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NATIONAL ENERGY AUTHORITY

THE UNITED NATIONS UNIVERSITY

REPORT ON EXTENSION OF TRAINING IN BOREHOLE GEOLOGY

Jorge Flores

UNU Geothermal Training Programme, Iceland
Report 1980-9

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by

Jorge Flores +

1. OBJECTIVE

The writer of this report, newcomer in Borehole Geology, requested an extension lasting about two months in the 1980 UNU Geothermal Training Programme in Iceland on Borehole Geology, with the main purpose to complement the knowledge acquired during the first six months in the analyses of drill cuttings and drilling technology on drill sites.

2. DESCRIPTION OF TRAINING DURING EXTENSION OF FELLOWSHIP

a. Study tour of Italian geothermal fields

A short study tour to the Italian geothermal fields completed the six months 1980 UNU Geothermal Training Programme in Iceland. All the UNU Fellows travelled with Hjalti Franzson, supervisor of several UNU Fellows to Italy for a week on a study tour to the main Italian geothermal fields under exploitation and exploration: Larderello, Travale, Bagnore, Piancastagnaio, Torre Alfina, Latera, and Cesano. Specialists from the International Institute for Geothermal Research in Pisa and ENEL (Ente Nazionale Energia Elettrica) accompanied the Fellows on the study tour and gave seminars on the respective areas. This trip was very fruitful as it increased the international geothermal knowledge of the 1980 UNU Fellows.

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b. Completion of research report

The first two weeks after the trip to Italy were utilized for completing the author's final report of the 1980 UNU Geothermal Training Programme which was entitled "Borehole geology of SG-9, Svartsengi geothermal field, SW-Iceland", (UNU Geothermal Training Programme, Iceland, Report 1980-4, 39 pp.).

c. Training at drill site BJ-12, Námafjall geothermal field, NE-Iceland

Working with specialists of the Orkustofnun (NEA) during the drilling of well BJ-12 was the main purpose of the Fellow's application for extension. Nearly three weeks were spent at the drill site in the Námafjall geothermal field on analyzing and interpreting drill cuttings and learning about various aspects of drilling technology during the entire drilling of well BJ-12 (2000 m deep), with supervision from Asgrimur Gudmundsson and Hjalti Franzson. The author was present during the setting of the 300 m and 700 m casings and the cementing operations. Much was learnt regarding the drilling technology from the drill crew lead by Dagbjartur Sigursteinsson.

d. Work on drilling data from the Svartsengi geothermal field

The last two weeks were spent on interpretation of various geological and drilling data from various wells in the Svartsengi geothermal field in SW-Iceland. This was a follow up study of the author's research report, which dealt mostly with one well, SG-9. The data worked on were taken from drilling reports and geolographs and then correlated in detail (Figs. 1, 2, 3, 4, 5) with the geological cross section in the author's research report (UNU Geothermal Training Programme, Iceland, Report 1980-4). The following types of data were worked on:

(i) Penetration rate. Sections with distinctive different penetration rates were selected in all drill holes in the field and an arithmetic mean calculated for each one.
(ii) Circulation losses. Plotting of circulation losses in most of the drillholes, given in the daily drilling reports.
(iii) Load pressure. These data were worked up only for some of the wells and were found of little use for correlation purposes.

(iv) Drill bit. Data were worked on from most of the holes, but they were not found to have any significant bearing on the penetration rates recorded.

(v) Correlation. From correlation between the penetration rate, circulation losses, and geological cross section (Figs. 1, 2, 3) it is evident that the high circulation losses (>56 l/s) in SG-10 are associated with a relatively high penetration rate formation (>10 m/h) and occur in basaltic lava flows. The high circulation losses (>20 l/s) at the lower levels of SG-4 and SG-5 are similarly connected with relatively high penetration rates (>10 m/h), but most of those aquifers occur near contacts between hyaloclastites, basalts and intrusives. In wells SG-7 and SG-8, however, the high circulation losses (>56 l/s) appear not to be correlated with relatively high penetration rates, such as in SG-10, SG-4, and SG-5 (>10 m/h). In SG-7 and SG-8 most of the circulation losses appear near to contacts of hyaloclastites, basalts, and intrusives. In SG-9 both the upper and lower large aquifers (>56 l/s) are associated with high penetration rates (>10 m/h): the upper large aquifer occurs at the contact of hyaloclastites and basalts, whereas the lower large aquifer occurs within basalt lavas

3. COMMENTS

When I came to the UNU Geothermal Training Programme in Iceland I was a newcomer in borehole geology. With the great help of the staff of Orkustofnun and my enthusiasm I feel that I have acquired a competent knowledge on geothermal energy and especially on borehole geology during my eight months training as a UNU Fellow in Iceland. Although the natural conditions of the geothermal fields are different from one country to another, the elementary philosophy is the same. The latter I have learnt in the UNU-course in Iceland. Therefore, in the near future during the exploratory drilling stage and further development of our geothermal projects in Honduras, the knowledge and experience gained during my training as a UNU Fellow in Iceland will be of great value.

ACKNOWLEDGEMENTS

I would very much like to thank Hjalti Franzson and Asgrímur Gudmundsson, experts in borehole geology at Orkustofnun (National Energy Authority of Iceland) for their magnificent help during my training in Reykjavik and at the drill sites. I am very grateful to Ingvar Birgir Fridleifsson, Resident Co-ordinator of the United Nations University in Iceland for his ready cooperation during the extended training.

FIGURE CAPTIONS

Fig.1 Cross section of the Svartsengi geothermal field showing penetration rates during drilling.

Fig.2 Cross section of the Svartsengi geothermal field showing circulation losses in wells measured during drilling.

Fig.3 Cross section of the Svartsengi geothermal field showing load pressures on drillbits.

Fig.4 Cross section of the Svartsengi geothermal field showing the diameters of drill bits used.

Fig.5 Geological cross section through the Svartsengi geothermal field. (From the author's report, UNU Geothermal Training Programme, Iceland, Report 1980-4).

Fig.6 The location of drillholes and the surface geology of the Svartsengi geothermal field along with the delineation of E-W geological section (Fig. 5).

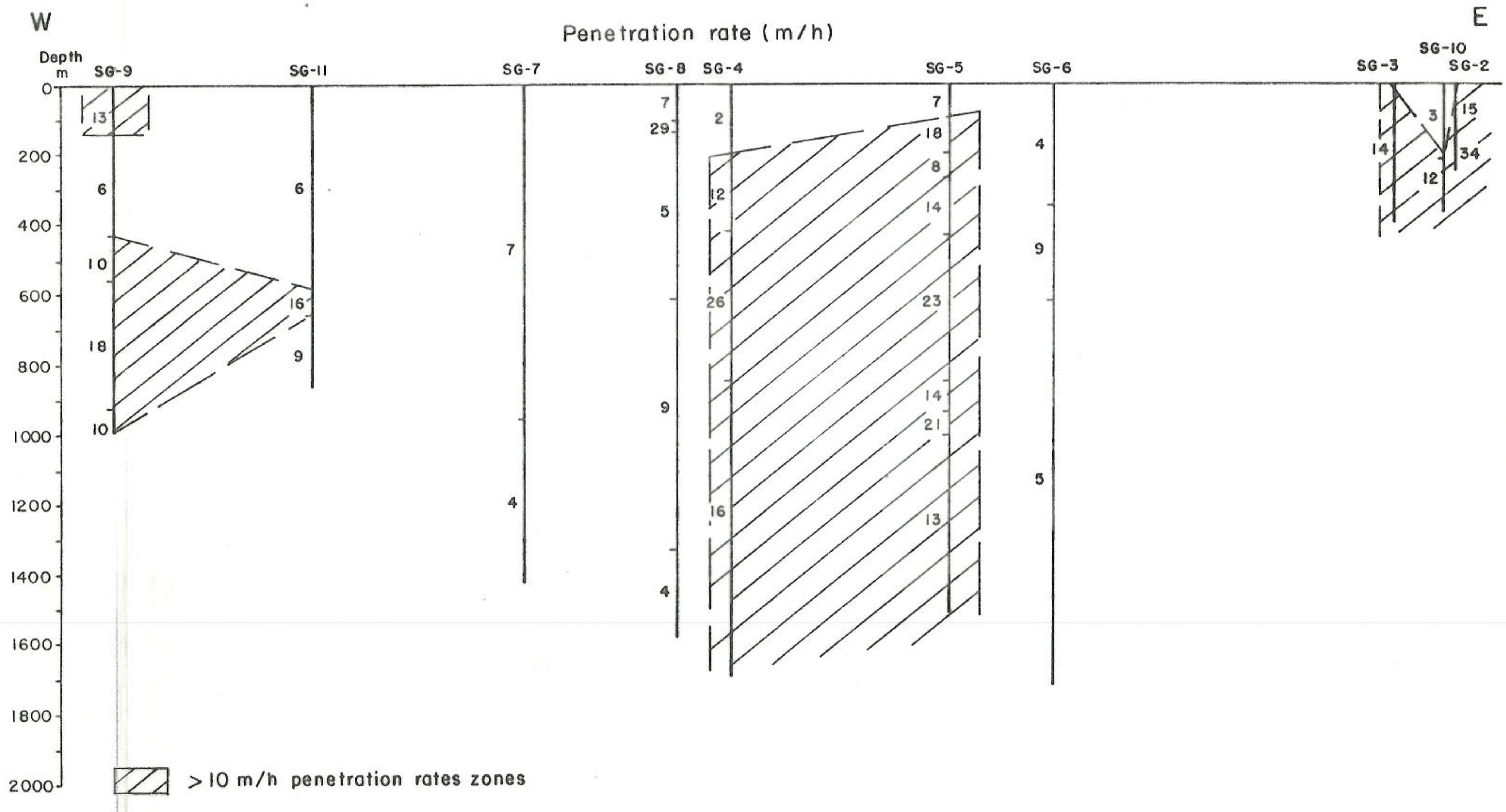

Fig. 1
Cross section (c.f. fig. 5.) of the Svartsengi geothermal field showing penetration rates during drilling

F. 20344

'80.12.21 Svartsengi HSP/ ÓD

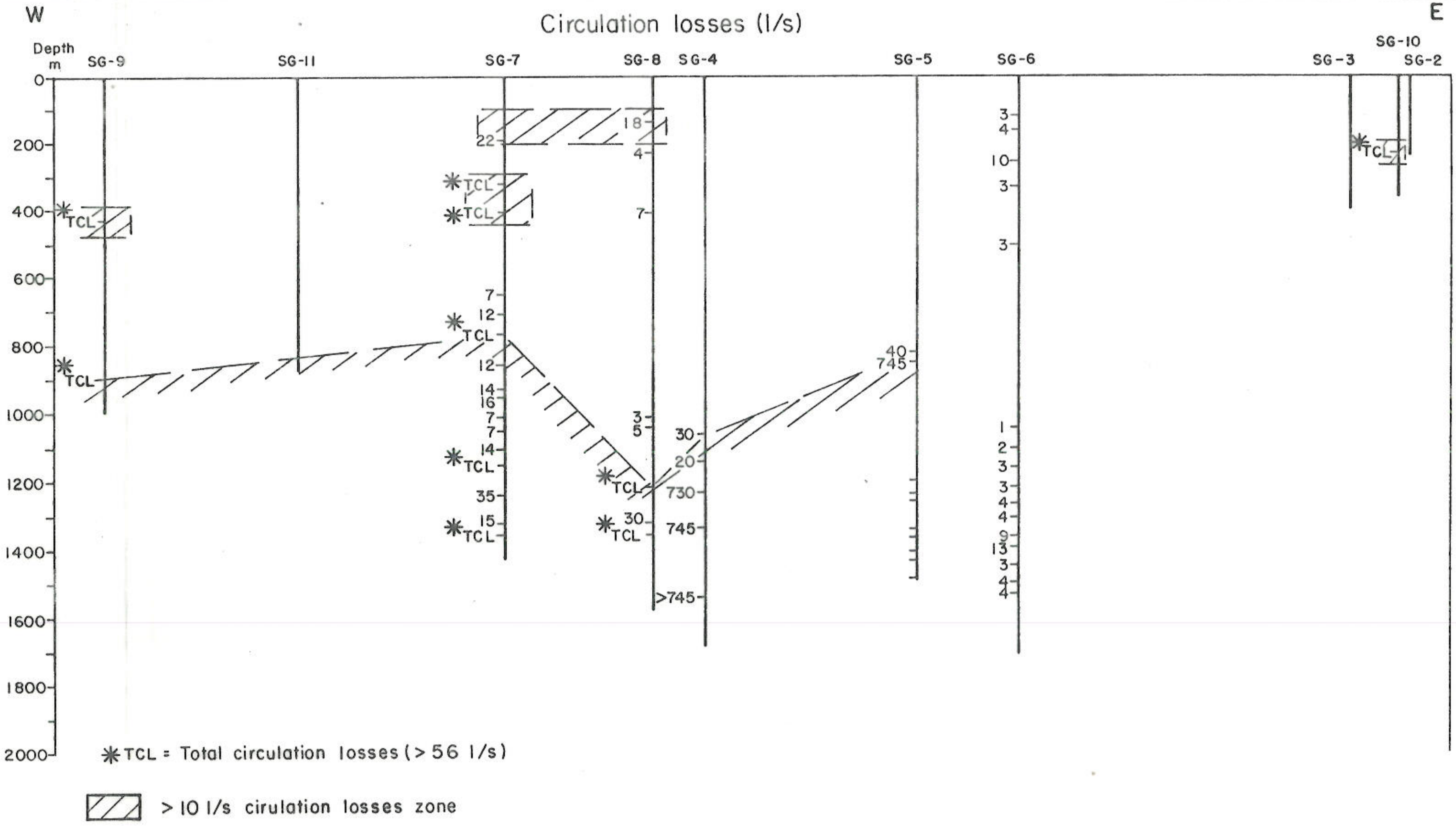

Fig. 2.
Cross section (c.f. fig.5.) of the Svartsengi geothermal field showing circulation losses in wells measured during drilling

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'80.12.21 Svartsengi HSP/ÓD

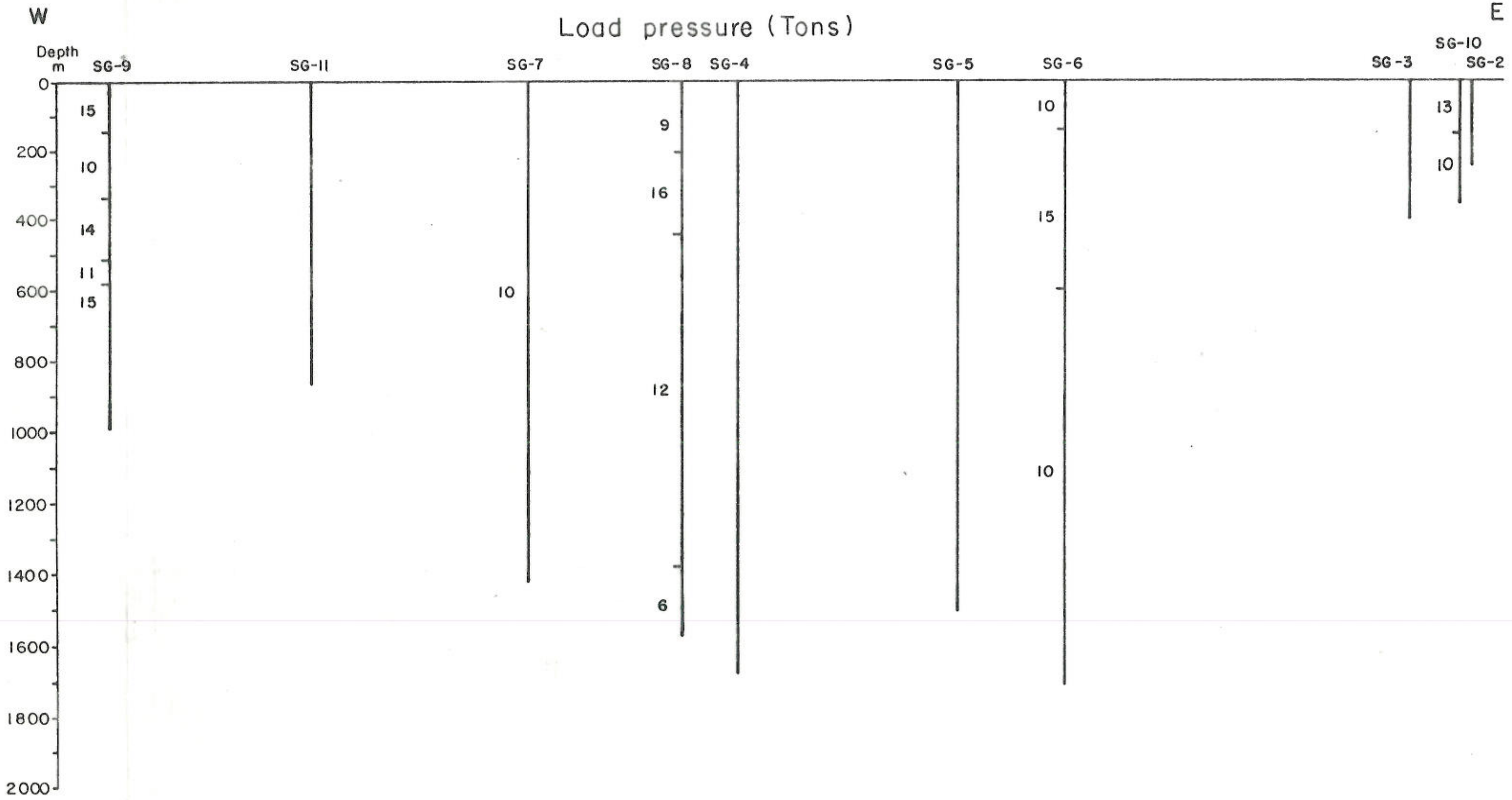
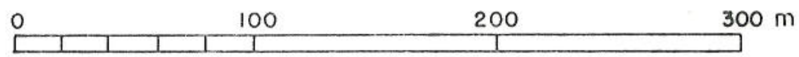


Fig. 3

Cross section (c.f. fig. 5) of the Svartsengi geothermal field showing load pressure on drill bits of some holes



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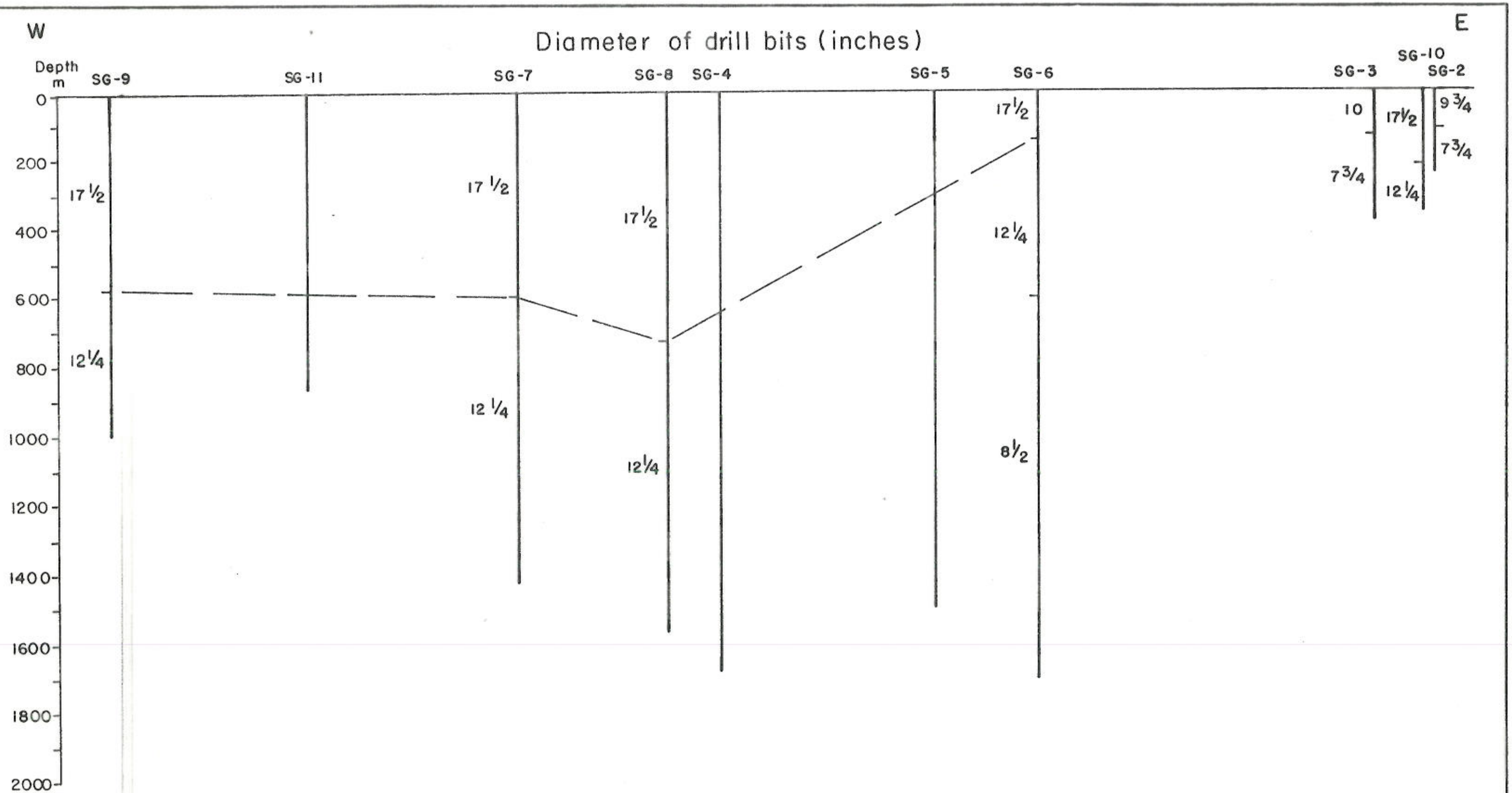

Fig. 4
Cross section (c.f. fig. 5.) of the Svartsengi geothermarl field showing the diameters of drill bits used

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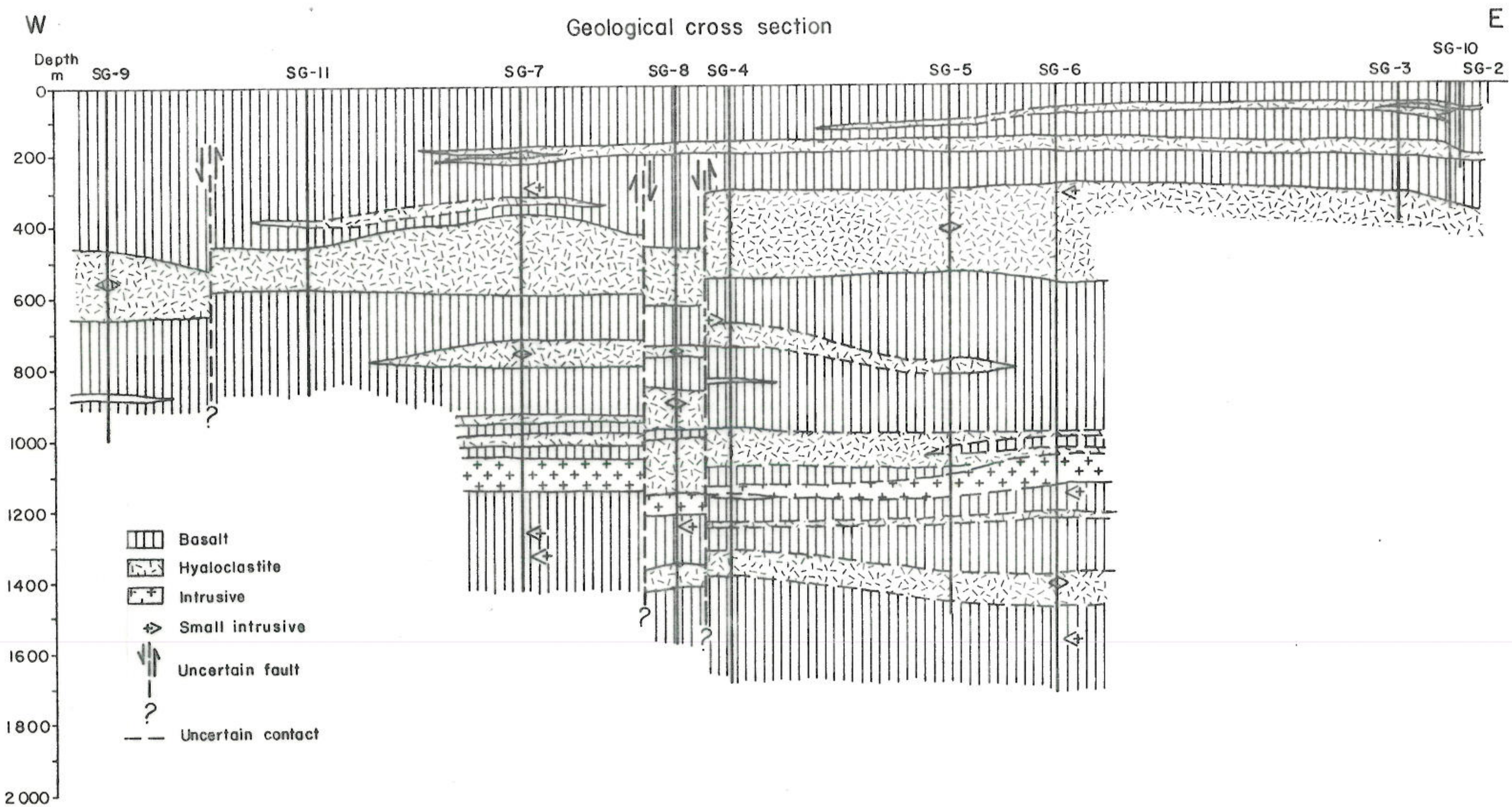
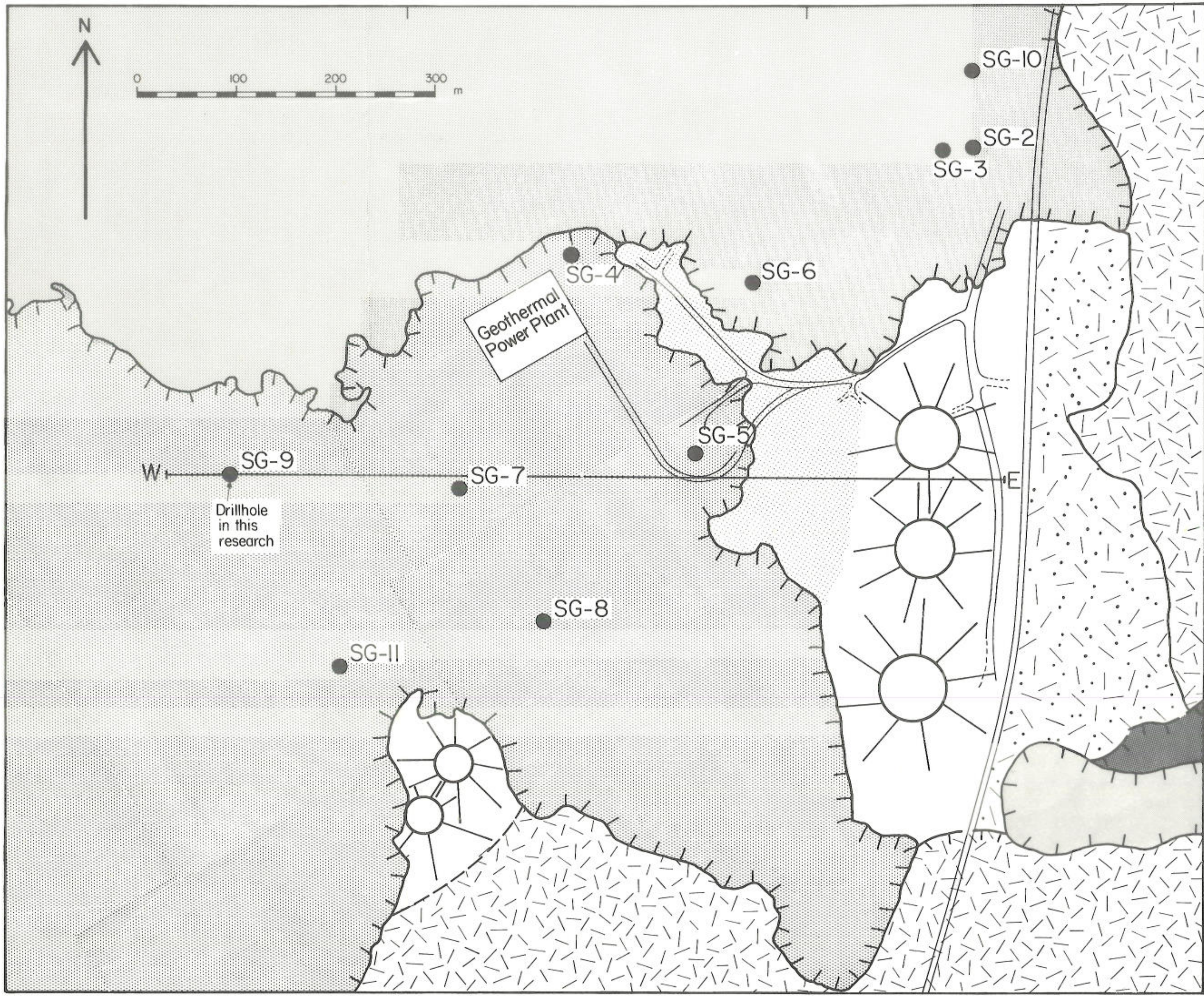


Fig. 5
Tentative cross section through the Svartsengi area
with the drill holes projected into the plane (c f.fig.6.)

F. 20055

'80.10.01 JF/EBF Svartsengi/HSP

30.12.21. ÓD



LEGEND

Pumice

Hyaloclastite

Basalt lava
Lava A is younger than lava B

H-9 Geothermal drillhole

Lava crater

W—E Delineation of geological cross section (fig.7)

Fig.6
The location of drillholes and the surface geology of the Svartsengi geothermal field (The geology is extracted from Jónsson, 1978)

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