

## PREFACE

The ever increasing population pressure around active volcanic systems means that they are in constant need of detailed geological and geophysical observations. The composition and concentration of volcanic gases have long been recognised as important indicators for better understanding and forecasting changes in volcanic activity. However, direct sampling of these gases is often dangerous or impossible due to the high level of activity and the common inaccessibility of the crater areas of many volcanoes. Indirect methods such as the remote sensing of gases such as sulphur dioxide (SO<sub>2</sub>) has thus proven invaluable in the geochemical characterisation of both passively and actively degassing volcanoes.

Ultraviolet correlation spectrometry (COSPEC) has been used to study volcanoes since the early 1970s and remains a vital tool for the measurement of volcanic SO<sub>2</sub> flux. These measurements are now being supplemented and complemented through the use of open-path Fourier Transform Infrared spectroscopy (OP-FTIR) and direct multi-gas sensor systems which allow for measurement of the ratio of selected gas species. When used together, these methods can provide a measure of the total gas flux of the volcano.

Although the COSPEC has been the workhorse for many scientists and volcano observatory staff, knowledge of its proper application and interpretation of the collected data has often been passed down through informal training or from limited published methodologies. Unfortunately, there is currently no consolidated, centralised work and thus the need for a COSPEC Cookbook to examine how best to make SO<sub>2</sub> flux measurements.

While new lightweight and low cost UV spectrometers (e.g., FLYSPEC, mini-DOAS, RMDI, etc.) have recently started to replace COSPEC, many of the fundamental issues regarding application and data interpretation remain the same and thus we believe that this book will continue to be of use to both scientists that are still routinely using COSPEC as well as those with newer instruments. Therefore, while the term COSPEC is used throughout the text, in most cases, one can easily swap this for any of the newer UV instruments that are now available.

Chapter 1 details the fundamental physics of ultraviolet Correlation Spectrometry and the developmental history of the COSPEC while Chapter 2 looks at the various methods of applying the COSPEC in the field. Chapter 3 then investigates the application and interpretation of COSPEC measurements at a number of active volcanoes. Chapter 4 considers the numerous important issues in the application of COSPEC to airborne measurements while Chapter 5 takes an in depth look at the extensive measurements that have been made at Popocatepetl volcano, Mexico. Finally, Chapter 6 looks beyond COSPEC to the rapidly developing miniature UV spectrometer systems.

As with any work of this type, the discussions and suggestions regarding data collection and interpretation have been made as comprehensive as possible but can never completely cover all situations. However, we nevertheless hope that this work will prove useful to both the novice as well as experienced volcanologist in the planning, application and interpretation of volcanic gas flux studies.

The editors