THE ALPINE GARDEN SOCIETY
CENTRAL SUSSEX GROUP

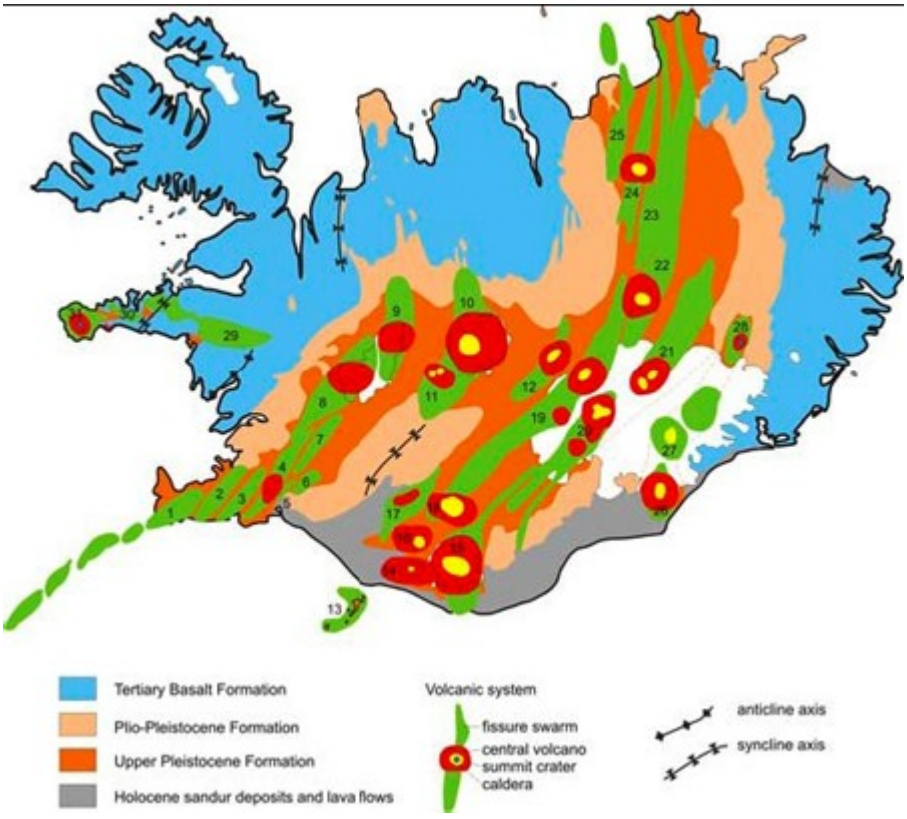
NEWSLETTER JANUARY 2008

MR. KEITH MOORHOUSE
ICELAND: A LAND SHAPED BY FIRE AND ICE AND THEIR IMPACT ON ITS FLORA

Initially, Keith was reluctant to visit Iceland, but he found that there was a wide variety of plants in habitats related to its fascinating landscape. Greenland lies 180 miles to the west, Norway 625 miles to the east and is a two hours flight from England. 300 miles from west to east, 190 north to south with an area of 39,756 square miles and a coastline of 3700 miles. Of its population of just over 300,00, two thirds live in the region of its capital Reykjavic in the extreme south-west. 51% of Iceland is wasteland, 12% ice-caps, 11% old lava fields, 4% free draining volcanic ash carrying largely denuded vegetation, 3% lakes and rivers and of the 20% given over to agriculture, only 1% is cultivated and restricted to the coastal plains. Keith's completed his 1450 mile journey around the entire perimeter and with one trip towards its centre ,in 15 days from the 29 June.

Geology

The talk began with an insight into Iceland's geology. Unlike Greenland, it is one of the world's newest land areas, sitting astride the Mid-Atlantic ridge which is separating at about 1.8cm./year, the North American tectonic plate moving westwards and the Eurasian plate moving eastwards. Its rocks were formed within the past 25 million years and the oldest rocks exposed on the surface



are only 16 m.y. old and are at the westernmost tip of the country. The spreading also results in the formation of vertical dikes that can become pathways for magma to the surface. At the surface these rifts appear as swarms of linear volcanic fissures 20km wide by 50-100km long which were formed from an elongated magma reservoir at over 10km depth and such effusive lava flows may continue for years. Due to it's tectonic setting, volcanism is very pronounced in Iceland. The eruption rate during historical times (since 830) is an eruption every five years or so, the last being in Grímsvötn in 2004. The volcanic zones are split up into volcanic systems, typically represented by a central volcano and it's associated fissure swarms. Plants find it hard to colonise lava, where grey and green mosses are pioneers. Altogether there are around 30 active volcanic systems in Iceland. which are associated with earthquake activity. The type of magma depends on the percentage of silica, felsic ones are rhyolites forming crevices, mafic ones with blocky smooth surfaces. During subaerial conditions the predominant basaltic eruption products are lava flows from fissure eruptions or gently sloping shield volcanoes. The fissure eruption lavas in particular tend to smooth the topography of the rift zone floor. In contrast, sub-glacial fissure eruptions and sub-glacial "shield volcanism" produce high and narrow ridges and steep-sided table mountains, respectively.

Iceland lies over a plume of hot magma upwelling from great depths which has moved south-eastwards across Iceland over the past 20 million years and now lies below the Vatnajökull glacier. Here the eruption of the Grímsvötn volcano during a 13 day eruption in October 1996 formed a subglacial lake which on fracturing created a flood surge (Jökulhlaups) with huge blocks of ice, destroying bridges and the island's ring road in the south-east .Ice thickness above the 6-km-long volcanic fissure was initially 550–750 m. Only 2–4% of the volcanic material was erupted subaerially.

Volcanic activity brings not only eruptions but also geothermal activity. Large high temperature geothermal areas in the volcanic systems can be utilized for the production of electricity and hot water for central heating and bathing. Low temperature geothermal areas are widespread outside the active volcanic zones and are used for central heating and filling the numerous swimming pools that are littered across Iceland. In 2005, geothermal energy provided about 19.1% of Iceland's energy needs. One of a number of geothermal power plants is the 60MW at Kroflustod whose boreholes go down to 2000m where the rock temperature is at 340^0C.

There have been five glaciations over the period between 120 and 10 thousand years ago which have left their mark on the landscape – U-shaped valleys, striations in the rock,moraines and sandur plains, - glacial outwash of sediments deposited by meltwater at the terminus of a glacier. Glaciers and icecaps contain large amounts of silt and sediment, picked up as they erode the underlying rocks as they move slowly downhill and at the snout of the glacier, meltwater can carry this sediment away from the glacier and deposit it on a broad plain. The material is often size-sorted by the water run-off of the melting glacier with the finest materials like silt, being the most distantly re-deposited, whereas larger boulders are the closest to the original terminus of the glacier. Between glacial bursts, the sandur is usually criss-crossed by braided glacial rivers in normal flow.

In glacial periods, relict flora persisted on nunataks (summits standing above a surrounding ice-sheet). The Esjufjöll within the Vatnajökull is an example of such a refuge where it is believed that some 80 plant species can be found here. Many species were extinguished below the ice and as Iceland lies so far from both Europe and North America resettlement after the last glacial period is one reason that the number of species is low. Coarser plants are found at lower altitudes, arctic-alpines higher up with winter snow cover.

The itinerary

This began in the Snaefellsnes peninsula at the southern end of the Western Fjords with views of a black painted church at Budir, Olafsvik's harbour, ancient lava deposits at Gufuskalar being colonised by *Dryas octopetal*a, the Snaefillsjokull ice-cap and eroded lava fields, Hellnar, and mountains

Illustration 1: Snaefellsnes

Illustration 2: Almannag - fissure, braided streams

showing strata inclination, basaltic lava showing tensional cracks at Flokilandjr, the site of the Viking settler Arni Flokker. Above Dynjandi, July snowfields with open heathland, *Papaver radicatum* growing in roadside gravel, glacial alpine lakes and the Dyjandi Falls, a drop of 350ft. over basaltic rock. In Hrafnseyri, birthplace of John Sigurdson a campaigner for Icelandic independence from Denmark, its church and wooden buildings with turf roofs. Then northwards around the Western Fjords, Sandsheidi a glaciated valley on the north side of Dyrafjordur, glacial eratics and terminal moraine of an extinct glacier. The fishing villages of Bolungarvik and Osovor, an emergency shelter at Steingrimsfjardaheidi, the sharp pinnacles on Hrandangi seen from the Oxundalur Pass caused by two adjacent glaciers wearing away the mountain, Leirhnujujur a clay covered mountain brought about by chemical attach from fumeroles, steam vents with sulphur and gypsum deposits and mud pools.

Inland from the north coast and north east of Myvatn, black lava fields spreading into the distance from the 1975-84 Krafla eruption and the Kroflustod power station. A tephra (pyroclastic fragments) cone at Hverfjall, the church and tephra and ash deposits at Modrudalur.

On the Eastern Fjord coastline, we saw Seydisfjordur church with alpine lakes above, Fjardardalur with sheep grazing amongst shattered rock, thyme seemingly untouched by them, scree slopes at Hvalnesskridur and black shore sands, the Jokullsarlon lagoon, small icebergs and glacier. At Fagrifoss, a vertical basaltic dyke, the 25km long fissure craters at Lakagigar, the grey moss *Racomitrium lanuguinosum* colonising drier lava and green moss *R. ericoides* the wetter ones near caldera water level, the Svinafelljokull glacier snout and its glacial erratics and the Svinafellsjokull and Skaftfelsajokull mountains around Haftafell,.

Moving to the south coast, we were shown sea stacks and basaltic pillars at Reynir near Vik, basaltic columns, the rock arch of Dyrohoey Drangs, Reynir church, horses (which outnumber the human population) and the fertile plain of Myardalsjokull. Finally to the Geyser geothermal area with the Stokkur Geyser in the Haukadalur Valley - appearing first as a swelling bubble, which grows larger, erupts high into the air and ends with steam and hot water as it collapses.

Habitats and plant adaptations

The alpine tundras are fell fields with abundant rocky outcrops with low growing mounds and cushions, slow growing, with extensive root systems, brightly coloured flowers to enhance pollination and with no competition on these poor and immature soils. Here can be found hummocks of floriferous *Silene acaulis, Saxifraga caespitosa* with hairy stems and three pronged leaves, *Papaver radicatum* 5-6" tall, *Veronica alpina*, *Salix herbacea*, *Saxifraga hypnoides* with red stems and partially partially open flowers, *Arabis alpina* and *Sedum villosum* with hairy red leaves. On immature soils of moraines, huge spreads of *Saxifraga aizoides* and *Thymus praecox ssp. articus*, *Galium verum* and P*arnassia palustris*. Seen in snow hollows which last from autumn to early summer, *Cassiope hyp-*

Illustration 1: Gentiana nivalis

Illustration 2: Thymus praecox ss. acrticus

Illustration 3: Saxifrgga aizoides

Illustration 4: Cassiope hypnoides

Illustration 5: Saxifraga caespitosa

Illustration 8: Armeria maritima

Illustration 9: Lupinus nootkatensis

Illustration 10: Cardamine nymanii

noides with purple sepals, *Sibaldia procumbens* and *Alchemilla alpina*. On scree slopes arising from mass shattering of rocks where plants like *Thymus praecox ssp. articus*need need tap roots to anchor movement *T. Epilobium latifolium forma alba*, *Gentianella tenella* and *Rhinanthus minor* like wet river banks, water providing a means of seed dispersal. On river gravels, *Gentiana nivalis* less than 2" high, Thymus, Galium, *Trifolium repens*, *Viola tricolor* and growing everywhere *Silene uniflora* with its inflated sepal tube and colour variation. In wet places *Plantanthera hypoborea* and sticky *Pinguicula vulgaris*, *Ranunculus auricomus*, *Sedum acre* and the Cotton Grasses (actually sedges) *Eriophorum angustifolium* with drooping clusters of shaggy flowers and *E. scheuchzeri* with single flower heads. In drainage ditches, *Caltha palustris, Saxifraga stellaris,* stamens laid back and the non-native *Angelica archangelica*. Exposed heathland exposed to the full blast of cold winds leads to hummocks of *Silene acaulis* and large tussocks of *Cerastium alpinum*, *Armeria maritima*, *Dryas octopetala* and *Taraxacum ssp.* Dry hillsides are occupied by *Thalictrum alpinum*, *Armeria maritima*, both pink and white flowered seen close up, *Rumex acetosa*, suprisingly pretty when seen close up, *Cardaminopsis petraea* with very hairy leaves, pretty lavender flowered *Cardamine nymanii*, *Tolfieldia pusillla*, *Potentilla crantzii*, *Dryas octopetala*, *Erigeron borealis* and oddly, *Geranium sylvaticum*. Old, weathered lava flows form natural rock gardens with *Veronica fruticans*, *Pseudorchis albid*a and Dryas (at Gufuskalar). *Lupinus nootkatensis* with tight spikes of blue and purple. In dwarf shrub heath, *Arctostaphylos uva-ursi* and the Creeping Azalea *Loisleuria procumbens*. *Arenaria norvegica, Galium normanii*, and *Rhodiola rosea. Erigeron humilis* and *E. uniflorus* find volcanic ash plains favourable. Rock outcrops are home to *Saxifraga oppositifolia* and *Loisleuria procumbens*. On the seashores of eastern fjords, *Mertensia maritima* with grey foliage and flowers flopping on the ground, *Matricaria maritima*, the Sea Sandwort *Hokenya peploides* and *Saxifraga rivularis*. In grassy meadows where horses outnumber the population, *Prunella vulgaris*, another plant quite pretty close up, *Dactylorhiza maculata*, *Campanuula rotundifolia* and *Stellaria graminea.* The last slide was of *Papaver radicatum* and we were left marvelling how such a delicate plant with wafer thin petals could cope with such harsh conditions and still show off its blooms to such good effect.

Illustration 11: Silene uniflora

Illustration 12: Papaver radicatum

Well done and thank you Keith for a most instructive,well illustratederfj and pleasurable talk, linking plants with their habitats and the underlying geology. All the plant photos were taken by Keith and are among those we were shown.

RM.

Apologies for the delay in posting this newsletter – it's been an horrendous past two weeks!

MEETING 16 FEBRUARY 2.00 at 7.00

Mike Brett
Home and Away – a love of alpines