Gas-particle partitioning of carbonyls in laboratory and field measurements of organic aerosols

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Carbonyl compounds are believed to be important in heterogeneous reactions that produce secondary organic aerosol (SOA). In this work, a new denuder-filter sampling system, coupled with GC-MS analysis, has been used to identify gas and particle-phase carbonyls in laboratory and field studies of organic aerosols. A wide range of carbonyls, hydroxycarbonyls and dicarbonyls were identified in denuder and filter samples collected in simulation chamber experiments on the photooxidation of isoprene and several aromatic compounds (benzene, toluene, p-xylene). The results have been used to generate experimental gas-particle partitioning coefficients, which are compared to theoretical values based on standard absorption theory. The results provide further evidence to indicate that dicarbonyls such as glyoxal and methylglyoxal play an important role in SOA formation and growth.

The denuder-filter method was also used for sampling ambient air at Tivoli Docks, in the port of Cork, Ireland. In a summer measurement campaign, more than ten different carbonyl species were identified in ambient air, including aliphatic, aromatic and bifunctional compounds. Gas-particle partitioning values are compared to those obtained from laboratory conditions. The results are also used to identify the main natural and anthropogenic sources of the carbonyls, such as isoprene oxidation and combustion processes.

The dawn and destruction of Gondwana – Isotopic record from Antarctica and Mozambique

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Mesoproterozoic and Jurassic igneous rocks from Dronning Maud Land (DML), Antarctica, and southern Mozambique have been dated with single-zircon U-Pb and plagioclase Ar-Ar methods, and studied for Sm-Nd and Lu-Hf isotope compositions. The Proterozoic rocks are from DML and comprise A-type granites, mafic dikes, and igneous crustal xenoliths from Jurassic basalts and lamproites. All of these rocks are Grenville-age, between ~1010 Ma and ~1090 Ma, i.e., consistent with previously obtained results for DML. However, inherited zircon populations in the xenoliths and in the mafic dikes imply previously undocumented crustal growth events at 1.35 Ga and 2.03 Ga, respectively.

Our Jurassic samples represent the Karoo Large Igneous Province, and comprise mafic dikes from Vestfjella, DML, and rhyolite beds from Mozambique. The majority of their ages cluster around 180 Ma, which corresponds with the emplacement age of voluminous mafic magmas in both regions. In addition, the results manifest prolonged emplacement of rhyolitic (182–172 Ma), and compositionally variable mafic (175–150 Ma) magmas, covering the transition from continental to oceanic setting.

The mafic dikes in both age groups have initial ε_{Nd} values close to that of the depleted mantle, indicating that they are juvenile additions to the continental crust. Also the felsic rocks, both Proterozoic and Jurassic, are more radiogenic than most of their country rocks, with ε_{Nd} and ε_{Hf} values above chondritic. This feature could derive either from a rapid recycling of material previously differentiatied from the mantle, or from a significant depleted mantle component in the anorogenic magmatism.