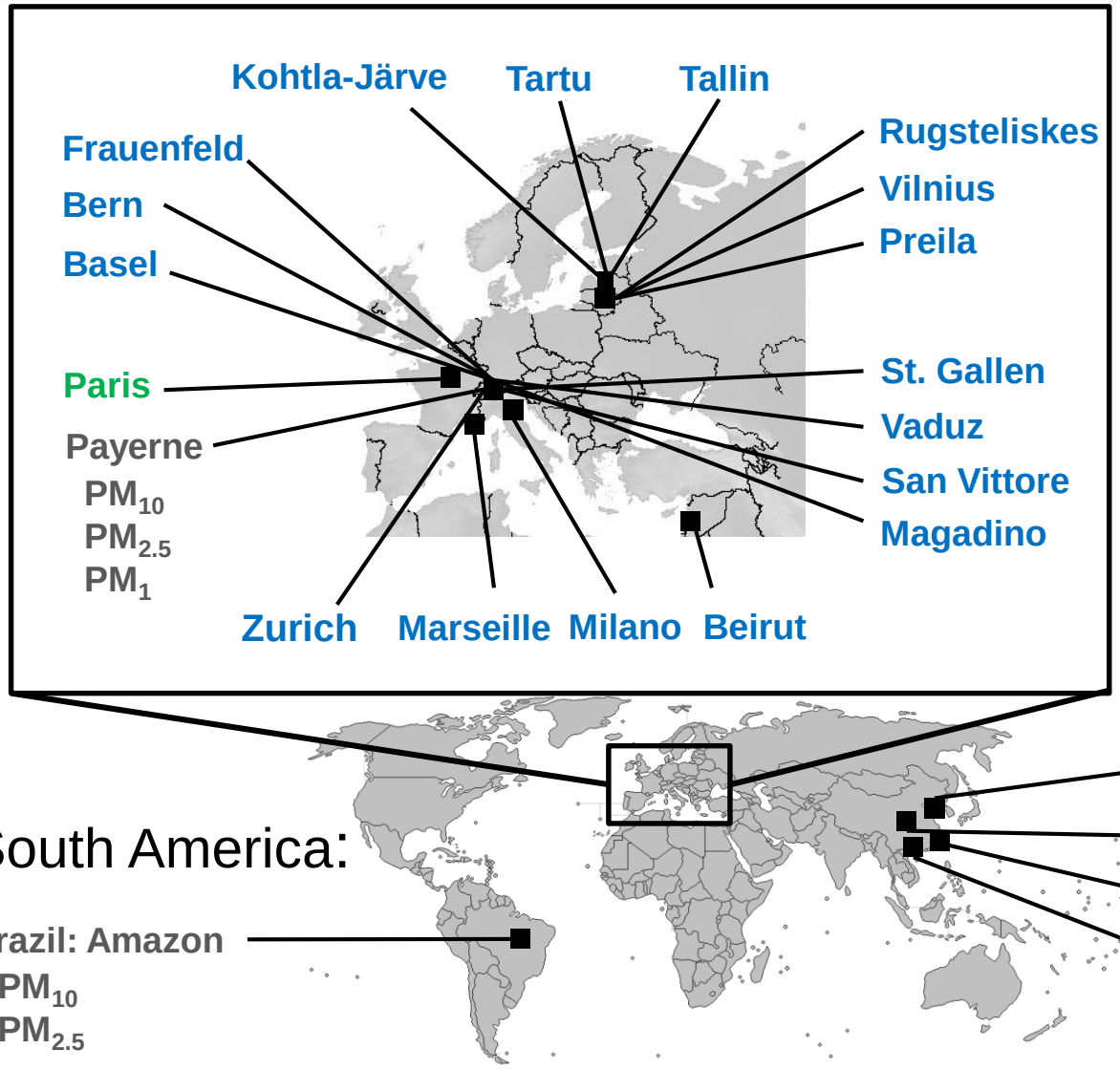
# Size-segregated long-term chemical analysis and source apportionment of the organic aerosol in the Northern hemisphere using offline aerosol mass spectrometry

I. El Haddad, K. R. Daellenbach, C. Bozzetti, A. Vlachou, and A.S.H. Prevot

# Main highlights




**> 2500 samples analyzed at > 25 sites**

**Long term, specially resolved datasets at urban and rural sites in Switzerland, France, Italy, Lithuania, Estonia and Lebanon**

**Size resolved data at rural locations in central Europe and Amazon**

**Investigation of haze events in Megacities in China and Europe**




South America:

Brazil: Amazon
$PM_{10}$
$PM_{2.5}$

*Daellenbach et al., 2016 and in prep; Huang et al., 2014*
*Bozzetti et al., 2016a, 2016b and 2016c.; Vlachou et al. in prep*
*El Haddad et al., in prep*

Asia:

China: 4 sites, heavy pollution episode

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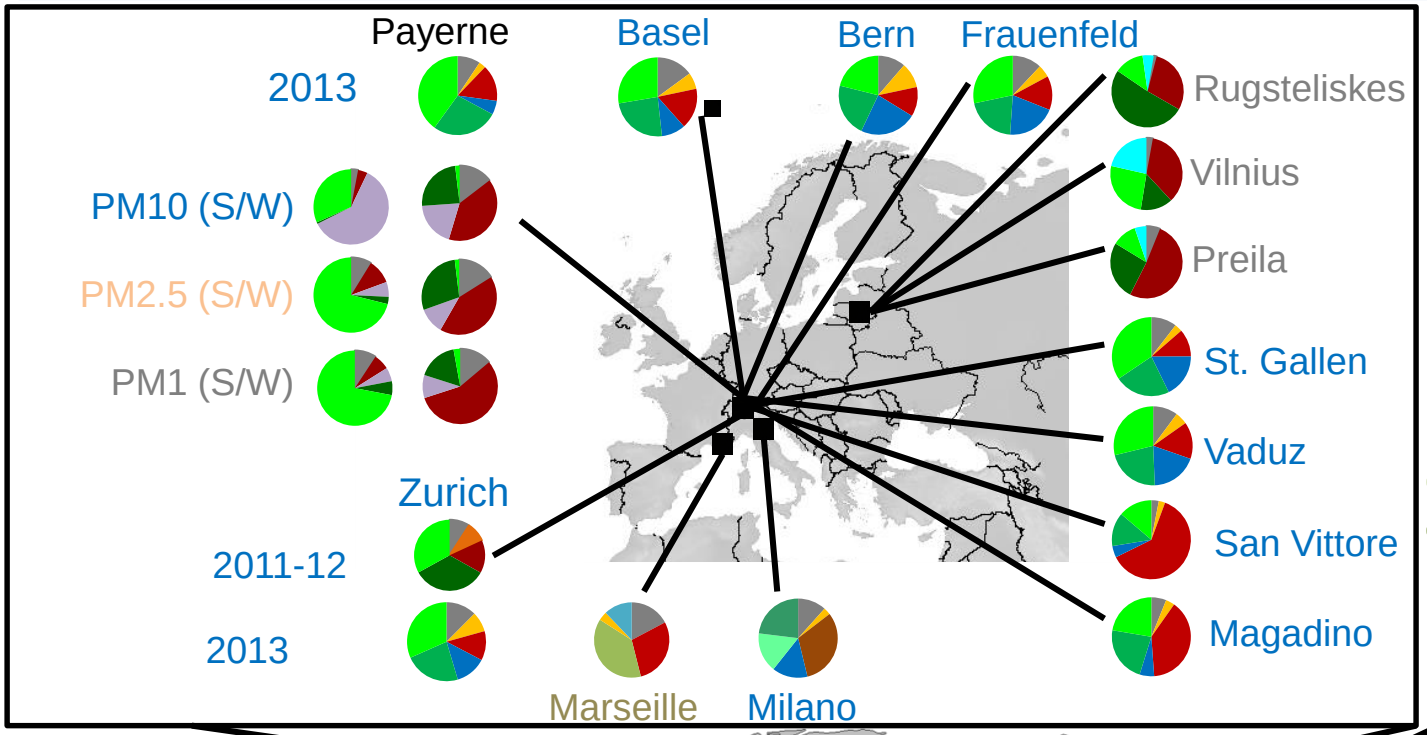


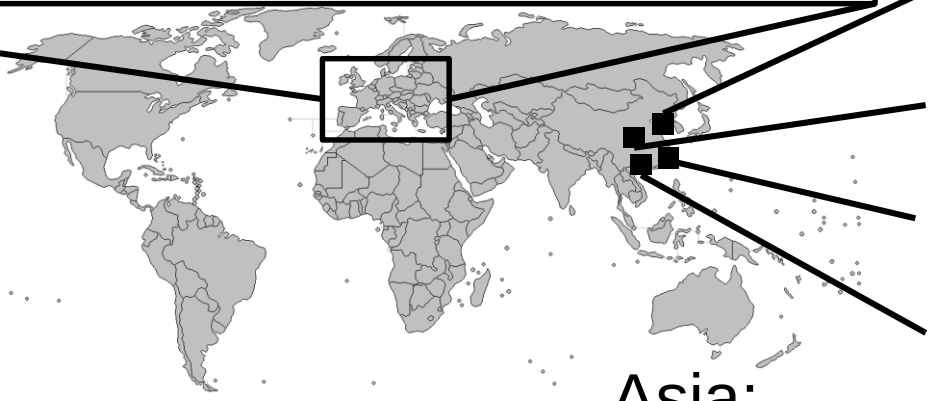


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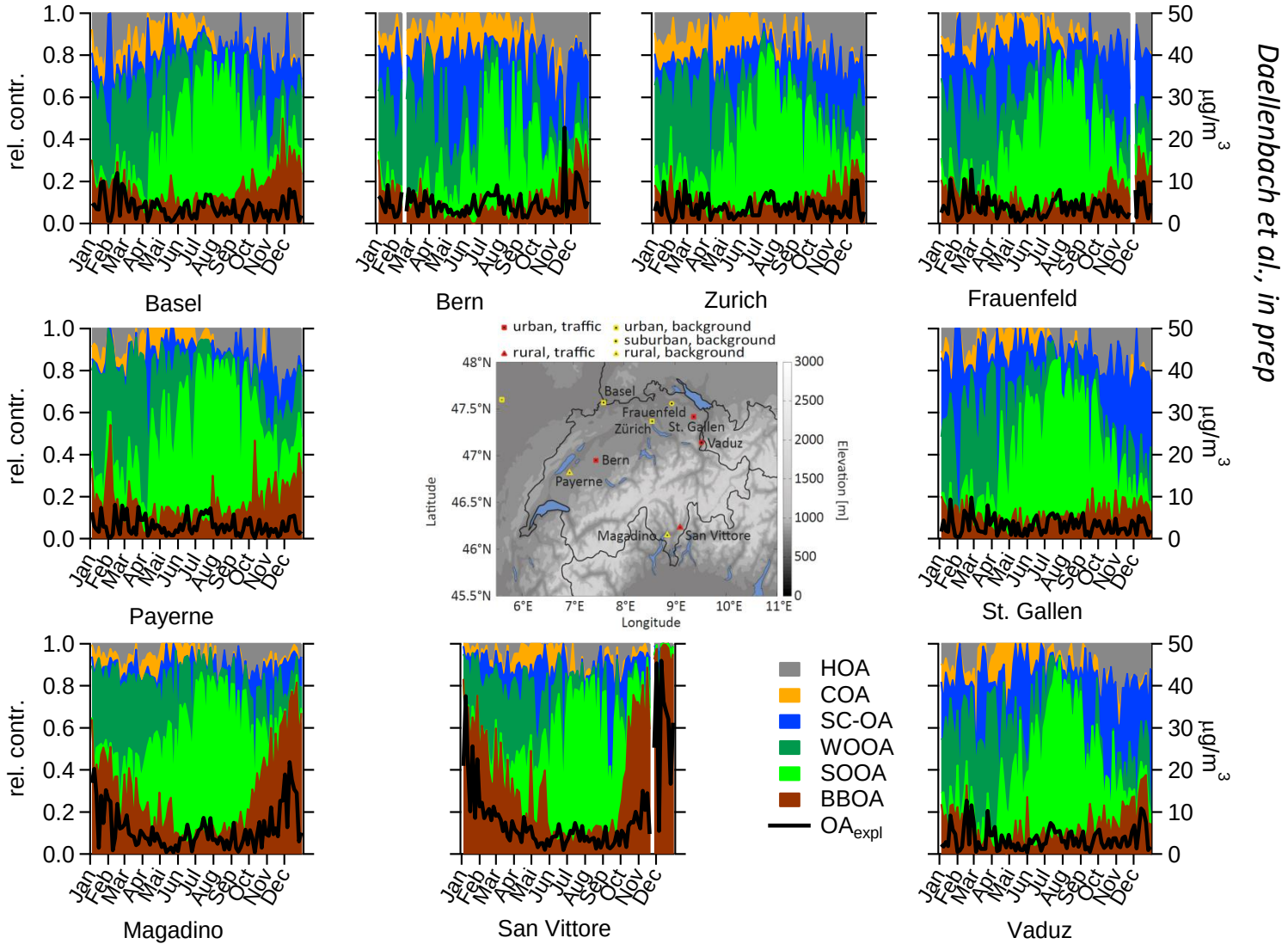
# Main highlights

## Case of Switzerland (similar to other European sites)

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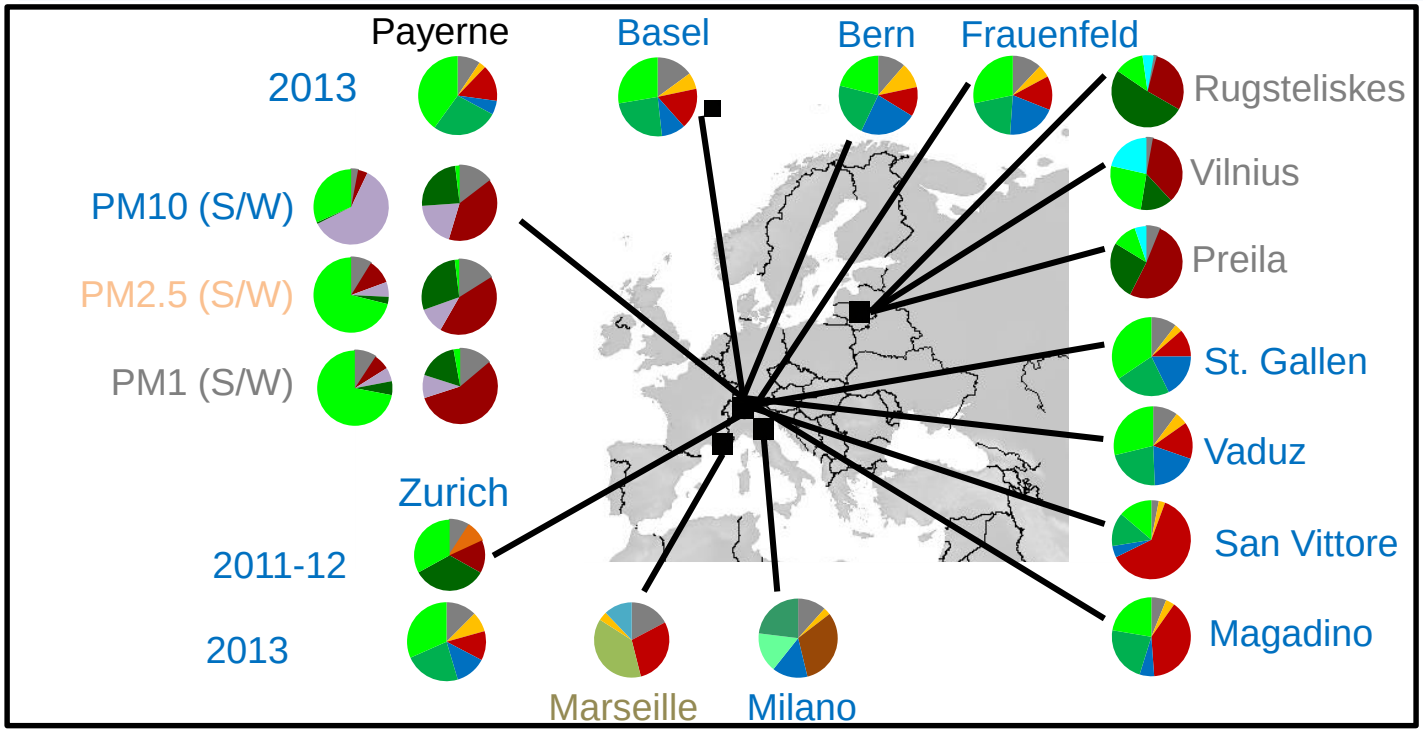


- Traffic
- Cooking
- Biomass burning
- Primary biological OA
- Local OA (waste treat)
- Summer OOA
- Winter OOA
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- Coal burning
- Secondary organic rich
- Secondary inorganic rich

⇒ BBOA is the main source in Europe during winter (only $PM_1$)

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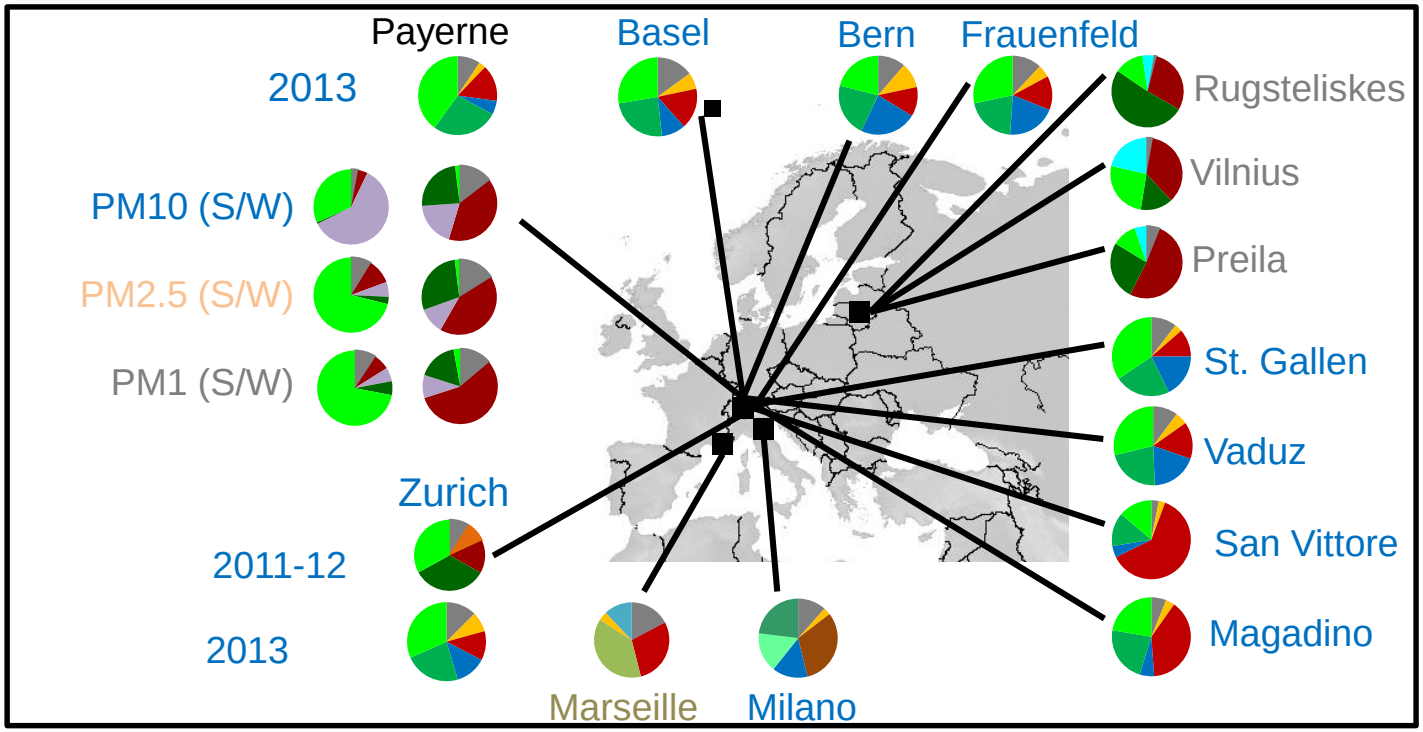


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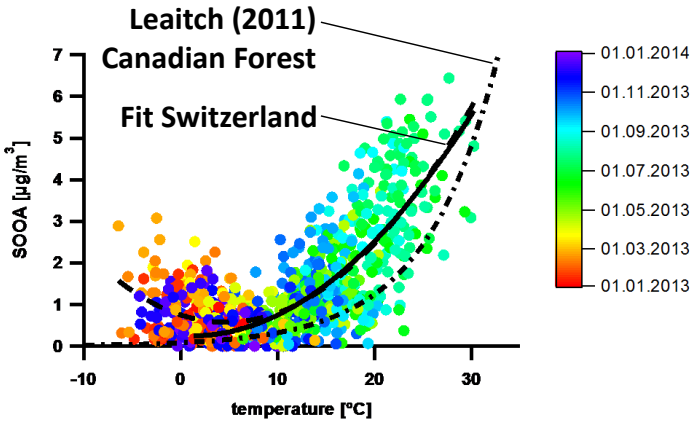

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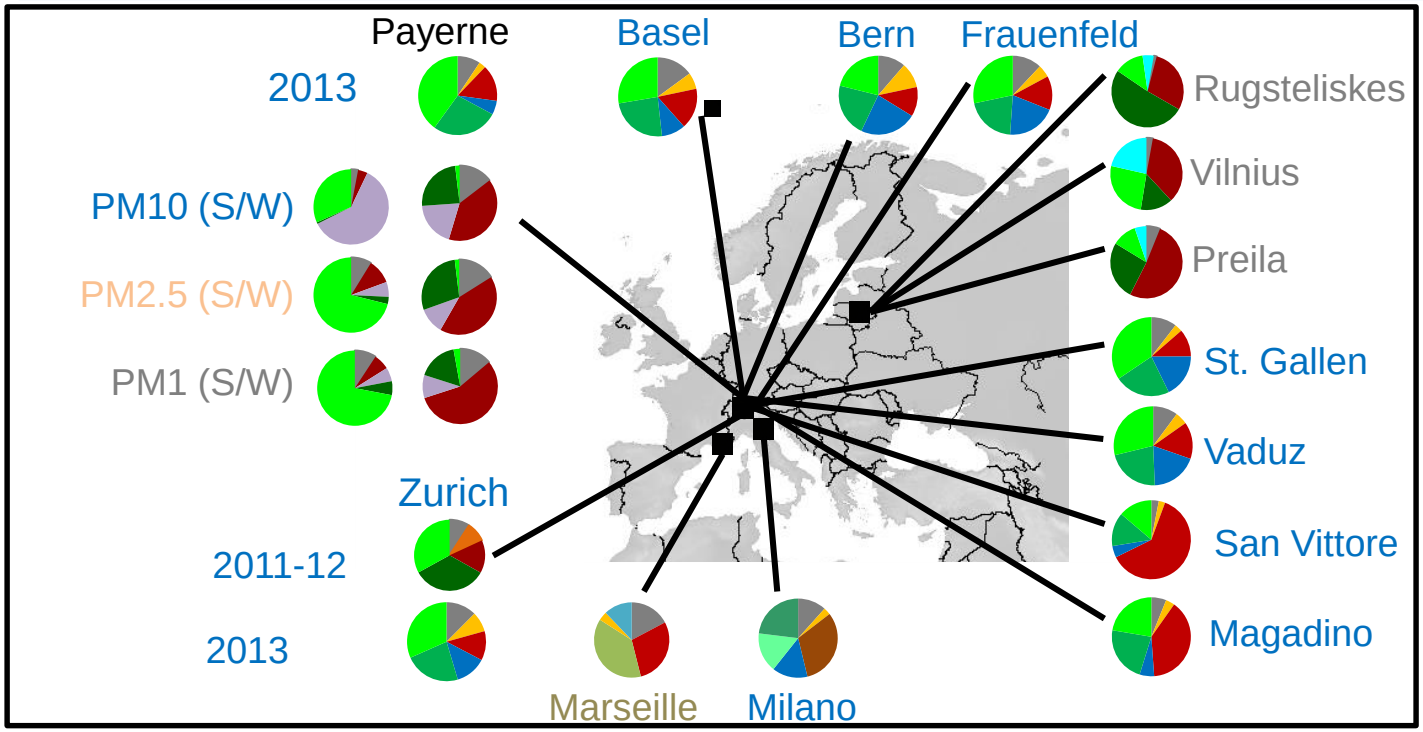


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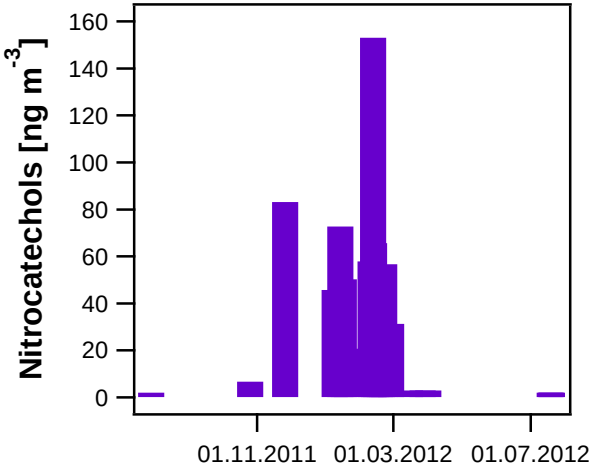

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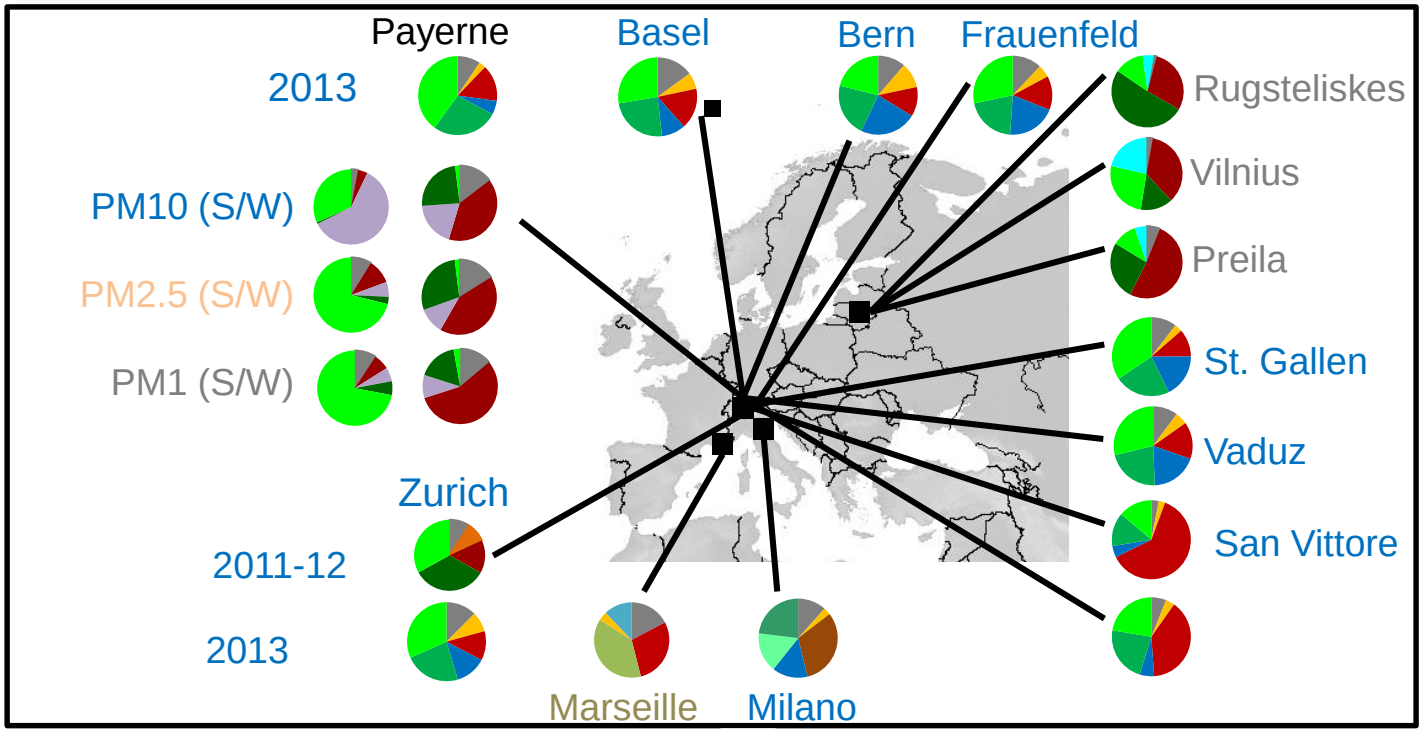


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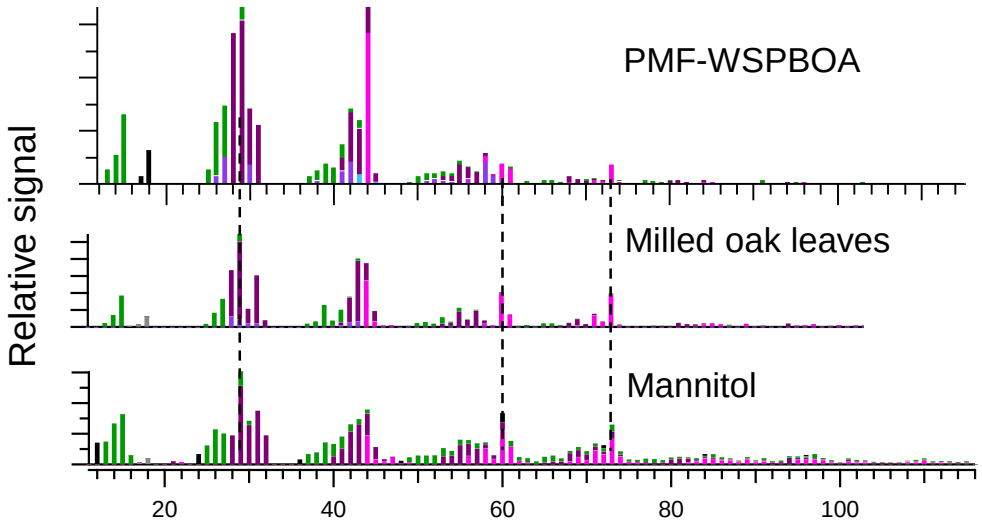

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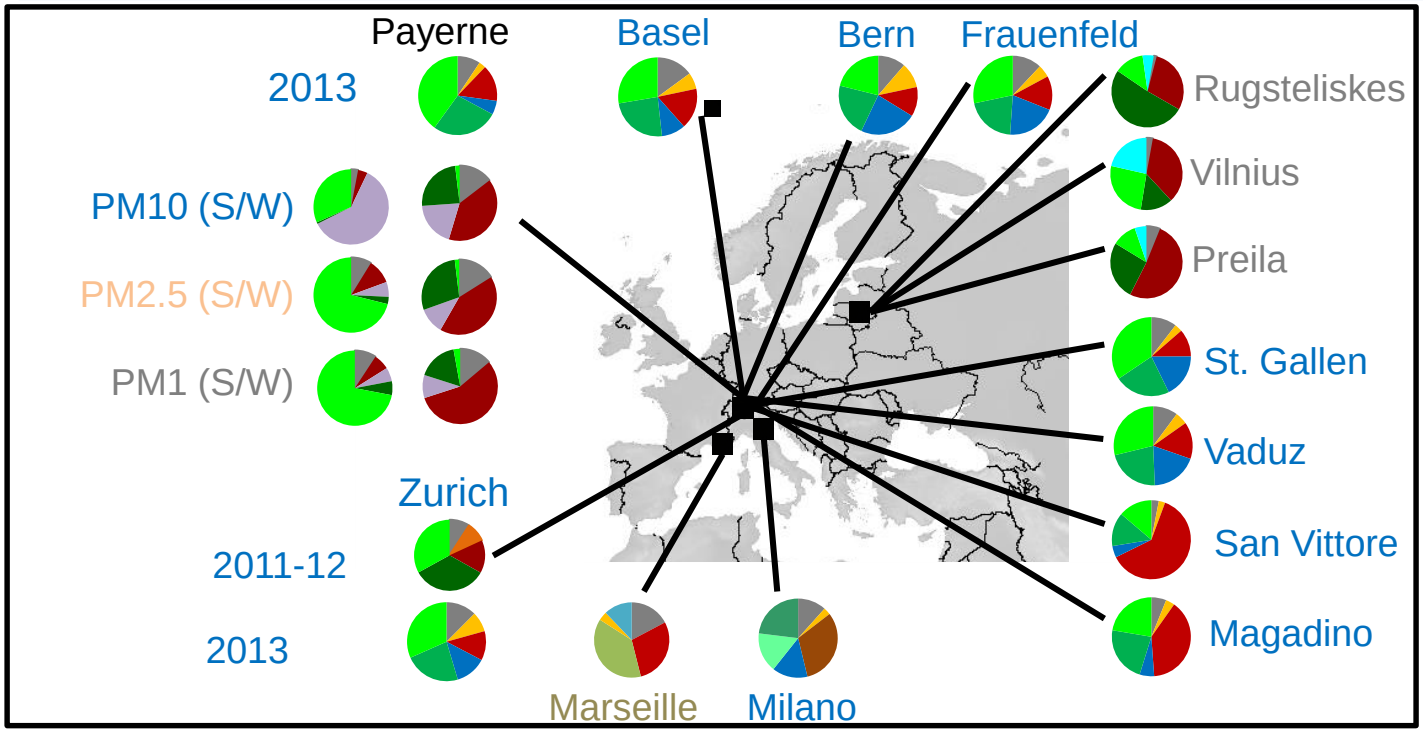


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⇒ SOA formation is important during Chinese haze events


China

# Better characterizing the AMS using the offline AMS technique

⇒ Identifying particle-vaporizer interactions (e.g. Pieber effect)

⇒ Probing the instrument/vaporizor status (e.g. potential drifts):
→ frequent injections of $NH_4NO3$ and $(NH_4)_2SO_4$ ($NO/NO_2$ and $NH_4$ and $SO_4$ RIEs)
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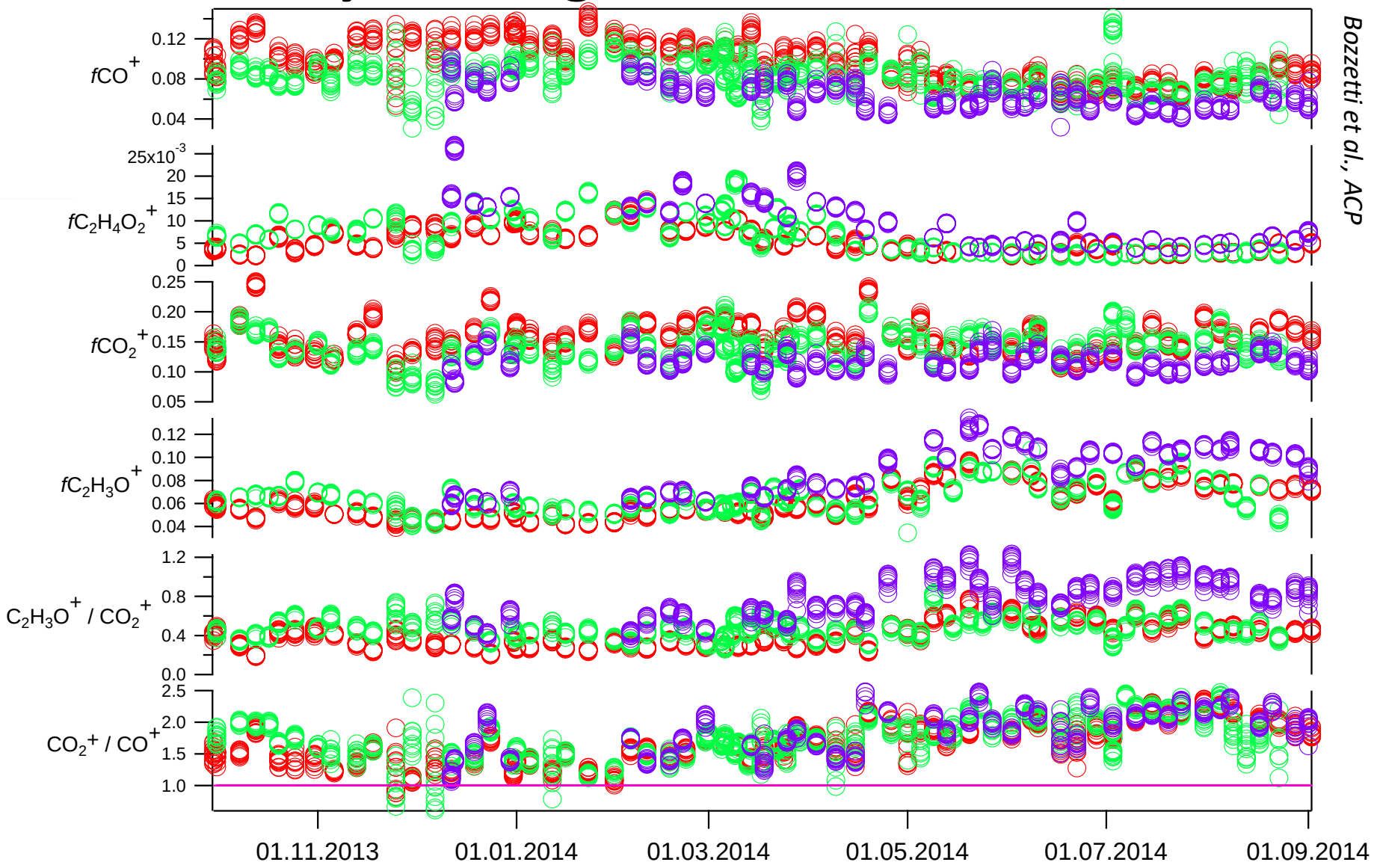
⇒ **Examining the OA fragmentation patterns**

⇒ **Detecting new species**

# OA fragmentation pattern

## Analysis in argon for 3 sites in Lithuania




*Bozzetti et al., ACP*

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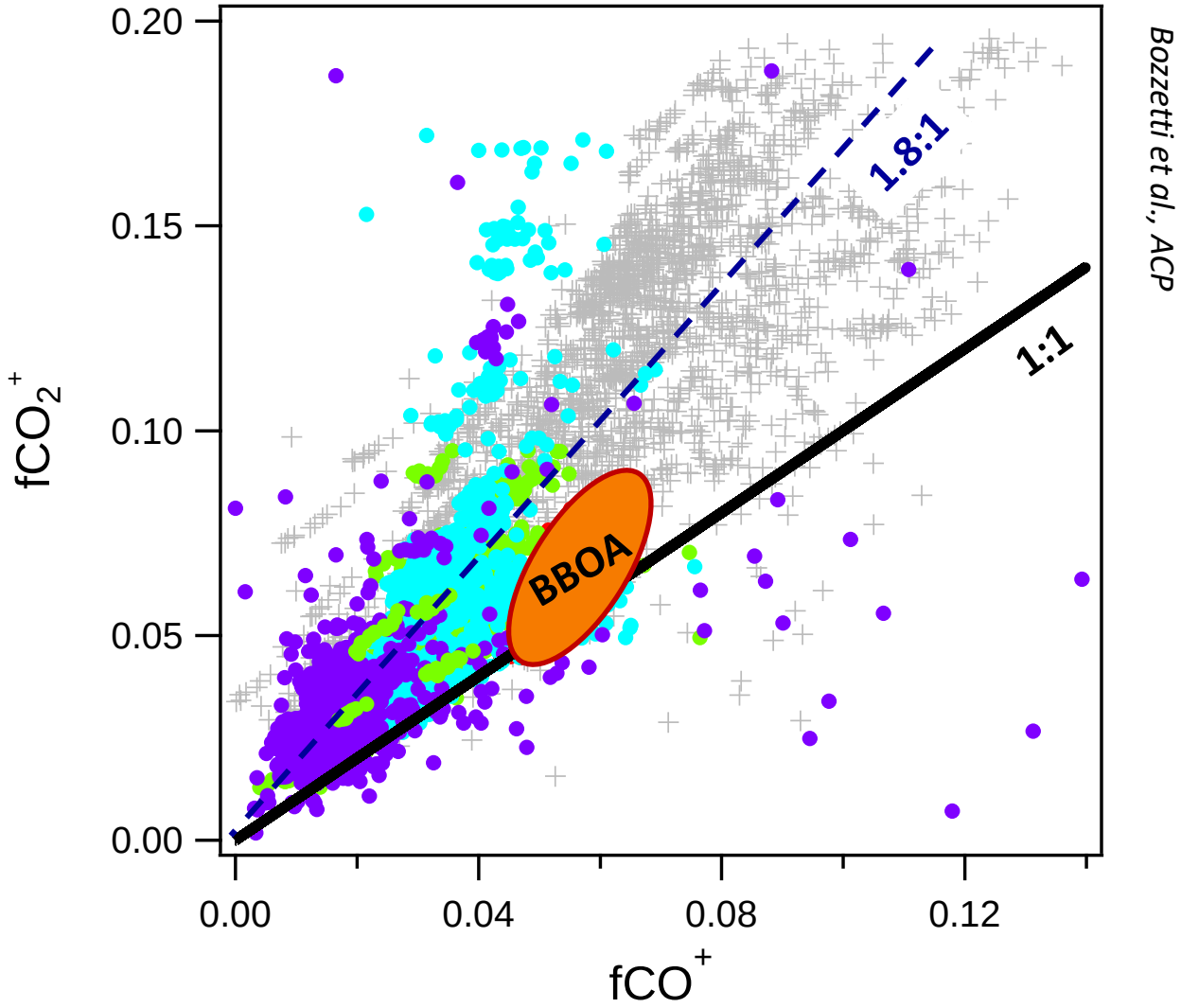

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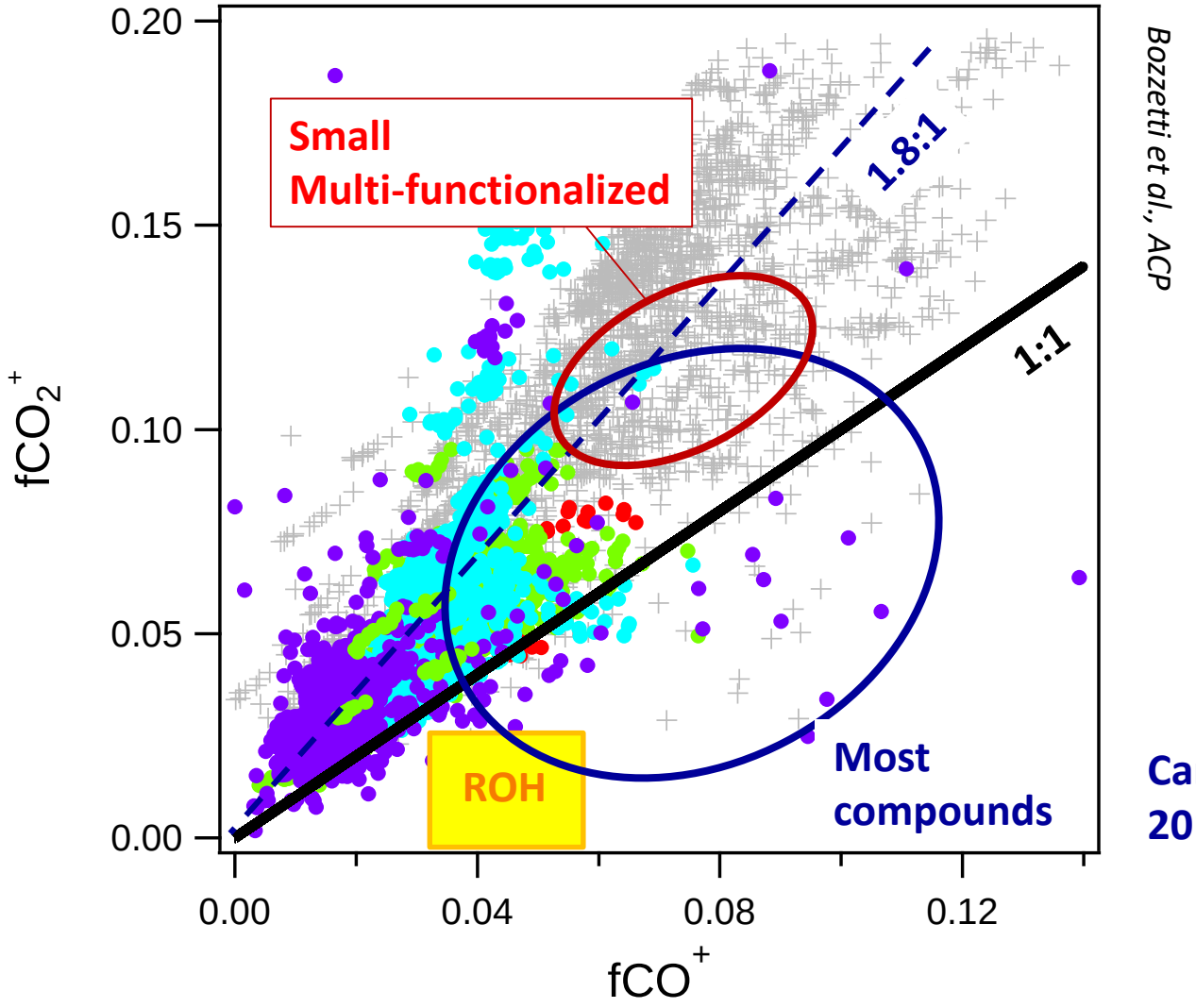


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Canagaratna, 2015

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# Carbonates



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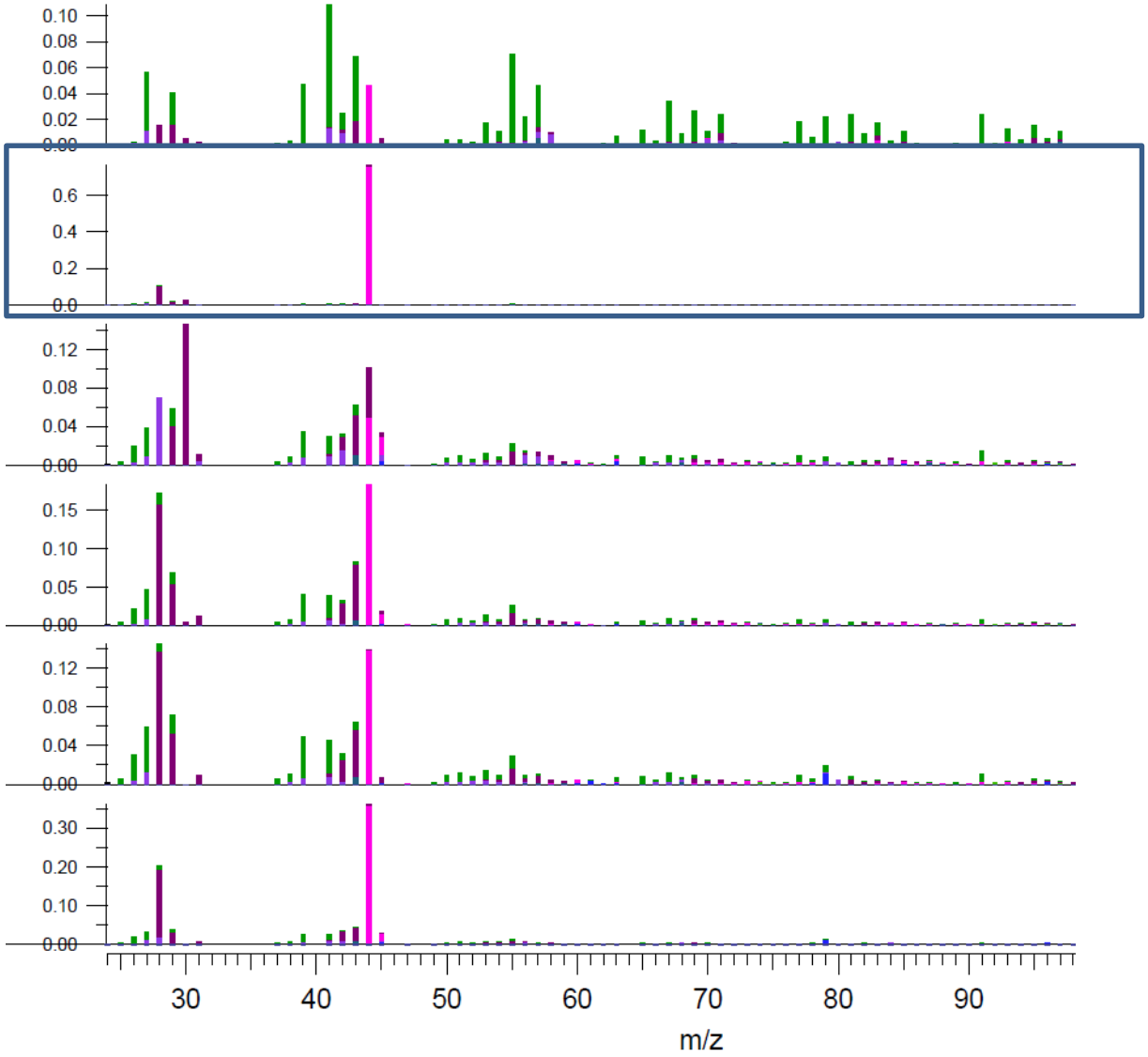


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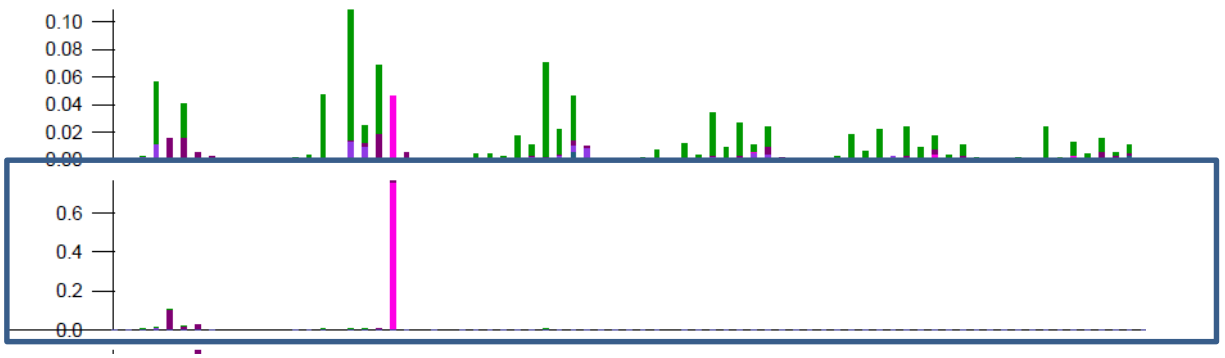


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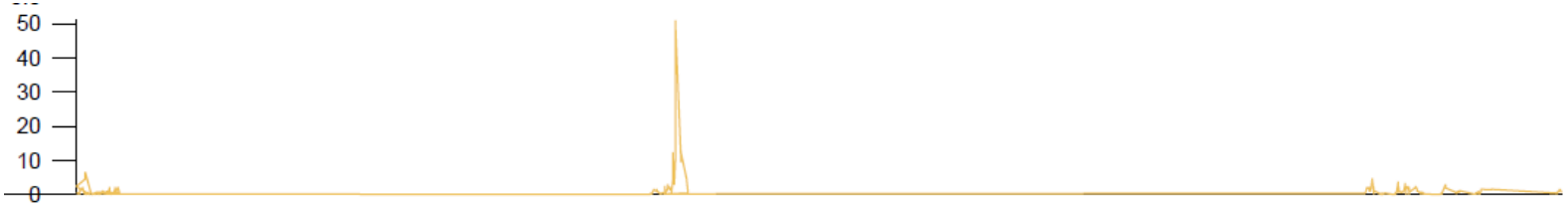


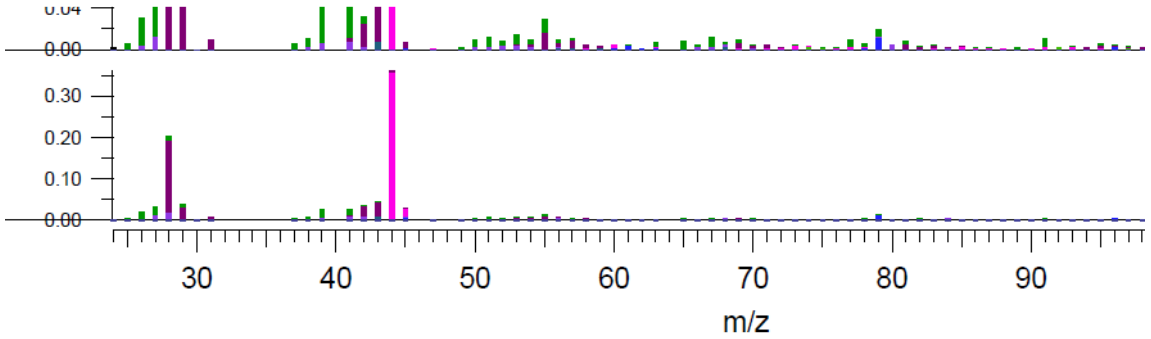

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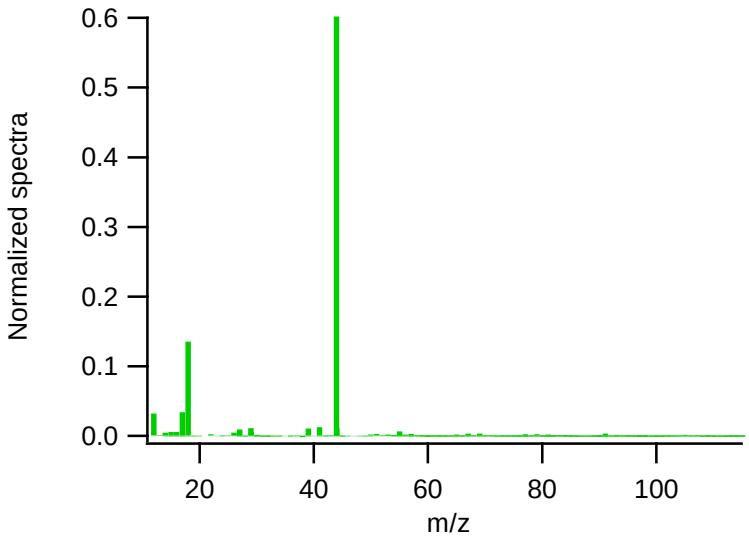


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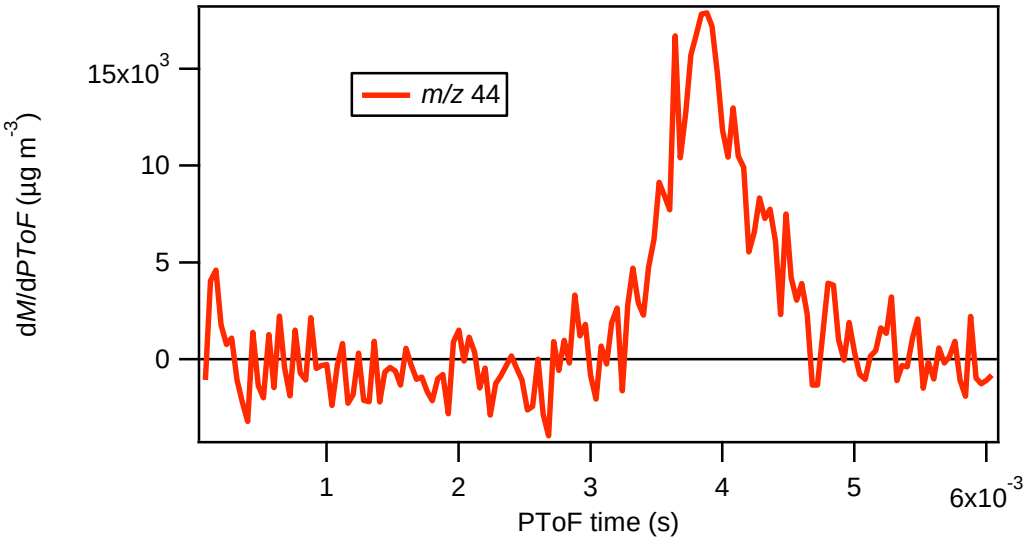



**RIE=1.4 using NaHCO3**

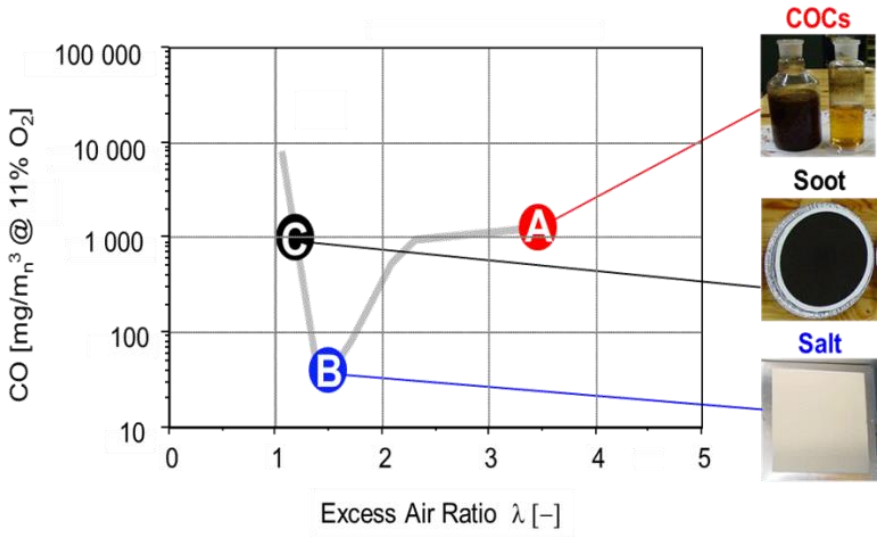
# Carbonates

## When does that matter?

⇒ Sampling $PM_{2.5}$

⇒ Sampling biomass burning

⇒ Offline AMS



# Carbonates

## How to deal with it?

⇒ For offline AMS: HCl fumigation (tested and works)

⇒ For non-AMS: PMF/ME-2?