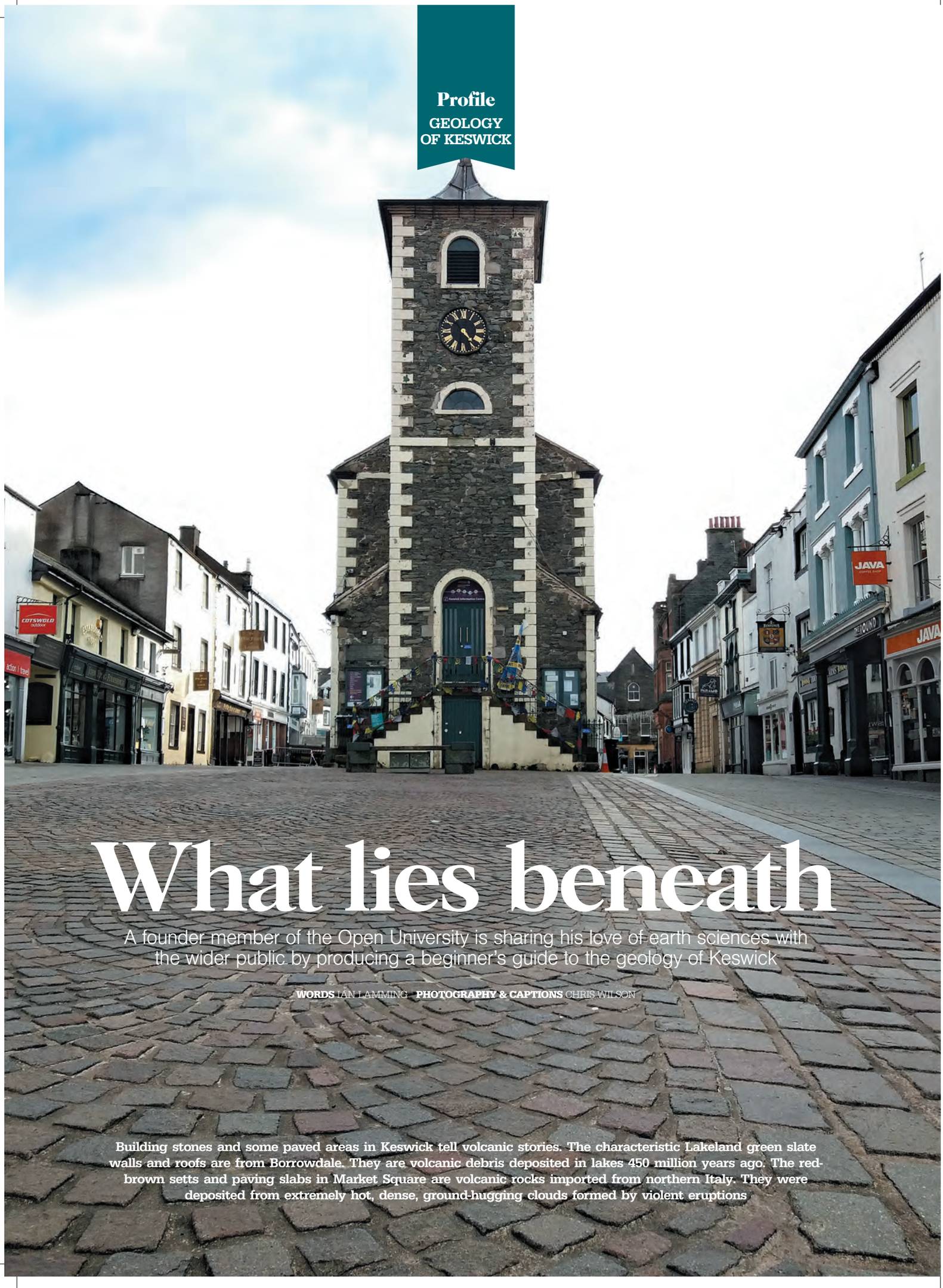

What lies beneath

A founder member of the Open University is sharing his love of earth sciences with the wider public by producing a beginner's guide to the geology of Keswick

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Building stones and some paved areas in Keswick tell volcanic stories. The characteristic Lakeland green slate walls and roofs are from Borrowdale. They are volcanic debris deposited in lakes 450 million years ago. The red-brown setts and paving slabs in Market Square are volcanic rocks imported from northern Italy. They were deposited from extremely hot, dense, ground-hugging clouds formed by violent eruptions

These Victorian houses in Stanger Street are typical of many Lake District towns. The roofing slates and walling blocks came from quarries in the Borrowdale Volcanic Group, south of Keswick. Despite being used as roofing slate for centuries its common use as a building stone only began in the 1850s. The red sandstones seen in many windowsills, door jambs and lintels were deposited in desert sand dunes 280 million years ago when Britain shared the same latitude as the Sahara Desert today

Moot Hall was built in 1813 using a mixture of gathered stone and some dressed grey-green material from the Borrowdale Volcanic Group. A closer look at the dressed blocks of grey-green volcanic ash contain irregular dark brown blobs of lava thrown out by volcanic explosions

After gaining a glimpse of a geologist's perspective of the world observers will never look at the landscape in the same way again, with mountains, valleys, lakes and rivers no longer just pretty postcard scenes but a chronicle of hundreds of millions of years of local Earth history.

For retired Emeritus Professor of Earth Sciences and founder member of The Open University Chris Wilson this passion for geology has been the motivating force throughout his childhood and career.

What is simply a beautiful landscape to many Lake District visitors finds new meaning with Chris, who now leads the Skiddaw University of the Third Age (U3A) Geology Group.

Rocks and minerals, formed and weathered over millions of years, produce the raw materials for man fashioning the pavements we walk on, the houses in which we shelter.

Rock layers cut and deformed by faults and folds inhabit the landscape. They provide a veritable guidebook for those who want to view their surroundings at a deeper level. It is like peeling back the layers and, once viewed, can never be unseen.

"I first came to the Lake District when I was about eight and still have an exercise book in which I tried to explain how glaciers were formed," says Chris, who lives just outside Keswick. "My uncle was a really enthusiastic geographer who helped me develop my love of the landscape from that time onwards.

"I developed a real passion for geology in my teens and when the Open University formed in 1969 I had the good fortune to be the second Earth scientist to be appointed. I spent the rest of my career there and was head of department when I retired in 2003. It was a wonderful opportunity and an exciting time to develop new courses which were some of the first to incorporate the new concept of plate tectonics, which had revolutionised our understanding of how the Earth works.

'I first came to the Lake District when I was about eight and still have an exercise book in which I tried to explain how glaciers were formed'

"Eleven years after I retired my wife and I had a summer holiday in the Keswick area and started to wonder about moving north from Dorset. On our second 'research' trip we had atrocious weather which did not put us off. We learned that the Skiddaw branch of U3A had just started and gained around 300 members in 18 months – we thought that this said a lot about the town."

During the first lockdown Chris came up with the idea of writing a beginner's guide to geology in and around Keswick based on materials already used in his U3A geology programme. It has now been made more widely available to anyone interested in the hows, whys and wherefores of this particular part of the Lake District.

Based on a walk around the town, it reveals what is hidden in plain sight, that the character of the buildings in Keswick and the landscapes around reflect not only the human history of a few thousand years but also its geological past extending over nearly 500 million years.

Chris says a good place to start a geological tour of Keswick is at the former home of Jonathan Otley, in Kings Head Yard, who is widely recognised for his contribution to understanding the geology of the Lake District. In 1820 Otley published a description of the geological structure of

Geology of Keswick

Gathered stone at the front of St Herbert's Social Centre, High Hill, built in 1833. The wall was constructed using a mixture of dark grey to black Skiddaw slate, grey-green Lakeland slate and boulders of rocks from the Borrowdale Volcanic Group

View looking north from Walla Crag. Keswick is built on low elongate rounded hills that extend westwards to Derwentwater and into the lake as islands. They were formed at the base of fast flowing glacier ice about 20,000 years ago. The rounded features of the Skiddaw massif and Blencathra on the RIGHT is typical of fells formed on the Skiddaw slates.

the Lake District identifying that the "the greater part of the central region of the Lake Mountains is occupied by three distinct groups of stratified rocks of slatey texture". He named these three groups Clayslate, Greenstone and Greywacke.

Now known respectively as Skiddaw Group, Borrowdale Volcanic Group and Windermere Super Group, Otley identified that Clayslate was the oldest, that the Greenstones contained lavas and volcanic ash deposits and the Greywackes contained alternating layers of slate and hard sandstones.

Chris says: "As you walk around Keswick you are surrounded by volcanic rocks. The green Lakeland slates are volcanic ashes that fell from eruption clouds into lakes about 450 million years ago. The red-brown pavement slabs in Market Square and some surrounding streets were imported from northern Italy. They too have a volcanic origin being deposited from hot (1,000°C) dense, ground-hugging clouds of volcanic debris.

"The red sandstones that are seen in many windowsills, door jambs and lintels were deposited as desert sand dunes 280 million years ago in the Vale of Eden when Britain was situated at the same latitude as the Sahara Desert is today.

"Walk to Latrigg or Walla Crag above the town for wonderful views and the landscape reveals more glimpses of the past. The contrasting shapes of the fells to the north and west of Keswick, and those to the south, reflect the different types of rocks beneath them.

"The smooth slopes of the fells to the north and west of the town are underlain by Skiddaw Group rocks. These were deposited on a deep sea floor as muds and fine-grained sands between 480 and 460 million years ago. Later these sediments were altered to slates and sandstones when they were buried beneath the younger units and then caught up in a major mountain building episode that culminated about 400 million years ago.

"The harder, erosion resistant, volcanic rocks of the Borrowdale Volcanic Group underlie the more rugged

'The red sandstones that are seen in many windowsills, door jambs and lintels were deposited as desert sand dunes 280 million years ago in the Vale of Eden'

Chris Wilson

Jonathan Otley

Central Fells to the south of Keswick."

This volcanic episode occurred between 460 and 450 million years ago and includes some of the largest eruptions known to science anywhere in the world.

"Most people are aware that the Ice Age has left its mark on the landscapes around Keswick," says Chris. "Twenty thousand years ago large glaciers flowed along Borrowdale towards Keswick, eastwards and north eastwards along the Newlands Valley and eastwards along the Greta Valley. These glaciers merged and flowed north westwards across what is now Bassenthwaite lake. The town is built on a series of low rounded and elongate hills composed of glacial debris that was sculpted beneath fast flowing ice.

"The landscape of the Lake District is absolutely fascinating and even after all these years I find myself still looking and still learning."

• For more information on the geology in and around Keswick, the beginner's guide is available on the Skiddaw U3A Geology Group webpage at u3asites.org.uk/Skiddaw/page/32891 (click on Geology of Keswick at the top right of the page)