

## Mercury emissions from herbaria cabinets

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High mercury (Hg) levels in herbaria, i.e. the botanical sections of natural history museums, are a potential health hazard for both museum workers and visitors.

The present work aims to quantify gaseous elemental Hg (GEM) emission from the cabinets hosting the plant collections of the *Central Italian Herbarium* (Natural History Museum of the University of Florence), one of the largest botanical section of natural history museums worldwide. Here, both historical collections (*closed herbaria*, i.e. collections not updated with new samples) and modern collections (*open herbaria*, i.e. collections continuously updated with new samples) are stored in metal (M) or wood (W) cabinets.

GEM emissions ( $\text{ng/m}^3$ ) following the opening of the cabinets were recorded using a Lumex® RA-915M analyzer, a real-time Hg<sup>0</sup> detector. In addition, dust samples were collected inside the same cabinets using an adhesive tape: the total Hg concentration on the cabinets surface (THg,  $\text{ng/cm}^2$ ) was determined using a direct Hg analyzer (Milestone DMA-80 evo), while the morphology and composition of the dust particles was studied by SEM-EDS.

The highest GEM emissions were reached at the opening of W-cabinets, containing both *closed herbaria* ( $1501 \pm 450 \text{ ng/m}^3$ , mean  $\pm$  SD) and *open herbaria* ( $860 \pm 507 \text{ ng/m}^3$ ): here the dust samples showed also the highest THg (*closed herbaria*  $28 \pm 26 \text{ ng/cm}^2$ ; *open herbaria*  $23.5 \pm 15 \text{ ng/cm}^2$ ). Differently, M-cabinets displayed the lowest values of both GEM emission and THg in dust samples. In this case the *closed herbaria* ( $998 \pm 540 \text{ ng/m}^3$ ) proved to contribute more to GEM emissions than the *open herbaria* ( $386 \pm 151 \text{ ng/m}^3$ ), while the THg was comparable in the two types of cabinet (*closed herbaria*  $6.5 \pm 11.1 \text{ ng/cm}^2$ ; *open herbaria*  $5.3 \pm 3.6 \text{ ng/cm}^2$ ).

SEM-EDS analysis of the dust samples showed that Hg is present in tiny particles (average diameter  $0.8 \mu\text{m}$ ) and is mainly associated with S, in agreement with Ciani et al. [1]. Particulate-bound Hg is more abundant in the W-cabinets than in the M-ones.

This study demonstrated that the opening of cabinets strongly contributes to rise GEM concentrations inside the *Herbarium* and that the W-cabinets are more contaminated with Hg than the M-ones.

### References

[1] Ciani F., Chiarantini L., Costagliola P., Rimondi V. (2021).