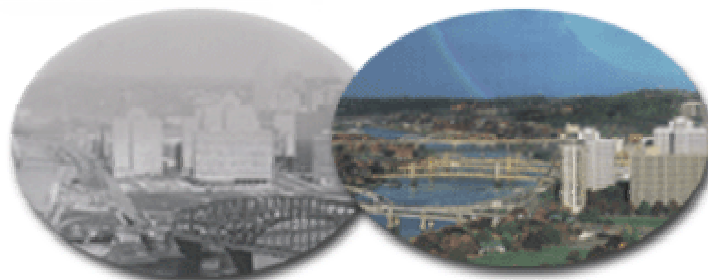


CHARACTERIZATION OF THE ORGANIC FRACTION OF ATMOSPHERIC AEROSOLS



Carnegie Mellon University
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SPECIES CONTRIBUTIONS TO PM MASS CONCENTRATIONS

- The **concentration of particulate organics** is generally estimated by multiplying the measured concentration of **organic carbon (OC)** by a factor of **1.2 to 1.4**.
- This factor, which is an estimate of the **average molecular weight (OM) per carbon weight for the organic aerosol (OM/OC)**, stems from very limited studies conducted during the 1970s (*Grosjean and Friedlander, 1975*).
- Recent investigations suggest that 1.4 is the lowest reasonable estimation for the OM/OC value for an **urban aerosol**, and that 1.4 does not accurately represent the OM/OC value for a **non-urban aerosol** (*Turpin and Lim, 2001*).

SPECIES CONTRIBUTIONS TO PM MASS CONCENTRATIONS

- Based on a recent literature review (*Turpin and Lim, 2001*), ratios of **1.6 for urban aerosols** and **2.1 for non-urban aerosols** appear to be more accurate (non-urban aerosols tend to be more oxygenated).

COMPOUND CLASS	MWt/CWt
<i>n-Alkanes (C23-C34)</i>	1.2
<i>Aliphatic dicarboxylic acids (C2-C9)</i>	1.7 – 3.8
<i>Multifunctional aliphatic acids (C3-C6)</i>	2.5 – 3.1
<i>Aromatic polycarboxylic acids (C8-C10)</i>	1.7 – 2.1
<i>PAHs (C6-C24)</i>	1.0 – 1.1
<i>Carbonyls (C2)</i>	2.4
<i>Sugars (levoglucosan, C6)</i>	2.3

Rogge et al., 1993, Schauer, 1998, Saxena and Hildeman, 1996)

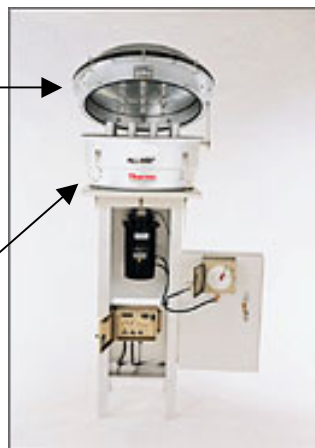
OBJECTIVES

- Development of an **analytical methodology** to characterize the organic component of the atmospheric aerosols.
- Estimation of the organic molecular weight per carbon weight ratio for the Pittsburgh area (**OM/OC ratio**).
- **Qualitative analysis** of the different fractions of the organic PM.

DETERMINATION OF OM/OC FOR THE PAQS SAMPLES

24-hour samples (July 2001-August 2002)

PM_{2.5}
Inlet



8"×10"
baked QFF

65 samples were
selected throughout the
year...



• OC

...sonicated for 15min in a
mixture of **HEXANE**,
DICHLOROMETHANE, and
ACETONE (1:1:2)...



...and **Soxhlet extracted** in
the same mixture of solvents



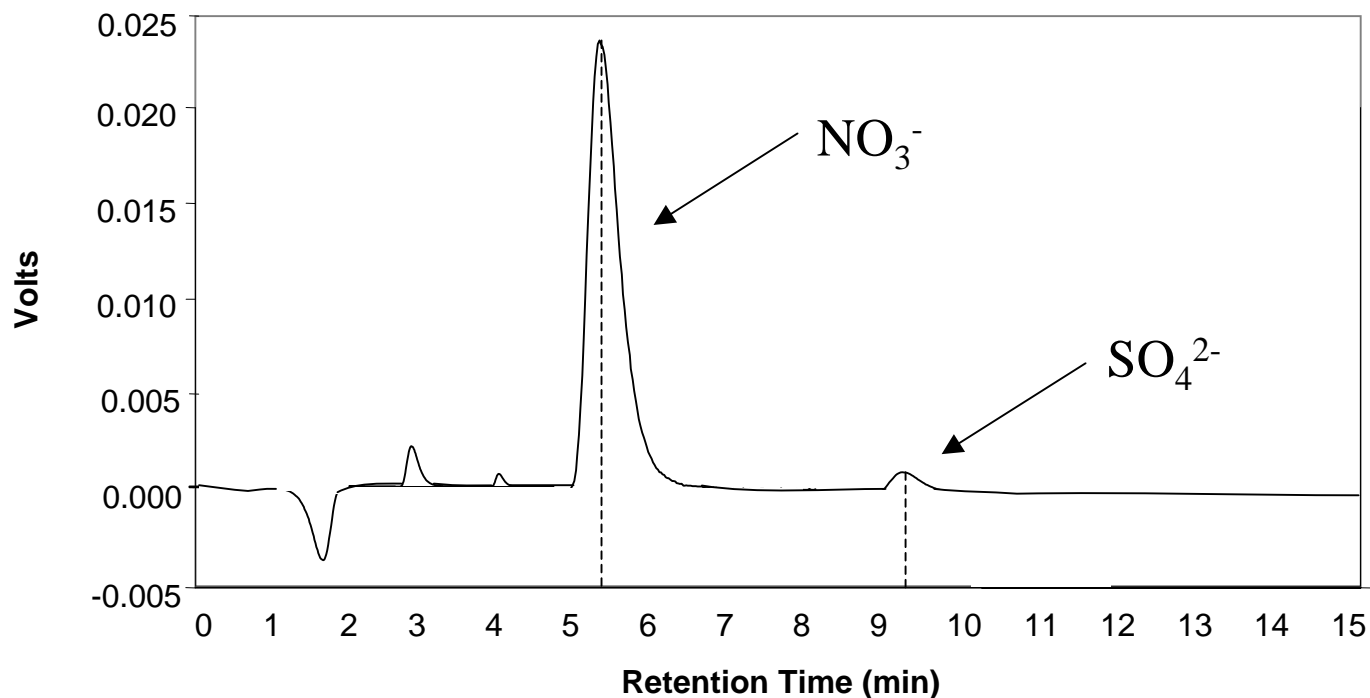
The extracts were
filtered...



...and applied on the top of a
glass column packed with
Silica Gel

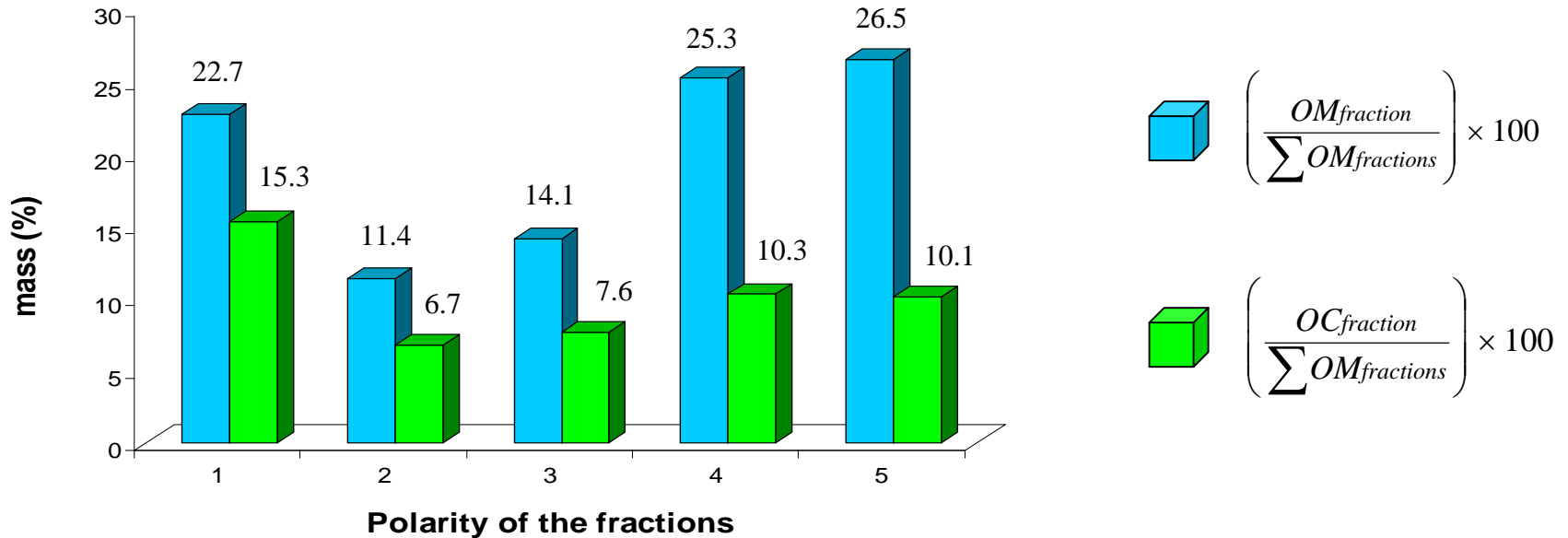
DETERMINATION OF OM/OC FOR THE PAQS SAMPLES

- All extracts/fractions were also analyzed by **ion-chromatography (IC)** to determine the amount of inorganic species present in each extract/fraction.



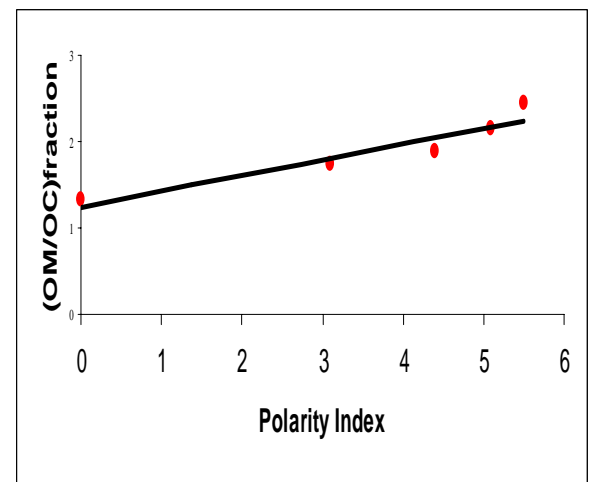
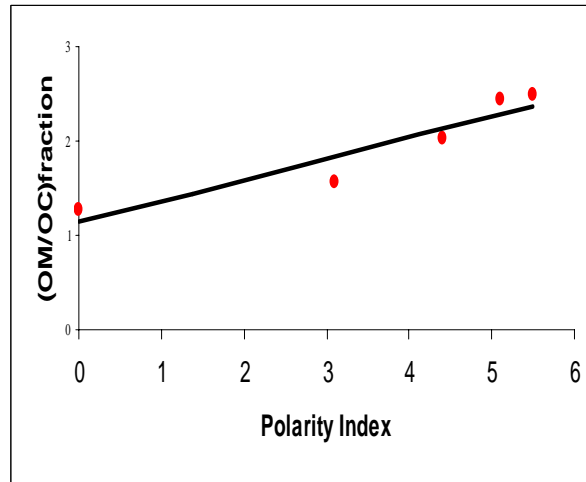
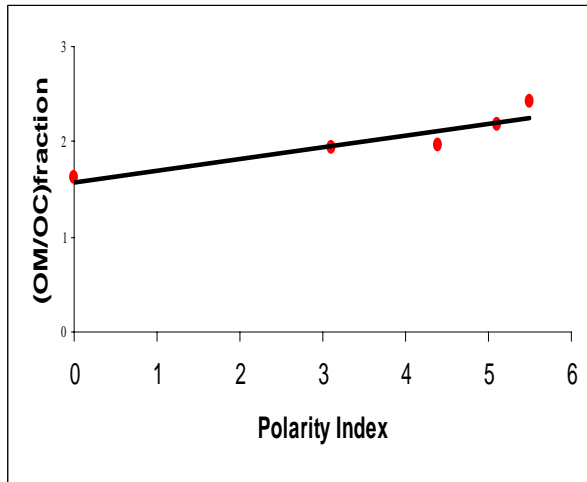
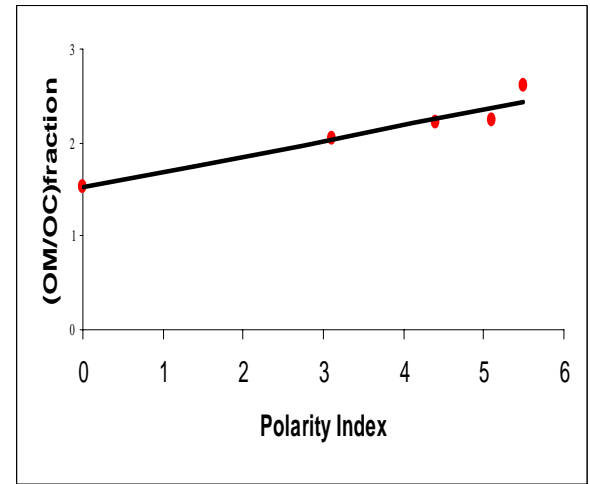
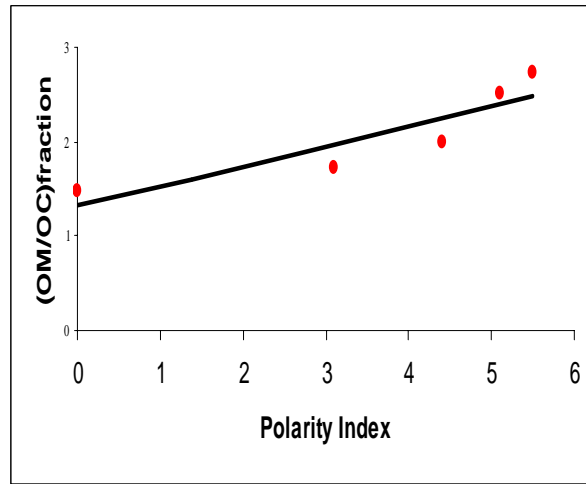
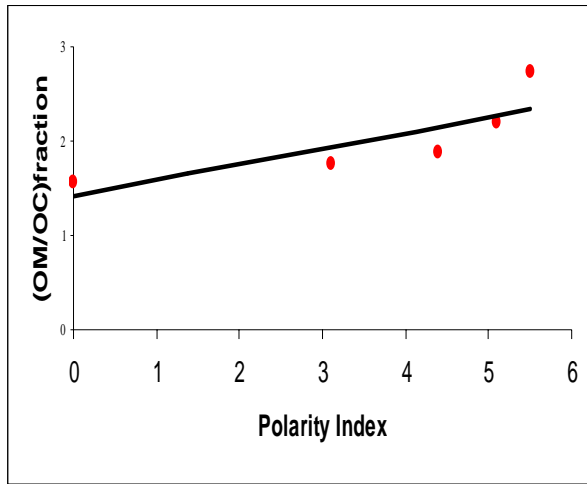
- $(\text{OM})_{\text{extract/fraction}} = (\text{OM}_{\text{extract/fraction}} - \text{OM}_{\text{blank}} - \text{inorganics})$
- $(\text{OC})_{\text{extract/fraction}} = (\text{OC}_{\text{extract/fraction}} - \text{OC}_{\text{blank}})$

THE DIFFERENT FRACTIONS



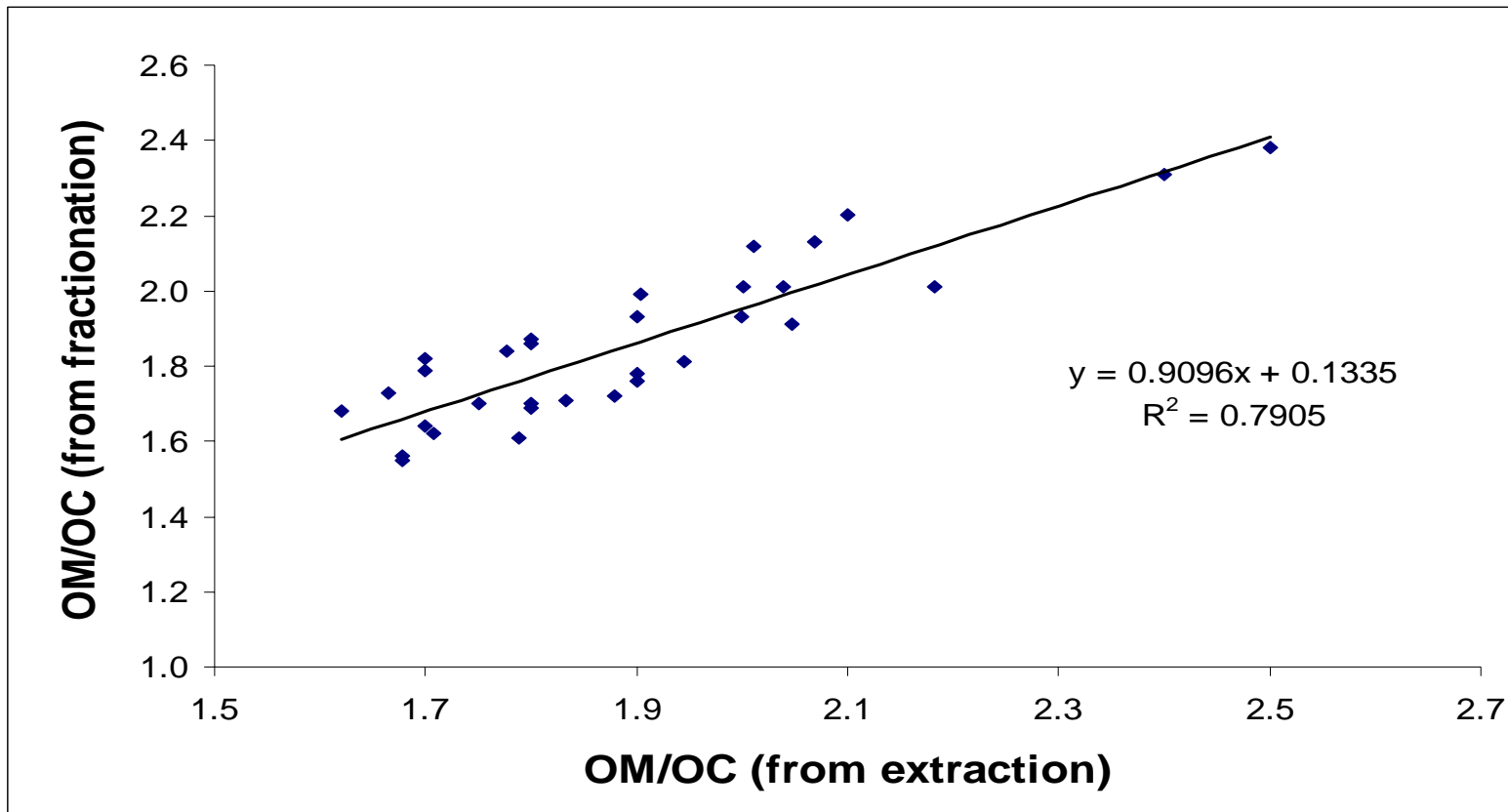
- The mass percentage of the **acetone-soluble** and the **methanol-soluble fractions** (4+5) varied between **45** and **74%**.
- The mass percentage of the **dichloromethane-soluble** and the **ethylacetate-soluble fractions** (2+3) varied between **7** and **35%**.
- The mass percentage of the **hexane-soluble fraction** (1) varied between **25** and **46%**.

THE DIFFERENT FRACTIONS



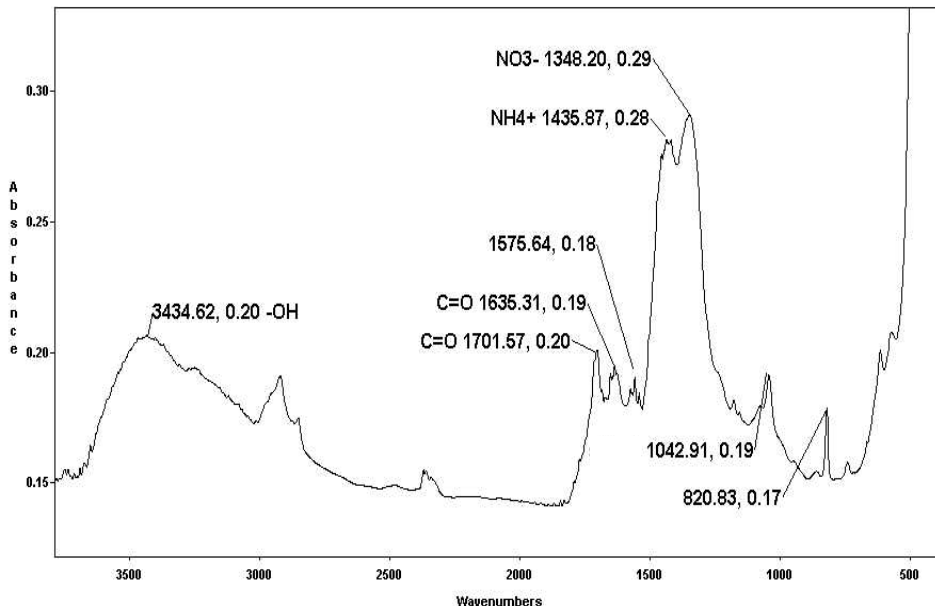
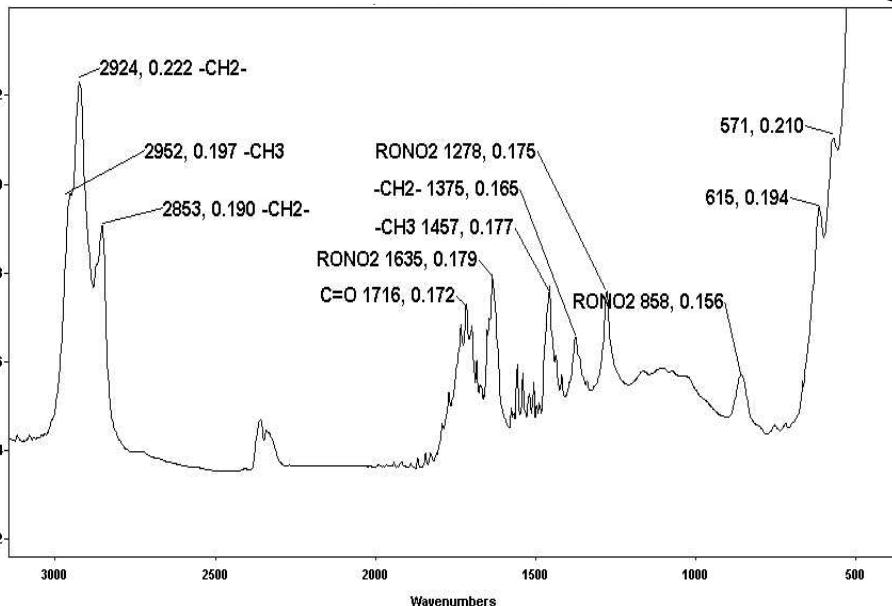
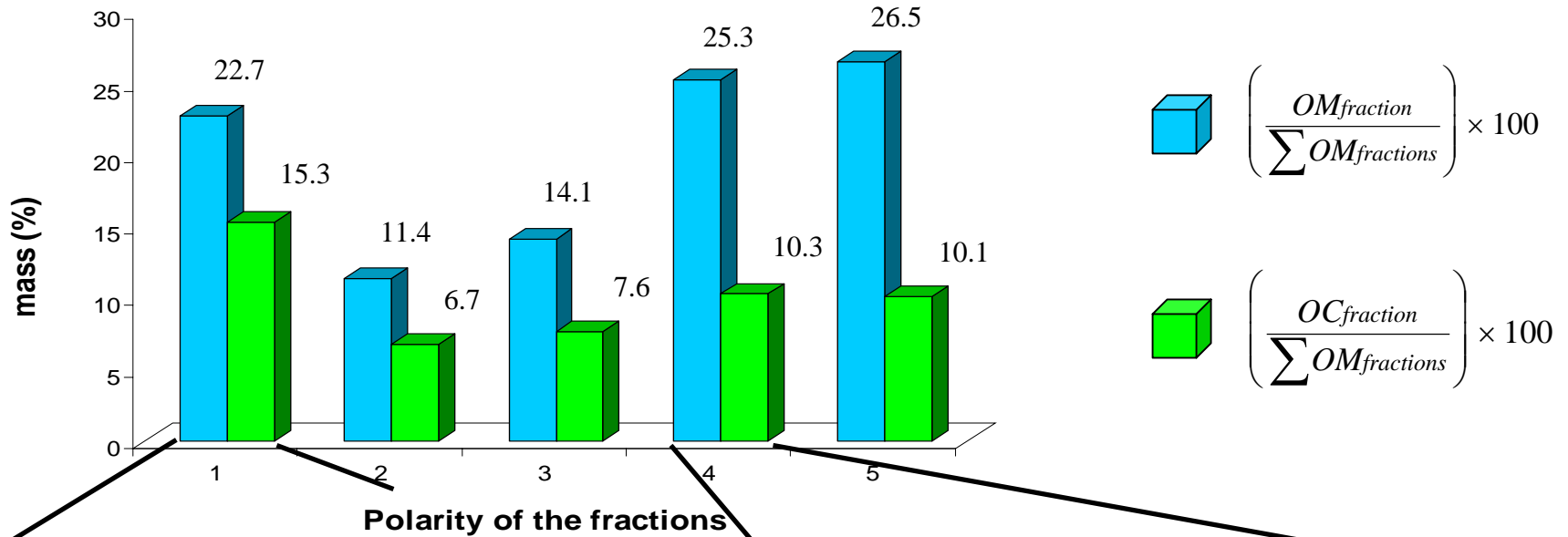
- The results confirm that **OM/OC increases with the polarity of the fraction** (the most polar compounds tend to be more oxygenated).

THE DIFFERENT FRACTIONS

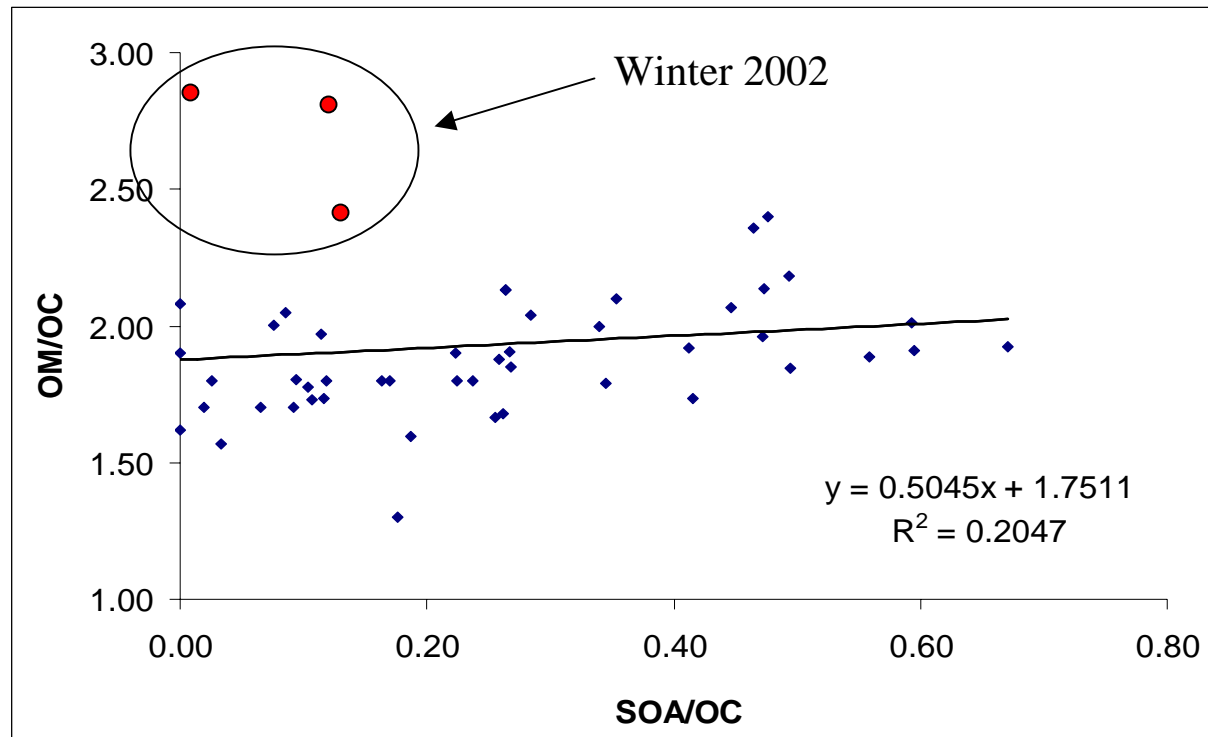


- **Two independent OM/OC estimates** were obtained for each sample: one estimate from the **analysis of the extracts** and one estimate from the **analysis of the fractions**. These independent OM/OC estimates are in good agreement.

THE DIFFERENT FRACTIONS



THE OM/OC VALUES



- OM/OC seems to be positively correlated with the amount of **secondary OC** estimated during PAQS (*Cabada et al.*, 2004, *Polidori et al.*, in preparation). However, the variation of OM/OC may also be affected by **other factors** (e.g. wood smoke production).

CONCLUSIONS

- The **average OM/OC** ratio for the Pittsburgh area was estimated to be **1.9**
- The lowest estimated OM/OC value was **1.3** and the highest was **2.8**
- Between **45** and **74%** of OM was in the two **most polar fractions**
- OM/OC seems to be positively correlated with the amount of **secondary OC** estimated during PAQS

ACKNOWLEDGEMENTS

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