Proposal for two Distance Learning courses

I have been offering and running Distance Learning courses in recent years as a response to the lockdowns of the Covid 19 pandemic, when geological field and indoor courses and trips could not take place. Although we are now able to mix more freely, the winter season, characterised by short days and the possibilities of bad weather, has always restricted geological activities.

We have the option to continue running Distance Learning courses in the main winter months of January and February; to that end, I am proposing two such courses in those months in 2023, and will run them if there are enough takers. They are independent of each other – I hope these may be of interest to you, and that you decide to enrol on one or both of them.

One of these courses is based on field work I have done when researching a specific area of great geological variety in the UK. The course describes a cross-country transect incorporating many exposures I have visited in the past, *en route*. The course uses Google Earth imagery throughout the route of the transect, so as to give as continuous an impression as practical between the start and end points. In order to make the transect as informative about the geology as possible, the locations described are not necessarily found immediately on the transect line, but may lie some distance adjacent; the aim is to give an illustrated impression as clearly as possible of the changing geology along the broad route of the transect. The transect line is located in south Shropshire, running NW – SE, across a direct distance of c. 20 miles, between Corndon Hill (just inside the Welsh county of Powys) and Titterstone Clee Hill near Ludlow.

The other course describes a subject I studied as part of my training when I was a research student, and which I found of much interest; much more work on the subject has been done in the time since, and international collaborations between multiple authors have been published in recent years. This subject is the opening of the North Atlantic Ocean.

Format of the Courses

The courses would, like previous Distance Learning courses I've run in 2020 and 2021, comprise a detailed document that would be received by each enrolee digitally; this would then be read by the enrolee within a specified time (2 weeks). This 'Reading Period' for the first of the courses would be followed immediately by the courses 'Dialogue Period' (1 week). The Reading Period of the second course would then take place (2 weeks) followed by the 1 week Dialogue Period.

The 2 week period for each course will enable enrolees to do the reading when convenient to them, even though they are likely to be busy with other activities (including those who are working from home and pre-retirement). As on previous courses, the documents would follow a format somewhat like those I provide for field trips, but with more figures, including many described photographs. A list of suggested reading would be provided.

As on previous occasions, the Dialogue Periods *would not be essential* for any enrolee to take part in if they are happy with their understanding of the course material in the documents, and what they can follow up if they wish from the list of optional reading. The Dialogue Period would as usual involve *email-based dialogue between each enrolee and myself*. No further dialogue would occur after each Period has ended.

In order to keep this second part manageable in case many enrolees respond, each question posed would need to be succinct and for which I could provide a brief answer if necessary (perhaps referring the questioner to published information they could follow up). The number of questions from each enrolee would be a maximum of 10.

Following the completion of each Dialogue Period, I would send to all enrolees what I consider to be the most informative questions / answers relating to the course material, in order to add to the learning of the group as a whole; this would be part of an email concluding both courses.

NB. Those enrolled on the course(s) would not have to be restricted in their reading to the planned Reading Periods if they did not have time; they could do so when convenient to them during the following weeks (or beyond). The Dialogue Periods, however, would be fixed, with both courses ending with the concluding email from myself the day after each Dialogue Period is completed.

The size of the course documents will be too large to send attached to emails; I will aim to have these reduced to PDF's, which will hopefully make them small enough for this purpose. An alternative is we use Dropbox, as on previous occasions.

For anyone who does not have a suitable IT device on which to easily read the course documents or print them out, I could provide a hard copy. Such would be expensive to produce as many of the included pictures would be in colour; one way around this cost factor would be to *produce a black and white print out version.*

Outlines of the two courses are given below.

Regards,

NICK CHIDLAW nickchidlaw@gmail.com

A GEOLOGICAL TRANSECT ACROSS SOUTH SHROPSHIRE

Tutor: Dr Nick Chidlaw

Reading Period: **Monday 16th – Sunday 29th January 2023** (2 weeks)

Dialogue Period: **Monday 30th January – Sunday 5th February 2023** (1 week)

Tuition fee £30.00 per person.

No prior knowledge of geology or the study area would be assumed. A detailed illustrated document would be sent out to be received by all those enrolled just before the arranged Reading Period begins.

Deadline for Fees

By **Sunday 8th January**

In view of postal difficulties, fee is best sent by bank transfer: account in my name, Barclays, Sort Code 20-33-83 Account No 80230227.

Geological background for the course

The study area for this course is located in the Welsh Borderland, almost entirely within the southern part of the English country of Shropshire. A small part of the Welsh county of Powys is also included.

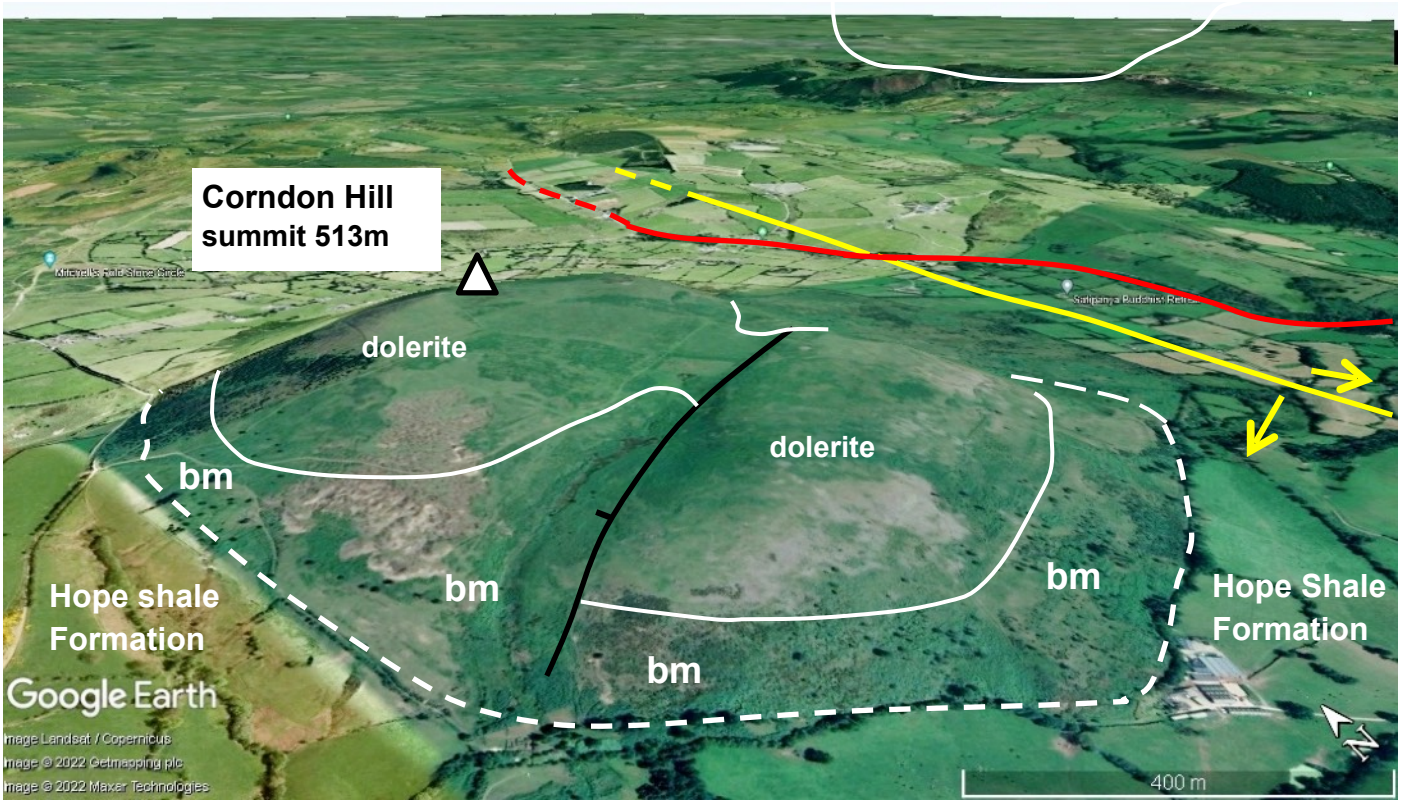

Fig.2. Google Earth oblique image of Corndon Hill, at the NW end of the transect. View is to E. Note scale bar in lower right side of the image. Corndon Hill is a distinct landform, rising noticeably above the general level of the adjacent countryside. It is considered to be a 'phacolith', i.e. a localised lens–shaped body of igneous rock that has intruded already-folded layered rocks (see Fig. 3 overleaf). The folding process may create spaces near to, or on, the fold axes, into which any molten rock present may flow and crystallise. The bedrock of the general Corndon Hill area is the Hope Shale Formation, which is deformed into anticlines and synclines with axes orientated SW – NE. The 'limbs' of the folds have angles of c. 40 – 65 degrees from horizontal. The intrusion at Corndon Hill is a dense, dark-coloured medium-grained rock known as dolerite, at maximum c. 60m thick; it is located on the NW side of the Shelve Anticline (axis

*shown in yellow). The Corndon Hill dolerite was intruded into a localised 'doming' up of the Hope Shale Formation. The Shale and dolerite were formed during the Ordovician period of geological time (485 – 444 million years ago). The heat of the intrusion caused adjacent Hope Shale strata to become re-crystallised and form a 'baked margin'. At Corndon Hill, the baked margin on top of the phacolith has been eroded away, exposing the dolerite, but on the sides of the hill it is still present (**bm**). Unaffected Hope Shale, beyond the limit of the baking process, forms low ground away from the hill. The A488 road (red line) runs N-S across this low ground. Parts of the Hope Shale Formation are composed of beds of volcanic pyroclastics, which are more resistant to erosion than the main shale rock; they form higher ground such as seen here on the SE side of the Shelf Anticline.*

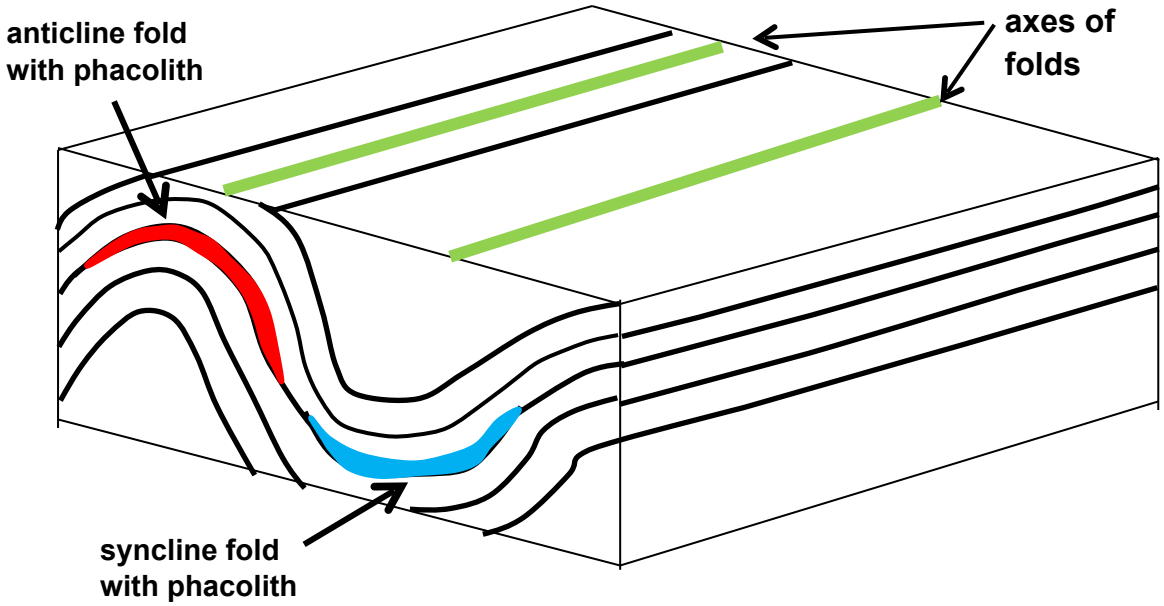

Fig. 3. Phacolith intrusions within folded rocks. The folding of the layered rocks may create spaces into which igneous magmas may flow and crystallise to form lens-like bodies parallel with the fold structures. The host rocks above and below the magma intrusions will be heated and altered, particularly if composed of muddy sediments that are easily affected, to form 'baked margins'.

Fig. 4. Corndon Hill viewed from the north east.

THE OPENING OF THE NORTH ATLANTIC OCEAN

Tutor: Dr Nick Chidlaw

Reading Period: **Monday 6th - Sunday 19th February 2023** (2 weeks)

Dialogue Period: **Monday 20th February – Sunday 26th February 2023** (1 week)

Tuition fee £30.00 per person.

No prior knowledge of geology or the study area would be assumed. A detailed illustrated document would be sent out to be received by all those enrolled just before the arranged Reading Period begins.

Deadline for Fees

By **Sunday 8th January**

In view of postal difficulties, fee is best sent by bank transfer: account in my name, Barclays, Sort Code 20-33-83 Account No 80230227.

Alternatively, a cheque payable to myself can be sent by post: 8, Silver Street, Dursley, Glos. GL11 4ND.

Please provide me with your postal address if you wish to receive a black and white copy of the document.

I will go ahead with the course if there is enough interest to make it viable: minimum 10 enrolees / fee equivalent. If the course has reached viability by the 8th January, arrangements will be able to continue, if not, fees received will be returned to those who sent them in, soon afterwards.

Geological background for the course

The Atlantic Ocean occupies a basin created by the break-up of continental crust forming part of the supercontinent of Pangaea, initiated in Permian and Triassic times (c. 300 – 200 million years ago). The crust of what is now the E side of North America and Greenland, and the W side of NW Africa and Europe, came under tension during this time. Ocean crust began to form between the USA and NW Africa during the Early Jurassic c. 180 million years ago, and over geological time since, more ocean crust has been created progressively northwards into the polar region. Continental crustal separation began to occur between what is now South America and central Africa during the earliest part of the Cretaceous period, c. 140 million years ago. The ocean crust forming the floor of the entire Atlantic Ocean continues to grow today.

This course examines the causes and processes of the opening of the Atlantic Ocean basin between North America and NW Africa in the S, and the Arctic Ocean in the N.

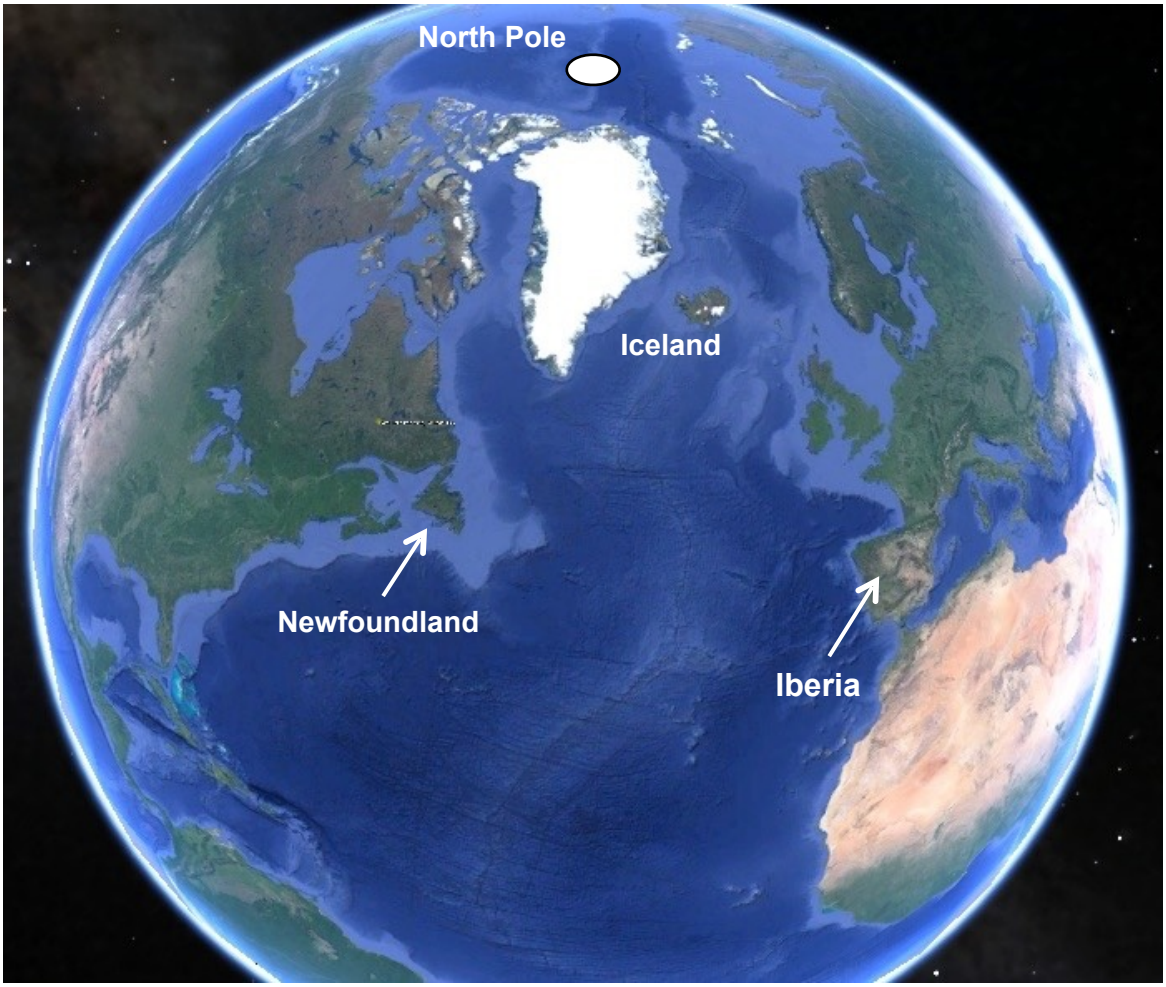

Fig.1. Google Earth image: earth from space, showing the extent of that part of the Atlantic Ocean to be studied. Ocean crust underlies the deepest water coloured dark blue; lighter blue areas, indicating shallower water, are also underlain by ocean crust around Iceland, forming Iceland itself, and down the middle of the Ocean. The shallow seas forming the broad continental shelves margining North America and NW Europe are underlain by continental crust that was originally joined together: notably, the shelf to the E of Newfoundland was once connected to Iberia.

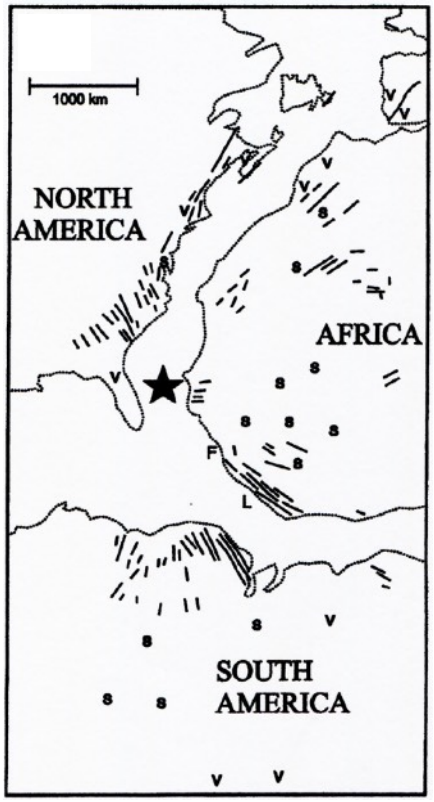

Fig. 2. The break-up of part of Pangaea to form the North Atlantic Ocean basin involved two enormous igneous systems: the Central Atlantic Magmatic Province (CAMP) and the North Atlantic Igneous Province (NAIP). Igneous systems of such size occur in many parts of the world, and are referred to as 'LIPs' (Large Igneous Provinces).

This figure illustrates the pre break-up continental crustal areas affected by the CAMP; the star symbol indicates its central focal point. Noticeable on this figure are numerous parallel lines radiating from the focal point; these indicate 'dyke swarms' i.e. near- vertical tension cracks that were infilled by magma rising up from the interior of the earth, and crystallising as wall-like bodies (dykes) of igneous rock. The S symbols indicate the location of 'sills' associated with the dykes: igneous intrusions that are parallel to the layering in the host rocks. V symbols locate the presence of volcanic rocks produced by magmas that reached the surface of the crust during development of the CAMP; it is likely that these were once more extensive, but have been reduced in area by erosion since their formation.

Fig.3. Exposure of part of the Palisade Sill, adjacent to the Hudson River in New Jersey, USA. This sill extends for c. 50 miles through New Jersey and New York States. It is composed of the dark, dense rock dolerite and is c. 300m thick. It was formed as part of the CAMP 200 million years ago, during earliest Jurassic times.

Fig.4. North Atlantic Igneous province (NAIP) basalt lava flows, formed c. 55 million years ago in the Palaeogene period, when NW Europe and Greenland separated. They have been deeply eroded to form islands with impressive cliffs. The Faroes, located between Scotland, Iceland and Norway.