Future challenges in tephra-fall studies

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Tephra fall deposits generated during explosive volcanic eruptions are both common, being generated by many of the world's active volcanoes, and of wide utility in the reconstruction of the past behaviour of active volcanoes. At many Quaternary volcanoes, the medial to distal tephra fall deposits provide the key information on the timing and scale of past activity. The value of such deposits derives not only from their widespread nature, and their potential for preservation in a range of contexts (both terrestrial and marine), but also from the fact that quantitative (but model-dependent) information about eruption conditions can be derived relatively simply from field data.

Recent years have seen significant advances in modeling (e.g. both forward and inverse), while a number of major eruptions have provided some valuable new datasets (both field and satellite) against which to test new generations of models. While the value of these advances is clear in terms of, for example, improving our capacity both to forecast plume behaviour in near-real time and to develop improved approaches to modeling of future eruptive scenarios and their consequences, there are also some dangers. One key factor is that the field data – against which models can be tested - are inherently limited. The vagaries of erosion and weathering lead to incomplete preservation, which usually deteriorates with deposit age. This in turn limits our ability to quantify the parameters (such as total deposit grain size distribution) which are increasingly needed as inputs to forward models. There is a danger, then, that advances in this field will be untested, or even untestable, against all but the handful of events for which appropriately large and complete datasets exist. A challenge for the next generation of models is to address the natural limitations of field data for eruptions which are only known from the geological record, and to develop new ways of reliably and simply extracting useful information from these important archives.