Lothian and Borders RIGS (Labrigs) is a working group of the Geomorphological Sites. RIGS stand for Regionally Important Geological and scientific, aesthetic and historical value to the local community. RIGS are sites chosen for their geoconservational, educational, and cultural values, and their potential to be used as teaching and research sites. Lothian and Borders RIGS Group and the British Geological Survey (Scottish Office) work together to identify and protect these sites.

Lothian and Borders RIGS (Labrigs) is a working group of the Edinburgh Geological Society. It consists of amateurs and professionals interested in producing information and educational materials about such sites with the aim of encouraging a wider appreciation of our Scottish earth heritage at all levels.

Contact your local RIGS group now, at no cost, and you could become involved in useful and interesting projects in the local area.

Our address is:
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Tel: 0131 667 1000

Meeting of Burns and Scott by Charles Martin Hardie.

The Scottish Borders James Hutton Trail, links locations associated with the life and times of James Hutton including sites of geological significance. The trail was initiated by Borders Foundation for Rural Sustainability in partnership with Marshall's at Slighthouses, the Thomsons at Nether Moinynut, Lothian and Borders RIGS Group and the British Geological Survey (Scottish Office). See www.james-hutton.org for more information.

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Sir John Clerk of Penicuik, Bt. for permission to reproduce the etching of the Leibnitz unification by John Clerk of Eldin, and to the Scottish National Portrait Gallery for permission to reproduce the Raeburn portrait of James Hutton.

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Text by Cliff Porteous and Mike Browne. Designed by Derek Munn.

Funding by Scottish Natural Heritage.

From the portrait by Sir Henry Raeburn

Lothian and Borders RIGS Group

James Hutton

A man ahead of his time
James Hutton: Founder of Modern Geology

James Hutton

In the 18th century, James Hutton (1726 – 1797) was a landowner, farmer, agriculturalist, physician, and an outstanding natural philosopher who was elected to the Royal Society of Edinburgh. Hutton, of course pre-dated photography so the only clues we have as to his appearance come from painting and sculpture, not all of which can be considered life-like.

Introduction

Scotland between the years of 1730 and 1790 enjoyed a spell of intense intellectual activity known as the Scottish Enlightenment - a unique period in history, one of optimism, improvement and discoveries in industry, commerce, agriculture, science and the arts.

James Hutton grew up during this period and made a considerable contribution to our understanding of Earth processes and of the immensity of Time. He was a landowner, farmer, agriculturalist, physician, and an outstanding natural philosopher who was elected to the Royal Society of Edinburgh. Hutton, of course pre-dated photography so the only clues we have as to his appearance come from painting and sculpture, not all of which can be considered life-like.

Processional frieze in the Scottish National Portrait Gallery. Left to right: Sir Henry Raeburn (painter), Lord Jeffrey (judge), Sir Walter Scott (novelist), John Hunter (surgeon), Robert Burns (poet) in striped waistcoat, James Hutton (geologist), Thomas Telford (civil engineer), James Watt (engineer, inventor of steam engine) and others.

James Hutton's Theory

The surface of the Earth is constantly being eroded and the products deposited in the sea. Hutton believed the sediments were then compressed, folded and uplifted, sometimes with volcanic activity, for the cycle of erosion to resume. He also said that earth processes of the past were similar to those occurring at present (‘perventid idee’ - Comte de Buffon 1790), and that the slow cycle was capable of repeating itself. He put it succinctly: “the result, therefore, of our present enquiry is that we find no vestige of a beginning - no prospect of an end.”

James Hutton Memorial Garden

This marks the site of James Hutton’s Edinburgh home on St John’s Hill in the Pleasance above Holyrood Road.

Memorial Garden Plaque

View of Salisbury Craggs from the Memorial Garden. A plaque at the entrance from the car park at Edinburgh University Centre for Sport and Exercise reads: - This memorial garden was constructed in 2001 for the University of Edinburgh and marks the site of the house and garden of James Hutton (1726 - 1797) at St John’s Hill. The garden contains a memorial plaque and five boulders (indicated on the key below) which illustrate two main themes of Hutton’s geological work. Hutton used the presence of granite veins in metamorphosed sedimentary schist in Glen Tilt near Blair Atholl to demonstrate that granite is an igneous rock and that it must have been younger than rocks it penetrated. The granite veins can be seen in the two boulders from Glen Tilt. The three other boulders are conglomerate from Barbour near Dunblane and are full of fragments of older rocks, demonstrating the continuity and cyclic nature of geological processes.

Memorial garden boulders. The two lower boulders from Glen Tilt came from close to the actual spot investigated by Hutton. They show granite veins penetrating the country rock. The upper boulder is full of fragments of pre-existing rocks from a previous cycle of erosion.

External Statue at the Scottish National Portrait Gallery, on the north-east Tower. Hutton is depicted with a hammer in his right hand and rock specimen in his left (sculptor David Watson Stevenson). On his left is John Hunter the renowned surgeon and anatomist. The building stone is red, wind-blown, desert sandstone of Permian Age (286-248 million years old) from Dumfriesshire.

Map showing localities associated with Hutton.

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Salisbury Crags Sill - Hutton's Section in Holyrood Park, Edinburgh

A key site in his new understanding of geology is at the south end of this escarpment formed by the intrusive dolerite sill that is over 300 million years old. Hutton associated ‘extreme heat’ as the agent of folding and uplift of strata. The question as to what produced the heat could not be answered at that time.

In Hutton's own words “We know that the land is raised by a power which has for its principle subterraneous heat, but how that land is preserved in its elevated station, is a subject which we have not even the means to form a conjecture.”

He believed that molten rock (magma) under pressure could be ‘intruded’ between or across layers of sedimentary rocks, sometimes reaching the surface as lava flows. He found evidence to support this in Holyrood Park. The photograph shows a section of the Salisbury Crags sill where igneous rock (called whinstone locally) has been intruded between sedimentary layers. Here at the base of the sill magma has forced its way into the underlying sedimentary strata. Such a dynamic contact feature is incompatible with the then contemporaneous view that igneous rocks "crystallised like salt from sea water".

North Newton shore, Arran 1787

Hutton discovered his first unconformity site in the summer of 1787. This site displays an angular unconformity between steeply inclined metasedimentary rocks of the Precambrian Dalradian Supergroup (600my. old) and the much younger sedimentary rocks of the latest Devonian / earliest Carboniferous Kinnesswood Formation (360my. old). The exposure is unusual in having a calcified “surface” in both series of rocks suggesting a long period of exposure of the unconformity surface in a hot semi-arid climate when the younger rocks started to be laid down.

Hutton’s farm at Slighhouses at Duns, Berwickshire.

At the start of the 18th century agriculture was still rather primitive in Scotland with heavy wooden ploughs, no hedges or fences, and a ‘runrig’ system of scattered strips of cultivation. Between 1697 and 1703 there were periods of famine in the land, and harvest failures. This farm and that at Nether Monynut, eight miles away were inherited by Hutton. From 1754 to 1767 he chose to live at Slighhouses. He set about enclosing and draining the land. He introduced new methods of crop rotation and ploughing, with modern ideas he had seen in practice in Norfolk and Flanders. During this time he never lost his enthusiasm for solving geological problems.

Slighhouses Farm is on Upper Old Red Sandstone sedimentary rocks (370my old) with a superficial cover of glacial till deposited during the last ice age about 27000 - 13000 years ago.

Hutton’s Marl Pit.

Hutton used Slighouses as a living laboratory to investigate agriculture and other natural history phenomena. The marl pit he created is still in evidence, and he wrote of using marl (limy mud) on his fields to improve crop yield. He was not always successful as some of the marl was not limey.

Dunglass Collegiate Church. (15th century Gothic)

This is the resting place of Sir James Hall of Dunglass, geologist and chemist, (1761 - 1832). He admired Hutton, while not accepting the enormous periods of time required for Hutton’s Uniformitarian view that geological history is a matter of ordinary forces and unlimited time.

Dunglass Church was completed in 1475, and is noted for its fine carved stone work and the fine stonework of its doors and windows. It is said to be the oldest church in Scotland still in use today.

Siccar Point near Cockburnspath 1788

Hutton believed that cyclic processes (similar to orbits in astronomy, and blood circulation in the body) operated in the Earth. He saw weathering and erosion denuding the land and producing sediments under the sea which then consolidated into rock. The cycle was continued through uplift with the necessary energy supplied by internal heat. He thought of the Earth as a dynamic heat engine capable of helping to drive the cycle. The most convincing proof of his cyclic theory was obtained on the Berwickshire coast at Siccar Point, the third of his unconformity sites which he visited with Sir James Hall and John Playfair.

Silurian sediments were laid down and consolidated into poorly sorted sandstones (greywackes). These rocks were uplifted, folded and eventually eroded. Deposition of fresh red sandstones took place during the following geological period of the Upper Devonian. The rock cycle continued, resulting in the present day picture. In this spectacular exposure, the gap in time represented by the unconformity is about 55million years.

Hutton’s, farm at Nether Monynut.

This farm rests mainly on Silurian sandstones and shales on the eastern flank of the Lammermuir Hills. The soil is thin and stoney, and the land rises to 300m above sea level.

Hutton roof, National Museum of Scotland.

Andy Goldsworthy’s four sandstone blocks invite us to look down through the layers of time and think of their formation from desert sands 270 million years ago, and yet again to the origin of the sand grains from erosion in periods even farther back in time.

Hutton’s grave in Greyfriars Churchyard Edinburgh.

His grave in the Balfour family vault in the section known as the Covenanters’ Prison was unmarked until November 1947 when a simple plaque was erected marking the 150th anniversary of Hutton’s death. In 1997 a Bicentenary International Conference was held in Edinburgh, a wreath laid, and a eulogy spoken by Professor Donald McAlpine which finished with these words:

“Today we have come to know that living creatures drift, that stars and galaxies are born, mature, grow old and die. We salute the memory of James Hutton, who opened our minds to these wondrous possibilities.”
Saltire

Hutton's Section

in Holyrood Park, Edinburgh

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He saw weathering and erosion denuding the land and the evidence of former uplift, a climate of extreme heat, volcanism, and the presence of fresh red sands as indicating regional effects of the Earth as a dynamic heat engine capable of helping to drive the cycle.

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In 1785, the Church held that the age of the Earth was nearly 6000 years. Bibles published in 1793 were annotated to that effect.

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