# Carbon-14 Measurements at 3 SEARCH Sites in the SE U.S.

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AAAR 2003
Charlotte, NC

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# Carbon is an Important Component of $PM_{2.5}$ in the Southeast

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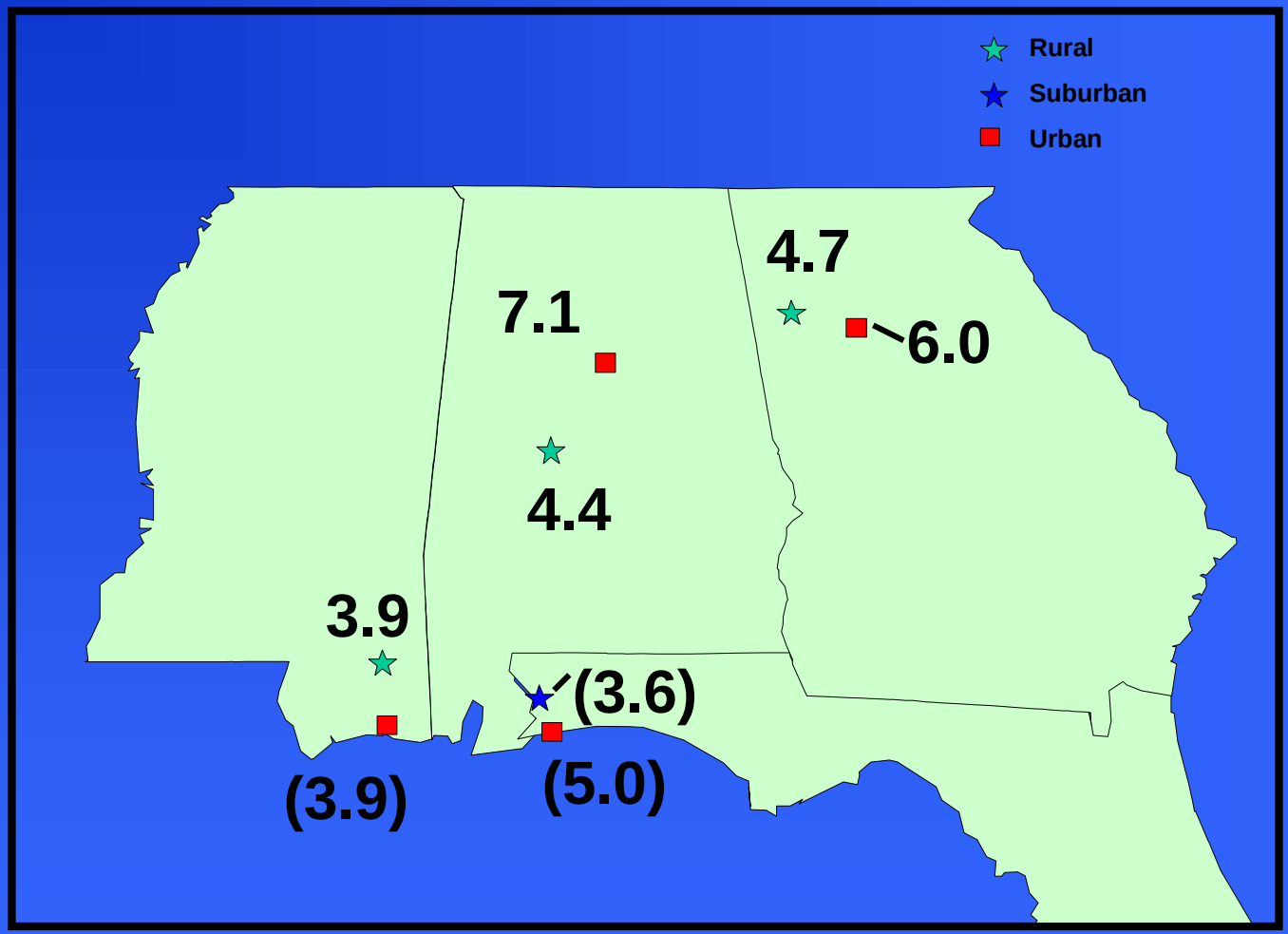
# FRM Equivalent $PM_{2.5}$ Organic Matter at SEARCH Sites ($ug/m^3$) 10/98-9/01




**Note: Project Year Begins 10/1/98, except for PNS, OLF, and OAK (in Parentheses) Begins 10/1/99**

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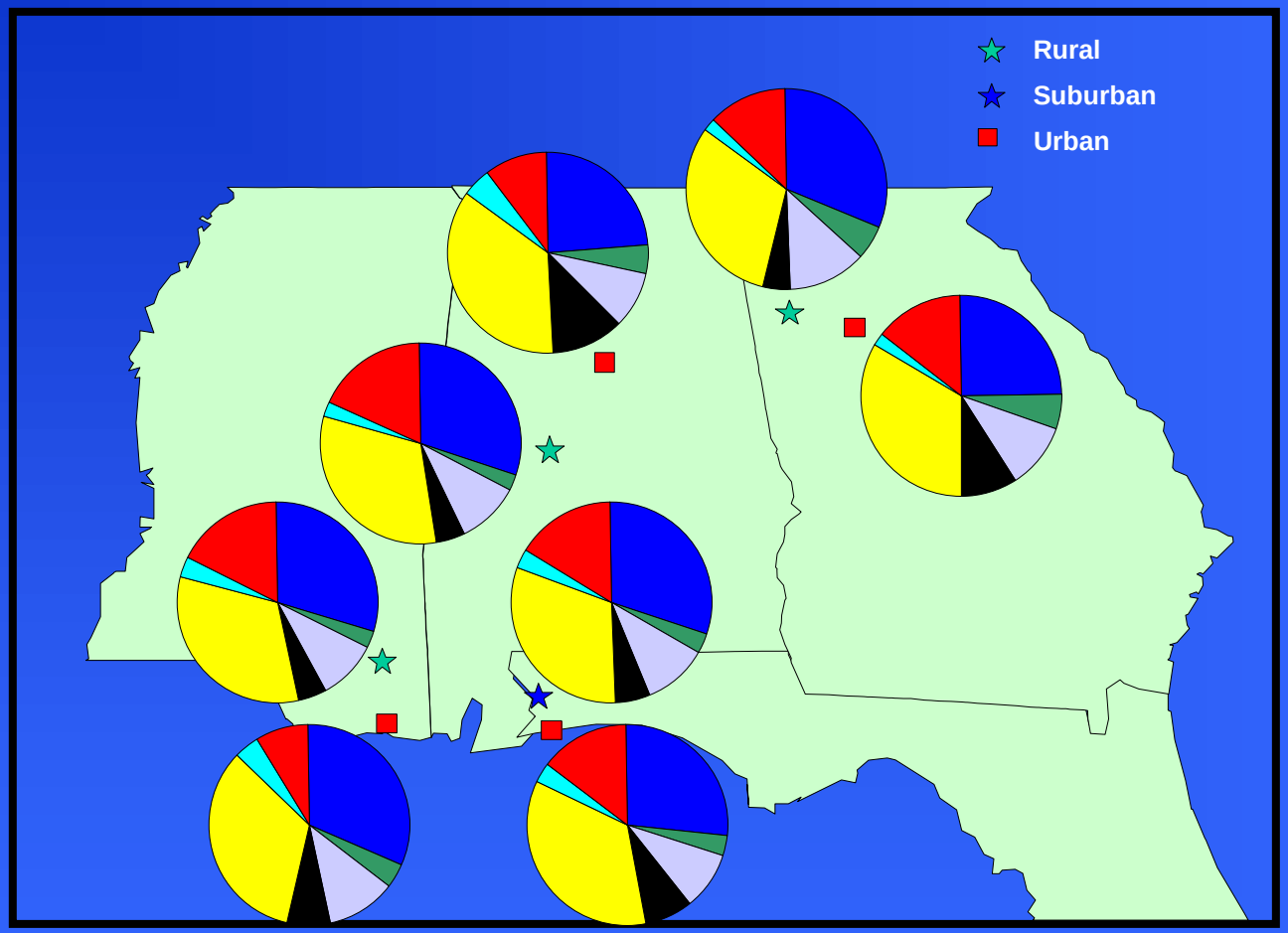
# Best Estimate $PM_{2.5}$ Composition

## 10/98-9/01




Details available at atmospheric-research.com

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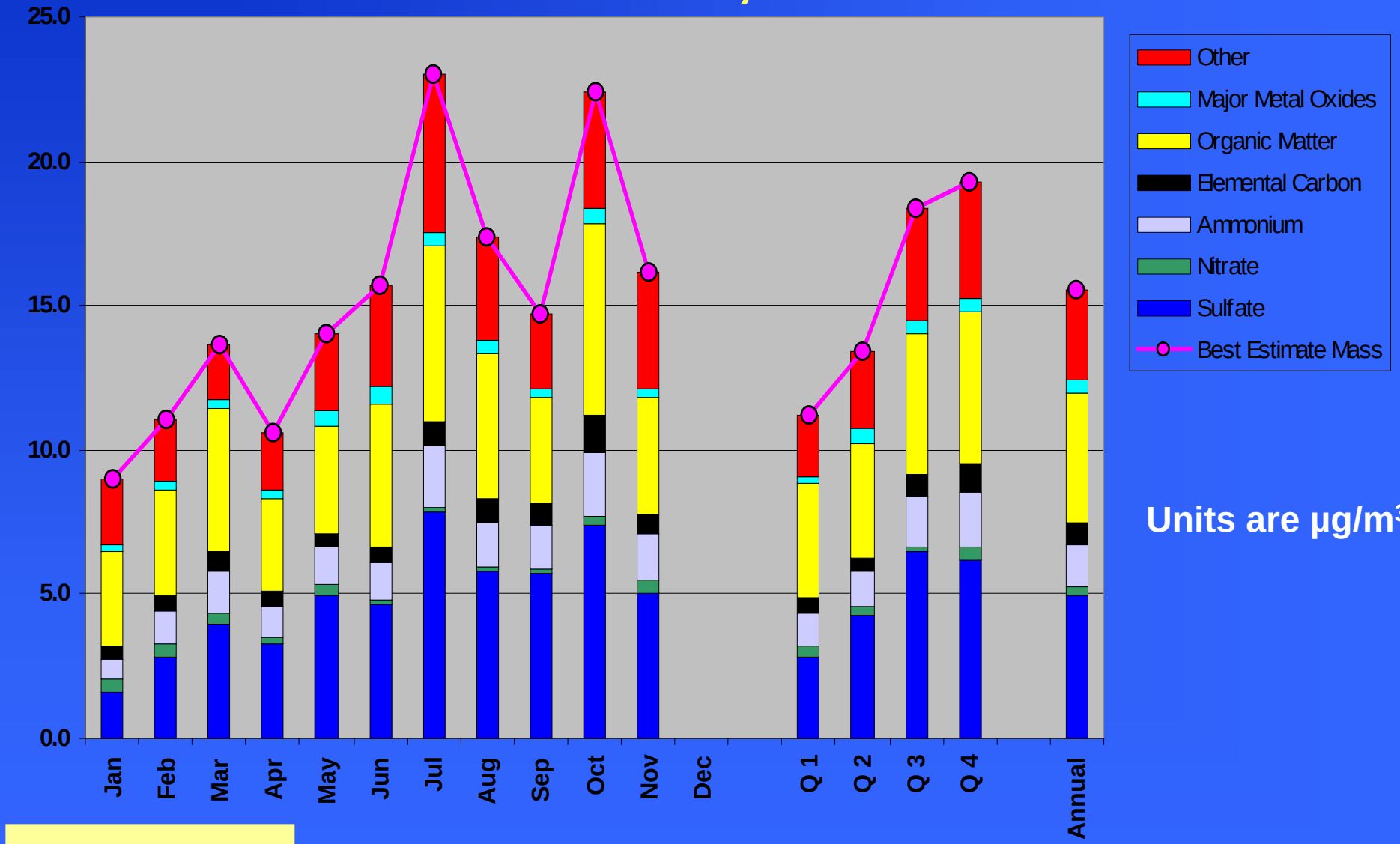
# Best Estimate $PM_{2.5}$ Composition
# Centreville, AL 2000




Units are $\mu g/m^3$

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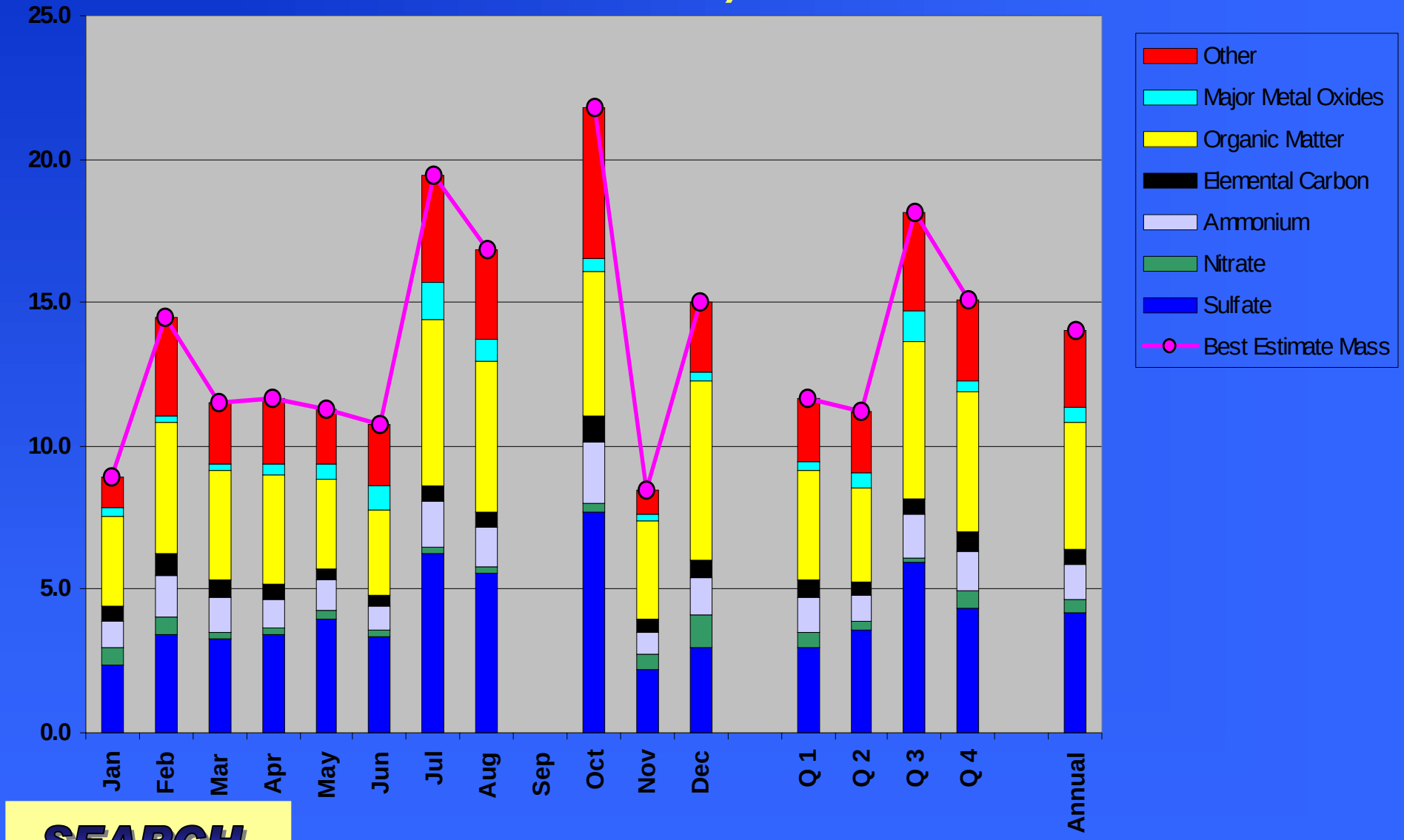
# Best Estimate $PM_{2.5}$ Composition ($ug/m^3$)
# Oak Grove, MS 2000

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# Where do Carbon-14 Measurements fit in?

## Simplified Organic Carbon Source Matrix

| | Primary | Secondary | Total |
|---|---|---|---|
| **Biogenic** | Speciation/CMB* | Speciation, Models, Difference | C-14 |
| **Anthropogenic** | Speciation/CMB* | Speciation, Models, Difference | C-14 |

Zheng et. al., ES&T, 2002; AAAR 2002.

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# Measurement Approach

- 24-hour or 72-hour quartz filter samples (low-vol.)
- Analyze OC/EC via TOR (DRI)
- Analyze C-13 and C-14 via accelerator mass spectrometry (NOSAMS)
- Yorkville, GA
  - 7/9/01-8/5/01 (n=6)
  - 12/22/01-1/27/02 (n=13)
- Jefferson St., Atlanta, GA
  - 7/1/01-8/21/01 (n=12)
  - 11/13/01-1/19/02 (n=15)
- Oak Grove, MS
  - 11/19/01-2/26/02 (n=18)

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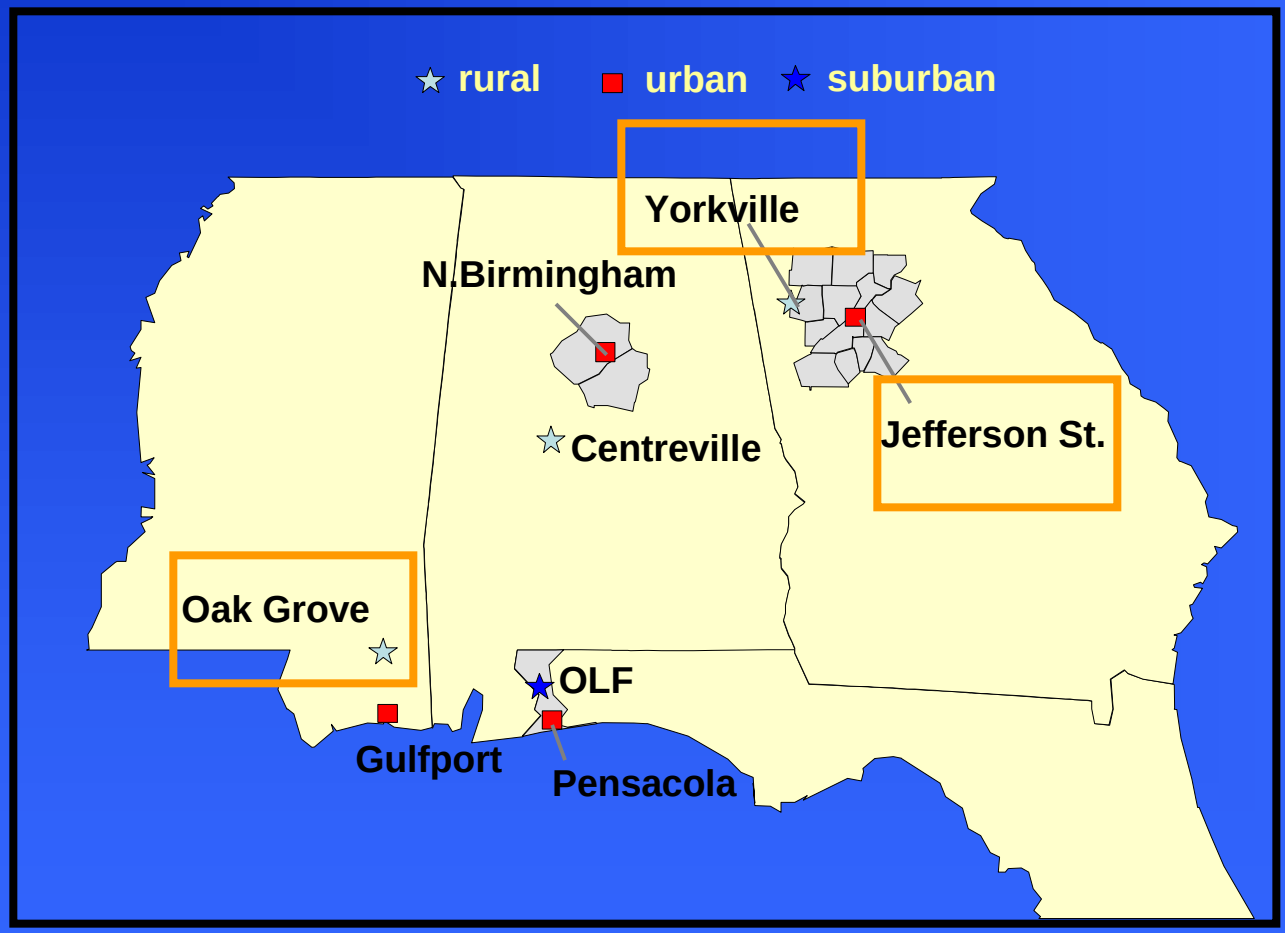
# SEARCH $PM_{2.5}$ Network

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# NOSAMS

National Ocean Sciences Accelerator Mass Spectrometry Facility

www.nosams.whoi.edu

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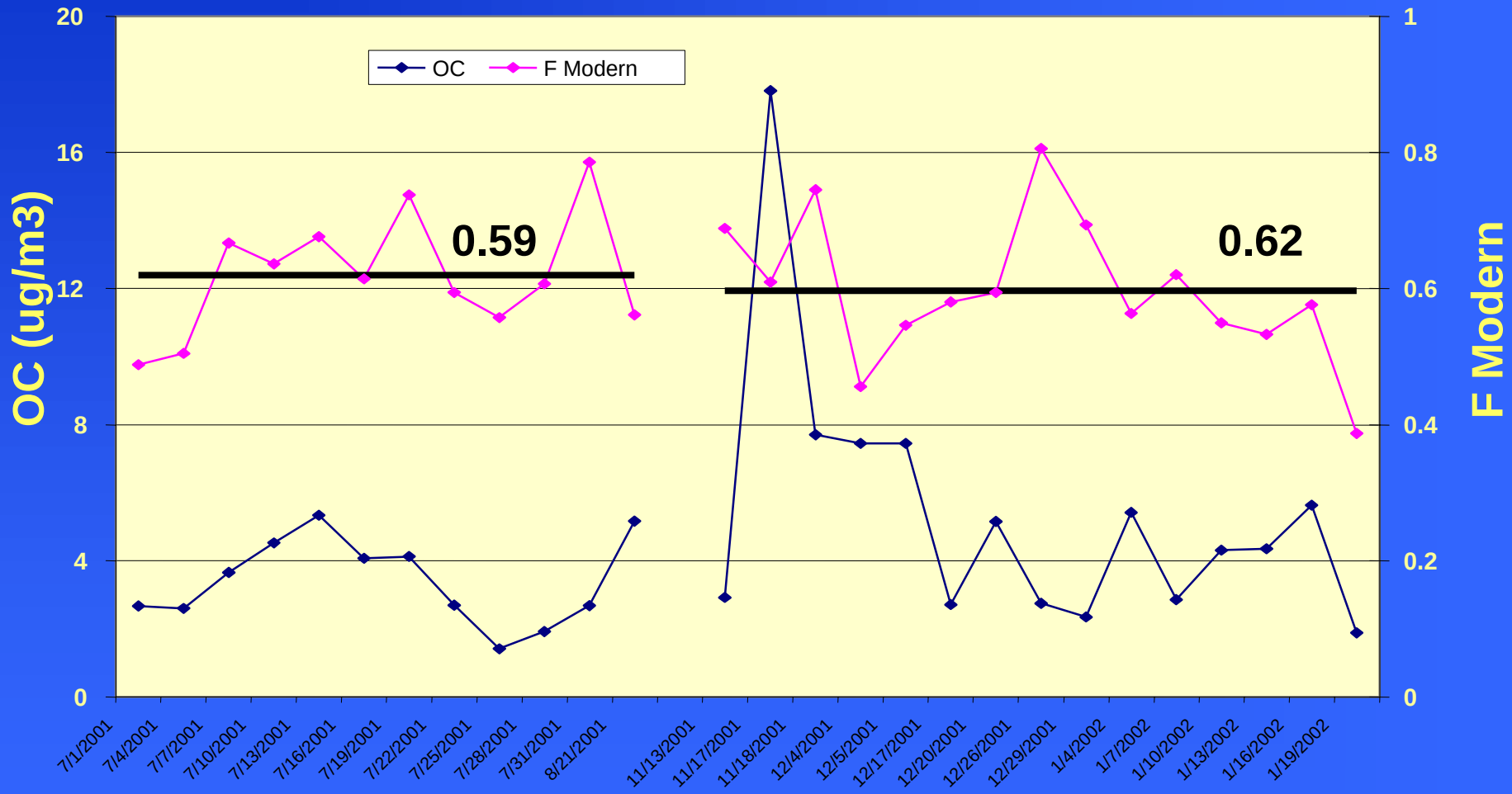
# Carbon-14 and OC Data
# Atlanta, GA (JST)

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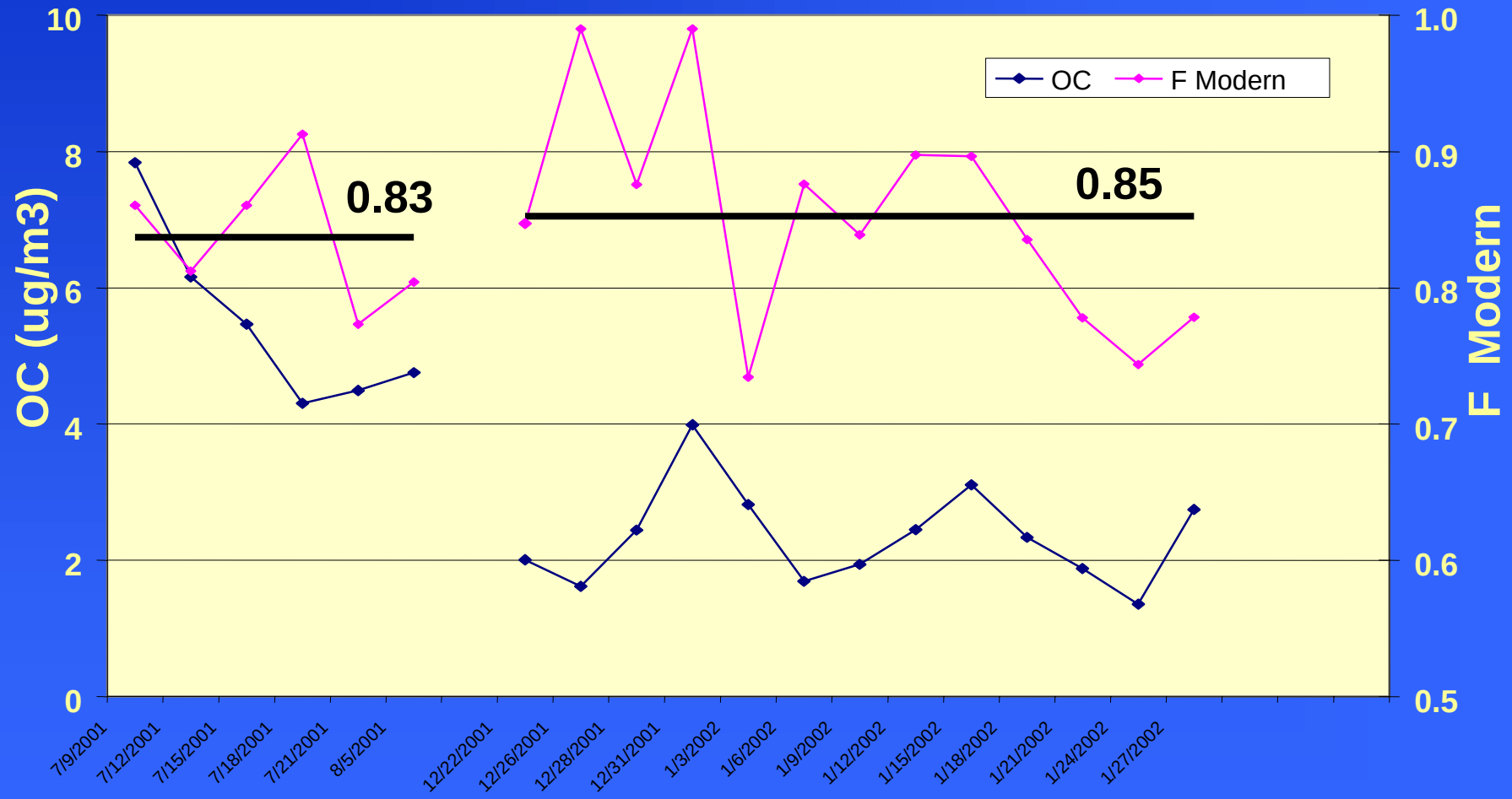
# Carbon-14 and OC Data
# Yorkville, GA

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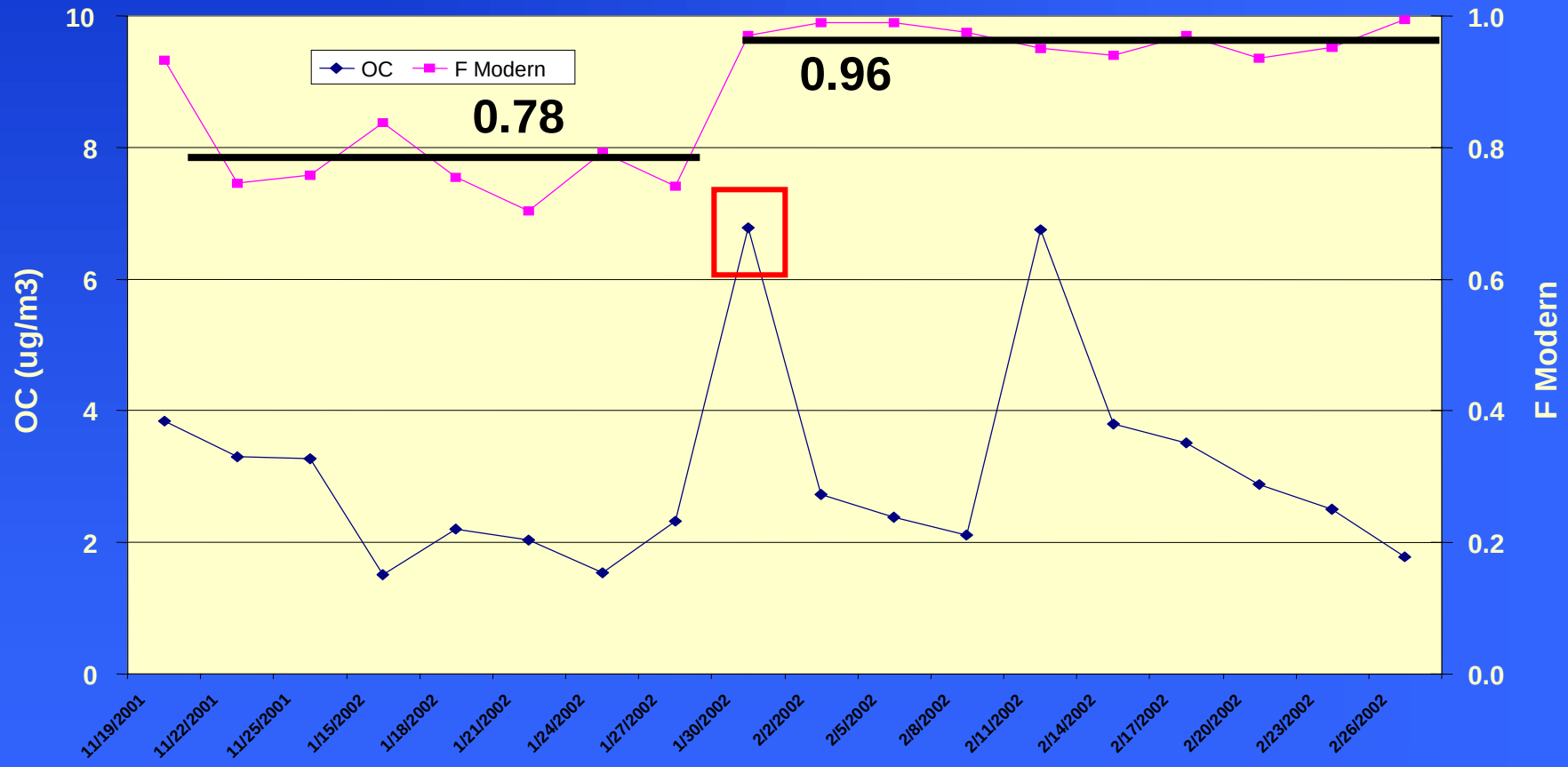
# Carbon-14 and OC Data
# Oak Grove, MS

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# Oak Grove, MS
# Biomass Burning Event

- January 31, 2002
- FRM Mass – 67.1 ug/m3
- 24-Hour TEOM Mass – 66.2 ug/m3
- Anecdotal Reports of Wood Smoke

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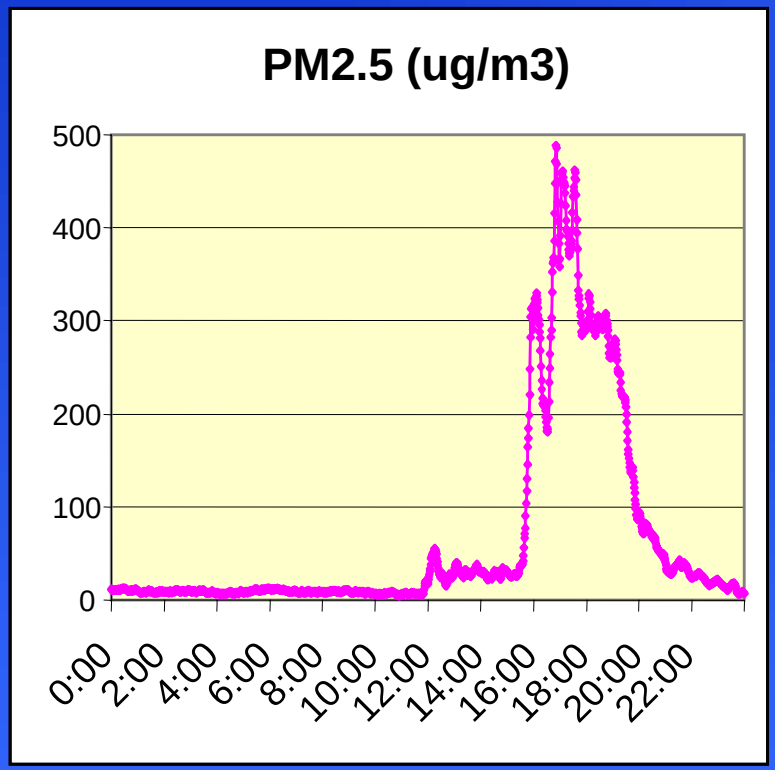
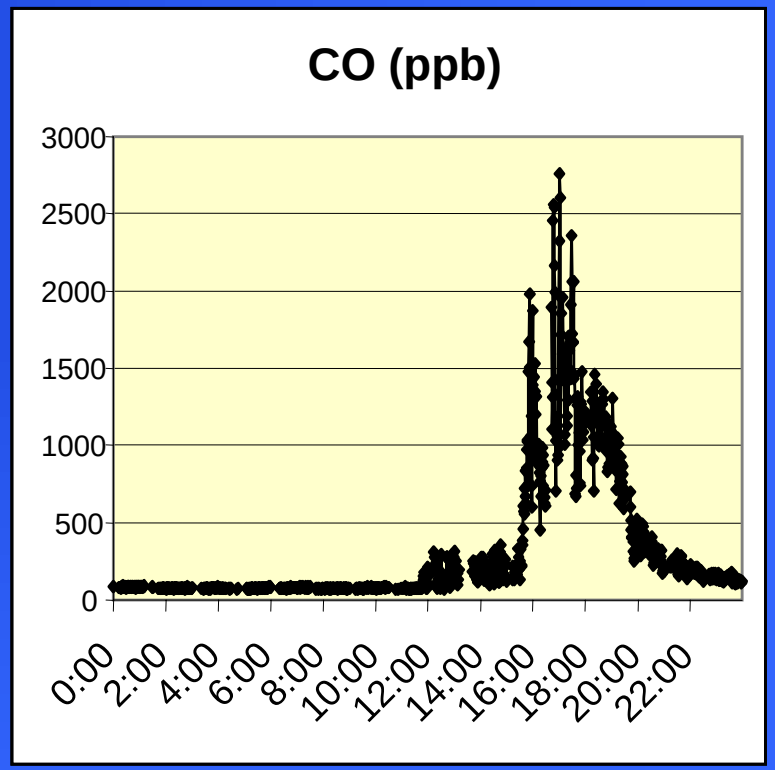
# Time Series of PM2.5 and CO
## Oak Grove 1/31/02

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# Oak Grove Event – 1/31/02

- Gas and Particle data together are diagnostic of biomass burning
- Continuous Speciation Data Suggest
  - 8% Black Carbon
  - <1% SO4
  - <1 % NO3
  - 2% NH4
  - >88% Organic Matter + Water

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# OC Source Matrix
# Atlanta, GA – July 2001

| | Primary | Secondary | Total |
|---|---|---|---|
| **Biogenic** | <5* | >50 | 59 +/-5 |
| **Anthropogenic** | 40* | <5 | 41 +/-5 |

* Zheng et al. Source Apportionment of Fine Particles at Atlanta, GA

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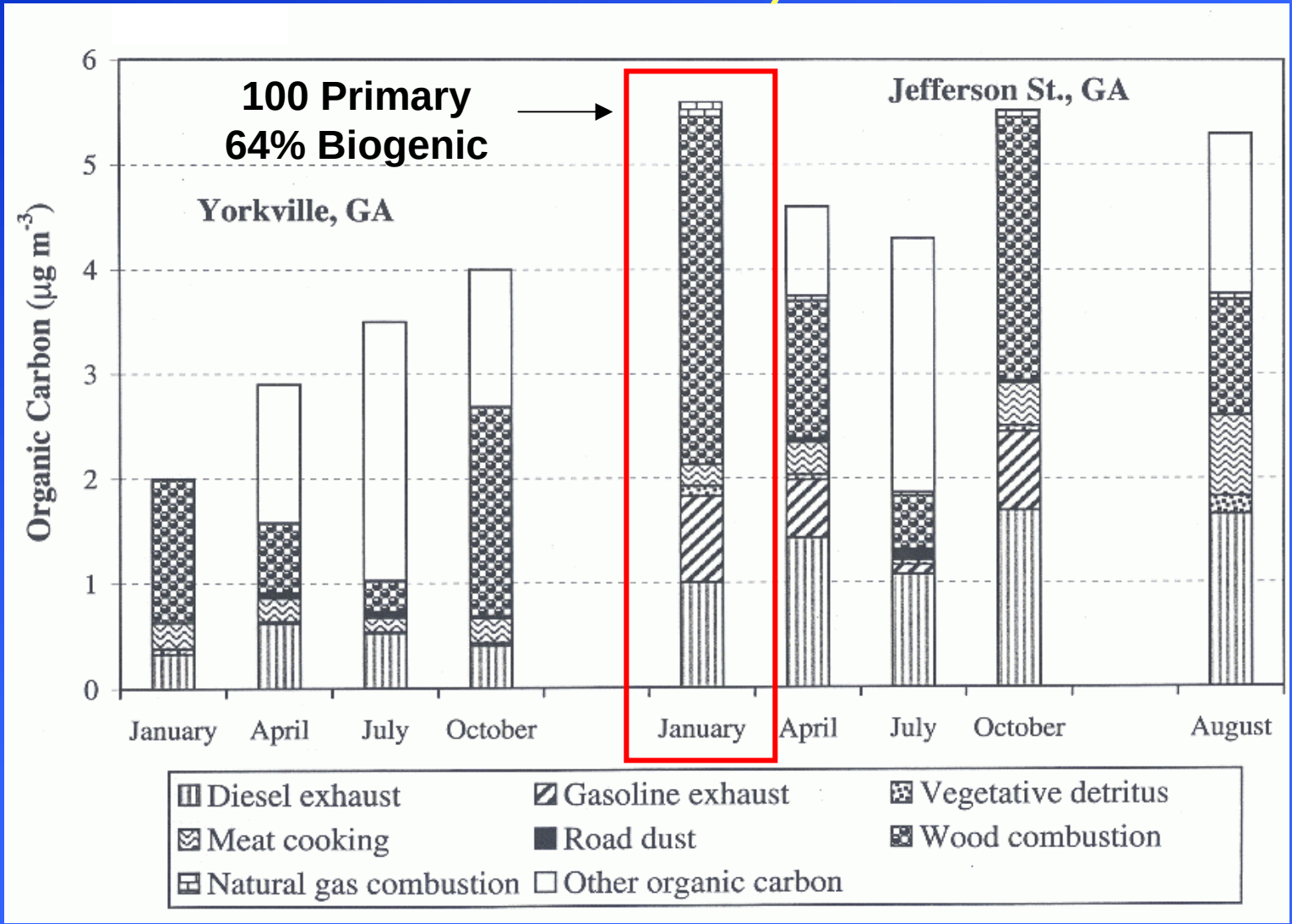
# Source Contributions of OC in Fine Particles, 1999

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Zheng et al. ES&T, 2002.

# OC Source Matrix
# Atlanta, GA – January 2002

| | Primary | Secondary | Total |
|---|---|---|---|
| **Biogenic** | 64* | <5 | 61 +/-5 |
| **Anthropogenic** | 36* | <5 | 39 +/-5 |

* 1999 Data: Zheng et al., ES&T, 2002.

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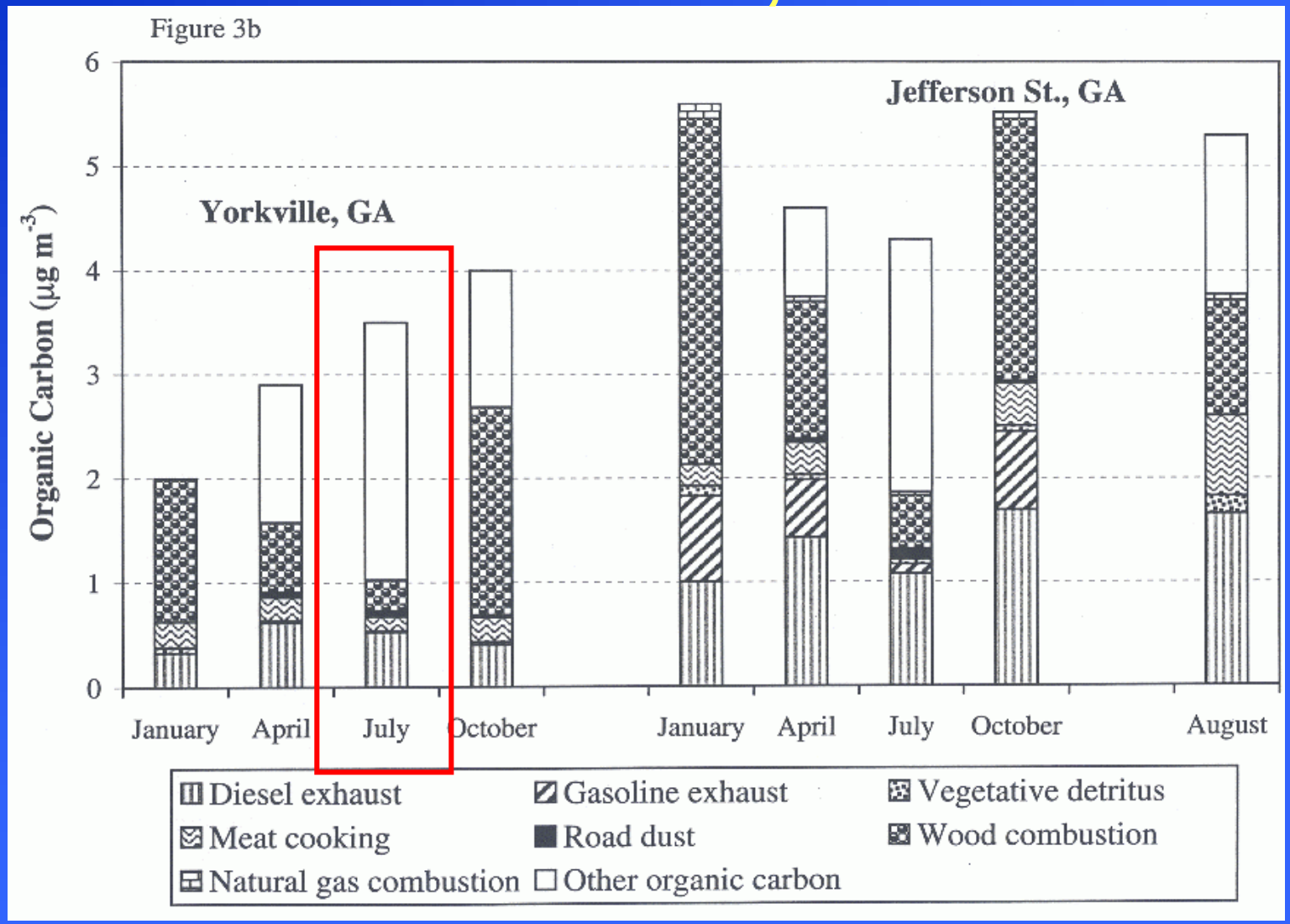
# Source Contributions of OC in Fine Particles, 1999

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Zheng et al. ES&T, 2002.

# OC Source Matrix
# Yorkville, GA – July 2002

| | Primary | Secondary | Total |
|---|---|---|---|
| **Biogenic** | 18* | 65 | 83 +/-6 |
| **Anthropogenic** | 20* | <5 | 17 +/-5 |

* 1999 Data: Zheng et al. ES&T, 2002.

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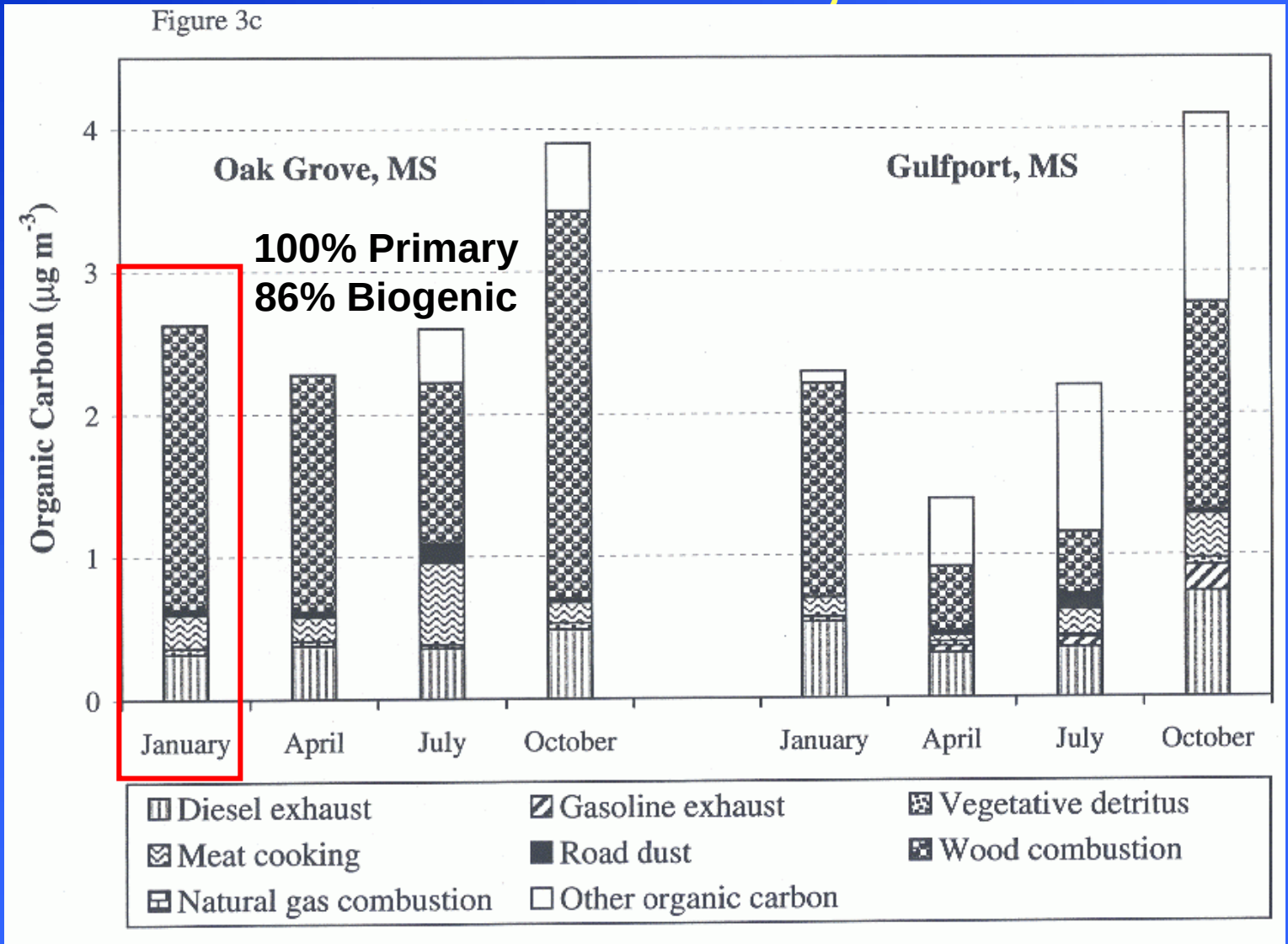
# Source Contributions of OC in Fine Particles, 1999

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Zheng et al. ES&T, 2002.

# OC Source Matrix
# Oak Grove, MS – February 2002

| | Primary | Secondary | Total |
|---|---|---|---|
| **Biogenic** | 86* | <10 | 95 +/-5 |
| **Anthropogenic** | 14* | <5 | 5 +/-5 |

* 1999 Data: Zheng et al. ES&T, 2002.

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# Summary & Conclusions

- Approximately 65 samples from 3 sites and 3 seasons collected and analyzed for OC/EC and C-14.
- F Modern ranged from 0.38 (JST) to 0.98 (YRK, OAK).
- Average F Modern was 0.62, 0.84 and 0.86 at JST, YRK and OAK, respectively, indicating predominance of biogenic OC.
- No evidence of strong summer/winter seasonality, but an interesting step observed at OAK (January 2002).
- Combination with other techniques may lead to valuable insights (complete OC Matrix).

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