Profiles of the Authors

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*Front cover illustration: Commemorative medal of John Smith by Bryden. Reproduced with permission of the Scottish National Portrait Gallery.*
FOREWORD

In 1895 John Smith of Dalry in Ayrshire published his famed book *Prehistoric Man in Ayrshire*. The Executive Committee of the Ayrshire Archaeological and Natural History Society resolved that the centenary of this landmark in Ayrshire archaeology should be celebrated. Accordingly, a Centenary Committee was set up to organise for 1995 an event, which would also mark Smith’s studies in geology and natural history.

The Committee consisted of four experts on Smith’s life and work. Mr John Hume of Historic Scotia was the chairman, geology was covered by Dr W D Ian Rolfe of the National Museums of Scotland, archaeology by Dr Alex Morrison of the University of Glasgow and natural history by Dr Ralph Kirkwood of Strathclyde University. The Committee first met on 22 April 1991 with Dr David Reid, Joint Honorary Editor of the Ayrshire Archaeological and Natural History Society, acting as Secretary.

A full-day meeting was planned by the Committee to mark the Centenary, and this was held in the Civic Theatre, Ayr on 25 March 1995. The opening lecture entitled “John Smith - the Man and His Times” was given by Mr John Hume, and was nominated by the Society of Antiquaries in Scotland as a Buchan lecture. This was followed by a section of six lectures on geology co-ordinated by Dr Ian Rolfe. The next section of three lectures on archaeology was organised by Dr Alex Morrison. Three lectures on natural history made up the final section arranged by Dr Ralph Kirkwood. The meeting was jointly chaired by the President of the Ayrshire Archaeological and Natural History Society, Mr T Eric Miller, and by Mr John Hume. The vote of thanks to the speakers was given by the Society’s Honorary President Colonel Sir Bryce Knox.

This part presents the extended versions of the six lectures in the Geology section, and is introduced by a biography of John Smith written by Dr R B Wilson. Mr John Hume’s Buchan lecture and the papers in the Archaeology and Natural History sections will appear in Part 2 to be published in the spring of 1996.

JOHN SMITH (1846-1930) - A BIOGRAPHY
by R. B. Wilson

Introduction

In Dalry today there are still people who have childhood memories of a kenspeckle character known as ‘Fossil Johnny’ but they were probably unaware of the achievements of John Smith in his earlier years. Mining surveyor, ironworks manager, geologist, archaeologist, botanist, lepidopterist, artist, student of languages, author - the list of his accomplishments is truly remarkable. John Smith may have had a very common name but he was a very uncommon man. In the following pages, an attempt is made to describe the life of someone who knew the countryside of Ayrshire like the back of his hand and who described in detail much of the geology, natural history and archaeology of the country.

Sources

Most of the information on Smith’s life is taken from a book by A. Boyd entitled *The Biography of John Smith, Ayrshire Geologist and Naturalist*, published by A. Guthrie and Sons, Ardrossan in 1930. John Smith died in November of that year and was aware that Boyd was writing his biography but unfortunately did not live to see it published. Much of the book must have been written before Smith’s demise but even allowing for this, Boyd finalised the work and had it published in less than two months, an example of very rapid publication.

M. Macgregor of the Geological Survey also published an article on the life of John Smith in the *Transactions of the Geological Society of Glasgow* (1941, vol. 20, pp. 155-60). He drew some of his information from Boyd’s book but added many important details,
including an extensive bibliography of Smith’s scientific writings.

The writer is grateful to his wife Elizabeth F. Wilson for research in Register House and the Record Office, Edinburgh which produced information on Smith’s family including a correction of the year of Smith’s birth. Thanks are also due to Mr A. Dunn of Dalry for much of the local information and to Mr J. Hume of Heritage Scotland. The photographs were taken by Mr P. J. Brand.

Family and early years

In the parish records of New Monkland for the year 1846 an entry states “John Smith, son of James Smith, collier in Clarkston and Elizabeth Drysdale his spouse was born 14th September and baptised 4th October 1846”. Clarkston was a village about 1½ miles east of Airdrie and is now on the eastern outskirts of the town. James Smith moved with his wife and baby son to Dalry in the following year to superintend the sinking of new pit shafts for the working of the rich ironstone deposits in the area.

During John’s boyhood in Dalry his parents first lived at Swinlees Smithy. By the 1851 Census two girls had been added to the family and by 1861, John had five sisters and a brother. In the Census of that year, James Smith’s occupation was given as Ironstone and Coalmining Manager and their dwelling, Kirkland Cottage, Dalry, was recorded as having eight rooms with windows. The picture which emerges from the official statistics is that when John was 14 he was the eldest of seven siblings and lived in a relatively large house in which two servants were employed.

His early schooling was spread over three local schools in Dalry and was interrupted for 3 years by a serious leg injury which fortunately had no permanent effect. His secondary education was at Irvine Academy where he gained 1st prize for drawing, a skill which stood him in good stead when he came to illustrate his books.

On leaving school, at about 16 years old, John went to Glasgow to serve a 5-year apprenticeship in mining and surveying. His intention was to follow his father in the mining industry as did his younger brother James who became a colliery manager at Blantyre.

John showed an interest in the theoretical side of geology as a boy but Dalry probably offered limited scope for studying scientific subjects. The move to Glasgow opened up new horizons and gave him the opportunity to broaden his education. At this period in Victorian times evening classes were given by famous academics in technical colleges and public halls and John took full advantage of this situation.

He joined the Geological Society of Glasgow and met the famous Scottish geologists of the day. He studied botany at the Anderson College under Prof. R. Kennedy, author of *The Clydesdale Flora*. Other classes attended included Chemistry, Astronomy, French, Latin and Greek. He must have had a talent for learning foreign languages as he later studied Spanish, Italian and German and became proficient enough in the last named to translate a poem by Schiller into broad Scots and published the result (Fig 3).

At the age of about 21, having successfully completed his apprenticeship and with his appetite for acquiring knowledge whetted by his stay in Glasgow, John Smith was ready to embark on his career.

Lugar

His first appointment, about 1868, was the position of under manager in the coal pits at Lugar. He held this post for 2½ years and during this period he took the opportunity to explore the Lugar, Muirkirk and Auchinleck districts. This was probably the first time that he explored other parts of Ayrshire outwith the Dalry area of his boyhood. During his rambles over the countryside he made notes and sketches concerning the flora and natural features which caught his attention. It was at this time that the idea first came to him of writing a book on the prehistory of Ayrshire.

Eglinton Ironworks, Kilwinning

Smith must have made a favourable impression during his stay at Lugar. One day he was told by one of the managers of Messrs W. Baird his employers to “take his cowl (hat) and away down to Kilwinning”. Awaiting him there was the post of manager of the Eglinton Ironworks, a position he held for about 19 years. There is some evidence in Boyd’s book that Smith was criticised by his employer for treating his workforce as human beings rather than as serfs. The fact, however, that he held the post for a long period suggests that he was a successful manager.

One fact about which there can be little doubt is that his managerial duties did not occupy all of John’s time and energy. He did not publish many scientific papers during this period but he must have spent a great deal of time gathering information and collecting specimens. This is evidenced by the spate of papers and books he produced in the next few years after he left the ironworks. While he was there, he did publish papers on such diverse topics as microscopic fossils from Shropshire, worked flints from the coast between Saltcoats and Troon, the geology of Dalry and a description of Cleaves Cove, Dalry.
The last named topic serves as a good example of Smith’s energy and dedication to scientific investigation and to the time he was prepared to devote to his research. Cleaves Cove is a maze of underground passages and chambers excavated in limestone by the Dusk Water at a time when the river flowed at a higher level. The work of exploring, making a detailed plan and exhaustively sampling the deposits in the passages started in January 1883. The work was done at night, two or three times a week, and lasted for six months. He was aided by six volunteers in this major task during which 300 tons of deposits were removed. When the project was completed, he took his helpers on a pleasure cruise on the Clyde.

Smith then proceeded to study the samples of the deposits obtained, sieving them layer by layer and removing the contents which included bones, human artefacts, shells, etc. He published the results of the whole investigation in the Transactions of the Geological Society of Glasgow in 1885 and published privately a Monograph on the Stalagmites and Stalactites of Cleaves Cove in 1894, printed by Elliot Stock, London.

His major works - Prehistoric Man in Ayrshire (1895) and The Botany of Ayrshire by Parishes (1896) - although published after he left the ironworks both contain such a volume of information that it could only have been collected over a great many years. In the foreword to the former work he stated “I have traversed nearly every inch of the country on foot, and have collected with my own hands hundreds of prehistoric relics from caves, crannogs, shell-mounds, rock shelters, sands, gravels, etc., taking measurements, making drawings which have been reproduced in this volume”. In his botanical work he claimed that he had travelled all over Ayrshire three times.

The time required to have done all this field work strongly suggests that Smith spent all his spare time and perhaps some ‘Company time’ on these projects. It seems likely that managing the ironworks was in direct competition with his scientific investigations. It has been said that his employers gave him the classic choice between his work and his hobby and that he chose the latter. Whatever the truth of the matter, he resigned from his employment about 1890.

Full-time Scientist

With no managerial responsibilities, no family commitments and living in lodgings, John Smith was able to devote his whole energies to scientific research and to publishing the results. This period of peak activity lasted from 1890 until the outbreak of the First World War. With the exception of his work on Cleaves Cove, all his major books and papers were published during this time.

His life must have been spent on physically demanding fieldwork, amassing the identifications and observations, the painstaking cleaning and examination of the specimens collected and the collation of the data. He would then have to prepare the results for publication and supervise the books and papers through the various stages of publisher’s
also, taking his collections with him. His first lodgings were at Monkredding near Kilwinning where he wrote *Prehistoric Man in Ayrshire*. They then moved to Dykes Farm near Dalry, about 1910, and it was there that Boyd first met Smith in 1912. From 1922 to 1930 they lived at Baidlands Mains in the Dalry area. In 1930 the final move was to Golconda near Kilwinning. It was before this last move took place that Smith parted with his collection of fossils and rocks.

John Smith died of a sudden heart attack at Golconda on Sunday 30th November 1930 and was buried beside his parents at Cumnock Cemetery on 4th December.

The Man Himself

The principal source of information on John Smith’s character comes from Boyd’s biography and it must be remembered that Boyd only knew him in his later years. He quoted Smith as saying of himself “I ken I am a wee kinna abrupt”. An example of this abruptness was shown when Boyd visited Smith and was greeted by “There’s your chair”. During walks it was fairly common for a wee laddie to approach Smith and say “Gie’s a fossil”. The latter would take a specimen out of his pocket and, while still walking, hold it behind his back. From there the boy would take the desired object and make off with his prize.

The fact that he had a gift available in his pocket suggests that he enjoyed this little charade. His liking for children is shown by his taking the sons and daughters of the employees at the ironworks on an annual summer outing to the coast, arranging for railway wagons to transport them.

Smith appears to have had little interest in affairs outside his personal scientific pursuits. He had no enthusiasm for politics and never voted in his life. His views on Home Rule for Scotland were that “It would do no good. A few men would get large salaries and that would be all about it”. On religion he said “Modern science cannot be reconciled with the Biblical cosmogony”. He stopped going to church when the minister at Kilwinning started to make adverse comments about science.

He must have been a man who was happy in his own company as he spent much of his life alone, wandering over the countryside or examining rocks in out of the way places. He claimed for instance that he carried out all the investigations on the archaeology of Ayrshire on his own. Occasionally he travelled in the company of some other kindred spirit on some of his rambles but the main exception to his lone investigations was when he led numerous excursions of natural history societies, sharing his pleasure of exploration and demonstrating his discoveries.

He was obviously a very strong and fit man as he walked remarkable distances, sometimes carrying heavy loads of specimens. Boyd cites an example of Smith visiting his parents by walking from Kilwinning to Lugar, a distance of some 25 miles. Another outstanding feat was a ramble with a Mr Longmuir which started at Kilwinning and passed through...
John Smith (1846-1930) was born in the heyday of natural history; that period from 1820-1870 when the subject became a popular passion, offering rational amusement, spiritual enlightenment and outdoor recreation. By contrast with city drinking, fighting and gambling, it provided innocent and useful amusement and in its study, the enthusiast “looks through Nature up to Nature’s God”². For John Smith it became more than a pastime or amusement - he gave up his post as iron works manager to devote himself to geology³. As J.W. Gregory, President of the Geological Society of London and recently retired Professor of Geology at Glasgow University, said when he awarded the Society’s Murchison Fund to John Smith in 1930:

The roll of Scottish science includes the names of several men, such as Thomas Edward of Banff and Robert Dick, who spent their lives in the pursuit of natural science from its intellectual interest, in the disregard of their own financial opportunities or social advancement. Mr Smith in this noble spirit has for more that fifty years devoted his tireless energies and keen powers of observation to the geology and archaeology of the country around his home at Dalry and of Northern Ayrshire. His books and papers form an invaluable contribution to Scottish science.⁴

This was one of several marks of recognition of Smith’s achievement⁵, and the one which prompted the professional photograph of him shown in Fig 1⁶.

It is Gregory’s comparison with Thomas Edward and Robert Dick that I wish to explore here. Thomas Edward (1814-1886) of Banff:

was a poorly paid Scottish shoemaker whose formal schooling ended when he was six. He worked every day from 6a.m. to 9p.m. and spent all Sunday at prayer, so that his natural history excursions had to be made at night. He would collect as many specimens as he could before dark, and then sleep on the spot in order to collect a few more at dawn.⁷

He made large collections, principally of marine invertebrates from the Moray Firth, from which, for example, 27 new species of Crustacea were described. Robert Dick (1811-1866), the baker of Thurso, was a similarly self taught botanist and geologist who provided fossils and information to Hugh Miller. Both achieved renown as the subject of several biographies by Samuel Smiles, illustrating the virtues of “self-help”, the title of Smiles
influential work of 1859. In this book Smiles advocated self-reliance, struggle and self-creation as the only sound way to respect and independence, by being never idle. Smith certainly showed many of the qualities of Smilesian self-help. Like other Victorian self-disciplinarians he could carry this "to excess and turn it into an almost masochistic delight in privation", performing prodigious feats of intellectual stamina and endurance documented in others by Allen and in Smith by Boyd and Wilson. Indeed, the excessive demands imposed by some of Smith's geological excursions gave rise to protests that resulted in them being curtailed.

Compared with these Smilesian exemplars, Smith was well educated. Since 1855, geology had been taught regularly at the Andersonian University in Glasgow, where Smith studied. Through his father, John Smith met the popular geology lecturer Dr David Page in 1860, and was given one of his textbooks. An avid reader, he was familiar with the key works of leading geologists, and paid homage to David Page and others by naming the pillars of Cleaves Cove after them.

Like other self-helpers, he corresponded with leading workers of the day. These ranged from Thomas Davidson (1871) on brachiopods and Marie Stopes on microscopic plants in Carboniferous amber to T. H. Huxley on possible evidence for cannibalism in prehistory. It is now recognised that progress in science is not just made by heroes of the subject like Lyell and Darwin. Their syntheses relied on the observations of many field workers, as was spelled out by J. W. Salter, palaeontologist to the then young Government Geological Survey, in 1858: "What we want, in the present state of geology, is abundance of good facts, and these can only be collected by the industry of local observers." John Smith was one of these. A selection of Smith's diverse geological achievements would include:

1. The publication of at least 67 geological papers, and contributions by way of notes, observations and specimens to countless others.

2. Popular educational work, by writing numerous articles in newspapers such as The Ardrossan & Saltcoats Herald (see Appendix 1), by exhibiting at geological and natural history societies and by leading field excursions (Fig 2).
3. Utilitarian contributions: putting his knowledge to practical use - as in his pointing out where coal could be got in Dalry, during the General Strike in warning miners of impending roof falls; discovering fireclay in the Lynn Glen, Dalry; advising where to bore for water; how to get gas from coal; the distribution of ironstone; noting the dangers of inbreeding Ayrshire show cattle.

4. Collection, and preparation free from rock, of more than 30,000 geological specimens, including many microscopical preparations.

5. Noting in his many notebooks features of local interest, often illustrating them with sketches. These may record long-vanished geological sections, and have permanent value.

These achievements are greater than those of the amateur “local observers” of whom Salter was thinking. Indeed, Smith’s training and early career was more typical of those associated with the rise of UK geology, many of whom became the first professional geologists. He was, therefore, far from being a straightforward Smilesian self-helper, most of whom had little formal education, although he exemplified most of their Victorian values.

Notes and References

6. Original photograph in Hunterian Museum, University of Glasgow. Courtesy Dr N Clark.
7. Boyd, Biography, 80. GUA (DC 167, Box 1, 1/1(12)) records crocodile being collected from Swinlees in 1907.
10. Allen, Naturalist, 76-82.
11. R. B. Wilson, this volume. A remarkable example of Smith’s industry and self-reliance was his hand copying of the complete text and watercolour illustrations of G. B. Sowerby’s Illustrated index of British shells, London, 1859 presumably for use in identifying Quaternary molluscs. He copied this from Archibald Shanks’ original copy; Smith’s facsimile is now in Glasgow University Archives (hereafter GUA; DC 167 Box 1/1/4).
12. “Auchinleck 6.45 A.M. is a killer, better say 10.27 and I will likely get some to go”, Letter from John Renwick to J.S., 19.5.1896, in Dick Institute, Kilmarnock, another 15.2.1900 about his “too ambitious” Girvan excursion.

Fig 3 — John Smith’s pencil drawings of key Silurian ostracods, in his own copy of Armstrong et al. 1873 (shown in manuscript).
See John Hume, Volume 2.
Boyd, Biography 9.
In 1916 Smith sent a slide of this material to the Geological Museum, London.
Laing, S. & Huxley, T.H. 1866. Prehistoric remains of Caithness, London, 28. See Boyd, Biography 37; also

Fig 4 — John Smith, ca. 1890, with Carboniferous fossil plant Stigmia

Fig 5 — Smith's biographer Sandy Boyd (right) and latter day associate Archibald Shanks (1870-1951, left)

Fig 6 — Contents page of John Smith's own copy of Armstrong et al.1876, with his sketch (above, the Drumadoon sill).
Articles by John Smith in The Ardrossan and Saltcoats Herald Compiled by M Yuill

1894 2.2 Pitcon Glen and Swithlees
2.3 Andersonian Naturalists at Craigneds, near Houston
13.4 The Whangie
27.4 Correspondence about Pitcon Glen
18.5 Microscopic plants in Carboniferous amber of Ayshire coalfield
20.7 From the Girvan water to the March Burn, along the shore. Part 1.
26.7 Part 2, [includes Lendalfoot].
3.8 Part 3, [includes Binnan Head].
10.8 Part 4
17.7 Part 5, [includes March Burn].
9.11 Sections on Newmilns-Darvel railway [13.7.1894 excursion].
23.11 Geological and Natural History Societies of Glasgow at Water-Meetings, Auchenharvie, Montgremere [25.8.1894 excursion].
30.11 Geological and Natural History Societies of Glasgow at the Old Castle of Auchenharvie.

1895 26.7 Saltcoats Harbour, from High to Low Water
6.9 The stone coffins of Ayshire, Part 1
13.9 Part 2
20.9 Part 3

1896 3.1 Ancient blemmy on Ardeer Sands
1900 2.11 Geological railway sections in the Highlands
1903 9.10 West Kilbride rammers visit Blair
1904 5.2 Wanlockhead. Part 1
12.2 Part 2
20.3 Andersonian Naturalists among the Southern Uplands
3.6 West Kilbride rammers at Kilwinning.
1905 31.3 At Dalry & N. Johnstone railway
1.12 Carboniferous lamellibranchs
1906 20.4 Discovery of upns near Stevenson
4.5 Geology of coast railway (Girvan & Ayr)
17.8 Interglacial Formation in Ayshire, Part 1
31.8 Part 2
14.9 Part 3

1907 2.8 Muirkirk and Auchinleck rammers at Dunure and Heads of Ayr
1909 26.2 Ancient black country of south of Scotland, Part 2
5.3 Part 3
19.3 Part 4
26.3 Part 5

1913 9.5 Irvine whale-bed
1917 9.2 Havock in Hindog Glen [by “S”]
8.6 Glories of Hindog Glen [by “S”]
JOHN SMITH - GEOLOGIST
by R. B. Wilson

Introduction

John Smith's advance from a keen amateur geologist to an accepted authority on the science was truly remarkable. It is even more so when we consider that he was largely self-taught and had no professional status in the subject. His position among Scottish geologists can be gauged by the fact that in 1901 when the British Association for the Advancement of Science published a book on the Clyde area, the section on geology contained no fewer than eight parts contributed by Smith.

His interest in geology, particularly in fossils, was aroused in early boyhood. Captain Blair, a local landowner in the Dalry area, suggested that young John should go to Auchenskeith Quarry and fill his pockets with fossils. Some time later, a geologist called Page visited Dalry and John is said to have shown him this quarry and demonstrated his knowledge of it. Page was impressed and suggested to John's father that he should buy the boy a book on geology, written as it happens, by Page. This was done and the lad was introduced to the theoretical side of the subject.

There is a gap in our knowledge of his geological activities until he went to Glasgow, c.1863, to serve a 5-year apprenticeship in mining and surveying. We do know that his landlad there is said to have complained about the number of fossil and mineral specimens on display in his room. During this period he joined the Geological Society of Glasgow and was in contact with the foremost geologists in the country and went with them to the many famous localities in the west of Scotland.

His professional studies successfully completed, he returned to Ayrshire and lived there for the rest of his life. He did, however, go on numerous journeys to study the geology of many other areas.

The John Smith Collection

Much of his life was spent outdoors collecting specimens of fossils and rocks. The Dalry-Kilwinning area, where he spent most of his life, is underlaid by Carboniferous rocks and the bulk of his collection of fossils came from strata of this age. At that time, numerous quarries in limestone were being worked for industrial and agricultural purposes. These, together with natural exposures in streams, etc., gave him almost unlimited scope in his search for fossils. He also collected extensively from the older Ordovician and Silurian...
systems in the Girvan - Ballantrae area and then further afield in the Southern Uplands.

Over his lifetime he amassed a vast quantity of fossils and in 1930 presented his collection to the Scottish Office of the Geological Survey in Edinburgh. The number of his specimens registered and catalogued by the Survey is almost 30,000, and more than half of them came from Ayrshire. Of the Carboniferous specimens, 11,000 came from Ayrshire, 5,000 from other parts of Scotland, 2,700 from the Isle of Man and about 1,000 from English localities. From older rocks, there are over 6,000 from the Lower Palaeozoic of the South of Scotland, over 1,000 from the Silurian of Sweden, almost 500 Old Red Sandstone fish from Caithness and about 2,000 slides containing numerous microscopic fossils of various ages. This represents one of the largest collections of fossils ever accumulated by an amateur geologist in Scotland.

He also gave away many fossils as gifts or in exchange for others. When the collection was gifted to the Geological Survey, those specimens which were not sufficiently well-localised were presented to the Scottish universities for teaching purposes.

The magnitude of the collection is a measure of Smith's powers of observation and his capacity for sustained hard work. He also must have spent an immense amount of time cleaning, preparing and examining the specimens at his workbench. The vast majority of the fossils have the locality and identification written on them with Smith's initials and some have the year of collection. This information is written on pieces of paper glued to the specimen or on a flat, ground surface in the case of harder rocks such as limestone. Smaller shells are mounted on glass plates covered by glued paper and microscopic ones are stuck on specially made glass or cardboard slides.

The identification of the specimens must also have occupied a great deal of his time. He would have become familiar with the more commonly occurring forms during his years in Glasgow when he was in touch with many notable experts. He sent specimens to various palaeontologists who were describing the groups of fossils at the time. By this means he built up a collection of authoritatively named specimens which he could use for comparative purposes. Many of these specialists used his specimens to illustrate new species in their own descriptive works. In total, 215 of Smith's specimens are known to have been figured by twenty other palaeontologists over the last century. Of these, fourteen are holotypes of new species and fifty-nine are auxiliary type specimens. Specimens from the collection are still being studied and there is scope for much future research. Smith does not appear to have been very interested in the detailed description and classification of fossils but he did describe some microscopic plants from fossil amber which he found near Kilmarnock and some animal tracks from Carrick.

One of Smith's interests which deserves special mention was his fascination with microscopic fossils. As early as 1876 he started to extract such specimens from weathered limestone in cracks in quarry faces. Such work demands painstaking care and great patience. His efforts were soon rewarded when he found beautifully preserved sponge spicules. These
were officially recognised as a very important discovery by Dr Young of the Hunterian Museum, Glasgow University. Also present were conodonts, a group of minute fossils unknown to science until 1856 when they were first described from Russia. Smith’s specimens went unrecognised and were placed in the Hunterian Museum. They were eventually identified by the well-known specialist G H Hinde when he visited the Museum. Later Hinde published a monograph on conodonts in which many of Smith’s specimens from Scotland and England were illustrated.

Although Smith lived in Ayrshire for most of his life, he travelled widely to collect specimens from other areas. He obtained fossils from the English Midlands and from Devon while still the manager of the Kilwinning Ironworks. He spent some time in the Dudley district during this period judging by specimens in his collection. He may have been visiting this area of old-established iron manufacture in his professional capacity and took the opportunity to study the local geology. It was, however, after he left the ironworks (c.1890) and after his principal books had been published that his main travels commenced. From about 1905-7 he made large collections from the Solway area. In 1910 he explored the rocks of the Isle of Man for 10 weeks and published the results of this research the following year. In 1911 he visited Caithness to collect Old Red Sandstone fish and also went to Ireland.

He did not always work alone on these excursions. On his visit to the Solway Coast in 1907 he was accompanied by J Begg and J Neilson of Glasgow and J Wright of Kirkcaldy, all famous fossil collectors. The results of this work were published by Smith in 1910 suggesting that he was the leader. The same group minus Neilson visited the Swedish island of Gotland in 1913 to collect Silurian fossils. This was Smith’s only trip outside the British Isles. The writer was privileged to know James Wright (1878-1957) in his later years. Wright’s main recollection of the Gotland expedition was of three gentlemen hammering the rocks of a foreign shore, placing their prize specimens on large rocks and of the ensuing lively arguments concerning the ownership of the best specimens.

In 1914 Smith returned to Ireland and made a very fine collection of Ordovician trilobites from Pomeroy. He also visited the Yorkshire coast about the time the war started. He was working on the Jurassic rocks near Scarborough when he was mistaken for a spy, presumably having been seen acting in a strange manner. It took some time to convince his captors that his accent was Scottish and not German. This trip, at the age of 68, appears to have been his last one outside his home territory.

Published Works
Smith’s geological publications are largely descriptive of what he observed in the field and his interpretations of the geological phenomena. His first important paper was published in 1882 by the Geological Society of Glasgow and dealt with the geology of the Dalry district. From that time until the First World War a steady stream of papers on geological topics flowed from his pen. His productivity reached its peak in 1900 when he had no
fewer than eleven papers published. When it is remembered that he was also recording and publishing botanical and archaeological data during this period, the effort involved is truly remarkable.

**Other Geological Research**

Although the collection of fossils must have occupied the major part of his geological activity, other branches of the science also attracted his attention. Drift deposits, the clays, sands and gravels left by the last Ice Age, held a great interest for him. He made detailed descriptions of the types of deposits over large areas and suggested origins for the landforms left by the retreating ice-sheet. For Ayrshire alone he published a paper of 134 pages on the Drift deposits. He also wrote many accounts on the Drift of Southern Scotland and as far north as Clava near Inverness.

His studies of igneous rocks include published accounts of the granitic rocks of Arran, Ailsa Craig and Spango. In the field of minerals he was particularly interested in the distribution of barite in Ayrshire and published a book on the semi-precious stones of Carrick which deals mainly with agates.

Many of his shorter papers dealt with the detailed description of the sedimentary rocks at a particular locality and the names of the fossils present. Probably his most important discovery in this field was the finding of a bed with marine fossils on the Coal Measures of central Ayrshire. The significance of this find was recognised by C T Clough of the Geological Survey. He, in conjunction with Smith, correlated the Ayrshire band with one called Skipsey's Marine Band which had been recorded previously from Lanarkshire. This effected a major advance at the time in the classification of the Scottish Coal Measures and enabled comparison to be made with rocks of similar age in England.

Smith's work on the Scottish pre-Coal Measures Carboniferous rocks consisted principally of collecting extensive suites of fossils and describing the sequences of strata from which they were obtained. It was not possible to reach such far-reaching comparisons as his discovery of the marine band in the Coal Measures. Major classification and correlation of pre-Coal Measures in England only began to be made in a detailed fashion at the close of Smith's career. Nevertheless, his specimens were used by many subsequent researchers on the Scottish rocks to make major advances in correlating the Scottish Carboniferous succession with sequences in other countries.

John Smith's contributions to our knowledge of the geology of Scotland are immense. His descriptive writings and magnificent collections of fossils serve as a monument to his boundless energy and enthusiasm, his powers of observation and an overwhelming desire to record and interpret the mysteries of the natural world. For sheer dedication to the pursuit of knowledge he has had few peers in his own or any other generation.  

JOHN SMITH'S DISCOVERIES OF TRACE FOSSILS FROM OLD RED SANDSTONE AND CARBONIFEROUS ROCKS OF SOUTHWEST SCOTLAND

by John E. Pollard

In the years between 1890 and 1910 John Smith discovered and described a remarkable variety of trace fossils from Devonian and Carboniferous rocks of Ayrshire and Dumfries. These include probable early vertebrate footprints in the Upper Old Red Sandstone near West Kilbride\(^1\) (Fig 1,B), an unusual U-shaped burrow *Corophioidea* *polyplustra* \(^2\) from Carboniferous deltaic sediments near Kilmarnock (Fig 1, C), the rich arthropod trackway fauna from Lower Old Red Sandstone lava sequence of Dunure\(^3\) (Fig 1, A) and the first accurate illustration and listing of Carboniferous marine trace fossils from Arbigland on the Solway shore\(^4\).

During my own researches on Devonian and Carboniferous trace fossils in the past two decades, I have collected from three of Smith’s localities and examined many of his specimens in the Hunterian Museum, Glasgow and British Geological Survey collections in Edinburgh. I have grown to respect his accurate field observation, admire his industry of collecting, but been alternately intrigued and frustrated by his naming of trace fossils. His enthusiasm for Scottish local history and delight in self-taught Latin and Greek led to his creating a wealth of idiosyncratic and duplicated fossil names which are still being sorted out.

This paper reviews John Smith’s trace fossil contributions in stratigraphic order and attempts to assess briefly their importance in ichnology - the study of trace fossils (Table 1).

**Lower Old Red Sandstone arthropod trackways from Dunure**

Undoubtedly John Smith’s greatest contribution to our knowledge of trace fossils was his industrious collection and documentation of remarkably well preserved arthropod trackways from patches of sediment within andesite lavas of Dunure, which he described in his unique and rare book *The Upland Fauna of the Old Red Sandstone of Carrick* \(^5\). Here he documented more than 300 specimens he had collected from three localities (Fig 1, A1-3) (Dunure station 1905; coast or railway ½ mile southwest of Dunure, November and December 1907; coast 1 mile southwest of Dunure, March and April 1908). We know this because his collection was presented to the Geological Survey in Edinburgh in 1930, shortly before his death, and each specimen clearly bears details of locality and date of collection but not of his identification or relationship to his published illustrations or descriptions. However,
his accurate illustrations (1, Figs 1 - 56) have enabled his various genera and species, even sometimes particular specimens, to be recognised in our recent analysis of his collection.  

John Smith described 23 ichnogenera and 51 ichnospecies of trace fossils from Dunure, mostly new names with neither clear explanation of their etymology nor reference to other workers. This is typical of the purely documentary understanding of trace fossils in the late 19th and early 20th centuries, but also reflects his isolation from academic palaeontology. He illustrated several types of walking trackways (Fig 2A-C, Table 1), swimming traces (Fig 2D, Table 1), resting traces (Fig 2F, Table 1), large trails (Table 1), fine hair-like trails (Mermia Fig 2E) and diverse “burrows or nests” (Table 1), many of which may be of inorganic origin. There were also several types of “heat blisters”, solid and hollow blister-like moulds, possibly produced by foam or outgassing of sediment associated with vulcanicity. Smith believed that the traces were made by essentially terrestrial animals on the surface of the sediments which tilled fissures within the contemporaneous lavas.

By application of a modern understanding of factors that affect preservation of trackways, behavioural variation of the producers, review of comparable trace fossils worldwide, and the sedimentological and structural context of his specimens, we have been able to revise both the nomenclature and palaeoenvironmental conclusions. We concluded that approximately ten of his ichnogenera and twenty of his ichnospecies appear to be valid (Table 1) and that the ichnocoenosis reflects activity of a diverse early arthropod community in shallow water or marginal mudflats of freshwater pools, the soft muddy-silty sediments of which were intruded by andesite lavas with consequent baking, fluidization and production of gas flow and bubble structures. These unique conditions help to explain the remarkable quality of preservation of these trace fossils.

The documentation of this ichnofauna is remarkable in several ways. Smith clearly observed the intimate relationship of the lavas to the trace fossil bearing sediments, he collected and illustrated this rich fauna with considerable industry and accuracy and attempted to describe and analyse it to the limit of his knowledge. He failed to receive full recognition for his work because it was published privately in a small book with only very local circulation, his idiosyncratic nomenclature and “folksy” style may have caused it to be overlooked by serious academics. Also most subsequent studies of comparable trackways were either done in Germany or North America. We have attempted recently to set the record straight, but there remains yet more data to be gleaned from his unique collection of mid-Palaeozoic trackways which were preserved from a critical time in the terrestrialization of invertebrate life.

**Upper Devonian footprints from West Kilbride**

This brief record of possible vertebrate footprints from a railway cutting north of West Kilbride is again remarkable for they could be among the earliest vertebrate trackways known in Britain. The sizes and arrangement of these possible footprints (Fig 2G) do resemble those subsequently assigned to amphibian trackways in Carboniferous deltaic sediments.
sediments\textsuperscript{13} but they lack any clear evidence of digit impressions to confirm their tetrapod origin (\textsuperscript{14}, p.281). Smith's field data and description are again meticulous and he attempted to compare them with Carboniferous footprints from Dalkeith and Northumberland and with the well known Permian footprints of Corncockle Quarry in Lochmaben Basin and Elgin Sandstone in northeast Scotland\textsuperscript{14}.

Although Smith's specimen was not collected and the locality has not been described subsequently, the strata in which the possible trackway occurred have been assigned to the Stratheden Group (Upper Devonian age) and more definite vertebrate trackways have been recognised in the Upper Old Red Sandstone of the Orcadian Basin\textsuperscript{15} and mid to late Devonian rocks of western Ireland\textsuperscript{16}. These facts emphasise the importance of John Smith's footprints if they could be authenticated.

\textbf{Dinantian trace fossils from Arbigland, Solway shore}

Although the nature of the Lower Carboniferous rocks and their contained fossils, occurring on the north shore of the Solway Firth south of Dumfries, were quite well known prior to John Smith's 1910 paper, this was the first documentation and illustration of trace fossils from there. More recent studies\textsuperscript{17}, much yet unpublished, have confirmed a remarkably diverse shallow marine ichnofauna in these interbedded sandstones, shales and limestones, particularly in the Arbigland Group.

Smith listed about twelve discrete trace fossils (Table 1) assigned variously to "seaweeds" (fucoids), worms, tracks (trails in modern usage), burrows and "nest or open burrows" and clearly figured four types (\textsuperscript{,} Plates 2 and 3; Fig 3). The commonest trace fossils he rightly discerned were the burrows of sediment feeders \textit{Chondrites} and \textit{Teichichnus} (= \textit{Laminaria} of Smith) both listed as fucoids or fossil seaweeds, a common interpretation at that time, although he recognised in a footnote that they were probably not plants. New forms of silt-walled tubes \textit{Sabellitoida gregaria} SMITH (\textsuperscript{,} p.59, Plate 3) are probably now called \textit{Palaeophycus heberti} and the ribbon-like burrow \textit{Serpentaria problematica} SMITH (\textsuperscript{,} p.59, Plate 2., Fig 2) could be \textit{Scolicia}. Strangely, although he clearly recognised the "washed out dumb-bell" shape of the large U-burrows \textit{Corophioides polysulphon} SMITH (\textsuperscript{,} p.59, Plate 4, Fig 1; Fig 3) (\textit{Diplocraterion parallelum} Torrell here) Smith failed to identify the identical form of the smaller "dumb-bell" burrows he named \textit{Heuglia gregaria} SMITH (\textsuperscript{,} p.59, Plate 2, Fig 1) (\textit{Diplocraterion parallelum}). Transverse segmented trails or shallow burrows Smith correctly assigned to \textit{Cossoppodia} or \textit{Olivellites}, while the less distinctive horizontal burrows he called "Plinthoderma" or "Enteromorpha", dubious names.

This comprehensive listing and illustration of Carboniferous trace fossils in their context of both associated body fossils and sediments, stands as a pioneer study of British Carboniferous ichnology, yet to be fully documented and updated from this unique sequence.

\begin{table}[h]
\centering
\begin{tabular}{|l|l|l|}
\hline
\textbf{JOHN SMITH'S NAMES} & \textbf{MODERN ICHNOTAXA} & \textbf{INTERPRETATION} \\
\hline
\textit{Corophioides polysulphon} & \textit{Diplocraterion polysulphon} & U-burrow \\
\hline
\textit{Siskemia} & \textit{Siskemia} & ?eurypterid trackway \\
\textit{Stiaria} & \textit{Stiaria (Polychelcura)} & ?scorpionid trackway \\
\textit{Danstaria} & \textit{Danstaria} & ?myriapod trackway \\
\textit{Keircalla} & \textit{Keircalla} & arthropod trackway \\
\textit{Babylonia} & ?\textit{Diplichnites} & arthropod trackway \\
\textit{Stialla} & \textit{Stialla} & swimming trace \\
\textit{Icarlinia, Carrickia} & \textit{Stialla} & swimming trace \\
\textit{Archatonia, Droumia} & \textit{Isopodichmus (Rusophycus)} & crustacean resting trace \\
\textit{Cossoppodia, Plinthoderma} & ?\textit{Scolicia} & trails \\
\textit{Galania} & ?\textit{Scolicia} & trails \\
\textit{Mermia} & \textit{Mermia} & trail \\
\textit{Corculuthia, Heuglia} & \textit{INORGANIC?} & compaction cones \\
\textit{Curtia, Peasia} & \textit{INORGANIC} & bubble rings? \\
\hline
\textbf{1910} & & \\
\textit{Chondrites} & \textit{Chondrites} & feeding burrow \\
\textit{Laminaria} & \textit{Teichichnus} & feeding burrow \\
\textit{Sabellitoida gregaria} & \textit{Palaeophycus heberti} & tubular burrow \\
\textit{Serpentaria problematica} & \textit{Scolicia} & trail \\
\textit{Cossoppodia} & \textit{Cossoppodia (Olivellites)} & feeding trail \\
\textit{Plinthoderma} & ?\textit{Planolites} & feeding burrow \\
\textit{Enteromorpha} & ?\textit{Planolites} & feeding burrow \\
\textit{Corophioides polysulphon} & \textit{Diplocraterion parallelum} & U-burrow \\
\textit{Heuglia gregaria} & \textit{Diplocraterion parallelum} & U-burrow \\
\hline
\end{tabular}
\caption{Trace fossils described by John Smith, their modern names and interpretations.}
\end{table}
Corophioides polyupsilon SMITH from Carboniferous sediments near Kilmarnock

John Smith's name will long remain associated with the unique U-shaped burrow Corophioides polyupsilon SMITH (Fig 4) which he described from a deltaic sandstone close to the Index Limestone (Upper Limestone Group, Namurian) at Crawfordland Castle near Kilmarnock. Once again his painstaking fieldwork had located this distinctive burrow and its context in a remote stream section, as recorded in his notebook for 27 June 1888, now preserved in Glasgow University Archives.

This vertical U-shaped burrow with the unusual U-in-U form of the spreiten occurs in several beds in this section, but particularly in a carbonaceous sandstone rich in rootlets, plant fragments and other burrows (Fig 4). Although this ichnospecies has been reassigned to Diplocraterion, the distinctive form has been recorded widely from coal-bearing sediments of several ages including Jurassic deltaics of the Yorkshire coast and offshore in North Sea Basin.

In his description Smith clearly explained the origin of the spreiten by growth of the U-tube in response to sedimentation, noted their consistent vertical attitude but random horizontal orientation - a modern approach to field ichnology. He compared the burrows to those of the living crustacean Corophium and the lugworm Arenicola, but favoured a
crustacean producer shown by the name Corophioides. Here again his breadth of knowledge and experience as both a naturalist and a geologist led to a significant contribution to science.

Conclusions on John Smith's contribution to ichnology

From this brief review of John Smith's trace fossil discoveries it is possible to recognise his contribution to ichnology:

1. His detailed knowledge of the geology of Ayrshire and southwest Scotland led John Smith to make a series of remarkable discoveries of trace fossils in obscure localities and horizons.

2. His painstaking collection, field documentation and description have left unique records and specimens to posterity.

3. The breadth of his knowledge and devotion to geology and natural history enabled him to be intuitive in his interpretation and gave him a desire to record and publish his findings.

4. Although he must be recognised as a classic Victorian naturalist, his personality, self-taught science, limited resources and yet local eminence as a man of Ayrshire, may all have restricted his opportunities or desire to publish internationally. These factors have limited knowledge of his contribution and his true claim to be the pioneer of Scottish invertebrate ichnology. John Smith's work on invertebrate trace fossils should share the pioneer status that is accorded to Sir William Jardine's publication *Ichnology of Annandale* within the better known field of vertebrate ichnology.

Acknowledgements

I wish to acknowledge the help and contribution from my co-worker on Dunure trace fossils, Miss Elaine Walker, and advice and encouragement over many years from Dr. Ian Rolfe. Access to specimens collected by John Smith in both the Hunterian Museum and British Geological Survey collections is gratefully acknowledged. The Council of the Geological Society of Glasgow have kindly granted their permission to reproduce Figures 1, 3 and 4 from John Smith's illustrations in their Transactions.

References


GLACIAL DRIFT AND MARINE SHELLS
by J.D. Peacock

Introduction

The 85 years of John Smith’s life between his birth in 1845 and his death in 1930 spans the period between the foundation of the glacial theory in Scotland and its maturity into a picture that would be familiar to a modern Quaternary geologist, though dated. It also spans a great developmental period in marine biology and the application of the growing body of data to palaeoenvironmental studies of the period immediately post-dating the Ice Age, notably by amateurs associated with the Geological Society of Glasgow. Slightly earlier, following the biological results of early Nineteenth Century exploration, James Smith of Jordanhill, Glasgow, had discovered fossil remains of cold water ‘arctic’ mollusca in Scottish raised marine deposits and thus laid the foundations for the study of Pleistocene biogenic deposits in Britain. These two strands of research are intimately linked in late 19th Century thought, as they are in many more recent studies.

The idea that much of the superficial drift covering the bedrock was associated with glaciers and not the Deluge owes much to the visit of Louis Agassiz in 1840, though it had been foreshadowed in the lectures of Robert Jamieson, Professor of Natural History at Edinburgh, a decade or two earlier. However, the ghost of the Deluge persisted in glaciological circles in the form of the theory of the Great Submergence, said to have taken place between two episodes of land-based glaciation. The proponents of this theory, among whom was, at least initially, the great Scottish glaciologist T.F. Jamieson, held that boulder clay was a marine deposit. Thus, despite James Croll’s suggestion that the shelly boulder clay of Caithness was a product of land ice, the view accepted by many workers mid-way through the latter half of the 19th Century was as follows:

1. Great early glaciation by land ice
2. Glacial marine beds (great submergence)
3. Later glaciers.

Jamieson recognised that the amount of submergence was difficult to explain, even though marine shells had been found upwards of 1300 ft OD on Moel Tryfearn in north Wales; he was clearly more comfortable with an upper limit of about 500 ft, the level of shelly beds then recently discovered at Clava, near Inverness.

The 1870s also saw the publication of James Geikie’s seminal work on the Great Ice Age, the first edition of which appeared in 1874. In it he made a distinction between till, wholly a product of land ice, and boulder clay, with comminuted fragments of shells, which he took to be of marine origin. However, he admitted that it was often difficult to tell the one from the other. Like Jamieson, he did not accept there were marine deposits intercalated with till much above 500 ft OD. Three years later, in the second edition of his book, Geikie consolidated his view that many deposits and landforms in Scotland were the result of the work of glaciers and ice-sheets rather than marine processes. He concluded that there was no difference between till and boulder clay, that both were the products of land ice, and that broken shells occurred in such deposits in precisely the same way as stones or boulders (cf.). However, though Geikie’s views carried great weight, the glacial drift controversy (marine versus land ice) was far from over when John Smith started his work about 1880 (e.g.7,8) and would continue into the 20th Century.

John Smith’s Researches

It would be presumptuous to assess scientific work carried out 100 years ago solely in the light of modern knowledge. All those engaged in geology feel themselves fortunate if the theoretical results of their research stand for longer than a decade or two, and even the most careful descriptions of, say, sections in a river bank, may be found wanting in later years because the eye is guided to some extent by the current scientific fashion. Few people in the last quarter of the 19th Century had first-hand knowledge of glaciers and ice-sheets. Moreover Smith, with his wide interests, can be likened to earlier naturalists such as Hugh Miller but, unlike Miller, he lived at a time when it had become difficult, if not impossible, to be at the leading edge of science across a wide field.

Smith’s Quaternary interests were broad, though concerned chiefly with the glacial drifts of Ayrshire. However, he was also familiar with coastal geomorphology and recorded flint nodules and fragments of pumice in raised beaches in Scotland10,11. Other geomorphological investigations included dry river channels12,13 and the ‘Thousand foot platform’ on Arran14.

Smith also joined the enthusiastic band of Glasgow amateurs who took an interest in the occurrence of ‘arctic’ molluscs and other organisms in the ‘Post-Tertiary’ deposits (in what now would be termed Late- and Post-glacial marine and beach deposits), as well as in boulder clay15,16. The latter impinged on his views concerning the genesis of glacial deposits (see below). He pointed out that though bivalve marine shells in boulder clay were found as single rather than paired valves and that many were fragmentary, their most delicate features, such as the periostracum, could be preserved. This he thought was due to separation of the valves by agitation of the water following decay of the ligament and to the breakage of shells by stones dropped from floating ice17. These observations stand today, but with 100 years of hindsight, modern workers would add other possibilities such a rafting of marine sediments and deposition by debris flow from glacier ice.

Much of Smith’s most important work in the Quaternary field is included in a supplement to volume 11 of the Transactions of the Geological Society of Glasgow in 189818, though the accompanying fossil list was updated later19. The first part of the 1898 paper20 gives details
of 212 localities for glacial deposits, arranged according to height above sea level. It is illustrated by forty-nine figures and a map of Ayrshire showing the occurrence of stratified beds accompanying boulder clays, localities for marine shells and glacial striæ. The last part is devoted to a theoretical discussion.

Smith's changing views over the previous 20 years or so are summed up in the Preface of his 1896 paper7. The first paragraph reads "Before beginning a critical examination of the Ayrshire Drift or Glacial Deposits, I held the opinion that the various Boulder-clays were (so-called) 'ground moraines', or, in other words, accumulations of material supposed to have been made and deposited by land-ice". He seems to have held this hypothesis until at least 1891, when he published a paper on the Garnock valley18. Further, "section after section seemed to protest against this theory, but rooted ideas are difficult to eradicate, and it was only after the examination of a great number of sections that I was forced to abandon the land-ice theory of the origin of the drift beds, and definitely to attribute them to deposition in water". He goes on to say that he had reached this conclusion prior to finding marine shells at very high levels. His further examination showed that boulder clays are commonly well stratified, sandy parts often being seen in undeformed beds exposed in river scours. The discovery of shells to 1,000 feet OD left him in no doubt that the environment was marine. However, Smith also noted that the stratified beds were often deformed, chiefly by land ice, and it was probably this that had led many geologist to suppose the boulder clays were ground moraines. The only true ground moraine recognised by Smith was a thin layer of clay and stones immediately overlying bedrock.

It is clear from the above that Smith's views were those of a careful observer. Any geologist working on Quaternary deposits at the present day would have considerable sympathy with the dilemma that Smith found himself in. He was faced with evidence of two kinds. First, on low ground, there were several sections, well known at the time, that showed two boulder clays between which were varied deposits, including sands with marine shells, and sandy clays with mammoth bones (see17, p.11-12; p.13; p.20). These were ascribed to marine deposition by contemporary workers (e.g. 19). Indeed, the upper boulder clay was said to be of marine origin by one school of thought well into this century20. Only recently has it been confirmed at another, analogous site that both boulder clays are lodgement tills laid down by glacier ice and that the intervening deposits at this particular locality are lacustrine and fluviatile21.

Second, on higher ground, boulder clays are interbedded with known waterlaid deposits such as laminated silt, sand and gravel (Fig 1A), and (very rarely) thin peat, all items excepting the silt and peat locally containing marine shells (see above). Smith's detailed observations include notes of sections in which shelly beds are seen to be highly deformed and twisted both upwards and downwards into the boulder clays. In some cases he could ascribe such deformation to the dragging action of later land ice. He also recorded contorted laminated clay overlain by horizontally bedded clay (17, p.34), steeply dipping sand dykes cutting boulder clay (Fig 1B), laminated clay grading upwards and downwards into boulder clay (Fig 1D).
and four beds of boulder clay with interbedded sand and gravel (p.73). Such descriptions should excite the interest of any glacial geologists. Are the sand dykes tectonic, or are they ice wedge casts? Elsewhere he records a line of boulders in till (Fig 1C). This is possibly the side view of a boulder pavement that would now be associated with the passage of a glacier.

In hindsight it can be seen that a resolution of the land-ice versus marine origin for many glacial deposits was not possible pending the study of processes at glacier margins and the growth of sedimentology and structural geology, particularly in the period post 1950. The matter has still not been satisfactorily resolved in some instances. Despite W.B. Wright's view that what he termed the 'geological fiction of the Great Submergence' had effectively been destroyed by 1937, it has recently been revived in a new form (a consequence of glacioisostasy) for Clava and Caithness and for the Irish Sea. It has likewise generated opposing views, for instance Merritt for Clava; Austin and McCarroll for the Irish Sea.

Lastly, it is clear that the Ayshire drifts have been badly neglected by later research. They certainly deserve detailed reexamination by Quaternary workers as dedicated and determined as John Smith, and only then will it be possible to fully assess his contribution to glacial geology.

References

The Semi-Precious Stones of Carrick
by B. Jackson

The *Semi-Precious Stones of Carrick*, written by John Smith¹, is about agates: potato-like objects composed of silica, found mainly in lavas. Superficially uninteresting, when cut and polished they show a wonderful range of colours and structures. These beautiful semi-precious stones are commonly seen in traditional Scottish Victorian jewellery. John Smith records that visitors to Carrick seldom left without a few agates to have cut into trinkets as a memento.

The great age of railways presented Smith with a unique opportunity to study thousands of agates. The construction process for the coastal railway involved excavating extensive cuttings through agate-bearing Old Red Sandstone lavas. As Smith put it "it is not often one has one hundred navvies digging out specimens galore from which he may hammer, pick and choose at his own sweet will".¹ Wishing to throw light on agate formation, he carefully recorded his researches which form the basis of his privately printed book, one of the earliest works on agates. Smith would have been familiar with Heddle’s work on agate theory, but started from his own observations of the shapes of agates and their relationship with the parent rock.

One thread running through his book is that only one substance at a time is deposited; a view still fundamental to agate formation theory. Temperature of agate formation is important as it gives an indication of the processes involved. Smith considered the temperature of formation, thought it “idle speculation to enquire”,¹ but suggested there was nothing to stop cavities being filled before the rocks had cooled. He cites turbid structures in support of this, thereby advancing a hydrothermal origin of the agate-forming fluids. There is still speculation on the temperature of formation of agates but most modern researchers hold to a low temperature of formation from mineralized ground water.

Smith assigned mineral names to the different mineral components making up the agate but cited no supporting evidence. How did Smith differentiate these? Did he enlist the services of his friend the chemist Archibald Shanks? I suspect that he drew on Heddle² since he analysed many mineral phases in agates and described their gas cavity occurrence in detail.
One verifiable piece of evidence makes me believe that Smith did not undertake primary analysis. In her drawing of a seven component agate (Fig. 1) he describes both calcite and aragonite (polymorphs of calcium carbonate) in the same specimen. I have examined that specimen (Fig 2) and identified both phases as calcite. Techniques for differentiating these species were available at the time but Smith appears not to have used them. His identifications seem therefore, to be based on other people’s works and descriptions. Nevertheless, he confidently commits unsubstantiated identifications to print, reflecting reliance and faith in his powers of observation.

Painstakingly, Smith categorised agates by the number of features and minerals they contained, drawing several examples of each class. Her agate diagrams are acknowledged by Macpherson as the best at that time. He puzzled over the different features and made imaginative suggestions for their origins, e.g., the formation of curved and twisted stalactites in agates. Drawing from the agents responsible for twisted cave calcium carbonate stalactites, he questioned whether electrical currents could be involved. Diffusion, such as that involved in ring formation by periodic precipitation, is indeed affected by electric fields. However in an almost mind-expanding vision, perhaps brought on by his encounters with the literature of H.G. Wells, he postulates that “in agates formed in the rocksline of the future will it be too much to expect that electrograms will be found written which had been impressed by wireless telegraphic messages?”

Undaunted, Smith tackled the ultimate agate questions - how did the solutions get into the cavity and what happened next? The perceived wisdom of the day, accepted by Smith, was that solutions percolated through micro-fractures in the rock, dissolved minerals and eventually entered the gas cavities. He asked “did the substances, quartz, tridymite, chalcedony, semi-agate, cachalol, carnelian and opal, all closely chemically allied, exist in the solution as these substances, or were they differentiated from a uniform solution?” A question on whose answer Smith remains silent.

He turns instead to the feeder solution problem. His observations led him to reject the mineralogists’ view, first proposed by Heddle, that solutions enter through each layer as it is formed and exit through a hole, produced by internal pressures, which ultimately grows into a pipe or funnel shaped avenue - the so-called tube of escape. Why? He rarely saw agate with tubes of escape - perhaps only one in a thousand. There had to be another explanation and Smith’s answer was simple. If a solution charged with minerals could percolate through layers of agate on its way into the cavity, then, having lost its mineralized load through deposition, it would be no more difficult and perhaps easier for the watery solution to exit the same way. Smith’s explanation still has disciples but many cannot accept that solutions may freely enter and exit through solidified layers, even by osmosis.

In summary, The Semi-Precious Stones of Carrick makes a bold attempt to tackle the problem of agate formation. The descriptions and drawings are exceptional; no other author of the time presented such a wealth of detail. He summarised the theories of the day and
add his own. He could not, however, resist adding "or how the dickens was it". Macpherson wrote in the margin of the NMS copy of The Semi-precious stones of Carrick "give it up John". This is a flippant comment about someone who by careful observation gave us an original, plausible alternative to the mineralogical theory of the day. Smith rightly stands as an equal alongside other researchers who have tackled the mystery of agate formation, which, despite huge advances in scientific instrumentation, is still controversial.

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ALARMS AND EXCURSIONS
by Jenni Calder

In the 1920's John Smith led a number of excursions for ladies, recorded by him in the Ardrossan and Saltcoats Herald in 1921. We do not know who these women were - perhaps locals fired by Smith's own enthusiasm, perhaps some who went to develop a professional involvement - and Smith's articles provide no clues. However, this little vignette nonetheless sheds a fragment of light on women's involvement in science.

Women in science in the 19th century were typically characterised as helpers and amateurs. Literature and languages were the traditional territory of women's intellectual activity. But attention began to turn to the sciences, and perhaps because the professionalization of science was slow to come, women gained reader access to some areas then might have been expected. Geology, with natural history and botany, seemed particularly accessible, though many barriers, psychological and physical, survived. The view that it was misguided to educate women lingered: "There is a strong and ineradicable male instinct, that a learned, or even over-accomplished young woman is one of the most intolerable monsters in creation".1

The frustration of women with scientific aspirations can only have been intensified by the increasing numbers of books of 'popular science' and the many museums featuring natural history and geology displays and offering lectures to all comers. For women were excluded from the learned societies, essential stepping stones to professional scientific activity: the Royal Society, the Linnean and Microscopical Societies, did not admit women. The British Association for the Advancement of Science strongly resisted the participation of women, with repeated attempts to exclude them from meetings and lectures. But at a local level natural history clubs did accept women members, and in London the Royal Institution positively encouraged women to attend the lectures there, which they did in large numbers.

Part of the appeal of geology was that it could be pursued without sophisticated equipment or special premises. Women did not need rooms of their own to be amateur geologists. Collecting specimens had grown as the almost inevitable consequence of the interest in landscape and the works of nature. Women such as Mary Anning and the Misses Philpot who collected fossils for a generation of geologists made a significant contribution. In addition, although it was assumed that the professional had to be male, women were often partners in science as well as in marriage. Charlotte Murchison, Pauline Jermy, Mary Morland (the wife of William Buckland), Mary Elizabeth Horner (married to Charles Lyell) were all practising geologists, however much they remained in the shadow of husbands and
mentors.

It is clear that the scientific education of women was being pushed and pulled in different directions. Even in the early 20th century the assumption was that science was not for girls. Commonly, elementary chemistry and biology were taught, if at all, in the context of domestic science and hygiene. The emphasis was all on the preparation to manage a home and a family. Women themselves colluded in the view that certain subjects were unnecessary and stressful. "Mathematics should be kept at a minimum for girls", argued a headmistress of Manchester High School in 1907; "it does not underlie their industries as it does so many of the activities of men".2

Arguments about the inadequacy of women's brains and their general lack of intellectual and physical stamina rationalized a profound difficulty with an almost inevitable consequence of women entering formal further education: it was difficult to keep them apart from men. Even the foundation of all-female schools and colleges was seen by some as less a solution than the thin end of a wedge leading to a promiscuous association of men and women. Nevertheless, in the 19th century there was little resistance to the idea of women getting out into the open air and doing a little light collecting, even in male company.

It may not have been unusual in itself for John Smith to set off with lady geologists to make studies of sills or trap dykes. What may have been uncommon was the expectation that the women could and would participate at his level. Something rather different is implied in Alexander Boyd's account of a woman student at Glasgow University asking Smith to take a group of female geology students "on a few rambles and giving them some lessons on geology".3 The tone of Boyd's account in 1930 shows that the condescension and paternalism that colours so much of 19th century male attitudes to women in science were still alive and well. It was assumed that the "young ladies" were not serious students: "The young lady geologists soon wearied of the long and arduous walking". Was Smith's single-minded pursuit of his passion for geology a deterrent, too much for the sensitivities and the physical abilities of the ladies? Smith would certainly have had no inclination to arrange rambles to amuse the fragile.

The request to Smith suggests that some women students had less opportunity than men for the more robust aspects of their studies. In 1892 the four Scottish universities had all opened their degrees to women. By the 1920's women could study geology as integrated members of a university community, but for women to have a career was still problematic. The British Geological Survey did not recruit its first women until the late 1920's.

Given the huge social and cultural resistance to women's professional participation in science, any opportunity allowed to women to study geology was valuable. This applies not just to arrangements made specifically for women, but to the encouragement of an environment that opened up learning to all for 'whom access to education was difficult'. John Smith was generous with his own knowledge, even if there were few who could match his passion for his subject and his stamina in its pursuit. His journalism in itself spread an awareness of geology, which may have inspired women to follow in his footsteps, figuratively if not sharing his 'long arduous walking'.

References
1 Female Intuition, An Address to Mothers on the Education of Daughters, not dated, pp266-7
3 Boyd, A. 1930. The Biography of John Smith, Ardrossan, p.64.
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