



MARINE ORGANIC AEROSOL IN THE REMOTE SOUTHEAST PACIFIC MBL

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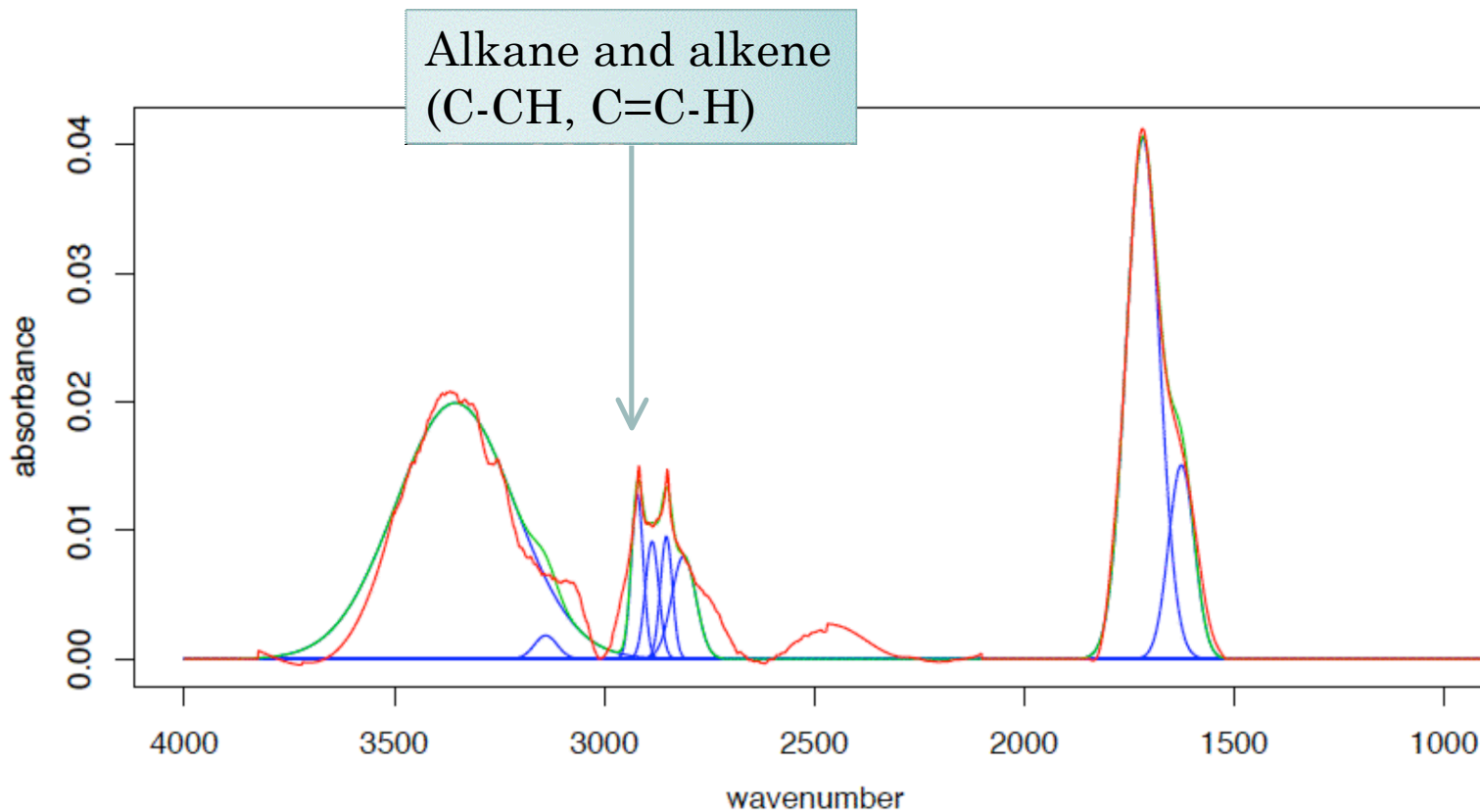
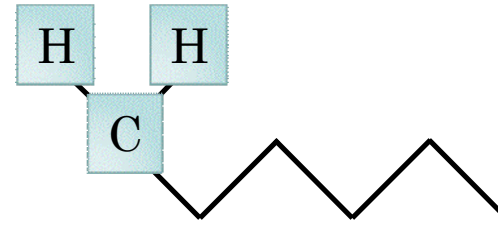
³Pacific Marine Environmental Laboratory, NOAA

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

SUBMICRON AEROSOL CHEMISTRY MEASUREMENTS

- Fourier Transform Infrared Spectroscopy (FTIR)
 - Organic functional groups ($\mu\text{g m}^{-3}$) from bulk submicron filter analysis
 - Carboxylic acid (COOH), alkane (C-CH), alkene (C=CH), aromatic (C=C-H), organic hydroxyl (alcohol, COH), primary amine (CNH₂), organosulfate (COSO₃), and non-acid carbonyl (C=O)
 - 12-24 hour resolution
- X-ray Fluorescence (XRF)
 - Elemental concentrations of Na and heavier elements ($\mu\text{g m}^{-3}$) from bulk submicron filter analysis
 - 12-24 hour resolution
- Aerosol Mass Spectrometry (AMS)
 - On-line sulfate (SO₄²⁻), nitrate (NO₃⁻), ammonium (NH₄⁺), and organic mass (OM) in $\mu\text{g m}^{-3}$.
 - 5-minute resolution

FTIR SPECTROSCOPY

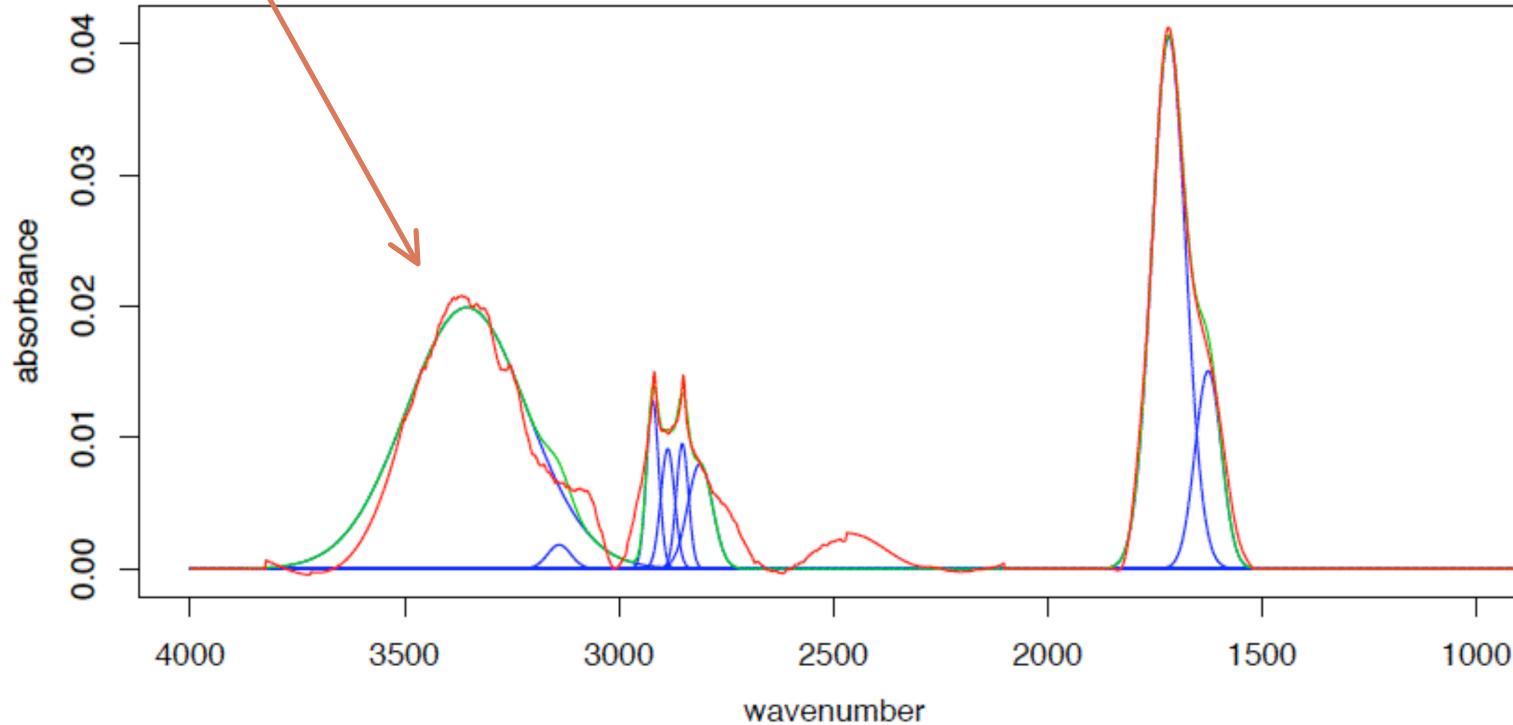


- Peak area is proportional to the moles of bond on the sample filter.
- Proportionality constant varies with each functional group and is calibrated.

FTIR SPECTROSCOPY



Organic hydroxyl or alcohol (COH)



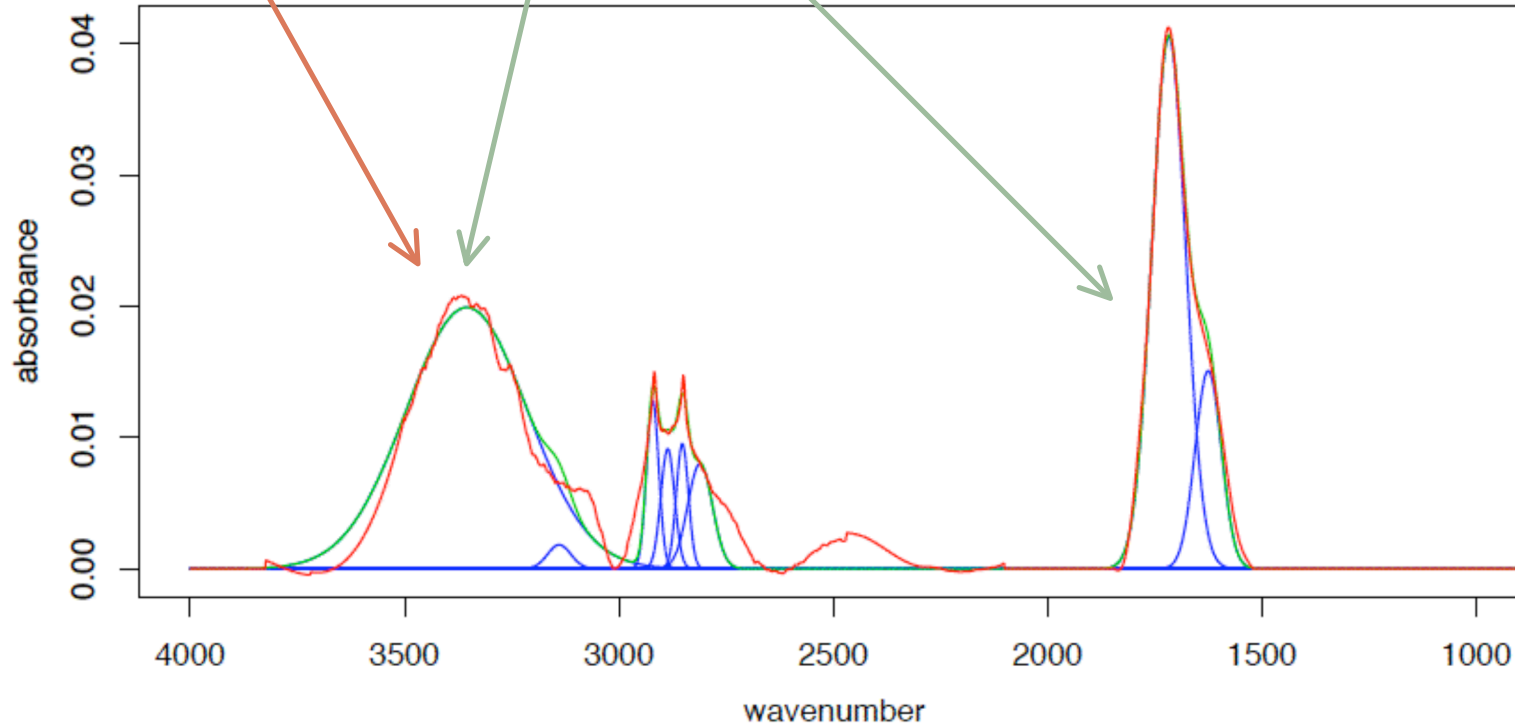
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Carboxylic Acid (COOH)

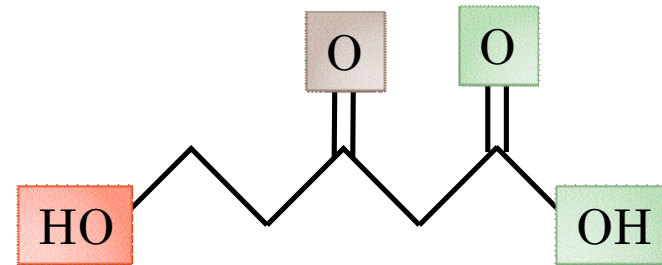


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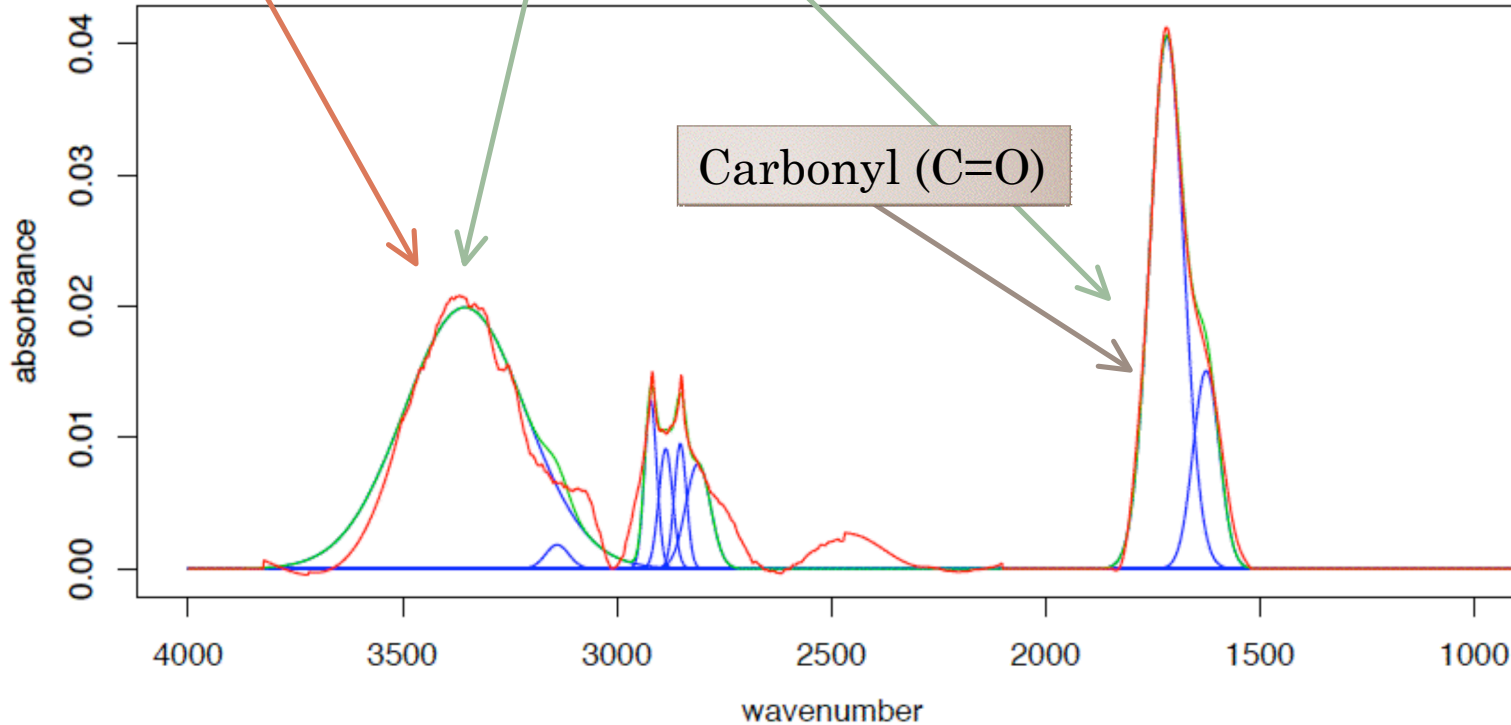
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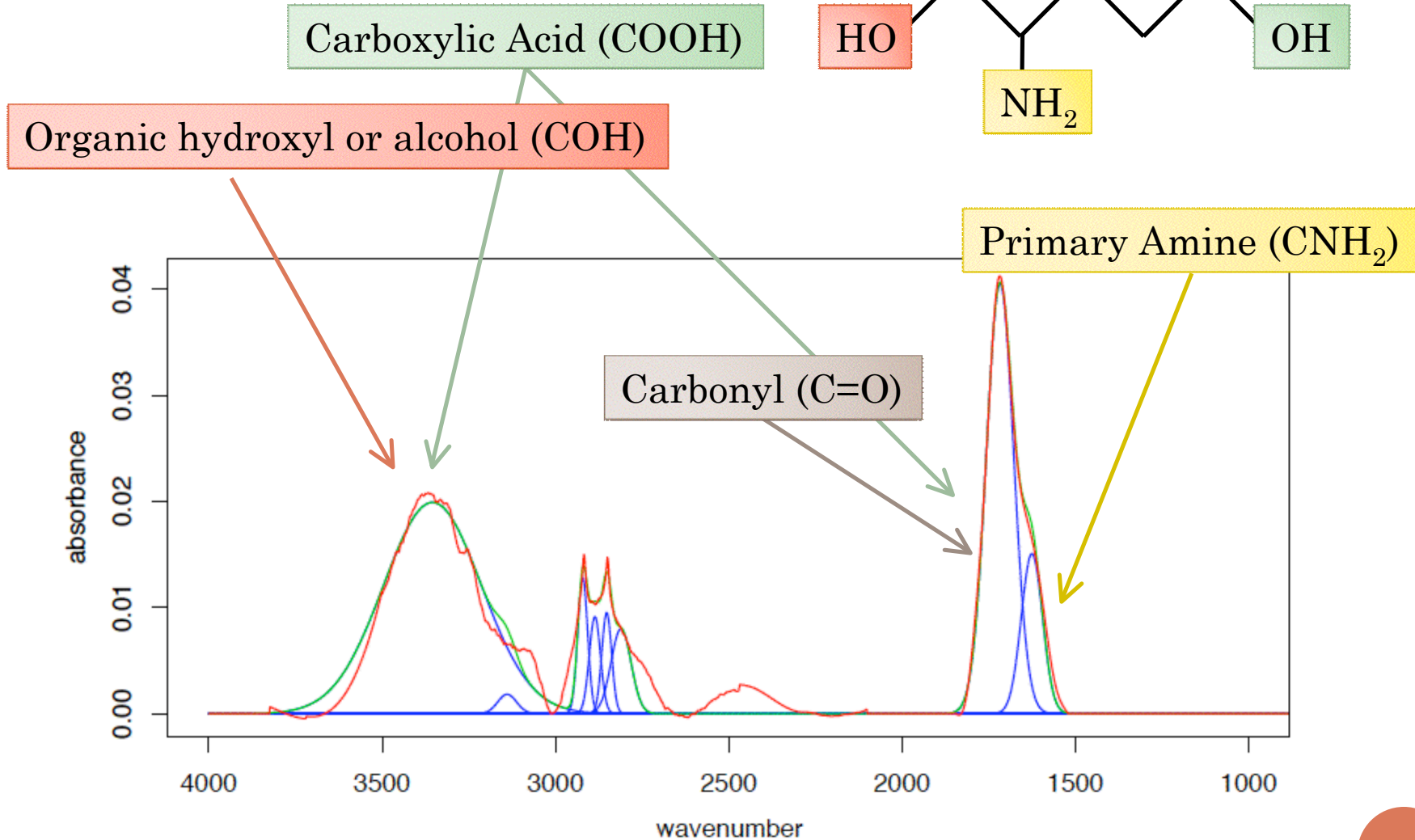
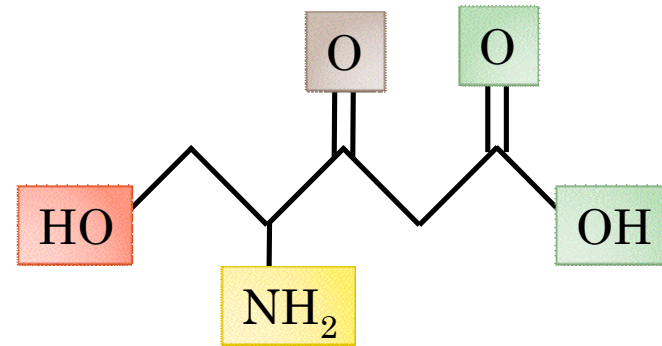
Carboxylic Acid (COOH)

Organic hydroxyl or alcohol (COH)



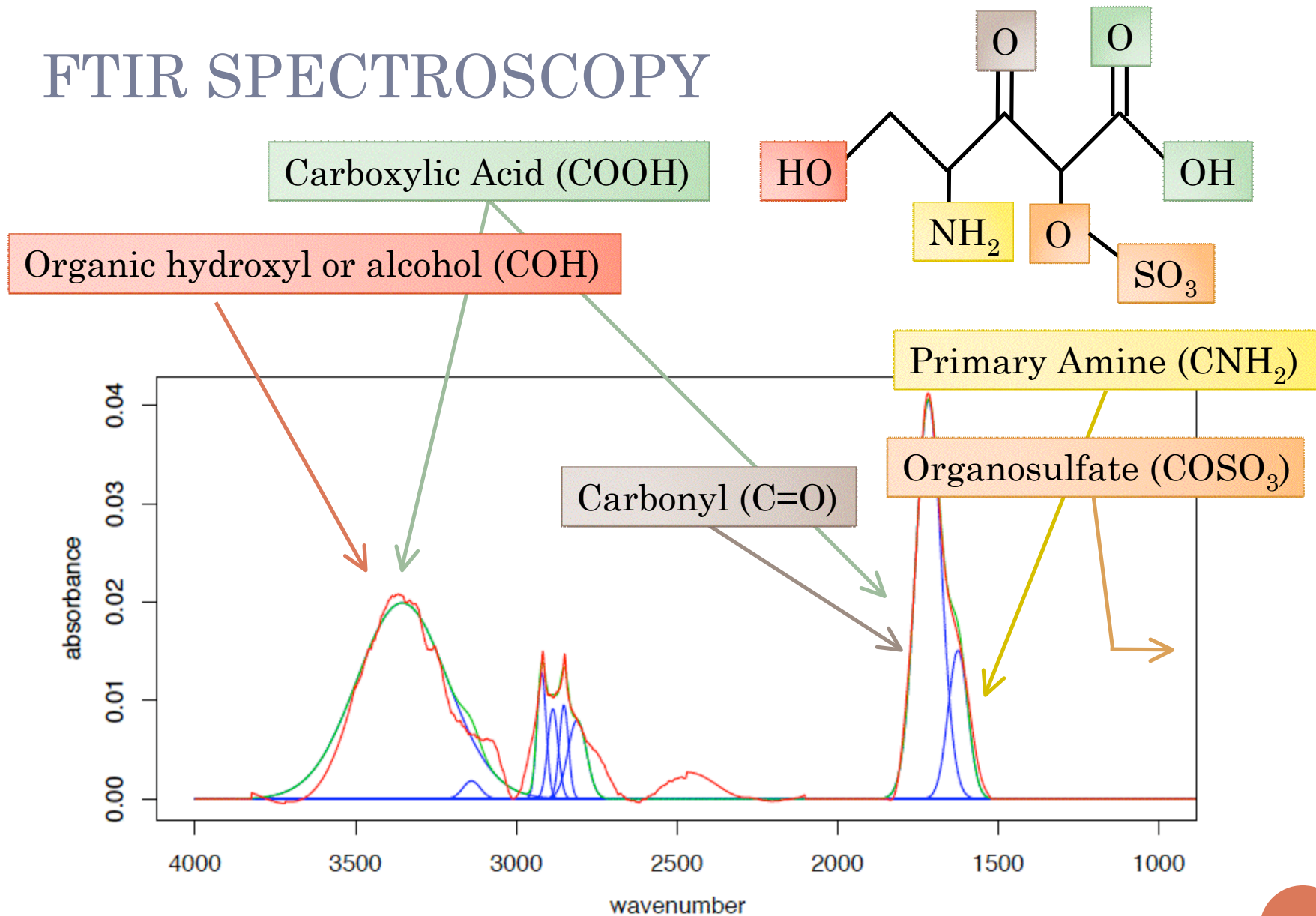
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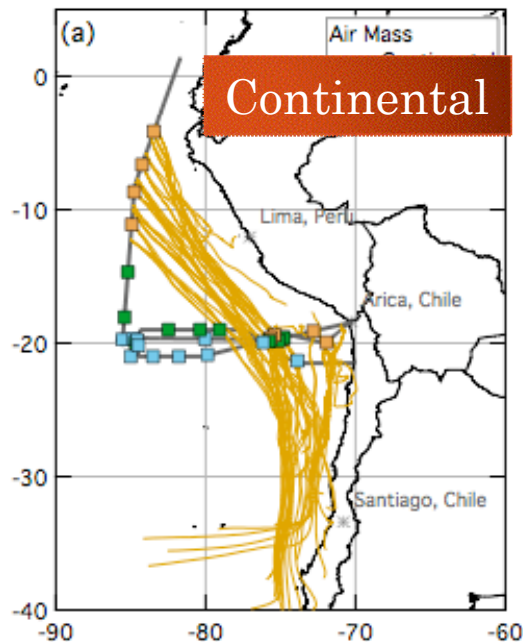


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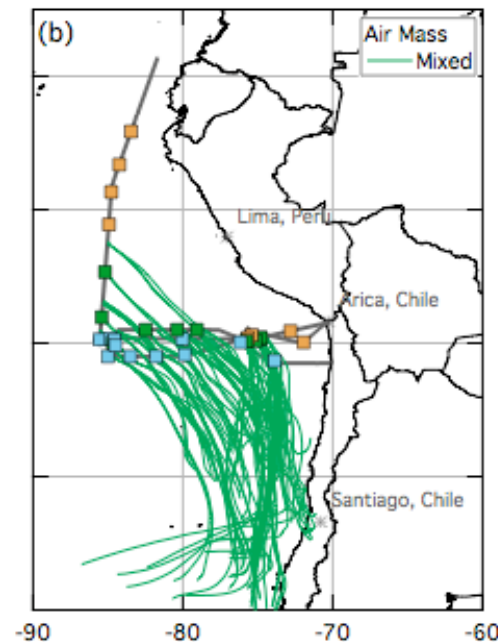
RONALD H. BROWN

AIR MASS SECTORS BY RADON

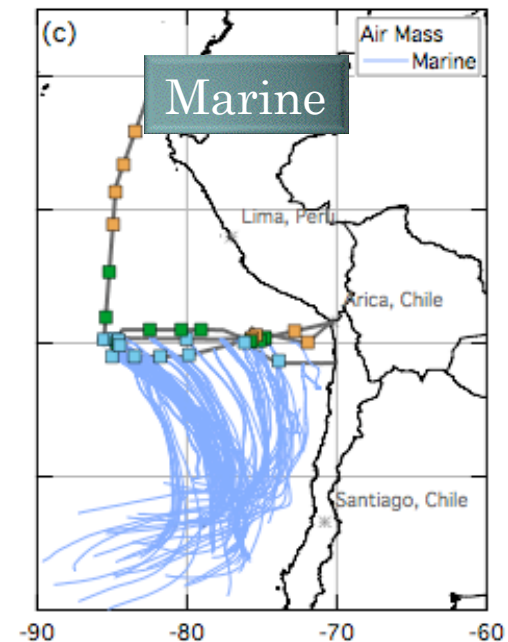
HYSPLIT 3-day back trajectories (50 masl, 100 masl, and 500 masl)



High radon,
recent (< 3 days)
continental contact



Intermediate radon



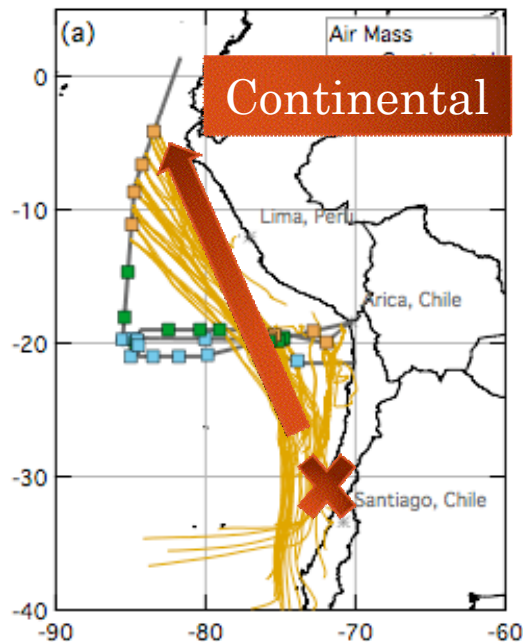
Low radon,
> 3 days
continental
contacts

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

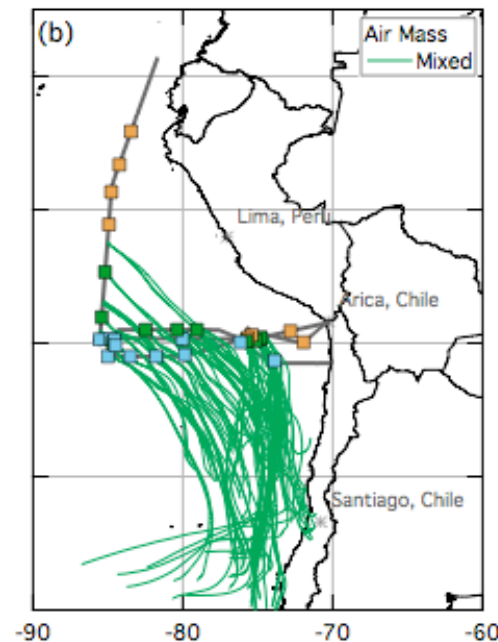
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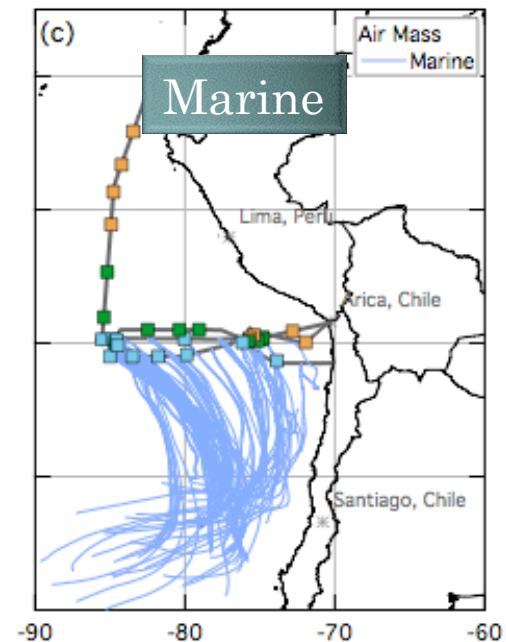
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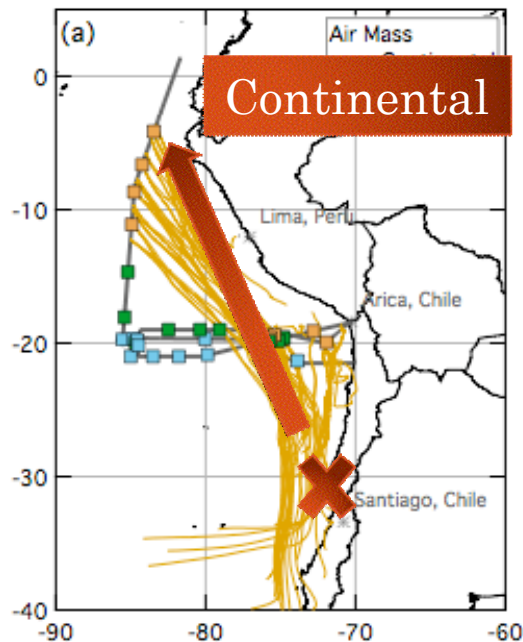


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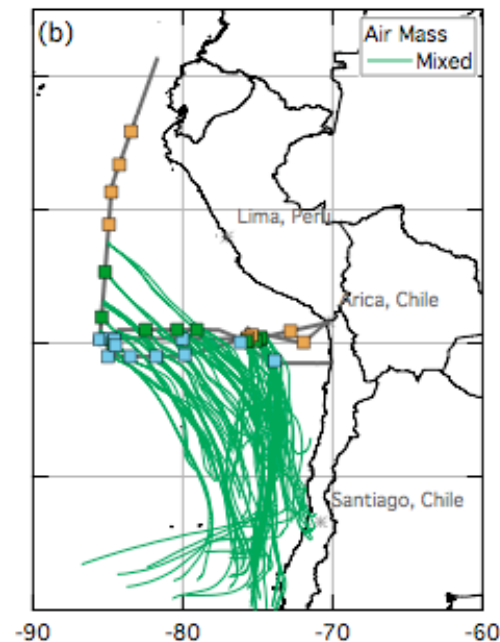
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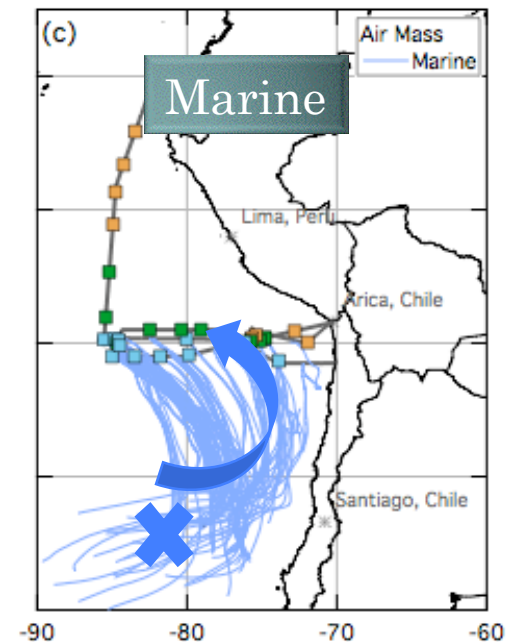
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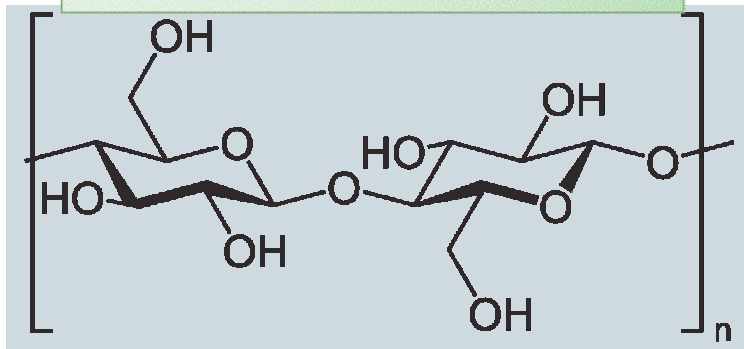
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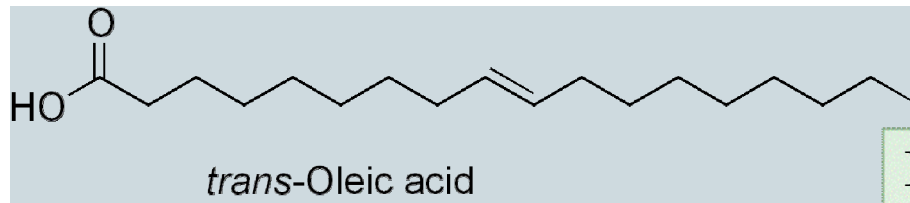
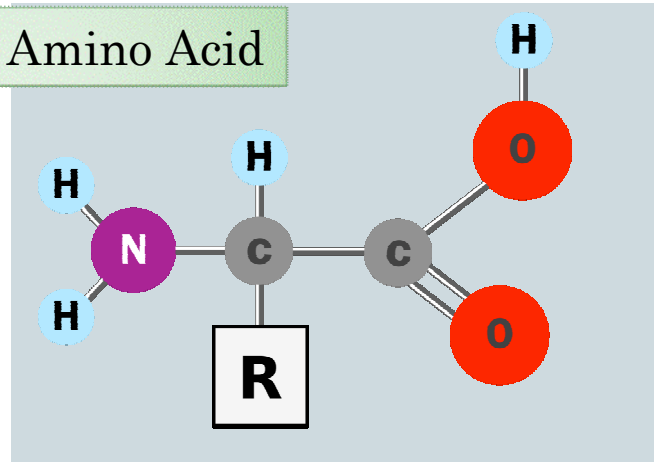
OCEAN-DERIVED PARTICLE COMPONENTS

- Seasalt ions (Na^+ , Cl^- , Ca^{2+} , K^+ , Mg^{2+} , SO_4^{2-})
- Non Seasalt SO_4^{2-} (from DMS oxidation)
- Marine organic compounds (polysaccharides, fatty acids, fatty alcohols, amino acids)

Cellulose (polysaccharide)



Amino Acid

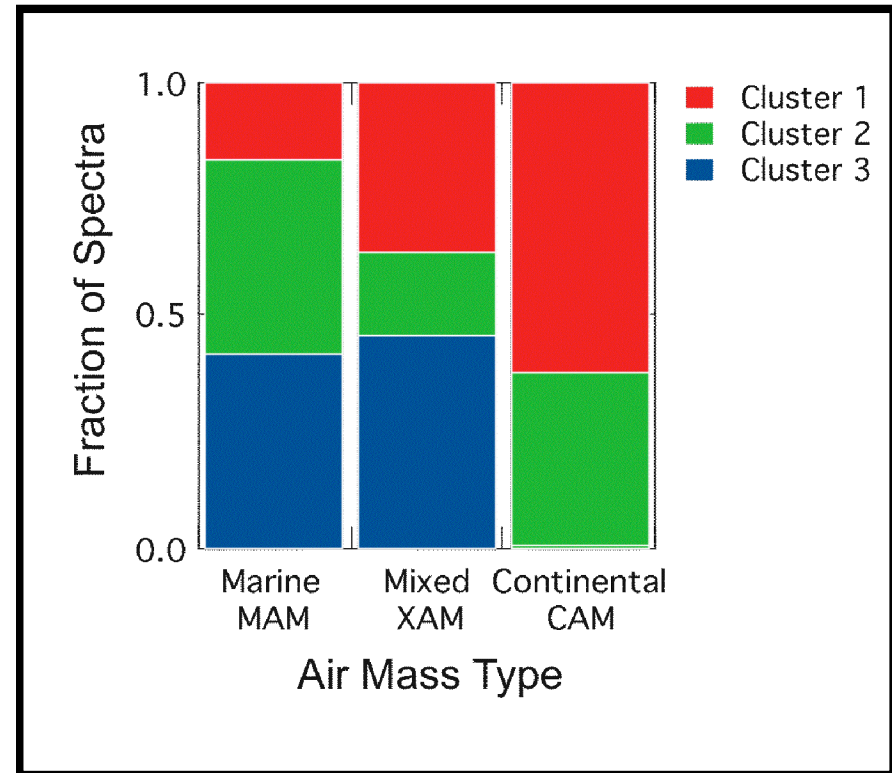
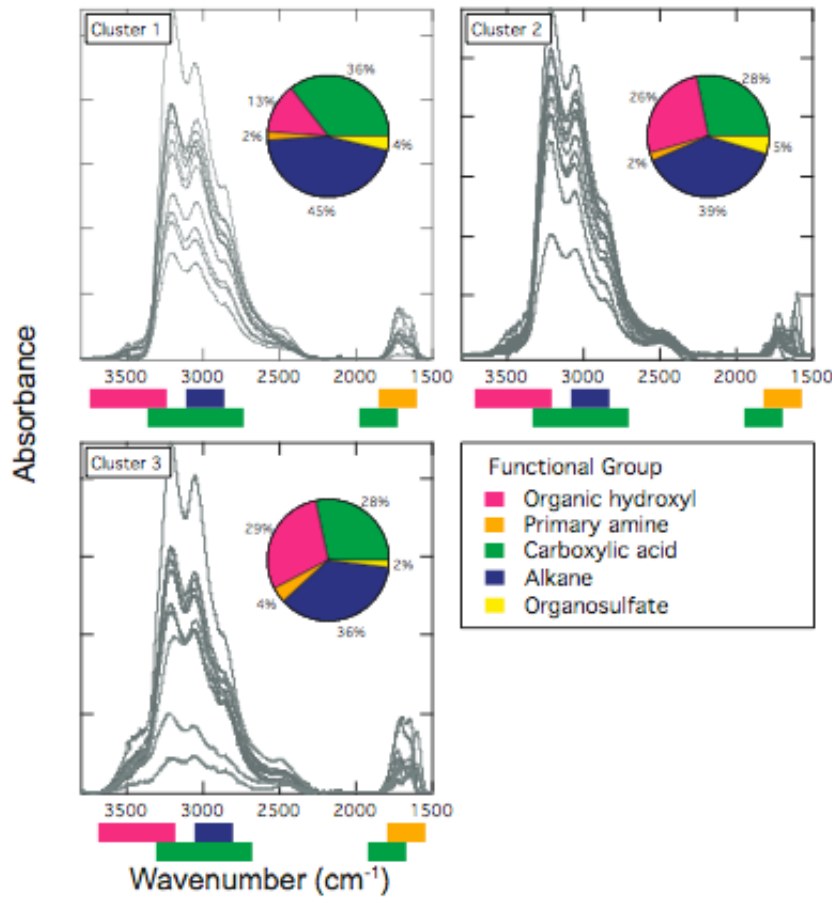


Fatty Acid



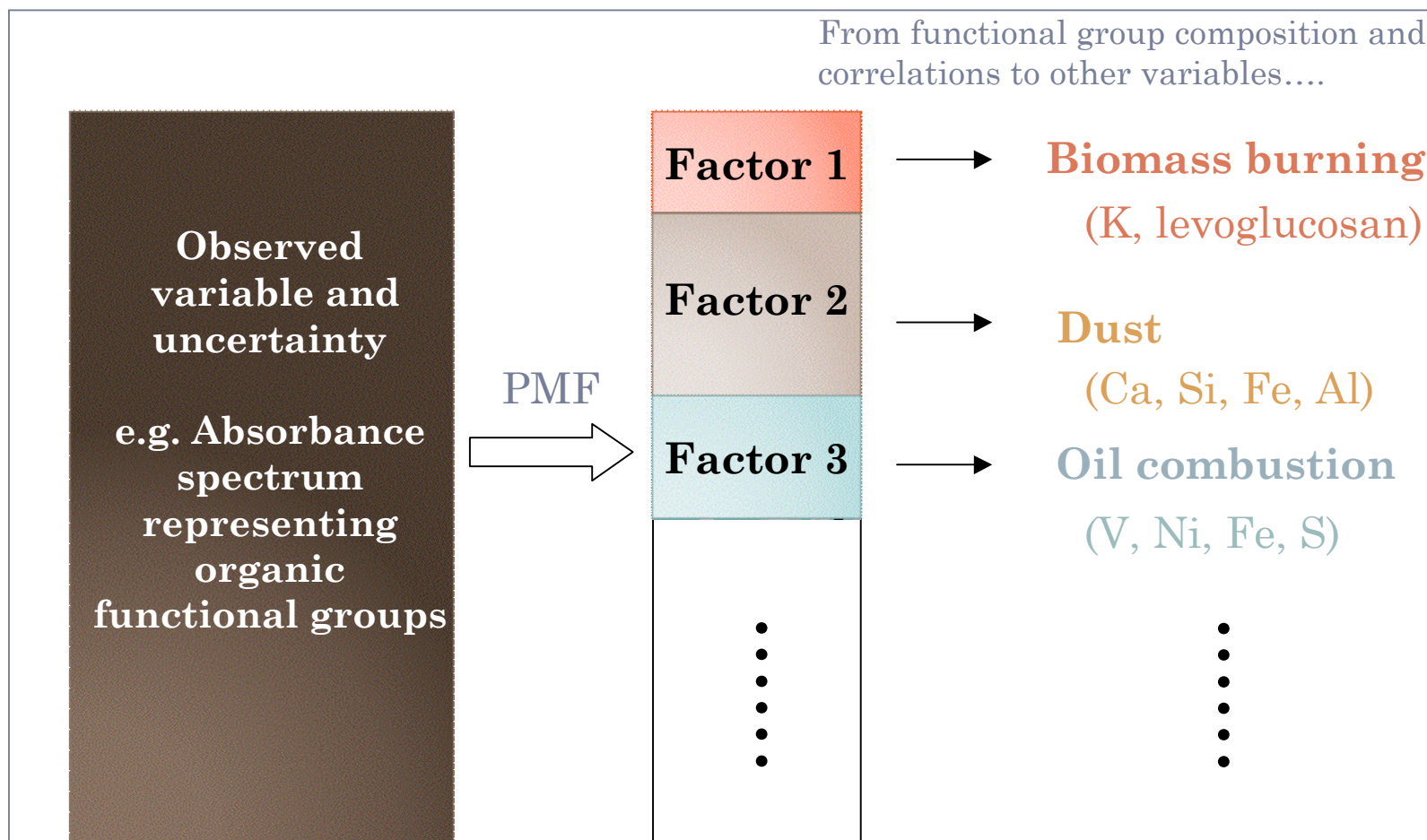
**FTIR SPECTRA
CLUSTERING AND FACTOR
ANALYSES**

AMBIENT SPECTRA WARD CLUSTER ANALYSIS



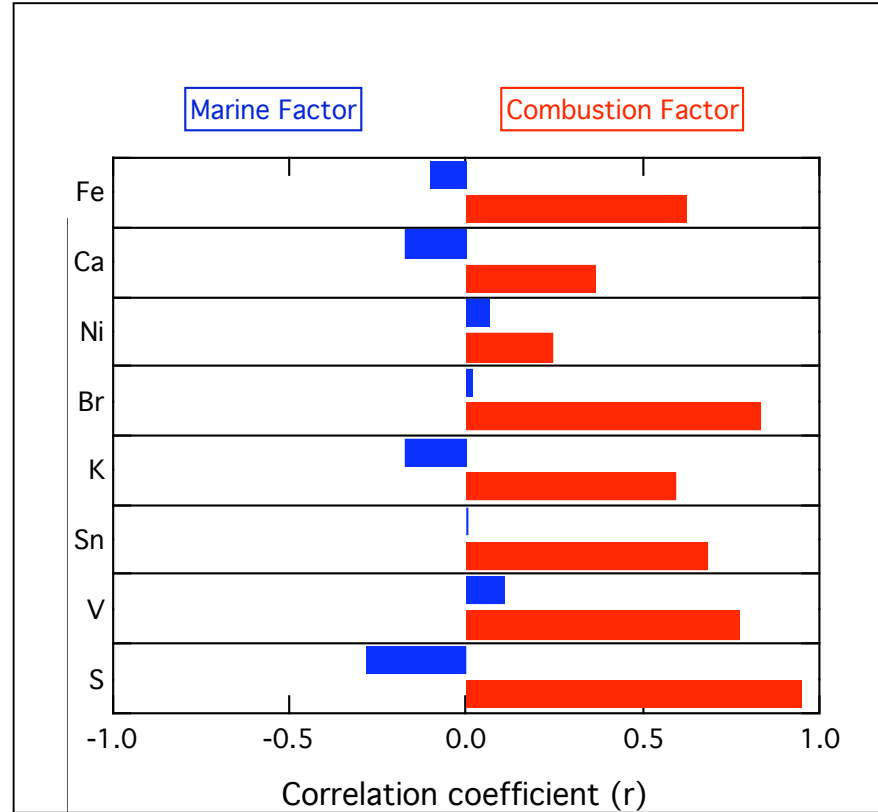
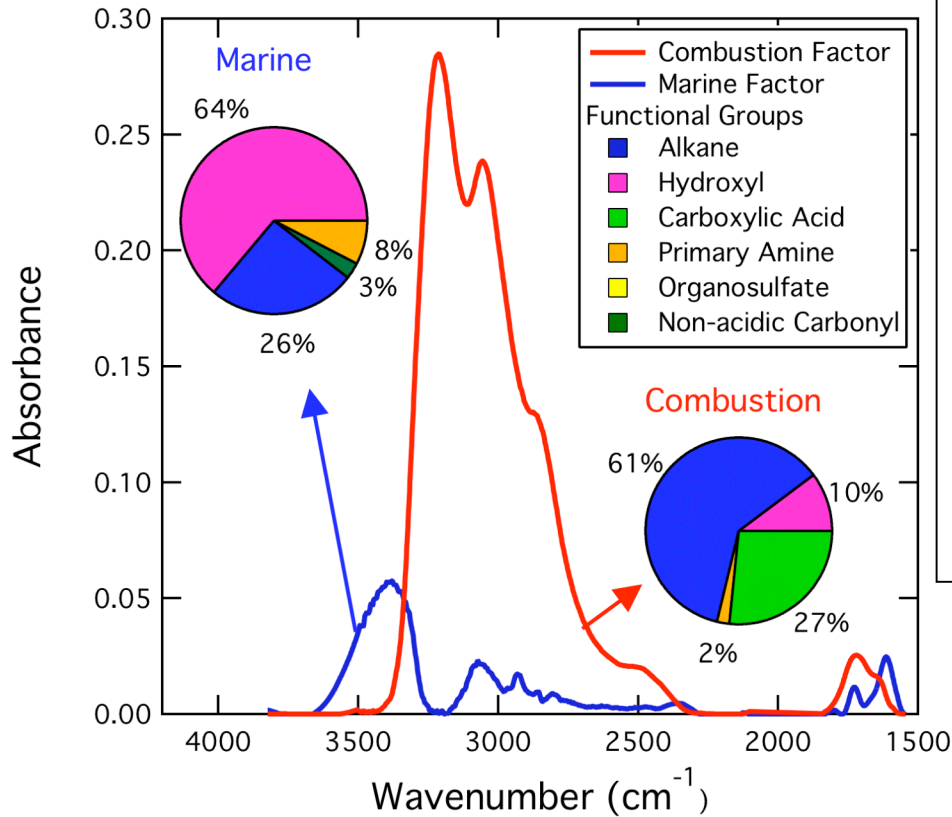
POSITIVE MATRIX FACTORIZATION

From functional group composition and correlations to other variables....



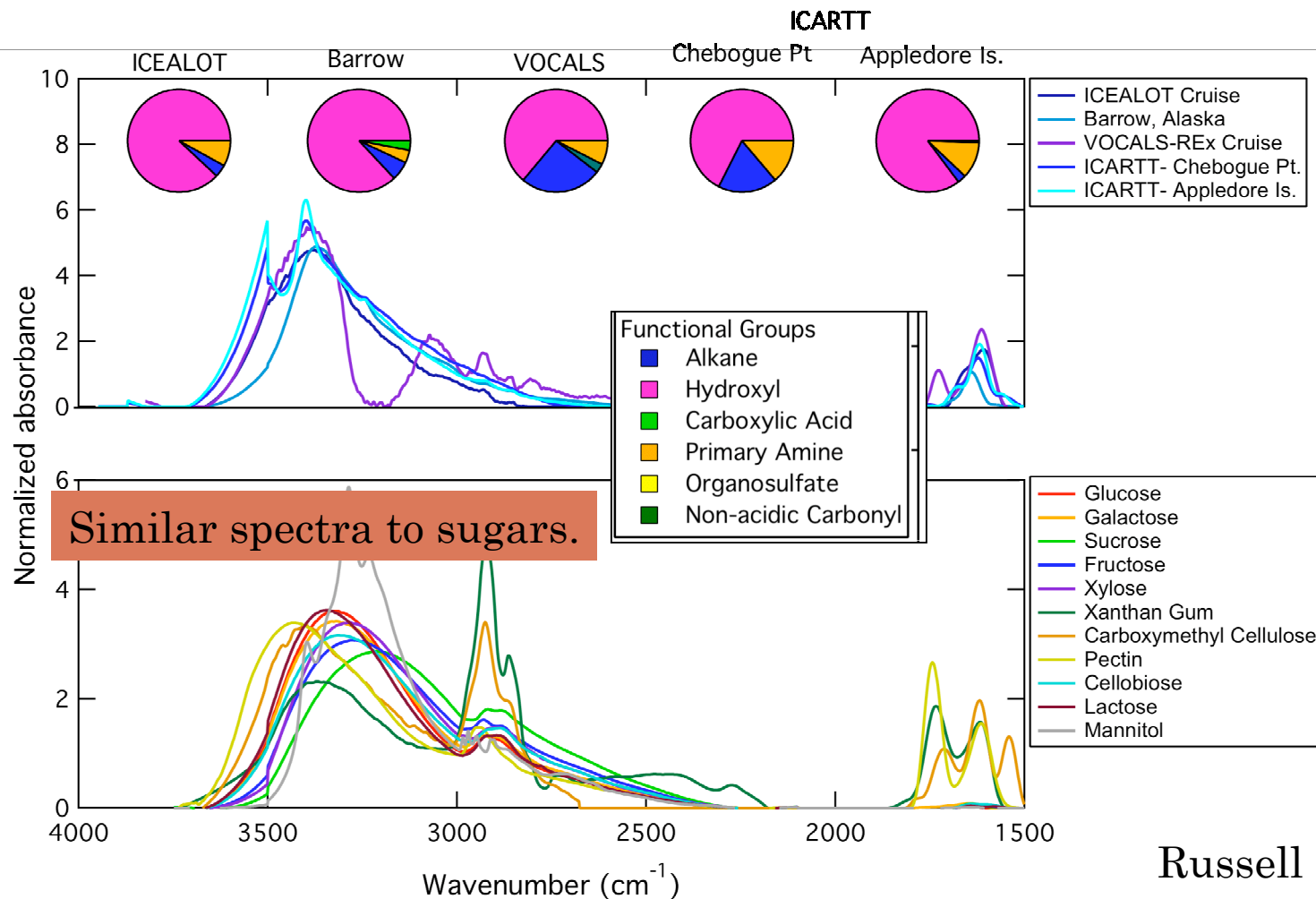
POSITIVE MATRIX FACTORIZATION OF VOCALS AMBIENT FTIR SPECTRA

2-factor solution

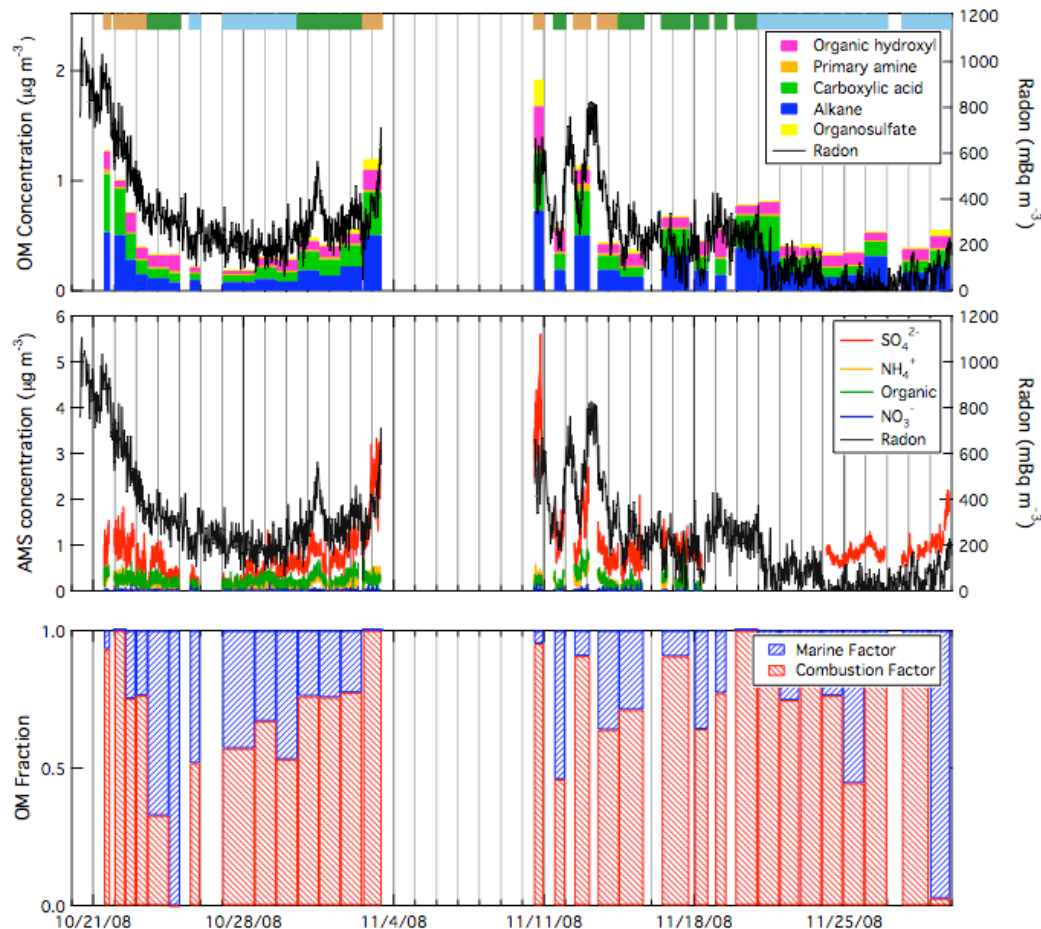


PMF MARINE FACTOR INTER-PROJECT COMPARISONS

Large hydroxyl (COH) fraction in all marine factors.



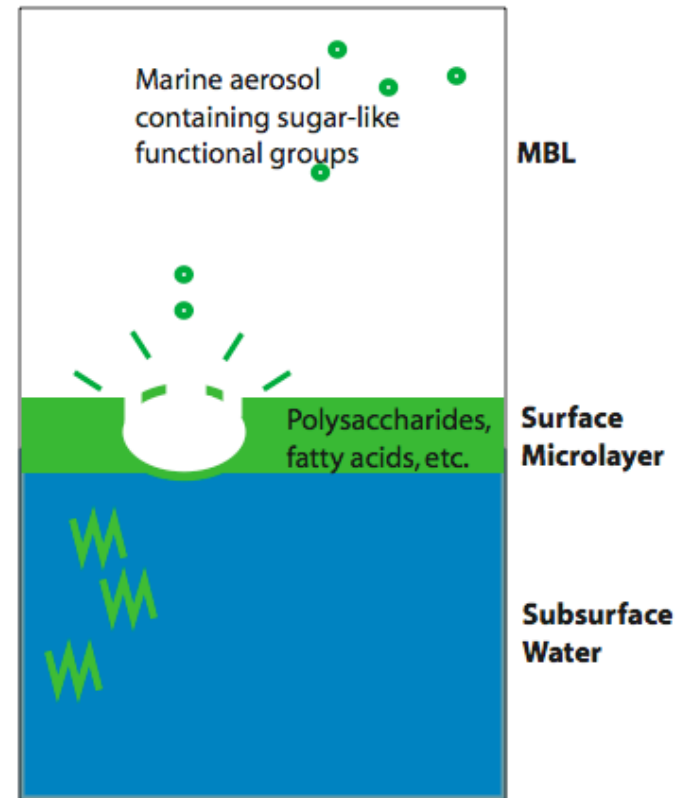
SUBMICRON PARTICLE COMPOSITION



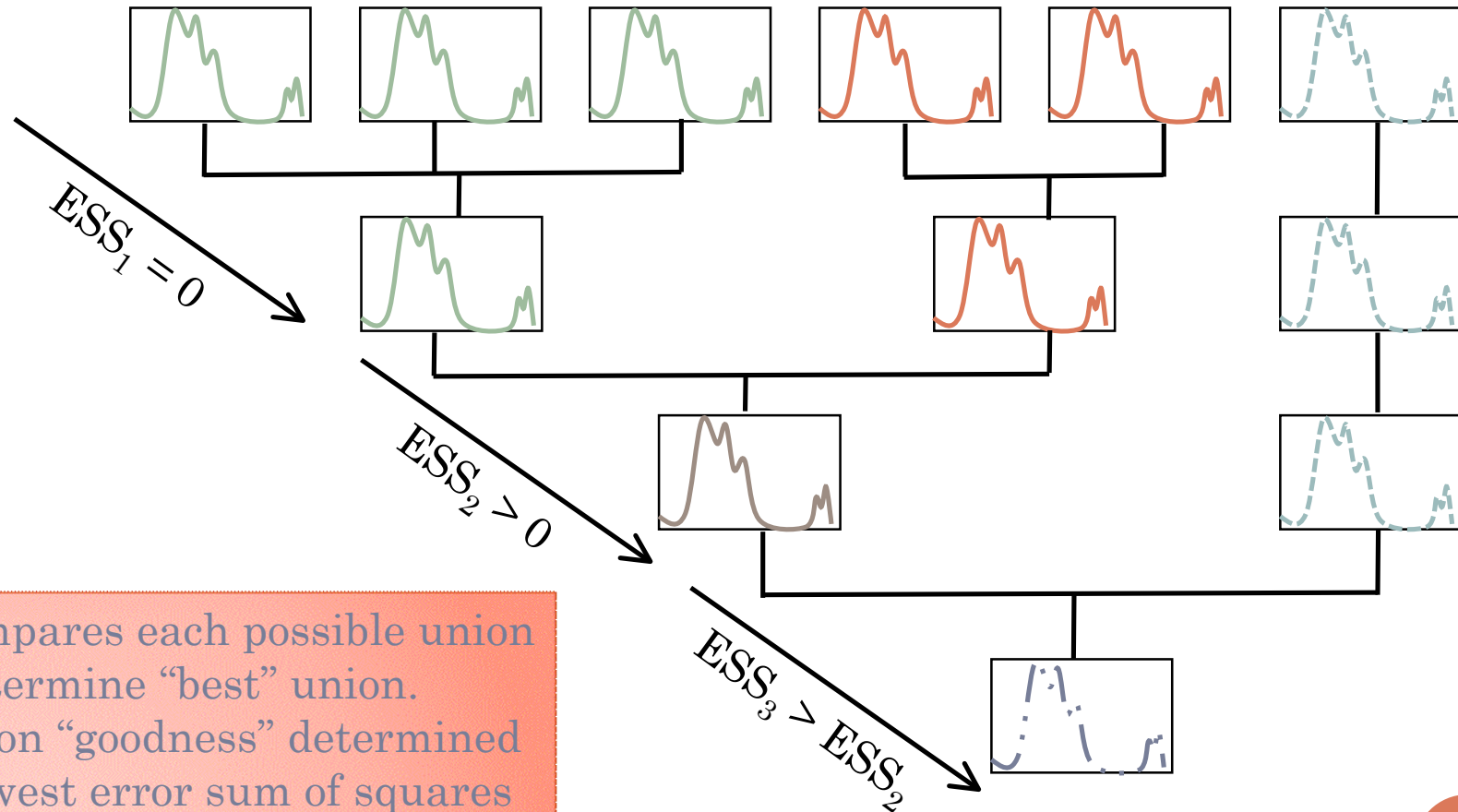
- “Combustion” factor dominates OM in high radon time periods
- “Marine” factor dominates in low radon time periods

CONCLUSIONS

- Continental and marine aerosol can be separated mathematically.
- Observed marine organic aerosol has similar composition to sugar (polysaccharides).
- For regions/times with little continental influence, “Marine” OM composed more than 50% of total submicron OM.



WARD HIERARCHICAL CLUSTER ANALYSIS



- Compares each possible union to determine “best” union.
- Union “goodness” determined by lowest error sum of squares (ESS, best would be 0, for clusters of identical spectra).

Ward, 1963