

Simulations of multicomponent aerosol processes on the regional scale

G. McFIGGANS*, S.R. UTEMBE, D. LOWE,
S. ARCHER-NICHOLLS AND D.O. TOPPING

Centre for Atmospheric Science, SEAES, The University of Manchester, Oxford Road, Manchester, M13 9PL, UK
(*correspondence: g.mcfiggans@manchester.ac.uk)

Organic material is a significant and variable component of tropospheric aerosol, accounting for between 10 and 90 % of fine particle mass. Owing to its complexity, large-scale models must represent the organic fraction and its interactions with inorganic aerosol components using highly simplified methods. Bottom-up representations usually underestimate organic particulate mass and more simplified bottom-up treatments may be expected to perform even more poorly. It is difficult to evaluate the reasons for such behaviour, in part because of the lack of traceability of the representation to more complex and realistic mechanistic approaches.

In this work, we present the coupling of the reduced Common Representative Intermediates (CRIV2-R5) scheme [1] describing tropospheric degradation of methane and 22 emitted non-methane hydrocarbons and oxygenated volatile organic compounds (comprising 220 species and 609 reactions), and traceable to the Master Chemical Mechanism (v3.1), to a sectional aerosol microphysics representation within the WRF-Chem model to enable prediction of the regional transformation of multicomponent aerosol in the oxidising atmosphere. The aerosol treatment uses the hybrid Partial Derivative Fitted Taylor Expansion (PD-FiTE) [2] coupled to the MTEM inorganic representation in WRF-Chem to provide computationally efficient calculation of the multicomponent gas / liquid equilibria in the particles. The model can be used to investigate the regional evolution of aerosol in the moist atmosphere and the organic contribution to aerosol mass predicted by a mechanism traceable to a more realistic representation of tropospheric VOC oxidation.

We will present results of the first simulations investigating the formation and transformation of tropospheric aerosols in the UK under a range of changing emission profiles and oxidant conditions.

[1] Watson, L. Shallcross, D. E. Utembe, S. R. & Jenkin, M. E. (2008) *Atmos. Environ.* **42**, 7196–7204. [2] Topping, D. Lowe, D. & McFiggans, G. (2009) *J. Geophys. Res.* **114**, doi: 10.1029/2008JD010099.

Monogenetic, but not monotonous: Basaltic eruptions in the Auckland Volcanic Field, New Zealand

L.E. MCGEE^{1*}, I.E.M. SMITH¹, M.-A. MILLET²,
C. BEIER^{3,4}, J.M. LINDSAY¹ AND H. HANDLEY³

¹School of Environment, Auckland University, Private Bag 92019, Auckland 1142, NZ

(*correspondence: l.mcgee@auckland.ac.nz)

²SGEES, Victoria University, PO Box 600, Wellington, NZ

³GEMOC, Macquarie University, Sydney, Australia

⁴Now at Universität Erlangen-Nürnberg, Germany

How melts are extracted from their mantle sources and what happens to them *en route* to the surface are fundamental questions in the workings of basaltic volcanic fields. The well-sampled Auckland Volcanic Field (AVF) – an intraplate volcanic system in northern New Zealand – offers excellent opportunities to build up a more detailed picture of the plumbing systems feeding such fields. Here we present major and trace element data along with new Sr-Nd-Pb and U-series isotopic data, in order to investigate the processes involved in the large chemical heterogeneity seen in the AVF.

Detailed sampling has shown that individual trends for each centre can be explained by either high-pressure clinopyroxene or shallow olivine fractionation. Near-primary magmas show a range in degrees of partial melting from ~5% down to <0.5% in the smallest centres. Trace element ratios and high (²³⁰Th/²³²Th) ratios (1.16-1.33) show melts are primarily formed within the garnet stability zone and involve two mantle sources: a FOZO-like source and a source displaying more radiogenic Pb isotope ratios. Mixing between these 2 end-members is seen at both the single volcano and the field-wide scale.

U-series isotopic data for the two most chemically extreme centres, both of which erupted twice, are used to model subtle changes in magma dynamics. Both volcanoes follow the same trend of eruption of an early, less primitive, smaller-volume magma with a higher ²³⁰Th-excess, then a more voluminous, more primitive magma with a lower ²³⁰Th-excess. Parameters including melting and upwelling rates, conduit lengths and porosities are modelled and found to be within the range of other intraplate volcanic fields, yet show considerable variation between AVF eruptions. Together with the lack of any spatial or temporal trend in the chemistry of the field, these results suggest that melt batches evolve in isolation, being subject to differing processes and are able to move at variable speeds and through variable porosities in the mantle, resulting in dispersed plumbing systems for such fields and an erratic pattern of eruptions.