Tar Balls from Biomass Burning

Morphological Studies

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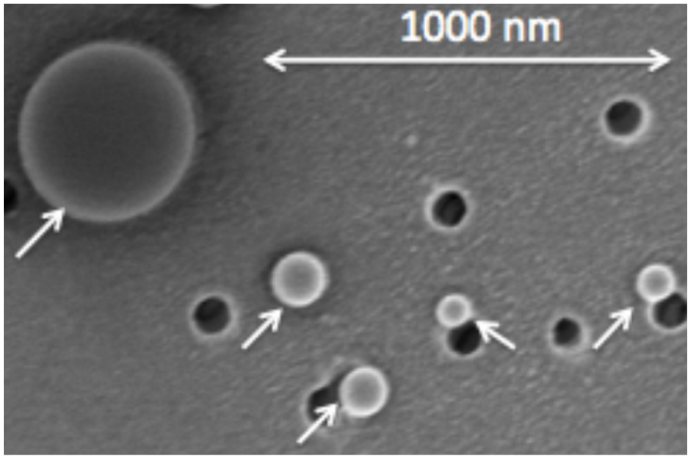

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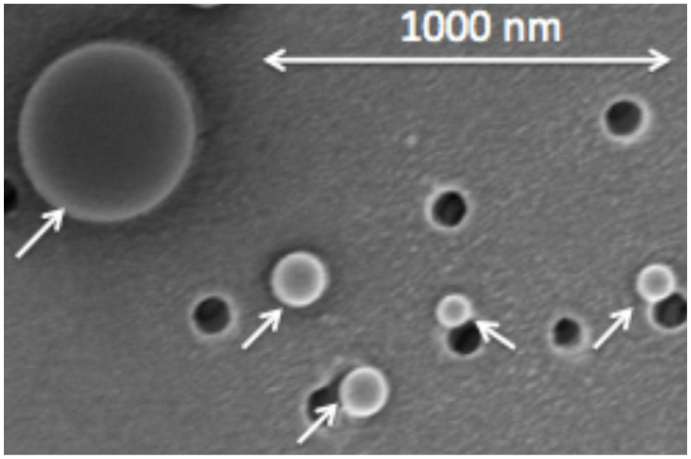
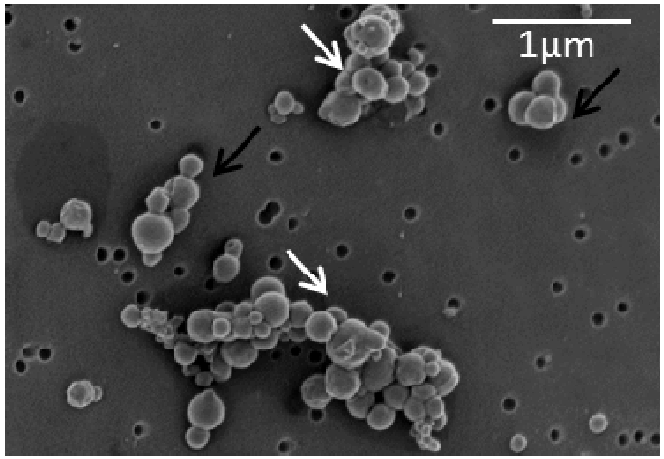
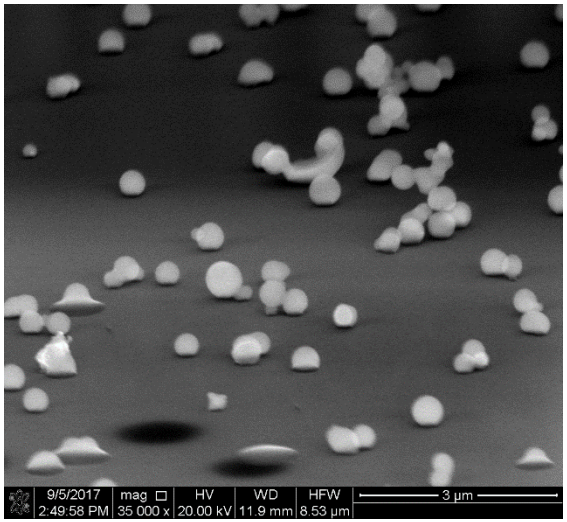




Tar Balls

TBs defined by electron microscopy:

- Spherical
- ~ 100-300 nm diameter
- Resistant to the electron beam
- Amorphous nanostructure
- Mostly composed of Carbon and Oxygen
- Thermally, rather stable



Courtesy Swarup China – Richland, WA, 2017

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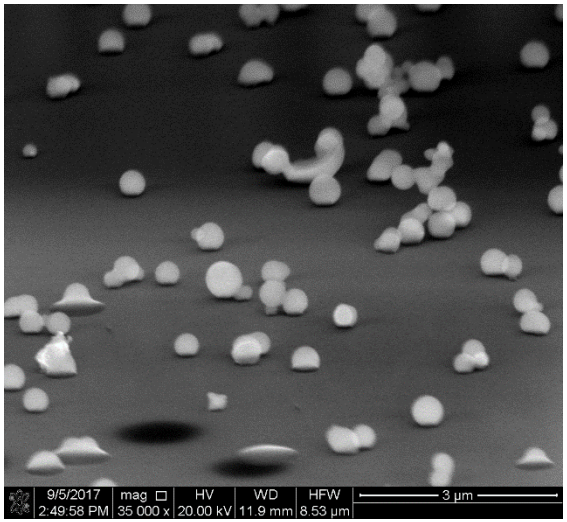

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Some challenges:

- Abundance very variable depending on source, plume age, combustion conditions…
- Formation processes and evolution
- Large range in published values of the material optical properties
  (e.g., *k* [imaginary part of the index of refraction] → ~ 0.002 – 0.27)

E. g.: Pósfai, et al. *JGR, 2004*
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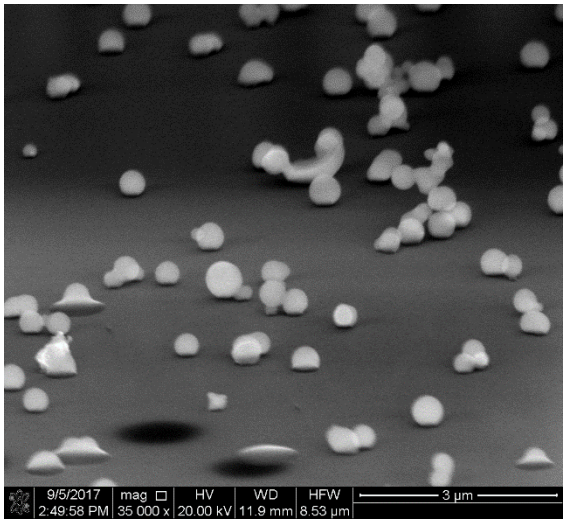

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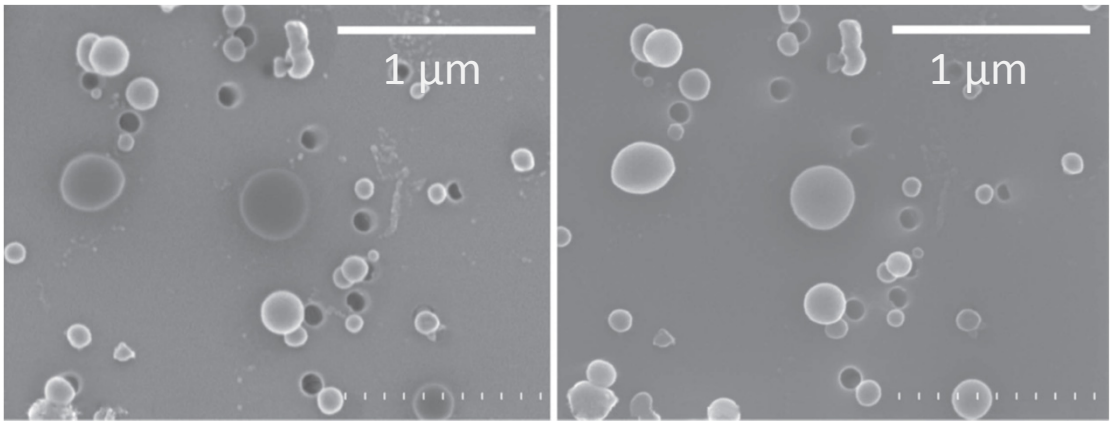
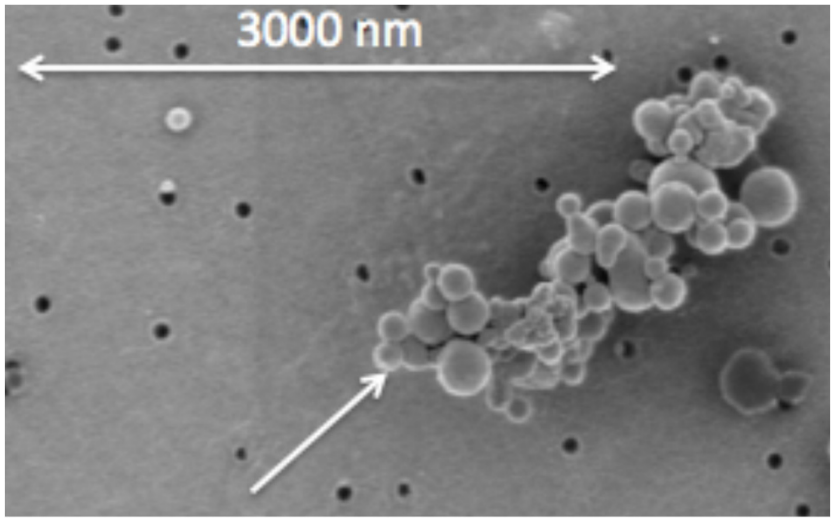


China et al., Nat Comm., 2013 *Las Conchas Fire, NM (2011)*

Tar Balls Aggregates



Whitewater-Baldy Complex fire, NM (2012)

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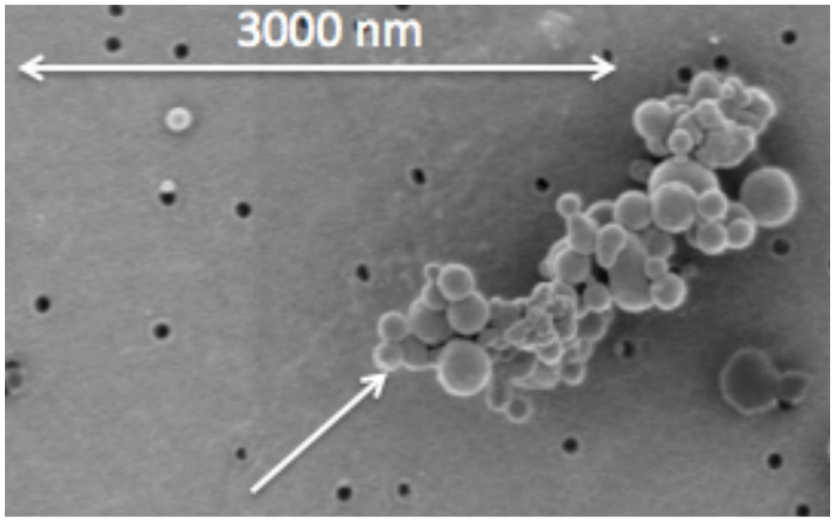

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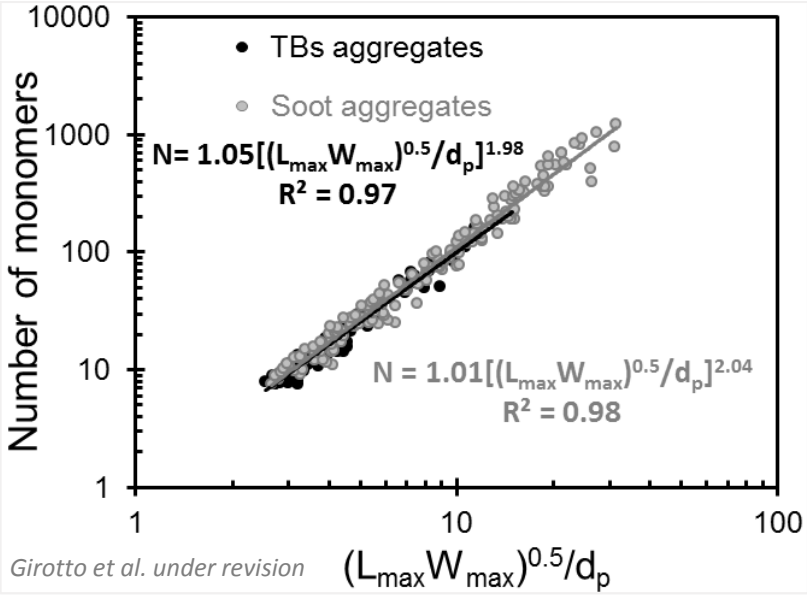

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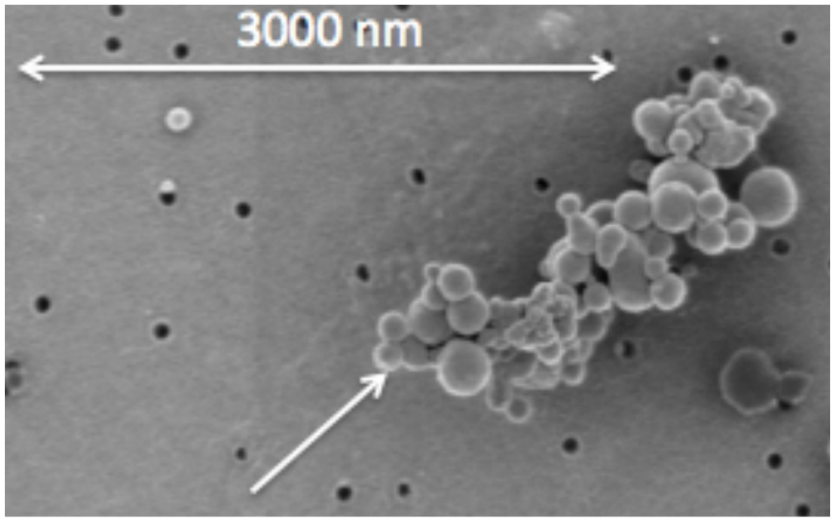

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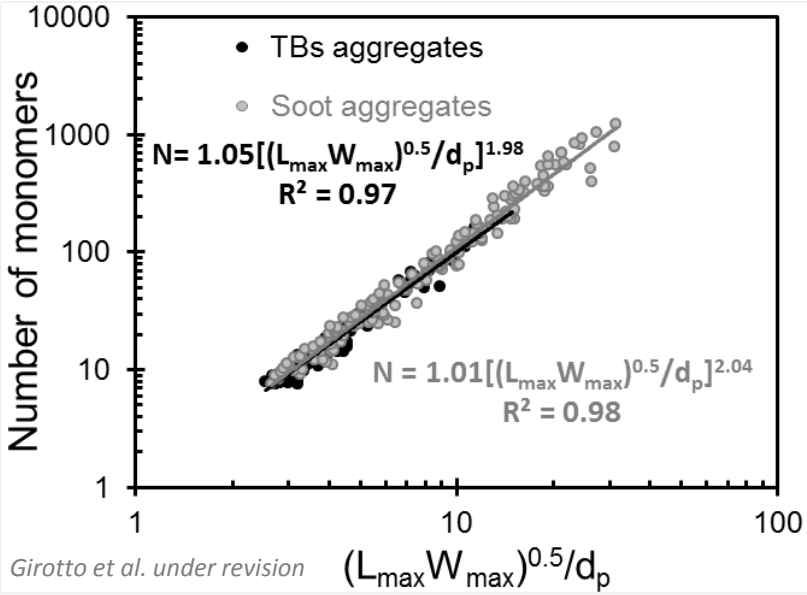

Aggregates
(T-matrix)

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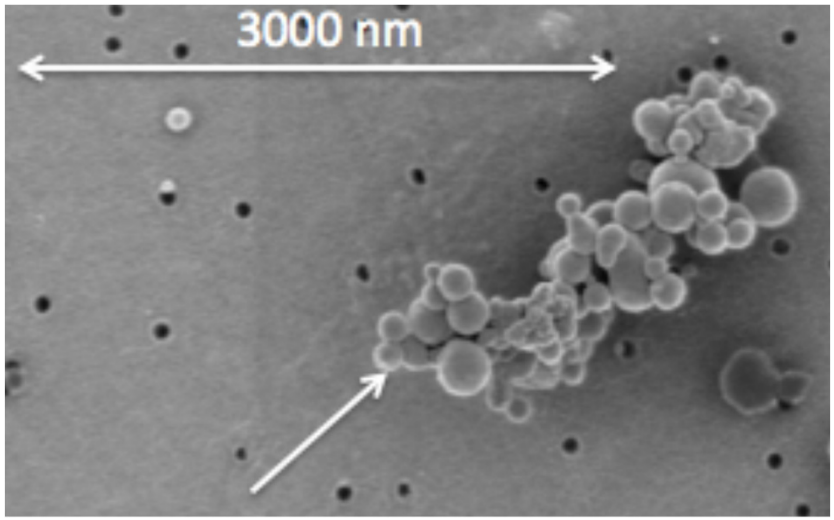

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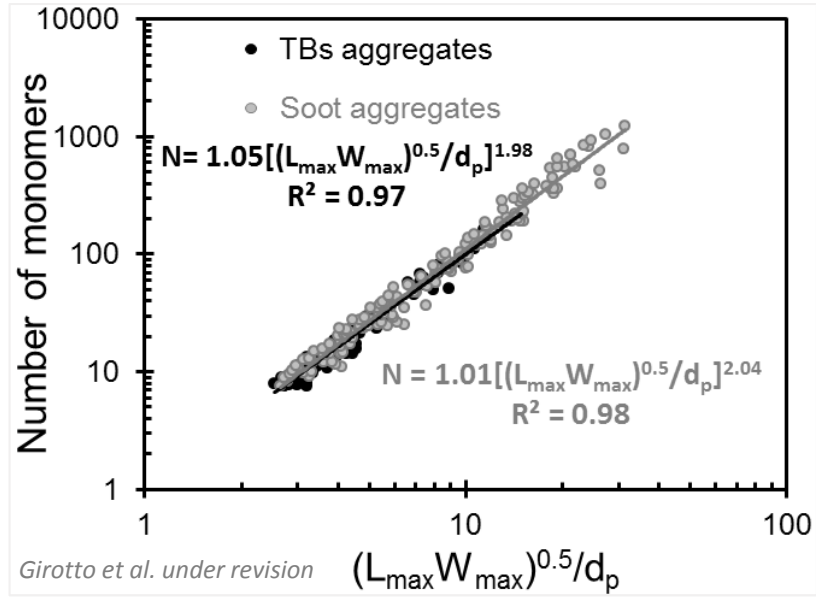
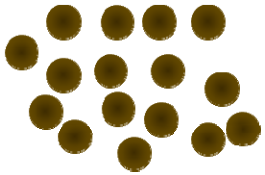


Aggregates
(T-matrix)

Individual TBs
(Lorenz-Mie)



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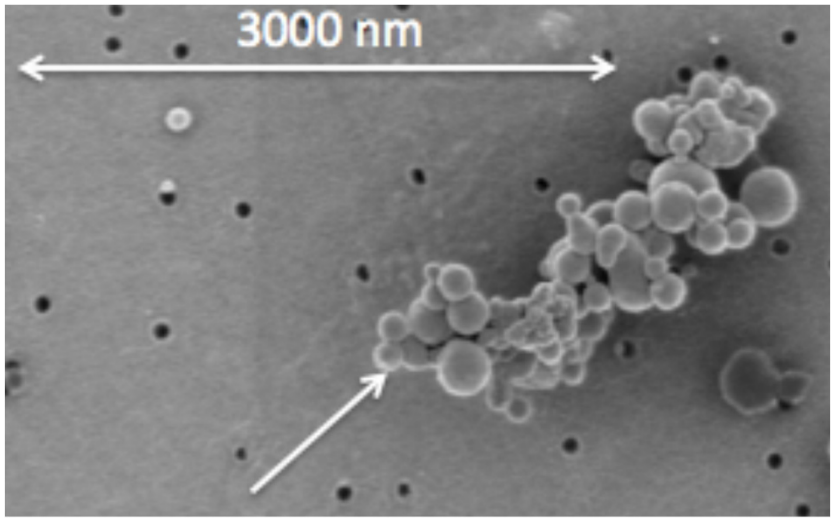

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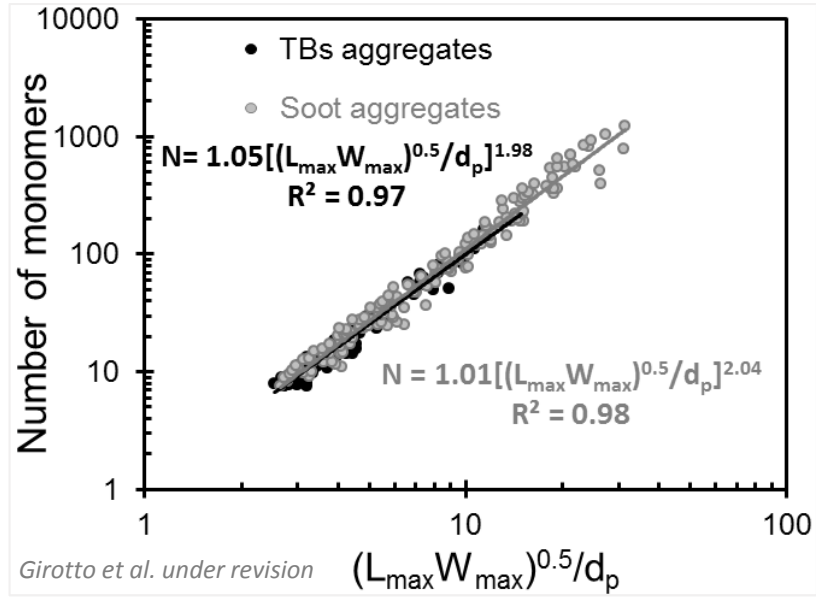

Girotto et al. under revision

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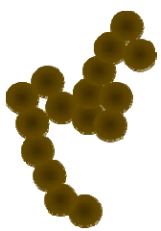

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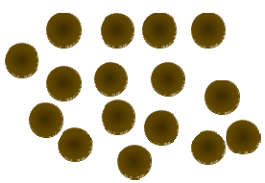

Volume equivalent
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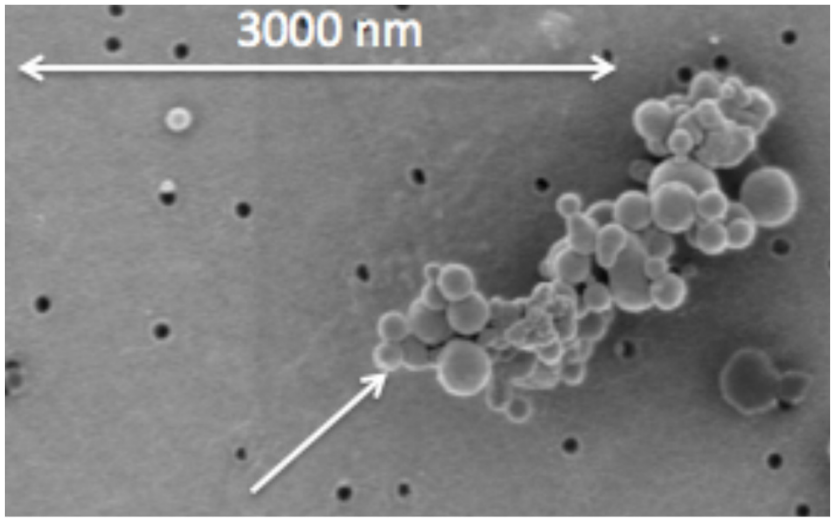
Bhandari et al. in preparation

Tar Balls Aggregates



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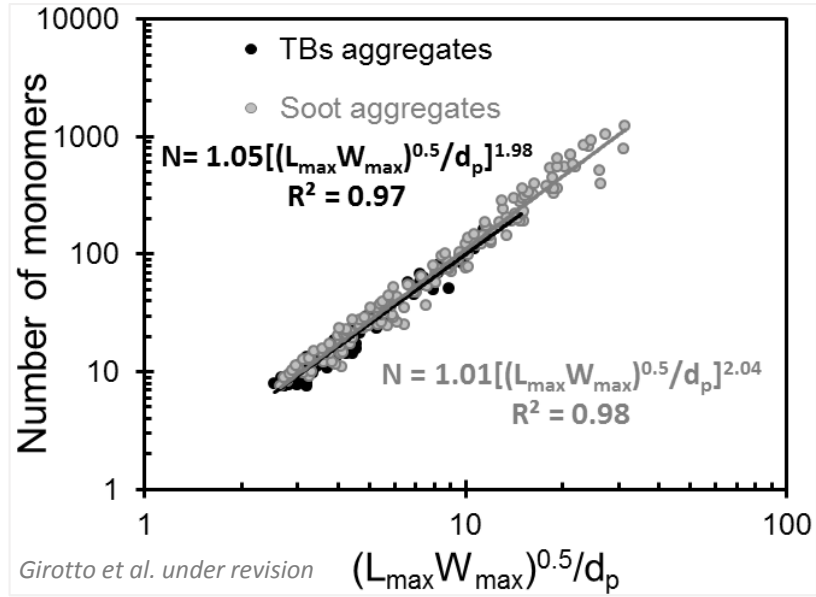

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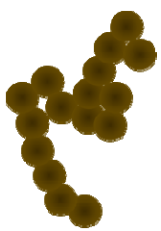

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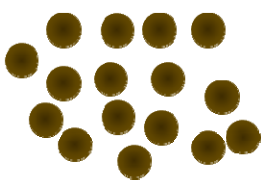

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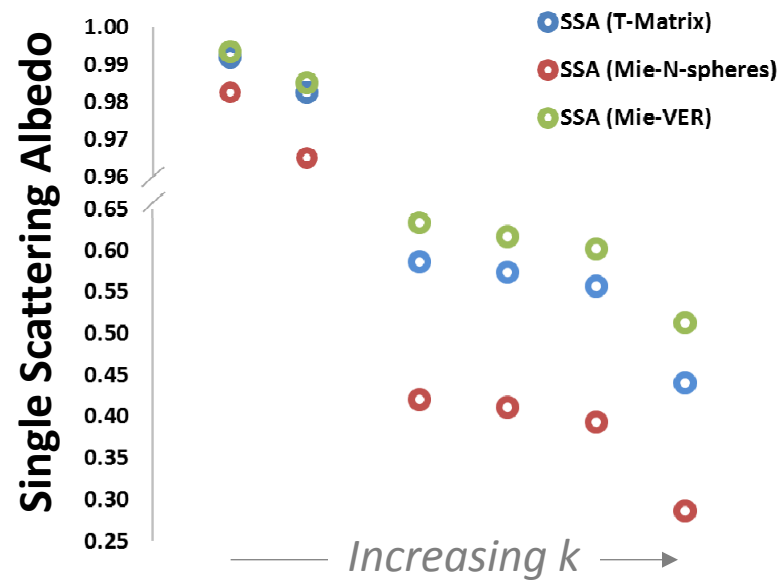

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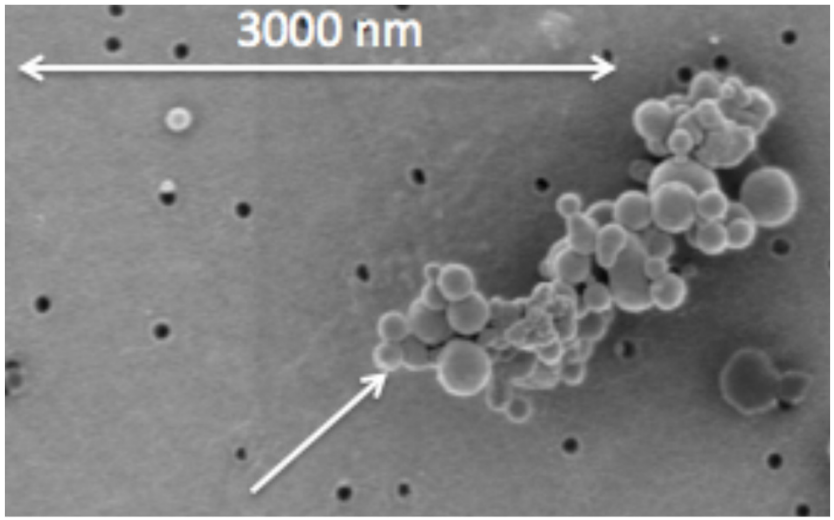

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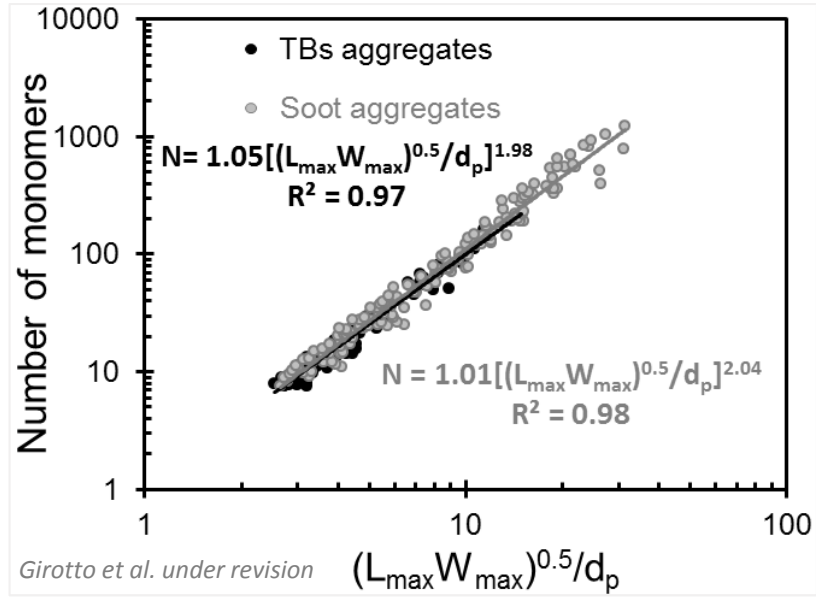

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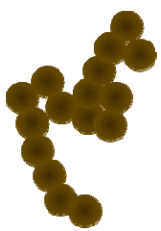

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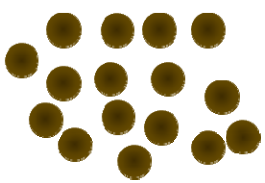

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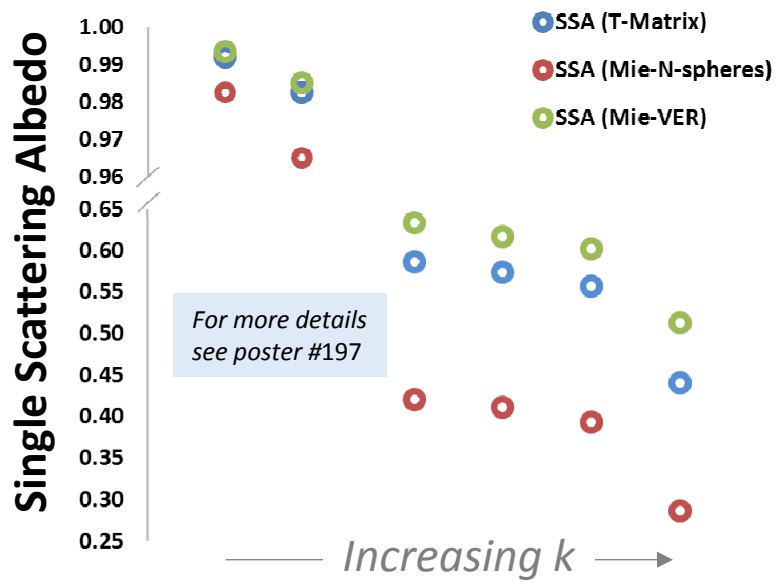

TBs aggregates from other plumes

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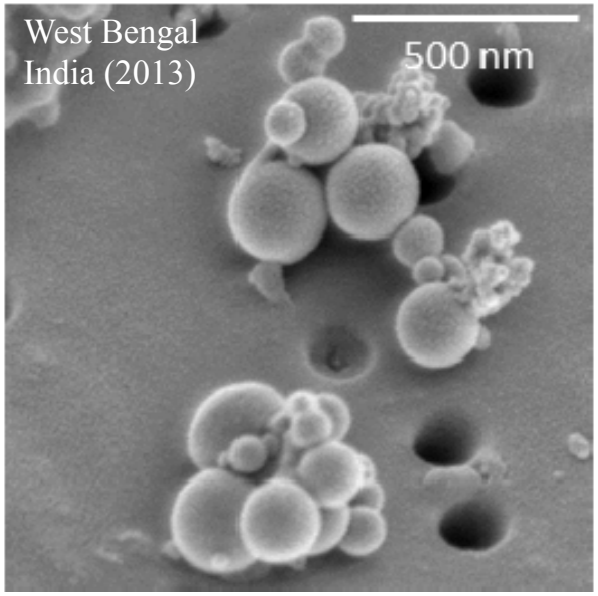

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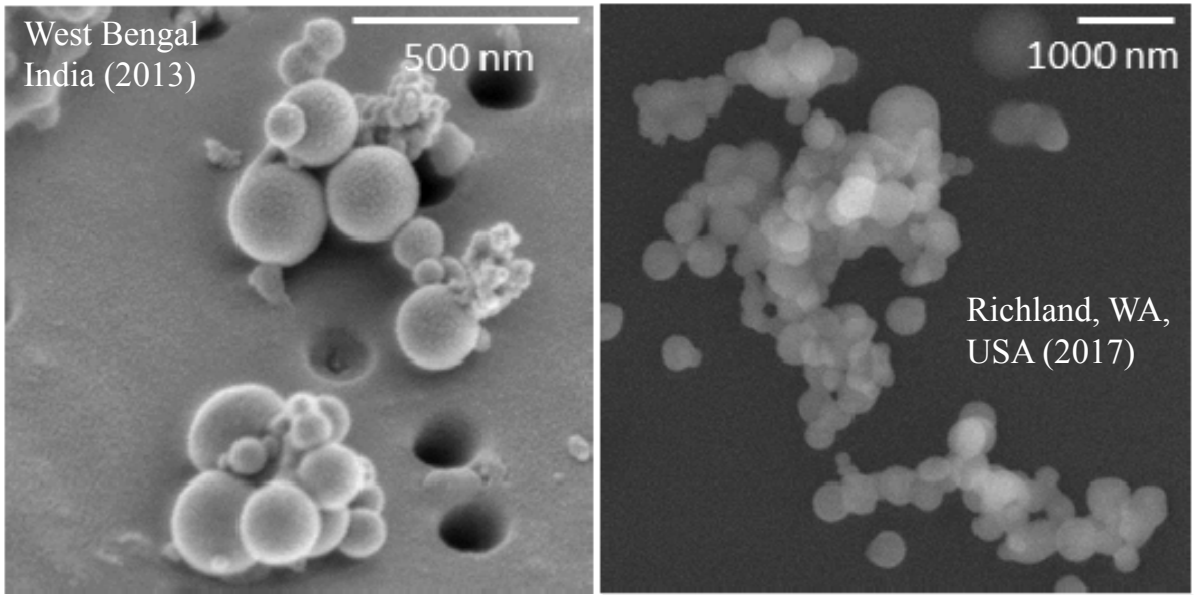

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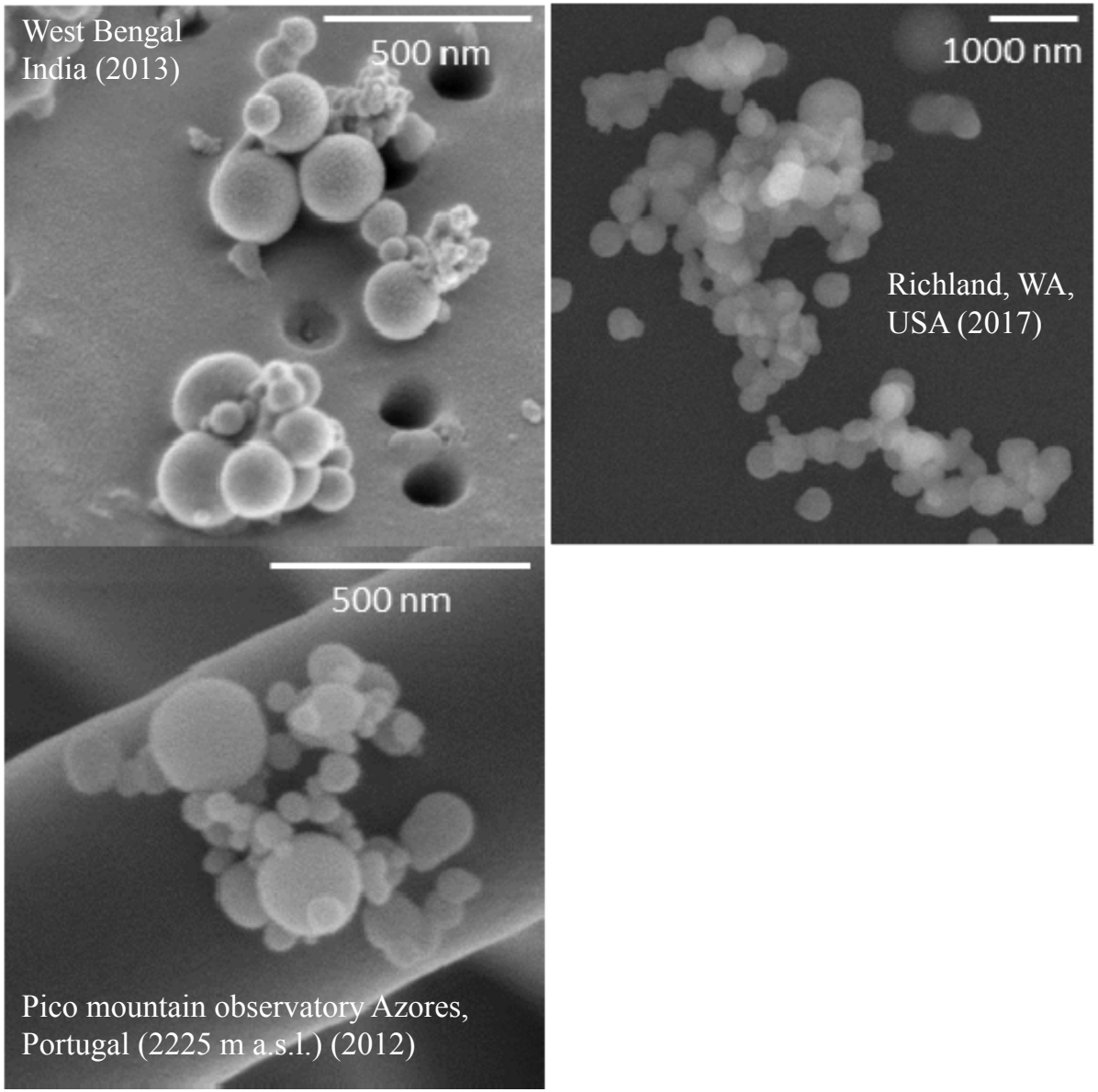

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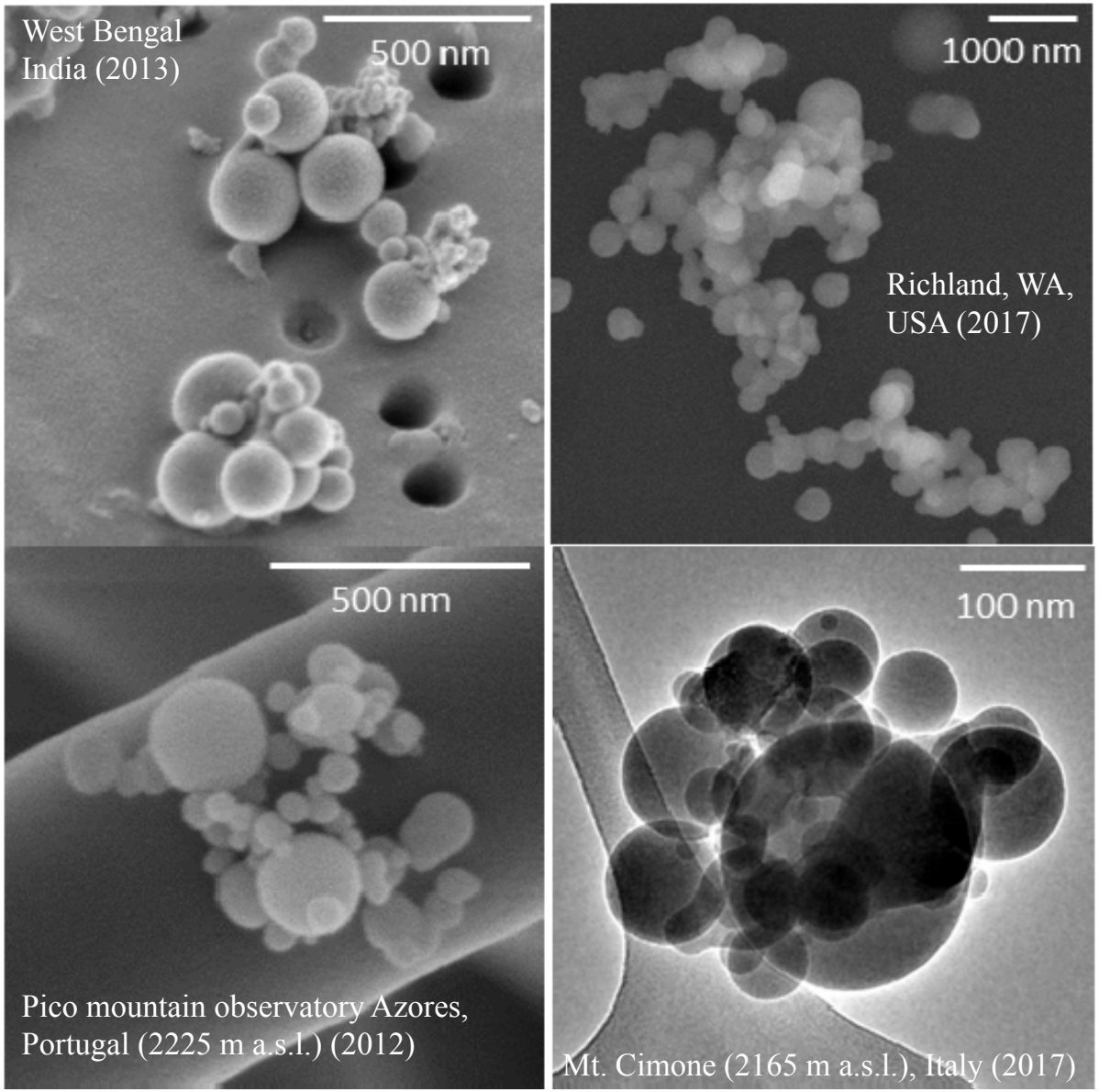
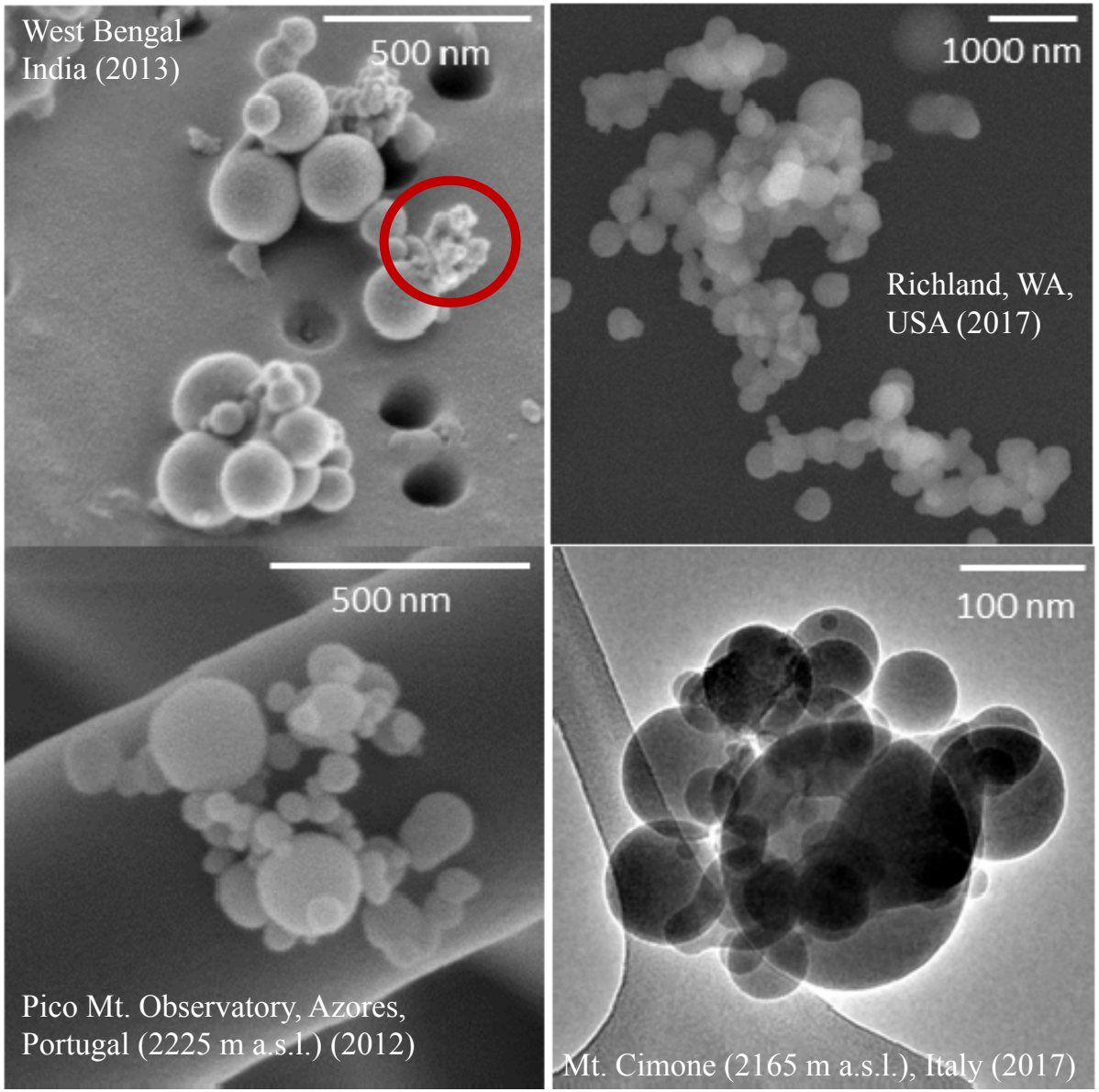
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