CARBOXYLIC ACIDS, SULFATES, AND ORGANOSULFATES IN PROCESSED CONTINENTAL ORGANIC AEROSOL OVER THE SOUTHEAST PACIFIC OCEAN DURING VOCALS-REX 2008

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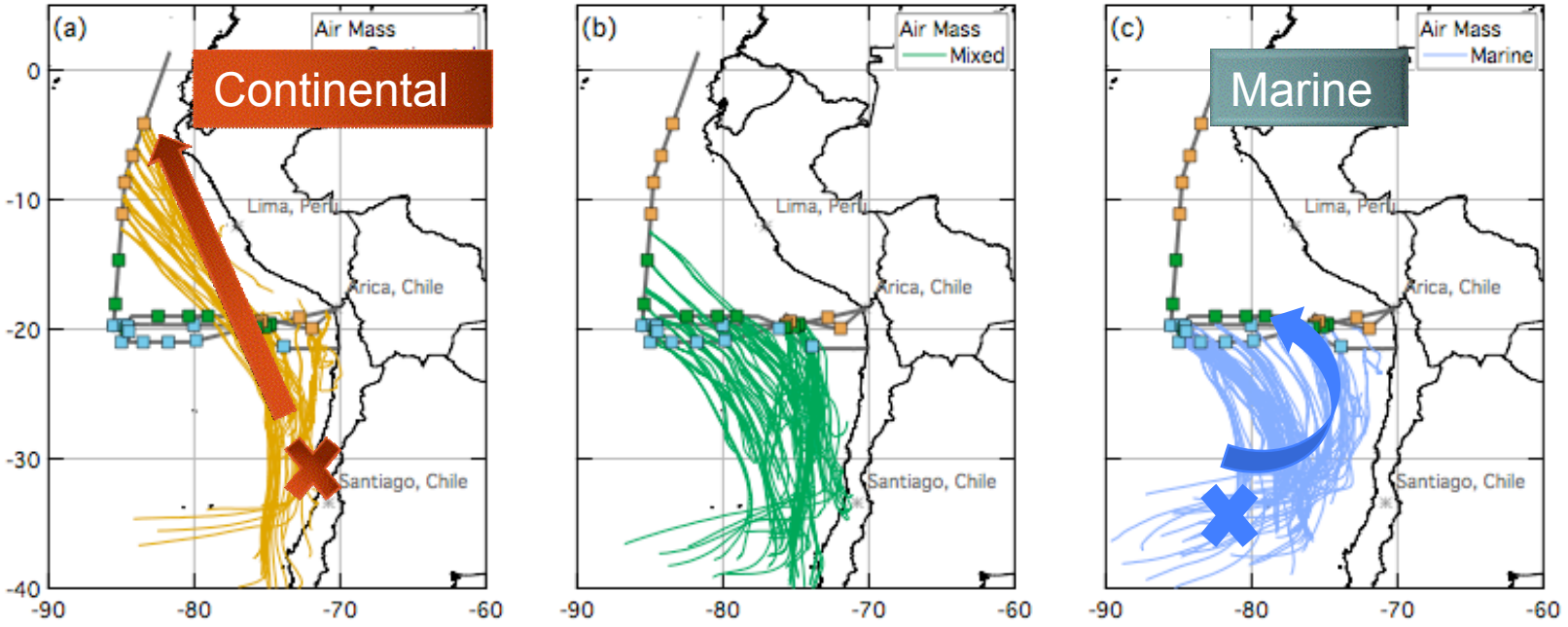
Hawkins et al., 2009, *in prep*.

RONALD H. BROWN
AIR MASS SECTORS BY RADON

HYSPLIT 3-day back trajectories (50 masl, 100 masl, and 500 masl)



High radon, recent (< 3 days) continental contact

Intermediate radon

Low radon, > 3 days continental contacts

For radon, see Bates et al., 2008 and references therein

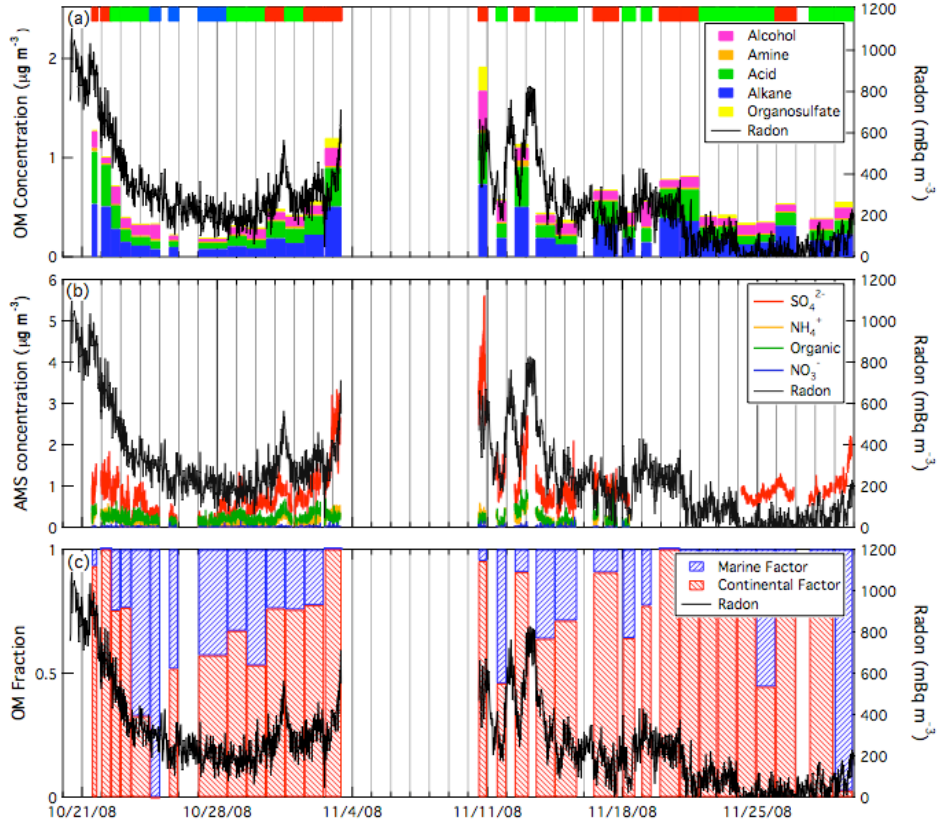
REPORTED SIGNATURES OF FINE PARTICLE SOURCES IN SANTIAGO, CHILE

Particles < 2 μm were analyzed for black carbon and elemental concentrations

- Copper smelting, coal combustion, residual oil combustion
  - sulfur (as SO_2 oxidized to SO_4^{2-}), vanadium, and nickel
- Transportation (buses, cars, etc.)
  - potassium, bromine, and tin
- Resuspended soil dust ("direct traffic emissions are generally mixed with soil dust")
  - calcium and iron

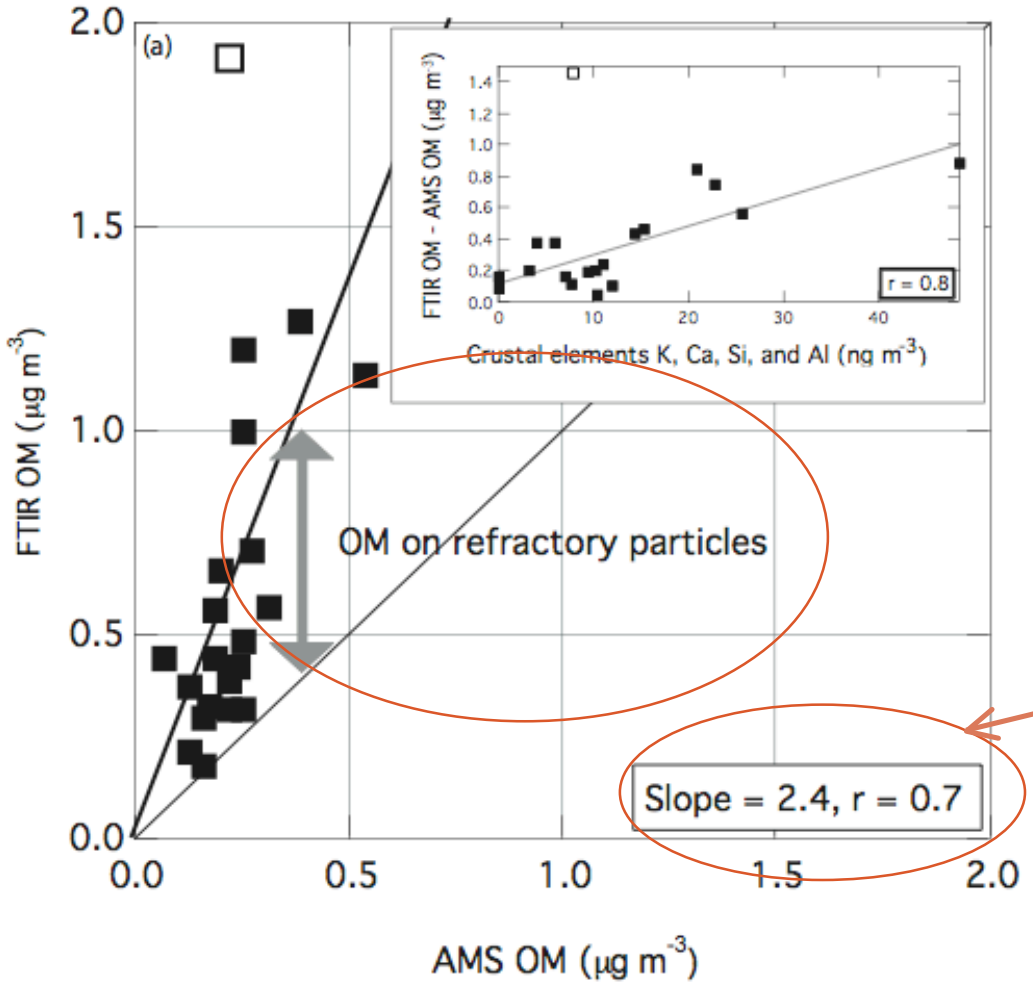
Artaxo et al., 1999

SUBMICRON PARTICLE COMPOSITION FROM FTIR SPECTROSCOPY AND AMS



- PM_1 generally follows radon
- AMS SO_4^{2-} and FTIR OM show similar time trends
- AMS OM does not

REDUCED COLLECTION EFFICIENCY (CE) OF ORGANICS ON REFRACTORY PARTICLES (DUST)



Estimated AMS CE of organics = 42%

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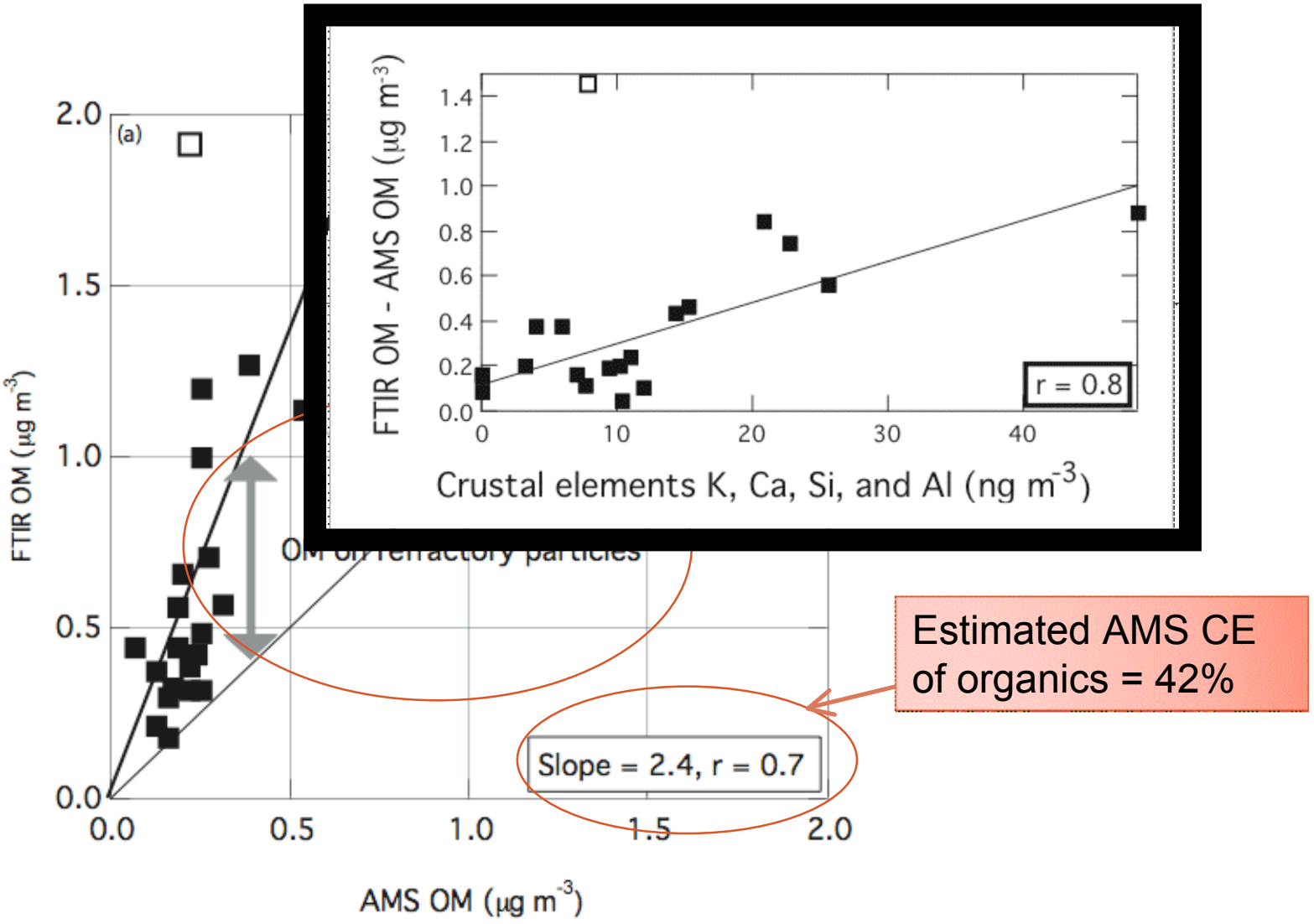

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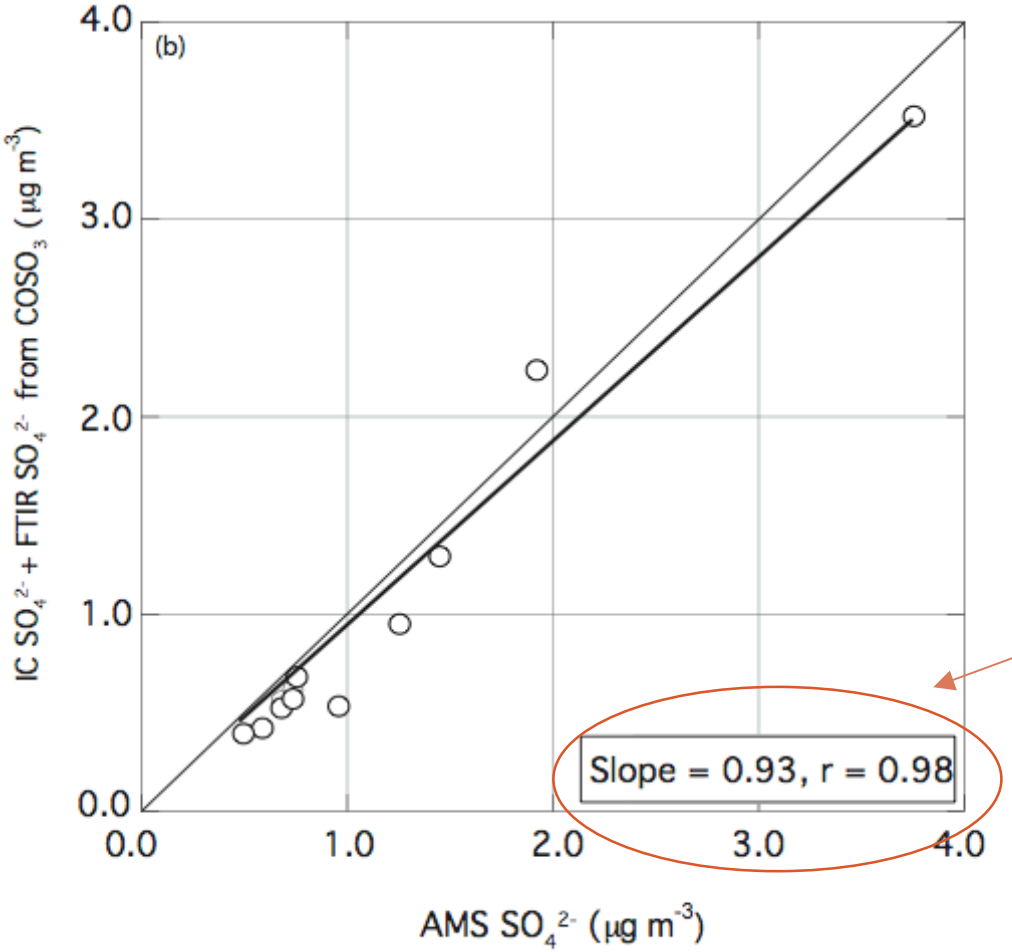
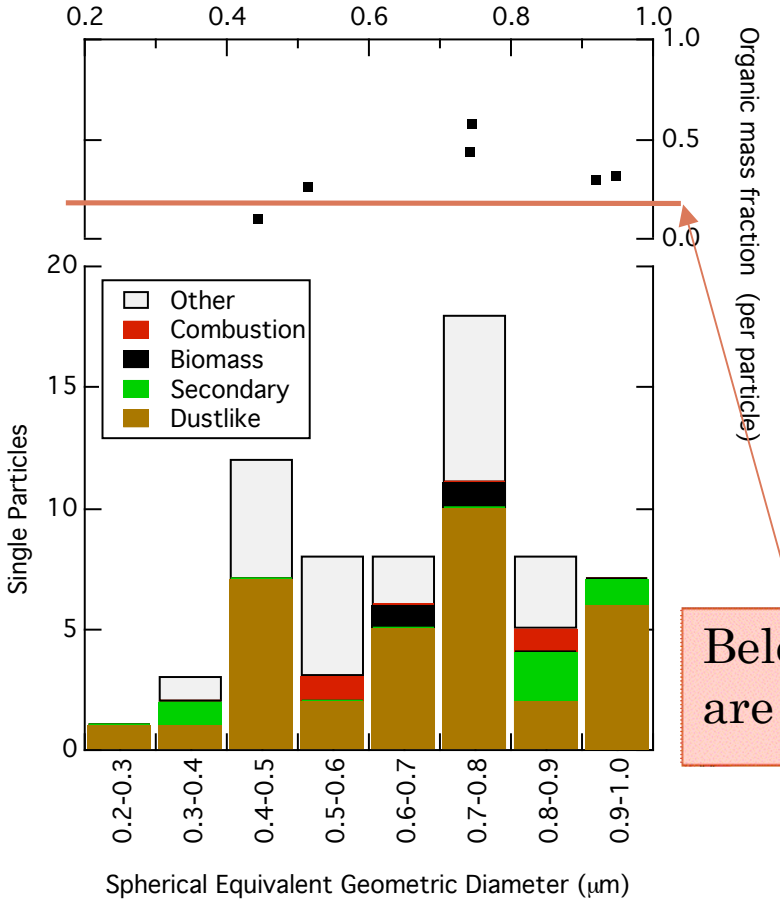
AMS CE OF SO_4^{2-} FROM IC SO_4^{2-}

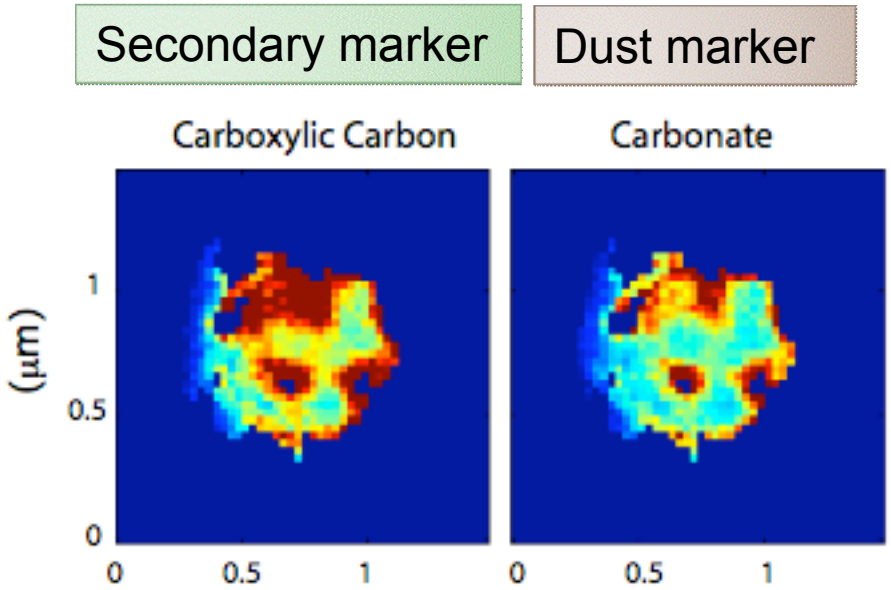


- Sulfate varied from acidic (no ammonium) to bisulfate.

Estimated AMS CE of sulfate = 100%

SINGLE PARTICLE MEASUREMENTS FROM STXM-NEXAFS (X-RAY MICROSCOPY)

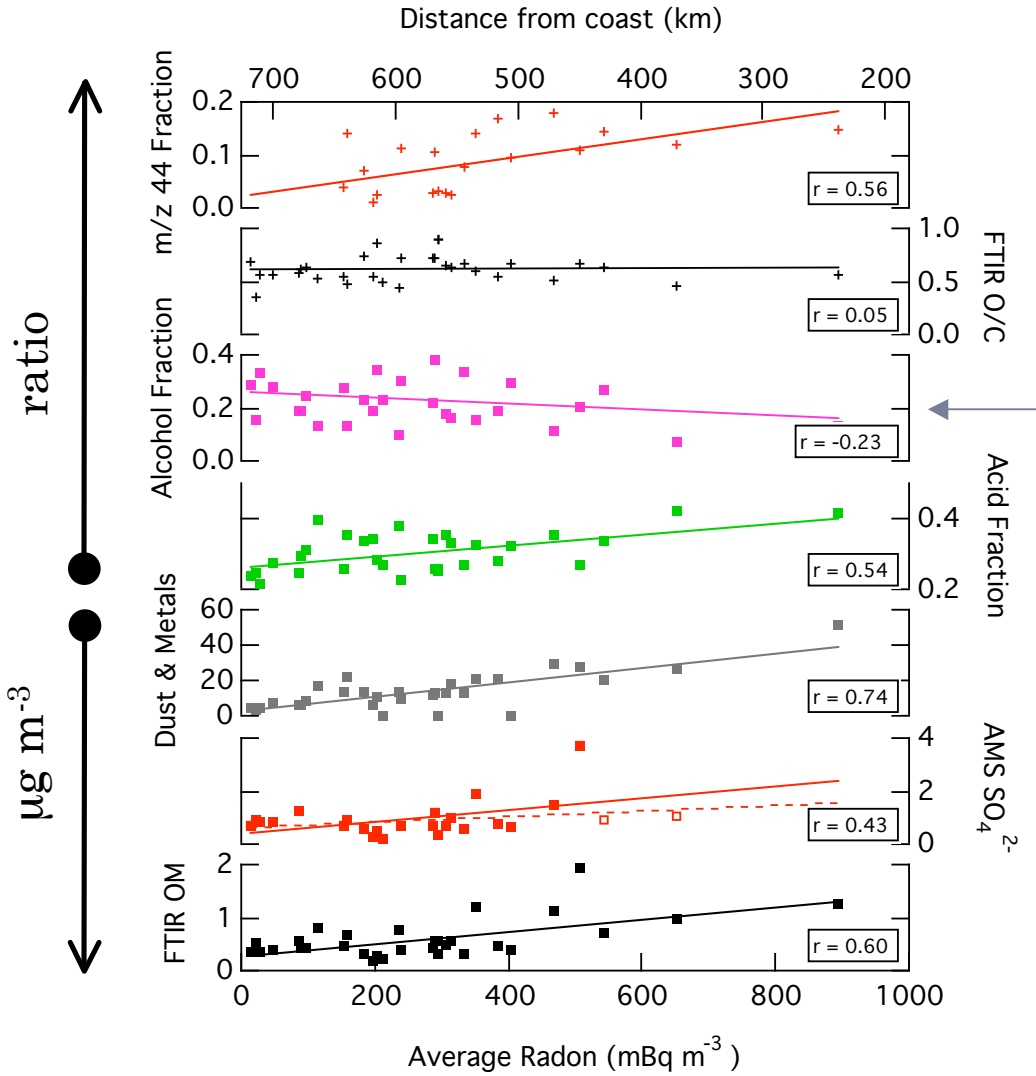




Below 0.7 μm, "dustlike" particles are 80% dust on average.

Takahama et al., 2007;2009

CONTINENTAL SOURCE OF PM_1 TO THE VOCALS STUDY REGION

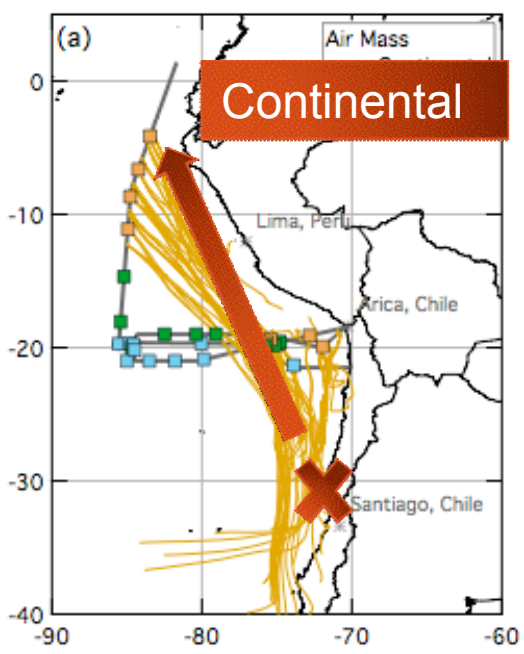


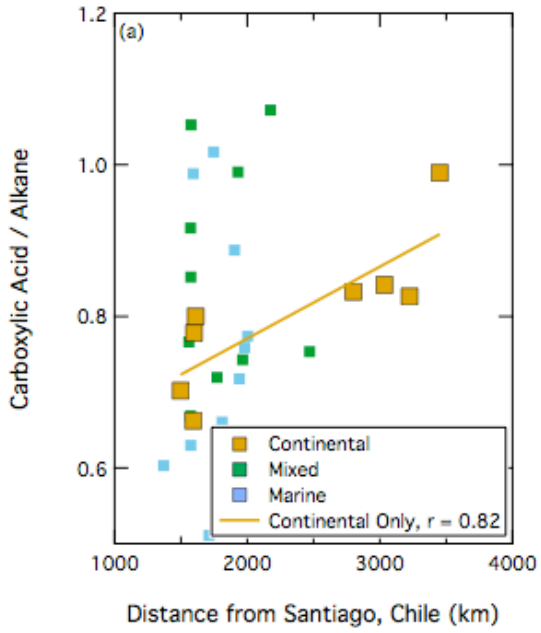
No (v. weak inverse) correlation with radon implies marine source

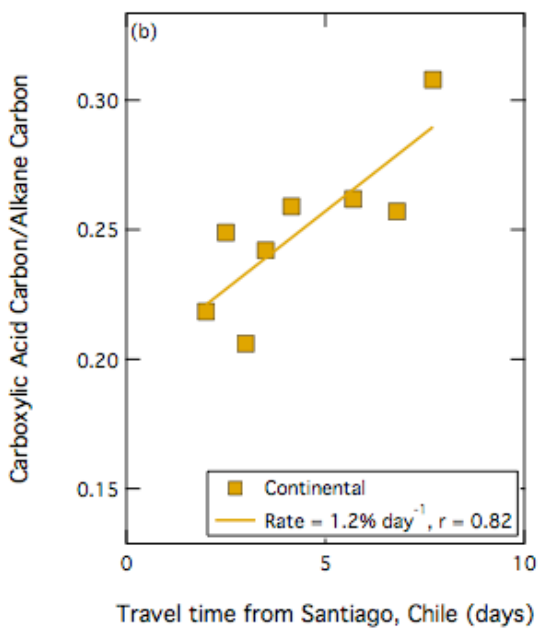
Positive correlations with radon imply continental source

Aiken et al., 2007;2008

EVIDENCE FOR AGING OF CONTINENTAL ORGANIC AEROSOL



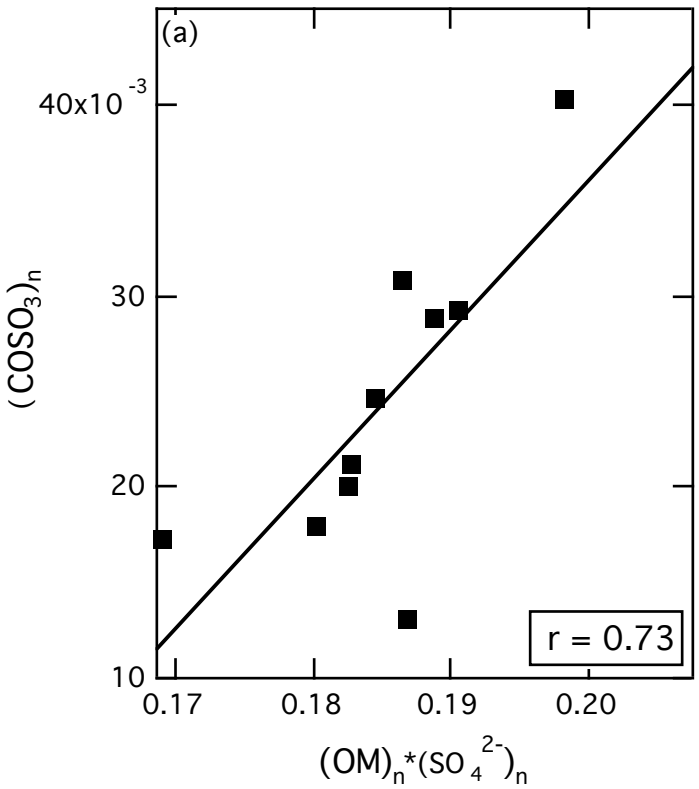




Low rate of oxidation is consistent with low O_3 (25 +/- 4 ppb average, compare to 75 ppb EPA 8-hour standard) measured on board the RHB (away from Santiago).

ORGANOSULFATE FORMATION: TRENDS WITH SO_4^{2-}/NH_4^+ AND RH

2-component formation



Surratt et al., 2007a,b; Altieri et al., 2009

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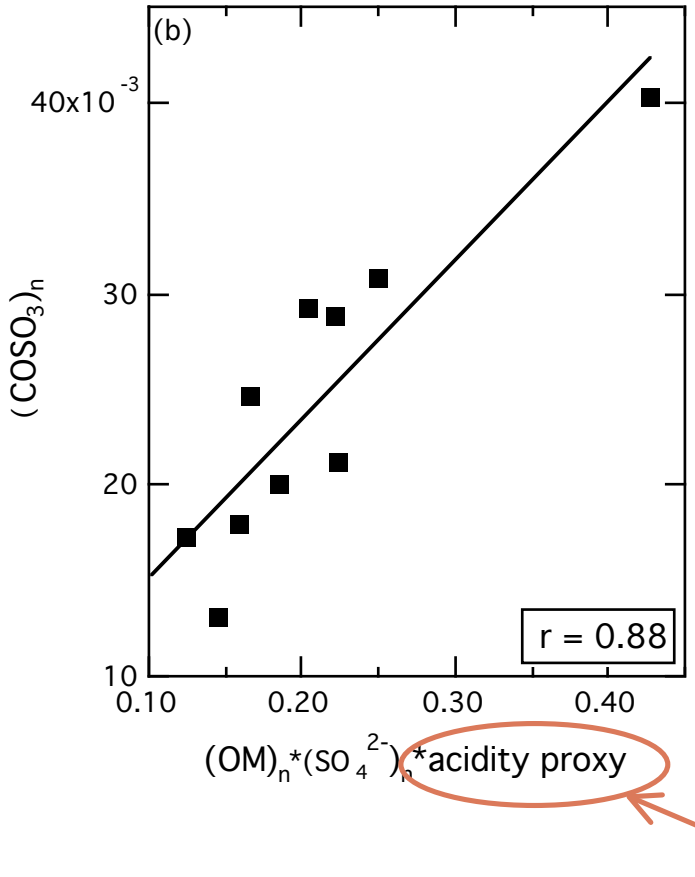
Acid-catalyzed reaction



Defined as AMS SO_4^{2-}/NH_4^+

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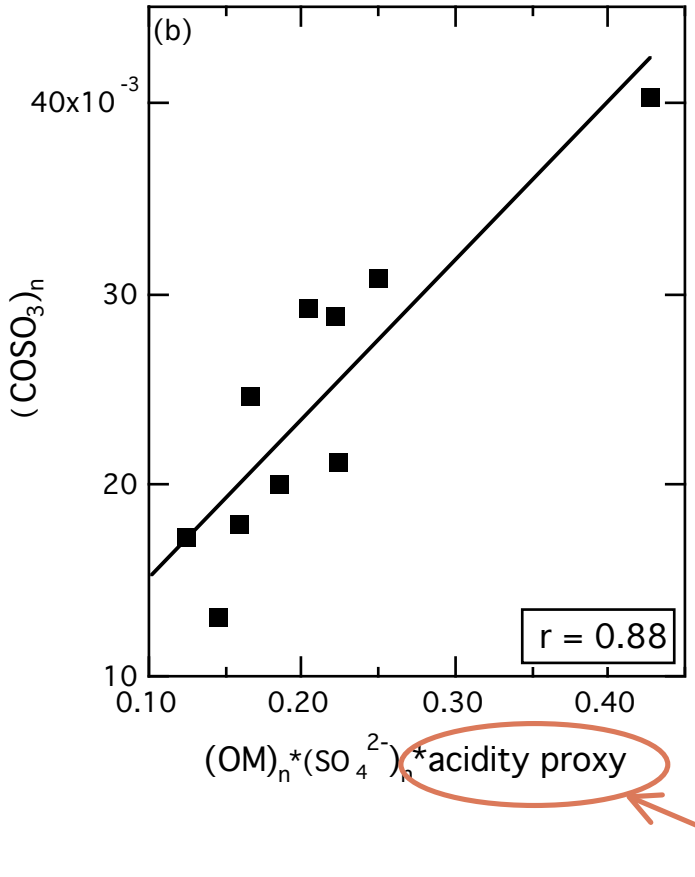
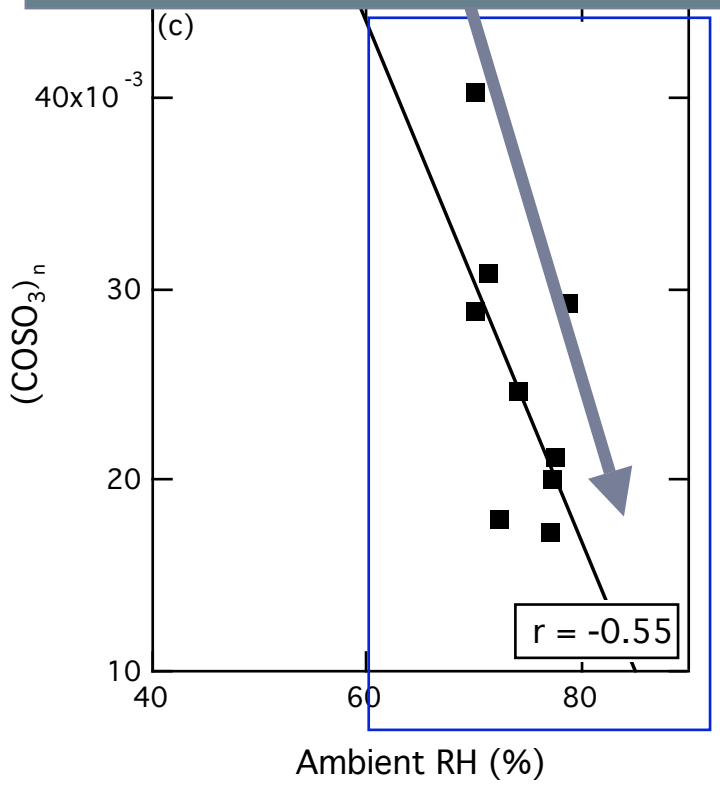


Formed in cloud processing, but removed during scavenging, rainout



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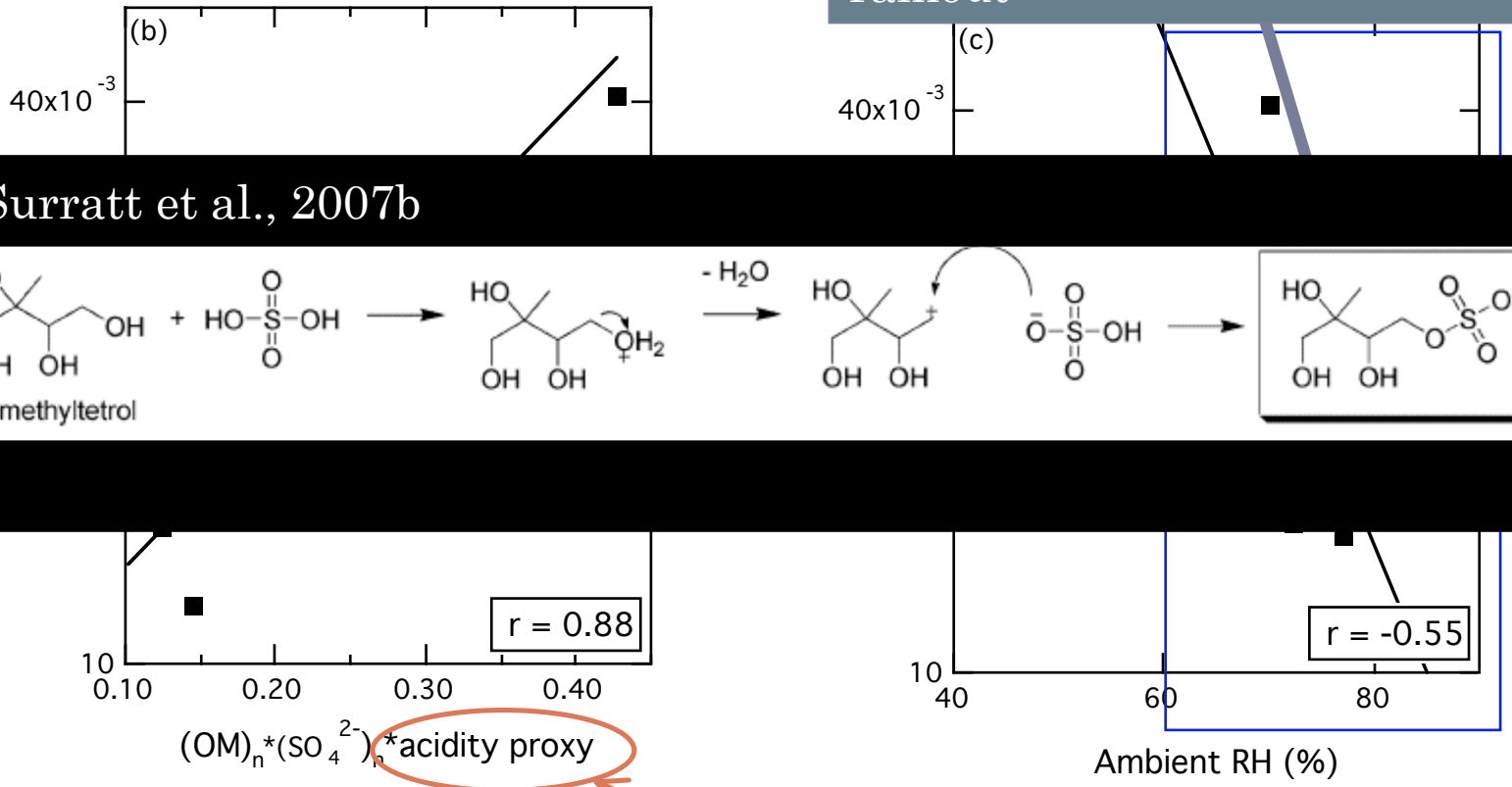

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CONCLUSIONS FROM RHB AEROSOL CHEMISTRY

- Continental outflow of organic, sulfate, and dust components is main PM_1 source.
- Santiago (and similar cities) are large contributors.
- Aging in continental air masses was slow (low ozone).
- Organosulfate increases with organics, sulfate, and acidity and decreases with RH.