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# Signatures of magma chamber replenishment in cumulates of the Rum Layered Suite, NW Scotland

B. O'Driscoll
Keele University, United Kingdom (gga58@esci.keele.ac.uk)

The Rum Layered Suite, NW Scotland, intruded during the Palaeogene opening of the North Atlantic Ocean, is a classic example of a layered mafic-ultramafic intrusion formed by open-system magmatic differentiation. The structurally lower Western Layered Intrusion (WLI) is separated from the Eastern Layered Intrusion (ELI) by a linear zone of chaotically deformed and brecciated cumulate: the Central Intrusion. The latter occupies the position of the Long Loch Fault, believed to have sited ascent and emplacement of the Rum Layered Suite. The WLI contains large volumes of harrisite, a spectacular 'disequilibrium' cumulate olivine texture formed as a result of deep undercooling of batches of picritic melt upon entry to the magma chamber. The ELI comprises 16 coupled feldspathic peridotite-troctolite ($\pm$ olivine gabbro) paired rhythmic units, which have each been recognized as representing major magma influx events. Historical and recent petrological study has largely focused on the ELI, finding much evidence of open-system magma chamber behaviour there, but comparatively little work has been carried out on the cumulates of the WLI.

Superimposed on the large-scale cyclic peridotite-troctolite layering of the ELI is a great degree of complexity and structural deformation of smaller scale (cm-to-m) layering, especially of feldspathic peridotite and troctolite, attributed to the 'leaky' open-system behaviour of the Rum chamber. Arguably the most striking feature of magma replenishment is the presence of Cr-spinel seams (chromitite) at the precise position of some of the major cyclic unit boundaries. These are typically $\sim$2 mm thick and may be laterally extensive over 2-3 km, generally immediately overlying 'restitic' anorthosite. The cumulates above and below the unit boundaries preserve evidence that the chromitite seams and anorthosites crystallised in situ following downward infiltration of primitive picrite and concomitant assimilation of the underlying troctolite.

Models that invoke the dissolution of troctolite in order to force the incoming magma to precipitate large volumes of Cr-spinel do not obviously account for the presence of chromitite seams in the centres of some of the thick peridotite bodies of the ELI. Abundant 2-4 mm thick chromitite seams in the harrisitic peridotites of the WLI, where there is a distinct absence of plagioclase cumulate, are also problematic. In both the ELI and WLI, subtle mineralogical and textural changes occur across such intra-peridotite seams. This chromitite-peridotite association bears similarities to another natural occurrence of chromitite, i.e. in 'dunitic' melt channels in the upper mantle portions of some supra-subduction zone ophiolites. These have been interpreted as representative of large degrees of melt-rock reaction, an observation supported by the enrichments of Platinum-group elements that they often contain. The implications of these observations are that (1) individual thick ELI peridotites may have been constructed by multiple magma batches and (2) replenishment events in the WLI have been numerous and open system behaviour there may have operated on a scale comparable to that in the ELI.