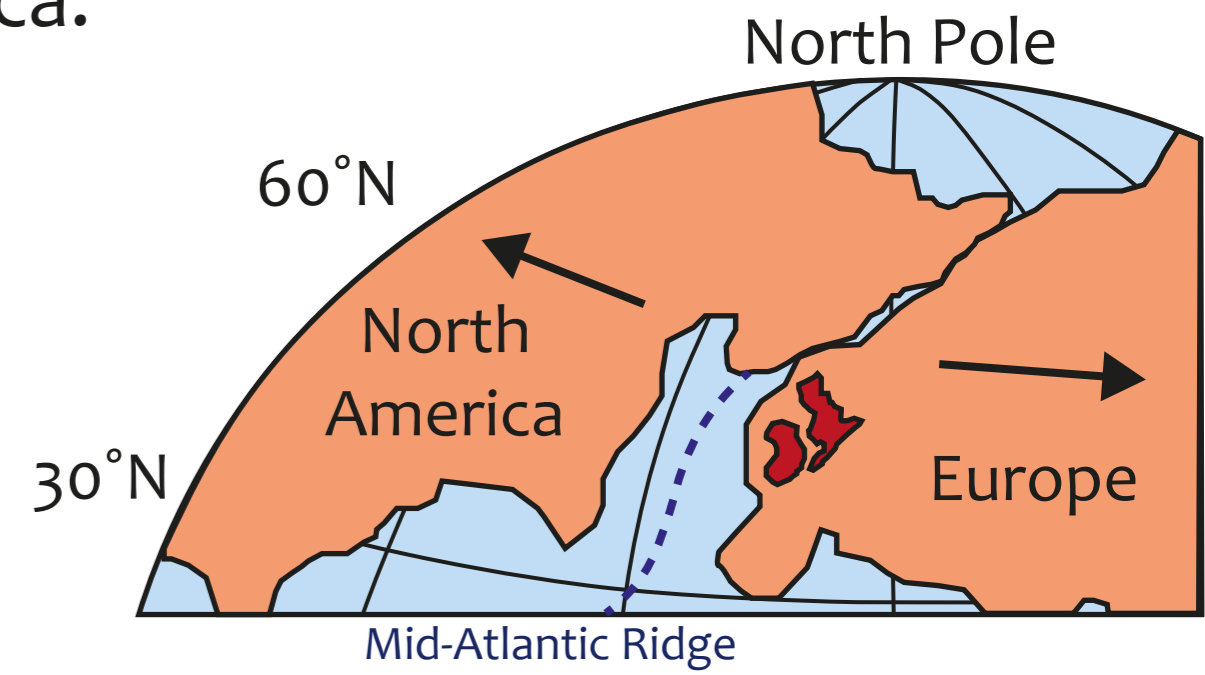


Fire on Arran

The British Tertiary Igneous Province

The youngest of Arran's rocks are a mere 57-59 million years old and consist of solidified lavas and magmas which make up part of the British Tertiary Igneous Province. During the Tertiary period the north-west of the United Kingdom was still joined to Greenland and North America (see right). Things took a volcanic turn when the northern section of the Atlantic Ocean began to open along the mid-atlantic ridge, separating Europe from North America.

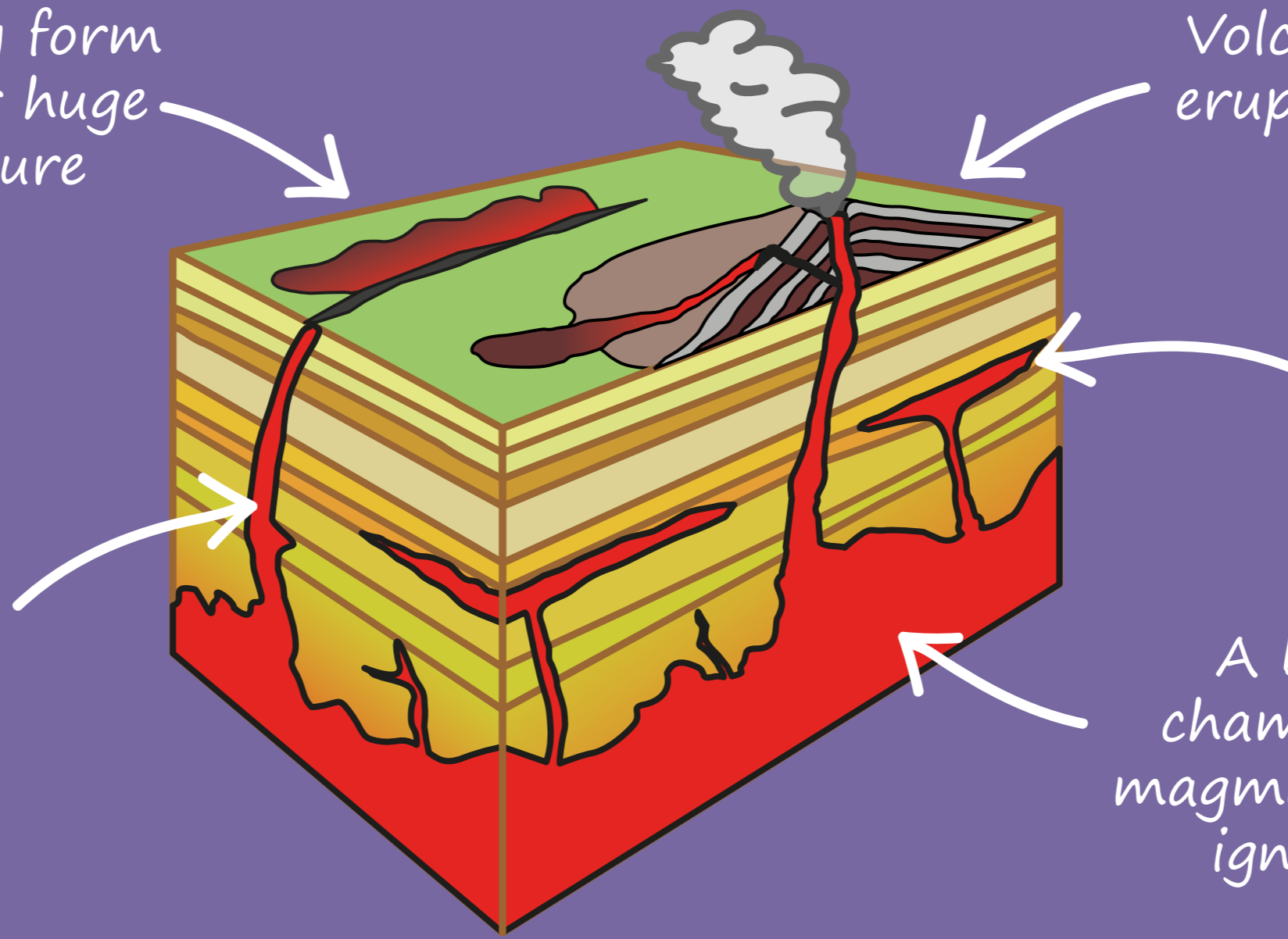
The crust thinned and stretched creating huge north-south running cracks. The thinned and cracked crust created pathways allowing hot molten magma to rise up and erupt onto the surface. Volcanism was particularly vigorous in north-west Scotland and Northern Ireland, but also extended across Scotland, north east England and the Bristol Channel.



What is the British Tertiary Igneous Province made up of?

If a dyke reaches the surface they form fissure eruptions which can cover huge area of land with lava - a feature known as a 'flood basalt'.

Magma rising up through cracks form a vertical sheet-like intrusion called a dyke. A large group of dykes with a similar orientation is known as a 'dyke swarm'.



Volcanic material and ash can explosively erupt onto the surface and accumulate to form a volcanic cone.

If magma is intruded between layers of pre-existing rock it cools to form a sill.

A batholith is a large magma chamber deep under ground. The magma cools to form hard, intrusive igneous rocks like granite and gabbro.

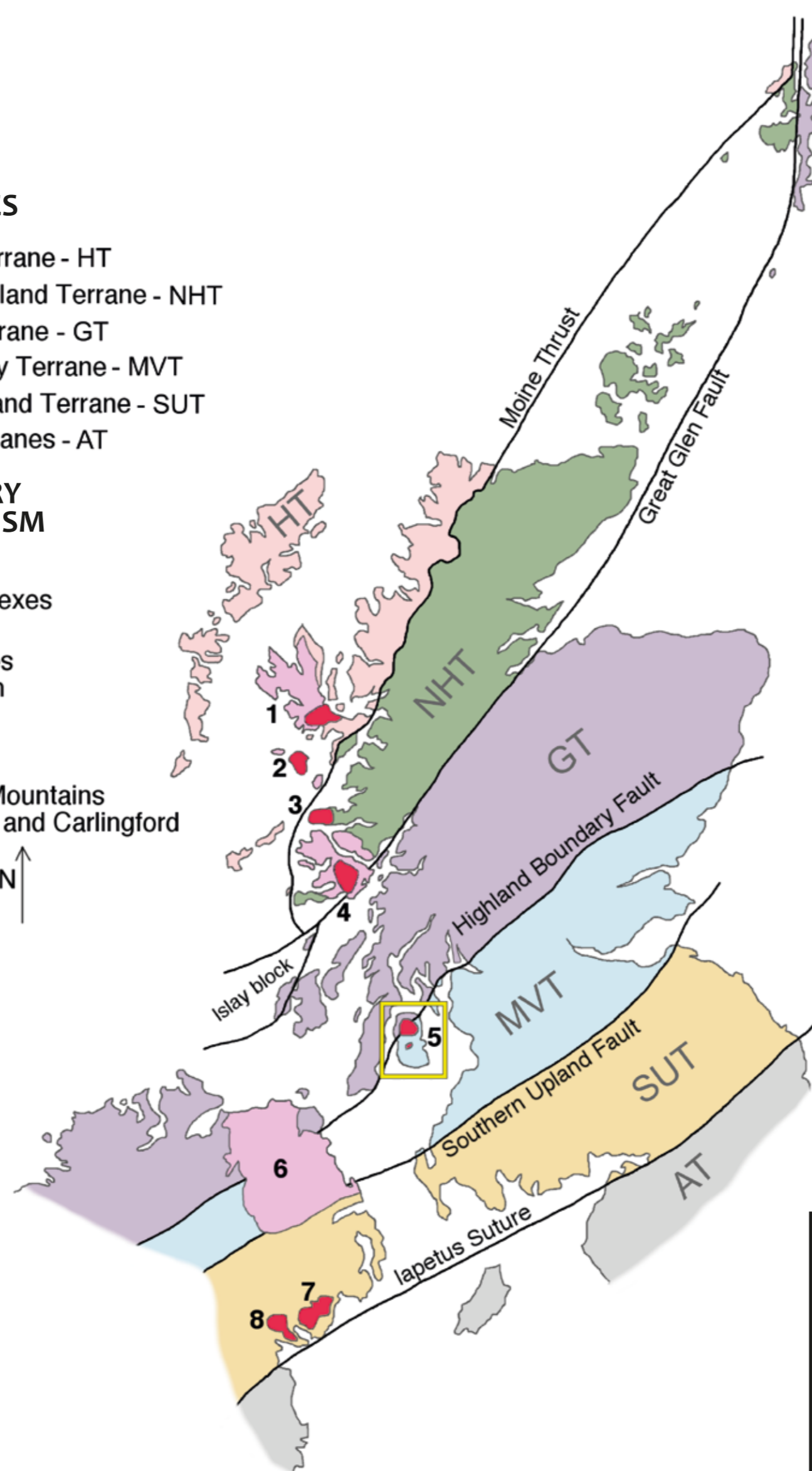
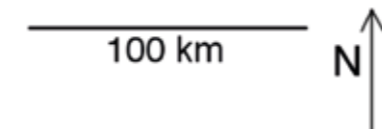
Rocks of the British Tertiary Igneous Province



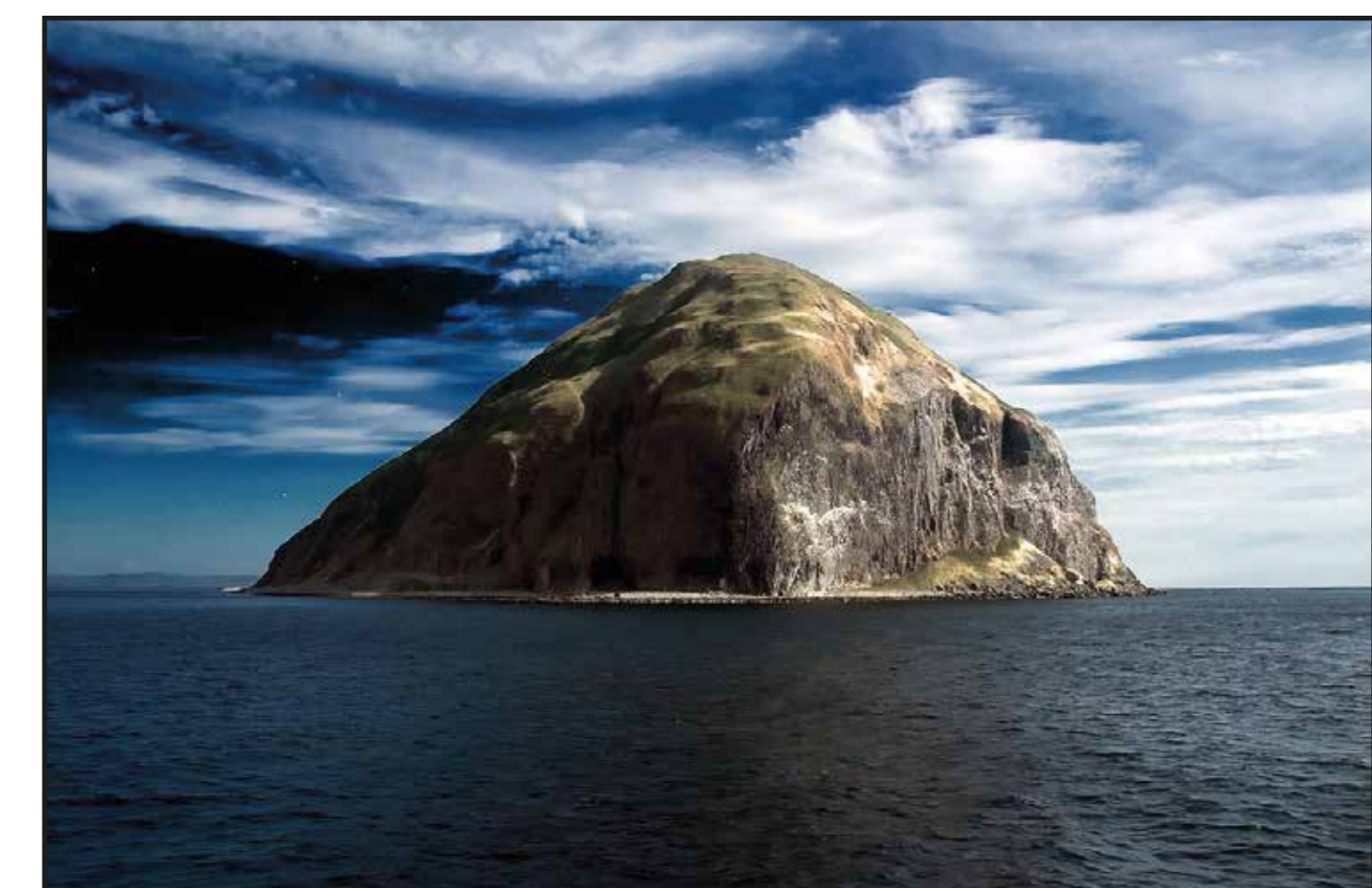
Hard, intrusive igneous rocks form a linear chain from northwest Scotland to the Bristol Channel. These represent the eroded roots of solidified magma chambers, and major volcanoes like Ailsa Craig (below). They give rise to the stunning, rugged mountain scenery of Skye (Cuillin Ridge shown above), Rhum, and Arran.

- KEY**
- TERRANES**
- Hebridean Terrane - HT
 - Northern Highland Terrane - NHT
 - Grampian Terrane - GT
 - Midland Valley Terrane - MVT
 - Southern Upland Terrane - SUT
 - Avalonian terranes - AT

- TERTIARY MAGMATISM**
- Lava fields
 - Central complexes
1. Skye
 2. The Small Isles
 3. Ardnamurchan
 4. Mull
 5. Arran
 6. Antrim
 7. The Mourne Mountains
 8. Slieve Gullion and Carlingford



Fingal's Cave on the Isle of Staffa (above) and the Giant's Causeway in Northern Ireland (below) are beautiful examples of lava flows from fissure style eruptions. They famously exhibit hexagonal columns, which is an effect of the lava cooling to form joints at right angles to the cooling surface.



Scotland can be divided into different geological regions or 'terrains', which are bounded by large faults. This map of Scotland and northeast Ireland show the locations of magmatism within the British Tertiary Igneous Province (Goody et al., 2018).



Fire on Arran

Iceland - Arran's modern day equivalent

During the Tertiary period, Arran would have looked very similar to Iceland today. The volcanic island of Iceland sits across the mid-atlantic-ridge's chain of underwater volcanoes which separate the Eurasian and North American plates. It also sits atop a hot mantle plume. These two types of volcanism have interacted over the past 15 million years to create Iceland.



Lava and ash erupt from volcanic centres such as Katla volcano. The red triangles on the map above mark the location of active volcanoes on Iceland. They have an underlying magma chamber which feeds surrounding volcanic eruptions. Arran had one large volcanic centre - the Central Arran Igneous Complex.

On Iceland, lava commonly erupts from fissures (or cracks) in the surface. Evidence for this on Arran is seen in the numerous dykes, like those at Kildonan, which would have brought molten lava to the surface in fissure style eruptions.

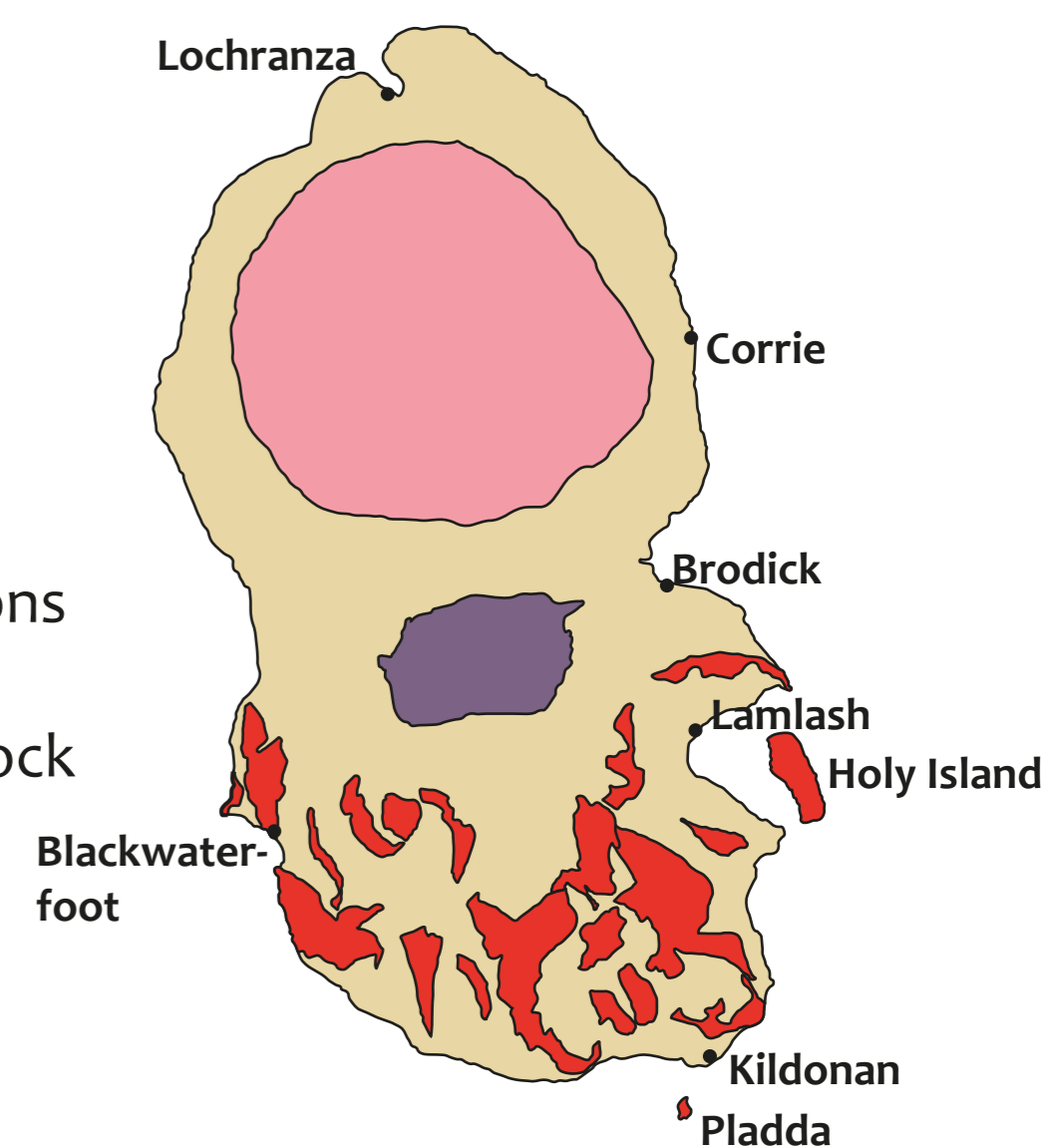
Arran's Volcano - The Central Arran Igneous Complex (CAIC)

It has been debated how many volcanoes were present on Arran during the Tertiary period. The North Arran Granite may have once fed a volcano of its own, however any evidence of such has long since vanished. Recent research has suggested that only one, large, volcanic centre existed on Arran, the Central Arran Igneous Complex (CAIC). This was formerly known as the Central Ring Complex.

The CAIC is made up of various igneous rocks which tell the story of Arran's violent volcanic centre. This unique arrangement of rocks represent the best preserved remains of a volcanic complex within the British Tertiary Igneous Province.

The principle igneous intrusions of Arran

- The CAIC
- North Arran Granite
- Other Tertiary intrusions
- Pre-Tertiary country rock



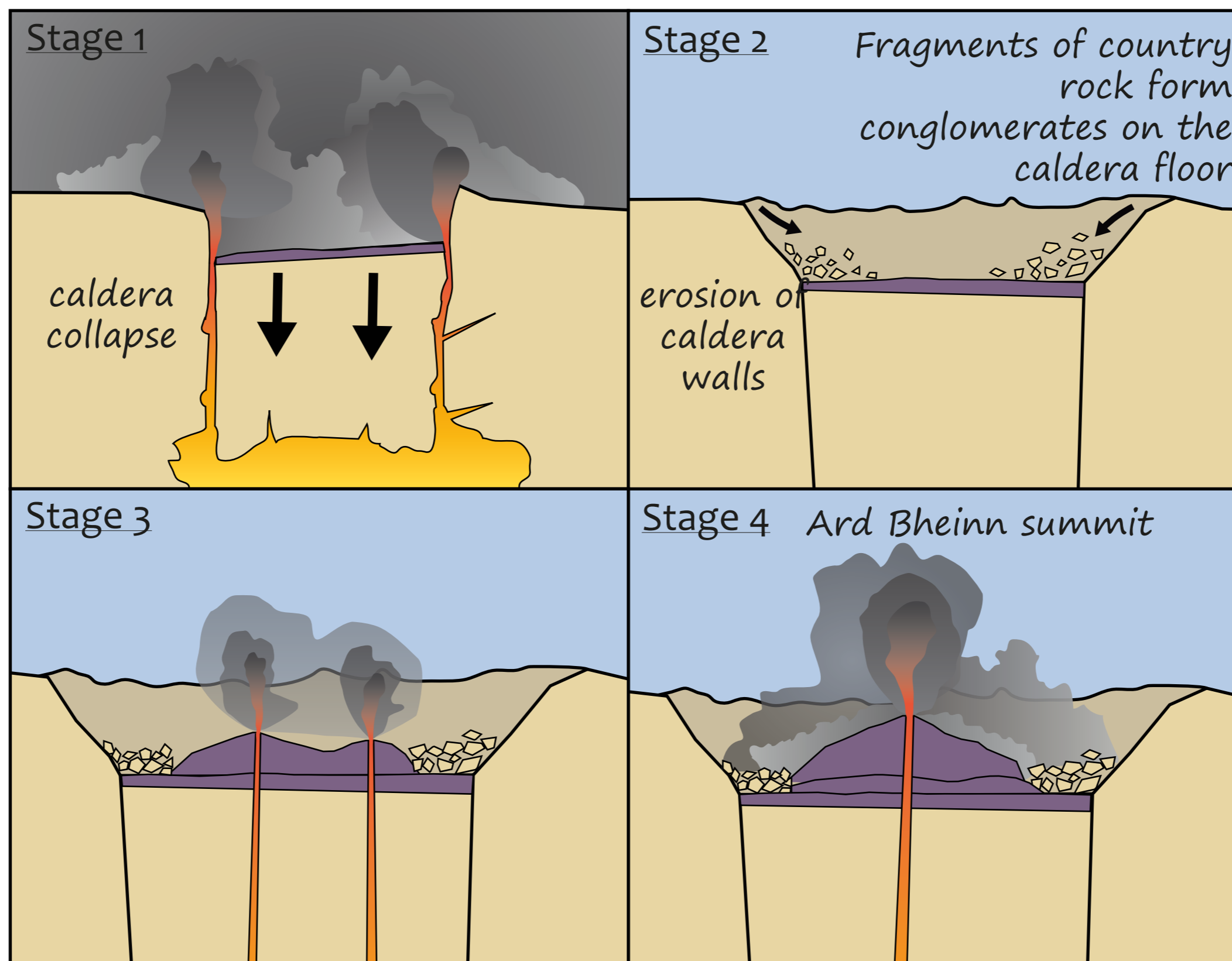
The Story of The CAIC

1. Highly explosive volcanic eruptions emptied the underlying magma chamber and resulted in the collapse of the overlying rocks into a caldera, or 'crater'.

A mixture of ash and rock fragments that were ejected from one of the many volcanic eruptions within the CAIC.



3. At least four, short lived, volcanic vents ejected ash, and rocks which formed layers of volcanic material on the caldera floor.

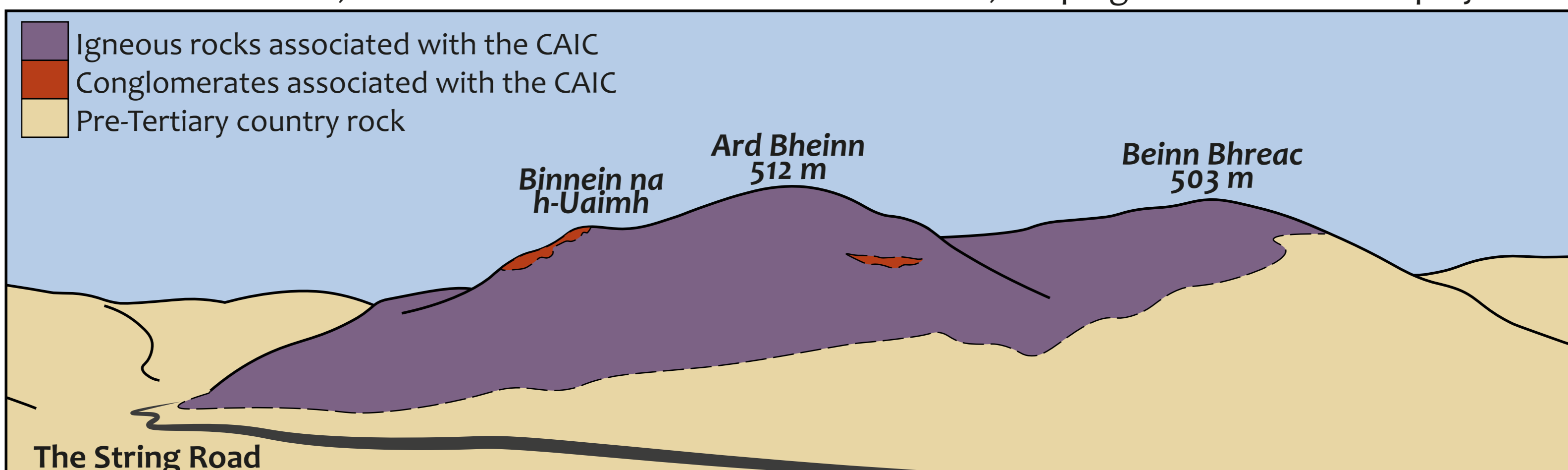


2. Collapse of the steep caldera walls allowed large blocks of country rock to fall inside and be preserved as 'conglomerates'. Amongst these are fragments of Jurassic aged sediments and Cretaceous chalk, which remarkably still contain fossils. Rocks of this age are not found anywhere else on Arran.

4. A final period of explosive eruptions deposit huge amounts of ash inside the caldera. The summit of Ard Bheinn is made up of these volcanic deposits!

A geological view of Ard Bheinn looking East

Over time erosion from ice, wind and rain have worn down the rocks, shaping it into the landscape you see today.



Thanks to Robert Gooday and his co-workers for access to their up to date research and figures on the Central Arran Igneous Complex (Gooday et al., 2018).