GLOBAL GEOPARKS

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My fans may have noticed that Parting Shots has been missing from the last couple of issues. I asked Jodi Rosso, for a break so that I could concentrate on developing content for a new geological visitor centre for Lochaber Geopark, a local voluntary organization for which I work, based in Fort William in the West Highlands of Scotland. Jodi suggested that readers might be interested in knowing more about the UNESCO Global Geoparks Network (GGN) and what is involved in creating visitor centres and informative material for the general public.

The GGN provides a platform for informing the general public about geology, as well as encouraging tourism and conservation. There are currently 119 geoparks worldwide: 68 in Europe, 47 in Asia (33 in China), 2 in Canada, and 1 each in Morocco and Brazil. There are none in the USA, although the USA has many outdoor interpretation panels and geological visitor centres, many of which are provided either by the US National Park Service or individual US state park services.

Background on the geopark movement can found at http://www.unesco.org/new/en/natural-sciences/environment/earth-sciences/unesco-global-geoparks/. Geoparks vary enormously in size, geological complexity and social context. Some are tightly focussed, on a cave or a mine for example. Lochaber Geopark (Fig. 1) covers 4,648 km^2 and is geologically complex. Each nation has its own administrative framework, including responsibility for geological conservation and sources of funding. Details about Lochaber (given below) give only a flavour of the variable social environments in which geoparks operate.

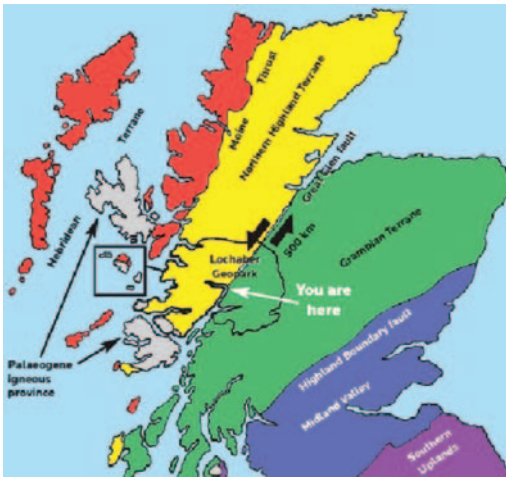

Figure 1 Map of Scotland showing the relationship between the Lochaber Geopark and the three terranes that make up the Scottish Highlands, together with the Palaeogene North Atlantic Igneous Province. From an interpretative panel in Fort William visitor centre.

You don't have to be a member of the GGN to set up a geopark, the name isn't a trademark. Lochaber Geopark is a limited company and a registered charity. It has operated since 2004, and, in 2007, gained admission to the European Geoparks Network (EGN). In 2010, we left the EGN because of the costs, running on a shoe-string until the end of 2013 as an entirely volunteer organization. We did, however, maintain many of the activities of a geopark, such as giving talks to schools and community groups and leading field trips. With UK and European funding, we installed a 'Rock-Route' of 21 interpretative panels throughout Lochaber (Fig. 2, and see *Elements*, 2014, v10n2, p 157).

In 2013, we were awarded a grant by the Scottish Government to develop a business plan. We have opened two visitor centres (Fig. 3) and now employ paid staff. The business plan requires that some costs be met by retail activities. We currently have 8 unpaid volunteer directors, 4 of whom are geology graduates, two who work for local government and two who have experience in wildlife and resource management.

Figure 2 Lonely and lovely. An interpretative panel overlooking the celebrated Palaeogene Ardnamurchan ring complex, and being enjoyed by Dutch visitors.

We have two part-time paid project officers and an office in our Fort William visitor centre (Fig. 3). Our second visitor centre is in Roybridge and has one permanent, one seasonal and five casual members of staff.

In 2015, the EGN was subsumed into the newly formed UNESCO GGN. The cachet of UNESCO status is likely to considerably enhance our ability to attract state and, perhaps, industrial funding, and in January 2016 we submitted an application to UNESCO. A two-man evaluation team from UNESCO came and went in mid-June, were wined-and-dined, met many representatives of community organisations, and, we hope, were bowled-over by our geological wonderland. Mercifully, they experienced beautiful weather. We await the outcome.

Lochaber Geopark corresponds with the District of Lochaber in the Highland Region of Scotland (Fig. 1), which has a population of about 19,000, of whom 11,000 live in Fort William. Outside the town, the population density is only 1.7 per square km. Encouraging tourism is a major factor when developing a geopark. It is the largest single employer, and a geopark can make a worthwhile contribution to the experience of tourists. Bus tours from all over Europe bring holiday-makers to explore our combination of mountains and islands. Ben Nevis (1,345 m), above Fort William, is Britain's highest mountain and is climbed by ~110,000 people each year. The mean annual temperature at the summit is –0.5 °C, the wind blows at gale force for 261 days each year, and it gets 4.35 m of rainfall. Its 700 m north face is a magnet for rock and ice climbers. A neighbouring mountain is a ski resort and home to the UK round of the Mountain Bike World Cup. Numerous rivers draw large numbers of white-water kayakers.

Our visitor centres provide attractions on wet and storm-bound days. The first centre was established in 2014 in the village of Roybridge, 18 km (11 miles) to the East of Fort William. Called Darwin's Rest, it sells coffee, cakes and local craft items, and tells the story of Charles Darwin's involvement in the controversy surrounding the 'Parallel Roads of Glen Roy', which Darwin came to regard as 'one long gigantic blunder' (*Elements*, 2015, v11n4, p 295). Periglacial features are well developed all over Lochaber, and the fact that a mere 11,500 years ago the site of Fort William was under 1,000 m of ice, with the tops of the higher mountains poking through as nunataks, is food for thought for any visitor.

Our larger visitor centre (Fig. 3) is in Fort William High Street. This was opened at the beginning of July and is still a work in progress, manned by volunteers. I do Mondays. It's fun! I meet people from all over the world and give little tutorials. With the support of an artist and a computer graphics expert I have designed illuminated wall panels that explain the geological evolution of Lochaber in terms of a colourful 'timeline' that places the main rock types in the context of past orogenies, episodes of magmatism, and periods of continental drift. I enjoyed supervising the building of a 3-D solid model of the Ben Nevis caldera and the surrounding mountains. Video screens provide virtual fly-overs combining topography and geology. There are mineral and fossil displays and things for children to do, including digging for

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2015 CARNEGIE MINERALOGICAL AWARD – GEORGE HARLOW

The Carnegie Museum of Natural History (Pittsburgh, Pennsylvania, USA) is pleased to announce that Dr. George E. Harlow (American Museum of Natural History in New York City, USA) is the winner of the 2015 Carnegie Mineralogical Award. The award was presented by Eric Dorfman, Director of the Carnegie Museum of Natural History, during the Saturday night Awards Banquet at the 2016 Tucson Gem and Mineral Show (Arizona, USA). The Carnegie Mineralogical Award honors outstanding contributions in mineralogical preservation, conservation, and education and is considered one of the most prestigious awards in the field of mineralogy.

In praise of Harlow's achievements, Marc L. Wilson, Collection Manager and Head of the Section of Minerals at Carnegie Museum of Natural History, says, "Dr. George Harlow has dedicated his career to furthering the science of mineralogy and nurturing the mineral collection, exhibits, and outreach programs of the American Museum of Natural History. I am very pleased to see him honored as the recipient of the 2015 Carnegie Mineralogical Award."

Harlow has spent his entire career (38 years) at the American Museum of Natural History. He currently holds the position of Curator of the Department of Earth and Planetary Sciences. His most recent concentration of academic research has been on the mineralogy, geology, and genesis of jadeite deposits in Mesoamerica. His previous research on the mineralogy of diamonds not only resulted in scholarly publications but also led to a special traveling exhibit for the museum (The Nature of Diamonds) and an accompanying book. This major exhibition opened at the American Museum of Natural History in 1997 and only closed in August 1998. It traveled to six other museums in the United States, Canada, and Japan.

Harlow is an active supporter of the science of mineralogy through an amalgam of outlets: publications, lectures, teaching, exhibit development, mentoring, and leadership in professional societies. He recently became the Vice President of the Mineralogical Society of America in 2016.

As a consistent leader in the advancement of collection computerization, Harlow has imaged and documented over 60,000 specimens at American Museum of Natural History for their new database and web presence, which he is spearheading. Additionally, during his tenure, the collection has grown from 40,000 to approximately 116,000 specimens.

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Figure 3 Our new and as yet incomplete visitor centre in Fort William High Street. A solid geological model of the Ben Nevis caldera and its surroundings is in the foreground and the large wall display behind it is a scale 'timeline' with examples of Lochaber rocks from the Archaean to the Palaeocene.

fossils in a sand-box. We sell maps, geology and wildlife books and pamphlets and will shortly be offering a range of good quality local craft products.

Lochaber Geopark straddles three distinct terranes (Fig. 1) with different metamorphic histories. The sedimentary age of the Northern Highland Terrane is ~1 Ga, and it has experienced three phases of orogeny: at 800 Ma, at 470 Ma and 430 Ma. At 470 Ma, Scotland was at the edge of Laurentia when it collided with the Taconic arc. The 430 Ma orogeny was caused by the closure of the Iapetus Ocean. The rocks of the Grampian Terrane were deposited around 750 Ma, but experienced only the 470 Ma orogeny, suggesting that transcurrent movement on the Great Glen Fault must be at least 500 km. Both terranes were affected by a long period of granitic magmatism. The 420 Ma Glencoe caldera was the first ancient caldera to be recognised in the world – in 1909. The Hebridean Terrane is a fragment of Laurentia left behind during the breakup of Pangaea. Between 61 Ma and 58 Ma, the lava-fields and central complexes of the North Atlantic Igneous Province formed at the edge of the head of a mantle plume centred under Greenland, which triggered the beginning of ocean-floor spreading west of Scotland and the opening of the North Atlantic.

Describing the geological evolution of such a complex region in ways that both educate and entertain ordinary folk, while being up-to-date and without over-simplifying, is very, very challenging. I've led student field excursions to the west of Scotland throughout my career, so I know how to explain things to geological beginners, but by the time students get into the field they have a geological vocabulary that the general public lacks. With thought, it can be done using ordinary language, and I've had a lot of pleasure writing and designing interpretative material. I always try out what I write on non-geologists. I've also enjoyed bringing myself up-to-date with a lot of reading of recent work.

If you fancy doing voluntary work that keeps you in touch with our science, and you live somewhere that is geologically exciting, I strongly urge you to get involved with a geopark. The GGN needs more qualified geologists if it is to serve our science well.

Footnote: The brief summary above dealing with the relationships of the three terranes is based on the following entertaining and polemic review: Dewey JF, Dalzeil IWD, Reavy RJ, Strachan RA (2016) The Neoproterozoic to Mid-Devonian evolution of Scotland: a review and unresolved issues. Scottish Journal of Geology 51: 5-30