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Seismic Investigation in Hvalfjörður in 1991

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Status report-
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SEISMIC INVESTIGATION IN HVALFJÖRÐUR IN 1991

1. Introduction

This report summarizes briefly the status of the geophysical investigations which Orkustofnun is performing for Spölur Ltd. in Hvalfjörður in SW-Iceland. It describes the progress of the project and gives example on data and preliminary results.

2. Acoustic

The acoustic profiling started on 18th of June and the field work was finished on July 1st. It was carried out by a subcontractor (Hafrannsókarstofnun) according to memorandum no 1 from Spölur Ltd. to Orkustofnun. The navigation data and measurement of the waterdepth has been delivered to Orkustofnun. The interpretation of the acoustic profiles in terms of sedimentary thickness will be done by Hafrannsóknarstofnun but Orkustofnun will make the desired maps based on them.

On Hnausaskersleið the boomer-technique gave information on the sedimentary thickness over the greatest part of the area but not on Kiðafellsleið. Therefore a small part of Hnausaskersleið was also covered by sparker acoustic and most of Kiðafellsleið too. On Figs. 1 and 2 the location of sparker-lines for both areas are shown.

The results of the acoustic profiling with sparker on Kiðafellsleið did not show a reliable picture of the subsedimentary basement. The reason is at least partly due to the fact that seabottom multiples appears at the same time as the expected primary signal from the basement. Therefore it was decided according to Memorandum 1 to try to get better results with a towed cable. In a letter from June 28, Orkustofnun proposed a simple version of multichannel reflection measurements as the next step in the investigations. They should be followed by few expanding spread profiles (ESP-profiles) at carefully chosen places as a test for the vertical velocity structure within the sediments. Spölur Ltd accepted the proposal in Memorandum no. 4 and the final number of lines was decided on Project Progress Meeting no 2. Figure 3 and 4 shows the location of the multichannel reflection lines.

3. Multichannel reflection measurements

The multichannel reflection profiles were carried out by a 76 m long streamer with 3.3 m spacing between hydrophones and 6.7 m between shots. This gives six-fold stack with 1.7 m between the CDPs. By combining adjacent CDPs, a twelve-fold stack was obtained with 3.3 m spacing between the CDPs. The near trace offset was 16.7 m. Sparker was used as energy source.

The collection of the multichannel data was finished on 20th of July and is now in the phase of data processing. Processing of multichannel data is a time consuming job, especially it takes lot of time to designed the proper filters and find the best processing procedure. Brute stack have been made for most of the profiles. Velocity analysis has not been carried out so we expect that the multiples will be further depressed after final processing, especially on Kiðafellsleið.

On Hnausaskersleið a relatively clear subsedimentary basement is found. An example is shown on Fig. 5 (line h-13) and a rough interpretation on Fig. 6. The basement appears as discontinuous reflectors, frequently followed by diffraction hyperbolas. These are either faulted basement

blocks or sharp edges of individual lava units or series of lava units. The deepest part of the basement in line h-13 is at 140 msec (twt), which corresponds to depth range of 110-137 m for sedimentary velocity ranging between 1.6 and 2.2 km/sec. No prominent intrasedimentary reflectors are yet observed on Hnausaskersleið, but might be seen when processing is finished.

The multichannel techniques seem to have solved most of the problems in imaging the basement on the greatest part of Kiðafellsleið although the basement is not as clearly defined as on Hnausaskersleið. It is fairly well defined in the westernmost profiles but are more difficult to identify as we go farther to east. Fig. 7 shows the brute stack for line k-1 and Fig.8 shows a preliminary interpretation. The bottom of the sediments seems to be at similar levels on this line as on Hnausaskersleið but it seems to be deeper in the easternmost part of the research area on Kiðafellsleið.

On some of the lines on Kiðafellsleið intrasedimentary reflectors are found. Some of these reflectors probably represents the top of the moraine. At some parts of the lines at Kiðafellsleið the sub-sedimentary basement is hard to find in the multichannel data. This happens in the area where sand and gravel has been mined from the seabottom, leaving a rough topography at the bottom which scatters almost all of the downgoing energy. On line k-23 on Kiðafellsleið, an opaque layer is found at shallow levels in the sediments. This happens over a distance of few hundred meters where the depth to the subsedimentary basement is greatest. The opaque layer is most likely caused by a gas-formation, but layer with considerable amount of gasses are almost perfects mirrors for seismic energy. It seems impossible to detect any reflectors below this layer.

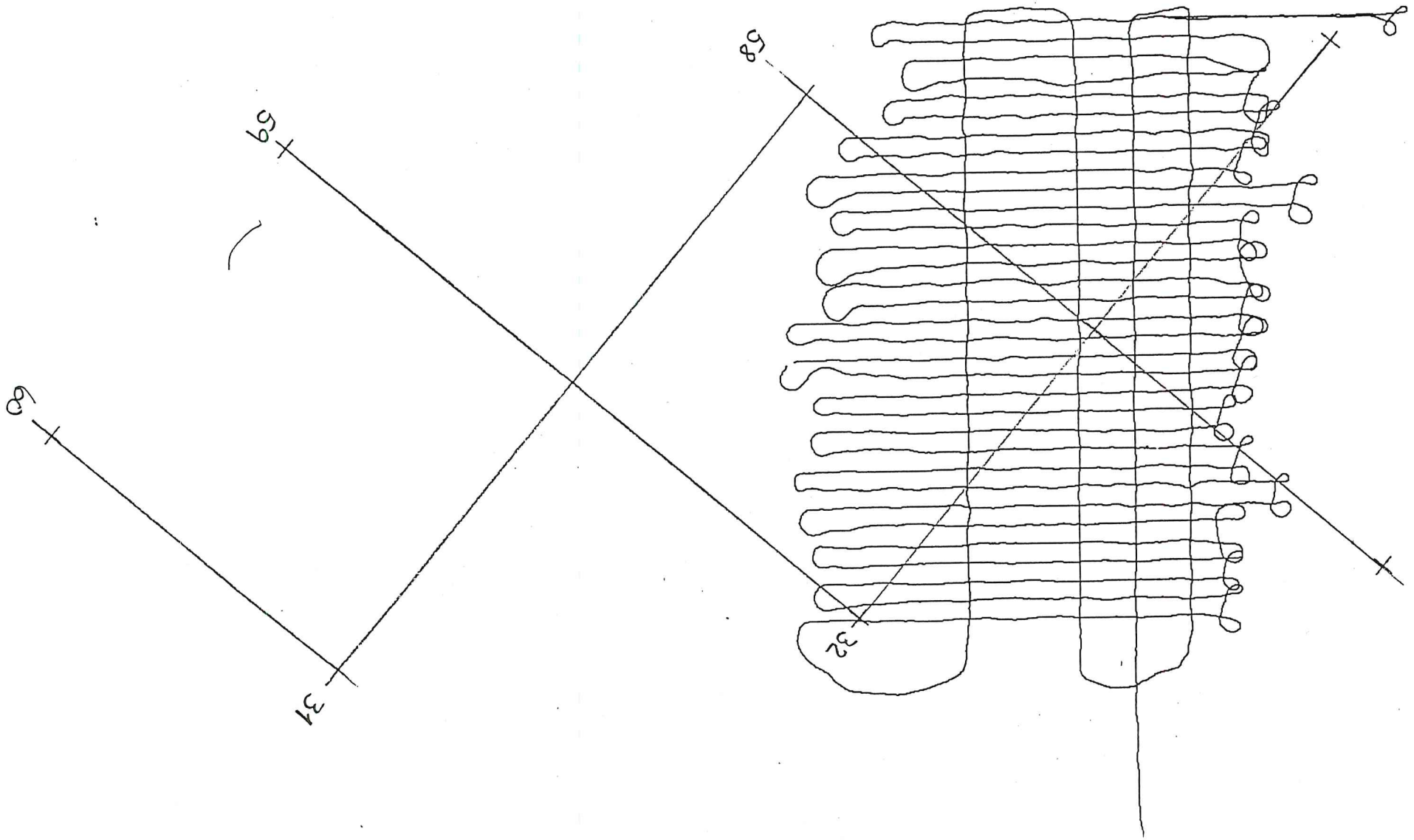
The final processing of the multichannel profiles will probably be over around 20th of August.

Some ESP-data where collected on July 21st but the data quality turned out to be inadequate, partly due to technical difficulties. Therefore further plans of ESP survey were postponed until after the completion of the bottom refraction survey.

The refraction seismic profiles on the sea-bottom are on July 27. on Hnausaskersleið according to the map in Memorandum no. 1.

At last we want to emphasize that all the results above are very preliminary as the processing of data is far from finished. Therefore they should be used and referred to with utmost care.

Fig 1. Navigation data for sparker profiles at Hnausaskersleid
The coordinate system refers to the 1:50.000 map



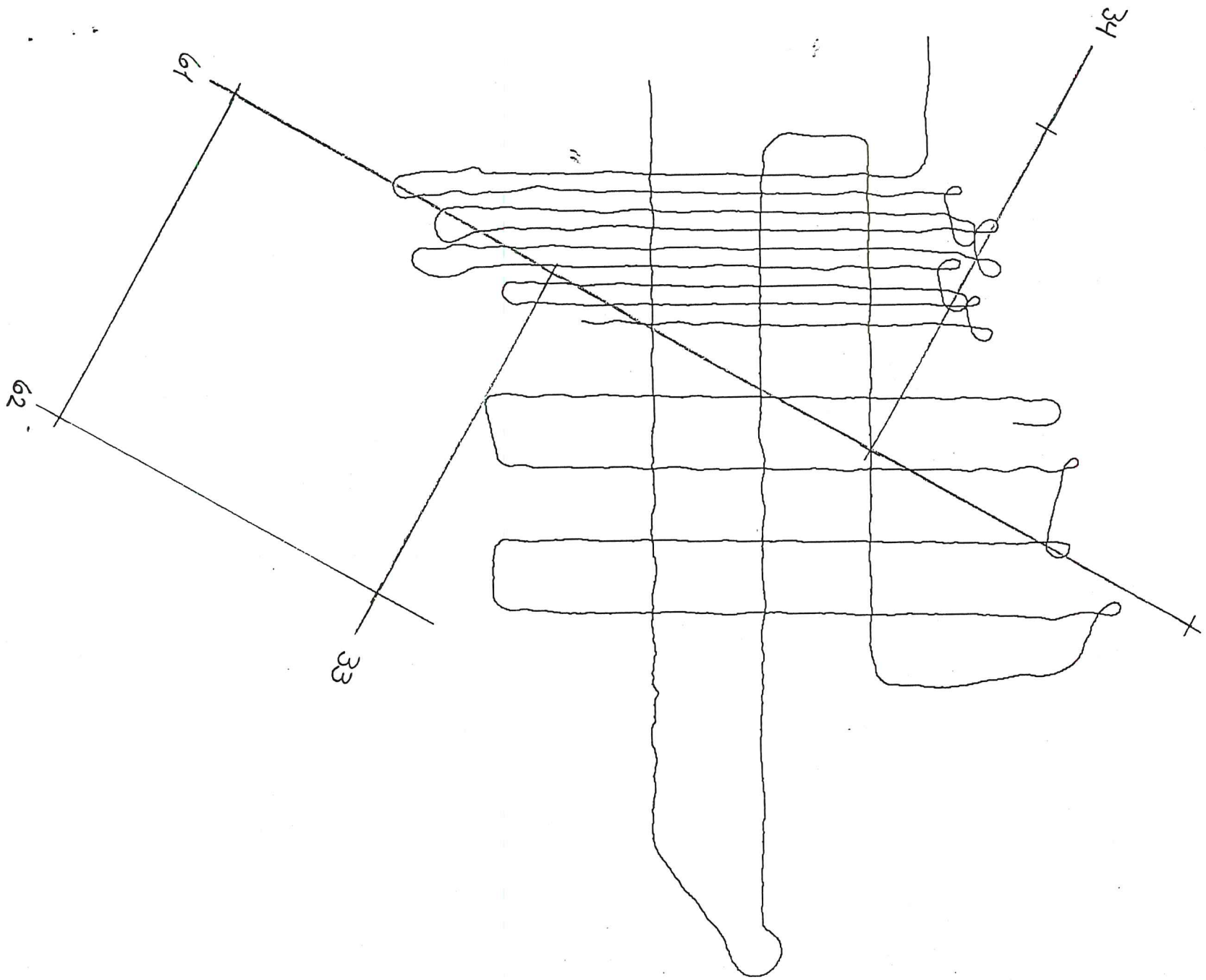
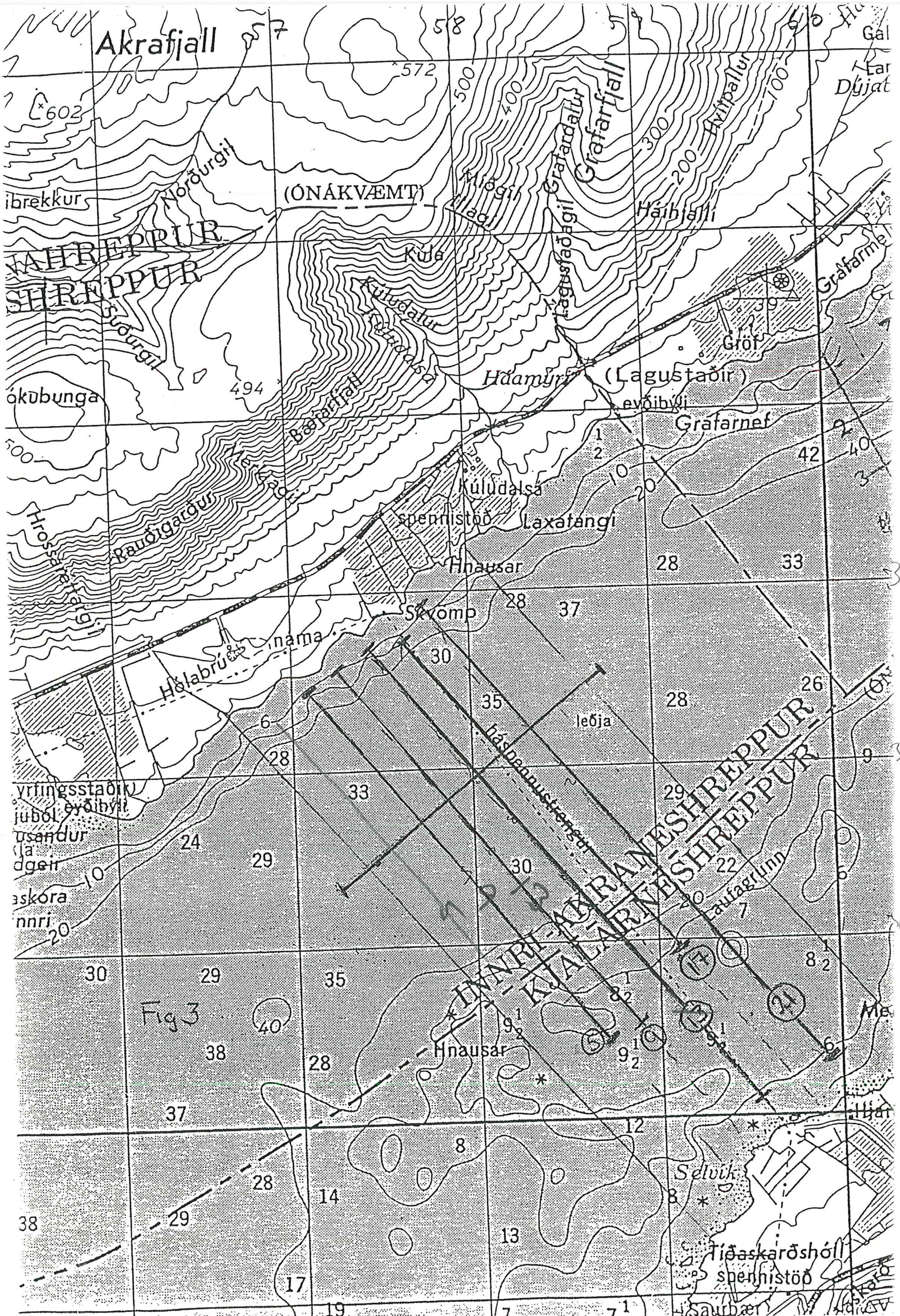


Fig 2. Location of sparker profiles on Kidafellsleid. Coordinate system from 1:50.000 map



Akrafjall
602
572
Grafarfjall
Grafardalur
Hvítpallur
Háihjalli
Norðurgil
(ÓNÁKVÆMT)
Miðgil
Lagustaðagil
Kúla
Kúludalur
Kúludalsá
494
Bæjarfjall
Rauðigarður
(Lagustaðir)
eyðibýli
Grafarnef
Gröf
spennistöð
Laxatangi
Hnausar
Skvomp
Hólabrú
náma
leðja
háspennustrengur
INNRI-AKRANESHREPPUR
KJALARNESHREPPUR
Laufagrunn
Hnausar
Selvík
Tíðaskarðshóll
spennistöð
Fig 3

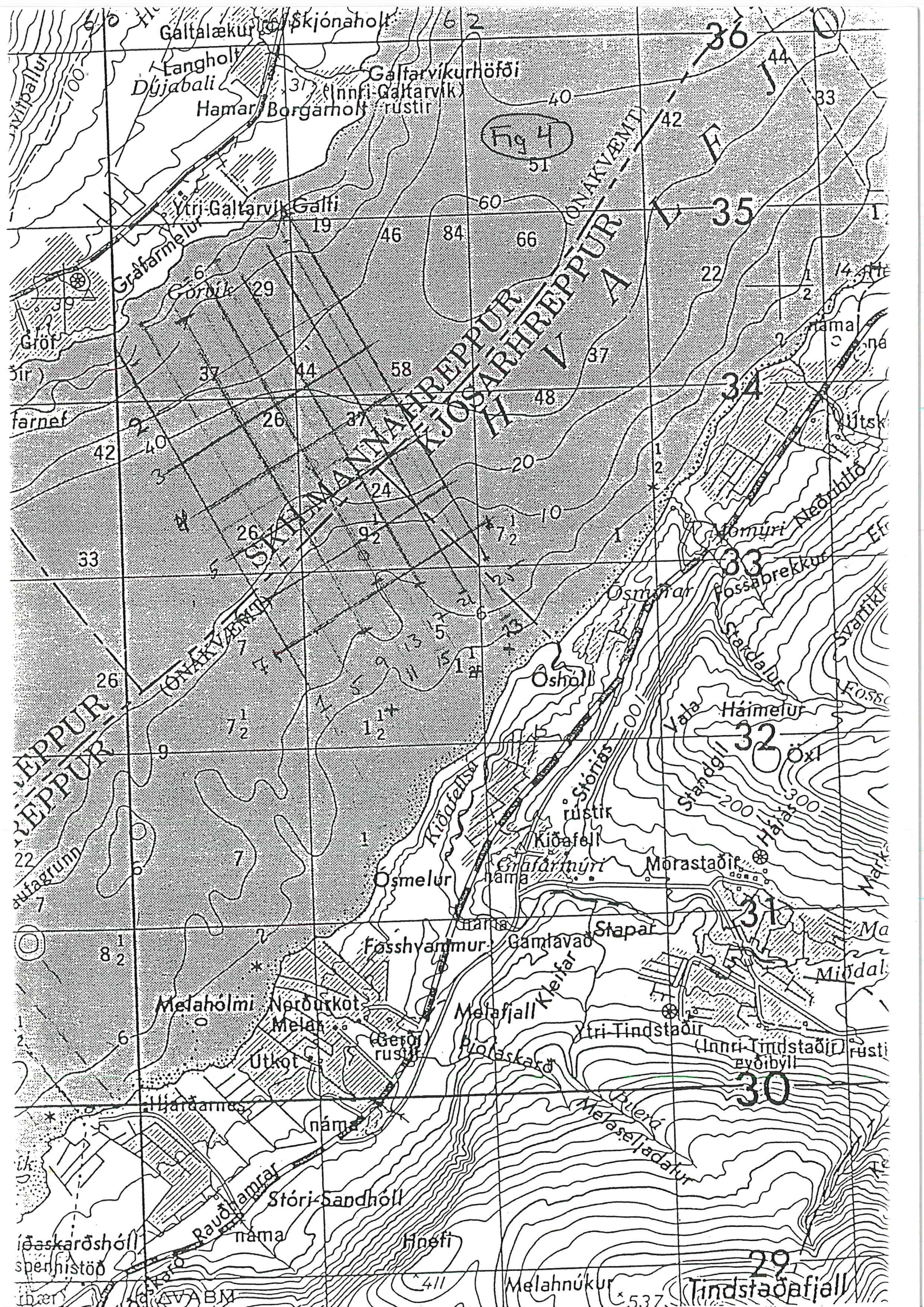


Fig 4
Galtalækur
Skjónaholt
Langholt
Dyjabali
Hamar
Borgarholt
Galtarvíkurhöfði
(Innri-Galtarvík)
rústir
Ytri-Galtarvík
Galti
Grafarmelur
Gröf
Önakvæmt
HVALFJ
SKILMANNAHREPPUR
KJÓSARHREPPUR
Ósmýrar
Ósmýri
Neðribúð
Fossabrekkur
Standalur
Svartikle
Óshóll
Háimelur
Öxl
Vala
Stóriás
Standgil
Háiás
rústir
Kiðafell
Grafarmýri
Mórastaðir
náma
Ósmelur
Fosshvammur
Gamlavað
Stapar
Miðdals
Kleifar
Melafjall
Melaholmi
Norðurkot
Melar
(Gerði)
rústir
Útkot
Ytri-Tindstaðir
(Innri-Tindstaðir) rústir
eyðibýli
Bláskarð
Melaseljadalur
Hjarðarnes
Rauðhamrar
Stóri-Sandhóll
Hnefi
Melahnúkur
Tindstaðafjall
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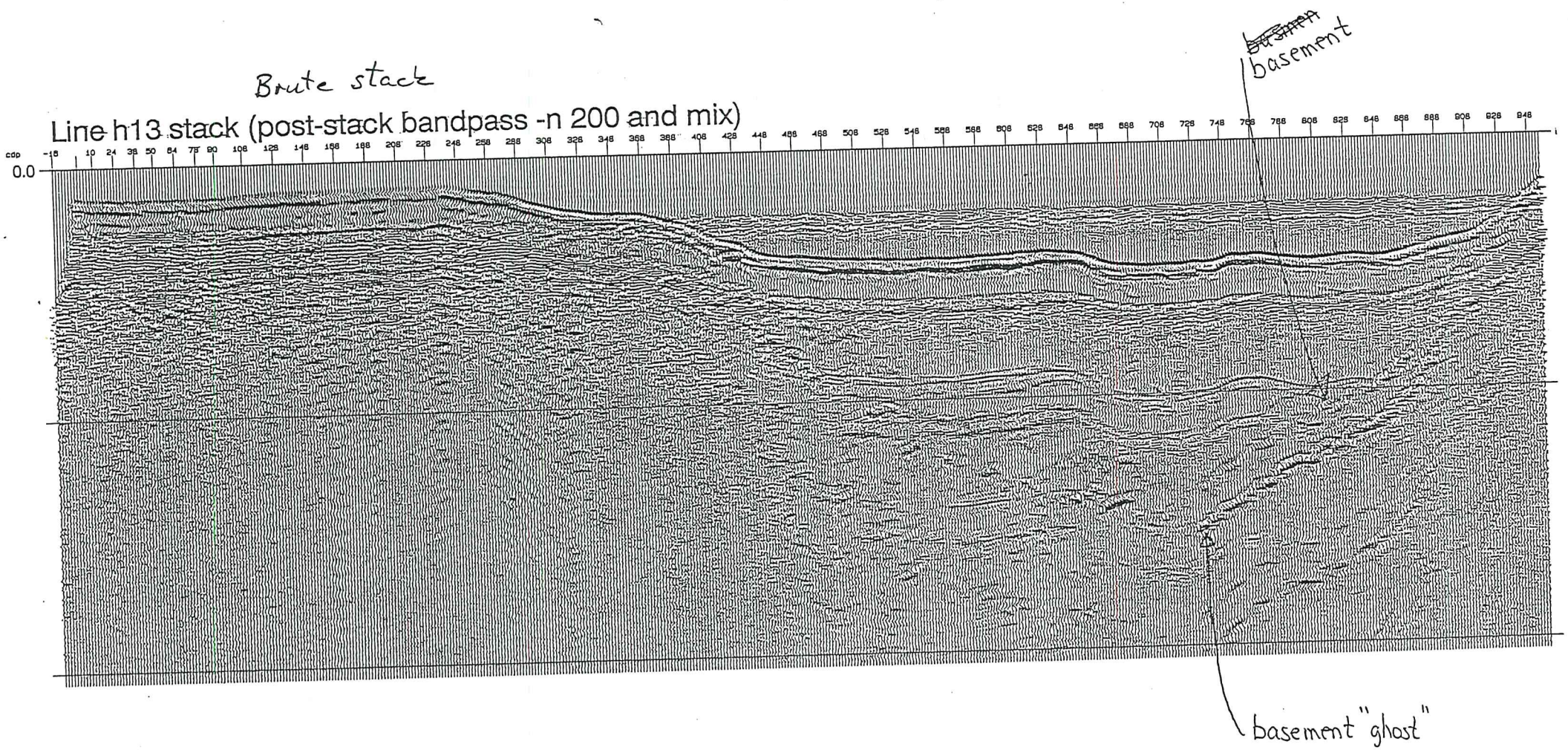


Fig 5

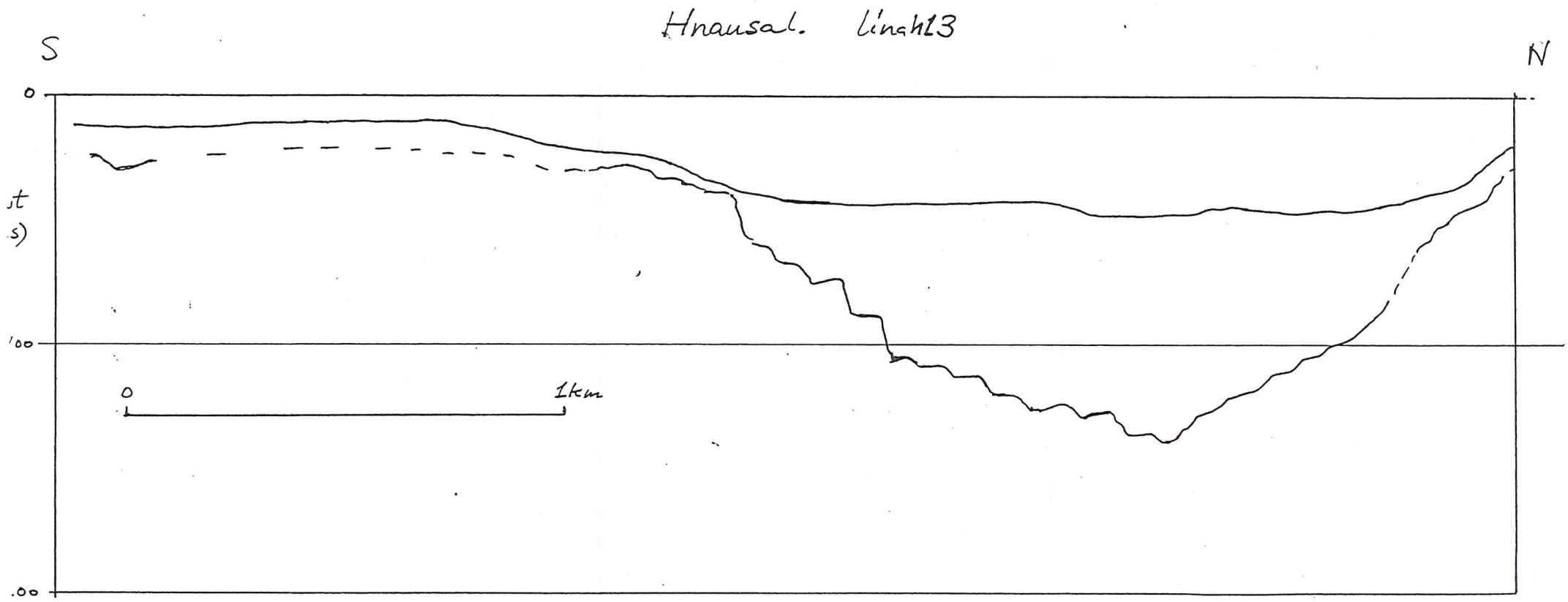
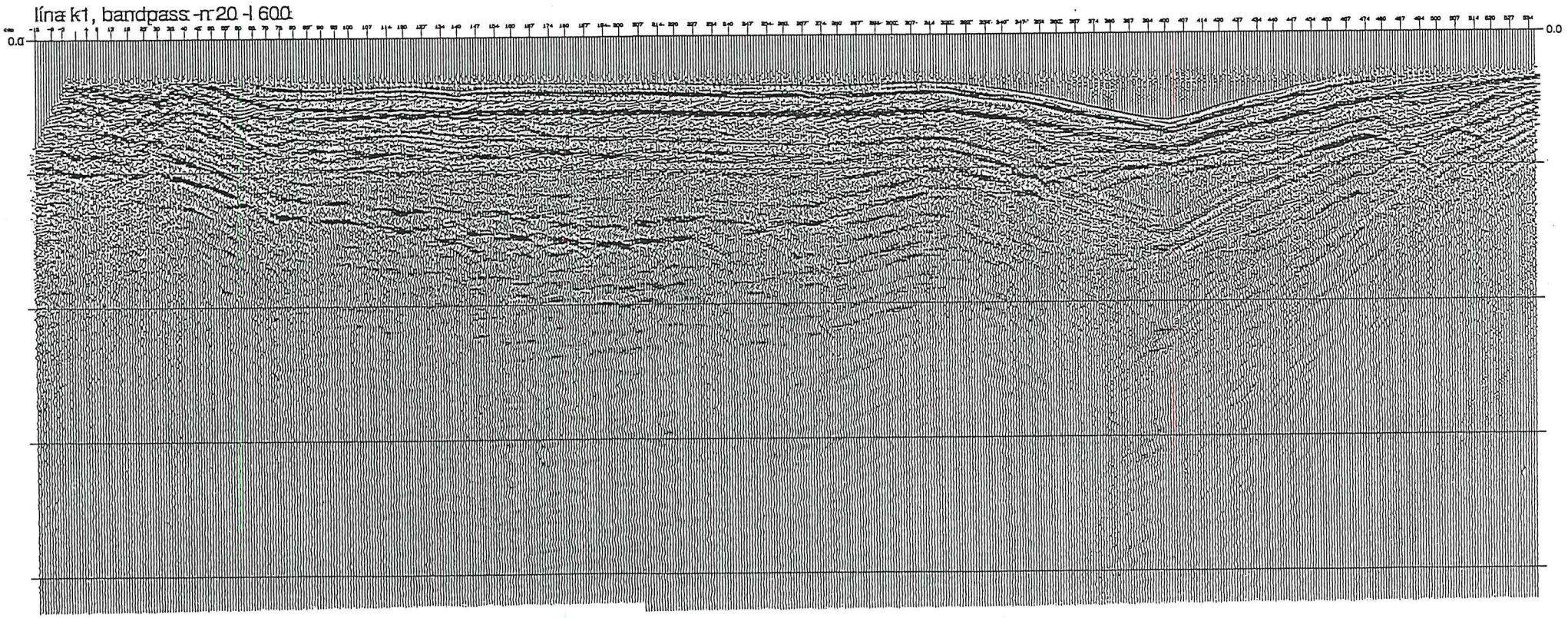


Fig 6

Fig 7



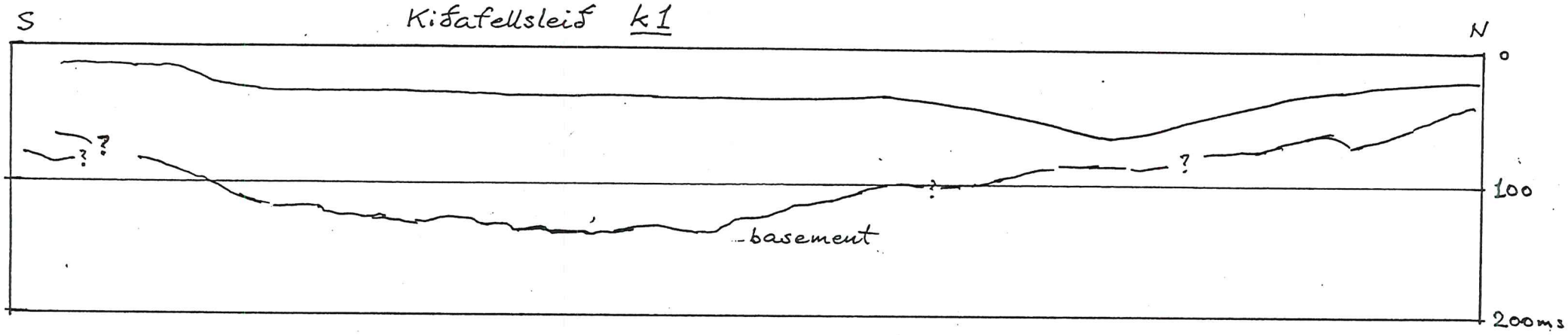


Fig 8