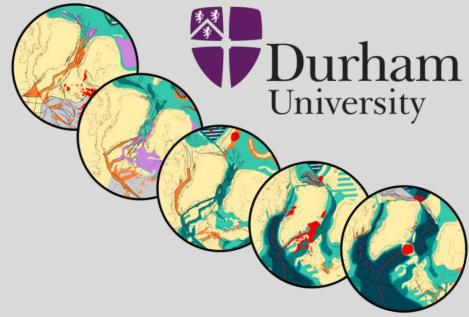


NORTH ATLANTIC DURHAM UNIVERSITY 2016

Seeking a new paradigm for the North Atlantic

St. Chad's College, Durham University, U.K.
19th - 21st September, 2016



WORKSHOP REPORT

The North Atlantic 2016 workshop was held in St. Chad's College 19 - 21 September, 2016. The organising committee comprised Gillian Foulger (Chair), Christian Schiffer and Alex Peace. Oliver Sanford provided technical support.

A total of 20 people attended. These were Tony Doré (Statoil), Henry Emeleus (Durham University, UK), Gillian Foulger (Durham University, UK), Dieter Franke (Bundesanstalt für Geowissenschaften und Rohstoffe [Federal Institute for Geosciences and Natural Resources], Germany), Laurent Geoffrey (Université de Bretagne Occidentale, France), Laurent Gernigon (Geological Survey of Norway), Malcolm Hole (University of Aberdeen, UK), Ármann Höskuldsson (University of Iceland), Bruce Julian (Durham University, UK), Nick Kuszniir (University of Liverpool, UK), Fernando Martinez (University of Hawaii, USA), James Natland (University of Miami, USA), Alex Peace (Durham University, UK), Vivi Pedersen (University of Bergen, Norway), Kenni Petersen (Aarus University, Denmark), Oliver Sanford (Durham University, UK), Christian Schiffer (Durham University, UK), Randell Stephenson (University of Aberdeen, UK) and Martyn Stoker (British Geological Survey, UK).

The workshop proceeded according to plan. Attendees delivered ~ 10-min presentations illustrated by slides followed by 20 min of discussion. An additional five hours were scheduled for discussion alone. The division of time was thus 30% for formal presentations and 70% for discussion. The final agenda delivered is available online at <http://www.mantleplumes.org/NAWorkshop/NAWorkshop.html>

Contributions were broadly divided into the themes:

- rift propagation,
- rifting,
- deep structure and magmatism,
- vertical motions,
- crustal and lithospheric structure, and
- discussion/publication planning.

Feedback from attendees following the meeting was generally positive. Attendees praised the:

- discussion-dominant division of time,
- high amount of cross-disciplinary transfer of knowledge,
- size of the meeting, and
- convenient domestic/meeting/restaurant facilities.

Negative feedback included the:

- aspect ratio of the meeting table and smallness of the projection screen,
- standard of accommodation,
- insufficiency of time for individuals to say all they wished, and
- insufficiency of focus on particular sub-topics.

The workshop achieved expanding perceptions of:

- the distribution of continental crust beneath the North Atlantic,
- similarities between the regional fault/volcanic system that comprises the Jan Mayen fracture zone, and the Greenland-Iceland-Faeroes zone,
- the commonality and dominant influence of rift propagation,
- the puzzle of the Reykjanes Ridge propagators,
- the importance of understanding the magmatism,
- remaining unknowns concerning the Jan Mayen microcontinent,
- the reason for abandonment of spreading in the Davis Strait,
- information that seismology can deliver on both shallow and deep structure, from the passive margins, Iceland and the ocean,
- geochemical indications of temperature and volcanic source compositions, and the variation of opinion among geochemists,
- from numerical modelling of breakup, processes likely to occur, *e.g.*, the likelihood of recycling different petrologies of the cratonic lithosphere into the new ocean,
- correlations between Greenland margin and Norwegian/British margin structure,
- vertical motions both of the oceanic and terrestrial parts of the passive margins,
- the status of understanding of the variation in crustal thickness and composition throughout the North Atlantic,
- the relationship between pre-existing structure and the style of breakup and subsequent spreading (“inheritance”),
- correlation or lack thereof of tectonism in various parts of the North Atlantic,
- comparisons with other areas such as the Rio Grande Rise/Tristan/Walvis Ridge region and the Sechelles region.

The following straw-man plan was suggested for moving forward:

1. Hold an additional two workshops, the next in Durham in the spring of 2017 and the third in late summer 2017. The objective of the 2nd workshop would be an update for

everyone on progress on Item 3. below. The 3rd workshop could involve a fieldtrip to Iceland.

2. When ideas have matured, consider writing a paper for submission as a *Nature* article, describing a new paradigm for the development of the North Atlantic and other analogous regions. This could be discussed at the spring 2017 meeting.
3. Proceed with the package of papers invited by *Earth-Science Reviews*. The following set with proposed leaders was developed. The leaders will organise those colleagues who wish to contribute to specific papers and co-ordinate assembly of the manuscript. Colleagues who were not able to attend the workshop are also welcome to be involved. The tentative time-frame would be a dead-line (or at least a gravely ill-line) for submission of 30 September, 2017:

- 1) General overview (Leader: Gillian Foulger, everyone a co-author)
- 2) What is the nature of Iceland? Does it contain a continental sliver? Structure, gravity, kinematics. (Leader: Ármann Höskuldsson & Gillian Foulger?).
- 3) What is the process and chronology of breakup? Conditions, rift propagation towards hotspots, kinematics, kinematic history up to the present. (Leaders: Laurent²)
- 4) What are the reasons for melting? Could be whether hot or cold, or extension rate controls volcanic rate. How wet? How fertile? What do we know and what not? Relationship with extension and vertical motions. (Leader: Malcolm Hole).
- 5) Inheritance. Piercing points, mantle reflectors, reactivation of Caledonian, delamination, numerical modelling, dynamic uplift. Could be from earliest known orogeny to present. (Leaders: Tony Doré & Christian Schiffer).
- 6) Reykjanes Ridge (Leader: Fernando Martinez).
- 7) Structure from top to bottom – crust, mantle. (Leader: Nick Kusznir).
- 8) Comparisons/extensions to other regions in particular Tristan and Réunion systems. (Leader: Alex Peace).

4. Design of future experiments that could test our final model. During the meeting it was highlighted, for example, that eastern Iceland and the region offshore was particularly poorly studied. At the same time it is particularly important to understanding the distribution of continental crust south of the known part of the Jan Mayen microcontinent, and the chronology of events in the “dark ages” between the time when the Aegir ridge became extinct and rocks currently exposed in Iceland formed.

*Gillian R. Foulger, Christian Schiffer and Alex Peace
Durham, September 2016*