Report on a field season to the Columbia River Basalt Province, USA.

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Continental flood basalt lava flows are widely considered to represent compositionally homogenous, rapidly erupted products of large, well-mixed reservoirs of magma. Each large-volume eruption forms a flow field consisting of many lava sheet lobes. Whilst previous work has occasionally documented compositional variation vertically within a single lobe, little has been done to assess the amount of geochemical variation within the products of individual eruptions. This project aims to explore the extent and cause of compositional variation by obtaining a sequence of vertical profiles, within individual (intra-) and adjacent (inter-) sheet flow lobes from the same eruptive package. The geochemical characteristics of the lava flows may be related to both the mechanisms of emplacement of individual flows and flow fields, and/or heterogeneities generated by magma source processes, dynamics and transport to the point of eruption. Such an investigation is needed to provide an understanding of flow field formation, which in turn is essential to understanding volumes, rates and durations of eruptions. This has implications for wider scale research into the atmospheric and environmental impacts of large-scale eruptions.

Financial assistance provided by the Mineralogical Society helped fund a two month field season this year to the Columbia River Basalt Province. This flood basalt province is the youngest on earth, believed to have formed between 17.5 to 6.0 Ma, with approximately 90% of its volume erupted in a period of roughly 1.3 Ma. Although it is small in comparison to some other large igneous provinces, the extensive canyon-side exposures, good access, preservation in a semi-arid environment and a history of research characterising the stratigraphy make this province an ideal natural laboratory. Fieldwork involved correlating and mapping individual lava units over a 100km^2 area based on physical characteristics related to emplacement through pahoehoe inflation. Detailed vertical logs and samples were collected alongside the construction of this framework to characterise three of the most voluminous eruptions in this province.

Initial results demonstrate the persistent presence of statistically and analytically significant geochemical variation within and between sheet lobes from one single eruption. Further comparison of the major and trace element and Re-Os isotope variation profiles provide an understanding of the emplacement of extensive sheet lobes and construction of a flow field. The link between the analytical sampling programme and an understanding of the physical volcanological framework of these eruptions, established through fieldwork, was essential, and has provided a temporal and spatial understanding of the geochemical variations.

I would like to take this opportunity to thank the Mineralogical Society for their contribution which enabled this field work to take place. The work accomplished has provided the essential basis for this research and the construction of a new approach to understanding large volcanic eruptions.

Figure 1. C. Vye in the field, examining canyon-side exposures.

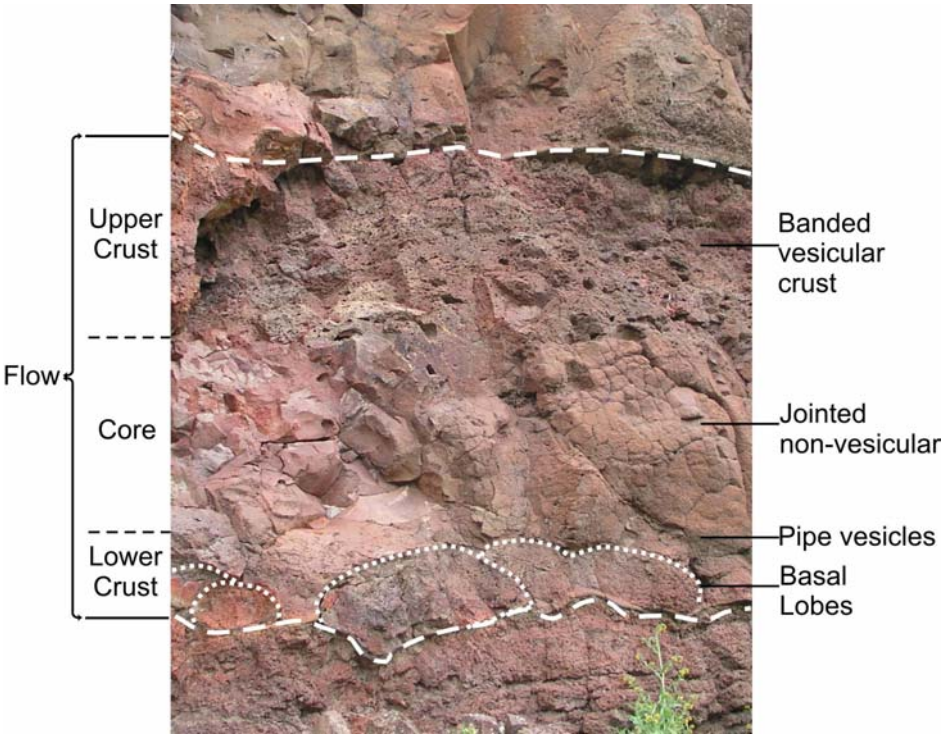

Figure 2. Typical example of features indicative of pahoehoe lobe inflation, used to construct the flow field framework.