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3 or 1? - 3D cone-sheet architecture provides insight into the centre(s) of Ardnamurchan

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The Palaeogene Ardnamurchan igneous centre, NW Scotland, was a defining place for the development of classic concepts of cone-sheet, ring-dyke, and dyke emplacement. It holds therefore an iconic status among geologists and has influenced our understanding of subvolcanic structures fundamentally. We have used historic geological maps of Ardnamurchan to project the underlying three-dimensional (3D) cone-sheet structure. The results illustrate that a single elongate magma chamber likely acted as the source of the cone-sheet swarms, instead of the traditionally accepted model of three successive centres. Our finding is moreover consistent with recent sedimentological, geochemical, geophysical, and structural investigations that all support a ridge-like morphology for the Ardnamurchan volcano. This challenges the static model of cone-sheet emplacement that involves successive but independent centres in favour of a dynamical one that involves a single, but elongate magma chamber that is progressively evolving. The latter model reduces the lifetime required for the Ardnamurchan centre considerably.