

Valley-filling ignimbrites and the incursion of a pyroclastic density current into a lake: the Stallachan Dubha Ignimbrite Member, Ardnamurchan, NW Scotland

David Brown¹, Charlotte McLean¹, John Buchanan¹, Peter Reynolds², Peter Nicholls³

¹University of Glasgow, UK, ²Durham University, UK, ³Uppsala University, Sweden

E-mail: david.brown@glasgow.ac.uk

The Palaeogene Ben Hiant Member of Ardnamurchan, NW Scotland, comprises a thick sequence of breccias and conglomerates interpreted as debris flow deposits. These rocks are unconformably overlain by a recently identified sequence of pyroclastic rocks, which we interpret as ignimbrites. We propose the name the Stallachan Dubha Ignimbrite Member for these rocks. Silicic explosive eruptions generated pyroclastic density currents that deposited a range of ignimbrite lithofacies. Lateral thickness variations in the ignimbrites record the localised filling of the palaeotopography. Periodically, the pyroclastic density currents entered a small lake and the ash was subject to aqueous reworking.

Four phases of eruption have been recognised in the sequence. Phase 1 was marked by the emplacement of valley-filling massive lapilli-tuffs and breccias. The presence of clasts of Phase 1 material in upper parts of this unit indicate that the current was eroding its own deposit during emplacement. Phase 2 was marked by the emplacement of rheomorphic tuffs and breccias. The rheomorphic tuffs display a strong flow-fabric/parataxitic texture and folds are locally present. The tuffs coarsen up in to a massive lithic breccia, which contains clasts of the rheomorphic tuff, before fining to rheomorphic tuff. The massive lithic breccia records a significant increase in mass flux, perhaps related to a high-energy vent clearing event, and/or vent collapse. Phase 3 is marked by the emplacement of a sequence of stratified tuffs, lapilli-tuffs and breccias. The tuffs and lapilli-tuffs are planar-to cross-stratified and alternate with massive lapilli-tuffs and breccias. In the finer units, convolute laminae and ripples are present. These rocks record the entry of a dilute pyroclastic density current into a small lake and the aqueous reworking of finer pyroclasts. Phase 4 is marked by the emplacement of a valley-filling crystal-rich massive lapilli-tuff. This unit unconformably overlies both Phase 2 and 3 rocks, including siltstones interpreted as lacustrine deposits associated with Phase 3. Locally, breccia lenses, dominated by clasts of Phase 2 rheomorphic ignimbrite, are present.