

In the steps of a master: following James Hutton around Scotland

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James Hutton is regarded in Britain as a founder of modern geological thought. We visited sites in Scotland which were important to him, some well known, but others less so. Many of these may be visited from the English Midlands in a pleasant series of weekend cross-border raids, or more leisurely and sensibly on a touring holiday.

After medical school in Leiden in 1750, Hutton never practiced medicine, but farmed at Slighhouses near Duns, Berwickshire, which is only a slight diversion from the A1 on the way north. In pursuing agriculture, he travelled extensively through England and the continent, and during these travels studied geology. Insight into his life at this time can be obtained by visiting the recently established exhibition (www.james-hutton.org.uk).

Hutton was supported by colleagues and friends, who accompanied and provided him with specimens and information that stimulated and guided his journeys. In 1764, he toured the Highlands with Sir George Clerk. It may have been a seminal moment when he saw the basaltic dyke near Drummond Castle, Crieff, thrusting aside the country rocks (Fig. 1) and which he thought might be traced to Campsie Linn near Perth.

He returned to Edinburgh in 1767, devoting his time thereafter to study of the Earth and agriculture. In the Midland Valley there are many basaltic volcanoes and intrusions. He described dykes in the Water of Leith, in drainage trenches in Edinburgh New Town and on the Clyde coast at Skelmorlie. He recognised Salisbury Crags as intrusive, and concluded that its rock was molten when it pushed aside sedimentary strata (see photo on page ///////////////). These and other locations were illustrated by Sir John Clerk (Craig et al, 1978).

In 1785 he lectured the Royal Society of Edinburgh on a “System of the Earth”, concluding that the Earth operated as a “machine fired by heat”, and he promulgated the idea of uniformitarianism (Hutton,



Figure 2. Veins of pink granite intrude metasedimentary rocks at Glen Tilt.

1785). The fusion of granite was not mentioned in the abstract, but stimulated by a specimen of graphic granite from Portsoy, given to him by Sir John Clerk in 1779, he concluded “It is not possible to conceive any other way in which quartz and feldspar could be thus concreted except by congelation from a fluid state in which they had been mixed. evidence that this body having been consolidated by fusion and by no other manner”.

From 1785 to 1788, Hutton sought evidence for the fusion of granite and its intrusion into sedimentary rocks. A visit to Glen Tilt was stimulated by Sir John Clerk, who in 1779 had seen granite dykes cutting metasediments at Dalnacardoch in the River Garry (McIntyre, 2008). At the Dail-en-eas bridge over the Tilt, a tributary of the Garry, Hutton found many veins of “red granite traversing the black micaceous schistus” (Fig. 2). His exuberant response was such that his guides “were convinced that it must be nothing less than silver or gold that could call forth such joy and exultation” (Playfair, 1802).

In 1786 he went with Clerk to Galloway “to see the junction of the granite country with the schistus strata of the south of Scotland” (Hutton, 1794) and at

Figure 1. Dolerite dyke left as a wall after erosion of weaker country rocks, near Drummond Castle, Crieff; the rib of rock is about 300m long, 15m high and 10m thick





Figure 3. Silurian greywackes are intruded by red granodiorite from the Dalbeattie pluton, at Needles Eye, on the North Solway coast.

Cairnsmuir they found granitoids cutting greywackes (now obscured). Further east, at Needles Eye on the Solway coast (Fig. 3), similar intrusions are seen, though they are less convincing than those at Glen Tilt. Indeed, Jameson, a Neptunist and one of Hutton's arch-critics, concluded that the evidence here was in favour of precipitation out of solution (Jameson, 1814; Brookfield, 1999).



Figure 4. Hutton's angular unconformity at Lochranza, on Arran, with the Carboniferous cover dipping steeply left nearer the sea, over the Dalradian rocks dipping right where the person is standing.

Hutton went to Arran with John Clerk Junior, in 1787 and found contacts between the northern granite and Dalradian schists in North Sannox Burn, and also in the Glen Shant stream above Brodick and in Glen Rosa. At North Sannox, Hutton described "... the schistus ... broken and invaded by the granite ... (which) enters and traverses the schistus in little veins terminating in capillaries" and concluded that the granite had been "in a state of fusion by ... subterranean heat". On Arran, Hutton observed the number and complexity of basalt dykes, some of which are largely glass and which he compared to glassmaking in Leith by fusion of sand and other minerals. At Lochranza, he described an angular unconformity between Dalradian schists and overlying Carboniferous sandstones (Fig. 4). He was clearly perplexed: "Here the schistus and the sandstone both rise at about 45°, but inclined in almost opposite directions like the rigging of a house", and "were it not for the little overlapping of the strata on the schistus it would have been impossible to have said which one of these two bodies of strata ... was superincumbent on the other".

Later in 1787, Hutton visited Jedburgh where he described the unconformity with horizontal Old Red Sandstone above near-vertical Silurian beds separated by a conglomerate (Fig. 5). Again he was perplexed by the process of deposition, uncertain whether the vertical strata had been broken or erected beneath overlying horizontal strata, or whether the older strata had been rendered vertical and broken prior to deposition of the younger rocks. Disappointingly, the unconformity is now obscured by trees and access is restricted, but Jedburgh is worth a visit to see the splendid memorial to Hutton in the form of a wall that represents an artist's concept of the unconformity (Fig. 6).

Hutton sought for other unconformities, and with Sir James Hall set out to explore the East Lothian cliffs by boat from Dunglass Burn. At Siccar Point, the junction between the Silurian greywackes and overlying Old Red Sandstone was obvious (Fig. 7). It clarified previous problems: "the sandstone strata are

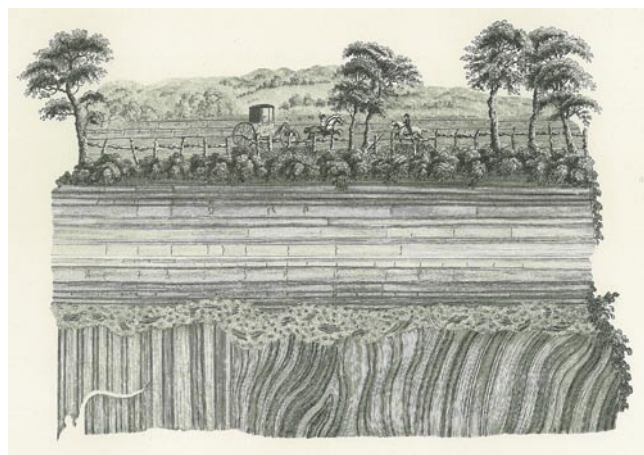


Figure 5. Engraving of a drawing by John Clerk of the classic unconformity at Jedburgh, as it was before being lost behind a screen of trees.



Figure 6. James Hutton's memorial wall at Jedburgh, with sandstone above and greywacke below.

partly washed away and partly remaining upon the ends of the vertical schistus; and in many places points of the schistus strata are seen standing up through among the sandstone”.

Hutton published his *Theory of the Earth* (parts I & II) in 1795. It was not a success due to its prolixity and obscurity, and his opinions were challenged by Neptunists. But, with an explanatory text by Playfair (1802) and continued input from his supporters over the next 40 years, his views were gradually accepted. A further volume was published posthumously, edited by Geikie in 1899.



Figure 7. Siccar Point, with horizontal Old Red Sandstone overlying the nearly vertical Silurian greywackes (photo: British Geological Survey).

The usual view of Hutton is coloured by Raeburn's rather priggish portrait in the Scottish National Gallery which R. L. Stevenson dubbed as a Quaker without a hat. He was far from that. His letters show a man who was humorous, bawdy, blasphemous and occasionally drunk. He wrote a doggerel latin toast to concubines, and had a particular fancy for married women (Jones et al, 1994, 1995).

He died in 1797, and was buried in an unmarked grave in Greyfriars Kirkyard next to his great friend, Joseph Black, discoverer of carbon dioxide. The Kirkyard is worth a visit, for in 1947 the Royal Society of Edinburgh and the Geological Society put up a plaque to commemorate him, 150 years after his death. After leaving the Kirkyard, stop at Greyfriars Bobby or Sandy Bells – two well-remembered pubs from medical student days - before proceeding to a last stop at St John's Hill where Hutton lived, just beyond where the Pleasance meets the Cowgate. There in 1997, to mark the bicentenary of his death a memorial garden was erected. Boulders placed in it include schists infiltrated by granite veins, from Glen Tilt, and appropriately one bears an inscription which earned him opprobrium in his lifetime but which is his everlasting legacy: “We find no evidence of a beginning, no prospect of an end. James Hutton, 1788”.

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