# Cold cloud formation potential and micro-spectroscopic analysis of individual ice nuclei from aerosols collected during CARES

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# Water Uptake, Immersion and Deposition Freezing for Particles Collected During CARES

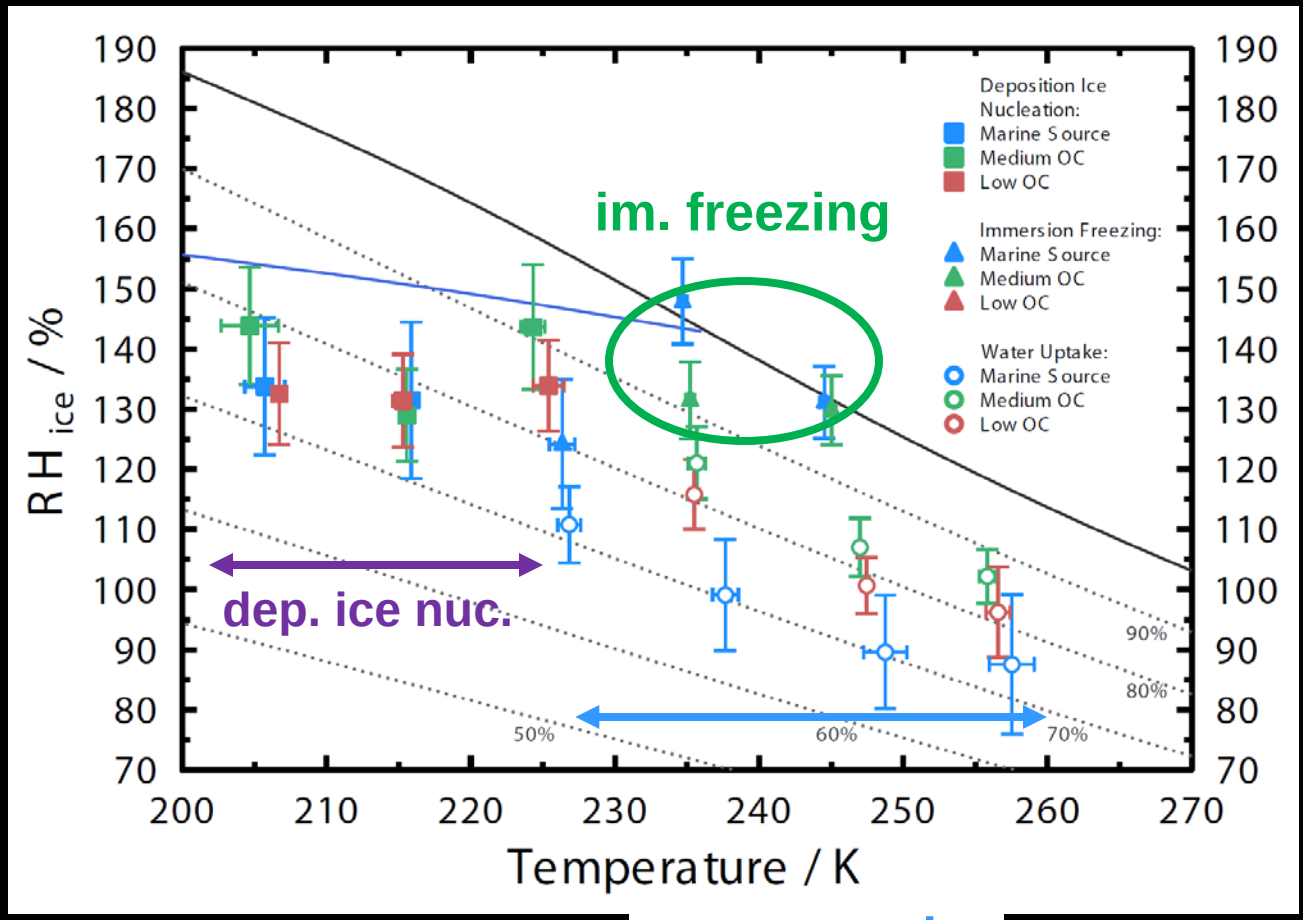
70 identified IN

Median IN diameter:

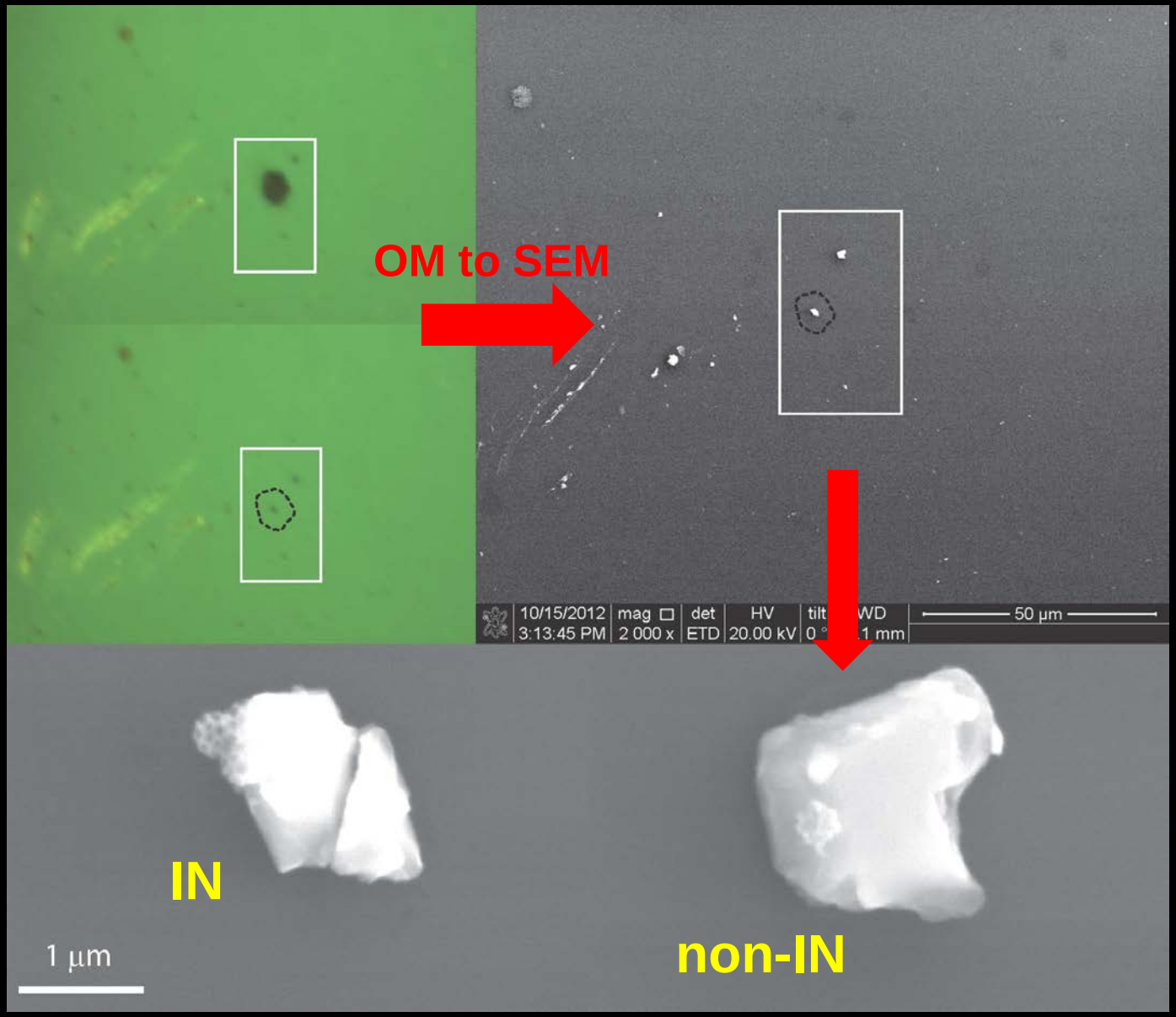
Marine Source
(6/28/2010) – 3.8 µm

Medium OC
(6/28/2010) – 0.84 µm

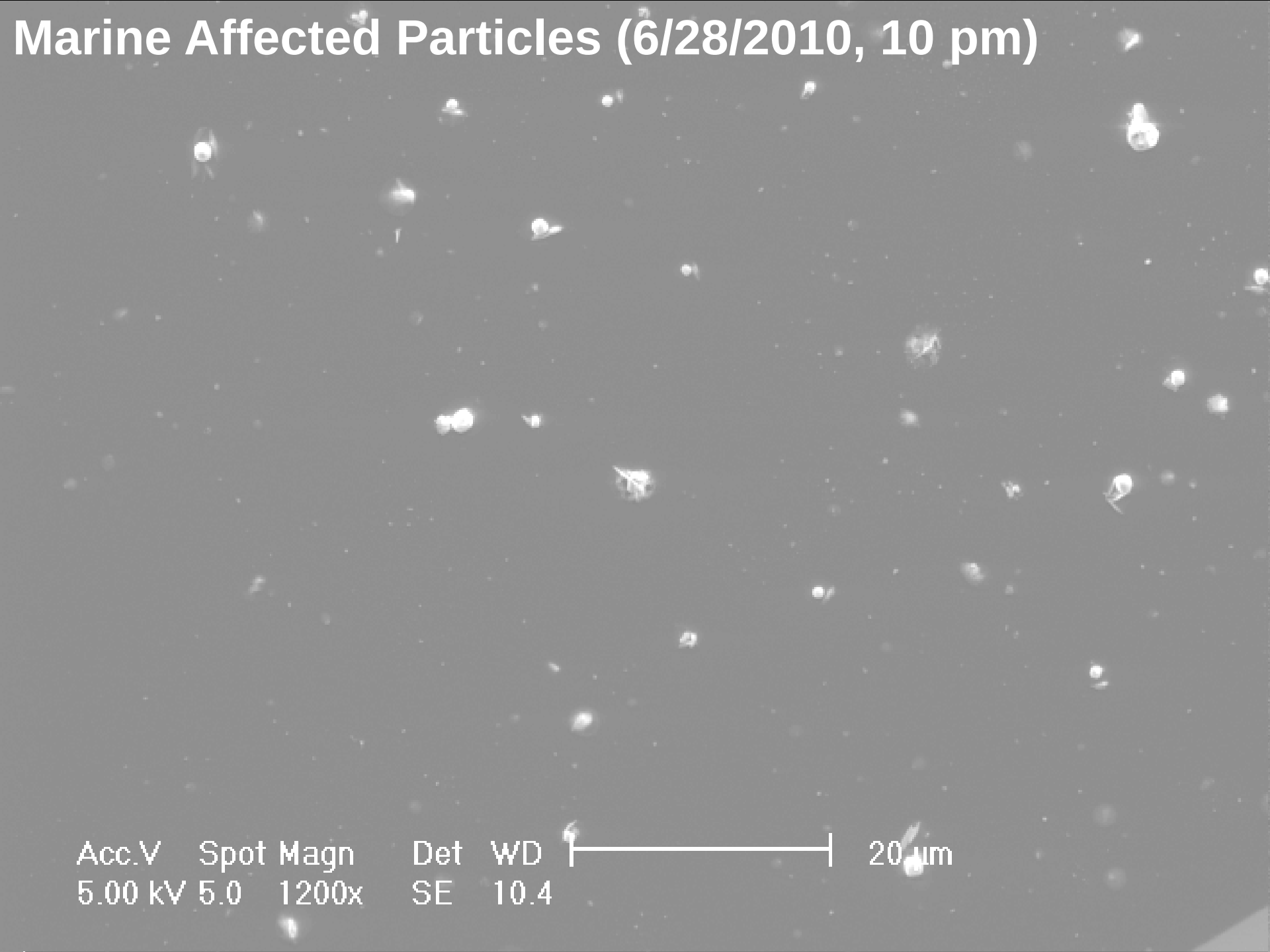
Low OC
(6/27/2010) – 1.1 µm



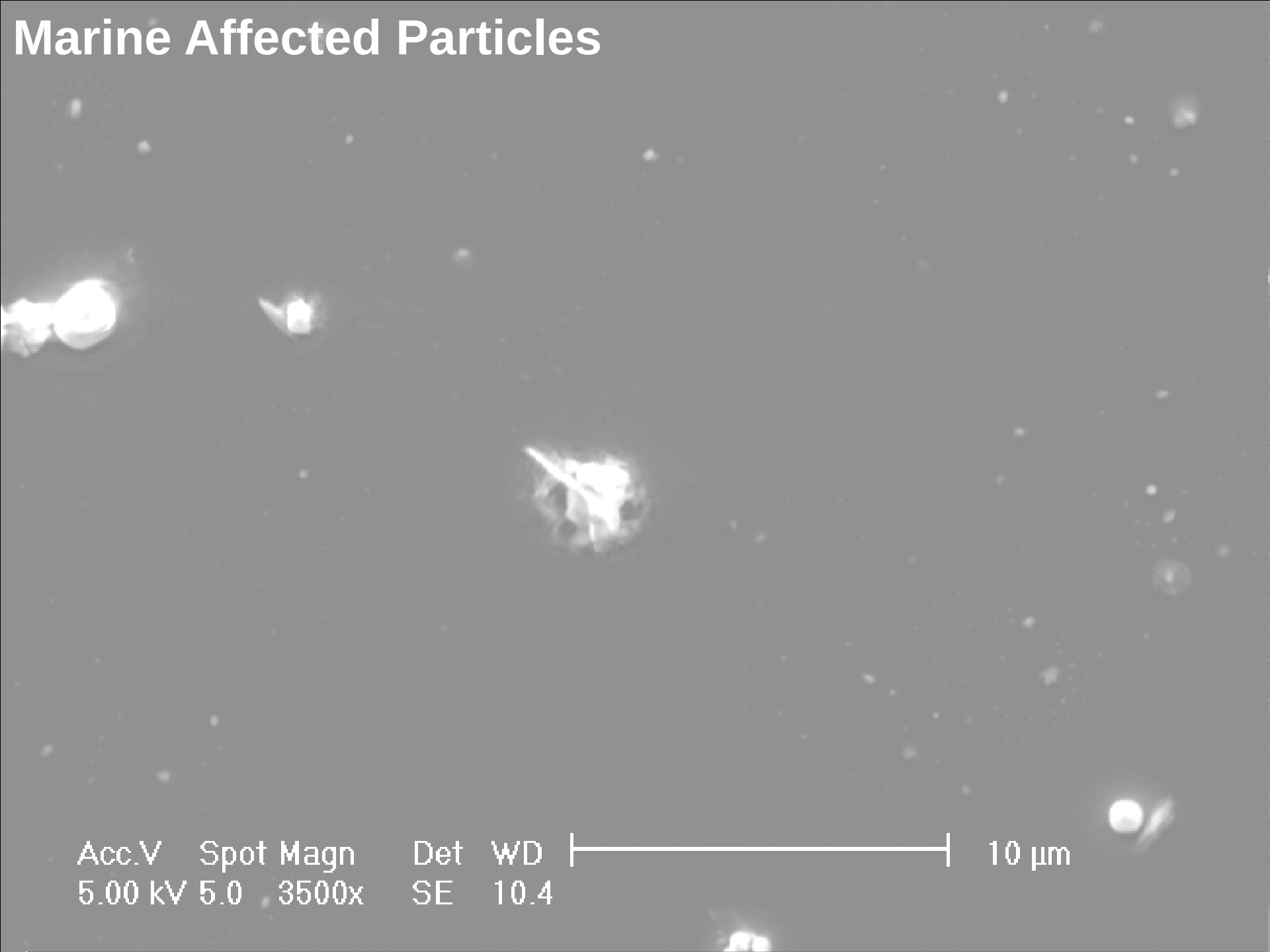
# Look at Individual IN Using OM, STXM/NEXAFS, and SEM/EDX



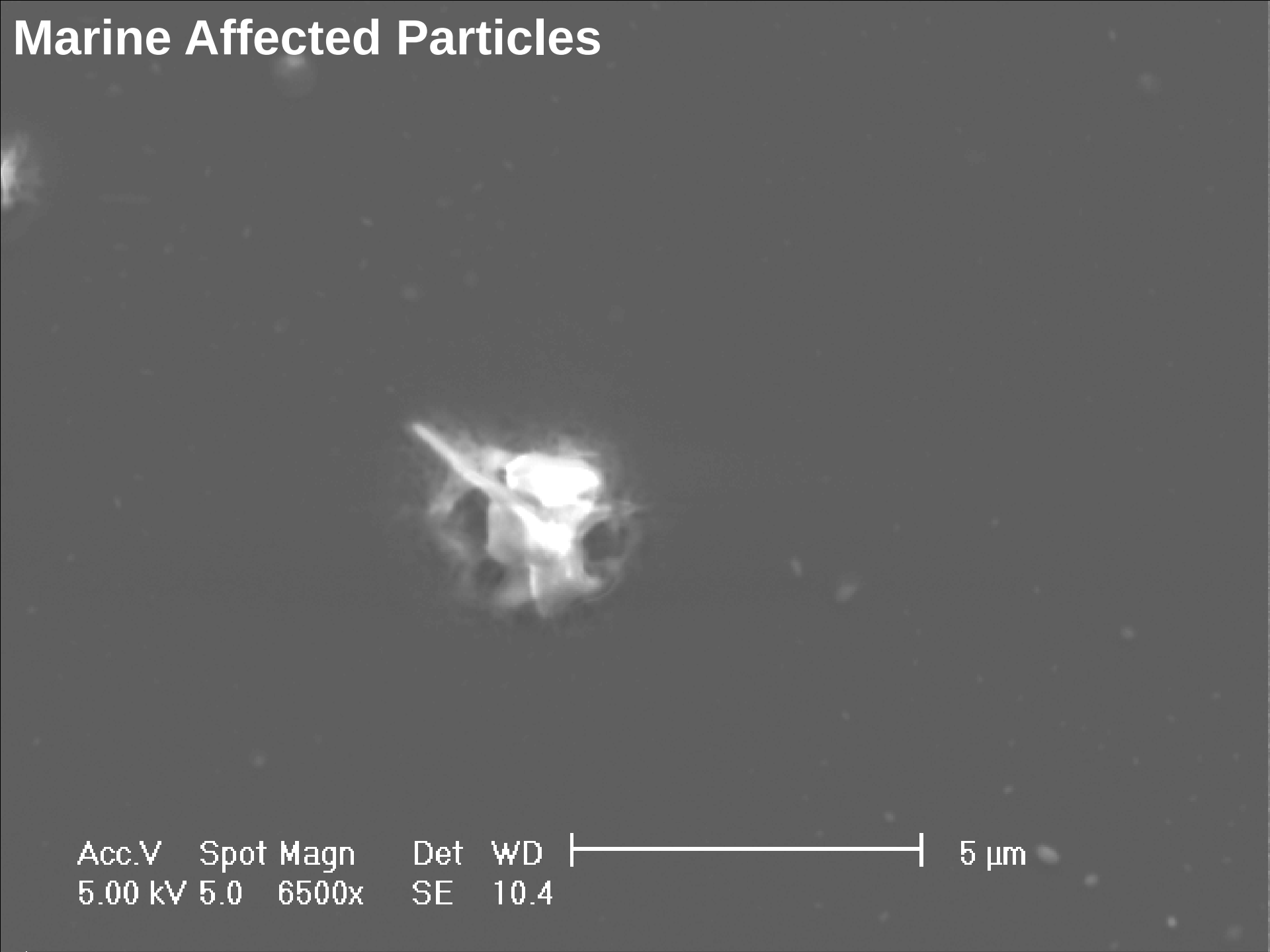
# Marine Affected Particles (6/28/2010, 10 pm)



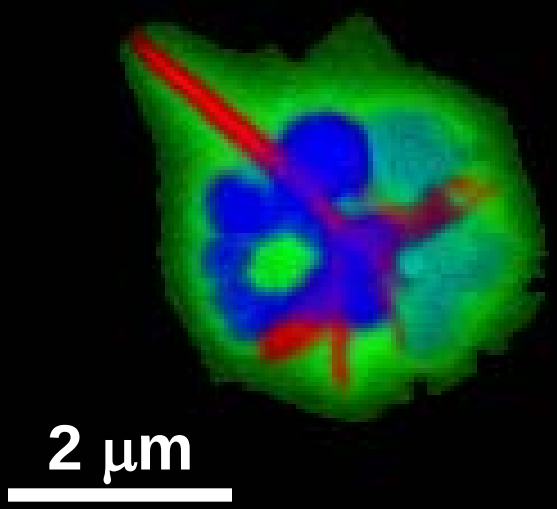
# Marine Affected Particles

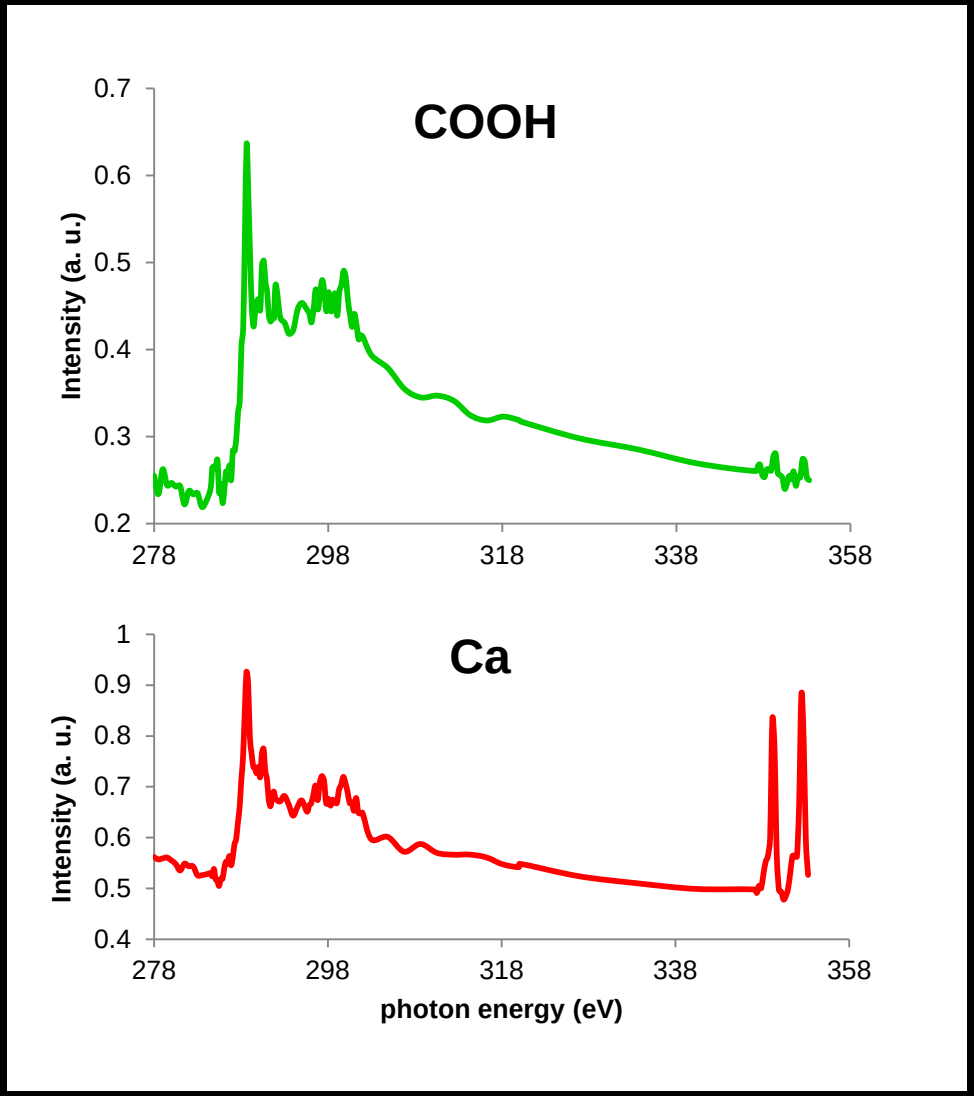


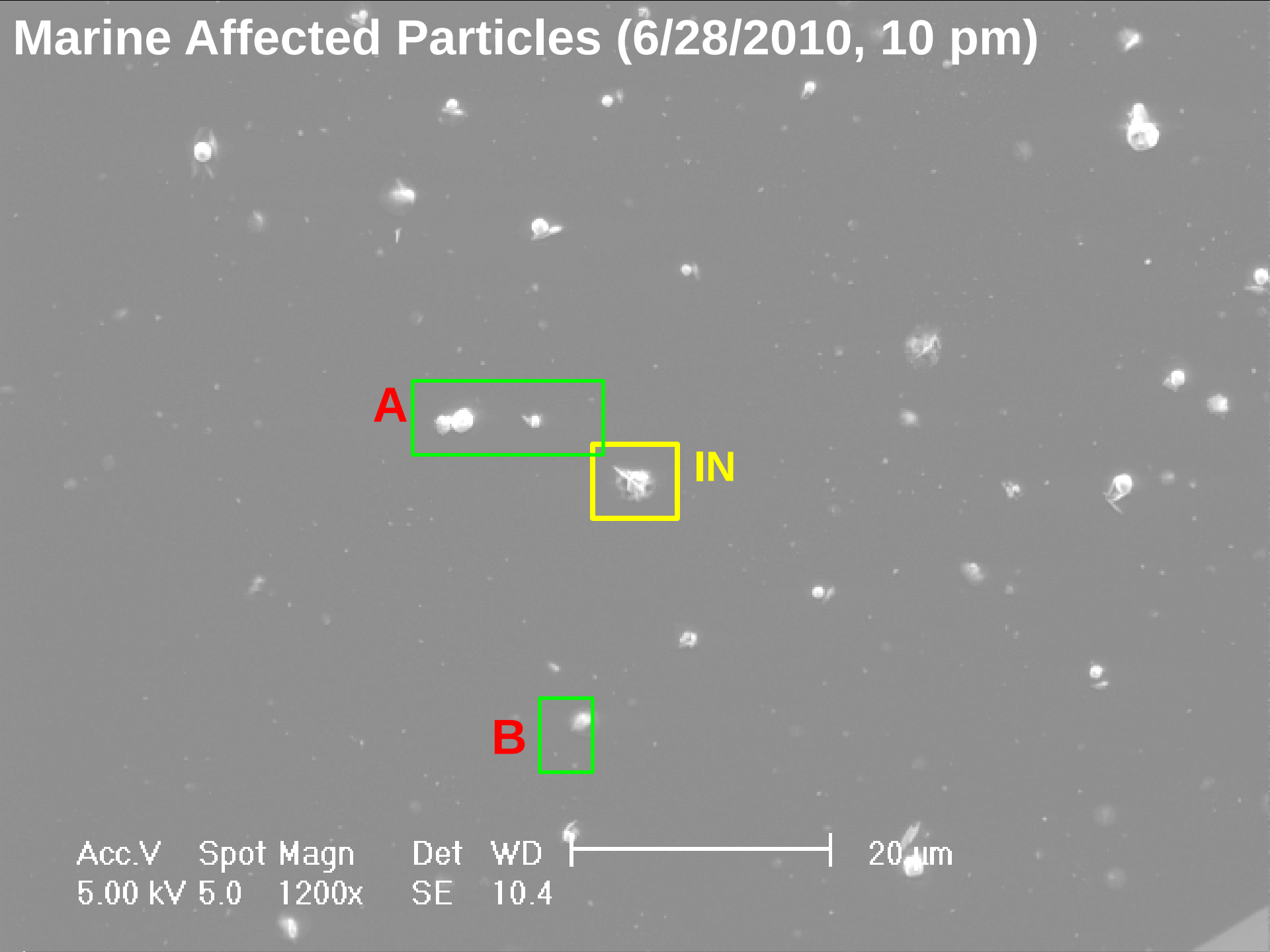
# Marine Affected Particles



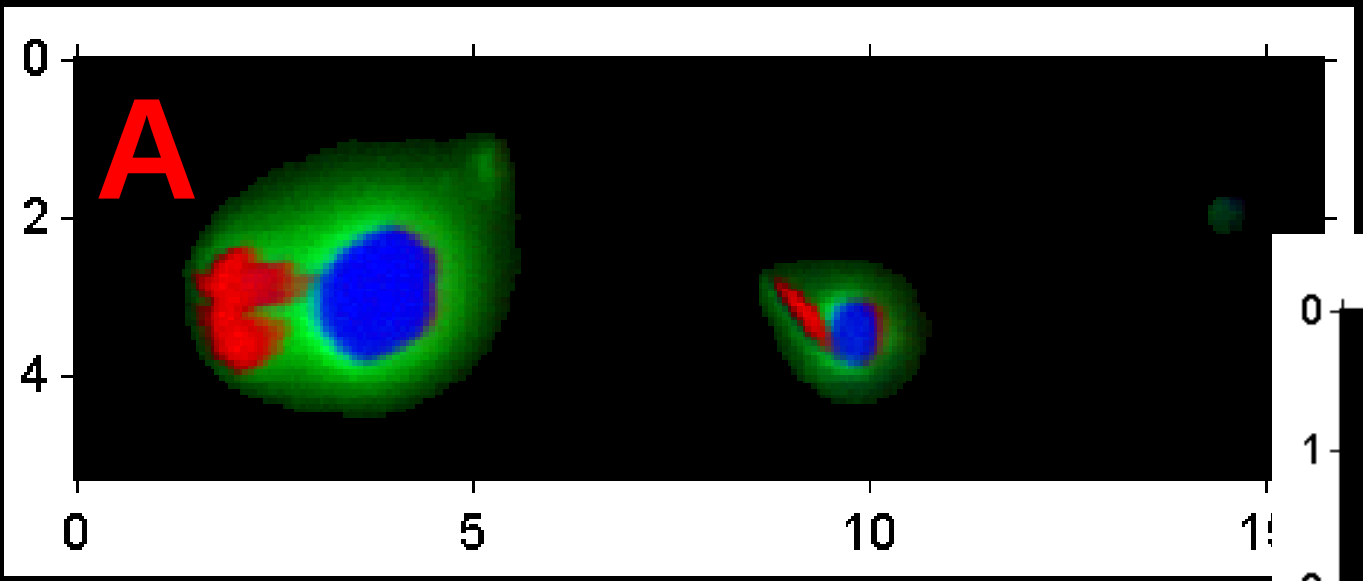
# Marine Affected Particles – IN STXM/NEXAFS Analysis

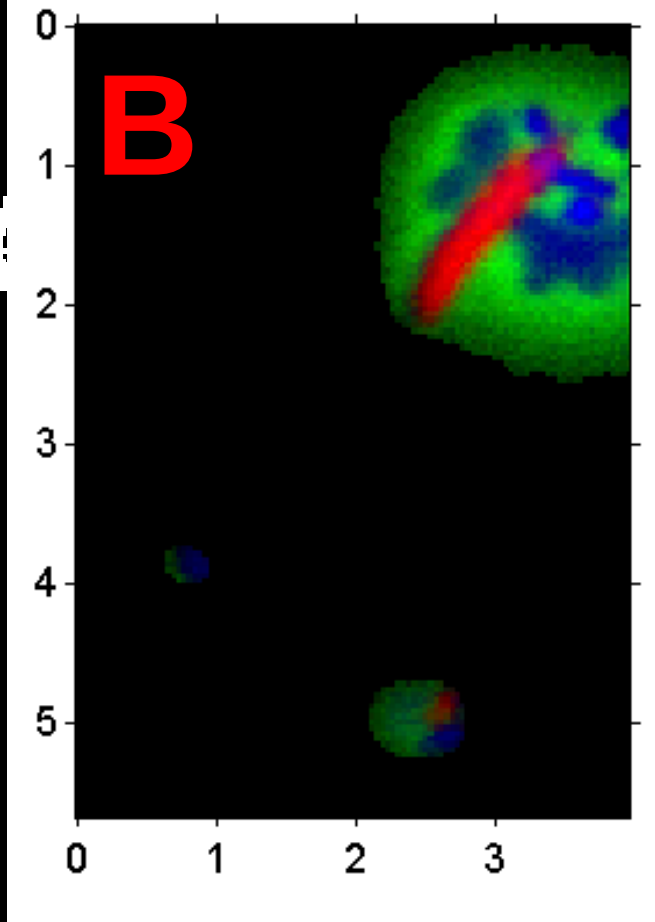



Marine Affected Particles (6/28/2010, 10 pm)
A
IN
B
Acc.V Spot Magn Det WD
5.00 kV 5.0 1200x SE 10.4
20 µm

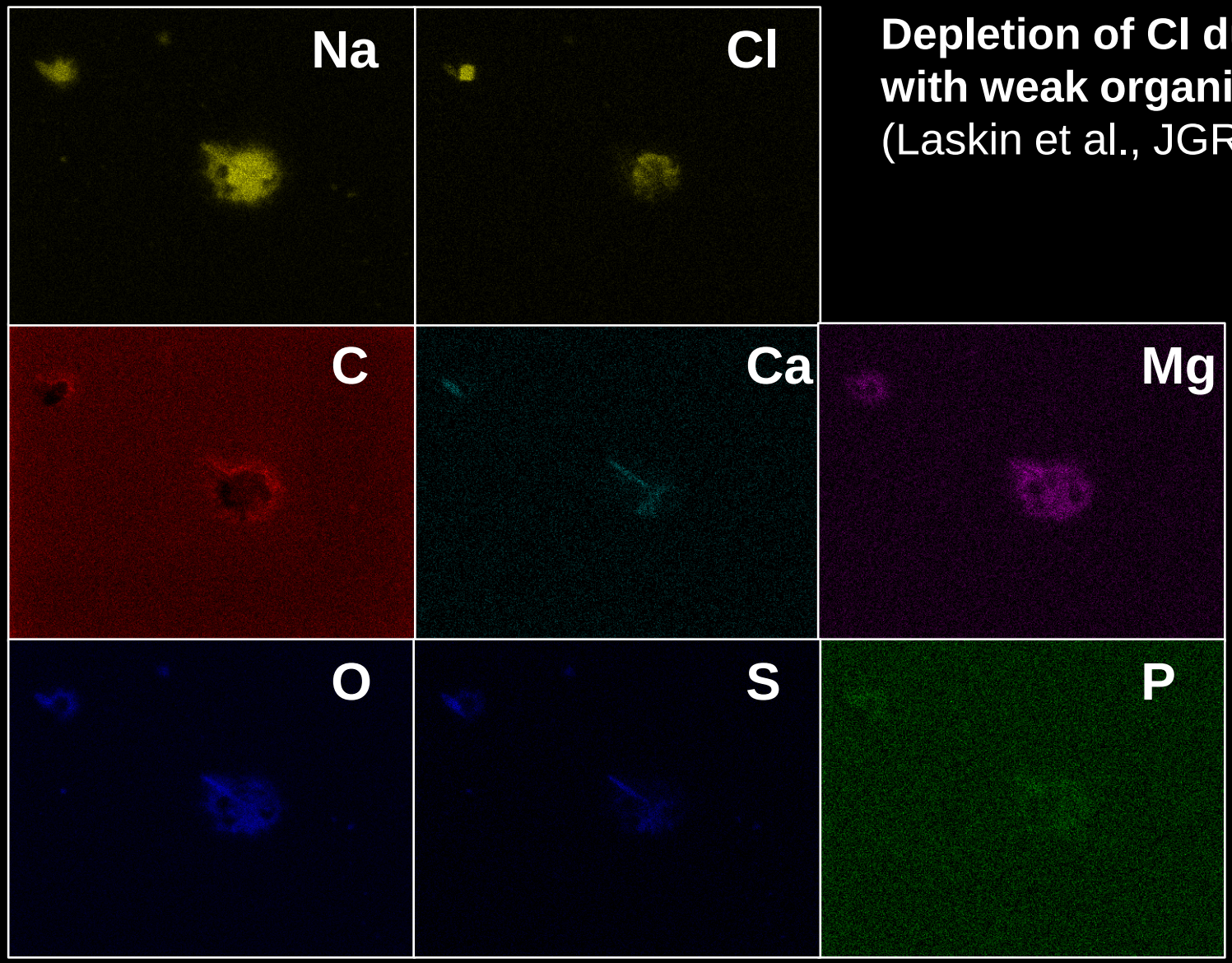
# Marine Affected Particles – STXM/NEXAFS Analysis




**Non-ice nucleating particles surrounding ice nucleus possess similar features as ice nucleus.**

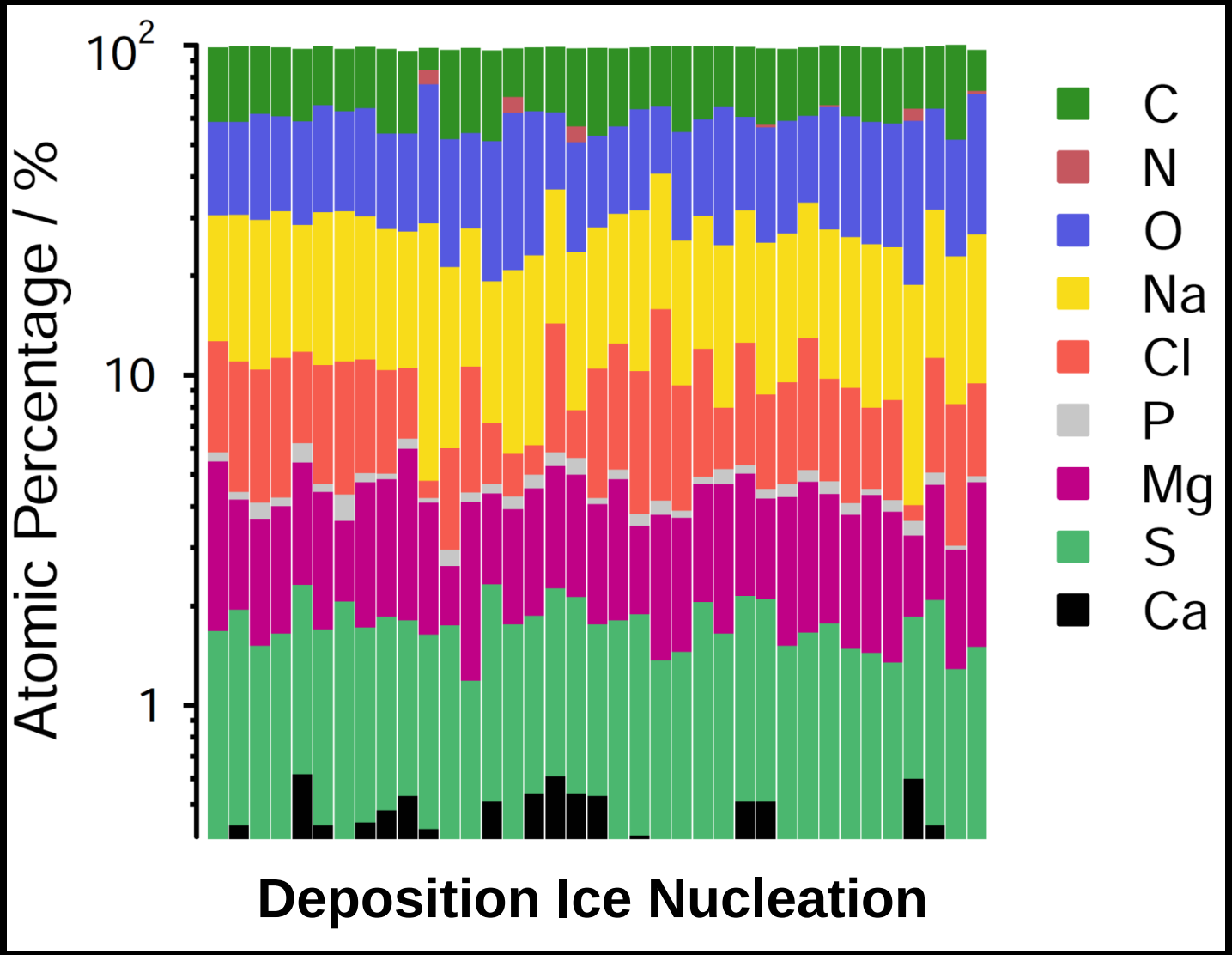
# Marine Affected Particles




**Depletion of Cl due to reaction with weak organic acids?**
(Laskin et al., JGR, 2012)

# Marine Affected Particles – IN SEM/EDX Analysis

## IN Particle Binned

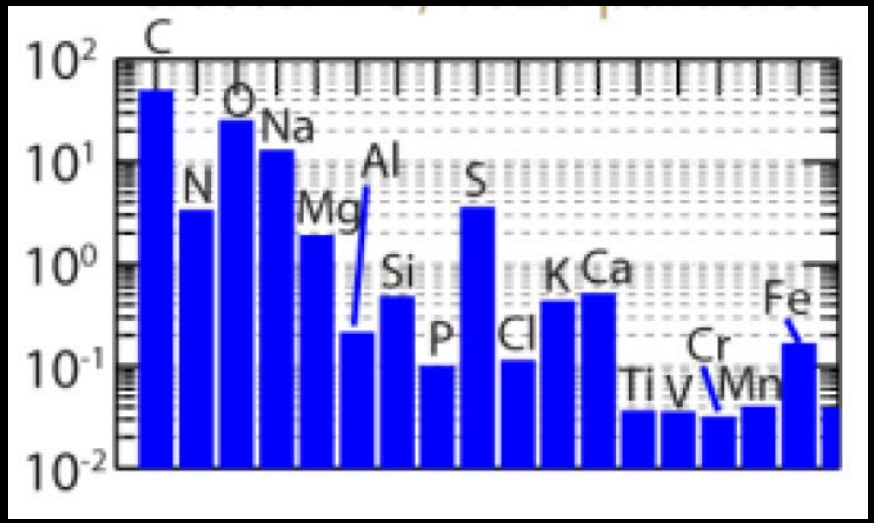


# How Do IN Compare to Overall Particle Population?

## Cluster Types

- Cluster 1 Nitrogen Rich Carbonaceous
- Cluster 2 Coarse Carbonaceous/Nitrogenous
- Cluster 3 CONa Dust/Seasalt
- Cluster 4 Secondary Carbonaceous
- Cluster 5 CaMg Dust/Seasalt
- Cluster 6 Refractory Carbonaceous

| Low OC | | Med. OC | |
|---|---|---|---|
| # IN | size | # IN | size |
| 3 | 1.31 | 0 | |
| 0 | | 0 | |
| 1 | 1.14 | 2 | 3.52 |
| 1 | 0.91 | 0 | |
| 16 | 1.41 | 19 | 1.22 |
| 0 | | 2 | 0.85 |




Cluster 5

Cluster 5 represents majority of particles in that size regime.

Similar cluster for marine affected IN.

# Conclusions and Summary

- **Identification of individual IN by SEM/EDX in combination with STXM/NEXAFS with resolution of about 30 nm.**
- **Most efficient IN do not appear unique with regard to composition, morphology, and phase state compared to overall particle population.**
- **IN are larger than 0.5 µm.**
- **Only common similarity between IN studied is organic coating which might govern ice nucleation efficiency.**

# Funding

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