Engaging with Geodiversity: 'Stone Voices', Creativity and Cultural Landscapes in Scotland

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ABSTRACT Geodiversity is an integral part of Scotland's natural heritage and is closely linked with many aspects of the cultural landscape and the development of geotourism. These wider links provide opportunities for creative ways of raising awareness of Scotland's Earth heritage, complementing more traditional didactic approaches. The 'voices' of the stones open new opportunities for re-engagement with geodiversity and are revealed in different ways through historical developments in geoscience, archaeology, the built heritage, literature, poetry and art. The creative influence of geodiversity also allows a broader interdisciplinary exploration of the cultural engagement with landscape and the deep connections between people and the natural world, highlighting the continuity between the present and the past, and helping to link people today with their cultural roots and sense of place. This approach can also

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enable Earth scientists to engage with a much wider audience and to promote better appreciation of the relevance of geoscience in an increasingly dynamic world under climate change projections.

KEY WORDS: Geodiversity, landscape, literature, art, cultural heritage, geotourism

Introduction

Scotland has a remarkable variety of landscapes, reflecting the diversity of its rocks and landforms and the events that have shaped them. This geodiversity - the variety of rocks, minerals, fossils, landforms, sediments and soils in an area, together with the natural processes which form and alter them – is the result of global tectonic processes, plate movements and long-term climate change during a geological history extending over some 3 billion years (Gordon, in press). The land mass that is now Scotland has experienced episodes of mountain building, volcanism, large-scale crustal deformation, uplift and erosion, and glaciation, all of which have left a legacy both in the rock record and in the landscape (e.g. Trewin, 2002; Gillen, 2003; McKirdy et al., 2007). Today, Scotland's rocks and landforms are an asset of national and international significance. They provide an exceptional record of geological processes and landscape evolution over much of the Earth's history, and fossils contained in the rocks have played a key part in studies of the evolution of the plant and animal kingdoms. More recently, particularly during the last 6000 years, the 'footprint' of human activity has increased, as recorded in

archaeological remains, soils, surface vegetation and the built environment (Edwards & Ralston, 2003).

The stories of these events and processes have formed the basis of the traditional didactic approach to raising awareness through Earth heritage interpretation (Gordon et al., 2004; Gordon & Kirkbride in press). Often this has involved geologists 'preaching to the converted', neglecting a wider audience unfamiliar with the concepts and technical language of geoscience and unable to read the history of the landscape from the two-dimensional representation of the geological map. Consequently, geology has been traditionally perceived by the wider public as "dull and rather opaque", conveyed through use of over-technical language and without reference to people's everyday experience (McKirdy et al., 2001). However, there is increasing recognition that geology affects all our lives and underpins many aspects of the natural heritage, landscape, economic activities, historical and cultural heritage, geotourism, a variety of recreation and leisure activities, and sustainable management of the land, rivers and the coast (e.g. Gordon, 2004; Gray, 2004; Stanley, 2004; McKirdy et al., 2007; Gray & Gordon, 2008). The European Geoparks Network, endorsed by UNESCO, represents one important expression of this changing perception, providing a means to integrate geodiversity, landscape, people and culture within a framework of sustainable development (Eder & Patzak, 2004). In particular, Geoparks offer alternative opportunities for people to engage with geodiversity through heuristic, cultural-experiental approaches that include explorations of the links with landscape, archaeology, built heritage, literature, poetry, art and music. Scotland is particularly well placed in this respect, since the landscape and its

geological features have been an integral part of human endeavour and a powerful source of inspiration for literature, poetry, art and music. This was clearly articulated by Neal Ascherson (2002) through the metaphor of "stone voices". He wrote that "…human experience in this difficult northern place has been built so intimately into the geology and the post-glacial ecology of Scotland that a people and its stones form a single cultural landscape" (p. viii). Although Ascherson was referring to stone monuments, the metaphor has a much wider resonance. In particular, this paper examines how the 'voices of the stones', expressed through the historical development of geological science, archaeology, the built environment, literature and art, reveal the creative influence of geodiversity on the cultural landscapes of Scotland. Such creative media offer alternative pathways for raising wider awareness of the value of geodiversity, fostering engagement with places and promoting better understanding of its relevance and significance today (Carter & Badman, 1994). They involve developing a new awareness of the influence of geodiversity through engagement with different forms of cultural experience and appreciation of the geopoetics of the landscape. In doing so, they open up additional perspectives on the connections between people, place and landscape, their cultural representations and the deep engagement of people with the natural world (e.g. Cosgrove & Daniels, 1988; Short, 1991; Daniels, 2004; Harrison et al., 2004; Nash, 2005).

Creating the Foundations of Modern Geoscience: the Legacy of James Hutton

Scientific enquiry and discovery are an integral part of the cultural landscape of Scotland, reflected not only in a remarkable lineage of eminent scientists and seminal publications, but also in wider public interest and engagement, both in the past and seen today in

events such as the Edinburgh Science Festival and centres such as Our Dynamic Earth in Edinburgh and the Glasgow Science Centre, and in the popularity of museums such as the National Museums in Edinburgh and the Hunterian Museum in Glasgow. Scotland's geodiversity has played an important part in the historical development of geoscience and today is a focus for research on questions of global significance. From a history of science perspective, the creative influence of Scotland's geodiversity is rooted in the work of James Hutton who laid the foundations of modern geoscience (McIntyre and McKirdy, 1997). Along with David Hume, Adam Smith, Joseph Black and others, Hutton was a key figure in the Scottish Enlightenment during the latter part of 18th century (Daiches et al., 1996). He outlined the principle of uniformity, that the processes shaping the Earth today are the same as those that operated in the past and that the rocks on the surface of the Earth have been recycled many times through erosion, sedimentation on the ocean floors, consolidation and uplift. He revealed the vast immensity of geological time, and in doing so, freed geology from the constraints of a literal interpretation of the Bible and Archbishop Ussher's calculated age of 4004 BC for the formation of the Earth. Hutton's ideas were solidly grounded by field observations. One particular site, Siccar Point in Berwickshire, is now famously associated with Hutton, which he visited in1788 with James Playfair and Sir John Hall. Here they observed a coastal exposure showing steeply dipping slates overlain by gently dipping beds of sandstone. Hutton's great insight was that the break or 'unconformity' between the two sets of strata represented an immense period of 'missing' geological time. The steeply dipping slates had originally been deposited on the floor of the sea and were later upended and eroded. The sandstones were subsequently deposited unconformably on the eroded surface, indicating the elapse

of a long interval of time after the deposition of the slates. Clearly, vast periods of geological time were required for these processes to occur, involving the recycling of whole worlds. Hutton (1788) memorably encapsulated this in his conclusion:

> *The result, therefore, of our present enquiry is, that we find no vestige of a beginning, - no prospect of an end.* (p. 304).

Hutton's work provided a foundation for later generations of distinguished Scottish geologists, including Charles Lyell, Roderick Murchison, Hugh Miller, John Horne, Benjamin Peach, Archibald Geikie and James Geikie, who developed many of the fundamental principles of geoscience. His ideas were advanced through the publication of John Playfair's *Illustrations of the Huttonian Theory of the Earth* (1802), and later through Charles Lyell's classic *Principles of Geology* (1830-1833). Hutton's influence spread beyond the field of geology. Most notably, Charles Darwin read Lyell's work and realised that Hutton's extended geological timescale enabled a realistic timeframe for his own theory of evolution. In the literary world, Sir Walter Scott and Robert Burns reflected his ideas in some of their own writing.

In the 19th century, geology was also matter of wider public interest as well as scientific inquiry. For example, evidence from Scotland proved vital for the development of the Ice Age theory and Louis Agassiz's concept of continental-scale glaciation in the Northern Hemisphere because there are no present-day glaciers and the mountains are relatively

low in comparison with the Alps (Gordon, 1995). During his visit in 1840, Agassiz found abundant traces of former glaciers, notably in Glen Roy and Glen Spean, and later wrote:

> *It was in Scotland that I acquired precision in my ideas regarding ancient glaciers. The existence in that country of so considerable a network of these traces, enabled me to appreciate better the geological mechanism of glaciers and the importance of many facts of detail observed in the neighbourhood of those which now exist*. (Agassiz, 1842, p. 240).

Agassiz' confirmation of the former existence of glaciers in Scotland was first announced to the world in *The Scotsman* newspaper on 7 October 1840, described by Ascherson (2002, p. 31) as scooping "the biggest story on earth". Until then, in line with the Scriptures, surface landforms and deposits were widely explained in terms of marine submergence akin to the Biblical Flood. Ascherson (2002) noted the implications of Agassiz' revelation at a time when many of the paper's readers would have held creationist views and still followed a literal reading of the Bible. In the mid-19th century, geology and biology raised serious questions about Divine creation. The struggle to reconcile the geological evidence and the Scriptures is well exemplified in the writing of Hugh Miller (Knell & Taylor, 2006; Taylor, 2007). Miller was a stonemason and a self-educated man who became a newspaper editor, writer of popular science and world-renowned expert on fossil fish, particularly from the Old Red Sandstone rocks. In the Victorian tradition, he advocated the study of geology as a means of self-help and improvement. Through his skilful writing, he played an important part in promoting

wider public understanding of geology, influencing a whole generation through his unique literary style, weaving observations of rocks and fossils together with folklore, legends and local scenery into the accounts of his travels (e.g. Miller, 1858). For Miller, geology essentially "formed a landscape inhabited by people" (Taylor, 2007, p. 109). In his writing, he adopted a pragmatic approach, reconciling the geological evidence and religion by recognising both the truth of the scientific evidence in the rocks and fossils and also the role of divine Creation in their design (Knell & Taylor, 2006; Taylor, 2007).

Today, modern geoscience has a huge practical relevance, particularly in the context of global change (Boulton, 2001), but to most people, Scotland's geodiversity and the value placed on it remains largely unappreciated, despite the dependence of society on the sustainable use of the Earth's resources. Similarly, public understanding of Earth surface processes is poor, although awareness of the effects of climate change and geomorphological hazards, such as landslides, flooding and coastal erosion, is fundamental to many human activities and the decisions, from a personal level to government policy, which will need to be made in relation to future mitigation and adaptation.

Stone Landscapes: Archaeology and the Built Environment

At a more practical level, geodiversity has historically been an integral factor in daily human life in rural Scotland, for example influencing soils, sites for settlements and sources of water, but it is also a feature of the built environment. The use of stone for

monuments and buildings, in particular, is one of the clearest expressions of the links between geology and cultural landscapes, as revealed in archaeological monuments and in the more modern built environment, both in the countryside and in the city (Naismith, 1985; Edwards & Ralston, 1997; McMillan et al., 1999; Wilson, 2005). Two contrasting examples illustrate some of these links.

The Orkney archipelago is a series of low, ice-moulded islands formed predominantly of Devonian sandstones rising above the waters of the North Atlantic. These "whale islands", as described by George Mackay Brown (1989), are notable for their dramatic coastal scenery of cliffs and sandy beaches shaped under a predominantly rising Holocene sea level. People have been an integral part of the postglacial landscape of Orkney, attracted by fertile soils and rich maritime resources. However, the early Mesolithic hunter-gatherers would have encountered a rather different landscape, with sea level perhaps 30m lower and more woodland. Later Neolithic settlers have left a remarkable archaeological legacy in the form of stone monuments, burial sites and settlements now inscribed as a UNESCO World Heritage site. They include the symbolic use of monolithic slabs of sandstone at the Standing Stones of Stenness and the Ring of Brodgar, and the magnificent chambered cairn of Maeshowe with its entrance passage aligned with the setting sun at the winter solstice. George MacKay Brown (1992) eloquently described the builder of Maeshowe as "a poet in stone". Skara Brae, a Neolithic village exposed by coastal erosion, reveals the skilled use of local stone both to build the houses and internally in the furniture. Later Bronze Age and Iron Age settlements also demonstrate considerable masonry skills, notably in the construction of

the Iron Age brochs. The magnificent St Magnus Cathedral in Kirkwall, dating from the early 12th century, is a further monument to the continuity of the cultural tradition of stone architecture in Orkney. It is built of local red Devonian sandstone, with yellow sandstone from Eday used for decorative effects.

The modern urban landscape of Scotland is also an intimate blend of geodiversity and cultural influences. In Edinburgh, for example, the physical landscape of the city is fundamentally shaped by its underlying sedimentary and volcanic rocks formed during the Devonian and Carboniferous. Differential erosion over many millions of years has shaped the present landscape, with the more resistant volcanic rocks now forming the higher ground. The Braid, Blackford and Pentland Hills are remants of volcanoes that were active around 400Ma; Arthur's Seat, Calton Hill, Castle Rock and the Craiglockhart Hills were formed by slightly younger volcanic activity around 350Ma. Molten rock from the Arthur's Seat volcano was intruded between layers of sedimentary rock and now forms the spectacular dolerite escarpment that overlooks Holyrood Park and the Scottish Parliament. During the Quaternary, ice sheets eroded the bedrock, forming a streamlined, ice-moulded landscape. Locally, the more resistant igneous rocks protected the sedimentary rocks on their lee sides, so that crag-and-tail landforms were produced, notably at Castle Rock and the Royal Mile, which now form the centrepiece of the Old Town, also a World Heritage site.

Geology is equally closely woven through the fabric of the city buildings. First worked to produce stone for Edinburgh Castle in the 17th century, Craigleith Quarry was one of the

principal sources of building stone during the 18th and 19th centuries and its sandstone features prominently in the buildings of the New Town (McMillan et al., 1999). More recent building works have involved the use of stone from further afield in Scotland, notably the extension to the National Museum of Scotland (Clashach sandstone) and the Scottish Parliament (Kemnay granite and Caithness flags), adding to the urban geodiversity. As part of a process of raising awareness of earth heritage in the urban environment, 'naming stones' events have been held in Edinburgh to help reconnect the built and natural heritage in people's minds (MacFadyen & McMillan, 2004).

The built landscape is therefore a witness to the past, recording the evolving links between archaeological sites, historical buildings, people, places and geological landscapes. The blending of landscape form, stone building materials and architectural style also helps to define a sense of place.

Literary Landscapes

Landscapes and their geological features have been a powerful source of inspiration for literature and poetry in Scotland, forming part of the fabric of the novels of Sir Walter Scott, Robert Louis Stevenson, Lewis Grassic Gibbon, George Mackay Brown, Neil Gunn and many others (e.g. Scottish Literary Tour Company, 2001). Neil Gunn (1959) wrote that: "A novelist cannot write about people in a vacuum. They must have a background, and the background becomes part of them, conditioning to some extent everything that they do." (p.43). The influence of geology and landscape in this context

is central in the work of Lewis Grassic Gibbon (Whittington, 1974). For Gibbon, people were an integral part of the landscape, vividly expressed in his essay, *The Land* (Gibbon, 1934):

> That *is The Land out there, under the sleet, churned and pelted in the dark, the long rigs upturning their clayey faces to the spear-onset of the sleet……*That *is The Land – though not quite all. Those folk in the byre whose lantern light is a glimmer through the sleet as they muck and bend and tend the kye, and milk the milk into tin pails, in curling froth – they are The Land in as great a measure*. (p. 293).

In *Sunset Song*, writing about the Mearns in NE Scotland, Gibbon (1932) marvellously captured the sense of place and the lives of the people living and working on the 'coarse' land on the 'long, stiff slopes of dour clay' - the red, stony soils developed on the Old Red sandstone glacial till. He conveys a harsh realism but also an elemental beauty rooted in the land and the sky, and he visualises continuity with the past and the eternal nature of the land compared with human existence –

> *...nothing endured at all, nothing but the land she passed across, tossed and turned and perpetually changed below the hands of the crofter folk since the oldest of them had set the Standing Stones by the loch of Blawearie and climbed there on their holy days and saw their terraced crops ride brave in the wind and the sun.* (p. 97).

The novel is set against a backdrop of the Great War and human cruelty, and at a time of great changes in the countryside and the passing of a way of life, yet the land endured –

> *... she turned to the land, close to it and the smell of it, kind and kind it was, it didn't rise up and torment your heart, you could keep at peace with the land if you gave it your heart and hands, tended it and slaved for it, it was wild and a tyrant, but it was not cruel.* (p. 174).

In contrast with the romantic picture postcard view and aesthetic experience of landscape, described below, people here were involved with the landscape, living and working as part of it, and their history is preserved in the archaeological remains buried in the ground, adding a sense of continuity with the past.

Other writers have stressed the sense of place and aesthetic quality of the landscape, as well as the powerful Earth forces which have shaped it. As an example, the Cairngorms are one of Scotland's best-known landscapes fashioned by geology. The great bulk and scale of these mountains closely reflects the form and characteristics of the granite intrusion and the processes which have shaped the landscape through geological time. Consequently, the Cairngorms have a special 'feel' of vastness and space, quite different from the mountains of western Scotland. Henry Alexander (1928, p.7) captured the essence of the landscape perfectly -

> *The very bareness of these mountain-tops is on a majestic scale, and it forms one of the elements in the massive grandeur and repose which are the distinguishing characteristic of the Cairngorms.* (p. 7).

And,

> *…one realises the immensity of the scale upon which the scene is set, and the greatness and dignity and calm of the Cairngorms cast their spell over the spirit.* (p. 7).

The integrity between the geological past and the present landscape, between the natural processes and the plants and animals, was also conveyed by Nan Shepherd (1977) in *The Living Mountain*. In one particular passage, she evokes the energies and forces that have shaped the landscape:

> *So there I lie on the plateau, under me the central core of fire from which was thrust this grumbling grinding mass of plutonic rock, over me blue air, and between me the fire of the rock and the fire of the sun, scree, soil and water, moss, grass, flower and tree, insect, bird and beast, wind, rain and snow - the total mountain.* (p. 93).

In her poem, *The Hill Burns*, she expresses an uplifting sense of essence or purity emerging from the great turmoil of the geological past (Shepherd, 1934):

Out of these mountains,

Out of the defiant torment of Plutonic rock,

Out of fire, terror, blackness and upheaval,

Leap the clear burns,

Living water,

Like some pure essence of being,

Invisible in itself,

Seen only by its movement.

In a similar vein, John Muir, one of the most powerful Scottish writers about the natural world, drew inspiration from the wilderness areas of North America. Amongst many memorable passages, he captured wonderfully the role of glaciers in shaping the landscape:

There is sublimity in the life of a glacier. ……..glaciers, back in their white solitudes, work apart from men, exerting their tremendous energies in silence and darkness. Outspread, spirit-like, they brood above the predestined landscapes, work on unwearied through immeasureable ages, until, in the fullness of time, the mountains and valleys are brought forth, channels furrowed for rivers, basins made for lakes and meadows, and arms of the sea, soils spread for forests and fields; then they shrink and vanish like summer clouds" Muir (1912).

Although writing about Yosemite, Muir's words are equally applicable to Scotland where the glaciers have also long since disappeared but their effects on the landscape are still clear. His choice of the word "sublimity" encapsulates the very essence of the glacier. Susan Strauss has acclaimed Muir's writing to possess a musical, corporeal quality that passes far beyond the mere proclamation of information, in this case about the shaping of the landscape by glaciers, and becomes "artistic, experiental and life giving" (Strauss, 2007, p. 13).

Poetry and Landscape

Recognition of the links between poetry and landscape is not new; for example, a century ago the eminent Scots geologist, Archibald Geikie, wrote about the role of literature and poetry in revealing the "inner meaning" of the landscape (Geikie, 1905). Gaelic poetry traditionally has a strong affinity with the natural world, exemplified in the work of the Celtic bards, notably Duncan Ban Macintyre, and the Ossianic poetry of James Macpherson (Hunter, 1995; McIntosh, 2001). Two modern examples, in particular, illustrate strong connections with geodiversity. Norman MacCaig and Sorley Maclean both used rocks and landscape to express their feelings about the history of human suffering in the Highlands and Islands. Norman MacCaig was strongly influenced by the stark beauty of the landscapes of NW Scotland and the distinctive mountains shaped by the rocks and the glaciers. But for him, people, too, are an essential part of the landscape. In *A Man in Assynt* (MacCaig, 1990), he laments the forced depopulation of the area and reflects on the longstanding issue of land ownership:

Who owns this landscape? –
The man who bought it or
I who am possessed by it?

Ultimately, however, human 'possession' is essentially transient on a geological timescale and the landscape is only tractable to natural forces:

And frost
thrusts his hands in cracks and, clenching his fist,
bursts open the sandstone plates,
the armour of Suilven:
he bleeds stones down chutes and screes,
smelling of gunpowder.

Nevertheless, he hoped that the 'sad withdrawal of people' might one day be reversed.

Like MacCaig, Sorley Maclean used poetry and landscape as an inseparable means to reflect on the wider human condition. The landscapes of the Cuillin and the island of Raasay feature prominently in his work. He, too, was concerned with injustice in the world, with the struggles of the common people against oppression, both in his native Skye and elsewhere. In his epic poem, *An Cuilitheann/The Cuillin* (Maclean, 1999), the mountains become a symbol for human oppression throughout the world. In some remarkably agitated passages, he evokes dark despair, with the tortured shapes of those responsible for the Clearances dancing on the rocky pinnacles, and the bogs around the

mountains representing a morass of human corruption. But at the end, the human spirit breaks through the dark despair- "the Cuillin is seen rising on the other side of sorrow", the mountains symbolising the indomitable human spirit overcoming adversity:

Far, far distant, far on a horizon,
I see the rocking of the antlered Cuillin,
Beyond the seas of sorrow, beyond the morass of agony,
I see the white felicity of the high-towered mountains.

In his great sequence of love poems, *Dain do Eimhir/Poems to Eimhir* (Maclean 2007), the Cuillin also become a means to express his passionate love, for example, in *Am Mùr Gorm/The Blue Rampart*:

But for you the Cuillin would be
an exact and serrated blue rampart
girdling with its march-wall
all that is in my fierce heart.

Hugh MacDiarmid (2002) also wrote about the natural world. His long philosophical poem, *On a Raised Beach*, written in the 1930s, contains a wonderful stream of geological metaphors and allusions. In a remarkably prescient passage, he recognises the relevance of geology for society:

What happens to us
Is irrelevant to the world's geology
But what happens to the world's geology
Is not irrelevant to us.

In the *Bonny Broukit Bairn*, MacDiarmid likens the Earth to a lost child in comparison with the other planets, but celebrates its uniqueness in supporting human life. In a similar vein, in *The Eemis Stane*, he compares the world to a rocking stone delicately balanced in the sky, foreshadowing the images from the Apollo space programme of the Earth as a small, blue planet, unique but vulnerable, floating in the black void of space:

The warl' like an eemis stane
Wags i' the lift.

The importance of the interconnections between human beings and the natural world is also emphasised in the field of geopoetics. Developed by the Scottish poet and writer, Kenneth White, as a response to a need for radical cultural renewal arising from our loss of connection with the landscape, geopoetics is concerned with developing sensitive contact with the world and working out original ways to express that contact (White, 1998; McManus, 2007). The roots of geopoetics go back to the geological foundations of the landscape and our connections with it. In *Scotia Deserta*, White (2003) describes the emergence of Scotland from the last glaciation:

thinking back to the ice

watching it move

from the high middle spine

out into the Atlantic

feeling it gouge out lochs

and sculpt craggy pinnacles

and smoothe long beaches

the land emerges

bruised and dazed

in the arctic light

On this emergent landscape, people developed a poetic culture, connecting with the world and involving a strong grounding or relationship to the Earth. In his essay, *A Shaman Dancing on the Glacier*, he envisages the early inhabitants of Scotland, "the companions of Finn", as shamans moving over the then recently deglaciated landscape of Rannoch Moor and he argues that we must try to re-discover an "earth-sense, a ground sense, and a freshness of the world such as those men, those Finn-men, knew when they moved over an earth from which the ice had just recently receded" (White, 1998, p.48). Following a similar stream of thought, Alastair McIntosh (2001, 2008), too, argues passionately for a grounding that connects the land, community and the human spirit. He writes about getting "beneath the grassroots of popular culture and down to the eternal taproot" (McIntosh, 2001, p.2).

These examples reveal a deep spiritual attachment connecting people with the landscape and its geological roots, expressed through the medium of language.

Landscape Art

Geographical interest in art has provided new perspectives on people's interpretations and engagement with the landscape (e.g. Cosgrove & Daniels, 1988; Daniels, 2004; Nash, 2005; Morris & Cant, 2006). In Scotland, there is a strong tradition of landscape art, beginning with the romantic painters of the late 18th and early 19th centuries, such as John Knox, Horatio McCulloch, Alexander Nasmyth and the English painters, Edwin Landseer and William Turner (Holloway & Errington, 1978; Campbell, 1993). Many of their landscapes show wild, unspoiled scenery with awe-inspiring mountains and native wildlife, creating a sublime vision of Scotland still popular with visitors today. This reflected a radical change from earlier perceptions of the Highlands as a wild inhospitable place to be avoided (see below).

Turner's work was brought to a wider audience through his links with Sir Walter Scott and the use of his engravings to illustrate Scott's volumes of poetry and prose. Turner represented not only the places described by Scott, but also the mood of Scott's writing. His "explosively poetic impressions" (Schama, 1996, p. 508) fused light, cloud and turbulent skies, highlighting the grandeur of Nature that other poets and artists of the time were also expressing. In the view of John Ruskin, art critic and lifelong student of geology, Turner's work revealed a profound insight into natural forces and atmospheric

effects. This is well illustrated by his paintings of Loch Coruisk, Glen Coe and Staffa. Ruskin also noted that Turner realistically captured aspects of the geology in his work. In his discussion of 'Inferior Mountains', he wrote that "with a mere view to geological truth, I should not refer to geological drawings, but I should take the Loch Coriskin of Turner" (Ruskin, 1846, p. 288). Describing Turner's depiction of the nature of the gabbro and the layers of dipping cone sheets and their influence on the form of the mountains, Ruskin noted that:

> *the whole mass is felt at once to be composed with the most rigid parallelism, the surfaces of the beds towards the left, their edges or escarpments towards the right;* and
>
> *the edge of a bed is beautifully defined, casting its shadow on the surface of the one beneath it; this shadow marking by three jags the chasms caused in the inferior one by three of its parallel joints. Every peak in the distance is evidently subject to the same great influence, and the evidence is completed by the flatness and evenness of the steep surfaces of the beds which rise out of the lake on the extreme right, parallel with those in the centre* (Ruskin, 1846, p. 289).

In *Modern Painters*, Ruskin (1843-1860) emphasised the importance of faithful representation in landscape art, based on scientific truths. In particular, to portray the 'vital truth' of a landscape, it was necessary to appreciate and understand the underlying

rocks and geological structure. Against a background of the contemporary advances in understanding geological processes and the immensity of geological time, stemming from Hutton's *Theory of the Earth* and systematized in Lyell's *Principles of Geology*, Ruskin's advice on the depiction of rocks reflects more the truths they convey about the landscape history rather than their use as a picturesque device (Wagner, 1988). This was indicated not only in Ruskin's own work, but also in his wider influence on Pre-Raphaelite painters who sought to represent nature accurately. Thus, given his eye for geological detail, his choice of foreground for Millais' portrait of him standing on an outcrop of gneiss in Glenfinlas was particularly appropriate (Grieve, 1996).

The creative influence of geodiversity is also continued in more modern landscape art, for example, in the associations of the Scottish Colourists with the landscapes of the West Coast, and particularly Iona, Joan Eardley with the Kincardineshire coast at Catterline, James Morrison with Angus and Assynt, and John Lowrie Morrison with the Hebrides. A strong sense of connection with nature, geology and the landscape is also central to the modern genre of land art which involves articulating the experience of interacting with landscape, nature and the environment, including geology (Kastner & Wallis, 1998; Tufnell, 2006). Although it often has a strong basis in locating sculpture in the landscape as in the work of Andy Goldsworthy (e.g. Goldsworthy, 1994) or Ronald Rae's exhibition of granite sculptures in Holyrood Park in 2007 (Figure 1), it goes further in emphasising the connectedness of the art with the landscape and engagements with place (Morris and Cant, 2006). It represents a physical, non-pictorial response to the landscape expressed in a variety of ways, including the American earthworks tradition (e.g. Charles

Jencks' 'Landform' at the Scottish National Gallery of Modern Art in Edinburgh), but often in ways that leave no permanent trace in the landscape (e.g. Richard Long's solitary walks). This form of land art with a geological theme is becomingly increasingly popular, for example in the Striding Arches project in Dumfries & Galloway (Scottish Arts Council, undated a), Cairngorm – Reading a Landscape (Scottish Arts Council, undated b) and Charles Jencks' 'Garden of Cosmic Speculation' (Jencks, 2003). The multi-media production, *The Storr: the Unfolding Landscape*, brought together the interaction of music, poetry and light against the remarkable backdrop of the cliffs and weird pinnacles of the Storr landslide in Skye (Farquhar, 2005). Paradoxically, the oil shale bings in West Lothian now have an unintended appeal as a form of 'land art'. This is certainly so in the case of Seafield Law which has been re-shaped to mimic the natural glacial landforms of the area (Gray and Jarman, 2003).

Some of these elements have been brought together in the visitor attraction at Knockan Crag National Nature Reserve (NNR), in one of the classic areas of Scottish geology and now within the North West Highlands Geopark. Here, Peach and Horne unravelled the complexity of the Moine Thrust and provided the foundation for the modern understanding of large-scale, crustal deformation and thrust tectonics. New approaches add to the visitor experience and encourage people with little previous knowledge of geology to experience rocks and landscape in different ways. The interpretation includes rock art (Figure 2), sculptures, and quotations and poetry inscribed in rock along waymarked trails (Scottish Natural Heritage, 2002). Similarly, to enhance visitor appreciation in the Galloway Hills and at Cairnsmore NNR, art by Sylvana McLean,

sculpture by Matt Baker and poetry by Mary Smith have been combined with the stories and memories of the people who lived and worked in the area. Thus the natural world and human lives are inextricably interlinked – "once people spoke their maps" (Smith in McLean & Smith, 2008). In particular, Mary Smith's poetry captures perfectly the essence of the geological processes that shaped the landscape and inspires the imagination.

Iconography, Landscape and the Origins of Geotourism

The development of tourism in Scotland dates from the mid-18th century and is closely linked to the iconography of landscape, its geological features and how these were portrayed in contemporary literature and art (Smout, 1982; Butler, 1985; Durie, 2003). The publication of Macpherson's Ossianic poetry in the 1760s began a period of fascination with the Highlands, leading to a fundamental change in the perception of the region as a feared, uninviting and lawless area set against the background of the Jacobite rebellions. For example, in 1739 Sir John Clerk described the Grampian Highlands as a "barbarous tract of mountains" (cited in Holloway & Errington, 1978, p.3), and Dr Johnson later was "repelled by this wide extent of hopeless sterility" (Johnson, 1876, p.32). However, post-Culloden subjugation and pacification of the Highlands allowed more positive artistic interpretations of the landscape (Schama, 1995). Visitors now wanted to see and be awed by the places described and illustrated in the accounts of travellers such as Thomas Pennant, which included descriptions and illustrations of the geological wonders of Staffa and Fingal's Cave. Interest in such natural curiosities was

followed by the search for sublime and picturesque landscapes, influenced by the wider contemporary ideas of William Gilpin and Edmund Burke, and also sites with literary and historic associations (Smout, 1982).

Sir Walter Scott played a pivotal role in bringing the attractions of the Scottish landscape to a wider audience through popular literature in the early 19th century and inspiring a romantic view of landscape and Scottish culture. His engagement with the landscape was grounded in geodiversity. For example, *Lady of the Lake* (Scott, 1810) fostered a vision of the sublime mountains and lochs of the Trossachs, but also included an allusion to an earlier geological time period, reflecting Hutton's recycling of worlds:

> *High on the south, huge Benvenue*
> *Down to the lake in masses threw*
> *Crags, knolls, and mounds, confusedly hurled,*
> *The fragments of an earlier world.*

The Scottish romantic tour (Andrews, 1987), inspired notably by Scott's novels and poetry, was effectively an early form of geotourism. For example, Staffa was one popular attraction encouraged by Sir Joseph Banks' early description which expressed wonder at the creation of nature, a view reiterated by Scott (1815) in *Lord of the Isles*:

> *That mighty surge that ebbs and swells,*
> *And still, between each awful pause,*

From the high vault an answer draws

The romantic image was further emphasised in Turner's atmospheric painting of the island, depicting the rough weather and sea conditions. In parallel with developments in geological thinking, contemporary pictorial representations of the island reflected changing perceptions and popularity, from awesome creations of nature to the more sublime and picturesque (Klonk, 1997).

In *Lord of the Isles* (Scott, 1815), accompanied by a frontispiece picture of Loch Coruisk by Turner, Scott again reveals a familiarity with contemporary geological ideas, noting that the record of the processes (albeit mistakenly interpreted as earthquakes) that shaped the landscape is still preserved in the rocks and landforms of the Cuillin:

A scene so rude, so wild as this,
Yet so sublime in barrenness

Seems that primeval earthquake's sway
Hath rent a strange and shattered way
Through the rude bosom of the hill,
And that each naked precipice,
Sable ravine, and dark abyss,
Tells of the outrage still.

He also noted in his diary the presence of what would now be interpreted as perched glacial boulders:

> *some lay loose and tottering upon the ledges of the natural rock, with so little security that the slightest push moved them, though their weight exceeded many tons* (Lockhart, 1861, p. 120).

In Scott's novels, and in Stevenson's *Kidnapped*, the Highlands became a place of romance and adventure. This Victorian view of a romantic, untamed wilderness was reinforced by contemporary landscape painters, including Horatio McCulloch, John Knox and Edwin Landseer, depicting wild, unspoiled scenery with bleak, towering mountains. Similarly, Byron extolled the "steep frowning glories of dark Lochnagar", which were further popularised by royal association. Later in the 19th century, Thomas Cook began organising tours to Scotland with itineraries that included 'picturesque' locations such as the Trossachs, Loch Lomond, Loch Katrine and steamboat trips to Staffa and Iona (Cook, 1866). Further expansion included the recreational and sporting attractions of shooting, golf, fishing, mountaineering, the seaside and health spas (Durie, 2003), all based on the assets provided by Scotland's geodiversity.

'Opening the Gates': Re-engaging with People

The geological map of Scotland reveals many wonderful stories about our Earth heritage. These are well known to geologists and the challenge has been to interpret and reveal

them in a meaningful way and to engage with a wider audience. The traditional didactic approach has included on-site panels, leaflets, books, guided and self-guided walks, with a focus on explaining geodiversity through landscape and scenery, and using appropriate text and illustrations. The above examples have demonstrated how people in Scotland have a deep spiritual attachment to the landscape, hence "so much of what we call Highland culture – poems, songs, stories, novels, visual art – consists of celebrating, by one means or another, our physical surroundings" (Hunter, 2006, p. 8). Landscapes and their geological features have been a powerfully creative source of human inspiration, expressed through historical developments in geoscience, stone monuments, literature, poetry and art. These media offer alternative ways of interpreting the 'voices of the stones', and provide opportunities for renewed engagements between the human and natural worlds through iconography, people's experience and their responses to landscape geodiversity.

At the Vital Spark Conference in Aviemore in 2007, Susan Strauss regretted the deeply engrained 'information medicine' approach to interpretation and argued passionately for a more artistic approach embracing beauty, enjoyment and the artistic (Strauss, 2007). At the same conference, Sam Ham stressed that interpretation is about provoking people to think (Ham, 2007). That is not to say there is not a role for presenting information in an engaging way for those actively interested in geology, but it is about shifting the balance to engage with a wider audience. Creative engagement with the cultural landscape offers alternative ways of experiencing the voices of the stones, particularly for those who might otherwise not look at geological interpretation leaflets or boards. In this respect,

community involvement in establishing Scotland's two European Geoparks, in the North West Highlands and Lochaber, sets an important precedent as local people realise the value of their Earth heritage.

Seamus Heaney (2004) wrote that poets and geologists are asking questions of the stones, transforming geological landscapes into cultural landscapes, and that geology can open new doors - "the given can be re-imagined in the light of a world that is geological as well as historical". When the 'voices of the stones' are explored through a cultural prism, the rocks and landscapes can take on new meanings for people and provide a link with their cultural roots and sense of place. The powerful influence of the natural environment on Scotland's cultural history was recognised in a Parliamentary debate on Environment and Culture in 2007, which largely took the form of a celebration of the ways in which writers, artists and others have drawn inspiration from Scotland's landscapes (Scottish Parliament, 2007). Nevertheless, although the importance of landscape was repeatedly emphasised, the geological underpinnings went unrecognised. This is regrettable at a time of unprecedented global change when the need for awareness and understanding of geology and surface processes has never been greater in terms of informing the mitigation of projected changes in climate, sea-level rise and other natural hazards and adaptations to their impacts, as well as a more integrated approach to environmental management that recognises the dependencies between geodiversity and biodiversity (e.g. in floodplain restoration for natural flood management or managed realignment at the coast).

In *On a Raised Beach*, Hugh MacDiarmid (2002) wrote that the "gates" of the stones are open. Exploring the voices of the stones offers new opportunities to lead people through the gates, to rediscover the links between geodiversity and cultural landscapes, to deliver new and memorable experiences, to explore new pathways and to open the way for further creativity linking nature, history and place. Literature, art and the built environment offer creative opportunities to help people discover their roots in the landscape and to reconnect with the natural world and their geological heritage, and in so doing recreate the excitement of discovery and a fresh sense of wonder. It is appropriate to end with the thoughts of John Playfair (1805) who accompanied James Hutton on that eventful occasion at Siccar Point in the summer of 1788 when the testimony of the rocks revealed the great immensity of geological time –

The mind seemed to grow giddy by looking so far into the abyss of time; and ……we became sensible how much farther reason may sometimes go than imagination can venture to follow. (p. 73).

Reason and imagination – together they can inspire a new creativity, both from a cultural perspective and with practical relevance for how we respond to a dynamic planet in a more sustainable fashion.

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FIGURE CAPTIONS

Figure 1. Sculpture by Ronald Rae displayed in Holyrood Park, Edinburgh, 2007. The fish is carved in granite from Corennie Quarry, Aberdeenshire. The accompanying brochure notes that the creativity for the sculptor begins in the quarry, where he seeks out the right stone that "speaks" to him.

Figure 2. Rock sculpture at Knockan Crag NNR, North West Highlands Geopark. (Lorne Gill/SNH).

Whether you want to see majestic mountains, rolling farmland, rugged Atlantic coastline, or romantic islands, a drive through Scotlandâ€™s landscapes offers scenery as diverse as it gets. So what are you waiting for? Prep the GPS system, grab some roadside picnic goodies and jump in the car â€“ your great Scottish road trip starts here! This is by no means a complete guide to Scotlandâ€™s best driving routes â€“ there are simply too many! But no matter which one you choose, youâ€™ll have plenty of â€˜WOWâ€™ sights along the way: 1. Glasgow or Edinburgh to Glencoe. The route through Glen Coe is one of the mo