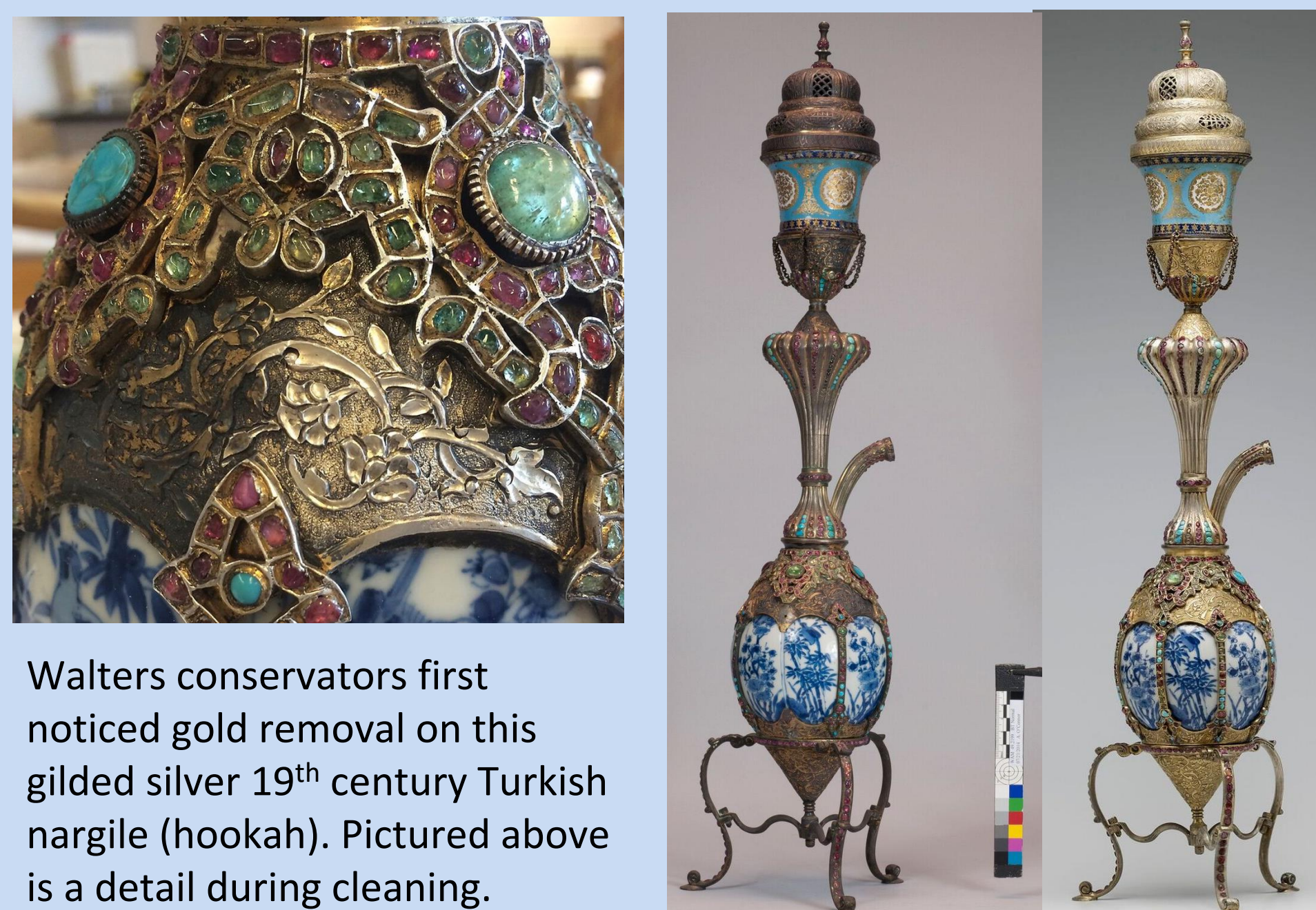


Go for the Gold: An Investigation into the use of Cosmetic Sponges for Tarnish Removal from Gilded Silver Objects

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BACKGROUND

Art conservators often use cosmetic sponges to mechanically remove tarnish from silver objects. However, recent practice revealed that these sponges can have deleterious effects on the surfaces of gilded (gold-covered) silver objects by removing the thin gold layers. The goal of this study was to understand the effects of this mechanical cleaning method, specifically by characterizing the sponge compositions.



Walters conservators first noticed gold removal on this gilded silver 19th century Turkish nargile (hookah). Pictured above is a detail during cleaning.

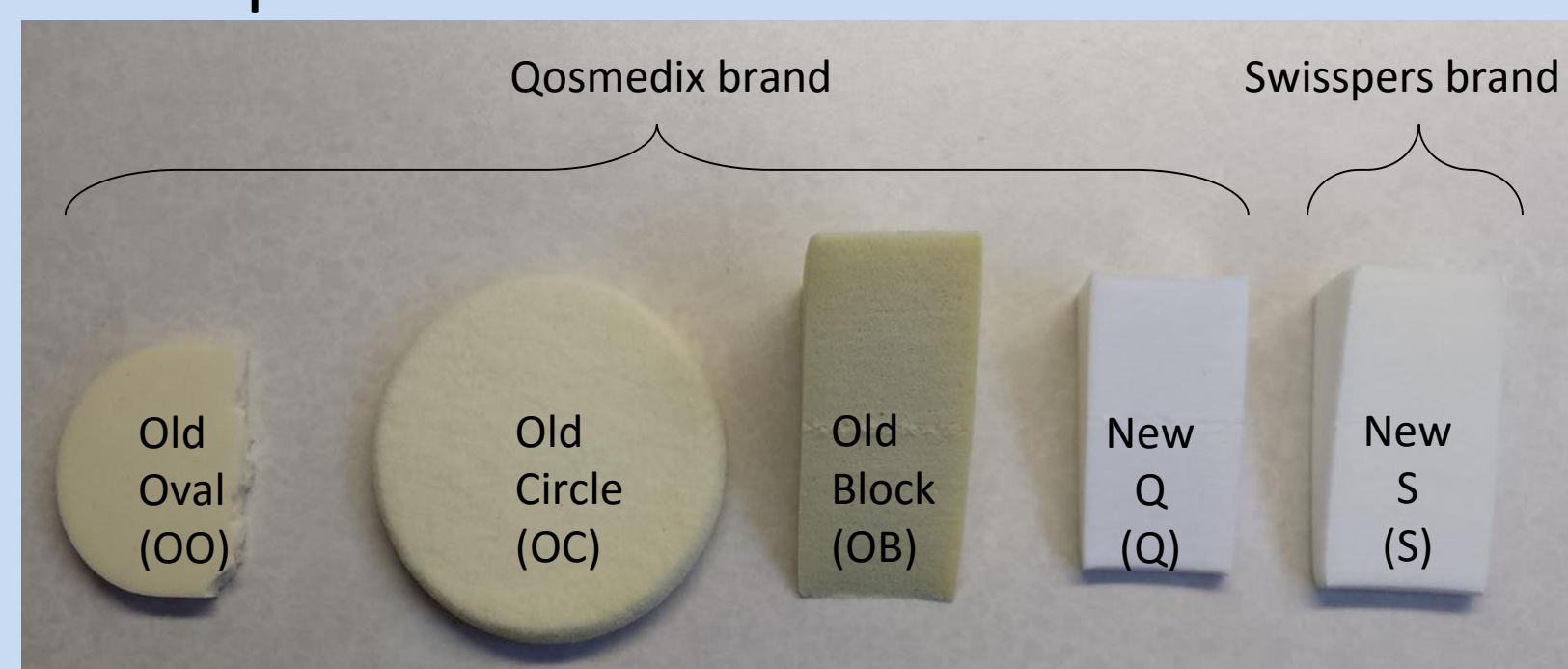
The nargile before and after cleaning.

QUESTIONS

- What are the effects of cleaning gilded silver and sterling silver with cosmetic sponges?
- What is the micro-structure of the sponges and how do they clean?
- Can we understand the mechanism by which thin film of gold is removed from a silver surface when using these cleaning techniques?

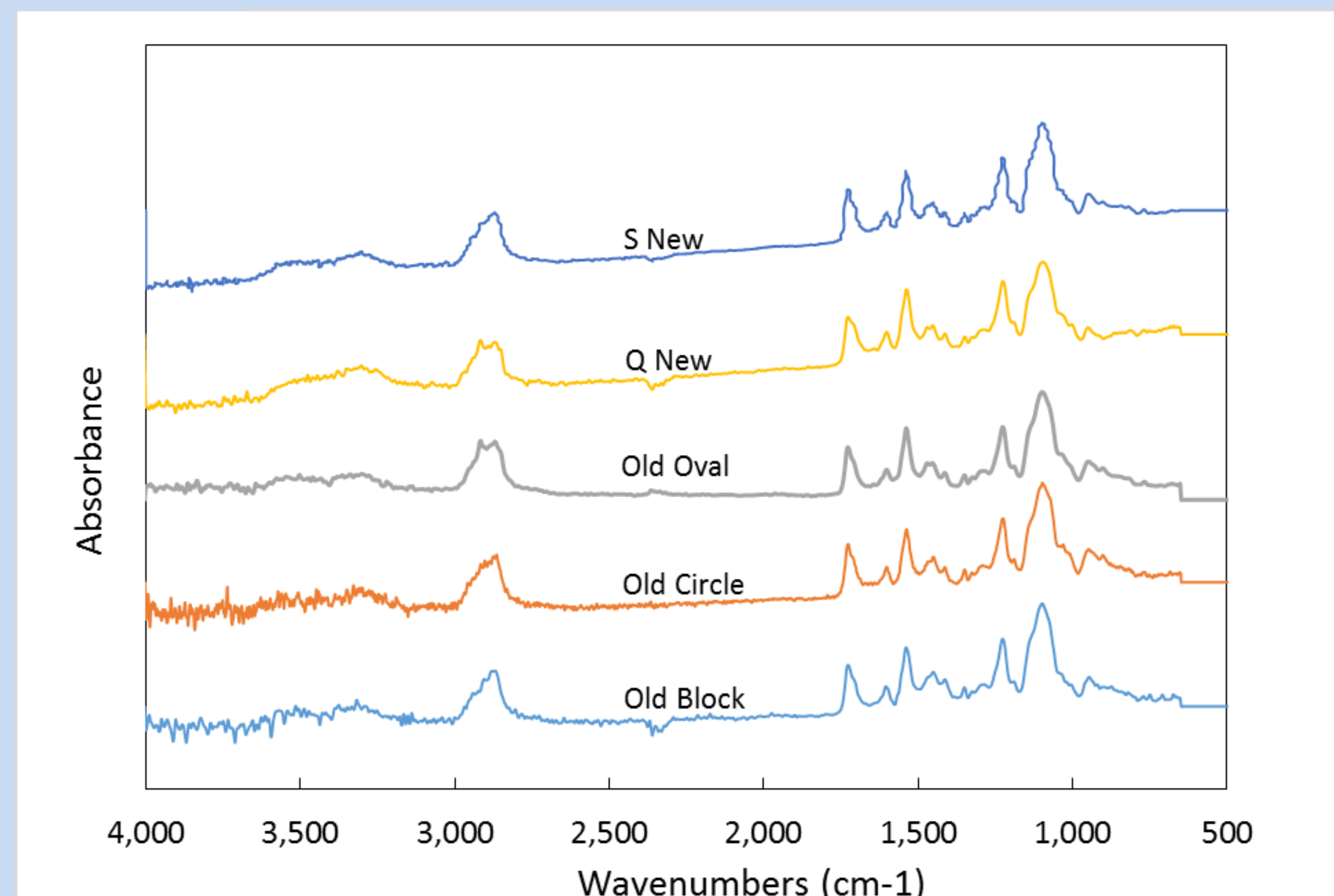
METHODS

- Leachables and extractables inductively coupled plasma mass spectroscopy (ICP-MS) characterized metals that leach out of sponges. Samples were prepared by soaking sponges in separate vials of ethanol and water.
- Gas chromatography mass spectroscopy (GC-MS) characterized organic constituents of the sponge extracts
- Attenuated total reflection Fourier transform infrared spectroscopy (FTIR) characterized the molecular composition of each sponge
- A scanning electron microscope with electron dispersive spectroscopy (SEM-EDS) was used to analyze the microstructure and elemental compositions of each sponge
- Sponges were used to clean laboratory-prepared tarnished, gilded silver one-inch coupons. Three people each cleaned three coupons with a Q, S, and old type sponge.
- Used sponges were dissolved in aqua regia, a 3:1 HCL and HNO₃ solution that is able to solubilize royal metals such as gold.
- ICP analysis of these samples was used to quantitatively measure the gold and silver removed from coupons.

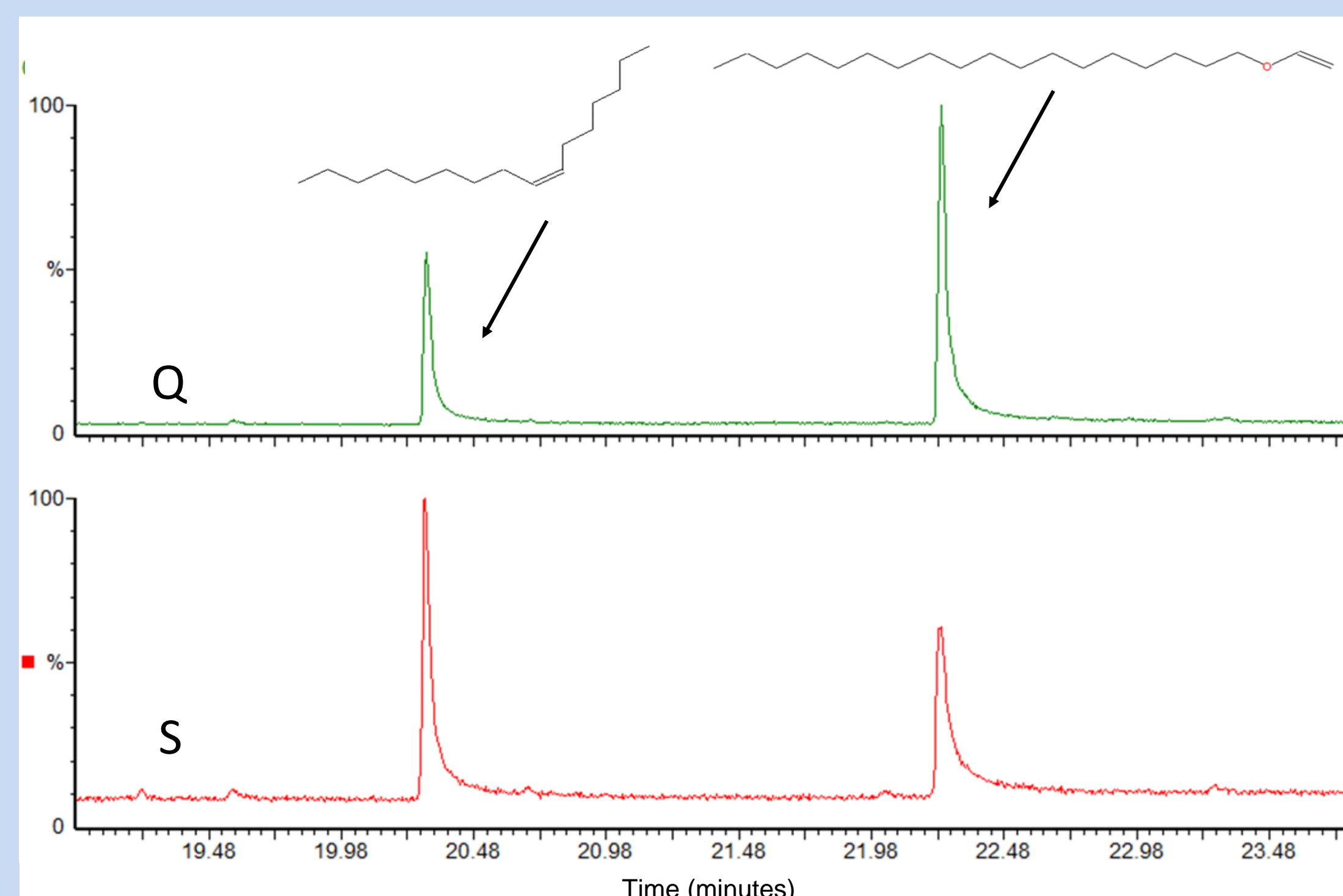


Cosmetic sponge used by conservators. Old sponges date to 2004 and new sponges were purchased recently.

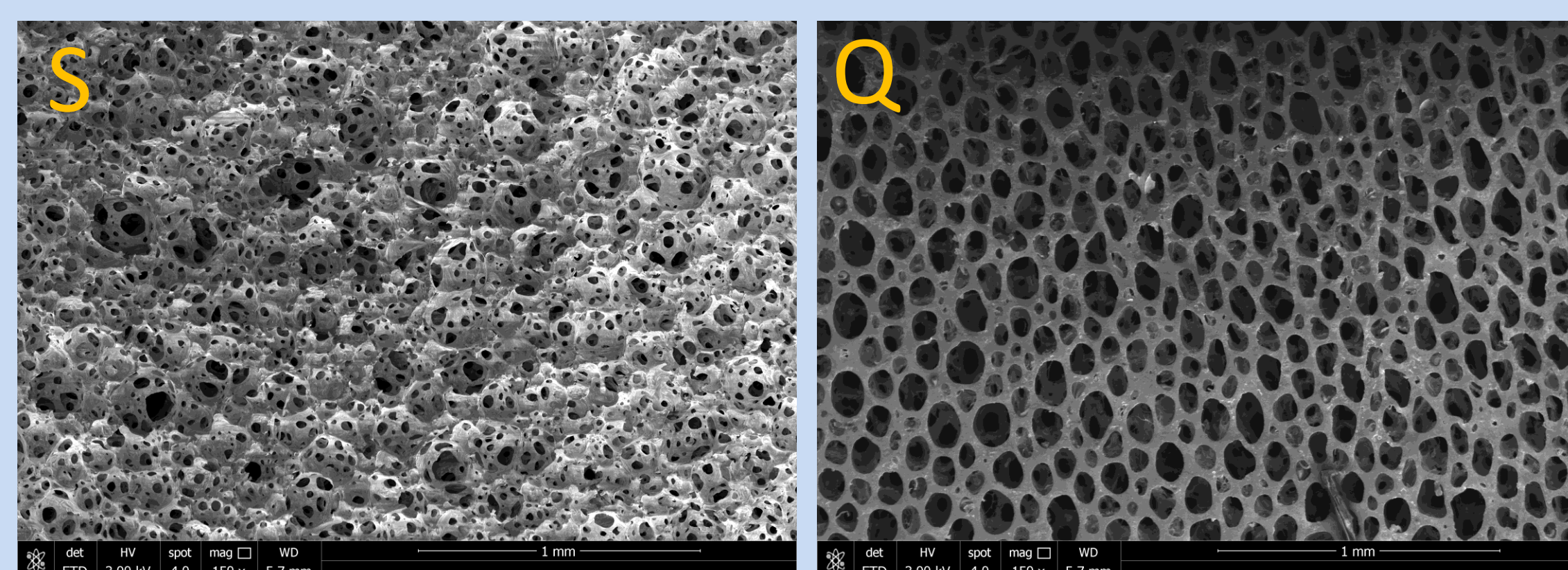
RESULTS



ATR-FTIR spectra from sponges used for mechanical cleaning

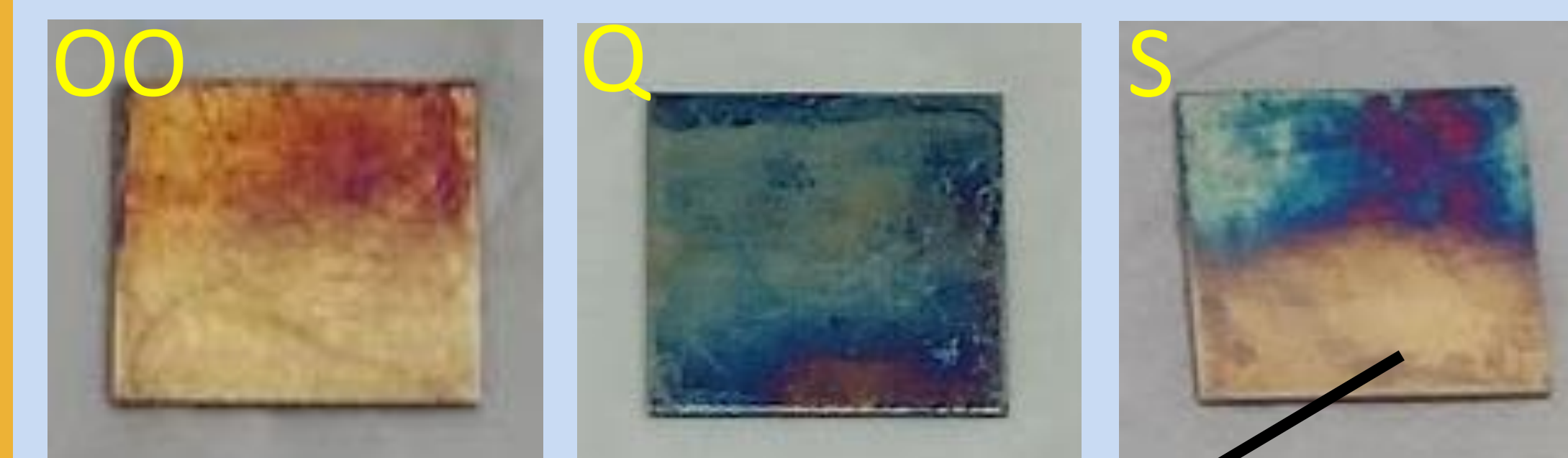


Leachables and extractables GC-MS results of Qosmedix (Q) and Swisspers (S) sponges.

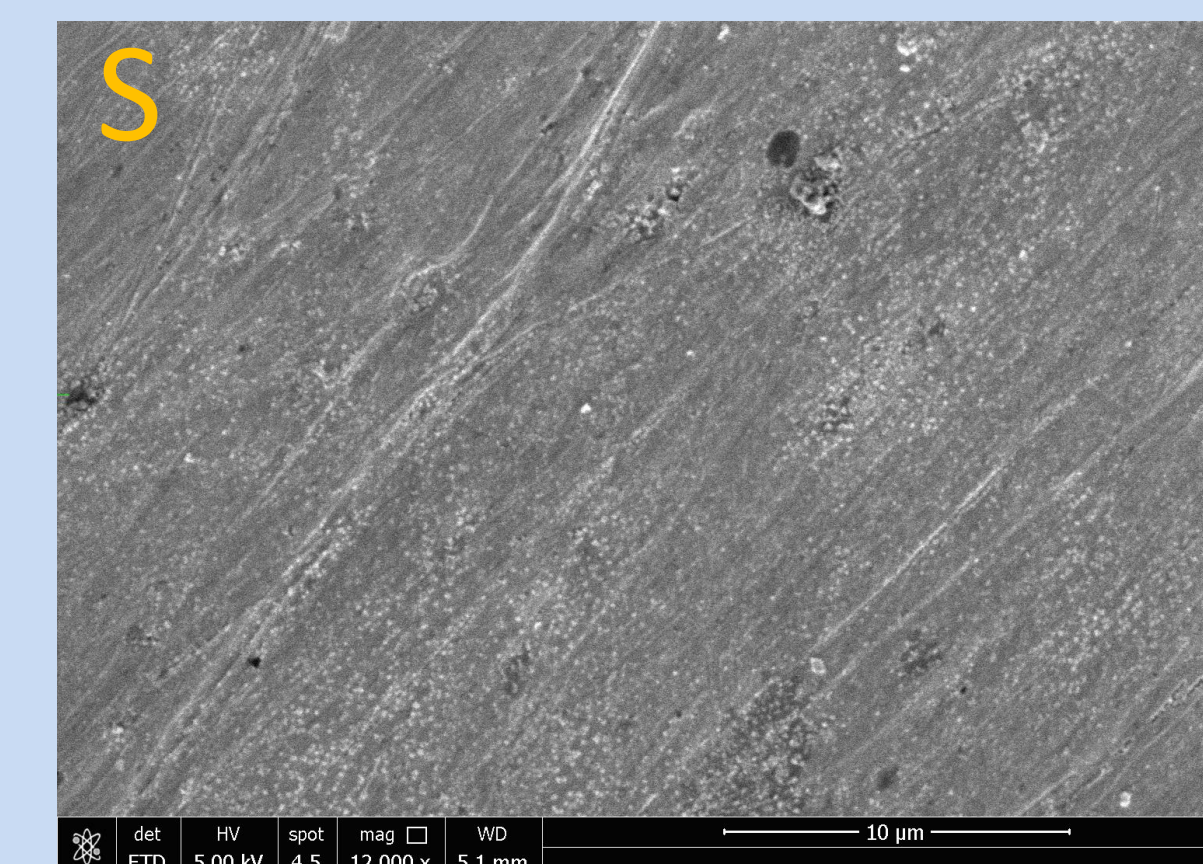


SEM micrographs at 150x of Swisspers sponge (S), Qosmedix sponge (Q) and old oval sponge (OO).

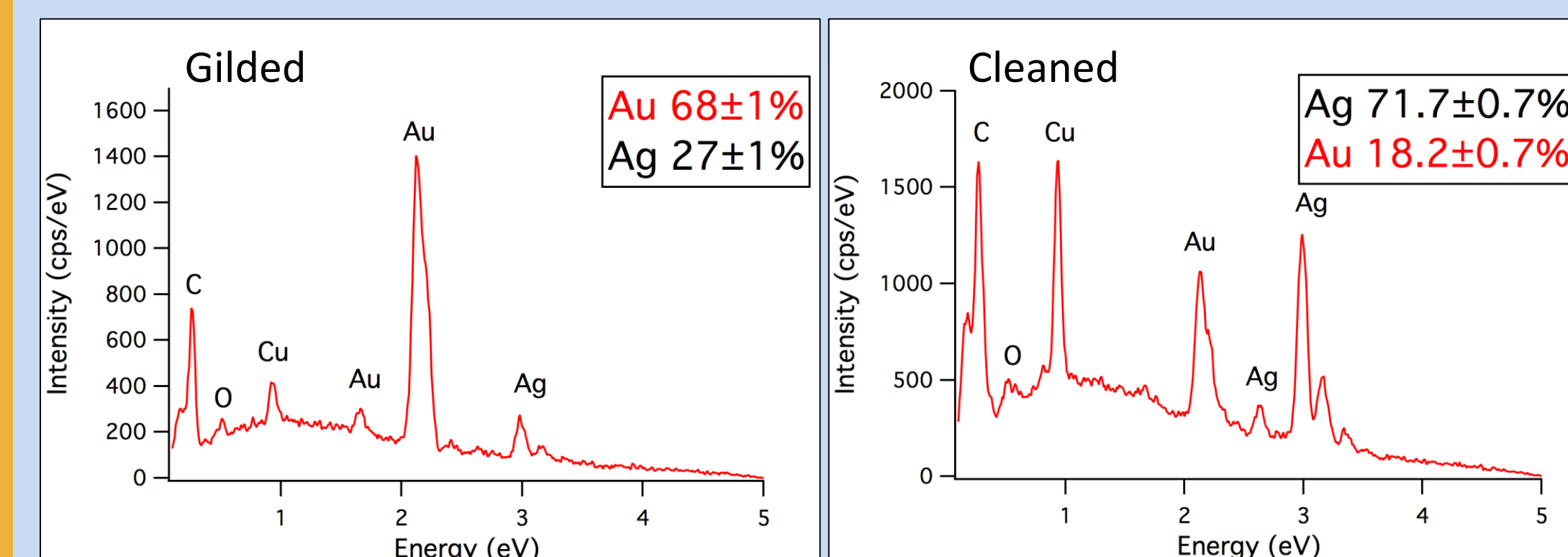
- ATR-FTIR results showed that all sponges have the same molecular composition (i.e. polyester).
- GC-MS showed that the sponges are leaching similar long-chain hydrocarbon molecules, likely from industrial processes.
- SEM showed that the sponges have very different physical structures. Swisspers sponges are rougher than new Qosmedix sponges.
- Old sponges appear rougher compared to new sponges of the same brand. This difference is likely due to degradation over time.



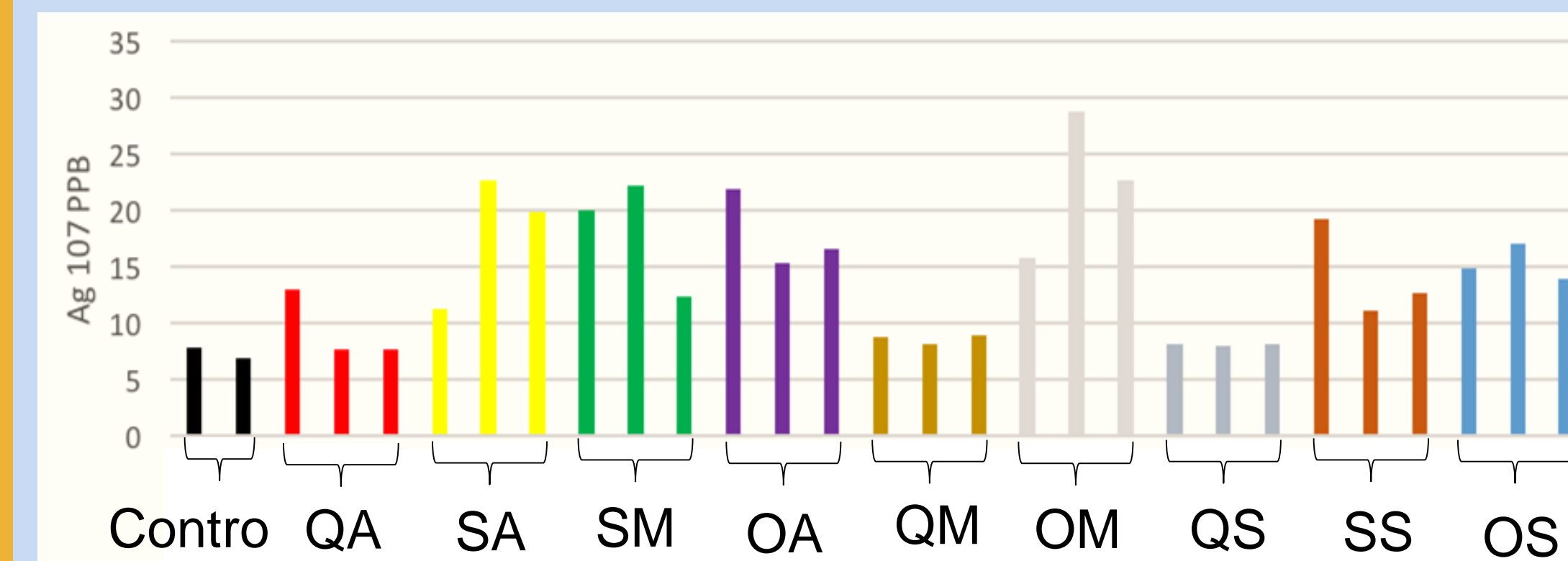
Coupons cleaned with each of the different sponges



SEM micrograph of a gilded coupon mechanically cleaned with a Swisspers



EDS spectra of coupon surfaces before (Gilded) and after (Cleaned) the mechanical cleaning process. In the inset of each figure are shown the percentages of the main elements found on the surface.



ICP results for silver found in sponges used to clean coupons

- Old and Swisspers sponges were significantly more effective at removing tarnish than the new Qosmedix sponges. There is a correlation between the roughness on the nanoscale of a sponge and its effectiveness at removing tarnish.
- ICP data confirmed that the roughest sponges, the Old Qosmedix sponges removed the most silver. The second roughest sponges, Swisspers, removed the second most amount of silver. The softest and flattest sponges, the new Qosmedix, removed the least amount of silver.
- ICP data for the presence of gold on the sponges confirmed that gold is being removed from coupons during mechanical cleaning. However, due to instrumental interference, these results were not quantitative.

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