The geochemical characteristics of a tephra are a powerful aid to its identification and correlation. Ten years ago there was little geochemical data available to researchers attempting to correlate distal and proximal Icelandic tephra layers, but now large amounts of high-quality data have been published and the WWW provides an effective system for researchers to access this material. TephraBase was developed in 1995 to enable the easy access and searching of spatial, temporal and geochemical data.

The successful correlation of tephra layers, however, relies not only on geochemistry but also on a variety of other data including chronological controls, stratigraphic relationships, related palaeoecology, geomorphological associations and archaeological context.

Relational databases provide a powerful tool for assembling and manipulating these datasets. TephraBase was the first tephrochronological database that allowed researchers access to both geochemical data and spatial and chronological information. TephraBase now provides a useful and growing dataset of the geochemical (over 1900 analyses), spatial, stratigraphical and chronological characteristics of 96 Icelandic tephra deposits (22 individual layers) from key sites in Iceland, the British Isles and Scandinavia. In addition, there is a second smaller dataset on Mexican tephras.

The large body of data stored in TephraBase can be searched by a variety of methods. For example, details on a particular tephra can be retrieved from an individual site, a country or all of the sites where it occurs. Geochemical analyses can be obtained for any tephra again at a single site, and growing dataset of the geochemical (over 1900 analyses), spatial, stratigraphical and chronological information.

The key historical tephra horizons have distinctive physical and stratigraphic characteristics. Geochemistry, however, is also a crucial correlative tool. This graph illustrates the geochemical properties of several historic tephra layers found in the tephrostratigraphy above.

Such reconstructions have only been carried out on relatively small scales. The integration of the large body of data collected from tephra profiles throughout Iceland will enable large scale studies to be undertaken. These tephra profiles provide detailed records of soil accumulation since post-glacial times.

An important strength of TephraBase is that it allows the effective use of the 3-D and 4-D properties of multiple, well dated tephra layers. A further source of important data is information on what is between the tephra layers. Where all of the tephra layers in a soil profile have been dated, for example, a detailed record of soil accumulation rates can be established. In Iceland in particular, the detailed historical tephrochronological record means that it is possible to reconstruct landscapes both at particular moments in time, and change over discrete time periods (>10 years) at various scales from 10^2 to 10^4 m.

Landscape reconstruction requires the integration of this data and its spatial nature means that processing through a GIS will enable its maximum potential to be realised. A better understanding of landscape evolution will provide valuable data for future policy decisions.

Reference

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