

James Hutton's Edinburgh: a précis

DONALD B. MCINTYRE

*Beaumont House, Flat 17, 15 North St John's Place,
Perth PH1 5SZ, UK*

Abstract: James Hutton (1726–1797) was born and bred in Edinburgh. Having decided to be a farmer, he went to Norfolk aged 24 to learn new methods of husbandry. From that base, he travelled widely and developed an interest in geology. In 1767 he left his Berwickshire farm and returned to Edinburgh, where he became a valued member of the remarkable group of men who founded the Royal Society of Edinburgh and made the city the unrivalled intellectual centre of the age.

Edinburgh was a capital without the distractions of king and parliament. When the Industrial Revolution began, many disciplines were already represented by men of world renown who knew each other – many, indeed, were related. There were still no boundaries between narrowly defined disciplines; there was shared interest in all knowledge.

Geological structure had constricted Edinburgh's growth, keeping the compact Old Town on its ancient defensive ridge. The North Bridge, completed soon after Hutton's return to Edinburgh, made possible the planned New Town, in dramatic architectural and intellectual contrast to the mediaeval city. The beauty and interest of Edinburgh's scenery is the result of an active geological past. Consequently, in a small and accessible space, rocks of different character are exposed in a natural geological laboratory.

James Hutton did not live in an ivory tower. War, rebellion and revolution, both political and industrial, all had their influence. In a turbulent world, a decade of peace (1783–1793) was another factor making possible Hutton's great contribution to modern geology.

This essay sketches the historical, social and political background of the Edinburgh of Hutton's time. Space permits only a précis here, but I am grateful to *Earth Sciences History* for publishing the full documentation (with references, bibliography and genealogical trees) (McIntyre 1997). At the suggestion of the Conference Organising Committee and Scottish Natural Heritage, a book on Hutton as a field geologist was published by the Stationery Office during the week of the conference (McIntyre & McKirdy 1997, *James Hutton: The Founder of Modern Geology*). Although addressed to a general readership, this book contains previously unpublished Huttonian material. Dennis Dean's augmented edition of Hutton's own eminently readable account (Hutton 1997, *James Hutton in the Geology in the Field and in the Study*) was also published during the conference. These resources on Hutton's geology being available (along with Dean 1992), this account deals with the environment that made his geology possible.

In one of his novels Walter Scott describes how an Edinburgh advocate gave letters of introduction to a visitor who 'was gratified with seeing that [the letters] were addressed to some of the first literary characters in Scotland. "To David Hume, Esq." "To John Home, Esq." "To Dr Ferguson." "To Dr Black." "To Lord Kaimes." "To Mr. Hutton." "To John Clerk, Esq., of Eldin." "To Adam Smith, Esq." "To Dr. Robertson." Upon my word, my

legal friend has a good selection of acquaintances ... [A man] must rub up his faculties a little, and put his mind in order, before he enters this sort of society.' My paper is intended to serve as a letter of introduction to that company.

It is helpful to keep the following dates in mind: 1726 Hutton was born; 1750 he returned from the Continent; 1767 he moved back to Edinburgh; 1785 his *Theory of the Earth* was read to the Royal Society of Edinburgh (published 1788); 1795 his extended *Theory of the Earth* was published; and 1797 Hutton died.

The *dramatis personae* includes pioneers not in science only, but lawyers, statesmen, soldiers, sailors, engineers, historians and other literary men. Consider William Smellie, a largely self-taught man with an enormous breadth of interest and accomplishment. Although apprenticed to a printer at the age of 12, five years later he won the Silver Medal of the Philosophical Society (parent of the Royal Society of Edinburgh) for the most accurate edition of a Latin classic. At the age of 20 he helped to found the Newtonian Club. In 1777 he founded the Crochallan Club, one of the most popular of Edinburgh's convivial clubs. Smellie was printer for both David Hume and Robert Burns. He played an important part in producing the first edition of the *Encyclopaedia Britannica*, to which he contributed many major scientific articles. Smellie was a founding member of the Royal Society of Edinburgh, an accomplished botanist and antiquary, and a versatile linguist – teaching himself Hebrew in order to print a Hebrew dictionary.

Henry Home, Lord Kames, was a judge, writer, influential critic, and agricultural innovator. He was a friend of Benjamin Franklin and David Hume, and a friend and sponsor of Adam Smith. Yet, though Smellie was 44 years his junior, Kames adopted him as a friend and trusted him as a literary confidant. In the end, Smellie wrote biographies of Kames Hume, and Smith.

Benjamin Franklin knew Edinburgh well. In 1759, he met Adam Smith, William Robertson and Adam Ferguson, and was Lord Kames' guest at his country house near David Hume's home at Ninewells, not far from where Hutton was farming. Perhaps Hutton and Franklin met during that visit. When Franklin returned to Edinburgh in 1771, he stayed with Hume in his new house in St David Street and was the guest of Lord Kames in Perthshire. Among Franklin's 'distinguished acquaintances in the medical faculty' he named Joseph Black, William Cullen and James Russell, all of whom were Hutton's close friends. As Hutton was then living in Edinburgh, he and Franklin might well have met.

Franklin and his son were among the nine Honorary Fellows elected when the Royal Society of Edinburgh was constituted in 1783. Recommending Edinburgh to an American acquaintance, Franklin wrote, 'At this time there happen to be collected a set of as truly great men, professors of the several branches of knowledge, as have ever appeared in any age or country.' He also noted an Edinburgh characteristic: the '*disputatious turn* – Persons of good sense, I have observed, seldom fall into it except lawyers, university men, and men of all sorts that have been bred in Edinburgh'.

Despite Hutton's innovations in farming, his pioneering work in industrial chemistry, his tests for coal and culm, his friendship with James Watt, and his involvement with the Forth and Clyde Canal, he has been criticized as an impractical theorist, 'loftily dismissive of utilitarian science' – as much a theologian as a scientist. This is wrong: Hutton was an experienced field geologist with a deep interest in useful applications.

Hutton had an 'exquisite relish for whatever is beautiful and sublime in science', and the implications of his geological discoveries 'were matter, not of transient delight but of solid and permanent happiness'. He loved to share the pleasure he had from his discoveries. After finding granite veins in Arran, it was characteristic of him that he

returned to Brodick for John Clerk, junior (son of his friend, John Clerk of Eldin): 'Not contented with this view of those two alpine bodies, in that jaunt which I had taken alone, I wished to give Mr Clerk the same satisfaction.'

In his last letter to Kames, Franklin wrote 'I almost envy the Abilities you continue to possess of instructing, delighting, and being useful at so late a Period in Life.' Ian Simpson Ross, in his biography of Kames, remarked that '*Delighting, instructing, and being useful* were the great aims of all the men of letters of the Enlightenment'. This was surely true for James Hutton.

Notable Edinburgh characters, chiefly lawyers and disputants

The Court of Session is Scotland's highest law court, and advocates raised to the Bench are known by honorary titles, often taken from their family estates. The General Assembly, the Church of Scotland's highest court, meets once a year in Edinburgh, where its debates provided opportunities for young advocates serving as Elders. As the legal profession outnumbered the ministers and professors, lawyers dominated the city's intellectual life. The spirited character of Hutton's Edinburgh is illustrated by highlighting the careers of some of these men.

Alexander Wedderburn, who as a young man was a protégé of Adam Smith and David Hume, became an influential figure in Lord North's government and rose to be Lord Chancellor of England, presiding over the House of Lords. Without intending the result, Wedderburn did much to shape Franklin's attitude towards American independence.

It has been said that the two most remarkable figures at the Scots bar 'in their own or any other time' were Henry Erskine and John Clerk, junior – Hutton's field assistant in Arran. Erskine succeeded Viscount Melville ('the uncrowned King of Scotland') as Lord Advocate and Dean of the Faculty of Advocates, and was considered the Scottish bar's most eloquent speaker as well as its leader. Erskine's brother, Thomas, began his career as a midshipman before rising to the top of the English bar. He became Lord Chancellor, and it is said that 'he was probably the greatest advocate the English bar has ever seen'. Edinburgh provided England with a third Lord Chancellor in Lord Brougham, who, while still a student, published papers with the Royal Society of London. He also reviewed Hutton's *Theory of the Earth*.

Sydney Smith, the founder of the *Edinburgh Review*, gave a shrewd summary of the questioning attitude characteristic of the Scottish Enlightenment: 'If you were sailing from Alicant to Aleppo in a storm, and if (after sailors had held up the image of a Saint and prayed to it) the storm were to abate, you would be more sorry for the encouragement of superstition than rejoiced for the preservation of your life; (and so would every other man born and bred in Edinburgh.'

As Lord Justice Clerk, Lord Braxfield presided over some of the most infamous trials in Scottish legal history. The fate of the Martyrs for Parliamentary Reform, condemned for sedition, shows how little freedom of speech was tolerated in the 1790s – this at the time when Hutton was writing his *Theory of the Earth*.

The reason John Clerk, junior, did not become a geologist was that in 1788 – the year after he had accompanied Hutton to Arran – he found fame as an advocate in the sensational trial of Deacon Brodie. Brodie was the Edinburgh Councillor whose double life inspired Robert Louis Stevenson to write his well-known tale, *Dr Jekyll and Mr Hyde*. A contemporary account of the trial was written by William Creech, a member of the jury

and Scotland's leading publisher. Brodie was defended by Henry Erskine, while John Clerk was counsel for Brodie's assistant.

Lord Monboddo, another judge, gave weekly *learned suppers*, which were regularly attended by Hutton, Joseph Black (Professor of Chemistry and practising physician) and William Smellie.

The Enlightenment from 1759 to 1799

A review of some of the intellectually significant events of this period in Scotland provides a context for Hutton, who was 34 years old in 1760, and 69 in 1795.

- 1759:** Adam Smith published his *Theory of Moral Sentiments*. When Hutton and Smith first met is discussed in the paper.
Franklin received an LLD degree from St Andrews and was admitted 'Burgess & Gildbrother of Edinburgh'.
Robert Burns was born.
- 1760:** John Roebuck founded the Carron Ironworks.
- 1760–1764:** Joseph Black distinguished between quantity and intensity of heat. His major contribution to chemistry was his use of quantitative methods.
- 1761:** Sir James Hall of Dunglass (founder of experimental geology) was born.
- 1762:** David Hume completed his *History of England*.
Revd William Robertson, the historian, became Principal of Edinburgh University, a position he held with success for 31 years.
John Robison (aged 23) was the Board of Longitude's representative in charge of Harrison's chronometer on its test voyage to Jamaica.
- 1763:** Watt repaired a model of the Newcomen steam engine.
- 1764:** Adam Smith left on the Grand Tour with the young third Duke of Buccleuch.
- 1767:** Adam Ferguson published his *Essay on the History of Civil Society*.
- 1768:** Construction of the Forth and Clyde canal began. Hutton was a member of the Management Committee from 1767 to 1775.
- 1769:** Watt took out his first patent.
- 1771:** Walter Scott was born in Edinburgh.
The *Encyclopaedia Britannica* was published.
Benjamin Franklin visited Edinburgh as Hume's guest.
- 1772:** Hutton found 'alkali in a stony body', and Black's pupil, Daniel Rutherford, discovered nitrogen.
- 1773:** Samuel Johnson and James Boswell visited Edinburgh on their way to the Hebrides and again on their return journey.
On Adam Smith's recommendation, Adam Ferguson became tutor to the Earl of Chesterfield and was absent on the Continent for two years.
- 1774:** Watt joined Matthew Boulton in Birmingham, where Hutton visited him.
- 1776:** David Hume died aged 65.
Adam Smith's *The Wealth of Nations* and the first volume of Edward Gibbon's *The Decline and Fall of the Roman Empire* were published
Franklin helped to draft the Declaration of Independence, which was signed by two Edinburgh graduates, the Revd John Witherspoon and Benjamin Rush.
- 1777:** Hutton's work on the distinction between coal and culm was published.

- 1779:** Hume's *Dialogues Concerning Natural Religion* was published posthumously.
- 1780–1781:** Playfair became acquainted with Hutton.
- 1783:** Ferguson's *History of the Progress and Termination of the Roman Republic* was published.
The Royal Society of Edinburgh received its Royal Charter.
- 1783–1786:** Sir James Hall visited Lavoisier.
- 1784:** Barthélémy Faujas de Saint Fond visited Hutton, Black and Smith.
- 1785:** Hutton's *Theory of the Earth* was read to the Royal Society of Edinburgh.
Hutton and John Clerk of Eldin found granite veins in Glen Tilt.
Black's pupils founded the Edinburgh University Chemical Society – the earliest chemical society in the world.
- 1786:** Hutton and John Clerk of Eldin made a geological excursion to Galloway.
- 1786–1788:** Robert Burns visited Edinburgh.
- 1787:** William Creech published Burns' poems.
Hutton, Black, Adam Ferguson and Dugald Stewart were present when Burns and Scott had their only meeting.
Hutton visited Arran with John Clerk, junior.
Hutton discovered the unconformity at Jedburgh.
- 1788:** Hutton's *Theory of the Earth* was published in the first volume of the *Transactions of the Royal Society of Edinburgh*.
Franklin's letter on geology was read to the American Philosophical Society.
On 19 October 1783, Arthur Holmes began his first lecture in Edinburgh on Advanced Physical Geology by referring to Franklin's theory of the Earth's fluid interior, before developing his own views on convection in the mantle.
Sir James Hall lectured on Lavoisier's *New Theory of Chemistry*.
- 1789:** The foundation stone of Robert Adam's new building for the University was laid with ceremony.
- 1790:** An accident at the Leith glass-house provided the impetus for Hall's experiments, which he began in 1790.
Hutton and Hall gave papers on granite to the Royal Society of Edinburgh.
Adam Smith died aged 67. Black and Hutton were his executors, and Hutton recorded Smith's farewell words.
Eight months after publication of Lavoisier's *Traité élémentaire de Chimie*, a translation by Black's student Robert Kerr was published in Edinburgh.
- 1791:** Sir James Hall revisited Lavoisier in Paris.
- 1792:** The Chemical Society of Philadelphia, the first in America, was founded by Black's former student, Benjamin Rush.
- 1794:** Lavoisier was sent to the guillotine.
- 1795:** Hutton's *Theory of the Earth* was published in two volumes.
- 1796:** Burns died aged 37.
- 1797:** Hutton died on 26 March aged 70.
- 1798:** Sir James Hall began a series of experiments on which he worked, often seven days a week, until 1805. By melting basalt and cooling the molten glass slowly he produced a stony, crystalline substance 'in texture completely resembling whinstone'. Hall showed this specimen to the Royal Society of Edinburgh on 5 February 1798. The present writer was privileged to display this specimen (labelled by Hall himself) at the Third International

Symposium on Experimental Petrology and Geochemistry in 1990, marking the bicentennial of the beginning of Hall's experimental work.

1799: Black died aged 71.

Historical background

After the Treaty of Union in 1707, the Scottish Parliament left Edinburgh. The Treaty, however, preserved Scotland's law, church and universities, which is why lawyers, clergymen and academics were prominent throughout Hutton's lifetime. On the death of Queen Anne, the only living descendants of Charles I were Catholic. To find a Protestant successor, the Whig government turned to the Elector of Hanover, whose grandmother was a daughter of James VI. The Elector was invited to London in 1714 as King George I, though he knew nothing of the language or culture of his new subjects.

Scotland was forced to accept the Hanoverian Succession, but many believed that Scotland had the right to choose its own king, and unsuccessful Jacobite Risings took place in 1715–1716, and 1719. In order to subdue the Highlands, in 1725 General Wade began construction of a network of military roads. The difficulty of travel in those days is not appreciated by those who deny Hutton's importance as a field geologist: Hutton travelled on foot, on horseback and in a chaise from the English Channel to Caithness.

A fourth and more serious Jacobite Rising took place in 1745–1746. Prince Charles Edward Stuart landed in the West Highlands and within two months had defeated General Cope at Prestonpans, and held court in Holyrood Palace. When Hutton and Clerk of Eldin visited Glen Tilt in 1785, their host was the fourth Duke of Athol, the grandson of Prince Charles' Lieutenant-General.

Benjamin Franklin arrived in France on 4 December 1776 to negotiate a Franco-American alliance. After Burgoyne surrendered at Saratoga on 17 October 1777, Lord North attempted to save the British Empire by making a conciliatory offer to the American Congress. The full paper describes the steps that culminated in French and British frigates racing one another across the Atlantic to bring the proposals of their respective governments before the American Congress.

Lord North despatched a Peace Commission, nominally under the Earl of Carlisle, in a desperate attempt to persuade Congress to accept his proposals. Adam Ferguson, as the Commission's Secretary, crossed the Atlantic in the company of Lord Cornwallis, newly appointed as Second-in-Command of the British forces in America.

The first engagement between British and French forces during the American War of Independence was an indecisive naval battle in July 1778 off Brest (Ushant). For reasons described in the full paper, Admiral Keppel, the British Commander-in-Chief, was court-martialled on the charge of misconduct and neglect of duty. These were capital offences: Byng, the last Admiral so charged, had been shot on the quarterdeck.

The court-martial began on 7 January 1779 and lasted for five weeks. Keppel, who was defended with great ability by Tom Erskine, was acquitted. Every captain in the fleet testified, and the reports were read and discussed with great interest in Edinburgh. No naval battle had been documented so thoroughly, and it was his study of these reports that made John Clerk of Eldin immerse himself in naval tactics. Indeed, this is probably why Hutton and Clerk's most productive geological activity was during the decade of peace from 1783 to 1793.

In 1781 Admiral de Grasse surprised the British forces by bringing his entire fleet to the Chesapeake. Travelling with him was the newly appointed French Minister

Plenipotentiary to the United States. Cornwallis was at that time fortifying Yorktown, close to the mouth of Chesapeake Bay, quite unaware that Washington was preparing to besiege him and that de Grasse was about to arrive with French troops, siege artillery, and supplies, supported by 28 battleships. When news of Cornwallis' surrender reached London, it signalled the end of Lord North's Government, and the Tories were swept out of every level of government. Adam Ferguson knew Cornwallis, and the news of the surrender at Yorktown must have been heard with great attention by Hutton's circle of friends in Edinburgh.

The principles of Clerk of Eldin's naval tactics were employed in 1782 by Admiral Rodney in the battle near the islands called the Saints, between Guadeloupe and Dominica. Rodney defeated the French fleet and took Admiral de Grasse prisoner. By winning command of the sea, Britain gained one of its few bargaining points in the negotiations that culminated in the Treaty of Paris on 3 September 1783 – signed little more than two months after the Royal Society of Edinburgh held its first general meeting.

Louis XVI was guillotined on 21 January 1793, and 11 days later the French revolutionary government declared war on Britain. Except for the time between October 1801 and May 1803, the two countries were at war for the next 22 years. Romantics, such as Wordsworth and Coleridge, welcomed the Revolution. Having sympathized with the Americans in their struggle against what was perceived to be a tyrannical government, they found it natural to support the cause of freedom. It was not, indeed, until French armies invaded Switzerland in 1798 that Wordsworth and Coleridge recoiled in dismay.

In Edinburgh the authorities dealt severely with anyone appearing to show sympathy with the French Revolution – or even with the idea of universal suffrage at home. Revisionists, judging Hutton on the basis of his theological references, may not fully appreciate the situation that obtains when speech is not as free as we may innocently think it always has been. In *The Decline and Fall of the Roman Empire*, Hutton's contemporary, Edward Gibbon, used irony 'with consummate art and felicity' because 'an attack on Christianity laid a writer open to prosecution and penalties under the statutes of the realm'. In the 1690s the Principal and half the Professors in Edinburgh University were dismissed for refusing to subscribe to every clause in the Westminster Confession of Faith. In the 1950s, Professors at the University of California lost their jobs for refusing to sign an Oath; as S. E. Morison said, 'Nobody who did not live through [the Senator McCarthy era] will ever believe what a sound and fury [it] made up' – and so it was in Hutton's Edinburgh.

Physical setting

Edinburgh Castle is built on a plug of basalt in the feeding pipe of a Lower Carboniferous volcano long since destroyed by erosion. The Castle rock stands high because it is more resistant than the surrounding sedimentary rocks, which dip at a low angle to the east. During the Ice Age, when an ice sheet moved eastwards across the Edinburgh area, the Castle rock protected the sedimentary rocks in its lee. This, along with an easterly dip, accounts for the mile-long ridge of the High Street from the Castle to the Palace of Holyrood. The ridge is accentuated by a hollow, gouged by the ice, that is now the site of Princes Street Gardens and the Grassmarket. This ridge was early chosen as a defensive site.

It has been estimated that Edinburgh's population grew from about 31 000 in 1755 to some 67 000 in 1800. The Old Town, protected by the City Wall, was confined to the

ridge, and tall tenements housed a compressed population. During Hutton's adult lifetime the city broke out from its enclosed defensive position, and the contrast between the narrow closes of the Old Town and Robert Adam's elegant buildings in the New Town is striking. In 1772 the North Bridge was completed, inviting expansion northwards from the city's medieval bounds. David Hume was one of the first to build in the New Town, and it was there that Franklin was his guest.

Landmarks in Hutton's career

1726–1747: Edinburgh

James Hutton was born in Edinburgh on 3 June 1726. This was the year that Dr Beringer published illustrations of what he believed to be genuine fossils, but which had in fact been fabricated by his Iago-like enemies. The science of geology was still in a primitive state, and the Earth was believed to be only some 6000 years old.

Hutton entered the University as a student of humanity in November 1740, but he developed an early and lifelong interest in chemistry, and while still a student he and his friend James Davie experimented on the production of sal ammoniac from the city soot. These experiments later became the basis of a profitable chemical business.

His student years included the 1745 Jacobite Rising, an exciting time when Edinburgh was occupied by the Jacobite army. Church ministers and University Professors left their duties to bear arms against Prince Charles. Professor Maclaurin, Hutton's admired teacher, organized the defence of the city. Maclaurin, a brilliant and popular teacher, taught with authority not only as a distinguished mathematician, but as Newton's friend and expositor.

Hutton was later to see evidence all around him for what he believed to be the 'necessary' decay and destruction of rocks. But he also saw that most rocks are themselves the consolidated products of destruction of still older rocks. He concluded that, as blood circulates in the microcosm (the subject of his MD thesis), so matter circulates in the macrocosm. Hutton wrote,

'We are thus led to see a circulation in the matter of this globe, and a beautiful economy in the works of nature. This earth, like the body of an animal, is wasted at the same time that it is repaired. It has a state of growth and augmentation; it has another state, which is that of diminution and decay. This world is thus destroyed in one part, but it is renewed in another; and the operations by which this world is thus constantly renewed, are as evident to the scientific eye, as are those in which it is necessarily destroyed'.

Hutton must have been familiar with the similar words that Hume put into the mouth of his character Philo:

'Now if we survey the universe, so far as it falls under our knowledge, it bears a great resemblance to an animal or organized body, and seems actuated with a like principle of life and motion. A continual circulation of matter in it produces no disorder: A continual waste in every part is incessantly repaired: The closest sympathy is perceived throughout the entire system: And each part or member, in performing its proper offices, operates both to its own preservation and to that of the whole. The world, therefore, I infer, is an animal, and the Deity is the SOUL of the world, actuating it, and actuated by it'.

We do not know the content of the classes Hutton took from Maclaurin, but Maclaurin's *Account of Sir Isaac Newton's Philosophical Discoveries* may have planted a geological seed that flourished later in Hutton's mind.

The Bible reports that God looked on the Earth 'and saw that it was good'; Hutton and some other scientists even down to our own day have concluded that (in Hutton's words) 'The globe of this earth is evidently made for man' – the alternative was hardly possible 200 years ago.

Maclaurin's book on Newton's *Philosophical Discoveries* was known to Hume and Hutton, and we find suggestive parallels. The following is an example:

Maclaurin: 'The plain argument for the existence of the Deity, obvious to all and carrying irresistible conviction with it, is from **the evident contrivance and fitness of things for one another**, which we meet throughout all parts of the Universe.'

Hutton: 'This globe of the earth is a habitable world; and on its **fitness** for this purpose, our sense of **wisdom** in its formation must depend ... Such, indeed, is the **admirable contrivance** of the system.'

1747–1750: Paris, Leyden, London and Edinburgh

Hutton spent the years 1747–1749 studying chemistry and anatomy in Paris, and then returned to Edinburgh in the summer of 1750. As Adam Smith gave his well-attended public lectures in Edinburgh in 1748–1751, we identify 1750–1751 as the first period when Hutton and Smith could have met. Hume was studying privately at his family home in Berwickshire from 1749 to 1751, but he was already friendly with Smith and might have come to Edinburgh to hear Smith's lectures.

1750–1752: Established in Berwickshire

Having inherited farming property in Berwickshire, Hutton 'resolved to apply himself to agriculture'. His decision was confirmed when he met Sir John Hall of Dunglass (Sir James Hall's father), a gentleman 'of ingenuity and taste for science, and also much conversant with the management of country affairs'.

David Hume's older brother, John Hume at Ninewells, and Henry Home at Kames were among the first to introduce modern farming methods to Scotland. They knew each other and it seems quite likely that Hutton would visit these neighbours, with whom he had much in common and from whom he could get help and advice. Dunglass is on the main road to Edinburgh and less than nine miles from Hutton's farm at Slighhouses. Ninewells is little over three miles from Slighhouses, while Kames is less than ten miles.

Much changed in 1751–1752: Smith was appointed to the Chair of Logic in Glasgow; David Hume's older brother married; and David moved to Edinburgh, where he was elected one of the Secretaries of the revived Philosophical Society, originally founded by Maclaurin. In 1752 Hume was appointed Keeper of the historic Advocates' Library, a position that gave him access to the books he needed. Smith transferred to the Chair of Moral Philosophy in Glasgow. Robertson became leader of the Moderate party at the General Assembly, a position he held with distinction until 1780; Black transferred to Edinburgh University; and Hutton went to Norfolk.

1752–1754: Hutton in England

As Hutton was ‘never disposed to do things by halves, he determined to study rural economy in the school that was then reckoned the best’, and in 1752 he set off for Norfolk. While there he made many journeys on foot into different parts of England, and began making those observations that later led him to formulate his *Theory of the Earth*. He returned to Berwickshire at the end of the summer of 1754.

1754–1767: Farming in Berwickshire

Though Hutton seems to have devoted these years mainly to the improvement of his Berwickshire farms, he pondered the meaning of the geological observations he had made on his travels. Moreover his two farms are on contrasting terrains – a fact unlikely to have escaped his observation. Playfair thought that about 1760 Hutton’s ideas began to come together to form a theory.

Black received his MD degree from Edinburgh in 1754, but it seems unlikely that he and Hutton became friends before 1766, when Black returned to Edinburgh as Professor of Chemistry. During the Seven Years War (1756–1763) Hume was frequently in London, and afterwards he was Secretary to the Embassy in Paris (1763–1766). Smith took the Duke of Buccleuch to the Continent in 1764. Hume returned to Ninewells in September 1766. Although this was for only a few weeks, it provided a possible opportunity for Hutton and Hume to meet.

In 1762 John Clerk of Eldin purchased a small coalfield. He was not a wealthy man: his finances were a constant source of anxiety, and we find him acknowledging his indebtedness to ‘our most benevolent and worthy friend Doctor Hutton’. Clerk had to direct the colliery operations himself – an occupation providing him with practical knowledge of sedimentary rocks that was no doubt helpful to Hutton.

In 1764 Hutton made a geological tour to the north of Scotland with George Clerk-Maxwell, Clerk of Eldin’s older brother.

In 1765 Hutton and Davie entered into a regular partnership for the commercial production of sal ammoniac.

1767: Return to Edinburgh

Hutton moved back to Edinburgh in 1767. Playfair tells us that this allowed Hutton to give his undivided attention to scientific pursuits, and enjoy ‘the society of his literary friends, among whom were Dr Black, Mr Russel, professor of Natural Philosophy, Professor Adam Ferguson, Sir George Clerk, Mr Clerk of Elden [sic], Dr James Lind, now of Windsor, and several others’.

From 1767 to 1774 Hutton was an active member of the Management Committee for the Forth and Clyde Canal. Between the years 1772 and 1783 he contributed several papers to the Philosophical Society of Edinburgh. In one of these, read to the Society in 1778, Hutton says Ferguson had suggested the project in 1776 and ‘carried’ Black and Hutton to the place where the observations were to be made. We know, therefore, that by 1776 Hutton had been in the field with George Clerk-Maxwell, Watt, Ferguson and Black.

Hume returned from London in 1769 and Franklin was his guest in 1771. Hutton may have attended one of the many dinner parties given during Franklin’s visit. If Hutton and Hume met, this would likely have been between 1769 and Hume’s death in 1776. Perhaps

the Clerk and Adam connections provided the opportunity. Robert Adam's family lived in Edinburgh, and Adam and Hume were good friends (Adam designed Hume's tomb); moreover John Clerk of Eldin was Robert Adam's brother-in-law and friend.

Adam Smith moved to Edinburgh on his appointment as Commissioner of Customs in 1778. His home was within a few minutes' walk from Hutton's house in St John's Hill. Perhaps Smith and Hutton met earlier, but it was during the years from 1778 until Smith's death in 1790 that Black and Hutton knew him well, and in the end they were his executors.

Robison returned from Russia in 1774 to take up his appointment in Natural Philosophy. Hutton would probably have met him through Black and Ferguson. The same year Robison's old friend Watt joined Boulton in Birmingham, where one of Watt's first actions was to invite Hutton to join him for a 'jaunt' to the Cheshire salt mines; an invitation that Hutton readily accepted.

Finally, we note that Hutton achieved his geological triumphs during the ten years of peace, 1783–1793, when he was accompanied first by John Clerk of Eldin and John Clerk, junior, and then by Playfair and Hall.

The Oyster Club

The distinguished French geologist, Barthélemy Faujas de Saint Fond, visited Edinburgh in October 1784, less than six months before Hutton's seminal *Theory of the Earth* was presented to the Royal Society of Edinburgh. Faujas enjoyed conversing with Hutton, this 'modest philosopher' who, Faujas said, was then 'busily employed in writing a work on the theory of the earth'. Faujas admits that he found more interest in the company of Joseph Black, the 'learned chymist', whom he visited as often as possible, and whose 'profound knowledge' he greatly respected. Faujas was entertained in a novel fashion by Adam Smith, afterwards correctly reporting that Edinburgh castle is built on a volcanic rock – however, he mistook some of the greywackes and shales of the Southern Uplands as volcanic rocks as well.

The three close friends, Adam Smith, Joseph Black and James Hutton, founded a club known as the Oyster Club, which met weekly and epitomized the best features of the Scottish Enlightenment. Among the regular members were Henry Mackenzie, Dugald Stewart, John Playfair, Sir James Hall, Robert Adam and John Clerk of Eldin. Playfair described how 'round them was soon formed a knot of those who knew how to value the familiar and social converse of these illustrious men'. As Faujas knew all three of the Club's founders, he presumably attended the Oyster Club during his Edinburgh visit.

Dr David Mackie has dated Sir Henry Raeburn's well-known portrait of Hutton to be about 1790. Looking at it, we remember that during Hutton's final years, although ill and in pain for much of the time, Hutton wrote a prodigious amount – on philosophy, physics, agriculture and his *Theory of the Earth*. Adam Smith died in 1790, James Hutton in 1797 and Joseph Black in 1799.

Epilogue

James Hutton is rightly regarded as the founder of modern geology, and a large literature is devoted to consideration of this assertion and its implication. But to think of him simply as a geologist is a mistake. He lived in a truly remarkable community of highly intelligent men, many of whom were involved in matters of national and even international

importance. They were bold and original thinkers, spanning a great range of subject matter and personal experience. Moreover they were all 'equally prepared to speak and to listen'.

Hutton, with his unique contribution to knowledge of our planet's history, was close to the centre of this community, not only by virtue of his lifespan but, thanks to his generous and warm personality, by his friendships with some of the most brilliant men of the age. If we could reproduce the intellectual environment that made Hutton and his friends possible, we would have found something of greater value than the philosopher's stone.

'What dust of extinct lions sleeps peaceably under our feet everywhere! The soil of this world is made of the dust of Life, the geologists say.'

Thomas Carlyle

References

- DEAN, D. R. 1992. *James Hutton and the History of Geology*. Cornell University Press, Ithaca and London.
- HUTTON, J. 1997. *James Hutton in the Field and in the Study*. Edited by D. R. Dean. Being an augmented reprinting of Vol. III of Hutton's *Theory of the Earth* (I, II, 1795), as first published by Sir Archibald Geikie (1899). Delmar, New York.
- MCINTYRE, D. B. 1997. James Hutton's Edinburgh: the historical, social and political background. *Earth Sciences History*, **16**(2), 100–157.
- & MCKIRDY, A. 1997. *James Hutton: The Founder of Modern Geology*. Stationery Office, Edinburgh.