

# Geology Matters

**The newsletter of Malvern USA geology group  
December 2016**

## **The leader**

Very good to see another superb turnout for our November meeting – 94 of you came along. I think those of you who came will have enjoyed very much Chris Darmon's talk on "Britain in the Firing Line: Ancient Plate Margins". What an enthusiast he is and bringing such an interesting perspective on the geology of the UK. He really made us realise how lucky we are, as geology enthusiasts, to be living in this world beating country. He has offered to speak to us again in the future and we will certainly take him up on it. I can see why his field trips are so popular.

Looking forward to next month's meeting (see Calendar), I think Dr Ralf Gertisser's talk on large scale vulcanism and future risks should be equally fascinating if not a little scary!

Work continues to follow up on the results of the survey and I'm pleased to announce that Richard Edwards, assisted by Alan Hughes, have put together plans for our first workshop on rock identification. It is intended to run the workshop on 2 dates in March next year – details will be circulated in due course. I hope that this will prove to be a popular initiative.

On a similar note and following up on our offer at the last meeting we have about 25 members who wanted to buy a hand lens. Consequently I have now made a bulk purchase to satisfy the demand. If anyone would like one and haven't given me their name I will have a few spares, so please let me know if you are interested.

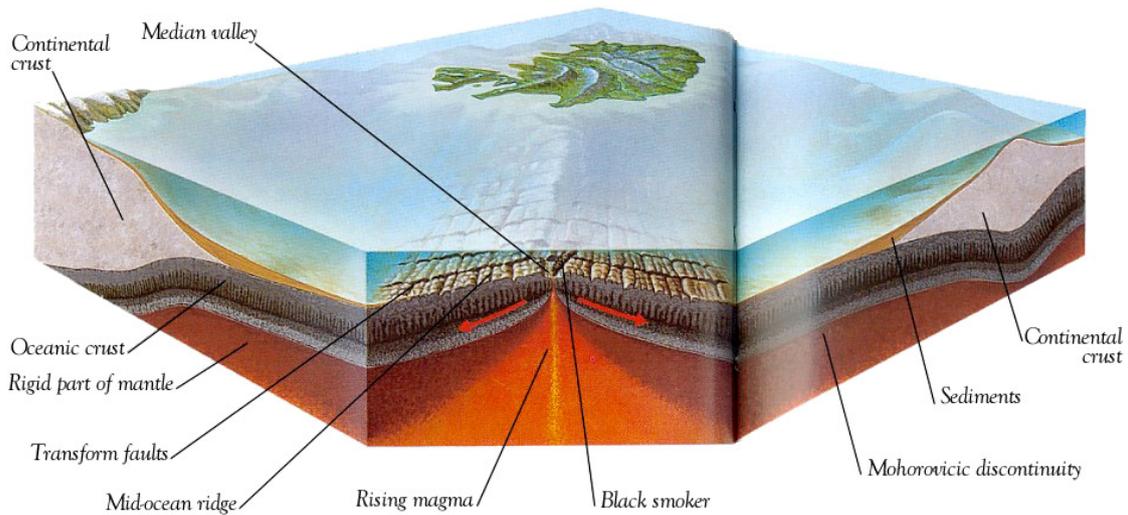
After the piece in last month's newsletter about digital microscope images, Margaret Rodway has offered to provide help and information to anyone interested in learning more about advanced rock identification techniques. She has her own polarising microscope plus a collection of thin section slides. She is also happy to answer any general geology queries. Her contact details are as follows: email [mer2@waitrose.com](mailto:mer2@waitrose.com) and phone 01684 567588.

Finally, here is the last call for anyone wanting to go on our Tenby trip next May. We could take up to 4 more but will be closing the books by the end of December. So if you are still wavering please decide soon!

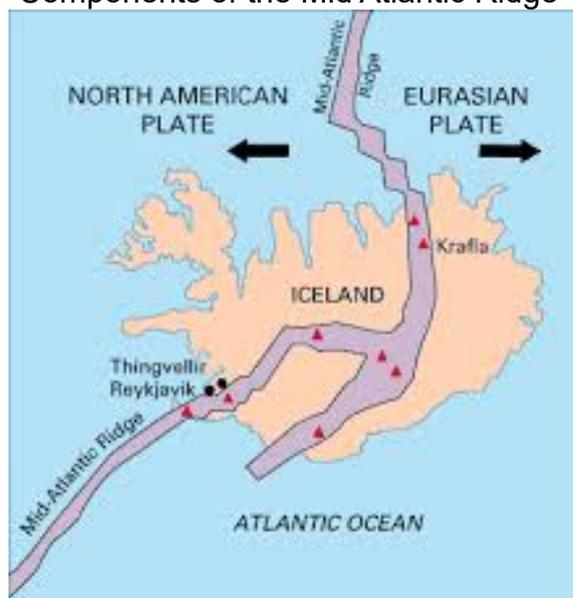
## **Plates Jim, but not as we know them**

Following on from our special edition devoted to fossils, the editorial spotlight has now switched to plate tectonics. Since this is a world wide phenomenon, then this is clearly going to be something of an international (albeit very eccentric) edition. We start with an article by Dick Harris who recently followed the increasingly well trodden pathway to Iceland and its hotspot.

Taking a 'Plate Tectonic' view of the Earth, Iceland occupies what is probably a unique position sitting squarely astride the mid-Atlantic ridge. Indeed to be more precise Iceland is itself part of the mid-Atlantic ridge which would normally be situated on the ocean floor at a depth of many kilometres.



### Components of the Mid Atlantic Ridge



### Mid-Atlantic Ridge in Iceland

The explanation usually attributed to this unusual situation is that Iceland is situated on a so-called 'hot spot' on the Earth's surface where a semi-permanent, deep 'plume' of hot mantle causes unusual upwelling of magma onto the ocean floor adding to the activity of the mid-ocean ridge. However this 'Mantle Plume' model is hotly disputed by other experts and the reason for Iceland's existence remains to be fully explained. Some experts even believe that we are seeing one possible mechanism for the creation of original continental crust.

The 'Median Valley' of the mid-Atlantic ridge can be viewed in the Thingvellir National Park as a lake bordered to the East by the ridges of the Eurasian Plate and to the West of the North American Plate:



'Median Valley' lake in Thingvellir National Park (Taken from the North American Plate looking South East towards the Eurasian Plate)

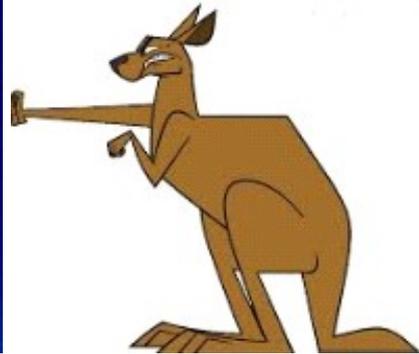
Away from the mid-Atlantic ridge regions, Iceland is still volcanically active with magma never being far from the surface. This results in many volcanoes, geothermal power plants, hot springs, geysers and extensive faulting:



Examples of faulting and uplift at Grjotagia Caves with associated underground magma heated pools on the right.

### **And now, quite logically, on to self driving cars and tractors in OZ**

What? You might reasonably ask, but stay with me. The Australian plate is moving northwards at a brisk 7 cm/yr. Since 1994 then, it has moved about 1.5m; the significance of the date being that The Geocentric Datum of Australia, the country's local co-ordinate system was then last updated. GPS satellites use a different reference system, which is independent of fixed positions on the ground and so over this time the two systems are starting to diverge significantly.



Now self driving vehicles use both systems to navigate around and so as you might imagine, it is rather important that they agree with each other. A fix is being worked on so that the self driving tractors will manouver through the gate of a field rather than through the fence.

### And now to rifting



This vigorously active lava lake is part of the Dallol volcanic complex in the Danakil depression in East Africa. We are fairly au-fait with spreading oceanic ridges and subduction zones, but rifts are less common and this is an interesting one. Tectonic forces are levering apart a substantial area of the continent in an area running from the Gulf of Aden in the north, several thousand kilometres south towards Madagascar

The Danakil depression is towards the northern end of the rift and in places is over 100m below sea level. It is a volcanically active and extreme environment, with fumaroles, toxic

lakes and air temperatures reaching 60°C, all combining to form an altogether hadean vista. It is a nascent ocean spreading centre. Eventually the Indian Ocean will break through and then we will have a new island for the politicians to squabble over.

When continents break apart and new oceans form and grow between them, they tend to follow a certain sequence. No one knows for sure what kick starts the process, but convection currents in the mantle building up heat under the blanketing effect of the continental crust and plumes of hot mantle rising from the depths are the main contenders. The crust starts to pull apart and thin and molten rock starts to flow into and through the continental rocks.

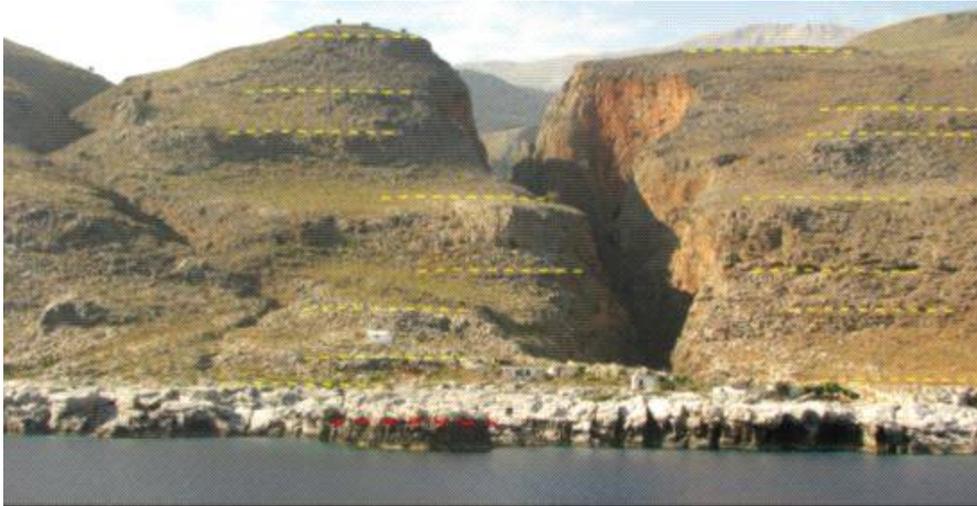
Elsewhere....after the separation of the super continent Pangaea, two main land masses known as Laurussia and Gondwana drifted apart. As the era proceeded, forces stirring deep below started to prepare the scene for the rifting apart of Gondwana, which took up much of the Cretaceous. Vast outpourings of lava breached the crust in what is now Antarctica some 180 million years ago. While subsequent erosion has removed much of the rock erupted above ground, the plumbing systems and large underground intrusions of lava into the country rocks that accompanied the event are some of the best exposed on the planet, but are unfortunately found in one of the globe's remoter and harsher spots: the Dry Valleys. A sequence 4km thick is open for exploration to those geologists willing to endure the somewhat extreme working conditions.

These rocks are called the Ferrar dolerite complex (after the geologist on Scott's 1901-4 expedition), and it comprises four massive horizontal sills extending for tens of kilometres and ranging from 100 to 350 metres thick, interconnected by a complex system of vertical dykes. The photograph below shows a split sill of black dolerite that intruded into the Beacon Sandstone, where it stalled in the crust, intruding through and between the layers of sandstone



### **And the next location on our eccentric journey is Κρήτη**

Africa has, for the last 100 million years or so, moved fairly relentlessly north and west even if its 2.15 cm/yr pace has been a little pedestrian. Well into the journey it encountered the Eurasian plate and then the tussle began. One of the outcomes has been the uplifting of oceanic crust to form the island of Crete (Κρήτη). This is not a smooth process, but an intermittent one that is marked by violent, large magnitude earthquakes. These processes are very clearly marked on the south coast of the island, as this picture shows.



The changes in gradient, marked by dashed yellow lines, show successive uplifts. The most recent of these being at sea level and is shown by the dashed red lines.

### **And now for the dramatic results of subduction**

Geo tectonic forces have caused some dreadful human suffering over recent years as this tsunami picture from Japan reminds us.



Kamchatka in Pacific Russia is situated on the subducting margin of the Pacific plate and has a remarkable concentration of 29 active and 131 dormant volcanoes.



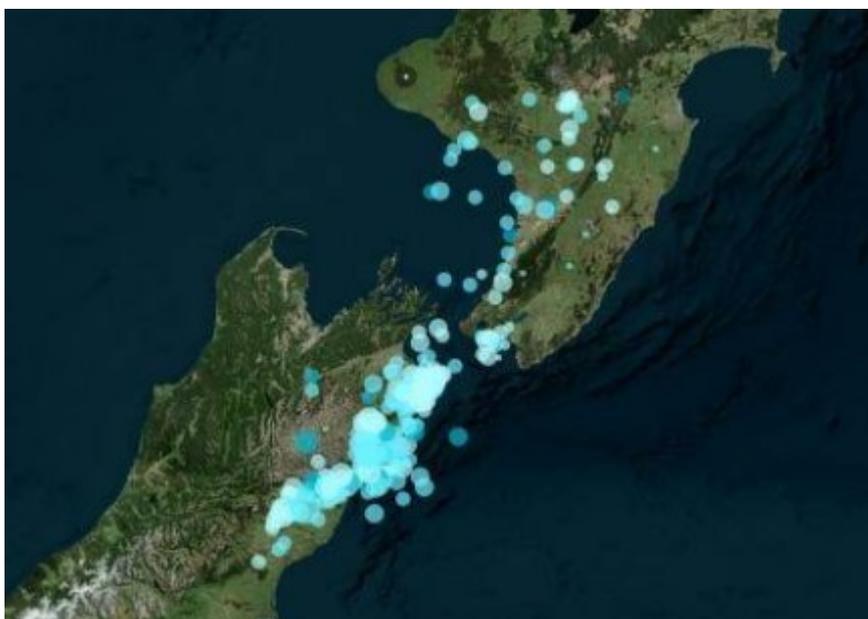
## Rock of the month (1)

Since volcanism is such an integral feature of plate tectonics, it was an obvious step to look for a volcanic rock to fill this slot and in particular an interesting one. Obsidian is such a rock. It is formed on the edges of highly silicic lava flows where it has cooled very rapidly so having no, or very few, crystals. It fractures forming very sharp edges and has been used since ancient time to produce edged weapons and tools.



## Rock of the month (2)

When last month we gave you a presentation about the rocks of the Alpine Fault in New Zealand, we said that it moved on average 3cm/yr. True, except for the occasions when they experience major earthquakes and this happened with a vengeance only a few days later. The picture below shows not only the major epicentres, but also the location of aftershocks.



An interesting sidelight on these major earthquakes – the editor's relatives in Waihi, North Island, slept through it all! There are many relevant collections of photographs available on line – here are a couple of examples:

<http://www.stuff.co.nz/national/86416467/gallery-large-quake-strikes-new-zealand>

or

<https://www.theguardian.com/world/2016/nov/14/like-living-on-a-waking-dragon-new-zealanders-count-cost-of-earthquake->

## Calendar

November	30	New Members - Gullet Quarry
December	7	New Members - Building Stones of Worcester
	14	Monthly Talk: Historical Large Scale Volcanism and Future Risks
January	11	Monthly Talk: East African Rift Valley
February	8	Monthly Talk: The Anthropocene
March	8	Monthly Talk: Geology and Tectonics in the Andes
April	12	Volcanoes of Southern Italy
May	5	South Wales (until 9 <sup>th</sup> )
	10	Members Meeting
September	19	Brittany (until 28 <sup>th</sup> )

## Who's who?

### Steering Committee

James Berry	01684 560334	<a href="mailto:zostera66@hotmail.com">zostera66@hotmail.com</a>
Geoffrey Carver	01684 560749	<a href="mailto:geoffrey.carver@btinternet.com">geoffrey.carver@btinternet.com</a>
Hilary Edgeley	01386 462725	<a href="mailto:hilary.edgeley@btopenworld.com">hilary.edgeley@btopenworld.com</a>
Robert Eveleigh	01531 632947	<a href="mailto:eveleigh.r@gmail.com">eveleigh.r@gmail.com</a>
Mary Geffen	01684 561890	<a href="mailto:mary@geffen.plus.com">mary@geffen.plus.com</a>
Dick Harris	01886 880699	<a href="mailto:richardlangleyharris@gmail.com">richardlangleyharris@gmail.com</a>
Roger Hunt	01684 565926	<a href="mailto:rmrhunt@sky.com">rmrhunt@sky.com</a>
Richard Newton	01684 565626	<a href="mailto:richard@renewton.plus.com">richard@renewton.plus.com</a>
Maggie Smith	01684 567278	<a href="mailto:maggietoshsmith@gmail.com">maggietoshsmith@gmail.com</a>

### Subgroup contacts

#### Fossils

Christopher Wright 01905 20920 [cnw48@hotmail.com](mailto:cnw48@hotmail.com)

#### Landscape Appreciation

Raphael Bate 01684 573882 [randhbate@gmail.com](mailto:randhbate@gmail.com)

#### Maps

Mary Geffen 01684 561890 [mary@geffen.plus.com](mailto:mary@geffen.plus.com)

#### Plate Tectonics

Dick Harris 01886 880699 [richardlangleyharris@gmail.com](mailto:richardlangleyharris@gmail.com)

### Newsletter

Geoff Carver 01684 560749 [geoffrey.carver@btinternet.com](mailto:geoffrey.carver@btinternet.com)

**Library**

Elizabeth Staley

01684 574392

[js@cmail.co.uk](mailto:js@cmail.co.uk)

**Group website**

## Malvern U3A Geology



<http://geology.malvernu3a.org.uk/>

**And finally .....**



**Our very best wishes for a very happy Christmas! We look forward to seeing you again in 2017**