

A soil mineralogical database for Scotland

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The Macaulay Institute maintains a large collection of Scottish soils in the National Soils Archive of Scotland - including the systematically sampled National Soils Inventory of Scotland (NSIS). The NSIS consists of soils sampled by horizon i.e in the context of the soil profile, on a 10km grid across the whole of Scotland. NSIS-1 was sampled between 1978 and 1988. Currently, a three year (2007-2009) re-sampling program, NSIS-2, is underway to sample a subset of the sites on a 20km grid, as part of the Scottish Government's Rural Environment and Research Analysis Directorate (RERAD) Programme 3 - objective 8 - Protecting the Nation's Soils. Soil protection is based around an understanding of the many functions and ecosystem services that soils perform. The minerals in soils are both directly and indirectly responsible for many soil functions. For example, buffering, binding, and nutrient supply and release capacities all have components that depend on mineralogy. In this context, soil samples collected from NSIS-2 and the corresponding samples from NSIS-1, are being prepared for mineralogical analysis by X-ray powder diffraction (XRPD). Thus far some 550 samples from all of the 180 NSIS-1 sites (for some sites no sample remains) across Scotland, and around 270 from 60 NSIS-2 have been prepared by McCrone milling and spray drying to produce random powder samples for XRPD (Hillier 1999). The XRPD data collected from the samples are being analysed by a full-pattern fitting method (Omotoso et al., 2006) to derived quantitative mineralogical data (even soil organic matter content can be analysed by this method!). Both the primary data and the mineralogical analyses will be stored in the Macaulay Institutes Soils database. Further analysis of the mineralogical data will contribute a much needed quantitative mineralogical perspective to the understanding of soil functions and the prediction of soil properties that relate to mineralogy. Integrated with other digital analytical multiple component measurements it may also eventually lead to a new digital paradigm in soil typing.

Hillier, S. (1999) Use of an air brush to spray dry samples for X-ray powder diffraction. *Clay Minerals* **34** (1), 127-135.

Omotoso, O., McCarty, D.K., Hillier, S., and Kleeberg, R. (2006) Some successful approaches to quantitative mineral analysis as revealed by the 3rd Reynolds Cup contest. *Clays and Clay Minerals* **54** (6), 748-760.