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Editors

SPECIAL ISSUE
Distal Tephrochronology, Tephrology and Volcano-Related Atmospheric Effects

Edited by
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Foreword

The fiftieth anniversary of the naming of tephrochronology passed in 1994, marking a milestone in the history of Quaternary chronostratigraphical studies. In 1944 Sigurdur Thorarinsson (Thorarinsson, 1944) published his *Tefrokronologiska studier på Island.* Here, Thorarinsson opted for the Greek term for volcanic ash first recorded in Aristotle's *Meteorologica.* We are fortunate here—had he chosen the second available Greek word for ash, we should now be rejoicing less elegantly in the anniversary of Conisology.

Over the fifty or so years since this denomination, and the seventy since Berry (1928) recognised the potential of volcanic layers as isochrons, tephrochronology has developed beyond recognition. At its onset tephrochronology was employed as a tool in the local correlation of the proximal volcanic products that could be recognised by their lateral continuity, stratigraphic association and optical properties. Today the tephrochronologist relies upon highly developed analytical methods to identify and correlate *crypto* tephras – tephra layers whose microscopic presence would have originally been unimagined. These studies demonstrate that the deposition of volcanic ash can occur at distances so remote from eruptive centres (> 2000 km) that far greater areas of the globe are available to the tephrochronological method than had been supposed hitherto. Tephrochronology and tephrostratigraphy have therefore become truly global in their application to the investigation of the rate and magnitude of palaeoclimatic and palaeoenvironmental change.

The papers in this volume focus principally on distal tephras from a wide representation of the earth's volcanic regions, including those in which the application of tephrochronology is in a developmental stage. The rapidity with which tephra studies have been extended beyond the eruptive regions is impressive and offers significant potential in refining the Quaternary stratigraphic record and the detailed eruptive histories of volcanic centres. Proximal volcanic areas are typically mountainous: preservation of tephra may be hindered by associated landscape instability; deposition of tephra may be prevented by the quasi-periodic presence of ice-sheets and mountain glaciers; stratigraphical disposition may be disrupted by sediment reworking or blurred by contamination of additional volcanic material. Often, such problems may be circumvented by the study of tephra records lying beyond the volcanic area. These distal sites have the additional and critical advantage of encompassing a wide variety of depositional environments. Distal tephras have been recorded in mires, soils, in lacustrine, fluvial, raised-marine and deltaic sediments, in estuarine, continental shelf and deep-ocean deposits and in ice-sheets and glaciers. The inter-environmental distribution of discrete but widely dispersed tephra isochrons therefore leads to the capacity for linking associated proxy-climatic and environmental signals in an unambiguous manner that no other dating or correlative technique can yet provide.

However, the promise that tephrochronology provides should not be treated with complacency. Analytical and stratigraphical problems remain. As the number of identified horizons increases with the detail and extent of investigations, so tephrostratigraphic complexity and the potential for mis-correlation or ambiguity increase. Problems may not be restricted to the tephra itself. Volcanic activity has become a popular mechanism invoked as having induced climate change manifested in the archaeological and pre-historical proxy-records. However, the phase of regarding tephra itself as a frequent substantive climate-modifier is nearing the end of its short but controversial life. Volcanic products such as acid fogs, perhaps, but not of necessity, synchronous with tephrogenesis, may be more probable

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agents of change in the environmental record. With this in mind, the bandwagon of volcanoes, comets or meteorites as invoked general modifiers of Holocene and Pleistocene climate change, should perhaps be boarded with greater caution than has been afforded in recent years.

The papers herein demonstrate that the application of tephra studies in determining the tempo of palaeoenvironmental change is an approach that offers one of the greatest promises in current Quaternary studies on local to global scales. However, as more attention is paid to the identification and isolation of *crypto* tephras from distal sediments, the more commonplace appears the tephra-signal. Over the years in which tephrochronology is advancing, so the radiocarbon chronology has appeared more complex; and as the ice-core revolution has taught us, climate change can occur on timescales shorter than a human life span and with a rapidity that transcends the resolution of radiocarbon dating. Whilst radiocarbon dating, of course, has the virtue of providing numerical age-estimates as opposed to the correlative links provided by tephra isochrons, it is this absolute correlation that offers the rare prospect of isolating the leads and lags between the components of environment-climate systems. In looking to the future, it seems probable that the tephrochronological revolution is nearing the point in time at which tephra-correlations may be as routinely sought as are radiocarbon dates today, and when tephrostratigraphy becomes a standard inter-and intra-regional tool for correlation of marine and terrestrial records of environmental change.

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