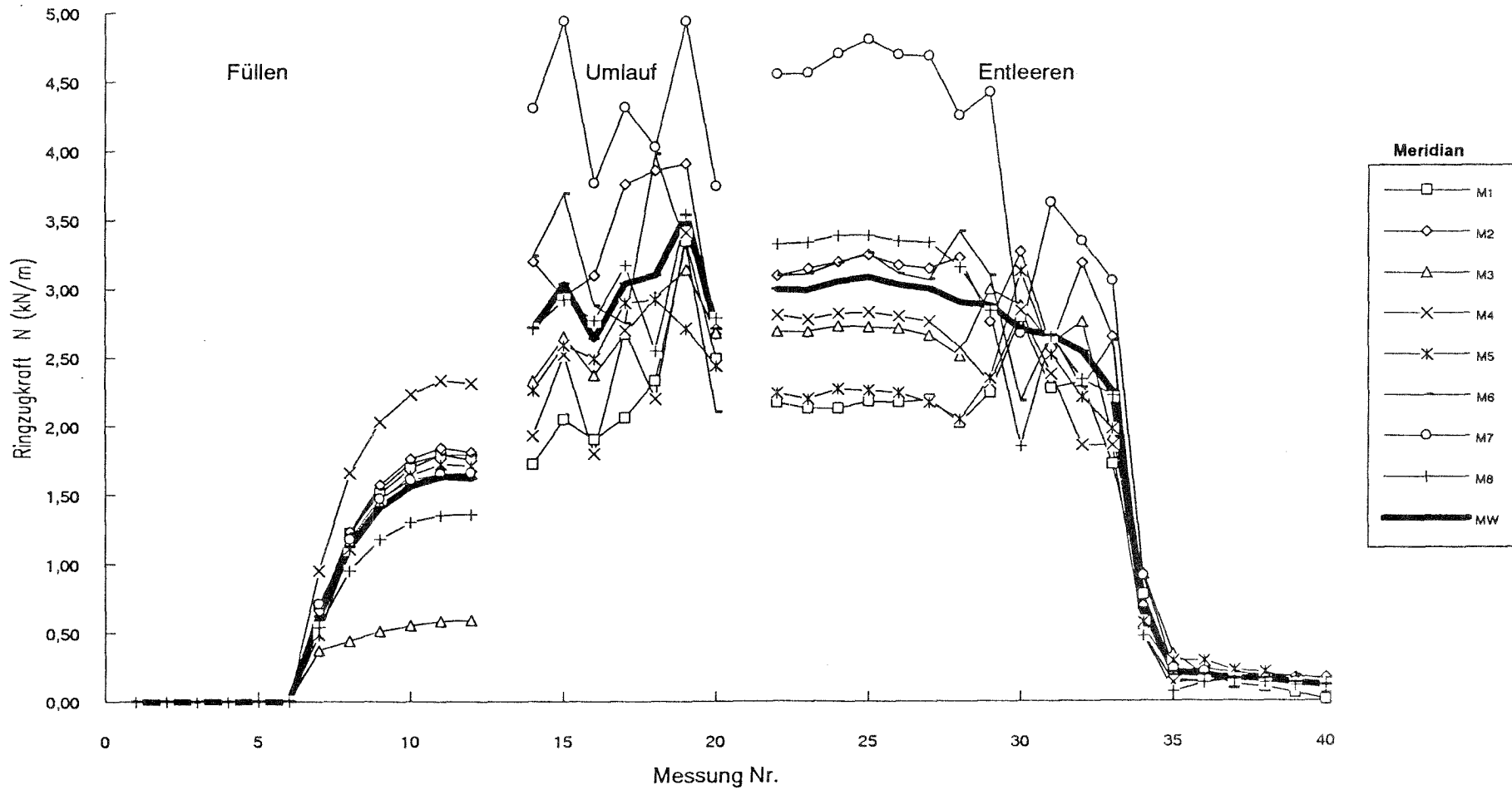
# Versuch Z 6 mittlerer Horizont



- Meridian**
- M1
  - ◇— M2
  - △— M3
  - ×— M4
  - \*— M5
  - +— M6
  - M7
  - |— M8

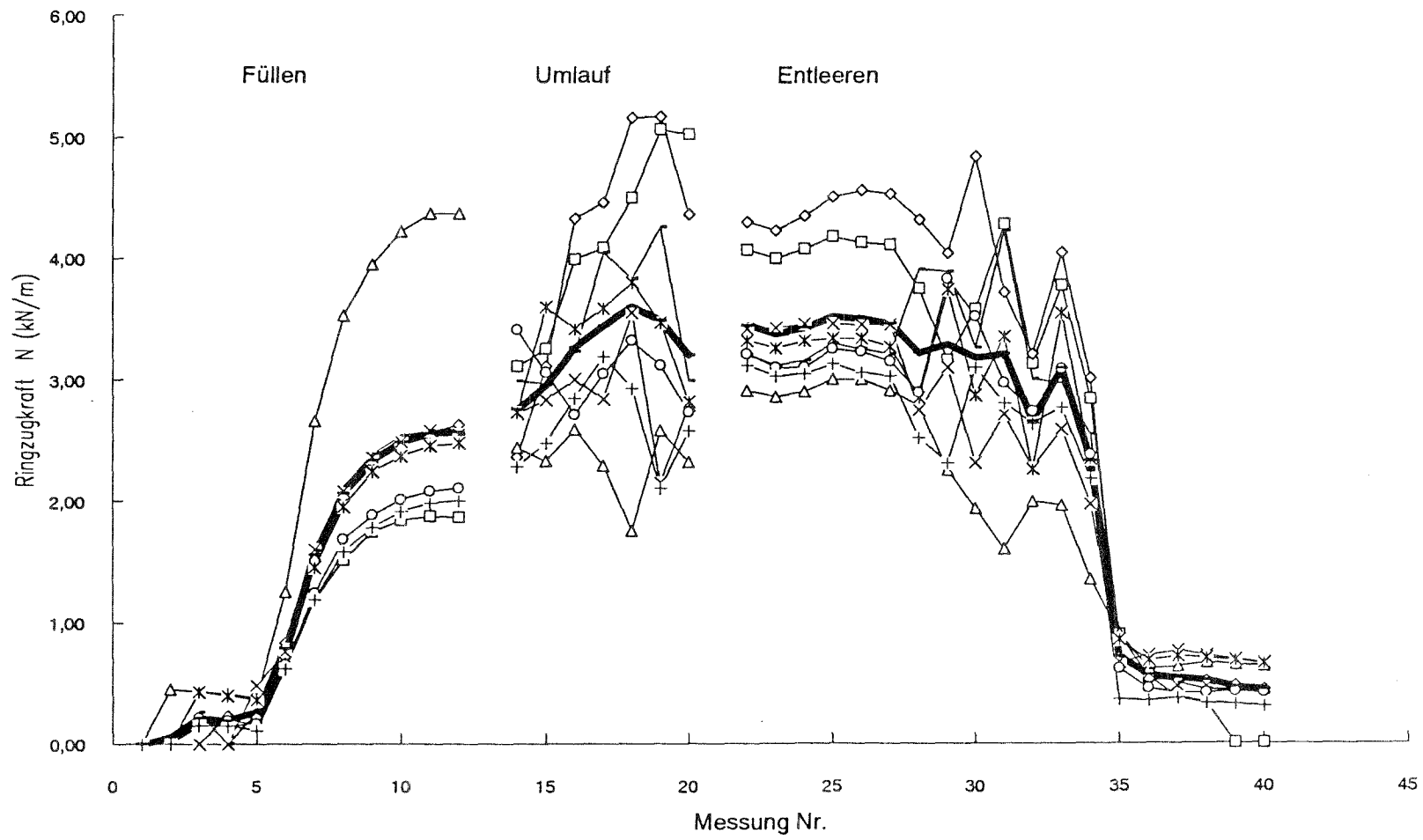
Au. 15.4

Versuch Z7 oberer Horizont



14.15.55

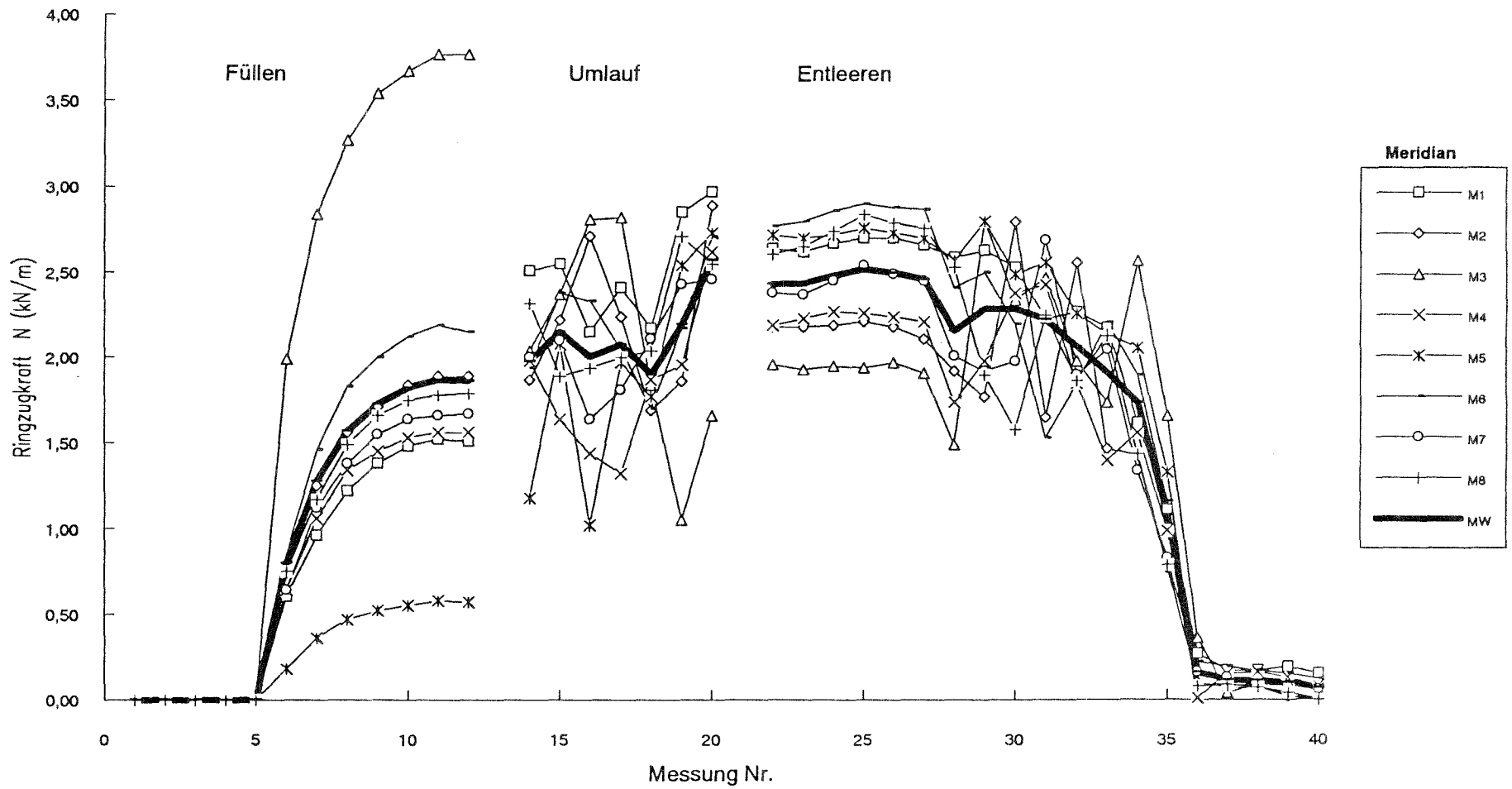
# Versuch Z 7 mittlerer Horizont



- Meridian**
- M1
  - ◇— M2
  - △— M3
  - ×— M4
  - \*— M5
  - +— M6
  - M7
  - +— M8
  - **thick line** — MW

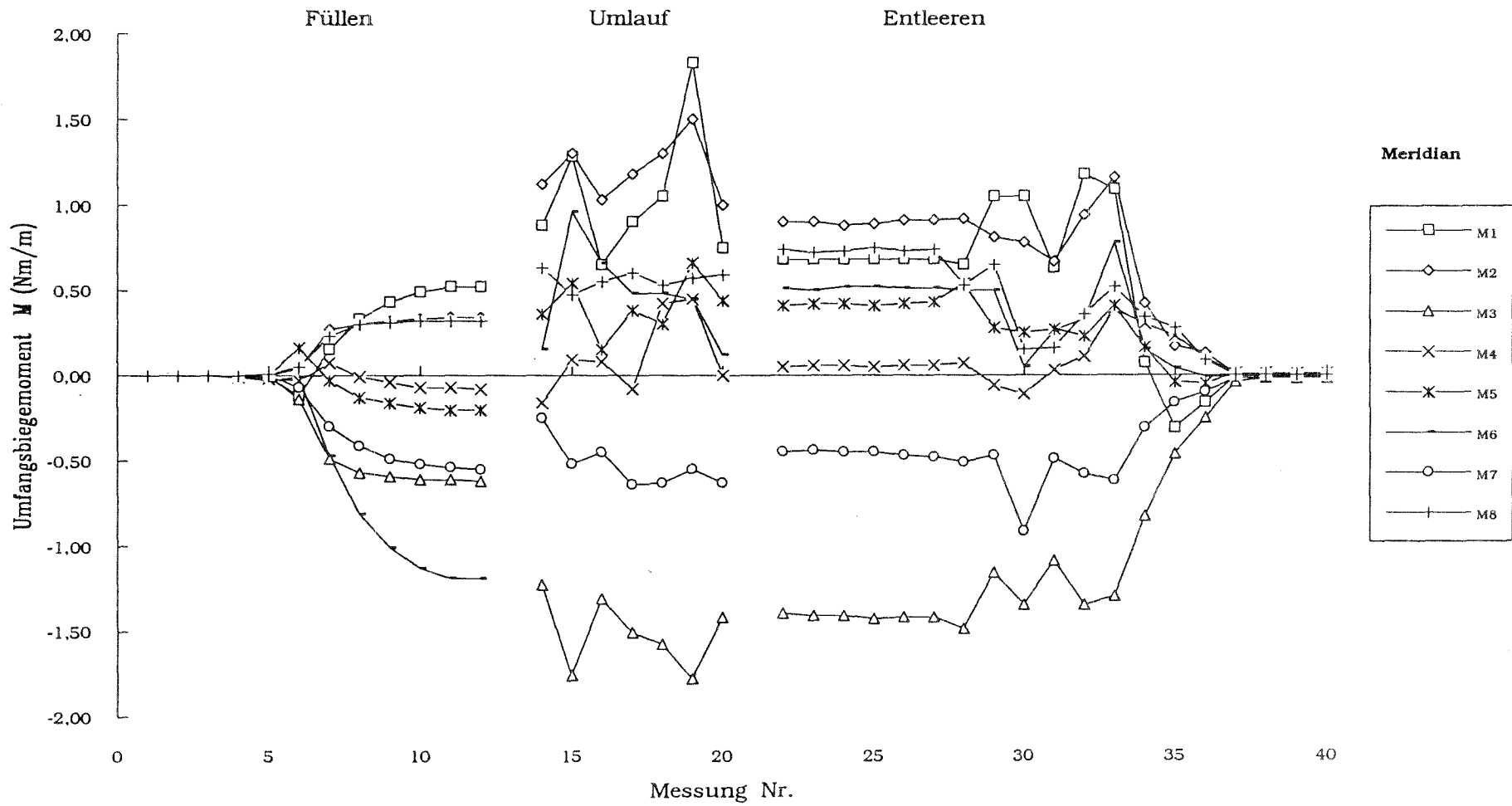
A 4.156

Versuch Z 7 unterer Horizont



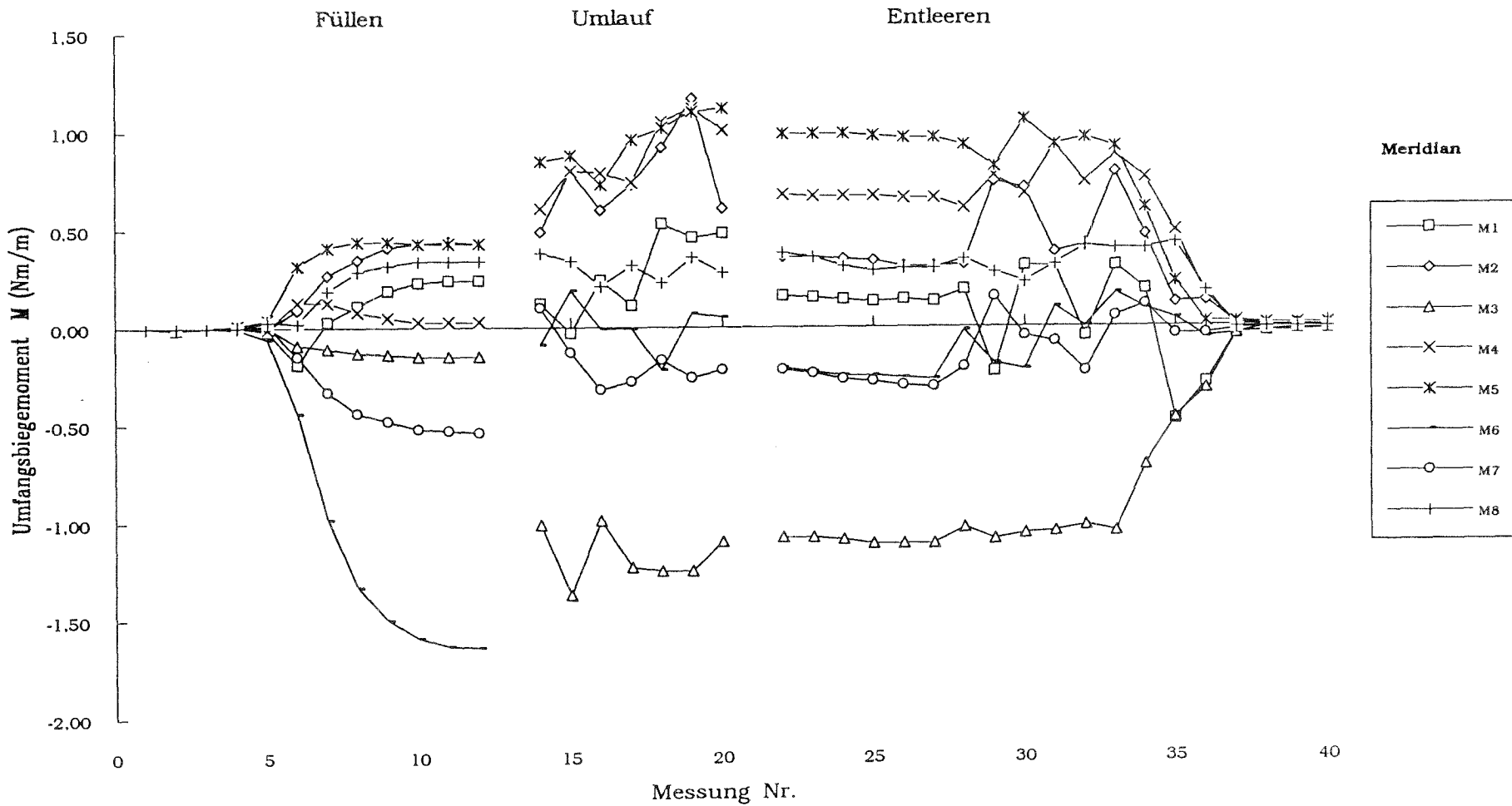
A. U. ST

**Versuch Z 7 oberer Horizont**



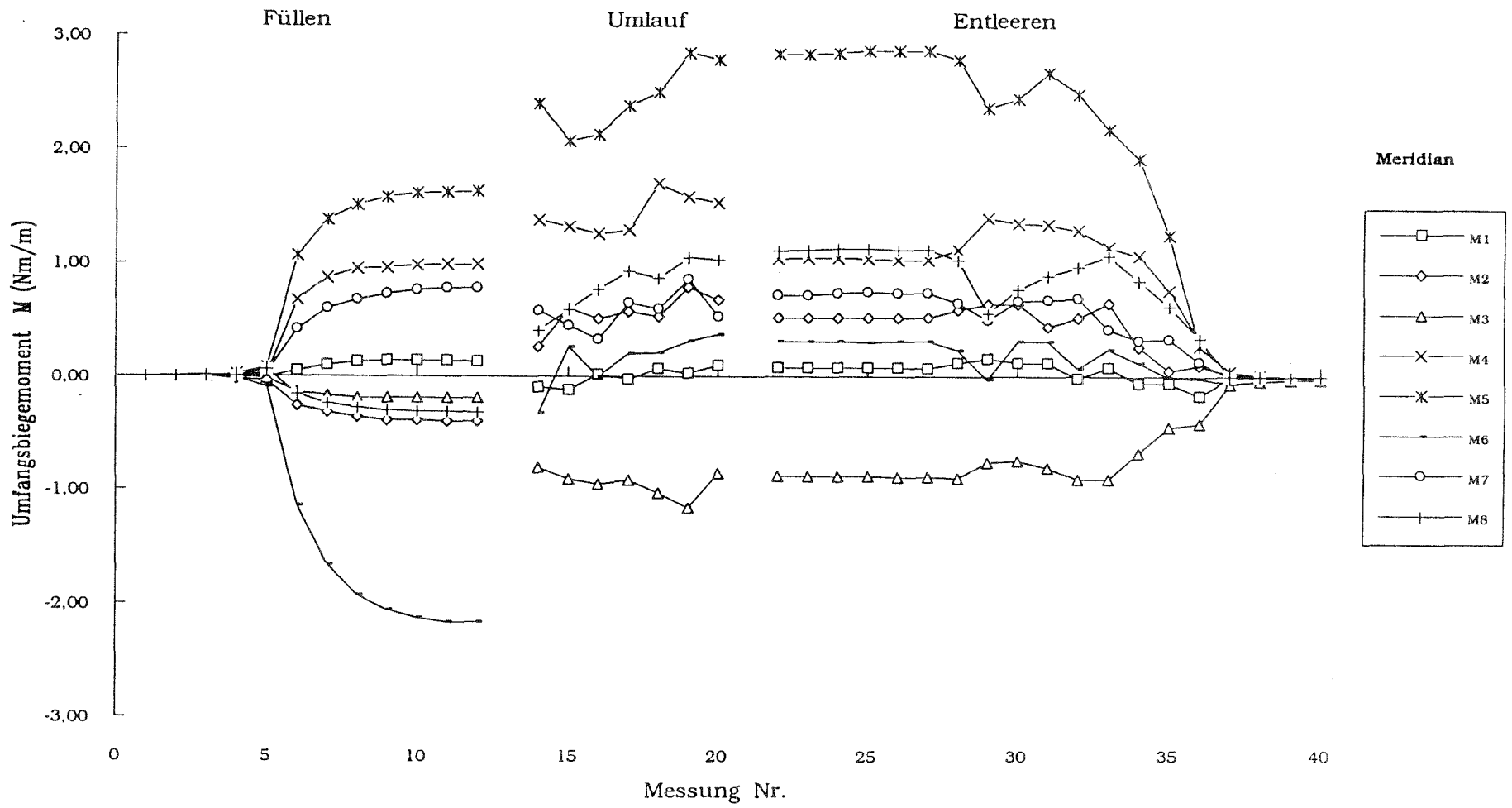
A 4.158

# Versuch Z 7 mittlerer Horizont



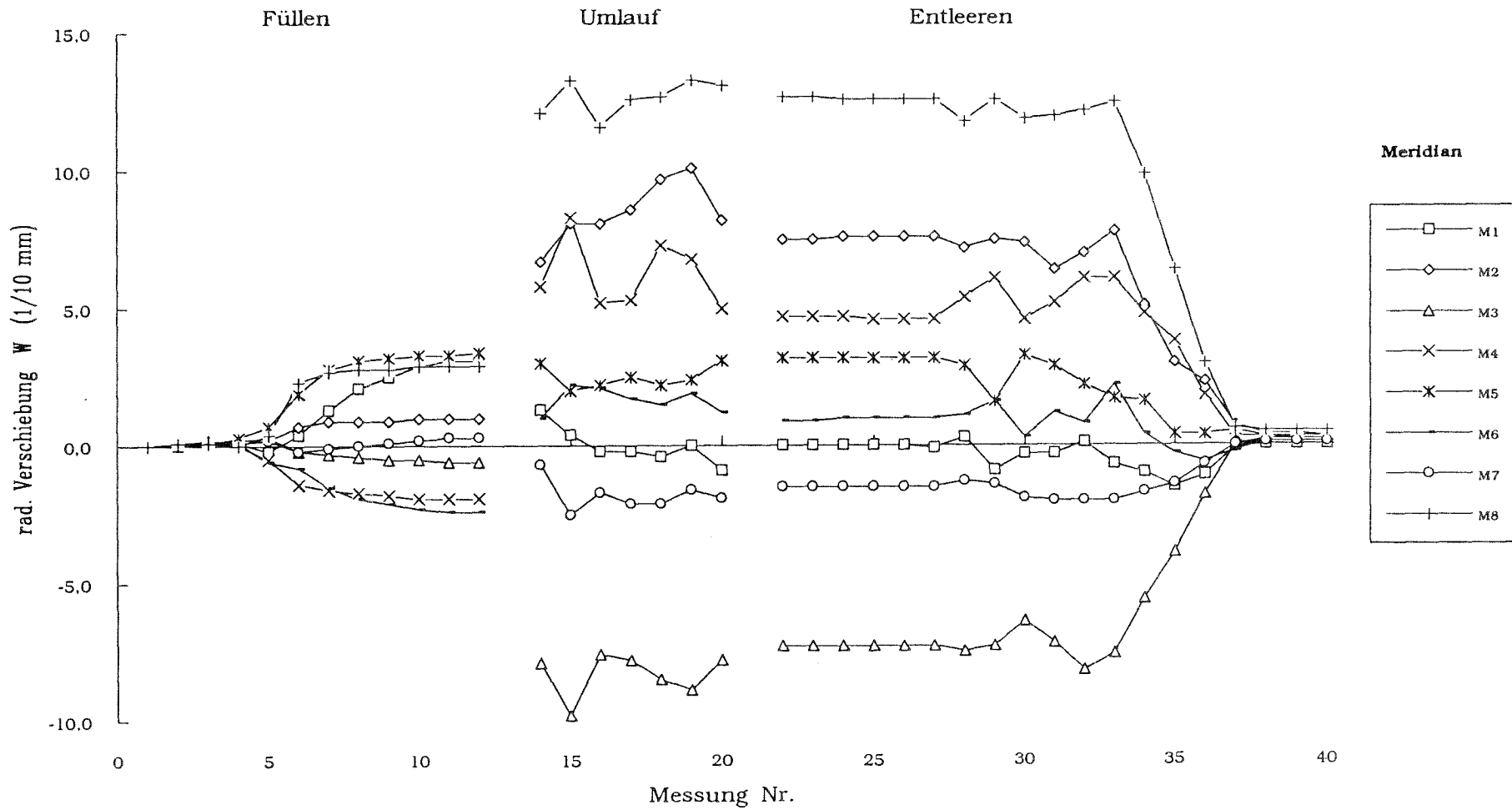
A 4.159

# Versuch Z 7 unterer Horizont



P 4.160

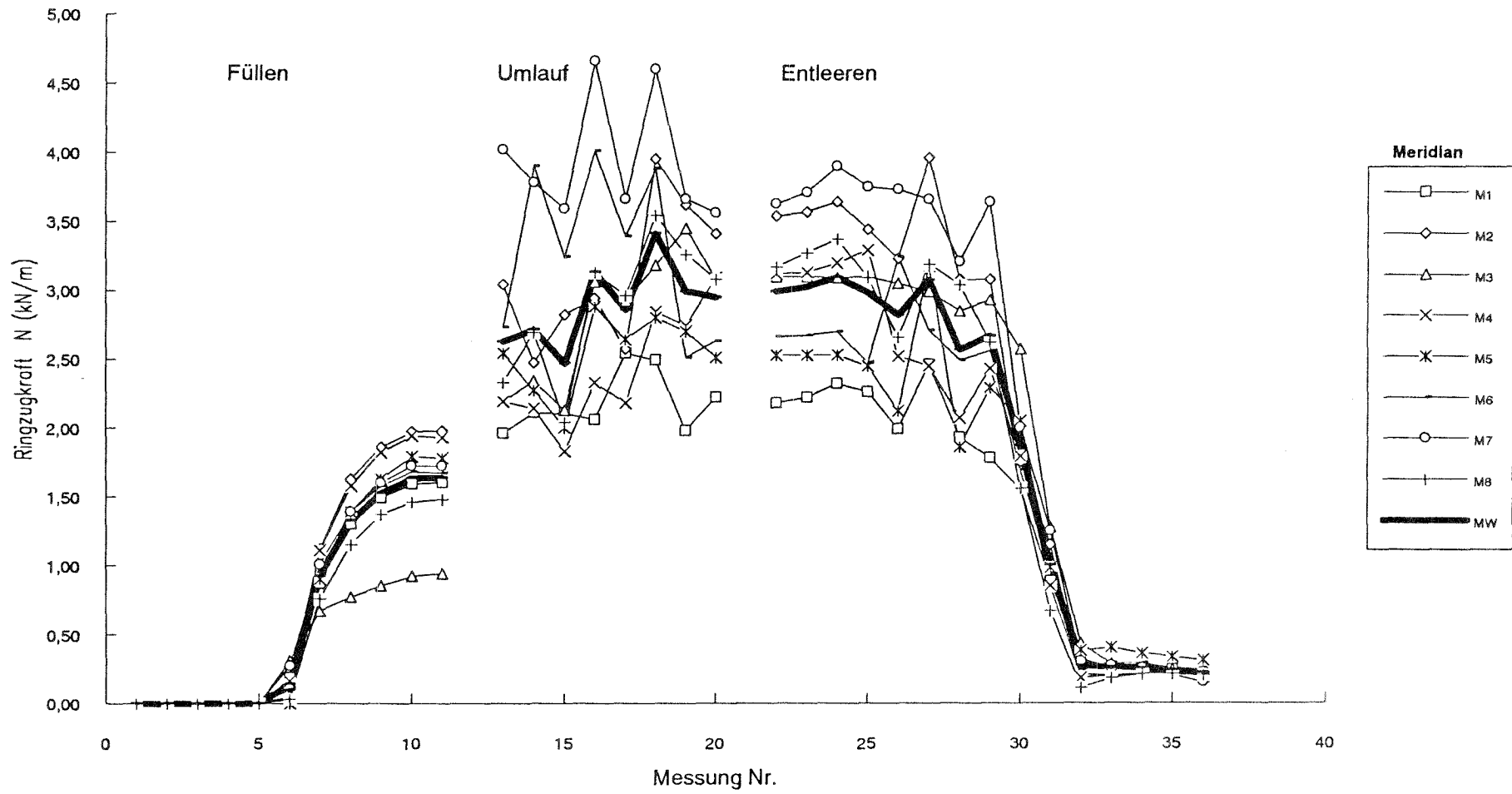
# Versuch Z 7 mittlerer Horizont



A 4. 16.1

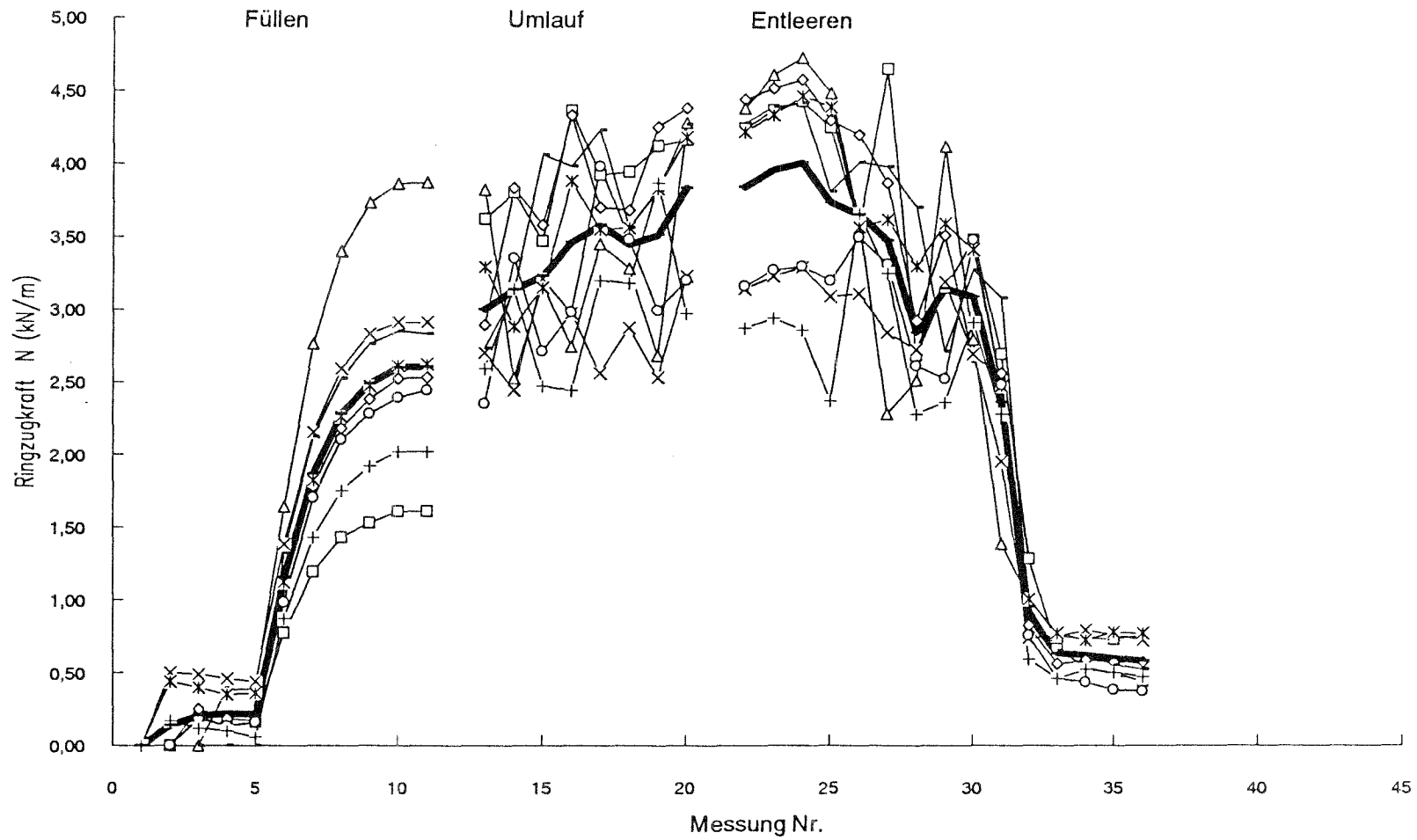


Versuch Z 8 oberer Horizont



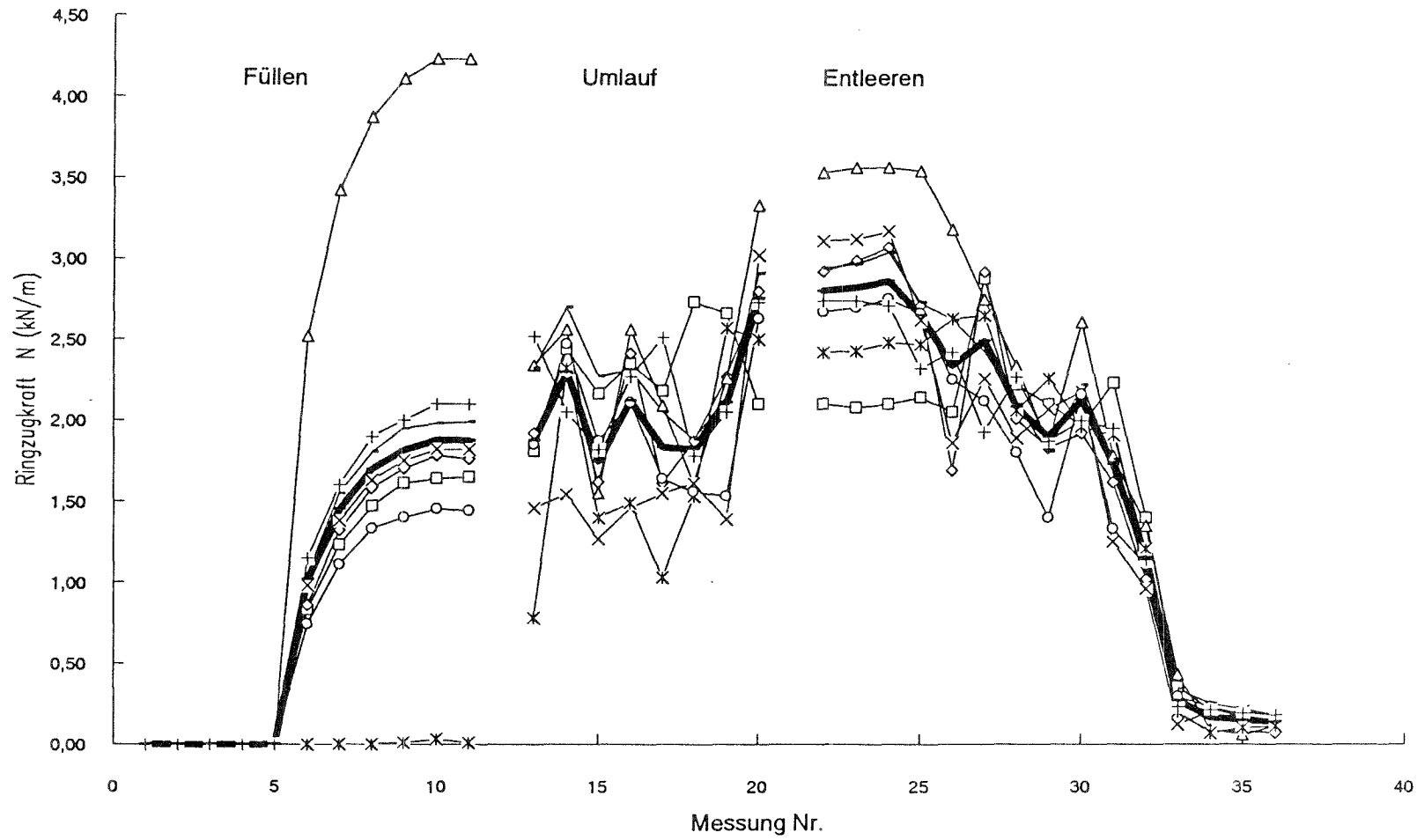
17.4.162

### Versuch Z 8 mittlerer Horizont



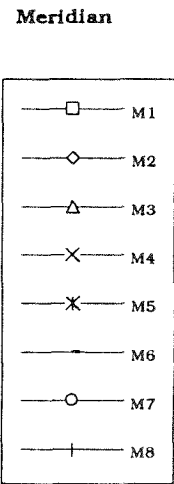
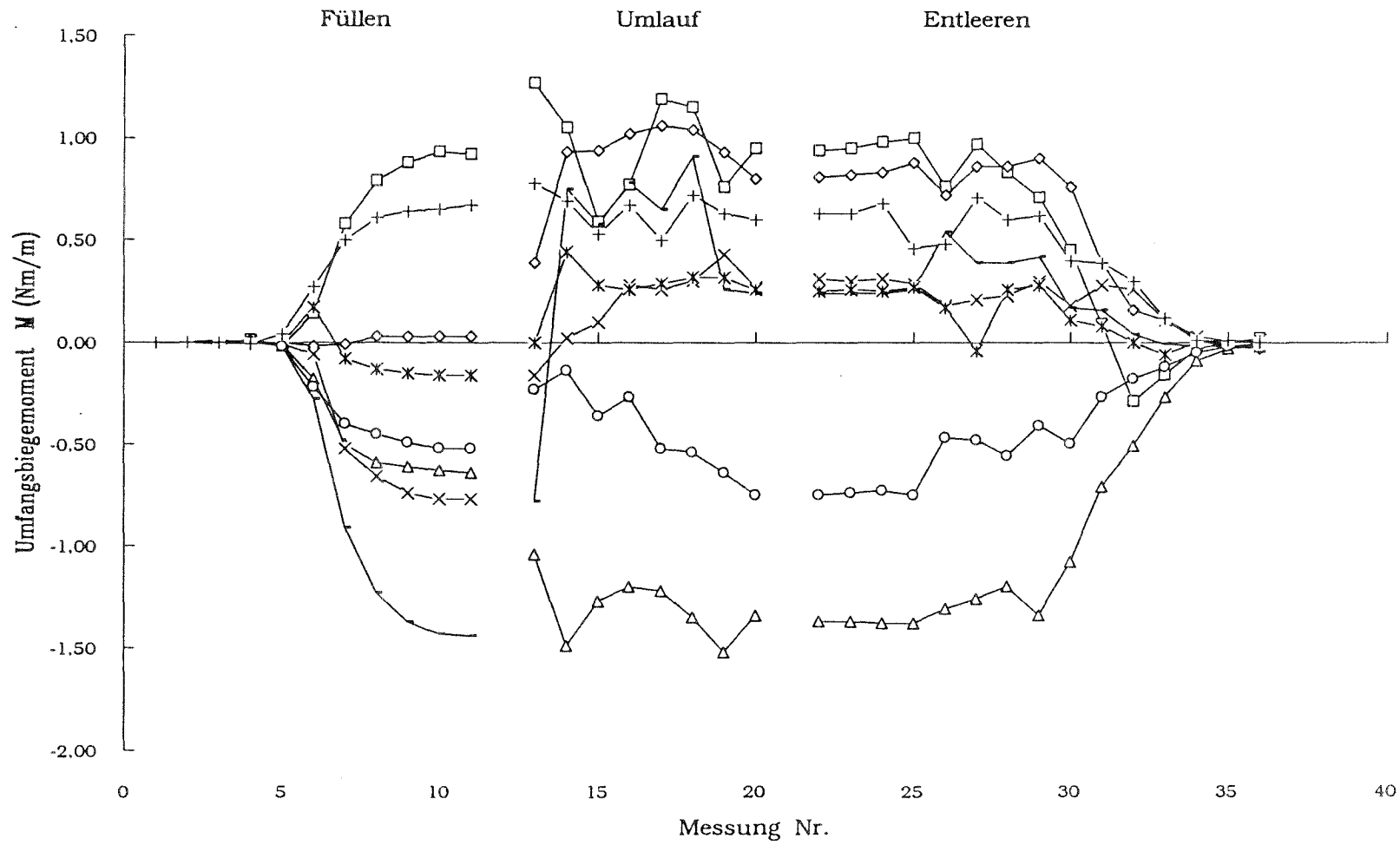
PA.163

Versuch Z 8 unterer Horizont



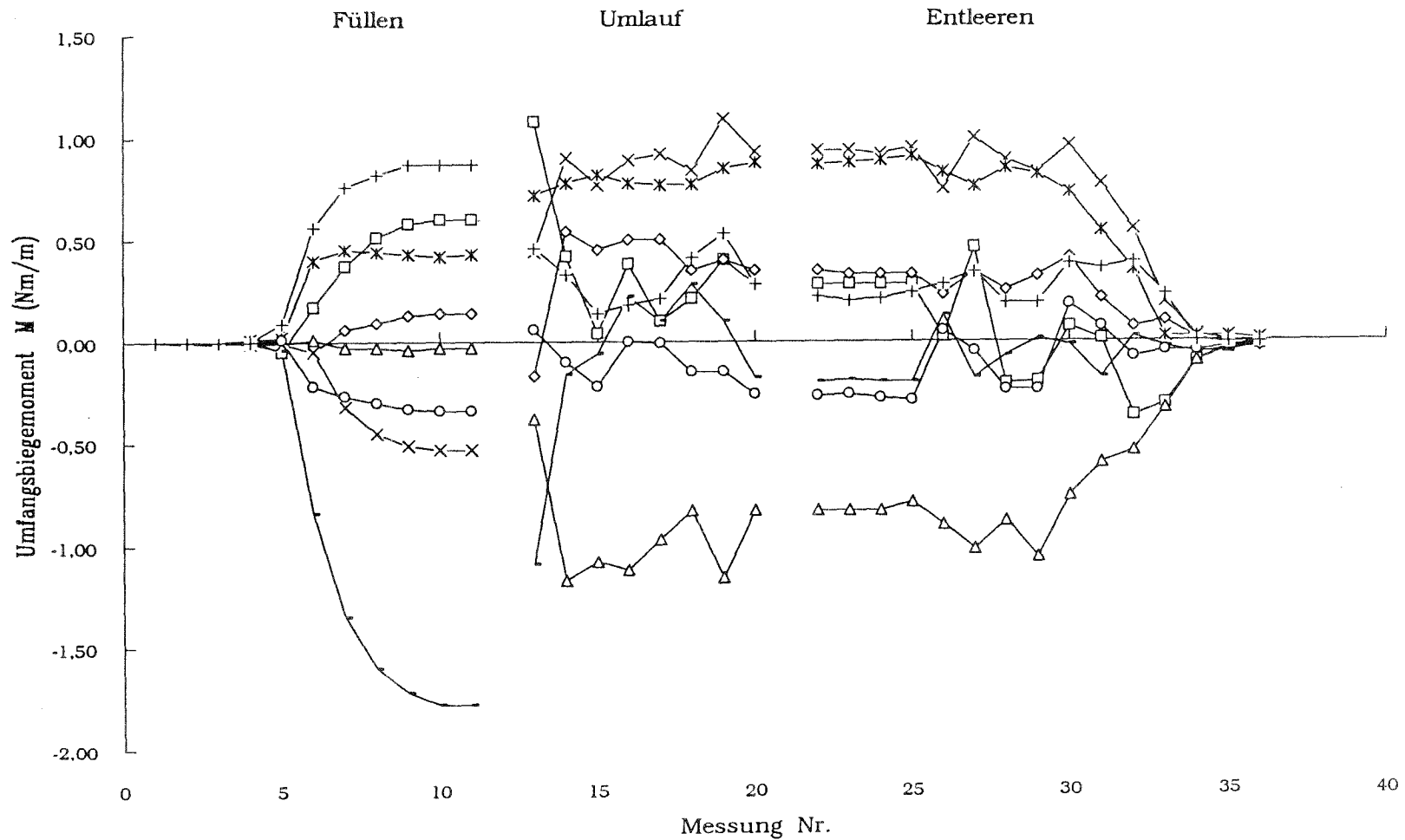
194.164

**Versuch Z 8 oberer Horizont**

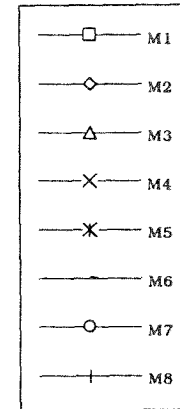


A4.165

# Versuch Z 8 mittlerer Horizont

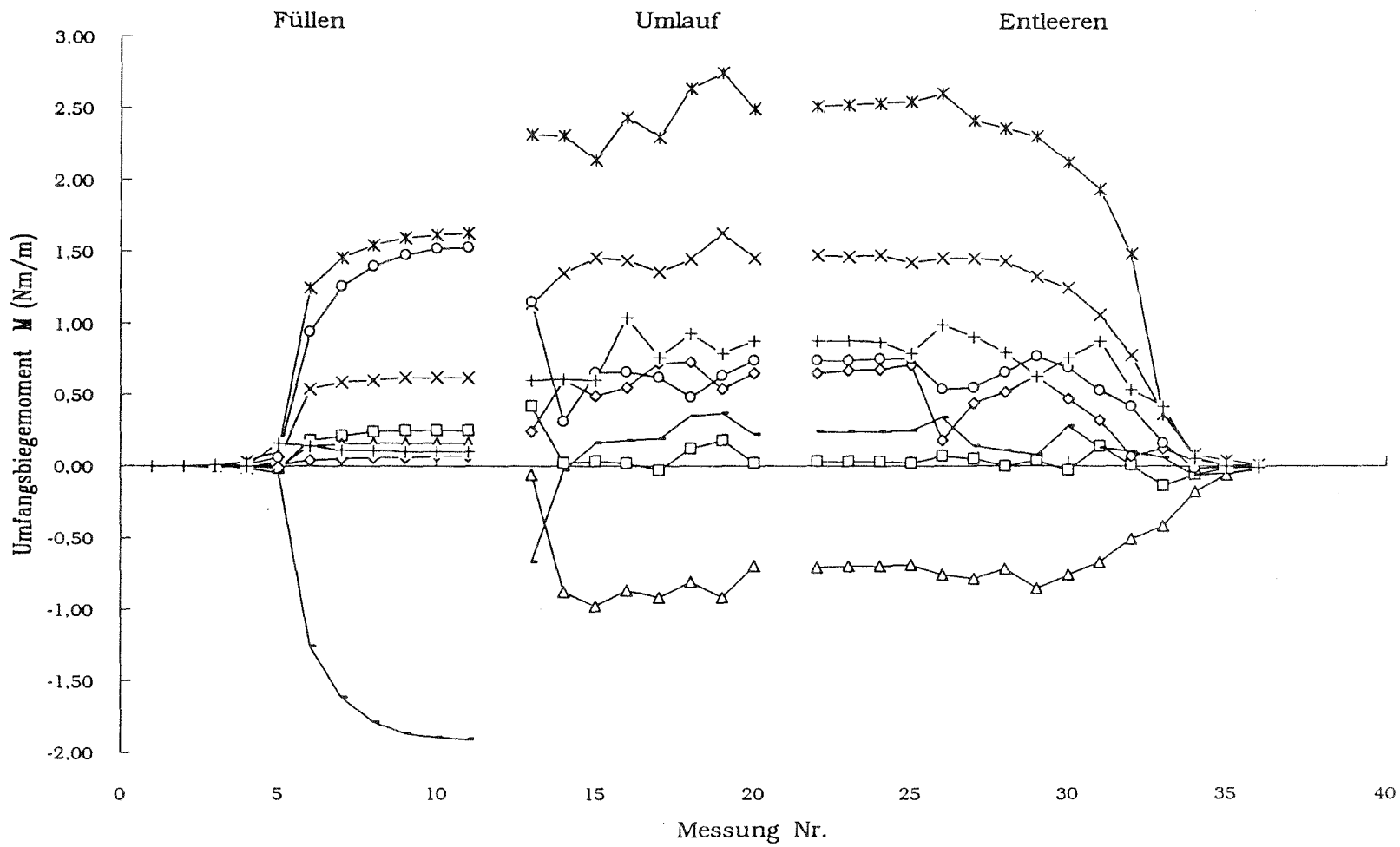


Meridian



19.4.1966

**Versuch Z 8 unterer Horizont**

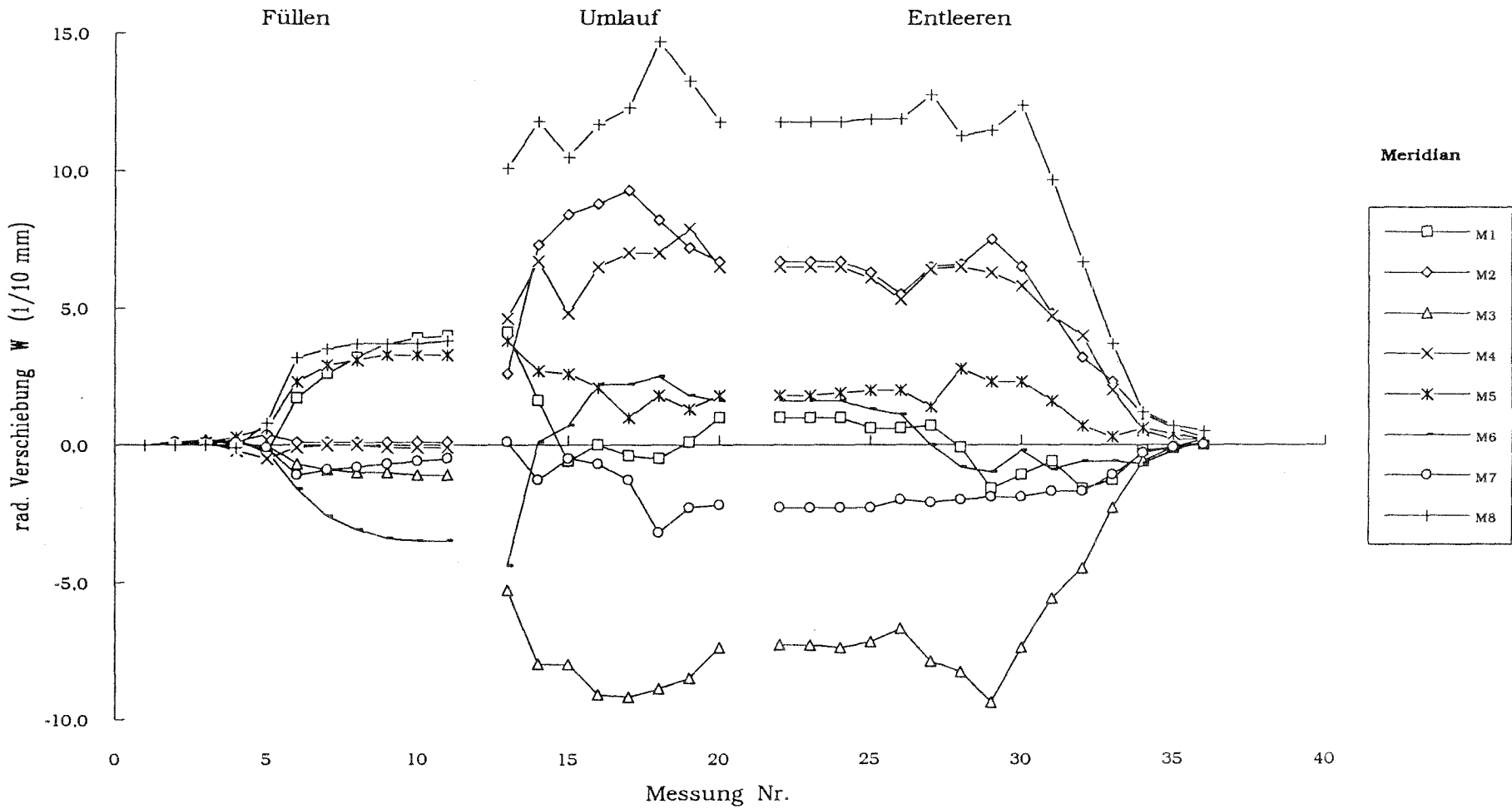


Meridian

- M1
- ◇— M2
- △— M3
- ×— M4
- \*— M5
- +— M6
- M7
- +— M8

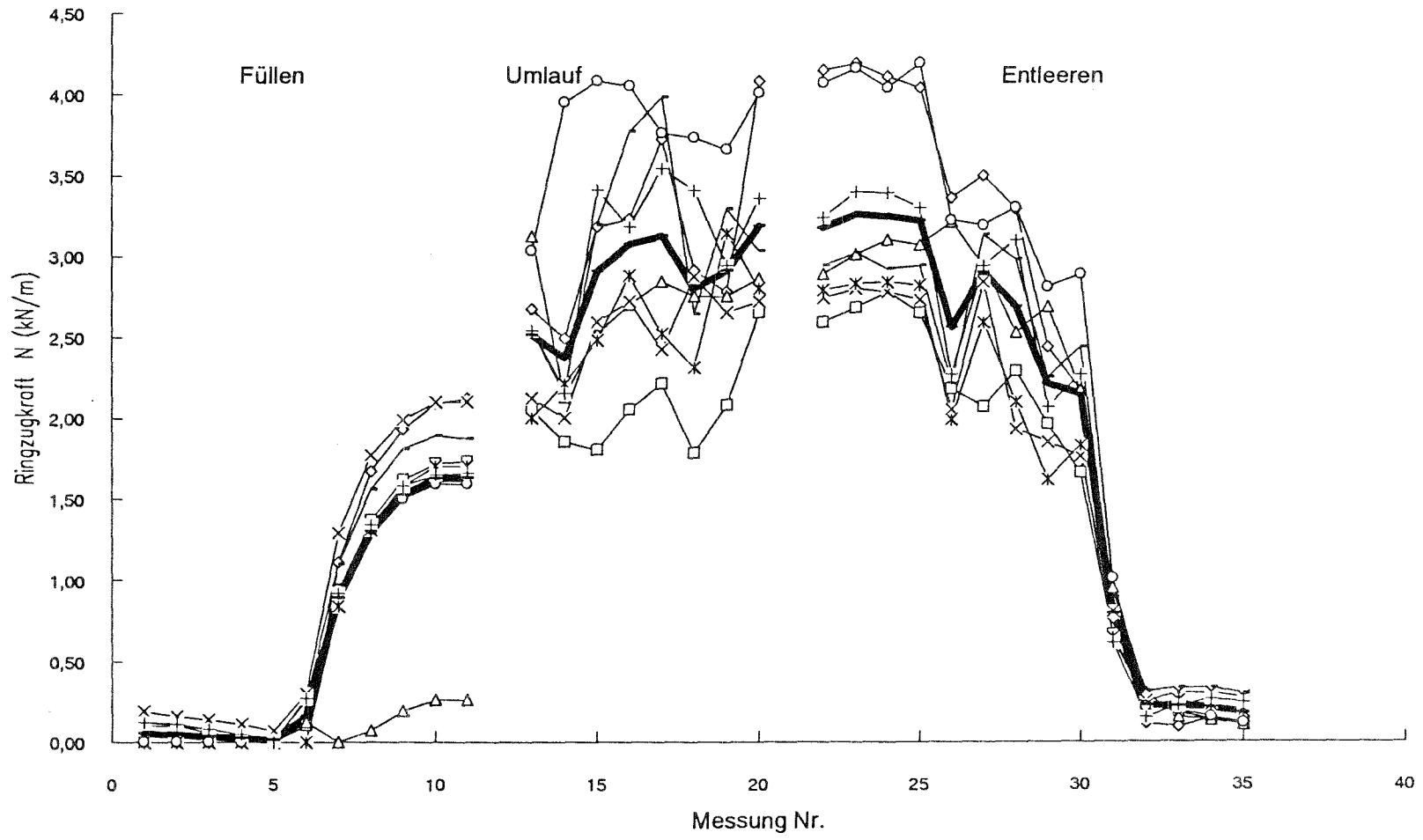
194.167

# Versuch Z 8 mittlerer Horizont



A4.168

**Versuch Z 9 oberer Horizont**

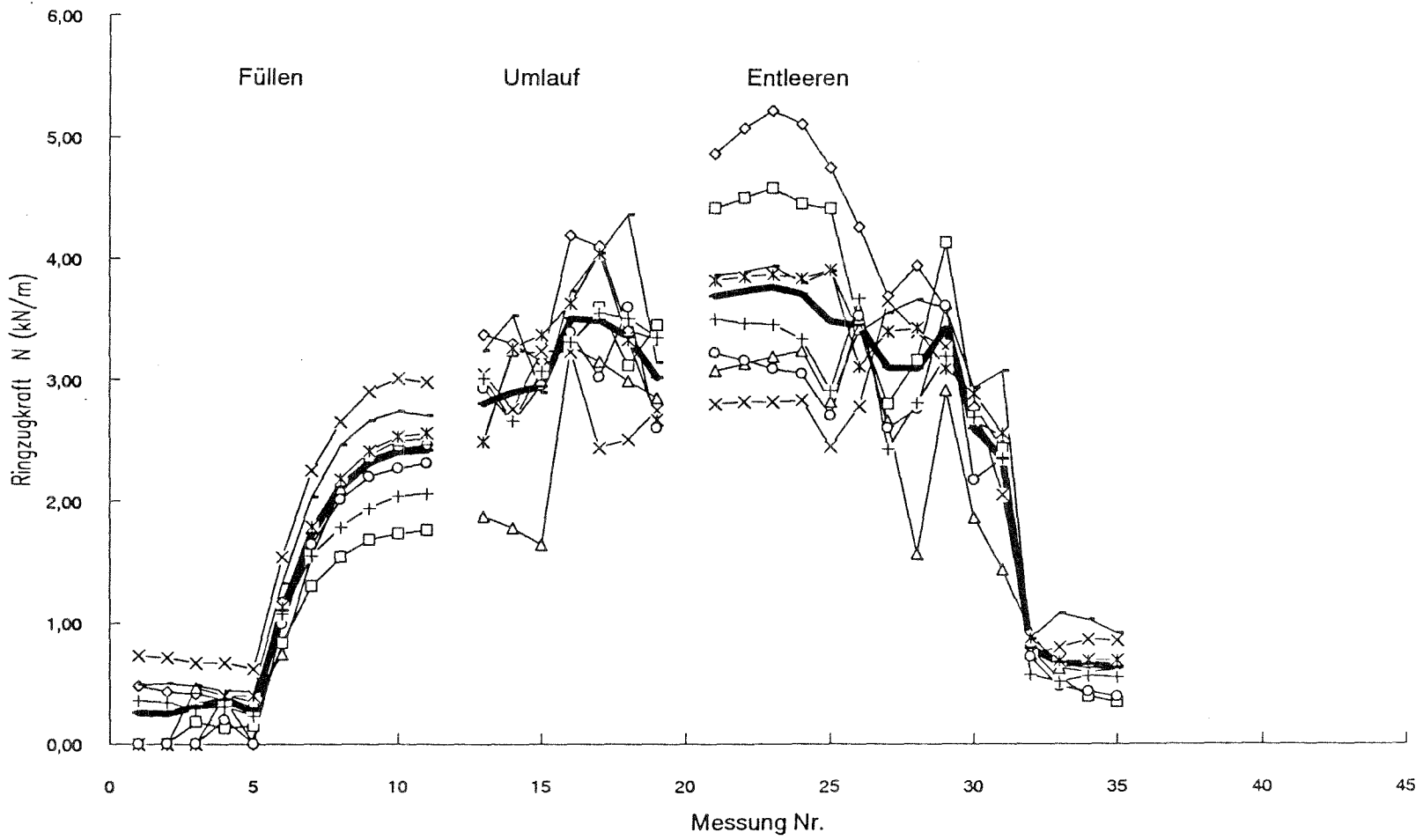


- Meridian**
- M1
  - ◇ M2
  - △ M3
  - × M4
  - × M5
  - M6
  - M7
  - + M8
  - MW

F4.16.9



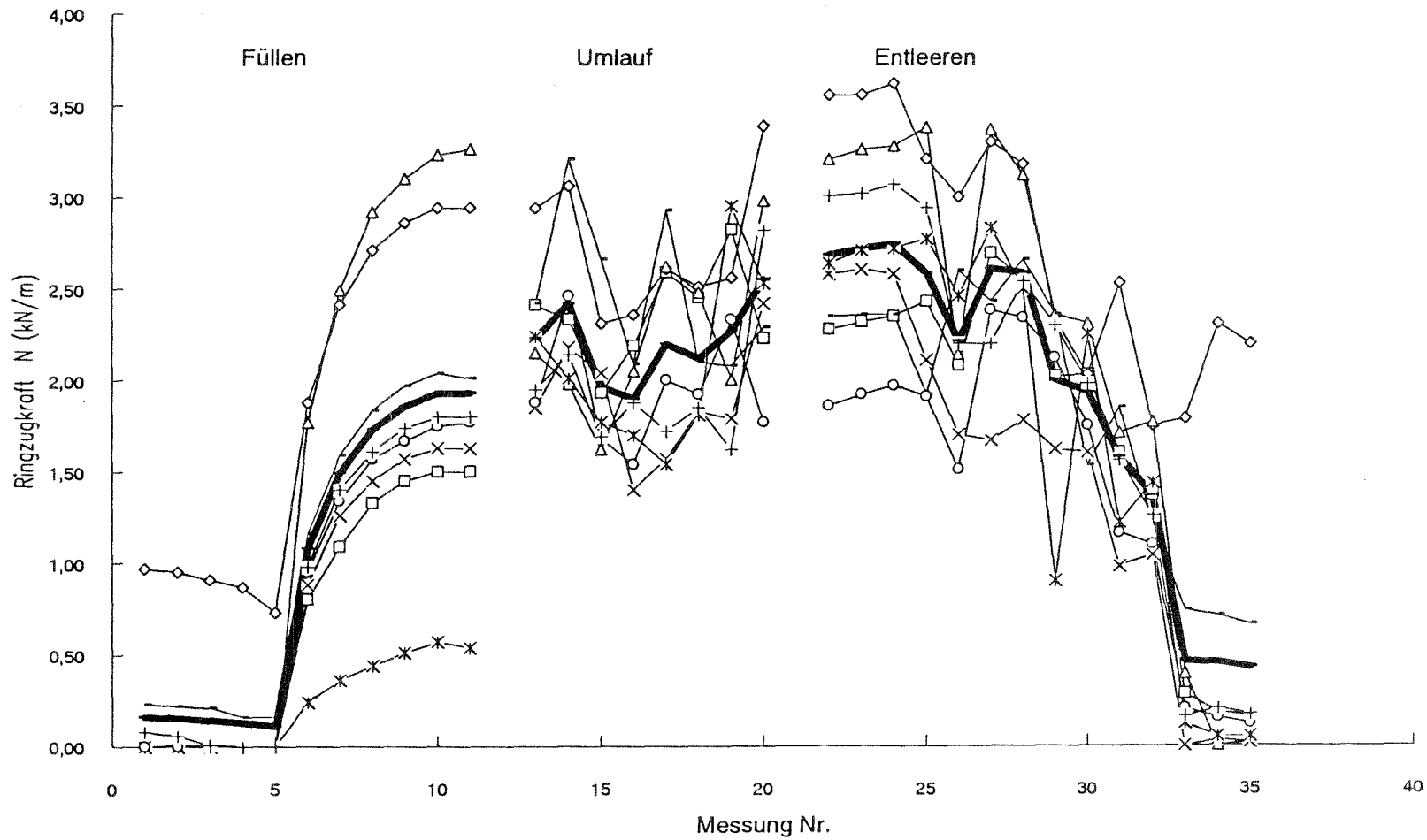
Versuch Z 9 mittlerer Horizont



- Meridian
- M1
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  - △— M3
  - ×— M4
  - \*— M5
  - M6
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04.11.10

# Versuch Z 9 unterer Horizont

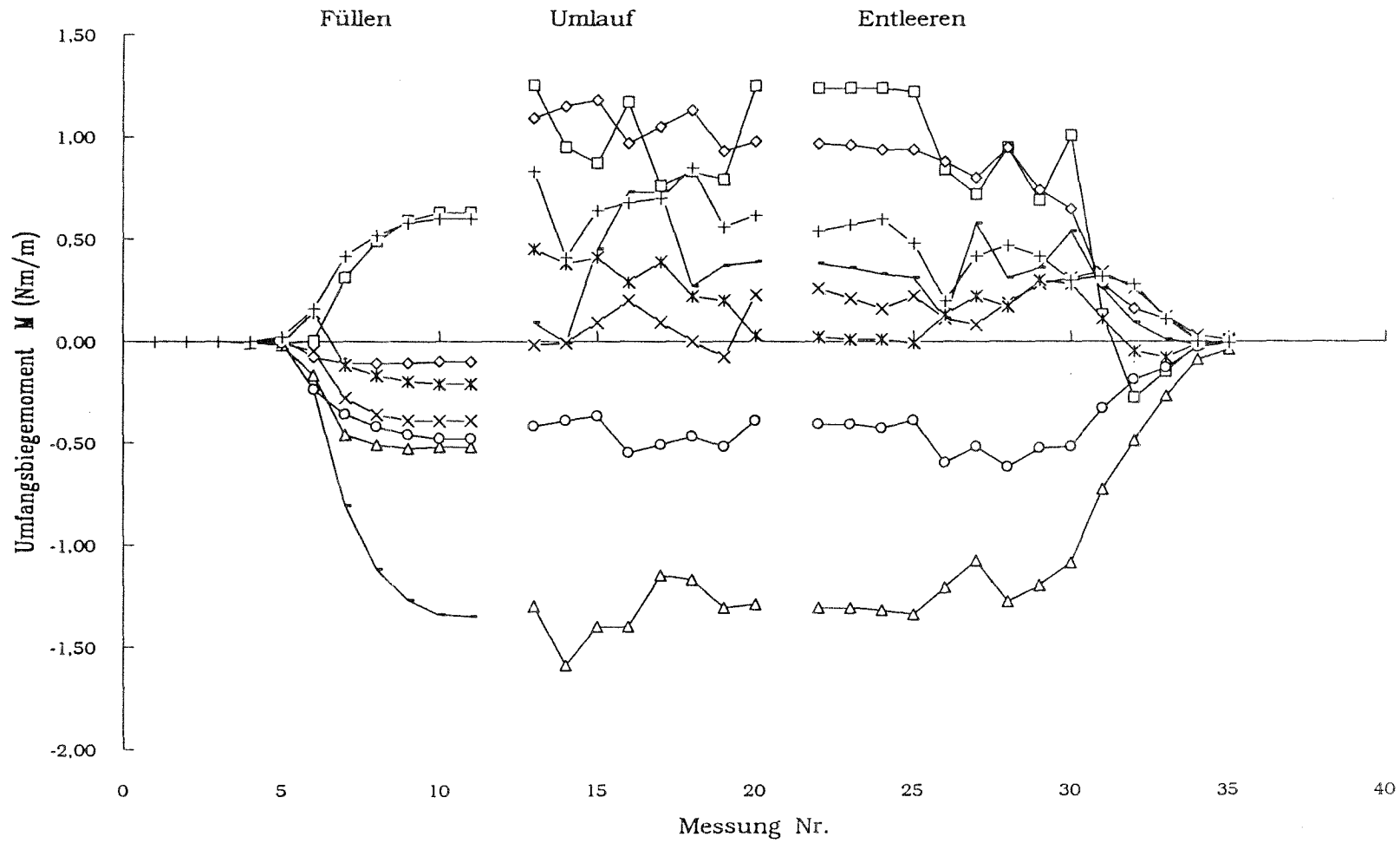


**Meridian**

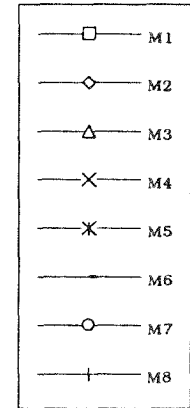
- M1
- ◇ M2
- △ M3
- × M4
- × M5
- M6
- M7
- + M8
- MW

24.12.11

**Versuch Z 9 oberer Horizont**

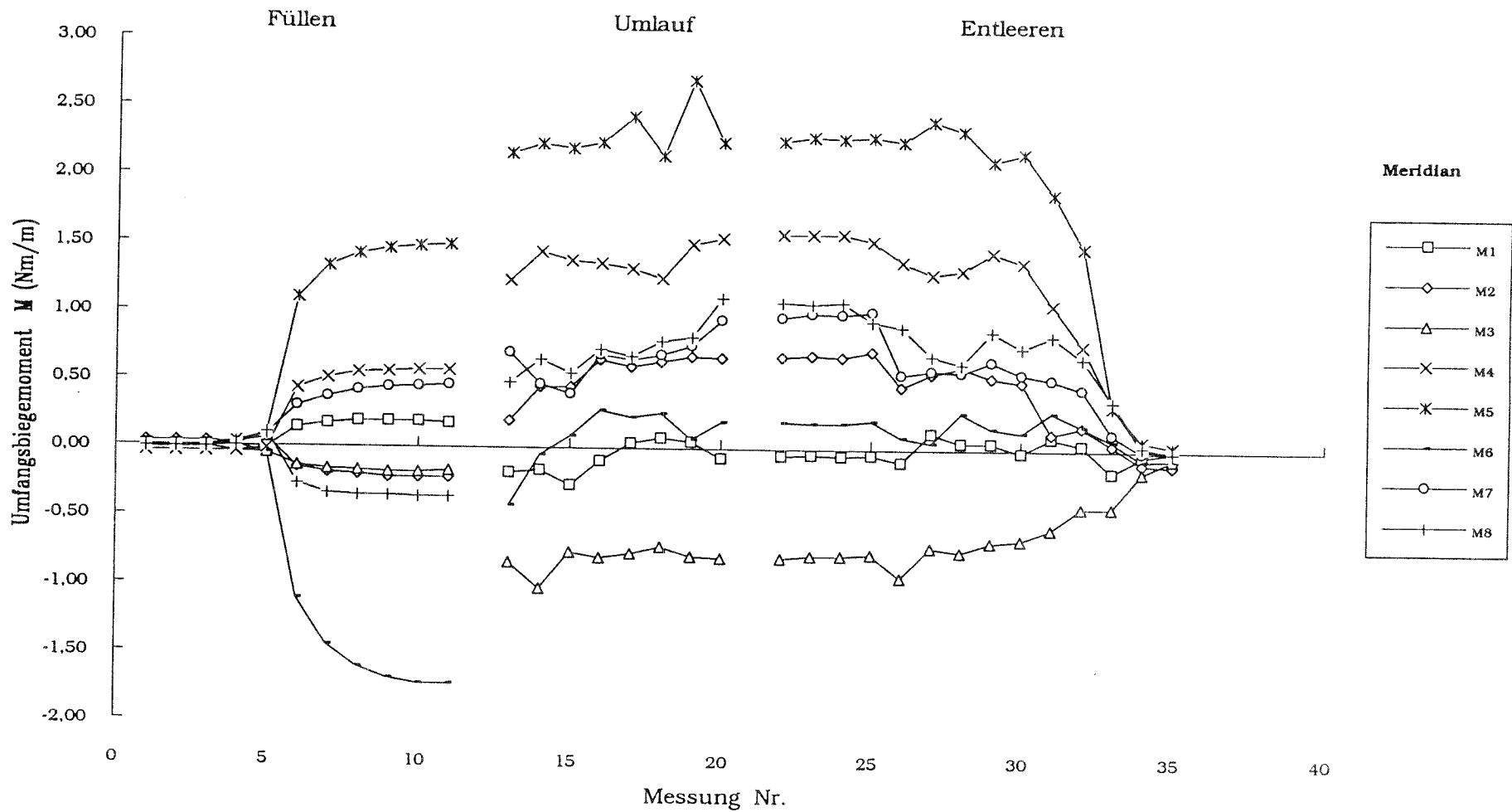


Meridian



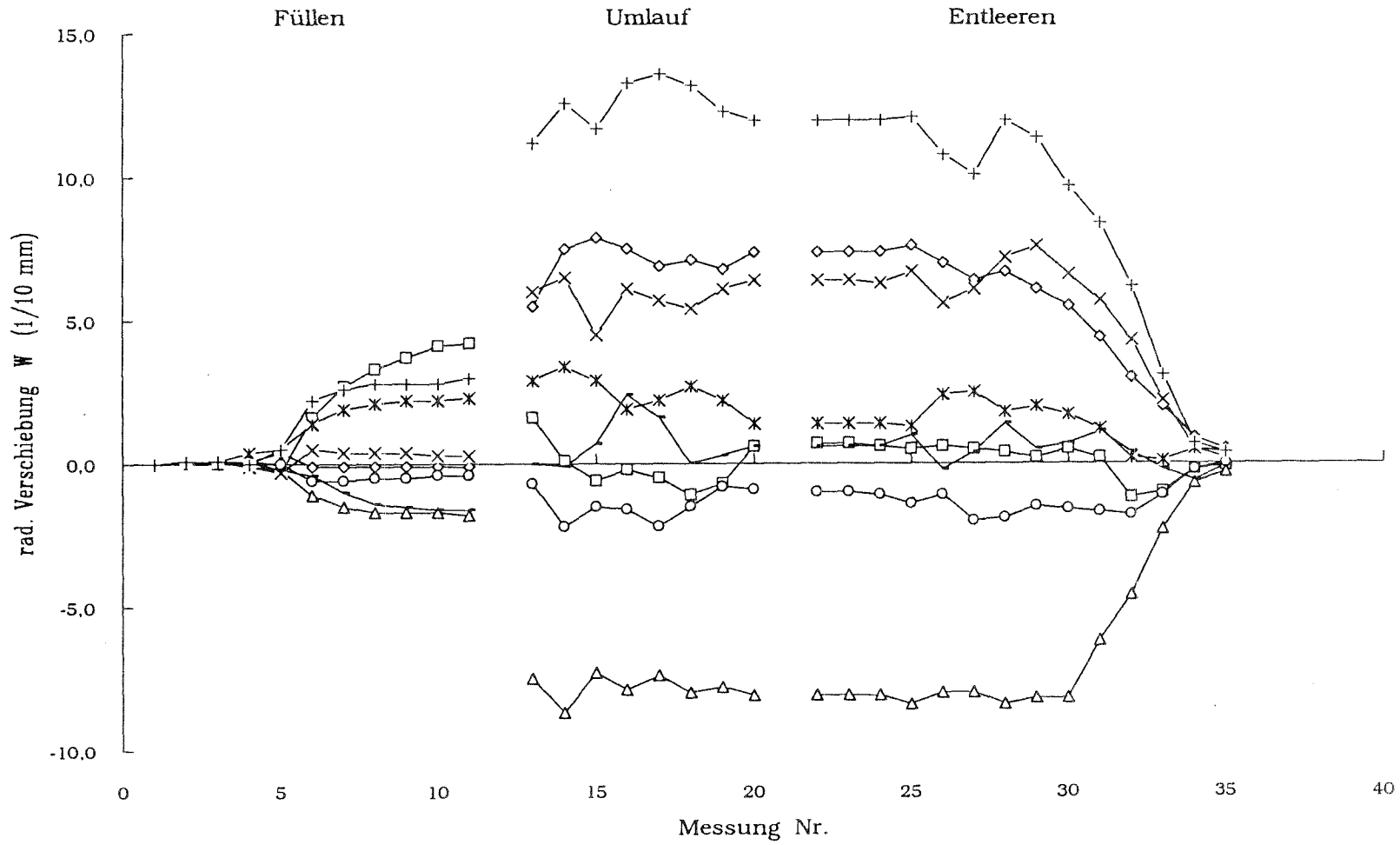
14.12

# Versuch Z 9 unterer Horizont



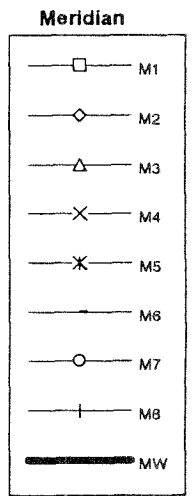
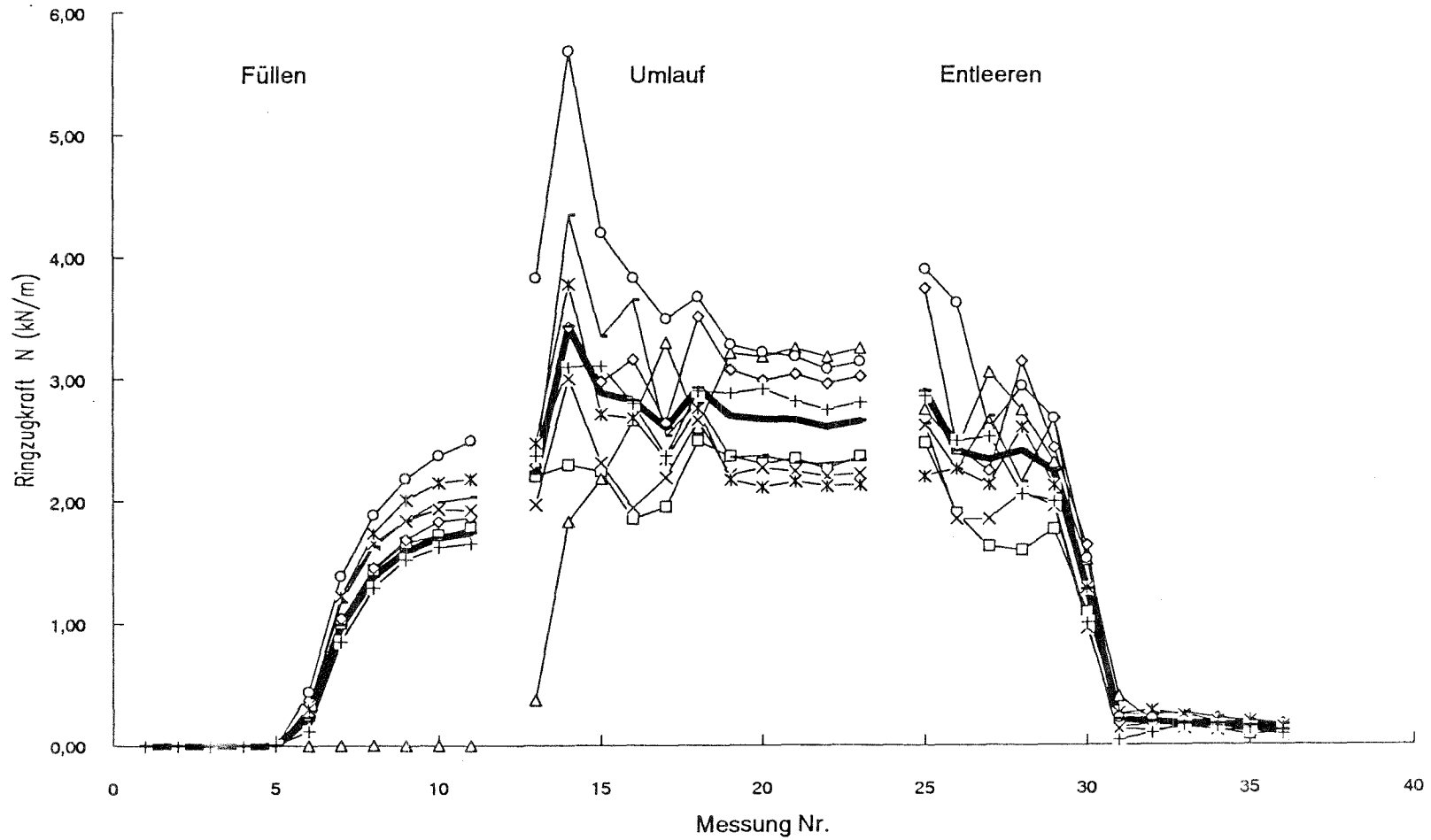
17.4.17.3

# Versuch Z 9 mittlerer Horizont



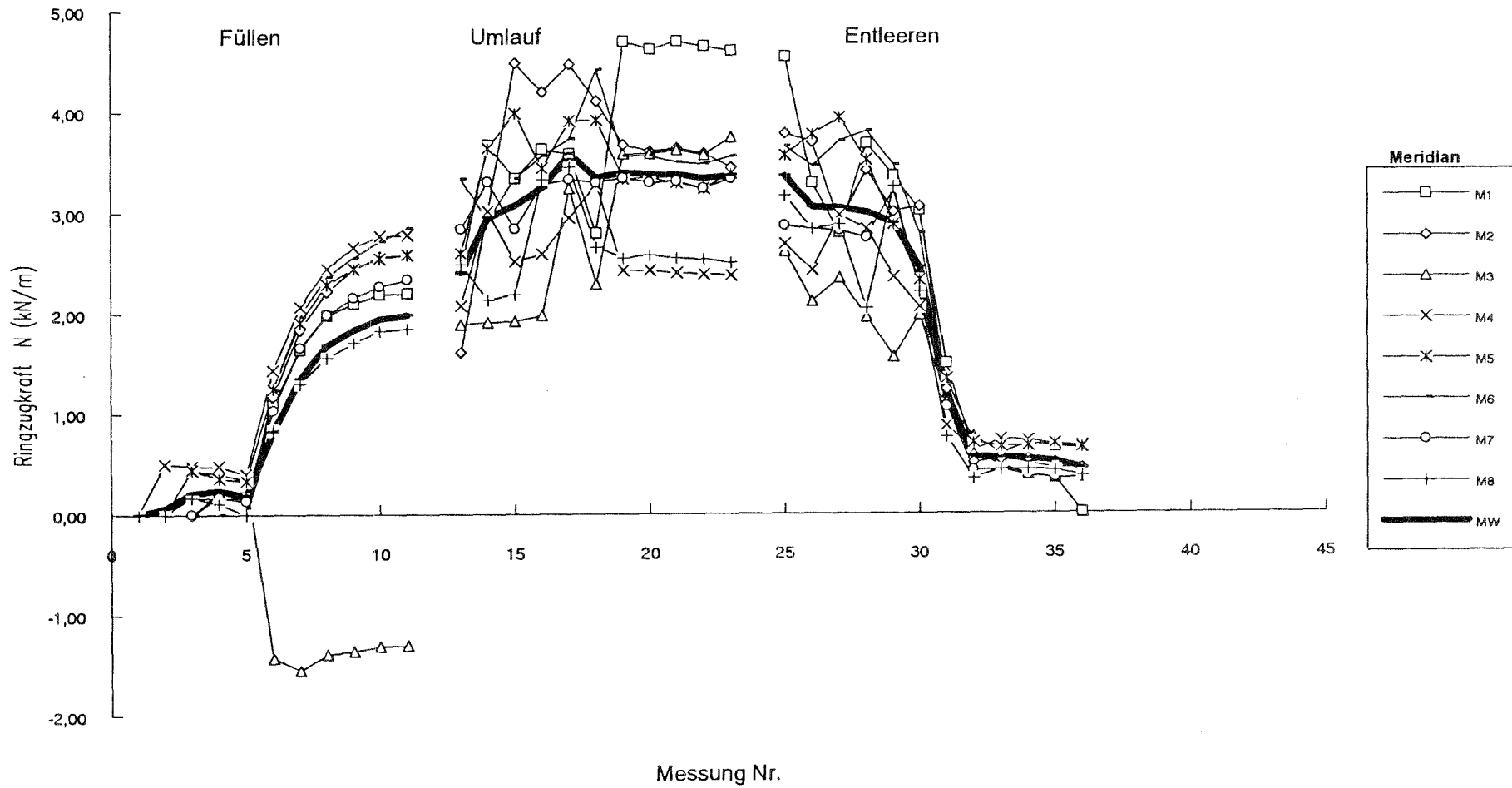
A. 2. 1. 14

Versuch Z 10 oberer Horizont



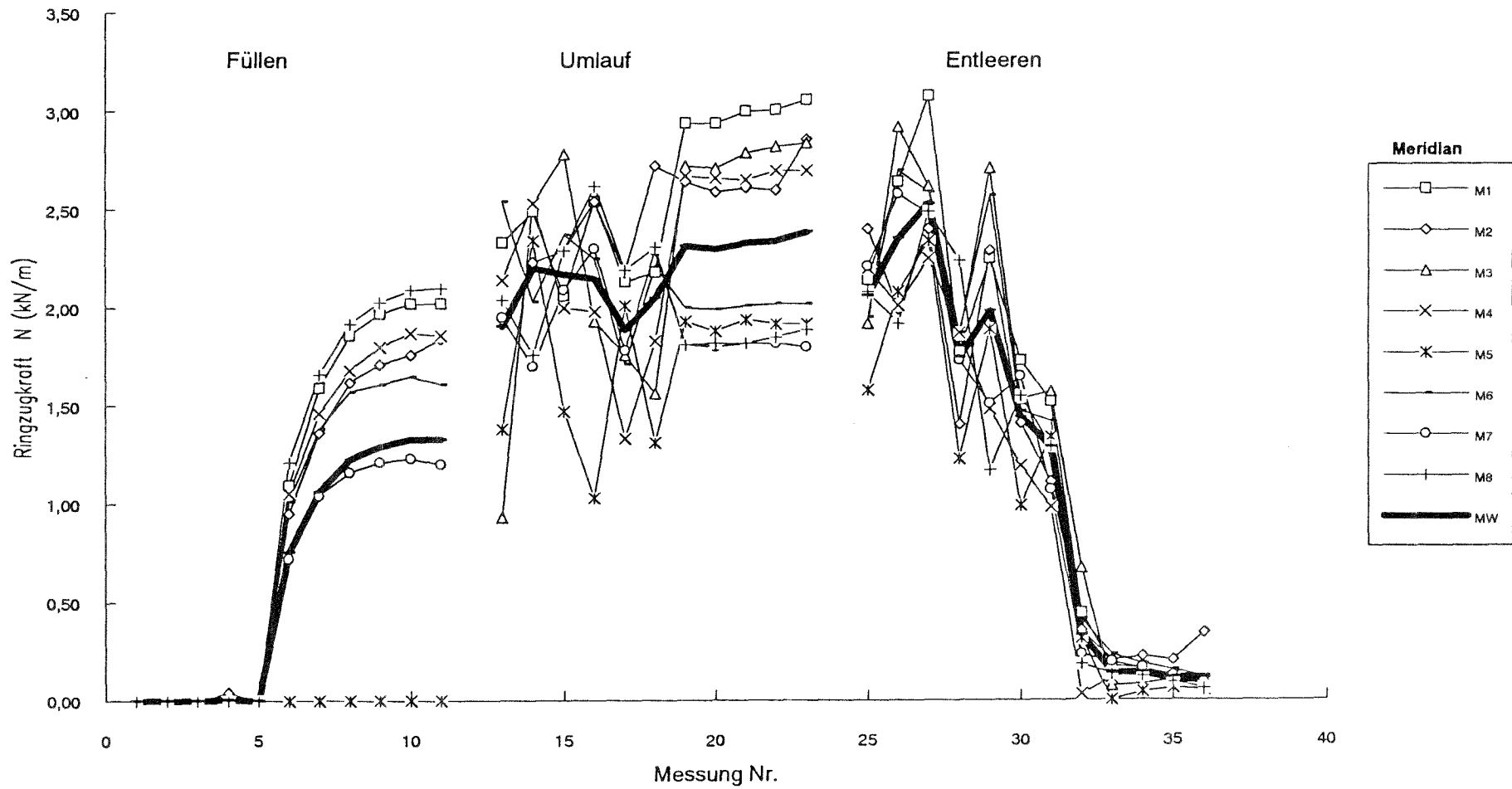
A.F.A.S

Versuch Z 10 mittlerer Horizont



9.11.19

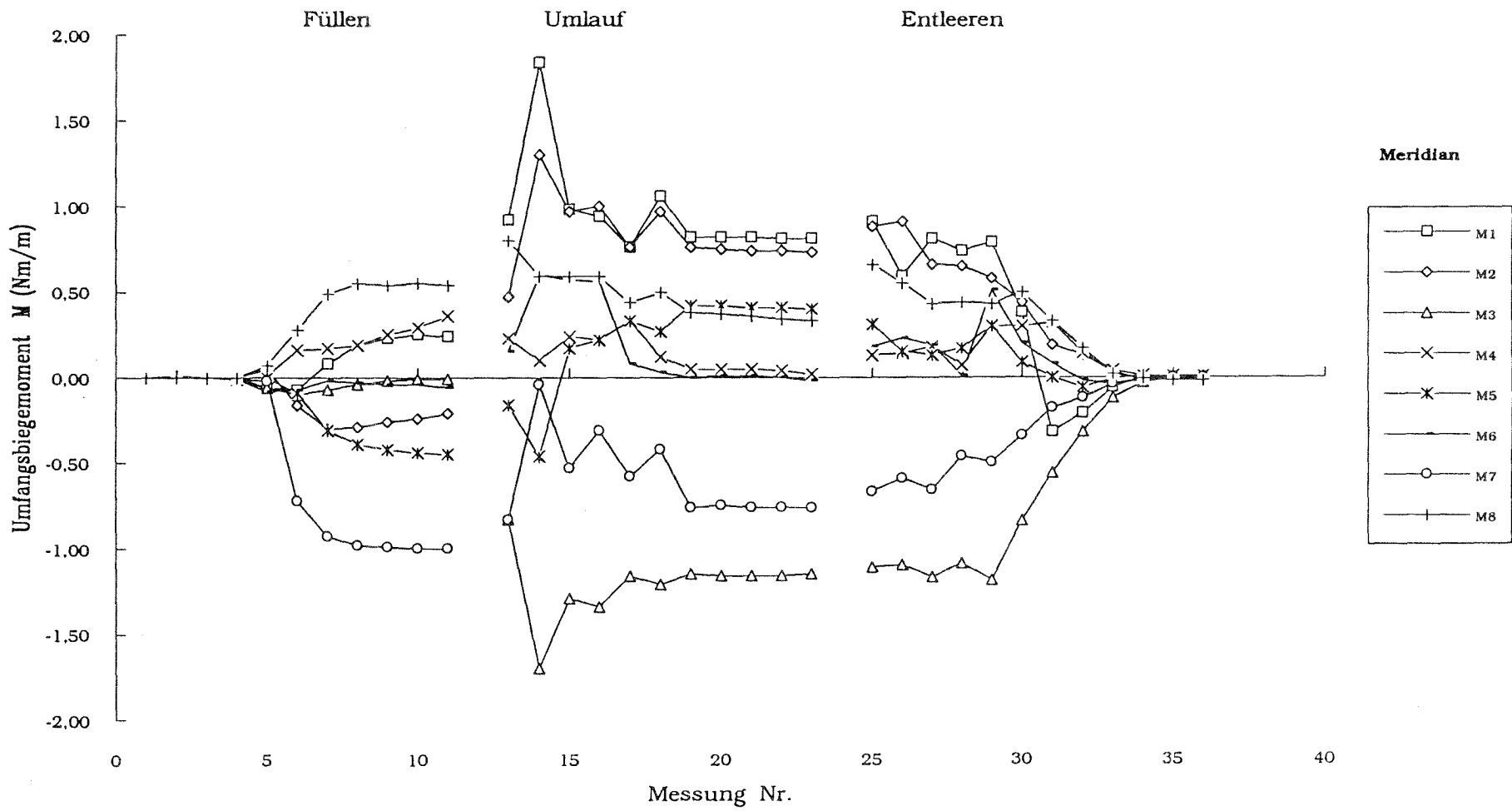
Versuch Z 10 unterer Horizont



14.11.77

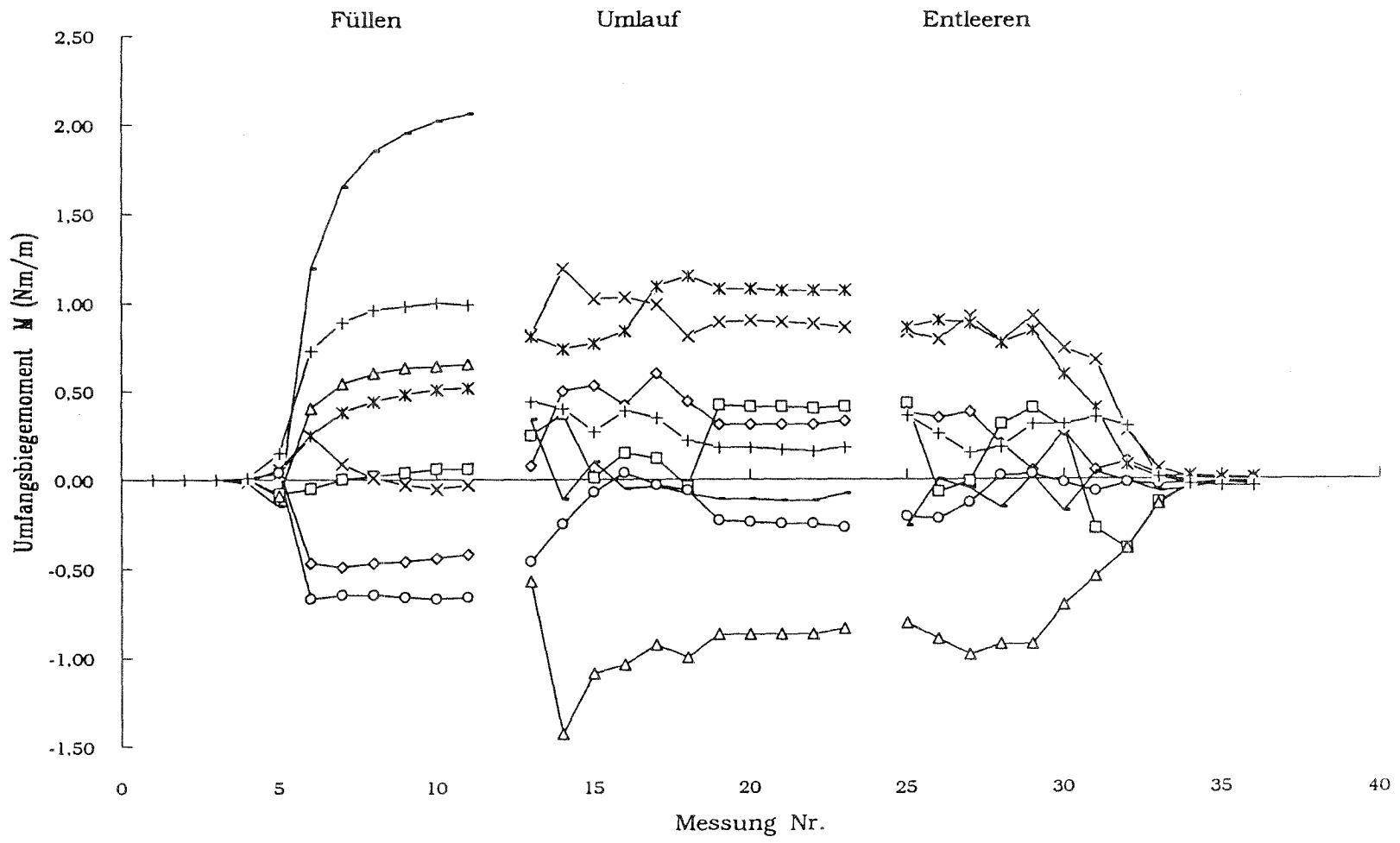


**Versuch Z 10 oberer Horizont**



14.178

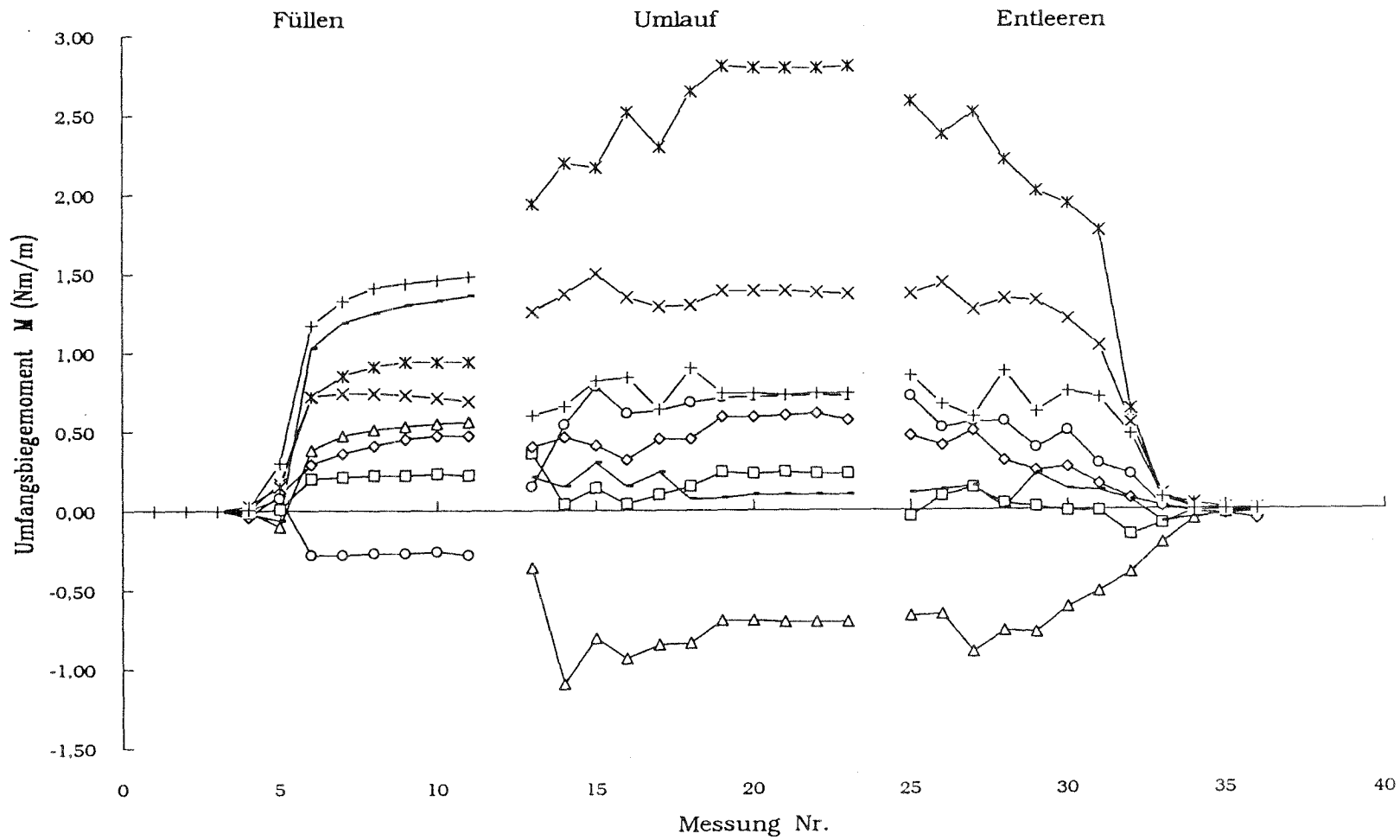
# Versuch Z 10 mittlerer Horizont



- Meridian**
- M1
  - ◇— M2
  - △— M3
  - ×— M4
  - \*— M5
  - +— M6
  - M7
  - |— M8

R4.179

**Versuch Z 10 unterer Horizont**

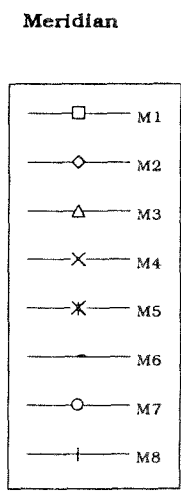
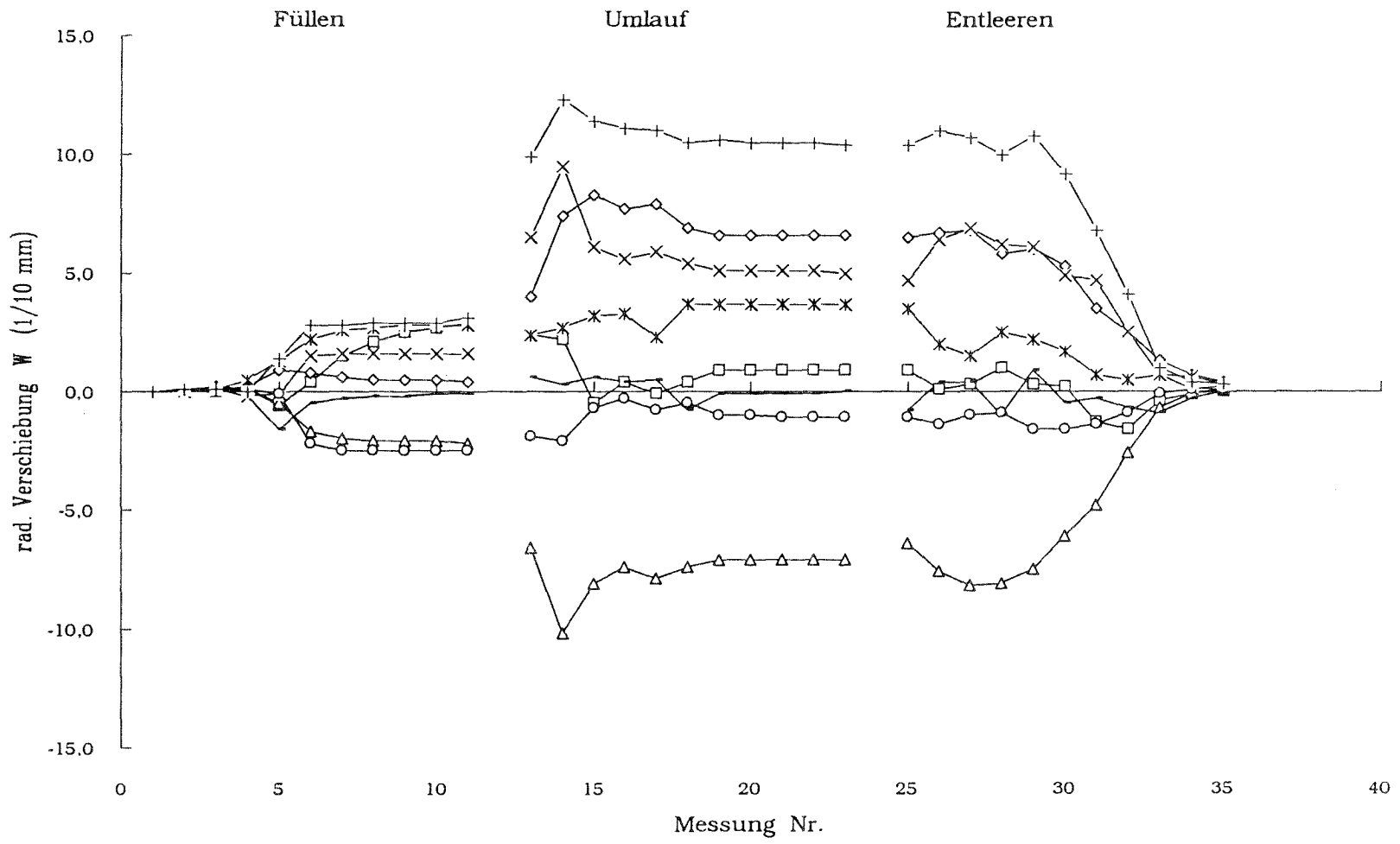


Meridian

- M1
- ◇— M2
- △— M3
- ×— M4
- \*— M5
- +— M6
- M7
- +— M8

194.180

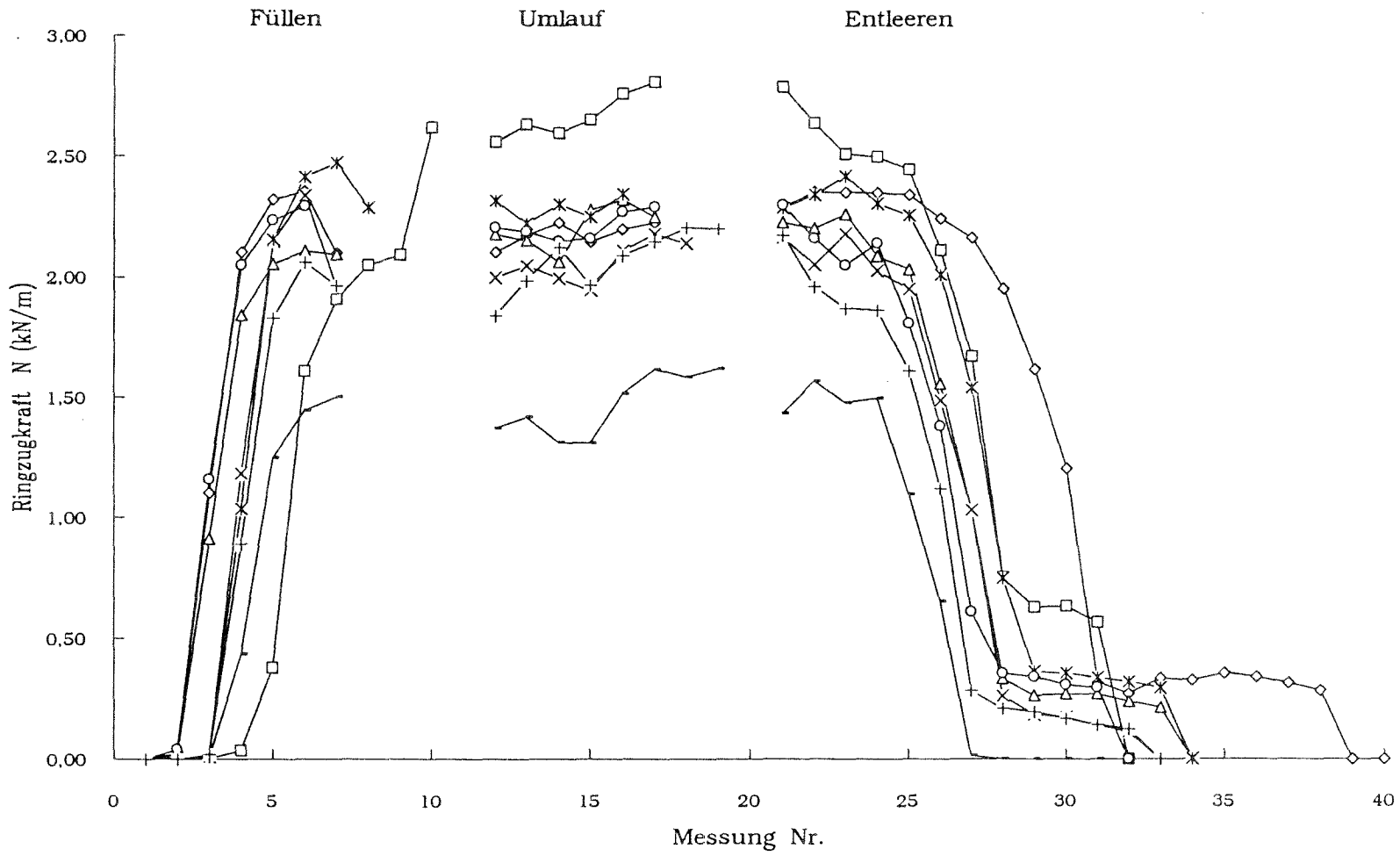
# Versuch Z 10 mittlerer Horizont



p4.181

Die Seiten A 4.141 – A 4.145 entfallen

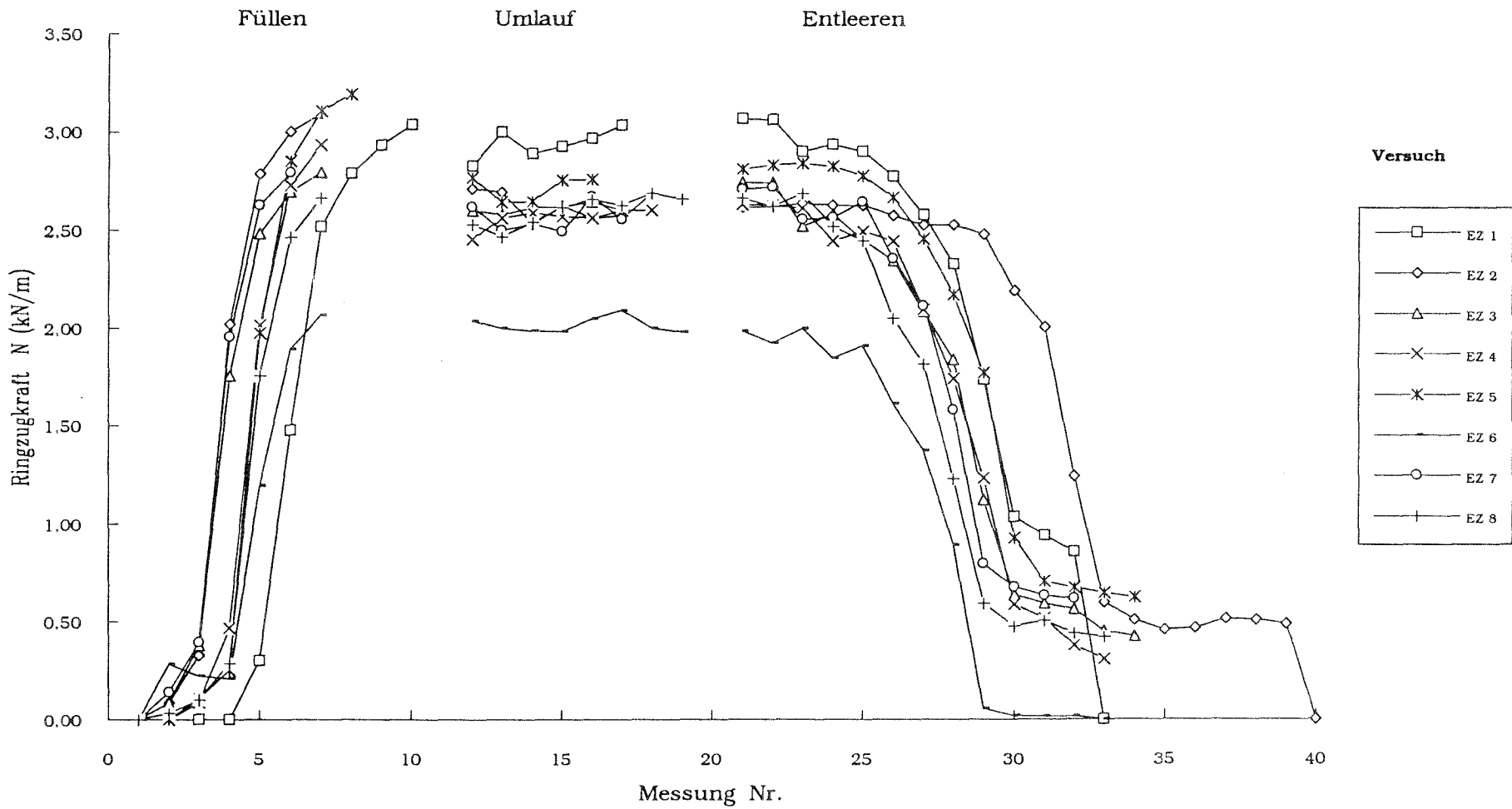
Mittelwert aus den Versuchen EZ 1 - EZ 8 oberer Horizont



- Versuch
- EZ 1
  - ◇— EZ 2
  - △— EZ 3
  - ×— EZ 4
  - \*— EZ 5
  - +— EZ 6
  - EZ 7
  - +— EZ 8

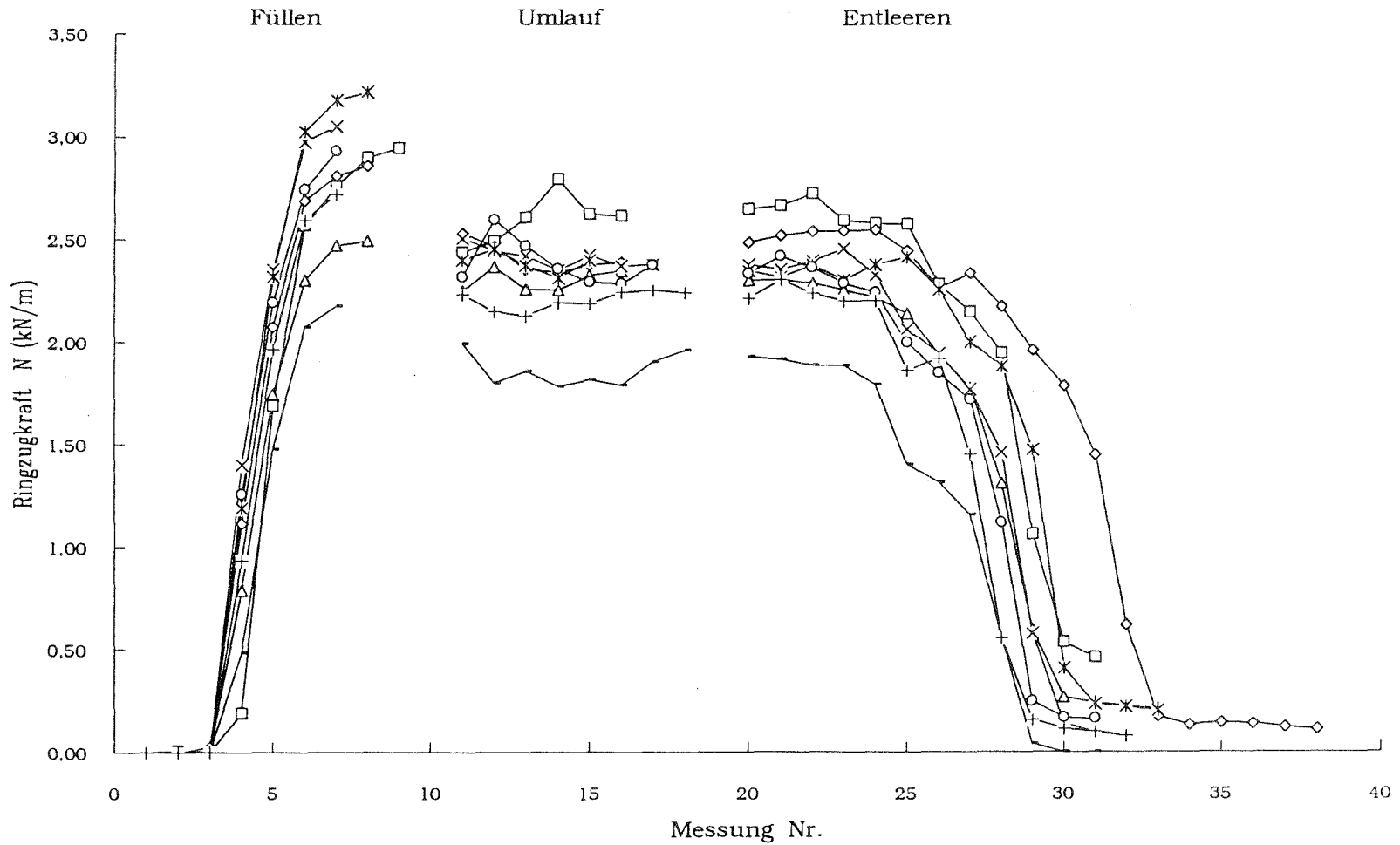
A4.183

**Mittelwert aus den Versuchen EZ 1 - EZ 8 mittlerer Horizont**



14.184

Mittelwert aus den Versuchen EZ 1 - EZ 8 unterer Horizont

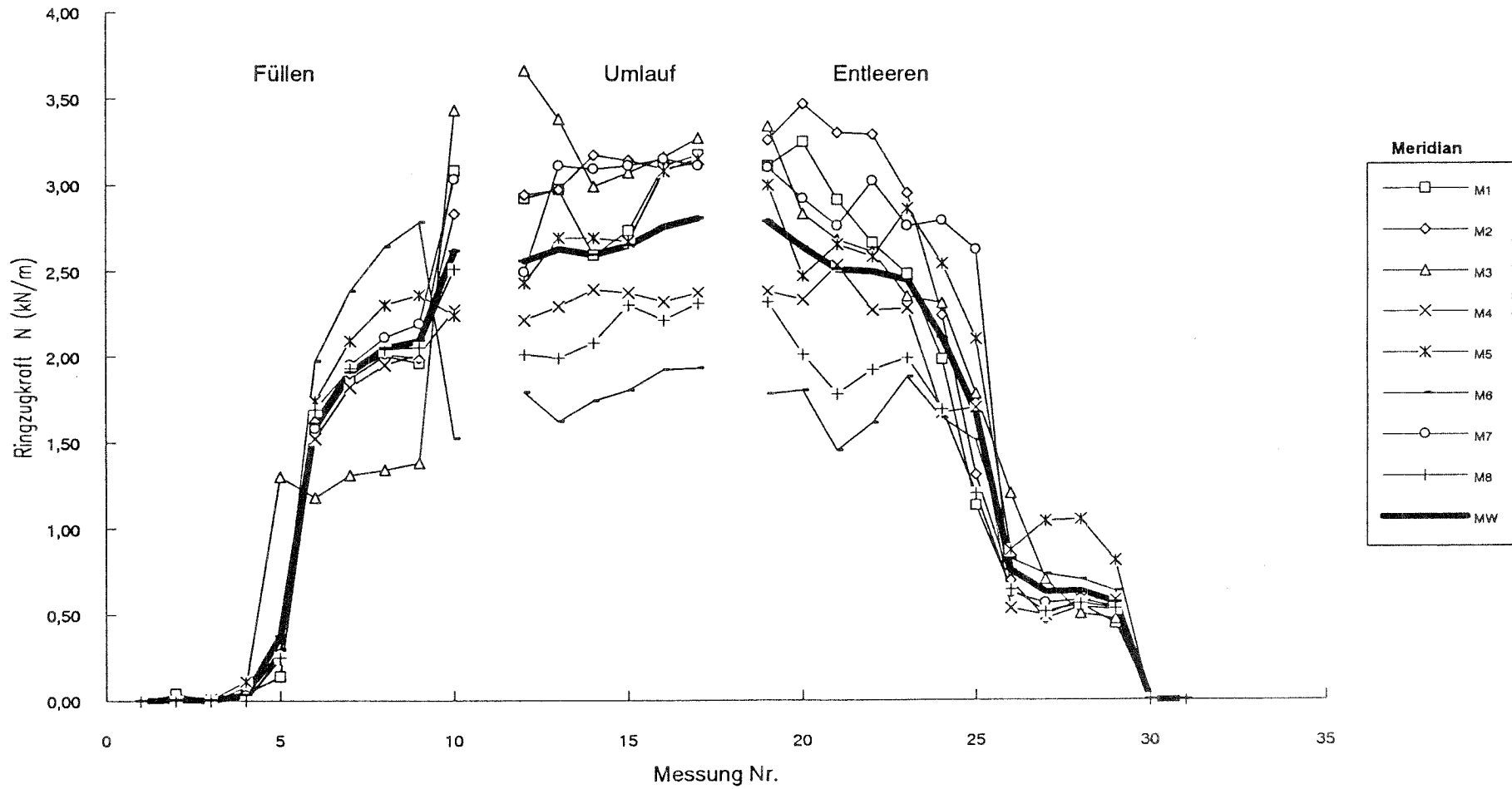


- Versuch
- EZ 1
  - ◇— EZ 2
  - △— EZ 3
  - ×— EZ 4
  - \*— EZ 5
  - +— EZ 6
  - EZ 7
  - +— EZ 8

19.4.185

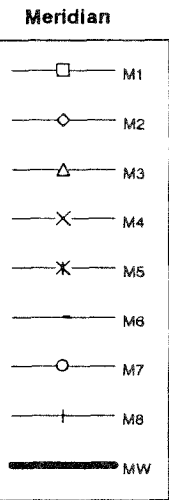
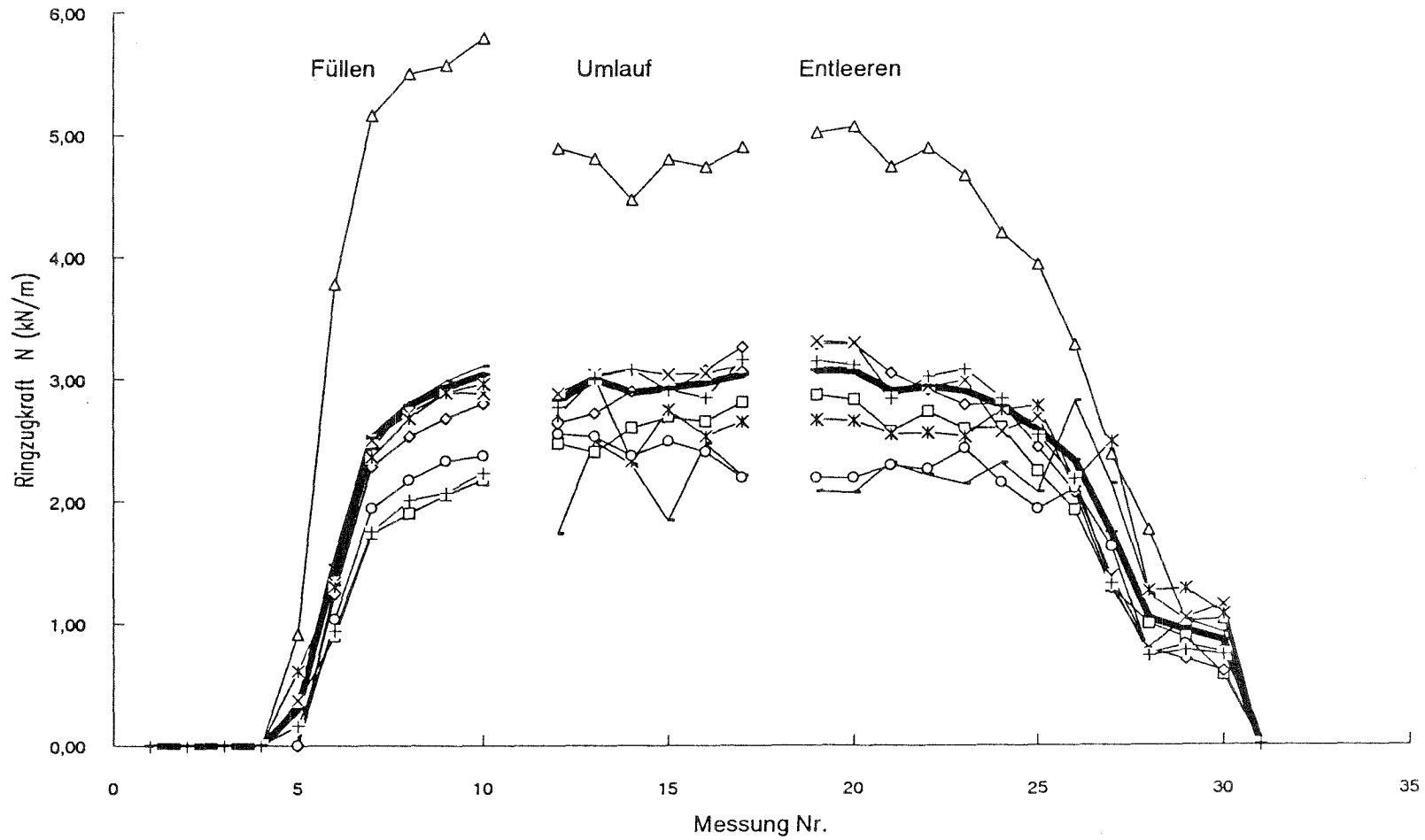


Versuch EZ 1 oberer Horizont



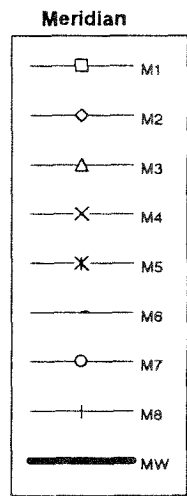
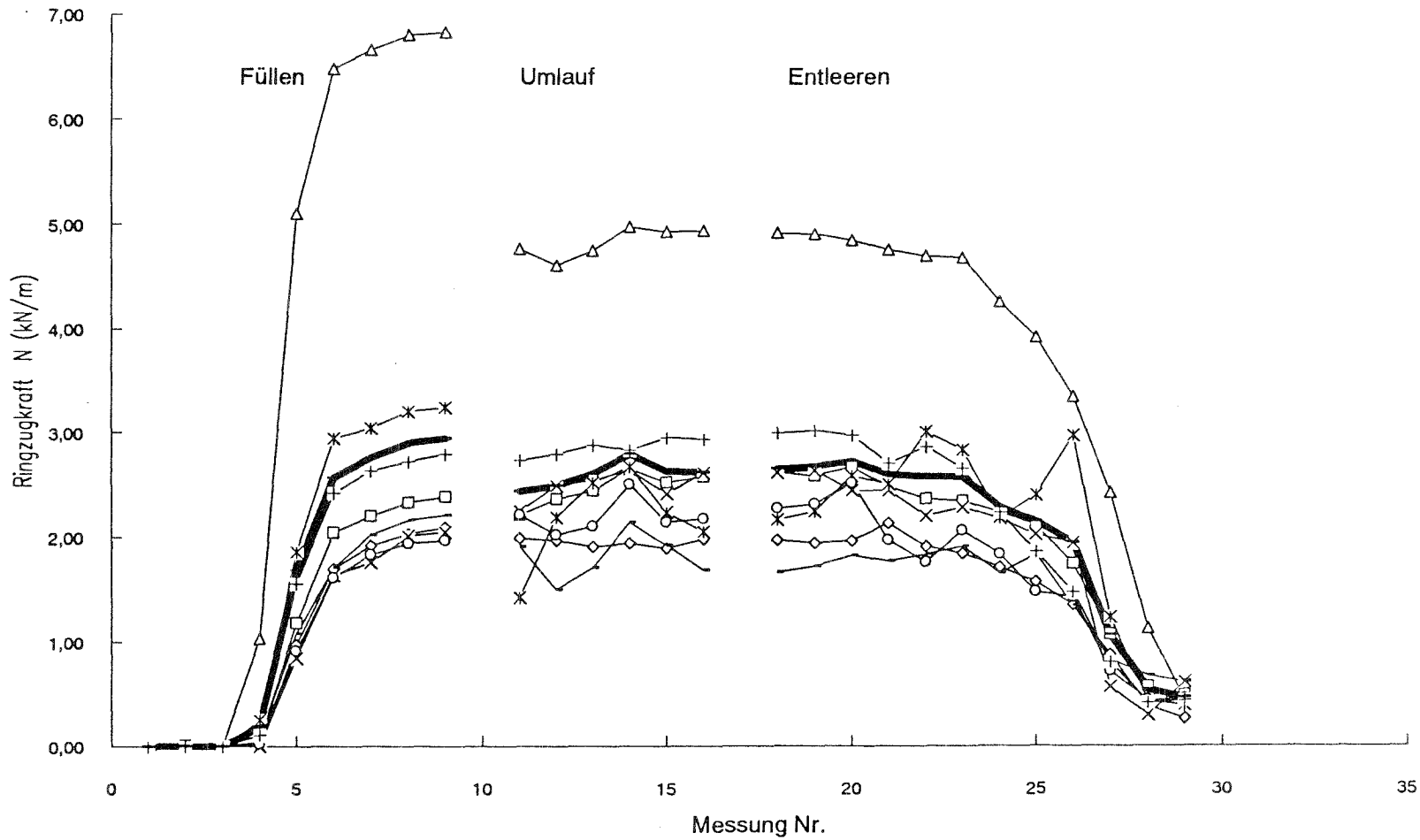
14.186

Versuch EZ 1 mittlerer Horizont



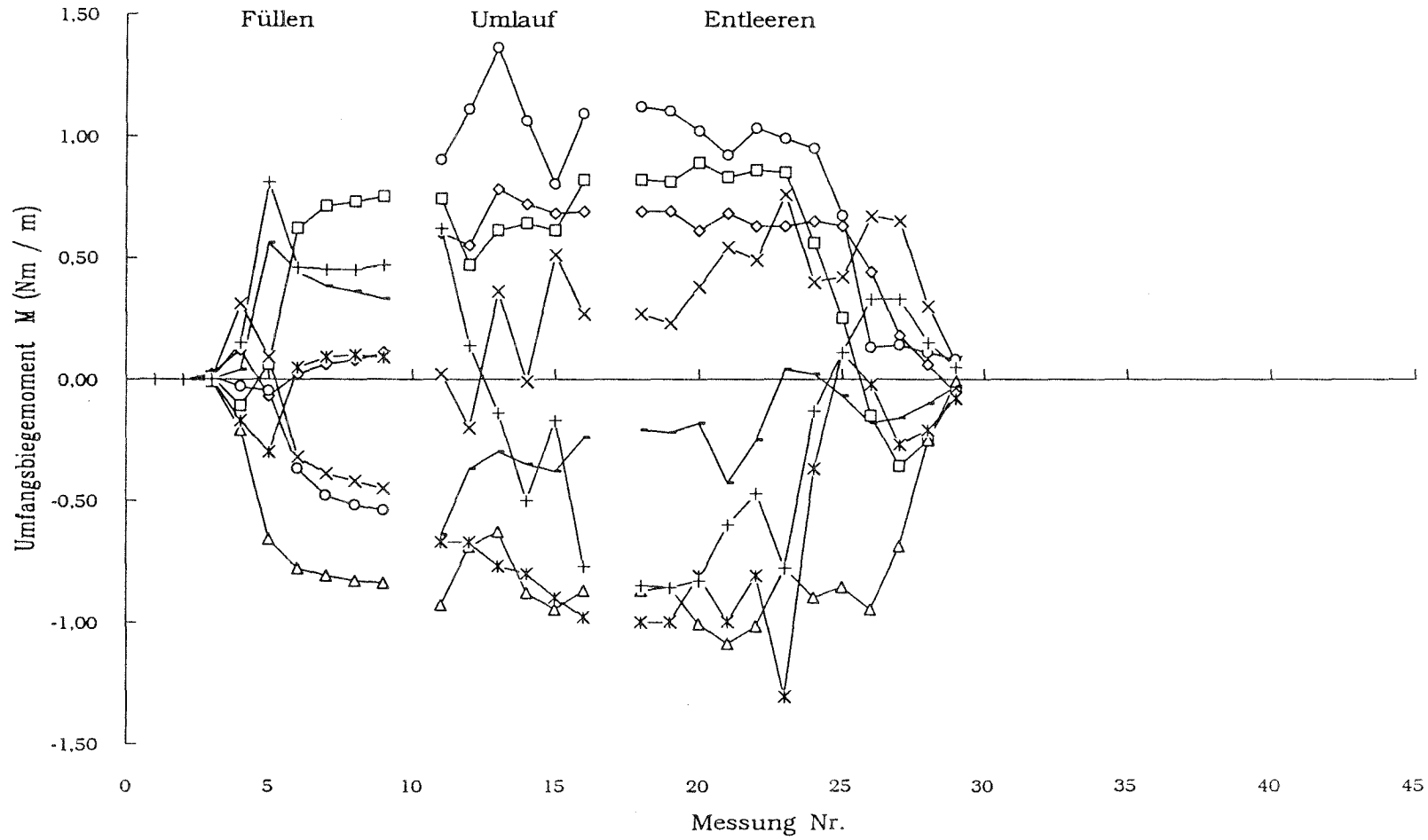
04.187

### Versuch EZ 1 unterer Horizont

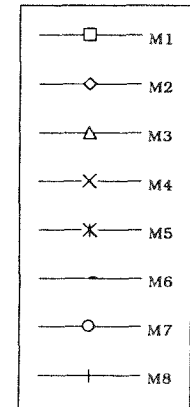


A4.188

**Versuch EZ 1 oberer Horizont**

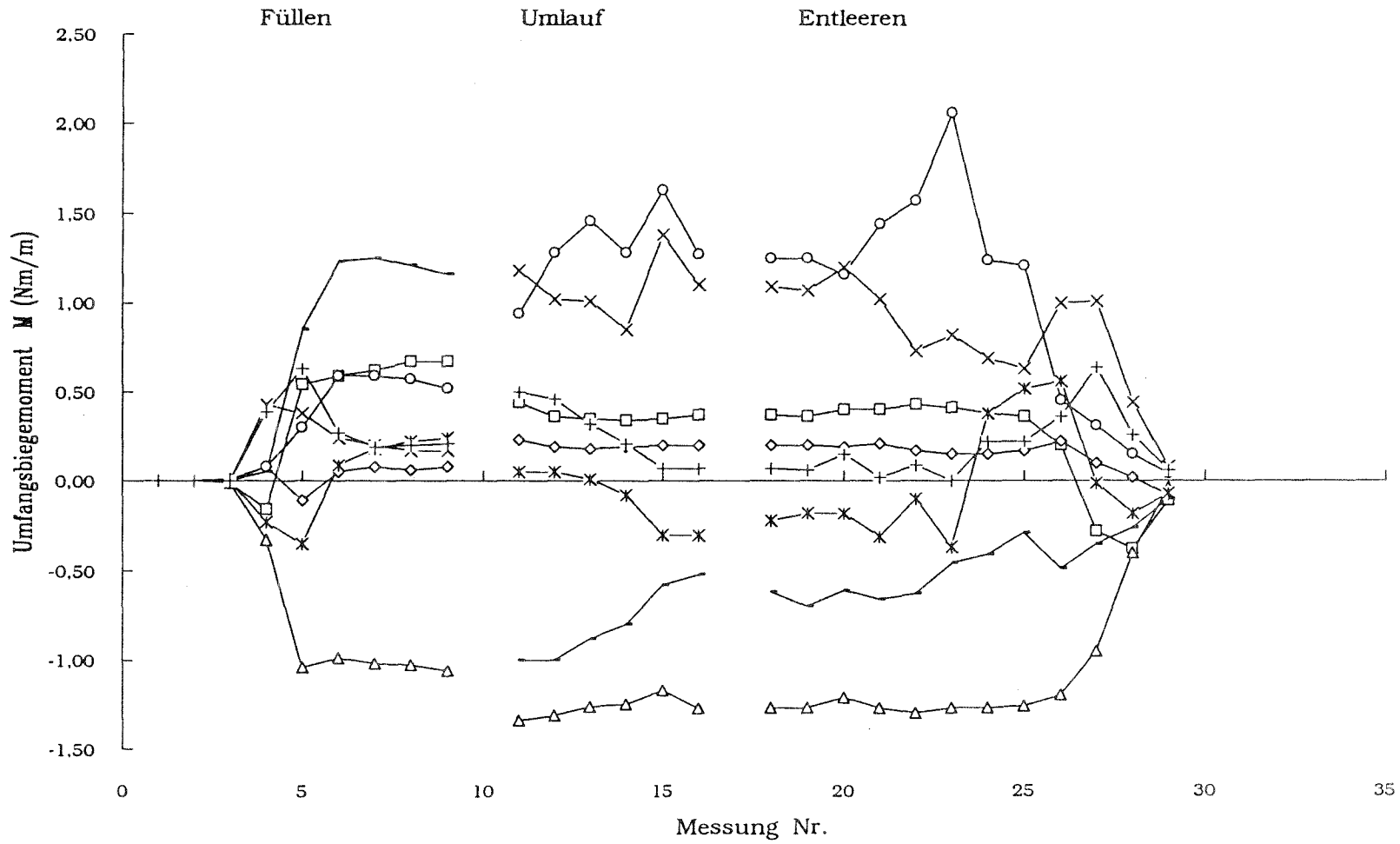


Meridian



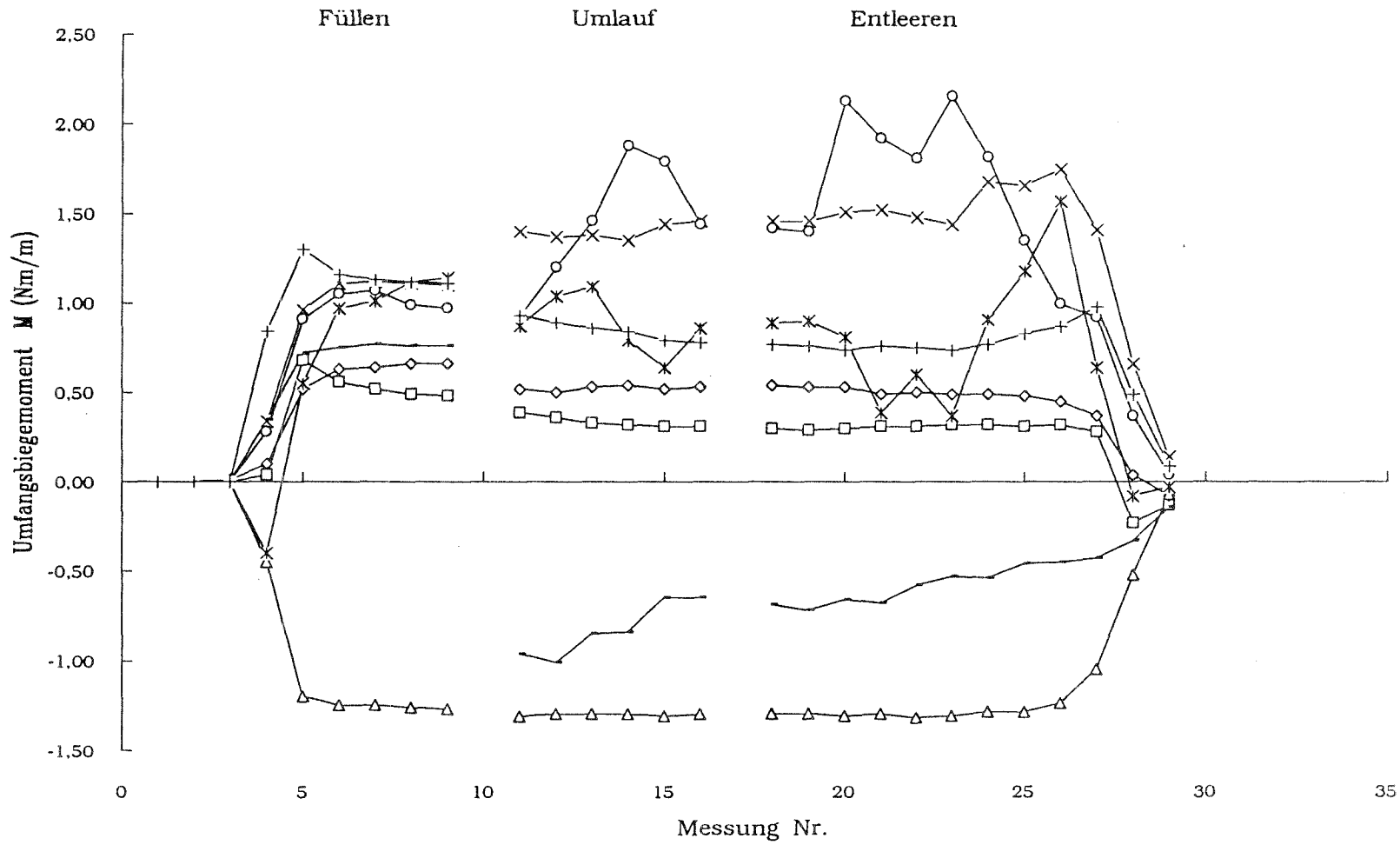
A 4.189

# Versuch EZ 1 mittlerer Horizont



174.1930

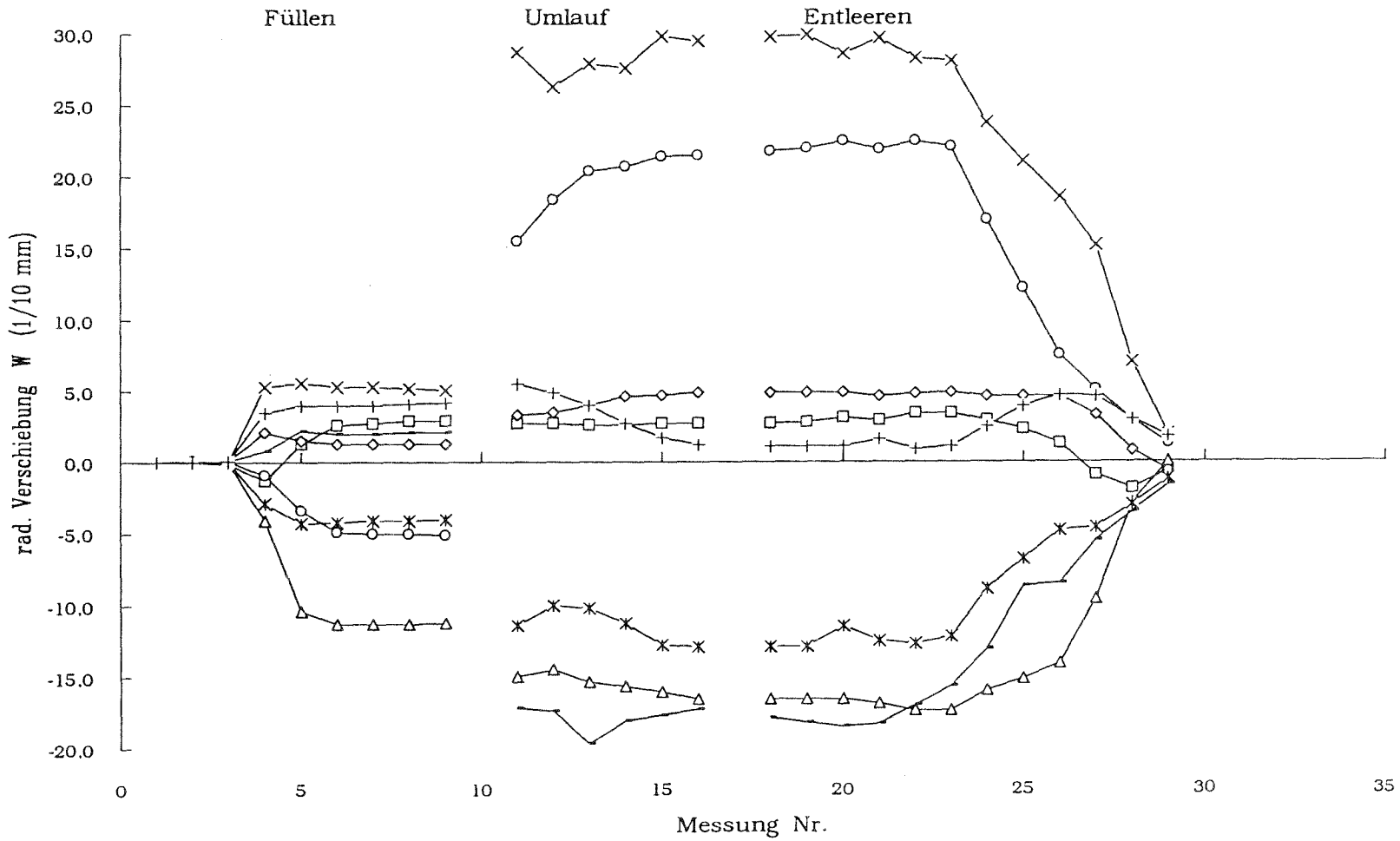
**Versuch EZ 1 unterer Horizont**



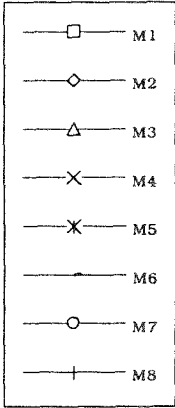
- Meridian**
- M1
  - ◇— M2
  - △— M3
  - ×— M4
  - \*— M5
  - M6
  - M7
  - +— M8

A 4, 1971

# Versuch EZ 1 mittlerer Horizont

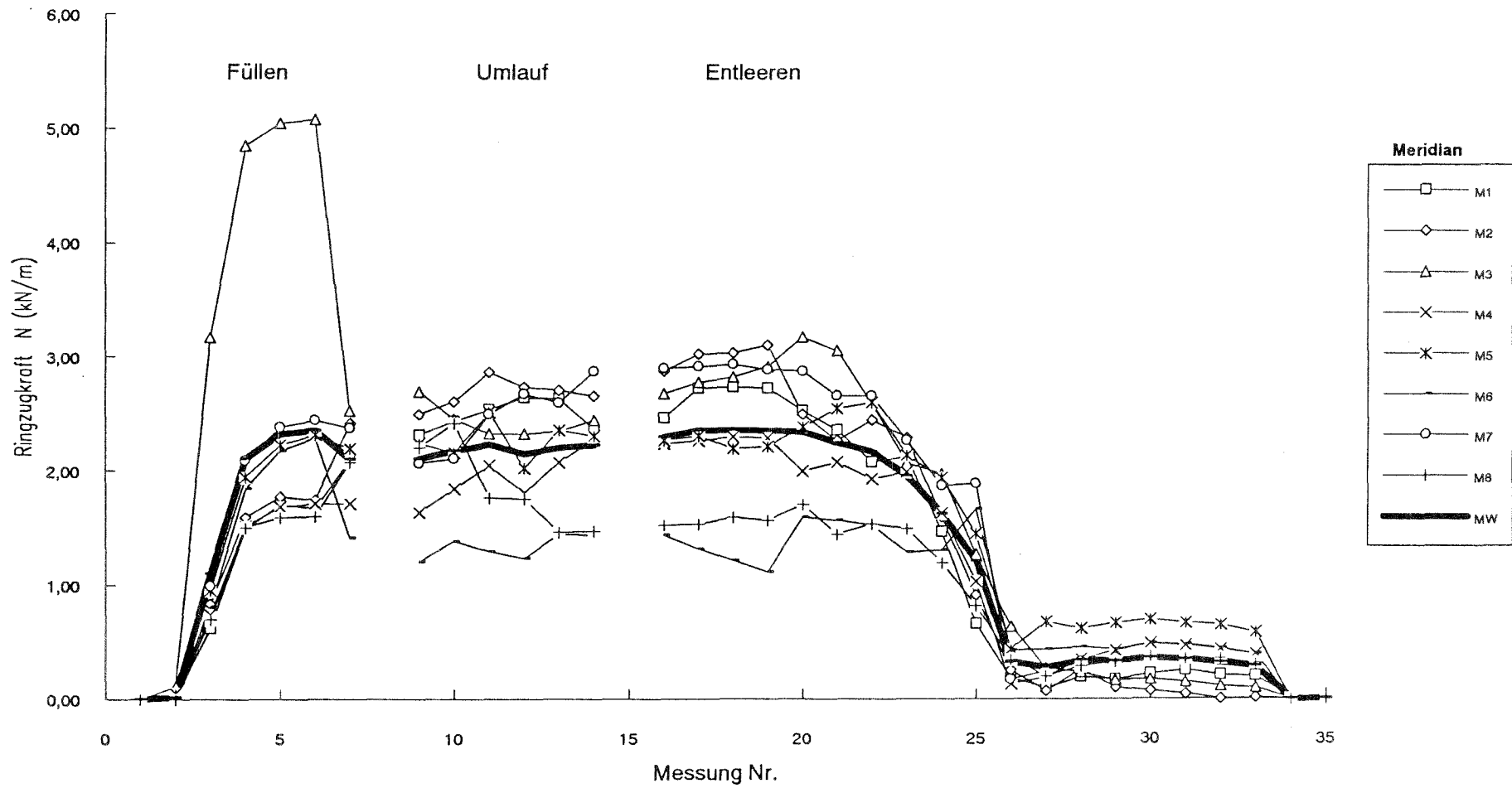


Meridian



R 4.192

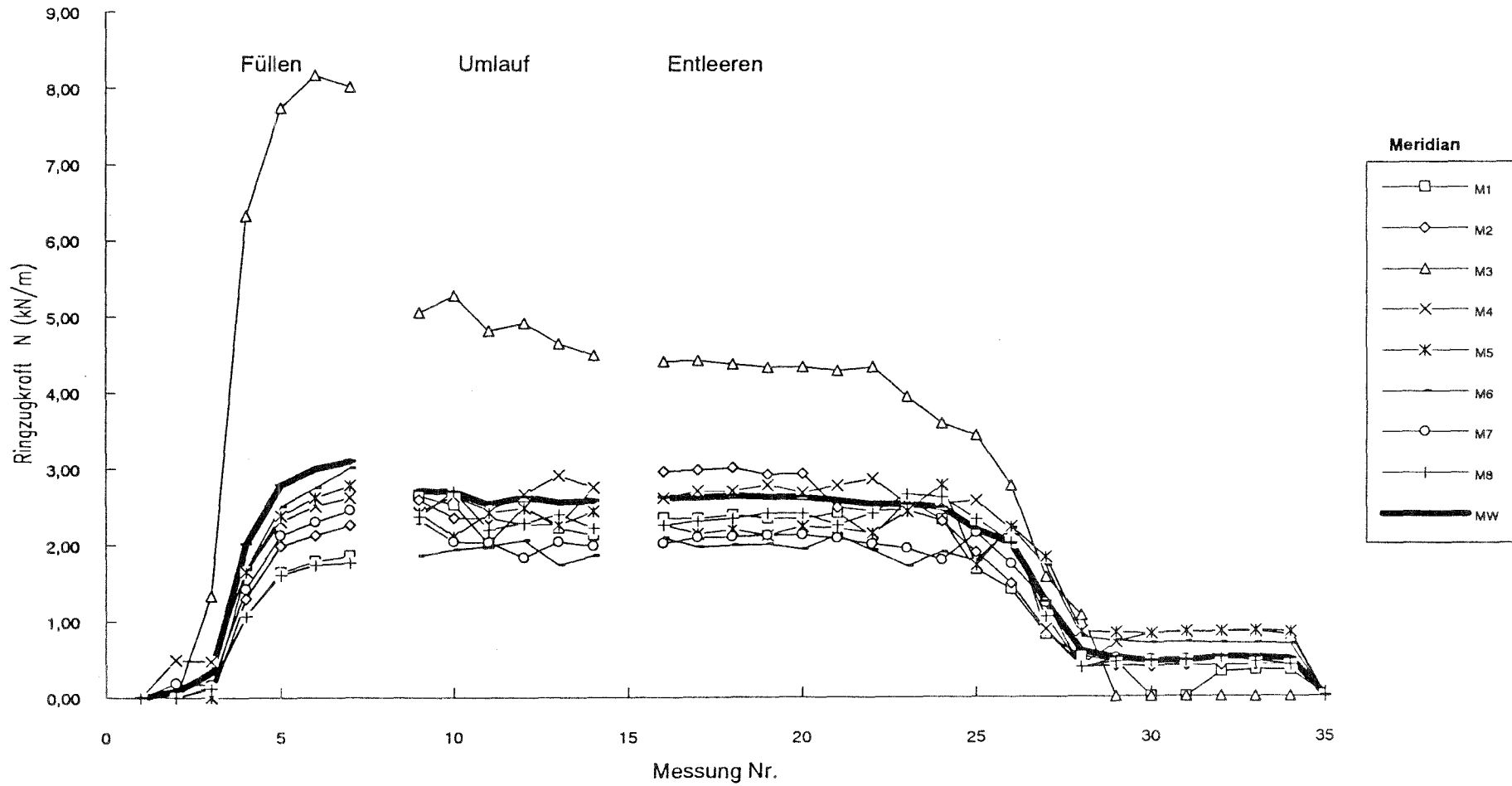
Versuch EZ 2 oberer Horizont



14.193

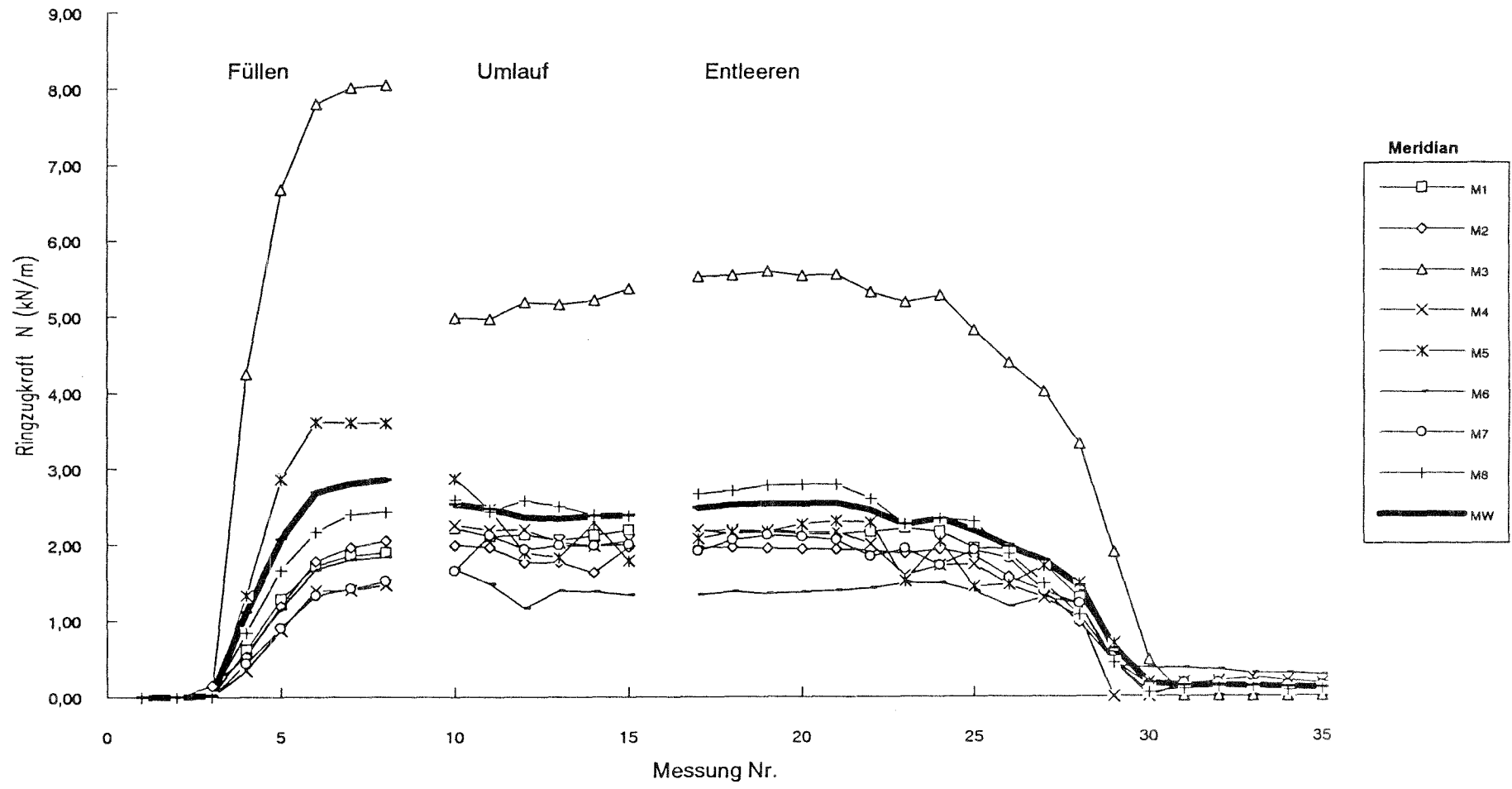


Versuch EZ 2 mittlerer Horizont



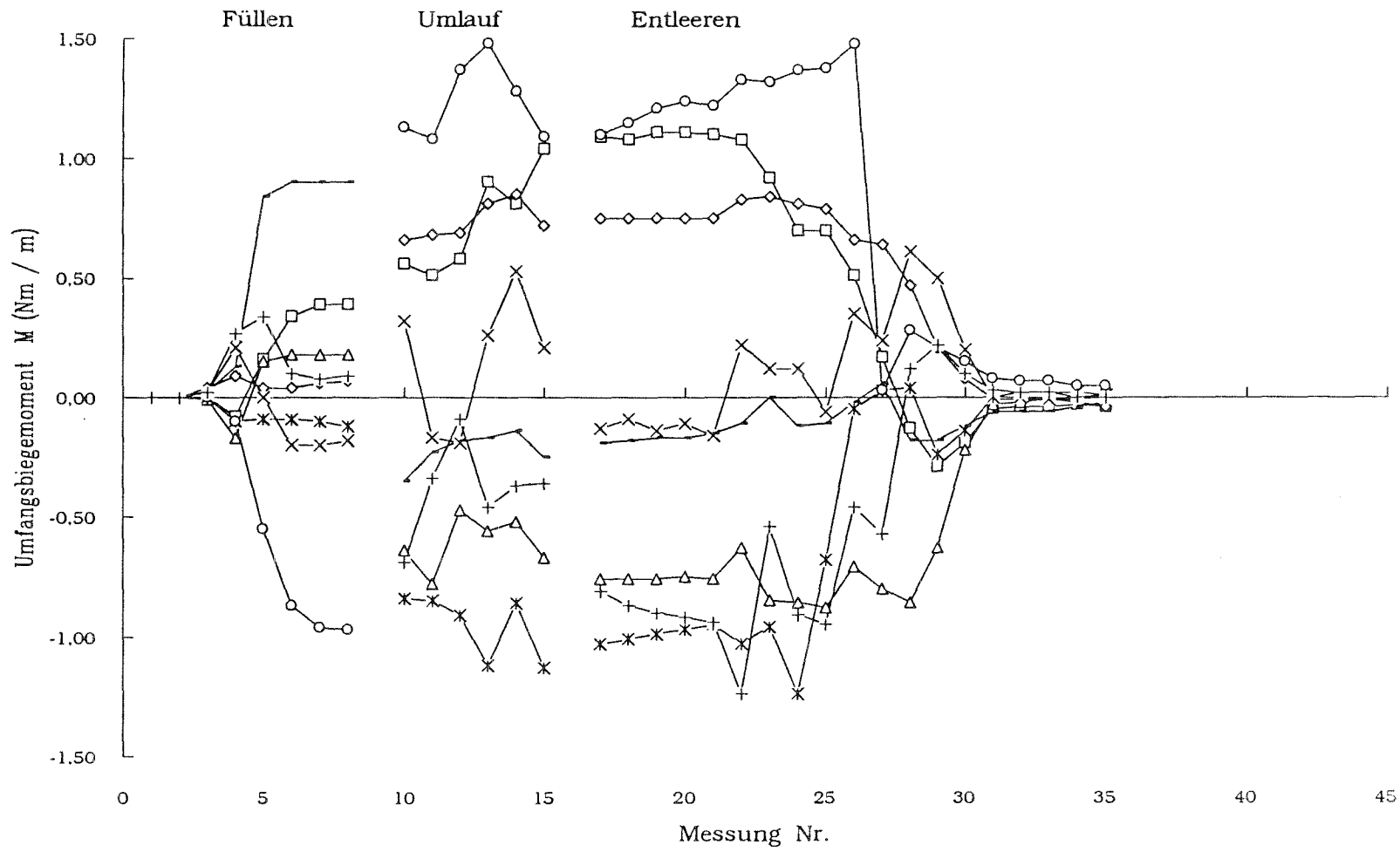
A 4.194

Versuch EZ 2 unterer Horizont



A 4.195

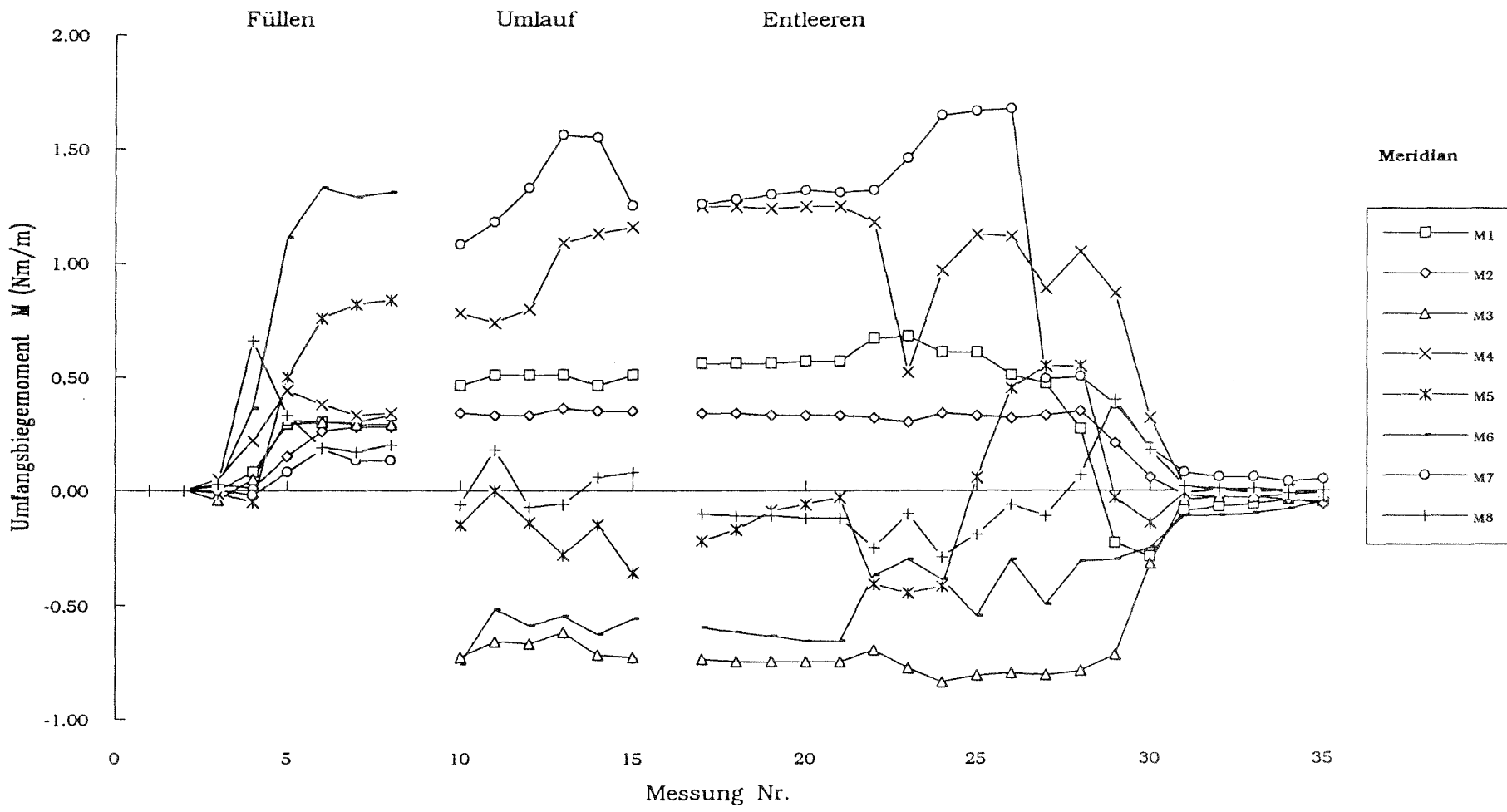
# Versuch EZ 2 oberer Horizont



- Meridian**
- M1
  - ◇— M2
  - △— M3
  - ×— M4
  - \*— M5
  - M6
  - M7
  - +— M8

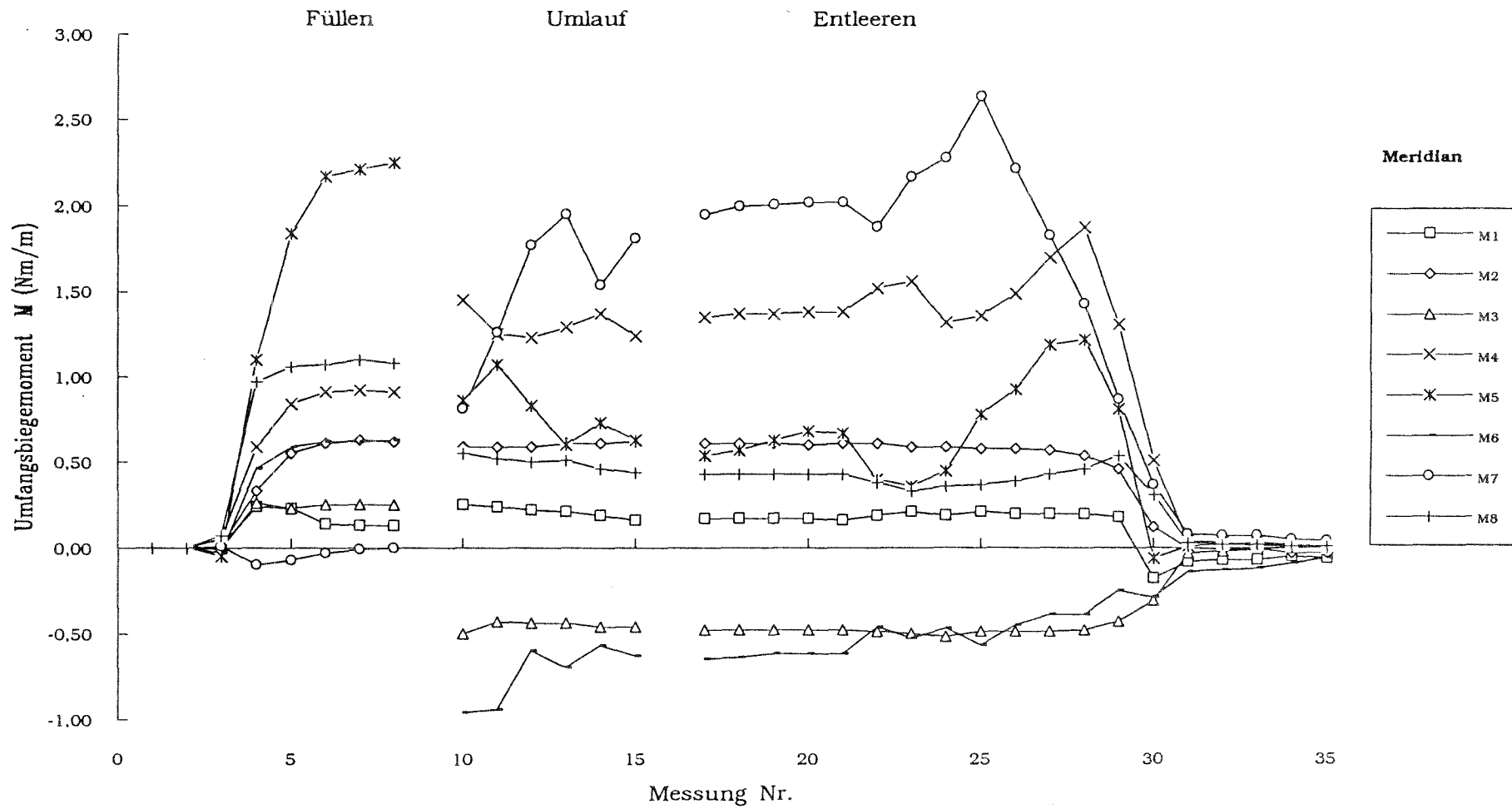
A 4.196

# Versuch EZ 2 mittlerer Horizont



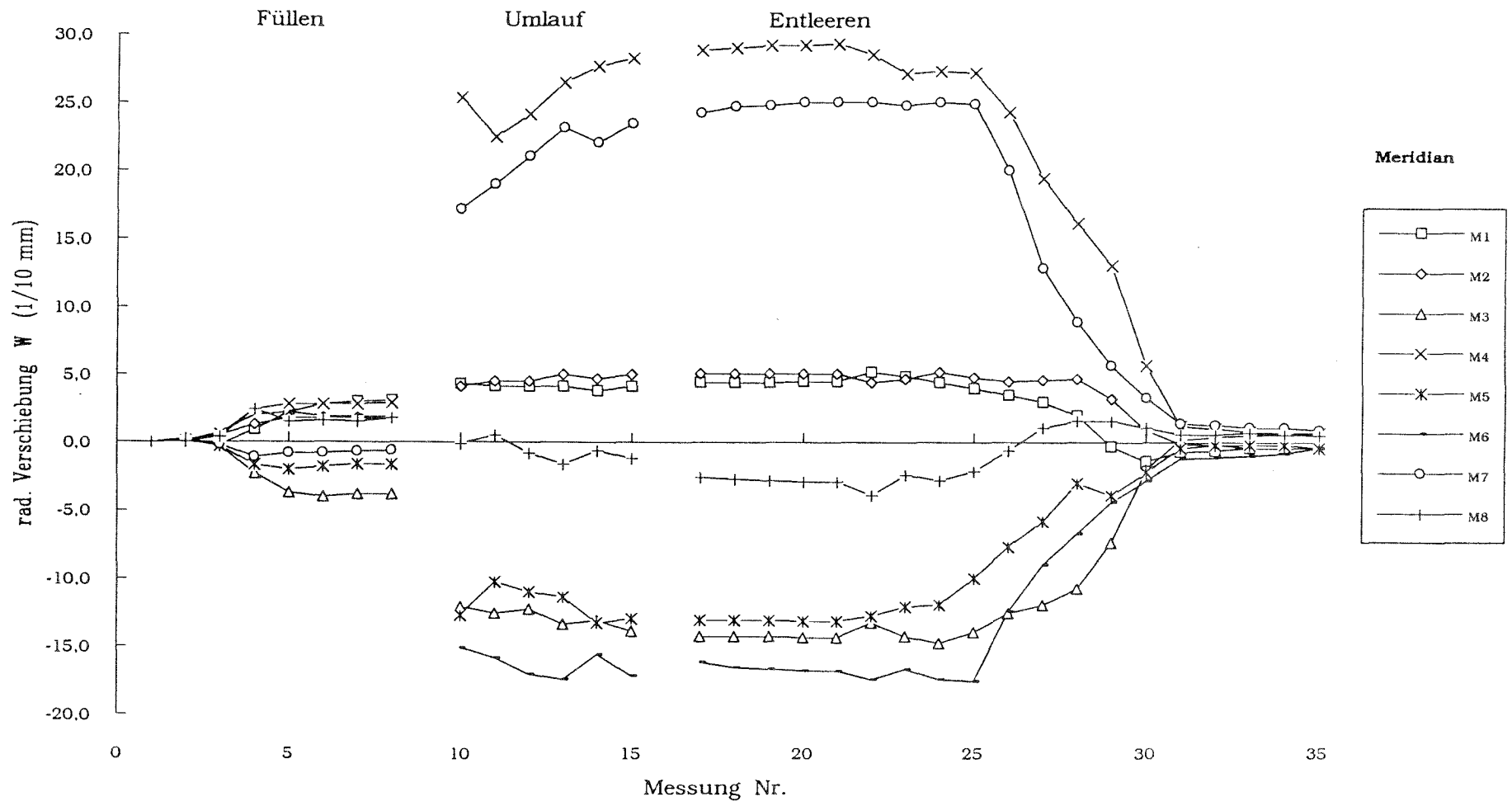
14.1.97

# Versuch EZ 2 unterer Horizont



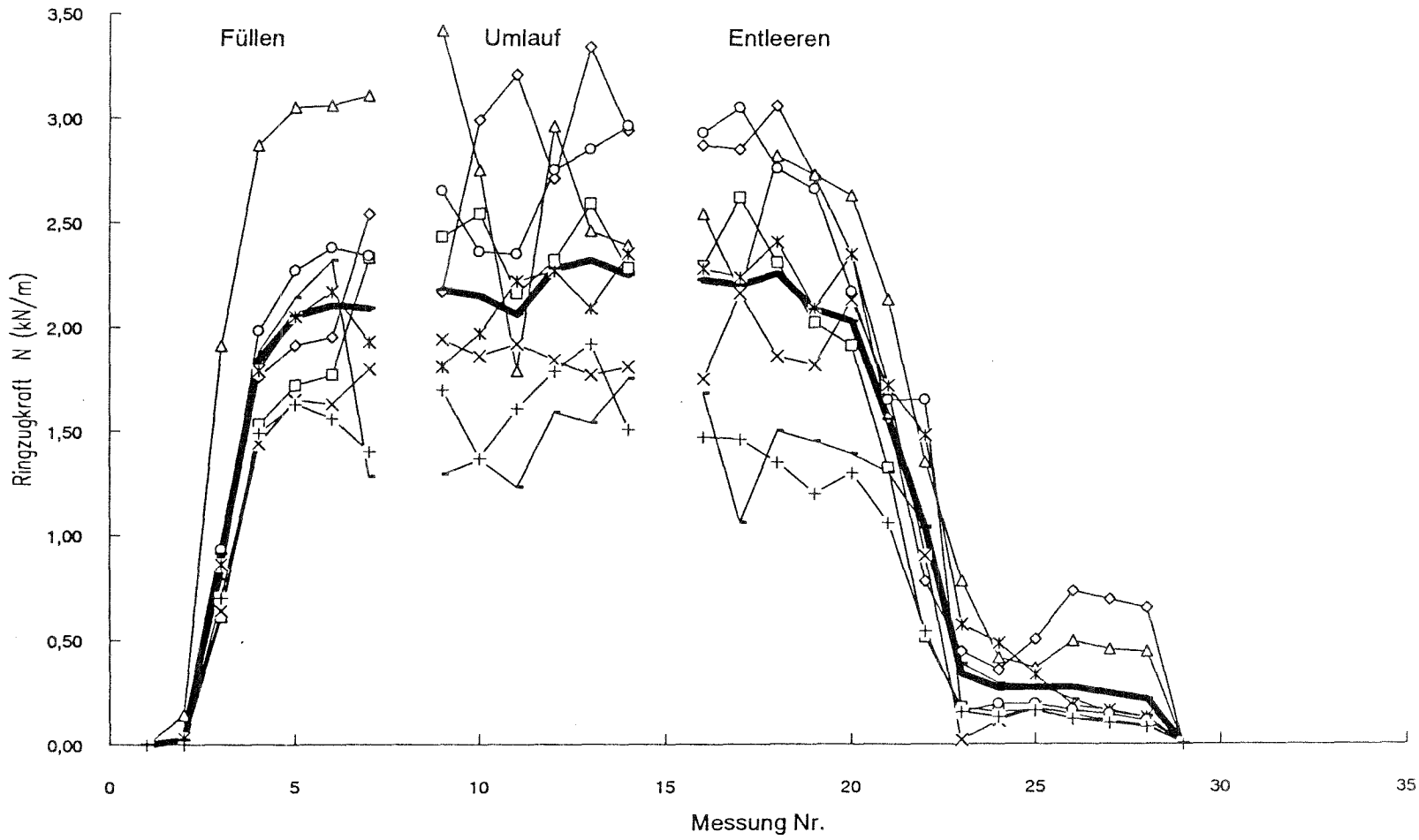
A4.198

# Versuch EZ 2 mittlerer Horizont



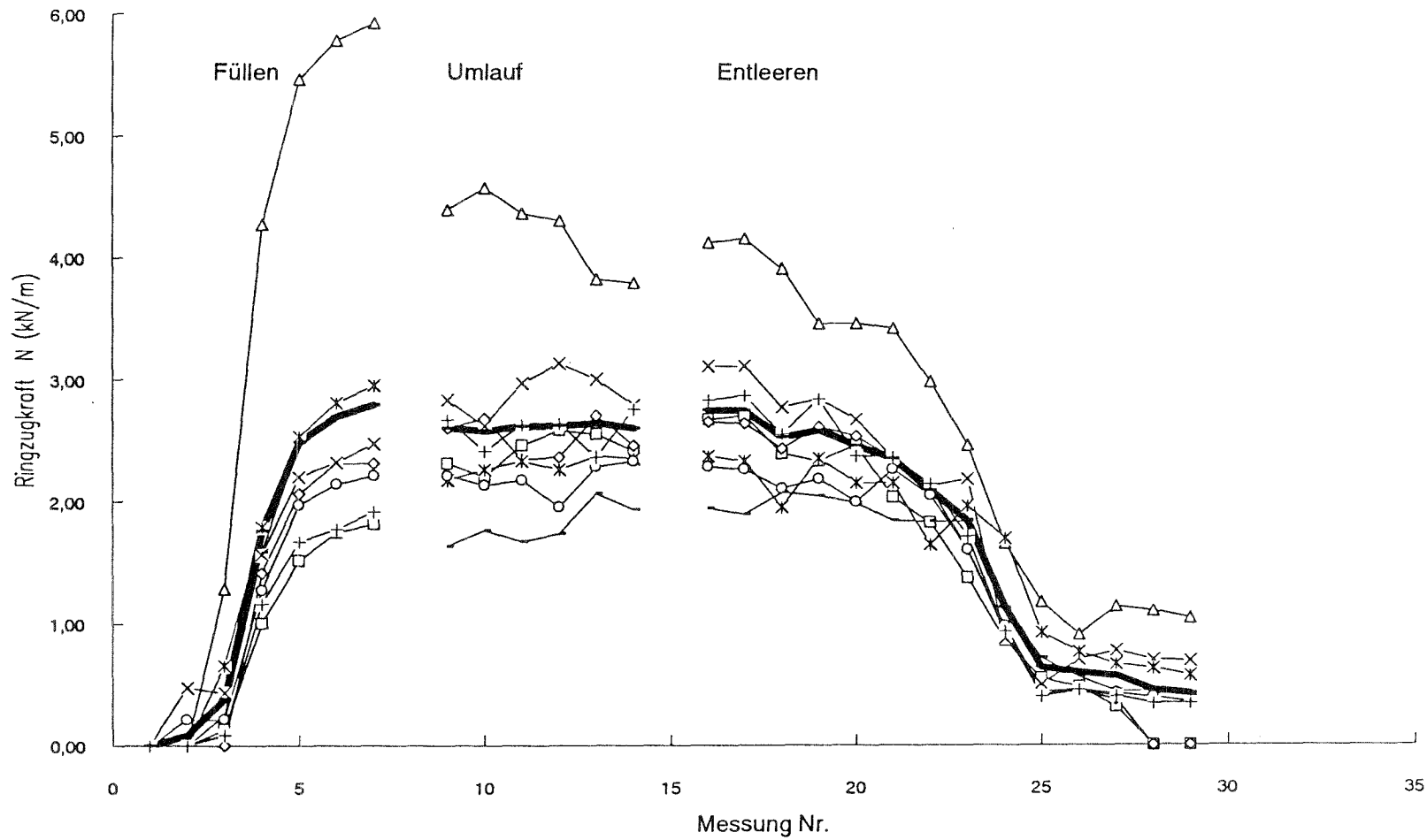
A 4.199

Versuch EZ 3 oberer Horizont



A 4.200

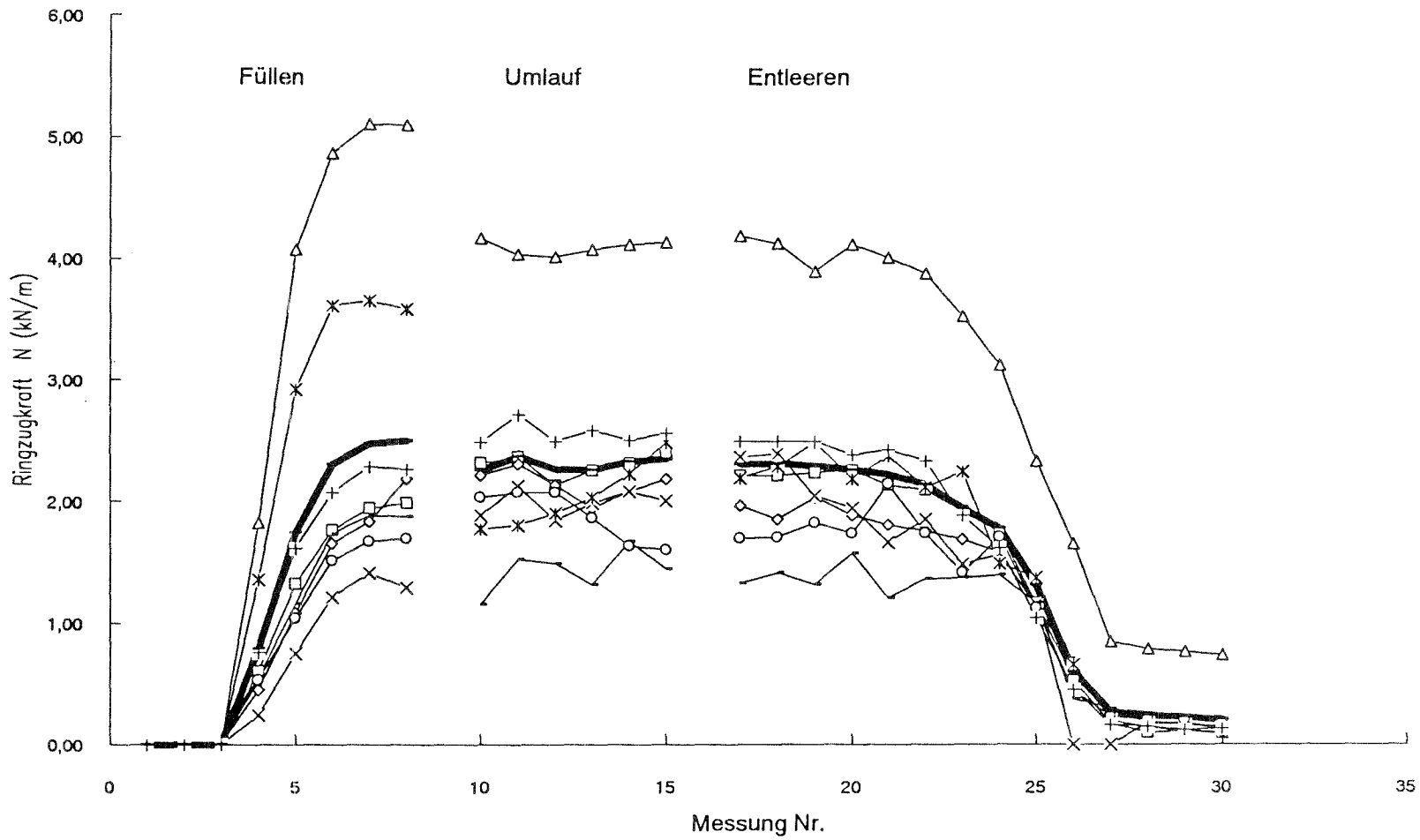
### Versuch EZ 3 mittlerer Horizont



A 4.204

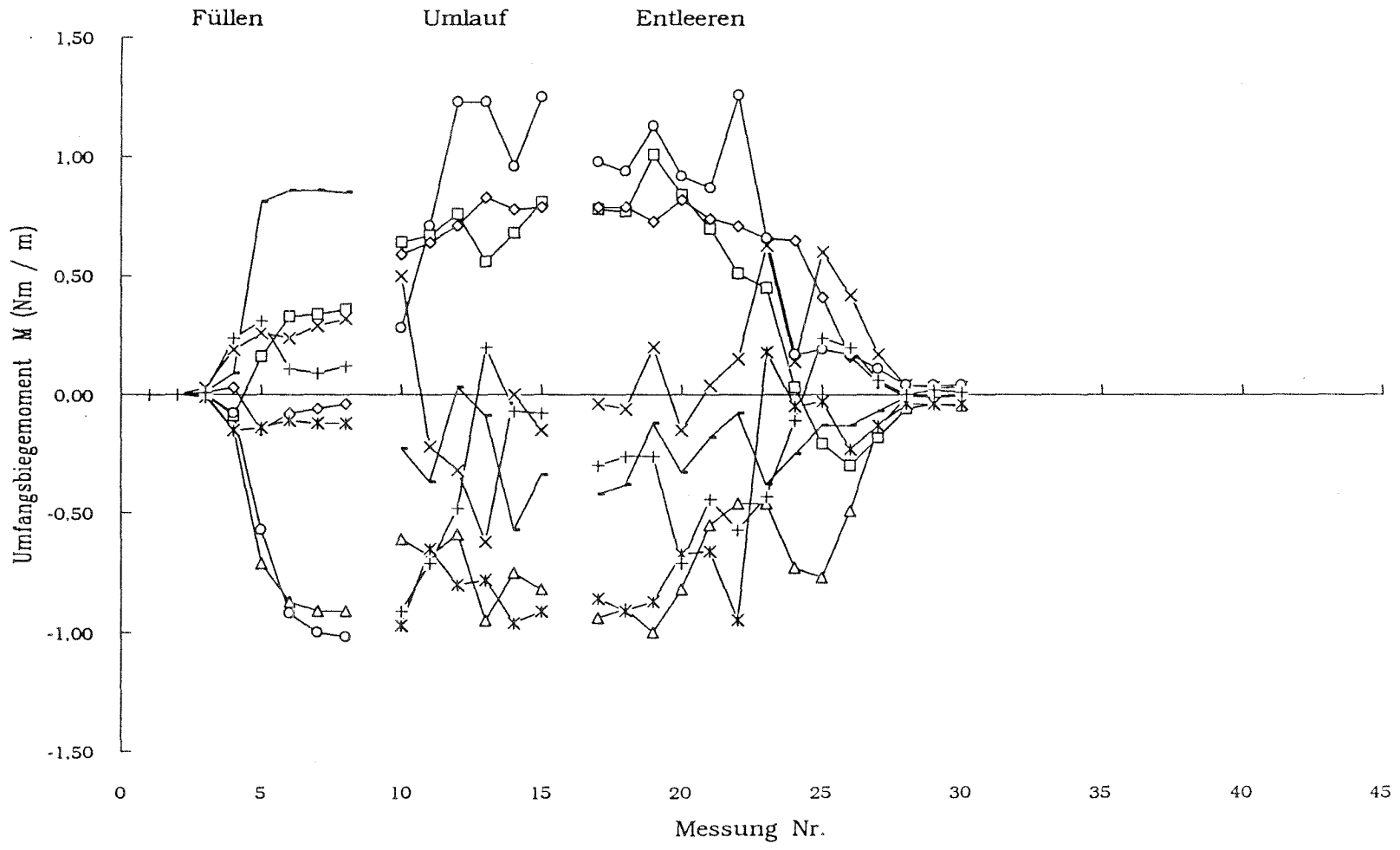


### Versuch EZ 3 unterer Horizont



A 4. 202

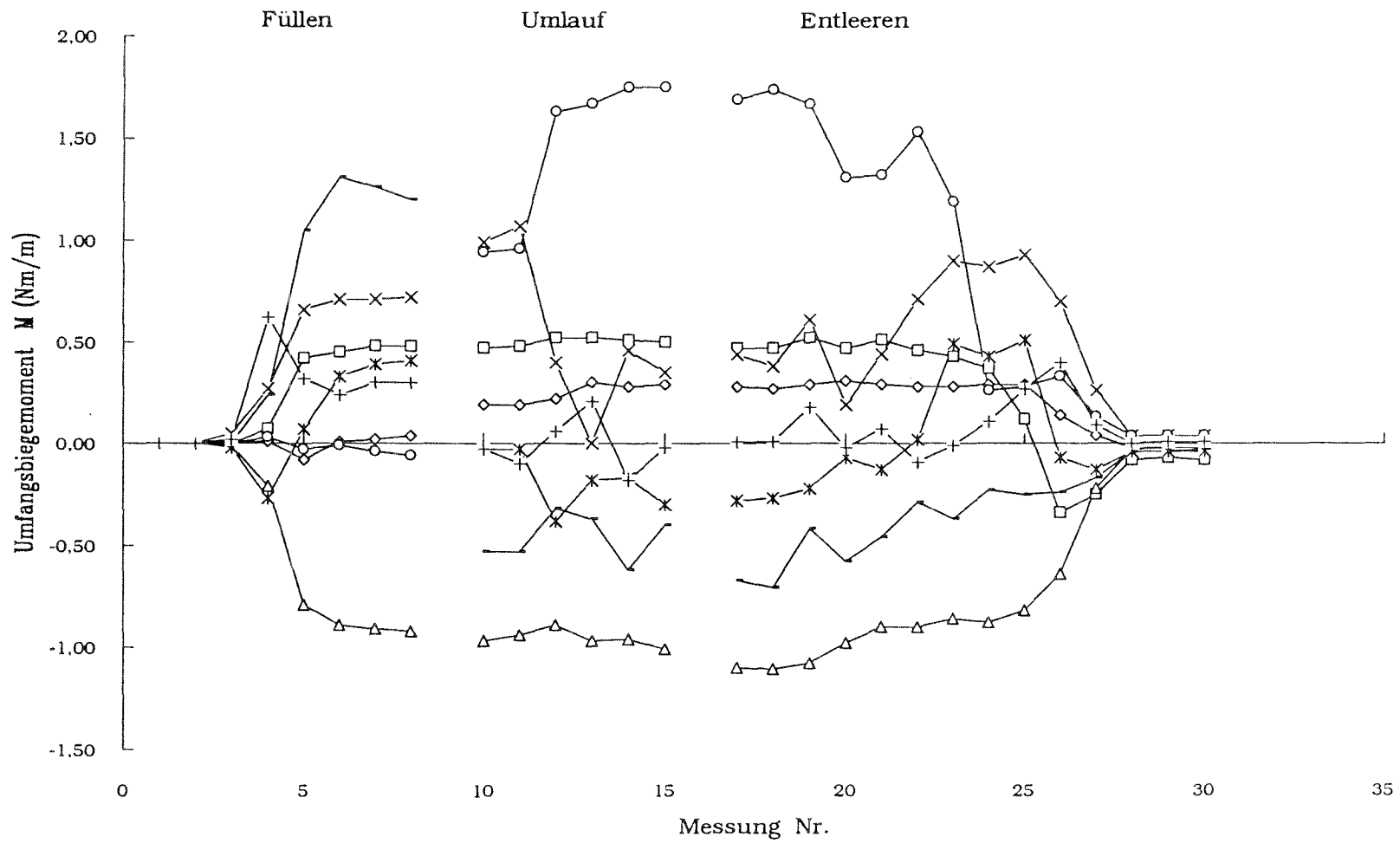
# Versuch EZ 3 oberer Horizont



- Meridian**
- M1
  - ◇— M2
  - △— M3
  - ×— M4
  - \*— M5
  - +— M6
  - M7
  - +— M8

A 4.203

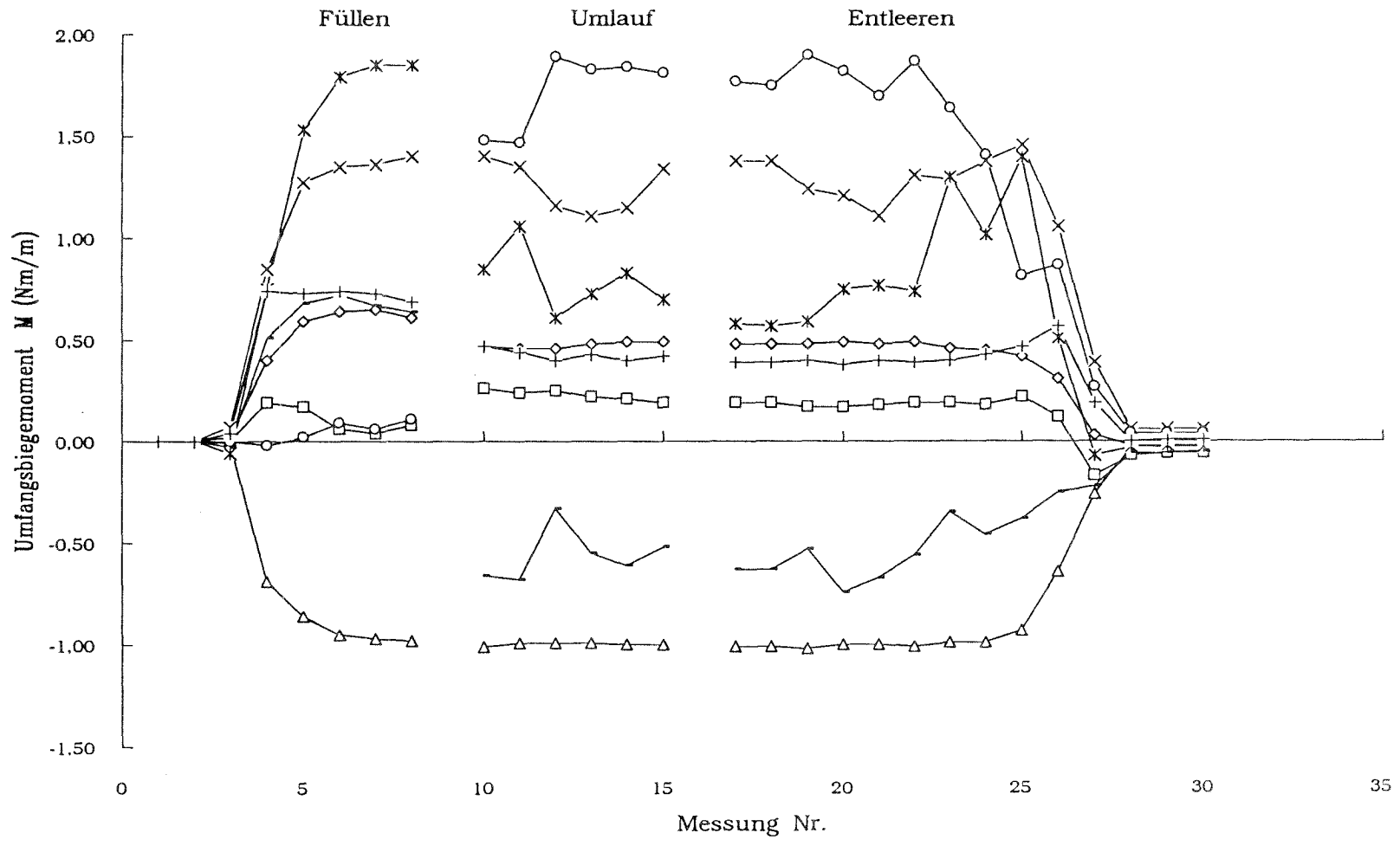
**Versuch EZ 3 mittlerer Horizont**



- Meridian**
- M1
  - ◇— M2
  - △— M3
  - ×— M4
  - \*— M5
  - +— M6
  - M7
  - +— M8

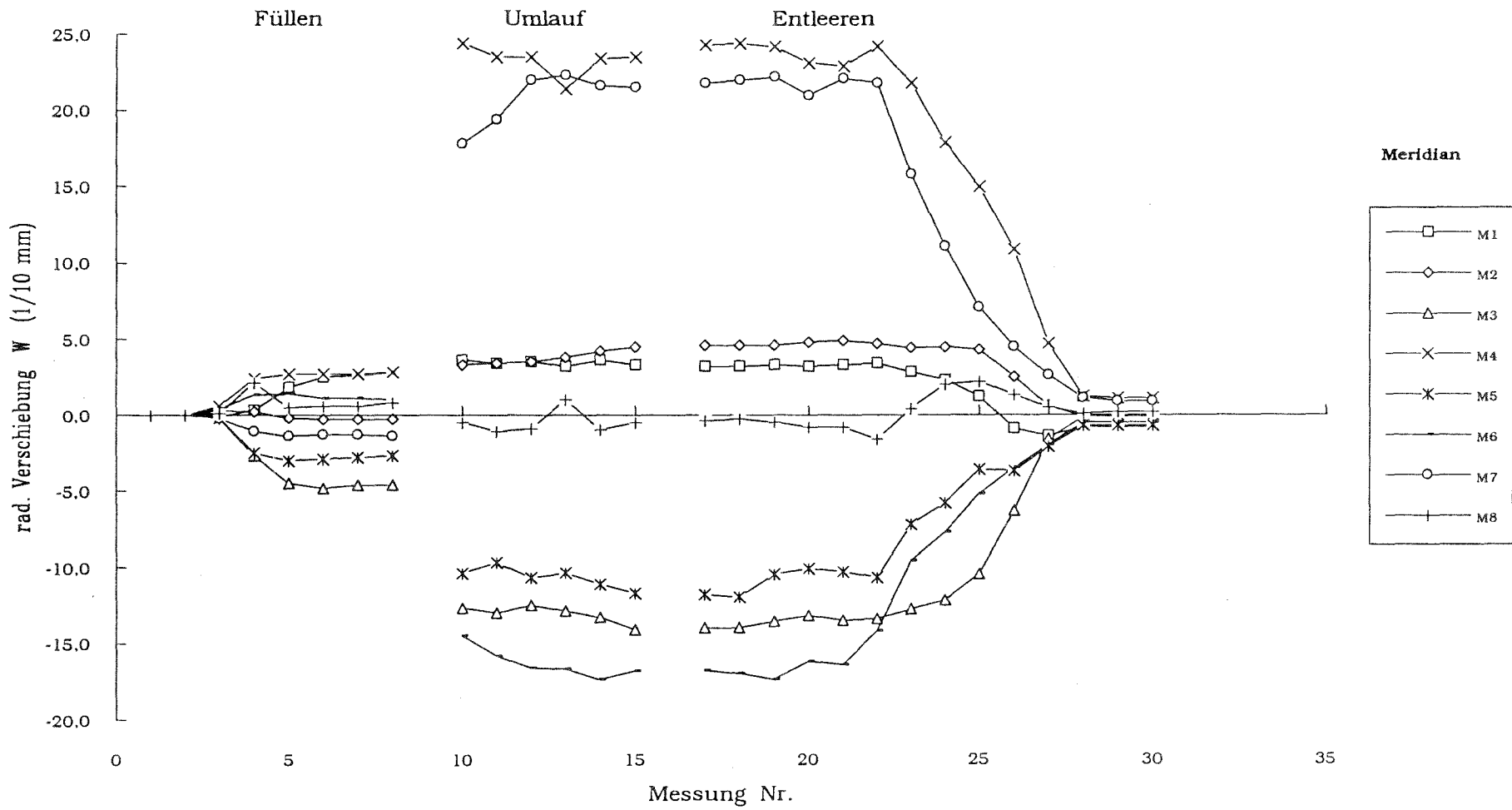
A 4.204

**Versuch EZ 3 unterer Horizont**



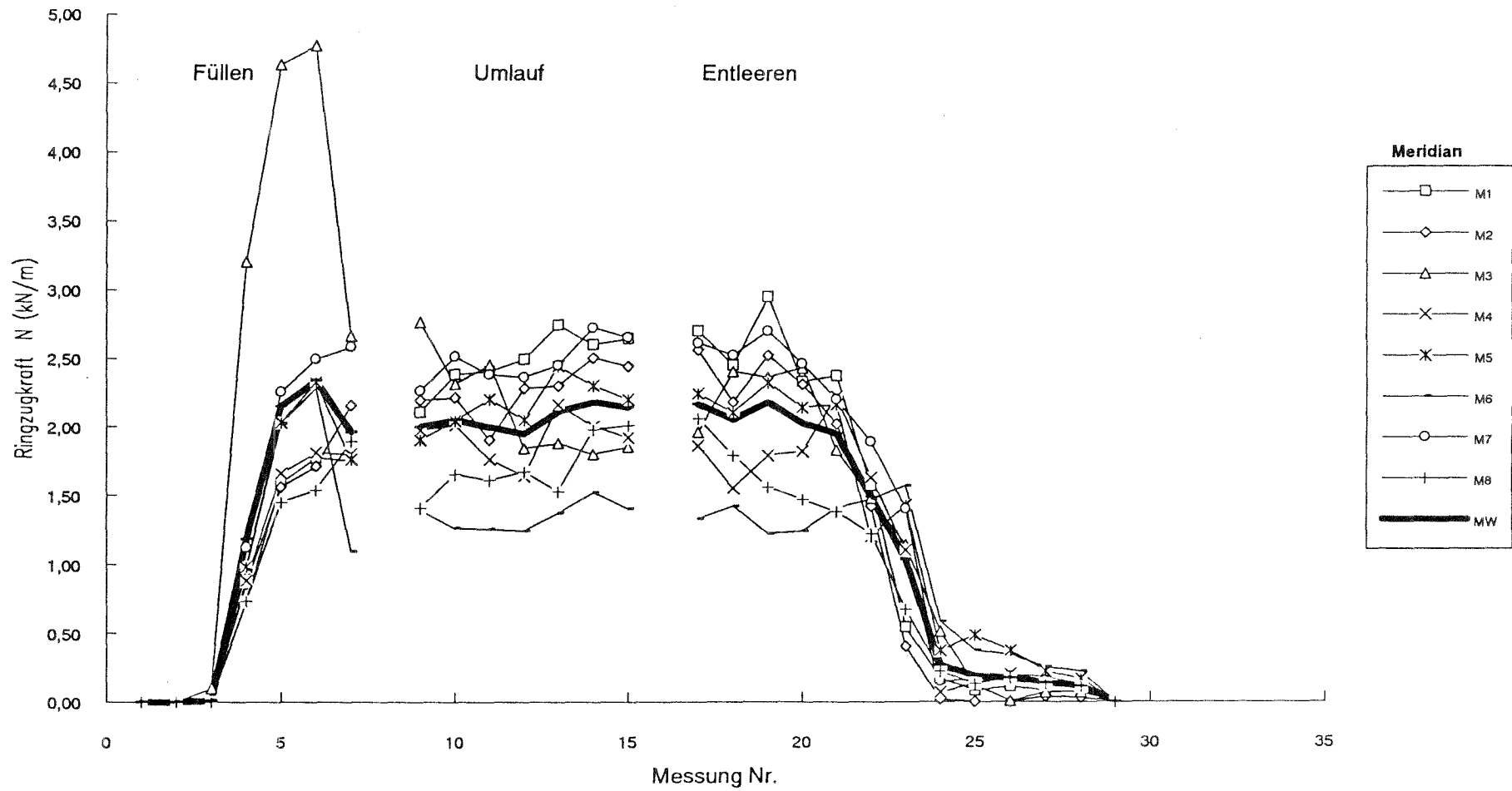
A 4.205

### Versuch EZ 3 mittlerer Horizont



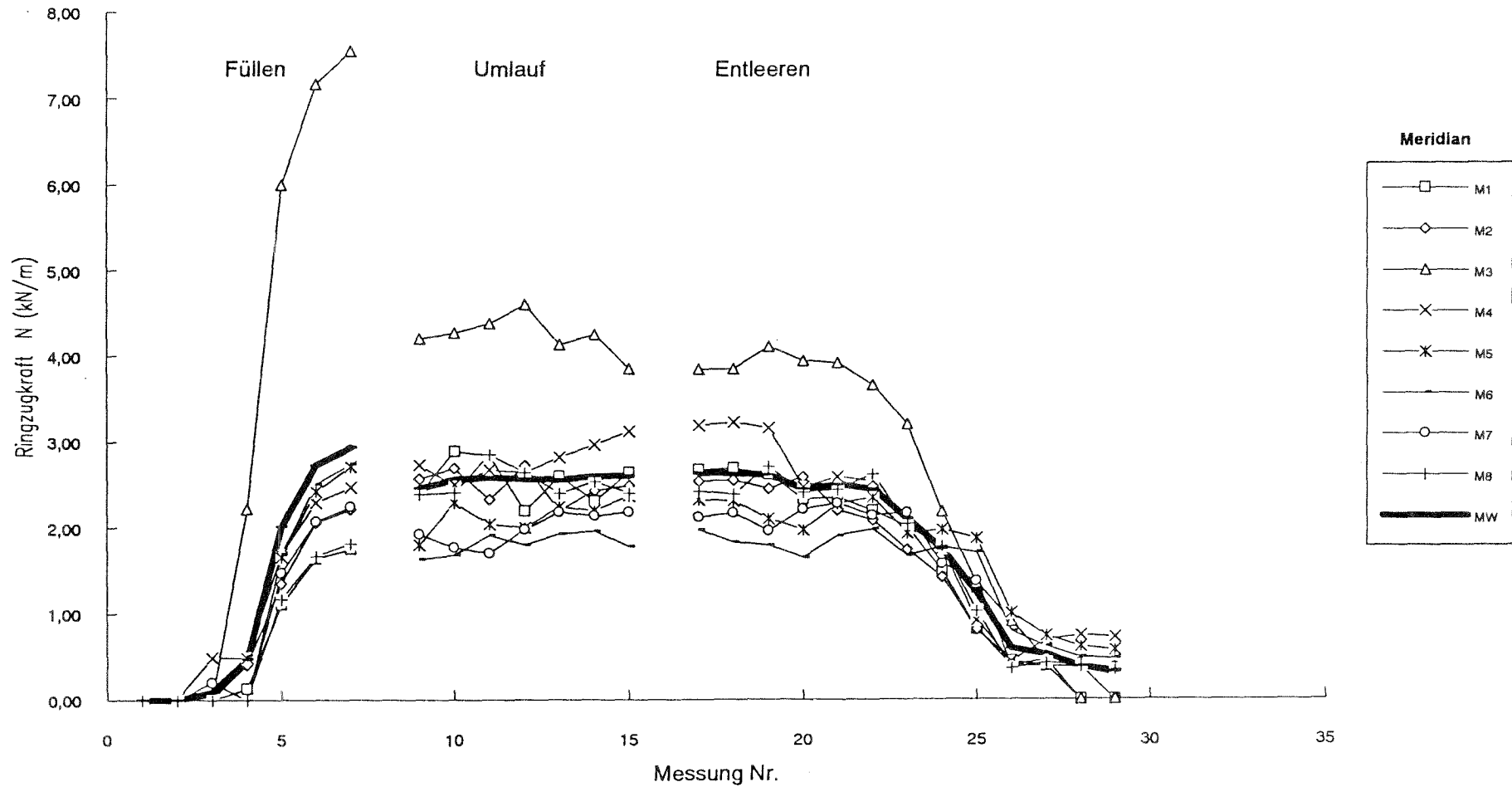
A4.206

Versuch EZ 4 oberer Horizont



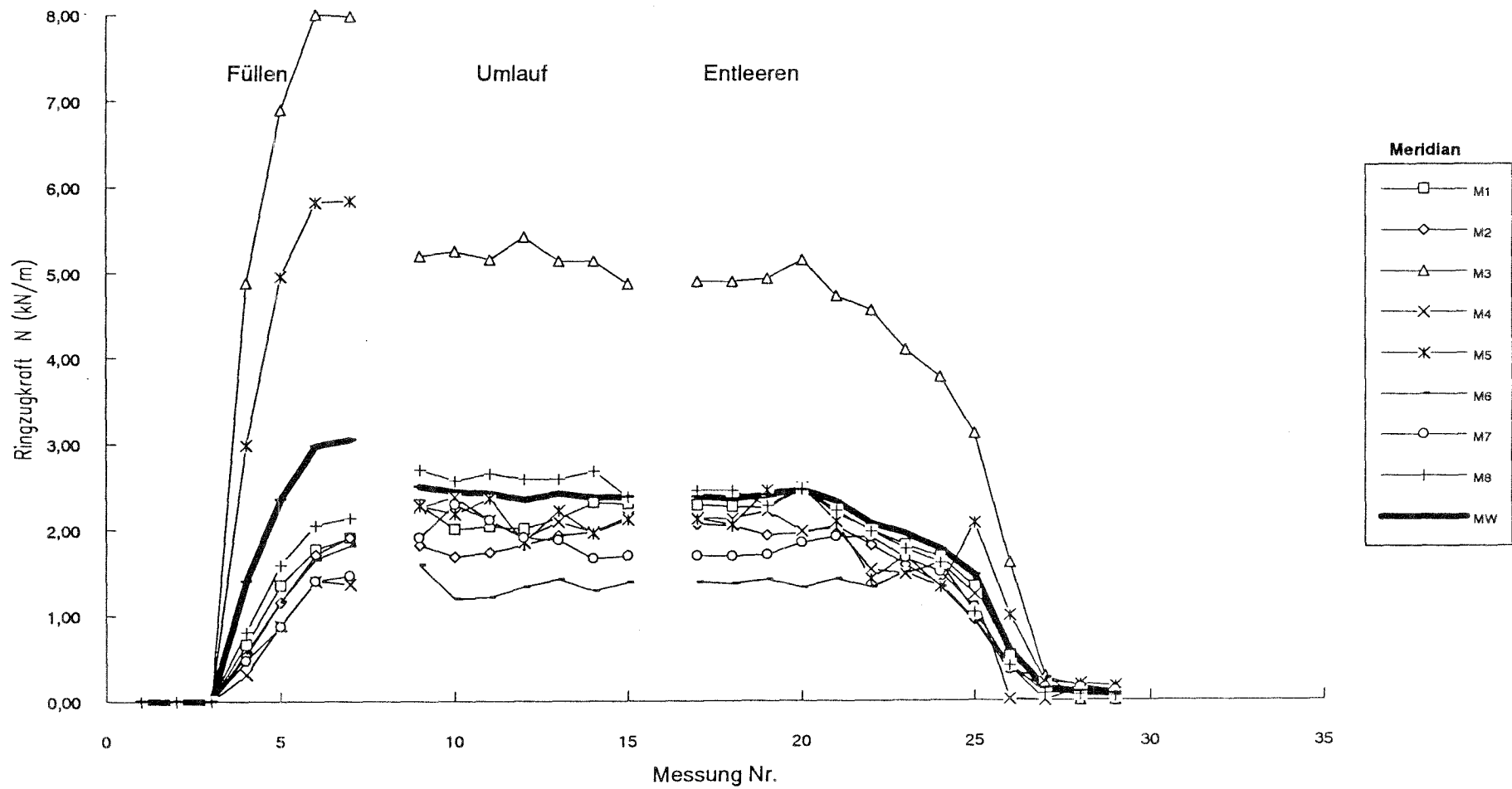
A4.207

### Versuch Ez 4 mittlerer Horizont



H 4.208

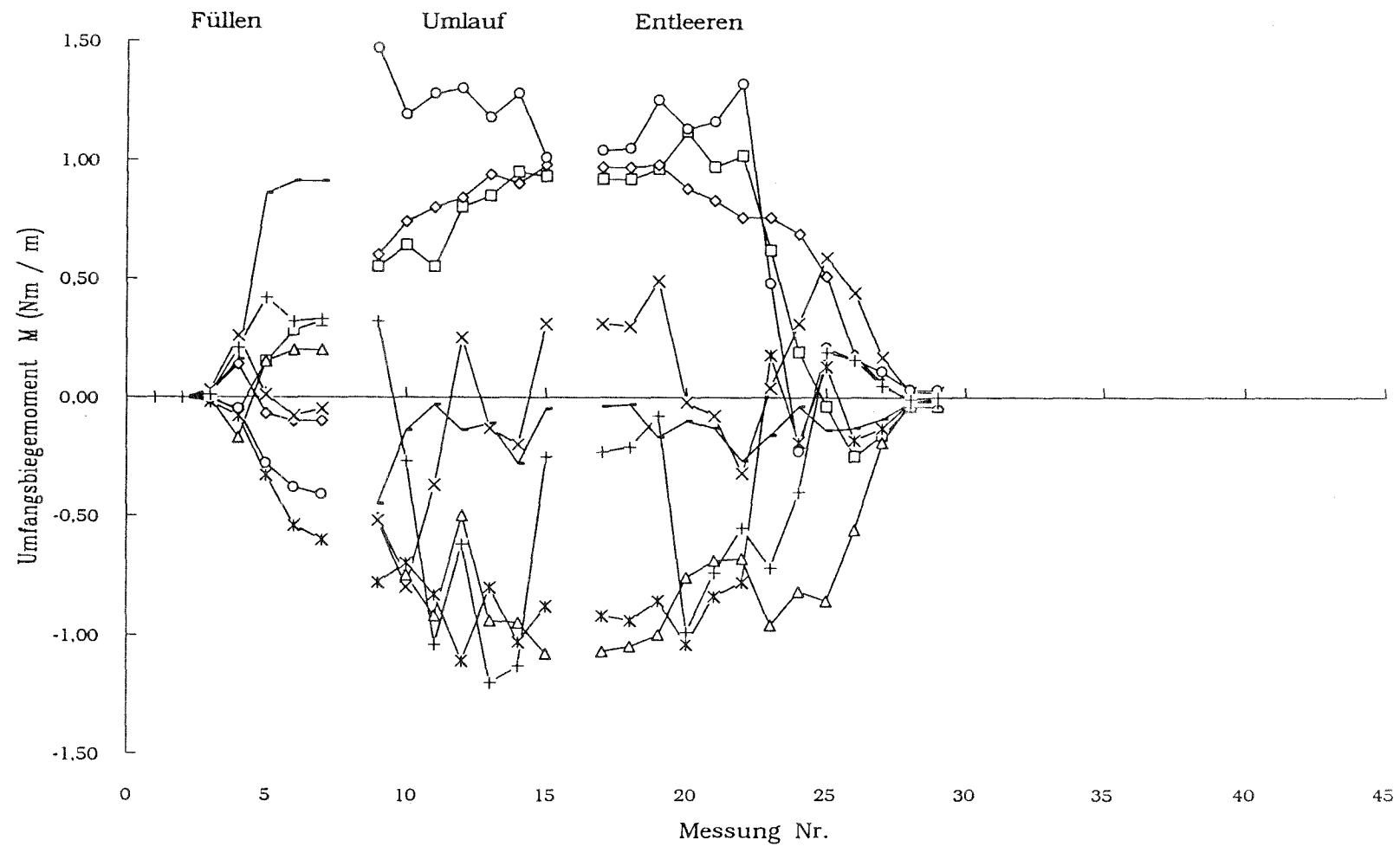
### Versuch EZ 4 unterer Horizont



A4.209



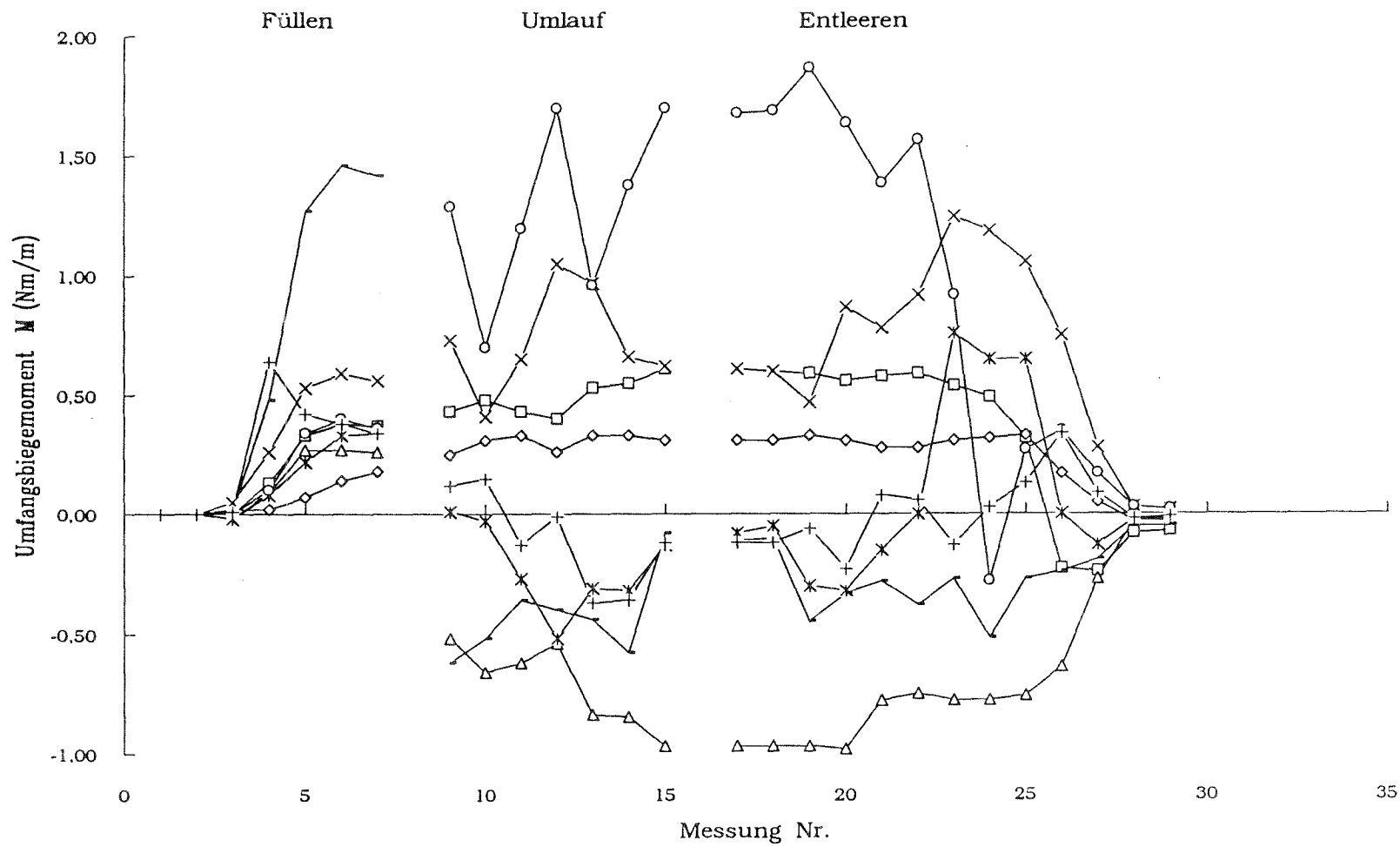
**Versuch EZ 4 oberer Horizont**



- Meridian**
- M1
  - ◇— M2
  - △— M3
  - ×— M4
  - \*— M5
  - +— M6
  - M7
  - +— M8

A4.210

**Versuch EZ 4 mittlerer Horizont**

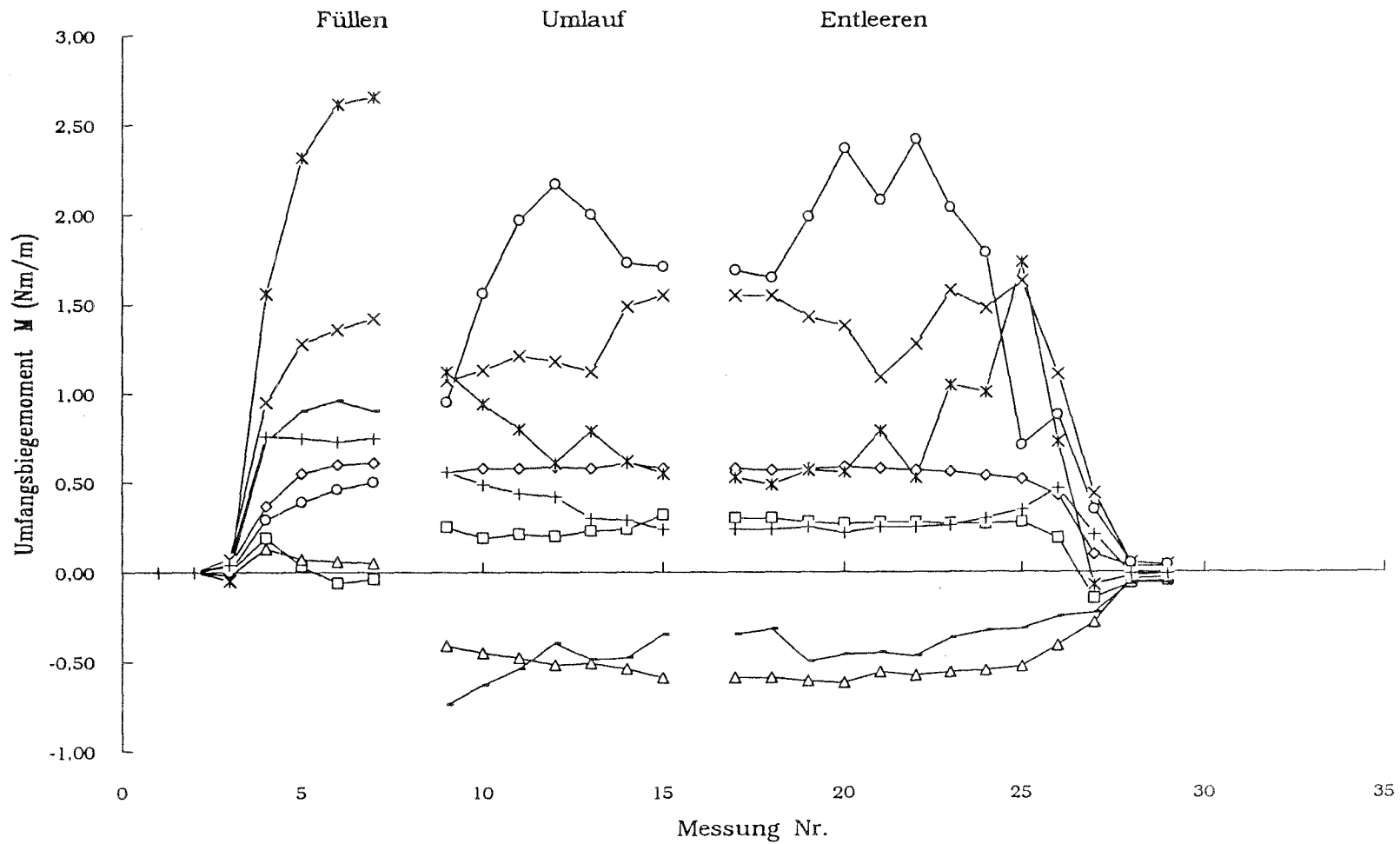


Meridian

- M1
- ◇— M2
- △— M3
- ×— M4
- \*— M5
- +— M6
- M7
- +— M8

R4.2AA

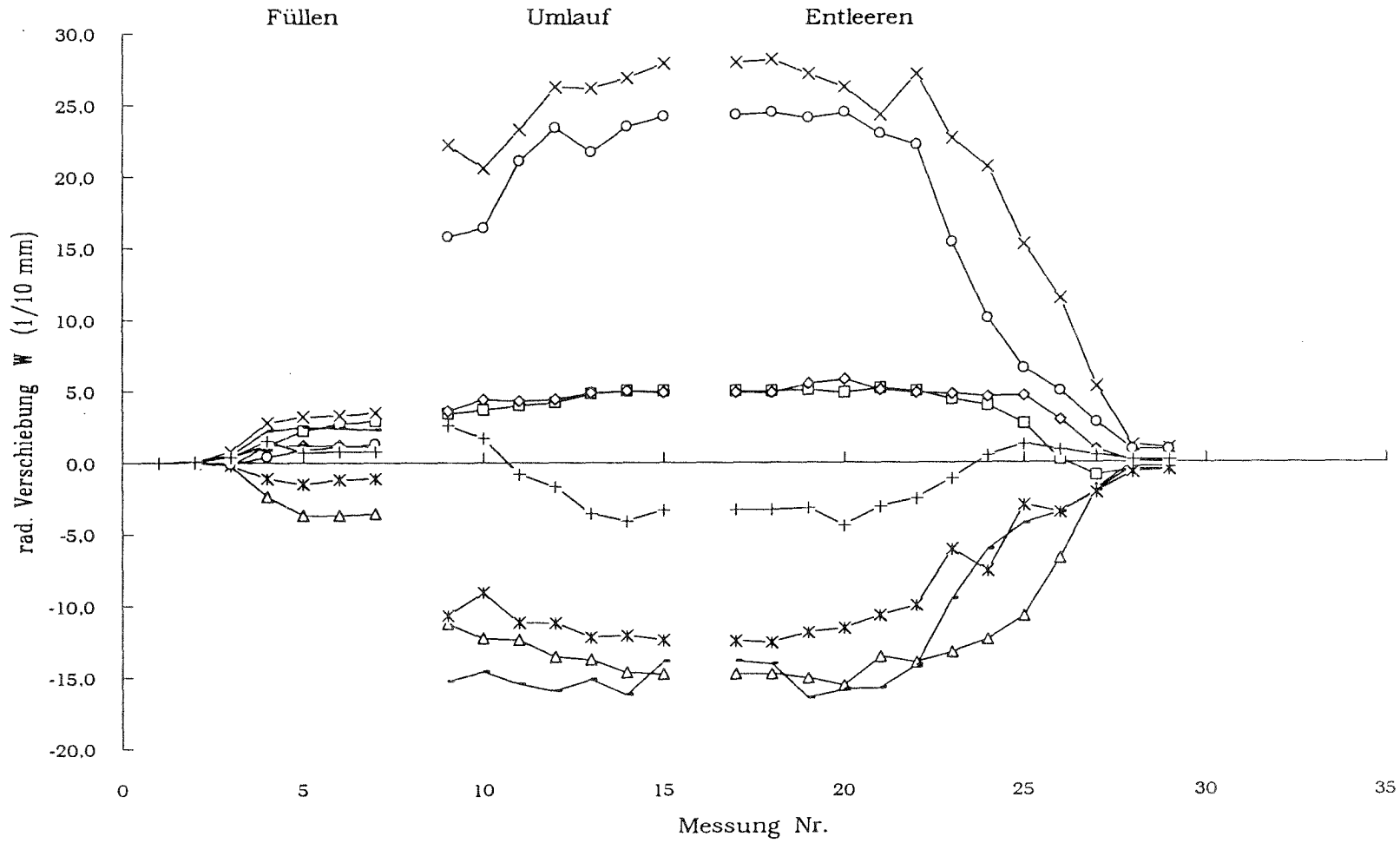
**Versuch EZ 4 unterer Horizont**



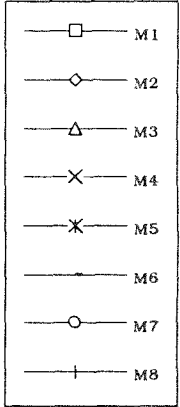
- Meridian**
- M1
  - ◇ M2
  - △ M3
  - × M4
  - \* M5
  - M6
  - M7
  - + M8

A4.2.22

# Versuch EZ 4 mittlerer Horizont

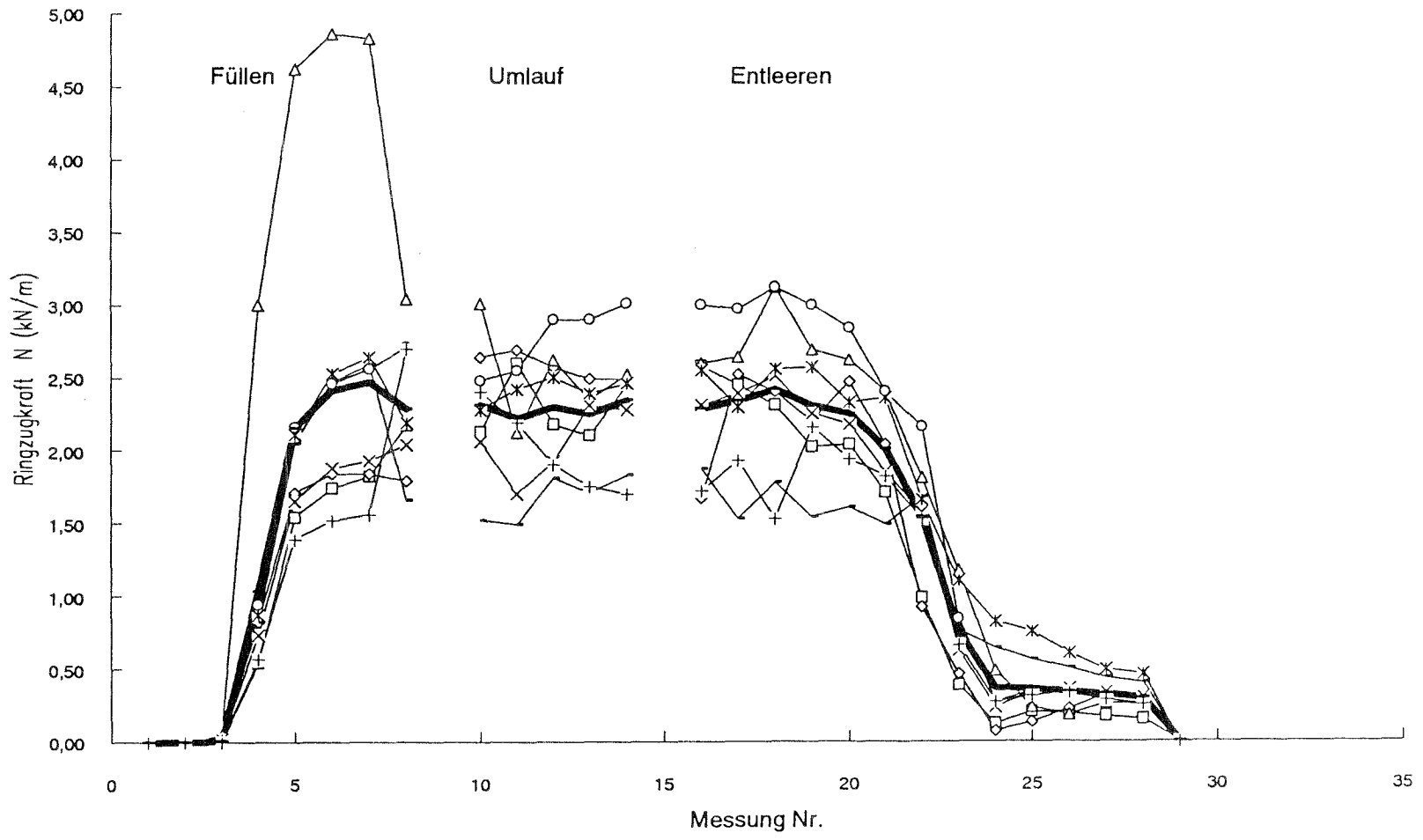


Meridian



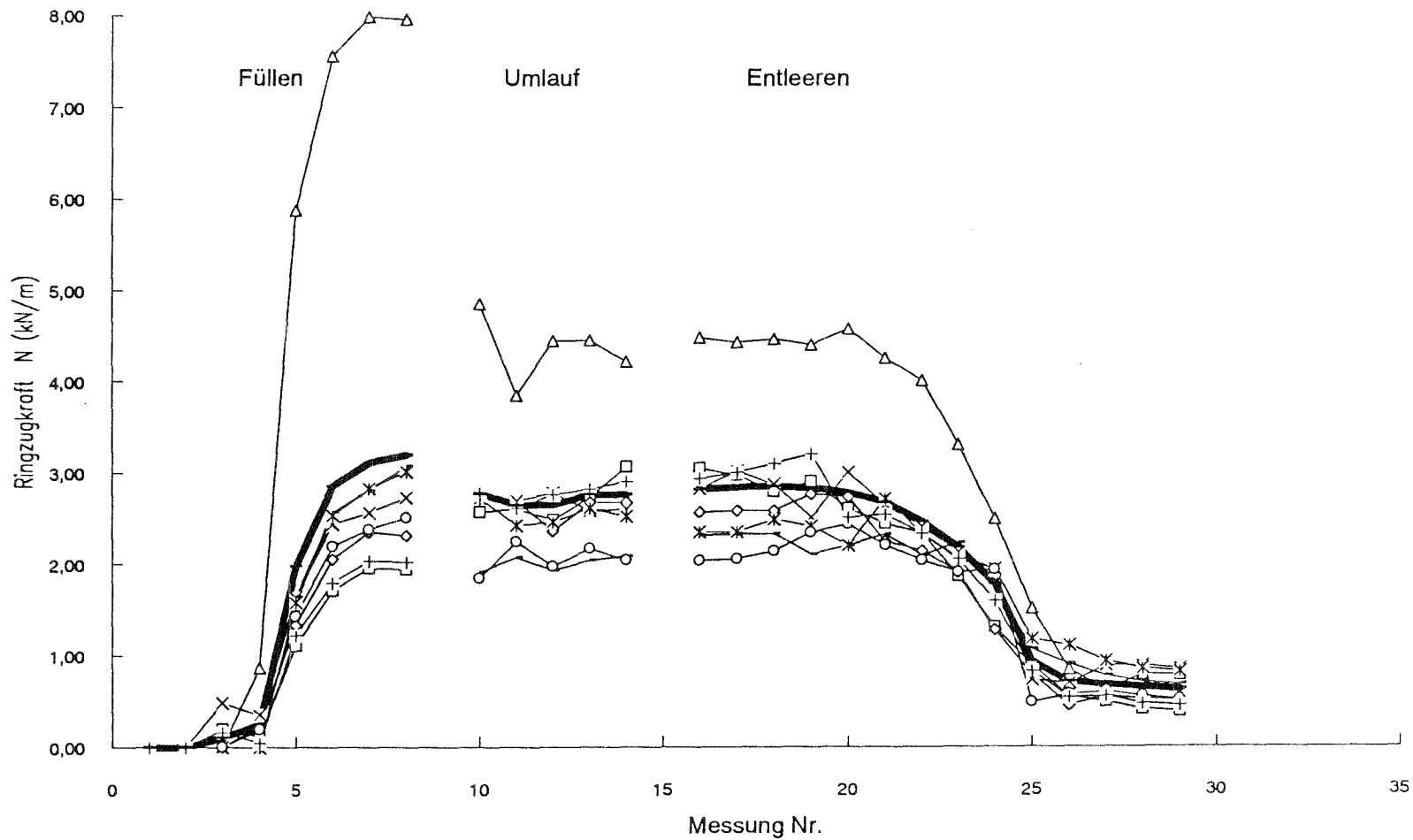
17.4.213

Versuch EZ 5 oberer Horizont



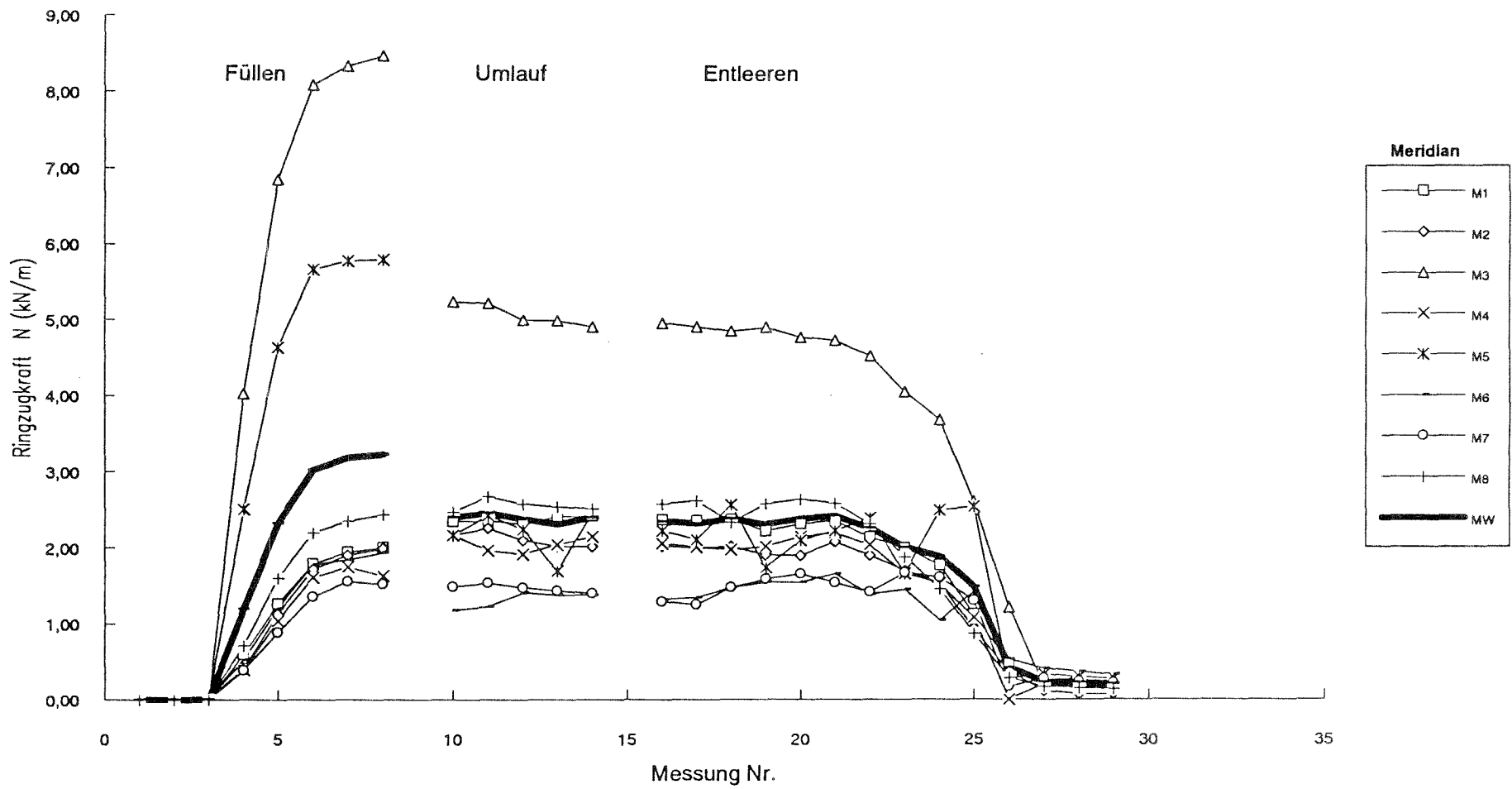
A 4.244

Versuch EZ 5 mittlerer Horizont



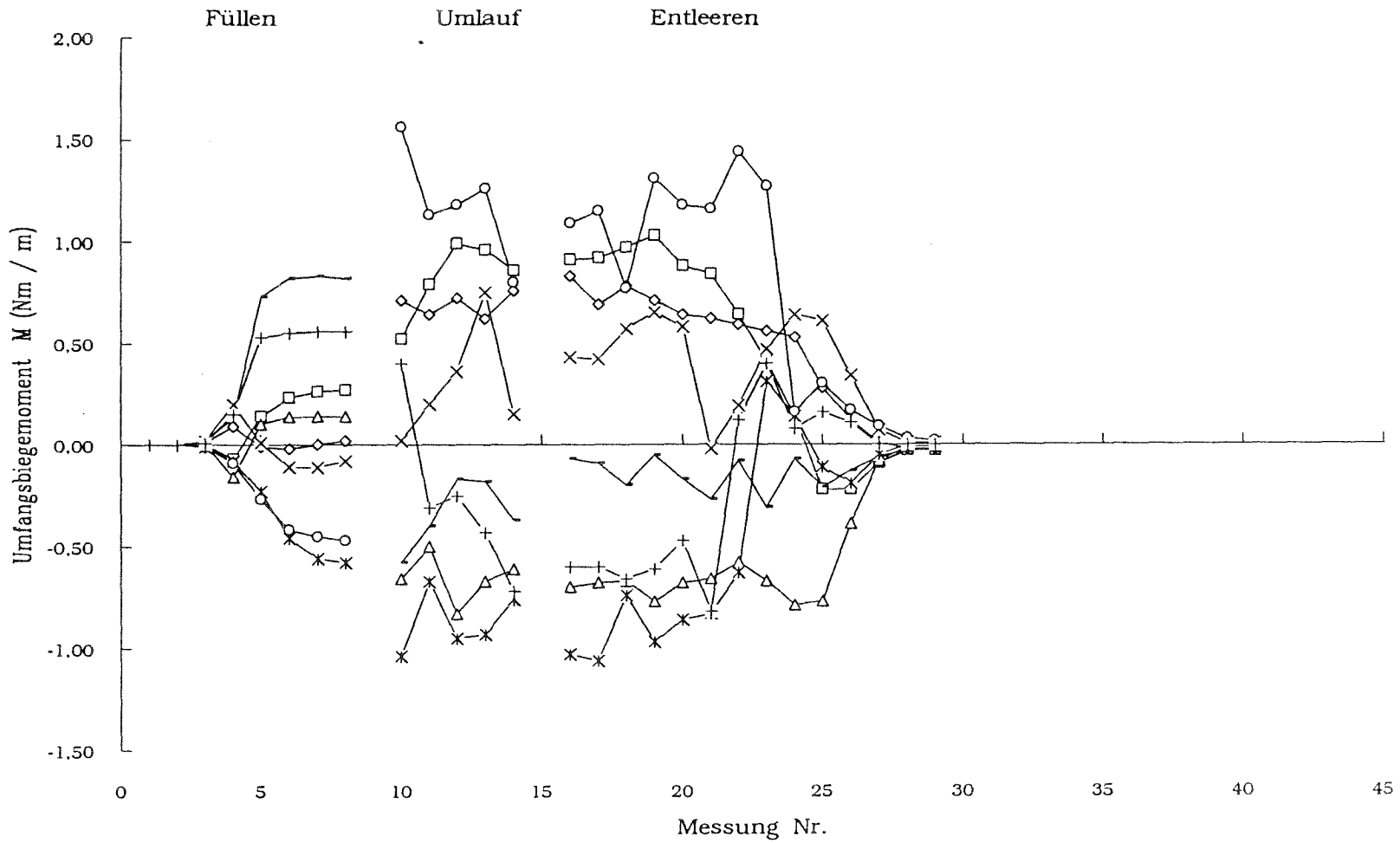
R 4.2.15

Versuch EZ 5 unterer Horizont



17.11.2016

**Versuch EZ 5 oberer Horizont**

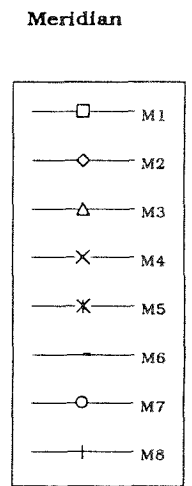
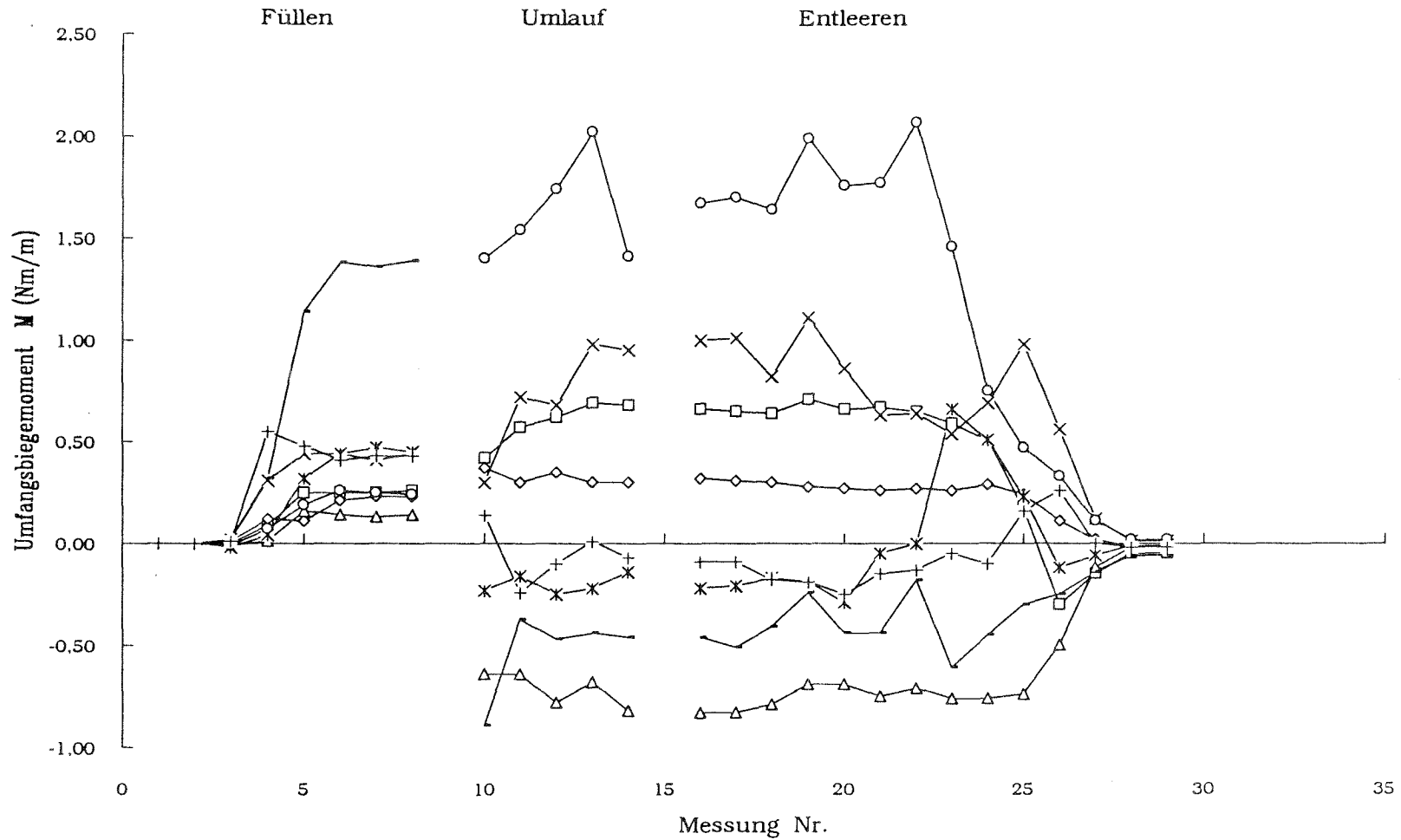


- Meridian**
- M1
  - ◇— M2
  - △— M3
  - ×— M4
  - \*— M5
  - M6
  - M7
  - +— M8

A4217

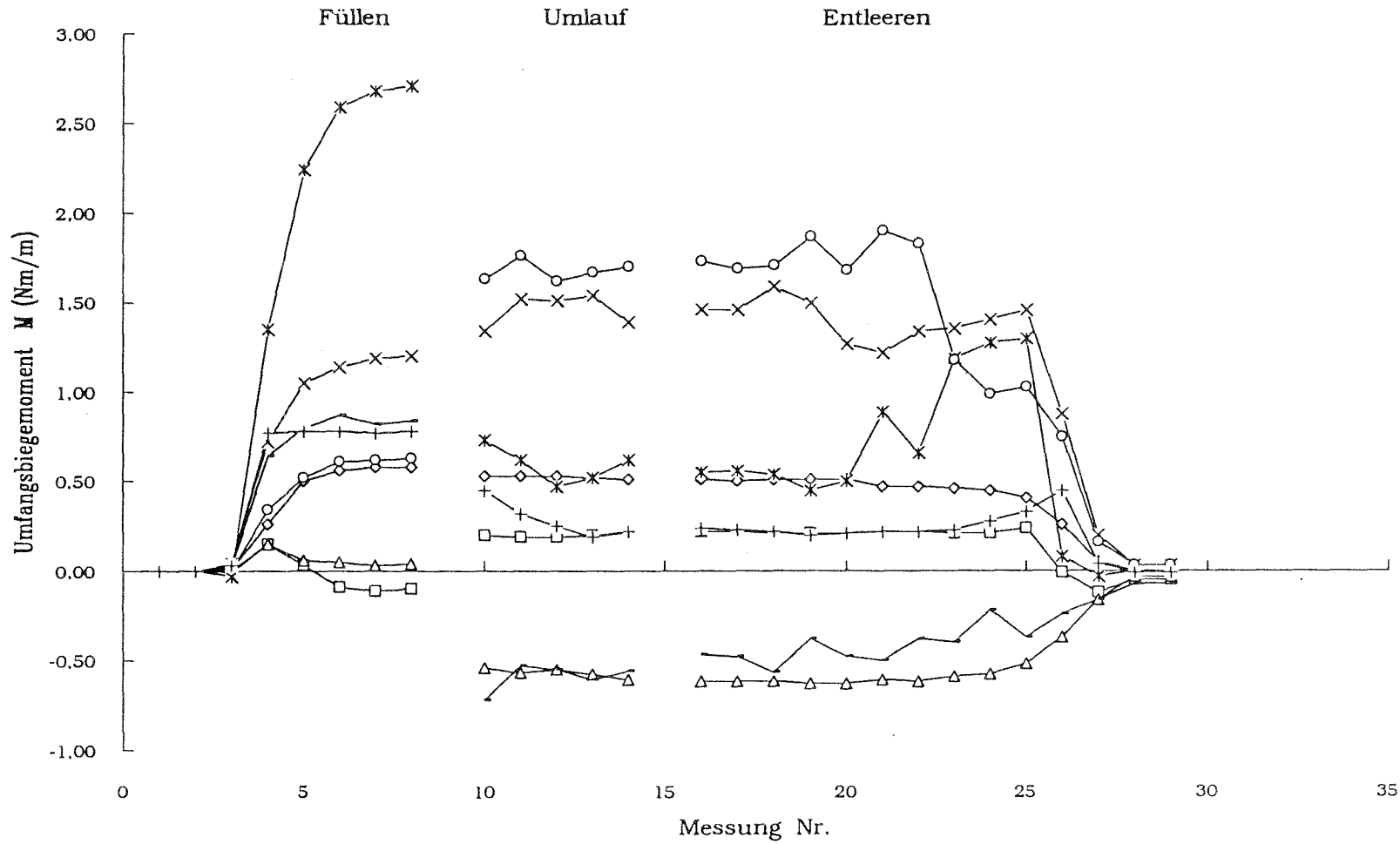


**Versuch EZ 5 mittlerer Horizont**



A4.218

# Versuch EZ 5 unterer Horizont

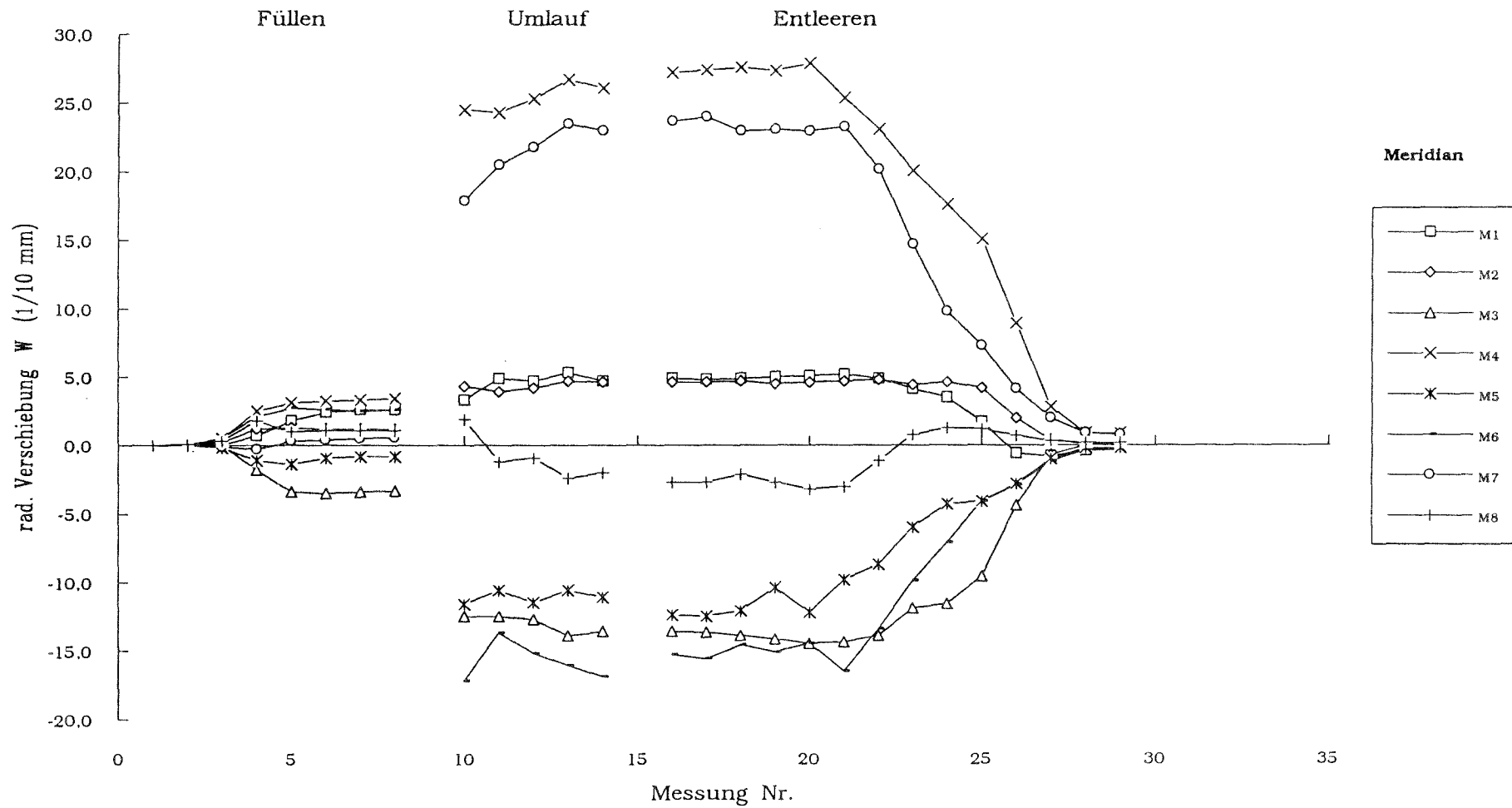


Meridian

- M1
- ◇— M2
- △— M3
- ×— M4
- \*— M5
- +— M6
- M7
- |— M8

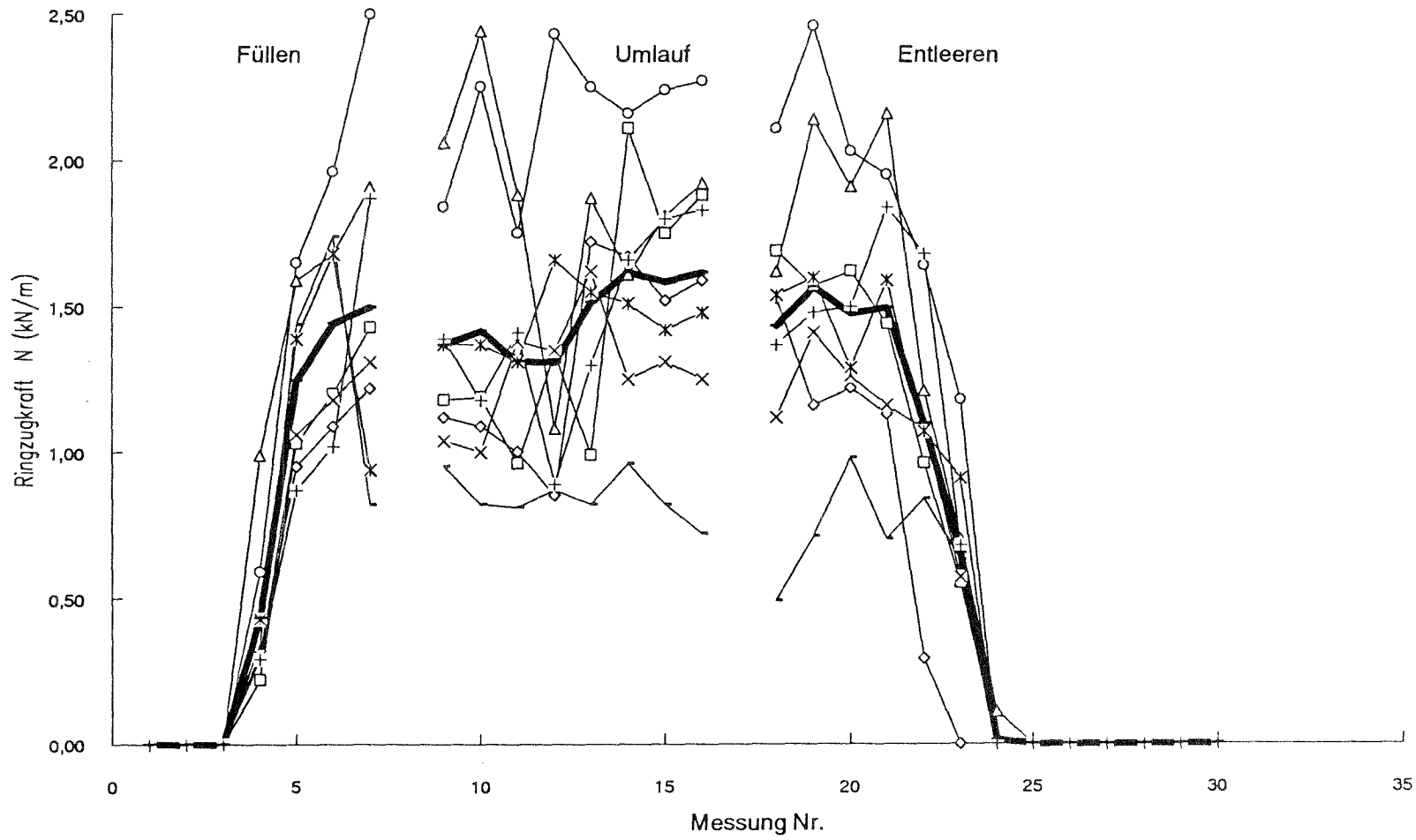
174.219

# Versuch EZ 5 mittlerer Horizont



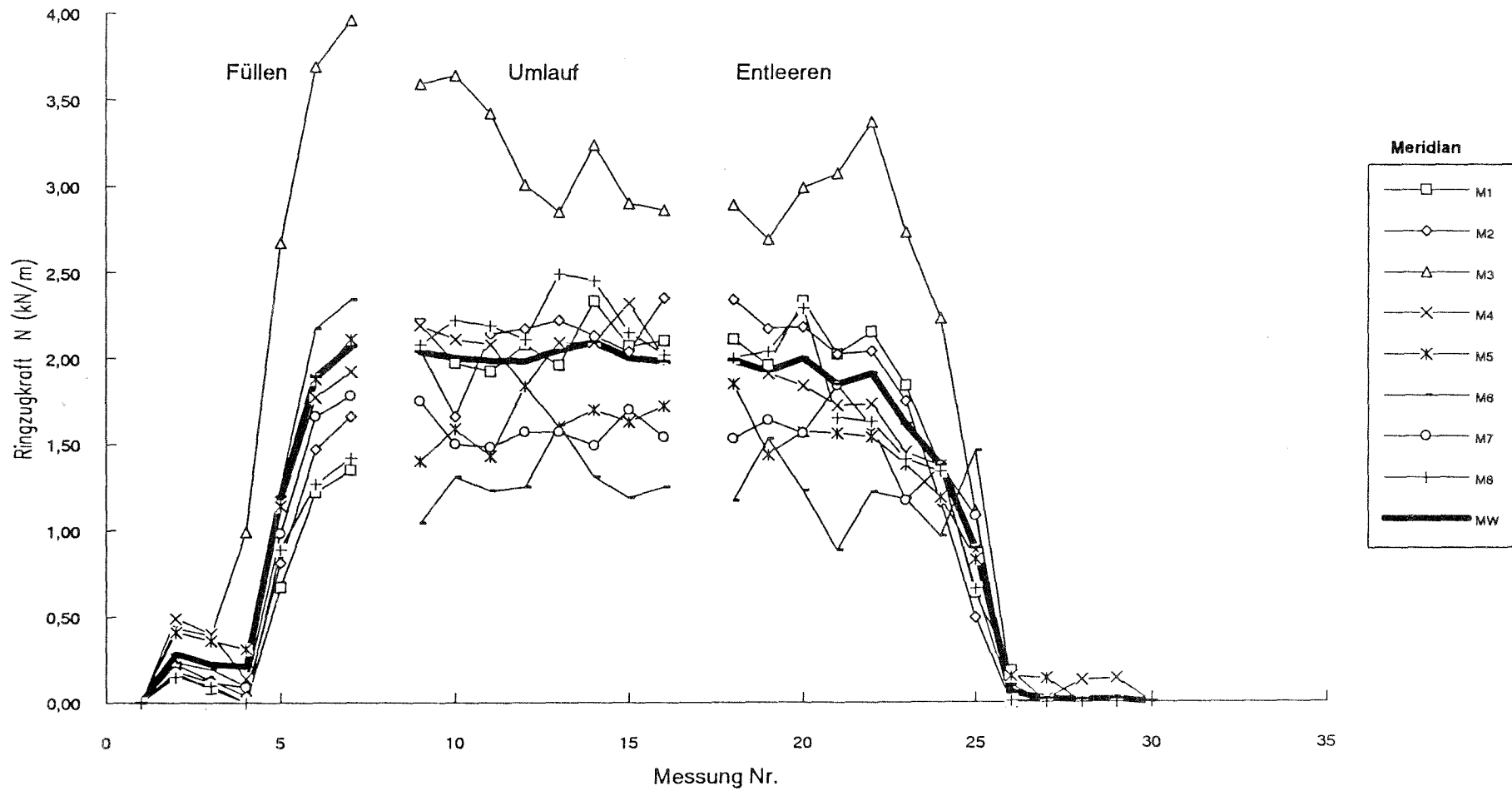
A4, 220

Versuch EZ 6 oberer Horizont



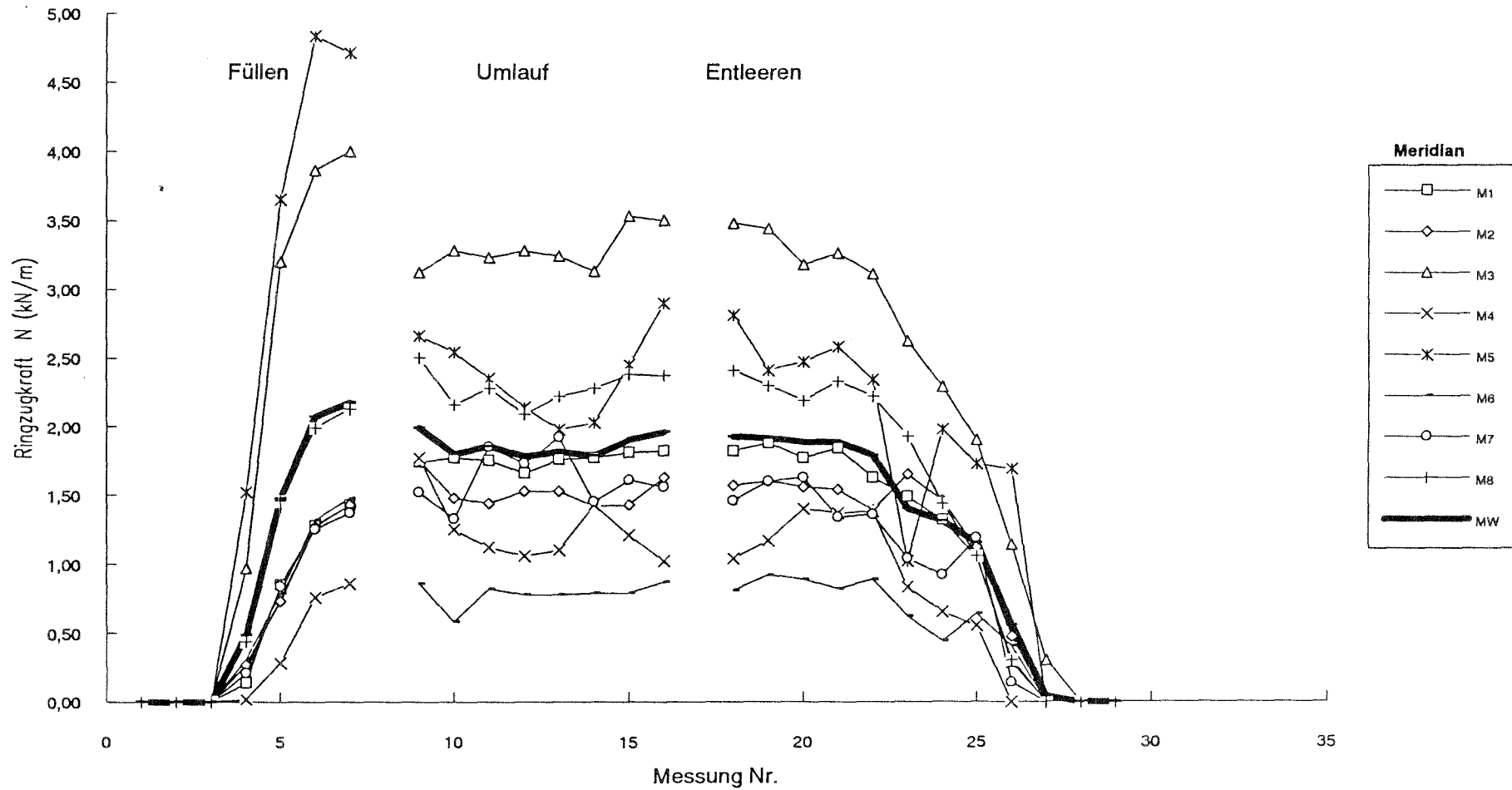
A4.221

Versuch EZ 6 mittlerer Horizont



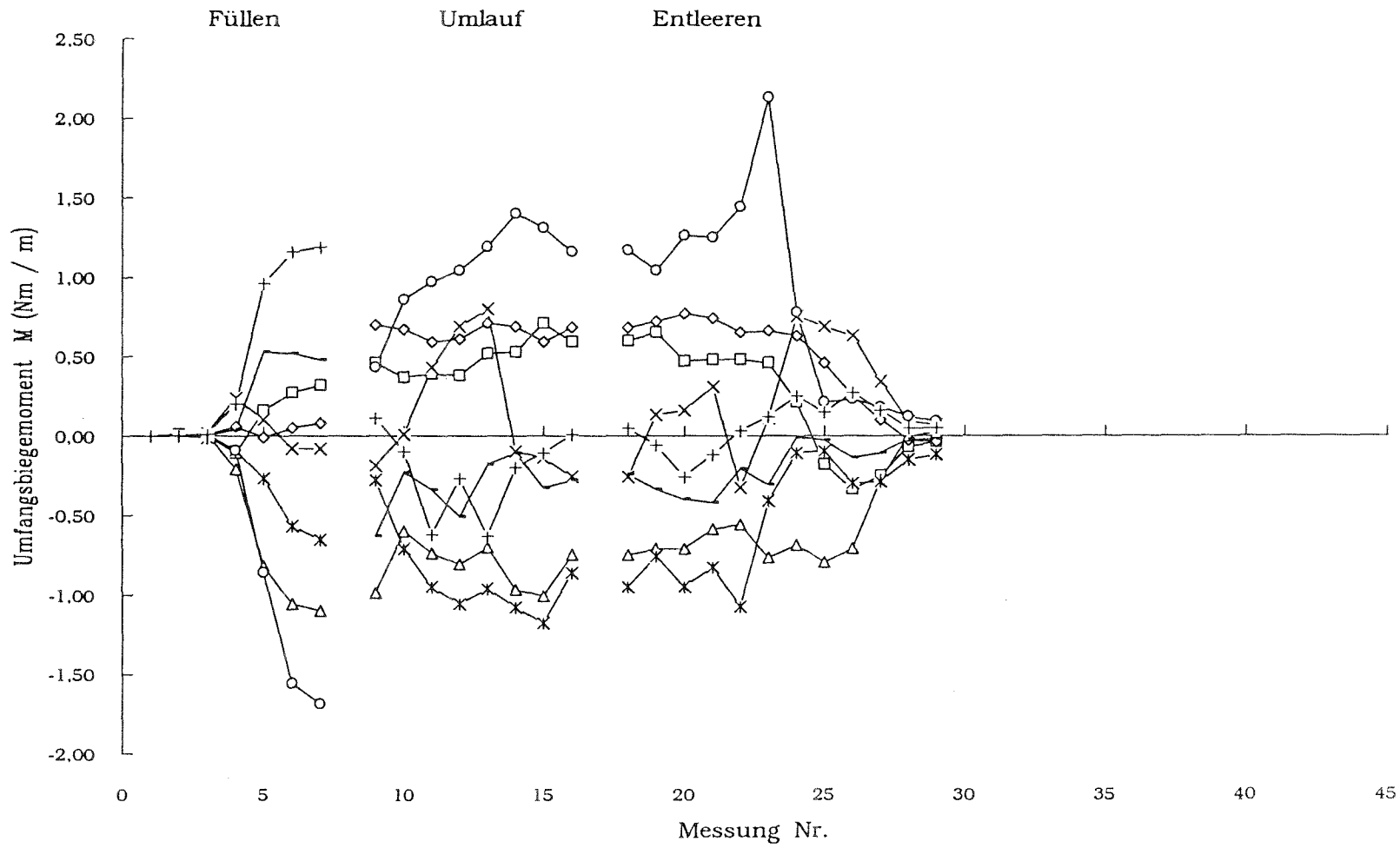
A 4222

### Versuch EZ 6 unterer Horizont



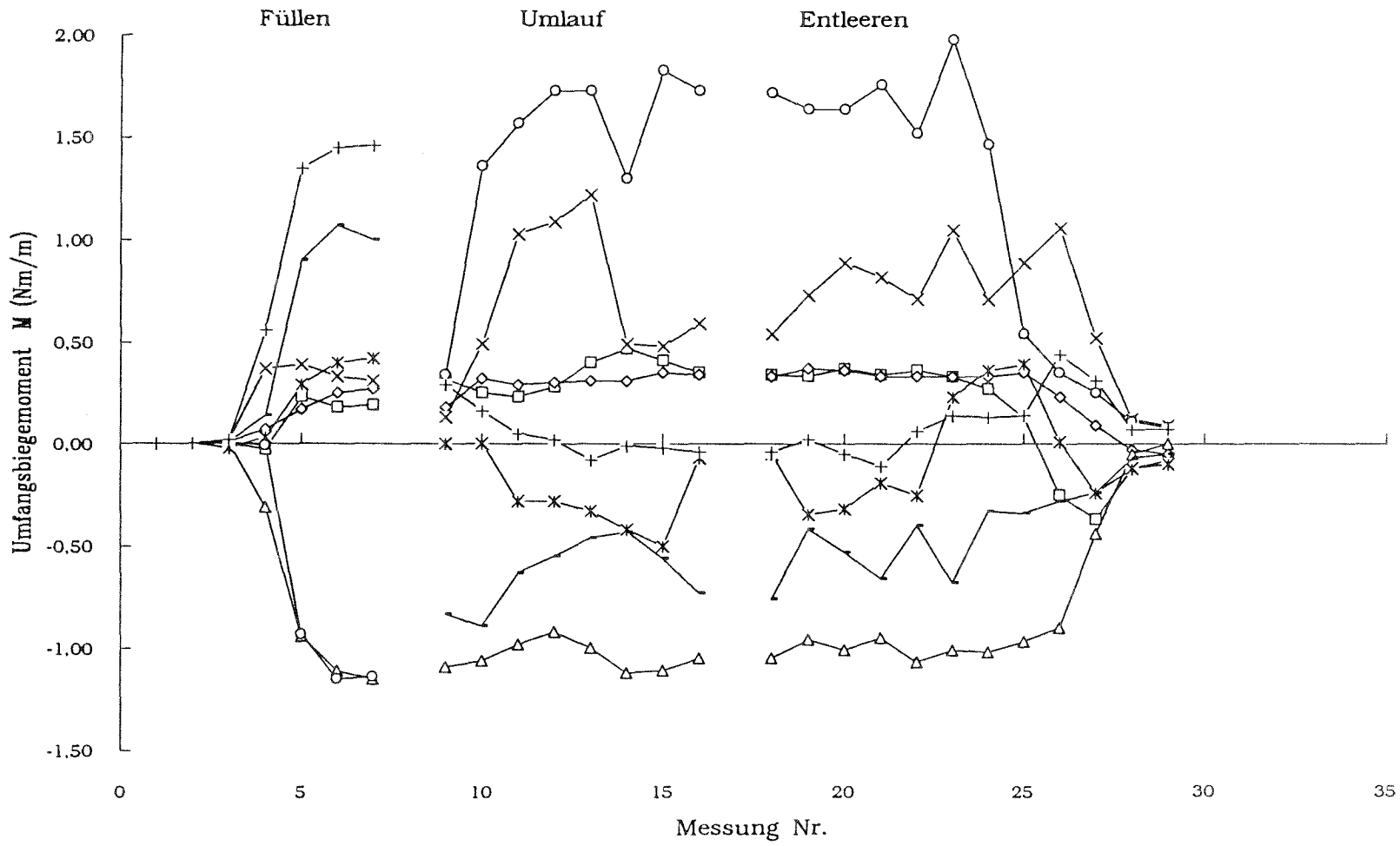
A 4.223

# Versuch EZ 6 oberer Horizont



A4.224

**Versuch EZ 6 mittlerer Horizont**

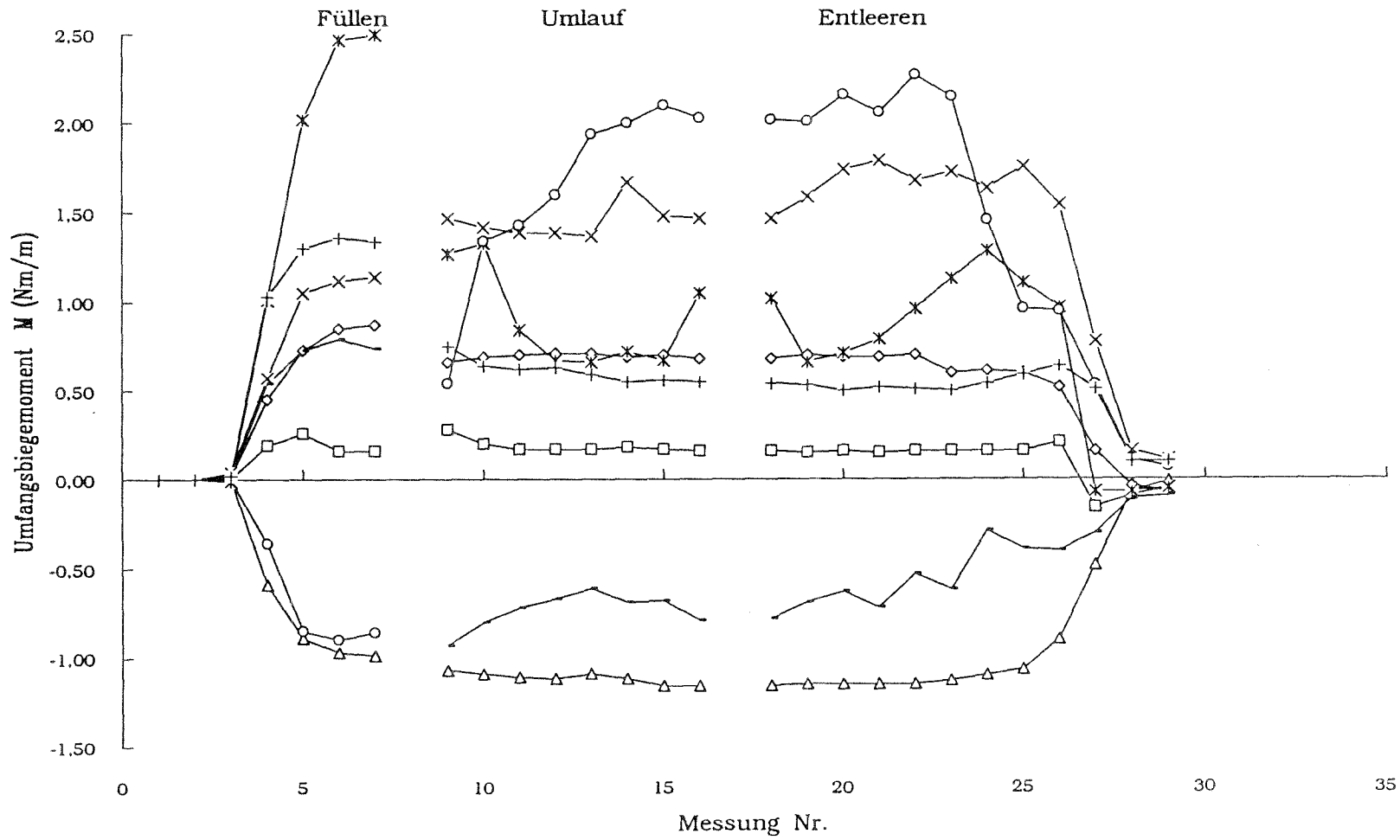


- Meridian**
- M1
  - ◇ M2
  - △ M3
  - × M4
  - \* M5
  - M6
  - M7
  - + M8

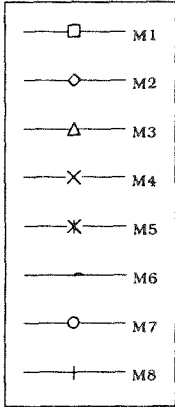
194.225



**Versuch EZ 6 unterer Horizont**

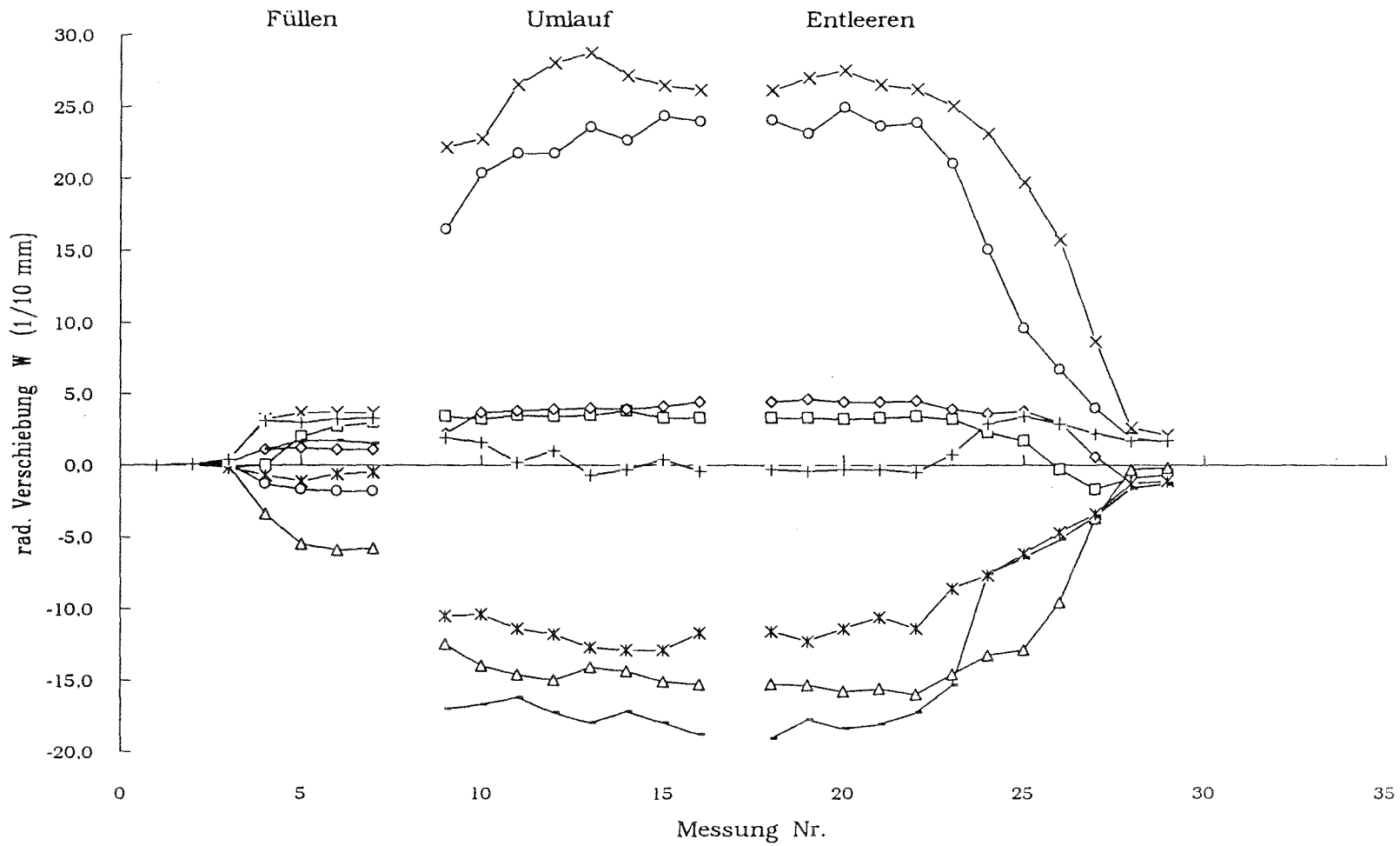


Meridian



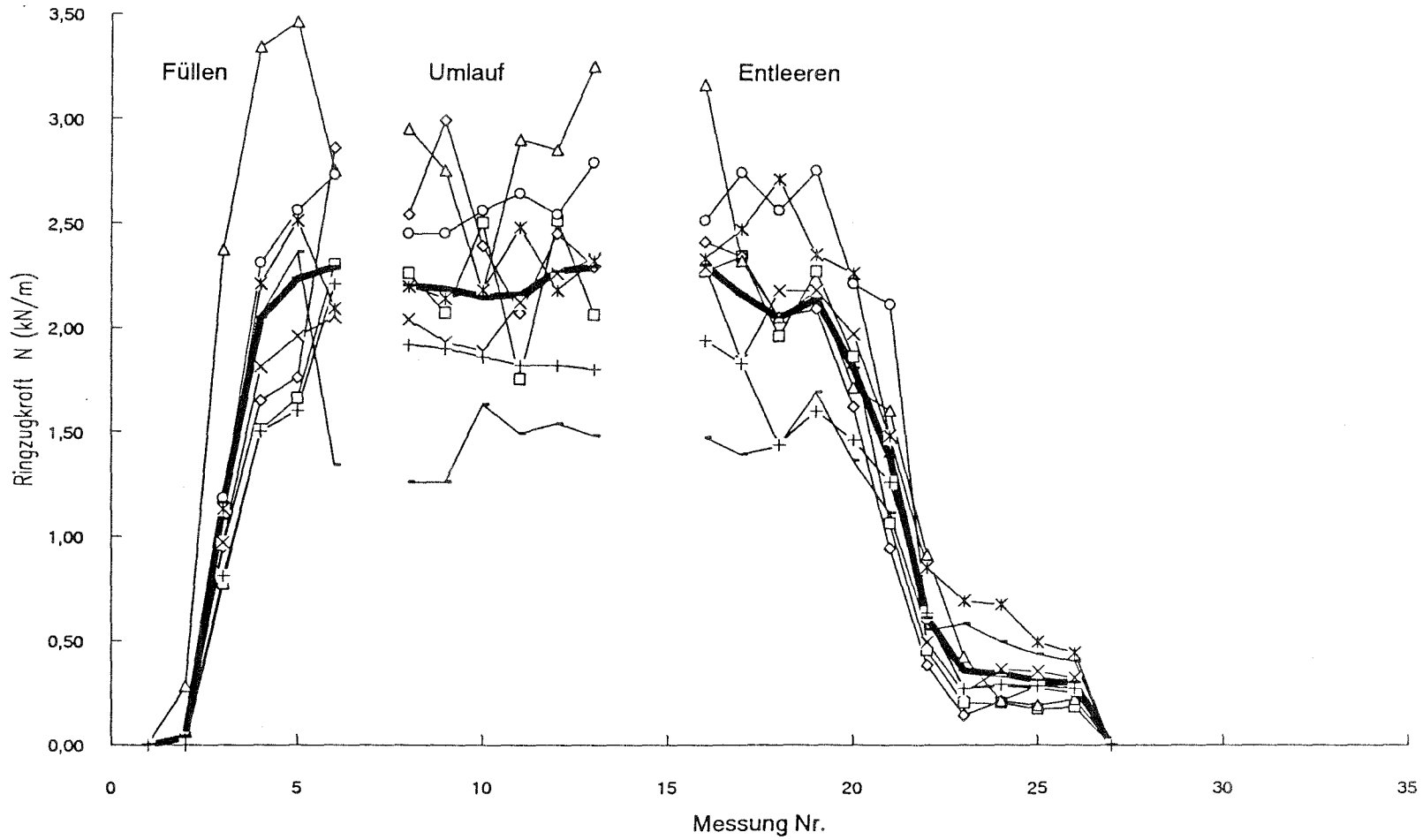
A 4.226

# Versuch EZ 6 mittlerer Horizont



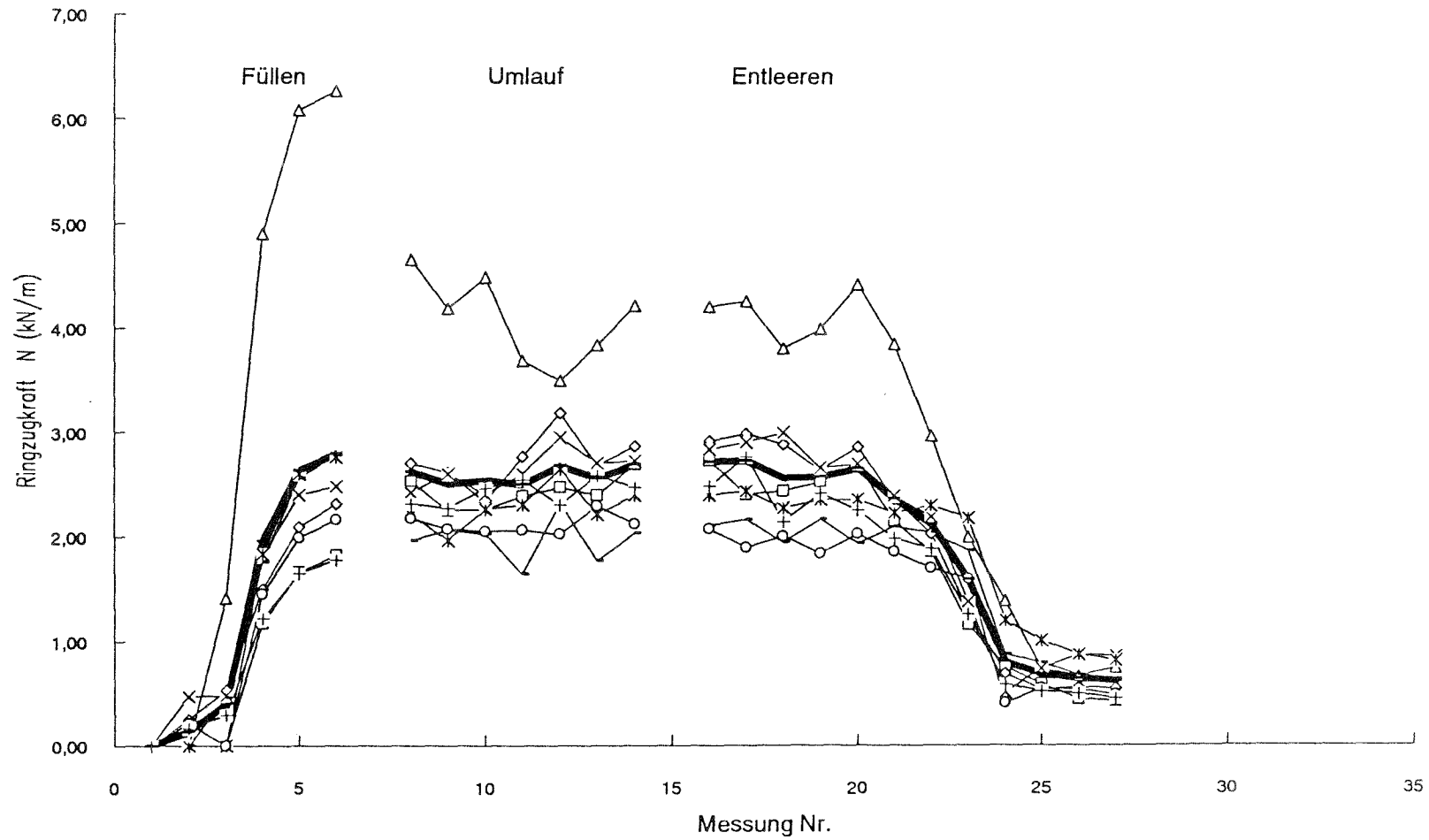
A 4.227

Versuch EZ 7 oberer Horizont



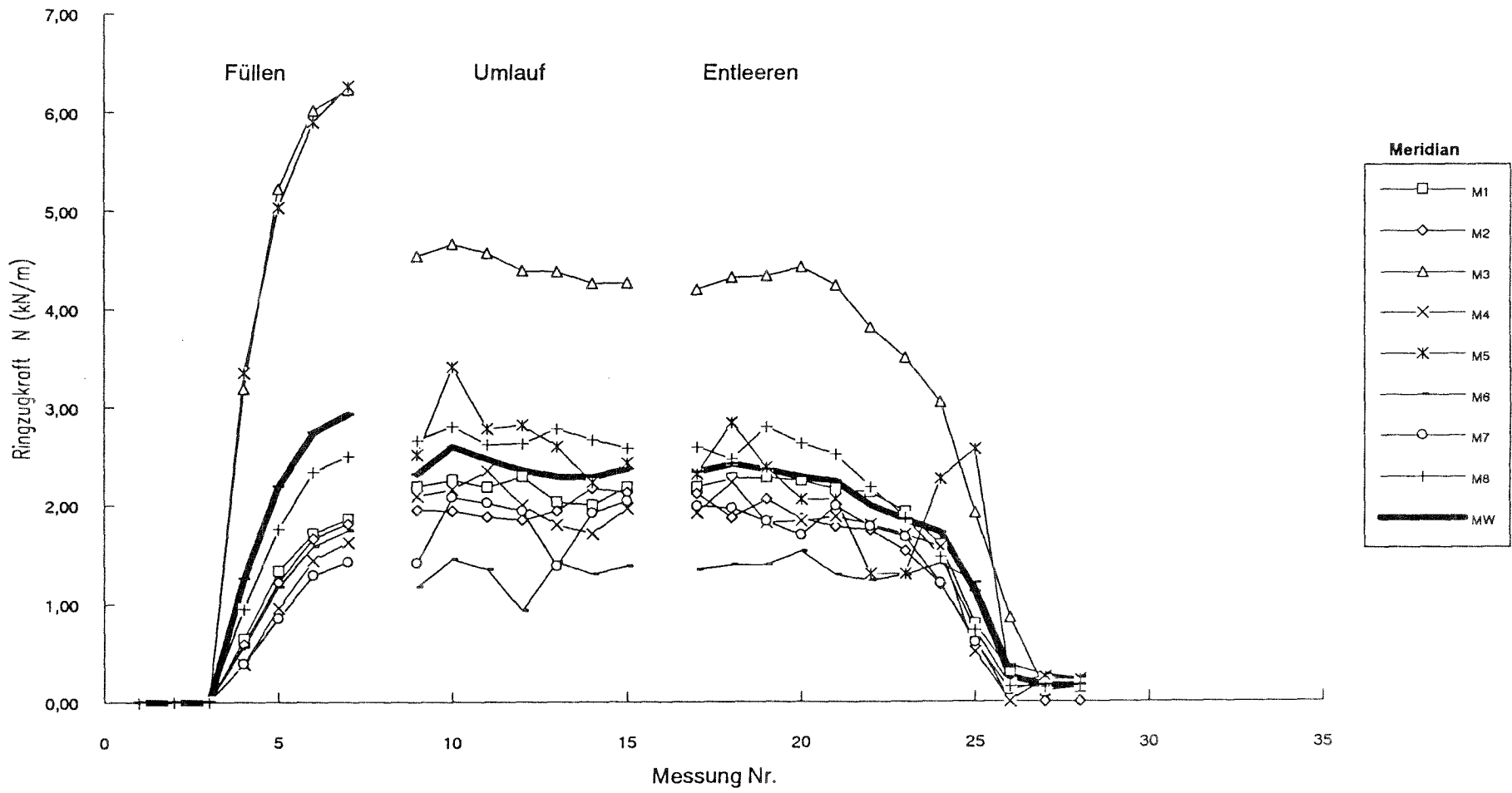
A 4.228

# Versuch EZ 7 mittlerer Horizont



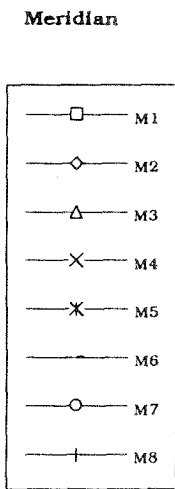
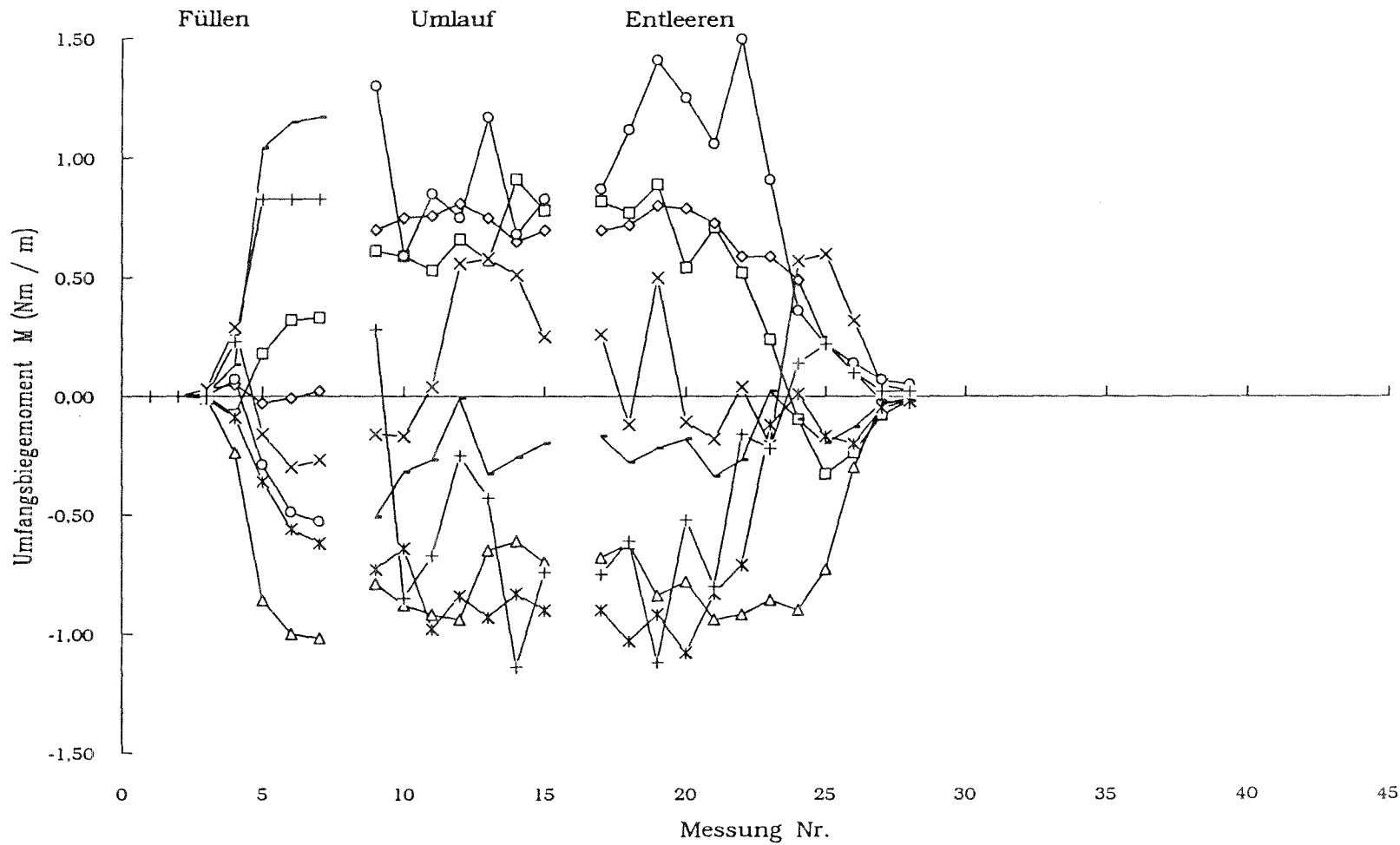
A 4.229

# Versuch EZ 7 unterer Horizont



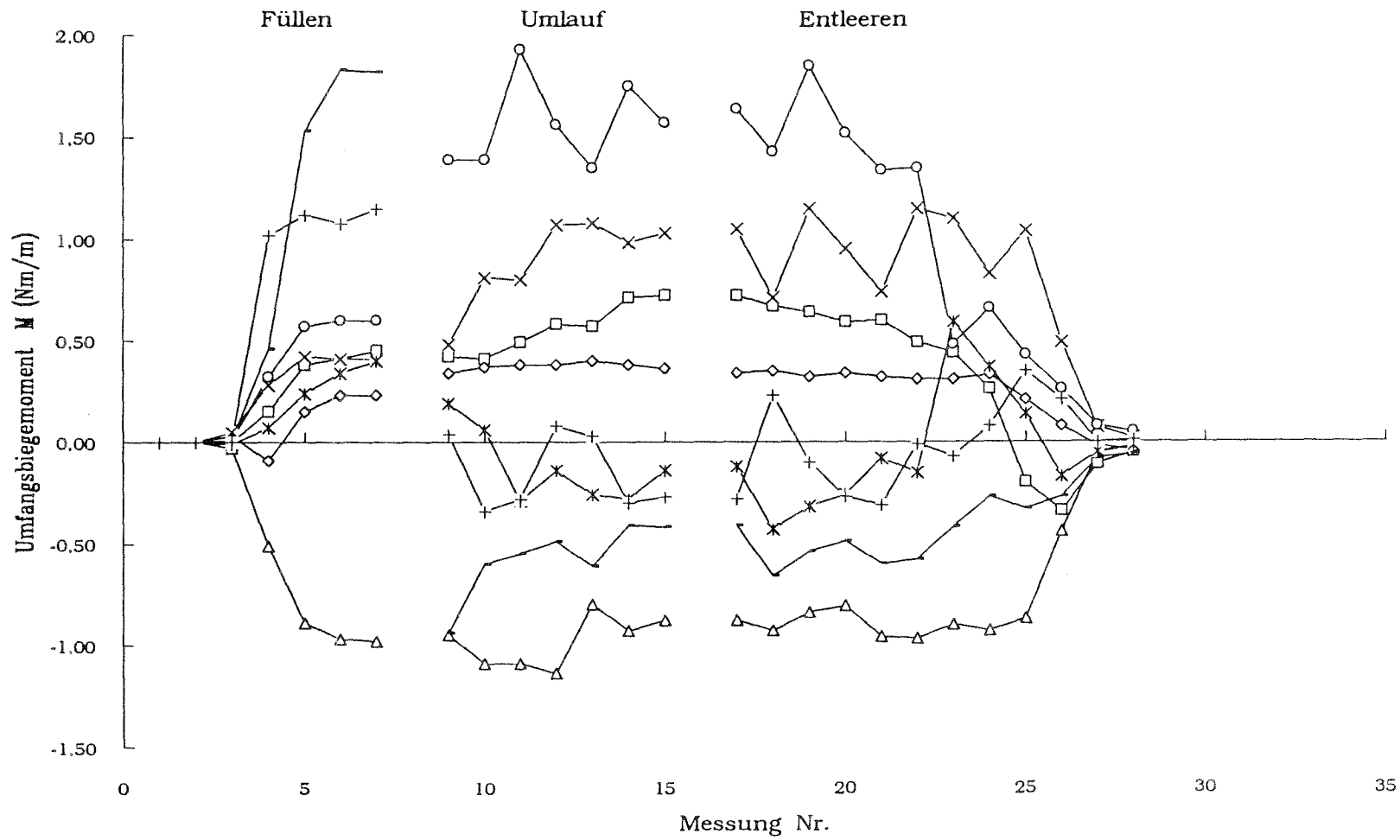
R 4. 250

**Versuch EZ 7 oberer Horizont**



A4.23A

# Versuch EZ 7 mittlerer Horizont

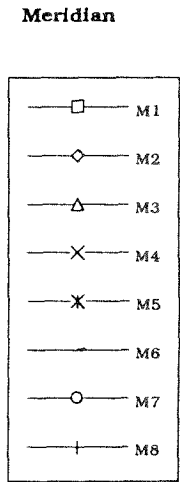
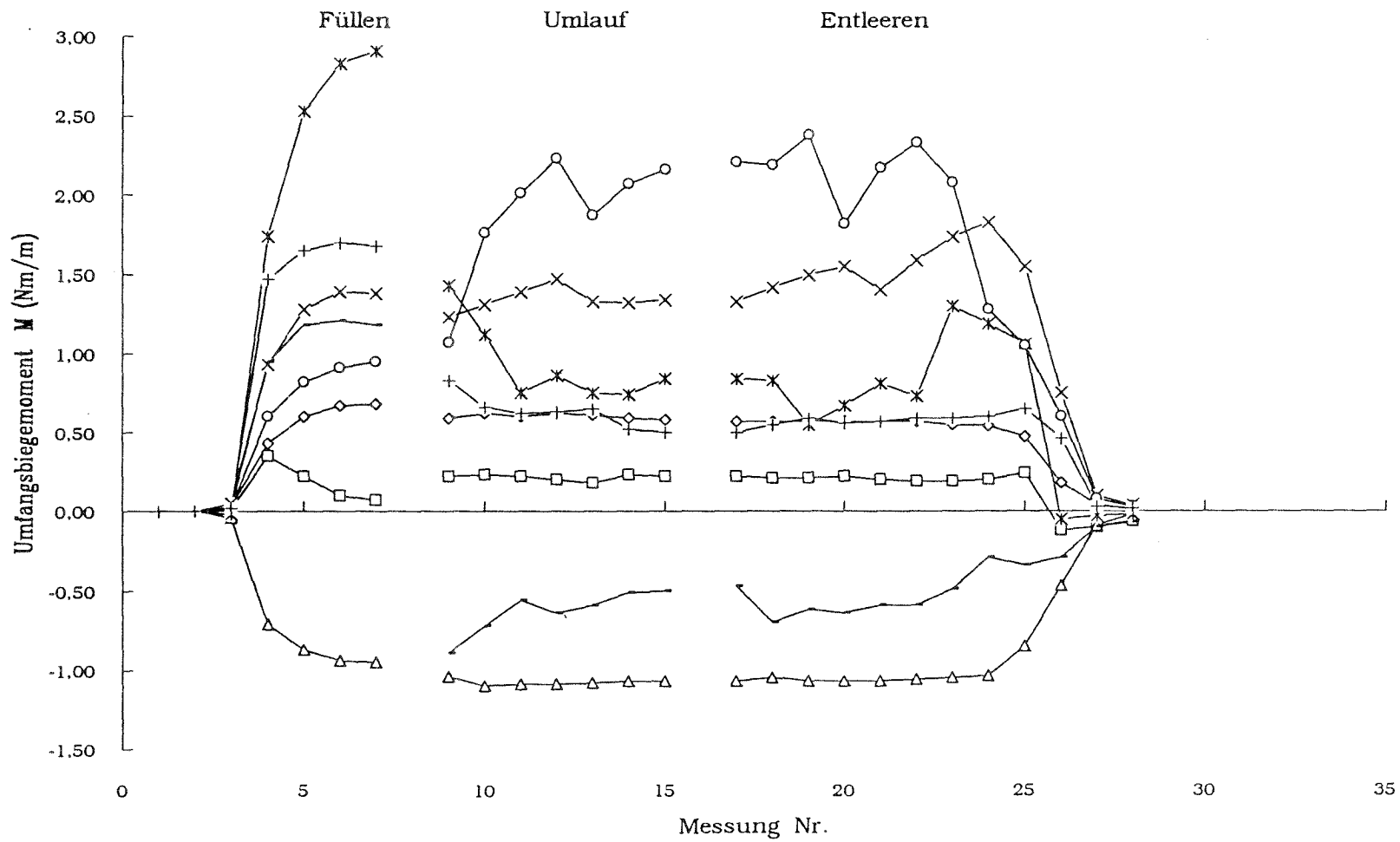


Meridian

- M1
- ◇— M2
- △— M3
- ×— M4
- \*— M5
- +— M6
- M7
- +— M8

A4.232

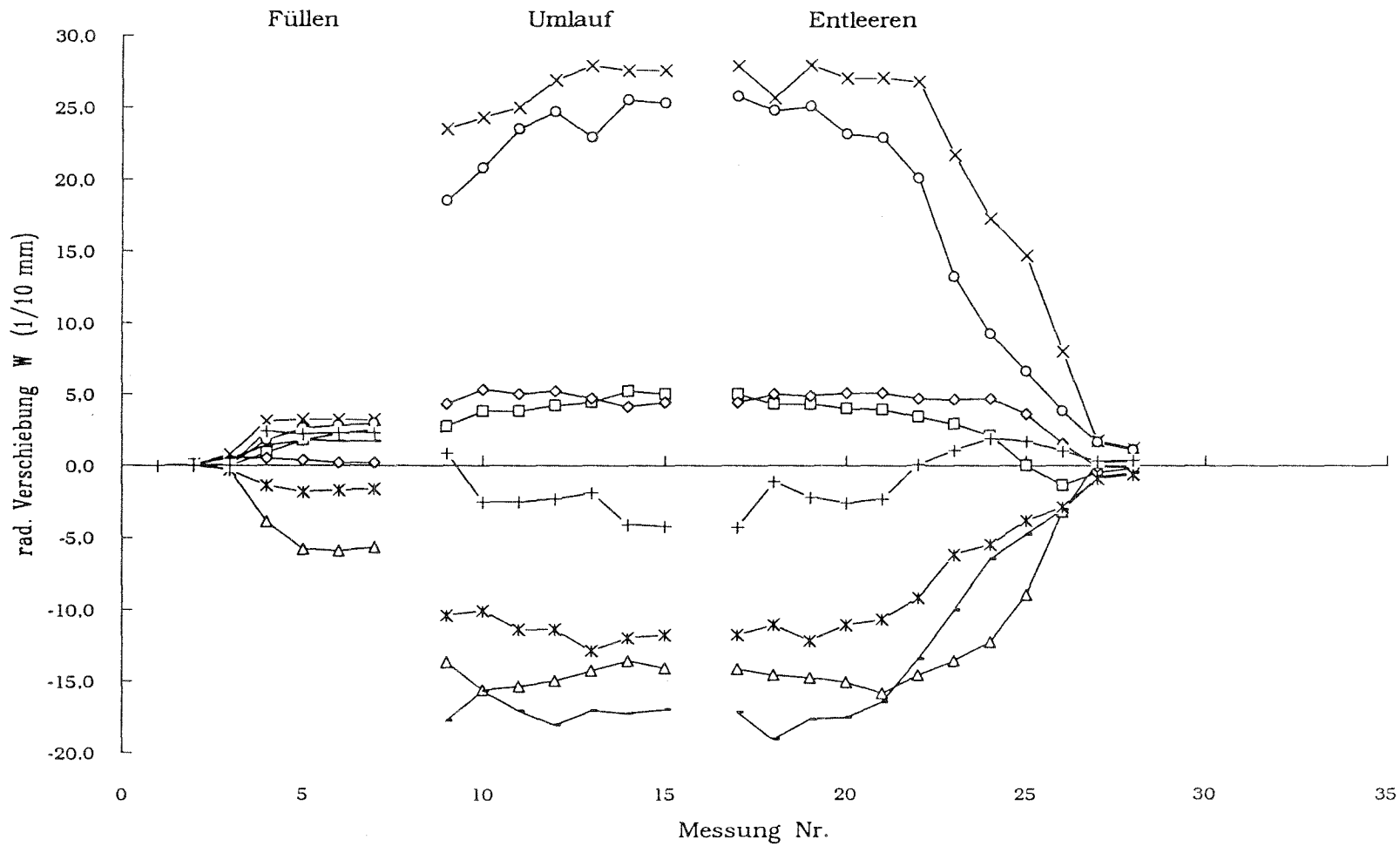
# Versuch EZ 7 unterer Horizont



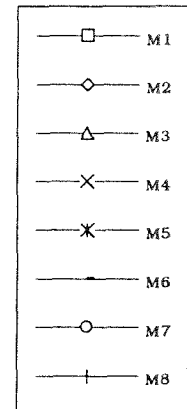
A41233



# Versuch EZ 7 mittlerer Horizont

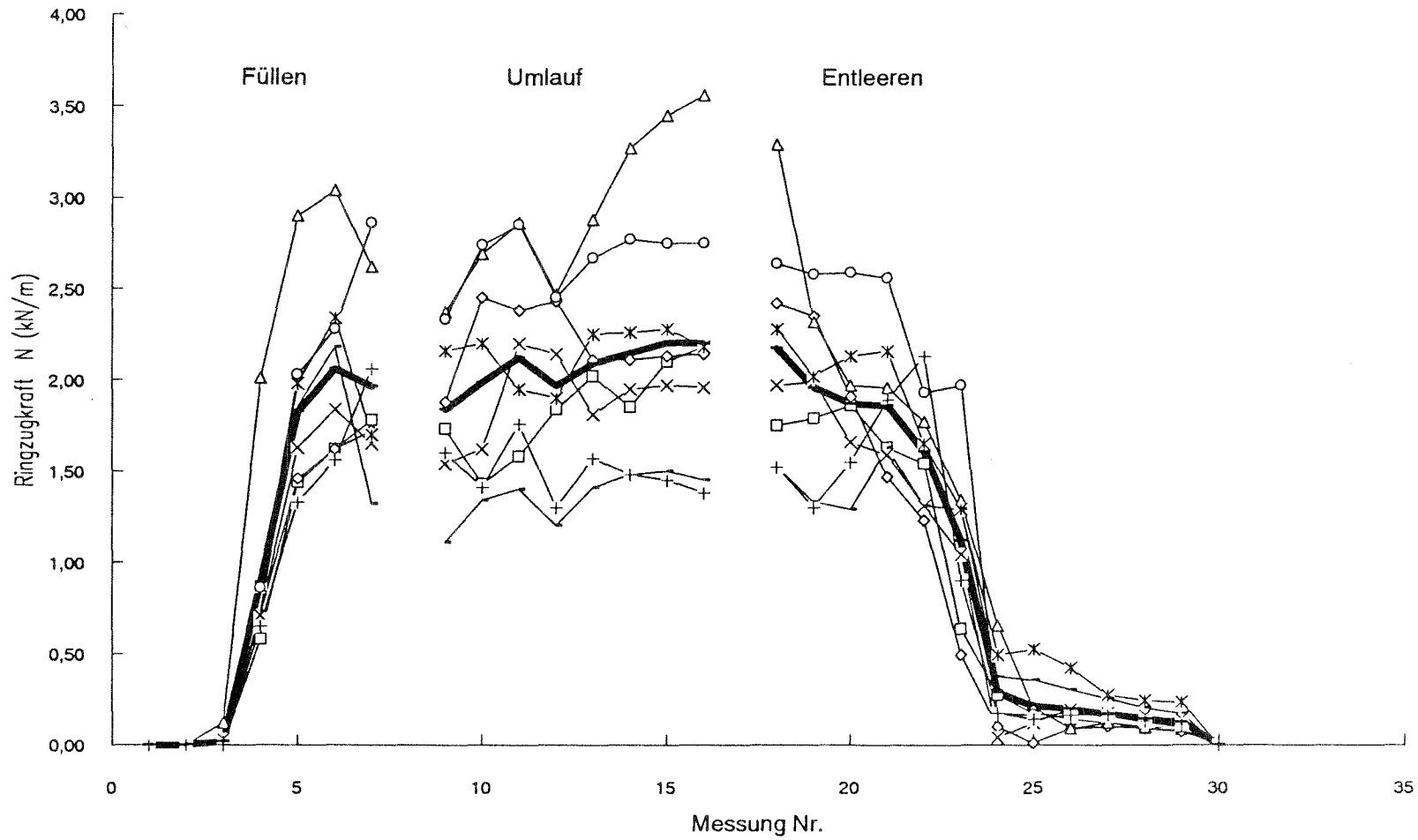


Meridian



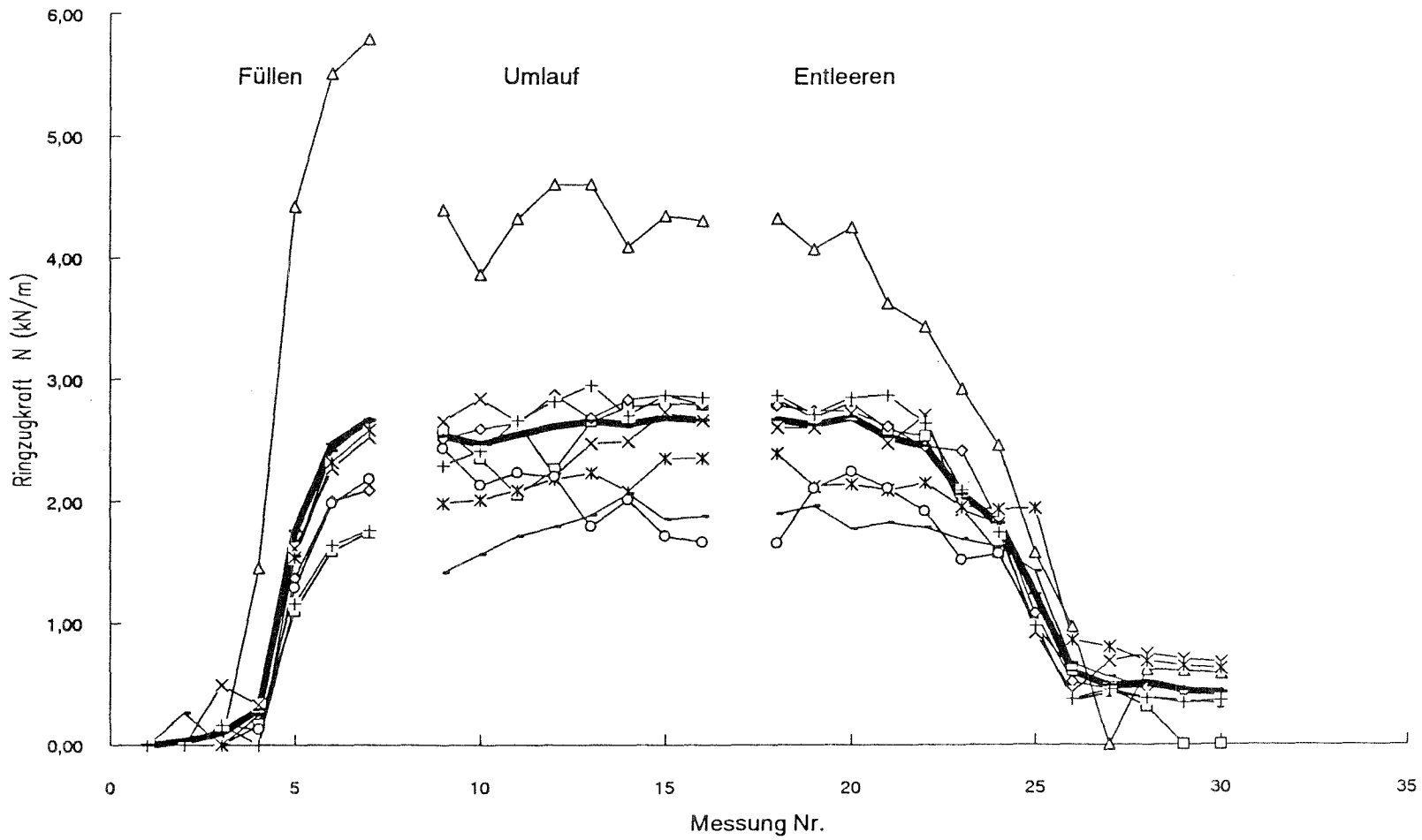
174.234

Versuch EZ 8 oberer Horizont



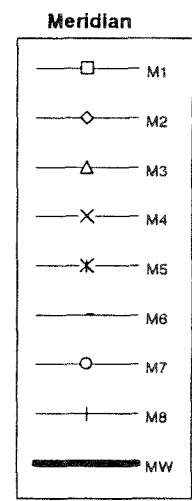
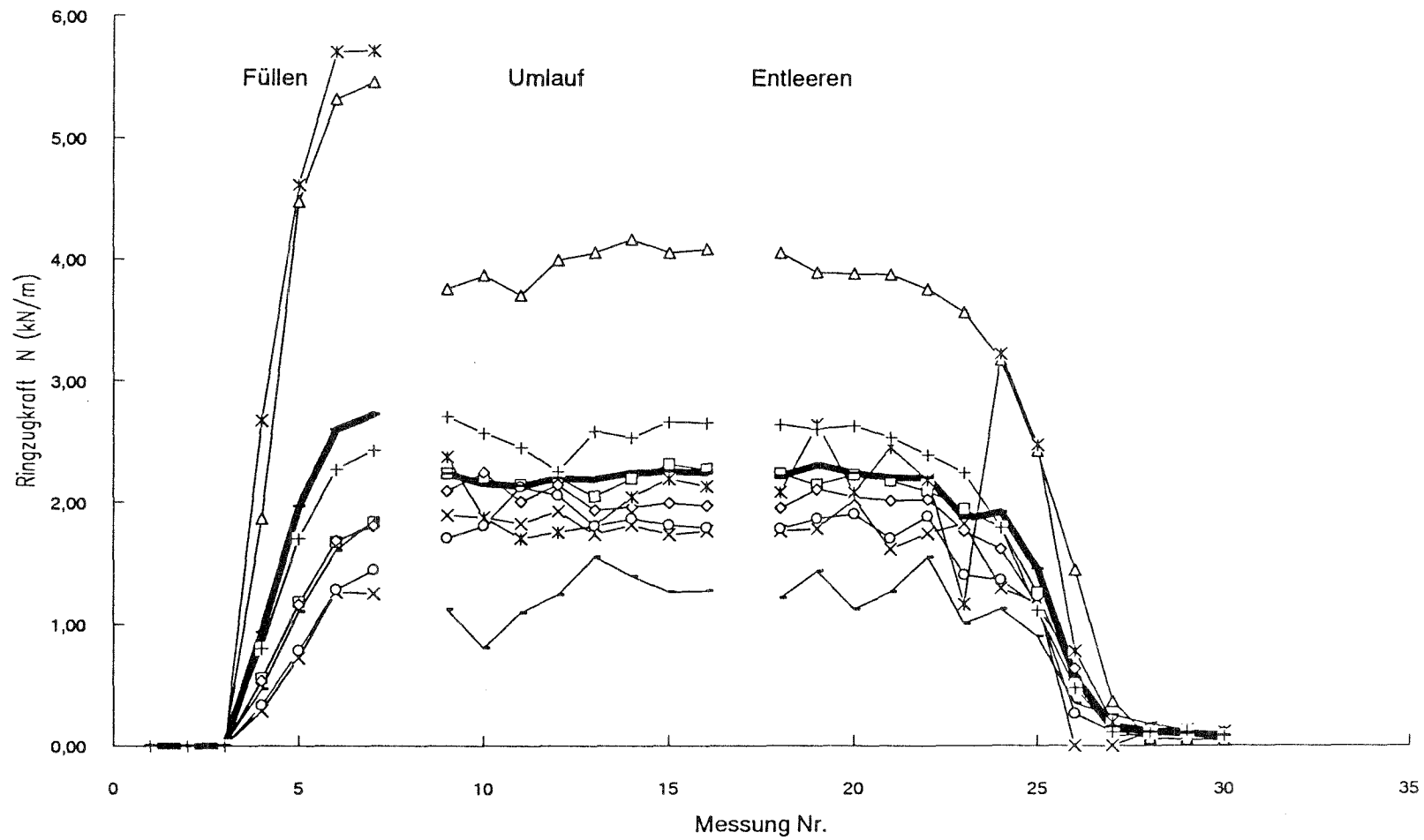
14.235

Versuch EZ 8 mittlerer Horizont



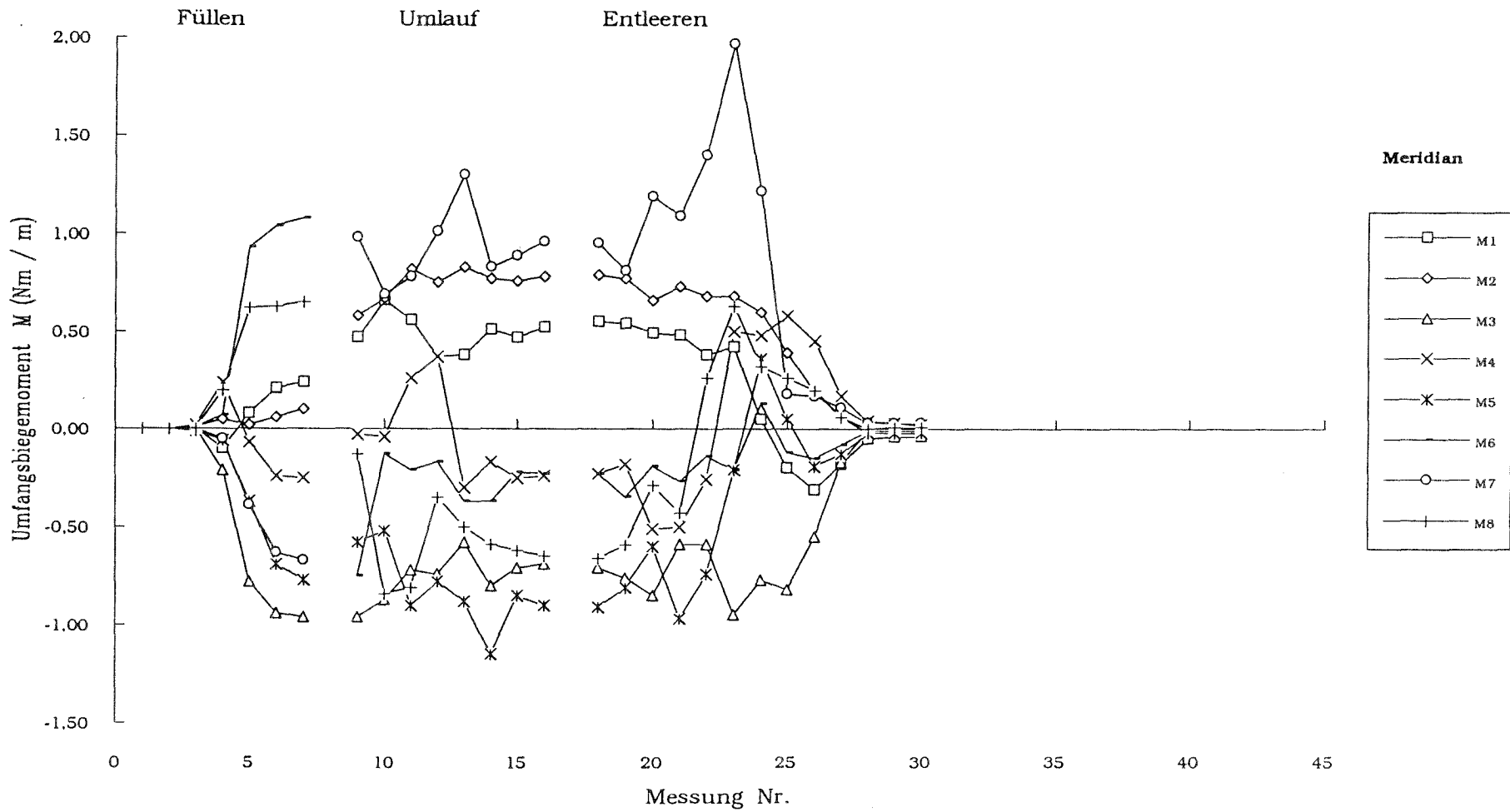
14.256

Versuch EZ 8 unterer Horizont



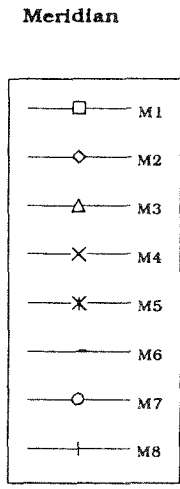
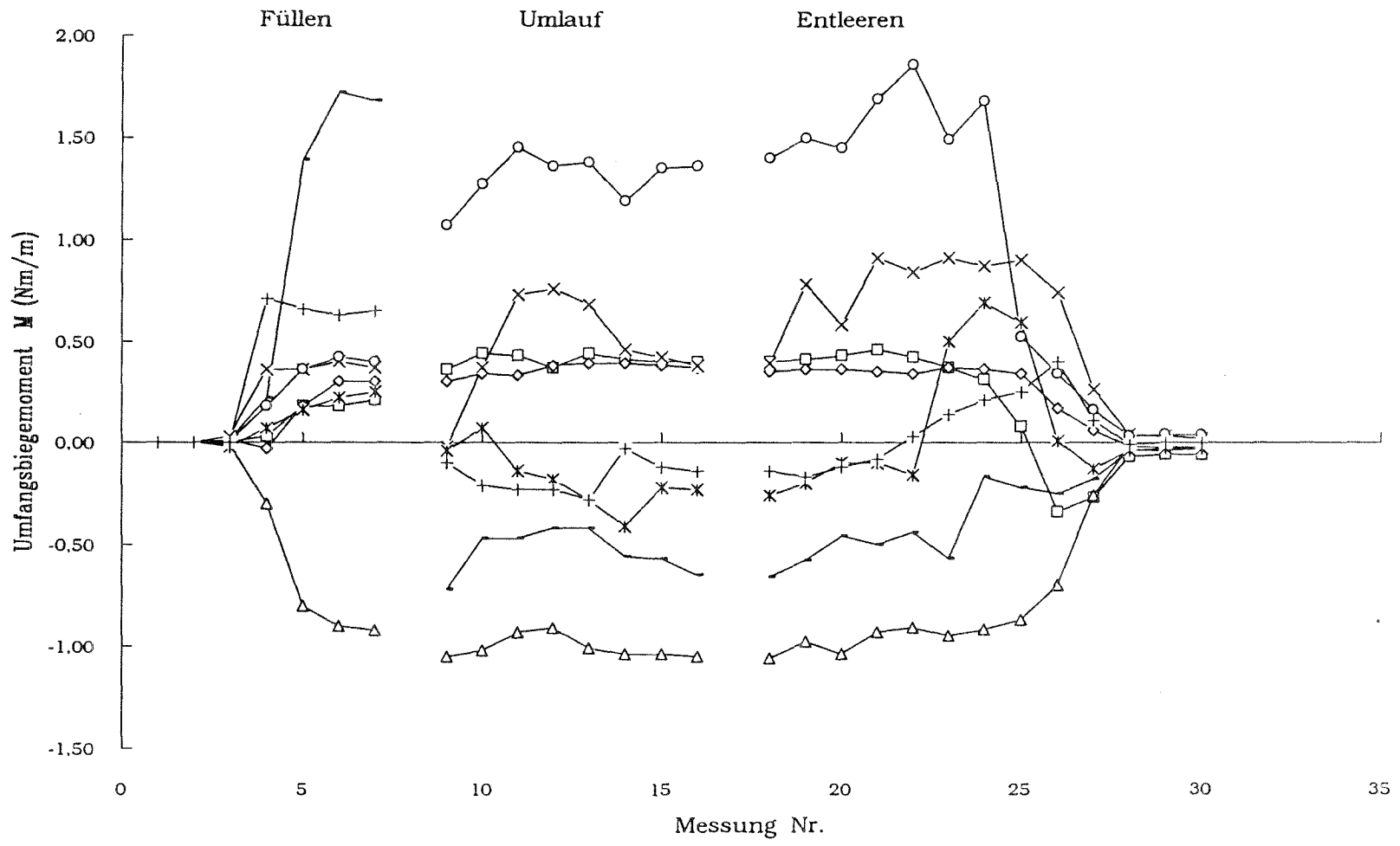
A4.257

# Versuch EZ 8 oberer Horizont



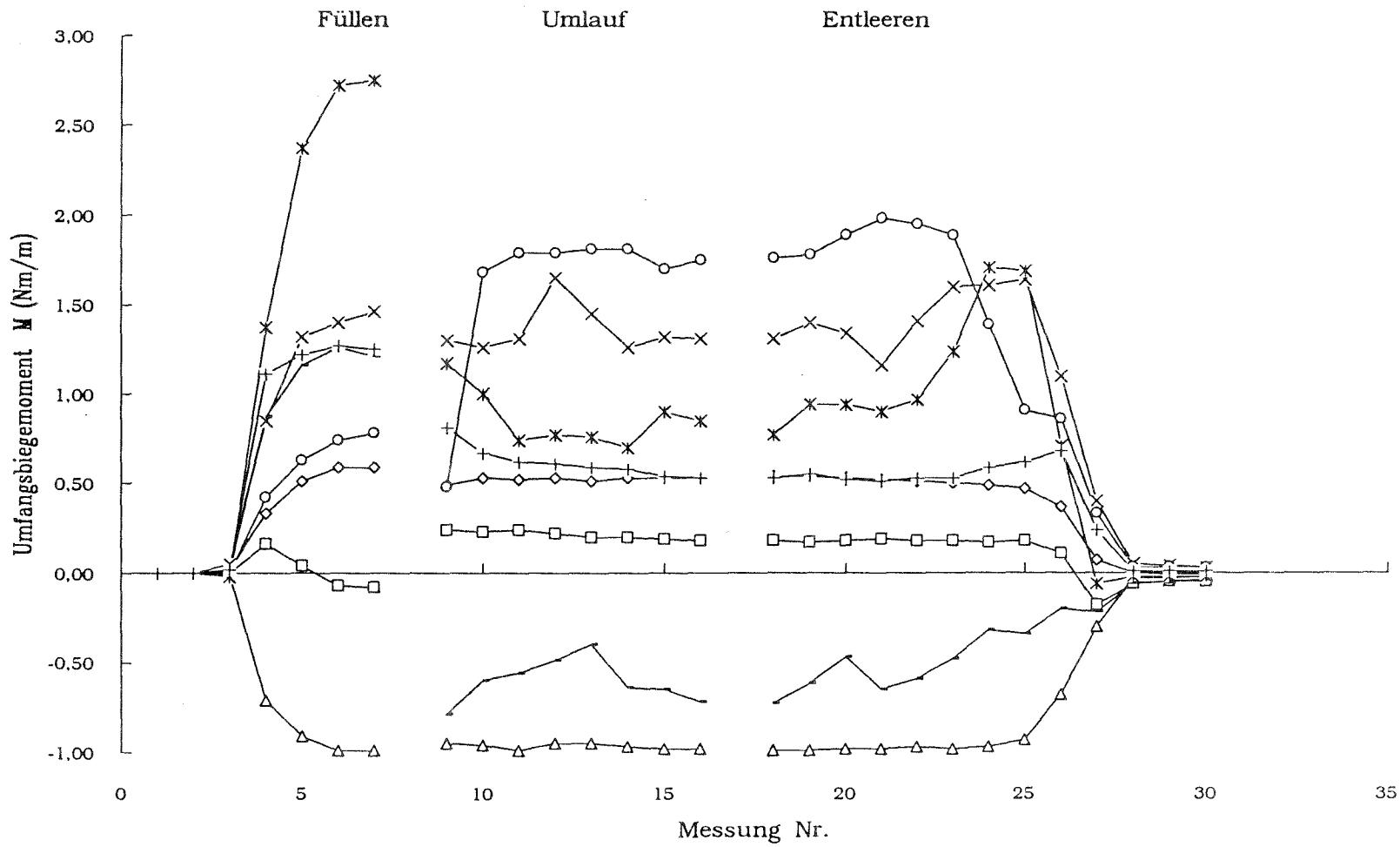
A4.238

# Versuch EZ 8 mittlerer Horizont

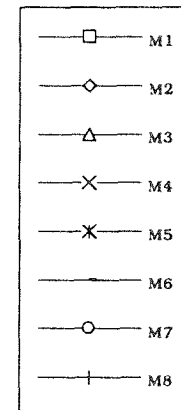


A4,259

**Versuch EZ 8 unterer Horizont**

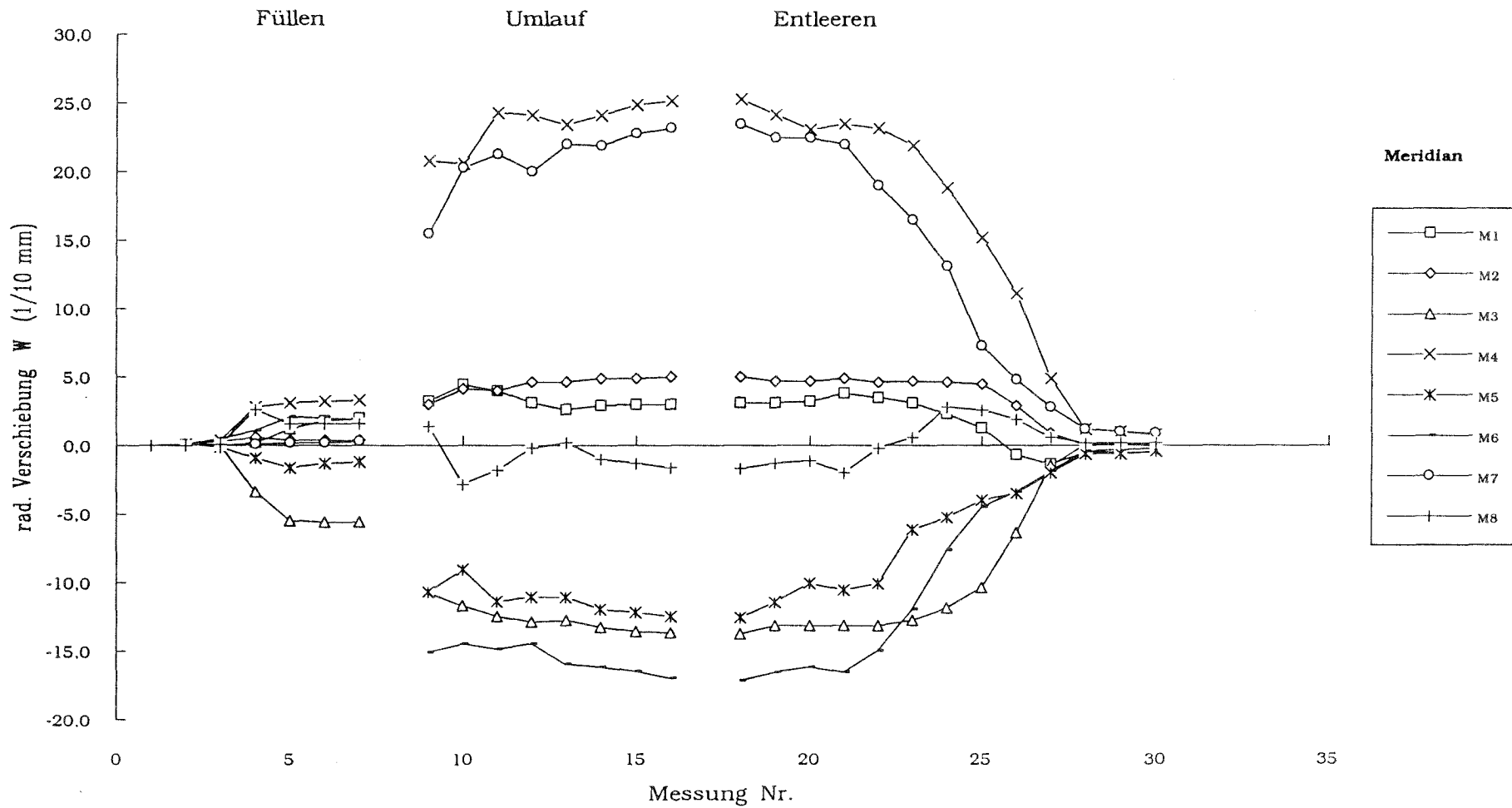


**Meridian**



A4.240

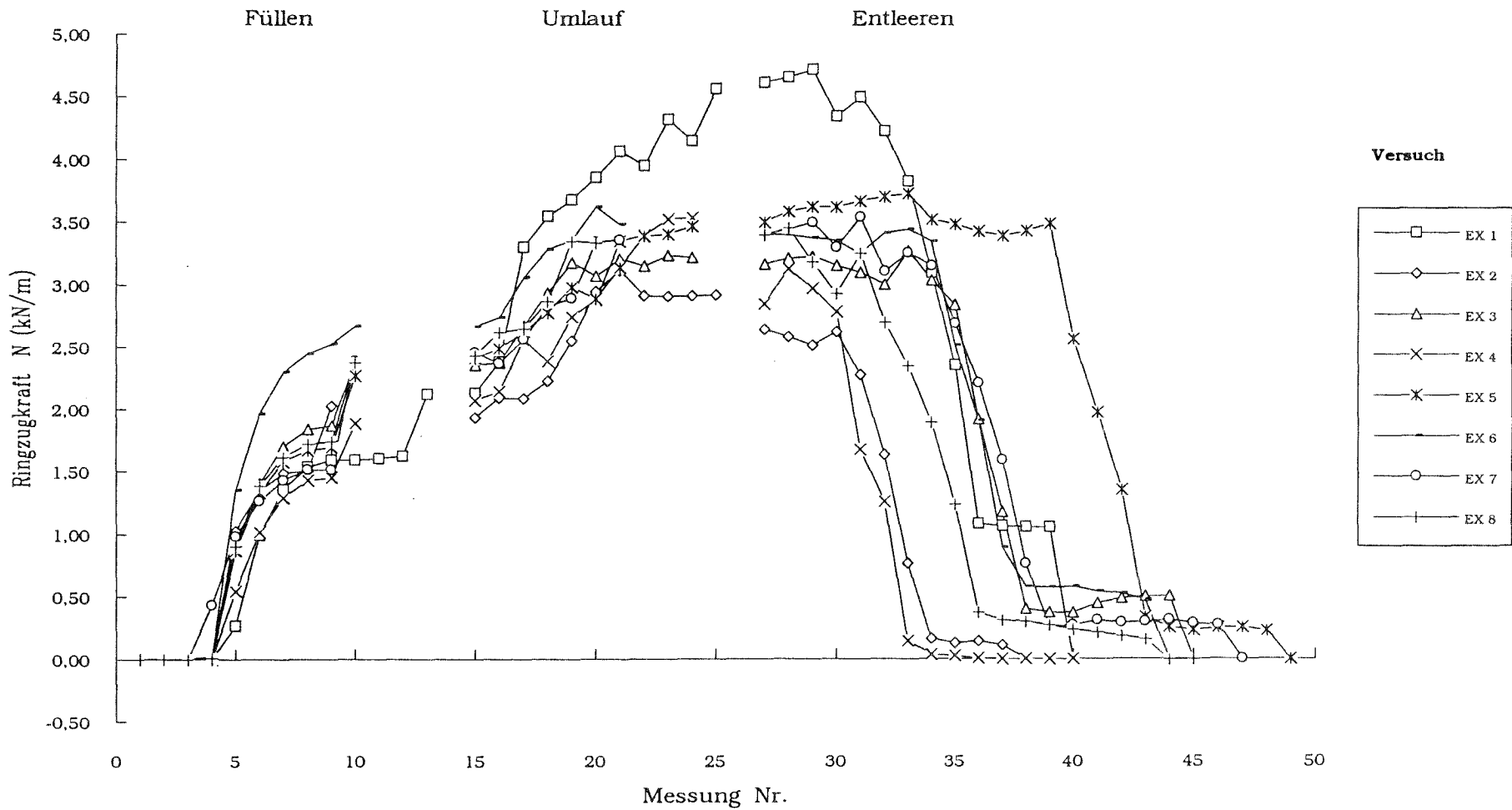
# Versuch EZ 8 mittlerer Horizont



P. 4.244

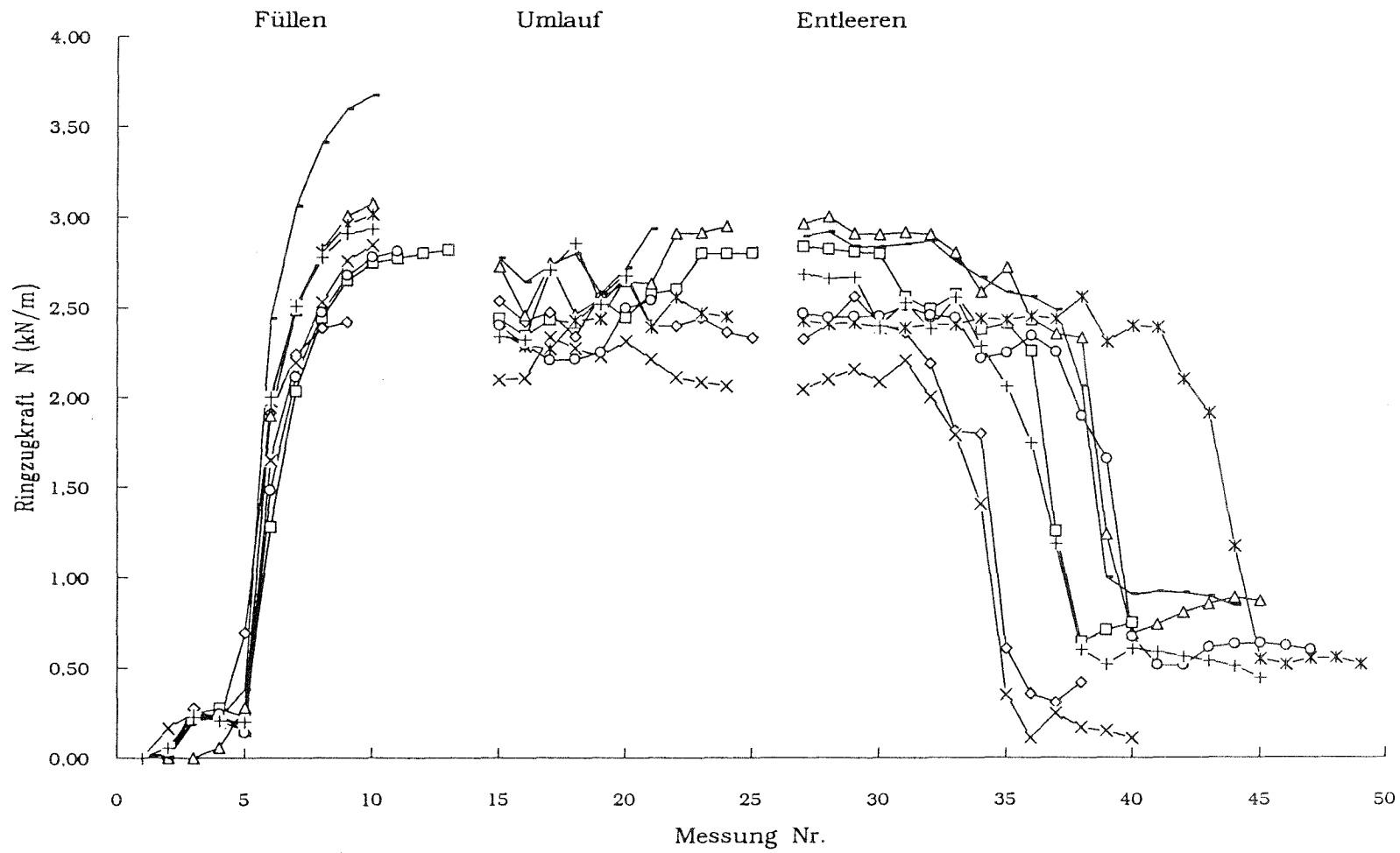


Mittelwert aus den Versuchen EX 1 - EX 8 oberer Horizont



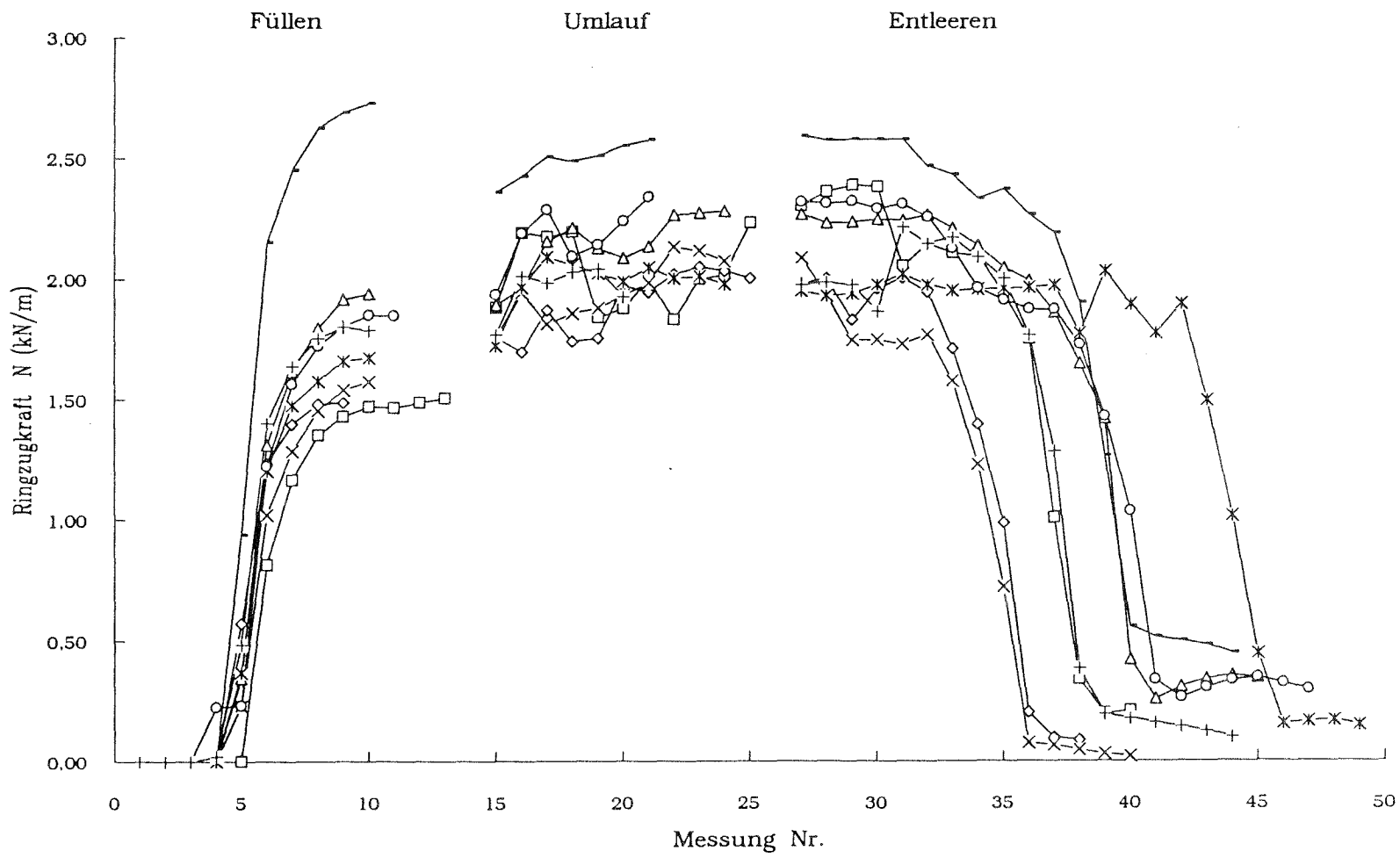
A 4.243

**Mittelwert aus den Versuchen EX 1 - EX 8 mittlerer Horizont**



A 4. 244

Mittelwert aus den Versuchen EX 1 - EX 8 unterer Horizont

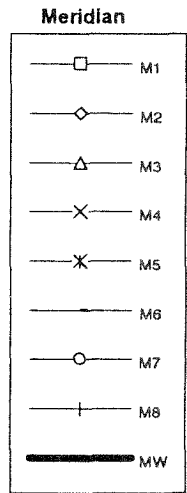
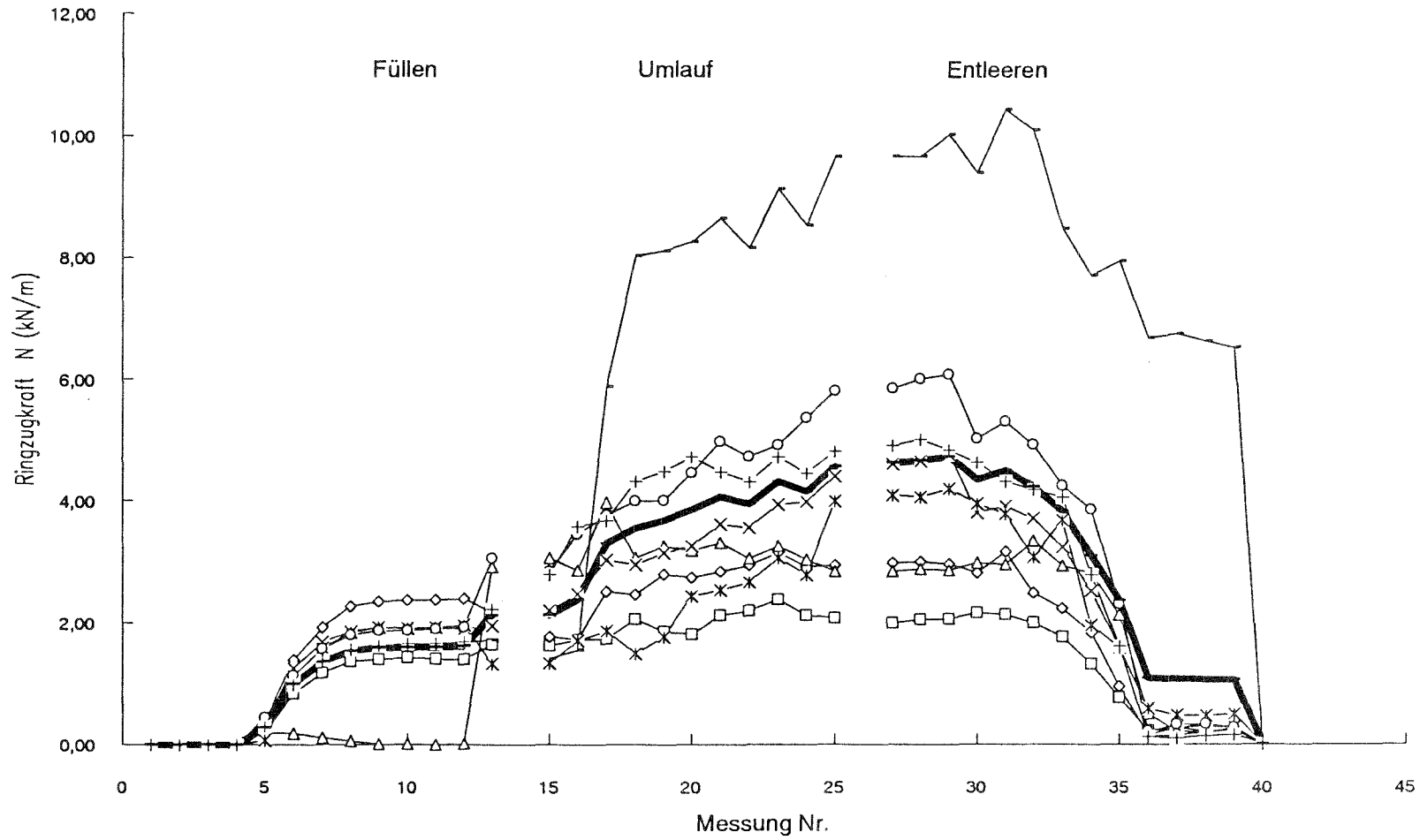


Versuch

- EX 1
- EX 2
- EX 3
- EX 4
- EX 5
- EX 6
- EX 7
- EX 8

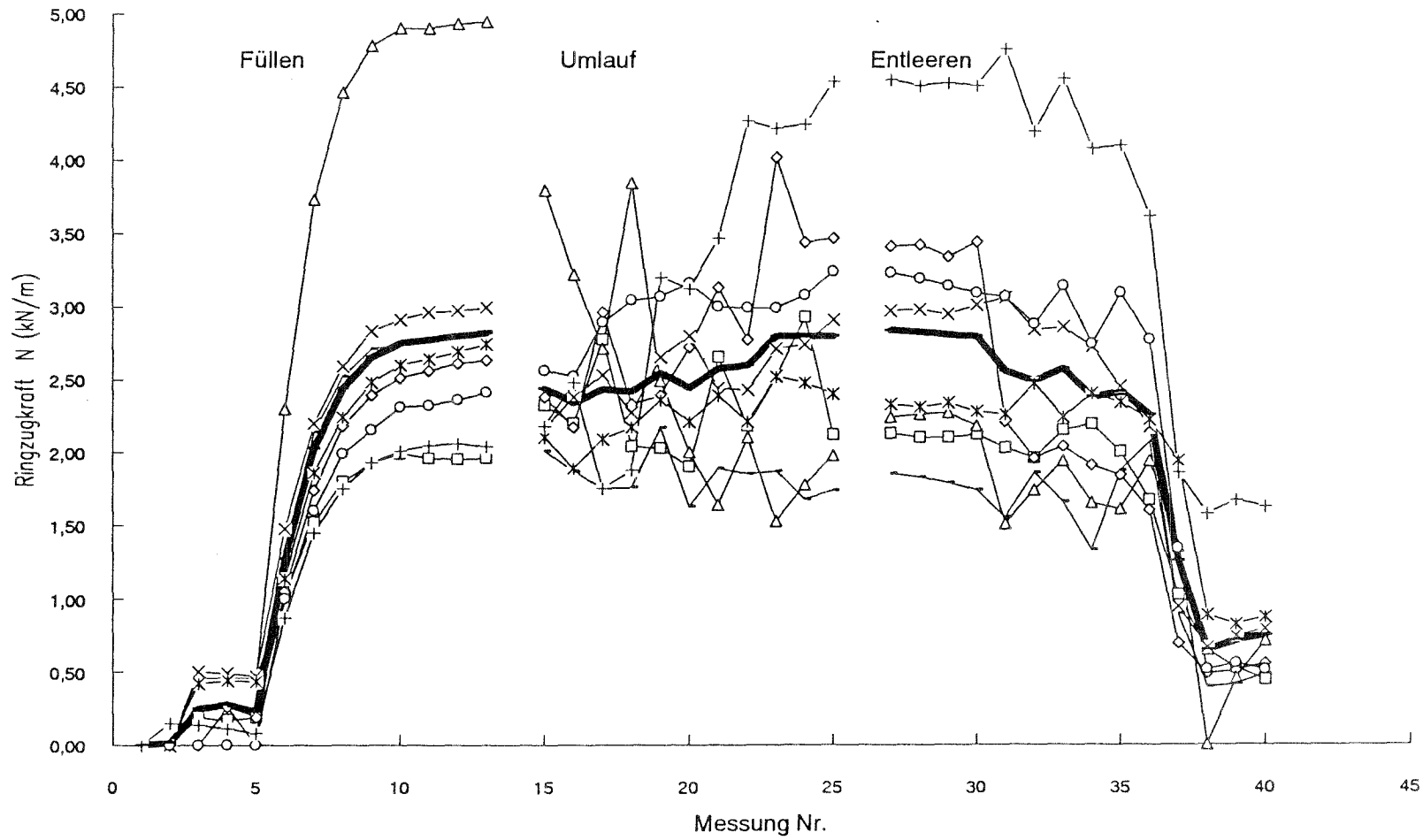
194.245

Versuch EX 1 oberer Horizont



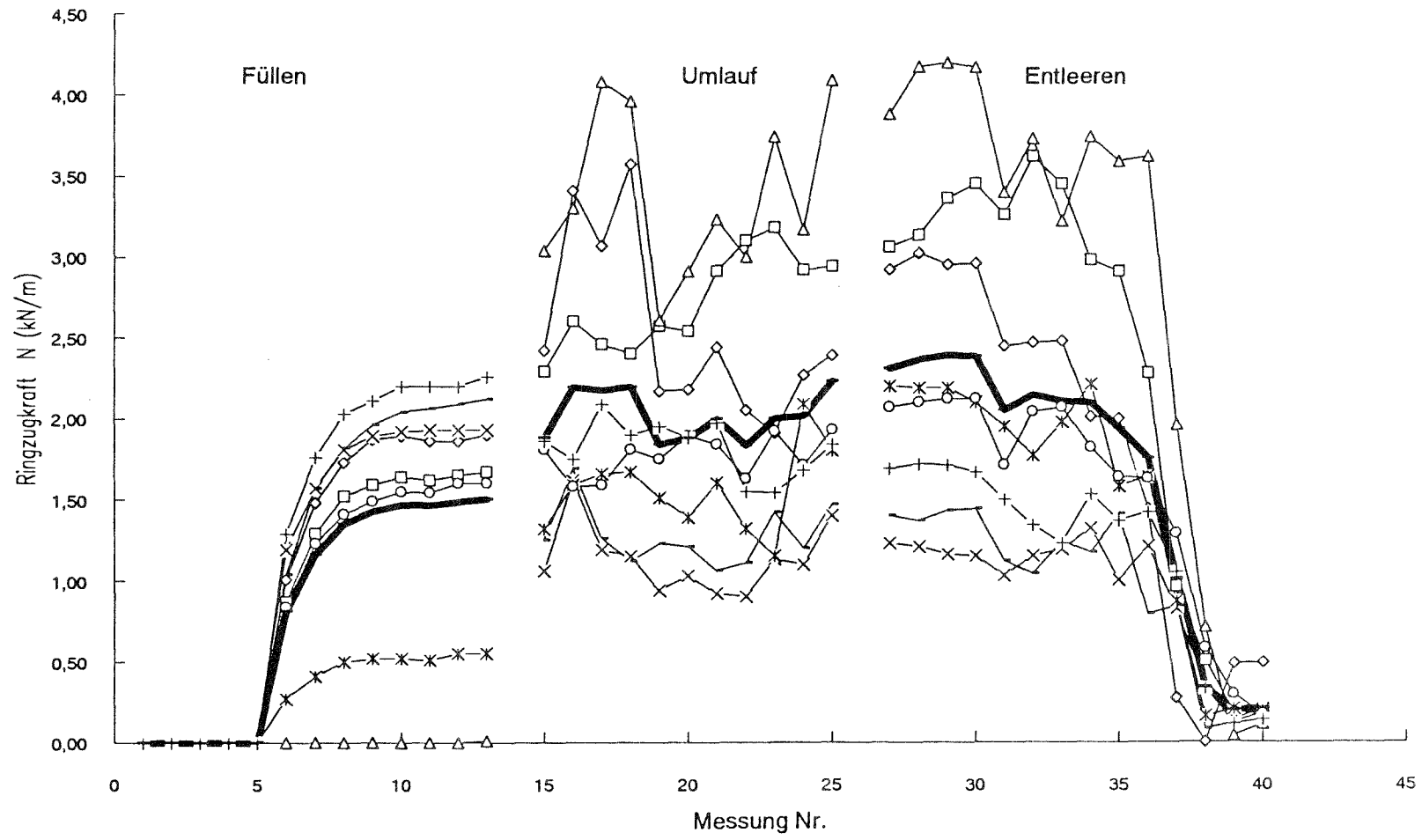
R 41246

# Versuch EX 1 mittlerer Horizont



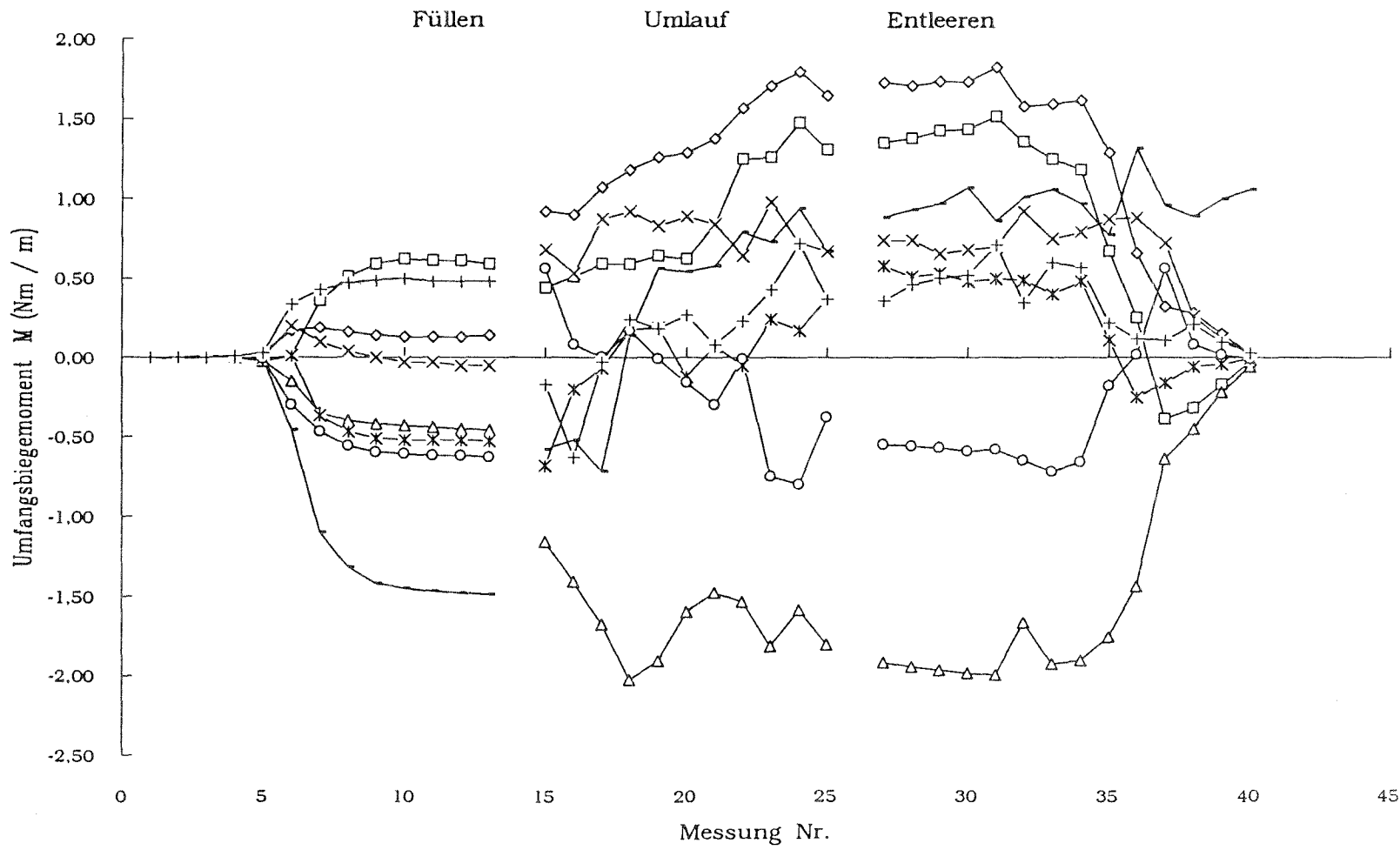
A. 1. 2. 4. 7

Versuch EX 1 unterer Horizont



17 4.248

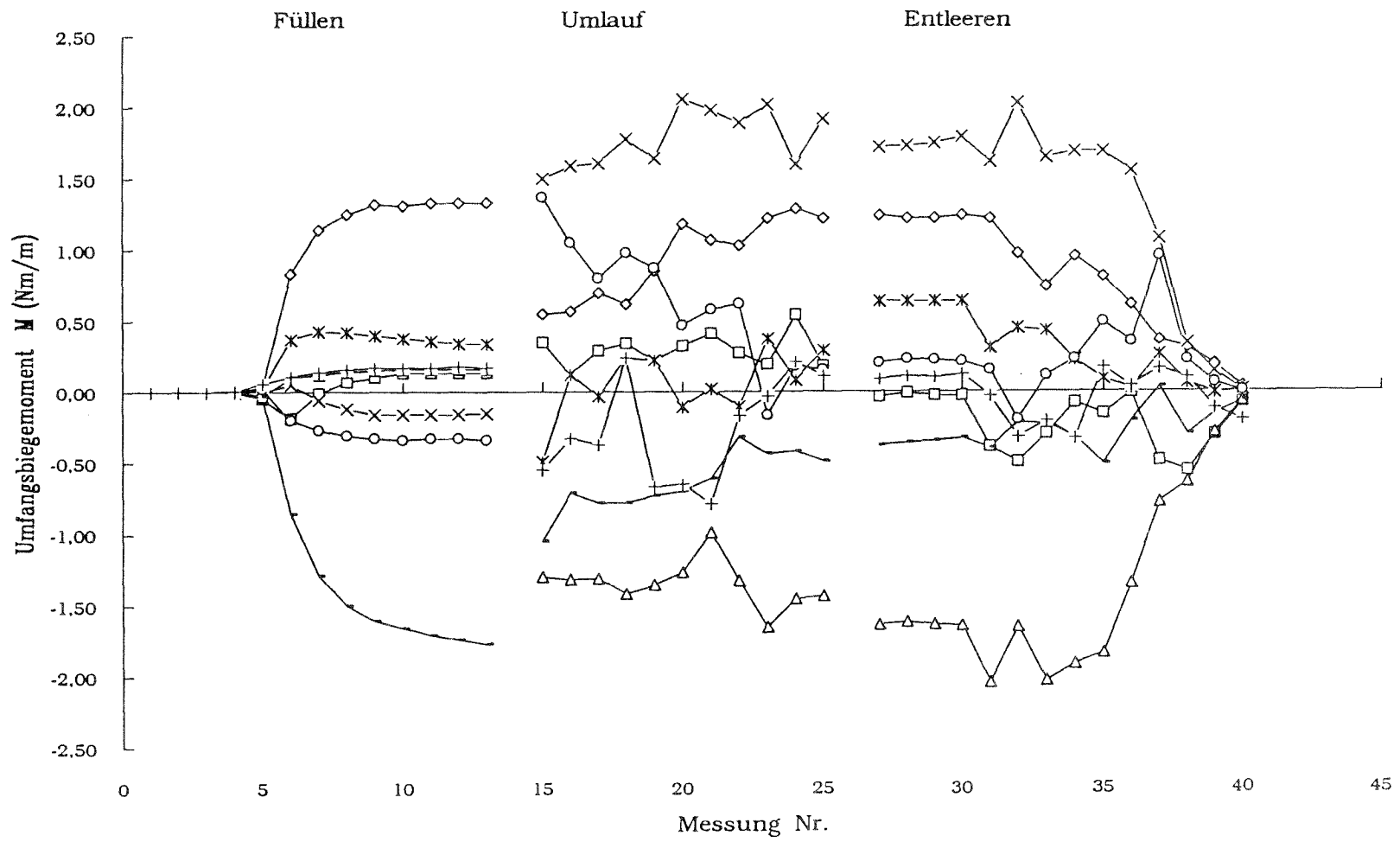
# Versuch EX 1 oberer Horizont



- Meridian**
- M1
  - ◇— M2
  - △— M3
  - ×— M4
  - \*— M5
  - M6
  - M7
  - +— M8

A 4. 249

# Versuch EX 1 mittlerer Horizont

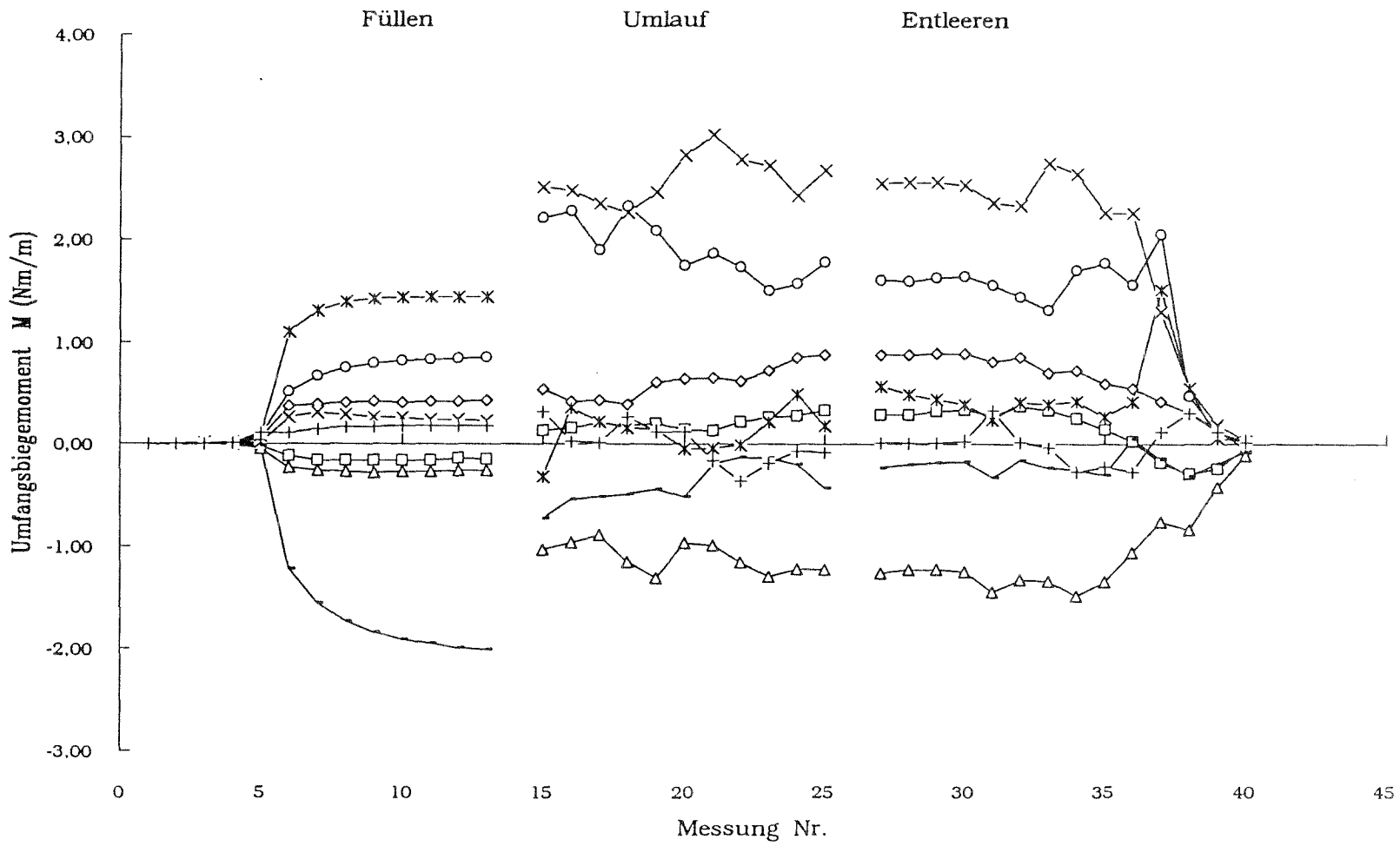


- Meridian**
- M1
  - ◇— M2
  - △— M3
  - ×— M4
  - \*— M5
  - +— M6
  - M7
  - +— M8

A4.250



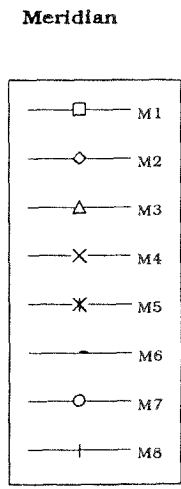
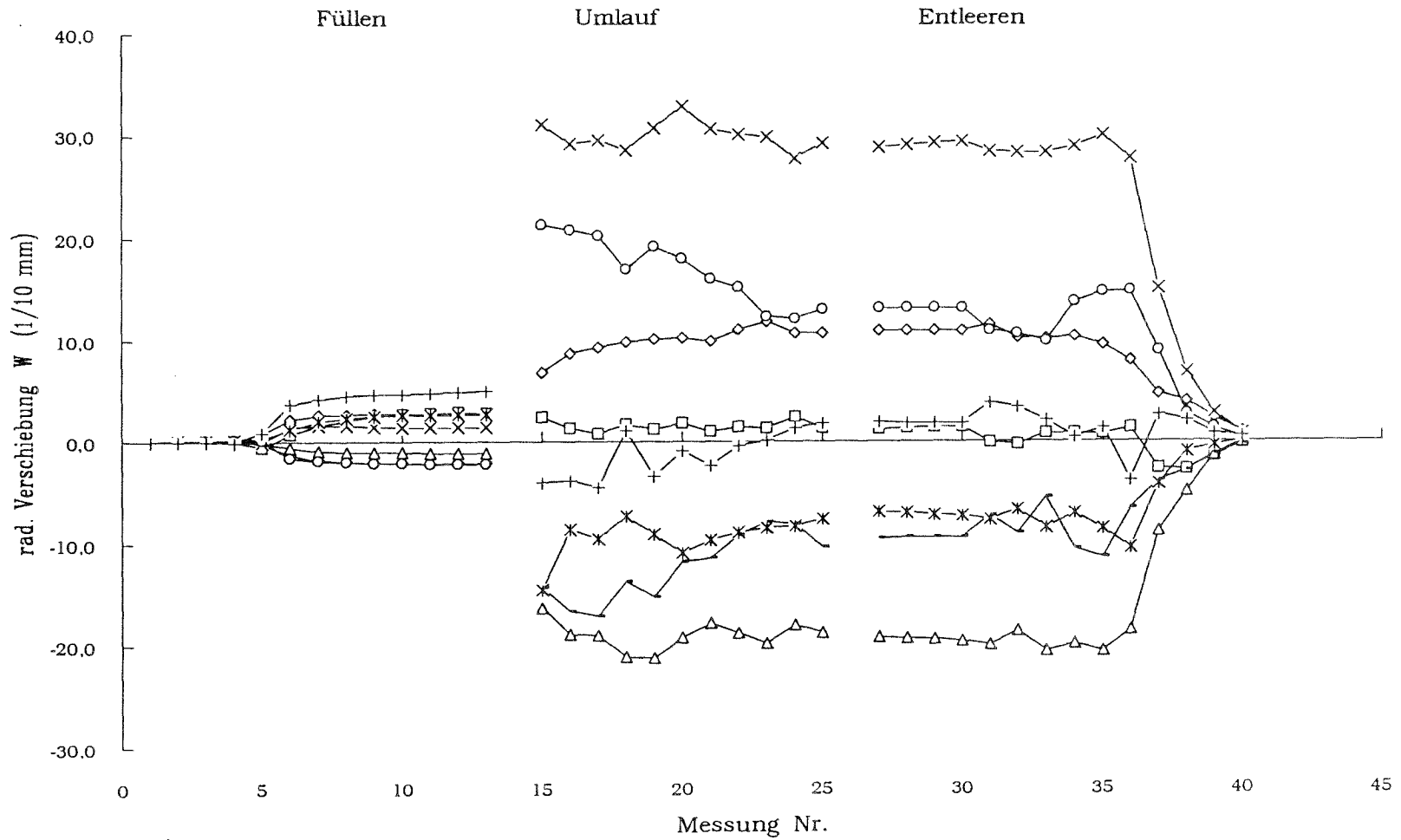
**Versuch EX 1 unterer Horizont**



- Meridian**
- M1
  - ◇— M2
  - △— M3
  - ×— M4
  - ×— M5
  - +— M6
  - M7
  - +— M8

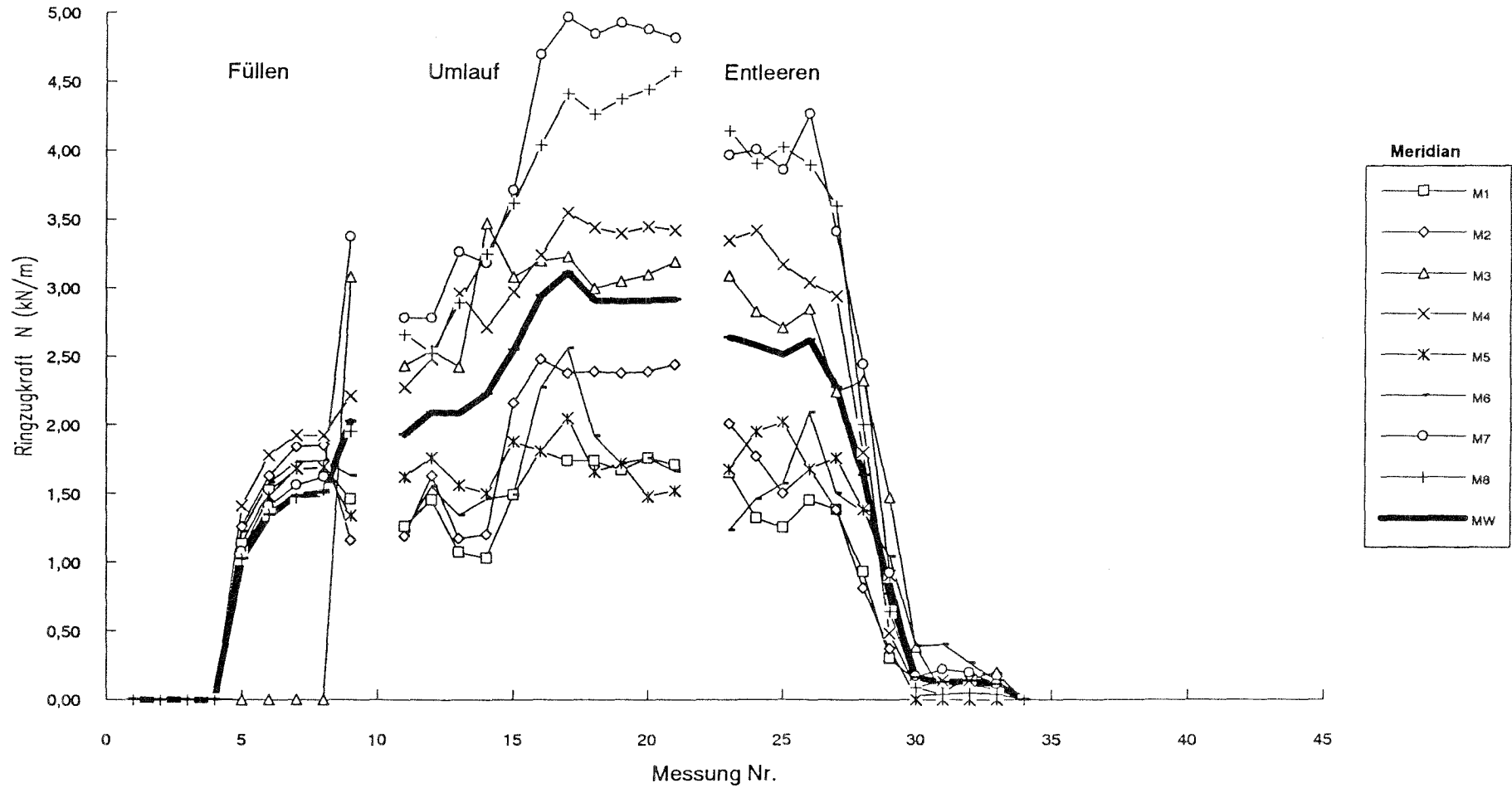
R4.25A

# Versuch EX 1 mittlerer Horizont



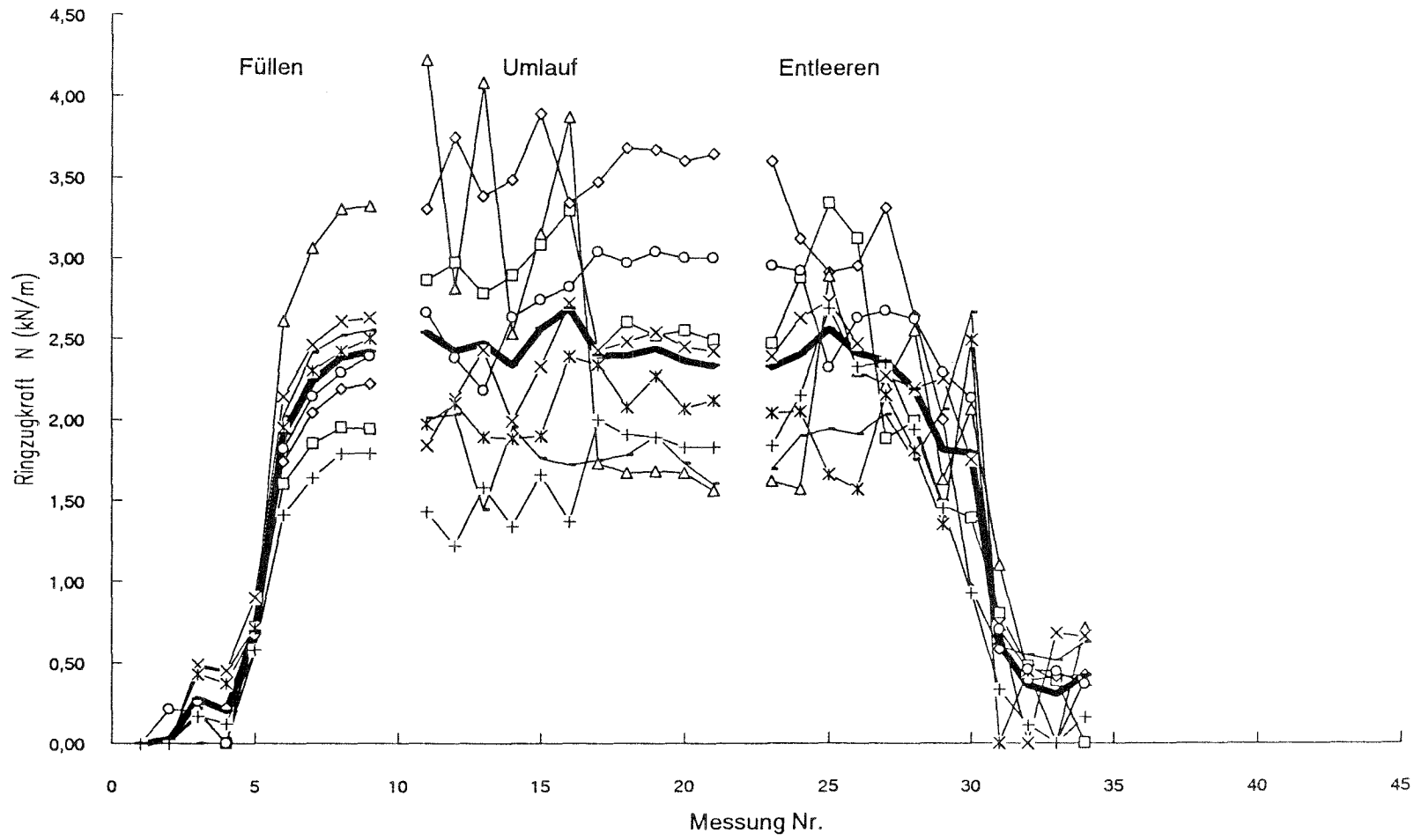
174.252

### Versuch EX 2 oberer Horizont



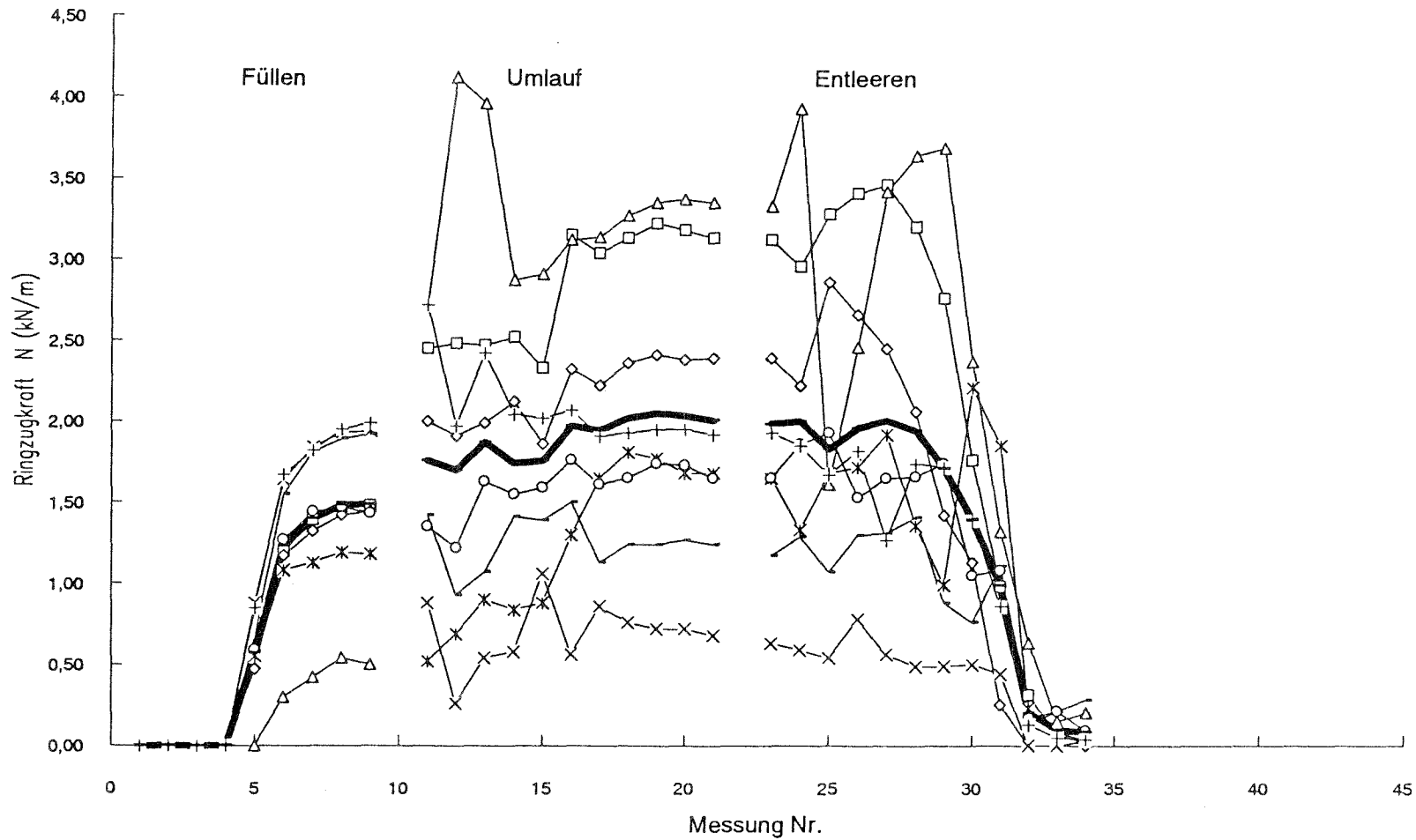
A. 4. 253

# Versuch EX 2 mittlerer Horizont



A 4.254

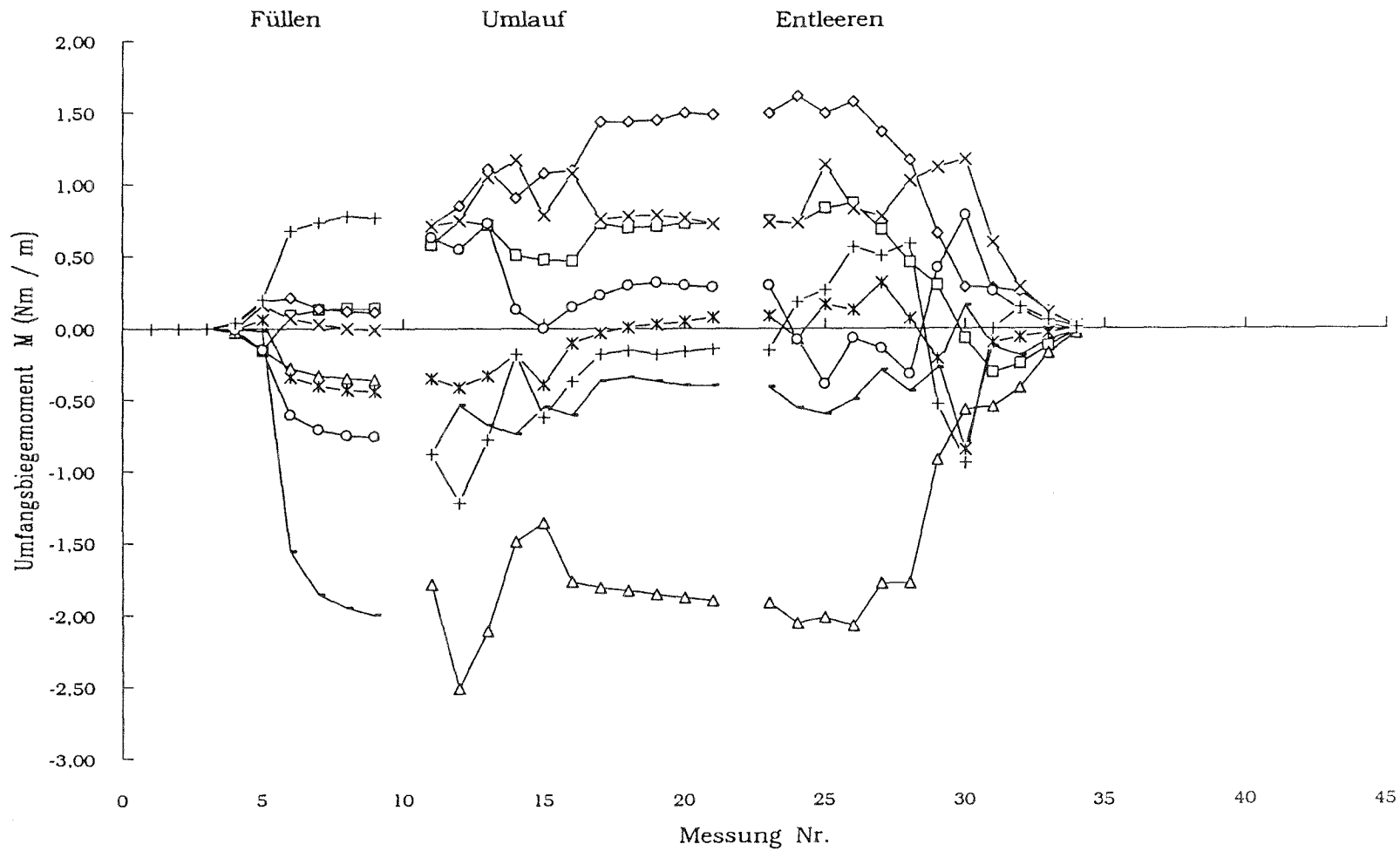
Versuch EX 2 unterer Horizont



- Meridian
- M1
  - ◇— M2
  - △— M3
  - ×— M4
  - \*— M5
  - +— M6
  - M7
  - +— M8
  - MW

A4.255

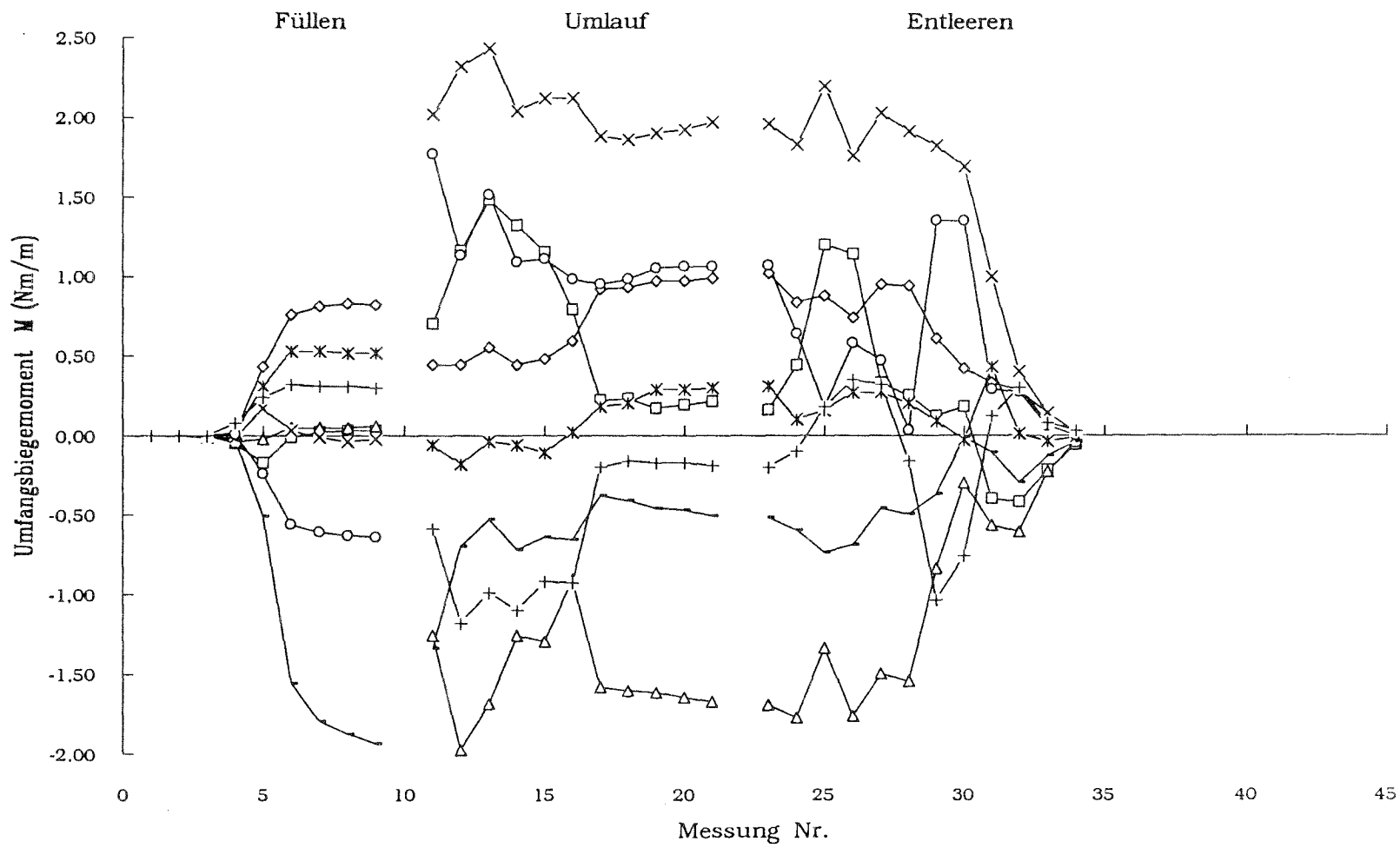
**Versuch EX 2 oberer Horizont**



- Meridian**
- M1
  - ◇— M2
  - △— M3
  - ×— M4
  - \*— M5
  - +— M6
  - M7
  - |— M8

174.256

# Versuch EX 2 mittlerer Horizont

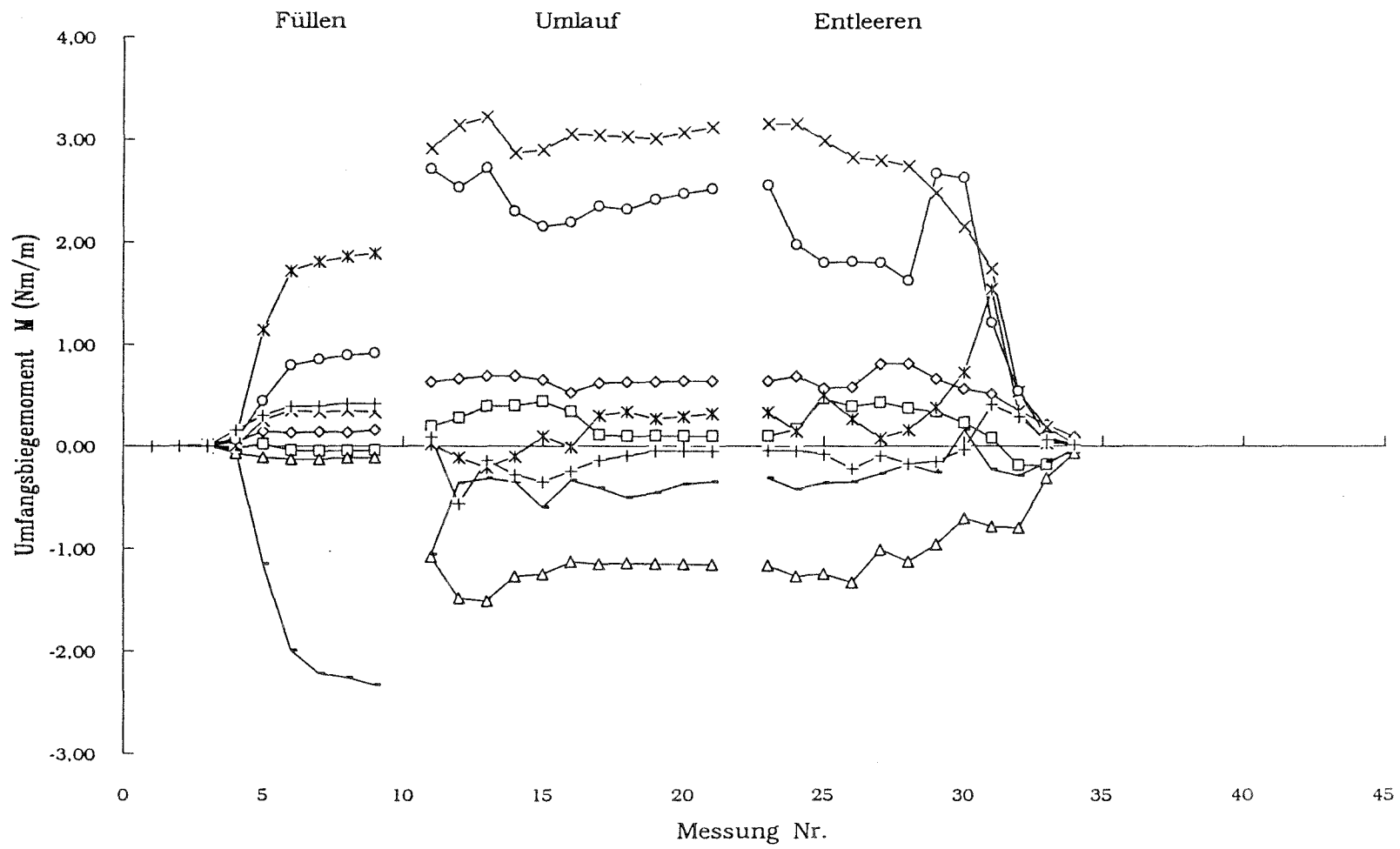


Meridian

- M1
- ◇— M2
- △— M3
- ×— M4
- \*— M5
- +— M6
- M7
- +— M8

19.4.257

# Versuch EX 2 unterer Horizont



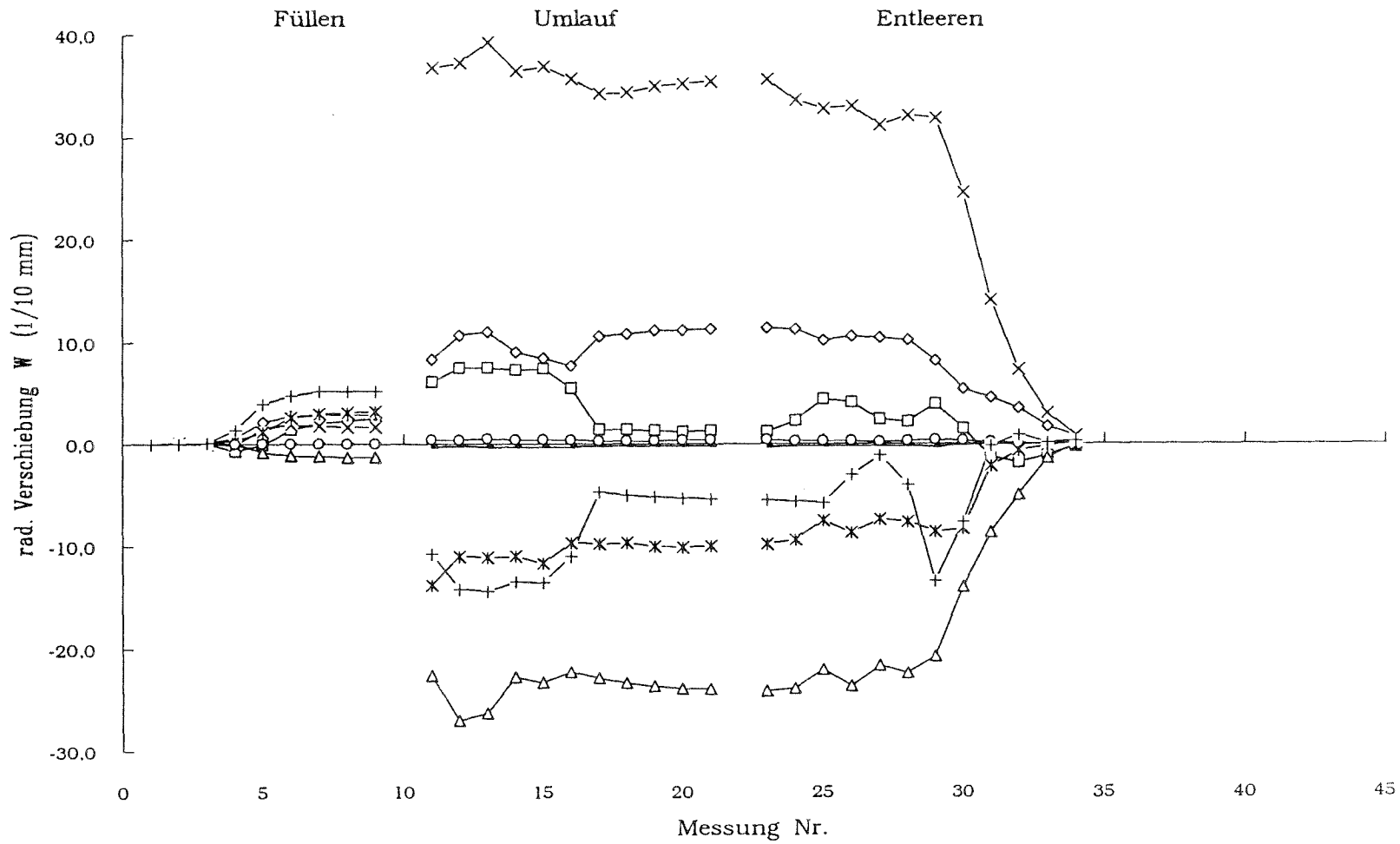
Meridian

- M1
- ◇— M2
- △— M3
- ×— M4
- \*— M5
- +— M6
- M7
- +— M8

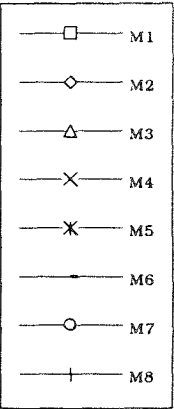
A 4.258



# Versuch EX 2 mittlerer Horizont

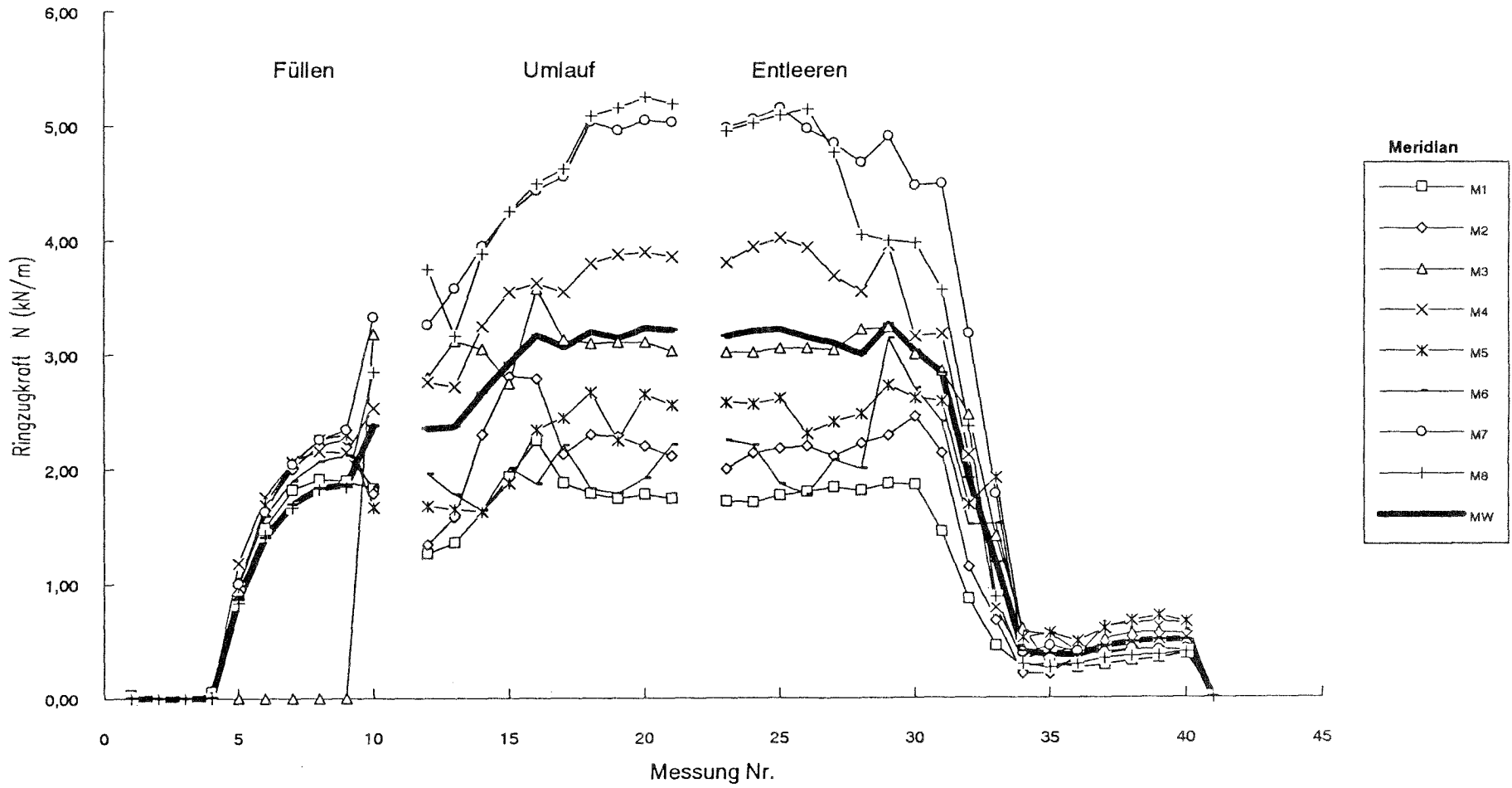


Meridian



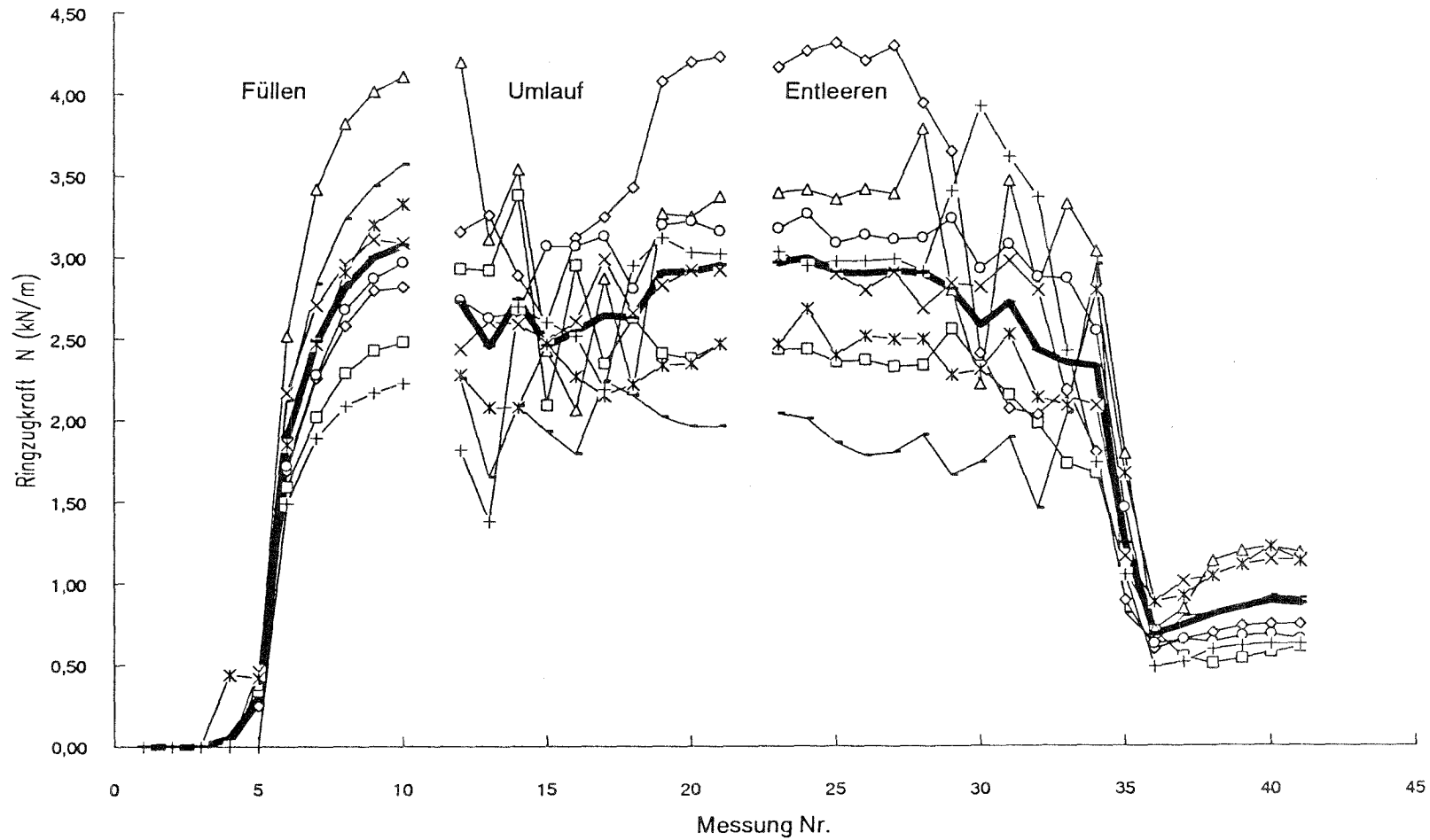
A4.259

### Versuch EX 3 oberer Horizont



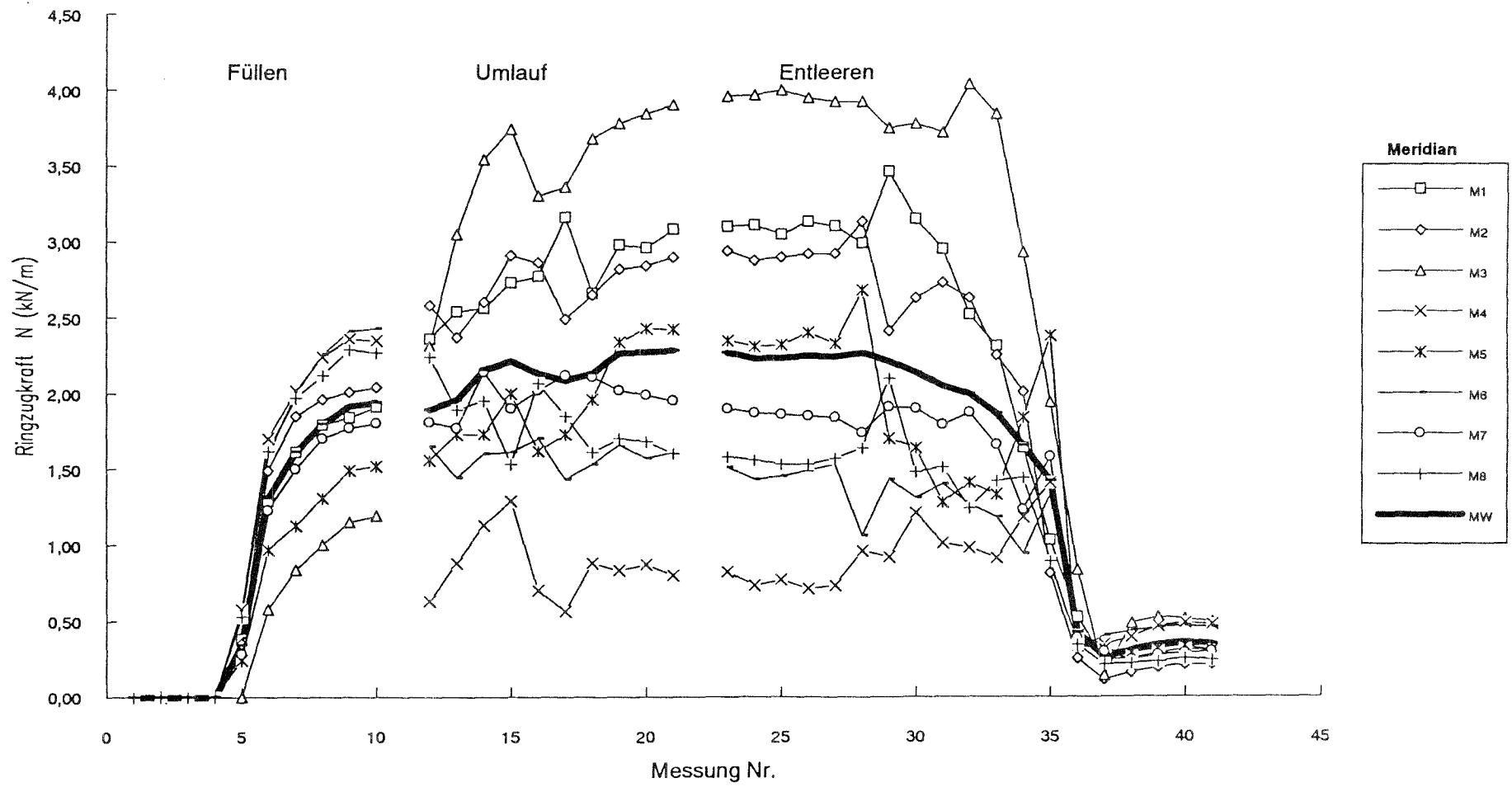
PA 4.260

Versuch EX 3 mittlerer Horizont



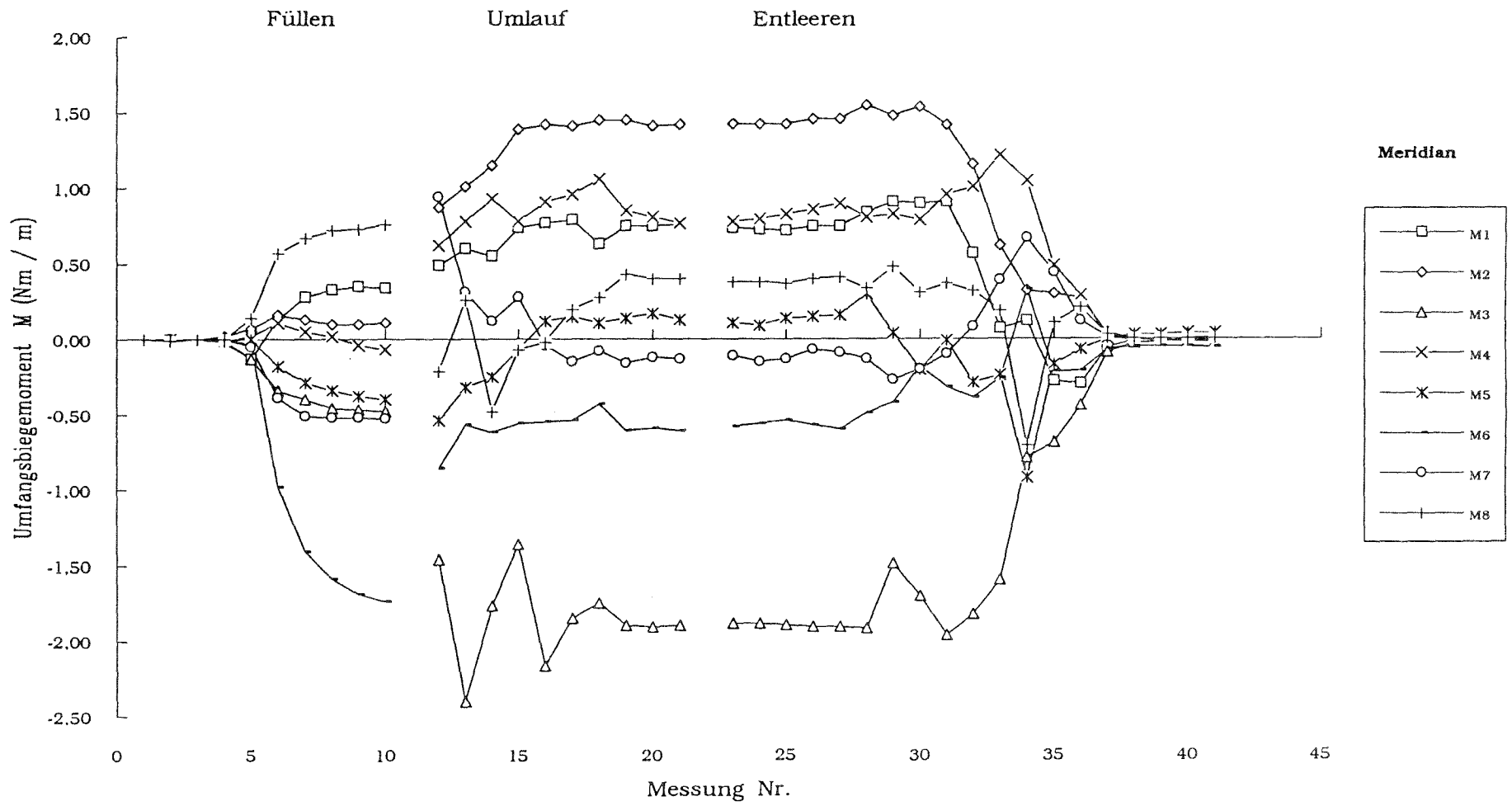
Pl. 261

# Versuch EX 3 unterer Horizont



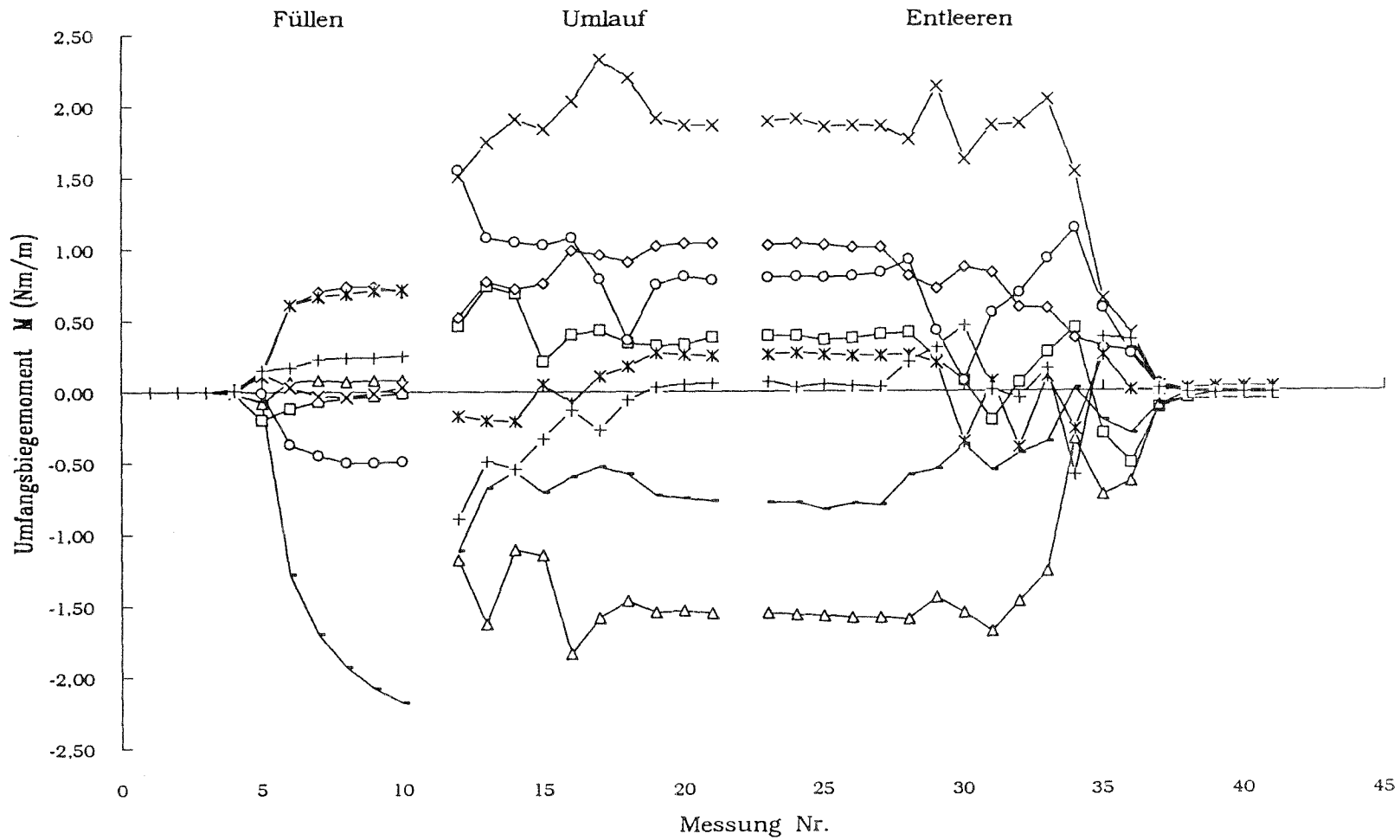
A 4.262

# Versuch EX 3 oberer Horizont



A4.263

# Versuch EX 3 mittlerer Horizont

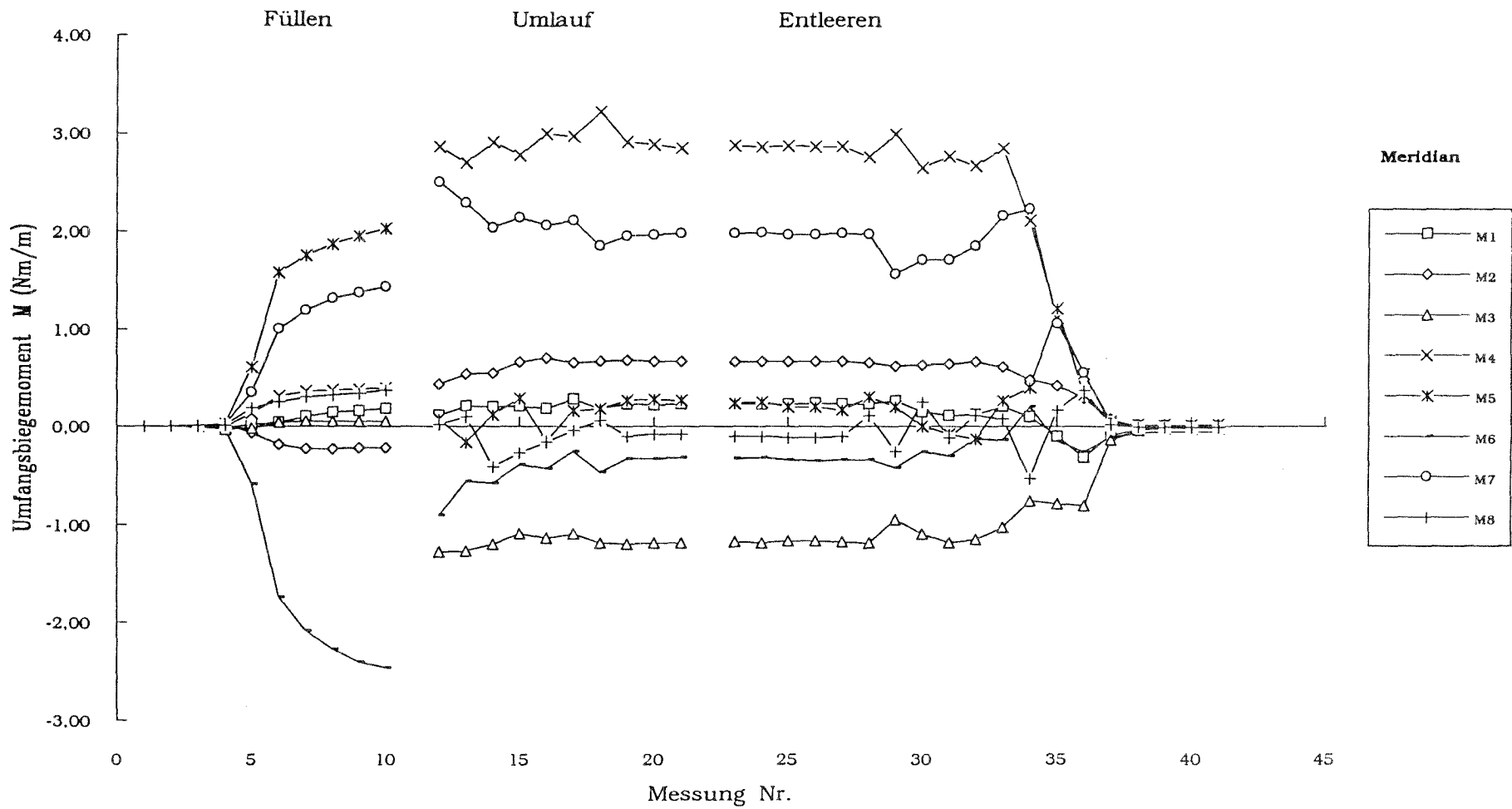


Meridian

- M1
- ◇— M2
- △— M3
- ×— M4
- \*— M5
- M6
- M7
- +— M8

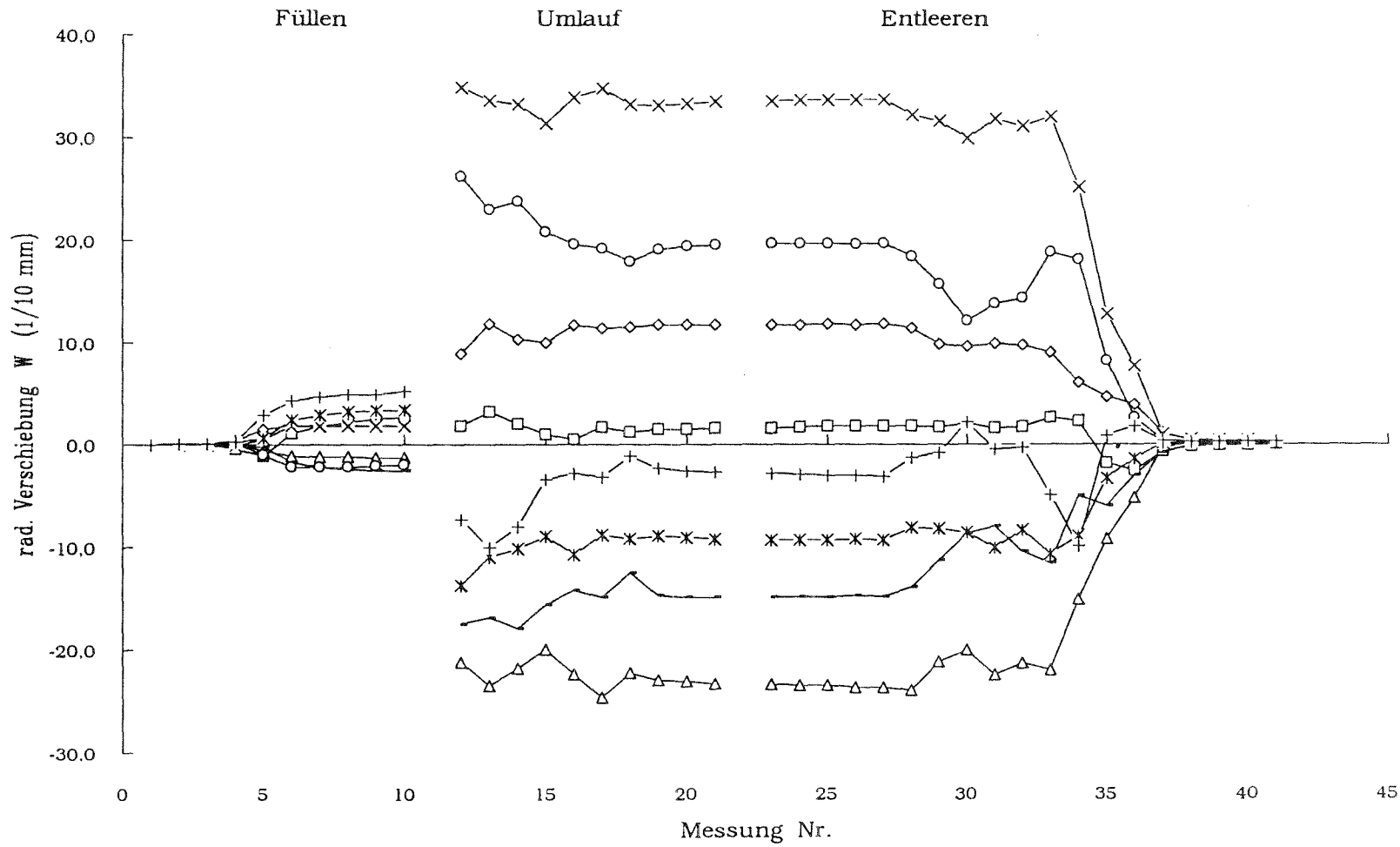
P 4.264

# Versuch EX 3 unterer Horizont



14.2.65

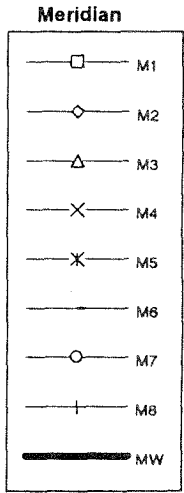
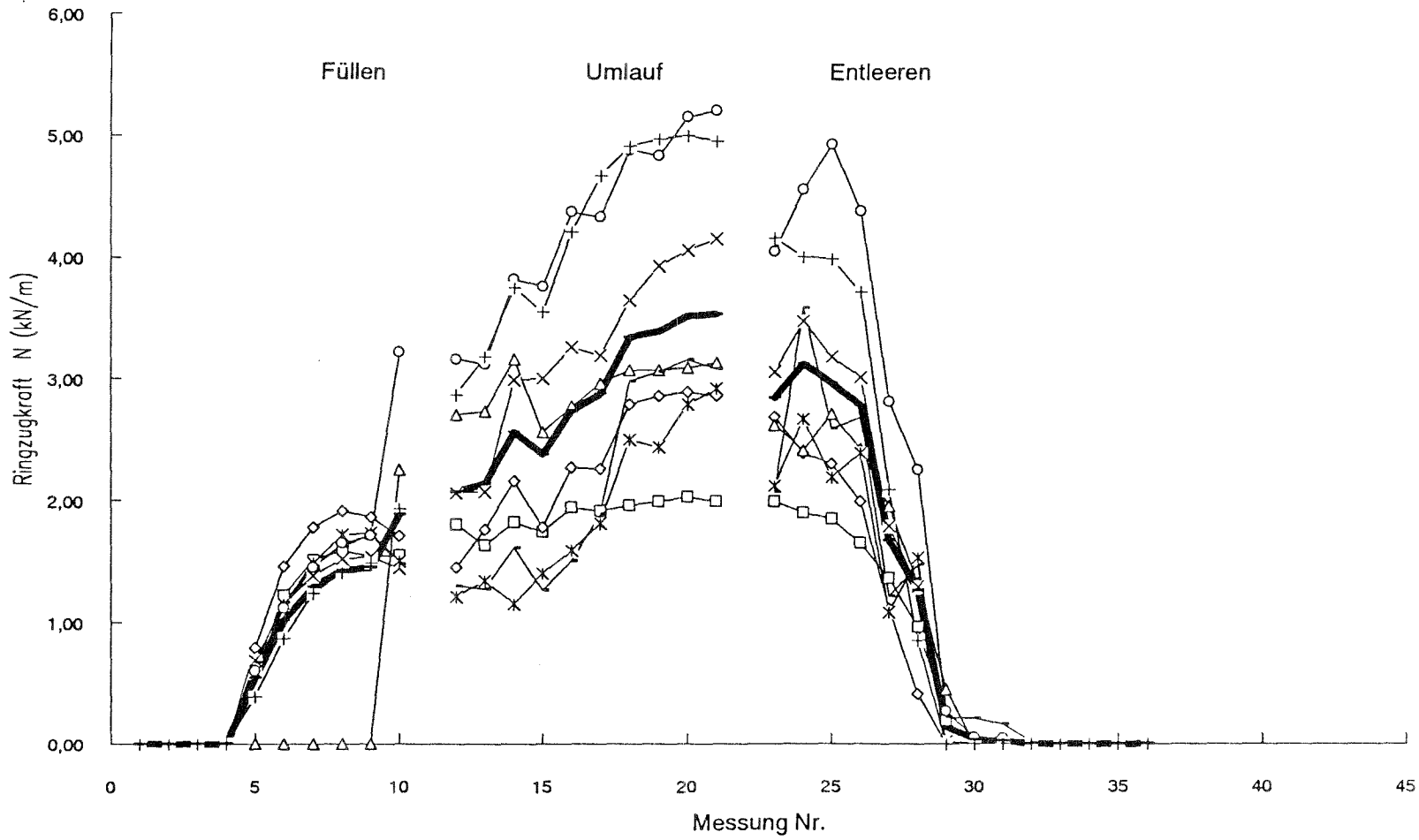
# Versuch EX 3 mittlerer Horizont



A 4.266

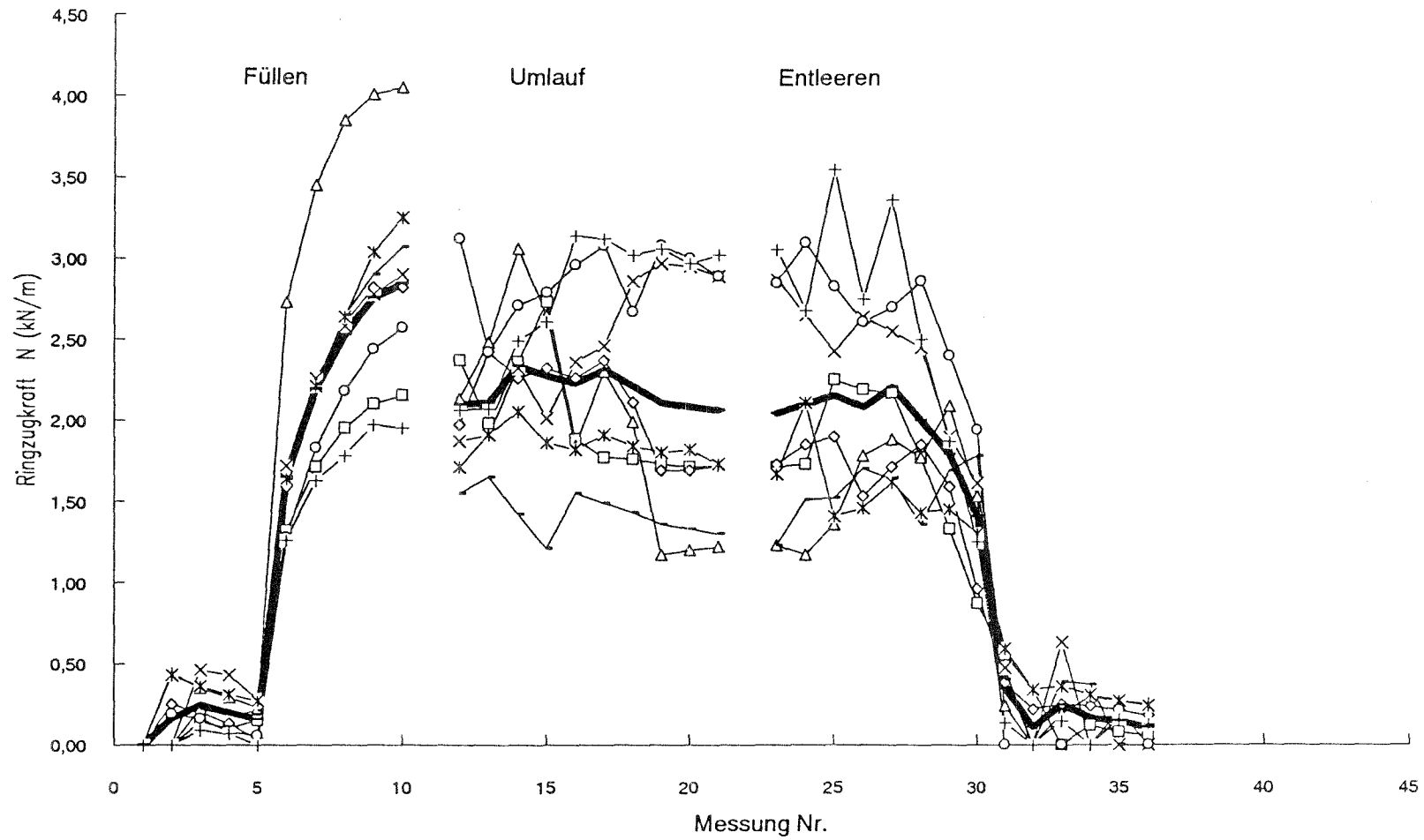


Versuch EX 4 oberer Horizont



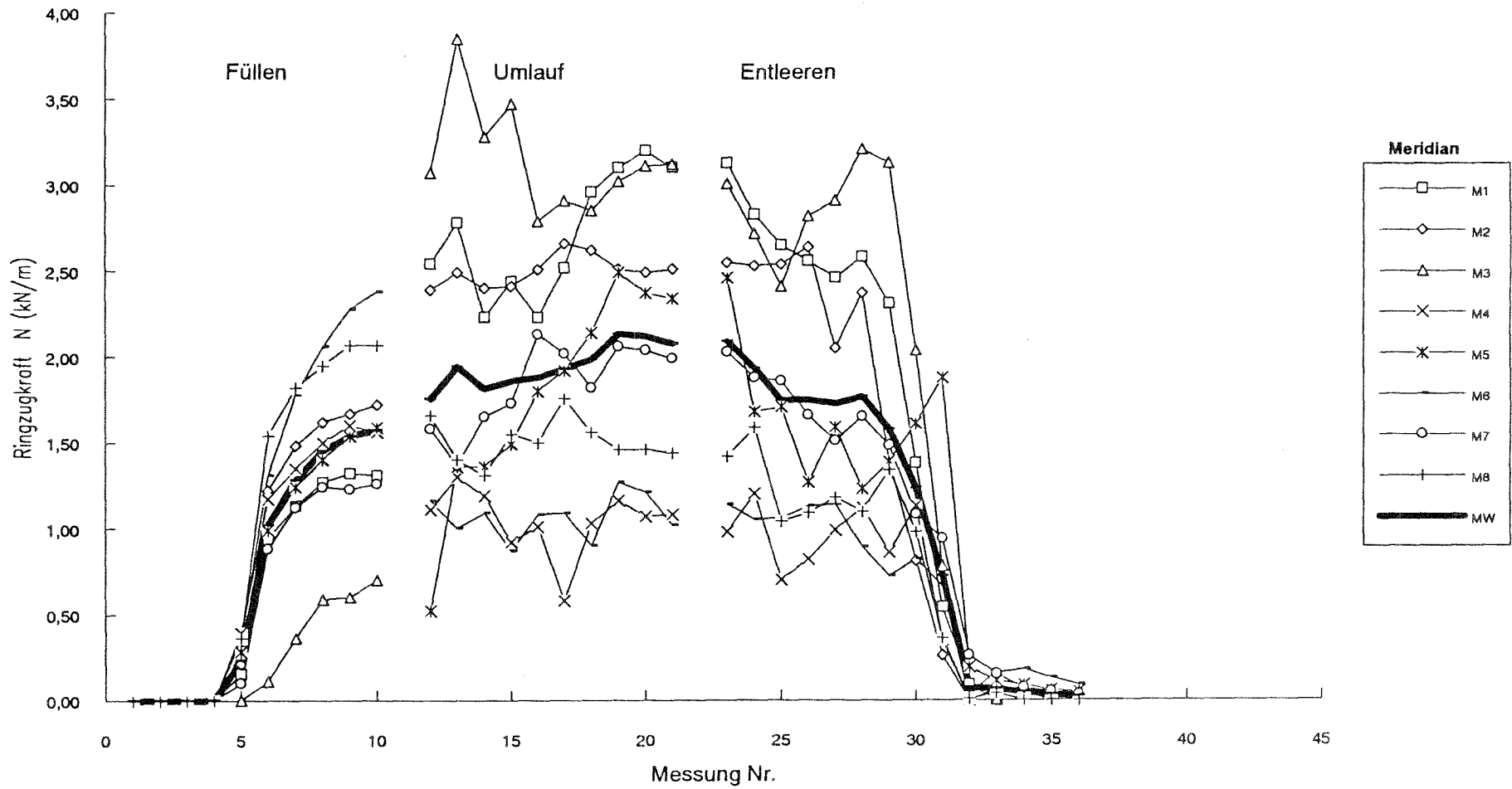
A 4.267

Versuch EX 4 mittlerer Horizont



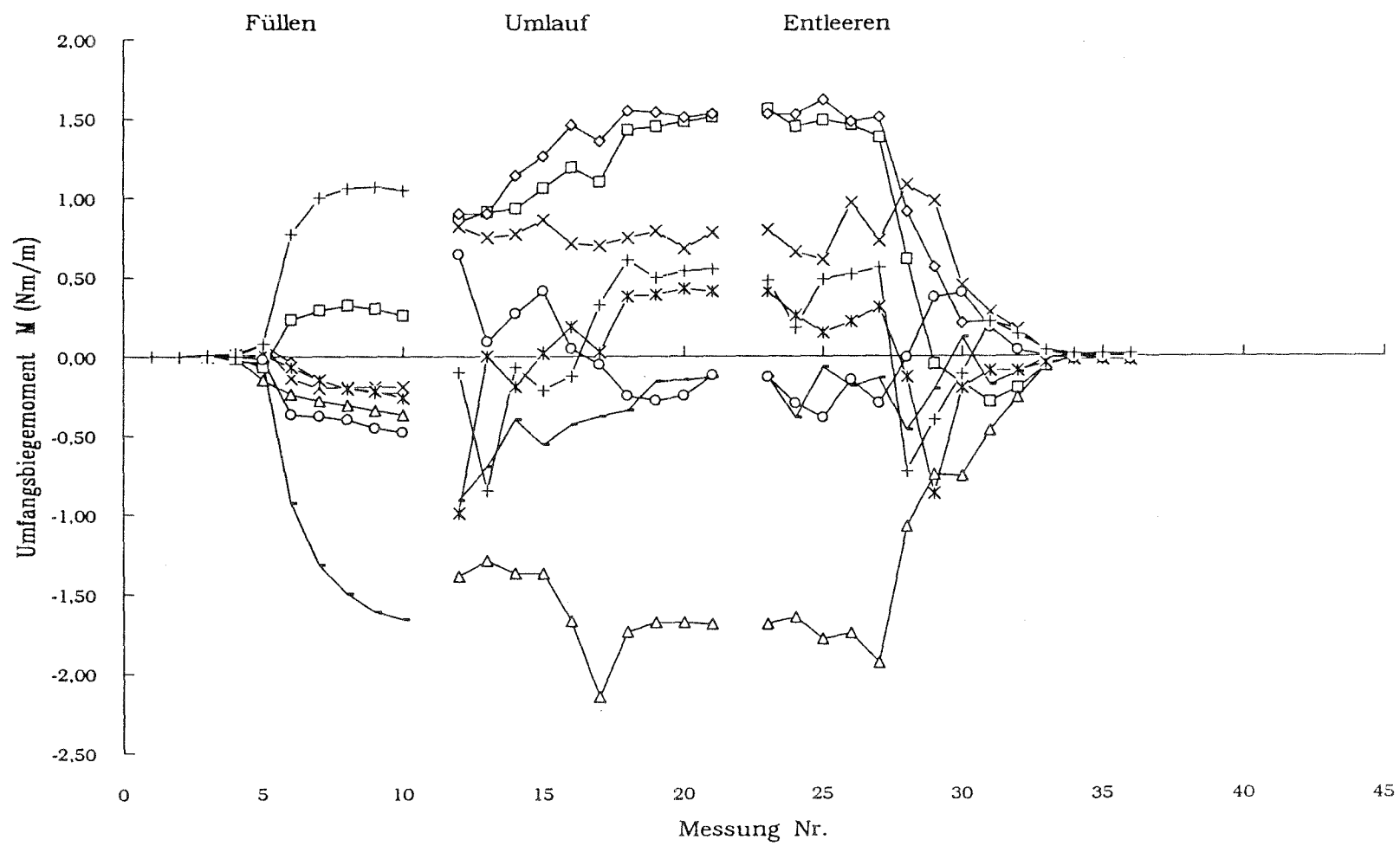
A4.268

Versuch EX 4 unterer Horizont



A 4. 269

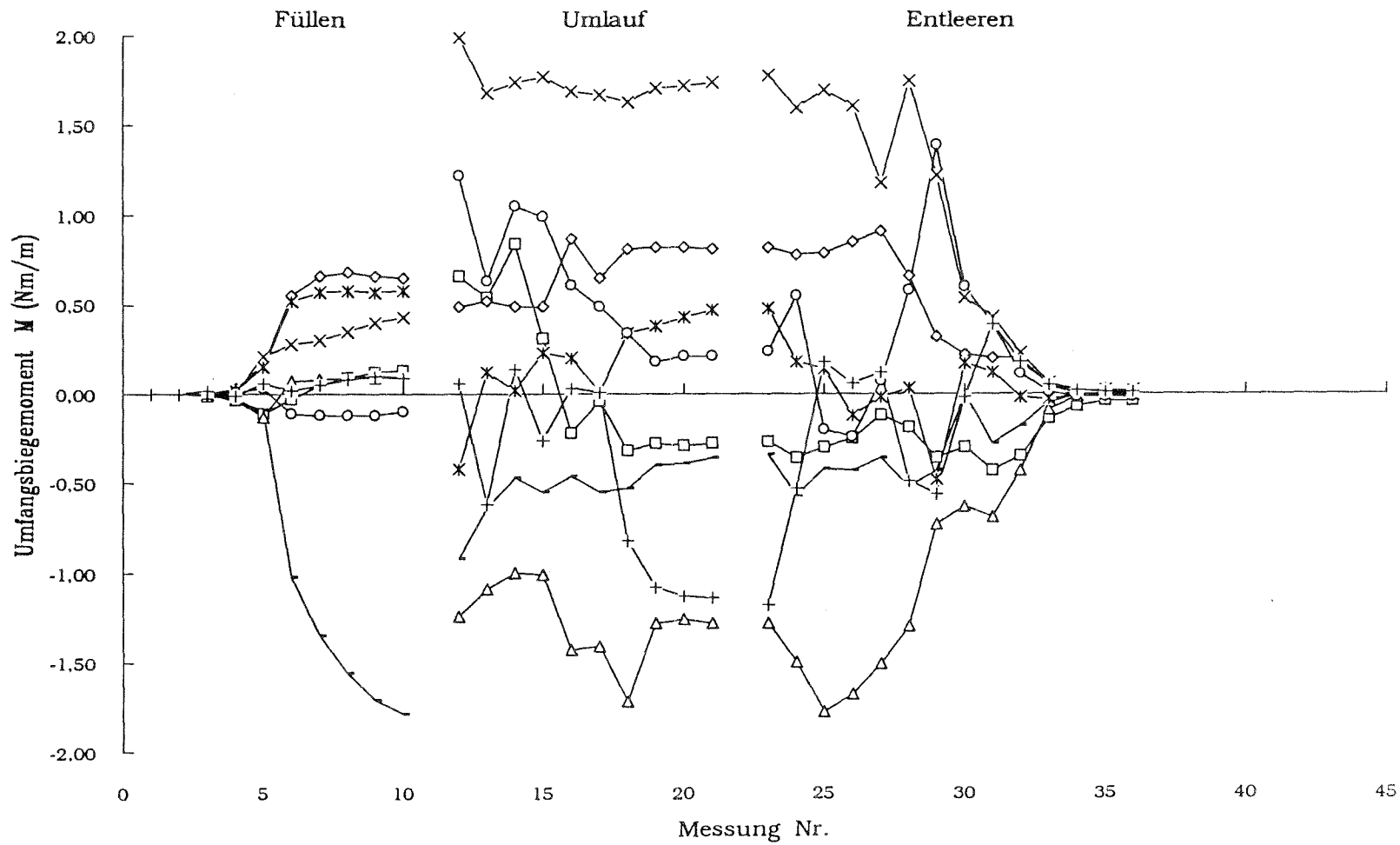
**Versuch EX 4 oberer Horizont**



- Meridian**
- M1
  - ◇— M2
  - △— M3
  - ×— M4
  - \*— M5
  - — M6
  - M7
  - +— M8

A4.270

**Versuch EX 4 mittlerer Horizont**

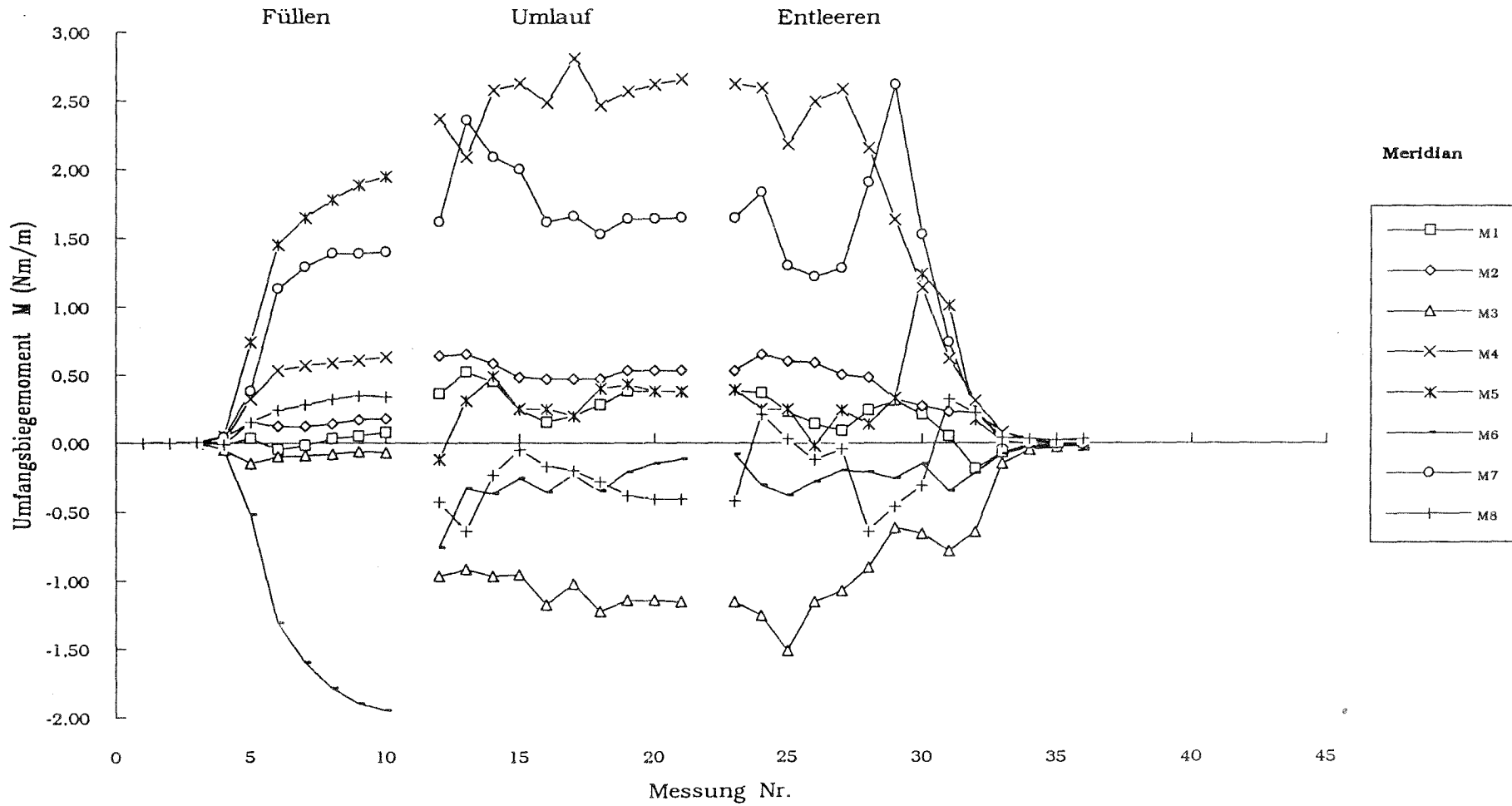


Meridian

- M1
- ◇— M2
- △— M3
- ×— M4
- \*— M5
- — M6
- M7
- +— M8

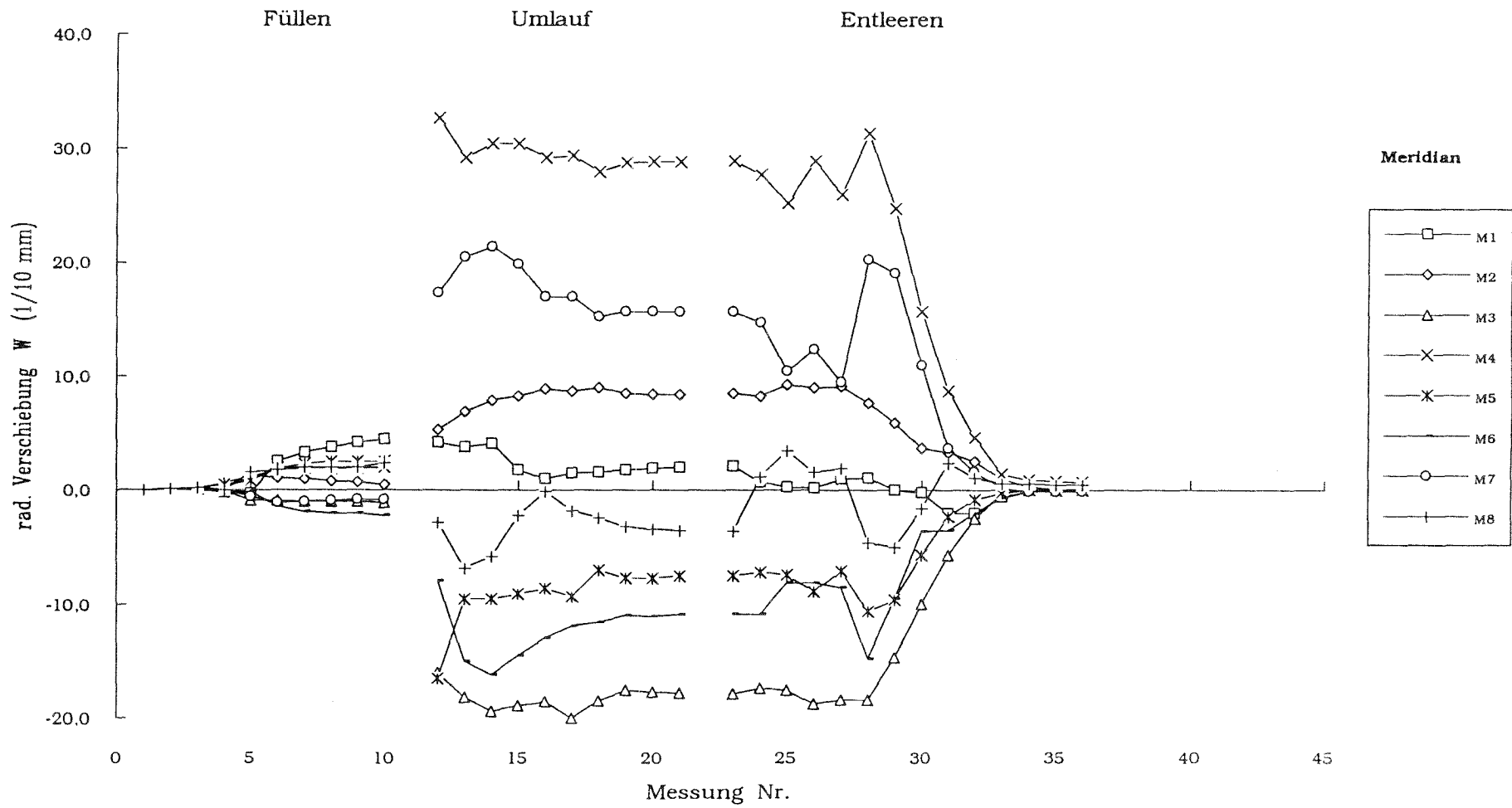
11.11.71

# Versuch EX 4 unterer Horizont



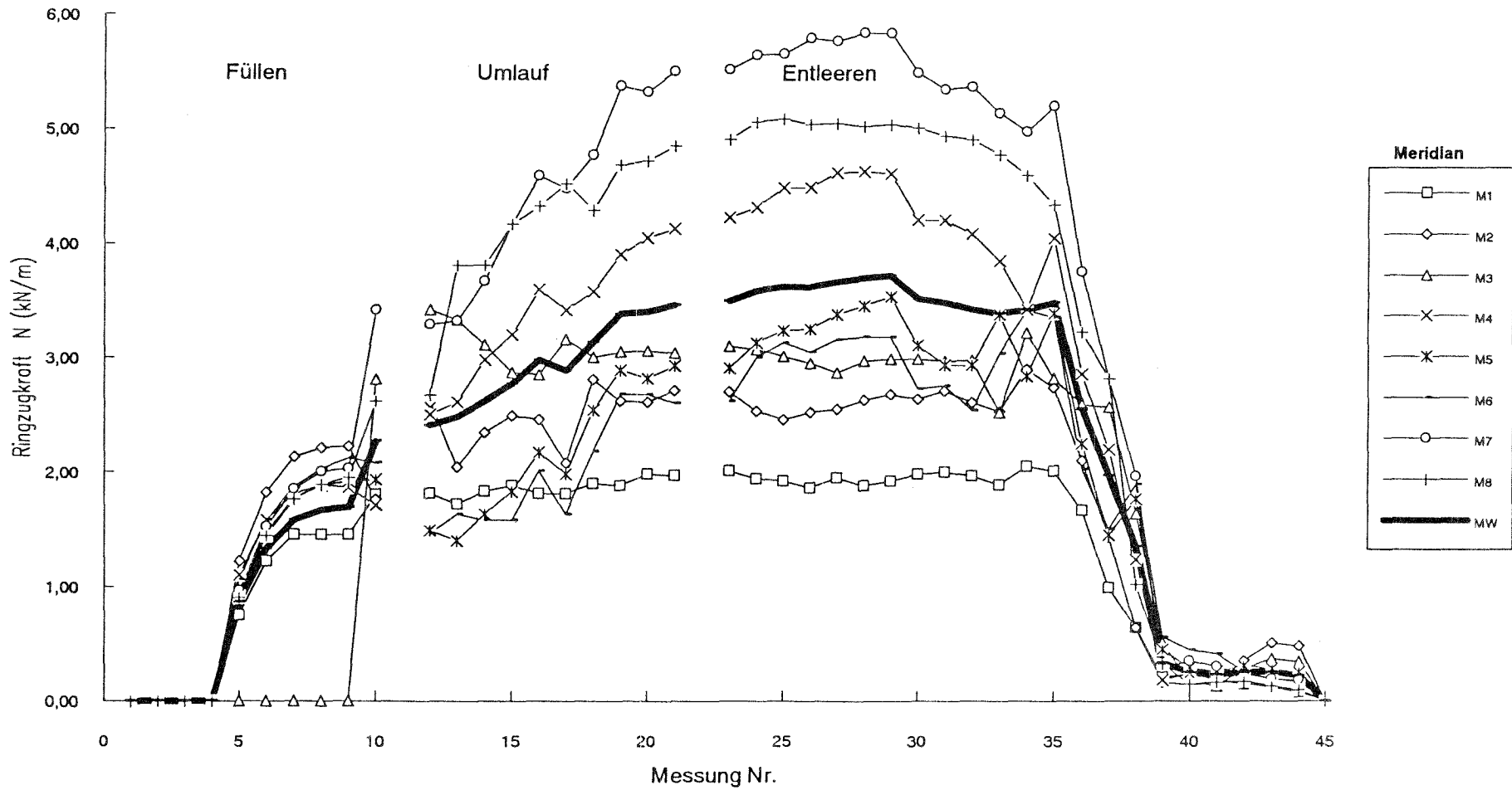
A 4.272

# Versuch EX 4 mittlerer Horizont



A 4. 273

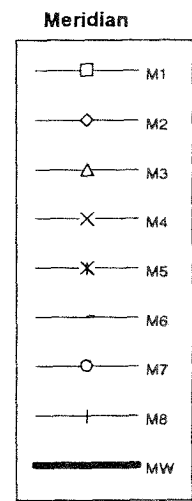
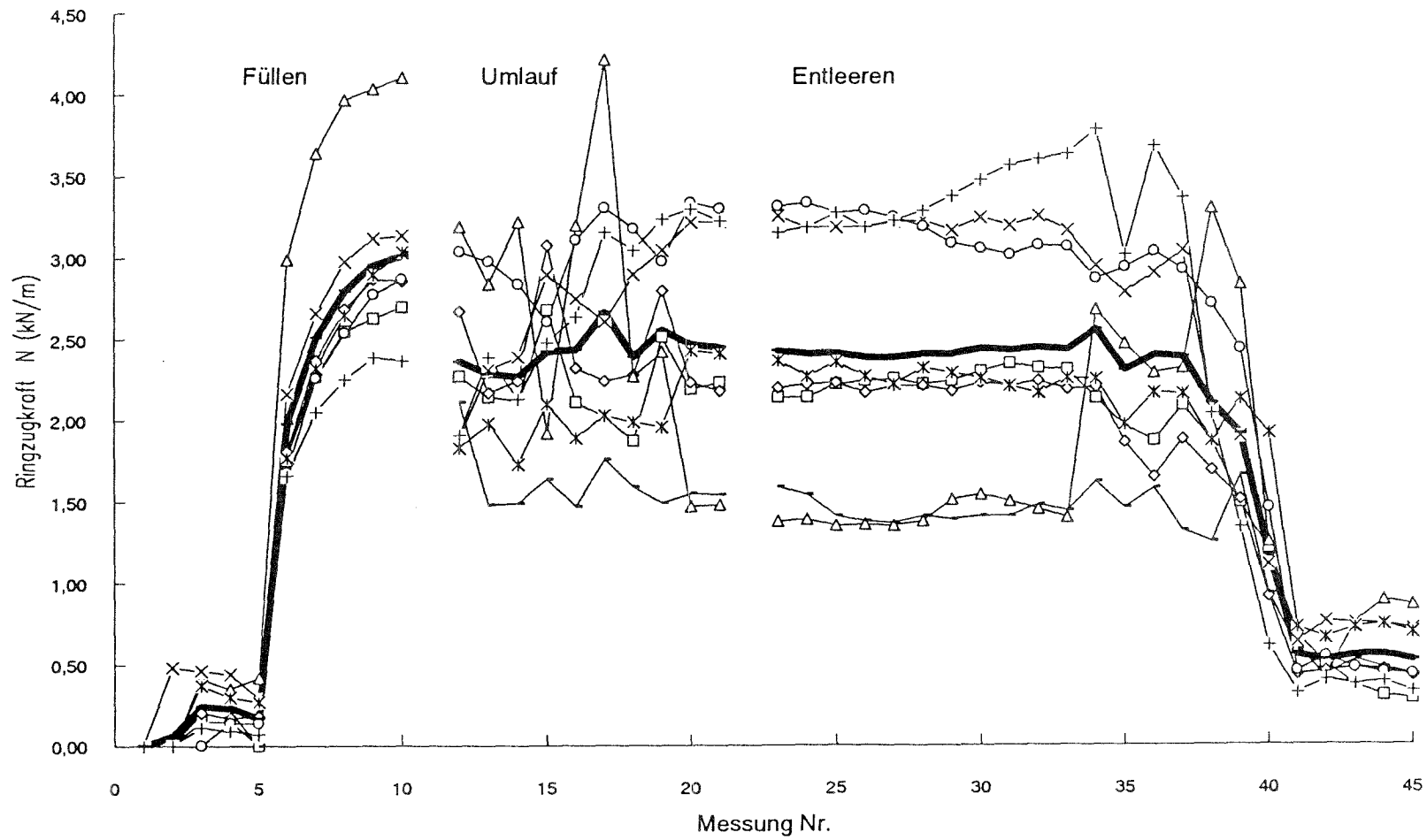
Versuch EX 5 oberer Horizont



11.11.2014

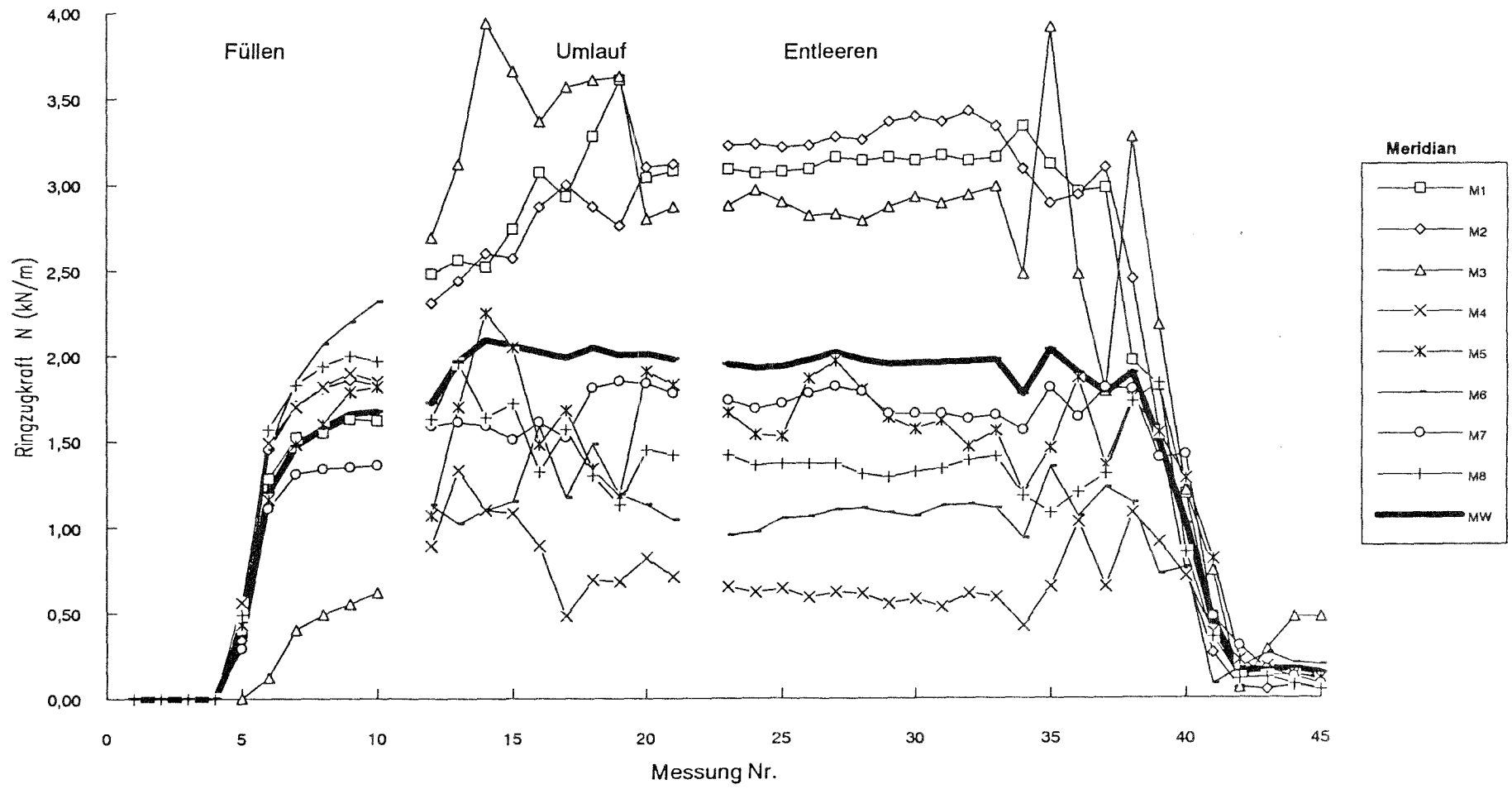


# Versuch EX 5 mittlerer Horizont



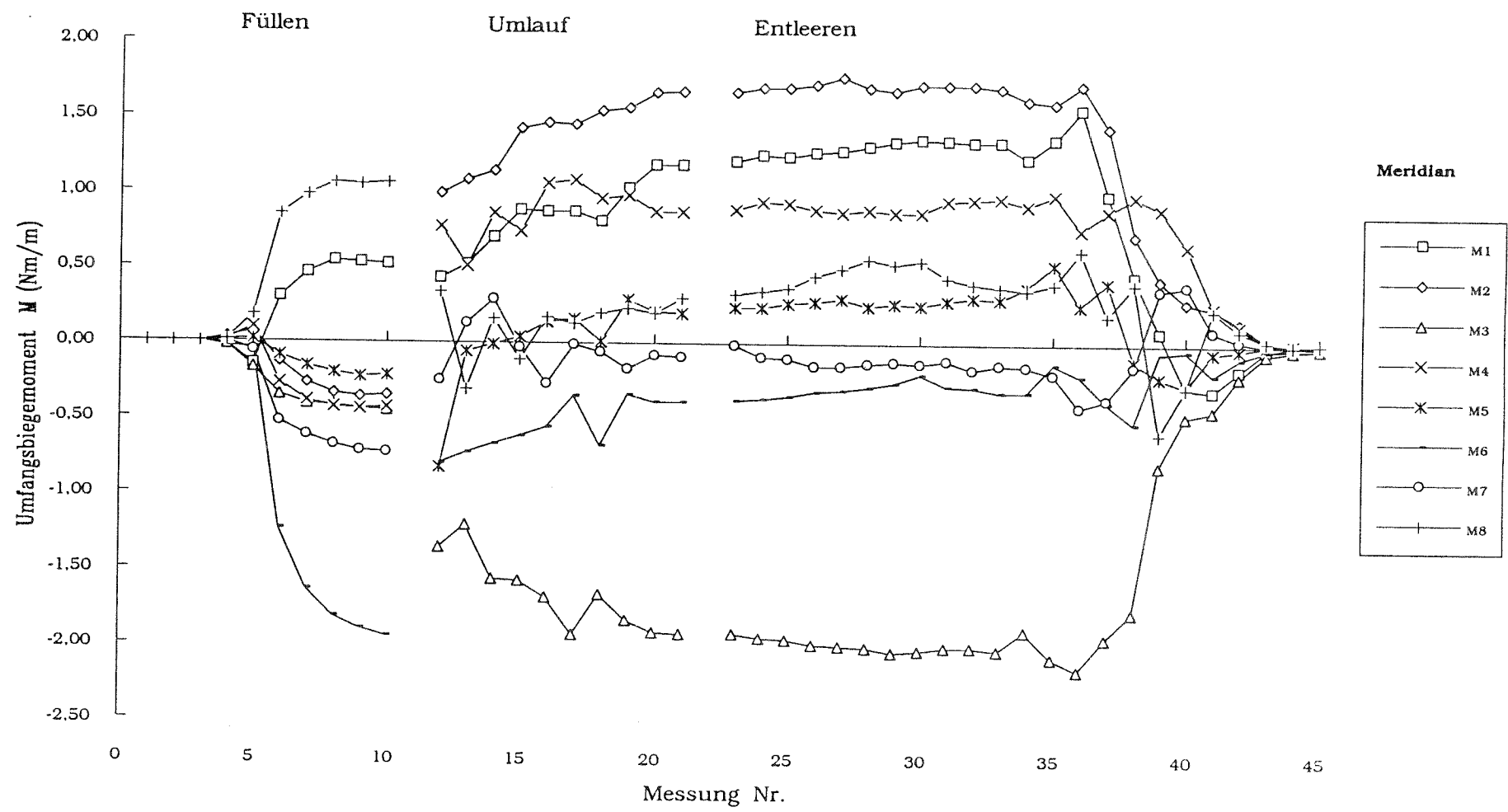
A. 4. 275

### Versuch EX 5 unterer Horizont



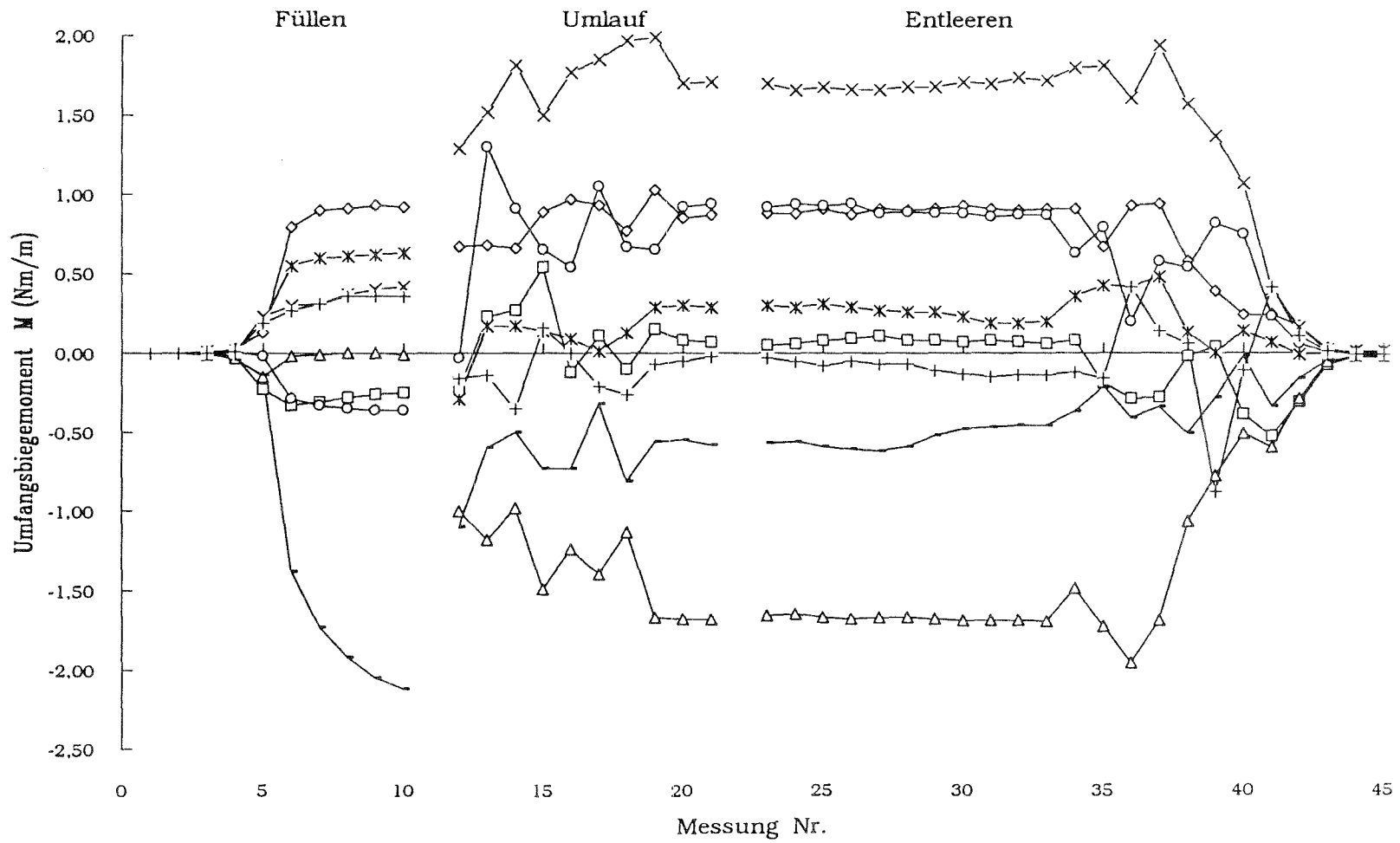
A 4.276

# Versuch EX 5 oberer Horizont



H 4.27

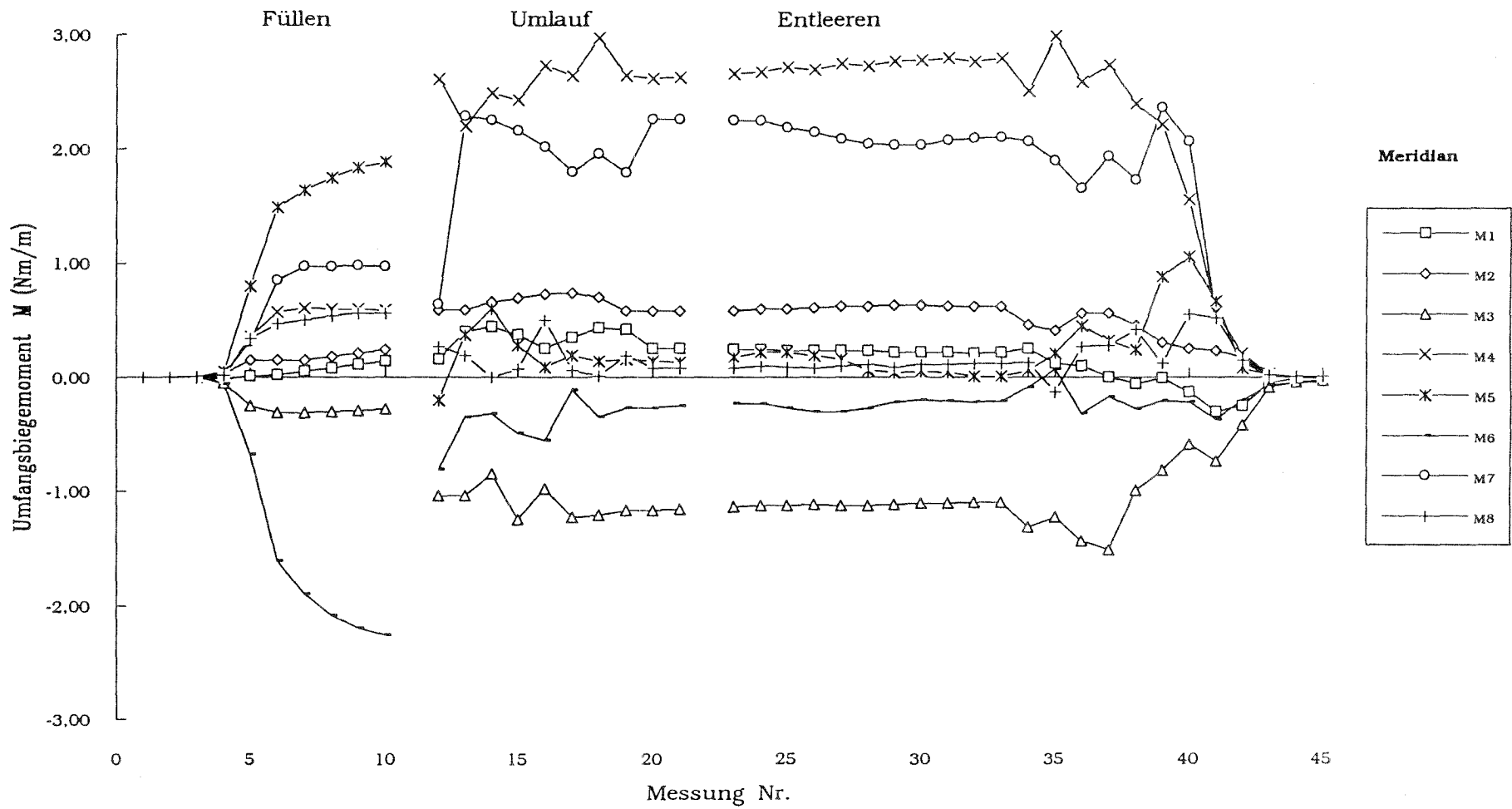
**Versuch EX 5 mittlerer Horizont**



- Meridian**
- M1
  - ◇— M2
  - △— M3
  - ×— M4
  - \*— M5
  - +— M6
  - M7
  - +— M8

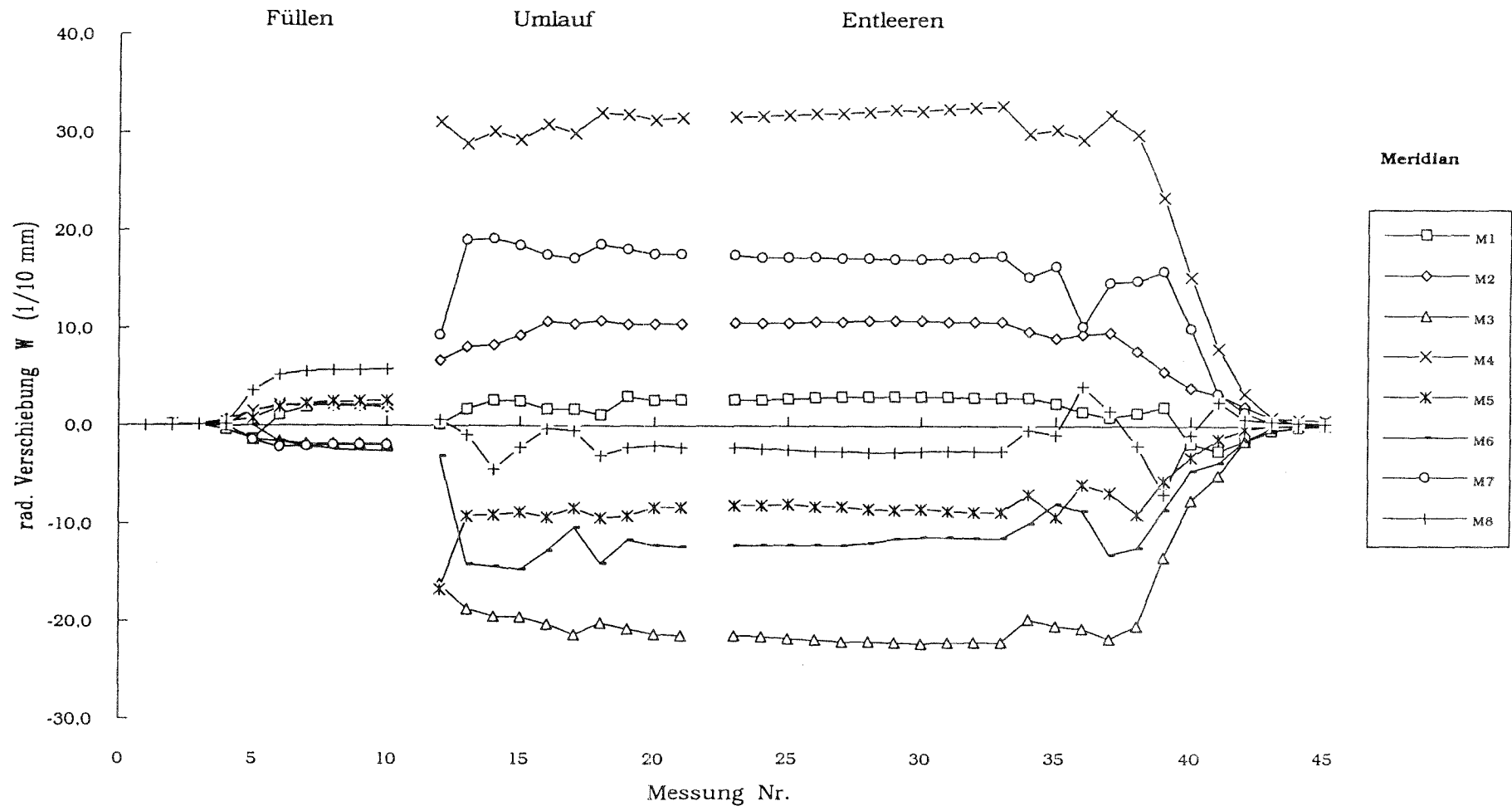
A 4.2+8

**Versuch EX 5 unterer Horizont**



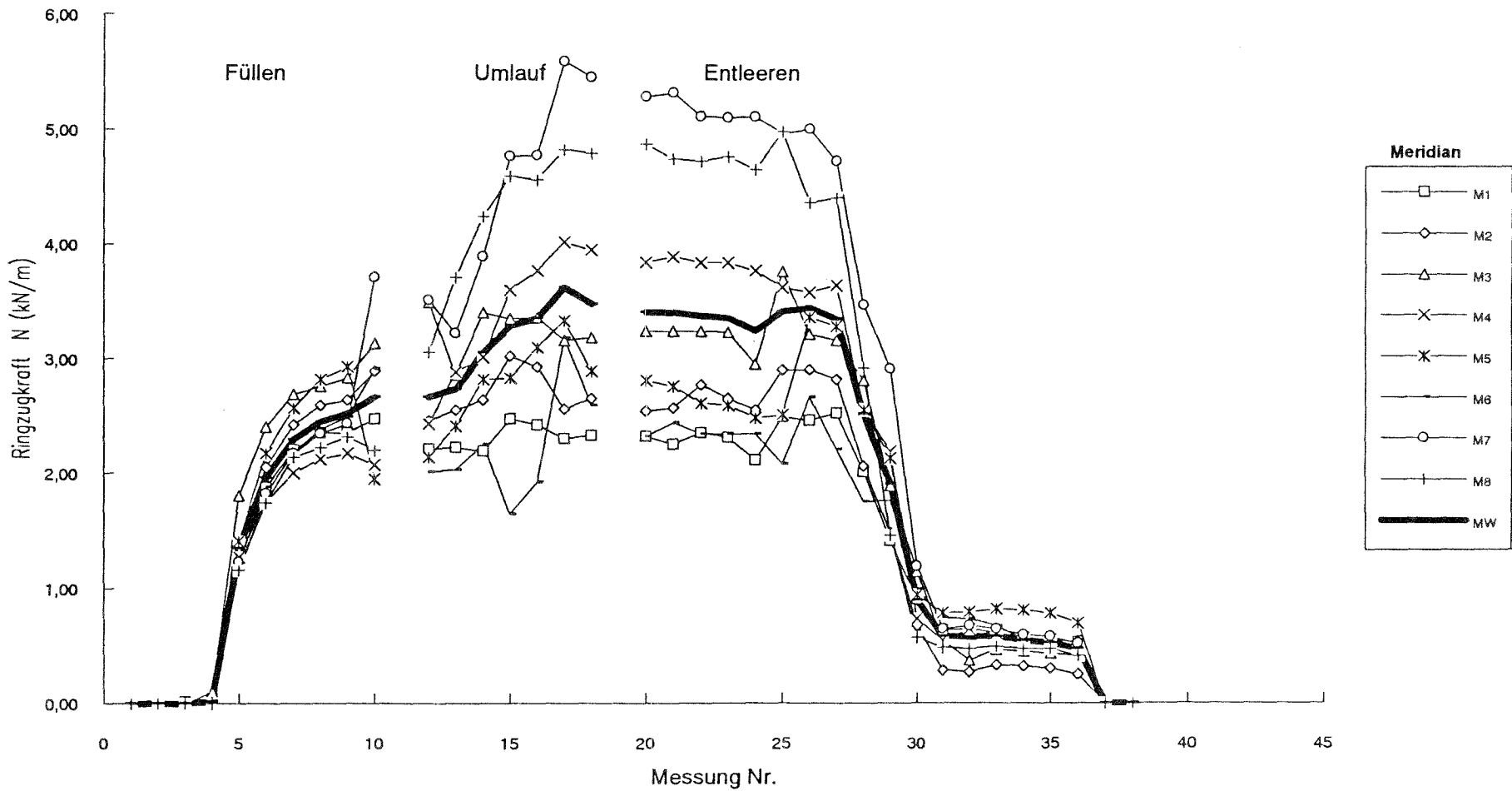
A4279

# Versuch EX 5 mittlerer Horizont



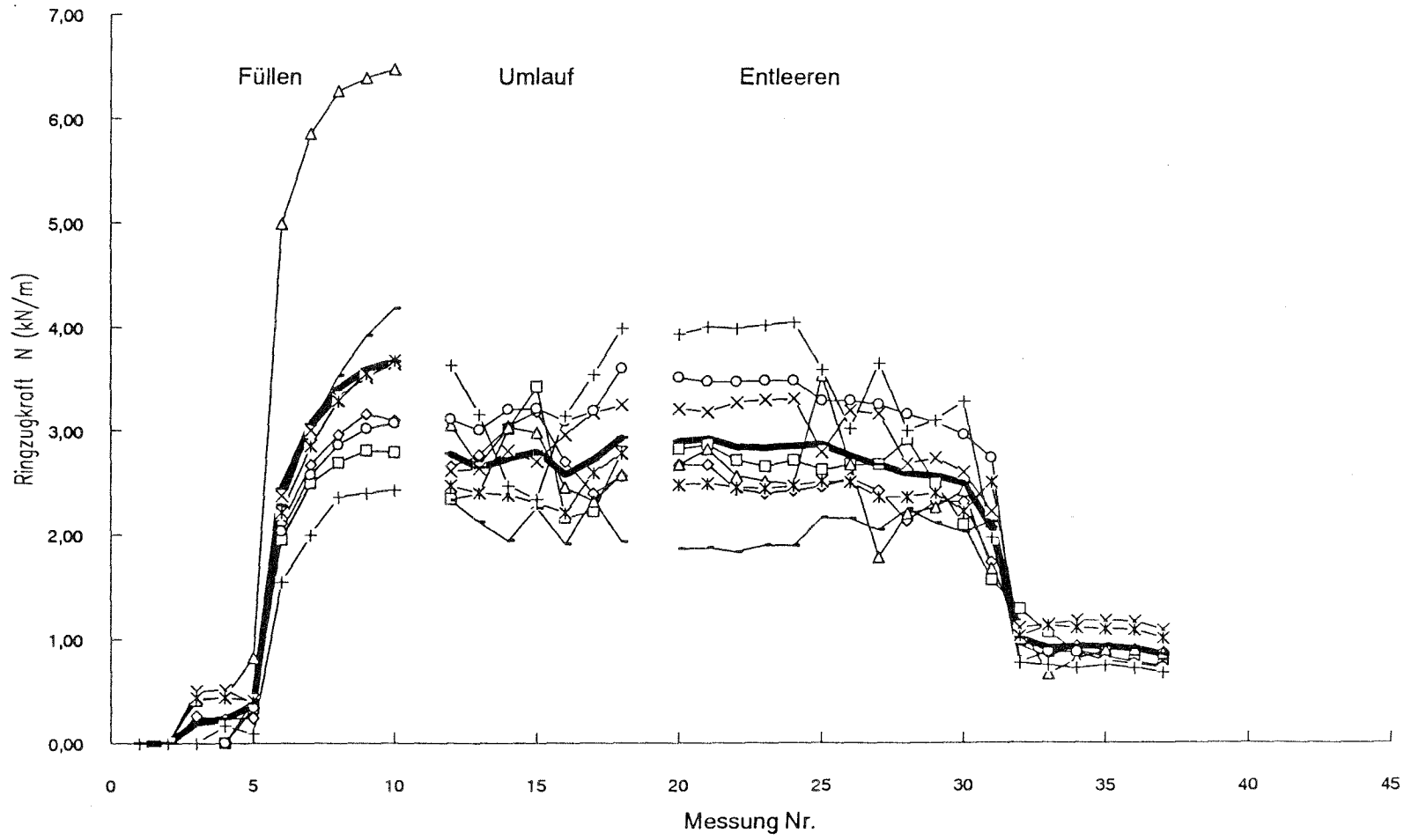
A 4.280

Versuch EX 6 oberer Horizont



A4281

Versuch EX 6 mittlerer Horizont



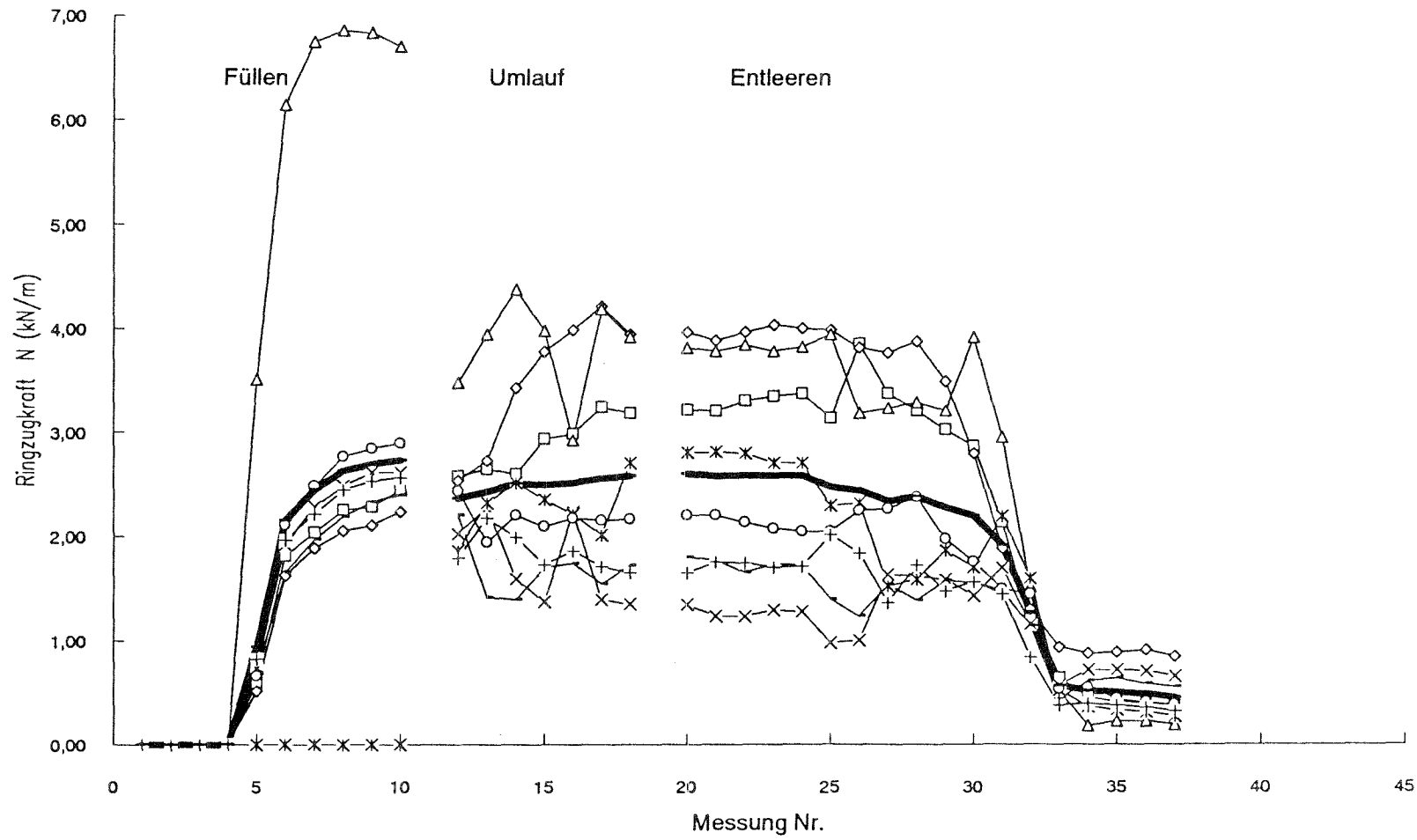
**Meridian**

- M1 (square)
- M2 (diamond)
- M3 (triangle)
- M4 (cross)
- M5 (asterisk)
- M6 (plus)
- M7 (circle)
- M8 (plus)
- MW (thick line)

AF.282



Versuch EX 6 unterer Horizont

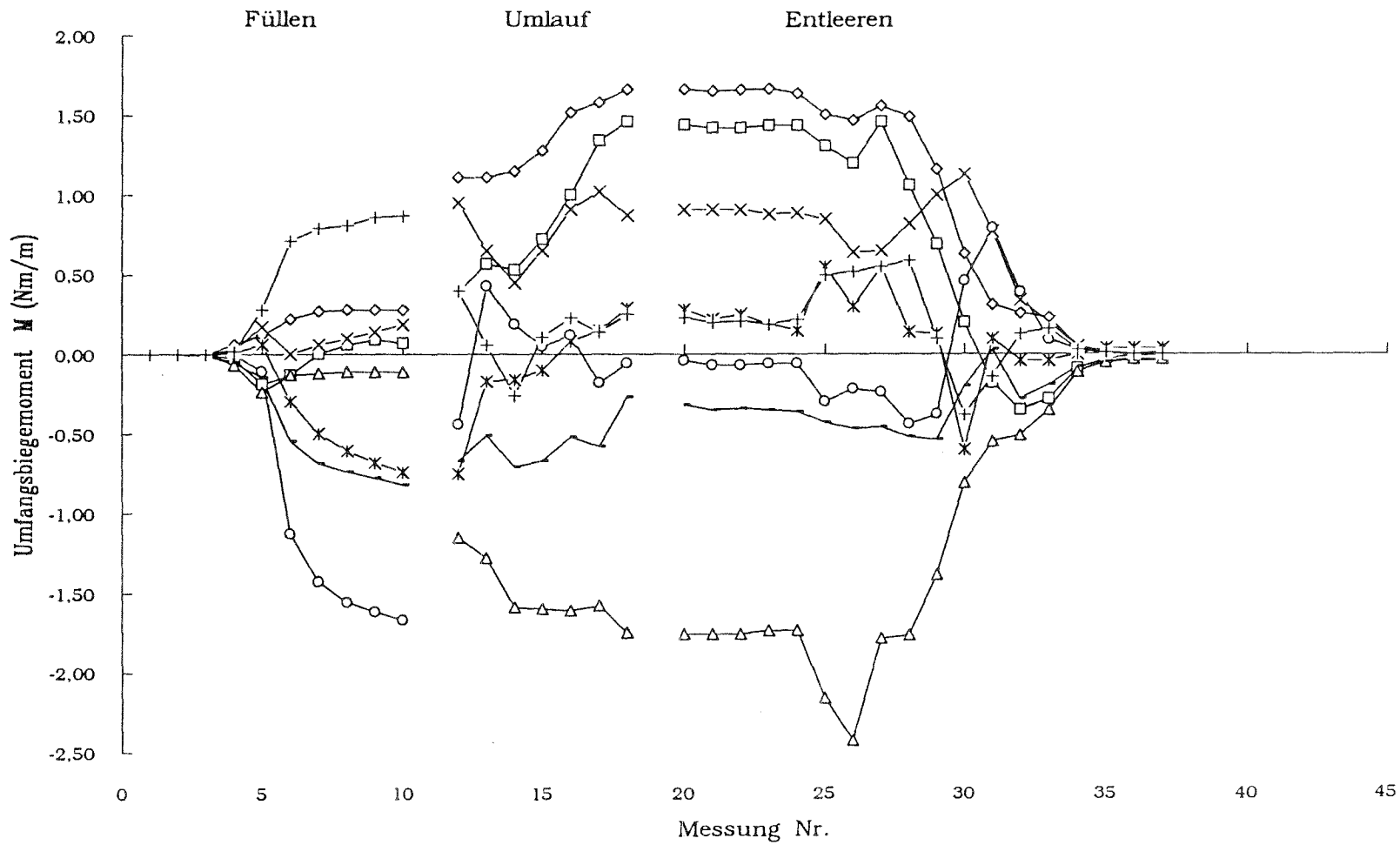


Meridian

- M1
- ◇— M2
- △— M3
- ×— M4
- ×— M5
- M6
- M7
- +— M8
- +— M9
- MW

144.283

**Versuch EX 6 oberer Horizont**

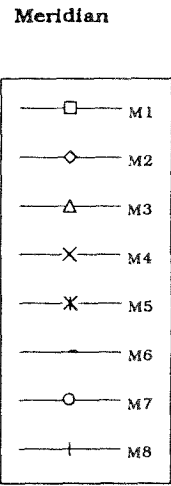
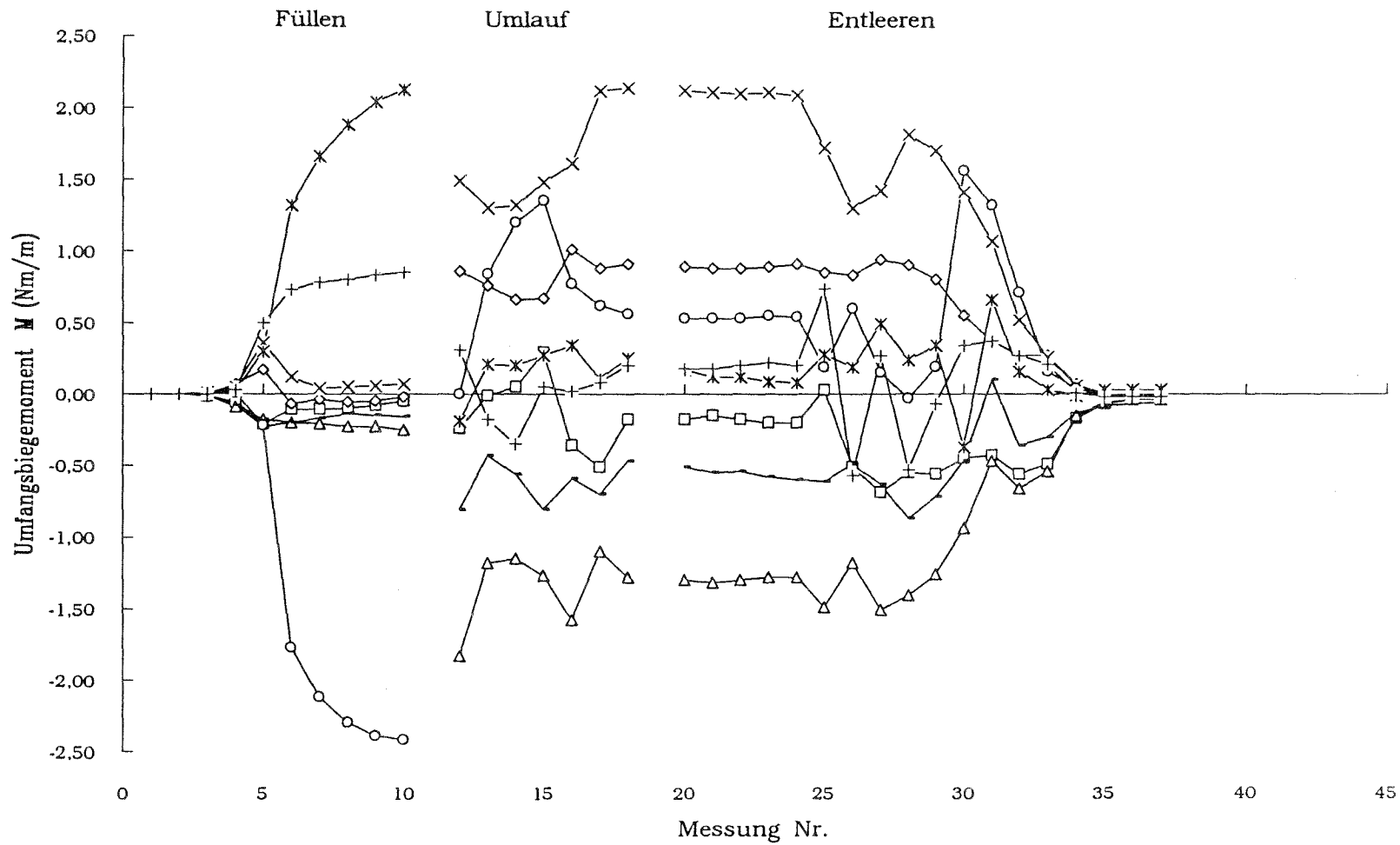


Meridian

- M1
- ◇— M2
- △— M3
- ×— M4
- \*— M5
- +— M6
- M7
- +— M8

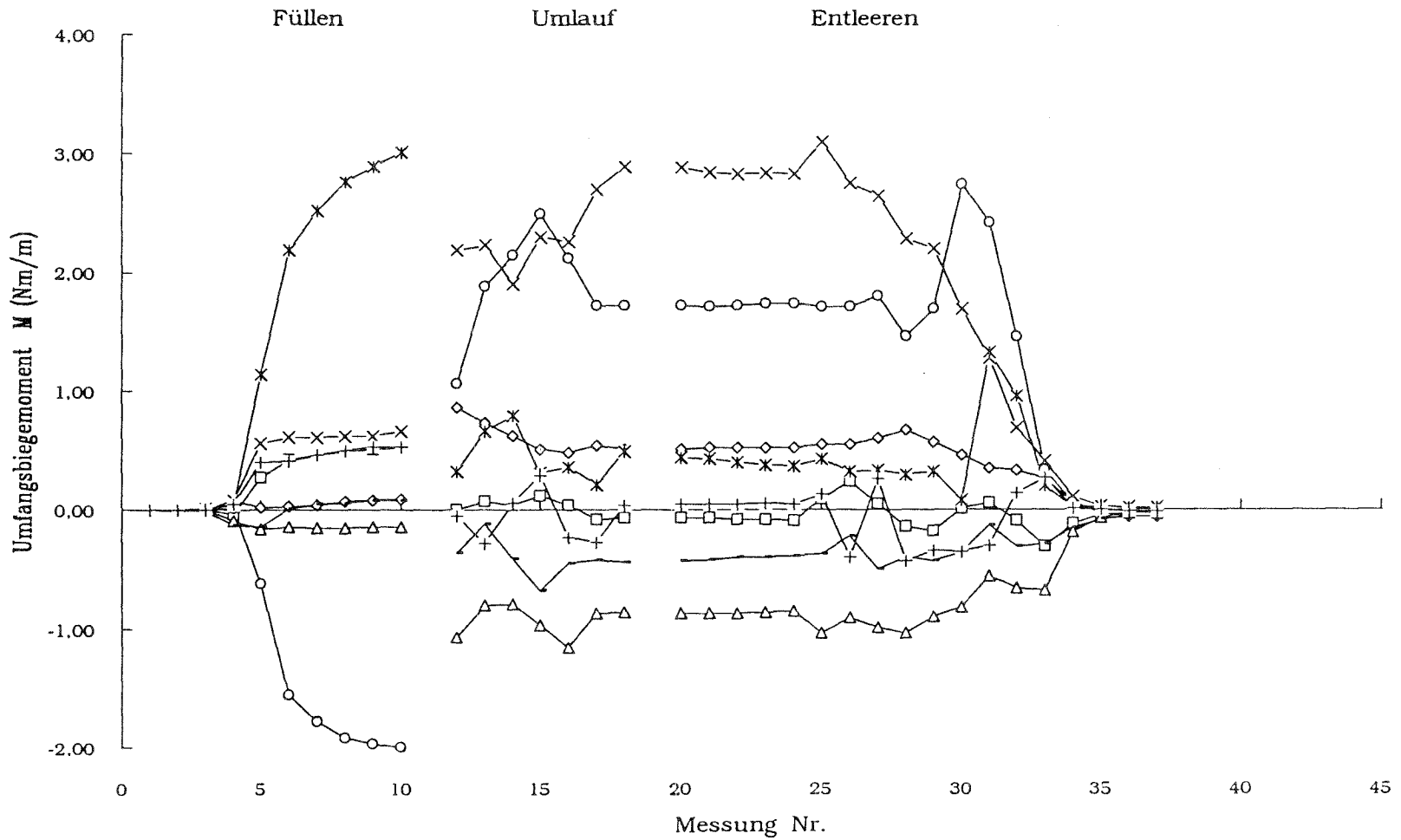
A4.284

# Versuch EX 6 mittlerer Horizont



A 4 285

# Versuch EX 6 unterer Horizont

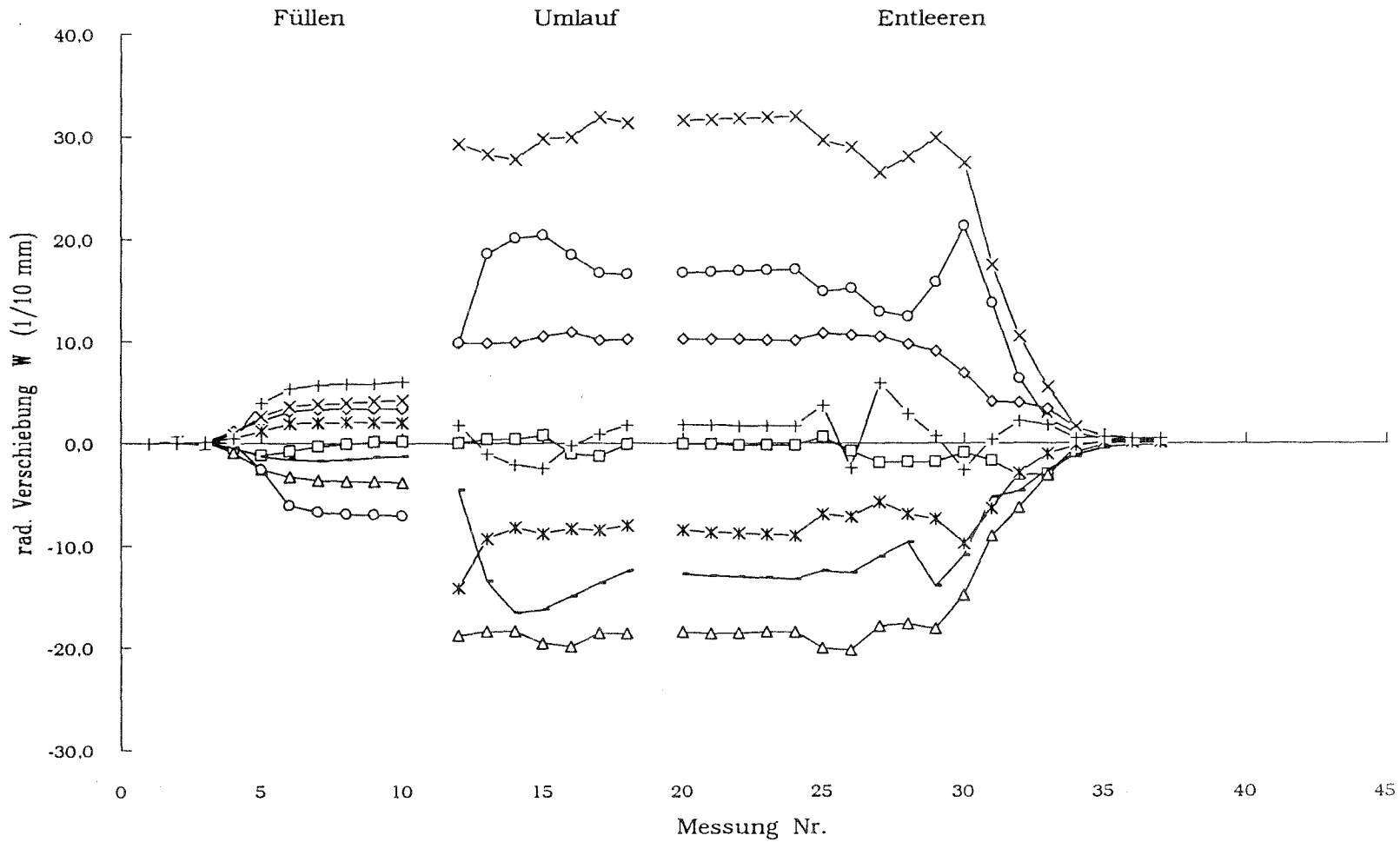


Meridian

- M1
- ◇— M2
- △— M3
- ×— M4
- \*— M5
- +— M6
- M7
- |— M8

A 4286

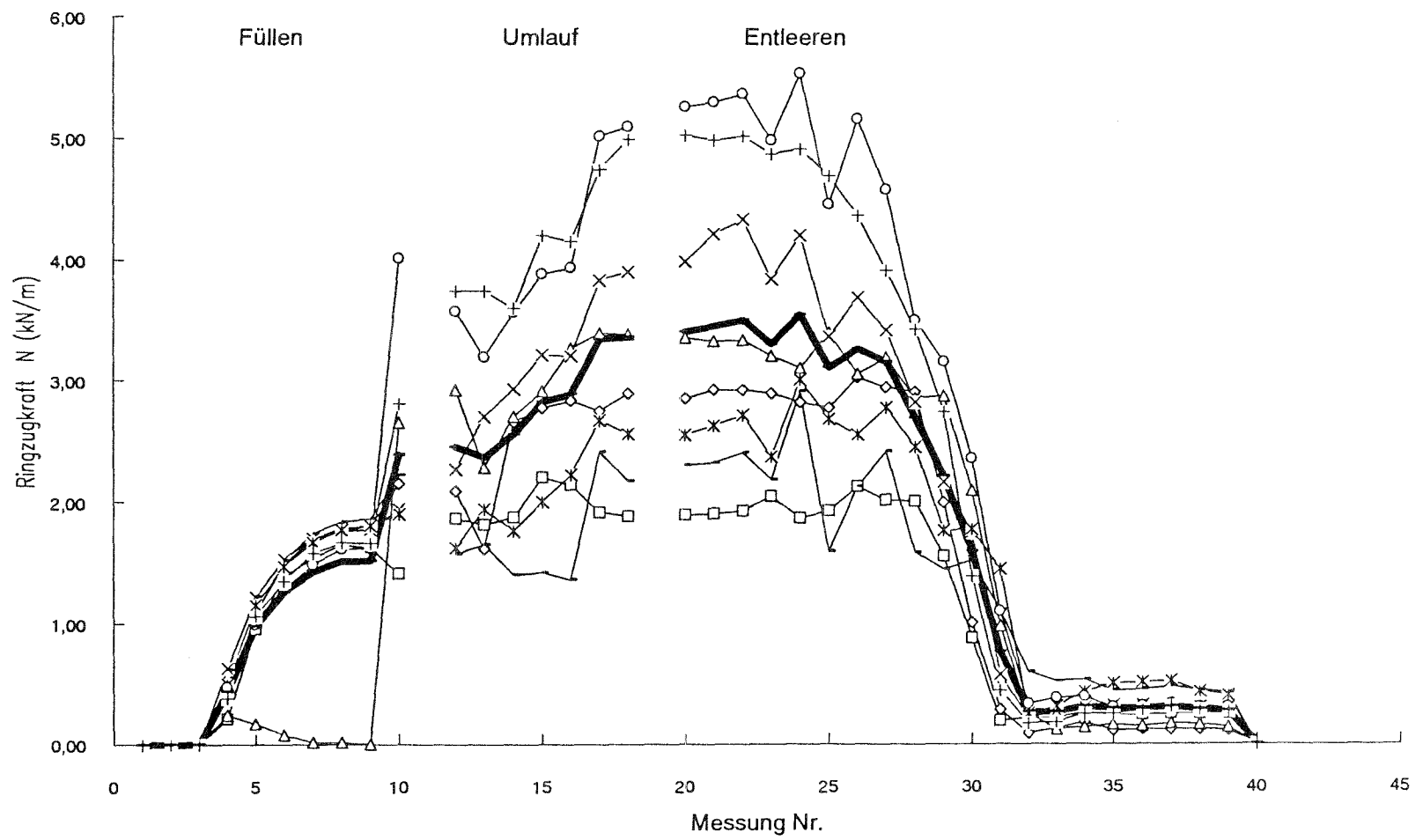
# Versuch EX 6 mittlerer Horizont



- Meridian**
- M1
  - ◇— M2
  - △— M3
  - ×— M4
  - \*— M5
  - +— M6
  - M7
  - +— M8

A 4.287

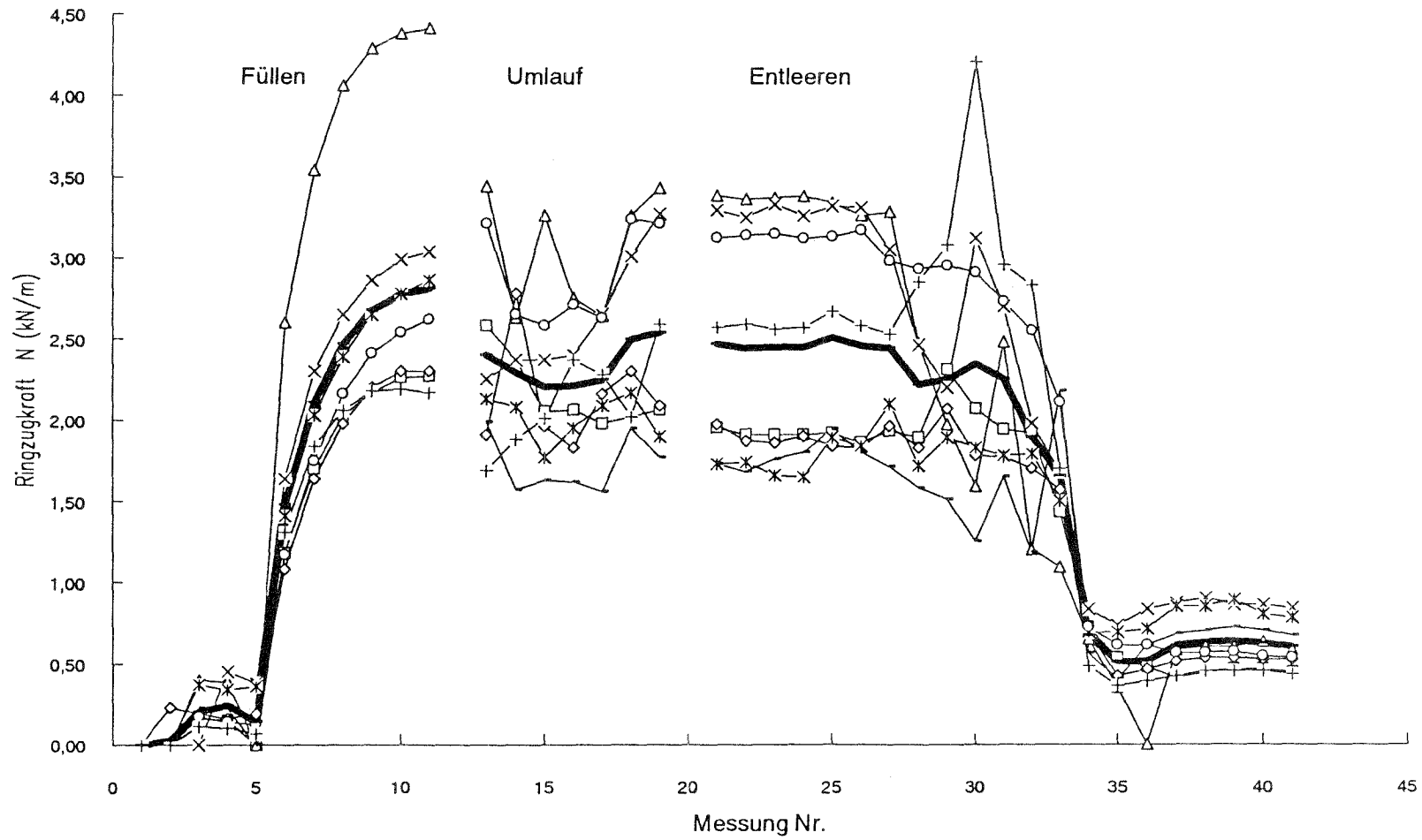
Versuch EX 7 oberer Horizont



- Meridian**
- M1
  - ◇— M2
  - △— M3
  - ×— M4
  - \*— M5
  - M6
  - M7
  - +— M8
  - MW**

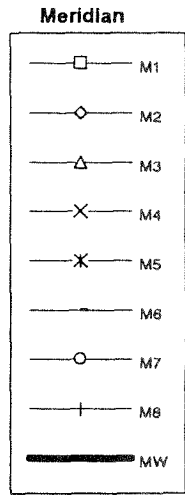
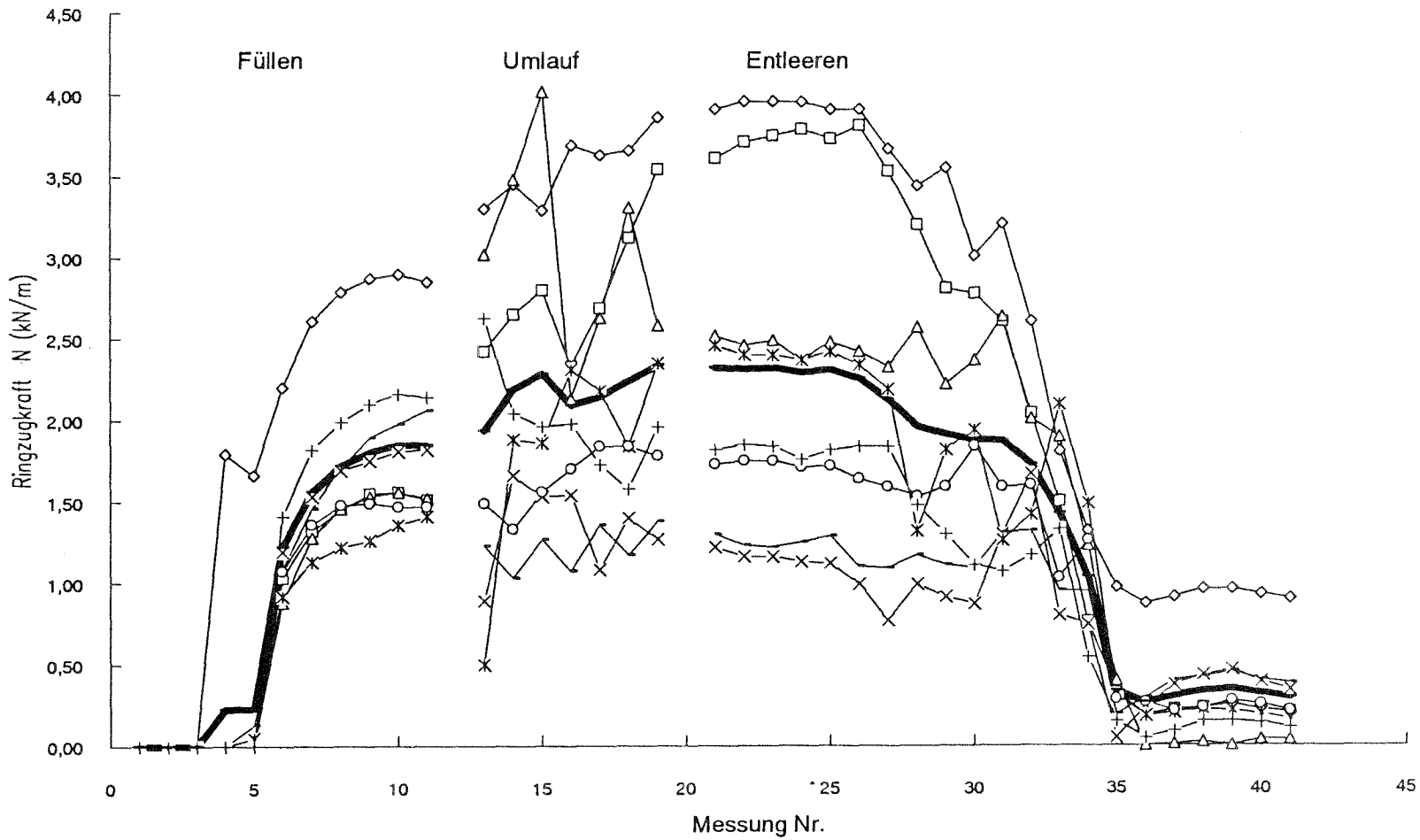
A 4.288

### Versuch EX 7 mittlerer Horizont



R 4.289

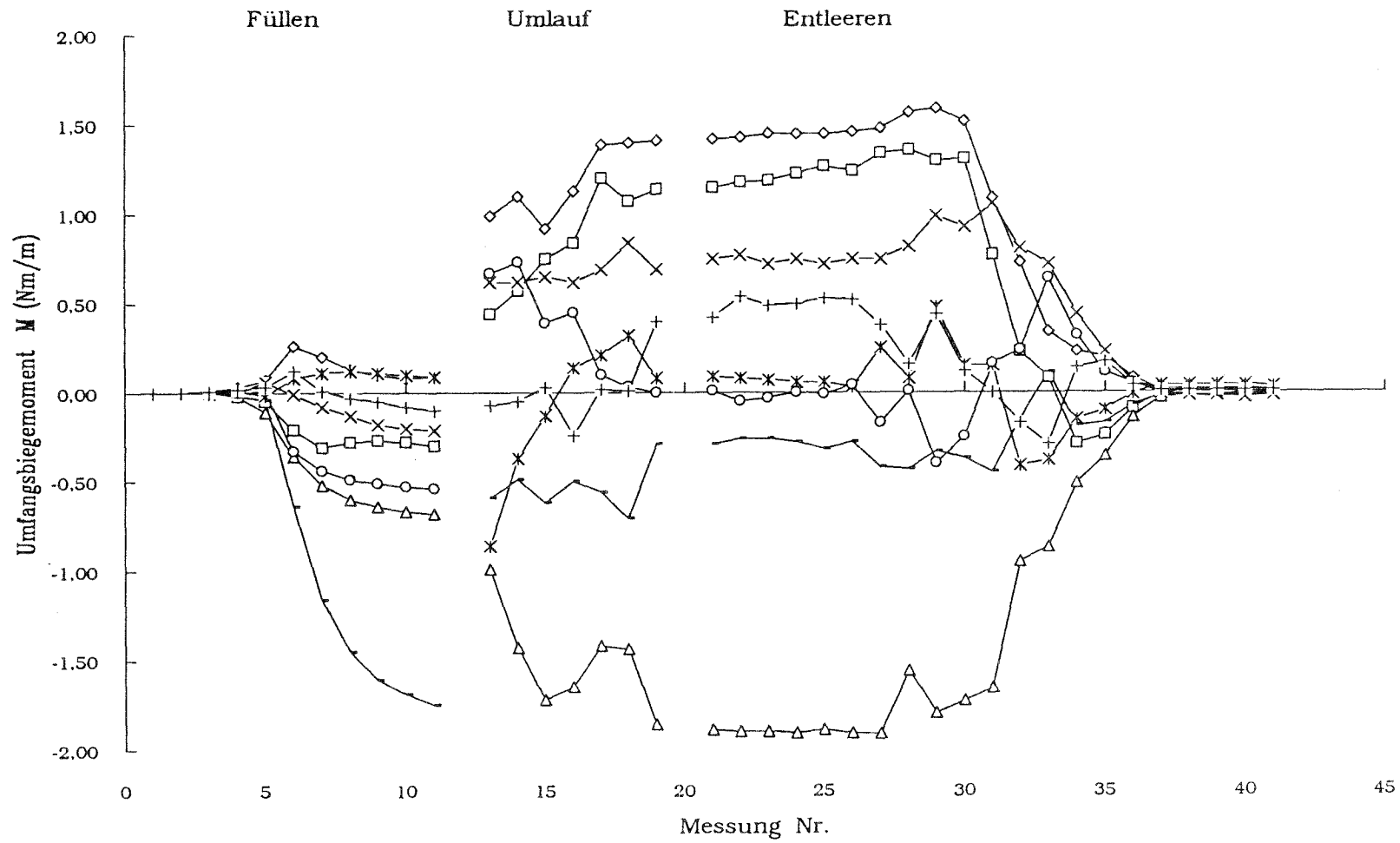
# Versuch EX 7 unterer Horizont



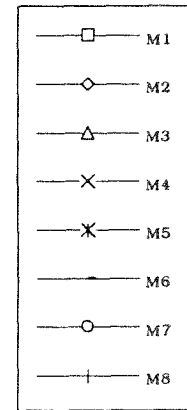
A 4.250



**Versuch EX 7 oberer Horizont**

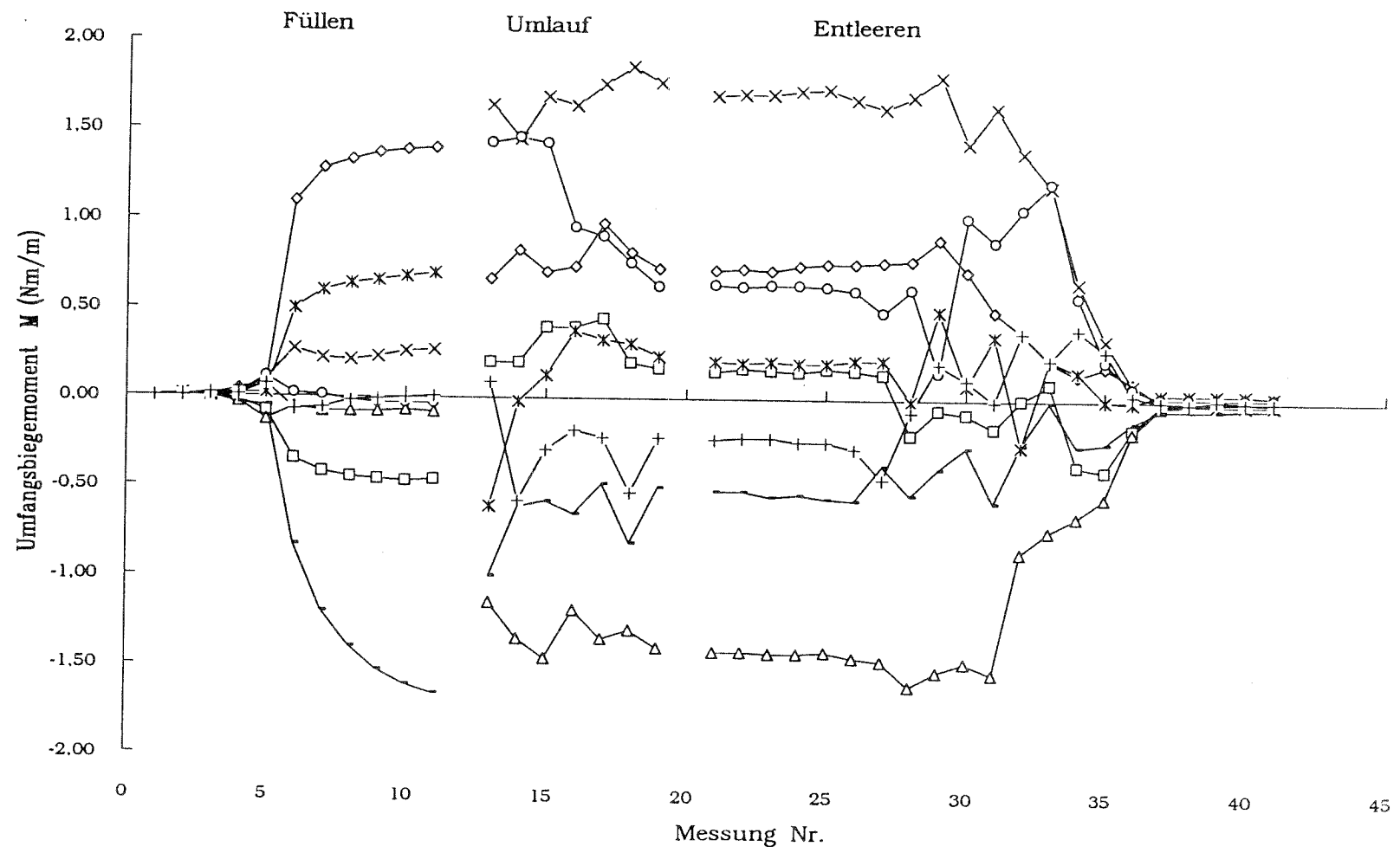


**Meridian**



A. 4. 251

**Versuch EX 7 mittlerer Horizont**

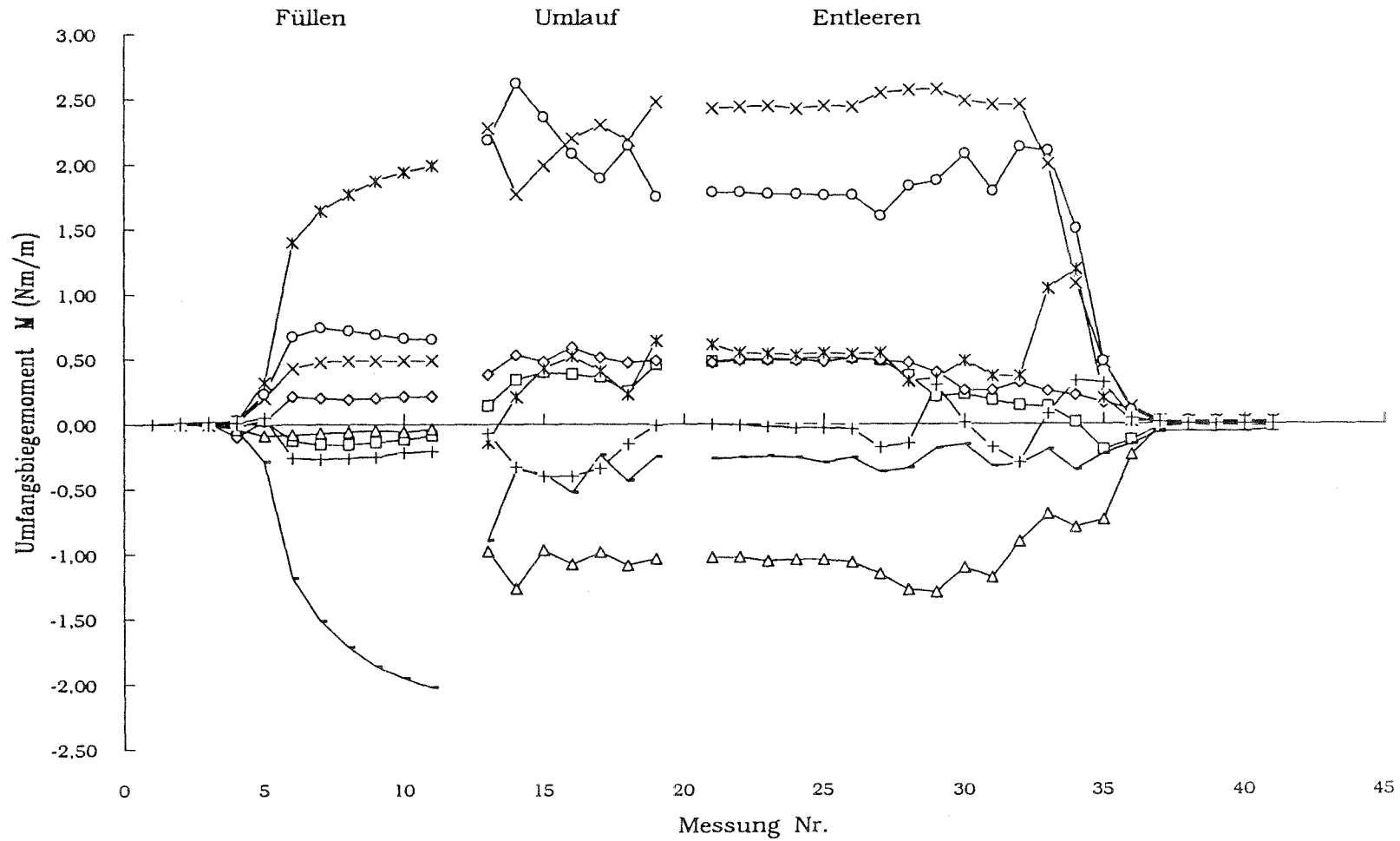


**Meridian**

—□—	M1
—◇—	M2
—△—	M3
—×—	M4
—*—	M5
— — —	M6
—○—	M7
—+—	M8

A 4. 202

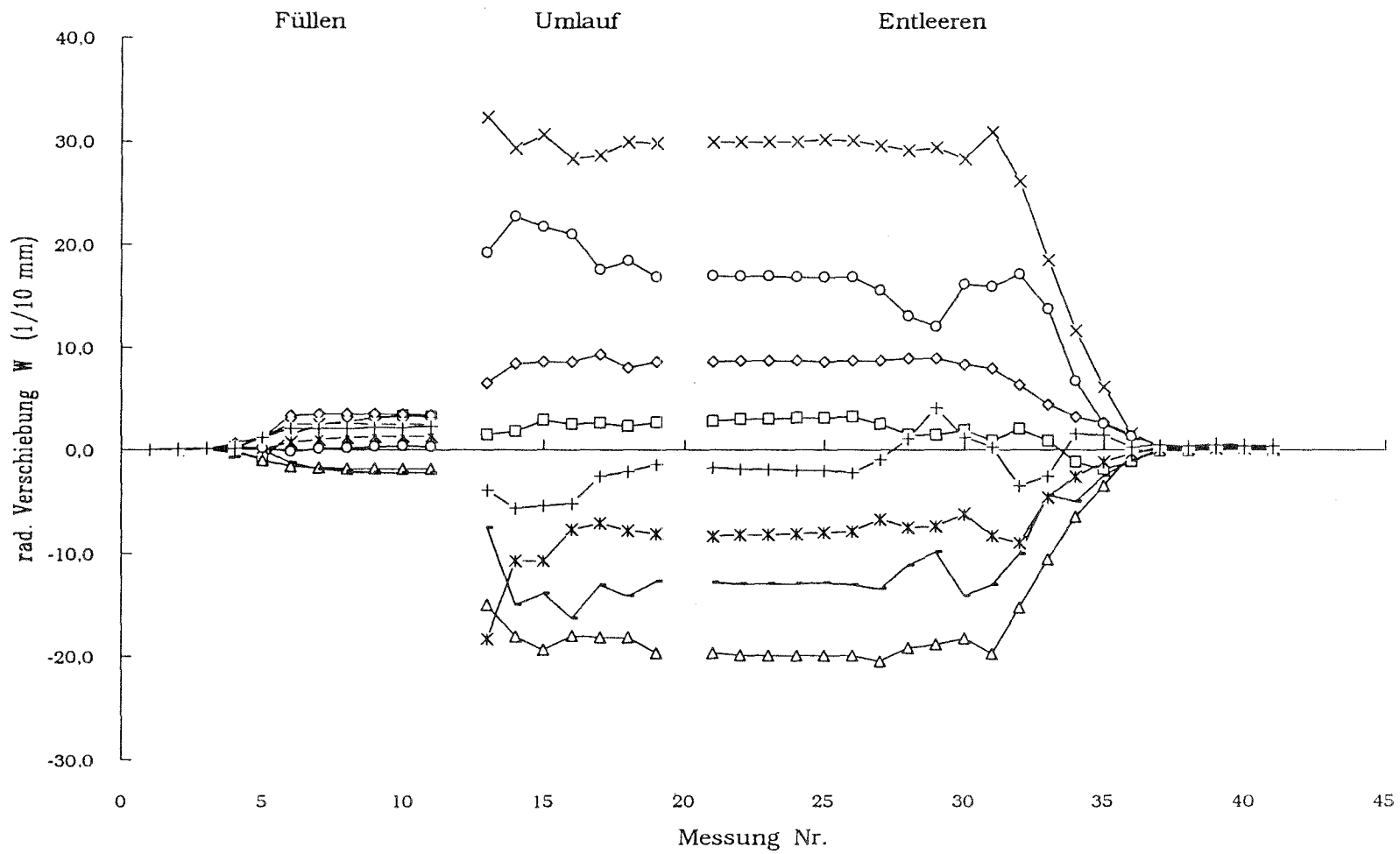
# Versuch EX 7 unterer Horizont



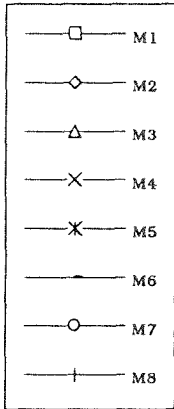
- Meridian**
- M1
  - ◇— M2
  - △— M3
  - ×— M4
  - \*— M5
  - +— M6
  - M7
  - +— M8

A4. 293

# Versuch EX 7 mittlerer Horizont

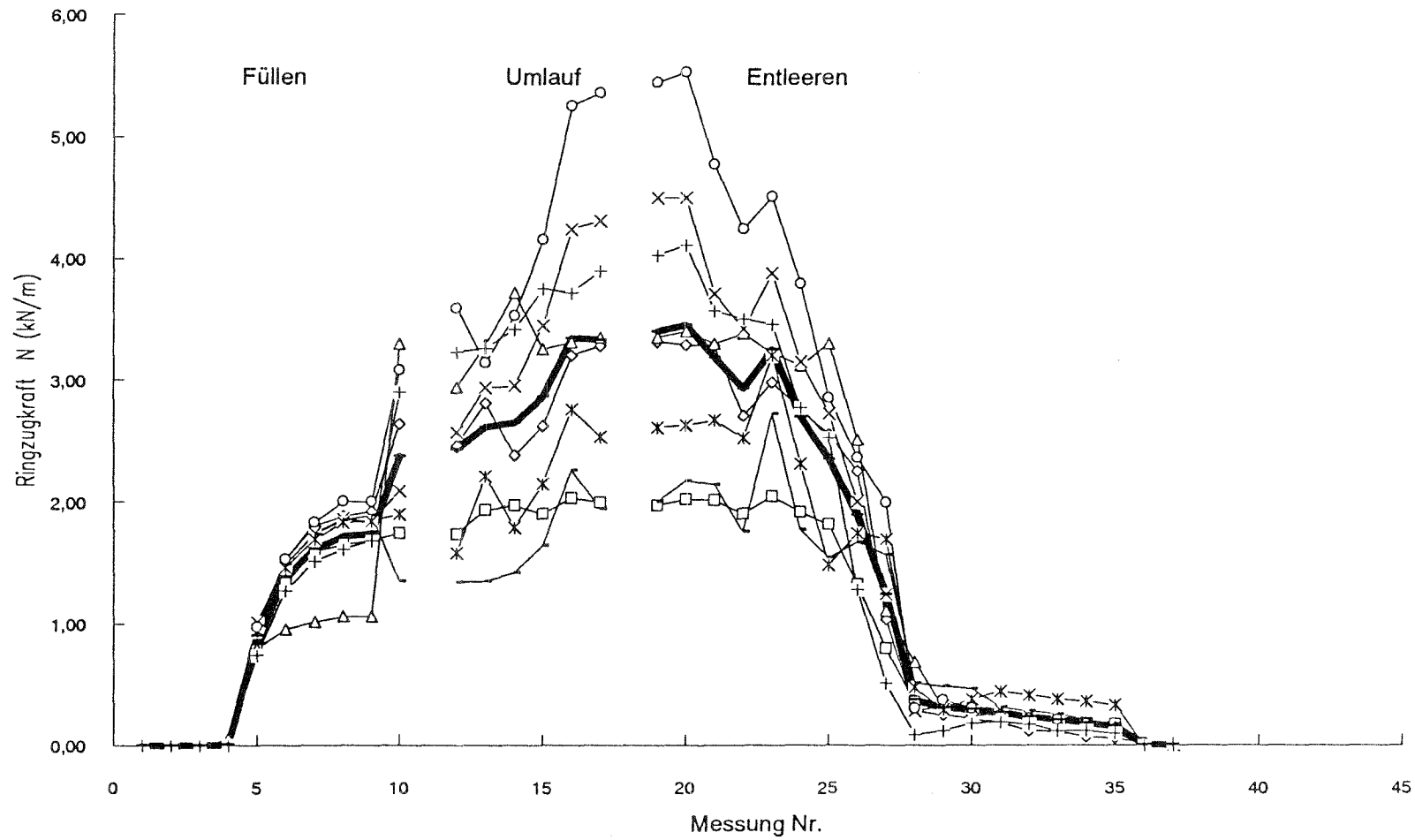


Meridian



A 4. 204

# Versuch EX 8 oberer Horizont

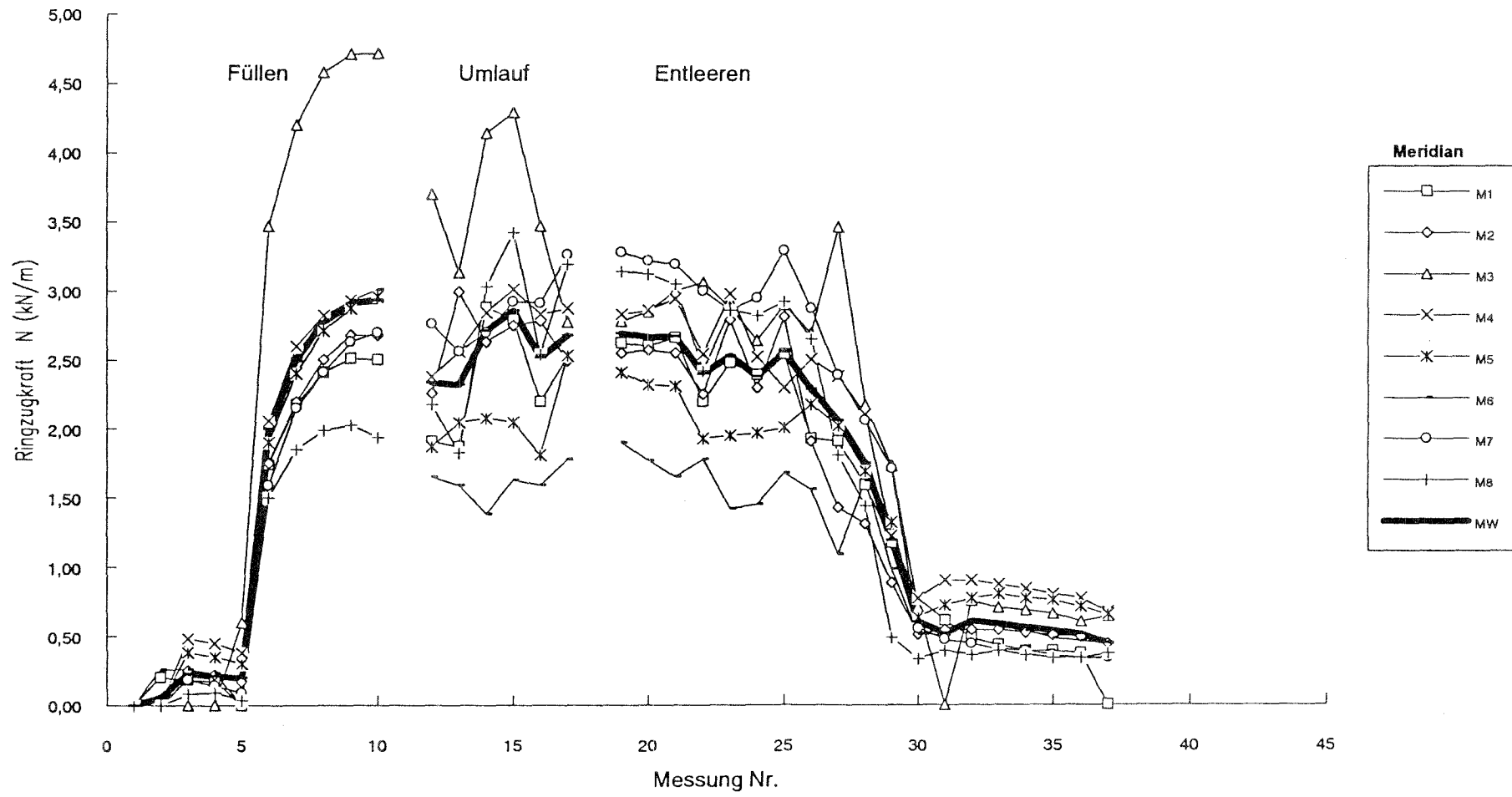


**Meridian**

□	M1
◇	M2
△	M3
×	M4
×	M5
+	M6
○	M7
+	M8
<b>—</b>	<b>MW</b>

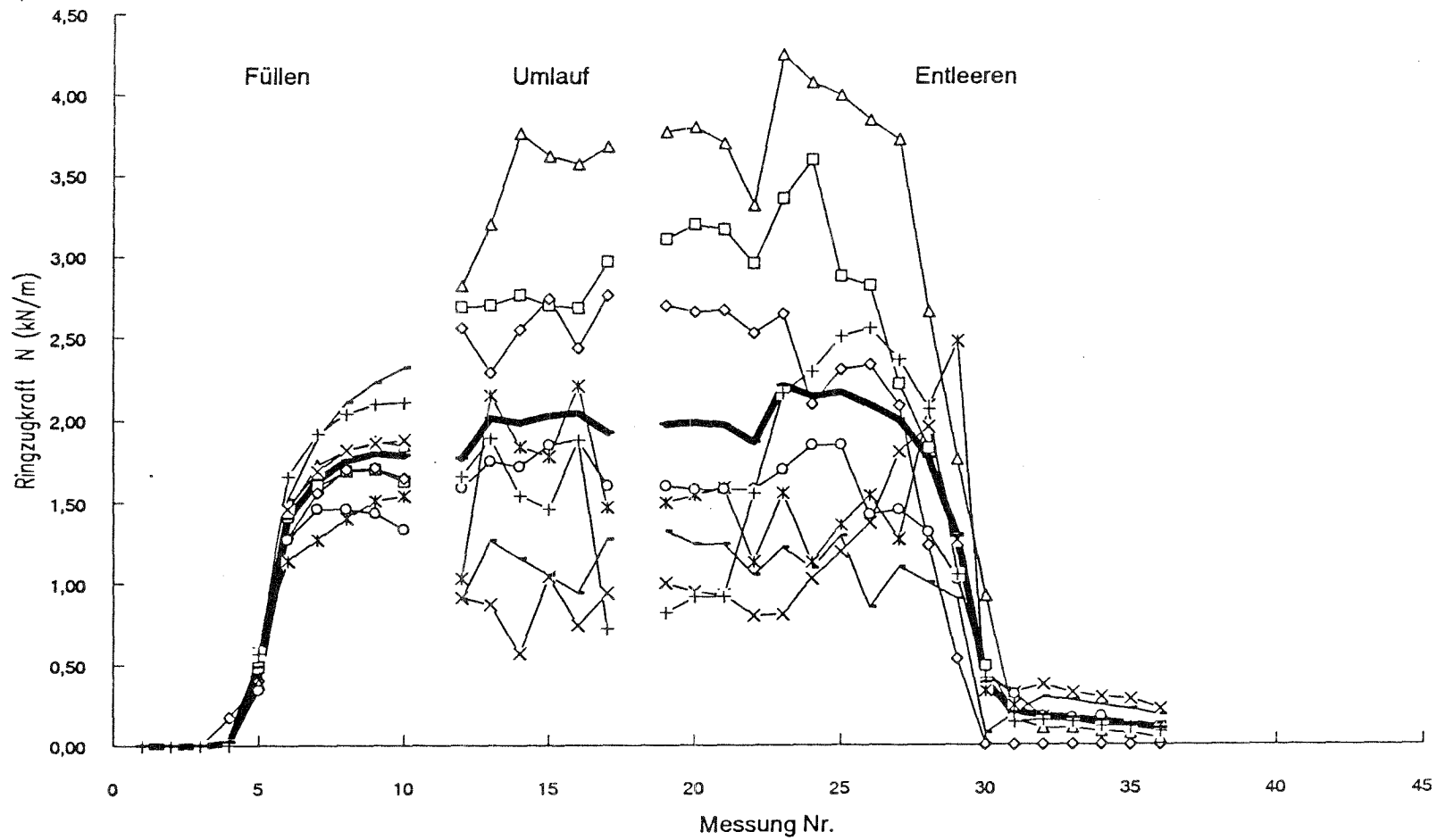
A 4.235

Versuch EX 8 mittlerer Horizont



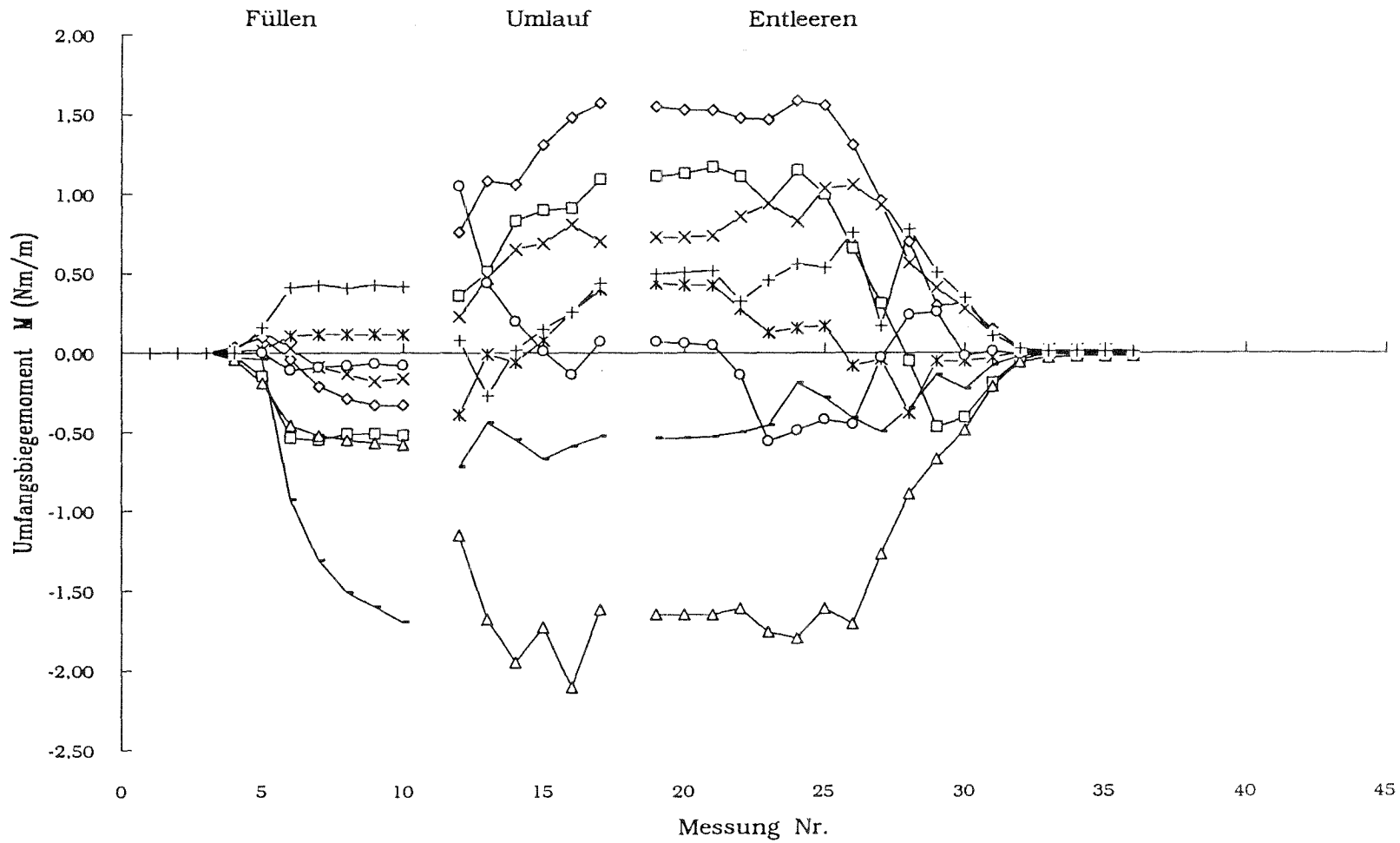
Nr. 296

### Versuch EX 8 unterer Horizont

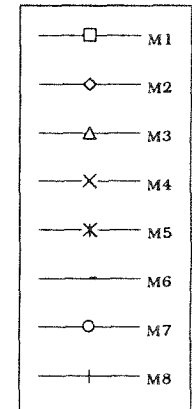


14.2.97

Versuch EX 8 oberer Horizont



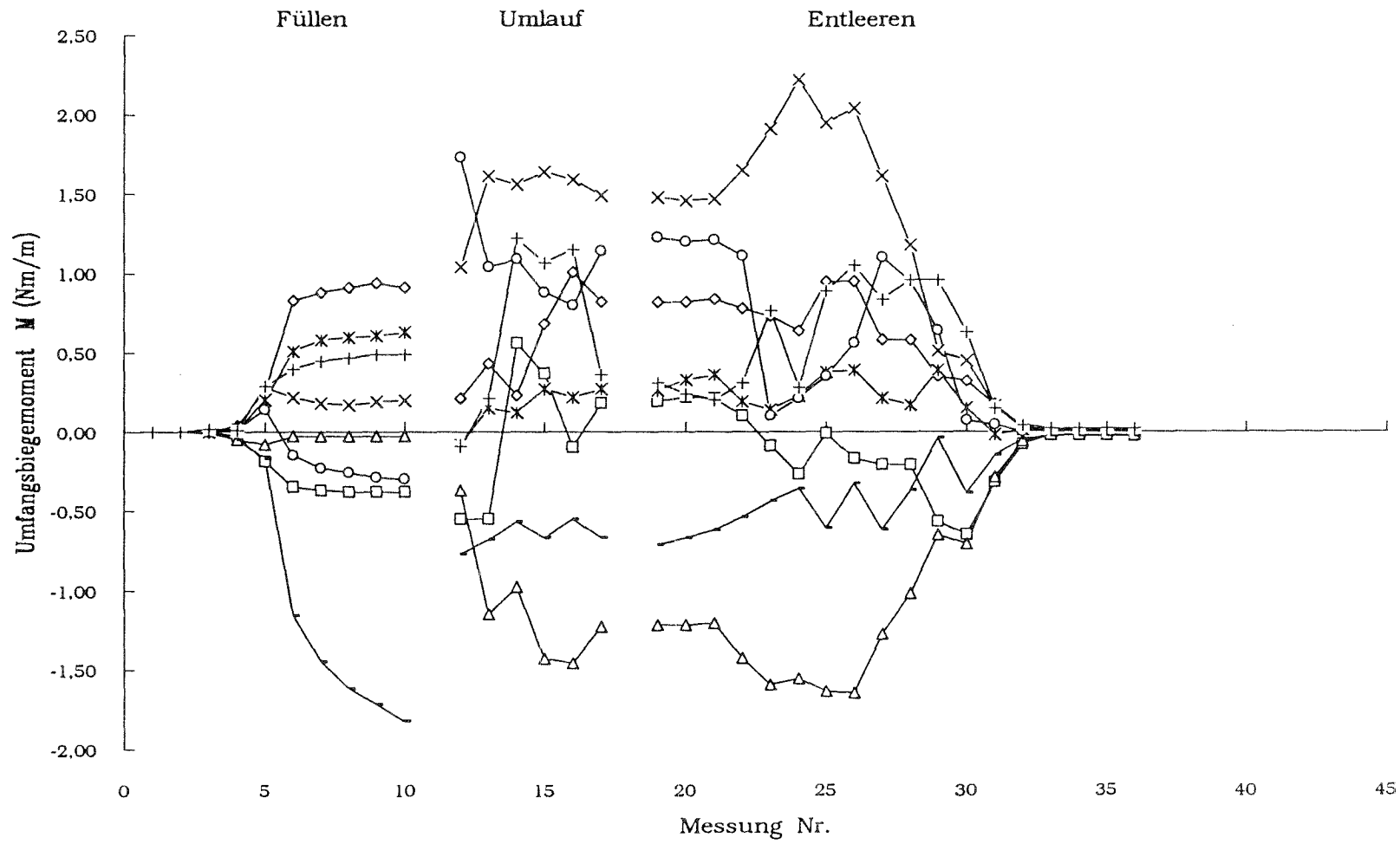
Meridian



A 4 298



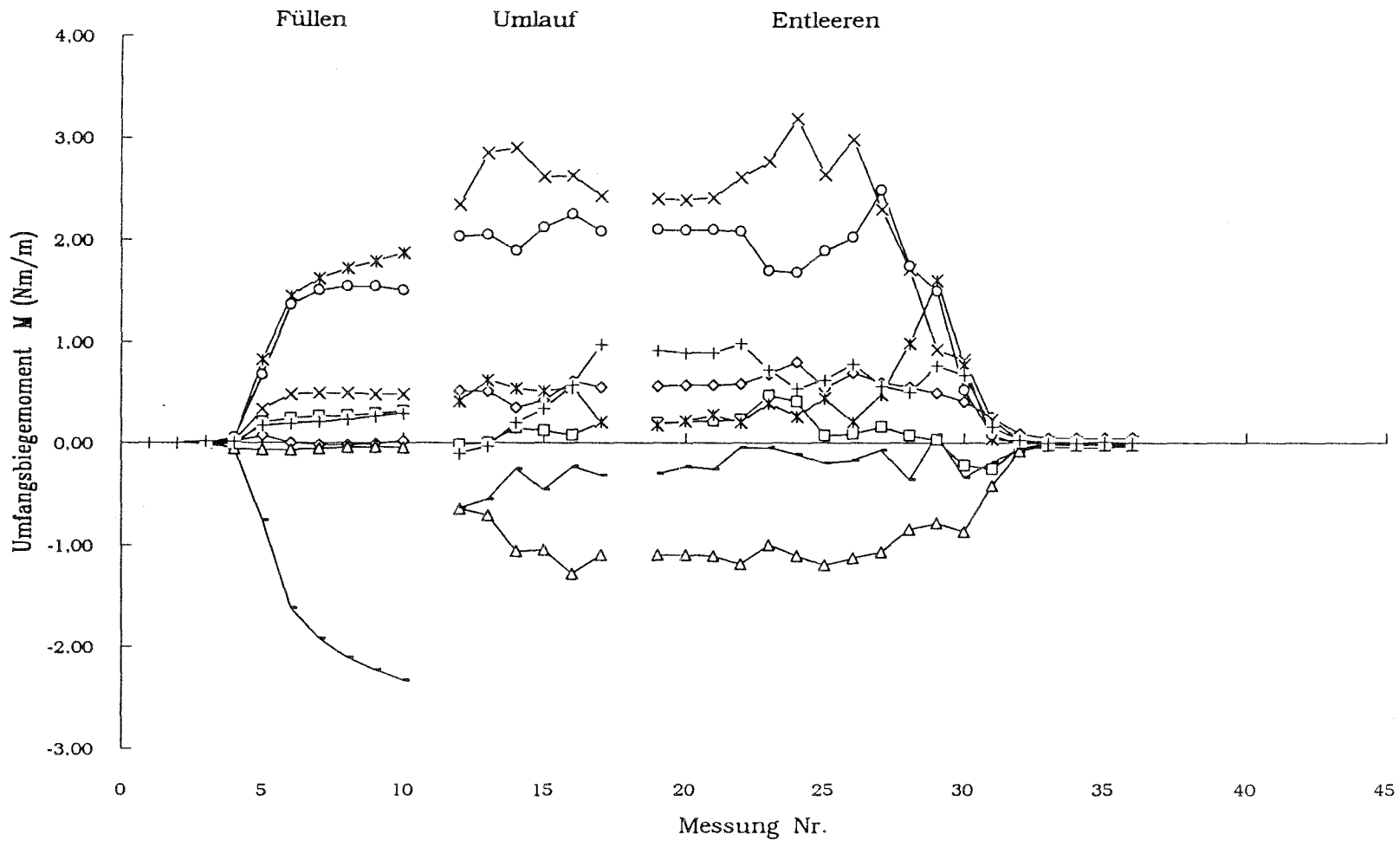
**Versuch EX 8 mittlerer Horizont**



- Meridian**
- M1
  - ◇— M2
  - △— M3
  - ×— M4
  - \*— M5
  - +— M6
  - M7
  - +— M8

A 4. 299

**Versuch EX 8 unterer Horizont**

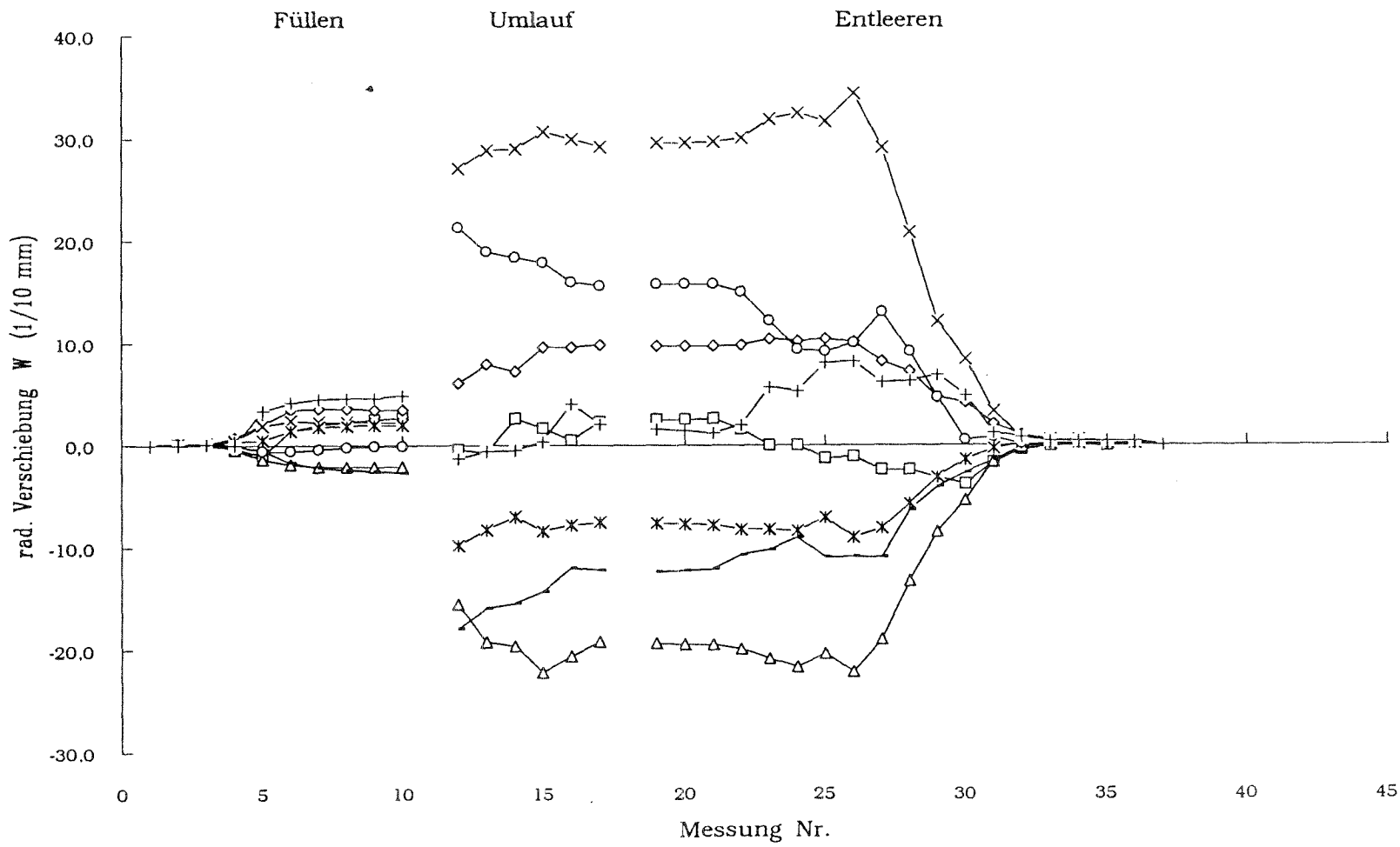


Meridian

- M1
- ◇— M2
- △— M3
- ×— M4
- \*— M5
- +— M6
- M7
- +— M8

R. 4. 300

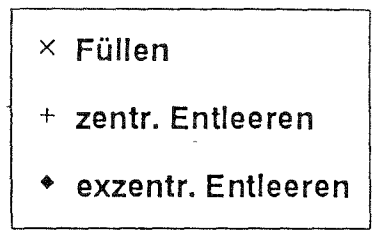
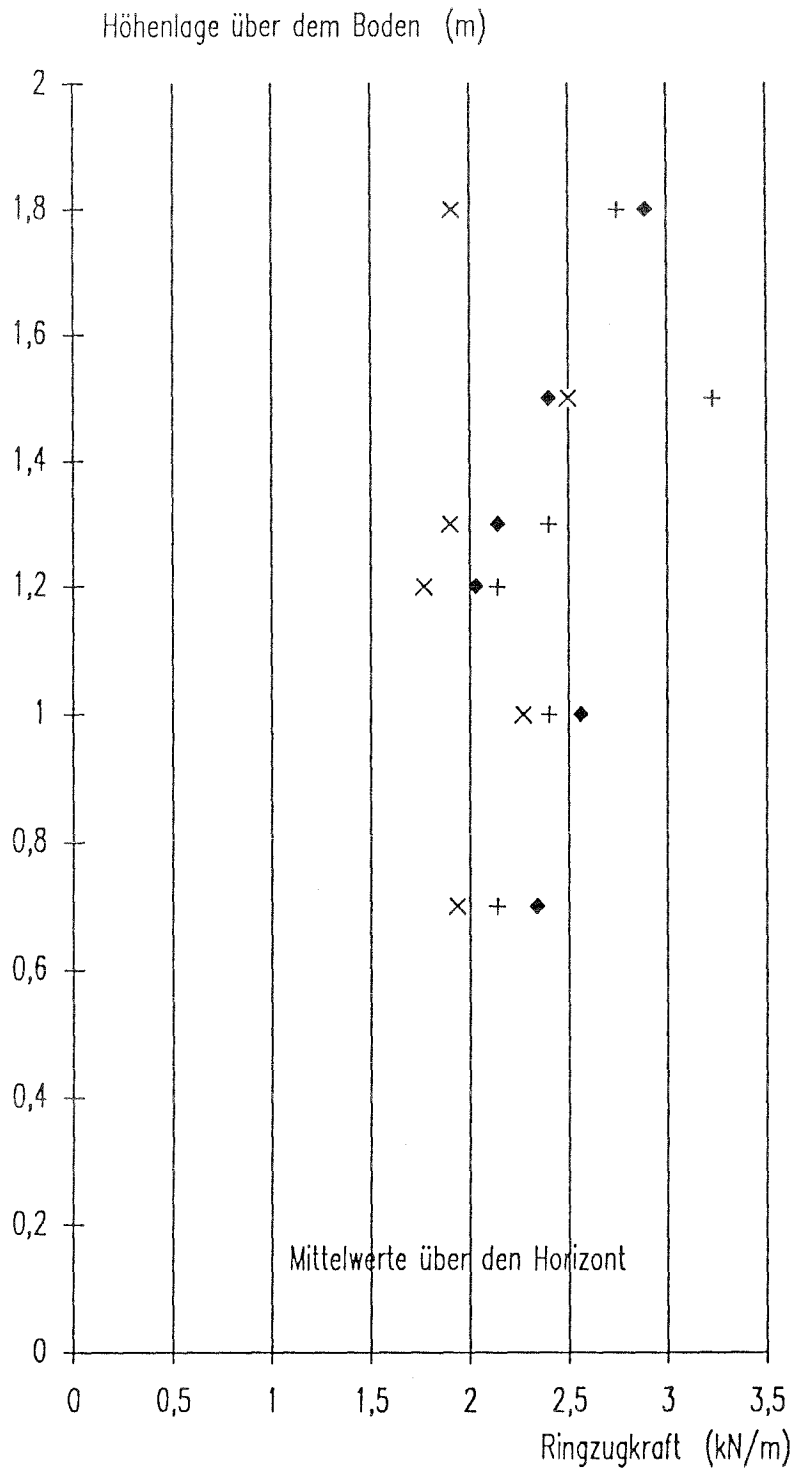
# Versuch EX 8 mittlerer Horizont

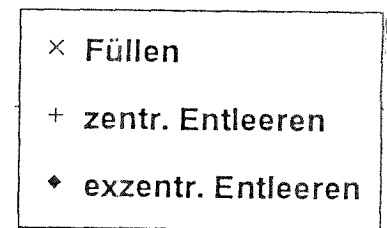
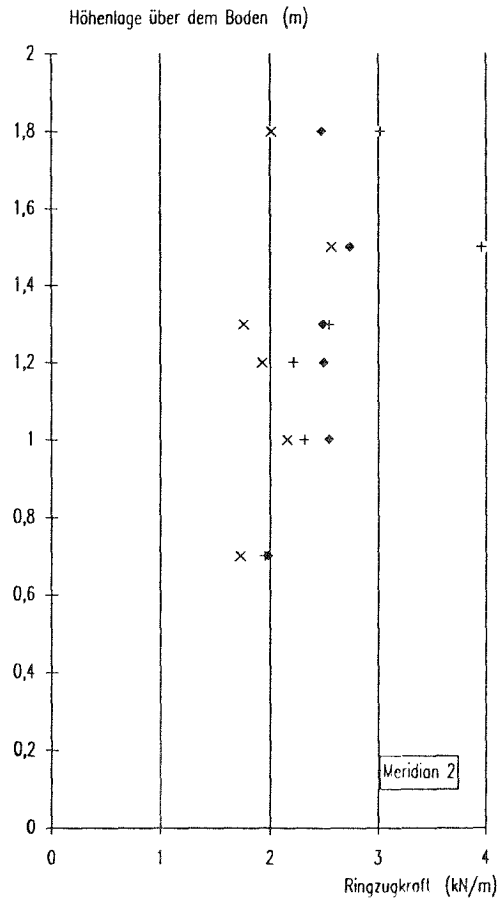
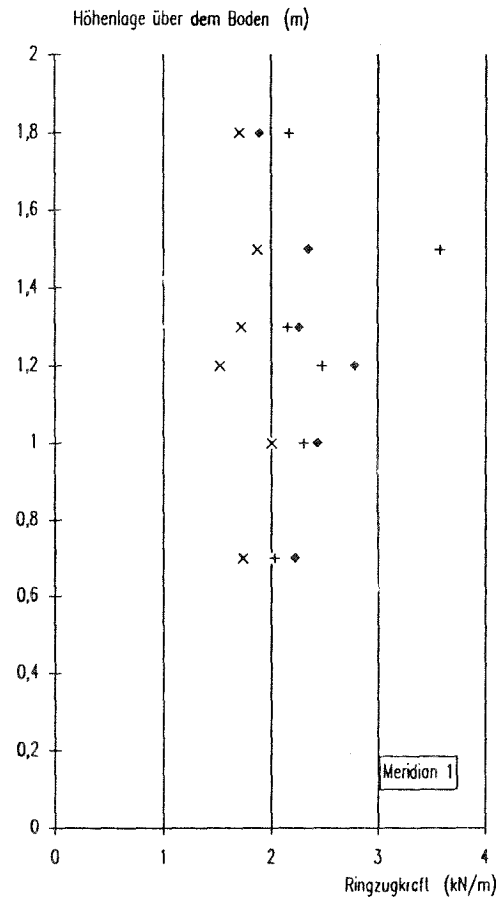


Meridian

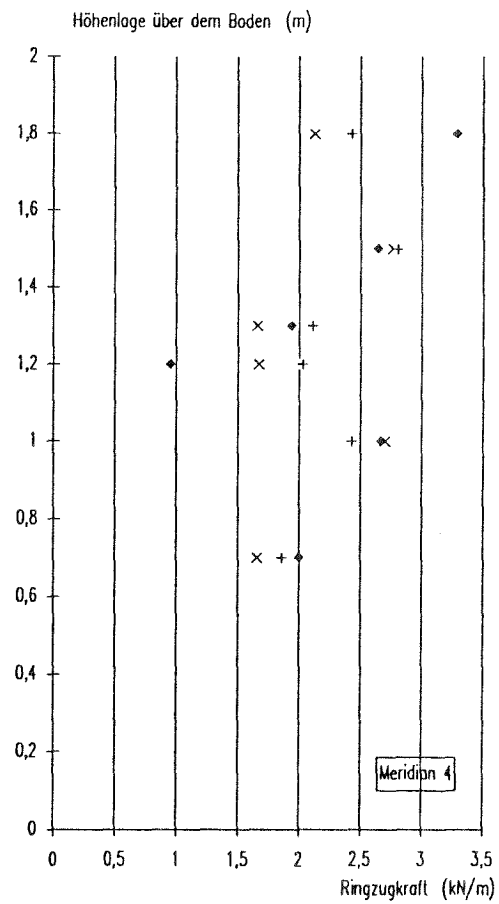
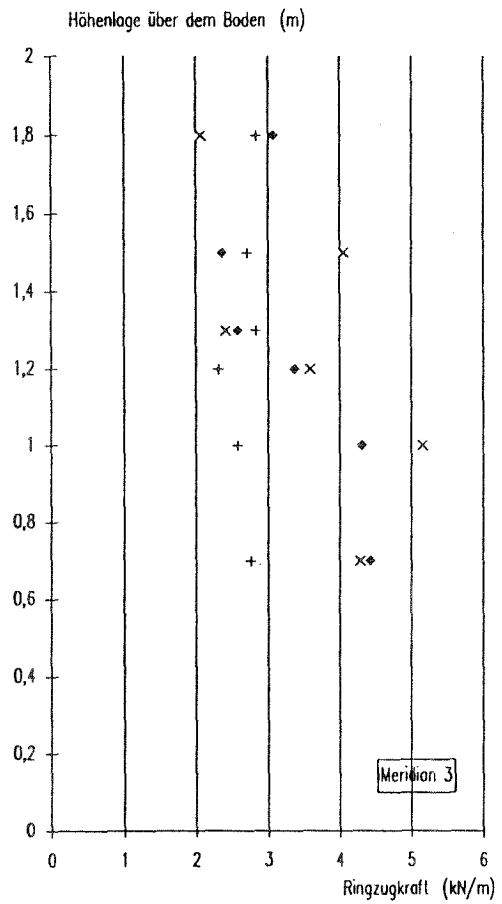
- M1
- ◇— M2
- △— M3
- ×— M4
- \*— M5
- M6
- M7
- +— M8

A 4.301

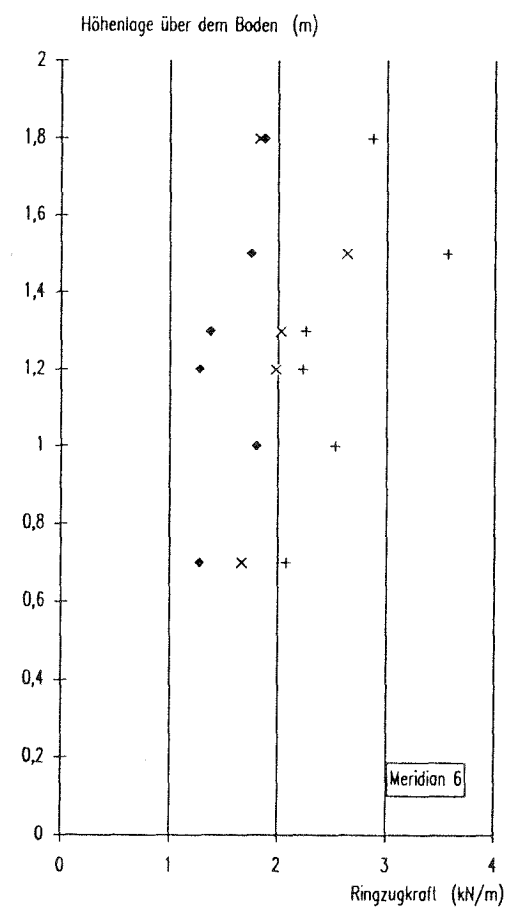
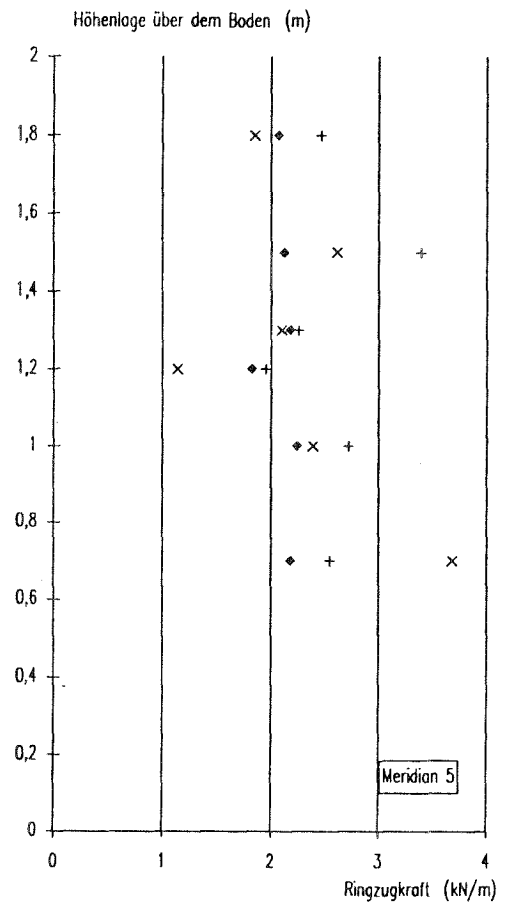




A 4. 304

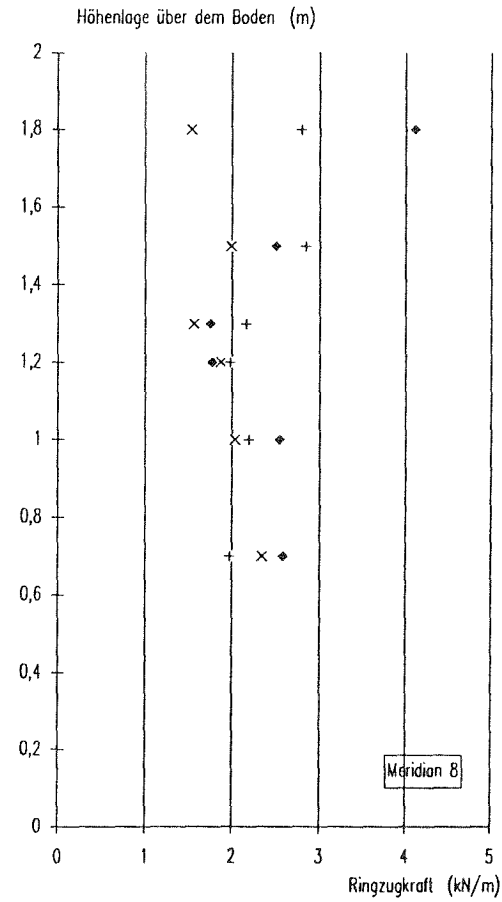
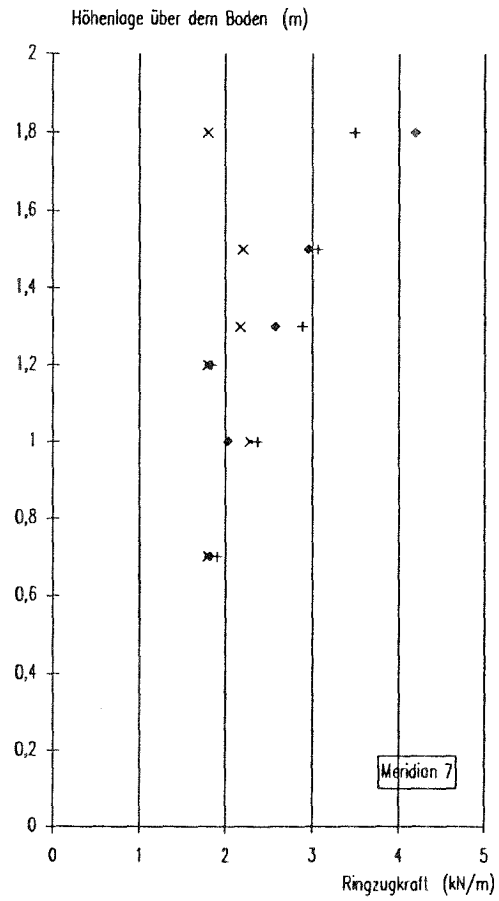


- × Füllen
- + zentr. Entleeren
- ♦ exzent. Entleeren



× Füllen  
 + zentr. Entleeren  
 ♦ exzentr. Entleeren

A 4.306

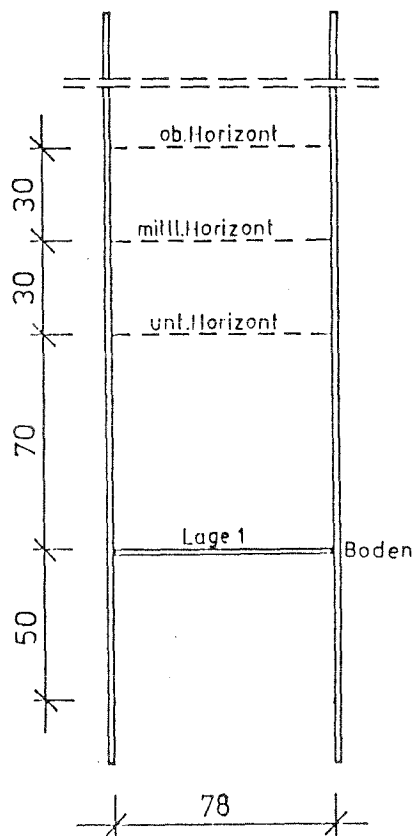
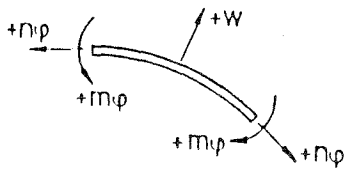
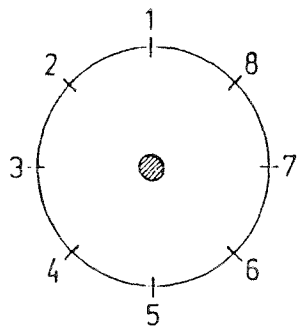
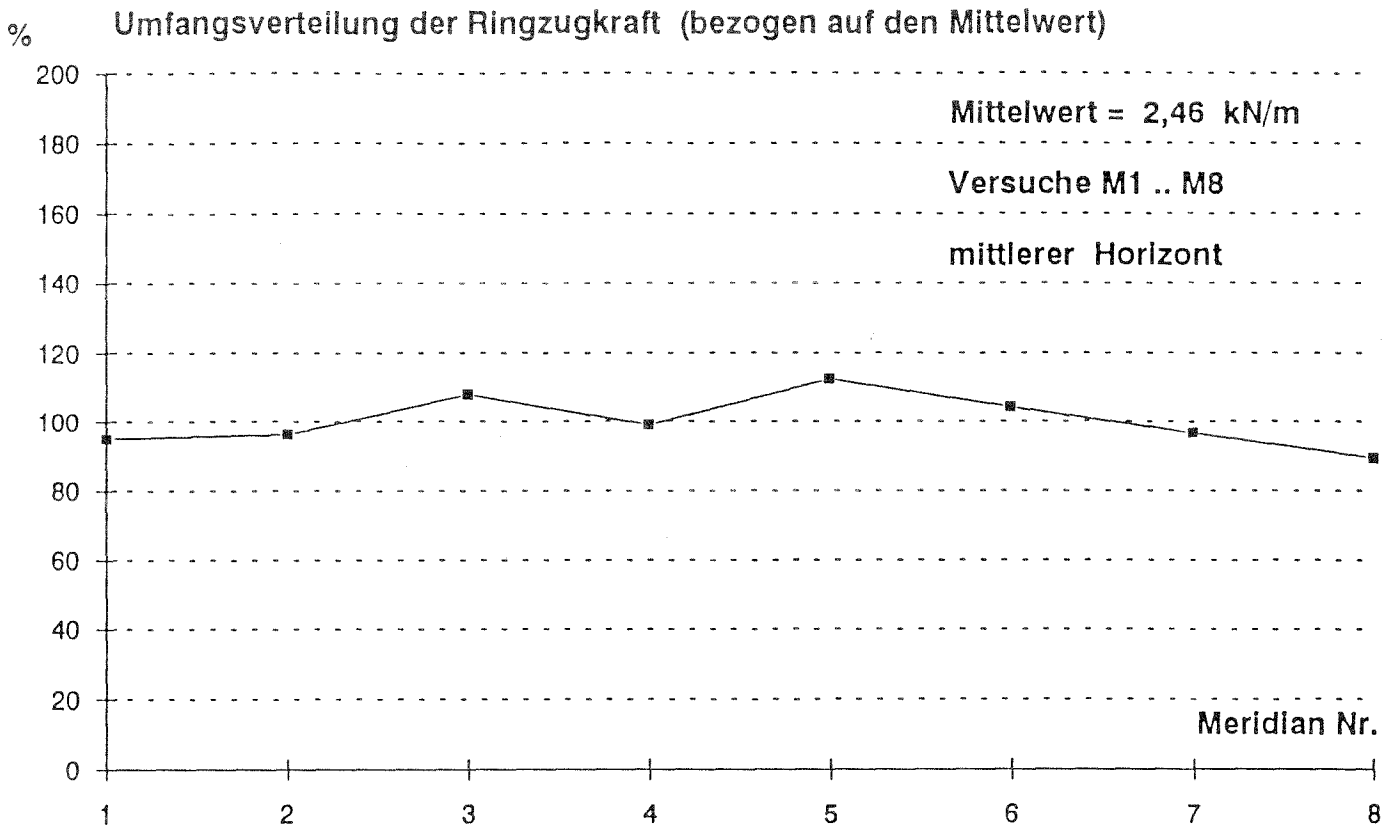


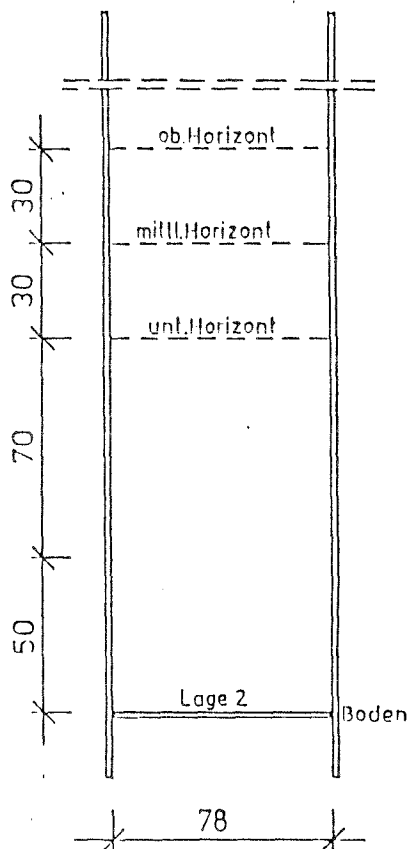
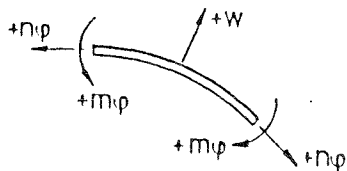
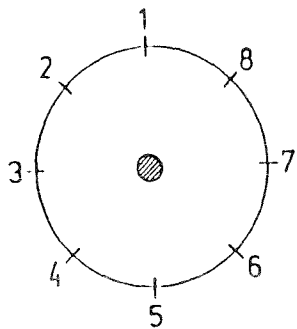
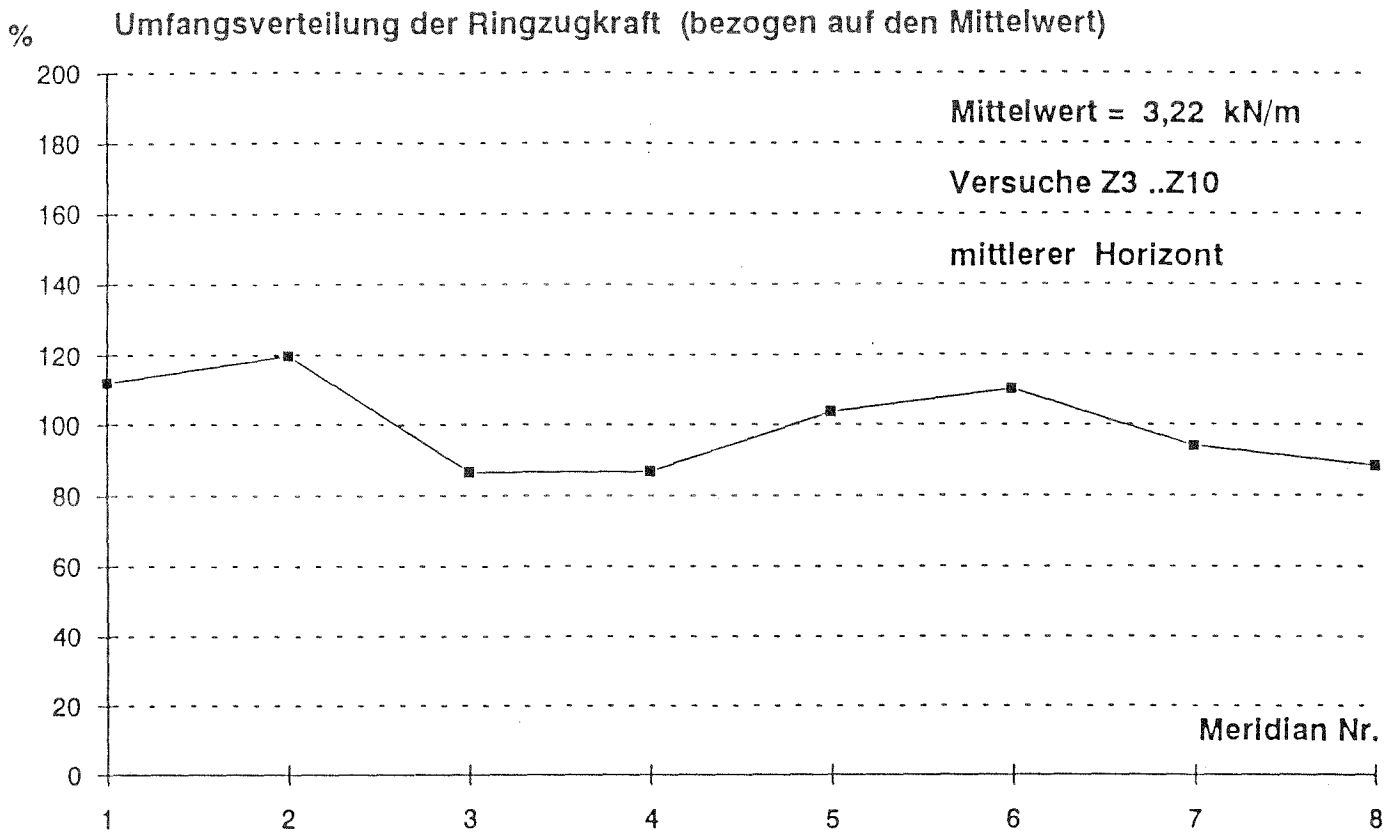
- × Füllen
- + zentr. Entleeren
- ♦ exzentr. Entleeren

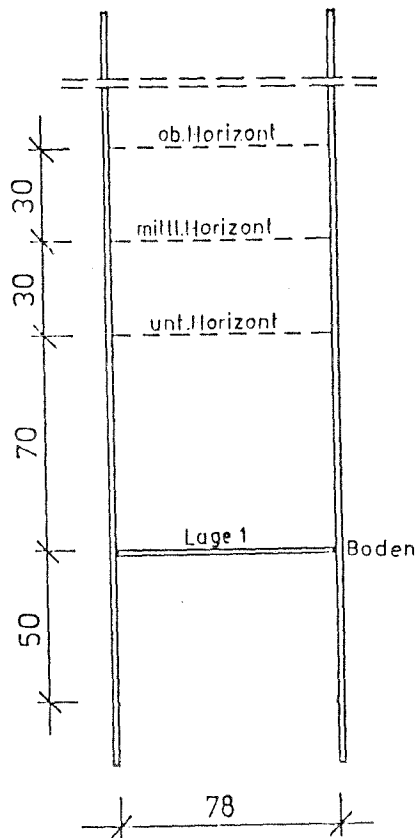
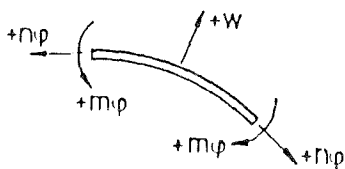
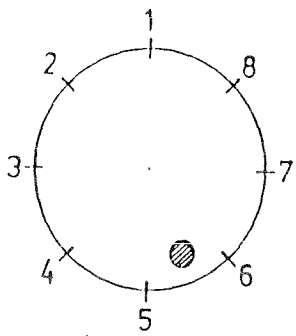
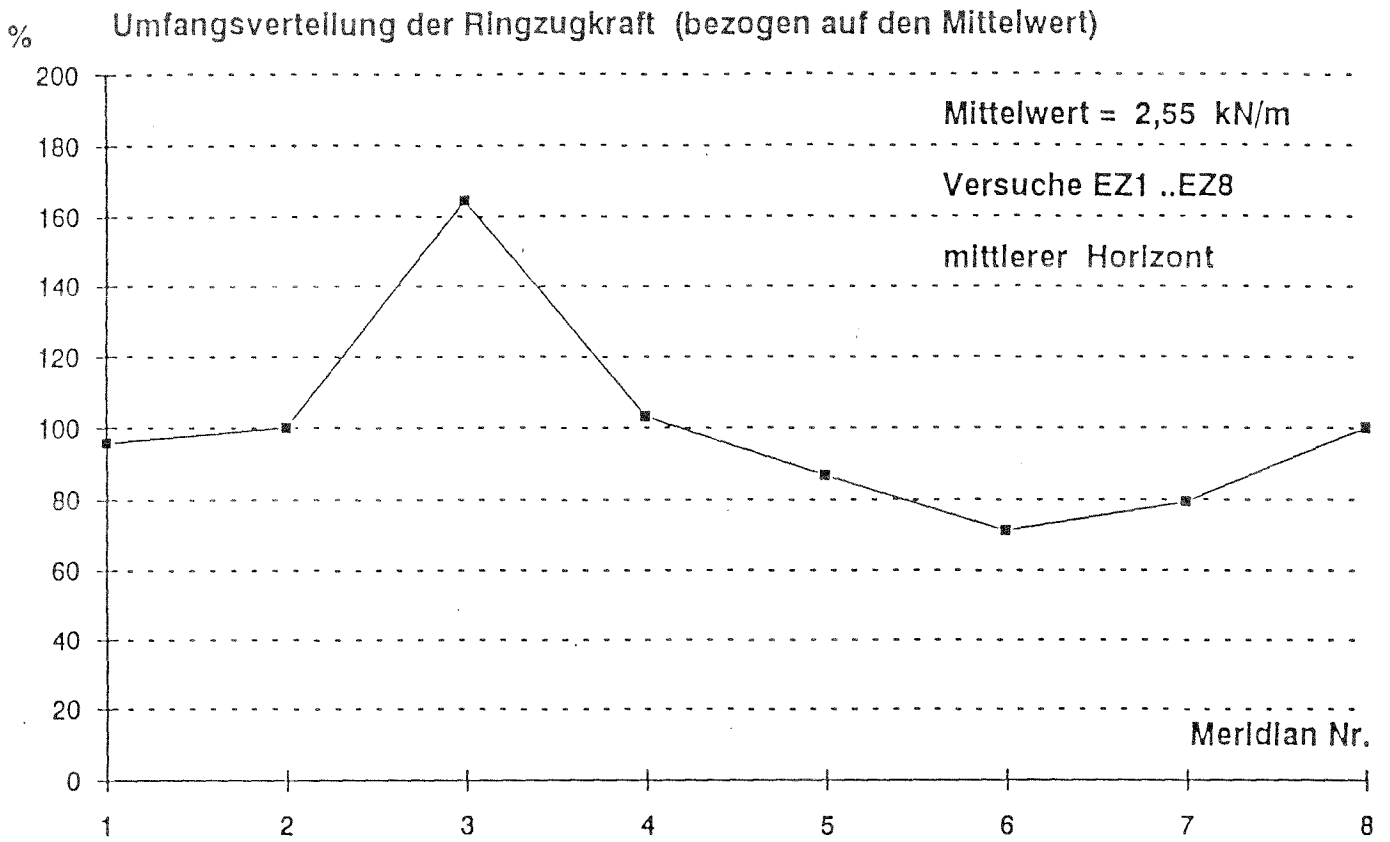
A 4.307

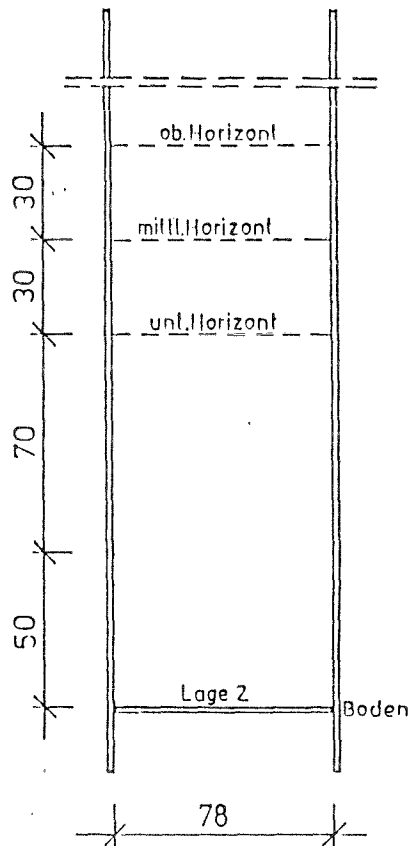
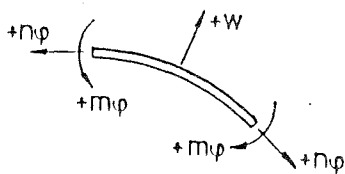
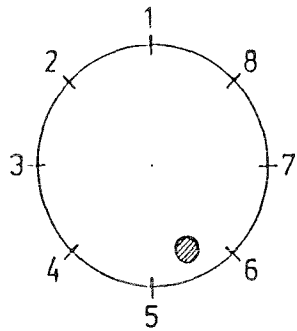
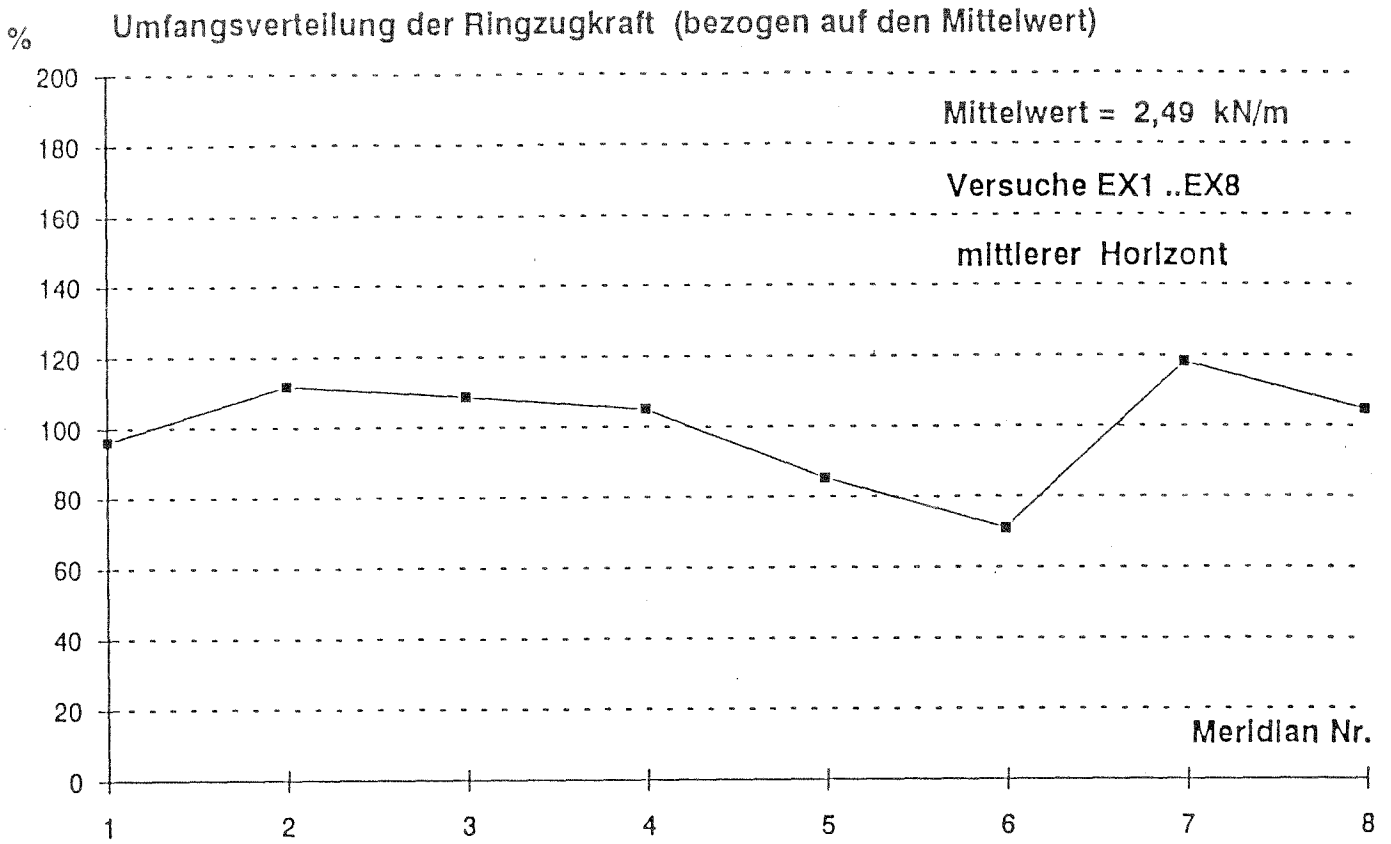


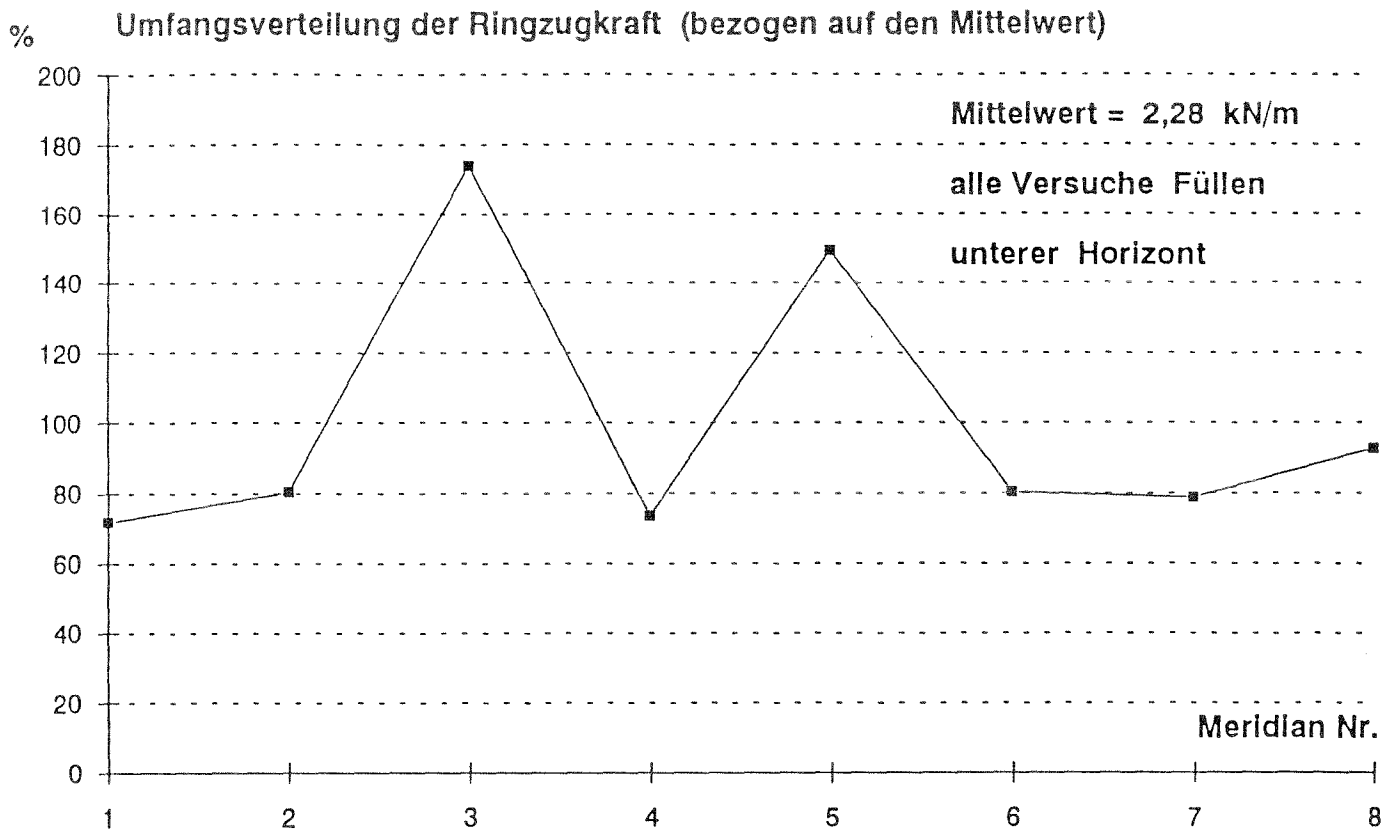


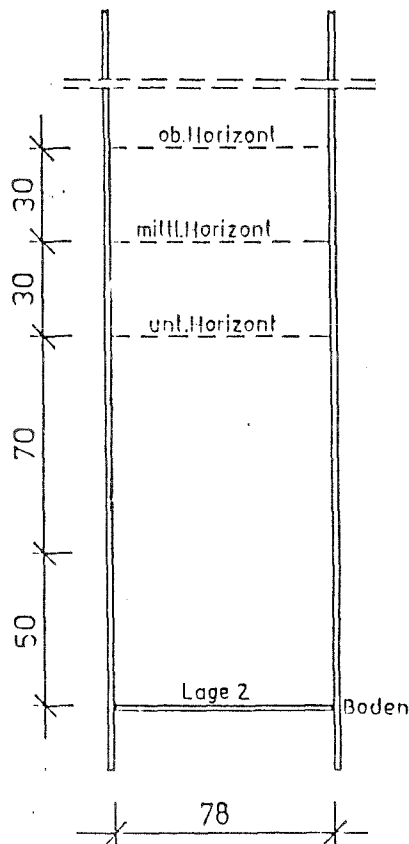
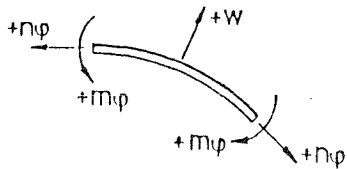
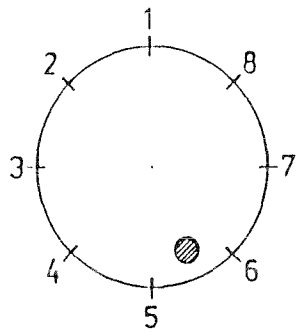
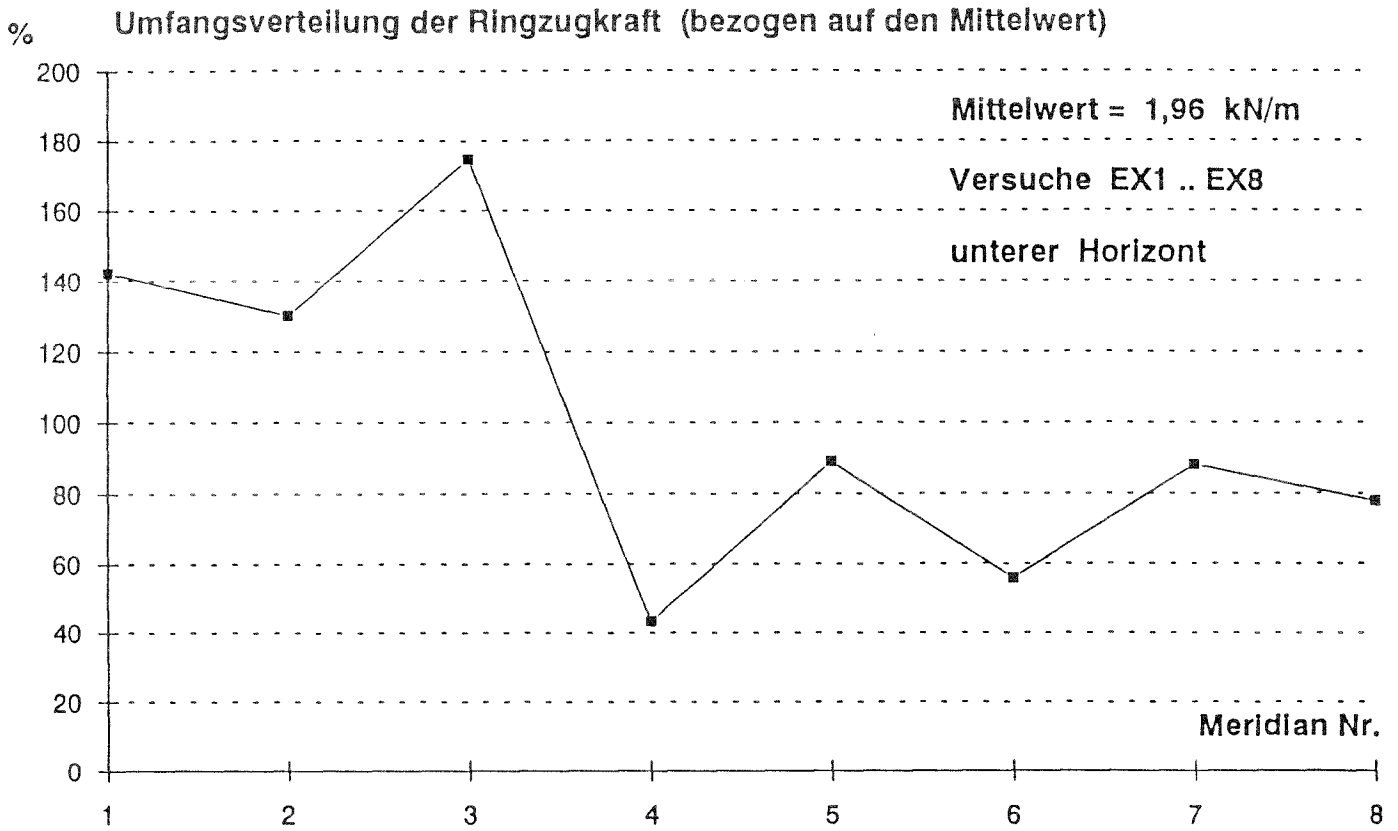


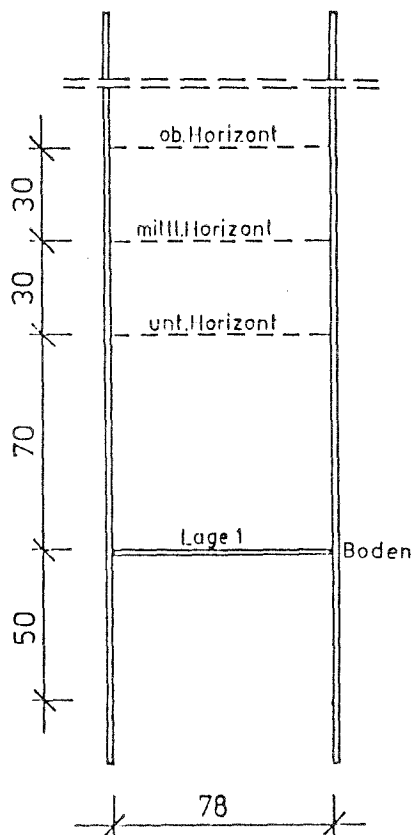
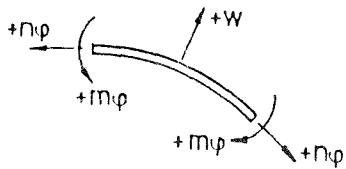
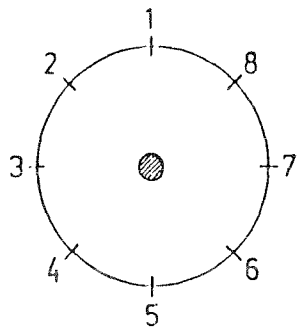
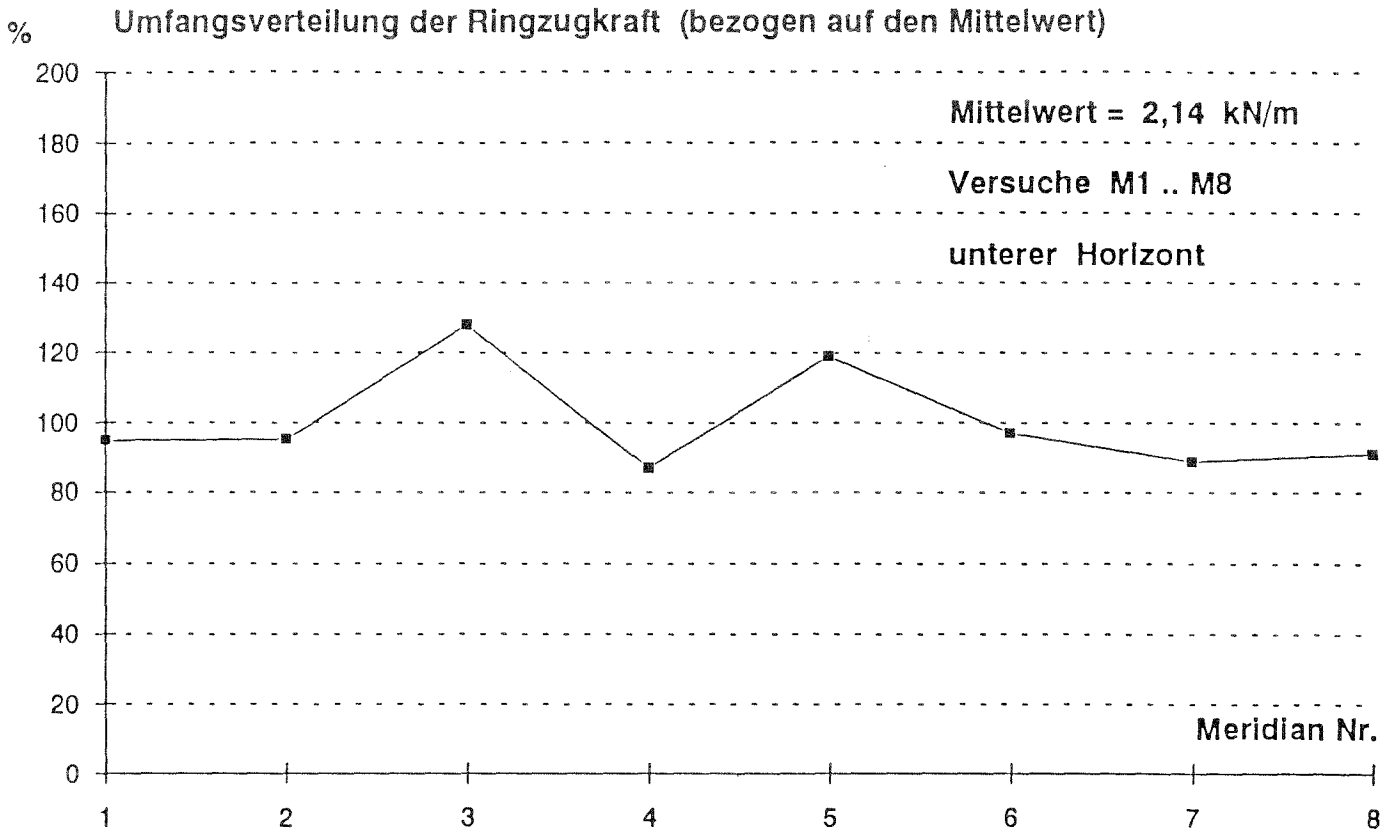




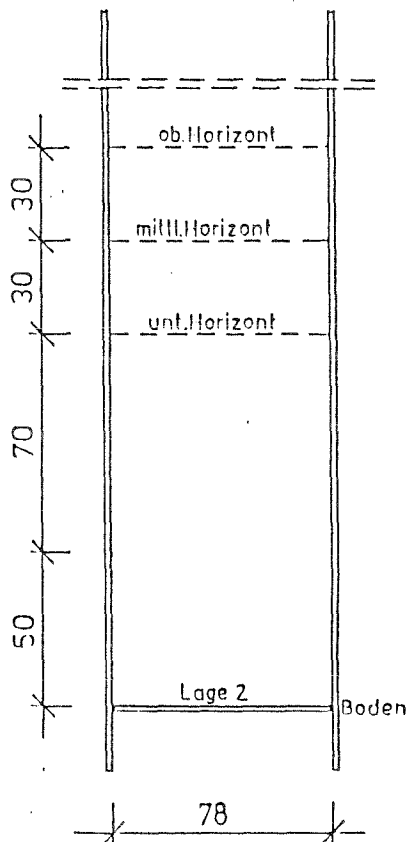
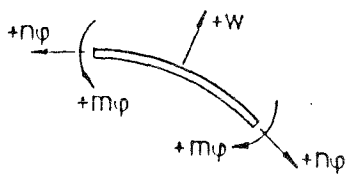
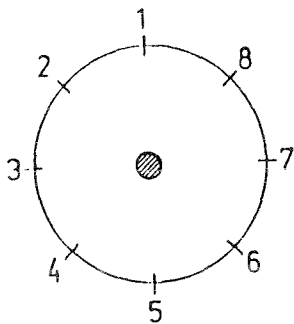
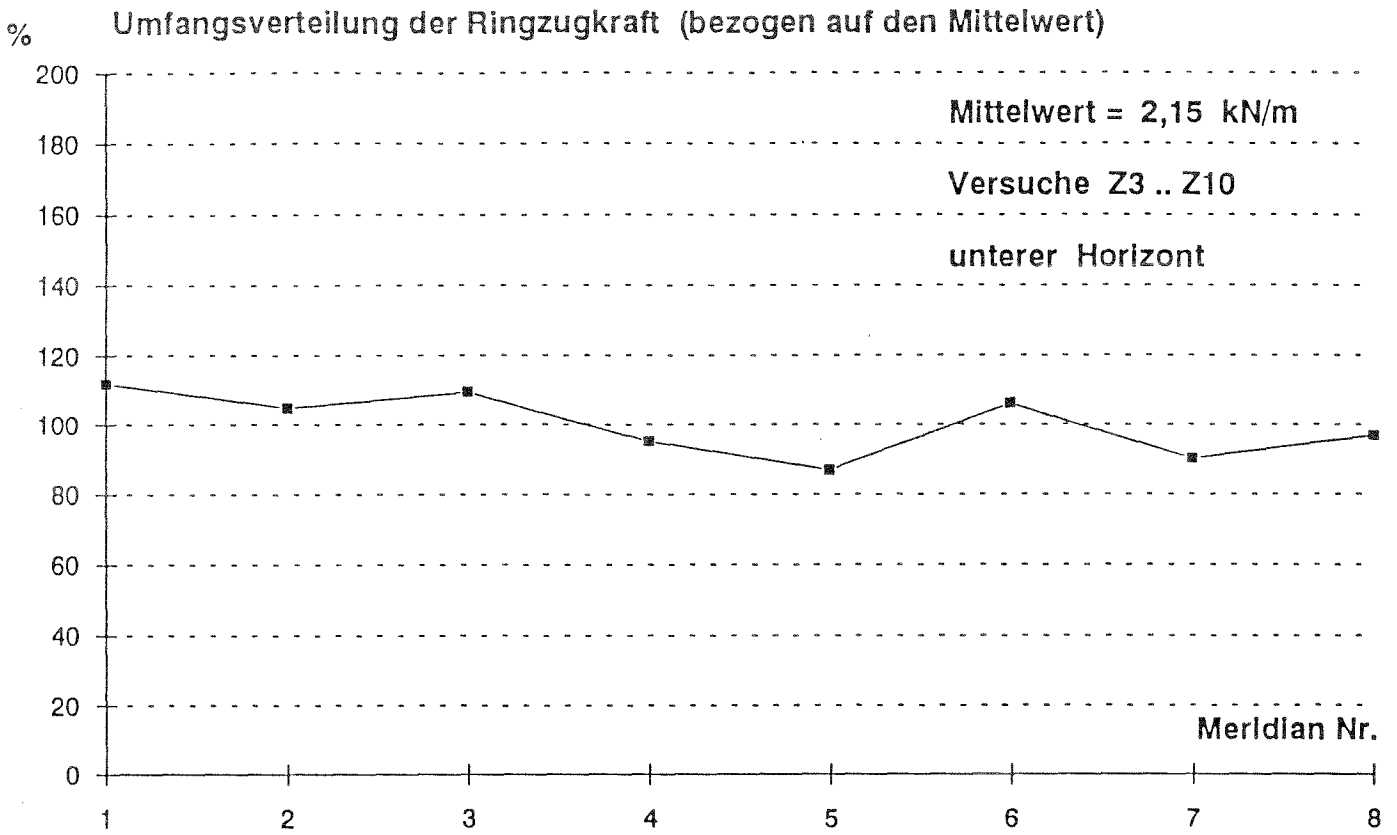


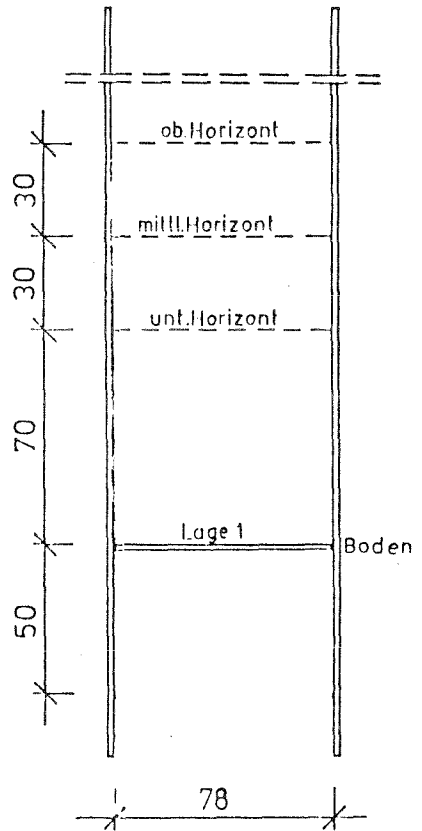
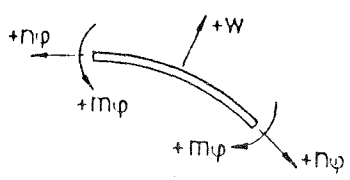
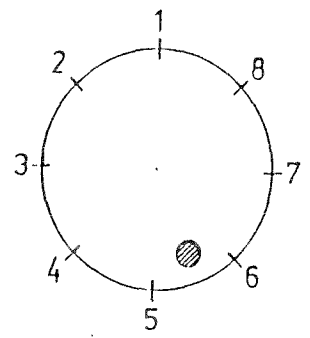
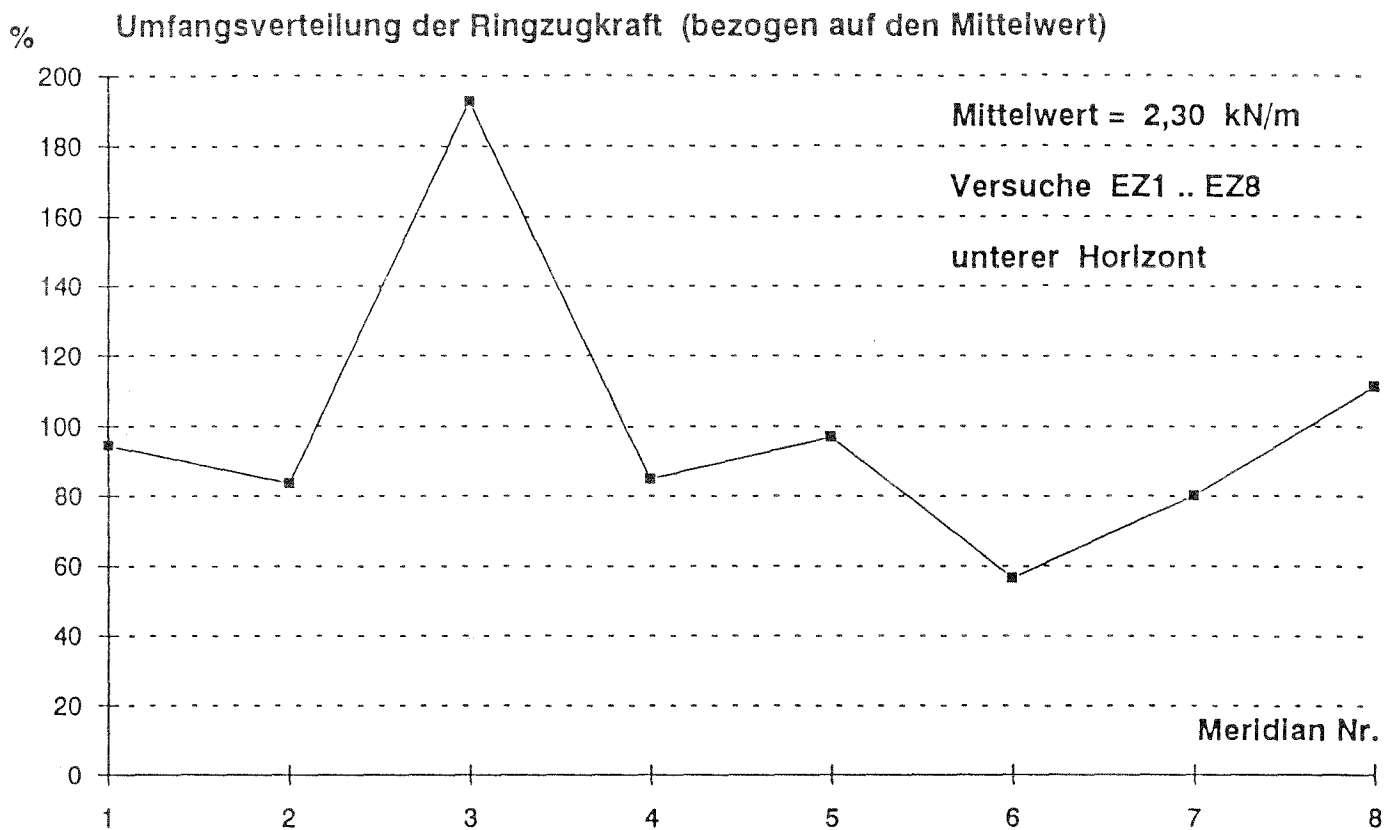


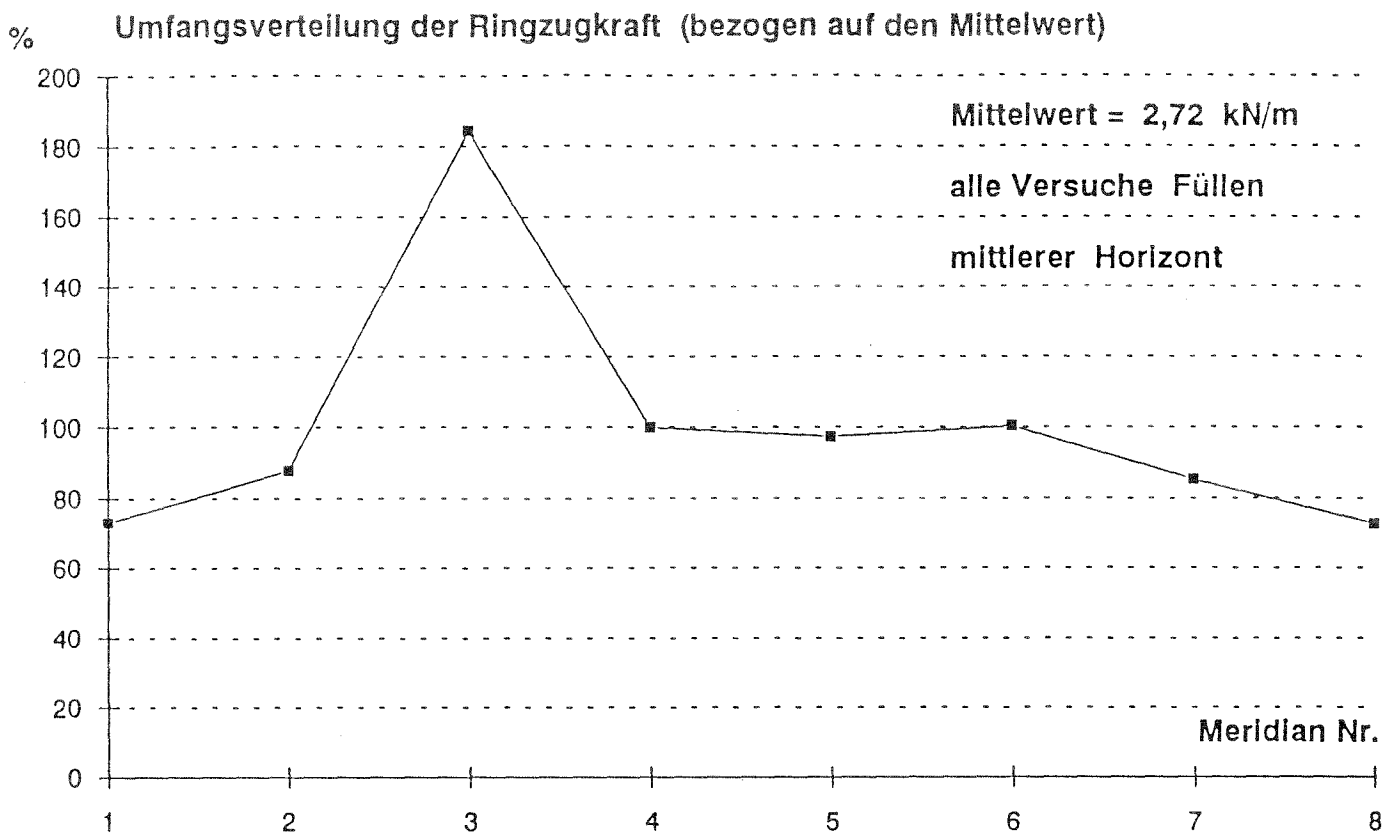


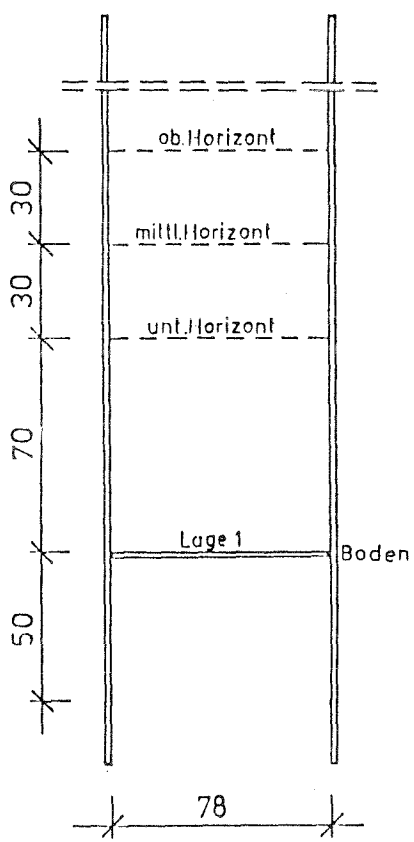
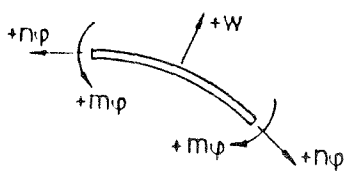
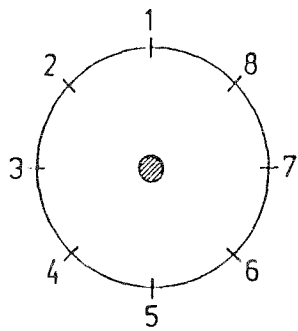
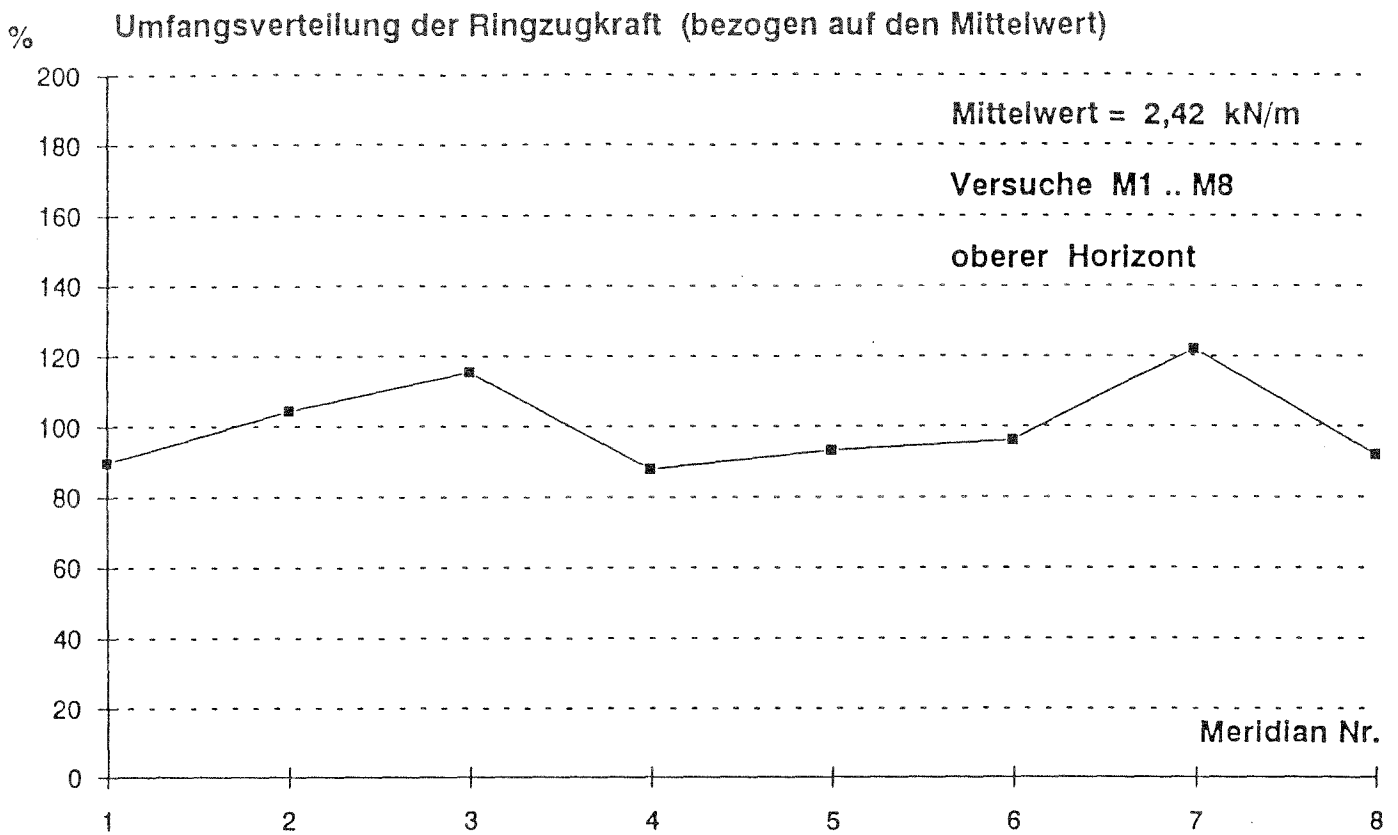


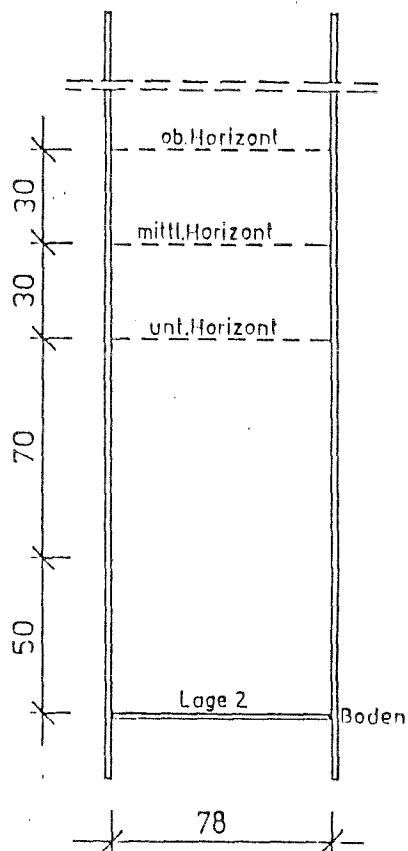
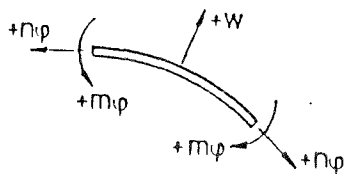
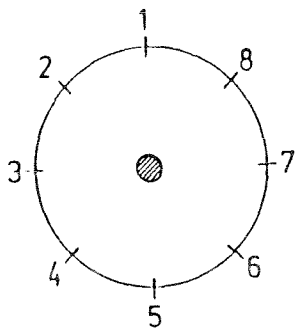
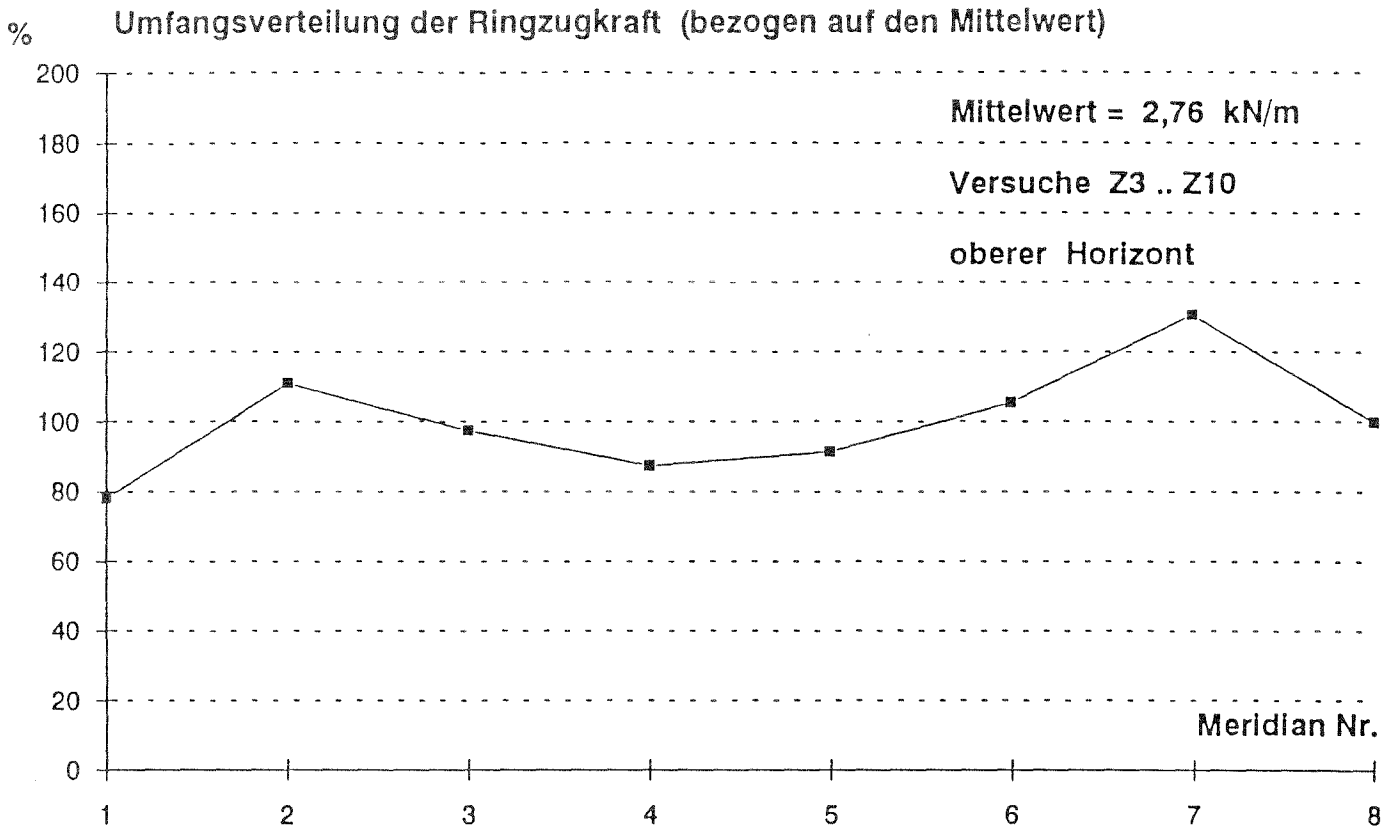


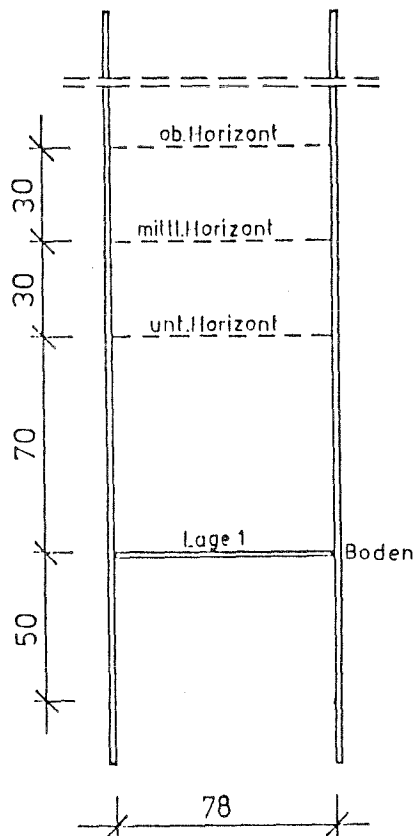
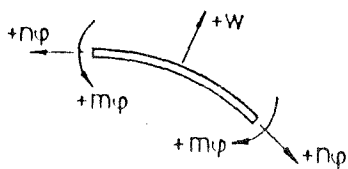
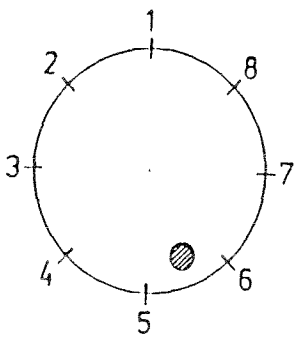
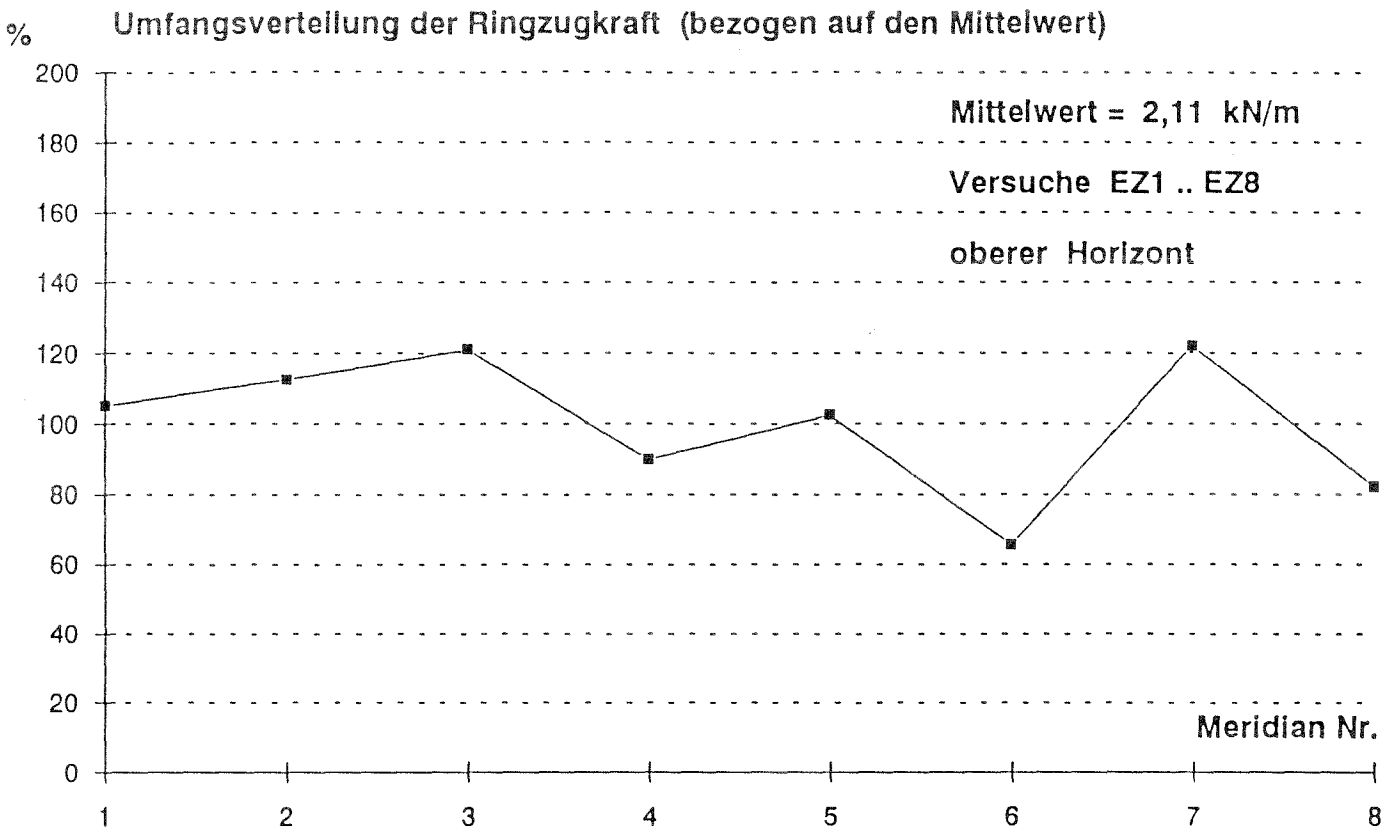


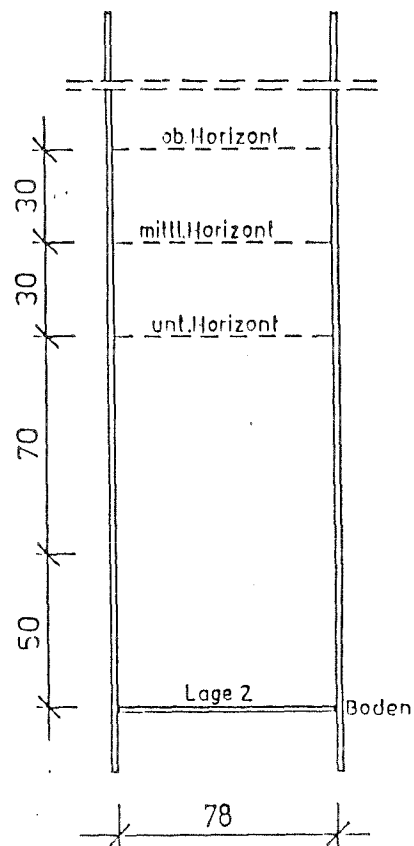
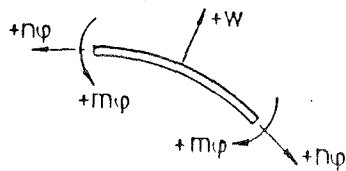
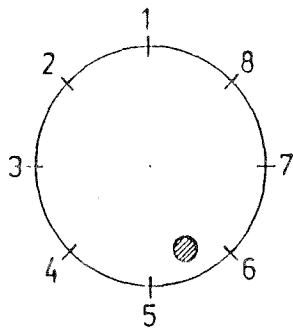
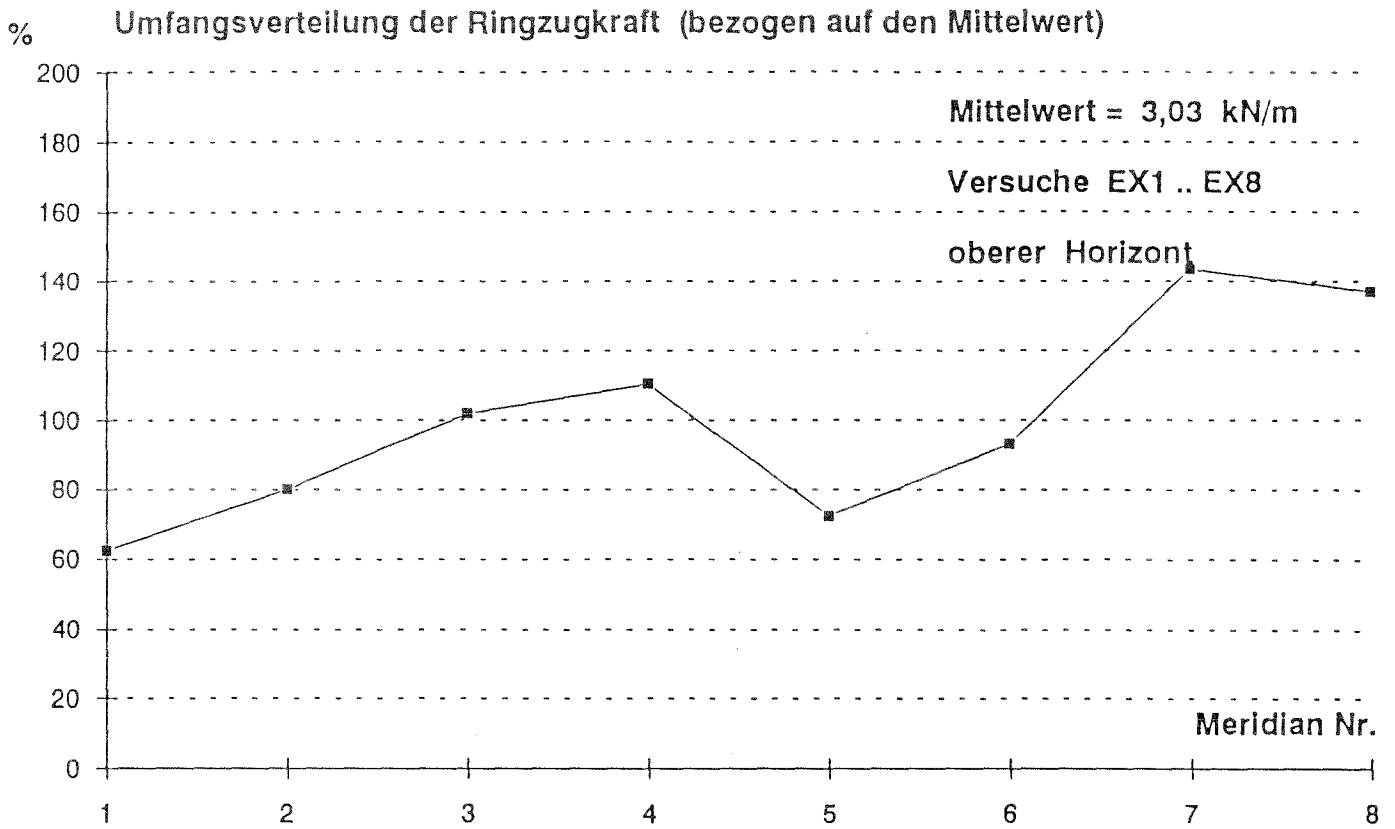












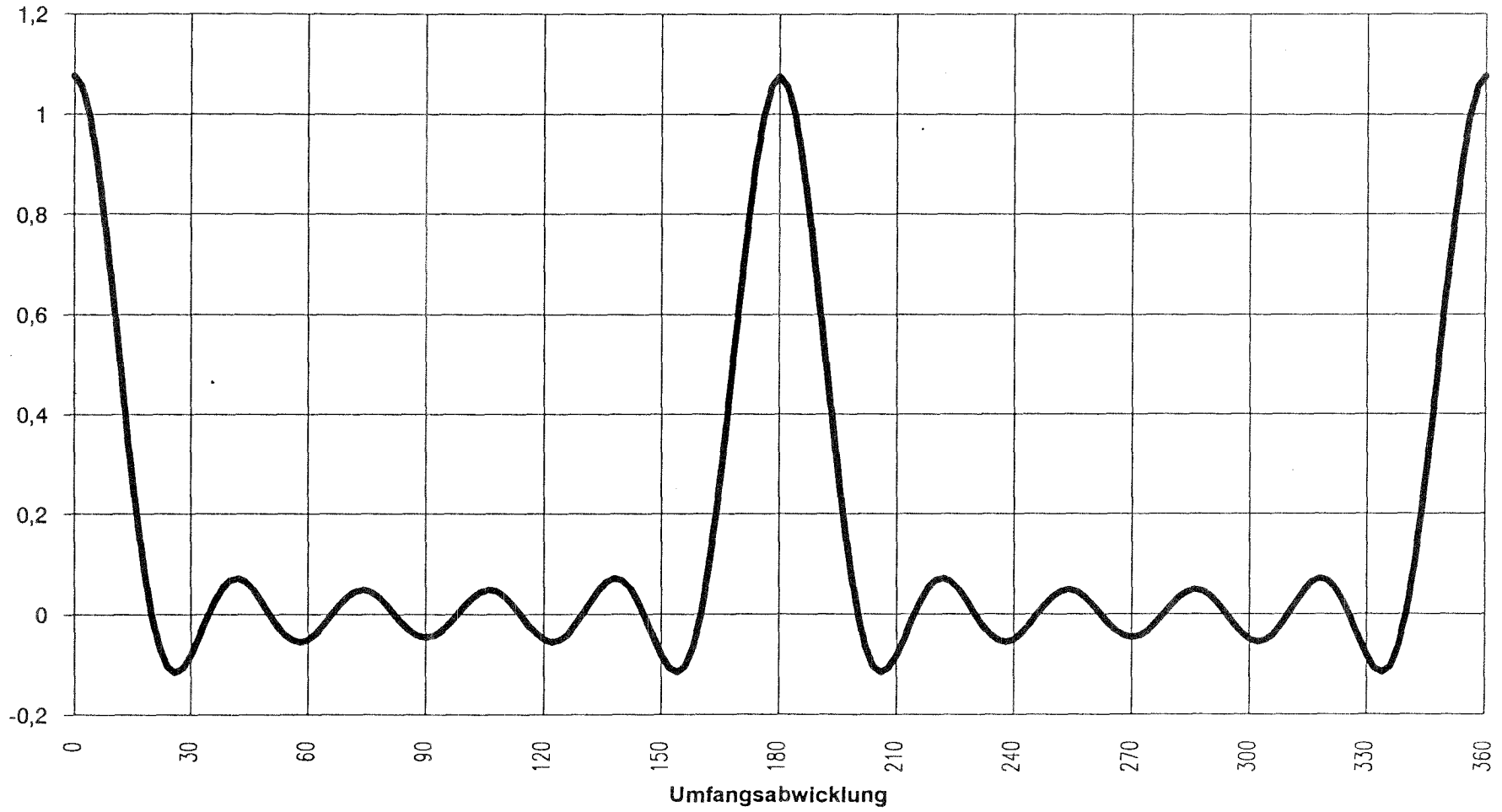
## **Anhang**

- zu Kap. 5
- Darstellung der Teilflächenlast als Fourierreihe
  - Fourierkoeffizienten
  - Beiwerte  $n^*$  zur Berechnung der Normalkraft bei nichtrotationssymmetrisch verteilten Lastansätzen  
Stahlbetonsilos  
Stahlsilos
  - Beiwerte  $m^*$  zur Berechnung des Momentes bei nichtrotationssymmetrisch verteilten Lastansätzen  
Stahlbetonsilos  
Stahlsilos
  - Steigerungsfaktoren  $S^*$   
Stahlbetonsilos  
Stahlsilos



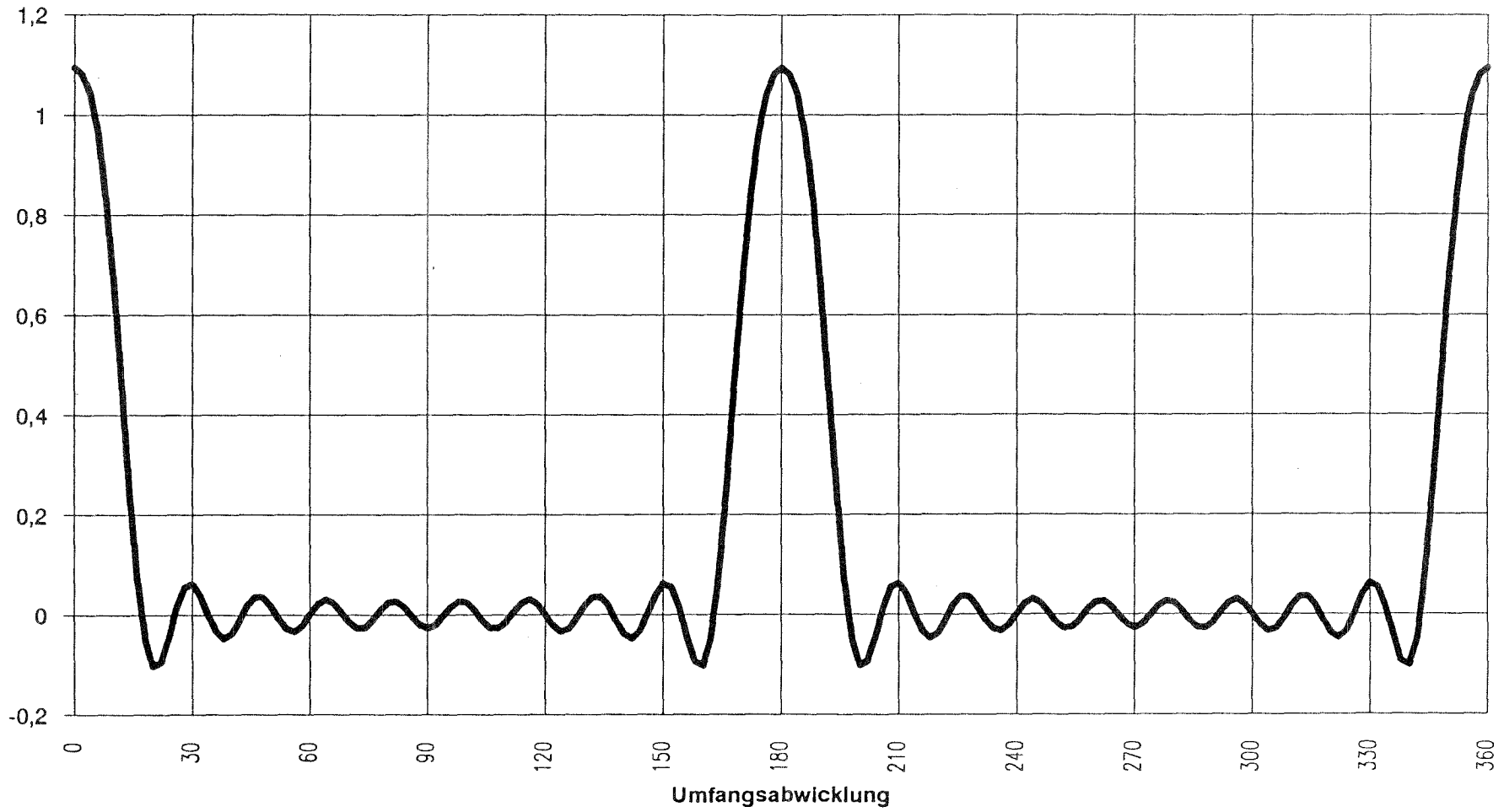
# Teilflächenbelastung

Reihenentwicklung mit 10 Koeffizienten



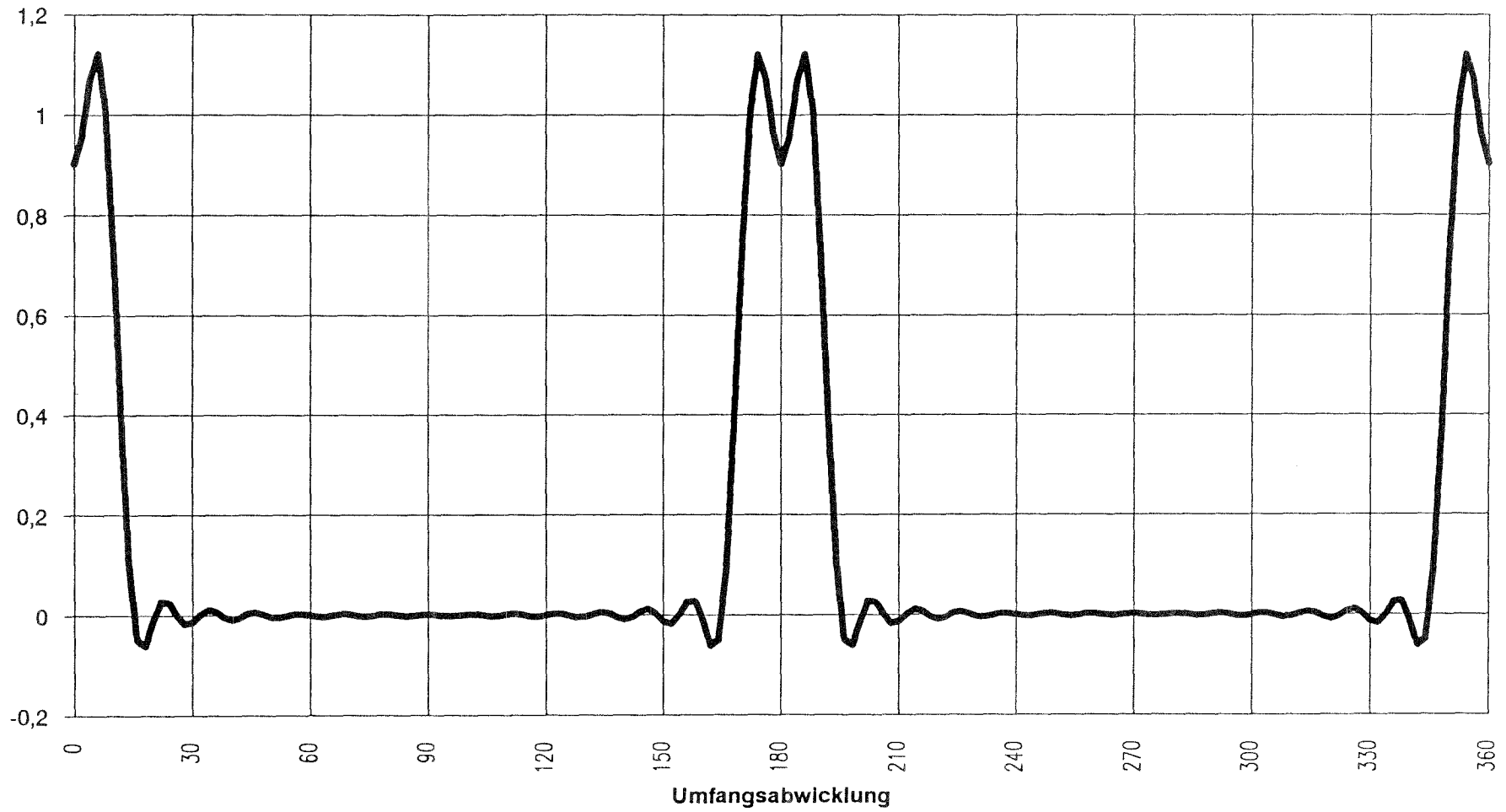
# Teilflächenbelastung

Reihenentwicklung mit 20 Koeffizienten



# Teilflächenbelastung

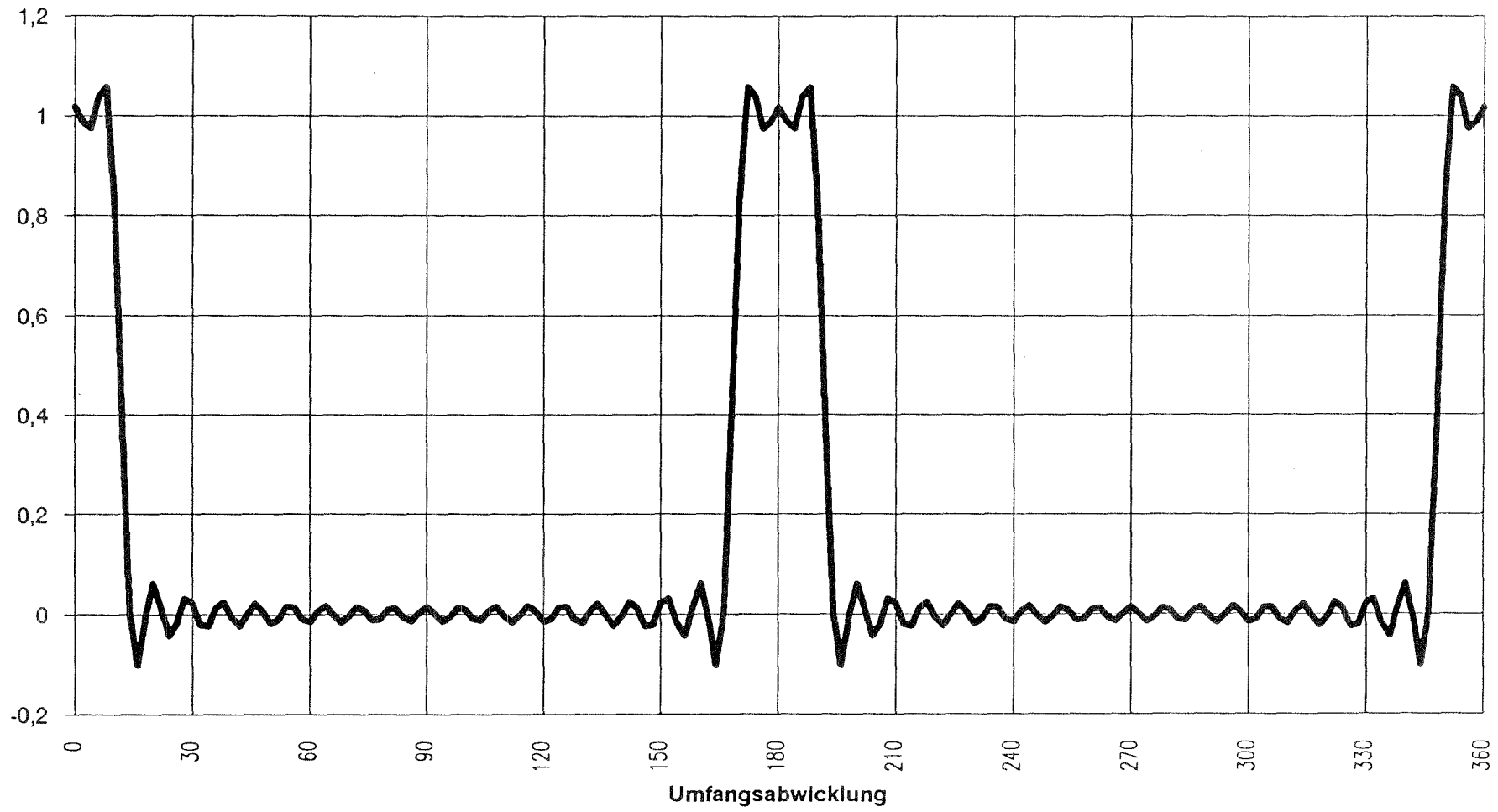
Reihenentwicklung mit 30 Koeffizienten



A.S. 3

# Teilflächenbelastung

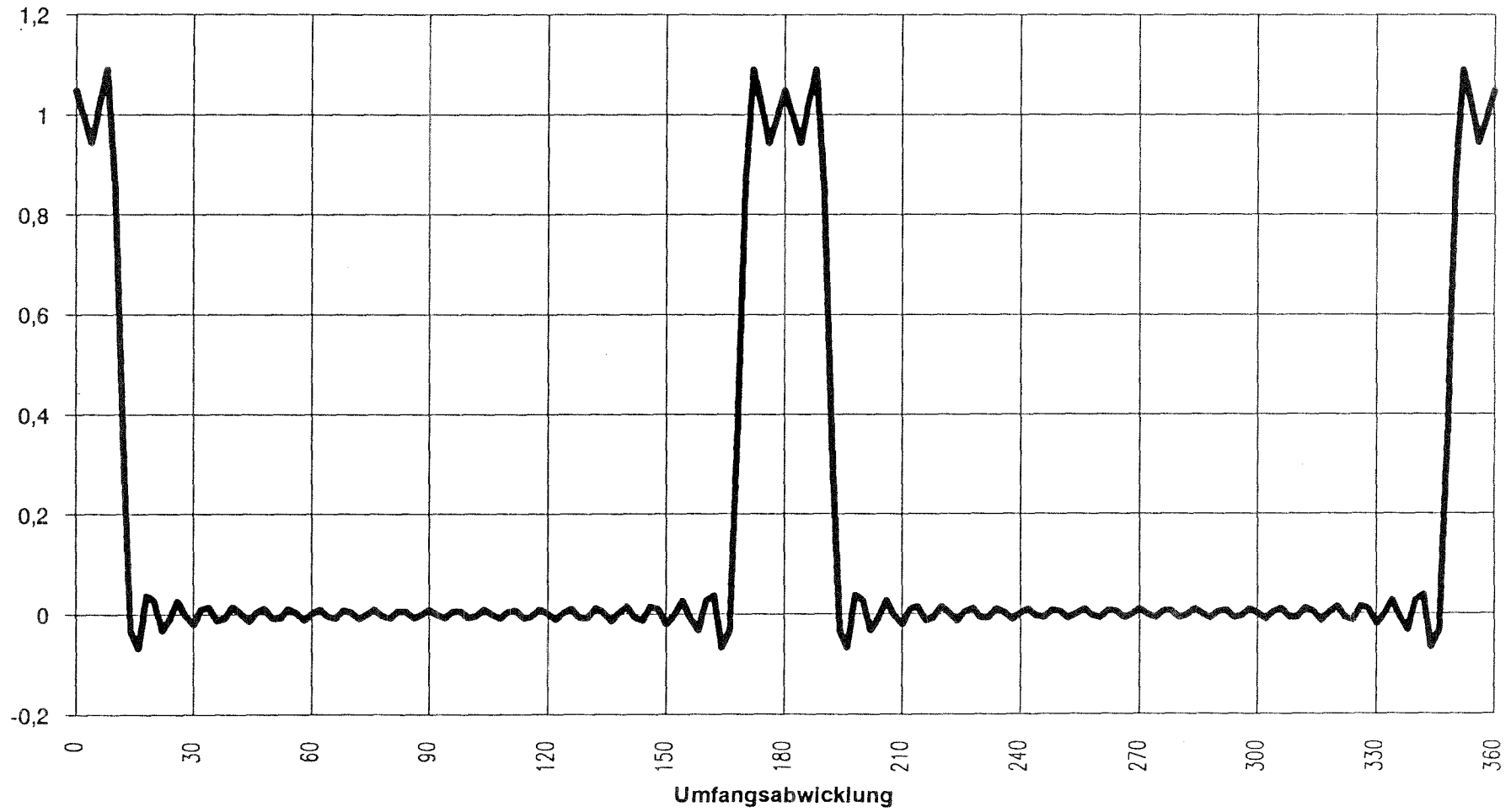
Reihenentwicklung mit 40 Koeffizienten



A S 4

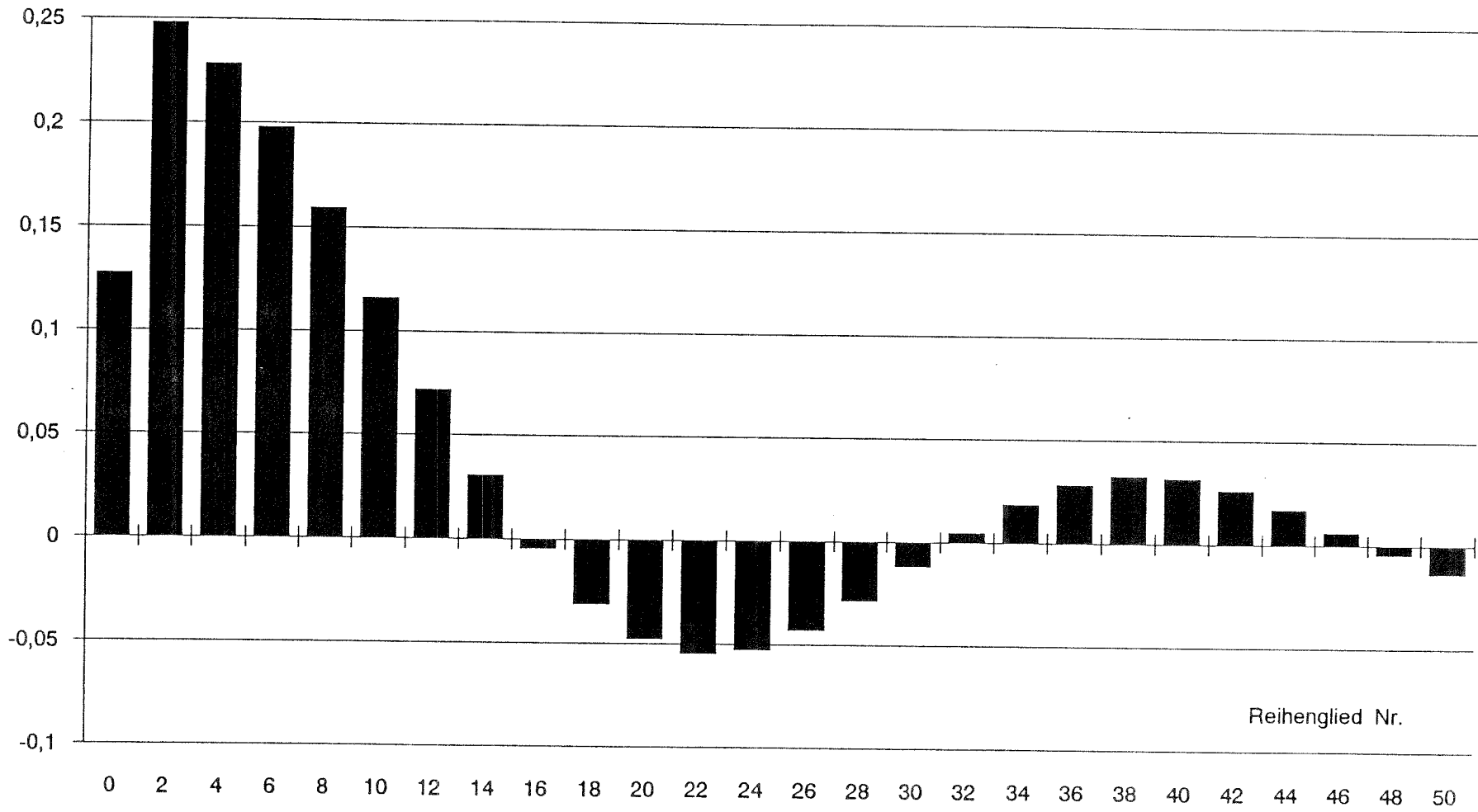
# Teilflächenbelastung

Reihenentwicklung mit 50 Koeffizienten

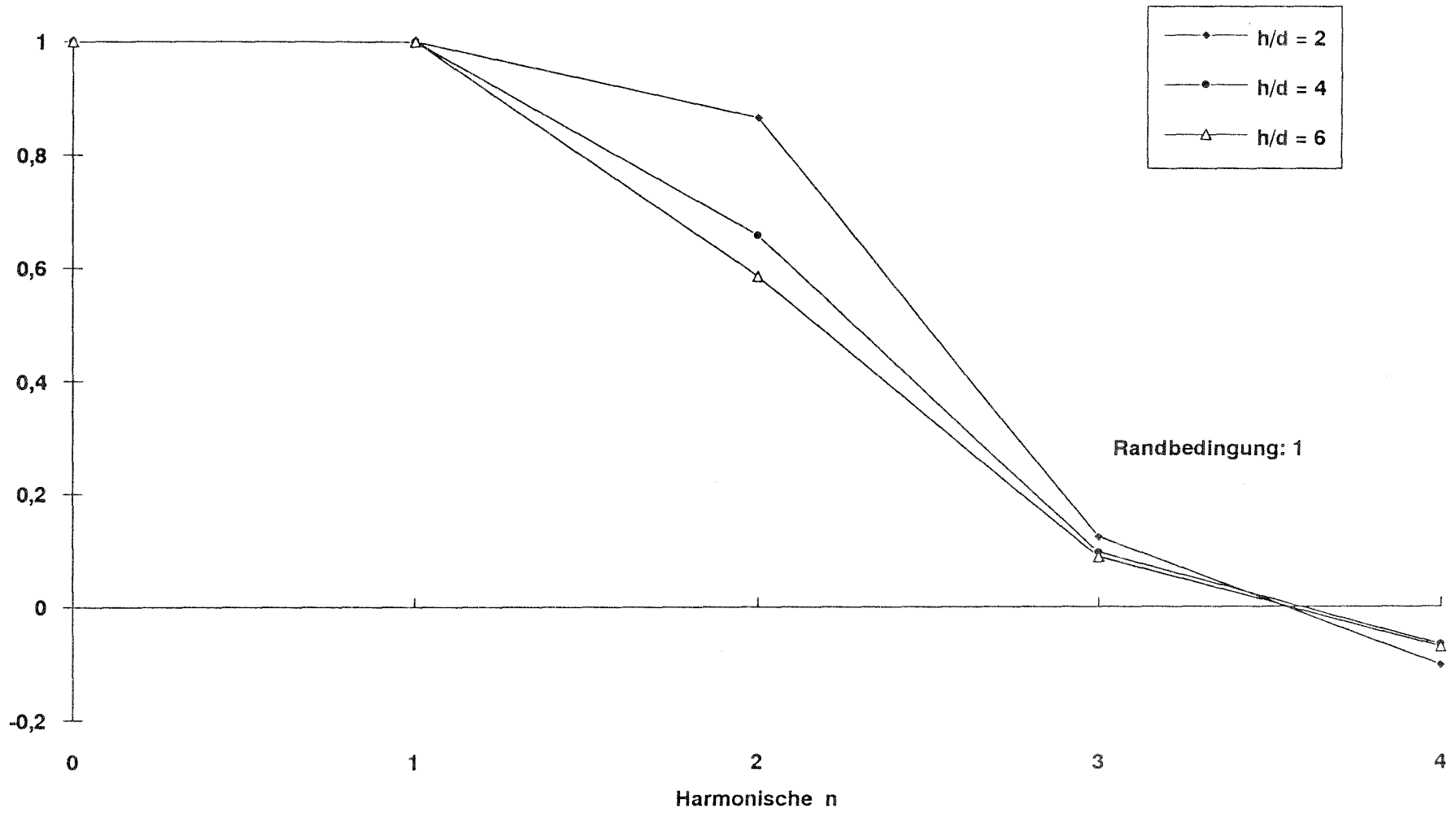


A.S.A

# Fourierkoeffizienten

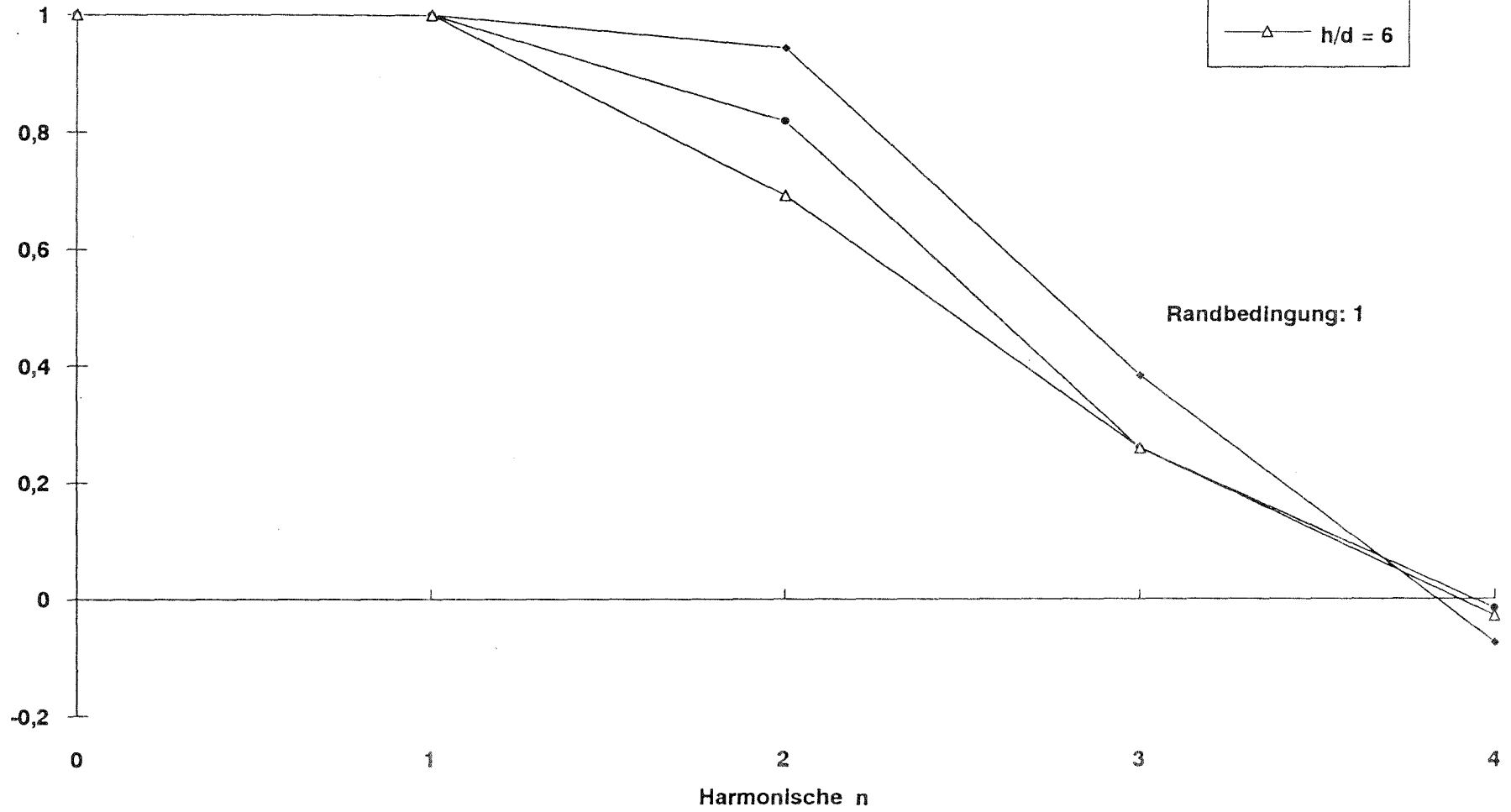
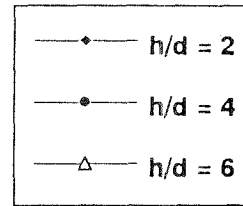


Beiwert  $n^*$   $r/t = 20$



A 5.7

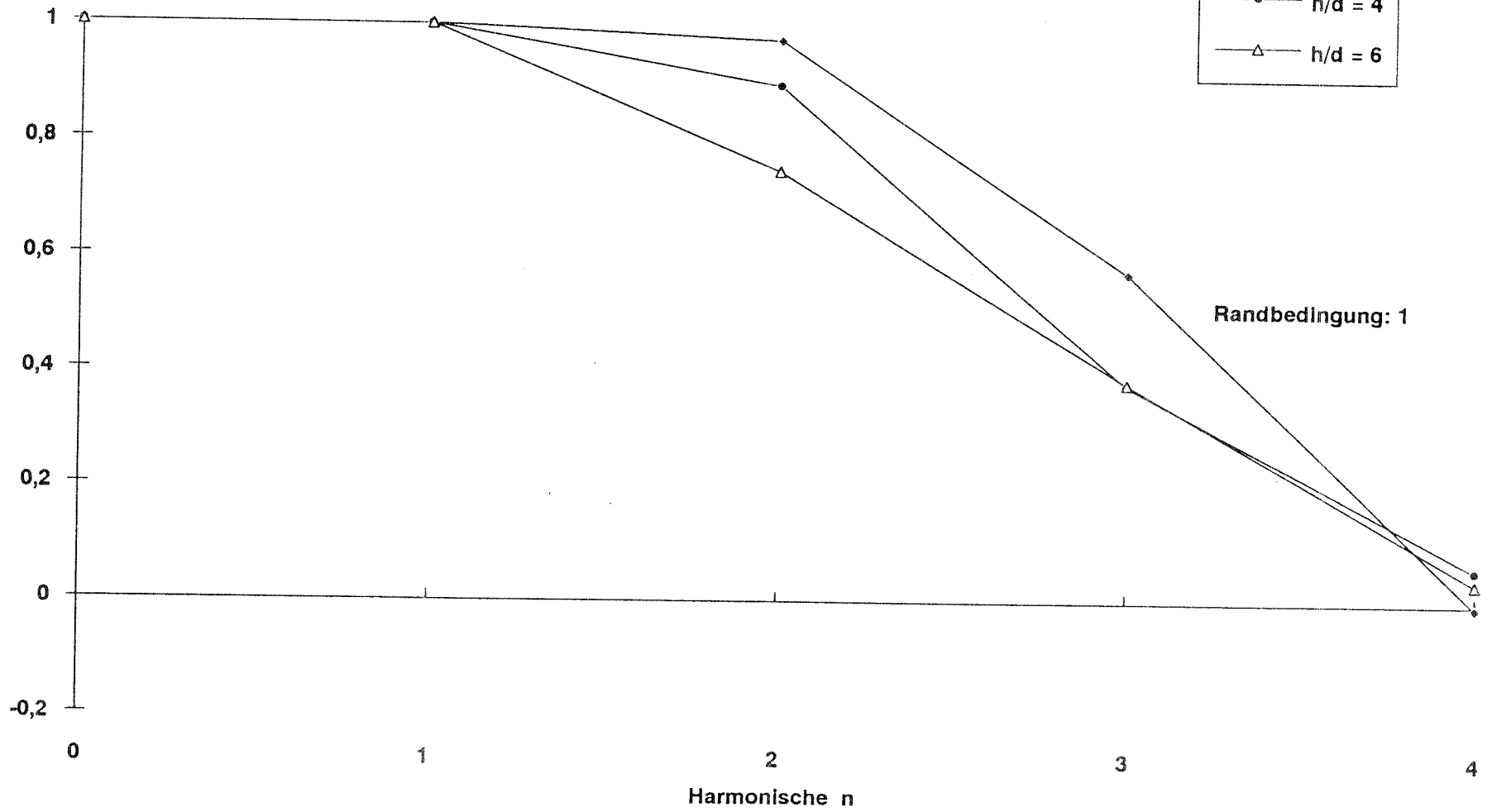
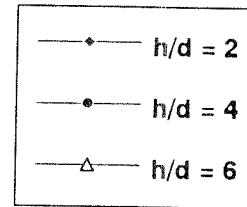
Beiwert  $n^*$   $r/t = 30$



A 5.8

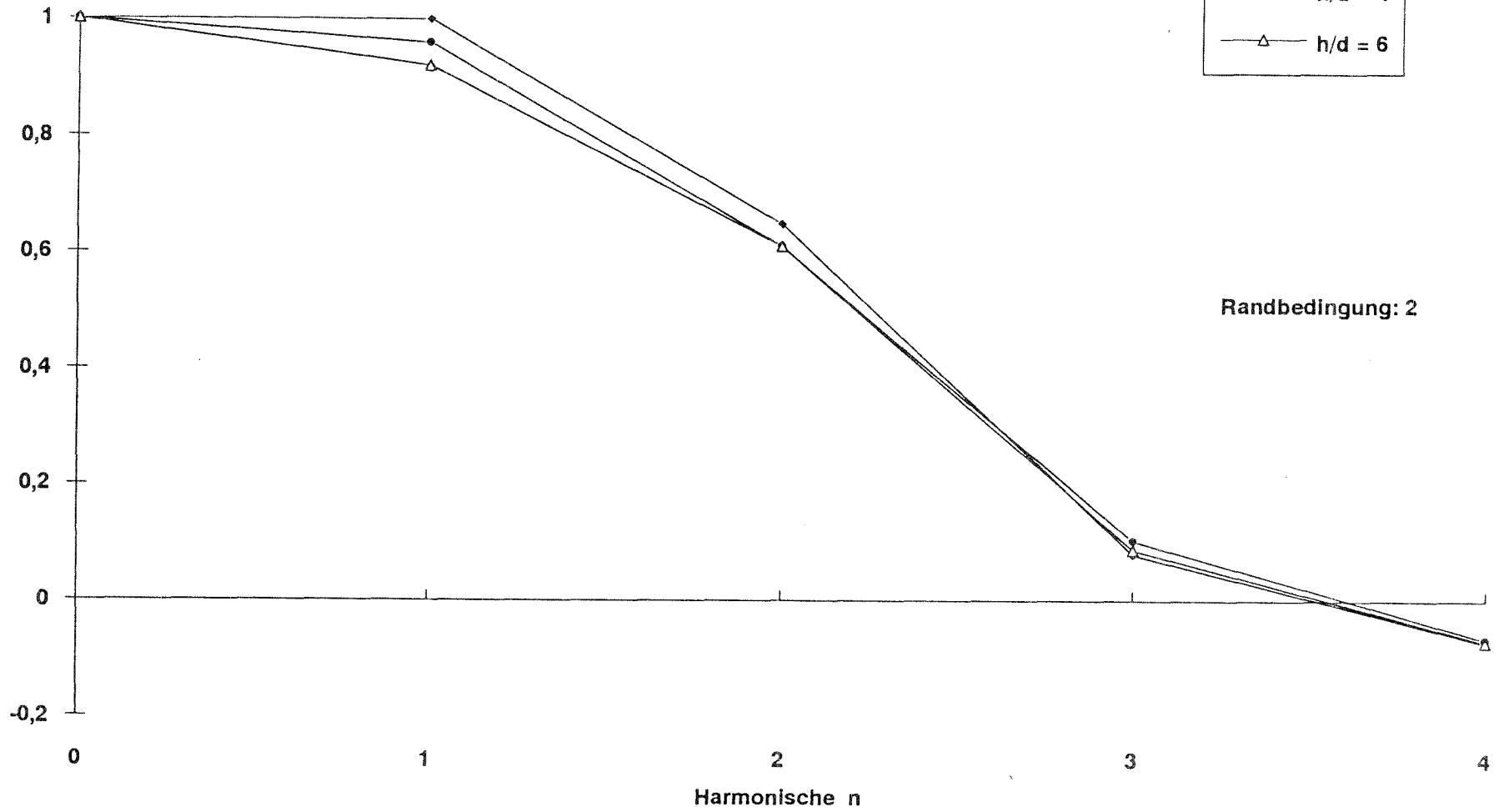
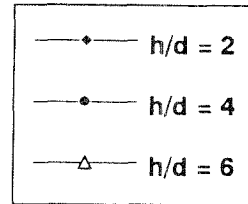


Beiwert  $n^*$   $r/t = 40$



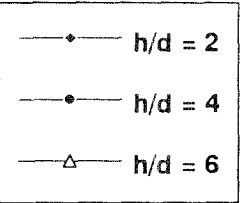
A.S.9

Belwert  $n^*$   $r/t = 20$

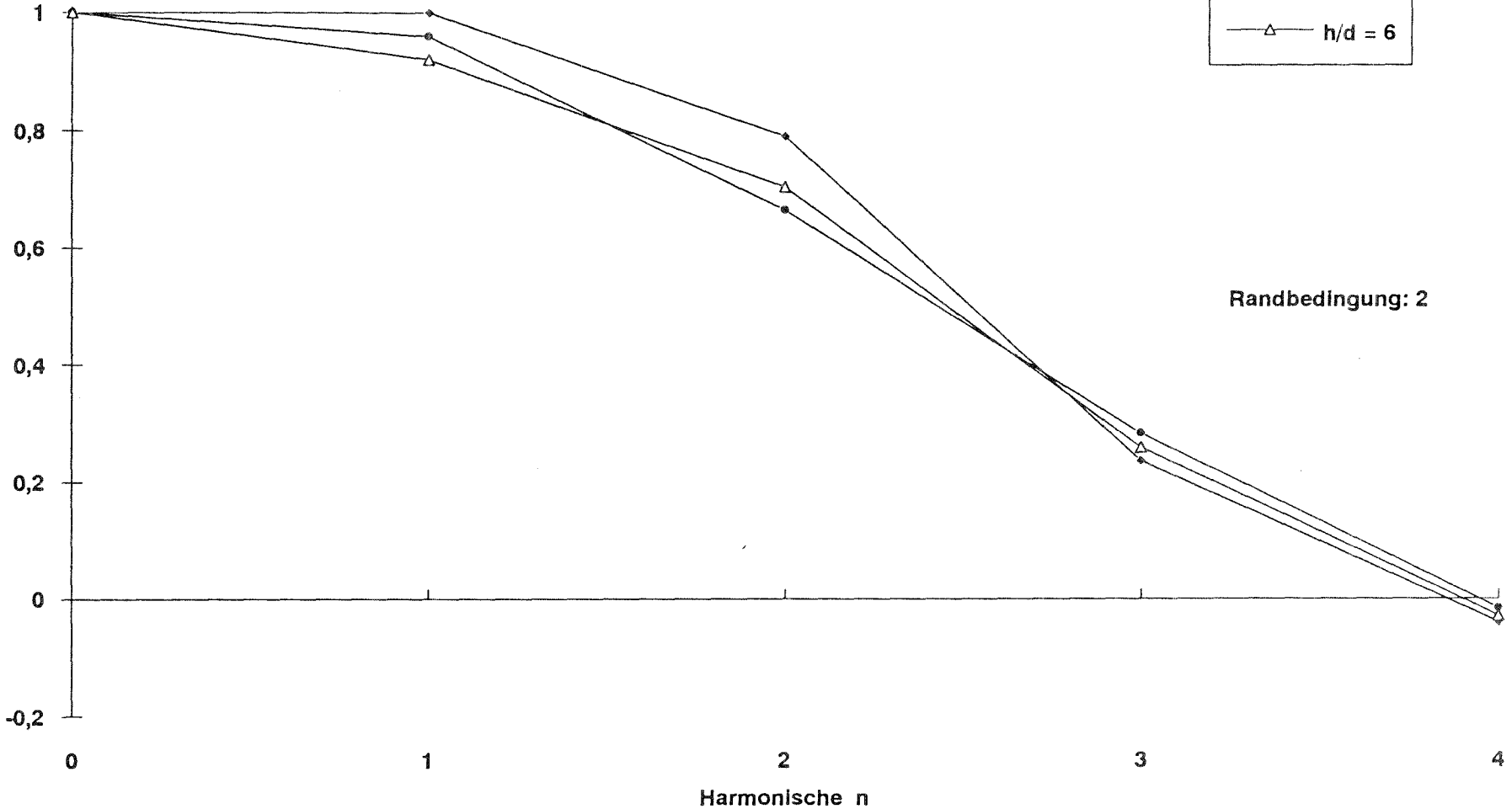


Randbedingung: 2

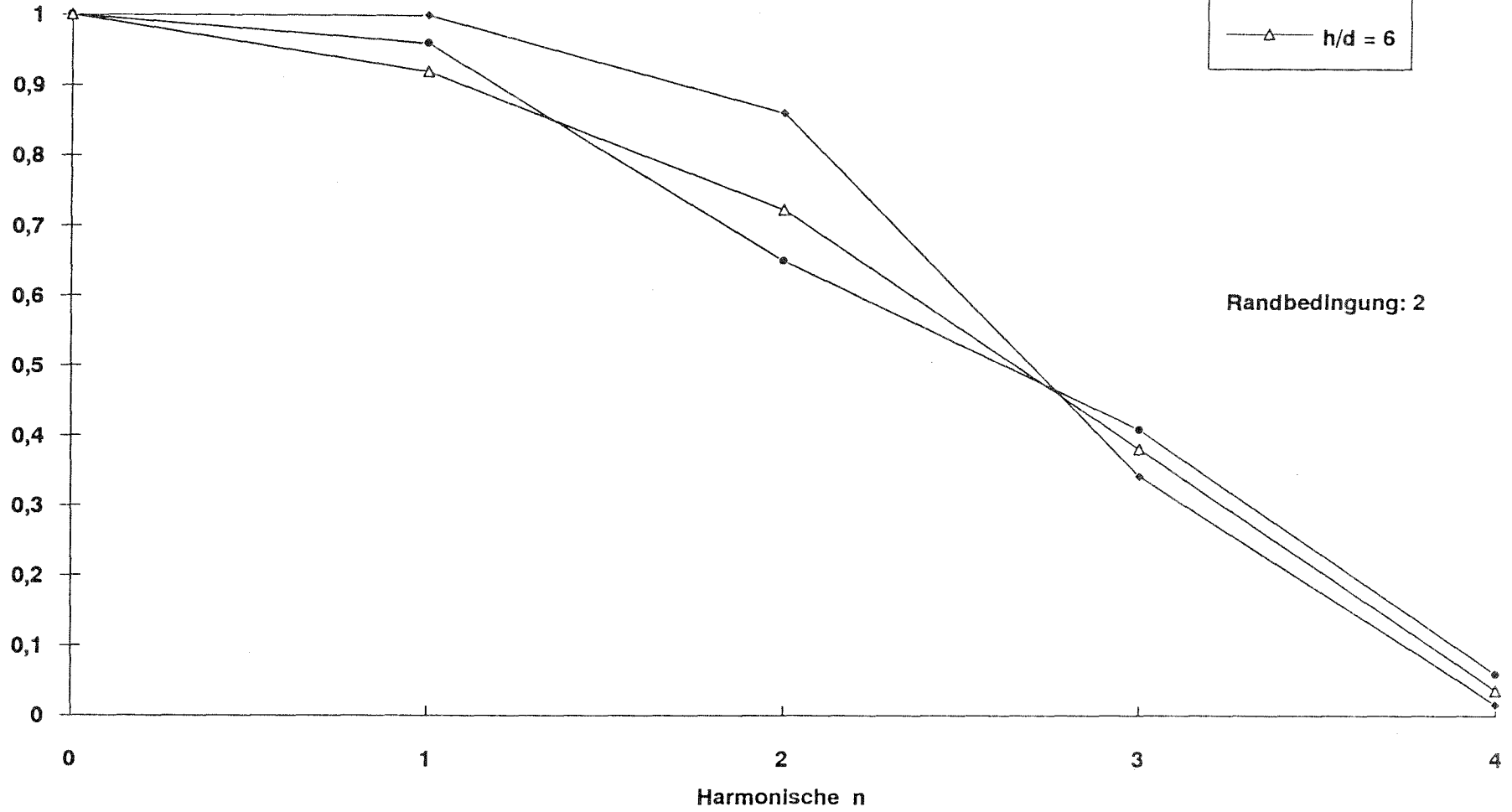
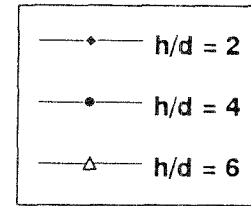
Beiwert  $n^*$   $r/t = 30$



Randbedingung: 2

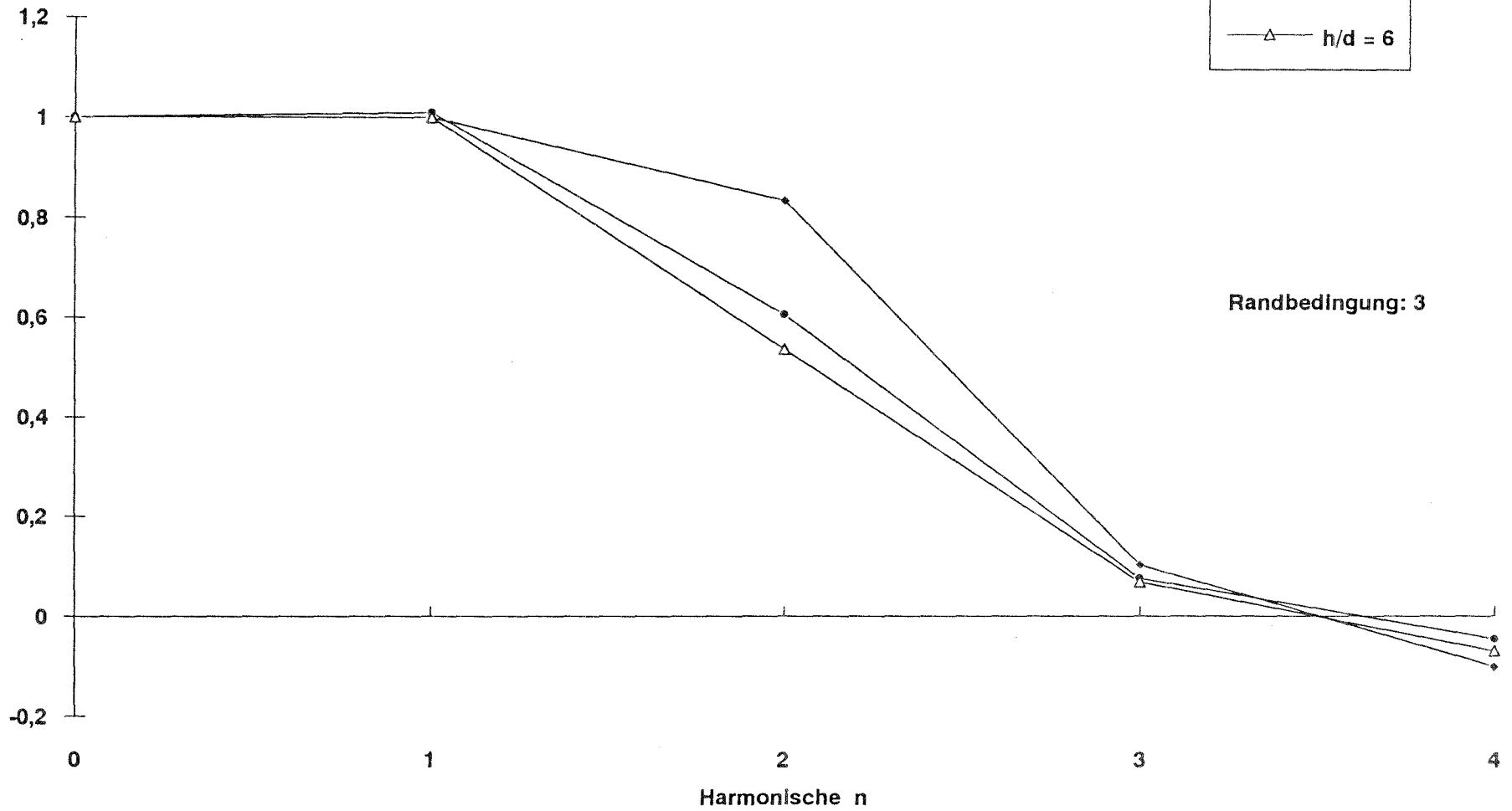
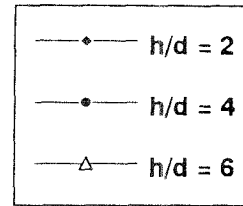


Beiwert  $n^*$   $r/t = 40$



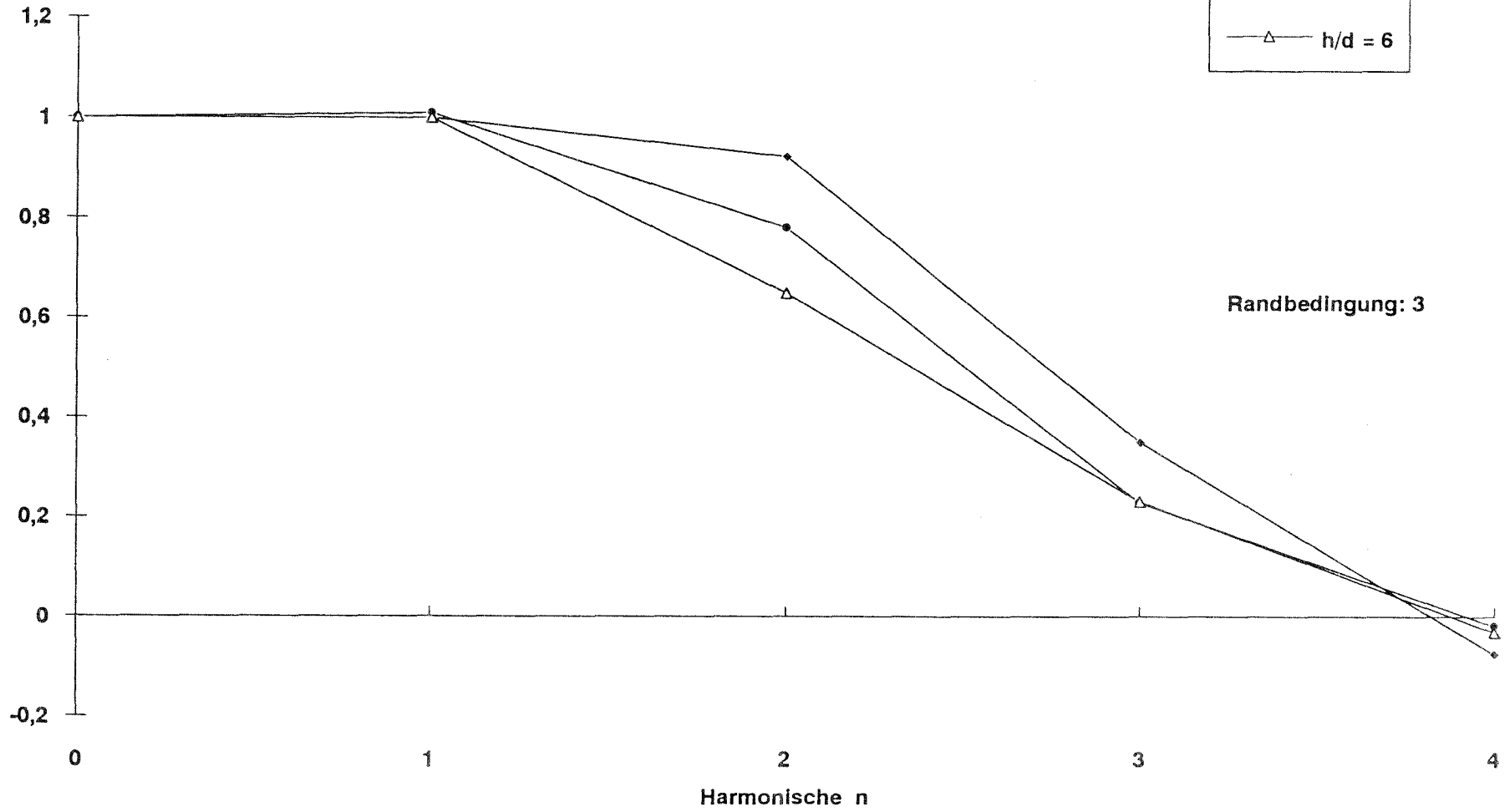
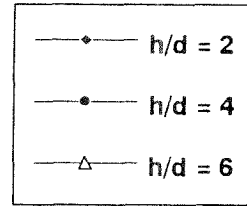
Randbedingung: 2

Beiwert  $n^*$   $r/t = 20$

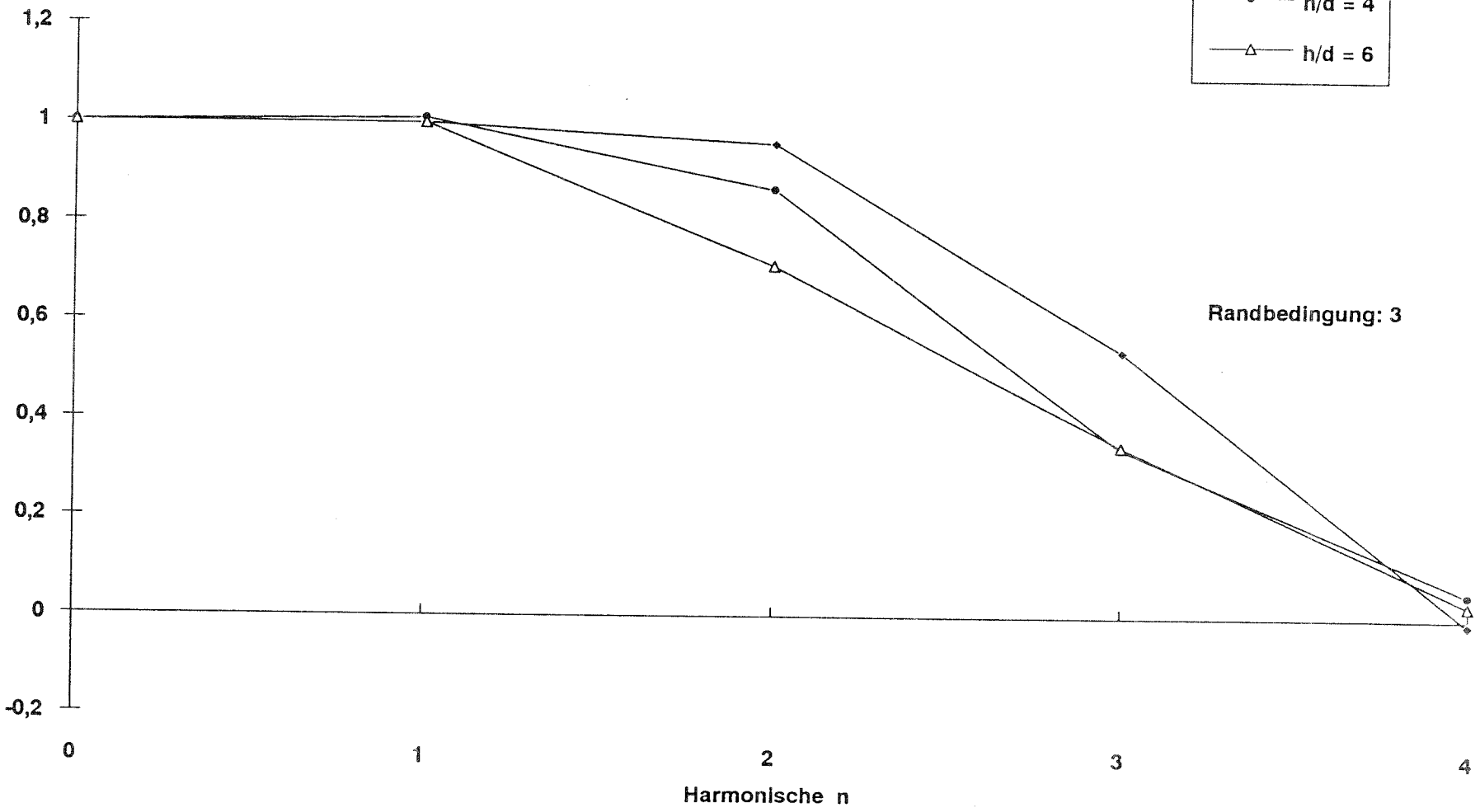
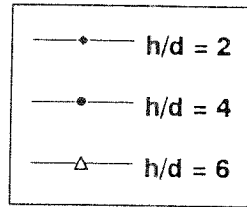


A S. 13

Beiwert  $n^*$   $r/t = 30$

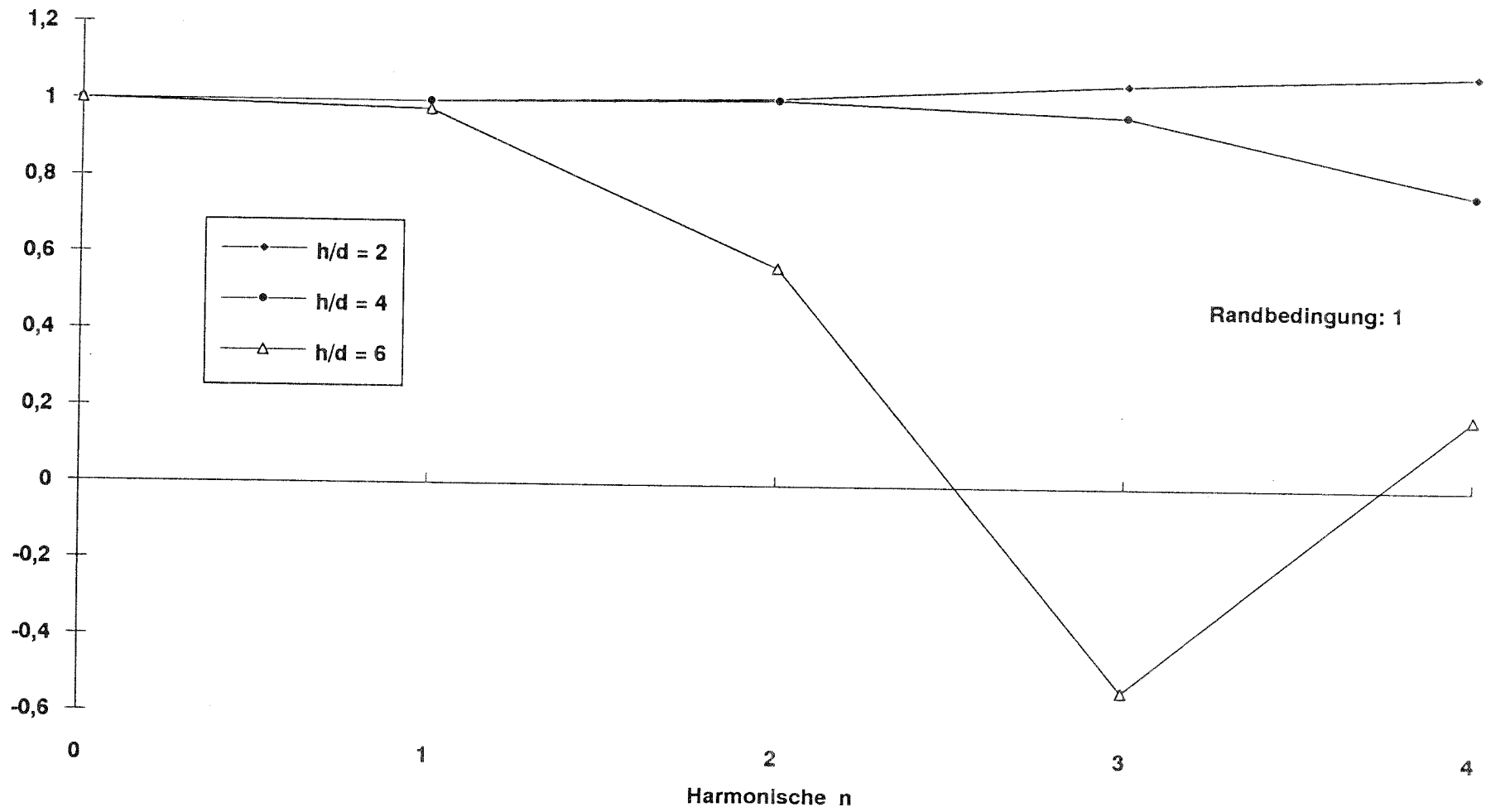


Belwert  $n^*$   $r/t = 40$



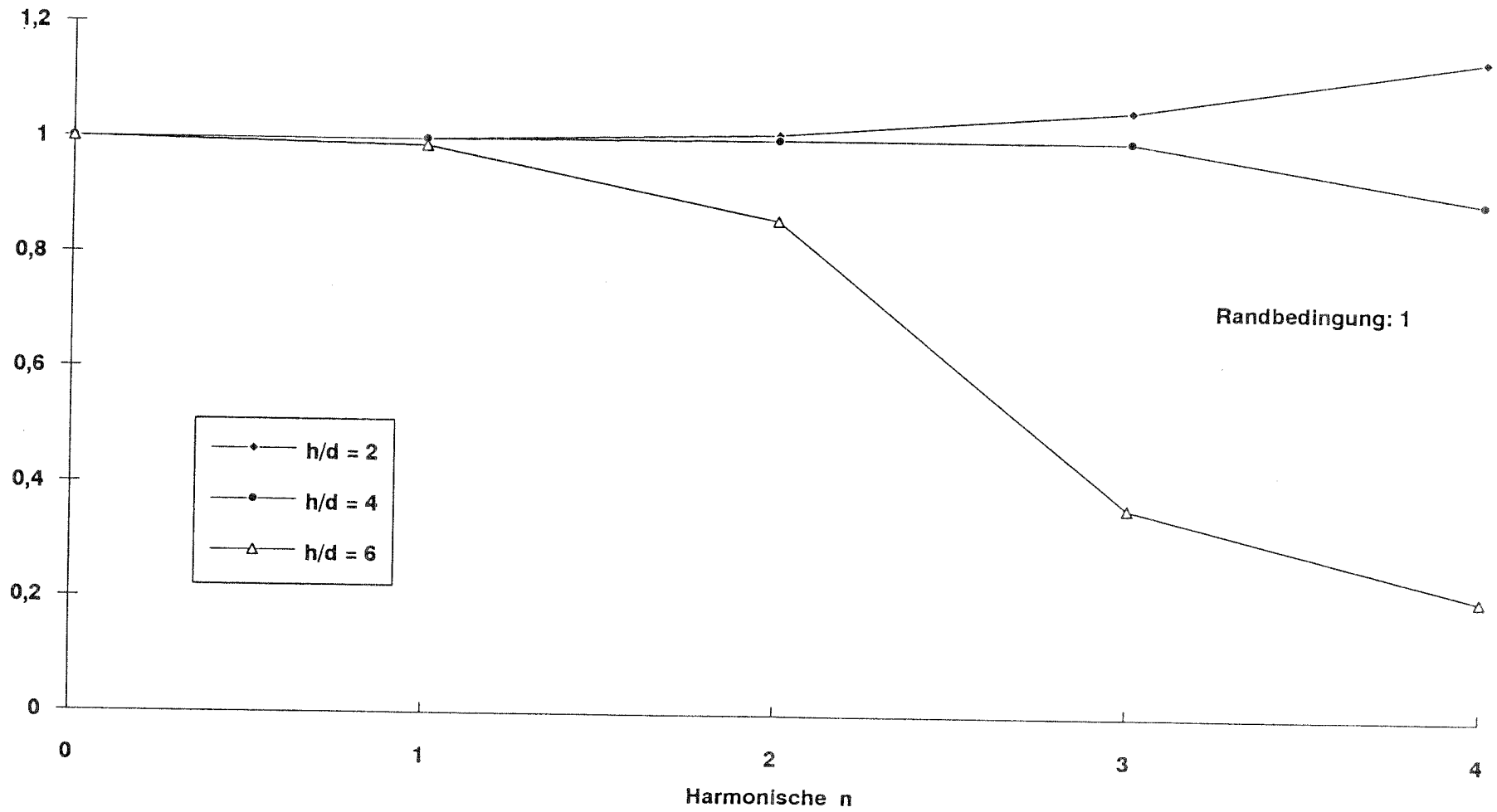
A 5.15

Beiwert  $n^*$   $r/t = 300$



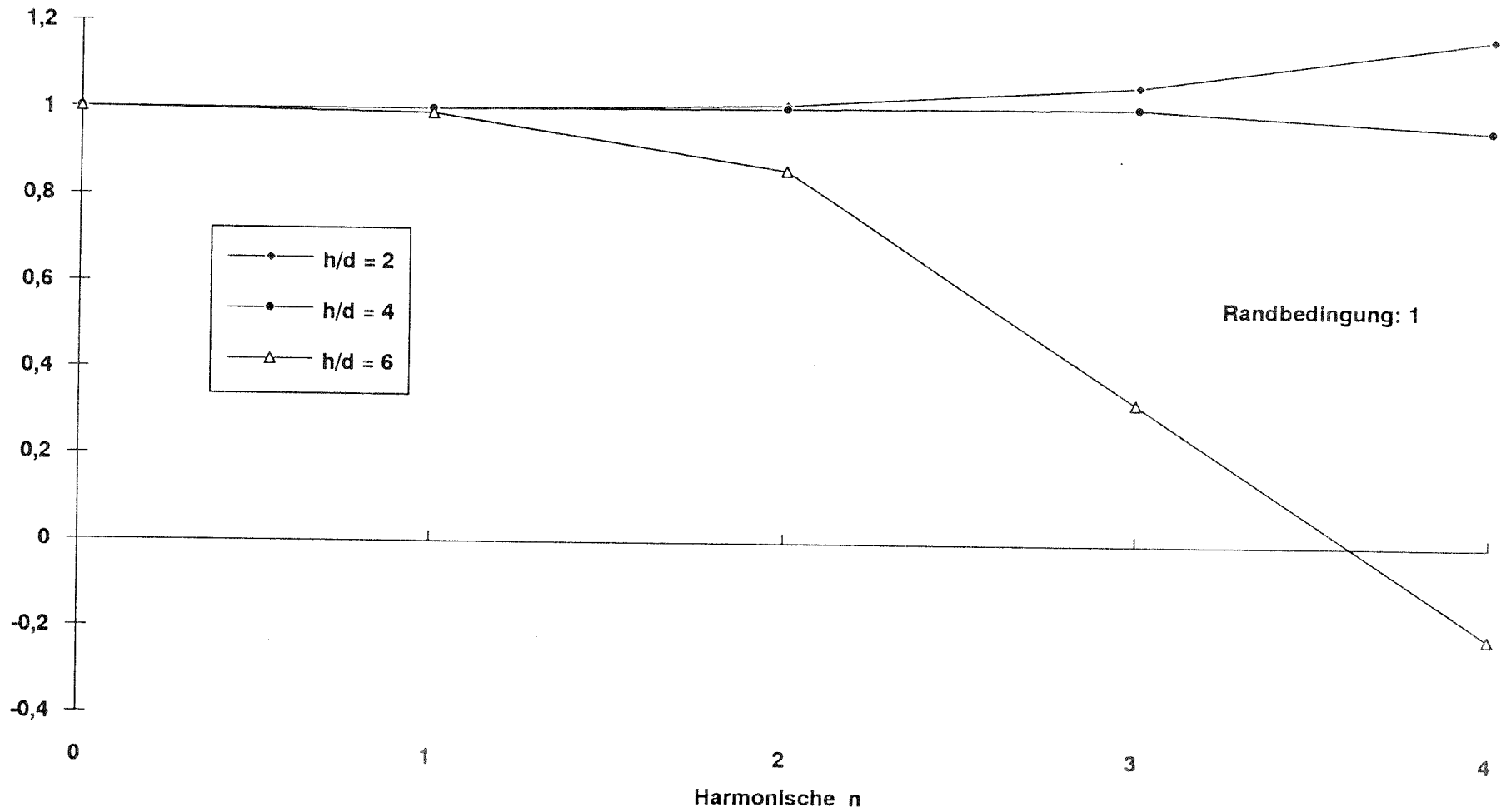


Beiwert  $n^*$   $r/t = 500$



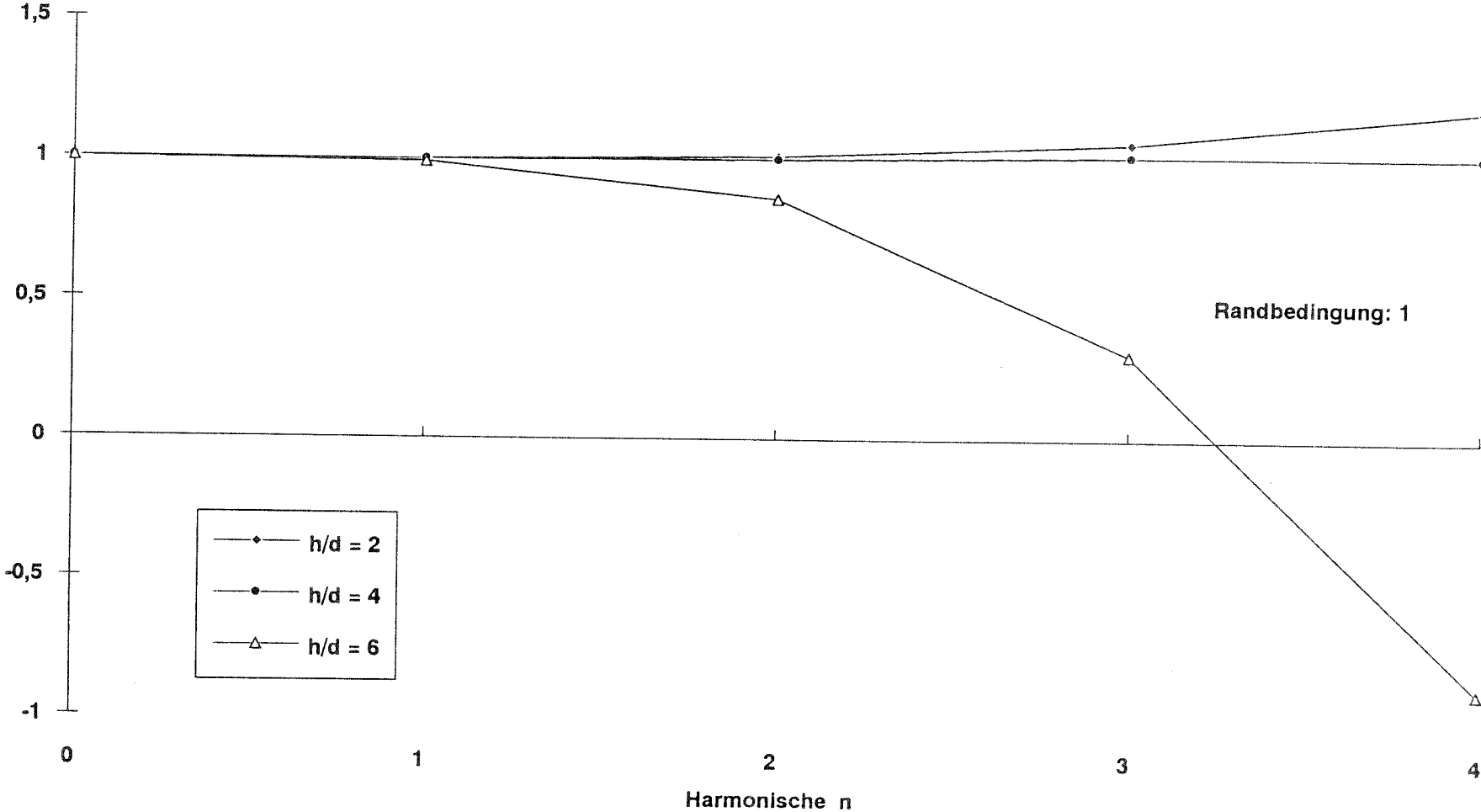
H. S. J. H.

Beiwert  $n^*$   $r/t = 750$



A 5.18

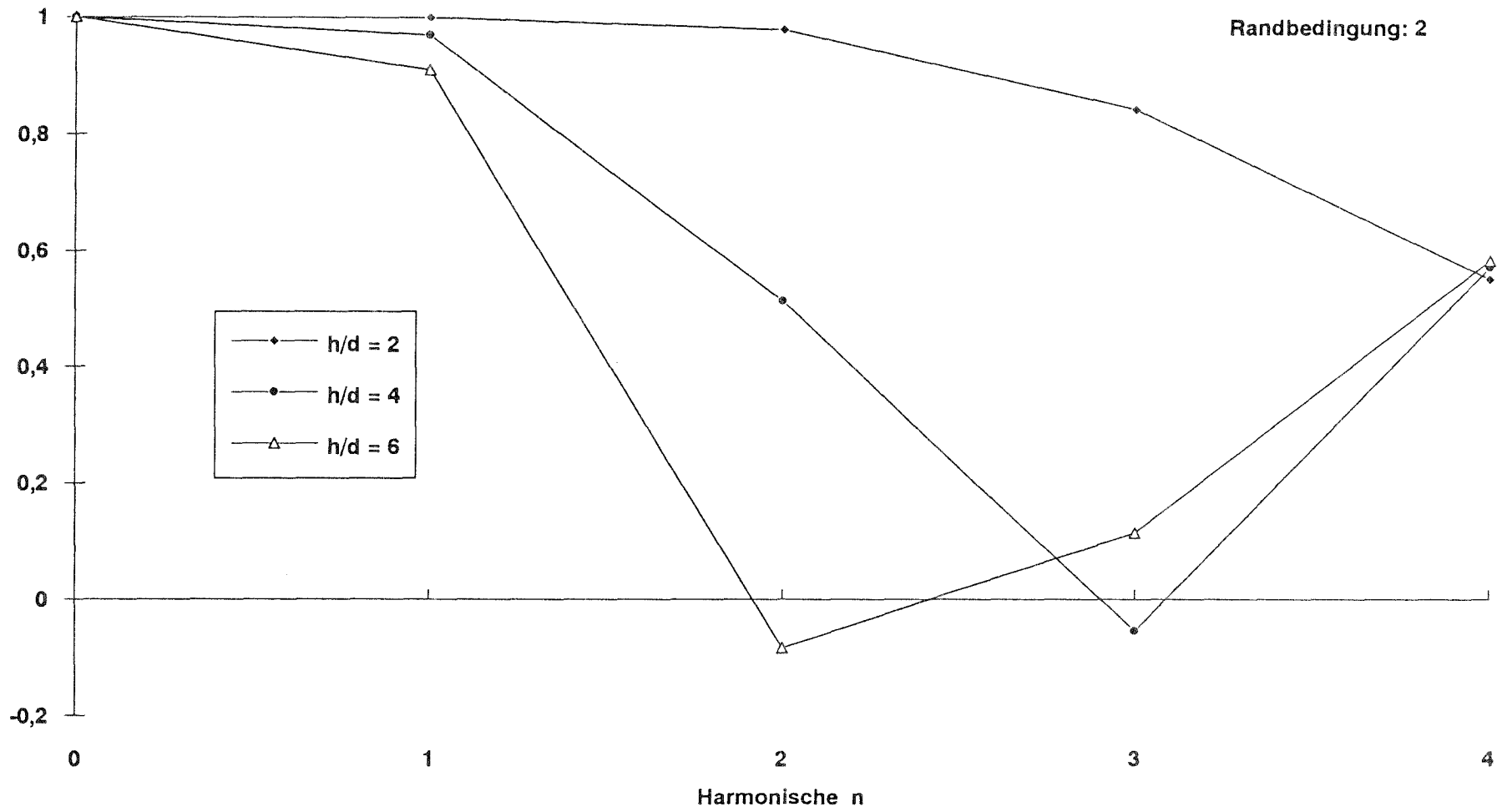
Beiwert  $n^*$   $r/t = 1500$



A 5.19

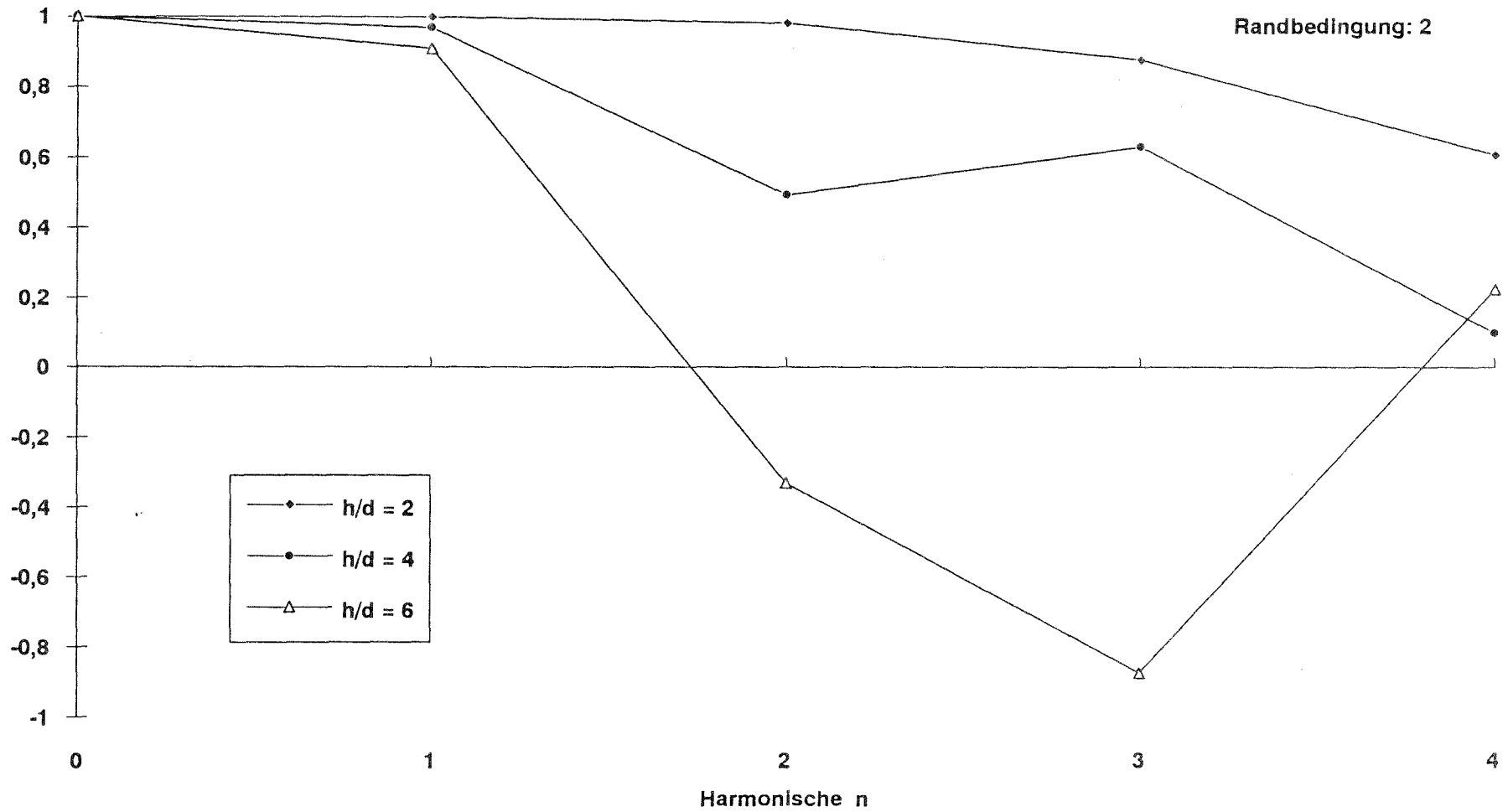
Beiwert  $n^*$   $r/t = 300$

Randbedingung: 2



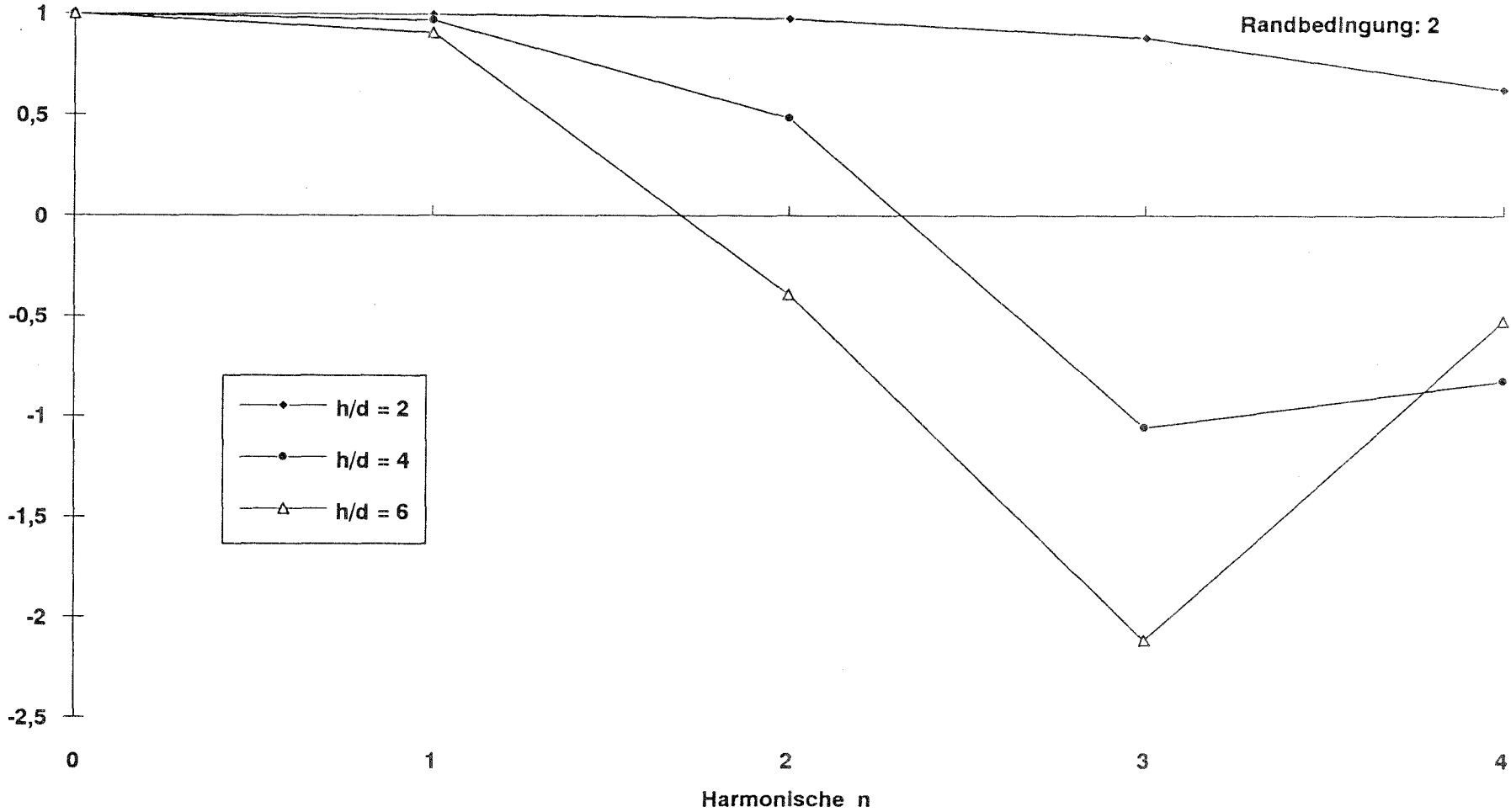
Beiwert  $n^*$   $r/t = 500$

Randbedingung: 2



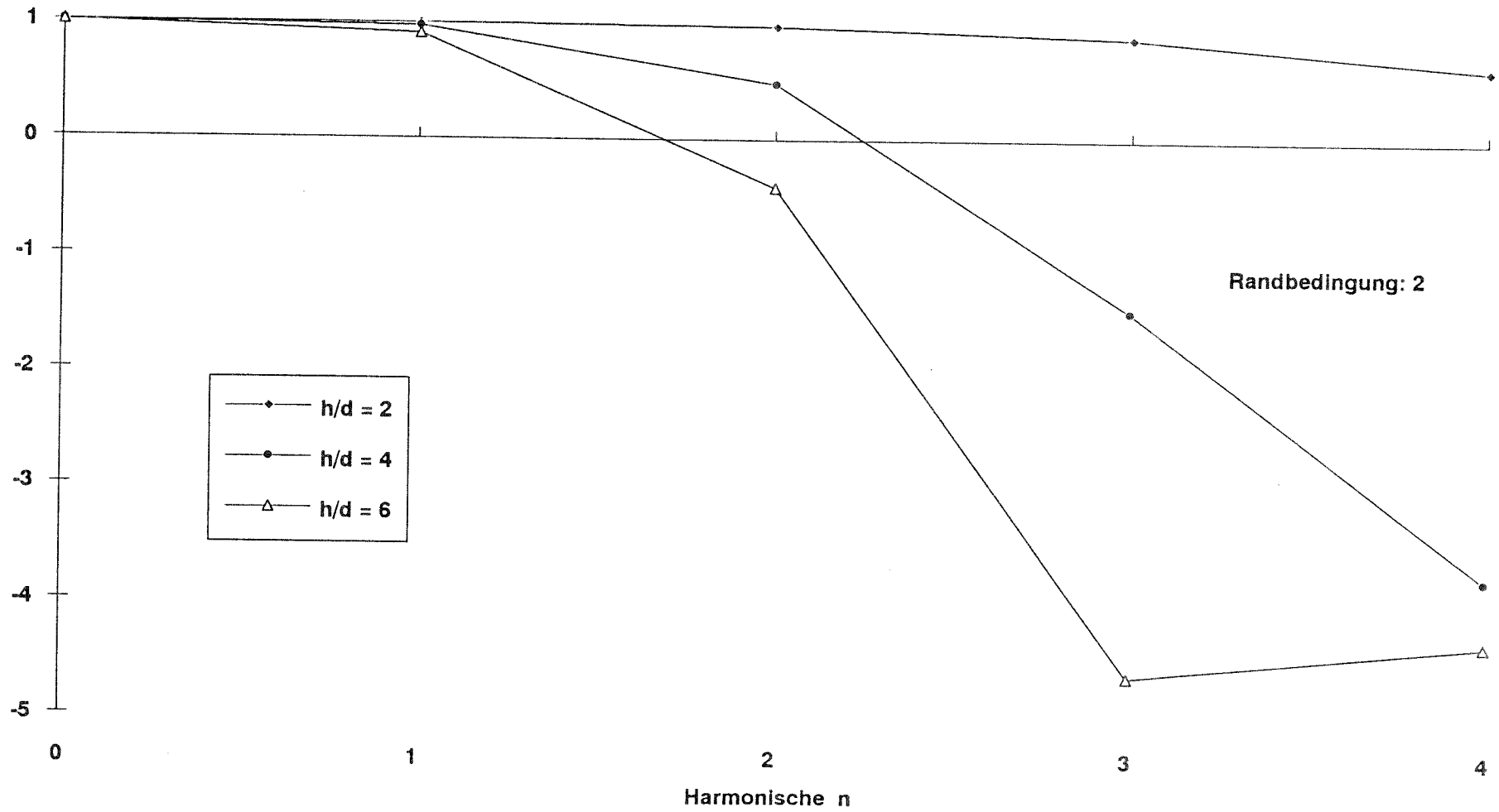
Beiwert  $n^*$   $r/t = 750$

Randbedingung: 2



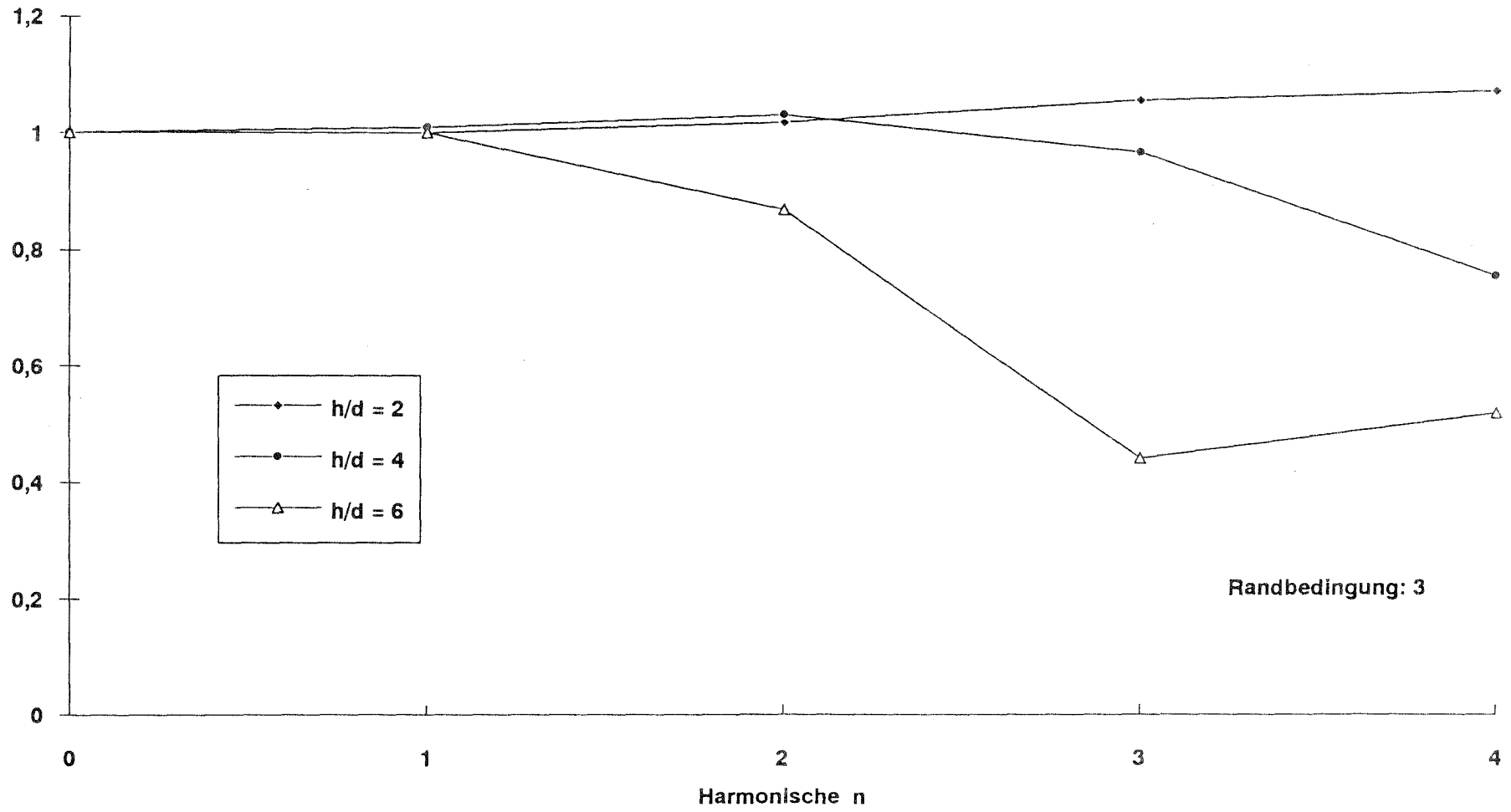
AS.22

Belwert  $n^*$   $r/t = 1500$



A 5.23

Beiwert  $n^*$   $r/t = 300$

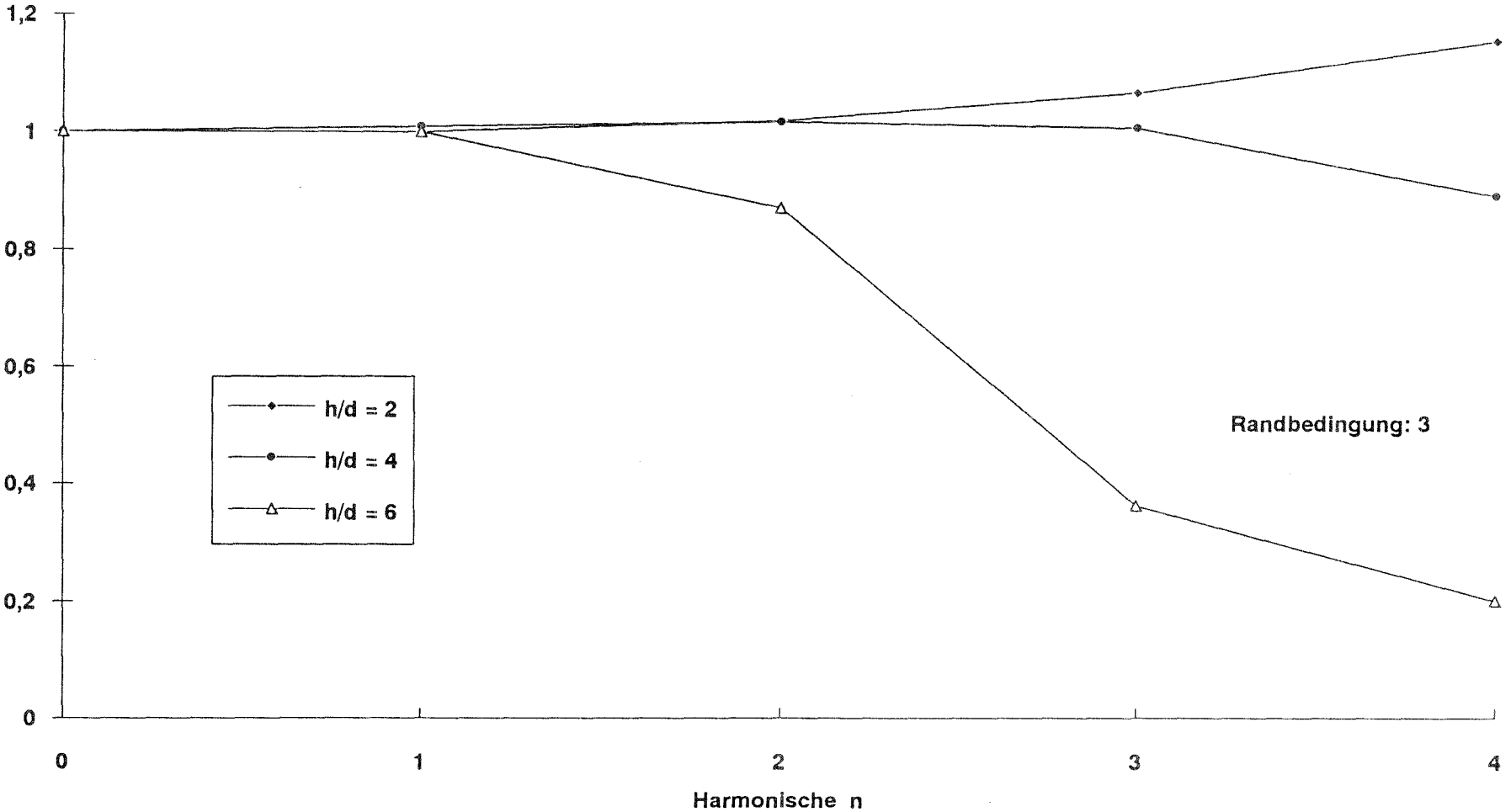


Randbedingung: 3

A 5.24

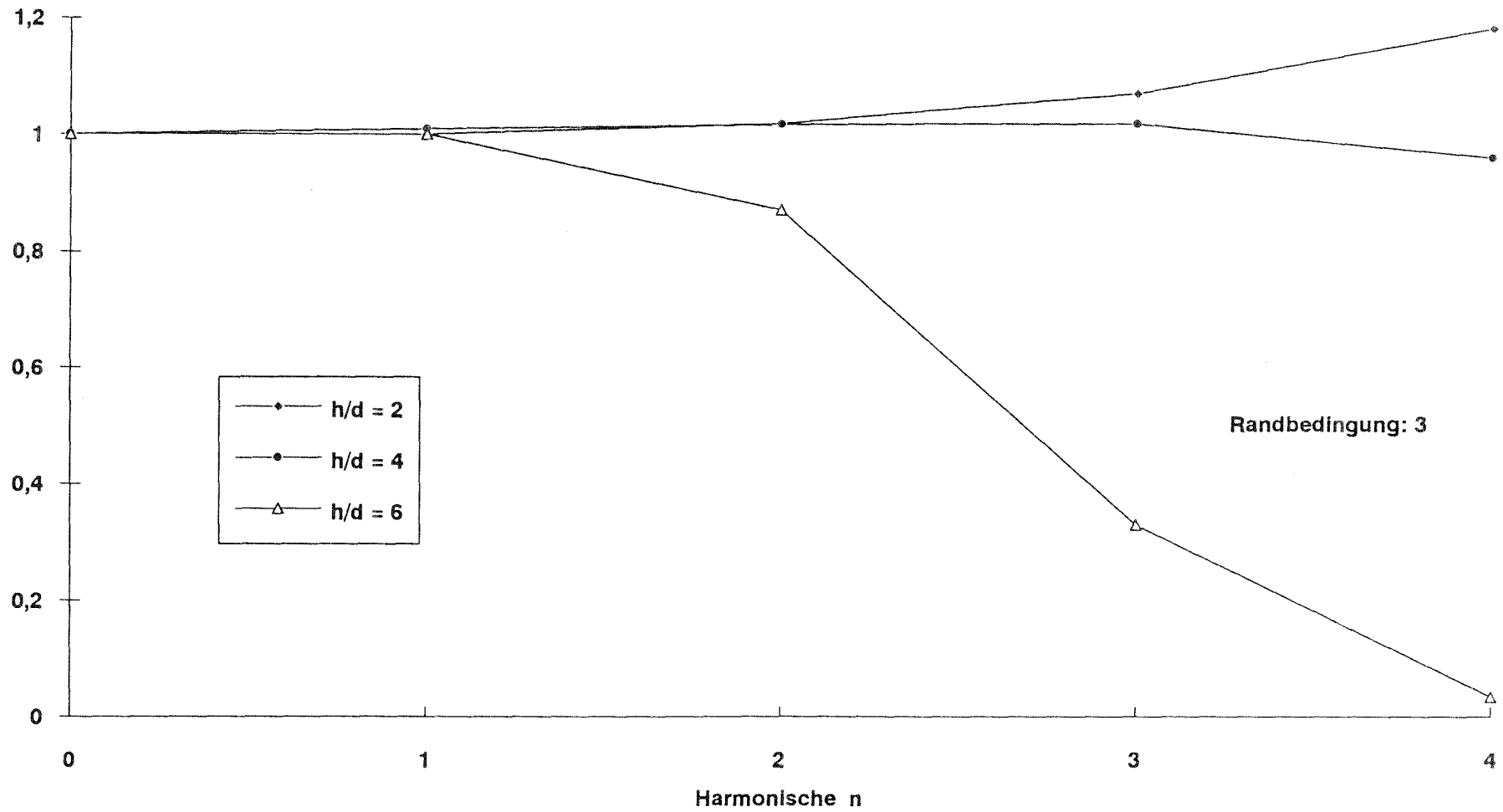


Beiwert  $n^*$   $r/t = 500$

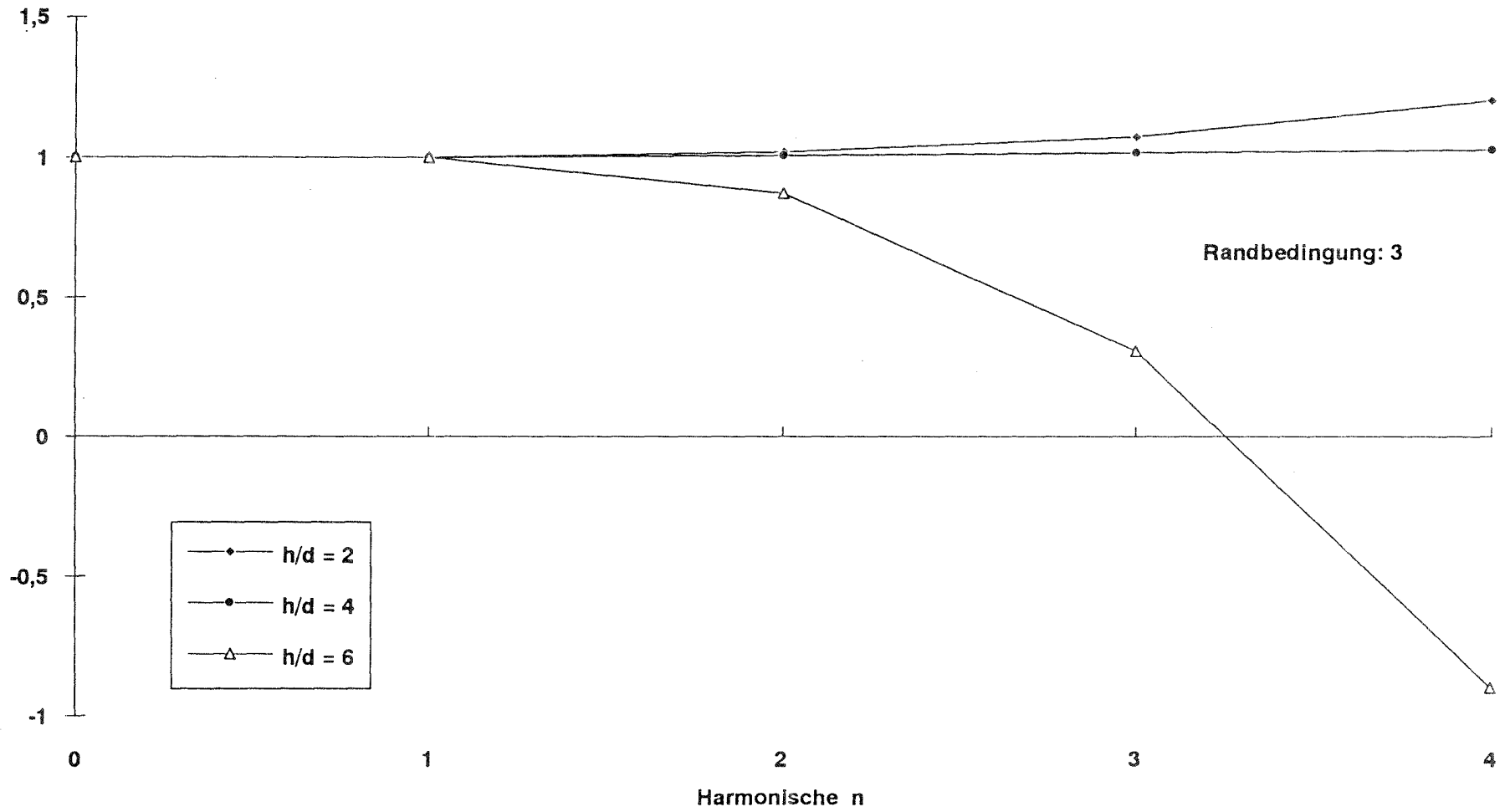


A 5.25

Belwert  $n^*$   $r/t = 750$



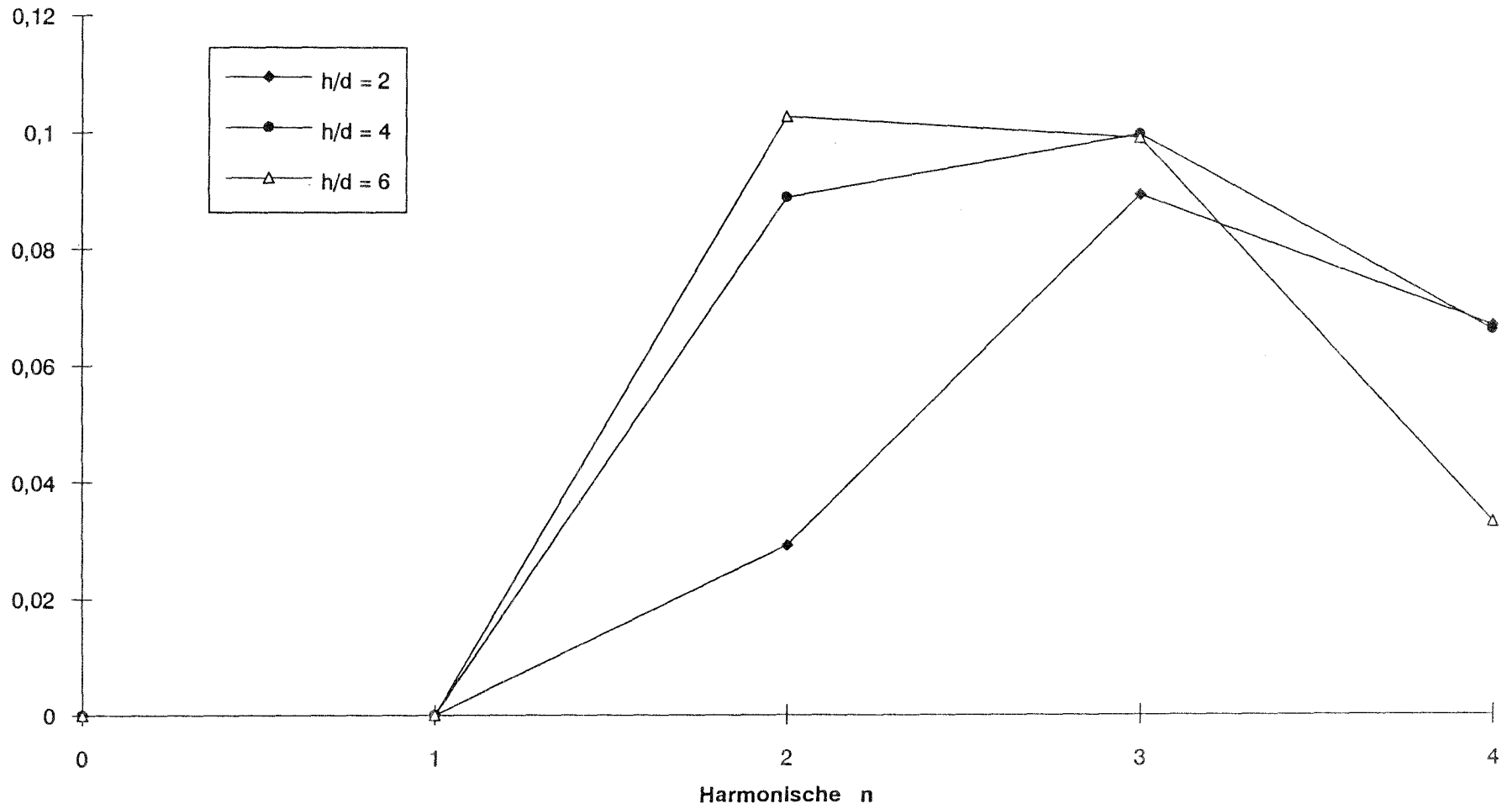
Belwert  $n^*$   $r/t = 1500$



A 5.27

Beiwert  $m^*$   $r/t = 20$

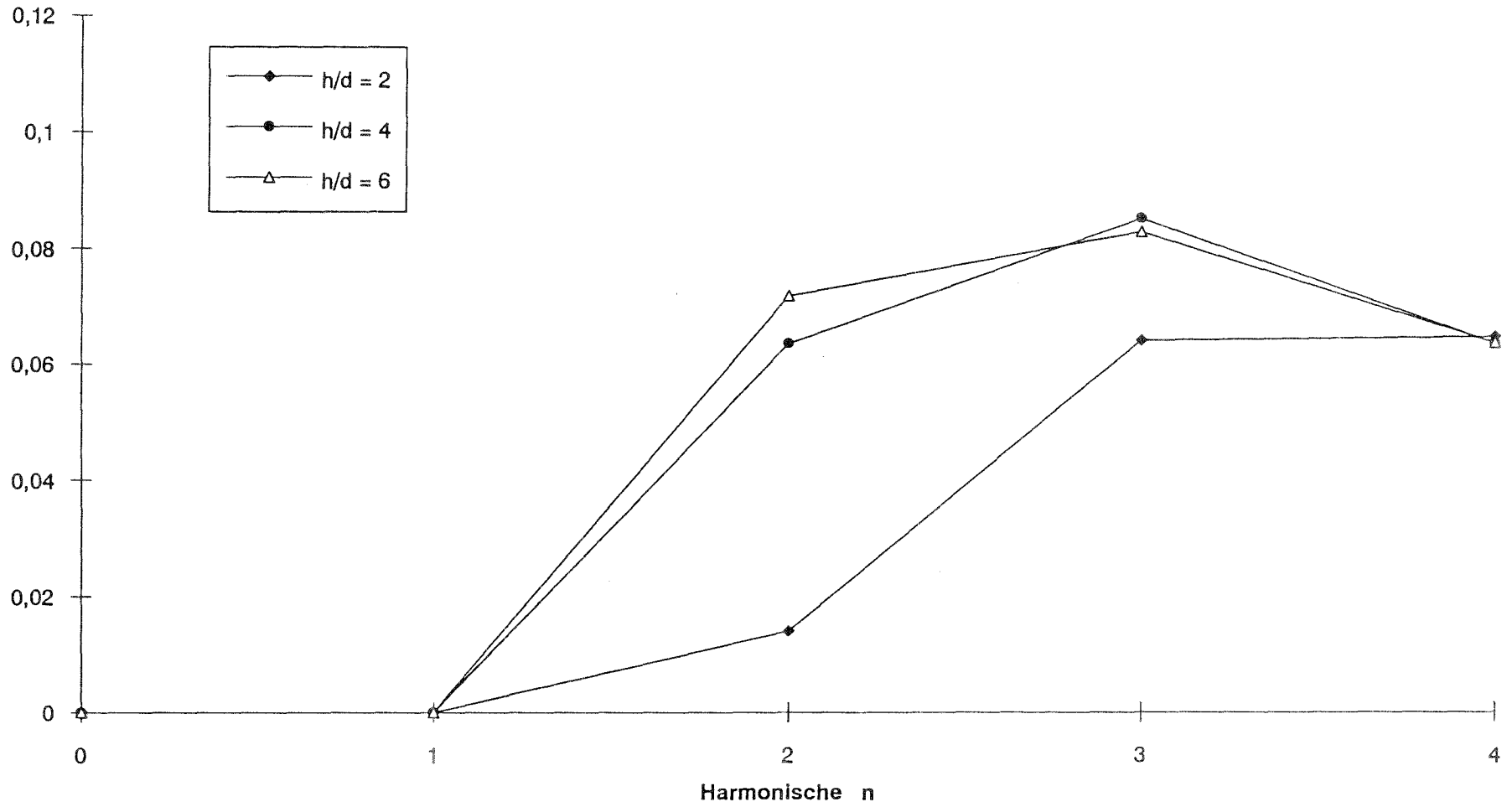
Randbedingung : 1



A 5.28

Beiwert  $m^*$   $r/t = 30$

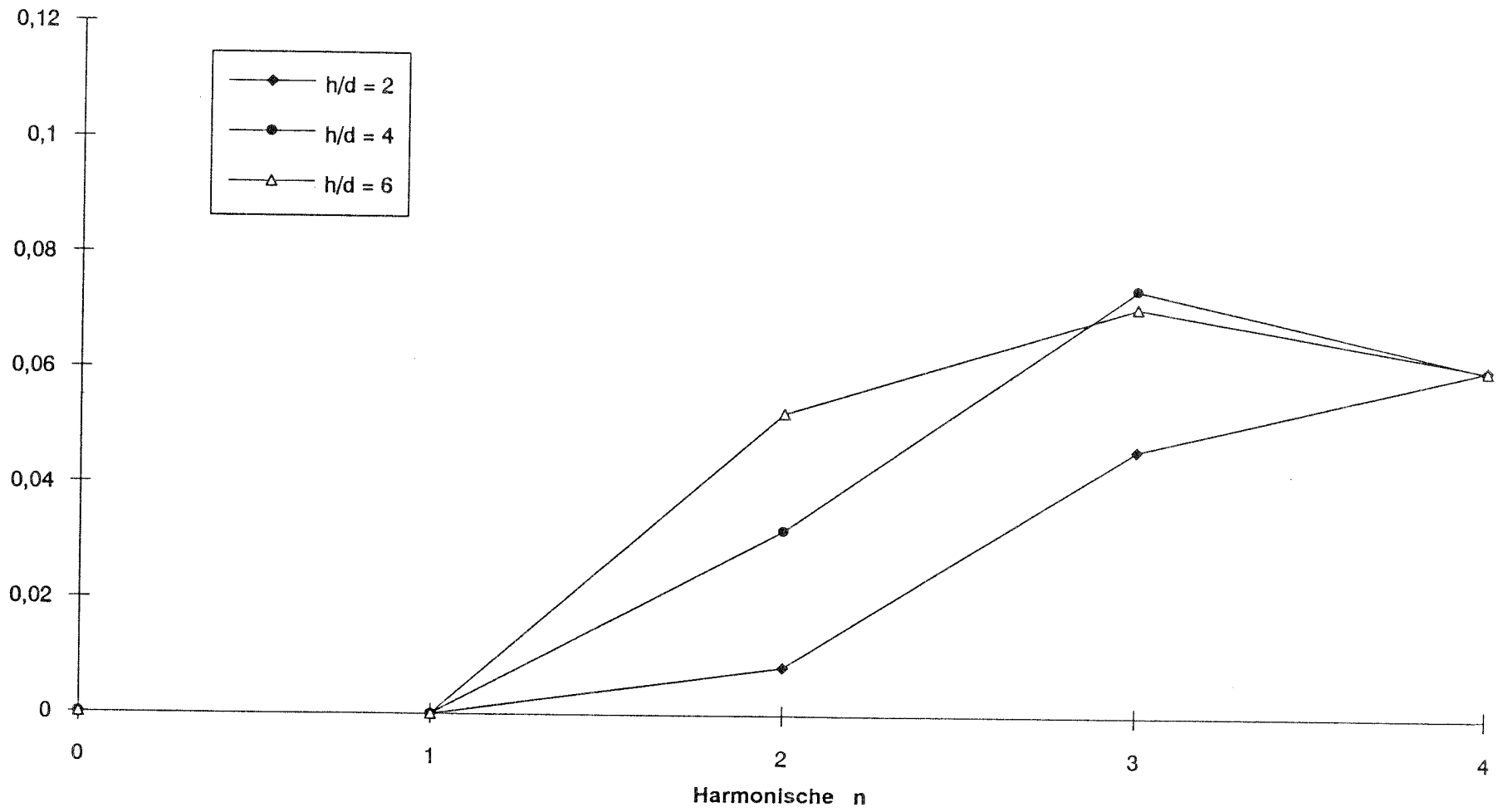
Randbedingung : 1



A 5.29

Beiwert  $m^*$   $r/t = 40$

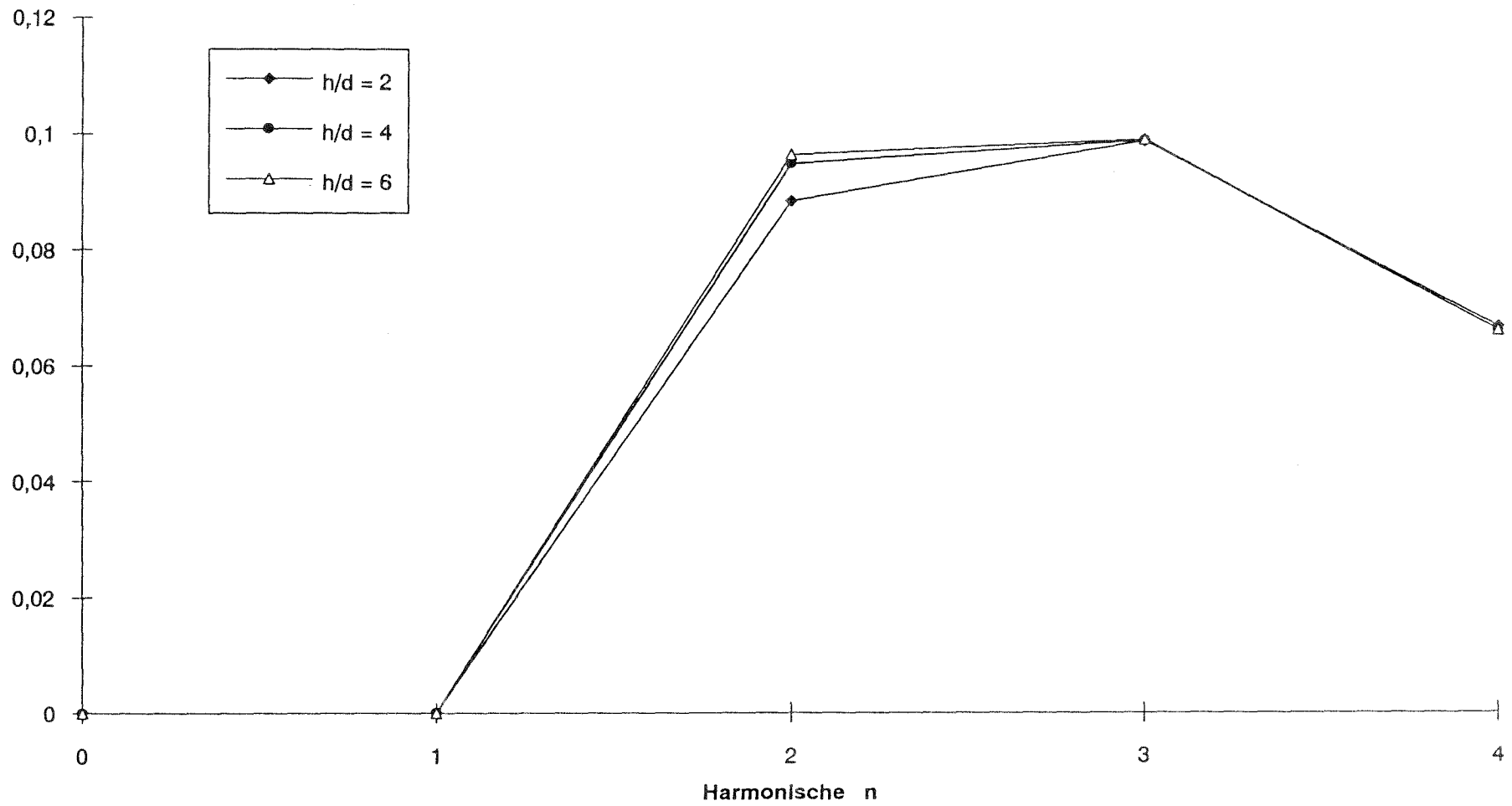
Randbedingung : 1



A 5.30

Beiwert  $m^*$   $r/t = 20$

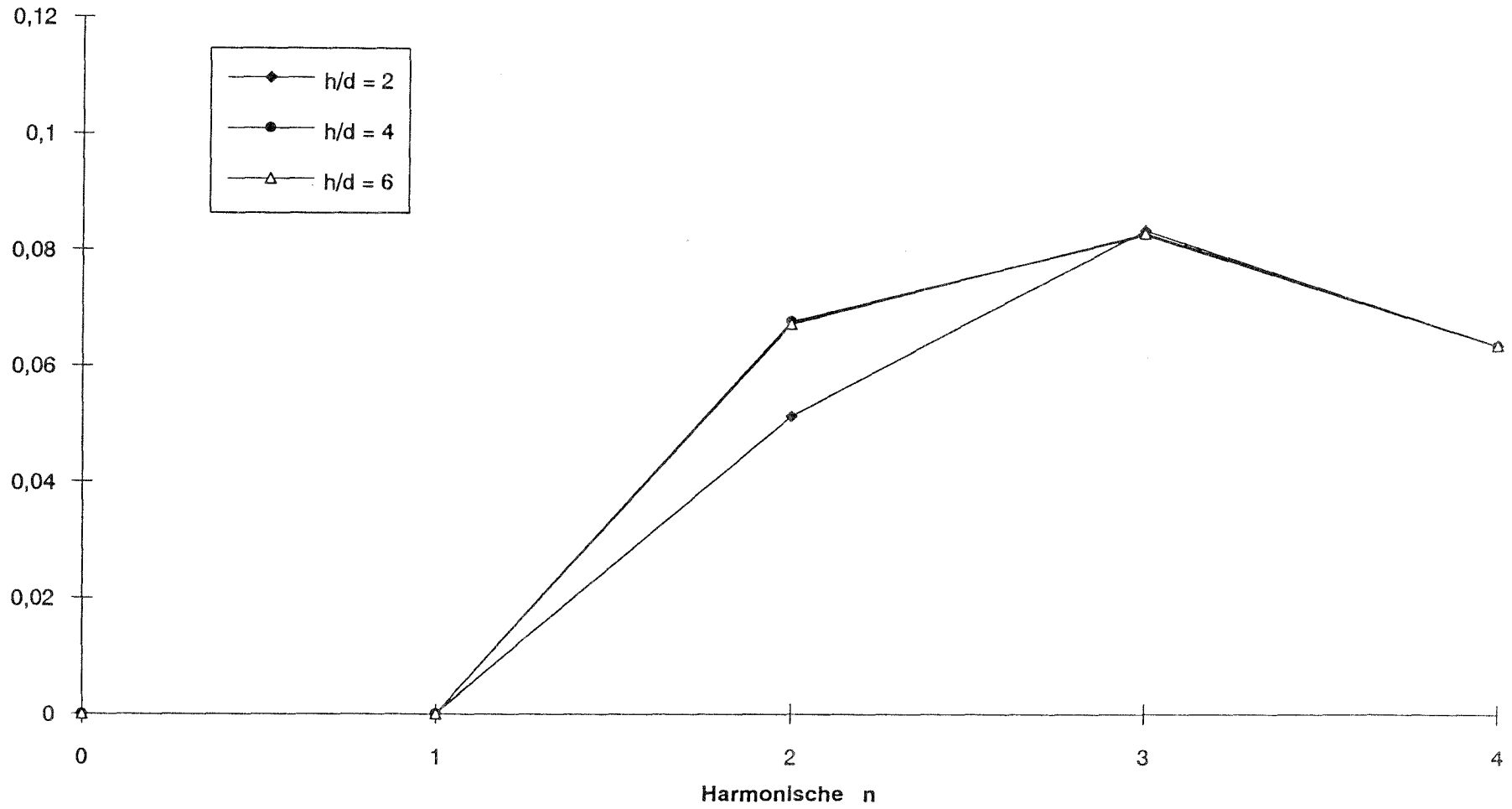
Randbedingung : 2



P. 5.3.1

Beiwert  $m^*$   $r/t = 30$

Randbedingung : 2

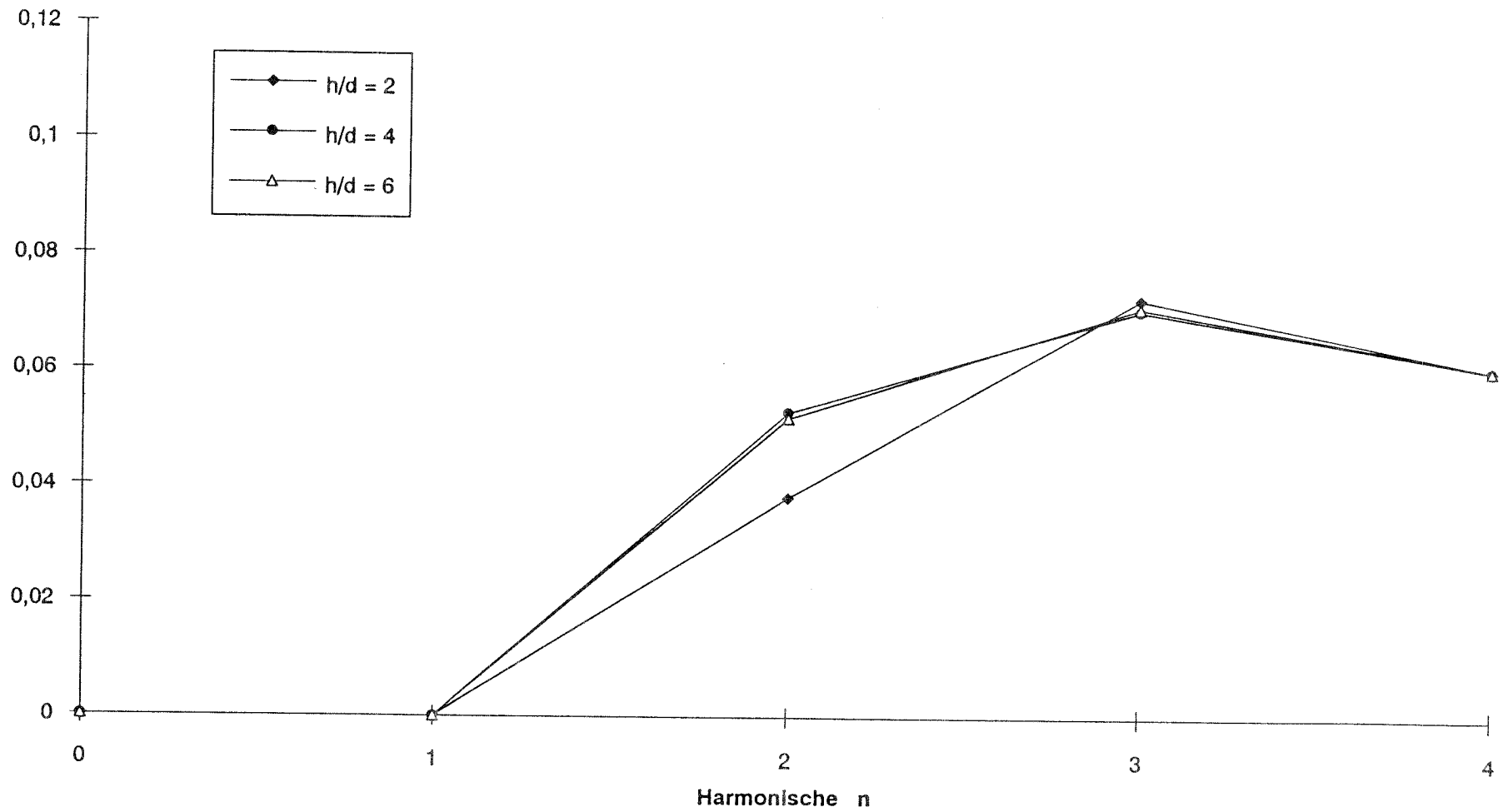


A 5.32



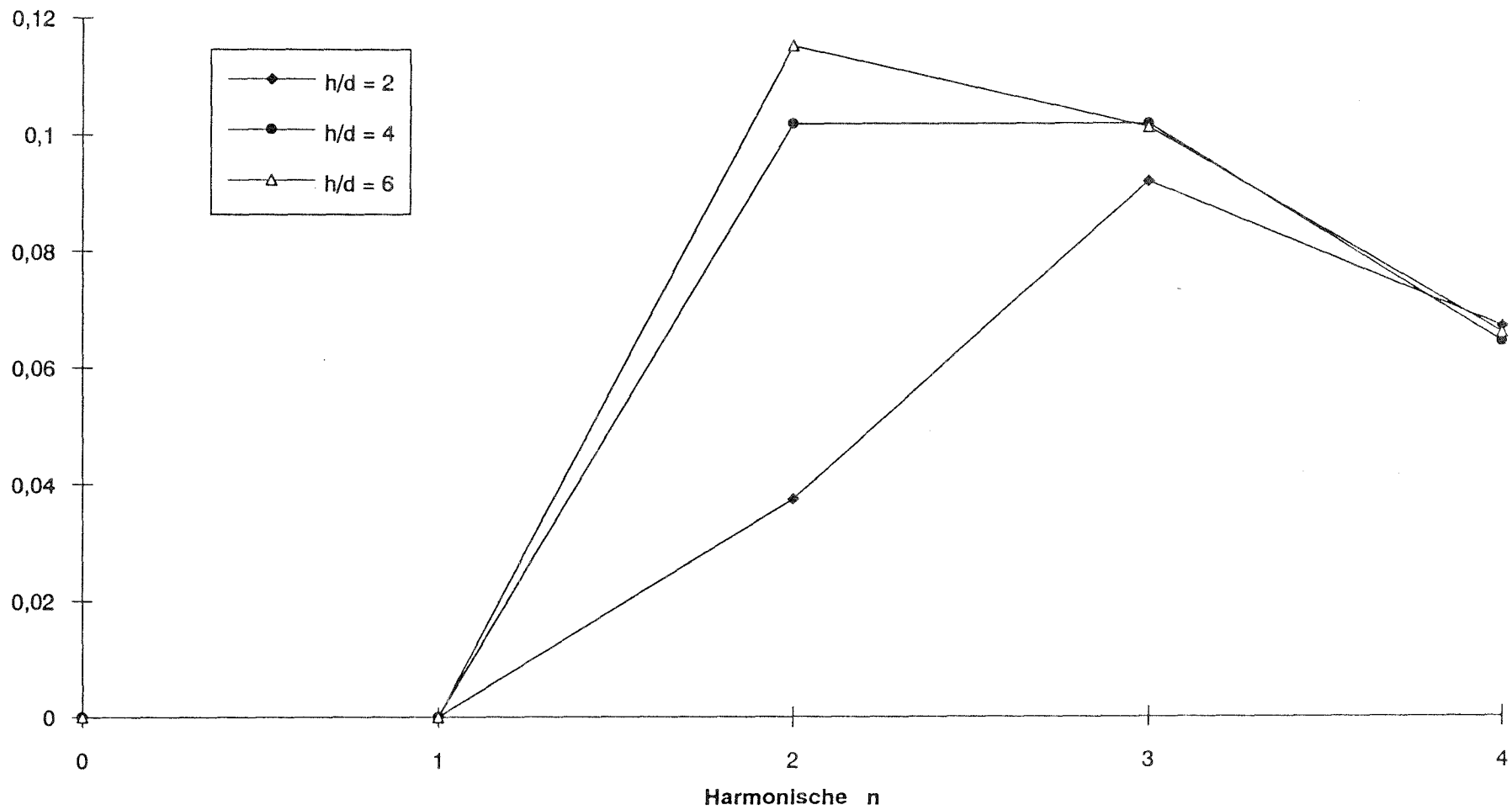
Beiwert  $m^*$   $r/t = 40$

Randbedingung : 2



Beiwert  $m^*$   $r/t = 20$

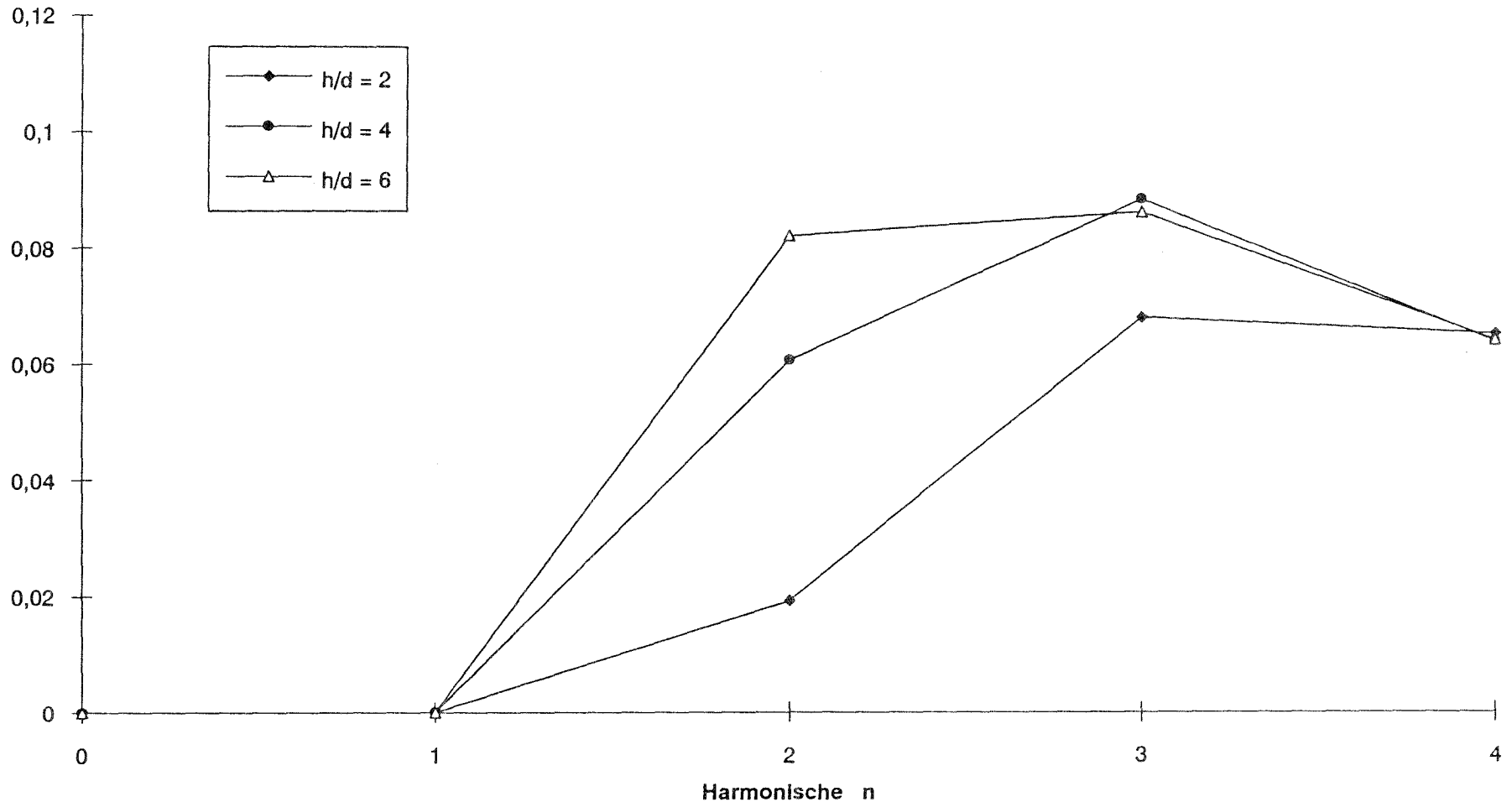
Randbedingung : 3



A 5.34

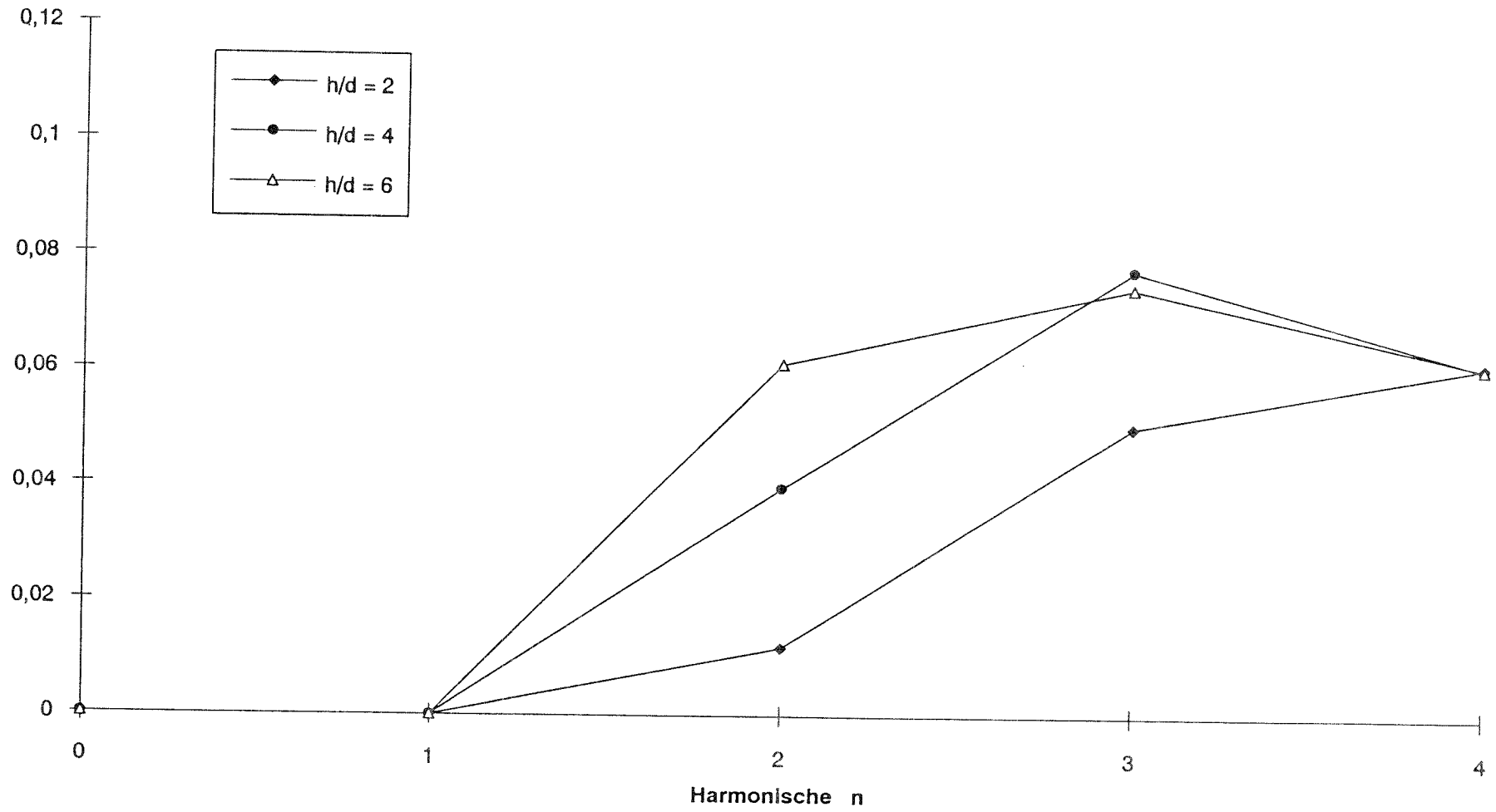
Beiwert  $m^*$   $r/t = 30$

Randbedingung : 3



Beiwert  $m^*$   $r/t = 40$

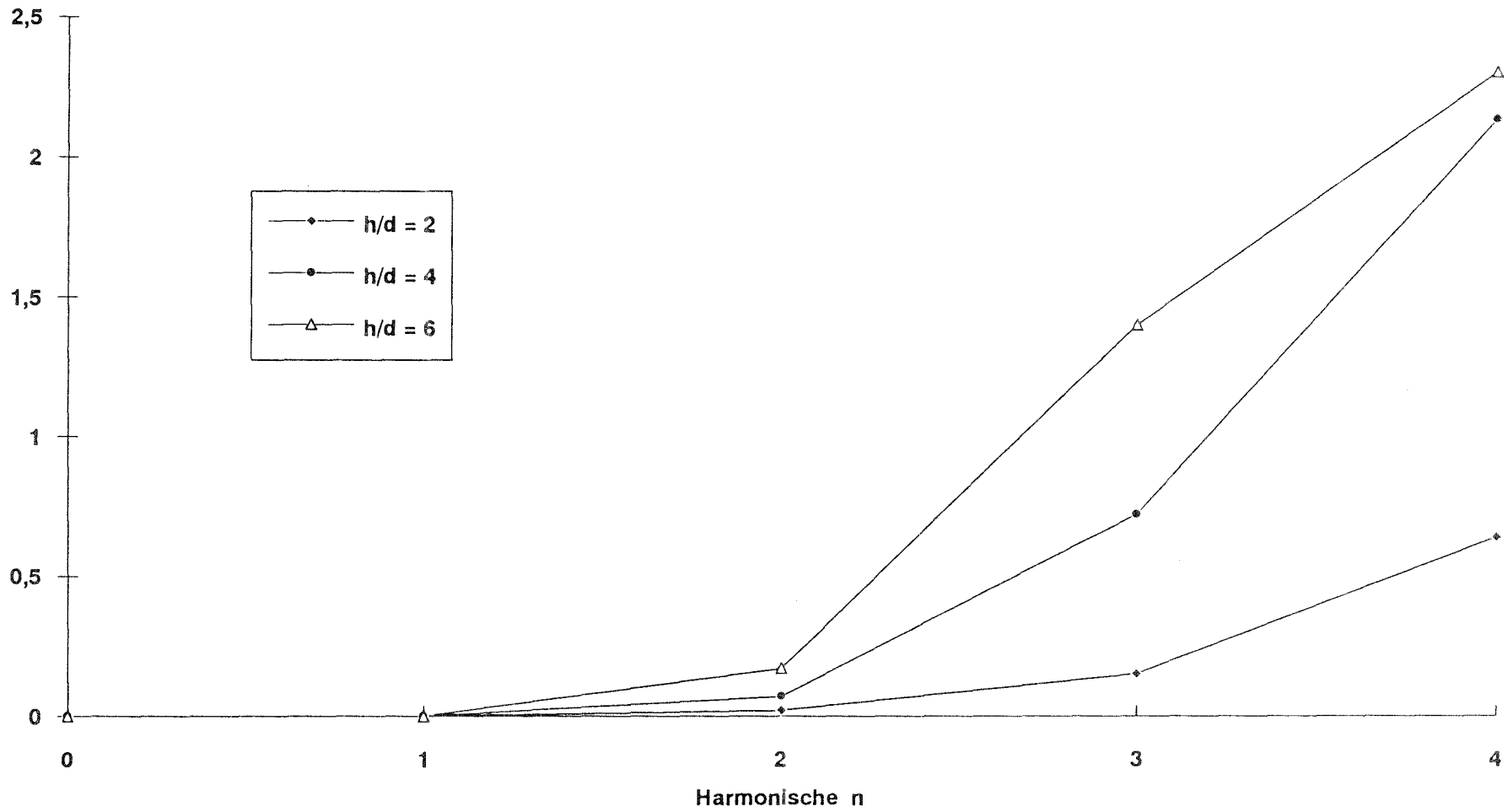
Randbedingung : 3



A 5,36

Beiwert 100m\* r/t = 300

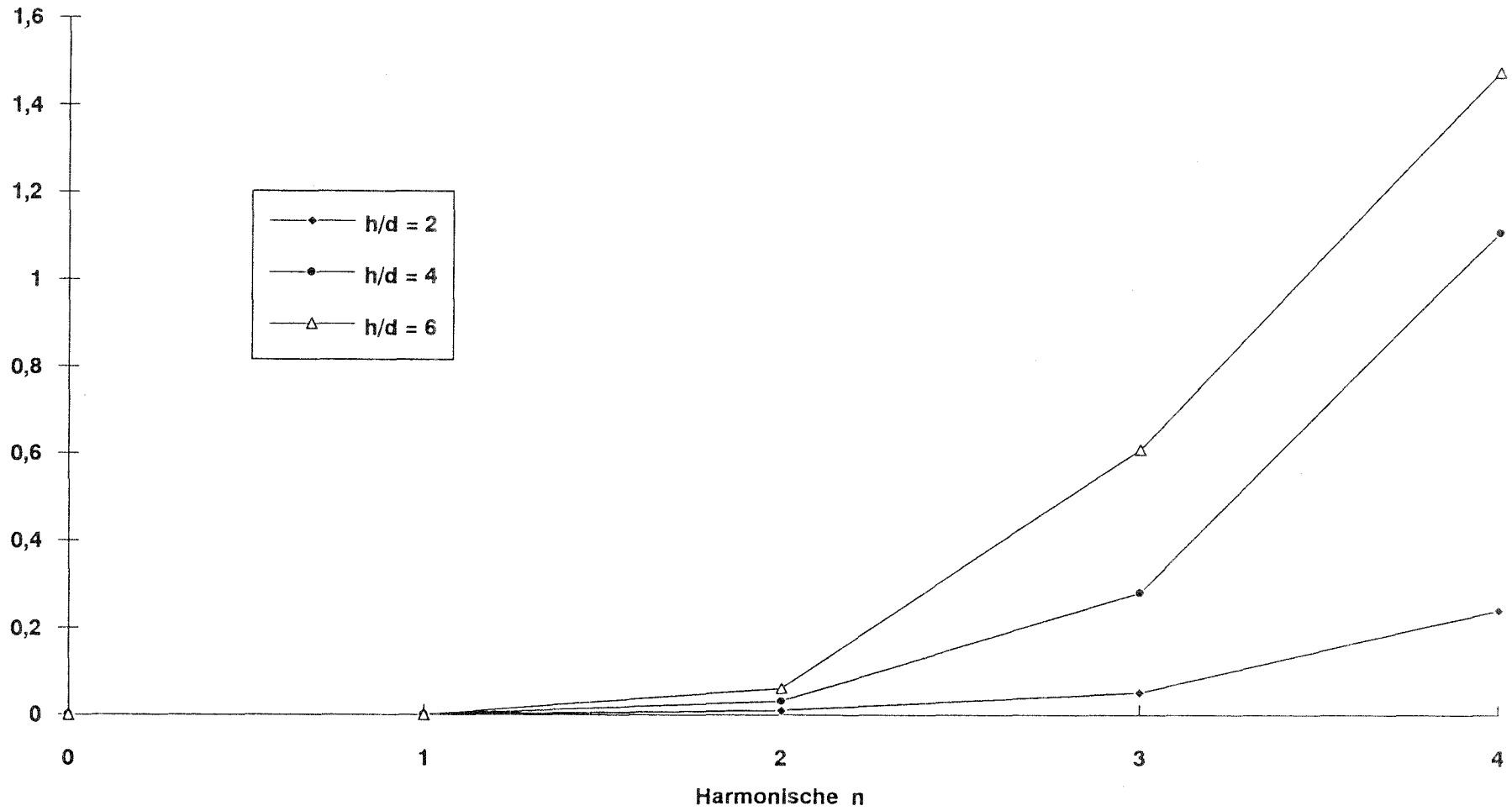
Randbedingung: 1



A 5.39

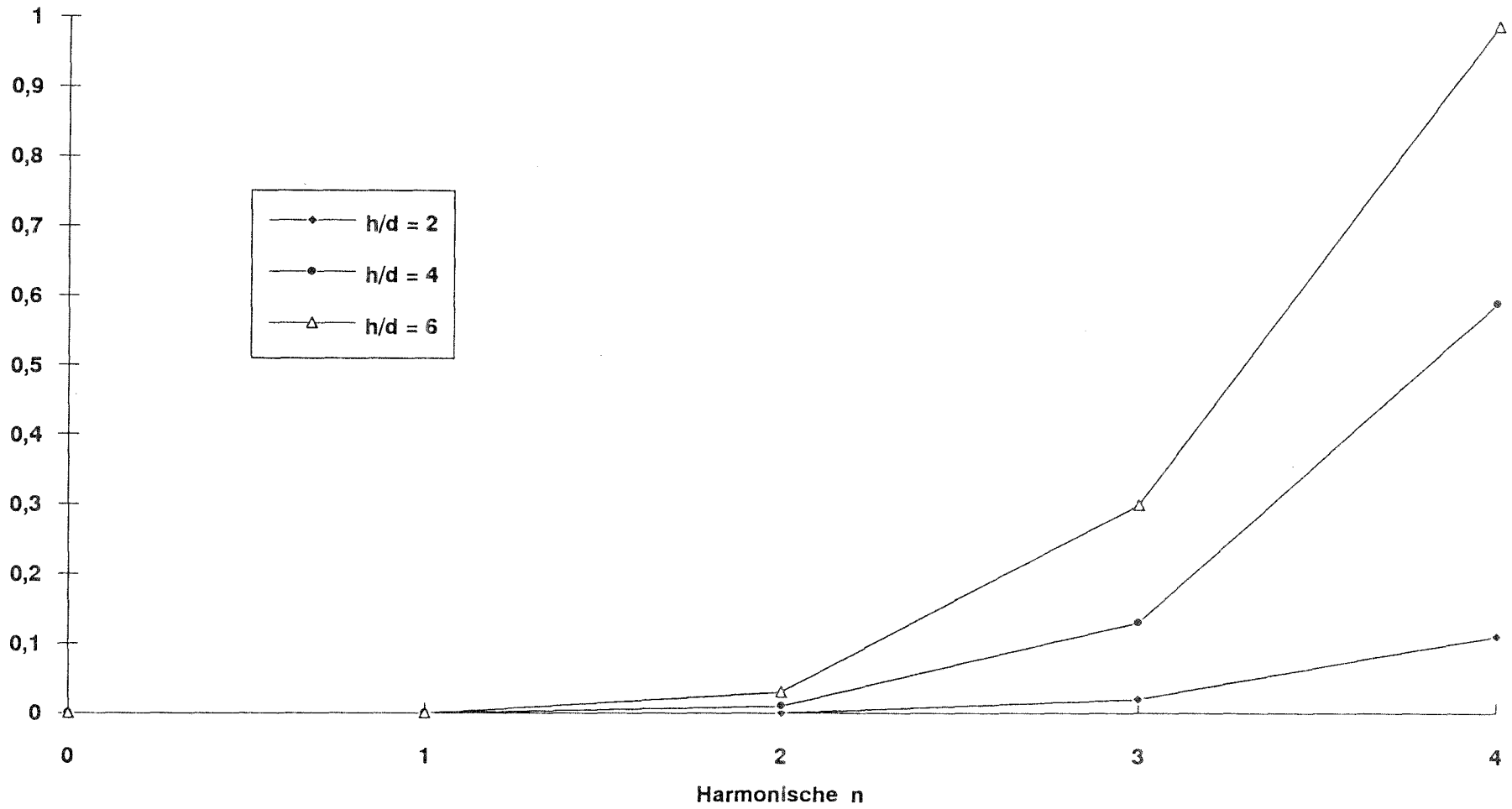
Beiwert  $100m^*$   $r/t = 500$

Randbedingung: 1



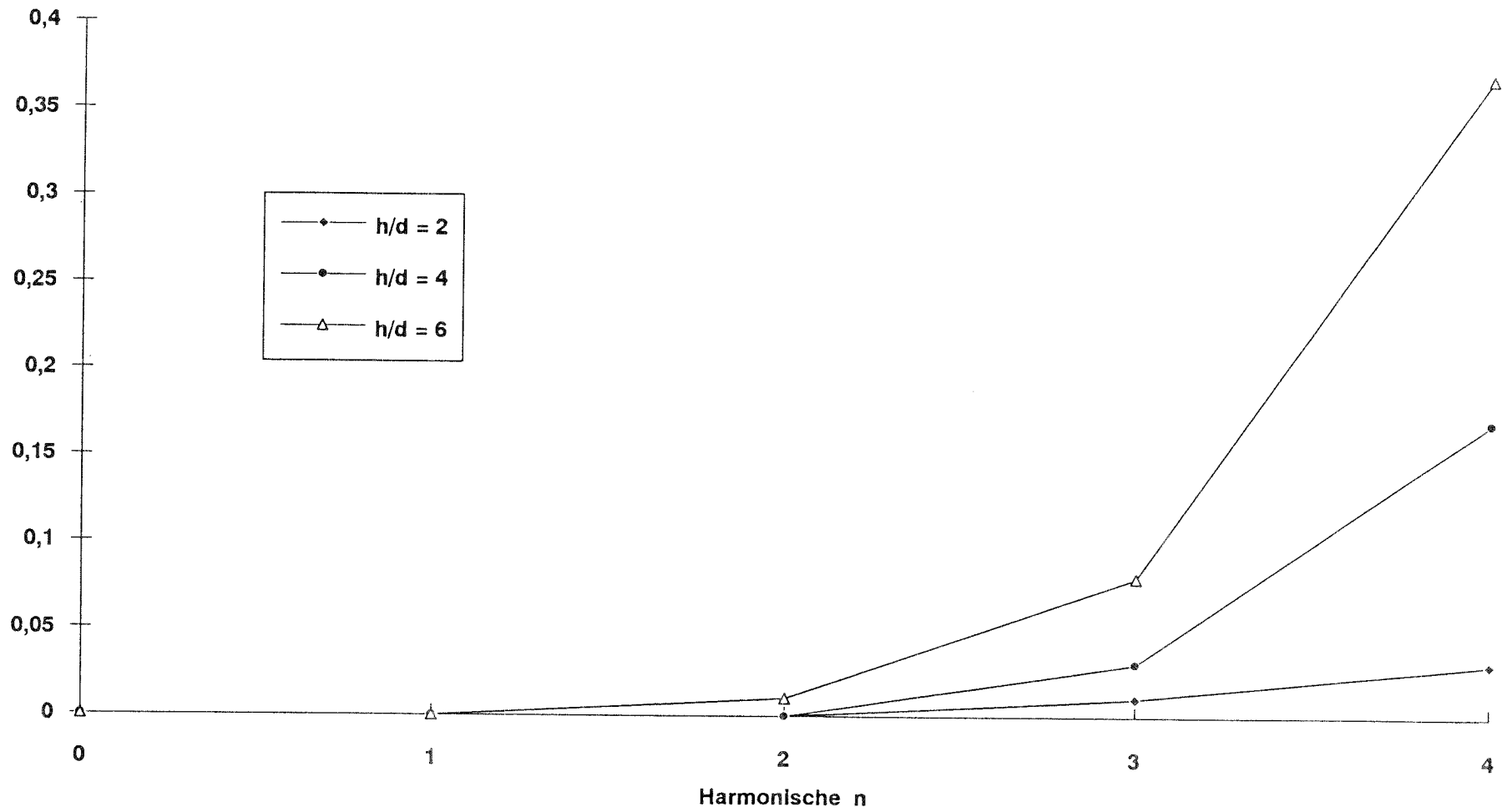
Beiwert 100m\* r/t = 750

Randbedingung: 1



Beiwert 100m\* r/t = 1500

Randbedingung: 1

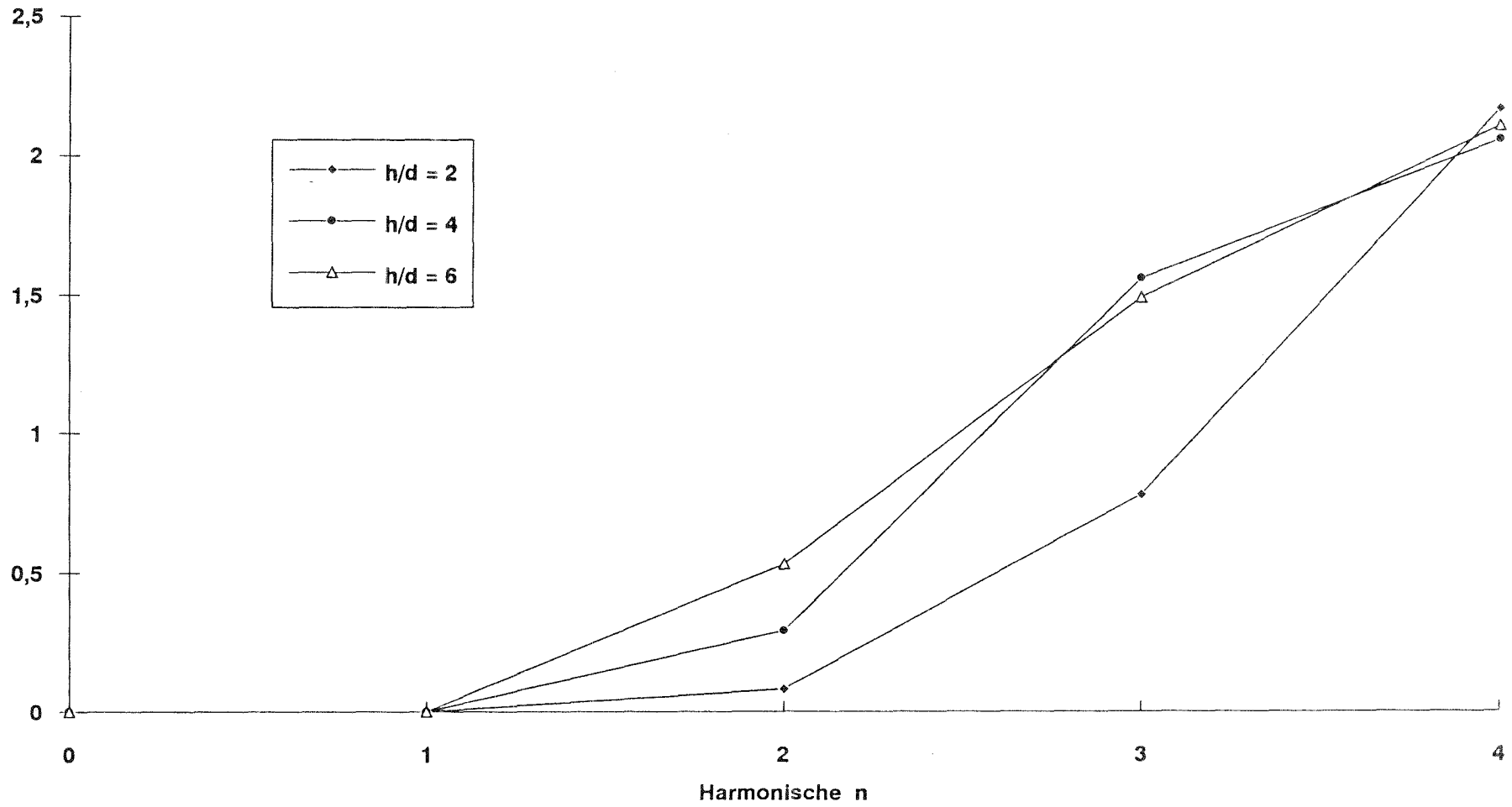


R 5.140



Beiwert 100 m\*  $r/t = 300$

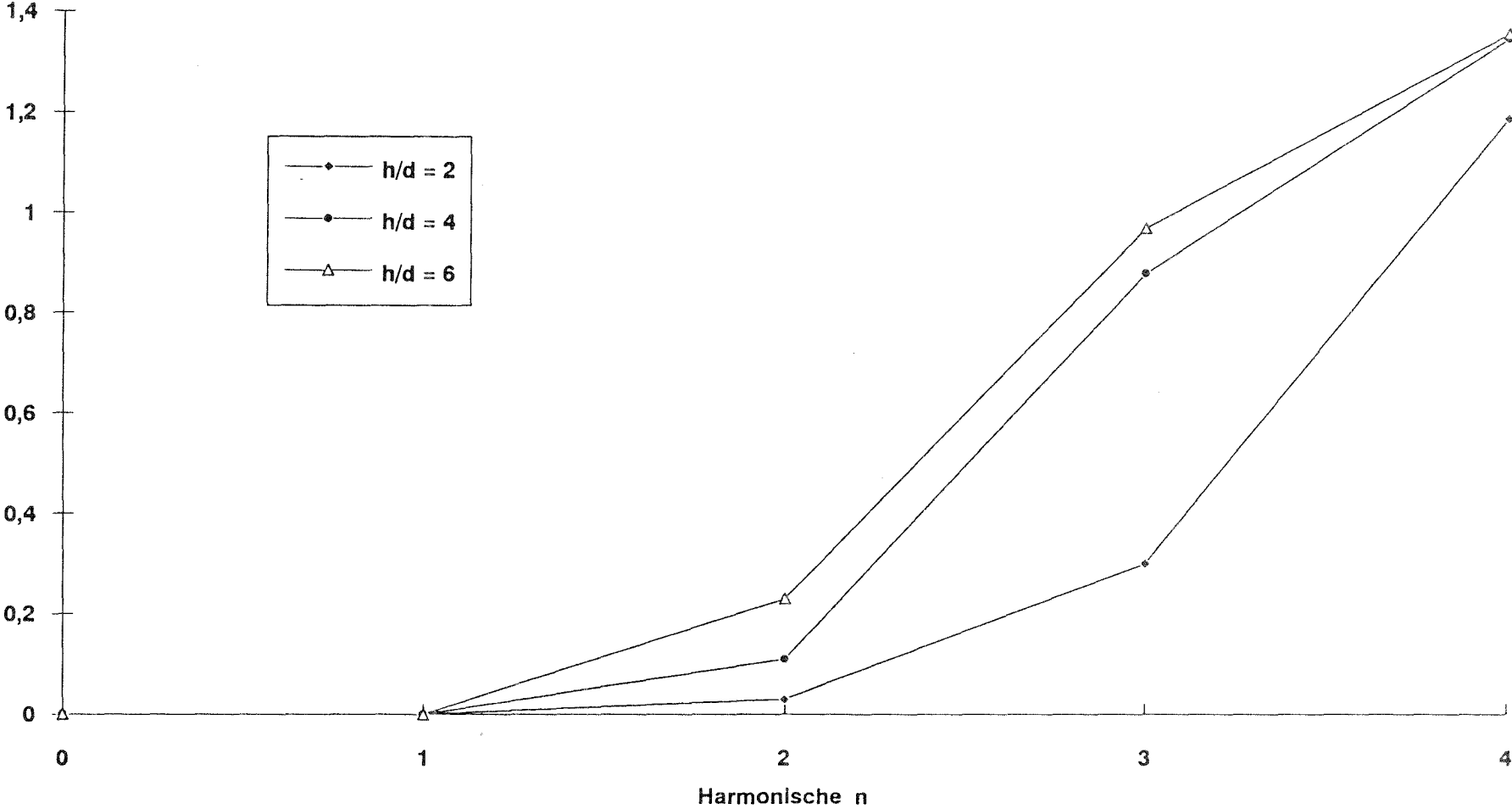
Randbedingung: 2



11.14.11

Beiwert 100 m\* r/t = 500

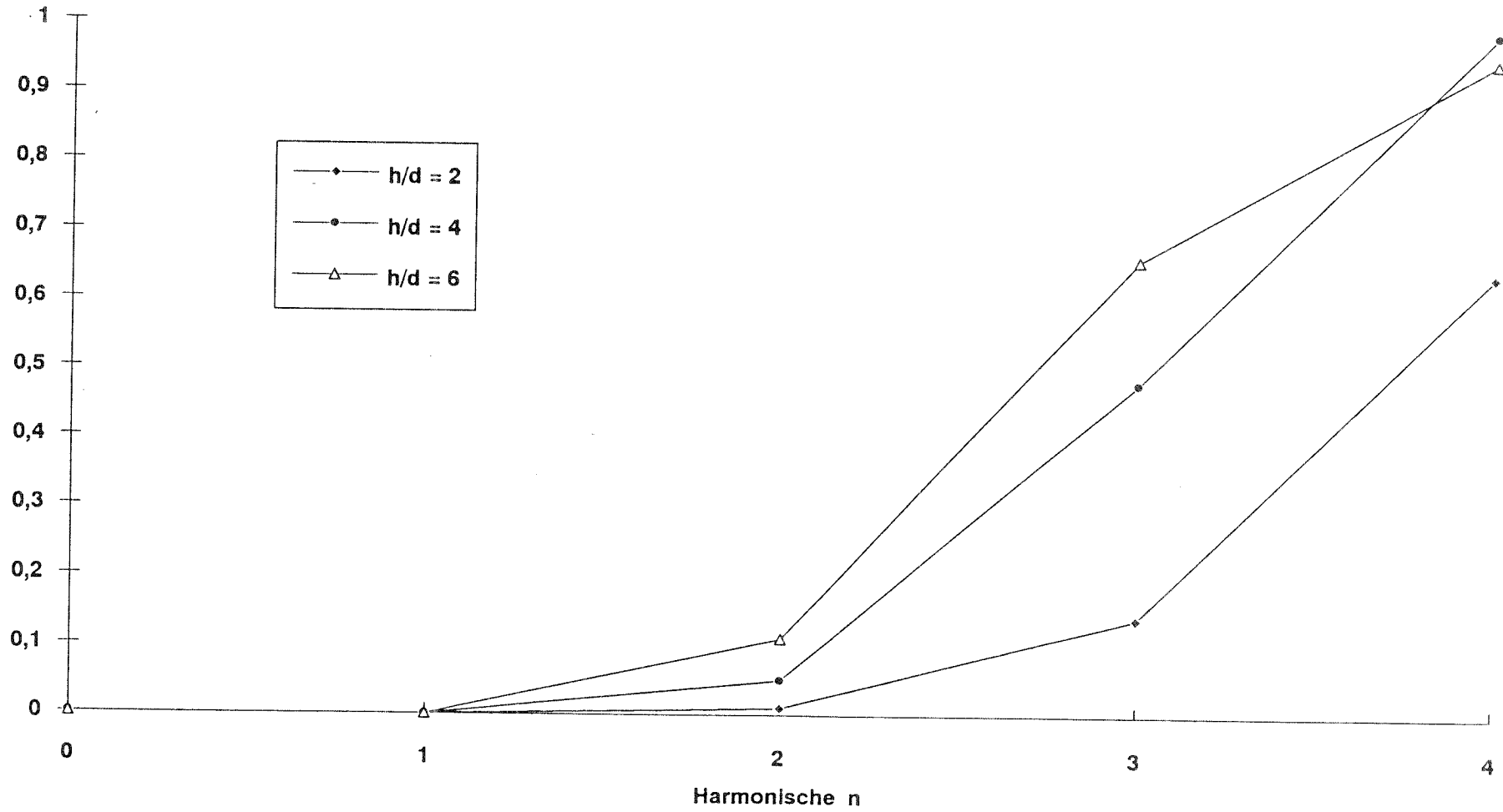
Randbedingung: 2



A 5.42

Beiwert 100 m\* r/t = 750

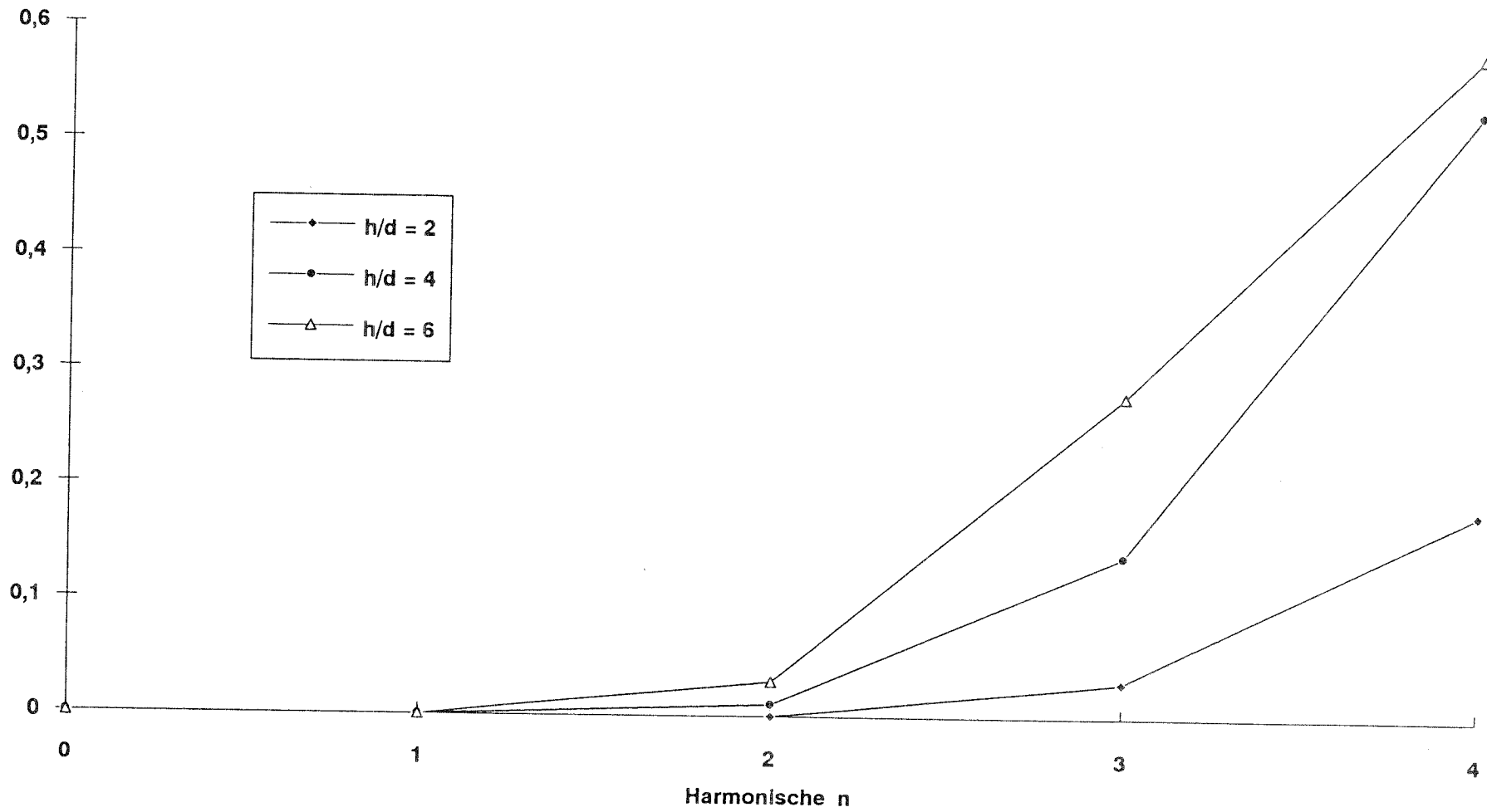
Randbedingung: 2



A 5.43

Beiwert 100m\* r/t = 1500

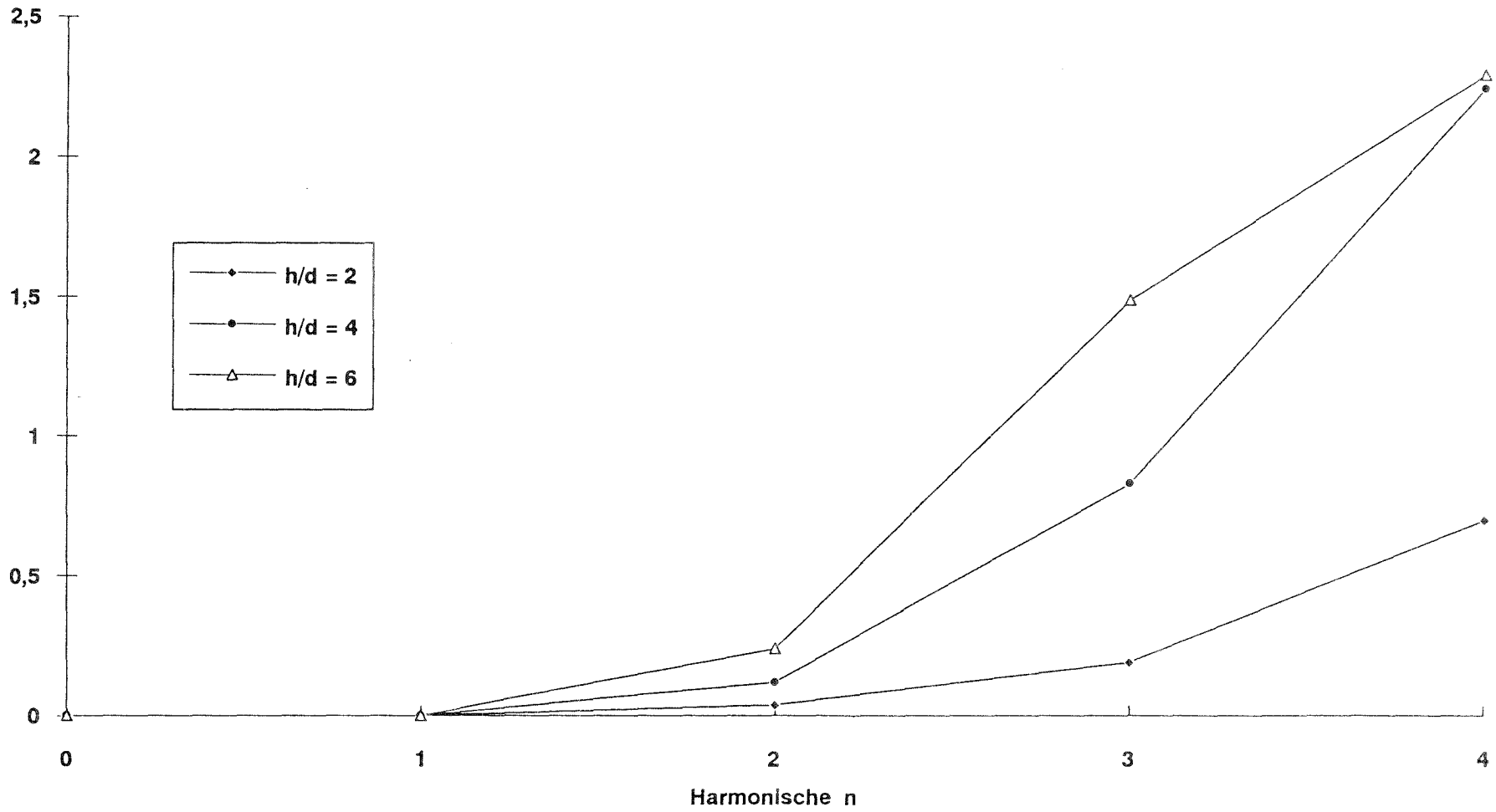
Randbedingung: 2



A 5.44

Beiwert 100 m\* r/t = 300

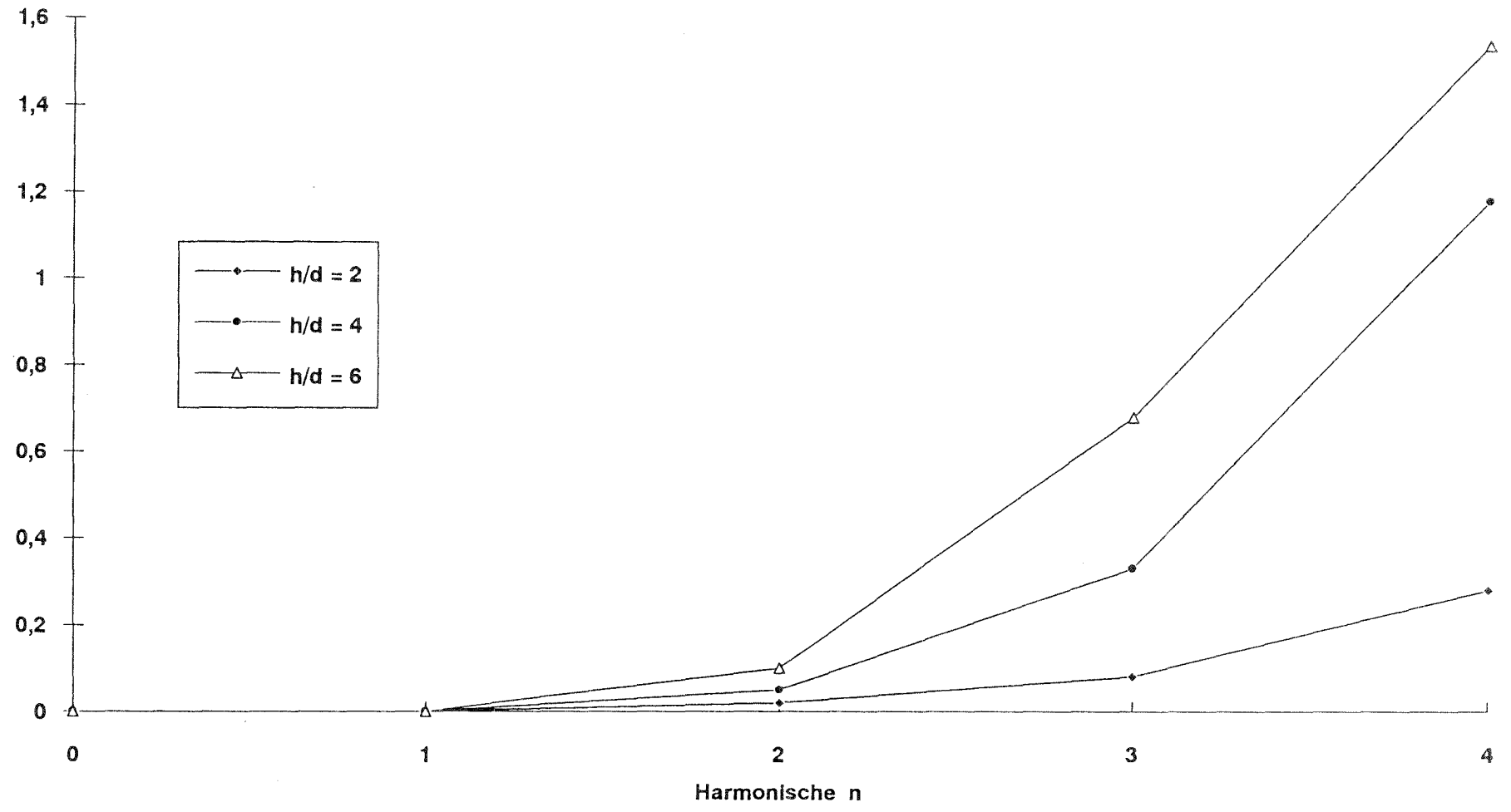
Randbedingung: 3



A 5,45

Belwert 100 m\* r/t = 500

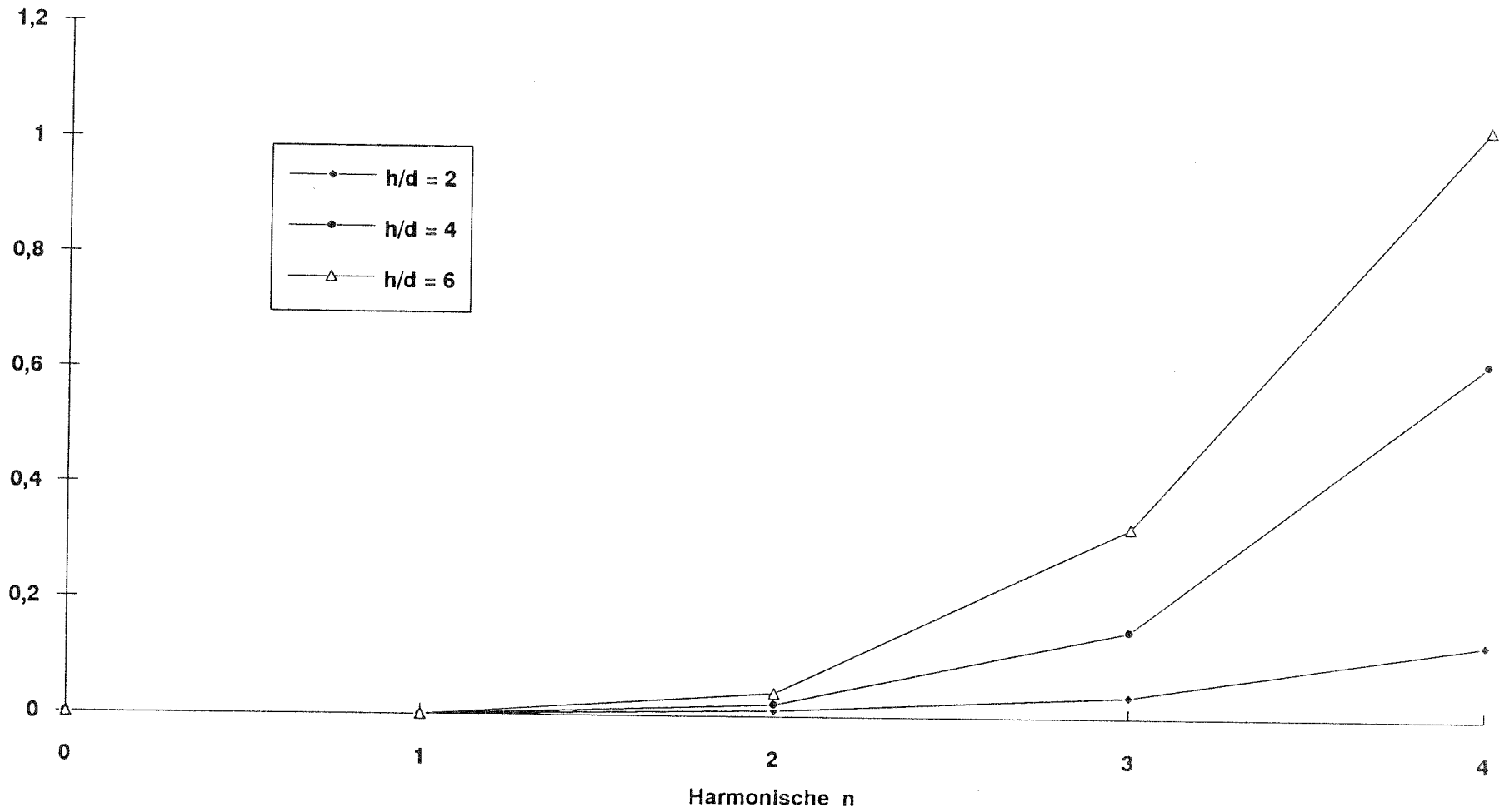
Randbedingung: 3



A 5.16

Beiwert 100 m\* r/t = 750

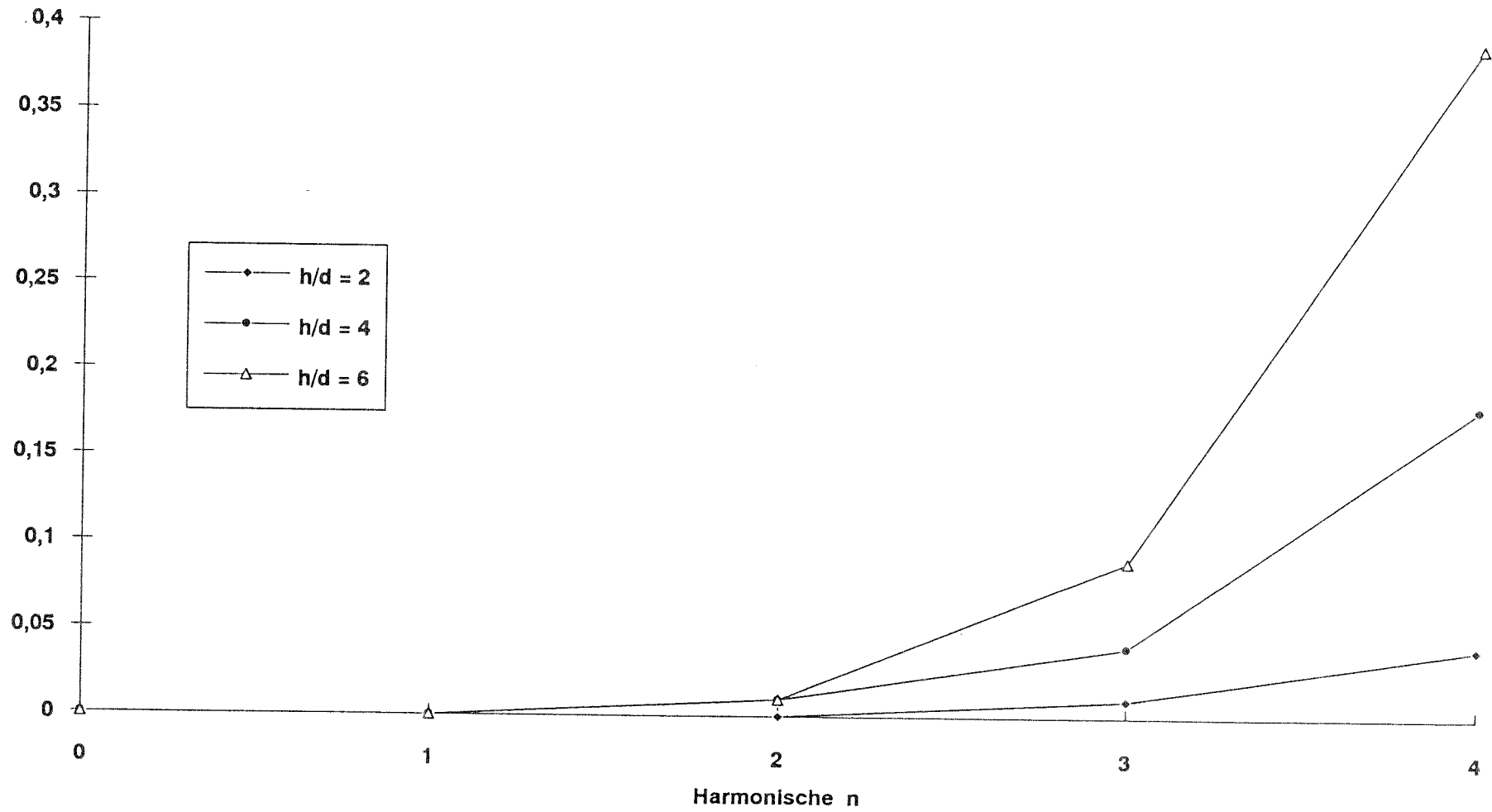
Randbedingung: 3



A 5.47

Belwert 100 m\* r/t = 1500

Randbedingung: 3

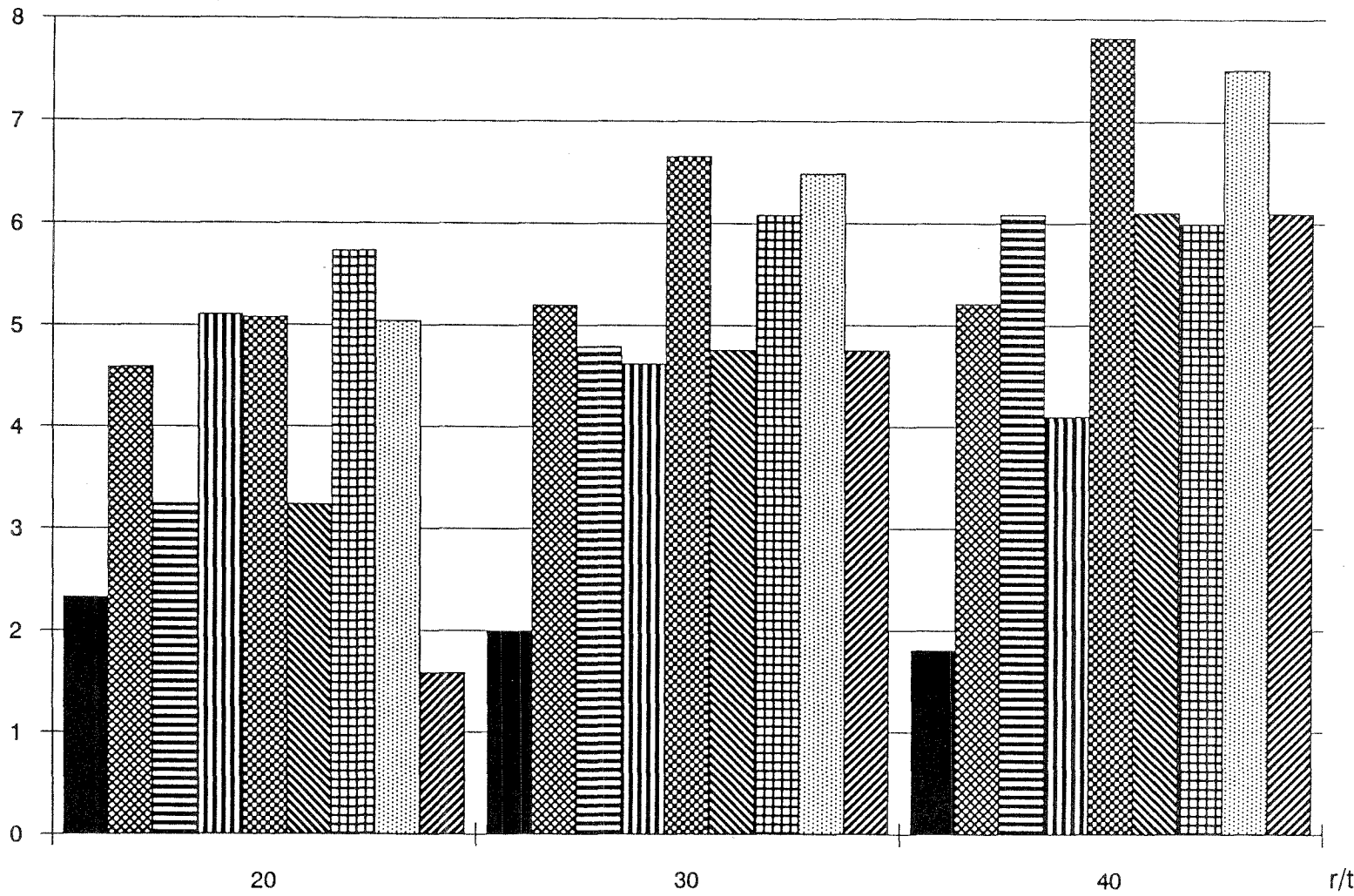


A 5.48



Steigerungsfaktor  $s^*$  Stahlbetonsilos  $r/t = 20 \dots 40$

Randbedingung 1

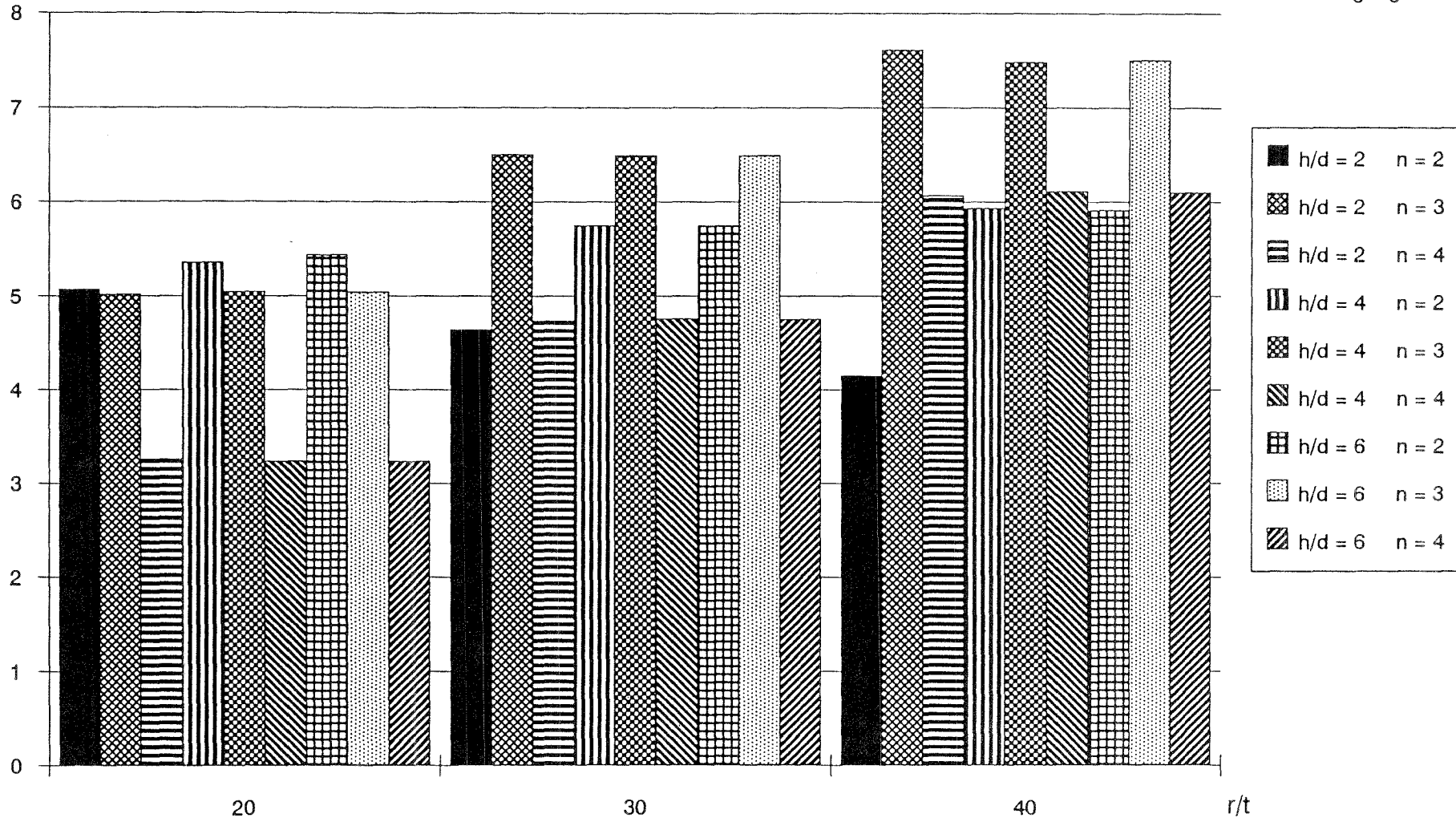


- $h/d = 2 \quad n = 2$
- ▣  $h/d = 2 \quad n = 3$
- ▤  $h/d = 2 \quad n = 4$
- ▥  $h/d = 4 \quad n = 2$
- ▦  $h/d = 4 \quad n = 3$
- ▧  $h/d = 4 \quad n = 4$
- ▨  $h/d = 6 \quad n = 2$
- ▩  $h/d = 6 \quad n = 3$
- $h/d = 6 \quad n = 4$

A 5.4.9

Steigerungsfaktor  $s^*$  Stahlbetonsilos  $r/t = 20 \dots 40$

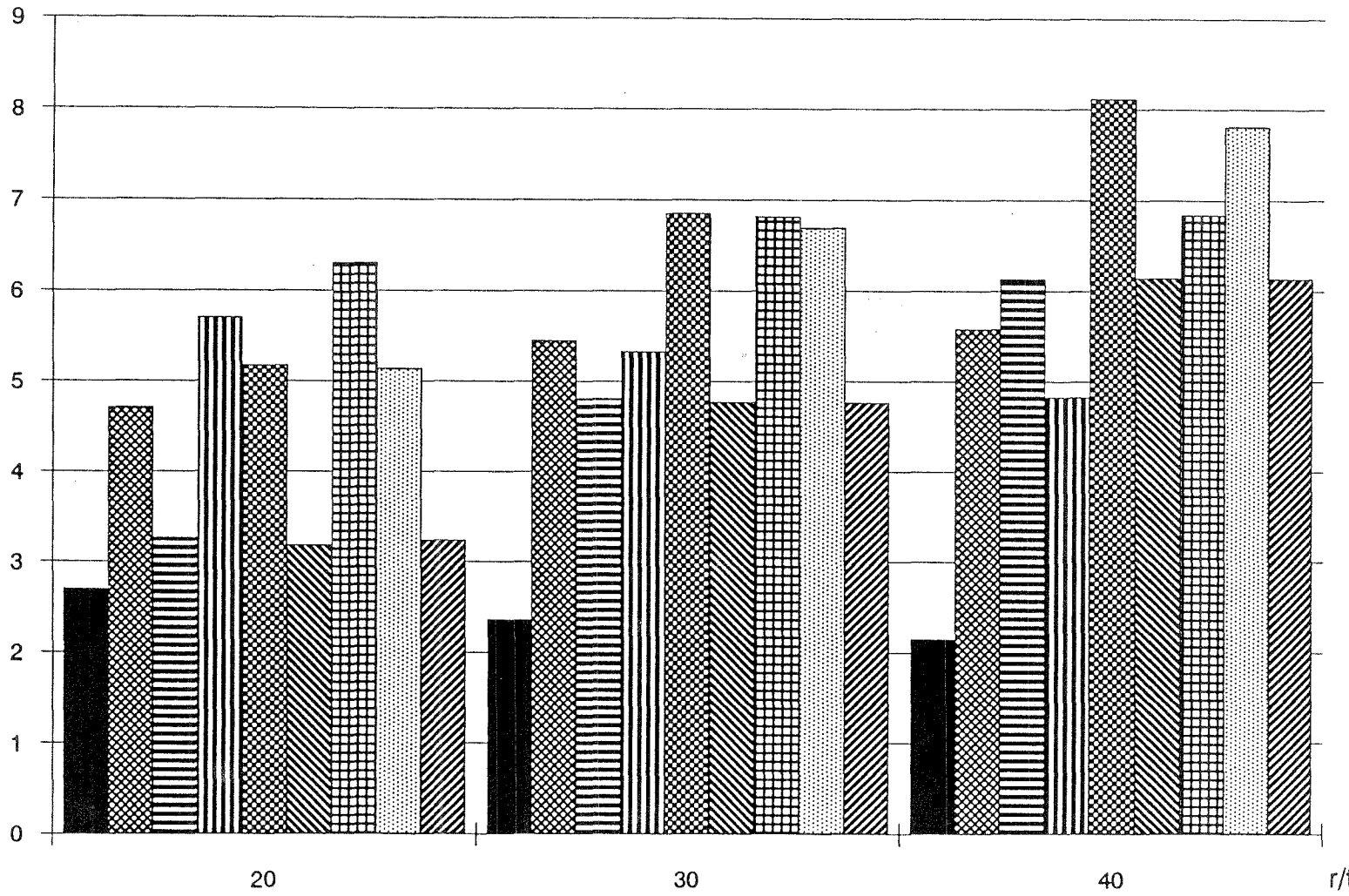
Randbedingung 2



A 5.150

Steigerungsfaktor  $s^*$  Stahlbetonsilos  $r/t = 20 \dots 40$

Randbedingung 3

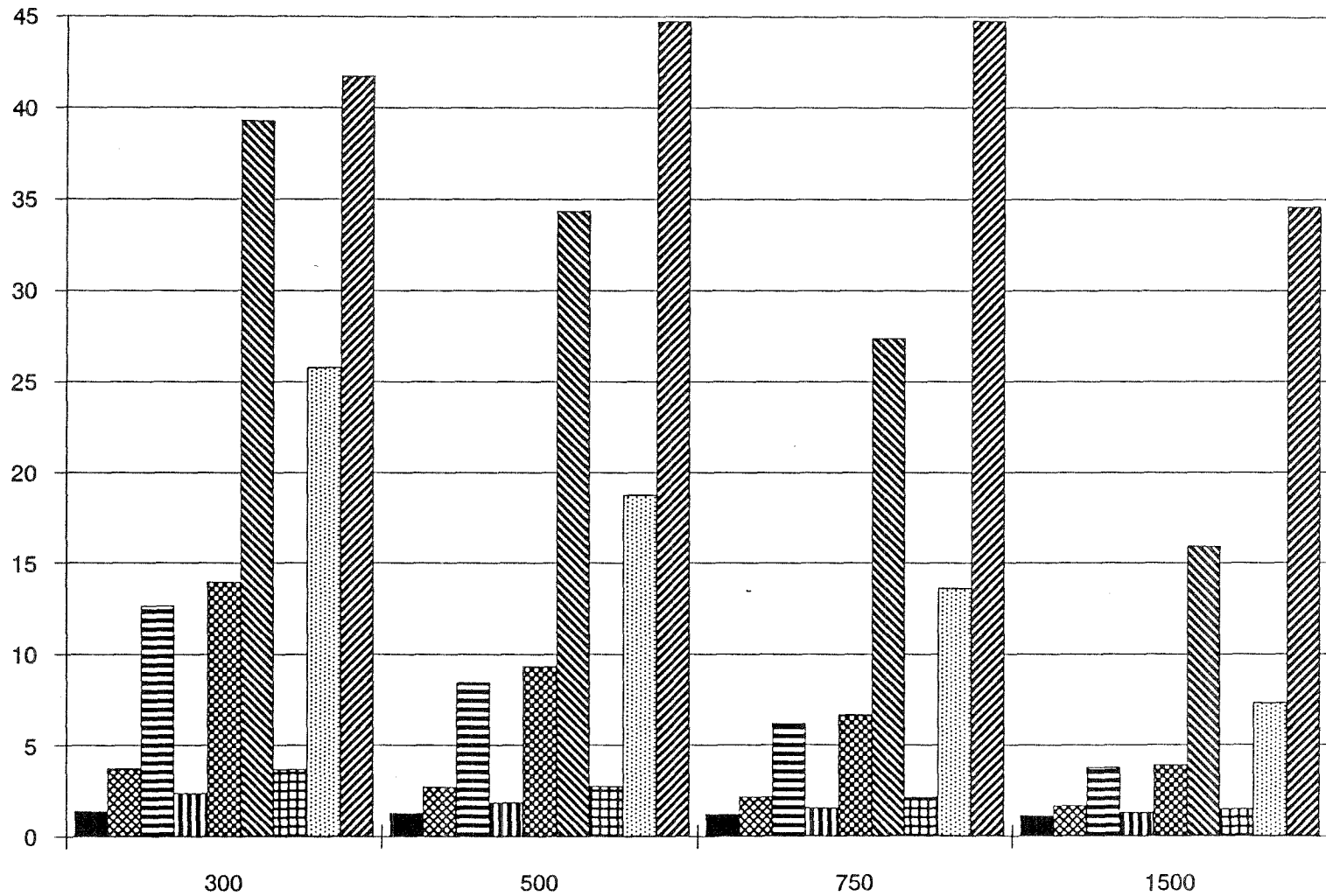


- $h/d = 2 \quad n = 2$
- ▣  $h/d = 2 \quad n = 3$
- ▤  $h/d = 2 \quad n = 4$
- ▥  $h/d = 4 \quad n = 2$
- ▦  $h/d = 4 \quad n = 3$
- ▧  $h/d = 4 \quad n = 4$
- ▨  $h/d = 6 \quad n = 2$
- ▩  $h/d = 6 \quad n = 3$
- $h/d = 6 \quad n = 4$

A.S.I.S.A

Steigerungsfaktor  $s^*$     Stahlsilos     $r/t = 300 \dots 1500$

Randbedingung 1

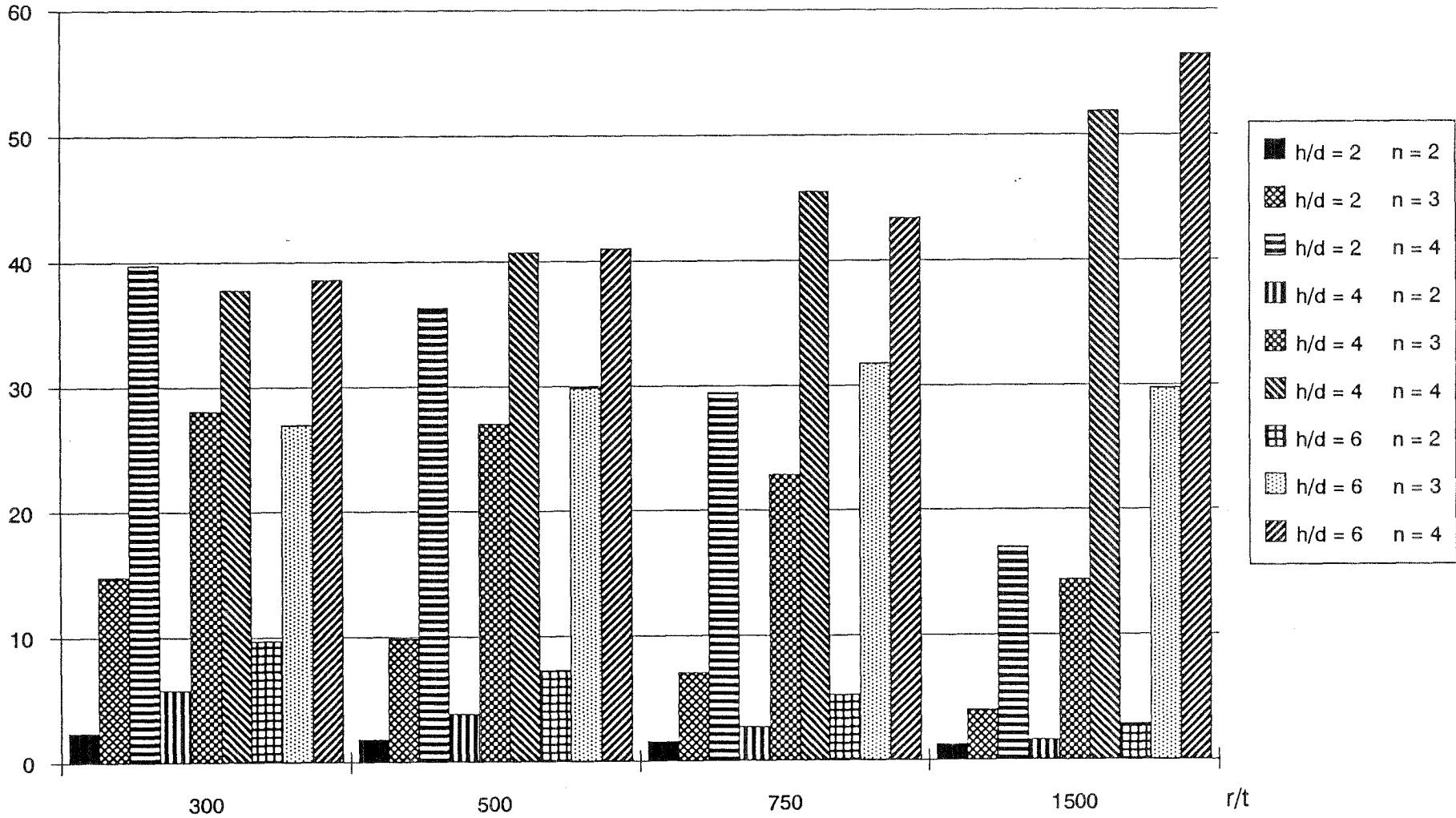


- $h/d = 2 \quad n = 2$
- ▣  $h/d = 2 \quad n = 3$
- ▤  $h/d = 2 \quad n = 4$
- ▥  $h/d = 4 \quad n = 2$
- ▦  $h/d = 4 \quad n = 3$
- ▧  $h/d = 4 \quad n = 4$
- ▨  $h/d = 6 \quad n = 2$
- ▩  $h/d = 6 \quad n = 3$
- $h/d = 6 \quad n = 4$

P. S. S. 2

Steigerungsfaktor  $s^*$     Stahlsilos     $r/t = 300 \dots 1500$

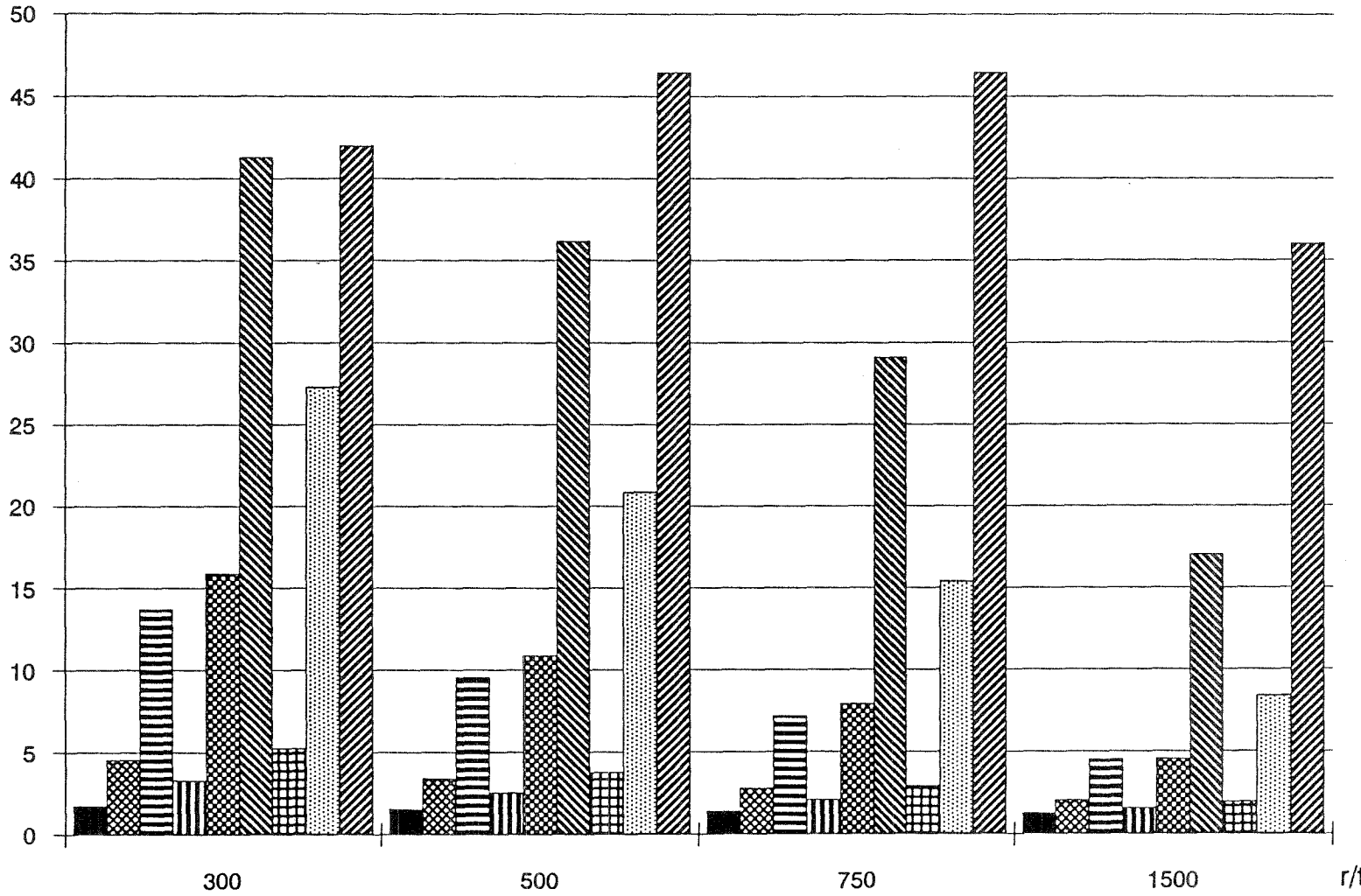
Randbedingung 2



A 5153

Steigerungsfaktor  $s^*$     Stahlsilos     $r/t = 300 \dots 1500$

Randbedingung 3



- $h/d = 2 \quad n = 2$
- ▣  $h/d = 2 \quad n = 3$
- ▤  $h/d = 2 \quad n = 4$
- ▥  $h/d = 4 \quad n = 2$
- ▦  $h/d = 4 \quad n = 3$
- ▧  $h/d = 4 \quad n = 4$
- ▨  $h/d = 6 \quad n = 2$
- ▩  $h/d = 6 \quad n = 3$
- $h/d = 6 \quad n = 4$

A 5,14