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Summary of information on the Heiðmörk groundwater resource

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SUMMARY OF INFORMATION ON THE HEIÐMÖRK GROUNDWATER RESOURCE

The present report is written to summarize information on the Heiðmörk groundwater resource. This supplies the Reykjavík area with pure drinking water, known for its quality, and also provides Thorspring with water for bottling. In neither case a treatment of the water is needed.

General characteristics of the Heiðmörk groundwater resource.

The characteristics of the Heiðmörk groundwater resource are well known from various studies over the past decades. These include geology, hydrology, borehole-logging, chemical and bacteriological analyses, well testing and reservoir modelling. The main results are as follows:

Catchment area.

The catchment area which is uninhabited extends from Lake Elliðavatn (75 m a.s.l.) towards Bláfjöll mts (500-600 m a.s.l.) in the SE. Its size is of the order of 50 km^2. The limits are poorly defined as there is no surface drainage due to the nature of the surface rock. Ground fissures and subsurface topography influence groundwater flow and may divert it from what would be expected from surface topography.

Precipitation.

Precipitation across the catchment area increases from about 1200 mm/y at Elliðavatn in the NW to about 3000 mm/y in the Bláfjöll mts in the SE.

Geology of the catchment area.

The bedrock of the catchment area is formed of basaltic rocks. **Holocene lava flows** are the youngest unit. They lie above the groundwater table except in the surroundings of the spring areas. **Interglacial lava** forms a bulky unit below the Holocene lavas. Their main occurrence in surface exposure is SE of Elliðavatn. Both the Holocene and interglacial lavas are highly permeable. There is a thin layer of **moraine and outwash sediment** between the Holocene and interglacial lavas. The sediment covers the interglacial lava partly throughout its outcrop area, being thickest in lows. The moraine is of low permeability. **Hyaloclastite** (collective term for pillow lava, breccias and glassy tuffs) forms irregular mounds both below and above the interglacial lava. The hyaloclastite was erupted subglacially. Due to the confining environment of the ice the volcanic products accumulated around the vents rather than spreading laterally. The glassy tuffs and breccias are generally poorly permeable, whereas the pillow lavas have a good permeability.

Groundwater flow.

Troughout the catchment area the rainwater drains directly into the permeable surface rocks and emerges in copious springs SE of Lake Elliðavatn. The average flow from the spring areas amounts to about 1200 l/s, of which 900 l/s are utilized by the Municipal Water Supply. Seasonal variation is 1000-1500 l/s. The flow of groundwater is mainly associated with the interglacial lavas. The primary permeability of the lavas is provided by joint fractures and by scoriaceous flow tops. As regards the interglacial lava there is in addition a very effective secondary permeability due to extensional fissures and faults. They are part of a NE-SW trending active fissure swarm that transects the Reykjanes peninsula.

Aquifer thickness..
Drilling in the NW-part of the catchment area has shown that the cold aquifer is at least 300 m thick. Resistivity measurements indicate an aquifer thickness of over 600 m. Temperature logs of a 900 m well on strike with the Heiðmörk aquifer to the SW support this value.

Water temperature.
The temperature of the spring water varies from 3.6-3.8°C. In boreholes a seasonal temperature variation is seen to reach some 20 m down. Below this depth the aquifer temperature is constant down to 150 m throughout the year about 3.7°C. Below 150 m there is a slight temperature increase of about 1°C/100 m. The good vertical mixing indicated by the aquifer temperature is enhanced by the secondary fissure-related permeability.

Water chemistry and hydrology.
An analysis of water from the Heiðmörk reservoir are shown in Appendix 1.

The water is typical for cold, deep groundwater in SW Iceland. The aquifer rocks are basaltic volcanics with accordingly low concentrations of heavy metals. This in turn affects the chemistry of the groundwater such that pH is relatively high and the concentration of dissolved solids is low. Icelandic rocks are known to have extremely low concentrations of radioactive elements, and their concentration in groundwaters are below detection limits.

The Heiðmörk spring area.
At present the spring water for bottling is collected from wells adjacent to the main springs in Heiðmörk. The conditions in this particular area are given below.

Geological conditions for emergence of the springs.
Surface flow from the Heiðmörk catchment begins E of Elliðavatn where a swarm of NE-SW trending fissures reaches a topographic low. The springs emerge at the edges of lava flows which have reached down to the depression from the SE. Less permeable rocks bound the fissure swarm on the NE acting as an aquitard to groundwater flow beyond it to the NW.

Collection of the water
The spring water of Heiðmörk is collected through boreholes in safe distance (200-400 m) upstream from the springs to avoid pollution at the surface. The depth of the boreholes is 15-25 m. The drawdown in the wells is kept within safe limits to preclude ingression of lake water. The aquifer is the lower fractured part of the lava and a layer of ground underneath it. In the near future a separate well will be taken into use for collecting the spring water.

Nature of the ground and protctive measures.
The Holocene lavas of Heiðmörk, the youngest of which is about 900 years old, are extremely rough surfaced, and mostly barren apart from a thick cover of moss. The roughness is hostile to pedestrians and stray animals alike, thus providing a natural protection.

The zone of interglacial lavas nearest to Elliðavatn is part of a nature reserve which is being reforested and used for outdoor recreation. It is traversed by roads used during the summer by people enjoying the nature of the reserve. There is no other land use within the catchment of the well field that could contaminate the groundwater. The nearest permanent dwellings are about 1/2-1 km distant laterally to and downstream from the wellfields.

A 1 km^2 (250 acres) area around the Heiðmörk wellfields is surrounded by a 2 m fence to prevent trespassing. Besides, the Heiðmörk recreation area as a whole is fenced off to prevent grazing of domestic animals (see acompanying map).

List of figures and other material to accompany the Report.

1. Topographical map of the catchment area.
2. Geological map of the SW-part of the catchment area. *
3. Hydrogeological map of the SW-part of the catchment area. *

Figures to accompany text:

1. Precipitation in the catchment area.
2. Geological map of the catchment area and its surroundings.
3. Geohydrological cross section through the catchment area.
4. Location of main spring areas and collecting well fields.
5. Computed contour lines around spring areas at 900 l/s production from collecting wells.

Chemical analysis of spring water.

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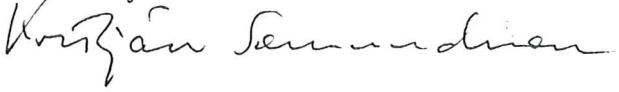
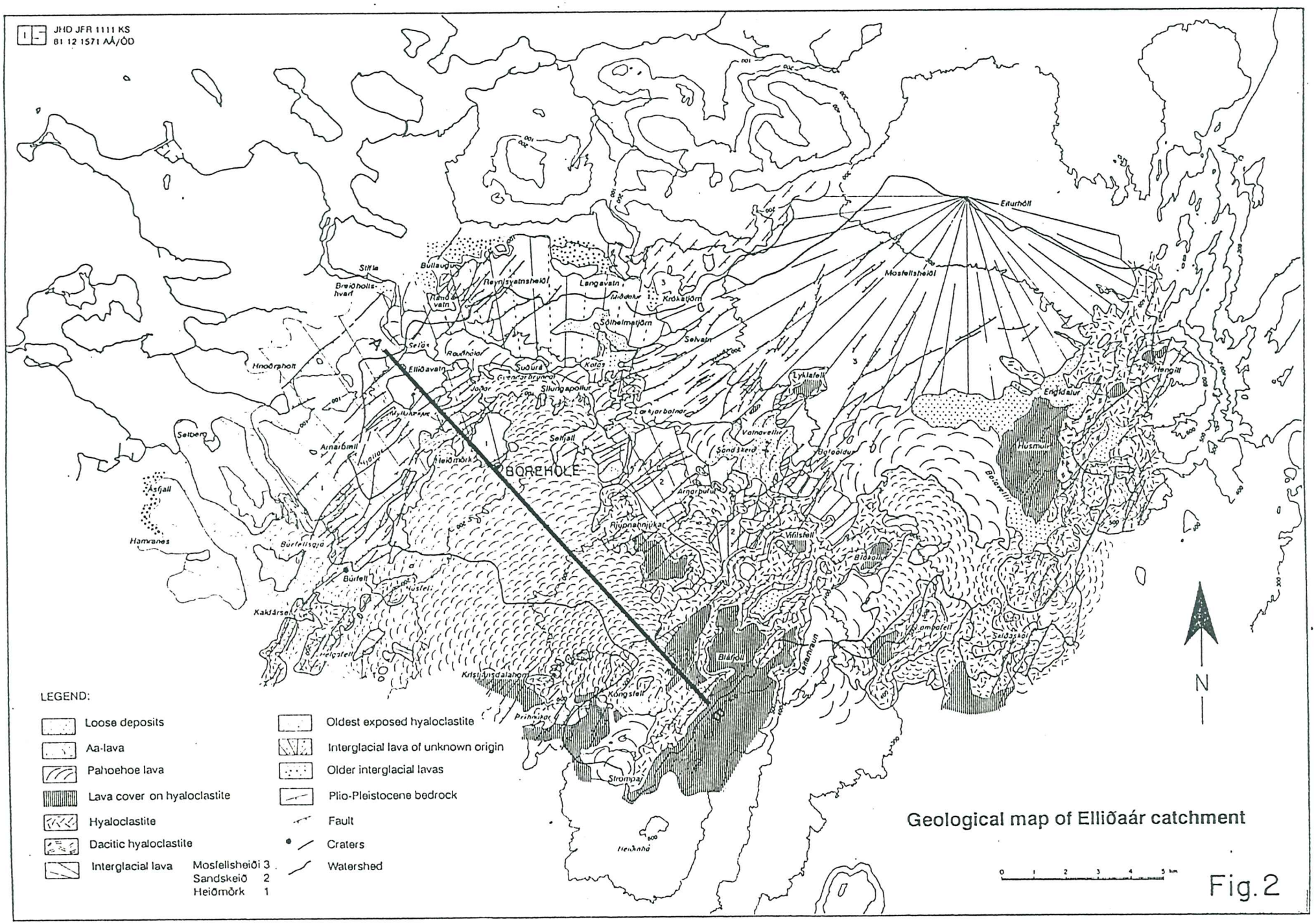


* The adjacent map to the east is under preparation.



Geological map of Elliðaár catchment

Fig. 2