Dundee University

Iceland Expedition 2004

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Expedition Report

Gino Watkins Memorial Trust
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Acknowledgements

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Itinerary

→ 9th August – 12th August: Travel to Iceland
→ 12th – 21st August: Carried out research at Heinabergsdalur
→ 22nd – 6th September: Carried out research at Sólheimajökull
→ 7th – 8th September: Travel back to Seyðisfjördur
→ 9th – 12th September: Travel back to Scotland

Glacial lake at Heinabergsjökull
Aims and Objectives

From the three projects that were carried out during this expedition there were several aims and objectives which we hoped to accomplish.

The main aim of project one was to present a case study of the drainage history of Lake Dalvatn, using surveying and lichenometric dating techniques, to discover what implications this may have had on the downstream landscape. By using the fossil shorelines found in Heinabergsdalur as a case study, the volume of discharge over time can be calculated. This will provide information on the climatic changes that have affected this area of Iceland with regards to jökulhlaups.

A secondary objective is to build on existing geographical literature and assess the accuracy of dating glacial landforms using lichenometric dating. Bennett et al. (2000) undertook a field study of the glaciolacustrine landform - sediment assemblages in Heinabergsdalur, on a total of eight lake shorelines; however, no dates were given to suggest drainage timescale. Evans et al. (1999) dated moraines on the Heinabergsjökull foreland in 1993, resulting in an estimation of glacial retreat and lake drainage, however very little work was carried out in order to date the lake shorelines themselves.

A number of papers have been published with an attempt to produce an accurate lichenometric growth rate curve for southeast Iceland, such as Evans et al. (1999) and Bradwell (2001, 2004). Other papers such as Maizels and Dugmore (1985) and Kirkbride and Dugmore (2001), have caused controversy due to the differences between lichenometry and other dating techniques, such as tephrochronology. This paper will attempt to test the accuracy of lichenometric dating on the fossil shorelines of Heinabergsdalur.

The first objective of project two was to create a detailed map of the immediate proglacial area showing general features of deposition and erosion and to compare the differences, if any in characteristics of the landforms upstream and downstream, beginning at the former glacier front and stretching for
approximately 2km downstream. Flood limits would also be shown on this map. The second aim was to produce vertical profiles along the course of the flood route way and identify clast characteristics and their distribution within the valley.

The main aims and objectives of project three were to create a map of the area showing on it the main features of glacial action, both erosion and deposition. The majority of features found were moraines, with some kettle holes and kettle lakes also present. To carry out this project, GPS was used extensively, as well as photographic analysis and observational skills. Abney levels were used to create slope profiles of the moraine sections and statistical tests were carried out to find if there were any relationships in the formation of the moraines the further away from the glacier they were.

**Budget**

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Money was saved by obtaining discounts in campsites due to the duration of our stay. Money was also saved by taking a diesel vehicle with us, as diesel is very cheap in Iceland. The majority of the available money went on our food budget as the standard of living in Iceland is very expensive.
Projects

Project 1 – Using Lichenometric Dating to Reconstruct the Drainage History of Former Marginal Ice - Dammed Lake; Dalvatn in Heinabergsdalur, Southeast Iceland.

Published research for the area of Heinabergsdalur in southeast Iceland identified 8 fossil shorelines, and dated them between 1887 AD and 1928 AD. A field study for this project on the drainage history of Lake Dalvatn, discovered not 8 but 12, and has dated the maximum shoreline at 1897 AD ± 48 years and the minimum shoreline at 1951 AD ± 36 years.

Through fieldwork it was also hoped to assess the accuracy of lichenometry as a dating technique on fluvial glacial deposits. Lichenometric dating was found to be accurate within prediction intervals at the 95% confidence level but could not be used to give an exact date of the glacial deposits at this site.
Glaciers are sensitive barometers of climate change, growing and shrinking in response to changes in temperature and snowfall. The fluctuations of past and present glaciers, therefore, serve as a valuable source of information on the workings of the global climate system. Glaciers also have an influence on local and global climate, altering pressure systems and wind directions, and serving to keep vast areas locked in perpetual cold.

Glaciers, therefore, affect, and are affected by, many elements of the global system and play a central role in the operation of that system. This means that studying of the glacier system gives a very valuable insight into understanding how our climate works.

During the month of August 2004 AD, a scientific field study was undertaken at the site of Heinabergsdalur, Southeast Iceland, for a period of 8 days (13th Aug. - 20th Aug.). During this period a number of sampling and surveying techniques were used in order to understand and reconstruct the drainage history of Lake Dalvatn.

G.P.S. (Global Positioning System) traverses were made around the two maximum shorelines and as many made around the lower shorelines as the terrain allowed. The G.P.S. consists of a constellation of 24 satellites, four in each of six orbital planes. The G.P.S. receivers convert signals from the satellites into estimates of velocity and position, expressed as latitude, longitude and elevation which can then be used for position fixing. This meant that fixed positions could be calculated for the perimeters of each shoreline using the Garmin GPS XS12, and plotted to form a map of the shorelines, with cartographic interpellation used where data was missing. The surface
area could then be calculated for each level of lake drainage. The G.P.S. is accurate enough for mapping at this scale, however does not provide accurate measurement of shoreline elevation.

The G.P.S. points were firstly plotted onto graph paper by hand and reduced onto a map of the Heinabergsdalur which was reduced from sheet 96, Hoffellsjökull from the National Land Survey of Iceland, using a plan variograph. This map shows the position of the lake level at its maximum level using the GPS positions of the upper most shoreline. The G.P.S. points and were then entered into Microsoft Excel so that the data could be manipulated and plotted.

The depth of each lake level was calculated by using Abney level slope profiles and compared to the data collected by Bennet et al. (2000). Once the Abney level data was entered into Microsoft Excel, a slope profile was constructed which clearly marked the height of each shoreline terrace and therefore from this the depth of each lake level could be derived. A profile was also taken at the entrance to the valley using an electronic total station; however this only gives an accurate depth for the upper shorelines as a glaciolacustrine fan covered the lower shorelines at this point. Difficulties with the total station set up meant that this approach to surveying could not be used elsewhere in the valley.

With these data giving the surface area and depth of each shoreline, the volumes could then be calculated for each lake level, using the equation from Petts and Foster (1985), \[ V_n - m = \frac{1}{3} (A_m + A_n + \sqrt{A_m A_n}) (n - m) \], where \( V \) is the volume of water contained between two adjacent contours at \( n \) and \( m \) metres depth; and \( A \) is the
surface area of water contained between two adjacent contours at n and m metres depth. This enables calculation of the volume of discharge and the rate of water release over time, which provides implications on possible downstream consequences. Is this in the form of rapid catastrophic drainage in the form of jökulhlaups, the sudden (sub-glacial) drainage of an ice-dammed lake or gradual letdown?

In order to date the shorelines lichenometric dating was used. The a axis (longest axis) of the five largest thalli of the lichen Rhizocarpon Geographicum Sento Lato, which is a distinctive yellow-green coloured crustose lichen that thrives in environments associated with glaciers, were measured at various random locations (in a 5 m² area) along each shoreline. Measurements were made to the nearest millimetre. The Mann-Whitney ‘U’ test was then used on these data to determine whether or not there was a significant difference between the lichen sizes on each of the adjacent shorelines. If no significant difference was found between adjacent shorelines, the second nearest shoreline was used and if still no significant difference was found the third was used and then the fourth, fifth and so on, until a significant difference was found.

A Mann-Whitney ‘U’ test was also used to test if there was a significant difference between the thalli sizes on the north facing bank of the valley against the thalli sizes on the south facing bank for each shoreline. This was done to test if the aspect of the lichen would have an impact on its growth rate.

The Mann-Whitney ‘U’ test tests the difference between two populations based on the mean ranks of random samples drawn from each population, on the assumption
that the samples are random (measured without error) and that they are applicable to ordinal or interval scale data.

In order to date the shorelines, lichen thalli size must first be established for surfaces of known age and then a lichen growth curve can be constructed based on these ‘fixed points’. These ‘fixed points’ of known age were gravestones, from four different graveyards within close proximity to the field site, Kálfafellsstaður, Brunnhólskirkja, Höfn and Stafafell. At each of these sites the largest lichen thalli on each gravestone were measured and the date of death noted, to provide the age of each gravestone. A regression curve was then plotted for each graveyard site to examine the regression best-fit line and obtain an equation and R2 value to be compared with the other sites. A calibration of these data, from all four sites, was then used to plot a linear regression establishing confidence in predictions at a 95\% confidence level. As the regression calibration was predicting age from size, age was used as the dependent variable and size as the independent variable. The equation obtained from this regression could then be used to date the fossil shorelines found in Heinabergsdalur, by entering the mean a axis thalli size for each shoreline into the equation, to provide a date with prediction intervals at the 95\% confidence level to when the lake levels drained, this tests the range of the dating technique. This was also done for the equation from Kálfafellsstaður, as this was the closest graveyard site to Heinabergsdalur and should therefore provide a more accurate calibration.

The aspect of the slope was also taken into consideration by entering the mean a axis thalli from each shoreline, from each side of the valley into the equation. In order to test whether or not as many measurements were required to produce an accurate date.
This was done by entering the measurements from the south facing aspect of the valley, as the largest thalli sizes were found here (suggesting optimal conditions for lichen growth), into the Kálfafellsstaður regression equation. The largest lichen thalli, mean of largest 3, mean of largest 5 and the overall mean for each shoreline on the south facing aspect of the valley were plotted.

All the results were then compared to work already undertaken on lichenometric growth curves in Iceland, such as the work of Bradwell (2001 and 2004), Evans et al. (1999) and Kirkbride et al. (2001). This was done in order to evaluate the accuracy of the dating methods of lichenography and to reconstruct the drainage history of Lake Dalvatn.

Had more time been available, a more accurate survey using the electronic total station to survey the whole valley of Heinabergsdalur could have been carried out. Electronic total stations enable accurate angle, distance and co-ordinate measurements to be taken relative to a base station. Data from the total station could then be programmed into the electronic mapping package, SurGe, to produce 2-D contour plot maps of the survey site along with 3-D plots of the survey site. Using these models and the data already collected for the heights and volumes of the lake levels, a model of the lake drainage pattern could then be superimposed over the 3-D models to re-create the drainage system of Lake Dalvatn.

A study of the outwash terraces identified by Evans et al. (1999) would also be useful in interpreting and predicting the drainage patterns in terms of jökulhlaups. These outwash terraces could be dated using lichenometry as well as other dating
techniques, such as tephrochronology, so as to tie in the dating of lake drainage with deposition of jökulhlaup. The tephrochronology dates could also be used against the data from Evans et al. (1999) to see if there were any similarities / differences in dating accuracy.

A date should also be obtained for the moraine to see if in fact this was the maximum advance of Heinabergsjökull and therefore the ice - dam causing the maximum lake level. A date should also be derived for the glaciolacustrine fan with a goal of discovering if the lake did in fact re - fill and therefore re - set the lichen growth rates on the lower shorelines.

As aspect, precipitation, and geology have been proven to affect the growth rate of lichen thalli, these data should be collected for the ‘fixed point’ data and more ‘fixed point’ surfaces should be included in the regression plots, such as mine soil heaps, abandoned buildings, stone walls and cairns, yet caution should be used in choosing the fixed sites such as these. Evans et al. (1999) discovered a bridge over the River Skala built between 1946 and 1957, from which lichen measurements were taken.

With an attempt to assess lichenometry against other dating techniques, the same study should be undertaken using some of these other dating processes, such as tephrochronology, to assess the accuracy for dating the same surfaces and to compare the results.

A more long term study would be to collect precipitation and sunshine data from various points on each shoreline as a control to testing if aspect is an important
implication on the growth rate of lichen thalli, although it would take some years of data collection before these results could be used effectively. Precipitation and sunshine records should also be recorded at the graveyard sites so that a comparison between the locations can be implemented.

It can be concluded that the shorelines of Heinabergsdalur were formed during the ‘Little Ice Age’ by the Lake Dalvatn. The upper shoreline has been dated as 1897 AD ± 48 years and the lower shoreline dated as 1950 AD ± 36 years. These dates do not match exactly with other publications, such as Evans et al. (1999), however the prediction intervals are large enough to match.

Lichenometric dating was found to be accurate with prediction intervals at the 95 % confidence level but cannot provide an exact date. Dating, using the lichenometric technique needs to be treated with caution as a regression curve requires a normally distributed variable (size). The aspect of the dating surface is an important indicator in providing an accurate lichenometric date, and is best to use south facing surfaces for the most accurate dates.

Care also must be taken when choosing ‘fixed point’ surfaces as lichen growth varies with altitude, precipitation levels, temperature, sunlight, proximity to sea and will vary among substrates. The lichen thallus increases with age and growth begins soon after the deposit is stabilised, however, growth rate slows with age.

The main advantage of lichenometric dating is that it can be applied at virtually all longitudes, latitudes and altitudes. However, presence of previously colonized rocks,
contamination of deposits by rockslides, measuring of more than one thalli, variations in substrate and variations in climate must be taken into consideration in order to provide an accurate date.

**Project 2 – Depositional and Erosional features Associated with the 17th-18th July 1999 Jökulhlaup, Sólheimajökull, South Iceland**

![Image of Kettle Lake at Sólheimajökull](image)

The main aim of this project was to identify the depositional and erosional features associated with the 17-18th July 1999 jökulhlaup in the Sólheimajökull valley, South Iceland. Jökulhlaup is the Icelandic term for a catastrophic outburst flood involving the periodic or occasional release of large volumes of glacially stored water. They occur predominantly in the ablation season and are a result of three main triggering factors: the sudden drainage of an ice dammed lake below or through an ice dam; lake water overflow and rapid fluvial incision of ice, bedrock or sediment barriers; and the growth or
collapse of subglacial reservoirs (Menzies, 2002). The particular event in question was the result of a subglacial volcanic eruption of Katla below Mýrdalsjökull.

This volcanically generated jökulhlaup burst from the snout of Sólheimajökull, an outlet glacier of Mýrdalsjökull and transported large quantities of glacio-fluvial materials down the valley washing away terminal moraines in its path. Most of the flood followed alongside the western margin however some flow was released from tunnels at the glacier snout. The average peak flood discharge nearest the glacier snout was 4780m$^3$s$^{-1}$, however, this had reduced to 1943m$^3$s$^{-1}$ by only 6km downstream (Russell et al., 2002). Since the energy of the flow had reduced, in theory the depositional and erosional impacts should also have decreased downstream. This formed a basis for the main aims of the project to be established.

The first objective was to create a detailed map of the immediate proglacial area showing general features of deposition and erosion and to compare the differences, if any, in characteristics of the landforms upstream and downstream, beginning at the former glacier front and stretching for approximately 2km downstream. The second aim was to produce vertical profiles along the course of flood route way and identify clast characteristics and their distribution within the valley.

Preliminary field sketches were carried out to firstly give a general idea of the landscape. Photographic analysis also aided this process and provided a record of the current condition of the valley. Carrying out this process was important since it provided a base to begin geomorphological mapping in more detail.

Sediment logging was undertaken at various points along the length of the ridge and each profile was recorded by sketching and through photographs to aid in the identification of the characteristics of the strata. The exact locations of the vertical profiles were chosen where noticeable differences in either the height of the ridge, sediment sizes or distribution of deposits were evident. In the field the precise position of each profile was recorded using GPS. This
aided in the analysis and reasoning as to what factors may have caused the present nature of deposits.

Since this project produced a number of maps and diagrams, it is not possible to show each one therefore an example of a sediment log will give some idea of the results found in the field study. This is shown below in Figure 1.

![Sediment Log Diagram]

- Fine, well sorted
- Poorly sorted
- Massive, well sorted sediment
  - matrix well sorted
- Coarsening downwards
- Sand, few large boulders

*Figure 1: Example of sediment log found at study site*

Pebbles and boulders in this section were sub rounded to well rounded with very few angular in shape. A layer of fine sediment with clast size no greater than 0.6cm capped the underlying units in profile. The second layer down was very poorly sorted with a wide range of particle sizes. The smallest of these were millimetre in size and the largest up to 10cm in diameter. The third unit down contained some but very few larger boulders therefore was very well sorted. The boulders, being no larger than 15cm were matrix supported. The next layer down exhibited coarsening of sediments in a downward direction. Towards the top of the section, average clast size was c.5cm but this increased to 15–20cm at the base. The final unit consisting of fine sand littered with boulders of varying size. This ranged between 10 and 25cm.
Observations carried out in the field suggested that the July 1999 jökulhlaup washed away a series of terminal moraines in its path leaving a distinctive ridge running parallel to the River Jokulsá on both the east and west of Sólheimajökull Valley. Most erosion took place during the rising stage of the flood when energy of the flow was at its peak. This exposed the valley floor to depositional process during the waning stage. Mostly all material eroded during the rising stage was transported downstream and deposited on Mýrdalssandur. A large volume of fine suspended sediment was washed out to sea as was evident from the lack of fine sediment present in the immediate proglacial area.

The sediment logs recorded showed varying patterns related to different stages in the jökulhlaup flow. The sediment profile taken from section A exhibits a noticeable coarsening downward of sediment in the unit second up from the base. This is considered normal grading in a bed (Nichols, 1999). This type of graded bedding is the result of the velocity of the flow decreasing over time. The largest boulders at the base of the unit will be deposited during high flow and as the velocity decreases, the size of grains will be reduced. The next layers up have a higher concentration of fine sediment and very few large boulders. These sections are matrix supported due to the large amount of fine sediment.

This would possibly be deposited during the final stages of the waning stage where flow rates decrease significantly. The thin layer of fine sediment capping the entire profile would most likely have been laid down post jökulhlaup when flow rates begin to reduce to normal levels. Predominantly fine sediment would be transported during this stage if the principles illustrated by Hjulström are adhered to. The jökulhlaup most probably deposited those sections above the sandy layer at the base of the profile. This layer would be the exposed surface as a result of erosion during the rising stage.

A thorough analysis and interpretation of the raw data, in conjunction with previous research allowed an in-depth discussion of the sedimentary impact proglacial areas are subject to during these high magnitude flood events.
Research undertaken suggests that erosive and depositional impacts decreased downstream. This was indicated by the decrease in concentration of large sized boulders and the reduction in depths of megaripples and kettle holes. This event provided a good example of the direct impacts in proglacial areas, however, if a full understanding is to be established further research needs to be carried out in the near future since subsequent flood events may completely destroy previous records.

**Project 3 - Using a Map to Provide Information on the Distribution of Erosional and Depositional Features in the Sólheimajökull Valley, Southern Iceland.**

![Moraine distribution in the Sólheimajökull Valley](image)

This project was carried out in the Sólheimajökull valley in southern Iceland. The valley has been extensively eroded by Sólheimajökull, which is an active outlet glacier of Mýrdalsjökull and the most southern glacier in Iceland. Sólheimajökull is directly affected by atmospheric and oceanic circulation (Mackintosh *et al.*, 2001),
which causes it to fluctuate regularly and so has been the object of much research. Sólheimajökull descends to almost sea level and is therefore more prone to rapid retreat (Mackintosh, 2003) because winter temperatures are mild and melting occurs year round. The melting of the glacier has formed the River Jökulsá - or the “Stinking Creek”, because of the pungent smell of sulphur that comes from the glacier - which caused difficulties in mapping due to the large scale of the river.

The Garmin GPS XS12 was used to find the position of each feature. This was done by walking around each feature and taking readings at changes in direction. The data that were collected from the GPS were the Easting, Northing, Altitude and Standard Deviation of each position. The features that were found were predominantly moraines, kettle holes and kettle lakes. These GPS points from the western and eastern sides were plotted individually on graph paper and shrunk down using a plan variograph. These two smaller maps were then put together and using tracing paper, were copied to make one large map of the entire area. To compare the maps which were drawn by hand, the data was also used in Microsoft Excel to create one map of the entire area. GPS is used frequently in mapping and surveying (Kaplan, 1996) and provided an excellent tool for this project as the information collected was accurate enough to create a map of the valley. The Abney Level was used to measure angles over the moraines so that a cross profile of all the moraines could be developed. Data to create eight cross profiles were collected, making up four profiles for the western and eastern sides of the valley. The Abney Level measurements were then put into Excel and a computer equation was used so that a cross profile could be formed.

The majority of the moraines found in the valley were terminal moraines. These spread across the western and eastern sides of the valley and are dissected by the
River Jökulsá. Terminal moraines are formed by the glacier advancing down valley and pushing all the debris that gets stuck in its path out of the way. This debris is then left behind when the glacier retreats or melts. Terminal moraines, therefore, show the maximum extent of the ice front (Clowes and Comfort, 1982). Most of the moraines in the valley were terminal moraines and show Sólheimajökulls maximum extent. From the statistical tests described in the results chapter, there is no significant difference in moraine size the further away from the glacier they are found. This could be explained by the moraines being relatively young and have not all been actively weathered enough to prove if they are fresh or subdued moraines. Dugmore (1989); Jaksch (1970); Jaksch (1975) and Kirkbride and Dugmore (2001) have all dated these, and various other, moraines by using teprochronology and lichenometry to find their age. However, using lichenometry is not always the best approach because it is restricted in temporal range (Kirkbride and Dugmore, 2001).

On the western side of the valley, circular moraine features were discovered. There were three present in very close proximity to one another. These moraines are still not entirely understood but there are several theories as to how they form. Ebert and Kleman (2004) provide a new hypothesis to the formation of circular moraine features. These moraines are explained by the hypothesis that they are formed by dead ice blocks becoming entrained in the ground. As these blocks of ice melt, the debris trapped inside slides down the ice and forms a circular moraine pattern. From observation in the field, and the use of photographic analysis, it can be seen that these moraines were found between terminal moraines. That means that they must have formed before the last glacial maximum. It is difficult to prove this theory, however, as the River Jökulsá has caused extensive damage to the valley and moraine features as a whole. It has washed away many small sections and caused flattening of
other areas. Several jökulhlaups have also contributed to the damage to the moraine systems in the past.

Fluvial action has contributed significantly to the structure of the moraines on the western side. Moraines in this area have not only been dissected by the River but evidence was found to support the idea that there had once been a large kettle lake or river feature present. This evidence was the presence of water loving vegetation, as well as the geomorphology of the land. The moraines, found at GPS point 05801397045808, were formed in the shape of a meander of a river. It was thought that this was just the natural formation of the moraine, but on closer inspection, it was found that it was very likely that this area had once been part of the river channel. Vegetation present in the area was also found around the edges of the nearby kettle lakes, as well as in boggy areas of the valley. The vegetation found at this, and many other ‘boggy’ sites in the valley, was bright green moss and some small ferns. This vegetation is water based and so suggests the presence of a former river or kettle lake that over flowed and flooded the area nearby. This area is relatively close to a large gorge, from which a tributary of the River Jökulsá flows, and a small stream that could have swelled large enough to flood the moraine area.

Sólheimajökull is an actively fluctuating glacier that has created many interesting features in the past, and will continue to alter the landscape in its path well into the future. This project has created a map of the area, which has led directly to a better understanding of the moraines in the valley and how they were formed. The discovery of three circular moraine features on the western side of the valley has built upon an interesting theory of how they were formed. If Swithenbank (1950) and Ebert and Kleman (2004) are correct, the formation of these features in the Sólheimajökull
valley is quite momentous as they must have been formed during a jökulhlaup event and become entrained in the ground. This entrainment and melting of the dead ice block would have led to the formation of these circular moraine features, an uncommon occurrence in geomorphological terms.

Therefore, in conclusion to this project, many interesting issues have arisen and led to the completion of a new map for the Sólheimajökull valley. This geomorphological map will provide an accurate addition to the already available topographical maps and aerial photographs. Although these existing forms of cartographic documentation are outdated, they provide an accurate enough base for the geomorphological map to be related to.

This project has many implications for future research because it has created a map that many future and current researchers can use to their advantage. Many projects of geomorphological relevance can now be furthered because this map clearly defines the geomorphological features in the valley. The map that has been created can help develop all sorts of projects, not necessarily only geomorphological ones. By using tephrochronology and lichenometry, each moraine can be individually dated at shown on the new map.
Personal Thoughts

James Lawrie

“Iceland offered the opportunity to explore a new part of the world whilst undertaking scientific research. The expedition offered the opportunity to develop my team work skills and field research techniques. The country's culture and landscape was interesting and exciting, providing a new experience for the group. Being able to put the theory from the lectures into practice in an actual glaciated landscape was a great benefit to my university study and future career.”

Vicki Low

“This trip was a fantastic experience that provided me with the opportunity to not only research a unique country, but also develop relationships with my team mates. I not only had the chance to explore the glacial features of Heinabergsdalur and Sólheimajökull but to improve my team leading skills and research methods. Visiting Iceland was an amazing opportunity from which the memories will last a lifetime.”

Maria and Vicki with the Total Station at Heinabergsdalur
Judith McAllister

“Visiting Iceland was an invaluable experience for me. I loved working in a team and have gained both individual and team skills from the trip. The volcanic and glacial landscapes allowed me to accelerate my learning experience. Being an assistant allowed me to encounter a wide range of fieldwork techniques, which will help me greatly in my last year of university.”

Maria in the river at Heinabergsdalur
Maria Peoples

“The expedition to Iceland was a fantastic experience and gave me the opportunity to study in a diverse and unique landscape which developed skills that I can apply to my chosen career. I also feel that I gained on a personal level and these skills will be valuable to my future and life after University.”

Gillian Semple

“The expedition to Iceland gave me the opportunity to develop, further, my ability to work as a part of a team. The landscapes we encountered helped me to relate the knowledge gained in the lecture theatre to real-life examples. Acting as a field assistant allowed me to put into practice, on a much larger scale, some of the research methods I have learnt throughout my university career.”
Bibliography


