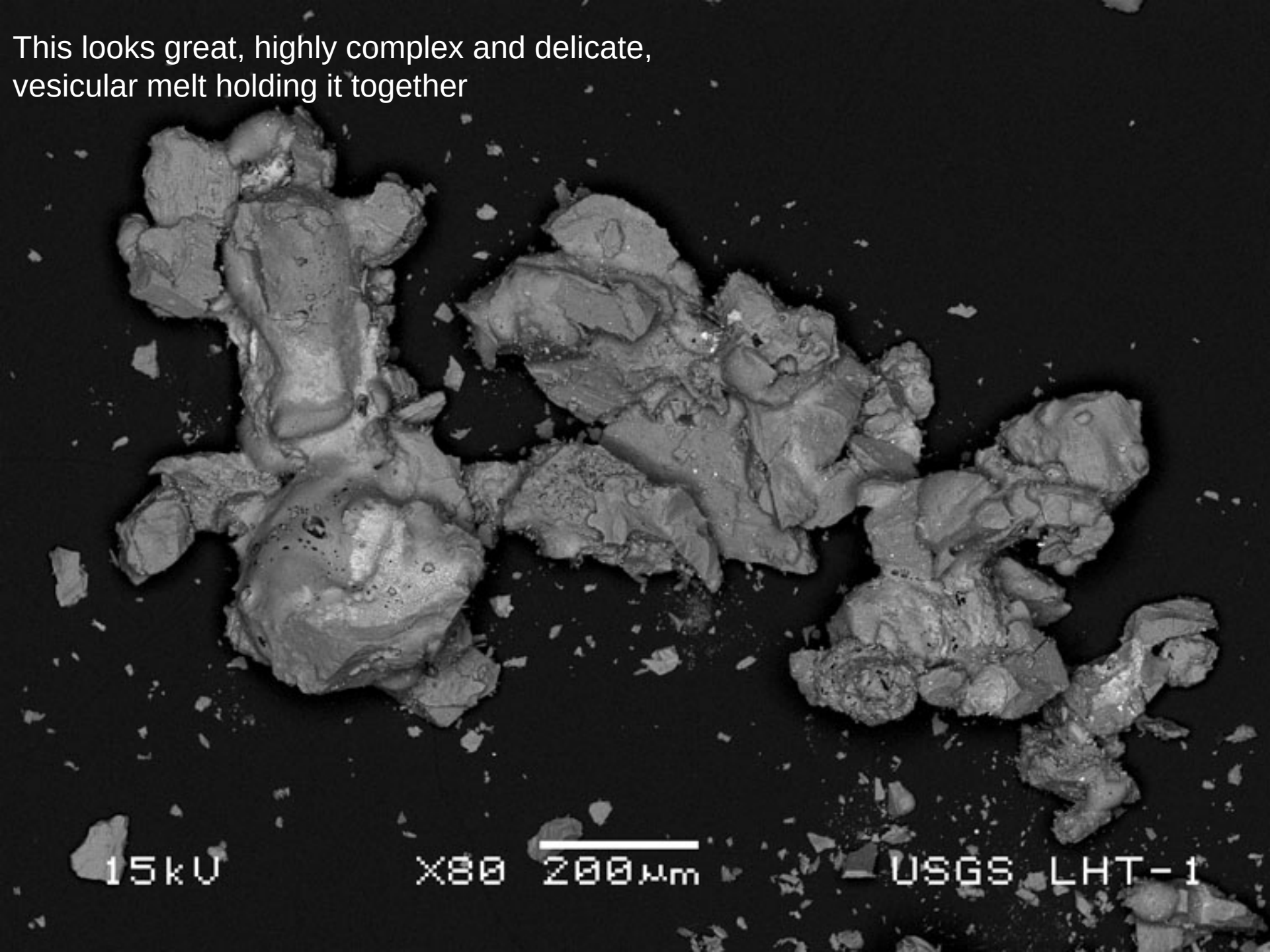
Analysis of USGS LHT-1 agglutinates

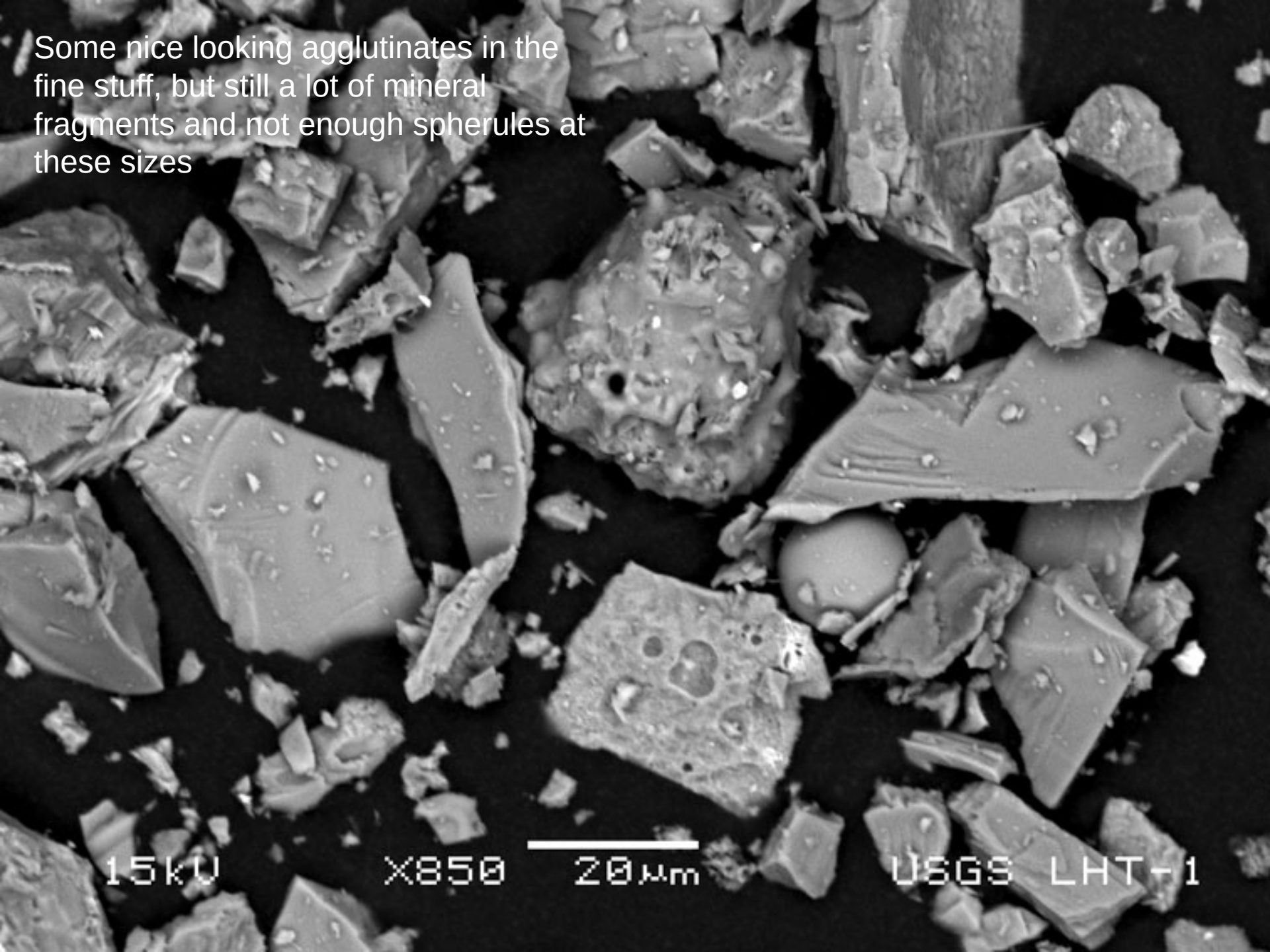
Sarah Noble
NASA JSC ARES
August 2007

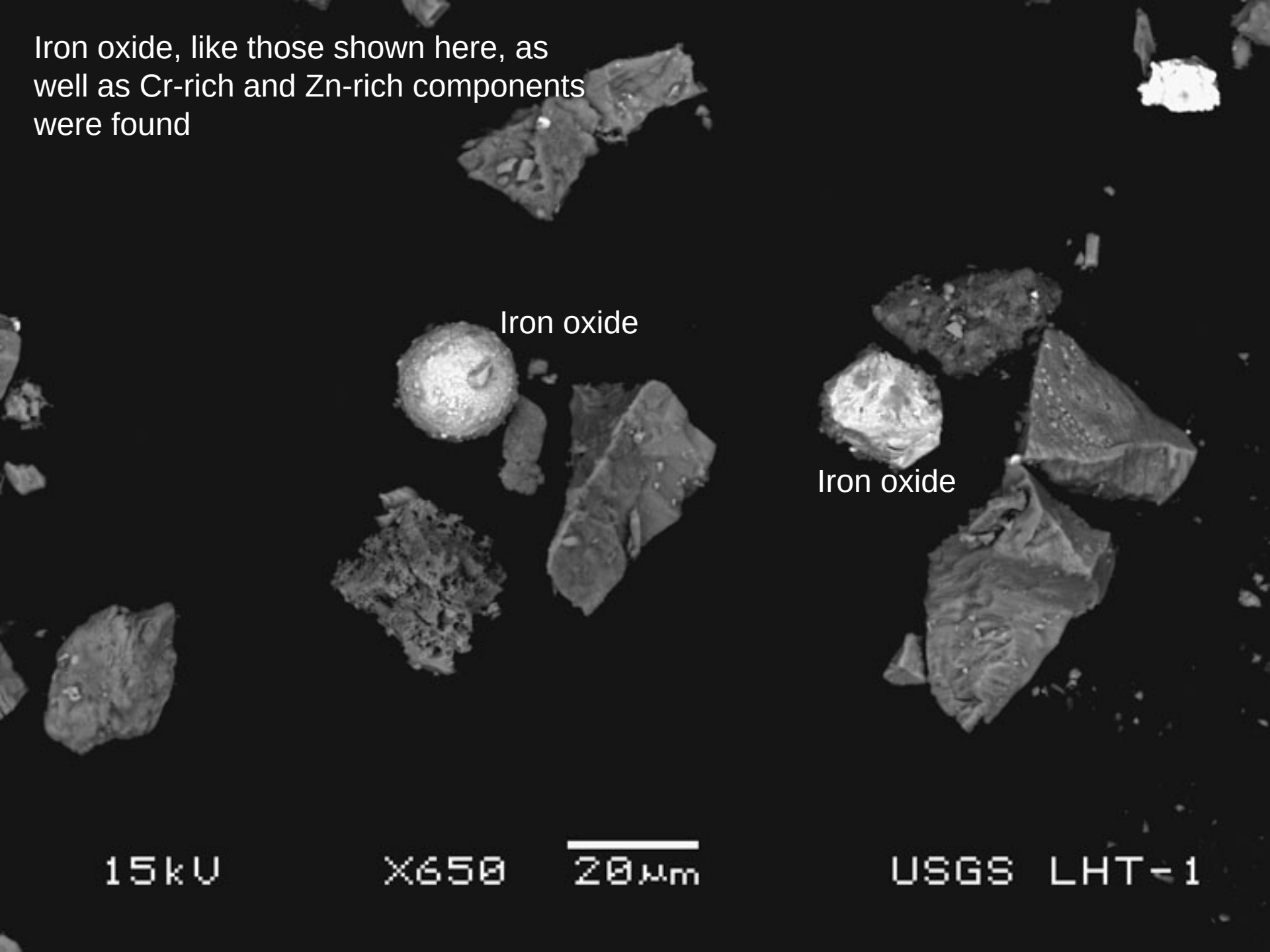
SEM Images
(backscatter)

USGS LHT-1 agglutinates


This looks great, highly complex and delicate,
vesicular melt holding it together
15kV
X80
200µm
USGS LHT-1


Morphology is right on for these bigger blobs – lots of melt, little bits sticking to bigger bits, spherules sticking to everything
15kV
X37 500µm
USGS LHT-1

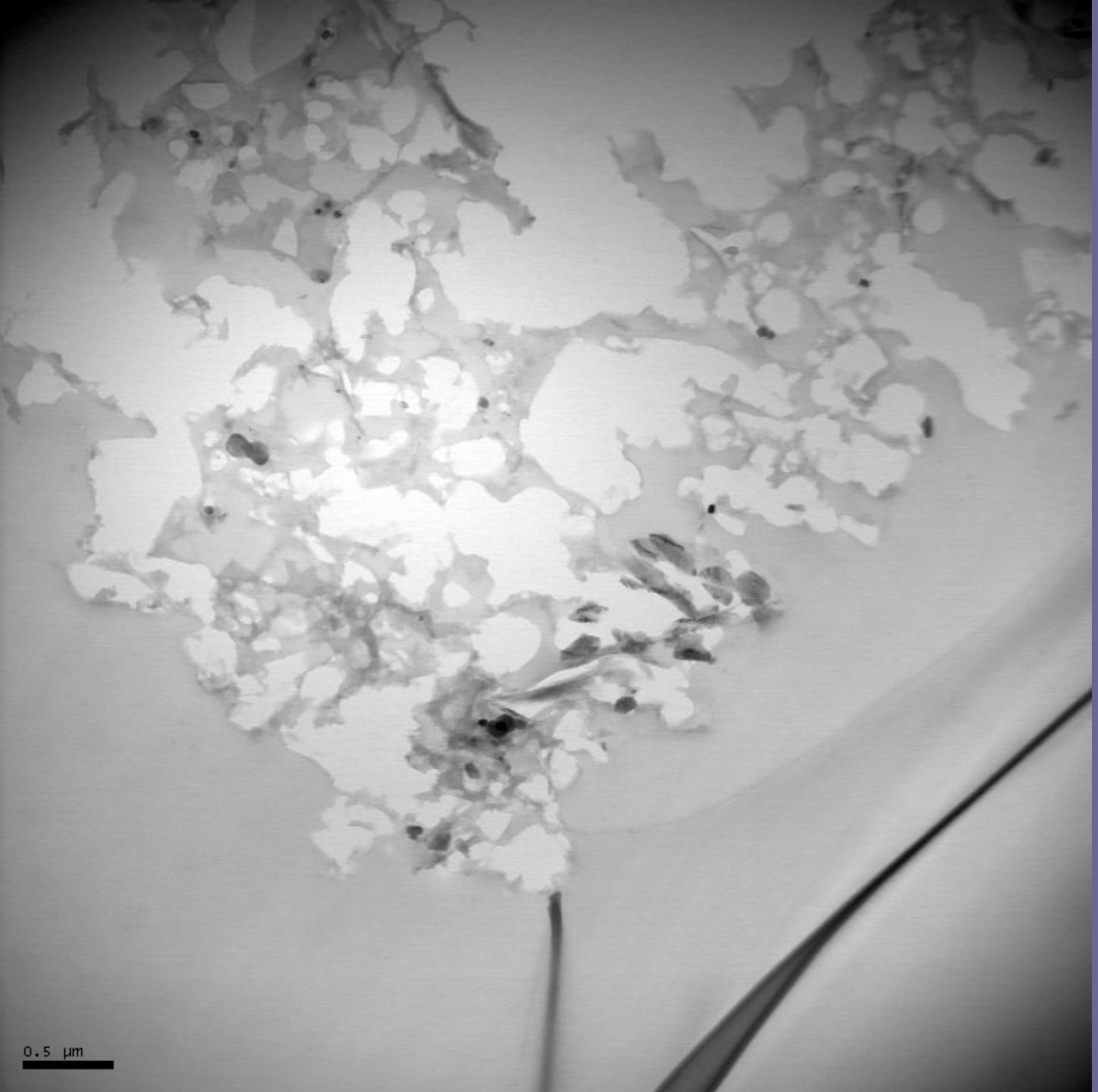

Some nice looking agglutinates in the fine stuff, but still a lot of mineral fragments and not enough spherules at these sizes
15kV
X850
20µm
USGS LHT-1


Iron oxide, like those shown here, as well as Cr-rich and Zn-rich components were found
Iron oxide
Iron oxide
15kV
X650
20µm
USGS LHT-1

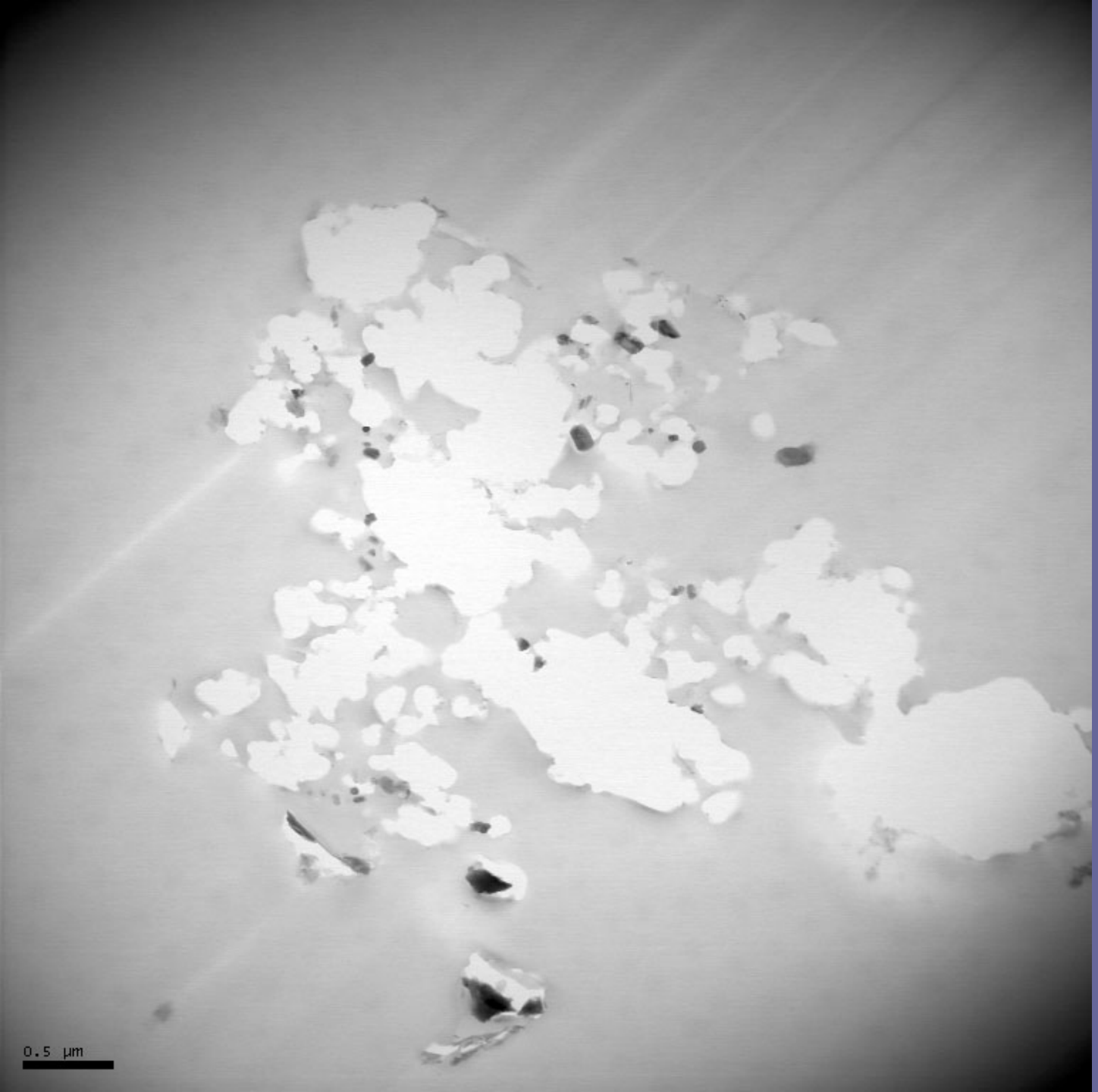
TEM Images

(bright field images of samples that were crushed and embedded in epoxy, then microtomed)

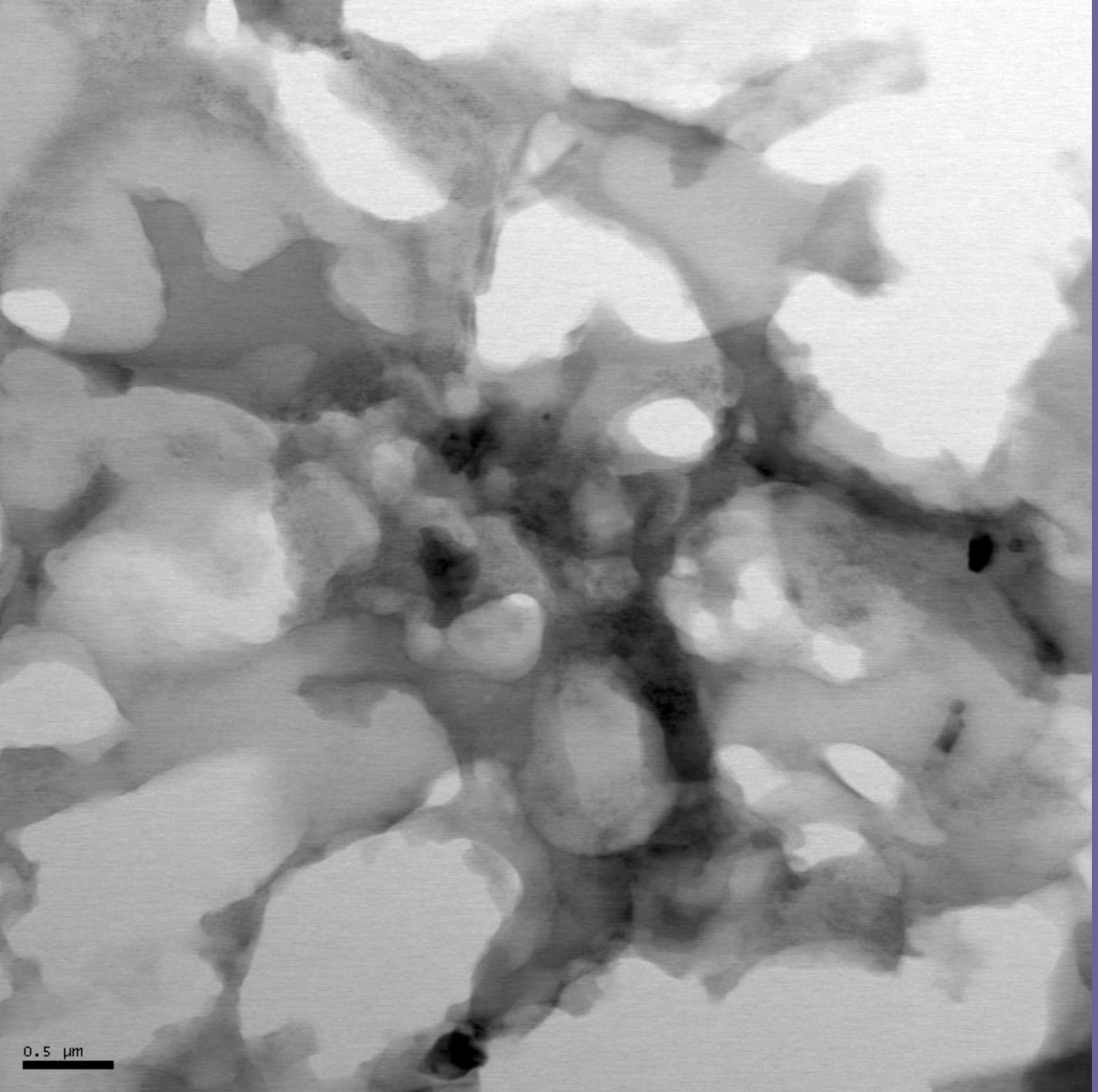
USGS LHT-1 agglutinates



Most of the material has been plucked out, but based on the texture of the remaining epoxy, I'd say it was pretty vesicular

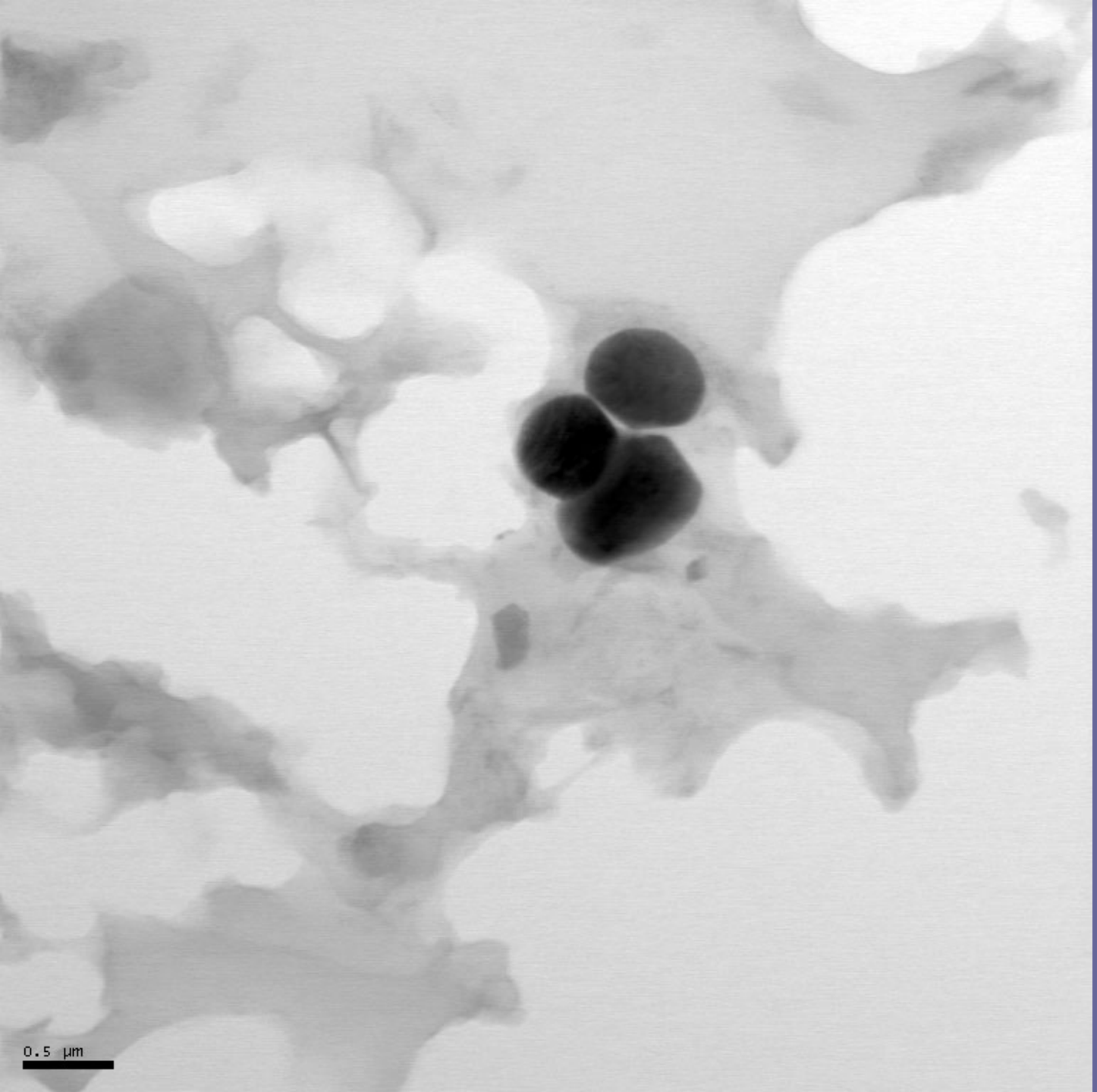


Another highly vesicular grain

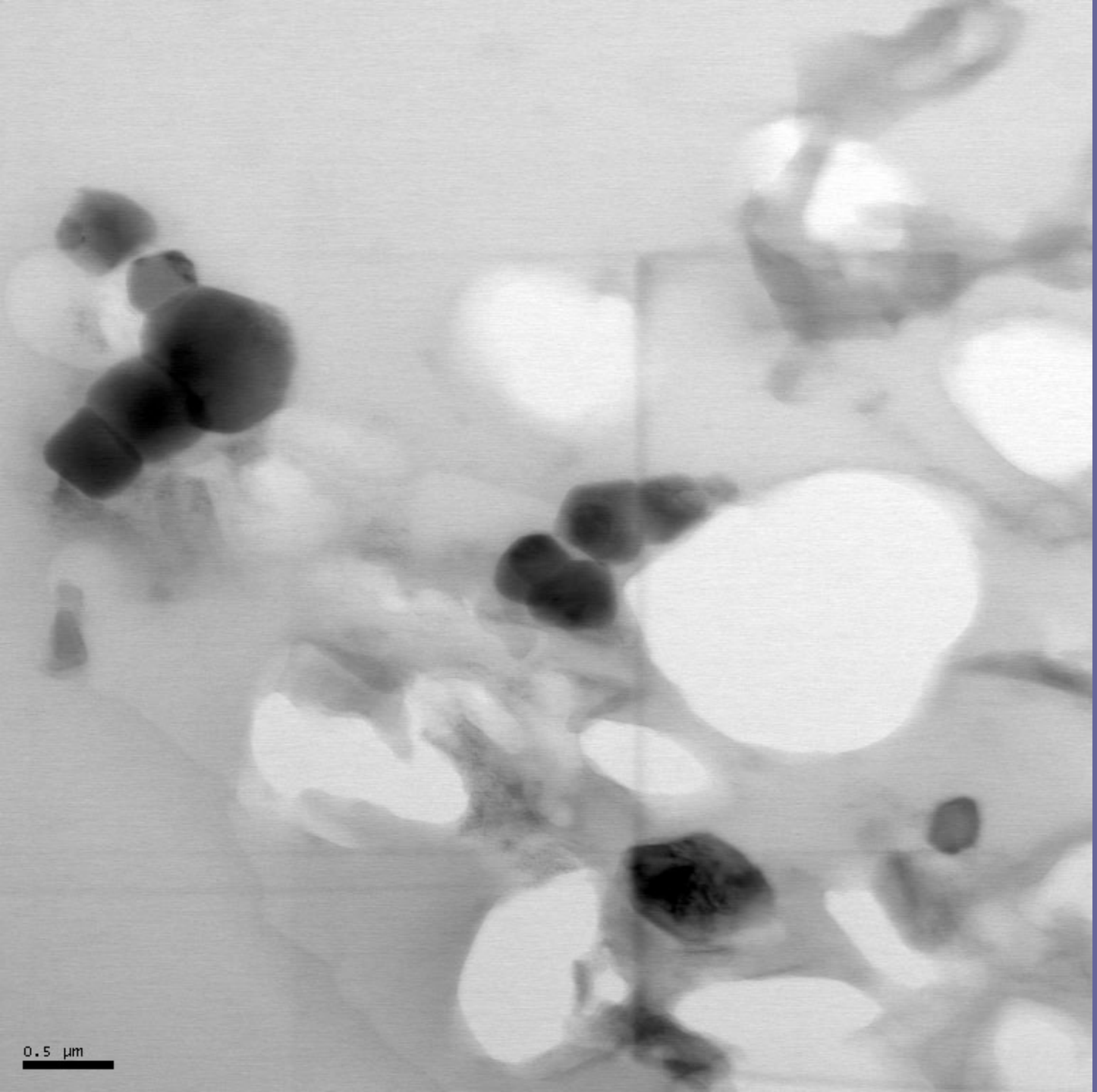


Glass matrix (close up of previous slide)

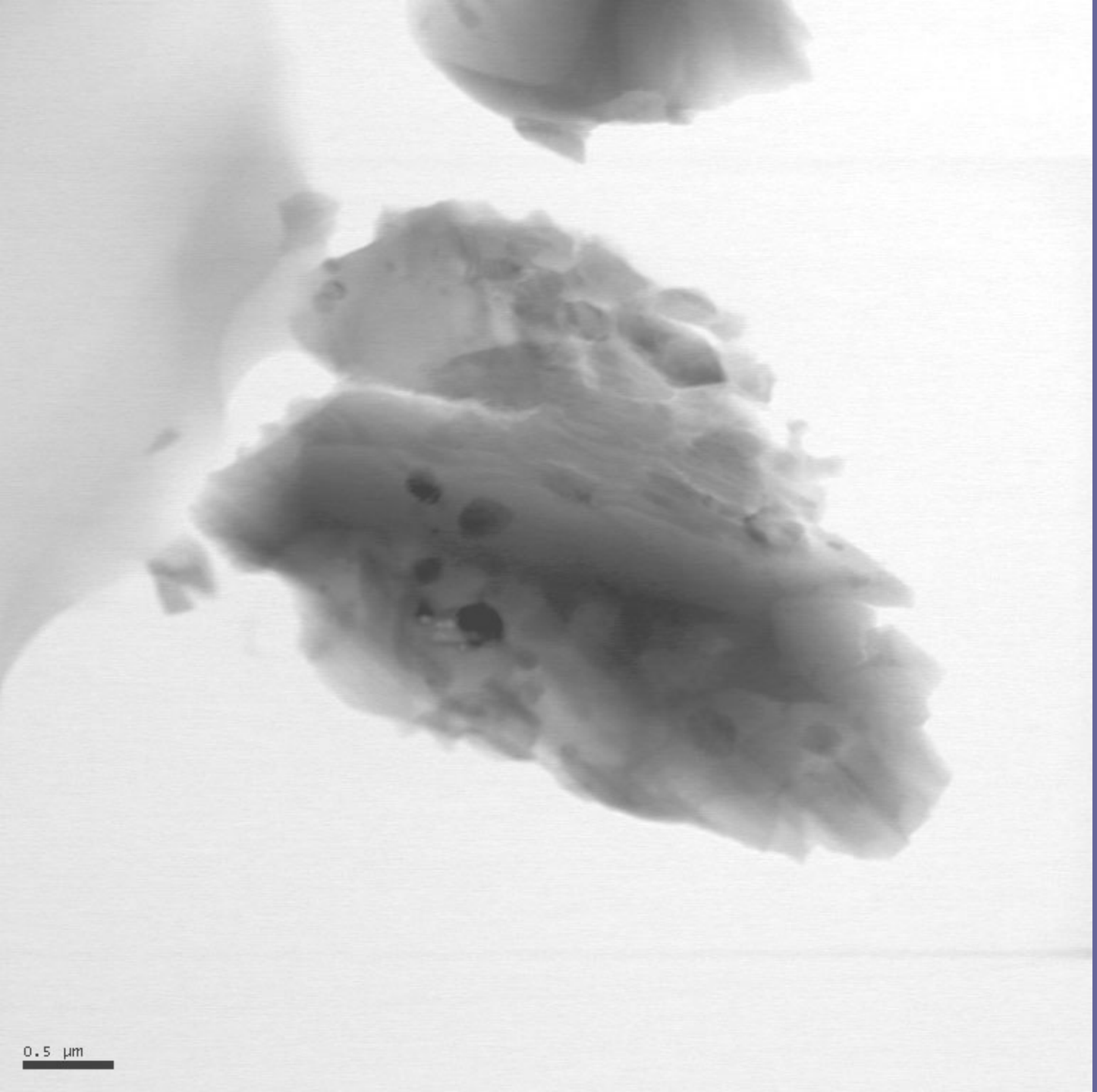
This region corresponds to the top spectrum on slide 11 (aggl-1(4))



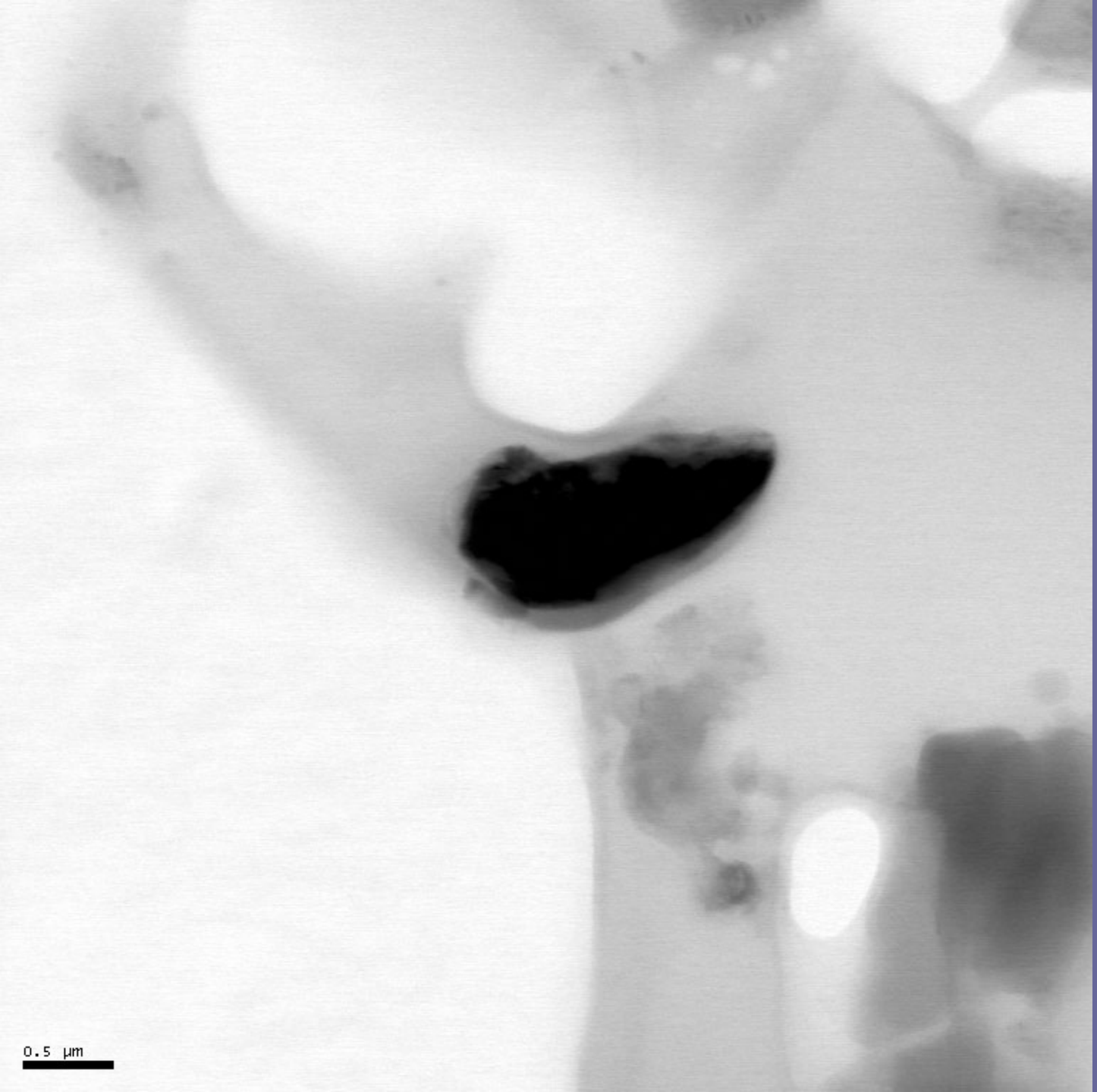
Zn, S



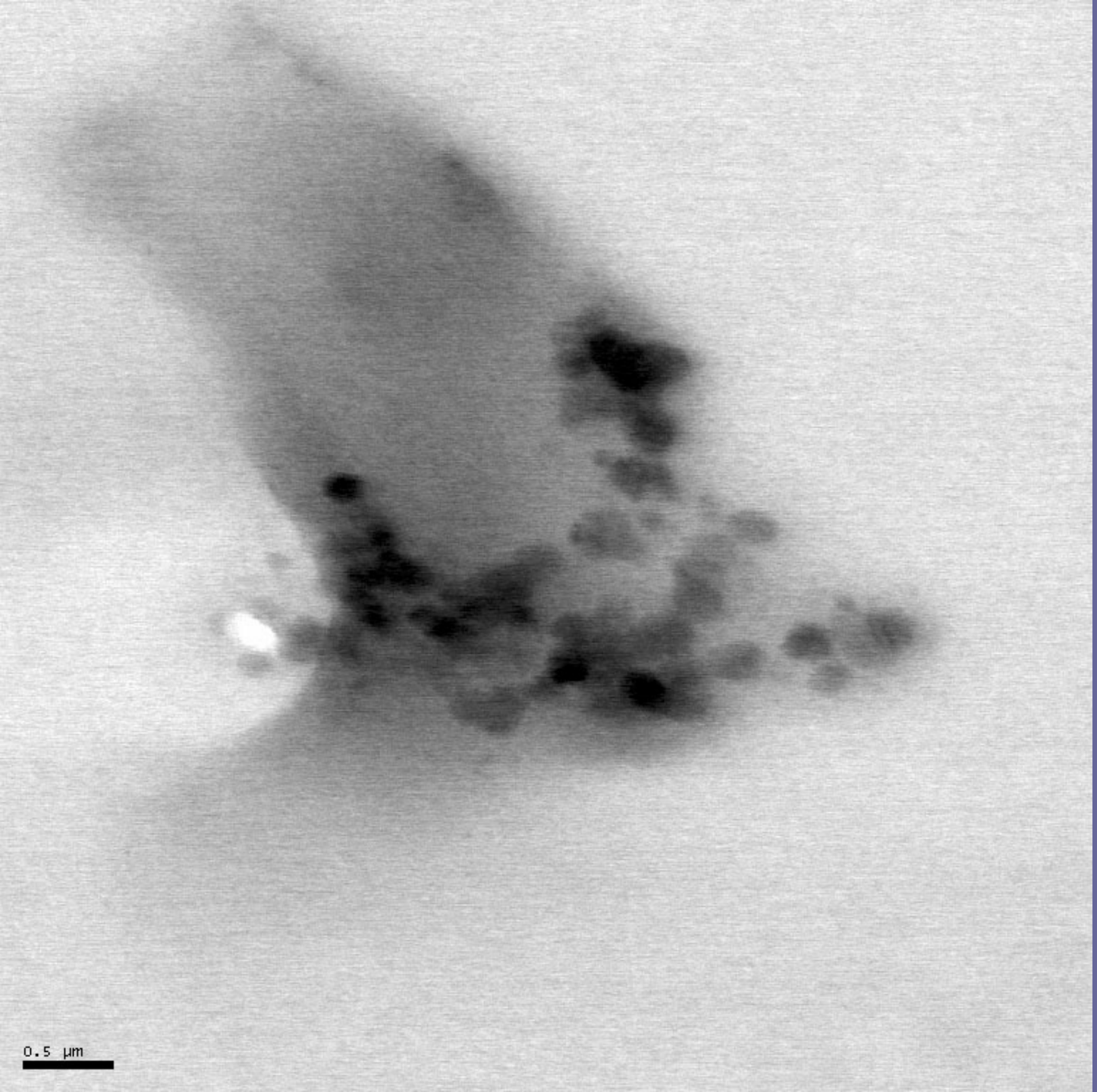
Rutile cluster in center



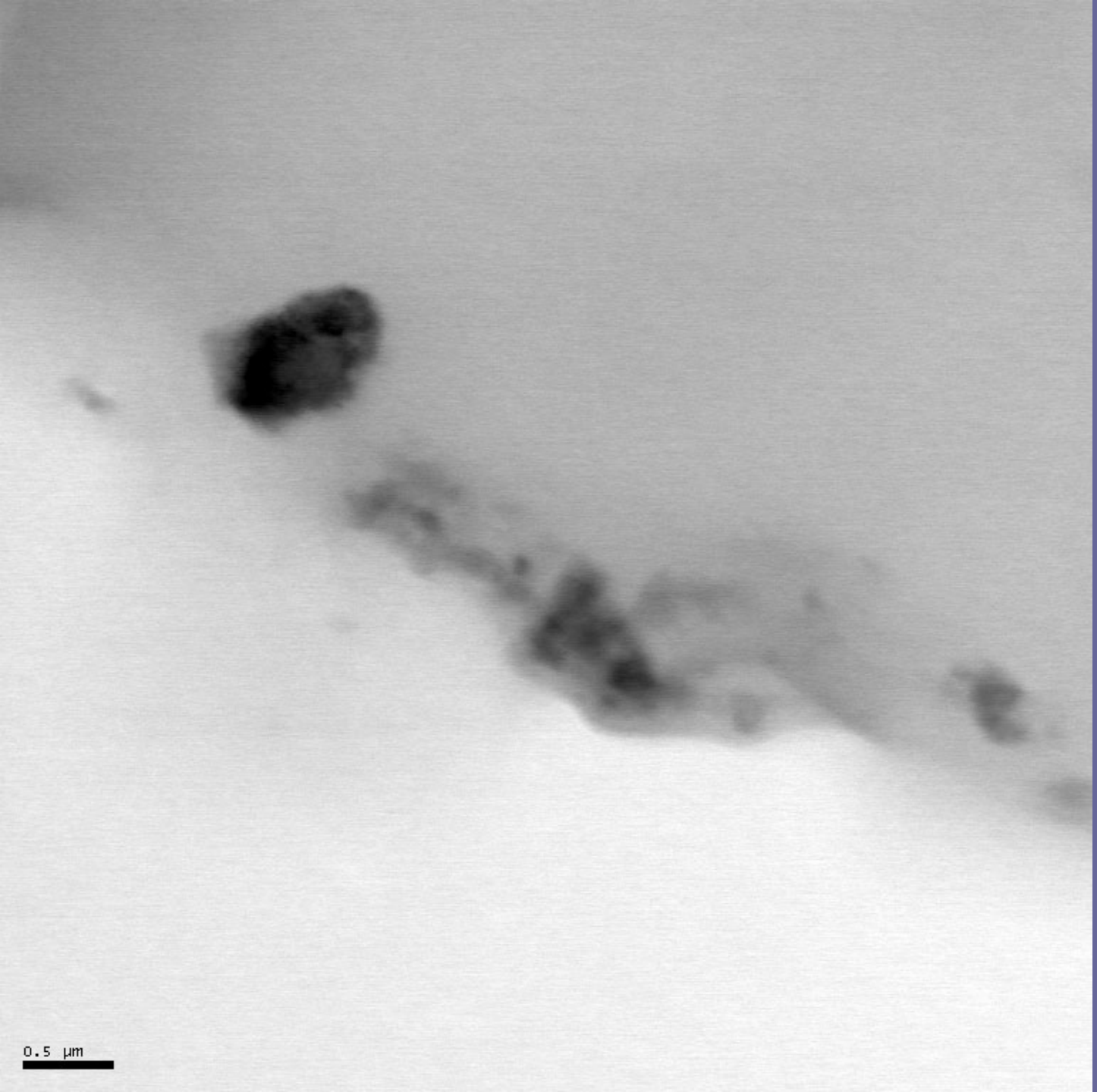
Plag grain (or plag-like glass) with Olivine



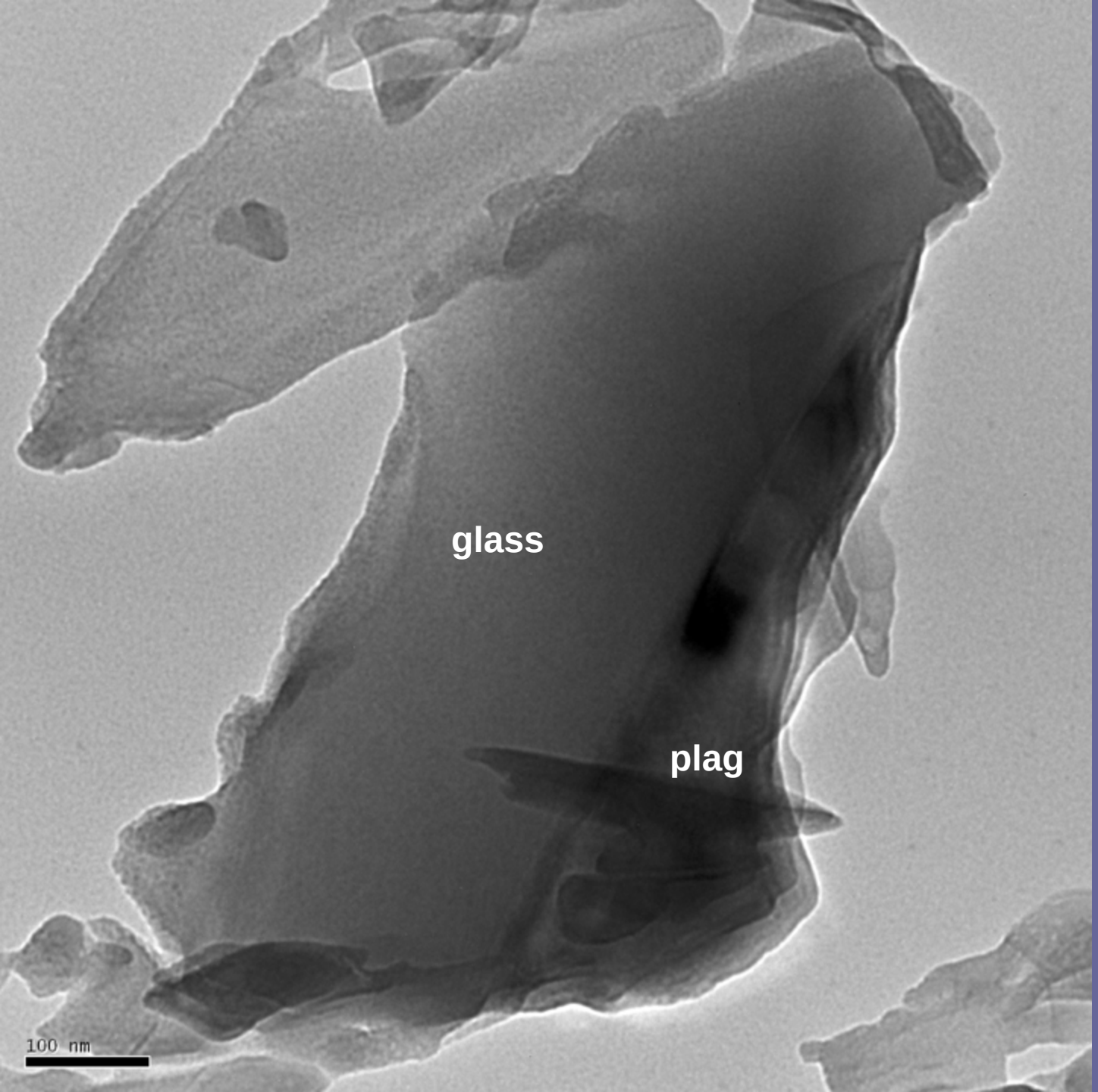
Chromite



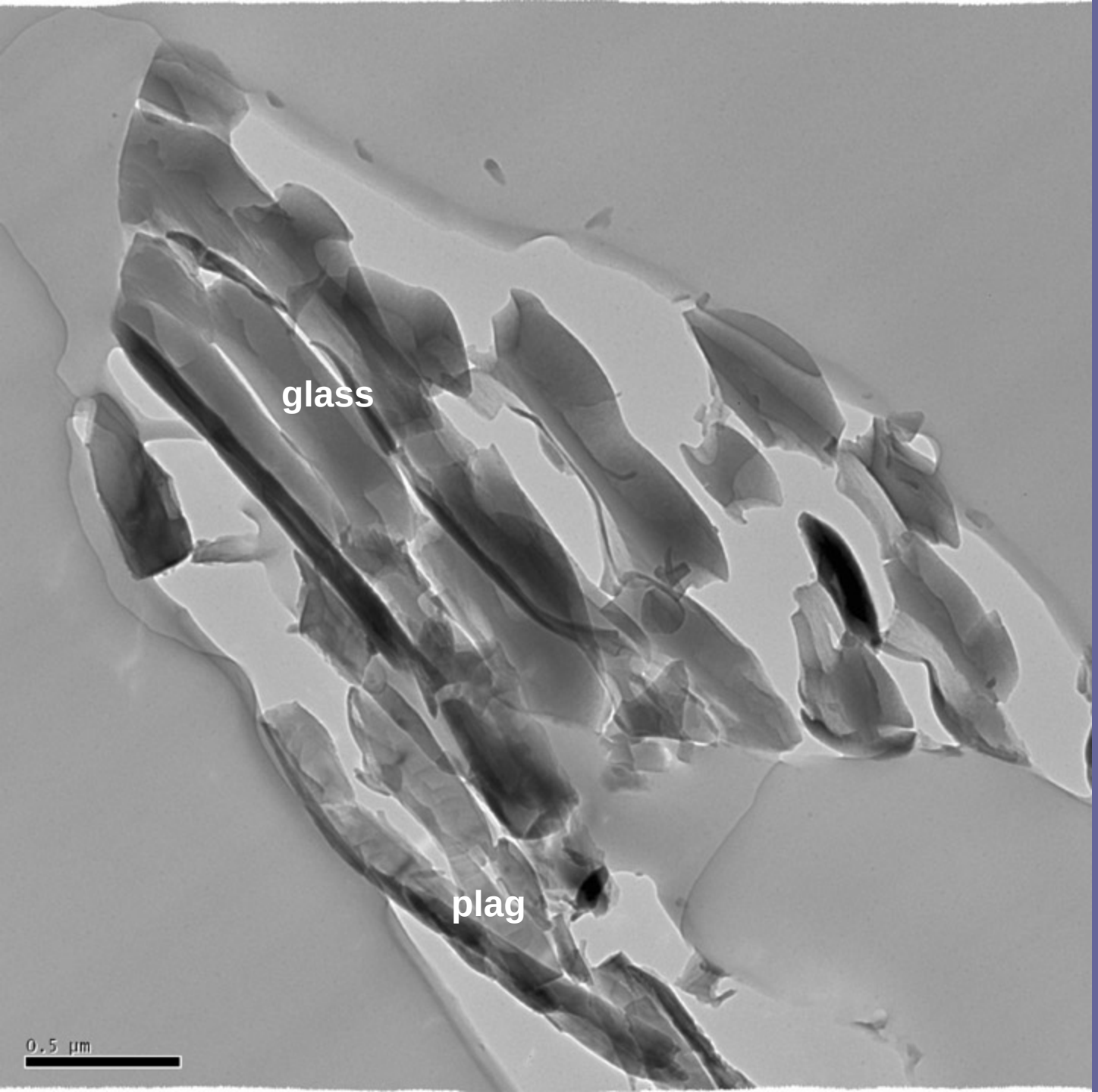
Zn and Cr-rich cluster



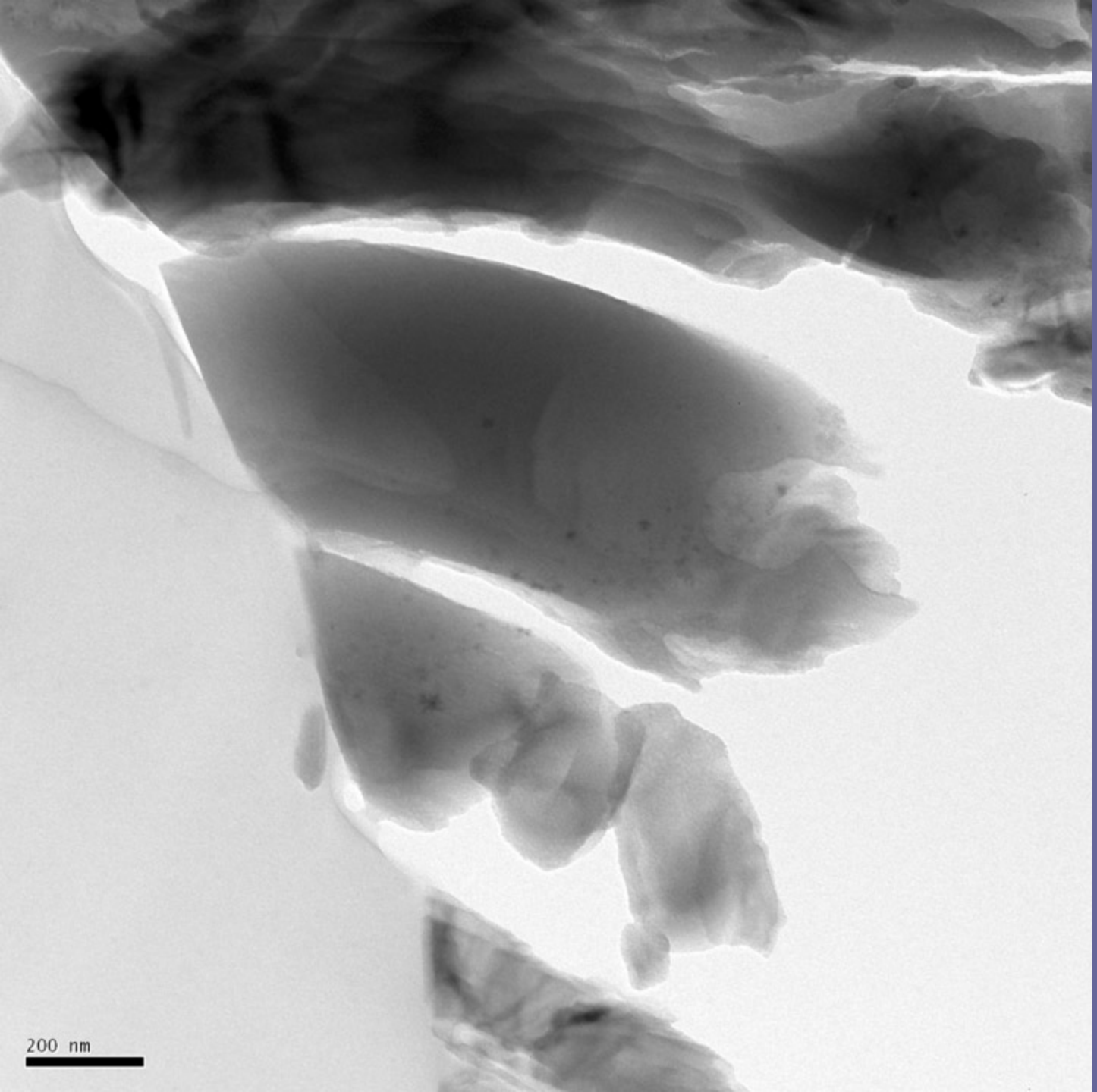
Zn-rich cluster



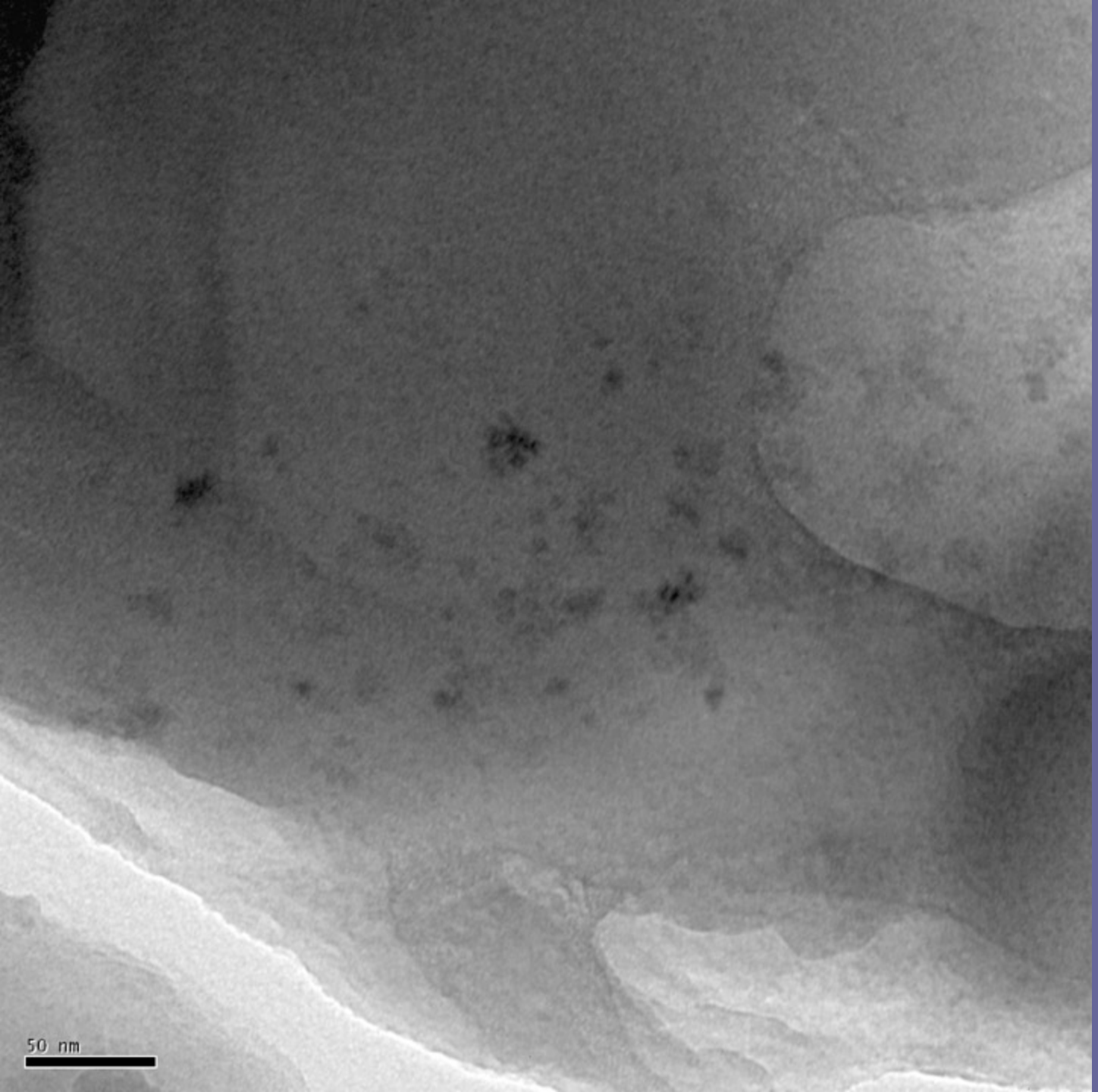
Glass and plag grain (no $npFe^0$)



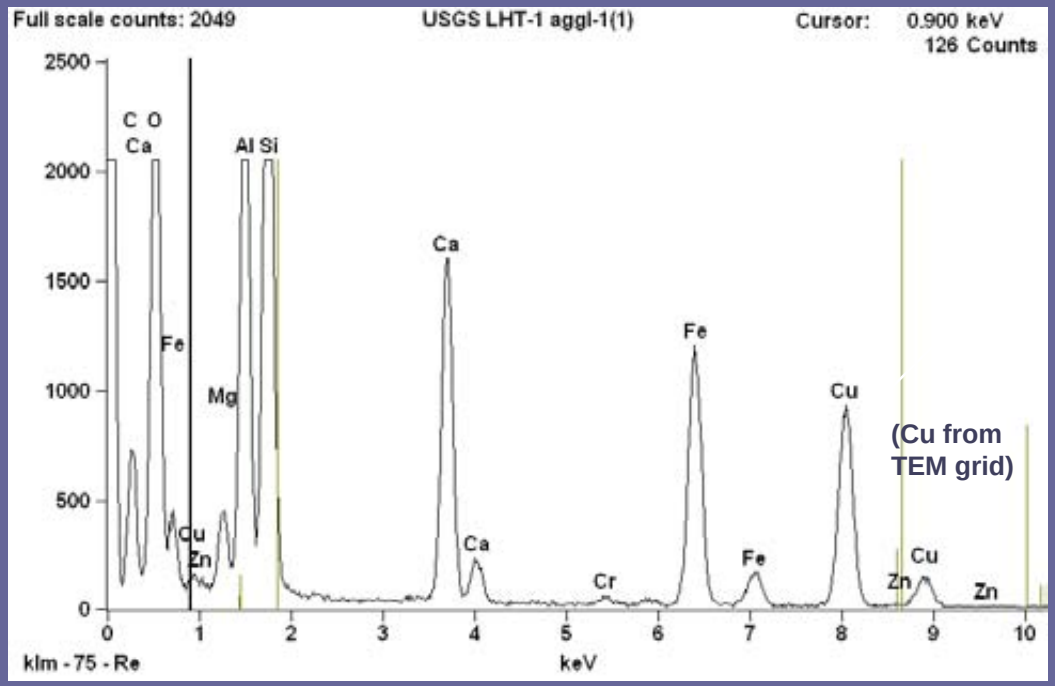
Glass and plag grain (no $npFe^0$)



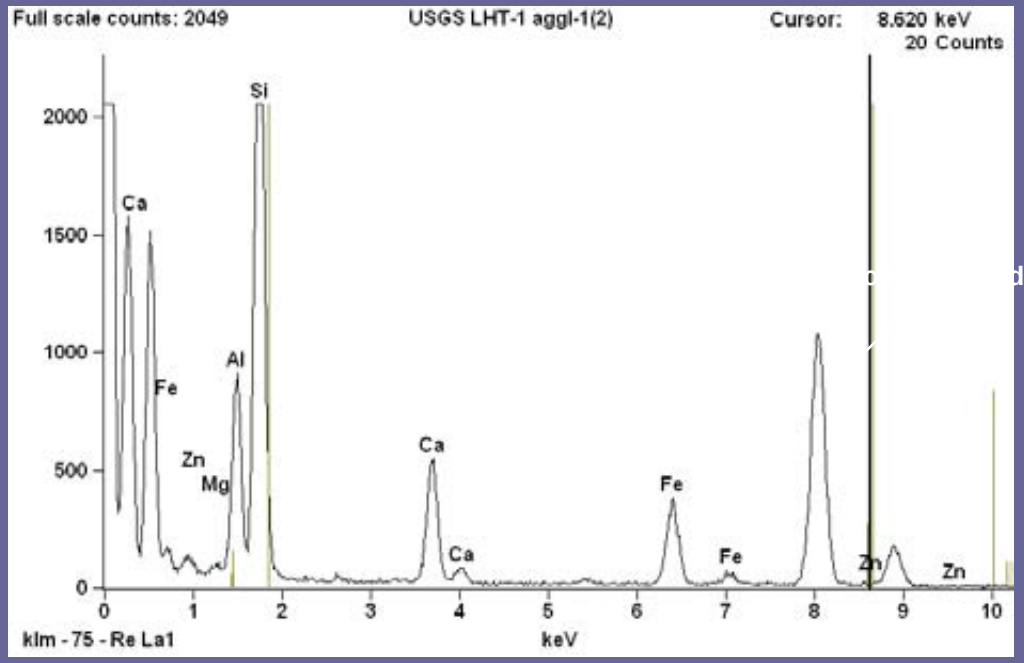
Glass with nanophase component

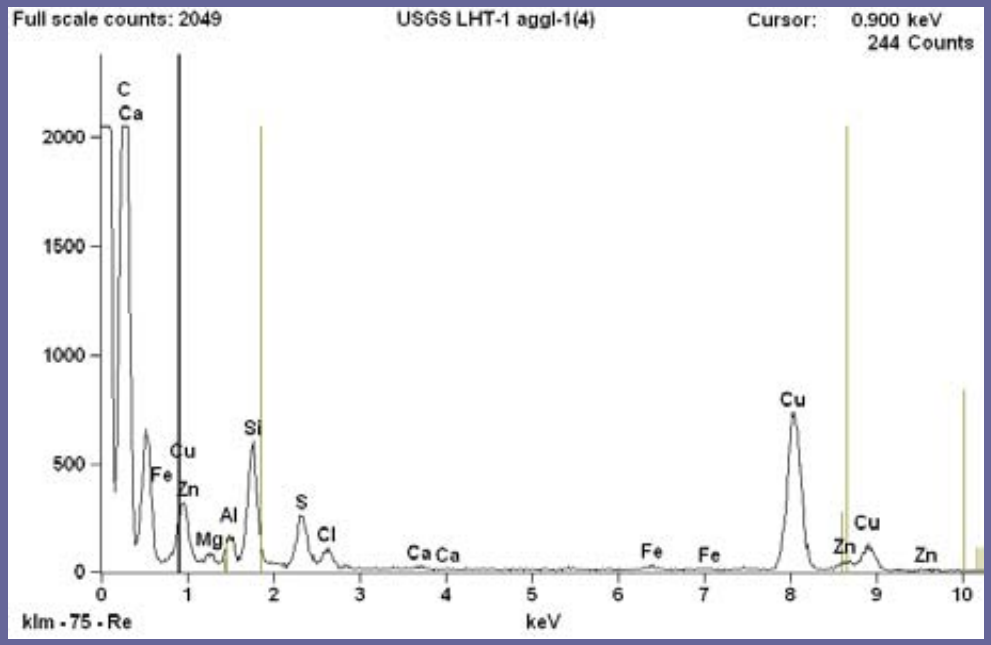


Some kind of nanophase component , but probably not iron, pyx or maybe ilm?

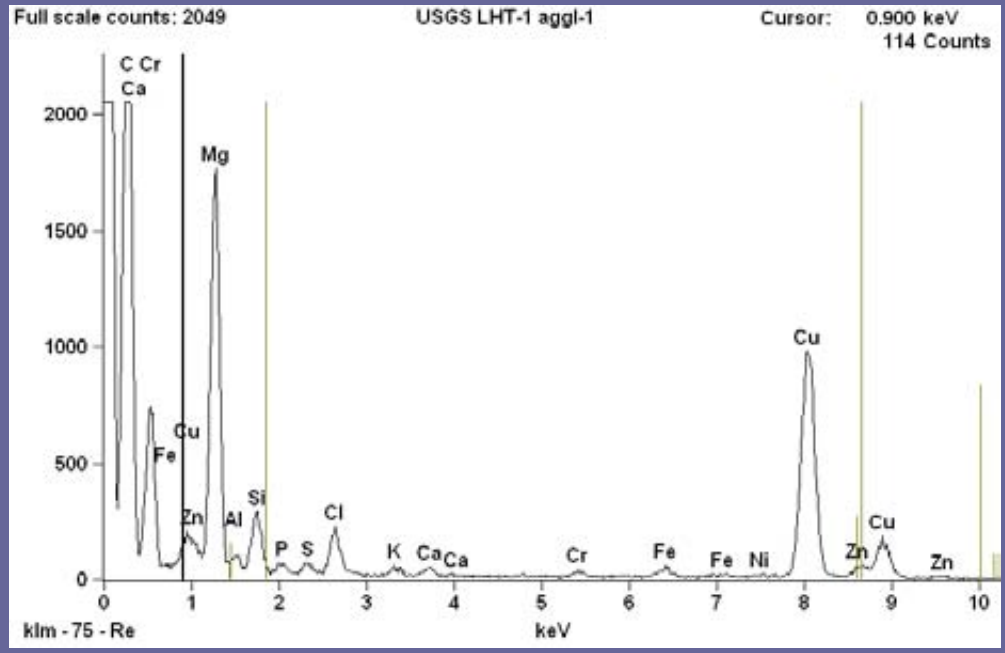


These spectra look pretty reasonable, lots of Al, Si, Ca, some Mg, and Fe – that's what highlands aggl should have in them, there is a little Cr and Zn, but pretty minor.





These spectra are a bit more worrying – S, Cl, K, P, Cr, Zn



General Thoughts

- Didn’t see any npFe, though there are some nanophase things, just not plain Fe
- Lots of Cr and Zn, some Ni
- Lots of assorted volatiles that the Moon doesn’t have (S, K, Cl)
- Not enough glass overall
- No little spherules