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SEISMIC SURVEY IN THORISTUNGUR 1974

by

Sveinn Thorgrimsson

RIT
OS-ROD-7502

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I. INTRODUCTION

In late July 1974 seismic survey was conducted in Thóristungur at Tungnaá river with the purpose of exploring the stratigraphy on the proposed tailrace canal route for the Hrauneyjafoss Hydroelectric Project.

The research area extends over about 1/4 of a km^2 and altogether 20 profiles were measured. Due to a layer of frozen ground generally at about 50 cm depth and 50-80 cm thick the profiles are confined to those few areas, where the frost does not affect the measurements. Experience showed that where grey moss was conspicuous frozen ground could definitely be expected.

The location of the seismic profiles is shown on the accompanying map (Figs 2 and 3) with as much accuracy as the map allows.

Acting as assisting staff were J. Hólmjárn, technician, and Ó. B. Smárason.

II. ON SEISMIC SURVEY

Under favourable conditions, as where the stratigraphy is partly known such as where core drillholes are located in the research area, and when the results of the survey are analysed and corrected as far as possible, the results of the seismic survey may be assumed to present the depth of an interface above 10 m to the nearest meter with fair degree of accuracy, but for deeper interfaces with 10% accuracy. All the results in this report should therefore be evaluated with regard to this accuracy.

For a given occasion it should be mentioned here that the seismic refraction technic applied here has great limitations for measuring thin strata.

As is known the seismic wave velocity is a function of frequency and wave length. Near the shot point where the velocity of the surface layers is 1-2 m/msec, the wave length is hardly less than 10 m. For layers to be measured with certainty their thickness must be about 1/4 of the wave length, i.e. about .3 m. With greater distance from shot point where succession of deeper situated layers of higher velocity are measured the layers may be expected to have to be at least 6-8 m thick to be recognized with certainty. Also the layers have to be thicker than the overlaying strata to be recorded. Yet this is considerably dependent on the difference in sound velocity between the individual strata.

According to my experience with seismic survey during the last two years measuring of surface layers thinner than 2 m under good conditions and thinner than 3 under poor conditions is fairly useless.

(Excerpt from "The Application of Shallow Seismic Methods to Mapping of Frozen Surficial Materials", by J.A.M. Hunter):

> "Mapping Structure in Permafrost
>
> "In many cases, the velocity structure of overburden materials in permafrost are amenable to refraction surveying techniques.
>
> "For accurate delineation, velocities must increase with depth, and the thickness of the layering must be at least one quarter of the length of the seismic wavelengths used. This suggests that most layers 3 m thick or more can be detected by the refraction method in permafrost."

III. THE RESULTS OF THE SURVEY

Within the research area four velocity zones were recorded, but the exact nature of individual zones is difficult to tell with certainty.

The uppermost velocity zone has U_p = 0.3-0.4 m/msec being generally about 3.5-6 m thick in the area. The sound velocity corresponds fairly well to dry soil [redacted] and tephra. Underlying the surface zone there follows a layer of U_p = 1.1 to 1.9 m/msec, which is often dissected by a layer of higher velocity of U_p = 2.3 to 2.7 m/msec. The velocity of this layer varies somewhat from one locality to another and reaches 3.0 m/msec or even more in restricted areas. Layers two and three could be the same rock layer, the difference in sound velocity being caused by a different degree of consolidation or different porosity. Such facies variations are rather common in the móberg formations and in glacial formations.

A possible explanation of the velocity difference between the surface layer (U_p = 0.3-0.4 m/msec) and the velocity layer U_p = 1.1 to 1.9 m/msec is that at this level ground water table is reached. With regard to the variable sound velocity I do not consider this very likely, but it can be decided very easily by borro-sounding and still better by piezometric observations.

The fourth velocity layer only appears in few places having sound velocity of 4 m/msec or higher.

The results of the survey are graphically presented on eight stratigraphical profiles forming a network over the area. The location of the profiles is shown on Fig 1. With the aid of these profiles and the sound velocity diagrams new profiles can be drawn in whatever direction desired within the area.

In seismic survey where shallow interfaces are involved the correlation of certain lithological units to a certain sound velocity is

often quite difficult. This is really not surprising when it is kept in mind that the sound velocity is a function of many factors, which are not taken into account in the lithological classification. E.g. the sound velocity of alluvium and glacial deposits (moraine, tillite and so on) is a function of composition (petrologic units) and grain size, consolidation, porosity, saturation and depth below surface. On the other hand only the two first factors enter the lithological classification. In well sorted, rather homogeneous sediment the last three factors can cause a great difference in velocity, especially the porosity. These factors of course also affect other rock formations as well.

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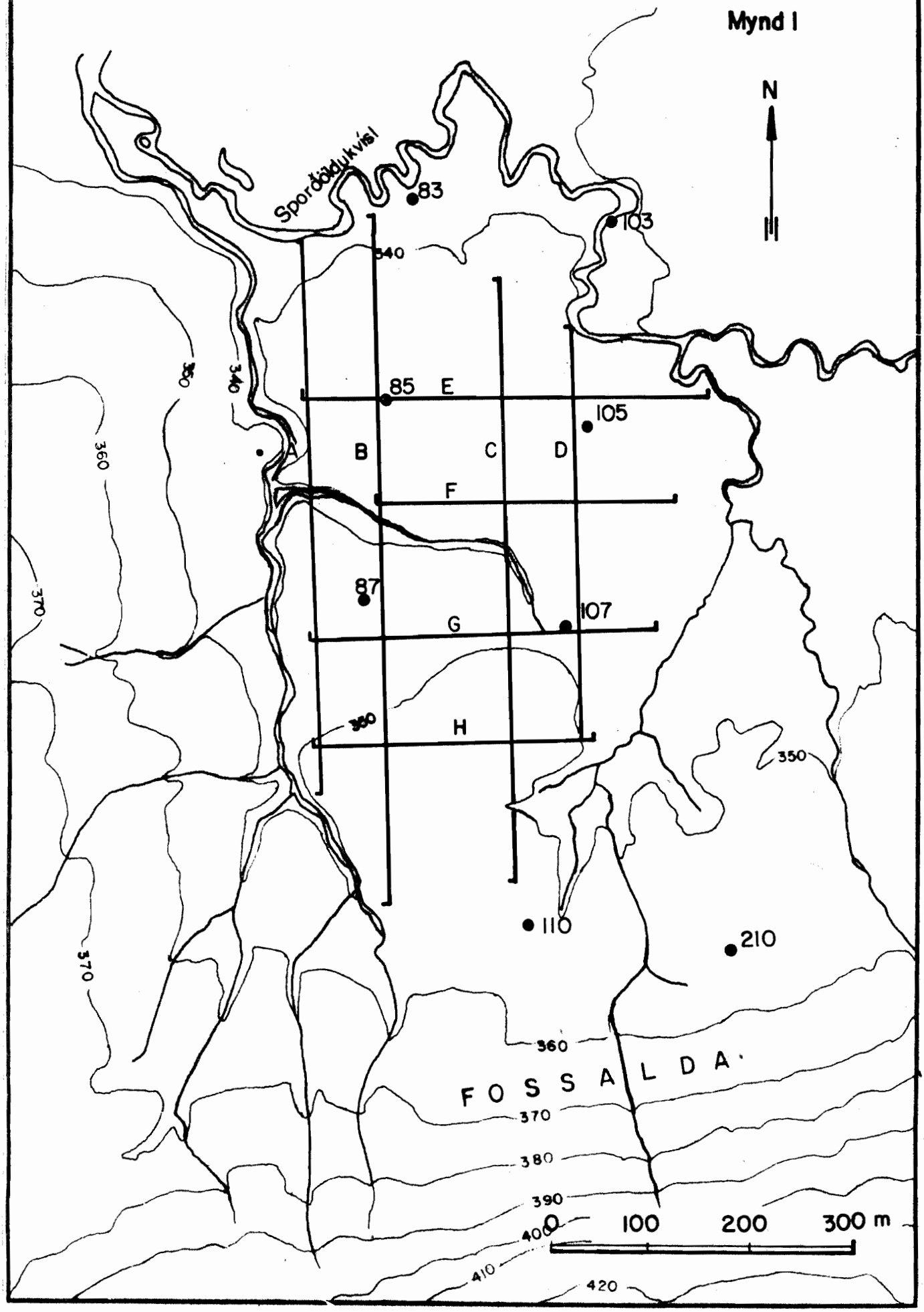
Þóristungur Stratigraphical Profiles

28.10'74 SÞ/Sy.J.	
Tnr 371	Tnr 100
B-332	J-Jarðsvm.
Fnr 12013	

Mynd 1



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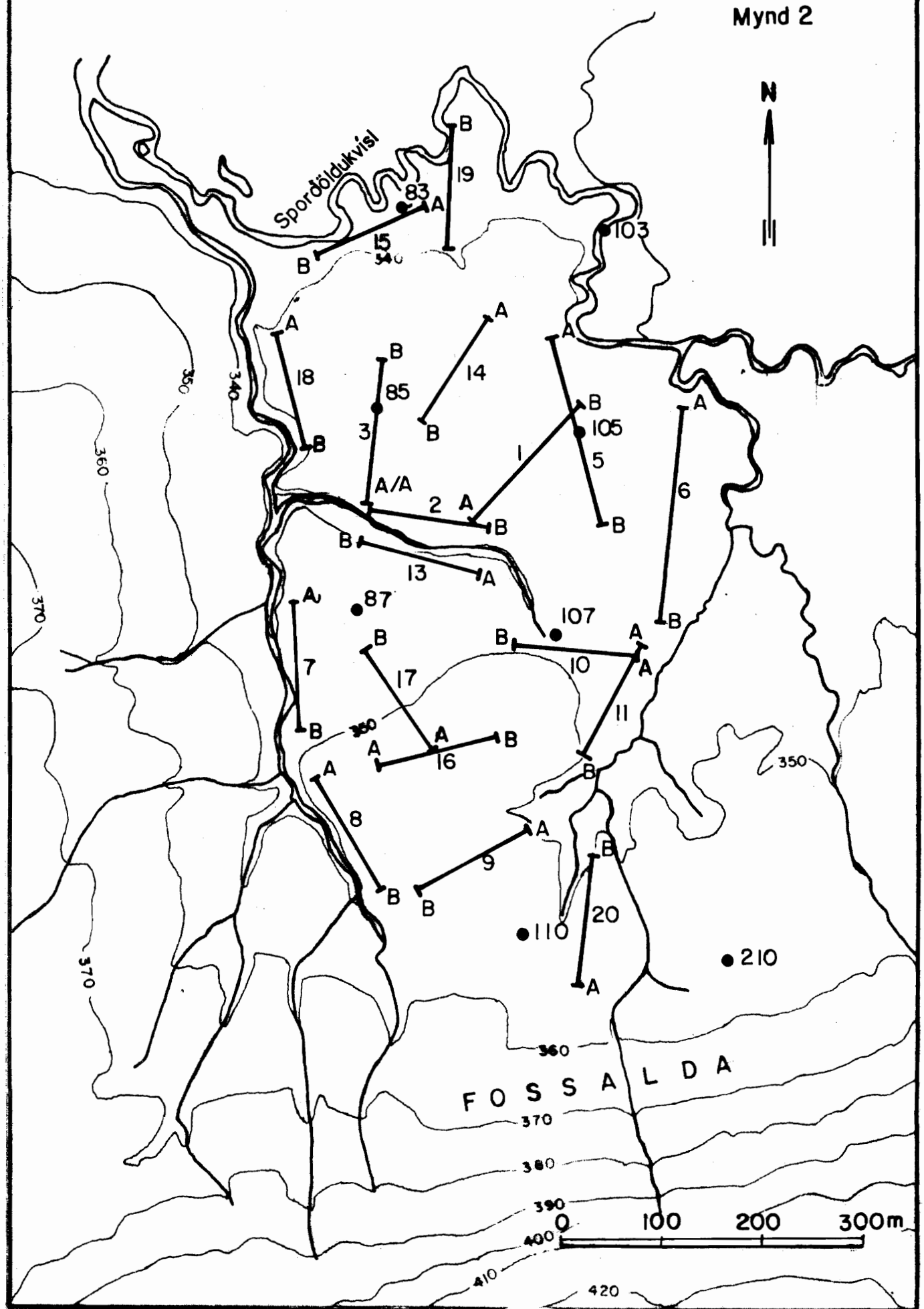
Þóristungur. Location of seismic profiles

2810'74 SÞ/Sy.J.
Tnr 372 Tnr 101
B-332 J-Jarðsvm
Fnr 12014

Mynd 2



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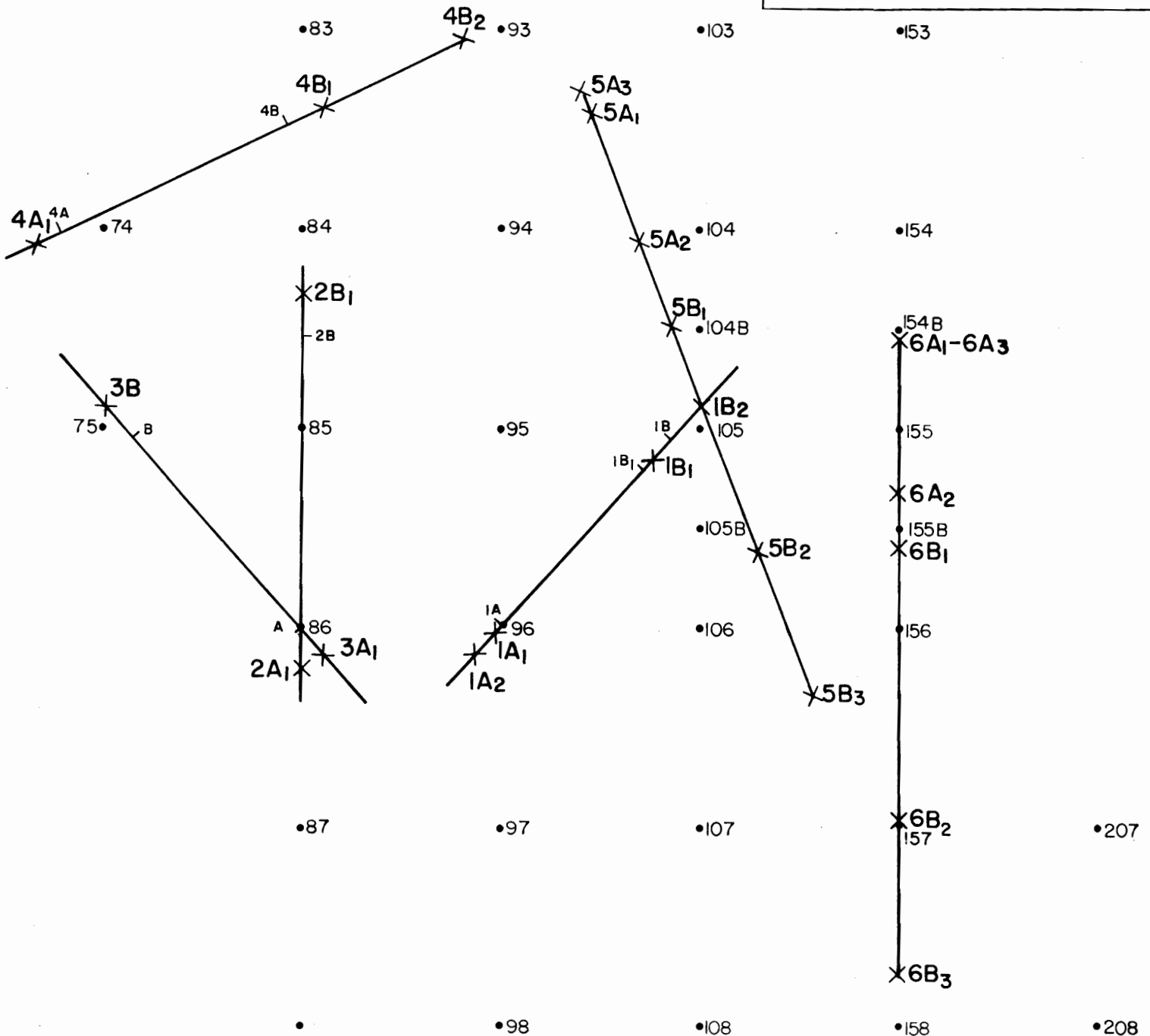
Þoristungur Lokation of seismic profiles

2210'74 SÞ/SyJ
Tnr 407 Tnr 136
B-332 J-Jarðsvm
Fnr.12049.

Mynd 3



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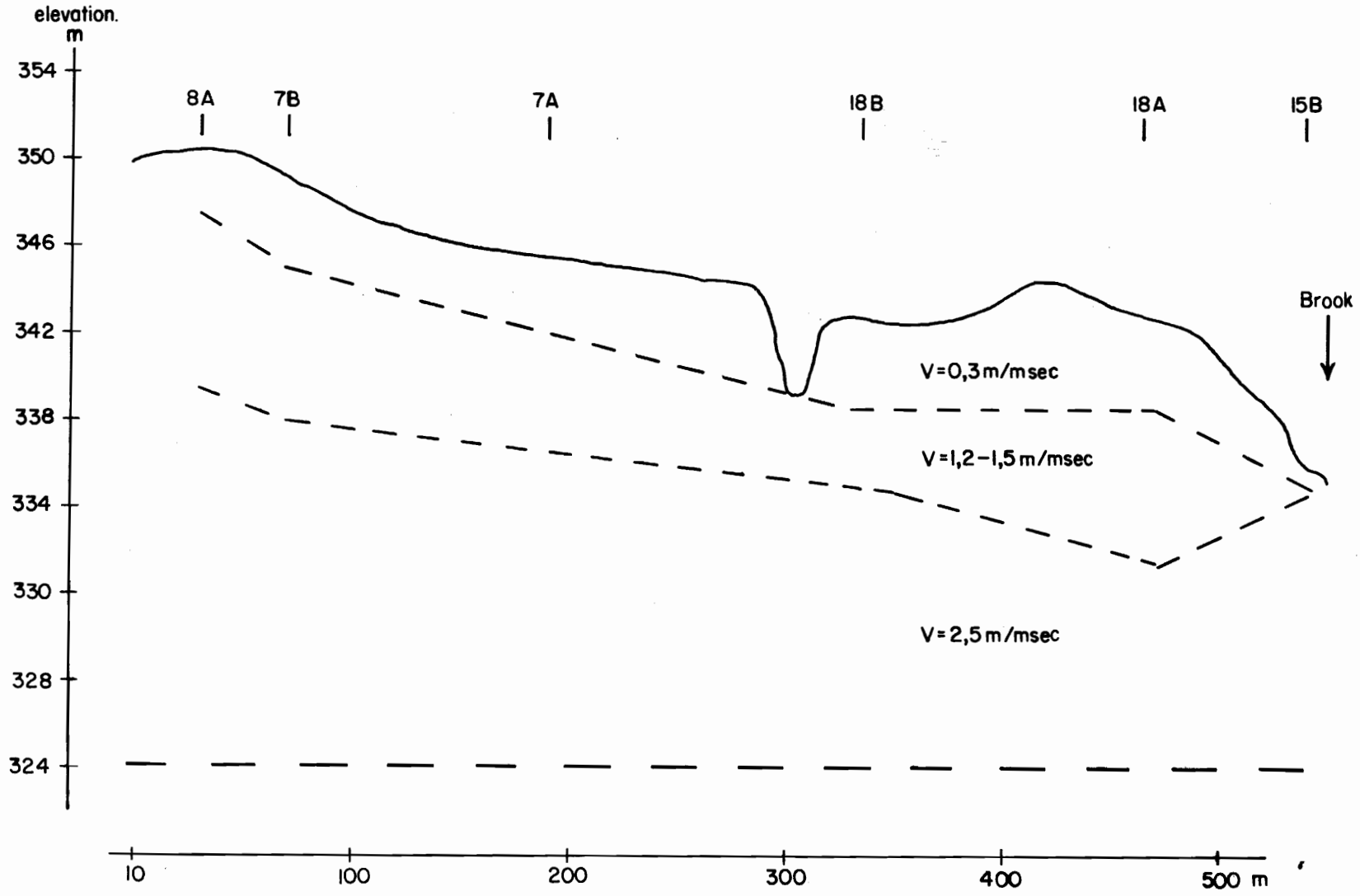
Þóristungur. Stratigraphical profile A

10.10 '74 SÞ/SyJ
Tnr. 373 Tnr. 102
B-332 J-Jarðsvm.
Fnr. 12015



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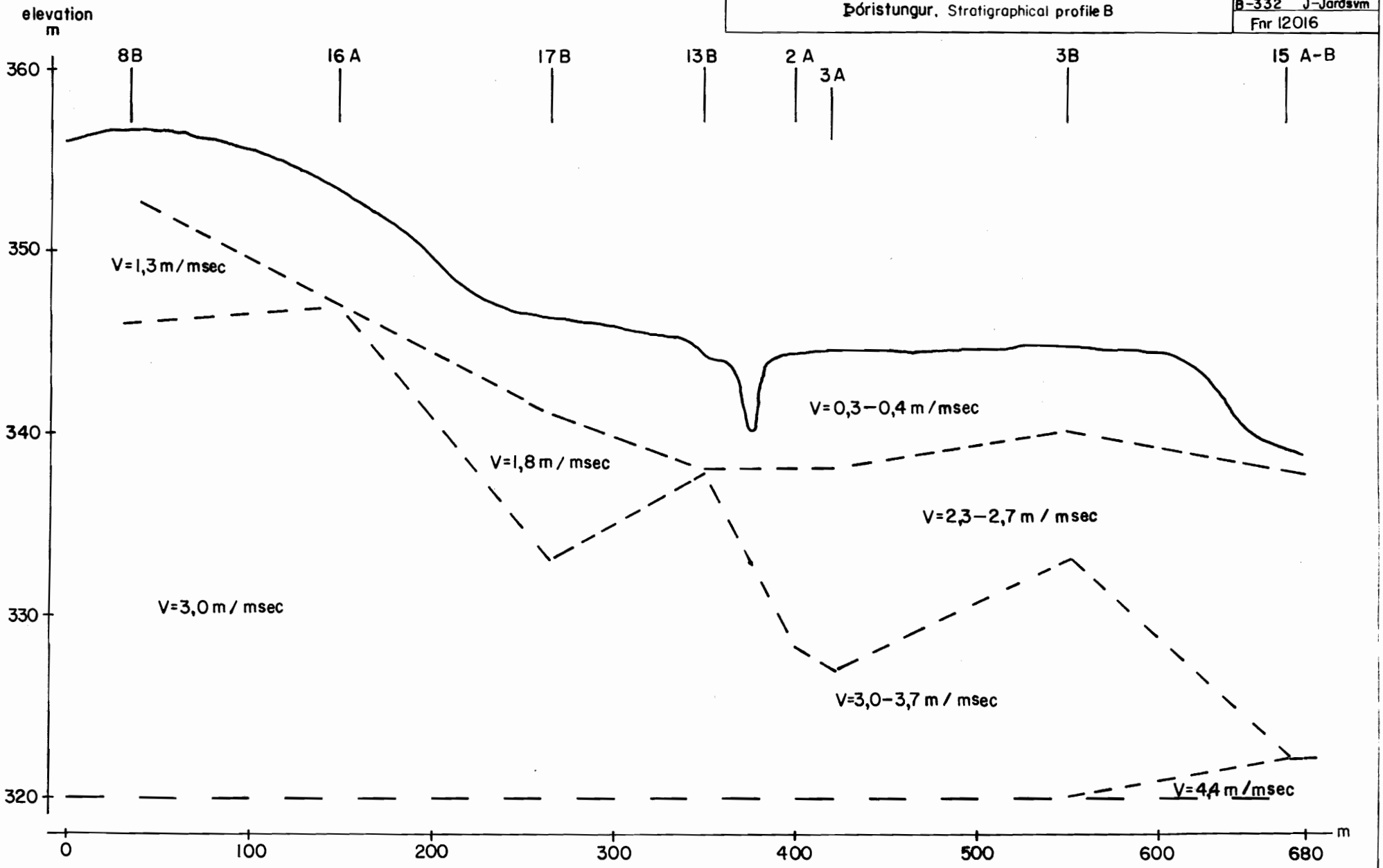
Þóristungur. Stratigraphical profile B

10.10.'74 SÞ/Sy.J.
Tnr 374 Tnr 103
B-332 J-Jarðsvm
Fnr 12016



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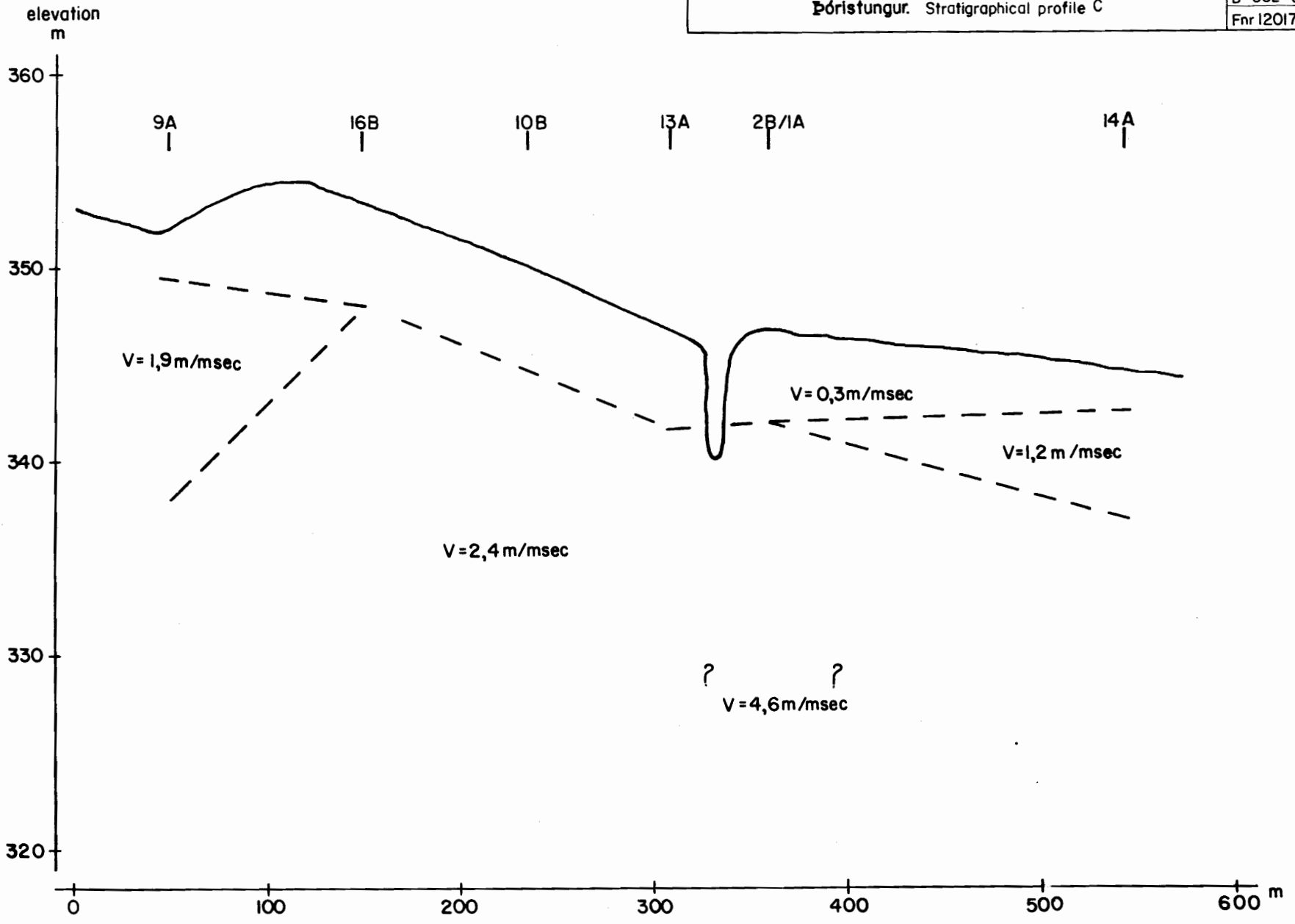
Þóristungur. Stratigraphical profile C

10.10'74 SÞ/SyJ.
Tnr. 375 Tnr.104
B-332 J-Jarðsv.m.
Fnr 12017



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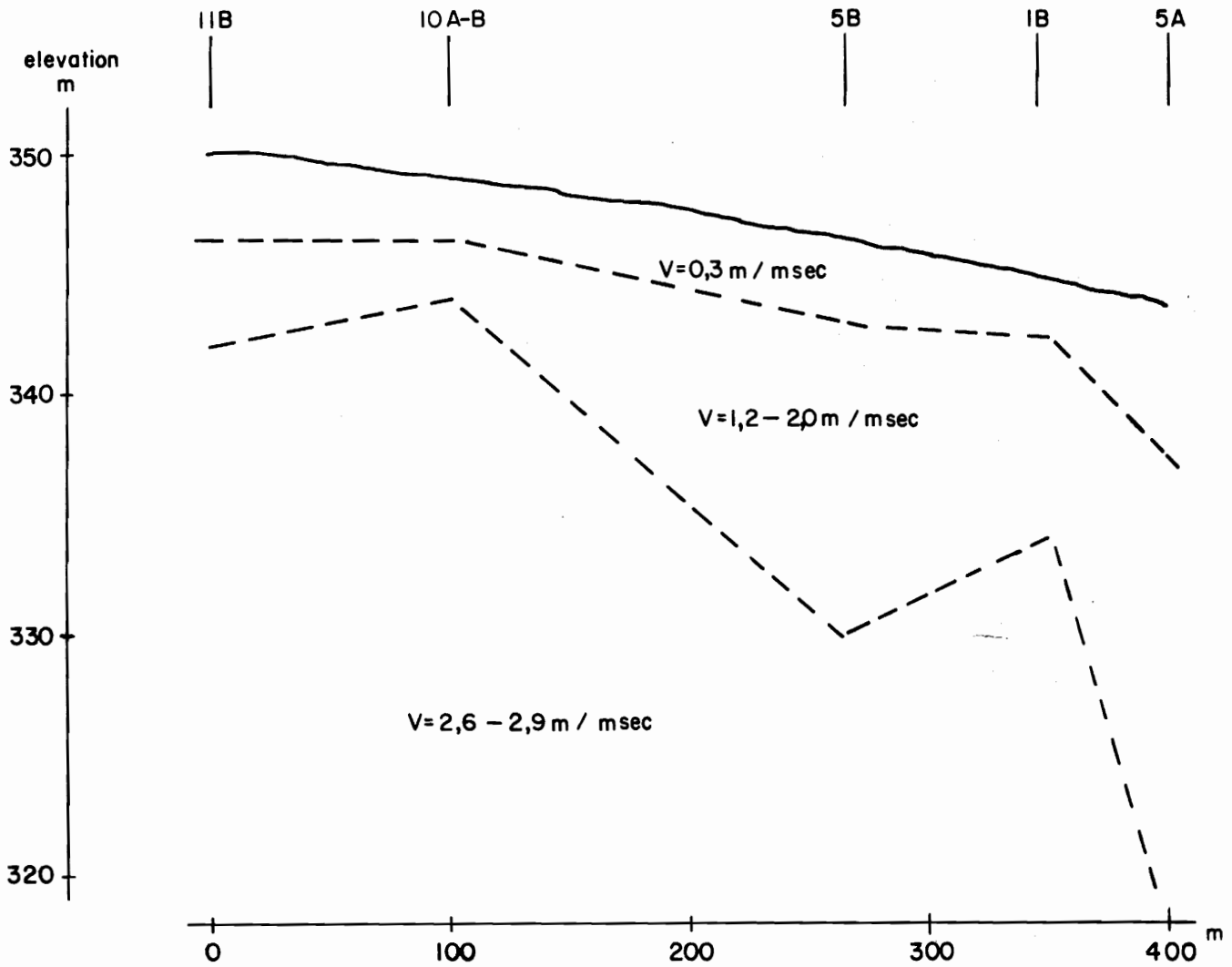
Þóristungur. Stratigraphical profile D

1010'74 SÞ/SvJ.
Tnr 376 Tnr 105
B-332 J-Jarðsvm
Fnr 12018



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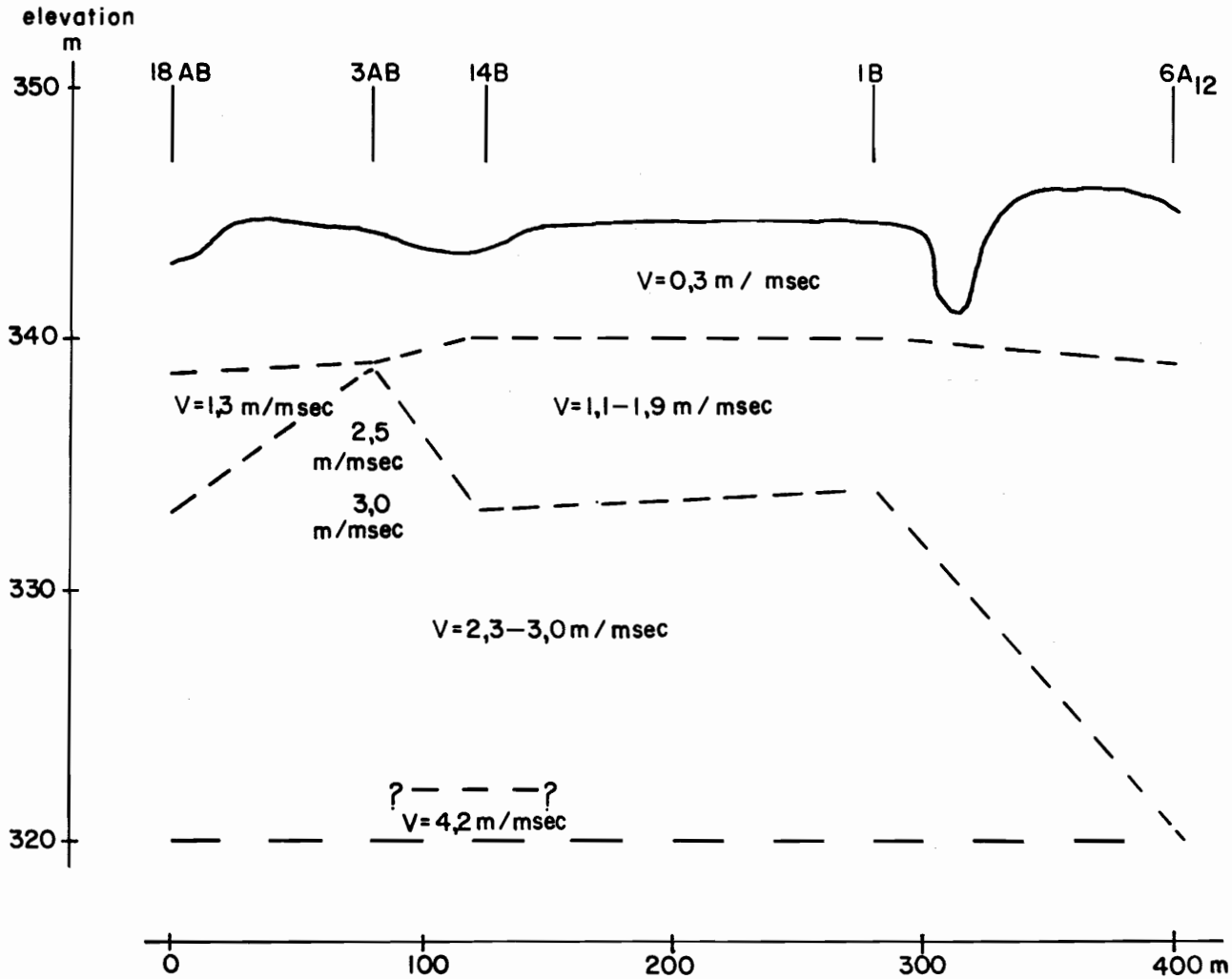
Þóristungur. Stratigraphical profile E

10 10 '74	SÞ/SyJ.
Tnr. 377	Tnr. 106
B-332	J-Jarðsvm
Fnr 12019	



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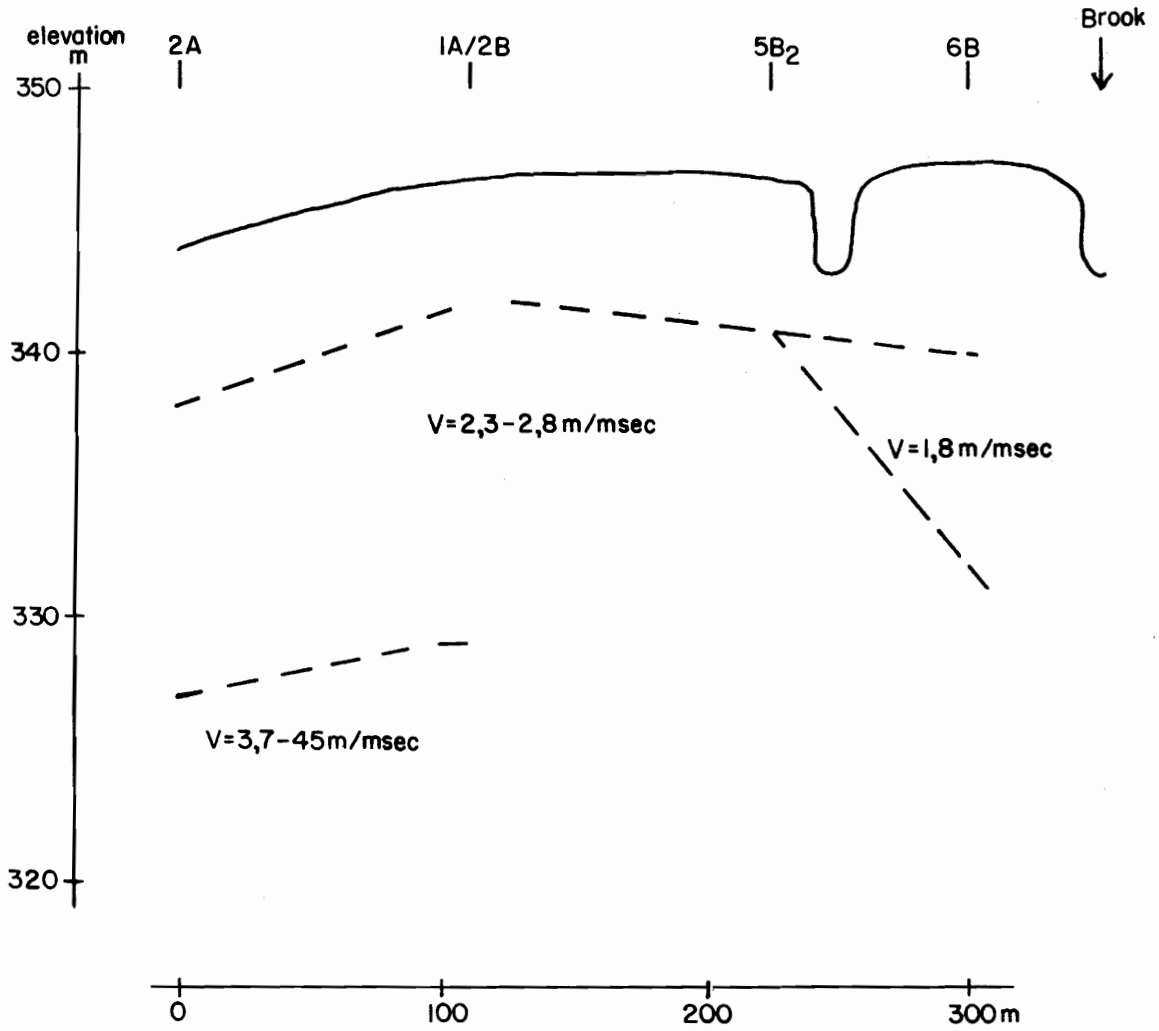
Þóristungur. Stratigraphical profile F

10.10'74 SÞ/Sy.J.	
Tnr. 378	Tnr.107
B-332	J-Jarðsv.m
Fnr.12020	



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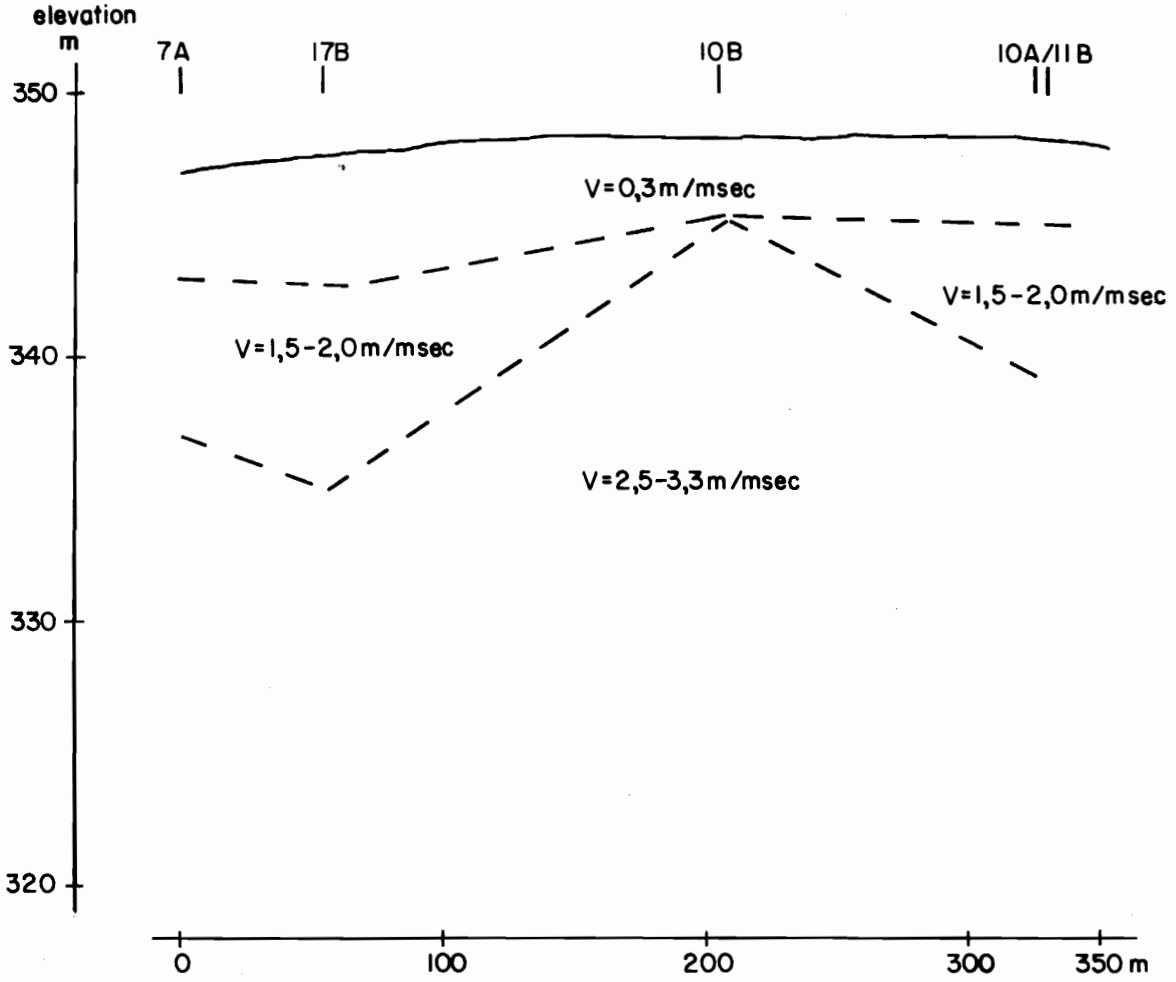
Þóristungur. Stratigraphical profile G

10.10'74 SÞ/SyJ.
Tnr 379 Tnr 108
B-332 J-Jarðsvm.
Fnr 12021



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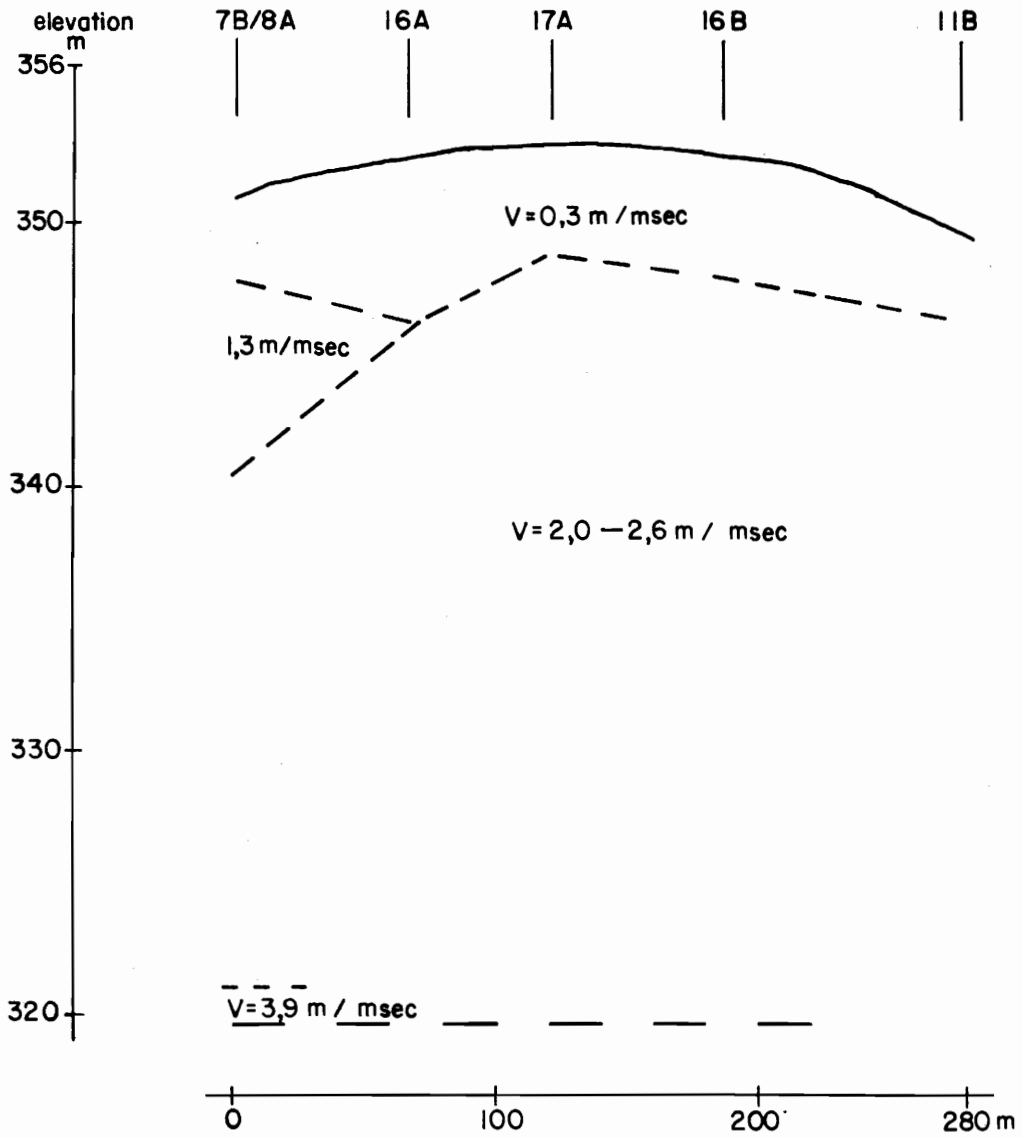
Þóristungur. Stratigraphical profile H

11.10'74	Sb/SyJ
Tnr. 380	Tnr. 109
B-332	J-Jarðsvm.
Fnr. 12022	



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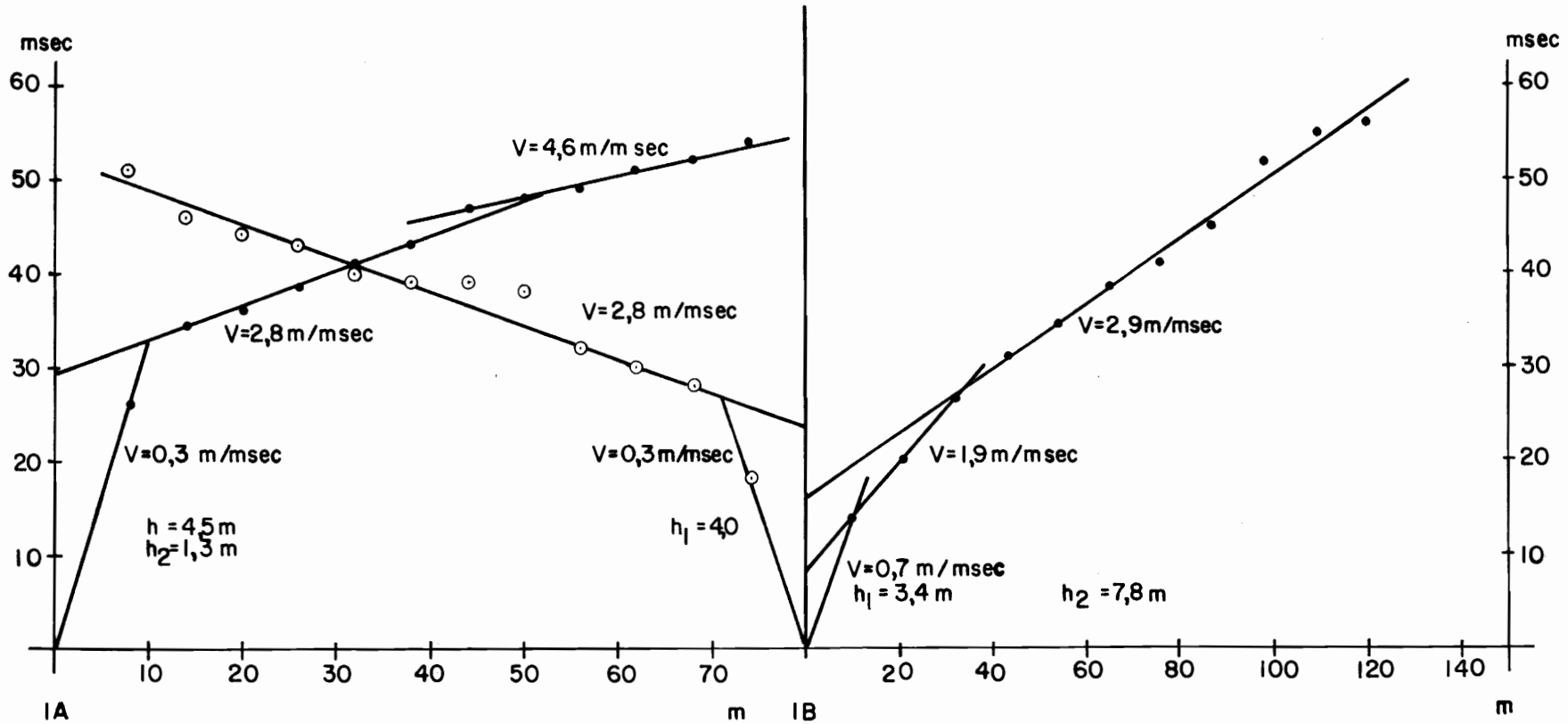
Þóristungur. Seismic profile 1A-B

11.10'74 SÞ/SyJ.
Tnr 381 Tnr 110
B-332 J-Jarðsvm.
Fnr.12023



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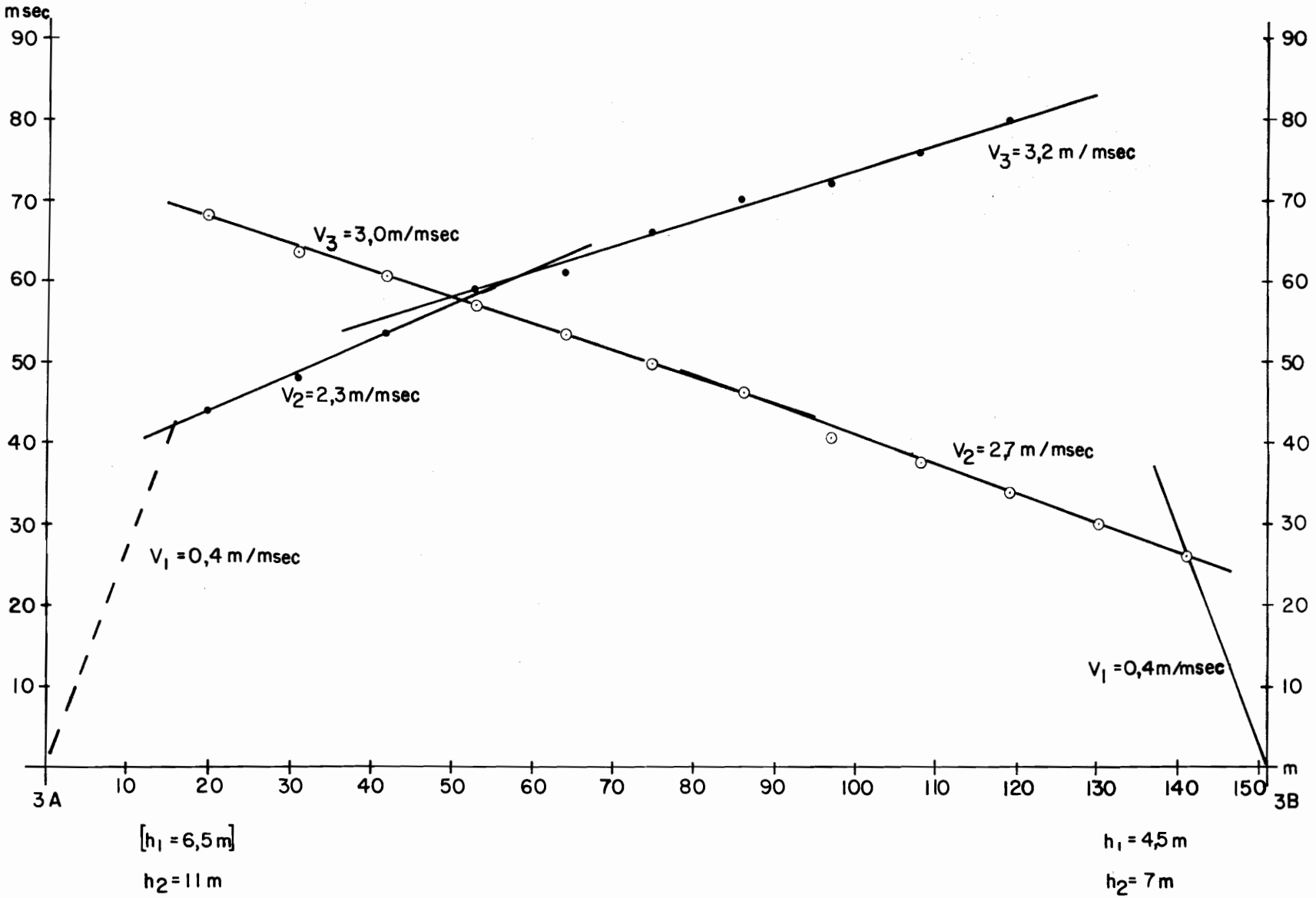
Þóristungur. Seismic profile 3A-B

11.10'74 SÞ/Sy.J.	
Tnr 383 Tnr 112	
B-332 J-Jarðsvm.	
Fnr 12025	



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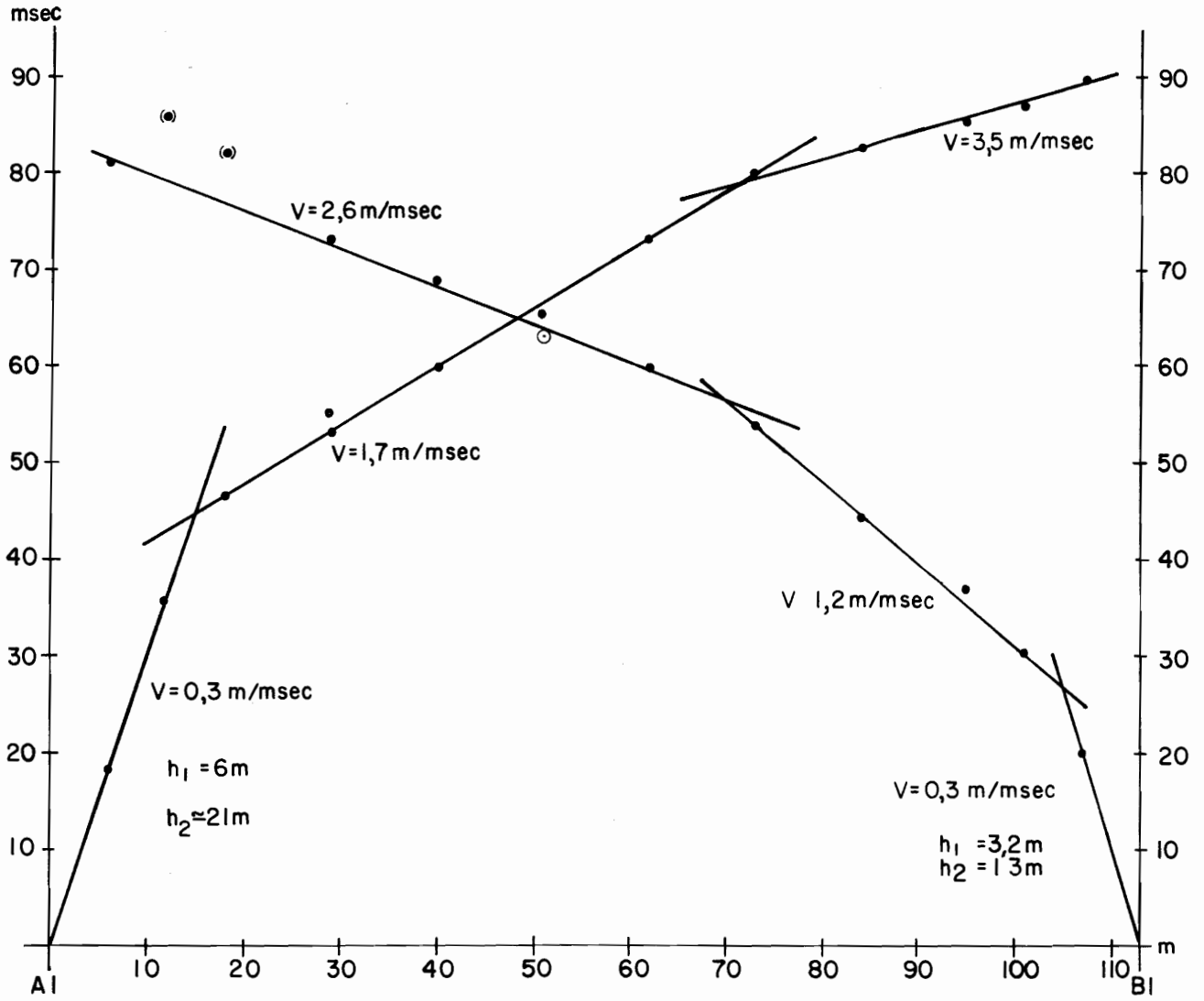
Þóristungur. Seismic profile $5A_1 - B_1$

14.10'74 SÞ/SyJ
Tnr. 386 Tnr.115
B-332 J-Jarðsvm
Fnr 12028



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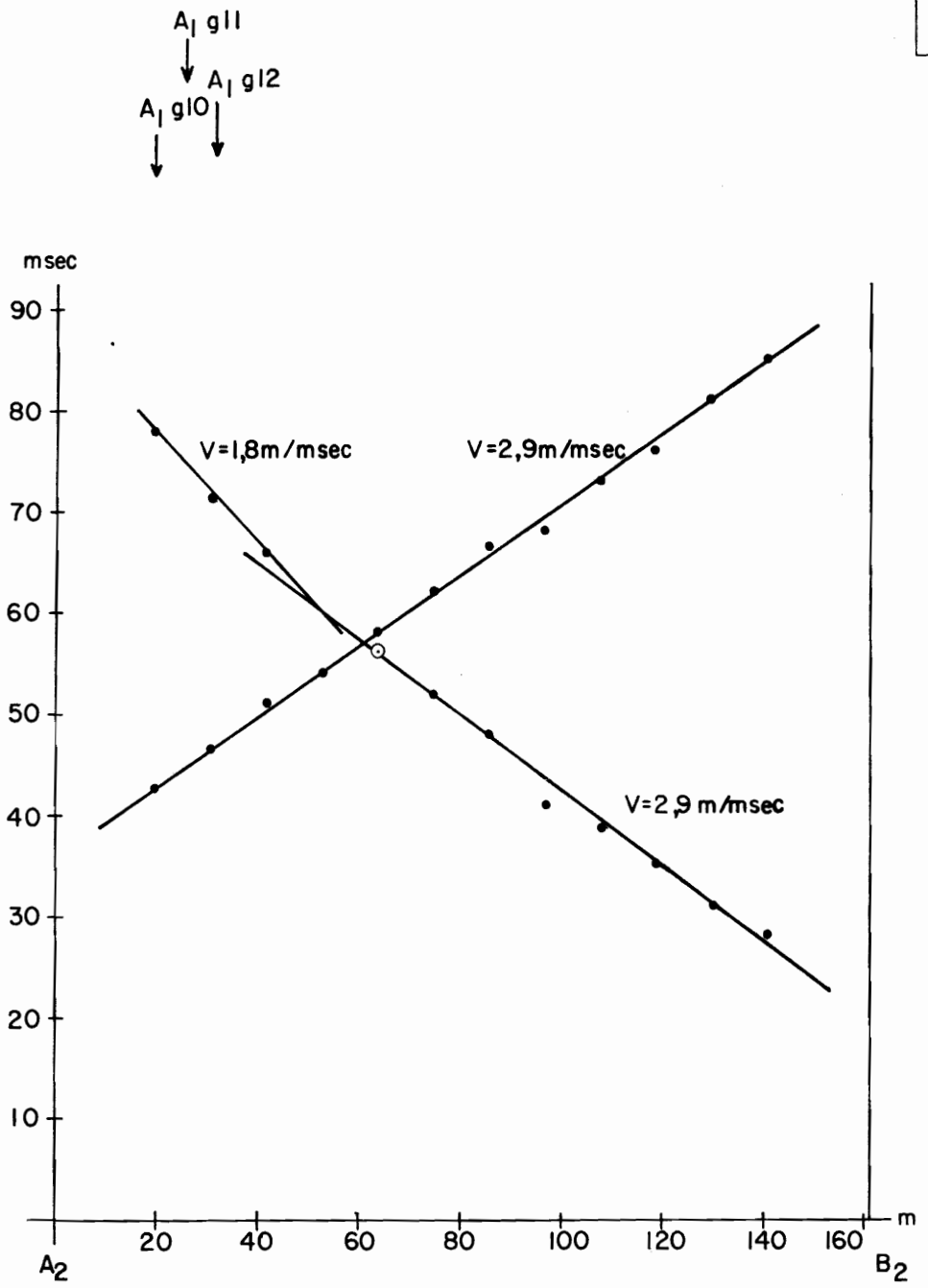
Þóristungur. Seismic profile $5A_2-B_2$

14.10'74 SÞ/SyJ
Tnr. 385 Tnr.114
B-332 J-Jarðsvm
Fnr. 12027



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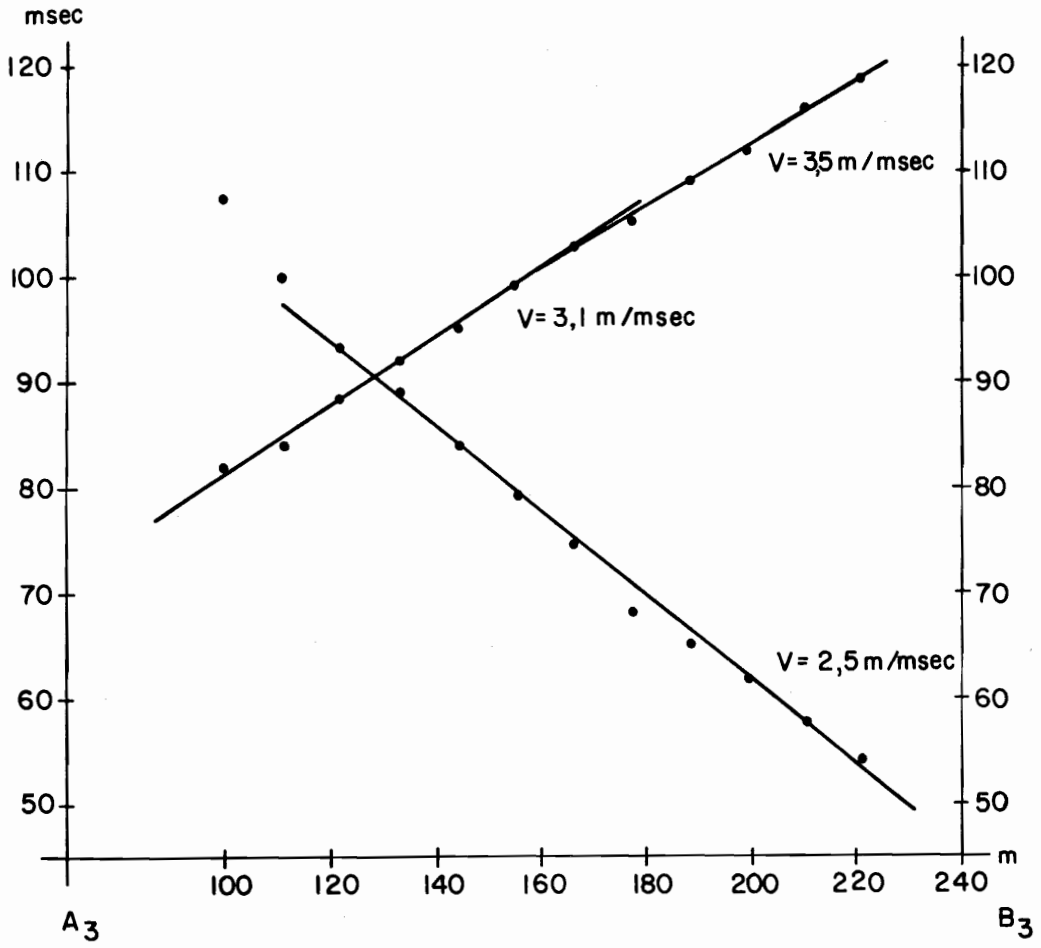
Þóristungur. Seismic profile 5 A_3–B_3

11.10'74 SP/SyJ
Tnr 382 Tnr III
B-332 J-Jarðsvm.
Fnr. 12024



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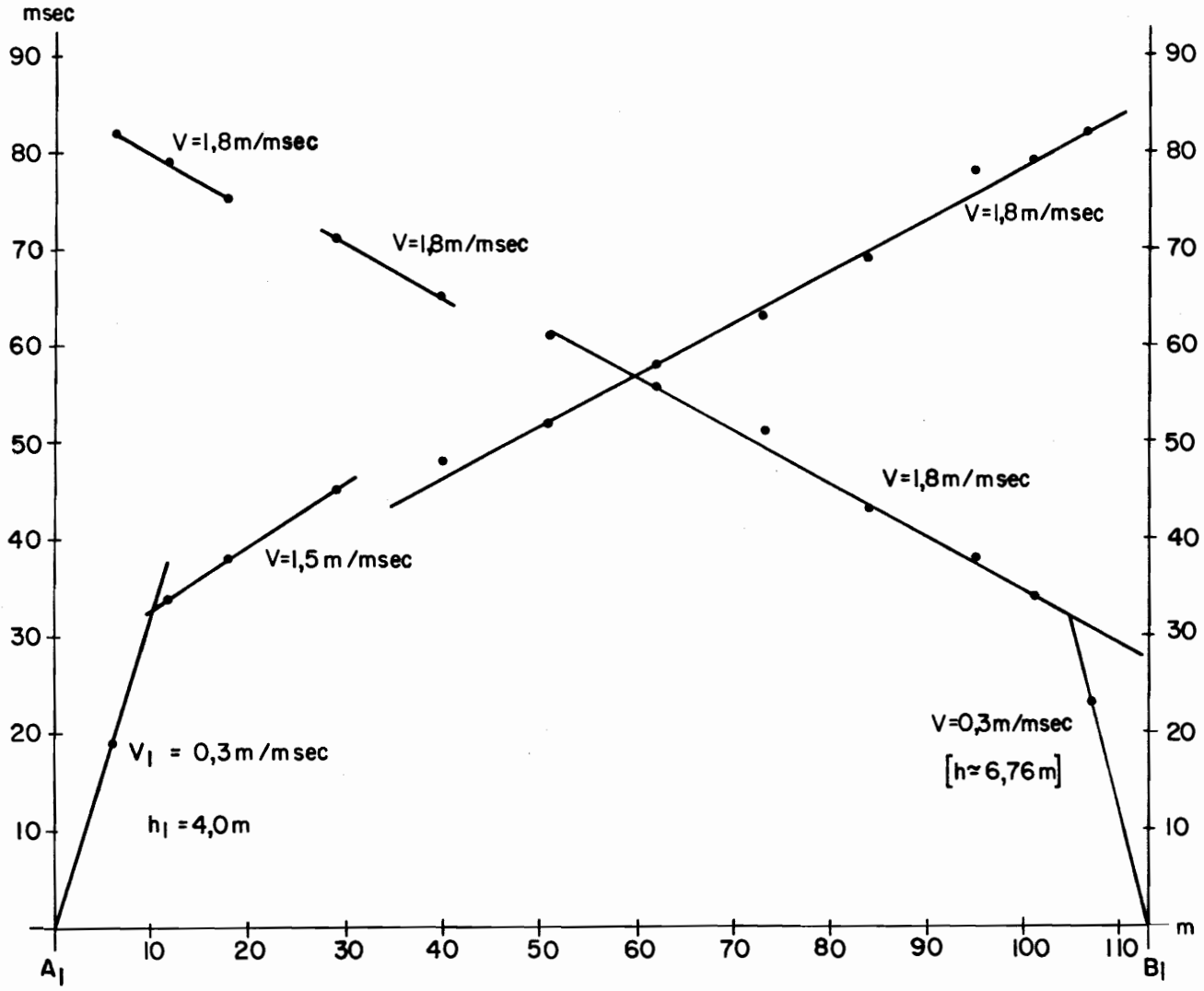
Þóristungur. Seismic profile $6A_1-B_1$

15.10'74 SÞ/SyJ
Tnr. 387 Tnr. 116
B-332 J-Jarðsvm.
Fnr 12029



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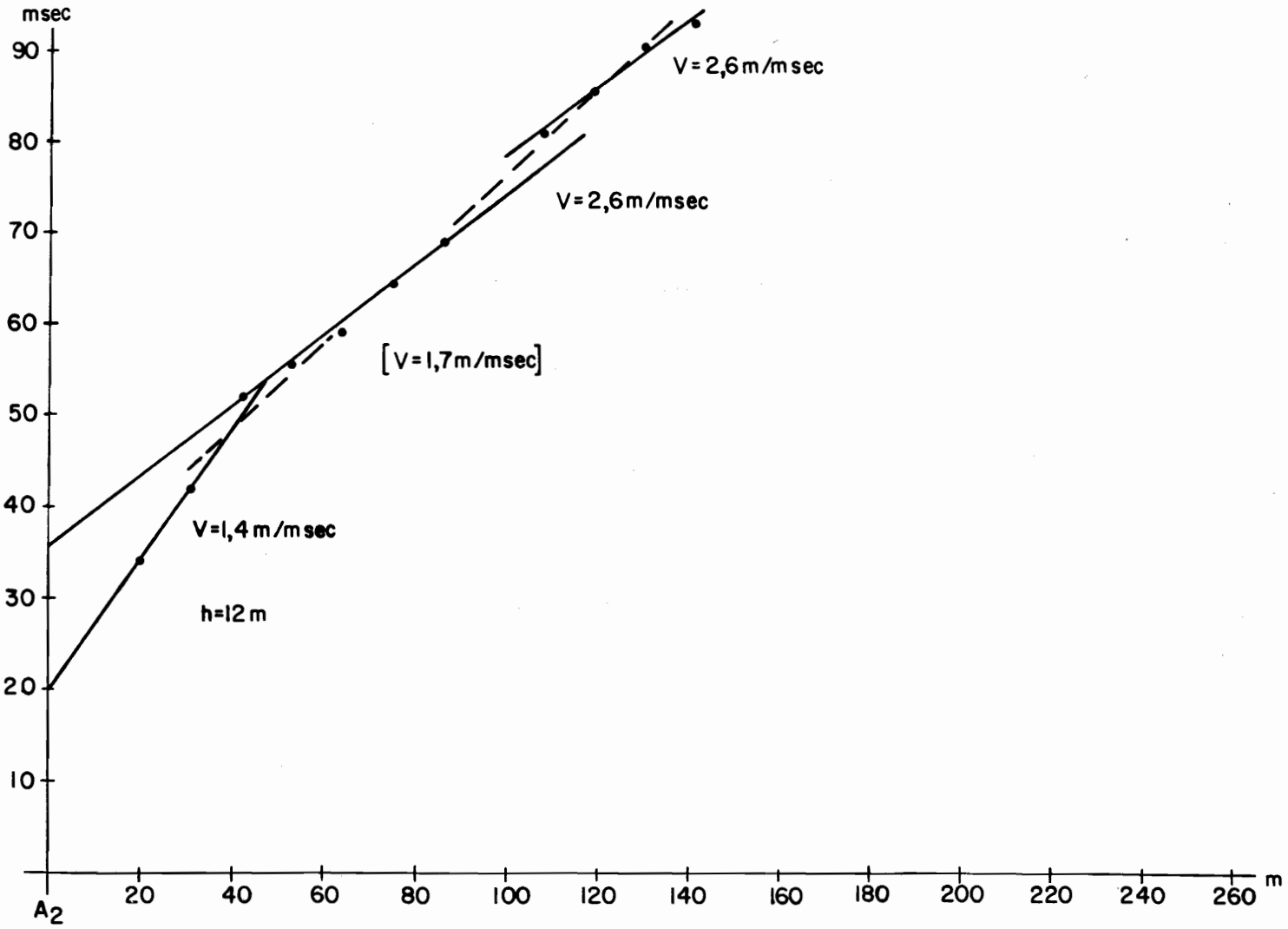
Þóristungur. Seismic profile $6A_2$

15.10'74 SÞ/SyJ
Tnr 388 Tnr 117
B-332 J-Jarðsvm.
Fnr 12030



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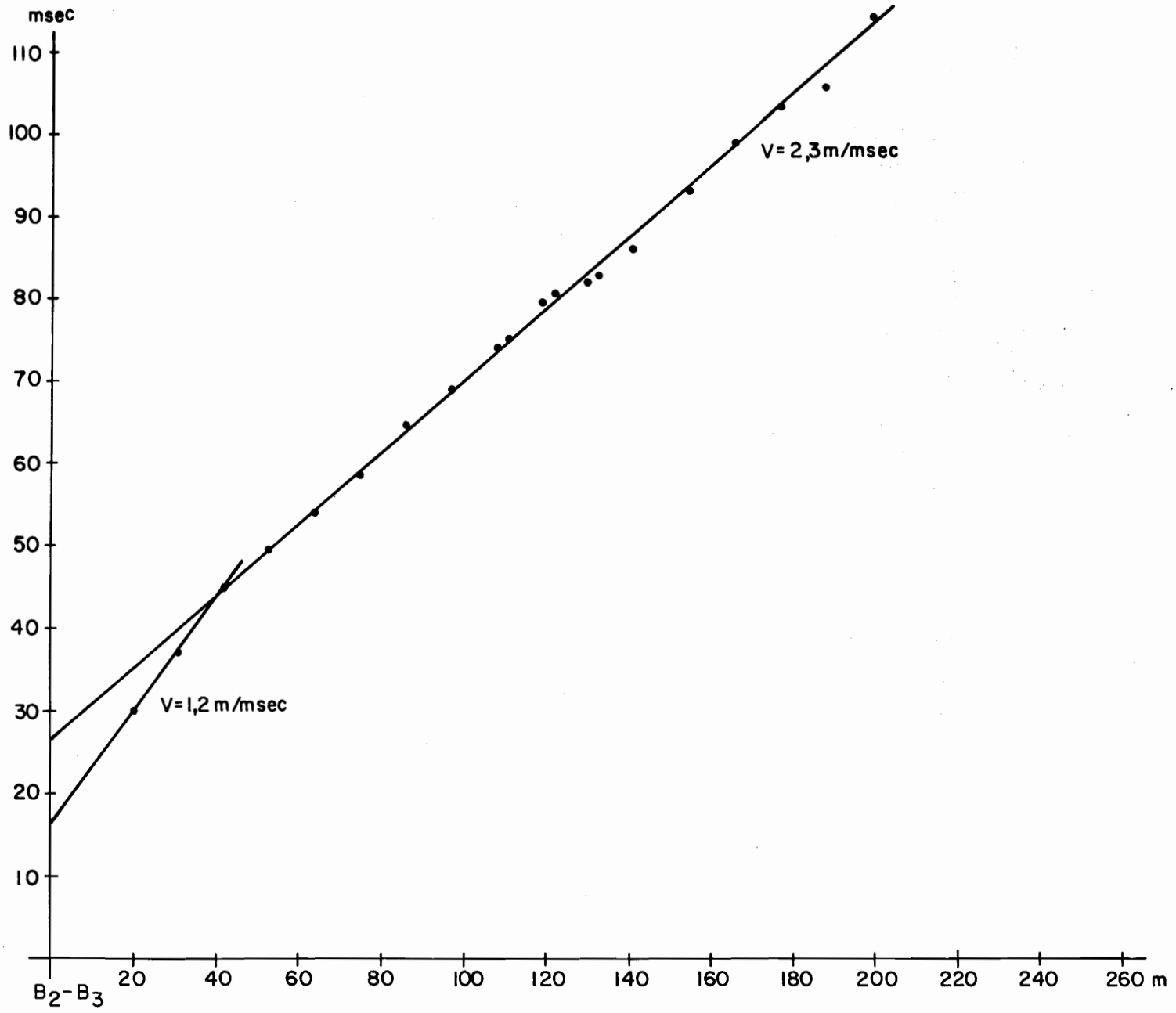
Þóristungur. Seismic profile $6B_2-B_3$

15.10'74 SÞ/SyJ
Tnr 389 Tnr 118
8-332 J-Jarðsvm.
Fnr 12031



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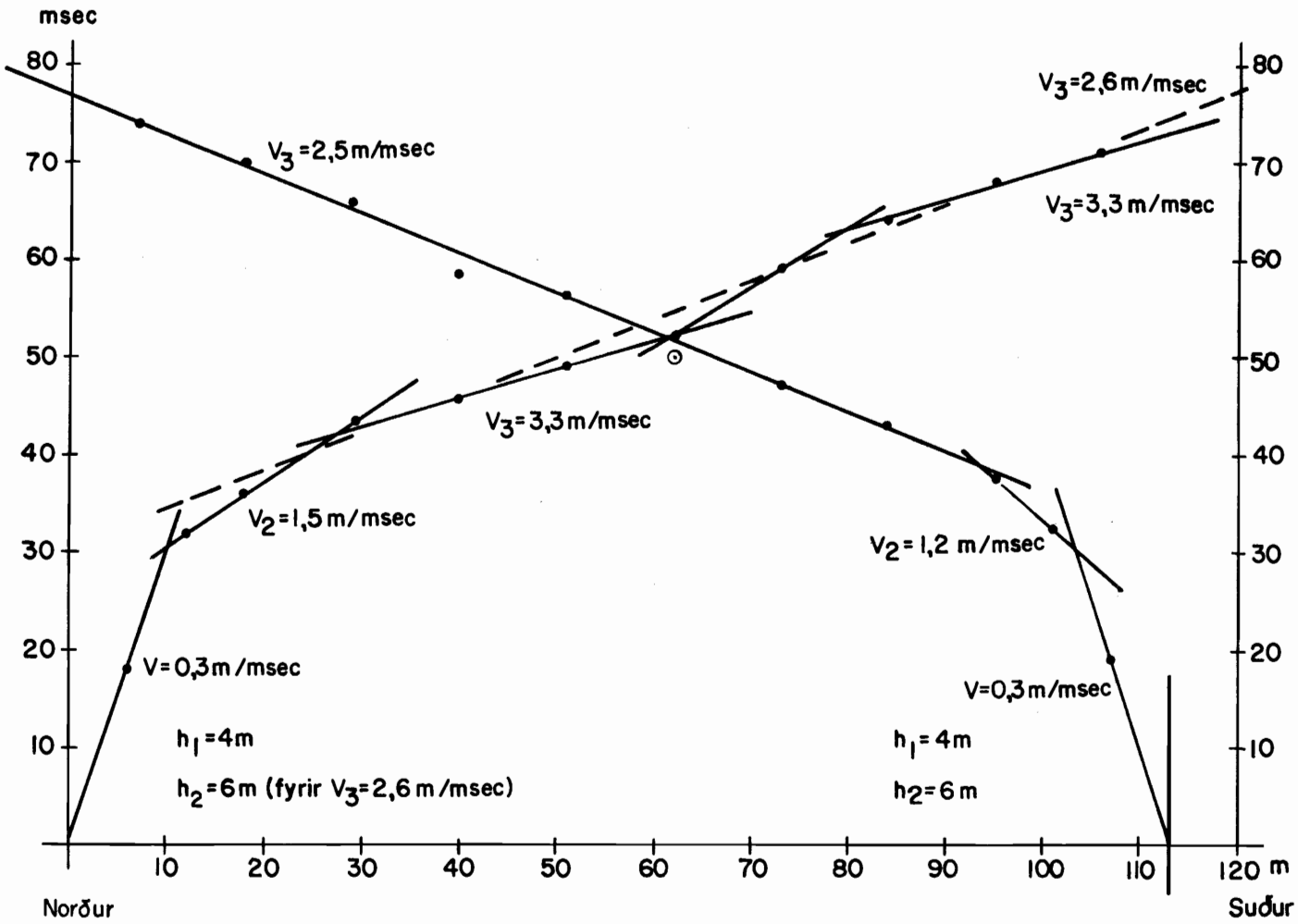
Þóristungur. Seismic profile 7A-B

16.10.'74 SÞ/Sy.J	
Tnr. 393 Tnr. 122	
B-332 J-Jarðsvm.	
Fnr. 12035	



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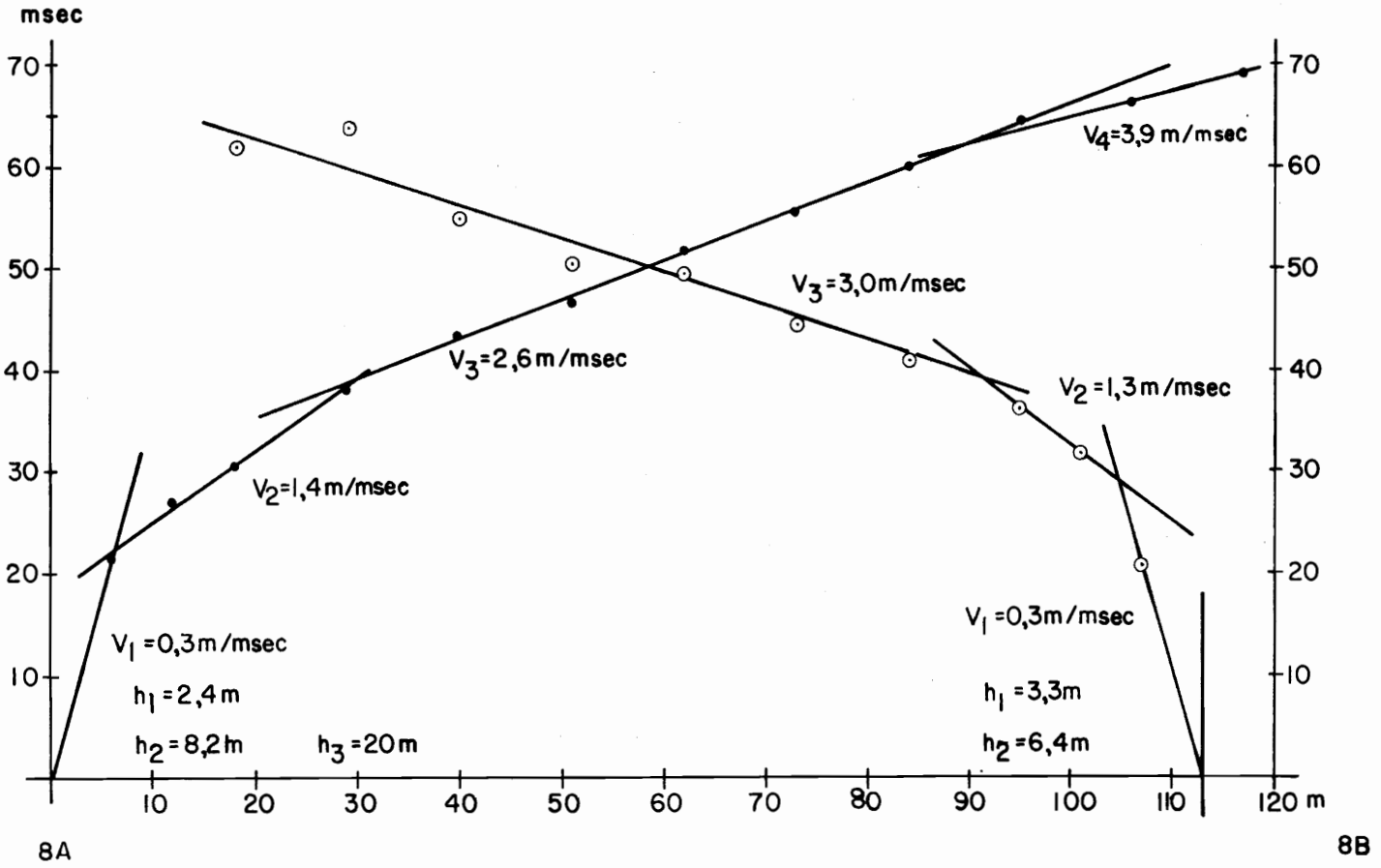
Þóristungur. Seismic profile 8A–B

16JO'74 SÞ/SyJ
Tnr 394 Tnr 123
B-332 J-Jarðsvm.
Fnr 12036



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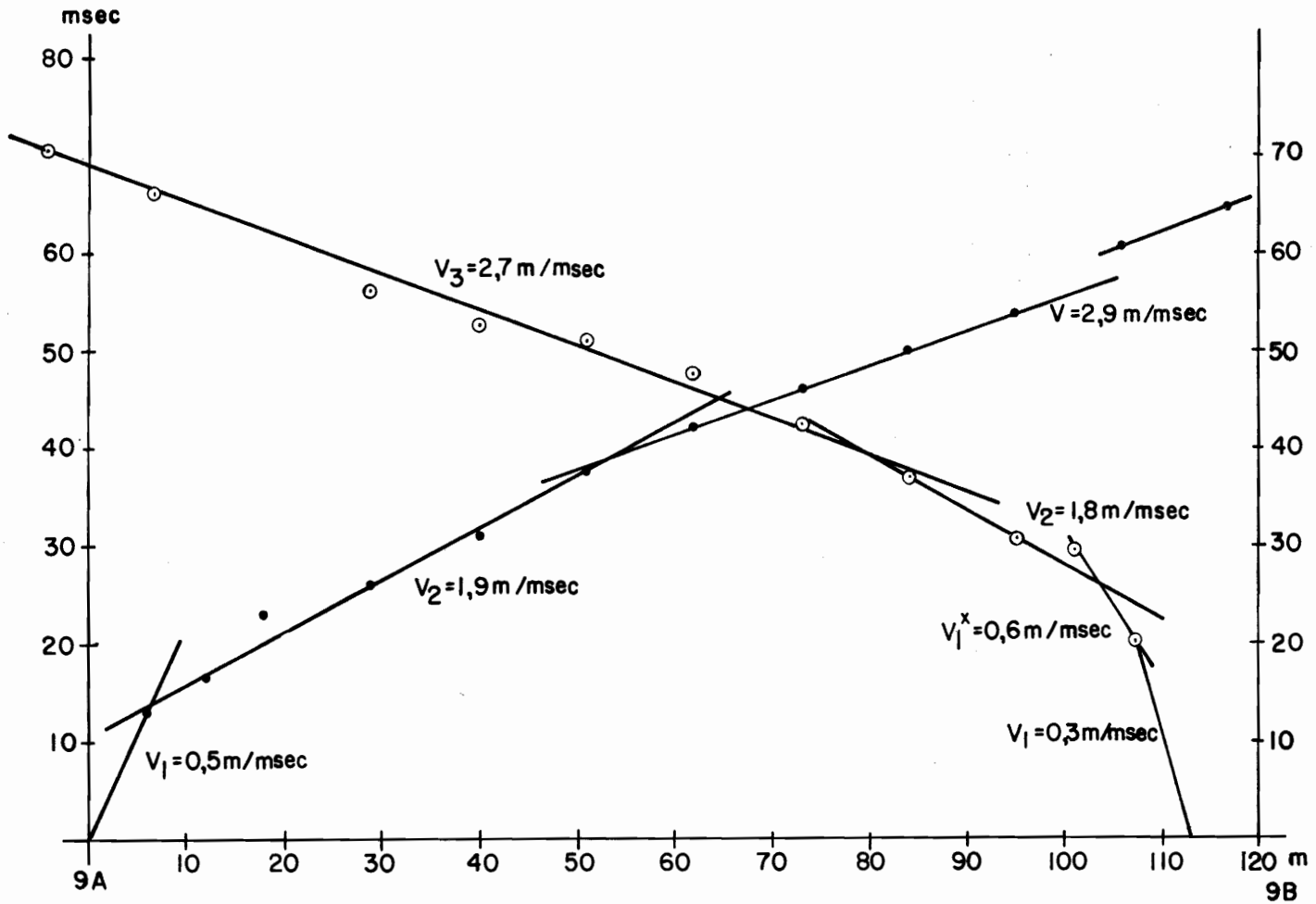
Þóristungur. Seismic profile 9A-B

16.10'74 SÞ/Sy.J.
Tnr 395 Tnr 124
B-332 J-Jarðsvm
Fnr 12037



$h_1 \cong 2,5$ m

$h_2 = 1,2$ m

$h_1 = 1,7$ m
$h_1^x = 2,8$ m
} eða $h_1 = 3$ m

$h_2 = 7,4$ m

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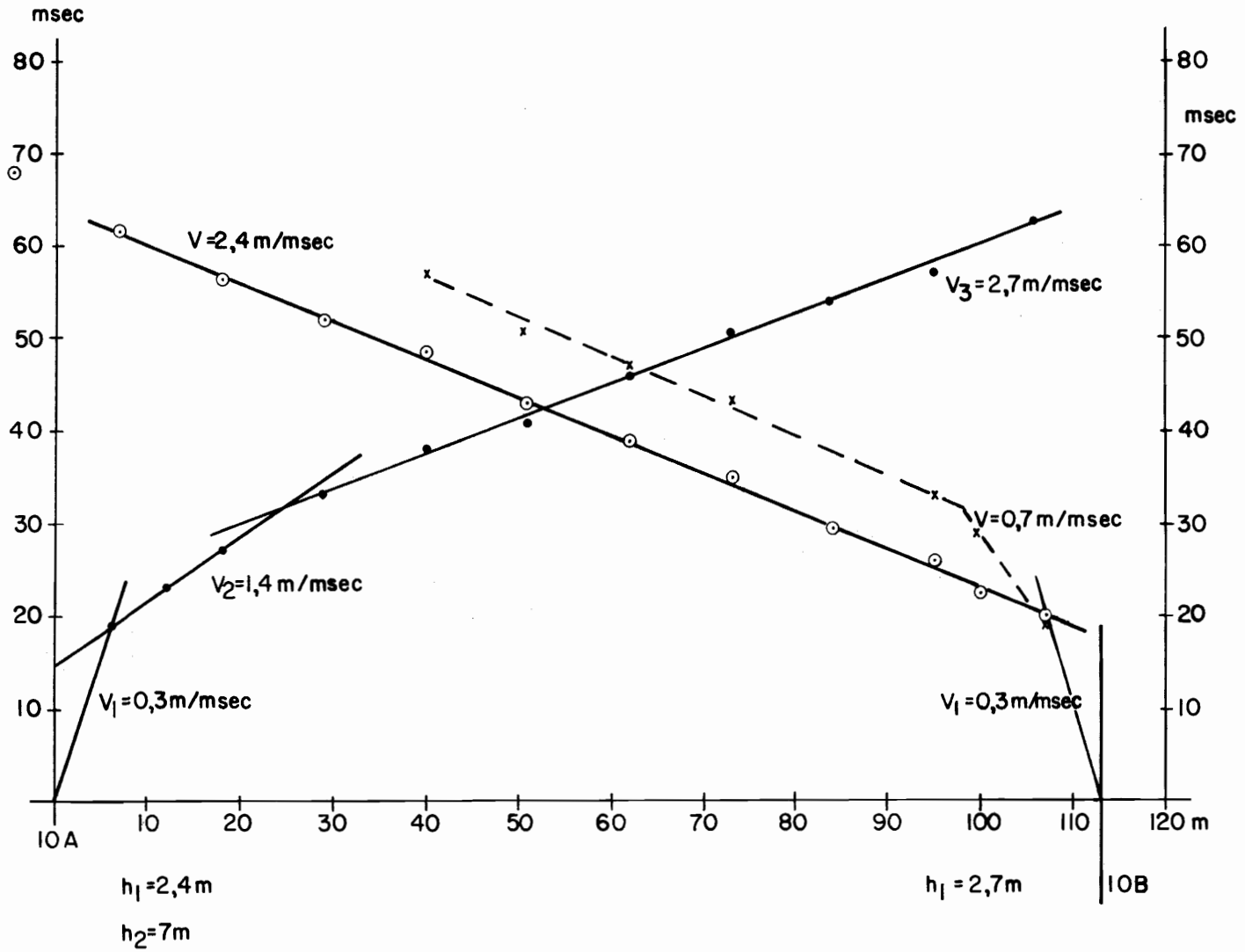
Þóristungur. Seismic profile 10A-B

16.10'74 SÞ/SyJ
Tnr 396 Tnr125
B-332 J-Jarðsvm.
Fnr 12038



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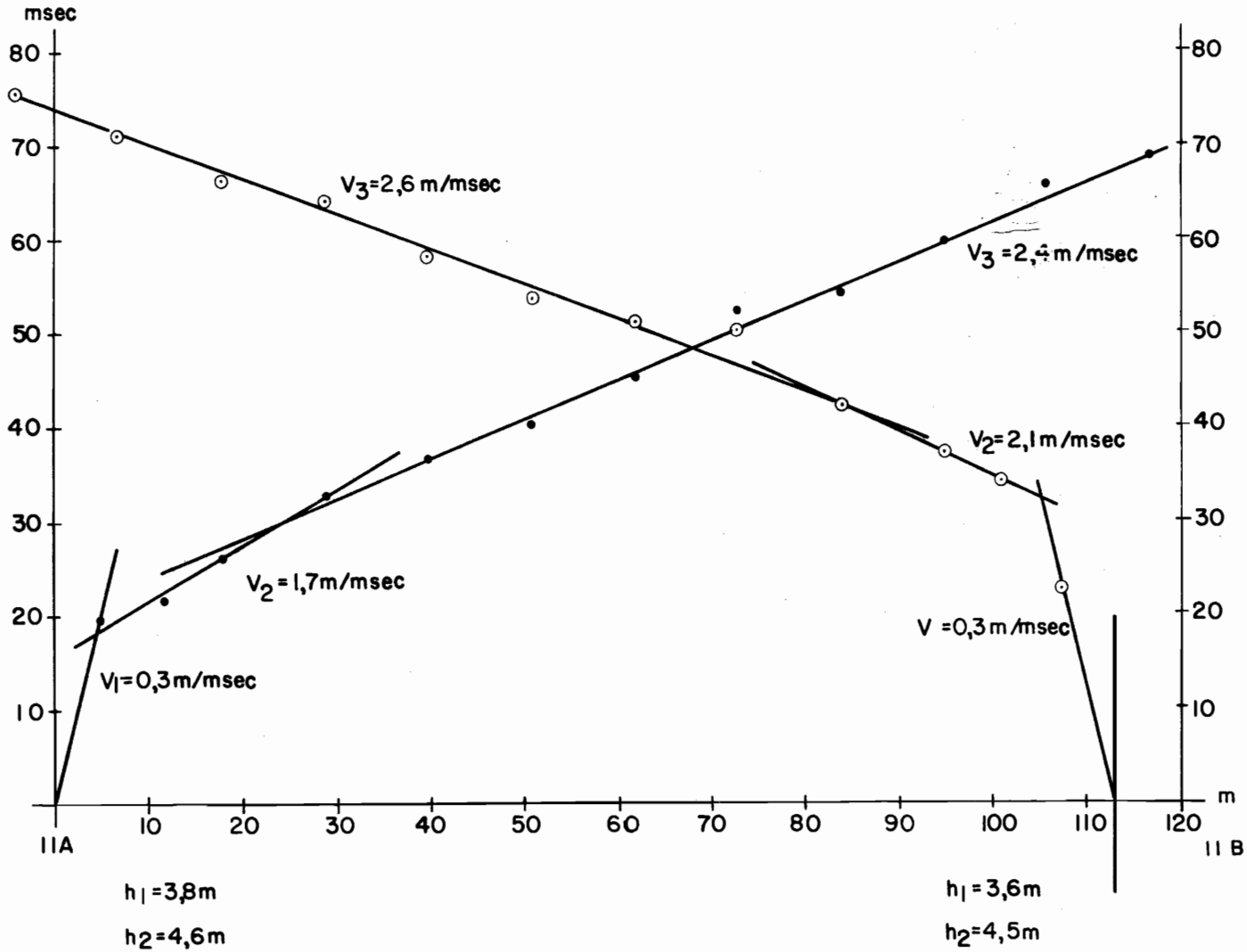
Þóristungur. Seismic profile 11A-B

18.10'74 SÞ/SyJ	
Tnr 397 Tnr126	
B-332 J-Jarðsvm	
Fnr. 12039	



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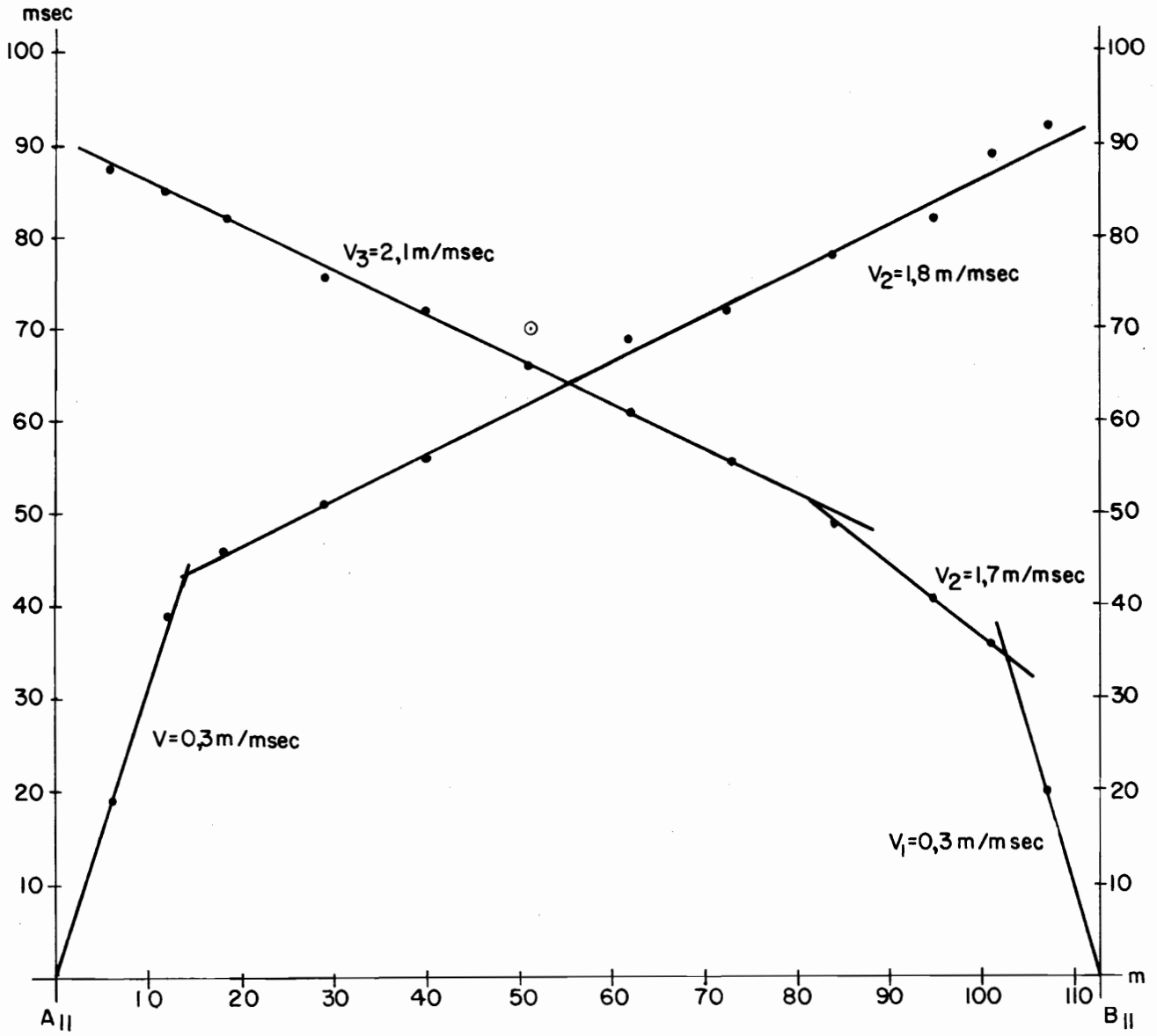
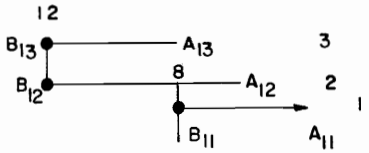
Þóristungur. Seismic profile A_{II}-B_{II}

18.10'74 SÞ/SyJ.
Tnr 392 Tnr 121
B-332 J-Jarðsvm
Fnr 12034





h_1 = 6 m

h_1 = 4,5 m

h_2 = 5 m

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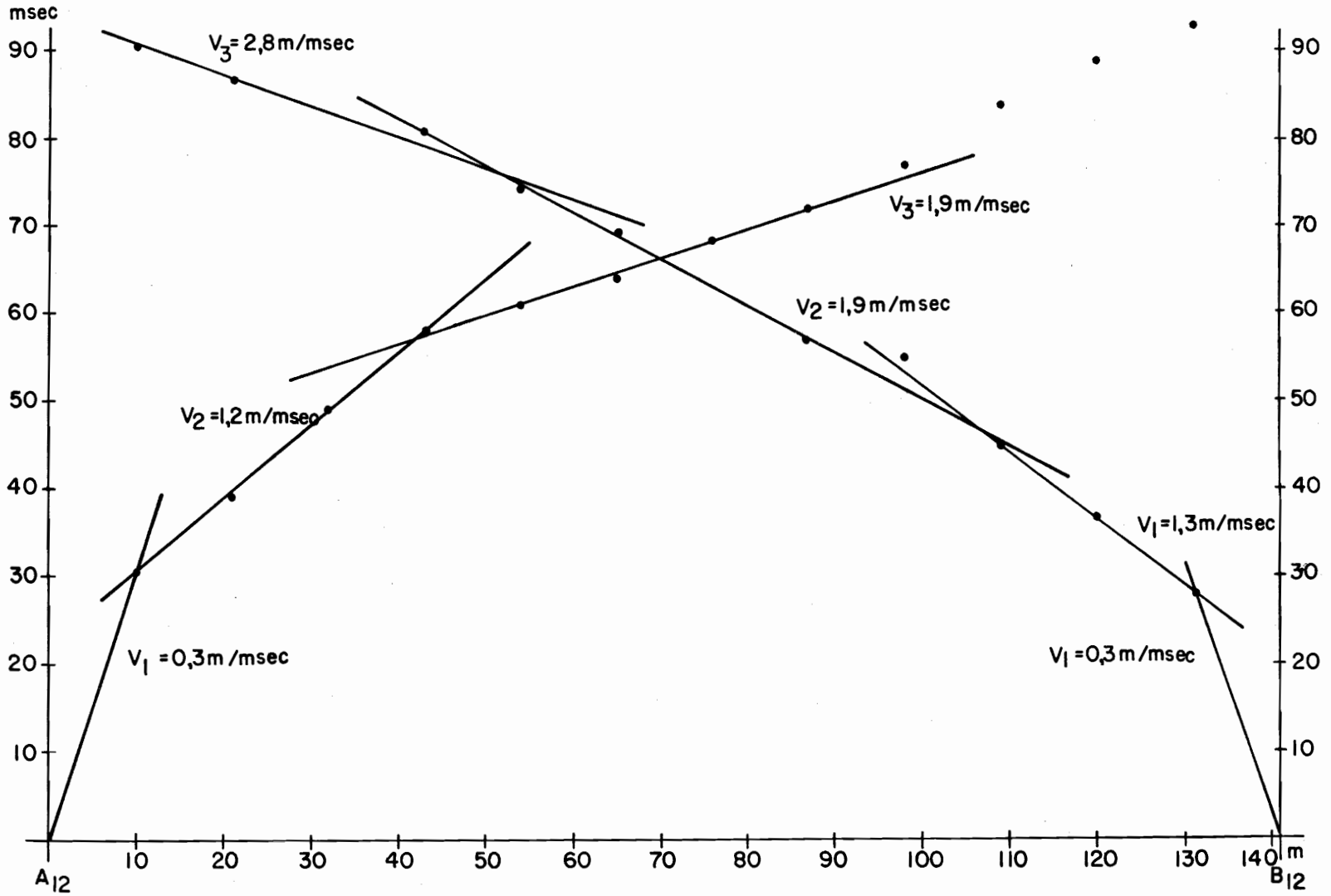
Þóristungur Seismic profile A_{12}-B_{12}

15.10'74 SÞ/SyJ
Tnr 391 Tnr 120
B-332 J-Jarðsvm
Fnr 12033



h_1 = 4m

h_2 = 10m

h_1 = 4m

h_2 = 7,5m

h_3 = 18m

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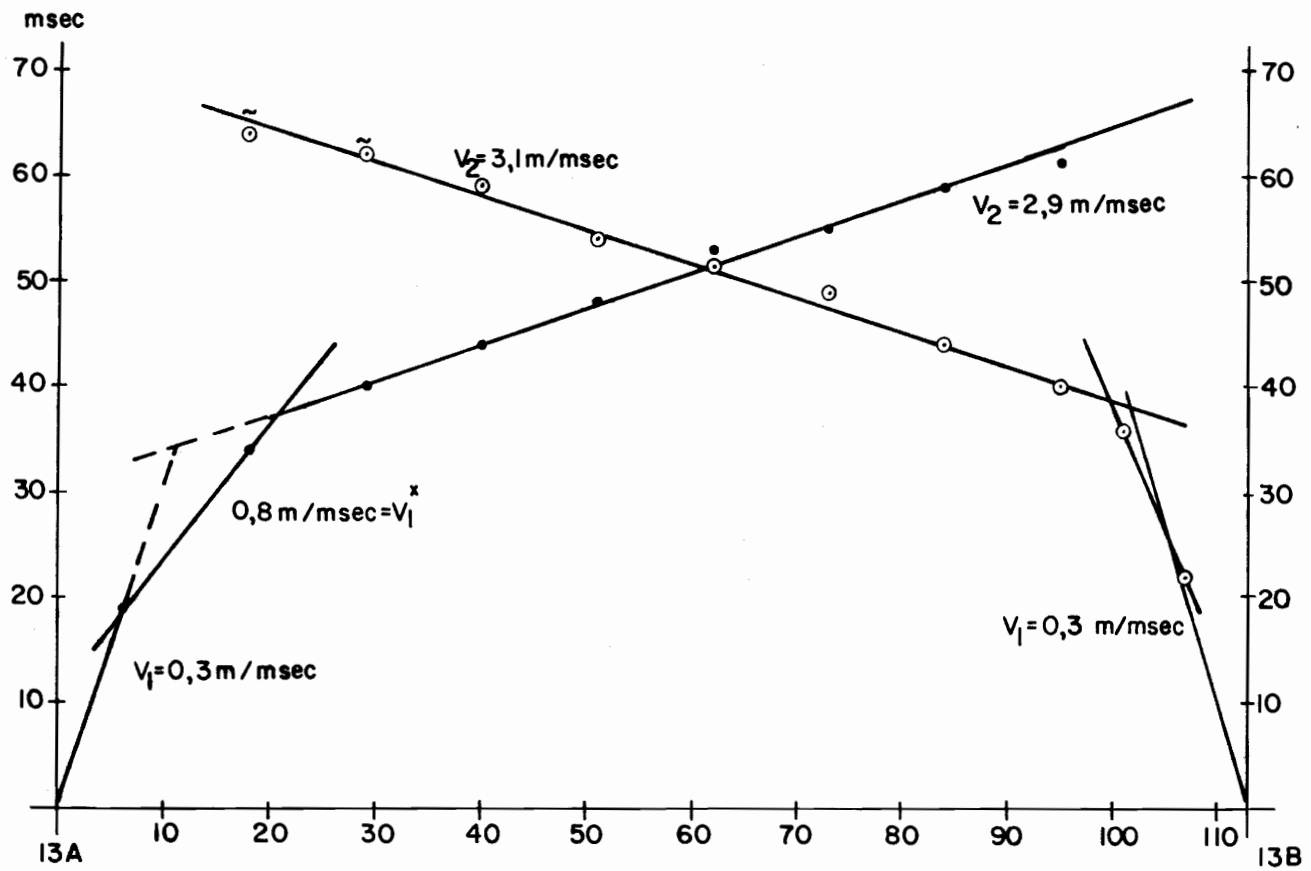
Þóristungur. Seismic profile 13A–B

17.10'74 SÞ/SyJ
Tnr 398 Tnr 127
B-332 J-Jarðsvm.
Fnr 12040



h_1 = 1,7 m
h_1^x = 8 m
} eða h_1 = 5m (ef V_1^x er sleppt)

h_1 = 6m - 8m

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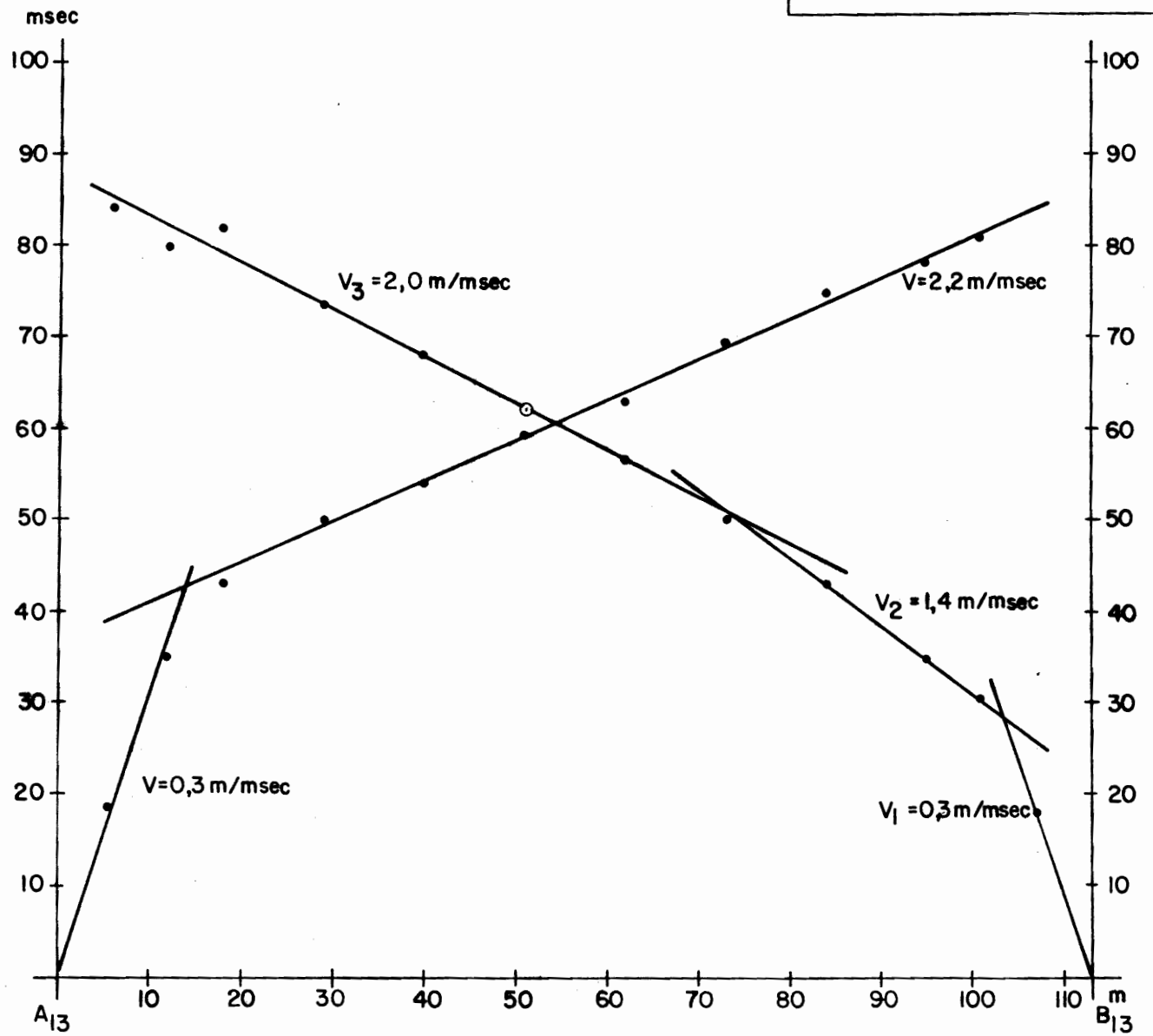
Þóristungur. Seismic profile $A_{13}-B_{13}$

15.10.'74 SÞ/SyJ
Tnr 390 Tnr 119
B-332 J-Jarðsvm.
Fnr 12032



h_1 = 6 m

h_1 = 3,8 m
h_2 = 8 m

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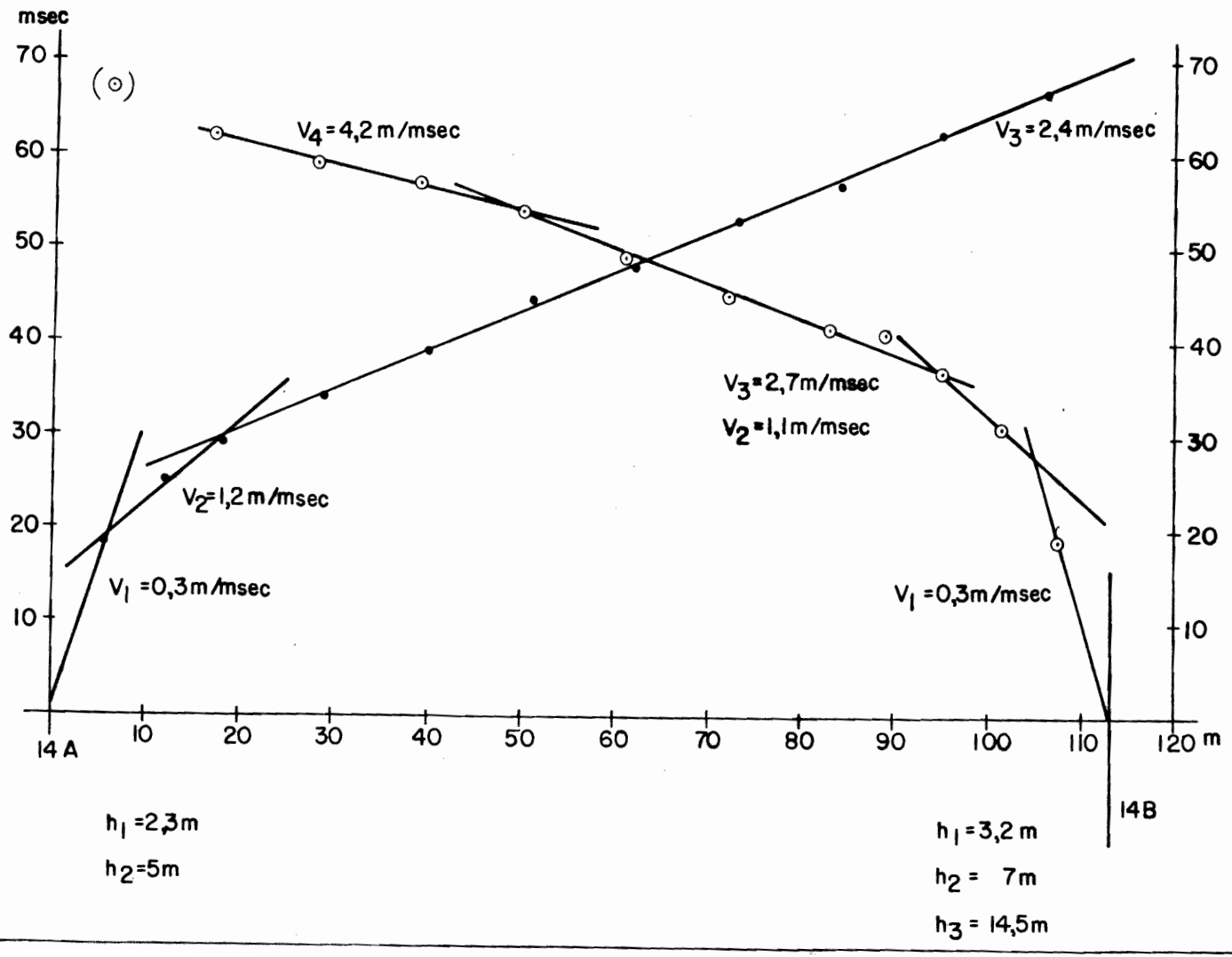
Þóristungur. Seismic profile 14A–B

1610'74 SÞ/SvJ
Tnr 399 Tnr 128
B-332 J-Jarðsvm
Fnr. 12041



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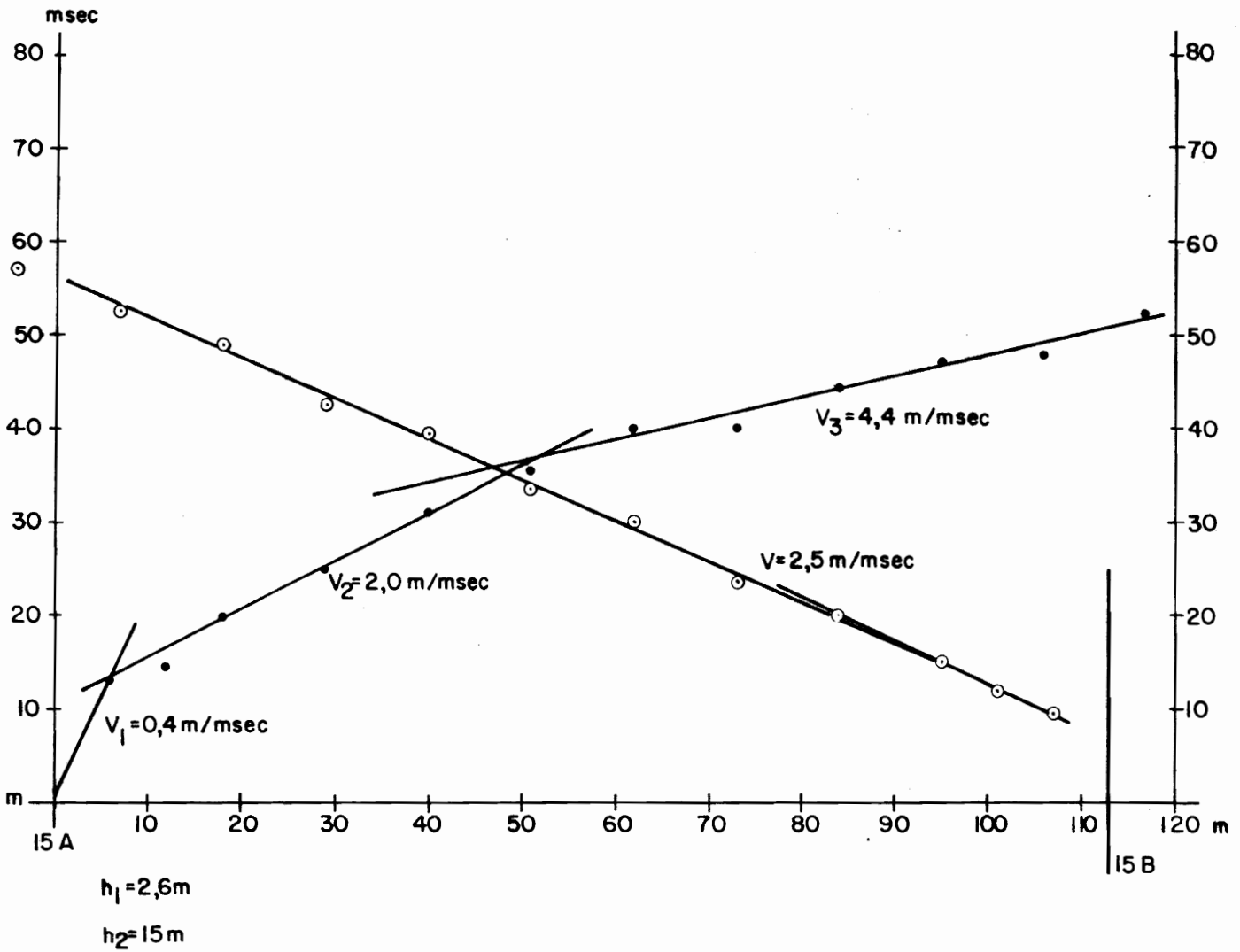
Þóristungur. Seismic profile 15A–B

21.10'74 SÞ/SyJ
Tnr 401 Tnr 130
B-332 J-Jarðsvm
Fnr 12043



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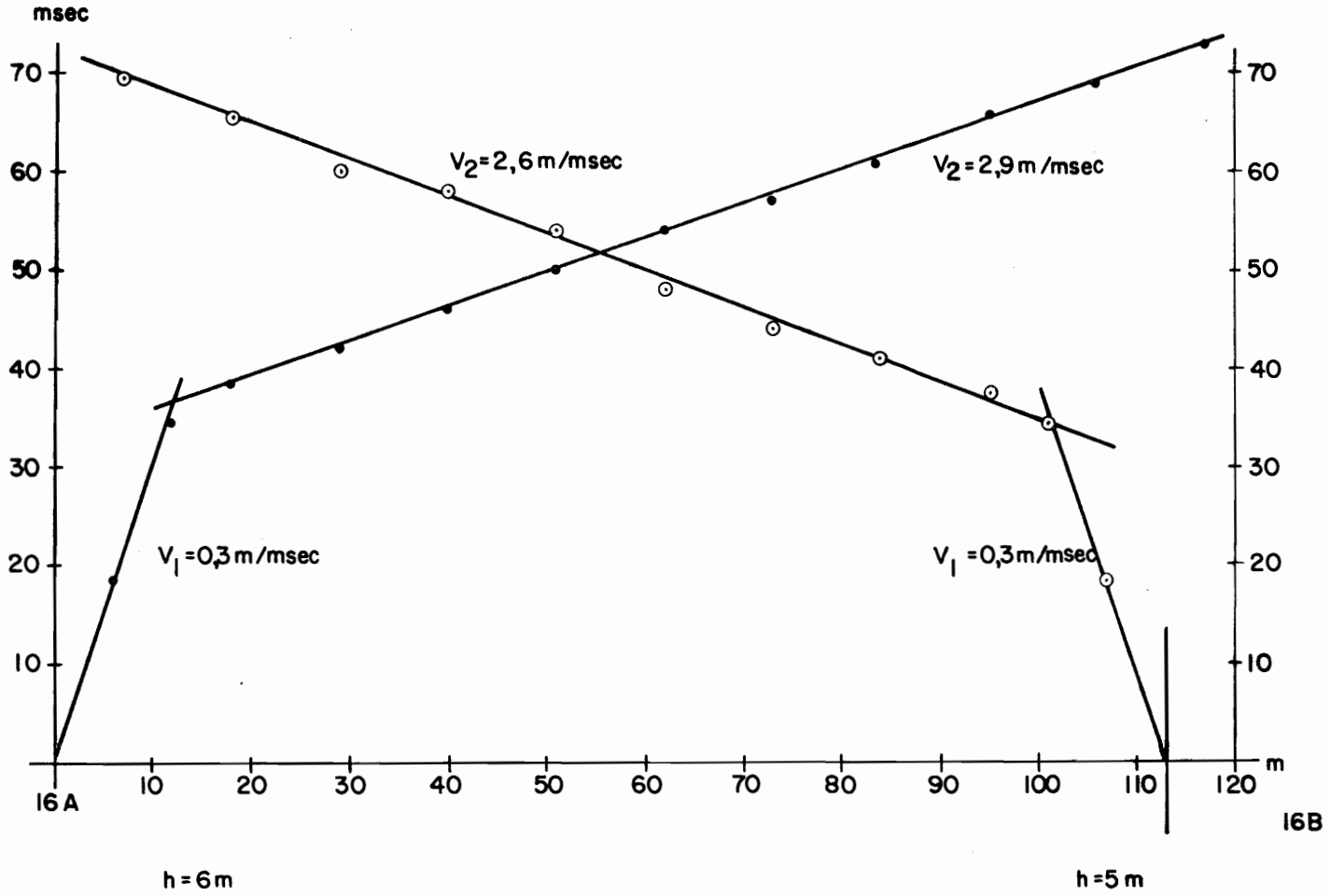
Þóristungur. Seismic profile 16A-B

21.10'74 SÞ/SyJ
Tnr 402 Tnr 131
B-332 J-Jarðsvm
Fnr. 12044



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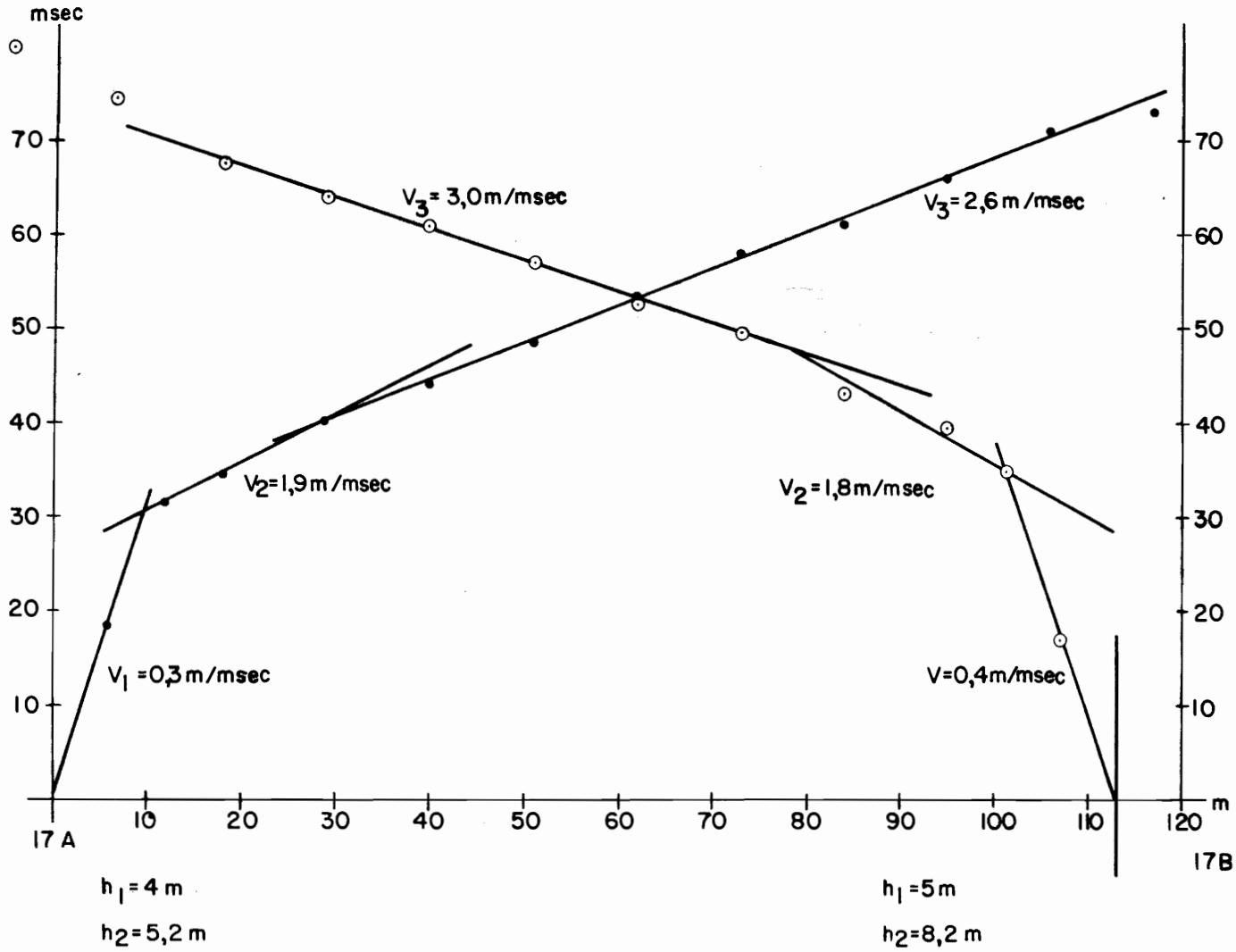
Hrauneyjafoss

Þóristungur. Seismic profile 17A–B

21.10'74 SÞ/SyJ	
Tnr 403 Tnr 132	
B-332 J-Jarðevm	
Fnr. 12045	



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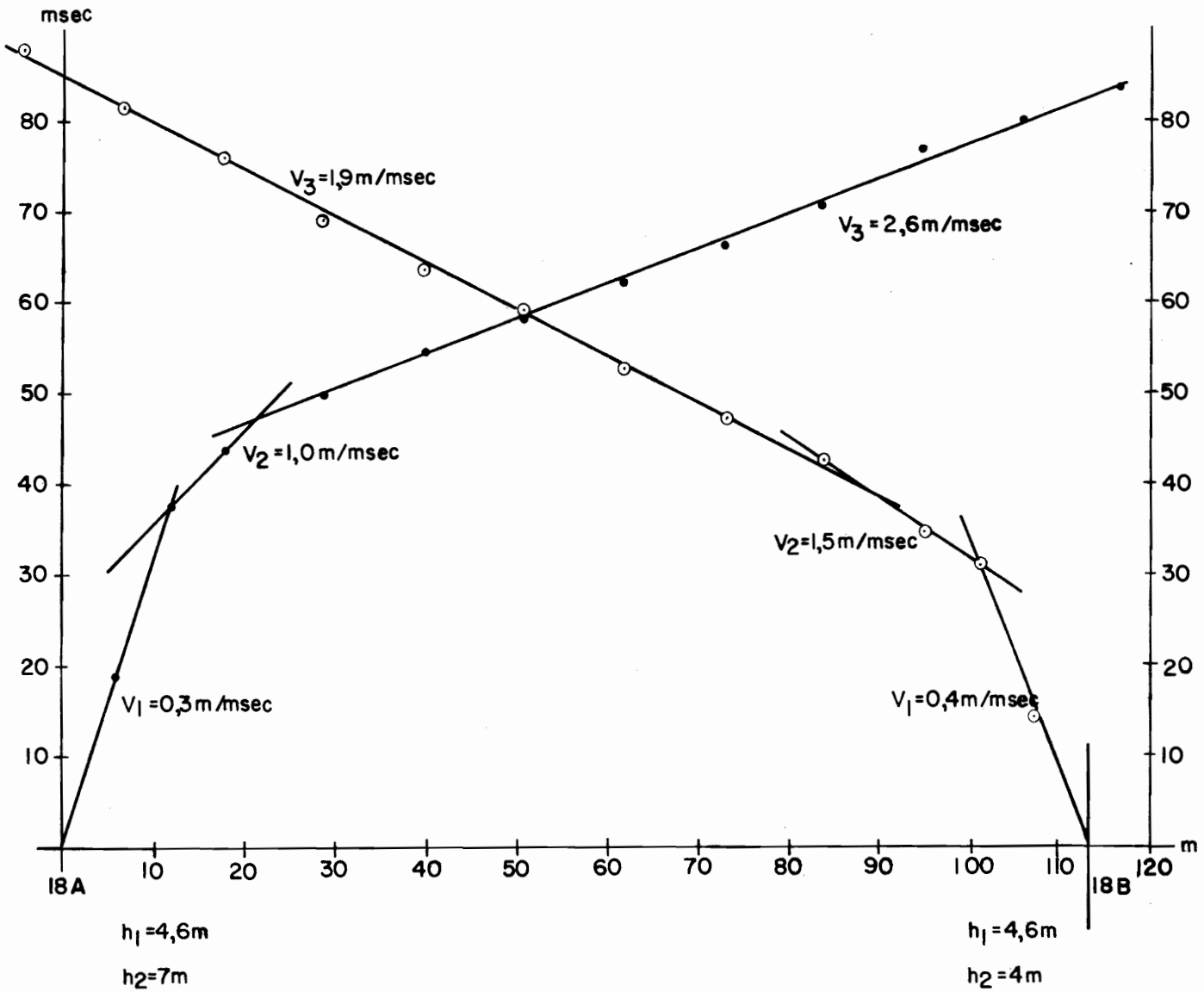
Þóristungur. Seismic profile 18A–B

22.10'74 SÞ/SyJ
Tnr 133 Tnr 404
J-Jarðsvm. B-332
Fnr. 12046



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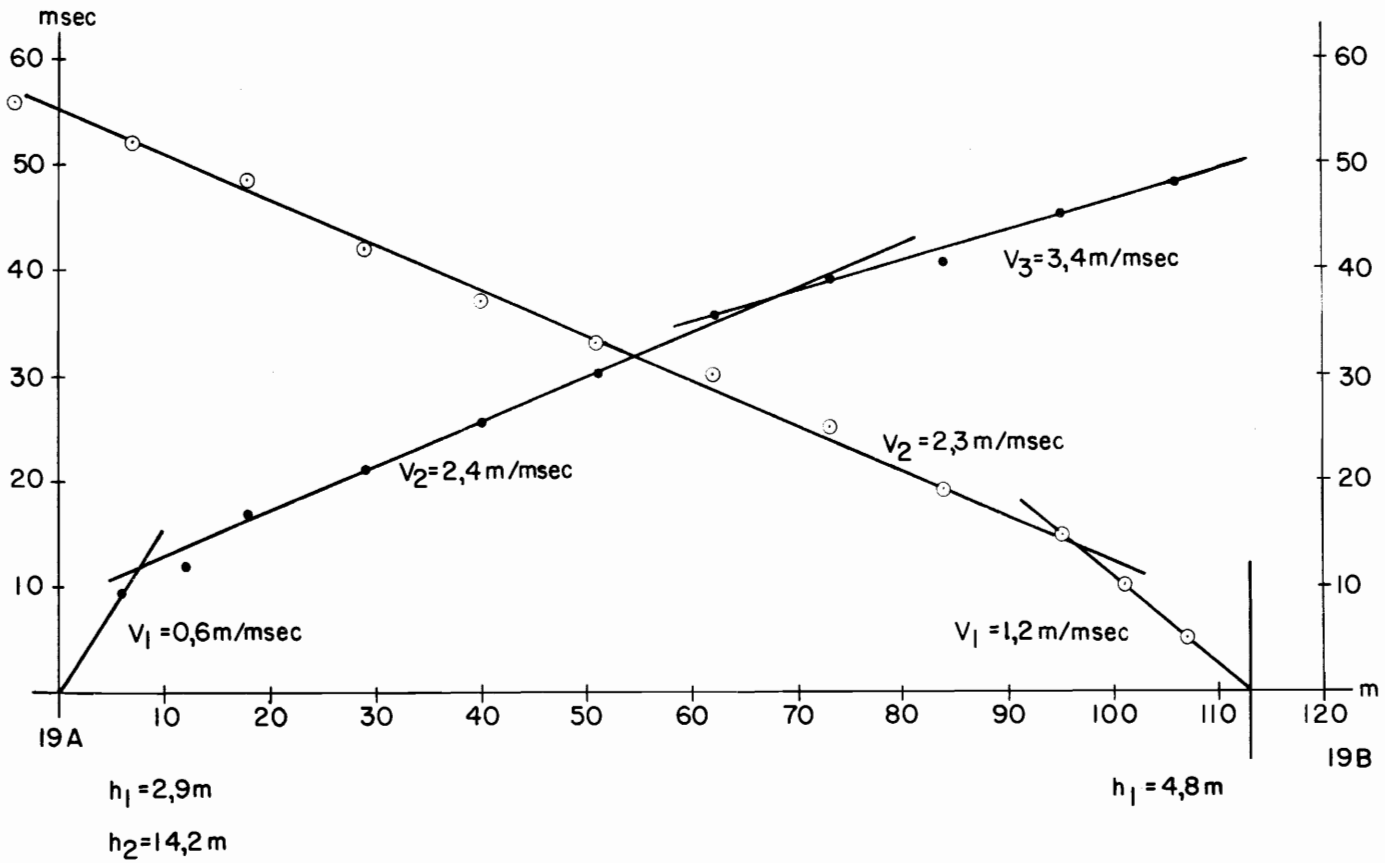
Þóristungur. Seismic profile 19A-B

2210'74 SÞ/SyJ
Tnr 405 Tnr 134
B-332 J-Jarðsvm.
Fnr 12047



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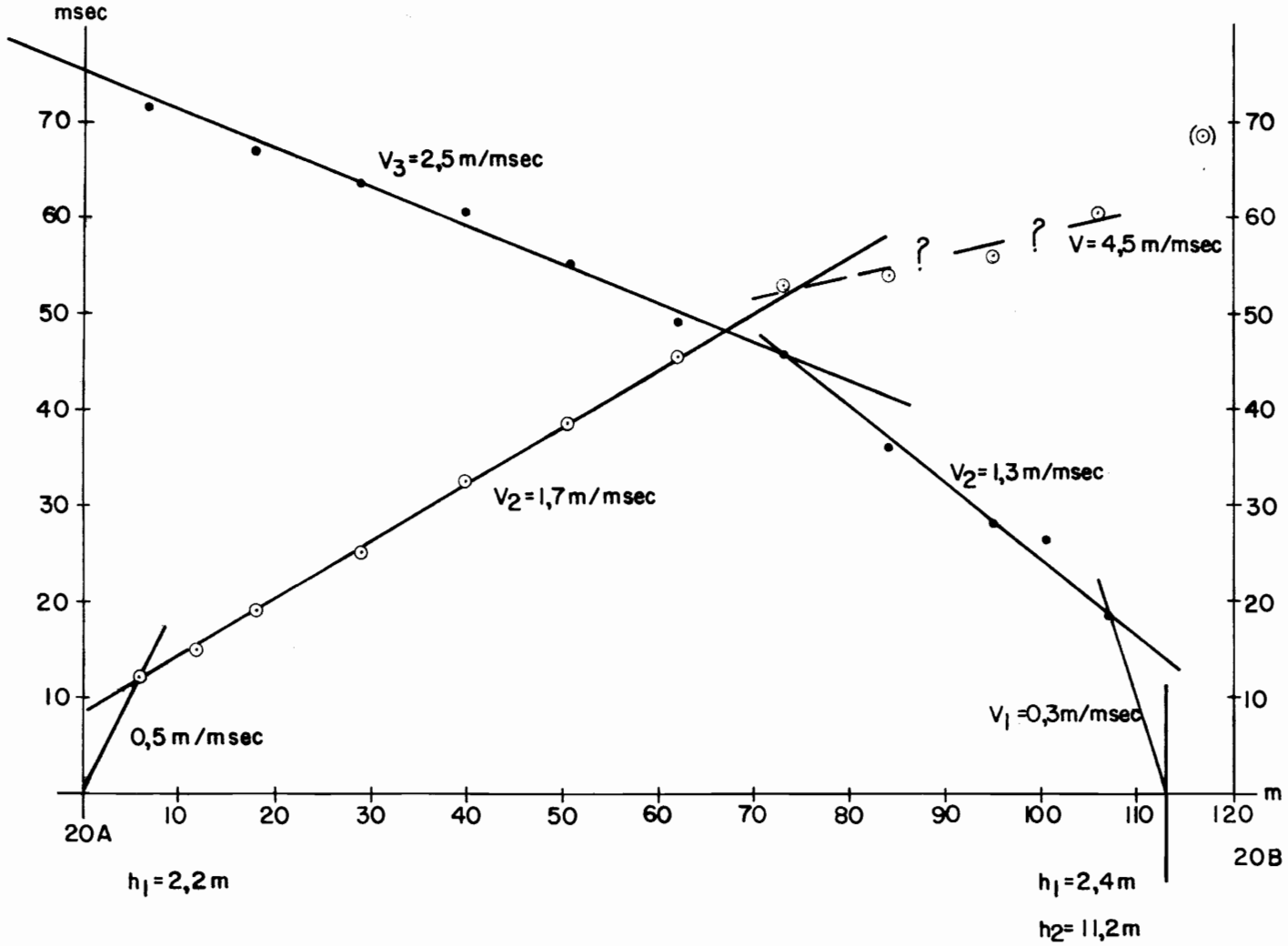
Þóristungur. Seismic profile 20A–B

22.10'74 SÞ/SyJ
Tnr406 Tnr135
B-332 J-Jarðsvm
Fnr 12048

20A lies ~ 5m. higher than 20B



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Þóristungur. Seismic profile BP86-BP96

14.10'74 SÞ/SyJ
Tnr 384 Tnr 113
B-332 J-Jarðsvm
Fnr.12026