Lizzie Derbyshire (Keele University) was awarded a grant in 2011 to undertake crystal structural measurements of twenty Cr-spinel crystals in the podiform chromitites contained in the mantle portion of the Shetland and Ballantrae Ophiolite Complexes. Podiform chromitites (>60% Cr-spinel) were analysed for key crystal structural parameters (cell edge length and oxygen positional parameter) and combined with Cr-spinel mineral chemistry. The data was used to decipher Cr-spinel thermal history from each ophiolite and used to provide new insights into chromitite petrogenesis in these classic British ophiolite complexes.

The robust nature of Cr-spinel to low temperature alteration means it often retains primary igneous compositions providing a unique insight into complex mantle melting processes and chromitite petrogenesis. The frequent occurrence of podiform chromitite in the mantle section of ophiolite complexes have been attributed to varying amounts of melt-rock interaction in channels of focused melt flow. Variation in Cr-spinel chemistry closely reflects subtle changes in the parental melt composition.

Inter-crystalline closure temperatures calculated from unaltered Cr-spinels record a range of 700-900°C whereas extensively altered Cr-spinels (>50% ferritchromit) preserve elevated temperatures >1100°C. These high temperatures are artificial, caused by the re-ordering of Mg and Al cations in the spinel structure during a late stage heating event (~500°C) that closely corresponds with the temperatures required for ferritchromit formation.

Initial findings from the most extensively altered Shetland Cr-spinel crystals provide artificial intercrystalline closure temperatures indicating Cr-spinel, predominantly used as a petrogenetic indicator for primary igneous processes, can record secondary alteration processes occurring in the mantle portion of supra-subduction zone ophiolites.