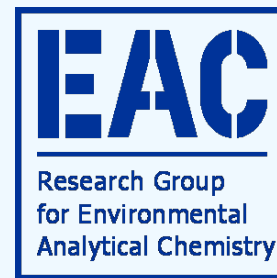




International Conference on  
Carbonaceous Particles in the Atmosphere  
August 12 – 14, Berkeley (CA)



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## Three Cities' Study of Biogenic Emissions:

*Annual trends and contributions of wood smoke and fungal spores to organic carbon in  $PM_{10}$  aerosols in Austria*

Heidi Bauer, Alexandre Caseiro, Christoph Schmidl  
and Hans Puxbaum

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# Most Important Biogenic Emission Sources

Wood smoke





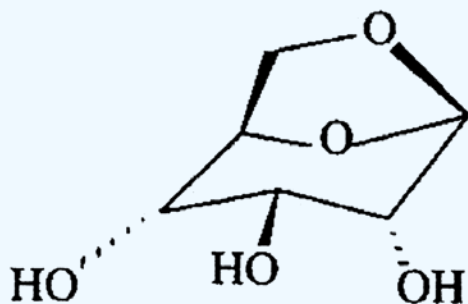
# Macrotracer Concept

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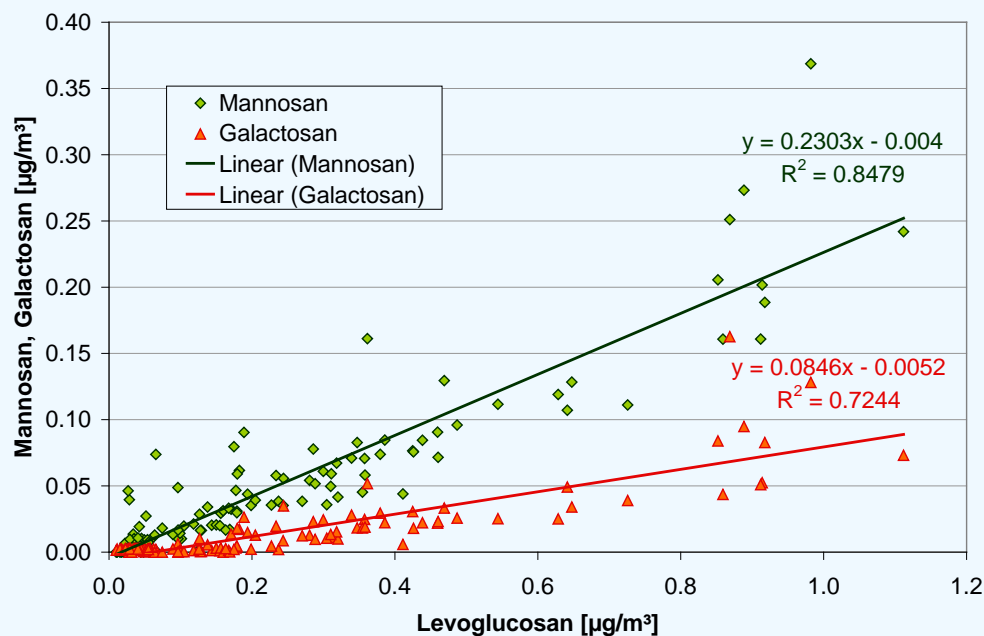
- Nine component model to derive source contribution of ambient particulate matter
- Six sources contribute to OC
  - Traffic exhaust and non exhaust
  - Wood smoke
  - Coal combustion emissions
  - Organic secondary aerosol
  - Fungal spores
  - Plant debris
- Macrotracers are contained to more than 1% in the source

# Chemical Tracers for Wood Smoke

## Anhydrosugars



Levoglucosan



Levoglucosan: combustion of cellulose

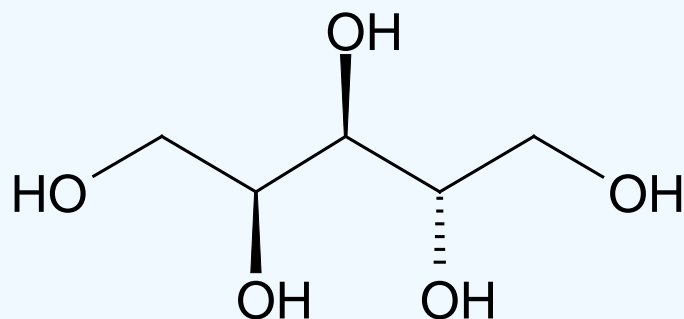
Mannosan, galactosan: combustion of hemicelluloses

Wood smoke = levoglucosan x 10.7  
(Schmidl et al., 2008)

Wood smoke OC:  
levoglucosan x 6.1

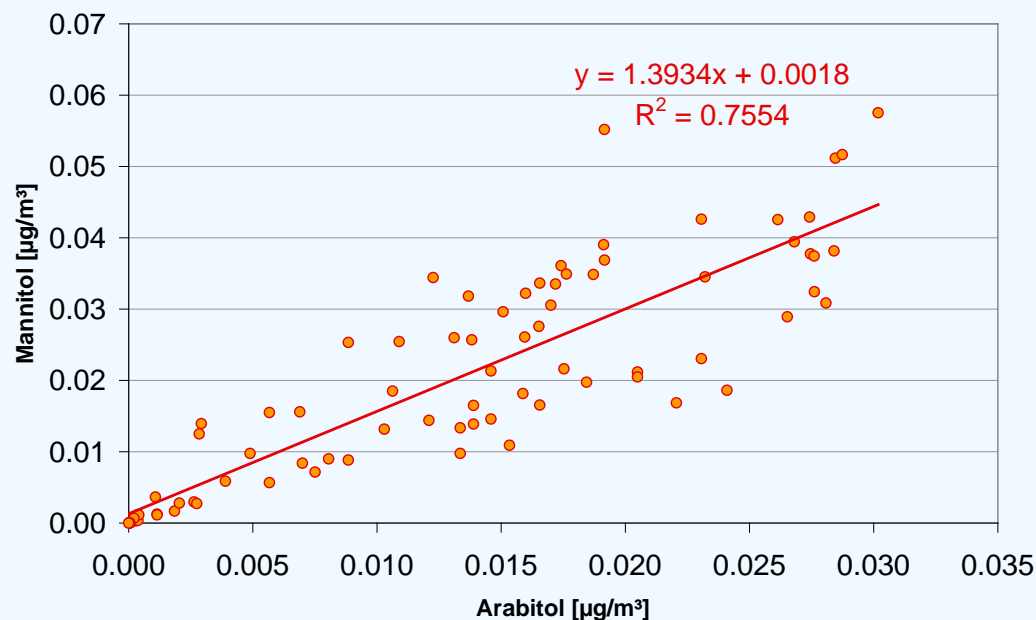
# Chemical Tracers for Fungal Spores

## Polyols



Arabitol: unique tracer  
1.2 pg/spore

13 pg C/spore  
Bauer et al., 2002



Arabitol and mannitol as fungal tracers:  
Qualitative: Carvalho et al., 2003  
Graham et al., 2003  
Ion et al., 2005  
Quantitative: Bauer et al., 2008

# Determination of Anhydrosugars and Polyols by anion chromatography

Extraction of a filter aliquot with water under ultrasonic agitation / cell disruptor



HPLC: separation of sugars by anion exchange mechanisms  
eluent: NaOH 0.5 – 20 mMol



Electrochemical detection



Quantification with external standards



Peak deconvolution using modified Gaussian curve



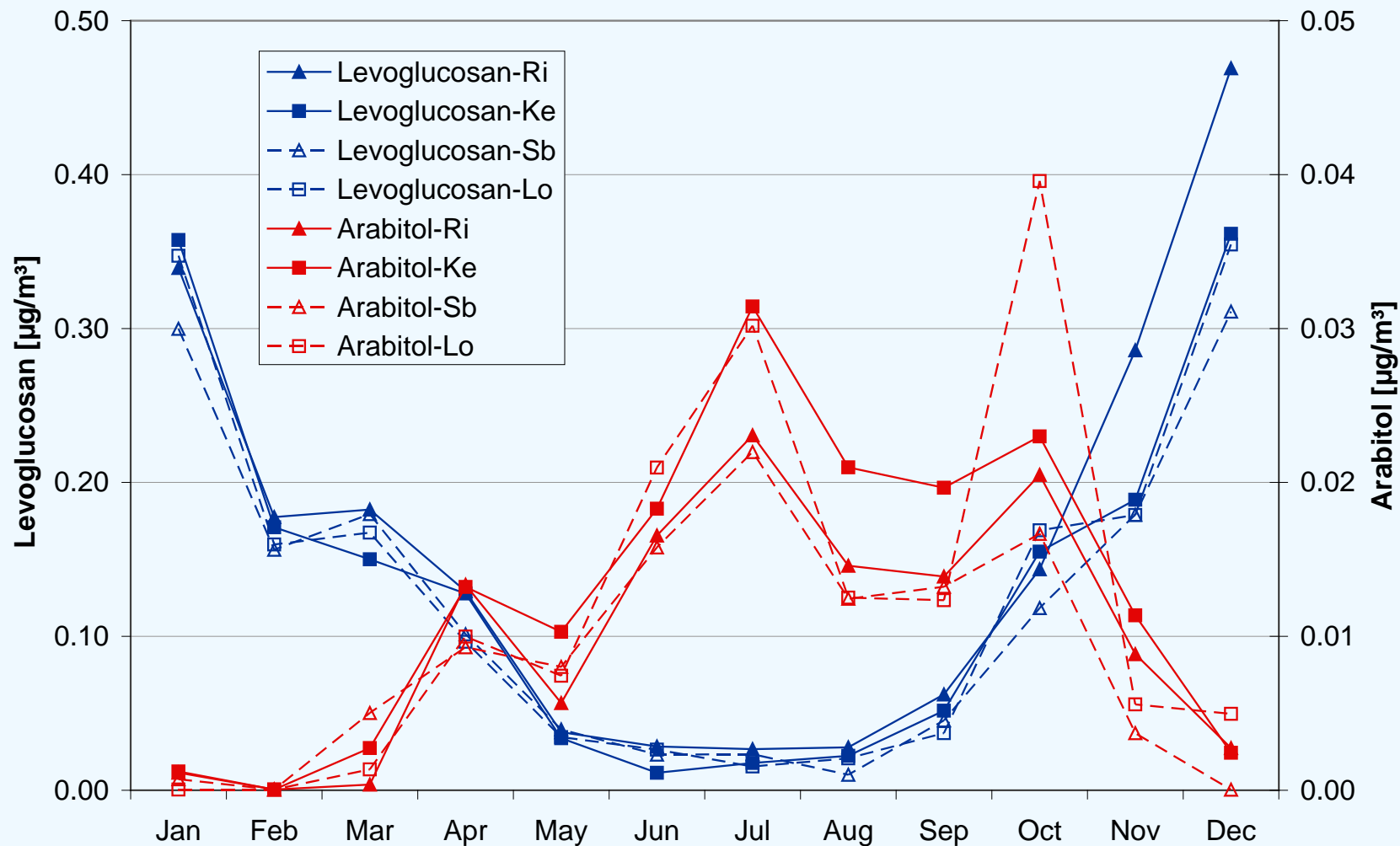
(Caseiro et al., 2007)



# AQUELLA: Sampling Sites 2004

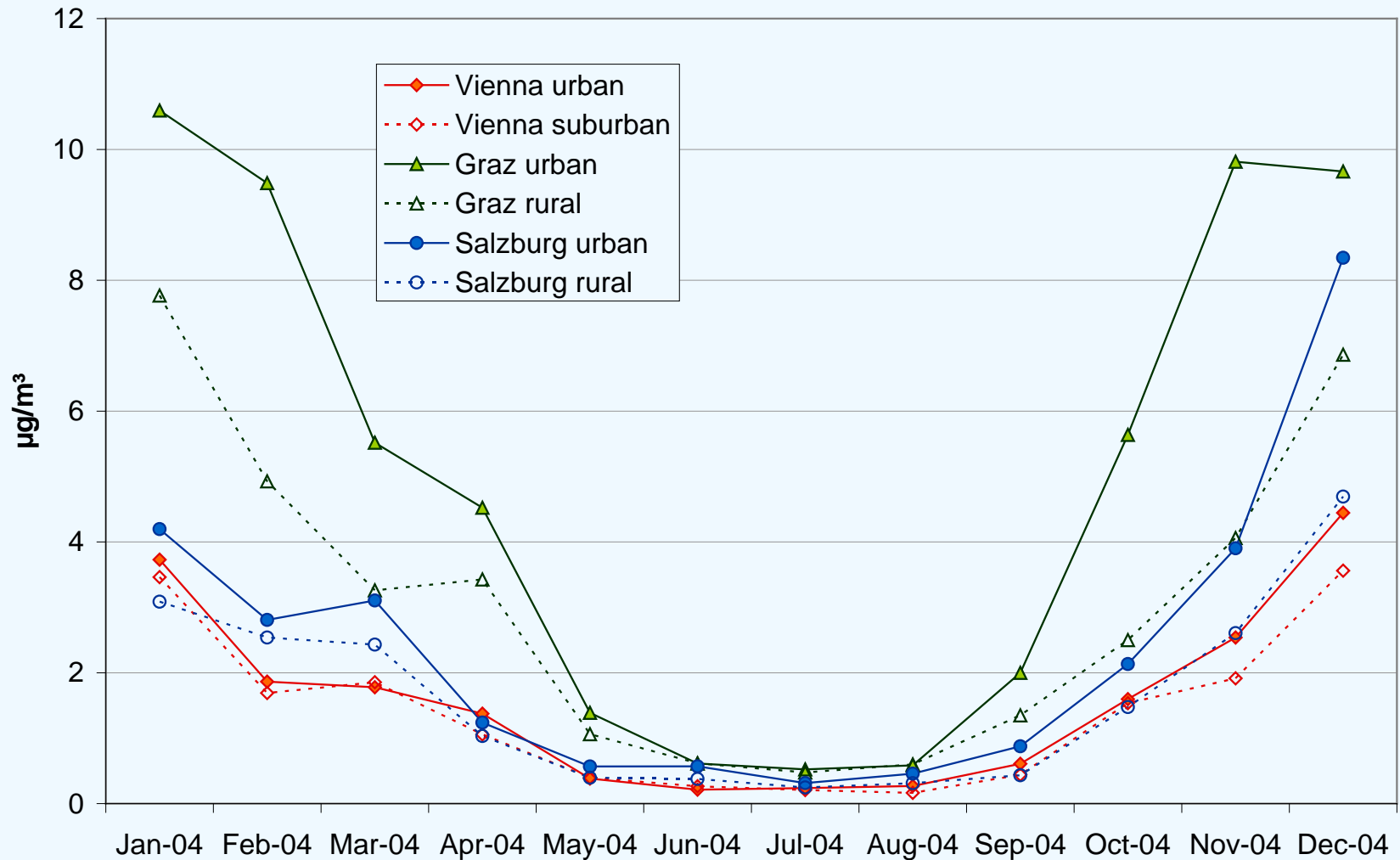


# Vienna, 2004

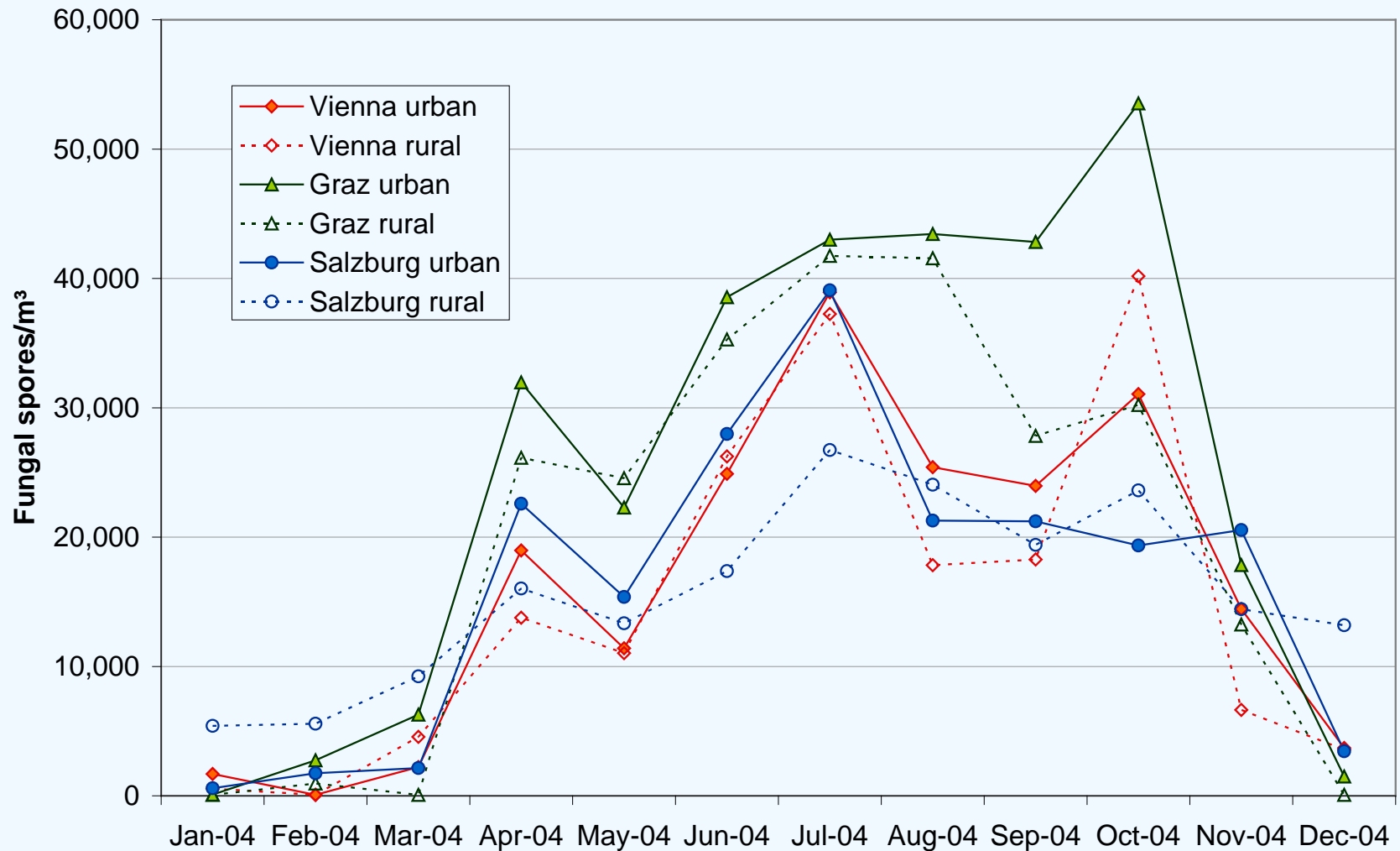




# Concentrations of Wood Smoke in three Austrian Cities: Annual Trend

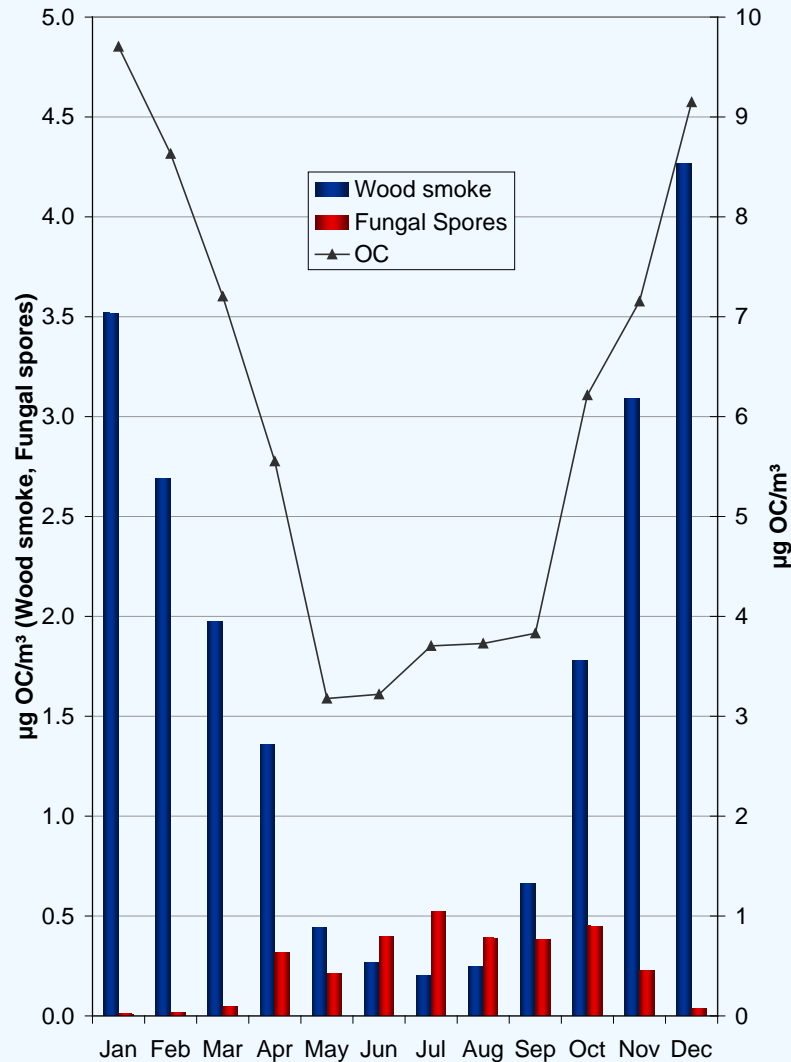


# Concentrations of Fungal Spores in three Austrian Cities: Annual Trend

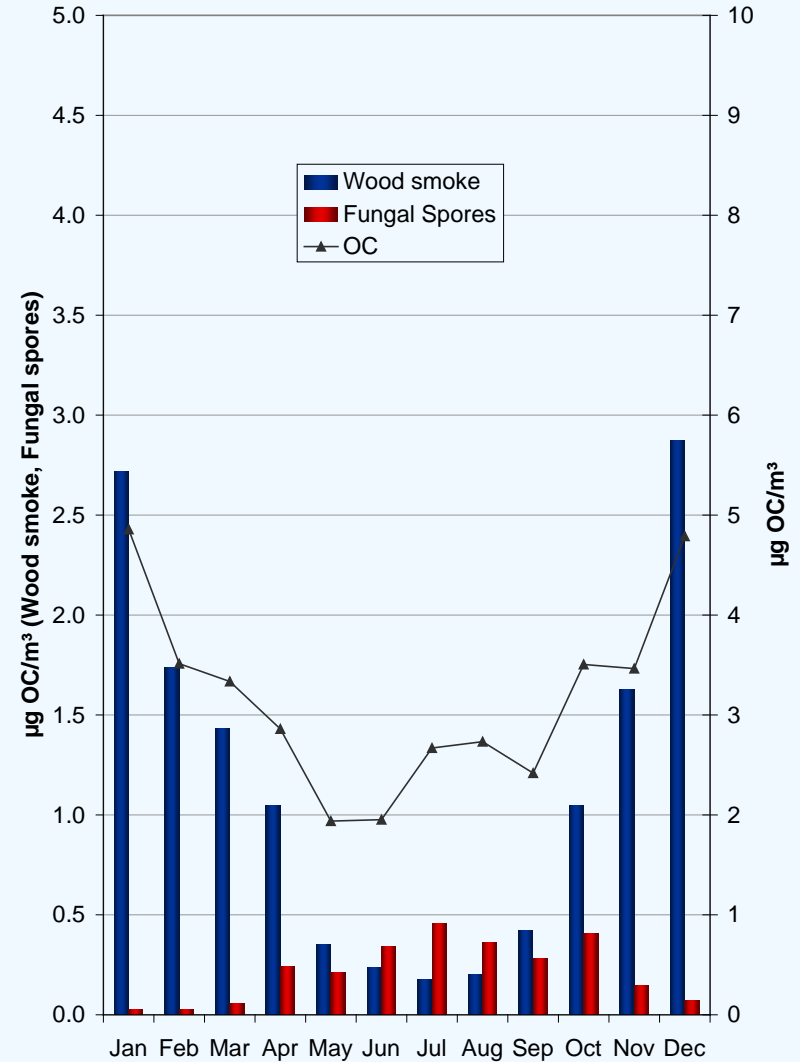


# Annual Trend of OC, Wood Smoke-OC and Fungal Spores-OC in Austria

OC - Urban Areas

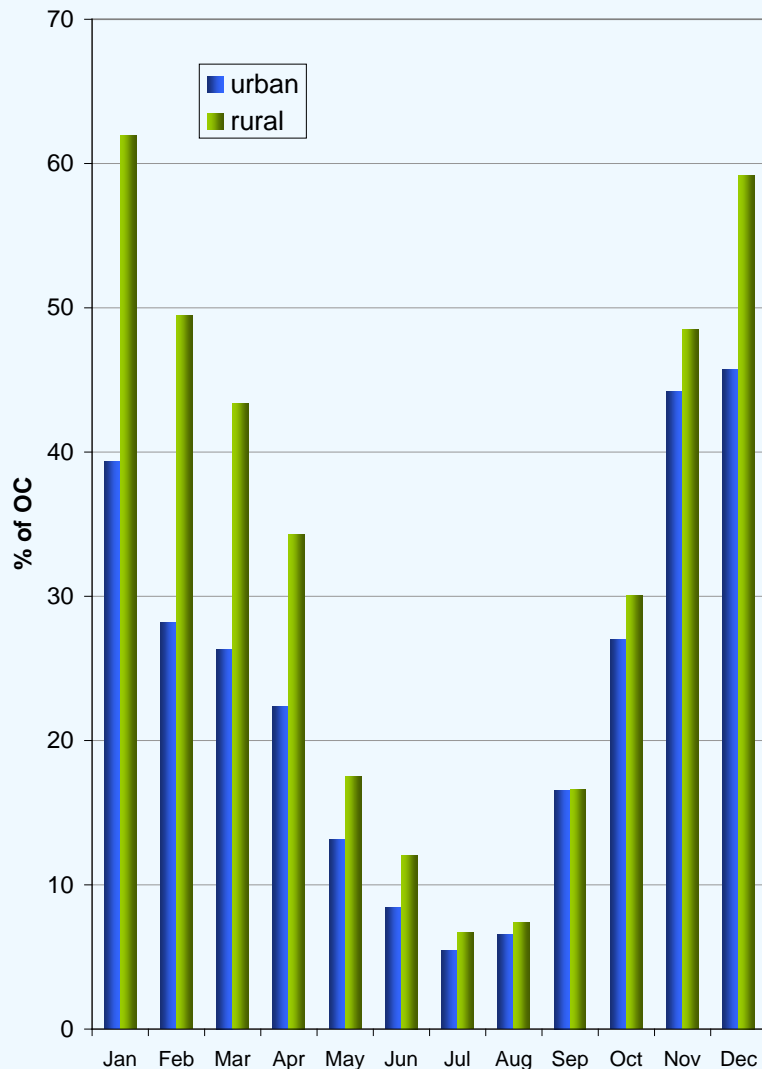


OC Rural Areas

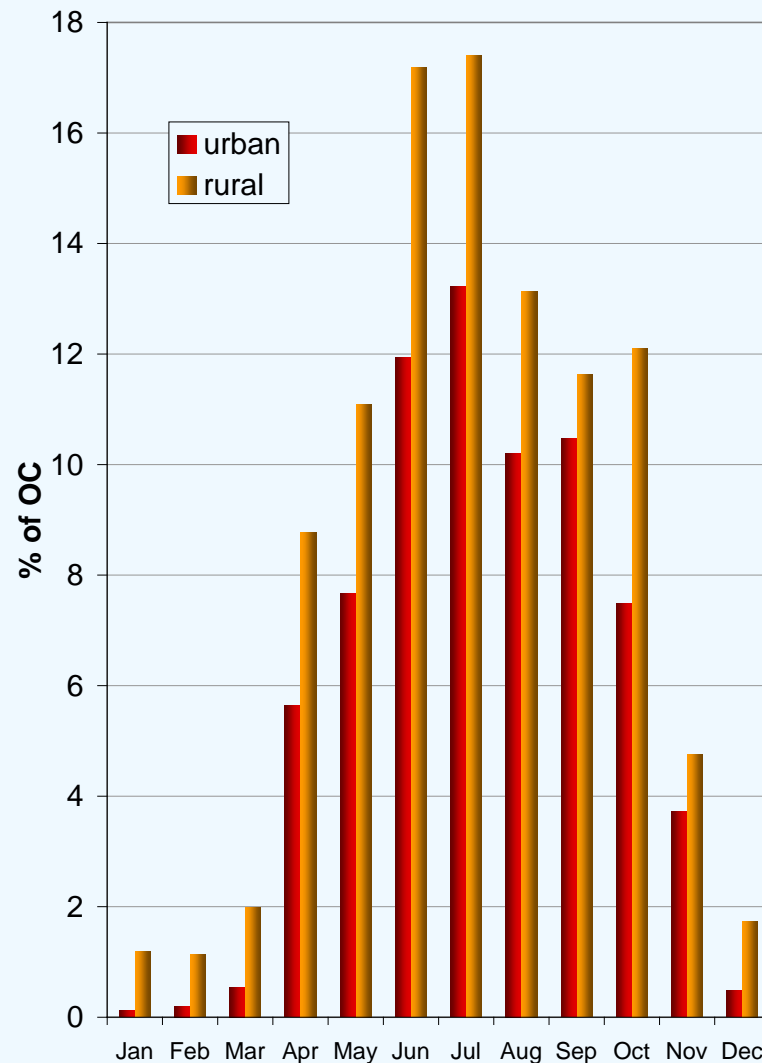


# Annual Trend of Wood Smoke and Fungal Spores in three Cities (Fraction of OC<sub>10</sub>)

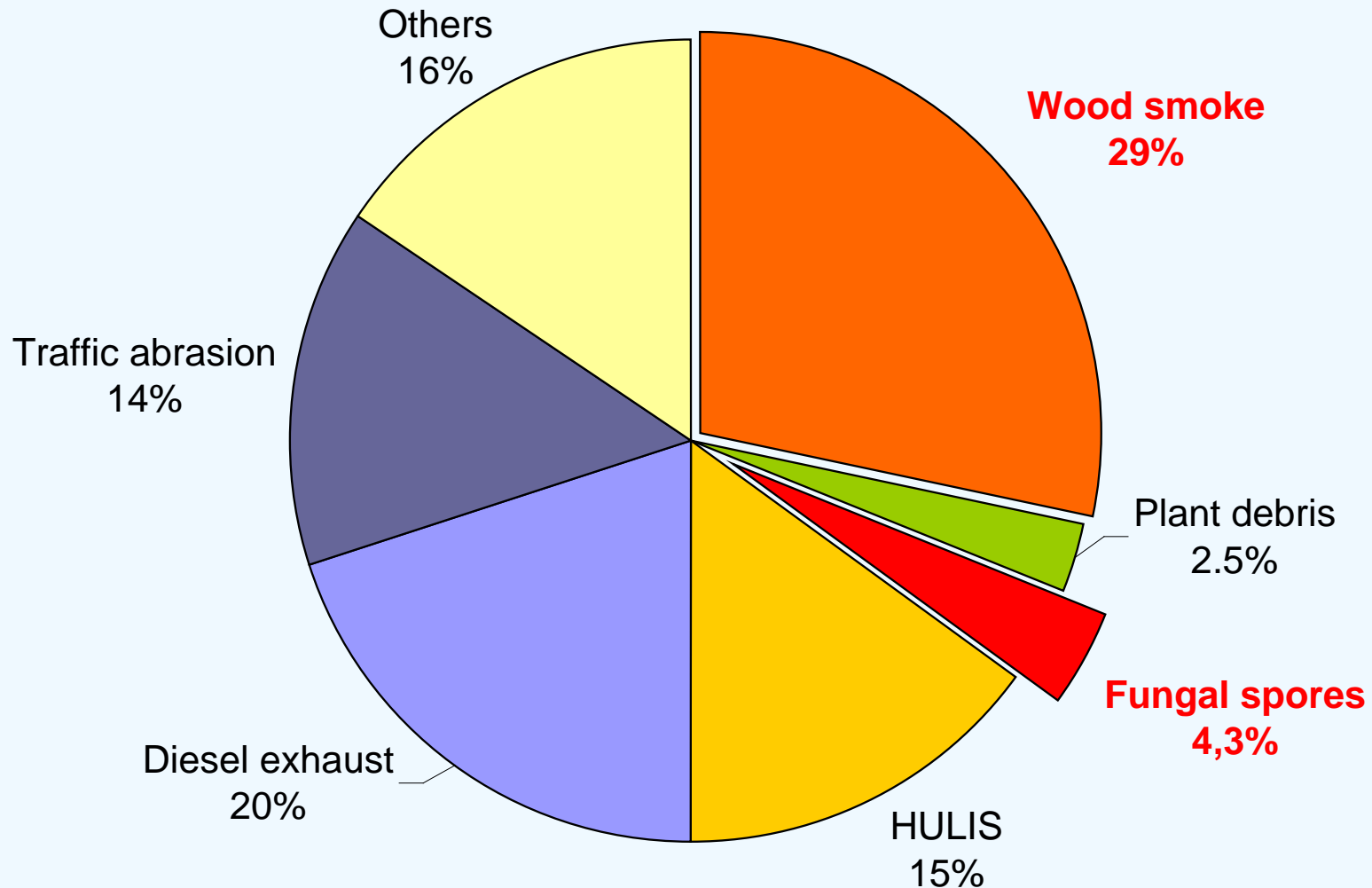
Fraction of Wood Smoke in OC<sub>10</sub>



Fraction of Fungal Spores in OC<sub>10</sub>

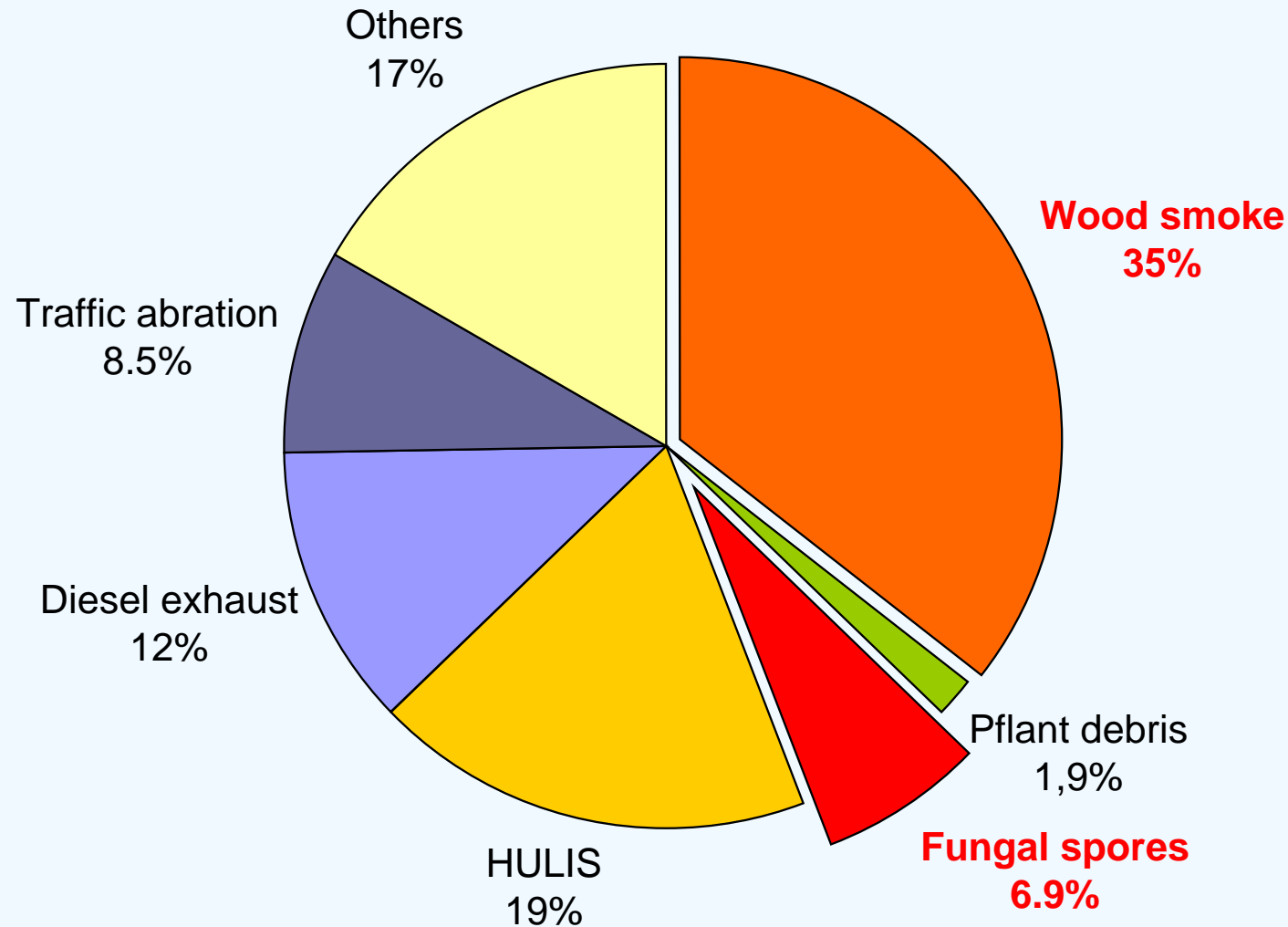


# Organic Carbon Balance (OC<sub>10</sub>) in Austrian Cities, 2004





# Organic Carbon Balance (OC<sub>10</sub>) at rural sites in Austria, 2004





# Summary

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- ✓ Fungal spores form the most important biogenic source for Austrian OC<sub>10</sub> in summer. The average number concentration of fungal spores is 40,000/m<sup>3</sup> or 13% of OC<sub>10</sub> in the cities and around 18% of OC<sub>10</sub> at rural sites. Fungal spores have to be considered as main components of OC<sub>10</sub>
- ✓ Wood smoke from space heating is the most important biogenic aerosol source in Austria in winter. Wood smoke contributes up to 50% to OC<sub>10</sub> in Austrian cities and to more than 60% at rural sites (monthly averages).

# Acknowledgements

➤ M

➤ E



Pharma



view

