Magma Plumbing: Understanding the regional Emplacement of Igneous Intrusions in the Faroe-Shetland Basin

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Abstract

Discerning how magma moves around the subsurface is integral to our understanding of how volcanic systems evolve. Our current understanding of magma transit through the crust is mainly based on petrological and geochemical methods. These methods have given us great insight, but are unable to give exact geometries of such systems; additionally they also cannot take into account movement of magma laterally through the crust.

The use of 3D oil industry seismic data has yielded incredible insight into understanding such systems and the ever increasing amount of seismic data available in frontier basins containing volcanics means that it is now possible to start to understand magma movement within the subsurface.

Understanding such systems not only has major implications for creating a paradigm shift in our understanding of volcanic systems, but is of particular importance to hydrocarbon exploration, which is increasingly moving into frontier basins containing intrusive volcanics (e.g. Faroe-Shetland Basin, Greenland, Brazil). Intrusions can act to compartmentalize both reservoir and source rock regions and at a regional basin scale can also act as barriers and baffles to hydrocarbon/fluid migration by acting as permeability barriers.

The student will work on regional seismic and well datasets from the Faroe-Shetland basin to understand the major magma flow pathways within the basin and the control of depth, lithology and basin structure on magma flow. The student will work closely with the StratLip research group based at the University of Aberdeen which has built up a detailed knowledge of the volcanic sequences and Palaeocene stratigraphy within the Faroe-Shetland Basin. This will allow the student to understand the evolution of the intrusive complex over time and its relationship to the lava sequences.

The student will receive training in seismic interpretation within volcanic terrains, additional possibilities for undertaking internships within the hydrocarbon industry also exist.

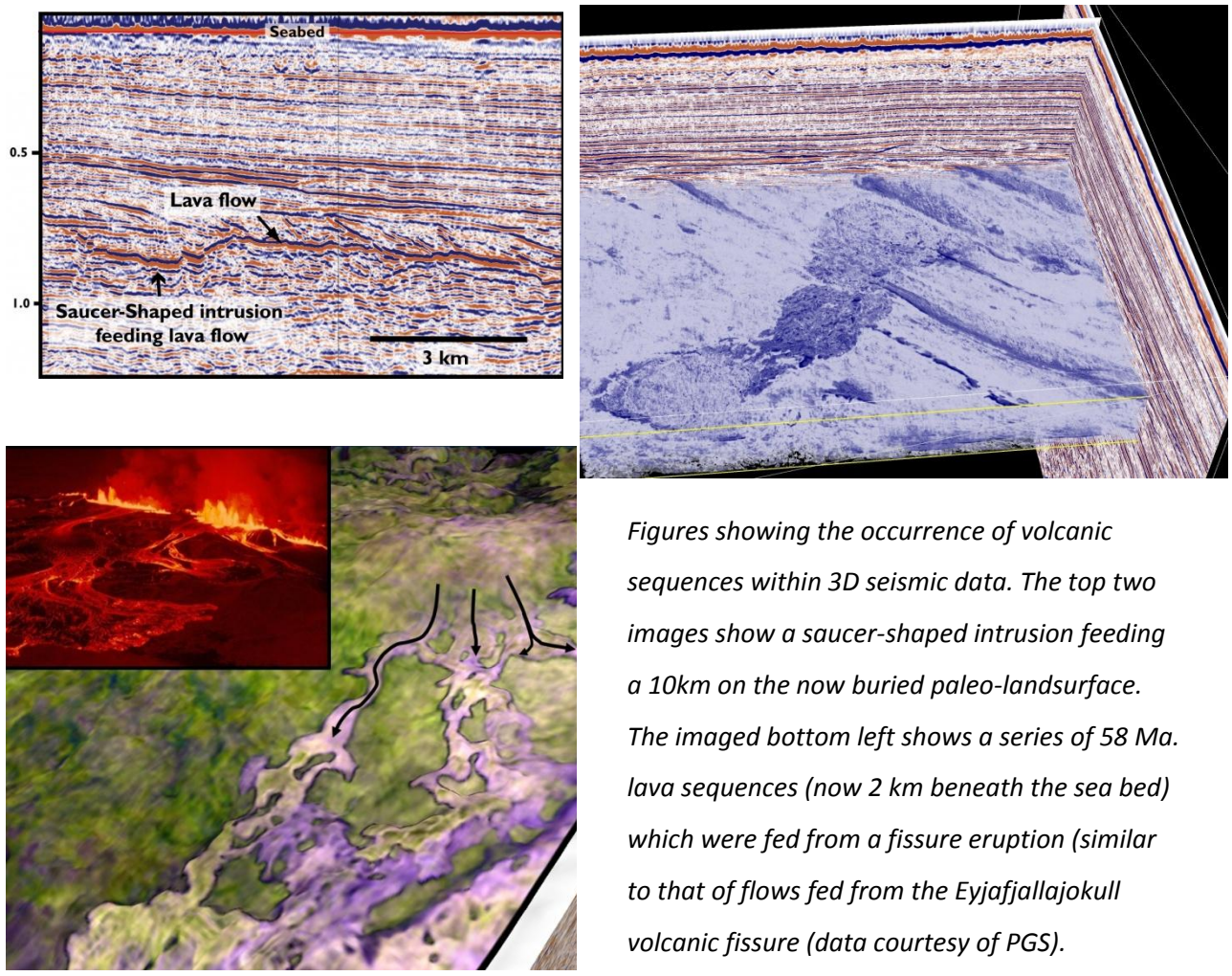
Description of Work

The work will fall into three main areas

1) Seismic interpretation of intrusive sills within the basin and reconstruction of the overall magma flow pathways. Particular attention will be paid to identifying any fault systems which have acted as long term conduits to magma.

2) Integration of the work with the knowledge of the age distribution of the lava sequences in the area, in an attempt to understand the evolution and change of the feeding systems of the lavas.

3) Formulation of detailed maps showing magma flow pathways and areas of potential compartmentalization of the basin sequences (both reservoir and source rock intervals). During the course of the PhD a understanding of the control of lithology, depth and pre-existing basin structure will be formulated.



Figures showing the occurrence of volcanic sequences within 3D seismic data. The top two images show a saucer-shaped intrusion feeding a 10km on the now buried paleo-landsurface. The imaged bottom left shows a series of 58 Ma. lava sequences (now 2 km beneath the sea bed) which were fed from a fissure eruption (similar to that of flows fed from the Eyjafjallajokull volcanic fissure (data courtesy of PGS).

The student will join a vibrant group of researchers at the University of Birmingham, where significant intellectual critical mass in the field of volcanic systems in sedimentary basins exists. The project is suitable for any individual with a 2:1 (or higher) degree with a Earth Science background. The student will receive training in seismic interpretation, well analysis, GIS and basin analysis. The student will also benefit from substantial exposure to the oil industry and academics from other leading institutions. Employment post-PhD could be sought either within the hydrocarbon industry or within academia.

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