Comparing ambient and generated marine particle composition, size, and production

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Oceans cover two-thirds of the Earth's surface, and the particles emitted by waves breaking on the ocean surface provide an important contribution to the planetary albedo. The contribution of sea salt particles to atmospheric aerosol has been recognized and qualitatively understood for almost a century. The quantity, size distribution, and composition of submicron particles released into the atmosphere from bubble bursting remains unknown because measurements of particle production in controlled conditions have never fully explained open ocean observations. This presentation compares ambient-observed and artificially-generated composition, size, and production of marine particles.

In addition to physical measurements of particle number distributions, chemical analyses are used to illustrate the important role of surface seawater composition in forming particles. Filter samples were analyzed using Fourier transform infrared (FTIR) spectroscopy to determine the functional group composition and total organic mass (OM) of the ambient and generated marine particles. Positive matrix factorization (PMF) of the ambient particle FTIR spectra was used to separate the marine and anthropogenically-influenced sources of OM in ambient observations. Samples from marine aerosol bubbling generation showed similar organic compositions to those determined from ambient marine factors, all showing high fractions of hydroxyl functional groups. Number concentrations of artificially-generated particles were also related to the properties of the seawater from which they were generated.

To evaluate the role of organic and inorganic components of seawater in forming particles, we also investigated particle production from laboratory bubbling in controlled conditions with simple seawater model solutions. These experiments serve to illustrate the important role of sea surface components in the film bursting process that leads to particle production.

Magma degassing processes during Plinian eruptions of La Montagne Pelée (Martinique, F.W.I.)

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Magma degassing process is the driving force behind explosive eruptions. To assess our knowledge on this phenomena, we have measured noble gas abundances and isotopic ratios in pumices produced by fragmentation of volatile-enriched magma.

Ruzié et Moreira (2009) [1] conducted analyses on pumice samples coming from worldwide Plinian eruptions. All samples are characterized by a systematic enrichment in neon over argon, a depletion of krypton relative to argon and an isotopically fractioned $^{38}Ar/^{36}Ar$ ratio. These features do not depend on geological setting, or on pumice age, or eruption intensity. However, they are similar for pumices from the same eruption. A correlation is observed between $^{84}Kr/^{36}Ar$ and $^{38}Ar/^{36}Ar$ ratio. This illustrates that only one physical process is at the origin of the fractionation. We therefore proposed a model of kinetic magma degassing before fragmentation to explain the elemental and isotopic fractionation. Noble gases diffuse in a magma shell surrounding a preexisting bubble with constant radius. The model explains measurements and shows the rapidity of the magma degassing process in the conduit (few hundreds of seconds).

We apply a more elaborate model taking into account bubble growth in pumices coming from La Montagne Pelée volcano (Martinique), which produced Plinian eruptions with various intensities. A detailed stratigraphic study for the last three Plinian eruptions is still in progress.

[1] Ruzié et Moreira (2009) *JVGR* **192**, 142–150.