Oceanic production of organic-enriched marine aerosols: Uncertainties and impacts

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Historically, the oceans have been considered an important source of supermicron aerosol mass to the atmosphere. Since these aerosols are very short-lived and largely composed of sea salt, they were previously thought to have a relatively small impact in the atmosphere. However, this paradigm is changing rapidly as new techniques and approaches to study marine aerosols are developed. Several recent studies have examined marine aerosol source functions and chemical composition, and these studies indicate that marine aerosols are dominated number-wise by submicron aerosols [1, 2] that are highly enriched in marine-derived organic matter [2, 3], representing a significant global-scale carbon flux to the atmosphere [4]. These and other published studies [5] provide strong evidence that marine aerosols, and in particular organic-rich submicron aerosols, play an important role in controlling the Earth's radiation balance, cloud formation and properties, and the chemistry of the marine atmosphere. Despite recent advances, many uncertainties remain and significant differences have been observed [5]. This presentation will highlight these advances, uncertainties and differences, with an emphasis on marine-derived organic matter present in these aerosols.

[1] Nilsson *et al*. (2007) *Atmos. Chem. Phys. Disc.* **7**, 13345. [2] Keene *et al*. (2007) *J. Geophys. Res.* **112**, D21202. [3] Facchini *et al*. (2008) *Geophys. Res. Lett.* **35**, L17814. [4] Long *et al*. (2010) *J. Geophys. Res.* In review. [5] Kieber *et al*. (2009) http://www.solas-int.org/aboutsolas/organisationaandstructure/midtermstrategy/whitepapers/aerosols.pdf

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EPMA, FTIR and LA-ICP-MS determination of the composition of fluid microinclusions in diamonds

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The analysis of sub-micrometer fluid inclusions poses difficult analytical challenges. In the case of diamonds, most studies use EPMA to determine the bulk major element composition of sub-surface inclusions. Due to their small size, the average analytical sum (oxides + chlorine) in the inclusions is only ~6%. Still, the analysis of ~50 inclusions yields a good average composition of the fluid trapped in the diamond. Analysis of mineral micro-inclusions found in some of the diamonds indicated accuracy of ~10%.

Quantification of IR absorbance of the secondary phases that formed upon cooling of the fluid yields the absolute concentration of mica, carbonate, apatite, quartz and water in the inclusions. Combining these data with the compositions of the detected minerals yields the bulk major and volatile composition of the trapped fluids. The composition calculated via IR spectroscopy compares well with the EPMA data.

LA-ICP-MS is now used by a few laboratories for diamond analysis. Using the calibration of Rege *et al.* [1], we studied the major and trace element composition of 28 diamonds. Comparison of major elements ratios (element/Fe) obtained by EPMA and LA-ICP-MS reveals good agreement between the two methods [2]. Good correlation between the trace element abundances obtained by LA-ICP-MS [1] and INAA [3] confirms the accuracy of the trace element analysis.

Combining the EPMA and LA-ICP-MS data sets we can translate the absolute concentrations of major and trace elements in the diamonds into the composition of the trapped fluids. Together with the concentrations of water and carbonate from FTIR, the full composition of the fluids and the mineralogy of the secondary assemblage that crystallized from them are now available.

[1] Rege *et al*. (2005) *J. Anal. Atomic Spect.* **20**, 601–611. [2] Weiss *et al*. (2008) *Chem. Geol.* **252**, 158–168. [3] Schrauder *et al*. (1996) *GCA* **60**, 4711–4724.