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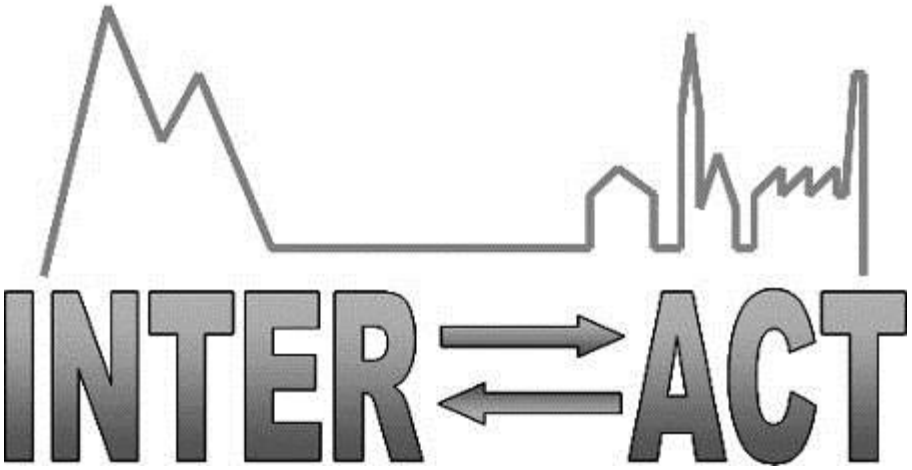

D8.1.1 - Information Packages and development of a Citizen Science program

Project No.262693– INTERACT

FP7-INFRASTRUCTURES-2010-1

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Dissemination Level		
PU	Public	X
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the Consortium (including the Commission Services)	
CO	Confidential, only for members of the Consortium (including the Commission Services)	

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1. Publishable Executive Summary

After consulting the INTERACT sites and the literature, it was decided that this deliverable would be more efficient by building on existing Citizen Science activities rather than developing its own, as the timespan of the INTERACT project may be too short to develop a new independent Citizen Science programme. Also, several EarthCache programmes at selected INTERACT sites were established. The Citizen Science activities have been followed in several places within the INTERACT network of research stations. The strategy of this work programme has been to link with local, national and international Citizen Science initiatives thereby encouraging the existing initiatives. We have communicated these experiences through the web site. The Citizen Science activities that are described in this report was successful in engaging volunteers and also in generating new information and data relevant to the INTERACT stations. One of the purposes of developing the Citizen Science activities within INTERACT was to engage the public and create a two-way dialogue between the scientific community and the public. The Citizen Science activities illustrated in this report provide examples of

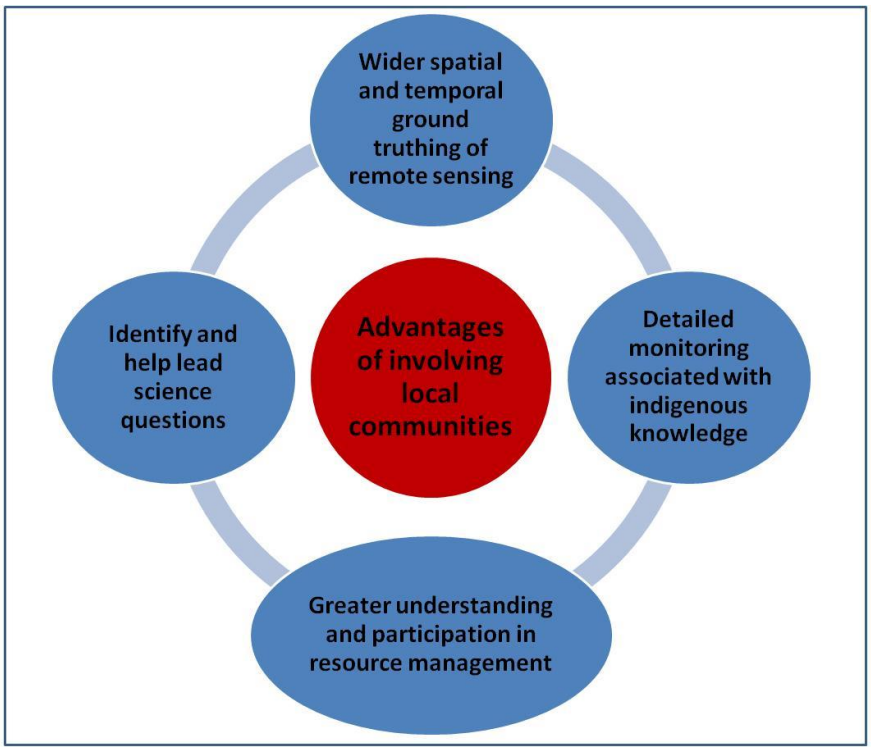
(i) a new one-off initiative (re-surveying tree seedling regeneration at the Environmental Change Network site in Cairngorms Scotland)
(ii) an on-going national program (bear monitoring at Bioforsk Svanhovd in Norway) and
(iii) historic monitoring of human memories (landscape change at Nólsoy in the Faroe Islands.

In addition, some INTERACT sites are being added to the international EarthCache programme, a Citizen Science activity that invites the public on hikes in the areas close to the INTERACT research stations. As this is not realistic for all stations, a number of stations have been selected for a first setup of EarthCaches in INTERACT. The sites chosen were Bioforsk, Svanhovd in Norway, the Environmental Change Network site in Cairngorms, Scotland and the Sornfelli station in the Faroe Islands. Based on these experiences there is good potential for further outreach to develop more EarthCache sites at other INTERACT stations in the future.

2. Information package and Citizen Science activities

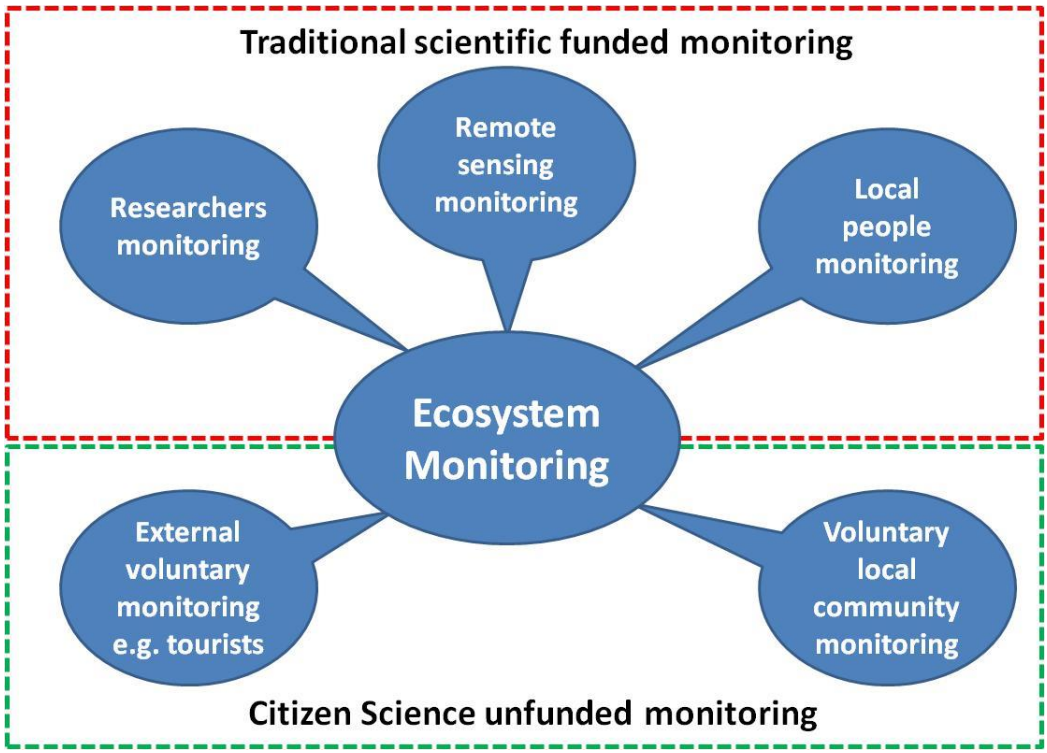
The INTERACT WP 8 has designed the strategy and content of the Wider Knowledge Exchange program including courses, lectures, excursions, mobile exhibition, exchange opportunities and other outreaching services.

During this work, the value of Citizen Science activities has been recognised. There are a number of advantages other than simply providing data to scientists (see figure below)



Within the INTERACT community a range of existing citizen science activities were analysed. The aim with these activities is to promote a two-way cooperation between the scientific community and the public where visitors are urged to learn about the activities and available information in INTERACT while also contributing to the scientific data collection.

A citizen scientist is a volunteer who collects and/or processes data as part of a scientific enquiry. The collection of this unfunded data collection fits within a wider scheme of funded data collection (see figure below).



Citizen Science is not new, - in fact these activities, - often focusing on subjects within environmental sciences, - go as far back as to the very beginning of modern science. The types and subjects of citizen science programmes have however grown during these past years. This is happening for many reasons, - one of them being a consequence of new technological possibilities. At the moment the technologies with smart phones and social media have given citizen science even more attention and interest (Silvertown 2009).

We initially looked into the possibilities to create a new diversified Citizen Science program within INTERACT with educational self-activating tasks where the public would be encouraged to carry out and report on local nature observation and monitoring in their local area. The idea with this was both to conduct outreach by engaging the public in monitoring and studying of the arctic nature, - while at the same time to open up for more data collection from volunteers. This concept was based on studies confirming that Citizen Science programmes are useful in educational purposes in order to advance scientific knowledge, and increasing scientific-reasoning skills among the public (Jordan, Gray et al. 2011).

A number of Citizen Science projects have been very successful in advancing scientific knowledge in various ways. Volunteers that have participated in these Citizen Science projects have contributed with a vast quantity of data about for instance species occurrence and distribution

around the world. It is important to most citizen science projects to also help participants learn something about the subject that they are observing. Even better if they are able to experience the subject first hand and learn about the process by which scientific investigations are conducted. However experience has shown that developing and implementing public data-collection projects that are useful to science as well as to education require a lot of sustained effort (Bonney, Cooper et al. 2009).

Experience has documented that it takes time and adjustments to develop a working Citizen Science programme (Conrad and Hilchey 2011). INTERACT may not be able to provide a time span longer than till the end of 2014, and according to these studies this timespan may be too short for an new independent Citizen Science programme. One of the reasons that the Citizen Science activities can face difficulties is the need for a rigorous scientific protocol for collaboration among scientists and the public This is something that often demands adjustments and may cause conflicts between scientific goals and the motivation of participants (Jordan, Gray et al. 2011; Shirk, Ballard et al. 2012).

Our review of Citizen Science programs (see reference list) showed that we would secure a longer time span as well as get a more diversified selection of logging activities within Citizen Science activities if we joined existing programmes which already are being used at various INTERACT sites or others that have been developed on a local, national or international scale and that are relevant to INTERACT.

Based on these conclusions we have chosen to adjust the initial plan of building a new specific standalone INTERACT network Citizen Science programme and rather encourage site specific activities and links to existing Citizen Science programs that have been working for a period of time. Some of these programmes are in use at INTERACT-sites while other programmes that we promote are national and international Citizen Science programmes that have specific relevance for the INTERACT network.

3. Citizen Science on the INTERACT web site

Citizen science is the involvement of volunteers in science. It is not new - keen individuals have been helping professional scientists with surveys and other studies for many years. In many countries, our current understanding of wildlife and the wider environment is due in large part to the efforts of amateur naturalists and enthusiastic volunteers.

3.1.Citizen Science in action

We have developed a section on the INTERACT website concerned with citizen science. The section is called "Citizen science in action" (**http://www.eu-INTERACT.org/outreach2/citizen-science-in-action/**).

The pages are intended to provide a developing resource for anyone interested in taking part in, or setting up, a citizen science activity in the Arctic or sub-Arctic.

Working in northern latitude regions can often present unique challenges but by sharing ideas and experiences about citizen science programmes we aim to encourage more research stations to provide high quality opportunities for citizen science.

The experiences of INTERACT station managers in relation to citizen science are being shared through this section of the website. Links to external programmes and other resources are being provided for anyone wishing to take part in, or develop, a citizen science programme.

In this section three contrasting examples of citizen science are highlighted (i) a new one-off initiative (re-surveying tree seedling regeneration in Scotland) (ii) on-going national program (bear monitoring in Norway) and (iii) historic monitoring of human memories (landscape change in Faroe Islands.

3.2. Citizen Science project: Quantifying tree regeneration in the Allt a' Mharcaidh catchment, Cairngorms, Scotland

The main ingredients of a citizen science project are a desire by both scientists and members of the public to research an interesting question with scientific rigour. This was the starting point of the partnership between Jan Dick of the Cairngorms INTERACT site in Scotland and a group of dedicated environmentalists, **Highland Facilitator Team**.

They held a joint awareness day on Thursday 19th July commencing at Badaguish Outdoor Centre, a resource funded by the Scottish Highland Council to encourage local people to connect with nature. The aim of the meeting was to develop a new citizen science programme. Jan presented the basic rationale of the project to quantify the regeneration of trees in the Allt a' Mharcaidh (pronounced 'Alt a Varcay') catchment to the organisers of the team while the younger members of the team went on a bike ride. In total five members of the team attended the first session: Justine Robertson and Amy Robertson, joint Coordinators of Highland Facilitator Team; Barbra Coull, Highland Facilitator Team Administrator; Michael Munson, Volunteer Youth Leader; Michaela Severin, Community Connecter for Inverness working for the charity Health and Happiness in the Highlands and Susan Ritson, Rural Skills Teacher at Charleston Academy.

Following a **presentation** it was agreed t this project would be an ideal vehicle engage the youngsters providing an ortunity for them to learn more about nce and providing very valuable data ch will help manage the remote wild ds which are part of the **Inversh**ie **and hriach National Nature Reserve** ned by Scottish Natural Heritage. ne of the members of the team have sical disabilities but Jan explained that y could still participate by using nputers. There was always a need for computer skills when conducting science as

the data would need to be analysed and she was very willing to teach group members the basic statistics which would be required to determine the rate of seedling regeneration and determine the factors which significantly influenced the establishment of tree seedlings on the site.
Following lunch Jan explained the project to the youngsters. With the aid of tree samples she asked them to identify the four dominant tree species they would need to be able to identify: they identified all four correctly, one more than the team leaders had managed in the morning session! The group then headed to the field site where Jan explained how to measure the trees. The team discussed the associated data which would be needed e.g. altitude, distance from seed source, ground vegetation etc. The youngsters agreed that they were interested in the project so preparations have started to turn this exciting idea into a fully fledged citizen science project. (http://www.eu-INTERACT.org/outreach2/studying-tree-regeneration-in-scotland-a-citizen-science-project/)

3.3.Citizen Scientists contribute data: Brown bears from an INTERACT site plays important role in climate change studies

With the genome from a triplet of bears, scientists hope to understand adaptation to climate change. The National Carnivore programme in Norway is a successful citizen science programme.

Photo: Jan van der Straaten, Saxifraga Foundation

A male brown bear originally from near the INTERACT station of Bioforsk Svanhovd in Norway is at the cutting edge of climate change research. His genome has just been sequenced and it is hoped that comparison with the recently released genome sequences of polar bear and giant panda could ultimately be the key to identify genes that are relevant for environmental adaptation.

The work was done in collaboration with the Biodiversity and Climate Research Centre (BiK-F) in Frankfurt am Main, the Norwegian research institute Bioforsk and the Chinese genome-sequencing institute BGI. Prof. Axel Janke, head of the research team, says: "With the entire genome sequences of those bears, we have an incredible resource at hand to understand the genetic basis of adaptation to different climates. The genome sequences will also prove an invaluable resource to study other aspects of bear biology, and will help us to better understand and protect those fascinating animals."

Snorre B. Hagen of Bioforsk Svanhovd´s Research Station said to INTERACT members at their recent station manager forum that "It is fantastic to be part of this international team as we are a small group working mainly at the national level on management and monitoring issues". The National Carnivore programme, run by the Norwegian Directorate for Nature Management, is a very successful citizen science programme because the citizens send scat and hair of brown bears which they then analyse for DNA at Bioforsk Svanhovd so that every individual is identified. "This allows individual bears to be identified, and their home range to be determined, without disturbing the bears", commented Mr Hagen. The monitoring data can be found on the web and citizens can

see their results and learn about the bears in their area. Because INTERACT is making this example of Citizen Science throughout the whole of the Arctic on its web site, similar studies may be stimulated.

http://www.eu-INTERACT.org/en/topmenu/news/nyhet/article/brown-bear-from-an-INTERACT-site-plays-important-role-in-climate-change-studies-11/

http://www.rovdata.no/Brunbj%C3%B8rn/Bestandsstatus.aspx (norwegian)

3.4.Citizen Scientists use local knowledge to help address environmental issues

The land bridge between the north and south of the island of Nólsoy, Faroe Islands, is disappearing because of sea erosion and increased sea level. The 70m wide land bridge, is part of the village and its disappearance poses a threat to the community.

Staff at INTERACT partner, Jardfeingi, interviewed ten elders in the village (aged between 60 and 90 years of age) about this erosion. This revealed the rate at which the bridge is eroding, and helped guide further field work, which can lead to a management plan.

In this work many of the villagers volunteered with finding images and information that could add to the understanding of the environmental change that had happened here over the past many

Example of photograph from the village of Nólsoy, which was collected by volunteering villagers.

centuries.

This local initiative organized in the village in order to collect historic data, revealed historic photographs that pinpointed environmental change since the 1930's.

Information and photographs of this kind as well as initiatives of this kind engage citizens in scientific work and is very helpful to scientists since most detailed maps and aerial photographs were of much younger date. Aerial photographs for instance only go as far back as to the sixties and late fifties.

4. Geocaches / EarthCaches and INTERACT

In addition to being linked by virtue of their northern latitude INTERACT sites also provide excellent examples of interesting geomorphology. This forms a window for outreach, where the public can learn about the environment of the sites, - either by going on hikes and actually visiting these places, or by learning from the web sites.

The information on the INTERACT website has been linked to the Geocache website and other popular out-of-doors portals. This is providing various ways for the public to discover and contribute to INTERACTs's wealth of information. Since these activities have been launched, they are expanding and developing during the period of the project and will continue beyond. This reflects the interest and engagement within the public as well as within the scientific community in INTERACT.

The intention with this is to encourage educational activity by enabling the public to learn about various areas in the Arctic, conduct loggings to answer questions asked and INTERACTively report findings. The outdoor monitoring activity has been organized as EarthCache-sites within the popular Geocache GPS global network. Three sites have so far contributed to the EarthCache website.

Launching Earth Cache sites of INTERACT

4.1.1.INTERACT EarthCache sites

1) A glaciated land surface on the Baltic Shield in the arctic

EarthCache at Bioforsk, Svanhovd. Coordinates $69^0$27’15.89”N, $30^0$02’14.17”E

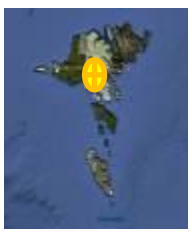
2) Subarctic environment and an ocean that disappeared

EarthCache at Environmental Change Network, Cairngorm, Scotland

a. EarthCache 1: $57^0$6’21.16"N and $3^0$53’11.96"W.
b. EarthCache 2: 57° 7'1.81"N, 3°50'59.86"W

3) The opening of an ocean

EarthCache at Sornfelli, Faroe Islands. $62^0$05’02.92”N, $6^0$56’16.93”W



4.1.2. INTERACT EarthCache at Bioforsk, Svanhovd

Educational hike: A glaciated land surface on the Baltic Shield in the Arctic

You have entered the Bioforsk Svanhovd station which is part of the INTERACT network of monitoring sites and field stations.

Coordinates 69°27'15.89"N, 30°02'14.17"E

The Bioforsk Svanhovd Station is in the village of Svanvik in the Pasvik Valley in Finnmarken in Northern Norway. The station is 400 km north of the Arctic Circle on the western side of the Pasvik River which draws the border between Norway and Russia.

The Bioforsk Svanhovd Station has a visitor's centre, where you can see an exhibition explaining the geology and ecology of the Pasvik area and national park.

In this area we find very old rock with an age of 900 million years. On the Russian side some of the rock dates to 3500 million years. The region is part of an archaic shield, called the Baltic Shield. This is a remnant of very old Earth surfaces. Some of the common rock types in the area include granite and gneiss as well as other types of

metamorphic rock. Special minerals have also been found in this region, - such as gold, diamonds and nickel.

During the ice ages the area was covered by up to 600 meters thick ice. Signs of glaciation, such as glacial erosion and abrasion can be found all over the area. Much of the area is covered by a relatively thin layer of till. Large boulders lie all over the area, being glacial erratics deposited by the ice.

The Pasvik Valley is part of the northern boreal zone. The northern Taiga region of Siberia reaches all the way to Pasvik.

Logging:

1) Outside the main entrance to the station and in the pond in front of the building, you find some large boulders. Describe these rock types and try and find out if some of them are part of the old Baltic shield. Mail the answer.
2) The water of the Pasvik river flows in the same direction as the glaciers during the last ice age. From where you are standing at the moment, can you point out the direction of the ice movement. Mail the answer.
3) Look around and see if you can observe what is being monitored at this place at the moment. Make a note of this and mail the answer.
4) In the mail please tell us how many are in your group

The Bioforsk Svanhovd is part of the circumpolar arctic network of monitoring field stations of the INTERACT project. Read more about the project: www.eu-INTERACT.org

There are more EarthCache sites to catch within the INTERACT network, so explore these.

You can learn more about the Pasvik region and the Bioforsk Svanhovd station at **http://www.eu-INTERACT.org/field-sites/svanhovd/** and at **www.svanhovd.no**

4.1.3. INTERACT EarthCache at the Environmental Change Network, Cairngorm, Scotland

Educational hike: Subarctic environment and an ocean that disappeared

Geological timescales vary in magnitude. With some processes we look at scales of hundreds of millions of years, while with other processes we look at much shorter time scales of only days and years.

This EarthCache site looks at change on various time scales and the cache is divided into two parts and two caches. The first site, placed by the public road, looks at the long geological scale of change of this region, while the second cache, placed at the end of a 3 km hike along a narrow road with restricted car access, looks at environmental change today based on measurements for a period of a few years.

Let us begin with the long time scale of hundreds of millions of years. The Cairngorm Mountains in central Scotland are a high granite plateaux forming the largest mountain area in Britain. The highest mountain is Ben Machdui, 1309 m. The site you are entering here is part of a nature reserve within the Cairngorms National Park. (http://www.nnr-scotland.org.uk/invereshie-and-inshriach/)

At these two EarthCaches we can observe the extraordinary changes these landscapes have witnessed over a long geological past of some 700 million years. And as these changes continue today, they are now being monitored. At EarthCache 1 we discuss the large scale landscapes and the long scale geological past. At the second EarthCache site we present the present day changes of the environment and the monitoring programme of the Environmental Change Network station.

Map of the two EarthCache sites at the Environmental Change Network site in the Cairngorm, Scotland.

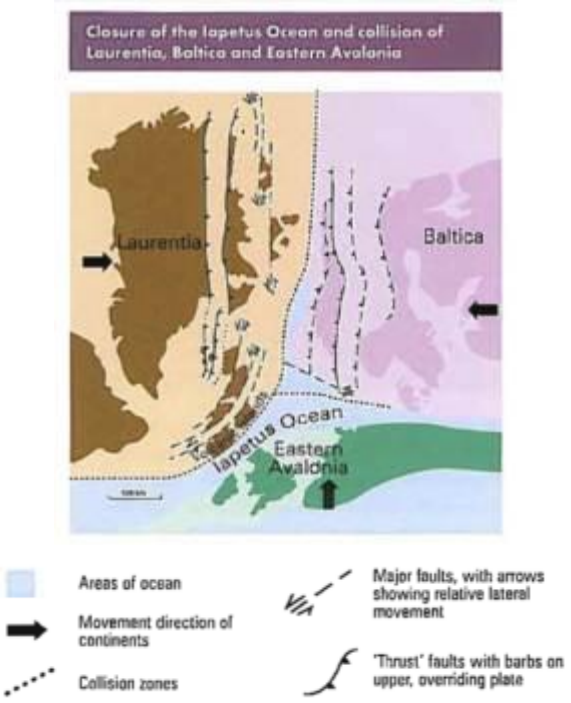
Cairngorm EarthCache 1

You find the first EarthCache just after a narrow road crosses the cattle grid and a dirt road at the coordinates: $57^0$6’21.16"N and $3^0$53’11.96"W. Find a place where you overlook the lowland as well as have a view through the woods towards the hillside of the mountain to your southeast: Creag Mhigeachaidh with an altitude of 742 meters above sea level. The steep hillslope is partly covered by debris which in places has been modified by snow avalanches.

At this place, looking at the lowland and the Cairngorm Mountains you stand on the brinks of a closed ocean at the roots of a disappeared mountain chain.

Overlooking the lowland

View through woods to the mountain

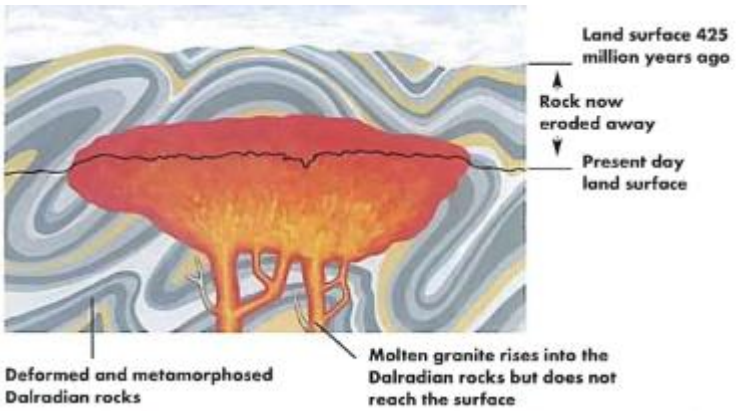


Let us begin by looking at the lowland. These are the remnants of an ocean, the Iapetus Ocean, that opened around 800 million years ago and closed again some 300 million years later. Underlying the lowland is a rock called Dalradian, which is a deformed and metamorphosed sedimentary rock. These sediments were first deposited in the coast where the new Iapetus Ocean opened. The ocean became large, - resembling for instance the Atlantic Ocean. A few hundred million years later the tectonic plates collided and the Iapetus Ocean closed up again. The closing of an ocean and formation of a mountain chain we can see today, when we look at the

Mediterranean Ocean and the Alps. Looking at it this way the Cairngorm Mountains at this stage in some ways resembled the Alps and the Himalayas.

You have been looking at the plains of the lowland. Now turn around and look the other way: at the mountain hillside of the nearby Creag Mhigeachaidh. When the continents collided and the Iapetus Ocean closed, a molten magma of granite formed deep within in the mountain chain a few kilometres below the surface. This happened about 427 million years ago.

The following million years the mountains eroded away and this area became a low relief upland area. The result of the erosion was that the rock above the granite mass was eroded, so the granite



When the continents collided and the Iapetus Ocean closed, a molten magma of granite formed deep within the ground. The unroofed granite form the present day land surface of the Cairngorm mountain.

formed the surface as it still does today. About 65 million years ago a new ocean formed west of Scotland, - the Atlantic Ocean. The Cairngorm mountain area was uplifted again and mountain plateau surfaces formed.

About 2.6 million years ago dramatic climate changes began. The Earth witnessed repeated climate changes alternating between ice ages and warmer interglacial periods. During the ice ages the Cairngorm Mountains were covered by numerous glaciers many times. We see the results from these processes in the landscape today with deeply eroded valleys and troughs, while on the high plateaux the ice was thin and frozen to the ground, resulting in much less erosion. On these plateaux we may see tors, which have survived from the preglacial period.

The mountain climate today is cold temperate to subarctic resulting in a rich variety of periglacial landforms, such as blockfields covering the mountain plateaux.

What may the future climate and environmental changes bring? We may get a hint from the monitoring facilities at the nearby Environmental Change monitoring station (**http://data.ecn.ac.uk/sites/ecnsites.asp?site=T12**), which will be presented at the next cache.

Logging task:

- Make three drawing
    - Drawing 1: Imagine what it looked like if you were standing on the coast line to the Iapetus Ocean, - 400 million years ago.
    - Drawing 2: Imagine what this place could have looked like 300 million years ago when the ocean had disappeared and you were standing on top of the mountain chain that formed by the collision of tectonic plates.
    - Drawing 3: Imagine what this place looked like 20.000 years ago when this whole area was covered by ice, and the mountains had been worn down, - only leaving the Cairngorms.
- Look around and see if you can observe what is being monitored at this place at the moment. Make a note of this and mail the answer.
- In the mail please tell us how many are in your group

The Environmental Change monitoring station at Cairngorm is part of the circumpolar arctic network of monitoring field stations of the INTERACT project. Read more about the project: www.eu-INTERACT.org

There are more EarthCache sites to catch within the INTERACT network, so explore these.

Cairngorm, EarthCache 2

In order to reach the next cache you hike down the dirt road along the Forestry Commission track for about 3.1 km (1.9 miles).

Walk from the first earthcache site past the road barrier and head northeast along the dirt road. You

Note the sharp hills between the trees.

The bridge

will find a road to the right after a little over 600 m (670 yards). Just pass it and continue straight ahead. At a road juncture at about 1,8 km (1.1 miles) take a turn right and follow this winding road for about 1.3 km (0.8 miles) until you reach the destination at 57° 7'1.81"N, 3°50'59.86"W.

Notice the landscape along the road, as you come closer to destination. These landscapes show evidence from glaciation. On the first stretch of the road you may be able to see remnants of lakes

about 500 metres to your left. These are kettle holes, which are glacifluvial hollows from massive melting of ice. The tree coverage gradually becomes more dense and in between the trees you can see abrupt hills and hollows with no outlets. These landscape features are glaciofluvial deposits originating from retreating ice during the deglaciation period.

The last few metres of the hike are on a path through dense woody vegetation towards a stream. Follow the path to the little bridge crossing the stream. Stand on the bridge and look at the landscape of the stream where the water has eroded into the bedrock.

You have now entered the monitoring site at Cairngorm Mountains of the Environmental Change Network. Monitoring stations measuring weather, hydrology and other various parameters, including taking photographs, are placed in this area.

The stream you are looking at drains an area of 1000ha where the minimum altitude is 320 m and the highest altitude is 1110 m.

A part of the monitoring of weather and hydrology is done at the monitoring station close to the bridge, while another part of the measurements is done at the automatic weather station on Craig Follais, about 680 m above sea level. You can read more about the monitoring activities here: **http://www.eu-INTERACT.org/field-sites/cairngorm/**

This Environmental Change Network site was established in 1998.

Logging:

1) Find a safe place where you can come close to the stream. Look at what kind of rocks you find in the stream. Take a picture of two different rock types and mail it to me.
2) Can you estimate how wide the stream is below the bridge. Include your estimate in the mail.
3) Look around and see if you can observe what is being monitored at this place at the moment. Make a note of this and mail the answer.

4) In the mail please tell us how many are in your group

The Environmental Change monitoring station at Cairngorm is part of the circumpolar arctic network of monitoring field stations of the INTERACT project. Read more about the project: www.eu-INTERACT.org

There are more EarthCache sites to catch within the INTERACT network, so explore these.

You can learn more about the Cairngorms:

http://data.ecn.ac.uk/sites/ecnsites.asp?site=T12

www.fettes.com/cairngorms/

www.scottishgeology.com/

www.snh.org.uk

www.cairngorms.co.uk

4.1.4. INTERACT EarthCache at Sornfelli, Faroe Islands

Educational hike: The opening of an ocean

Note of caution: If you arrive by car you leave the main road at 62005'02.92"N, 6056'16.93"W and turn up the steep and narrow one lane road towards the summit of Sornfelli. There are no signs and very little traffic, but be careful. In addition remember that if it is freezing or there is snow, there will be gradually more snow and more freezing temperatures the higher you come up the mountain. You should only attempt to reach this site if the weather permits.

Entering the Sornfelli site

(coordinates of the EarthCache: 62004'36.83"N, 6057'32.29''W)

You are entering the Sornfelli site, where there has been monitoring of environmental parameters, such as weather, plants and fauna since 2000. The Sornfelli site is part of the INTERACT network, the ITEX network and other international environmental networks.

Landscape reveals signs of volcanic activity and glaciation

On the hillside about fifty meters above the road you find the fenced-in areas where part of the monitoring is being carried out. From this place you get an excellent view over the region of the central part of the Faroe Islands (providing it is a clear day).

Looking to the southeast you see the fiord Kaldbaksfiord with its distinct u-shaped valley profile which is characteristic for a glaciated mountain landscape. Both valley sides are relatively steep,

while the valley floor is flat and wide. The fiord seems to form a winding road towards the open sea. Looking up the valley sides on both sides of the fiord you find distinct horizons forming black lines in the landscape with a dip that has a direction out towards the fiord.

Built by volcanic lava

What we are looking at is a landscape built by basaltic lava flows from volcanic activity some 50 million years ago. Each of the black lines that are so clear to see in the mountain sides represent a volcanic eruption where basaltic lava ran over a large plateau. Contrary to the land we look at today the early basalt plateau must have been quite flat. The volcanic activity began when the North Atlantic Ocean opened and split apart Europe from Greenland. After a few million years the Faroese area became volcanically inactive when it moved eastwards on the tectonic plate away from the volcanic rift. The volcanic rift is still very active, - this is where we find Iceland today.

Deeply eroded by glaciers

The reason that we can look into the volcanic past of the Faroe Islands is that the land area is so deeply eroded from numerous glaciations during the past few million years. A relatively large glacier filled the Kaldbaksfiord beginning in the valley bottom below the eastern part of Sornfelli. During maximum glaciation the glacier probably filled the whole valley and fiord covering the low mountain regions while reaching up towards the higher mountain tops in the area.

Here where you are standing is quite special in this context. You are standing close to a mountain summit that was not covered by the ice, but stood as an icefree region in the sea of ice in all directions. Such a place is called by a Greenlandic term: nunatak, defined as an exposed, often rocky element of a ridge, mountain, or peak not covered with ice.

Arctic Faroe Islands today

A part of the Sornfelli station is located within the fenced-in areas above the road close to the summit of the mountain. The rest of the monitoring site is located on the summit of the Sornfelli Mountain, 726 meters above sea level. This part of the site is not accessible to the public.

This mountain region demonstrates the arctic environment of the Faroe Islands today. The average annual temperature at this place is only a couple of degrees Celsius above freezing point so we are well within the zone of subarctic climate where the average temperature of the warmest month, July, is below 10 degrees Celsius. Another important aspect of the climate which is reflected by the

esses in the landscape today
nic character of the climate,
e is little difference between
r and winter temperatures.
s are not very cold and the
o not get warm.

nent the landscape represents
ects of a subarctic mountain
nt. One of the features in this
nt is frequent freeze-thaw
sing sorted ground and
of the top layers of the soils.
with loose material and no

vegetation you may find sorted ground formed as polygons, with fine material in the centers while the lines of the polygons are drawn by coarse stones. On slopes the sorted ground forms lines with alternating fine and coarse material.

Monitoring change today

The landscape we are looking at has gone through many changes, from being a volcanically active area, to later being worn down by repeated glaciations in a high arctic environment. The changes continue today, - and are being closely monitored.

If climate change leads to a slightly lower temperature at a place like this, we will begin seeing patches of ice surviving the summer and patches of permafrost in the ground. If climate on the other hand gets warmer we may see the lower zones of vegetation expand to the barren summit area. This may cause changes to the processes that are active today.

You can find more information on the activity at the environmental monitoring site at : www.eu-INTERACT.com

Logging task

1) Find an example of sorted ground with polygons or sorted ground with stripes. Send a picture of what you find.
2) Look around and see if you can observe what is being monitored at this place at the moment. Make a note of this and mail the answer.
3) In the mail please tell us how many are in your group

The Sornfelli station in the Faroe Islands is part of the circumpolar arctic network of monitoring field stations of the INTERACT project. Read more about the project: **www.eu-INTERACT.org**

There are more EarthCache sites to catch within the INTERACT network, so explore these.

5. Next steps

The activities developing the information package and the Citizen Science activities, including the EarthCache sites, have encouraged cooperation between the scientific community and the public and between INTERACT station mangers. It can be expected that further use will enhance the effect and benefit of these activities.

Citizen Science activities conducted at Bioforsk Svanhovd in Norway, at the Environmental Change Network site in Cairngorms Scotland and in Nólsoy the Faroe Islands have shown that valuable information can be gathered with these kinds of activities. It has also been demonstrated that the volunteers participating in these activities value the opportunities. Following this experience the strategy will be followed in order to expand the citizen science activities in INTERACT as well as other outreaching activities. These activities have included small courses and lectures, - and as the information packages will be used and developed they will form the basis for further outreach activities.

The EarthCache sites that have been developed so far have been set up at Bioforsk Svanhovd in Norway, at the Environmental Change Network site in Cairngorms Scotland and at the Sornfelli station in the Faroe Islands. These sites will invite the public to hikes in the vicinity of the station, - where it is possible and realistic. This work has paved the way for creating more EarthCaches at other INTERACT stations in the time to come.

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