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Biocide determination in ethnological collections – a methodological approach

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2: Ethnological Museum, State Museums Berlin

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2006

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Biocides

polycyclic aromatic hydrocarbons

organo-chlorine compounds

heavy metal compounds

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Biocides

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Biocides

qualitative detection methods

organo-chlorine compounds

heavy metal compounds

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Biocides

qualitative detection methods

fast and reliable
measurement techniques
and
methods

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Ethnological Museum Berlin

330,000 objects

Biocide contaminated storage areas

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Ethnological Museum Berlin

330,000 objects

Biocide contaminated storage areas

Objects = Sources?

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330,000 objects

Biocide contaminated storage areas

Objects = Sources?

Differences in contamination rates?

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Pre-information ➡ **Dust**

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Samples - criterion

Cabinet cases and shelves in storage

- already analysed area (ALAB)

- organic materials

- return from Leipzig/ Celle

Dust

- not taken directly from surfaces of objects

- sample mix

- two pellets

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Methods - usual

Organo-chlorine biocides → **GC / MS**

Active substances:
γ-Hexachlorocyclohexane (**lindane**), Pentachlorophenol (**PCP**), Dichloro-diphenyltrichloroethane (**DDT**) and its degradation products

Heavy metal compounds

Elements:

Arsenic and mercury

→ **Hydrid-AAS**

→ **ICP / MS**

→ **XRF**

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Method

XRF

Is chlorine a reliable indicator for the presence of organo-chlorine biocides (DDT, PCP, lindane)?

In cooperation with TU-Berlin
- financed by DBU -

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µ-XRF spectrometer ArtTAX Pro Bruker AXS

Portable
Non-destructive

Polycapillar lense
ø 0,1 mm
Mo-tube 30 W
SDD
step motor for
x, y and z
CCD

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Method

XRF

Organo-chlorine biocides → Chlorine intensity

Heavy metal compounds → Arsenic Mercury

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Method

But!

Organo-chlorine biocides → Chlorine intensity

Heavy metal compounds → Arsenic Mercury

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Method

But!

~~Organo-chlorine biocides~~ ⬅ **Inorganic chlorides**

Heavy metal compounds ➡ Arsenic
Mercury

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Method

But!

~~Organo-chlorine biocides~~ ← **Inorganic chlorides**

Heavy metal compounds ← **Lead and mercury overlap arsenic**

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Method

But!

~~Organo-chlorine biocides~~ ← **Inorganic chlorides**

~~Heavy metal compounds~~ ← **Lead and mercury overlap arsenic**

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Method

TLC

Organo-chlorine biocides → No consistent qualitative results

ICP/MS

Heavy metal compounds → Arsenic
Mercury

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Method

ICP/MS

No health risk values of heavy metals in dust

Statistics - Percentiles

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Method

ICP/MS

Orientation value for heavy metals in dust [mg/kg]

Heavy metals	Background value	Normal value	Remarkable value
	10. Percentile	50. Percentile	90. Percentile
Arsenic	**0,5**	**1**	**3**
Lead	**5**	**20**	**150**
Mercury	**0,15**	**0,5**	**1**

Source: Arbeitsgemeinschaft Ökologischer Forschungsinstitute AGÖF – Orientierungswerte für Inhaltsstoffe von Raum- und Hausstaub, 03/2005

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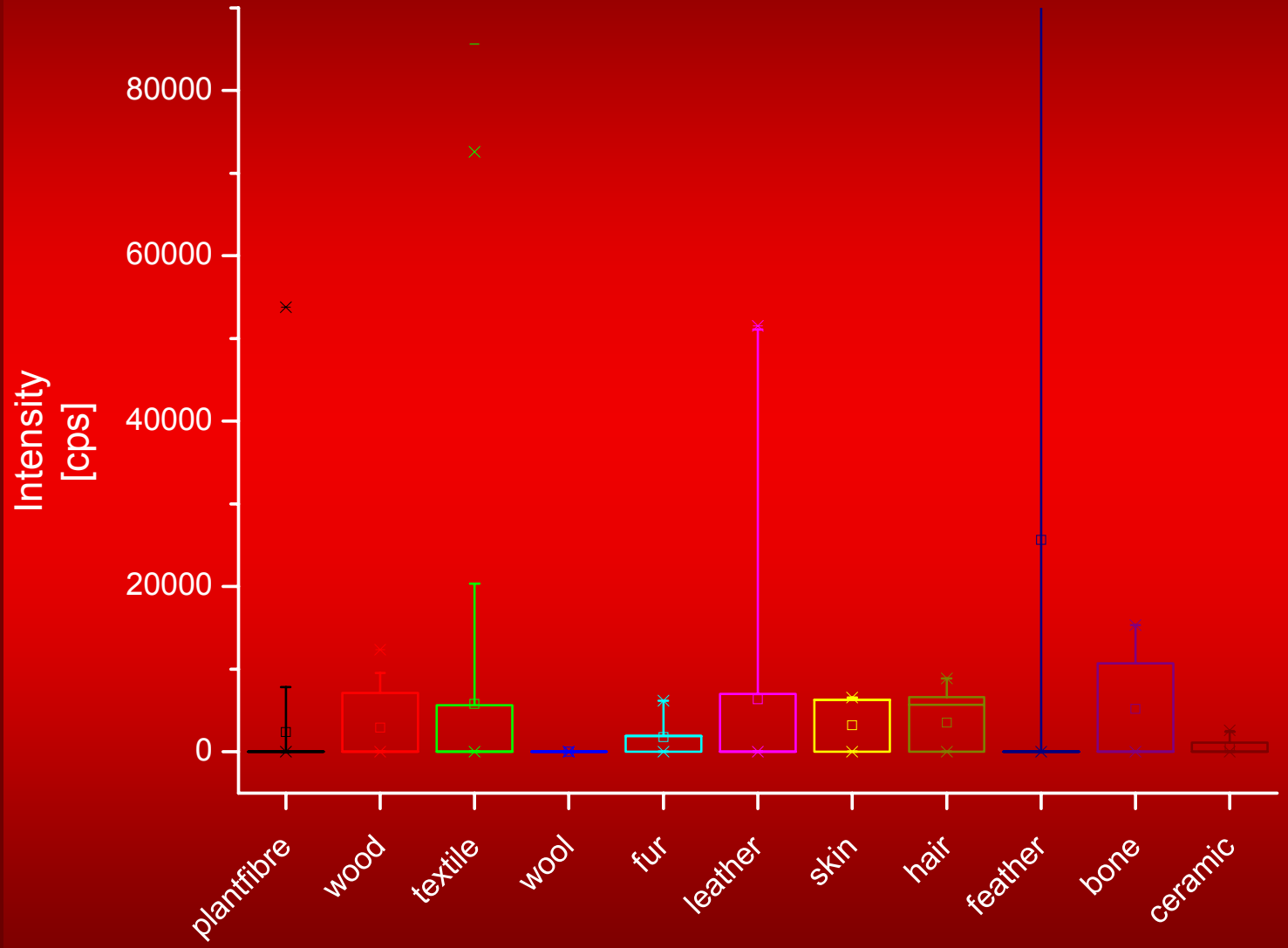
Results – arsenic on surfaces of objects



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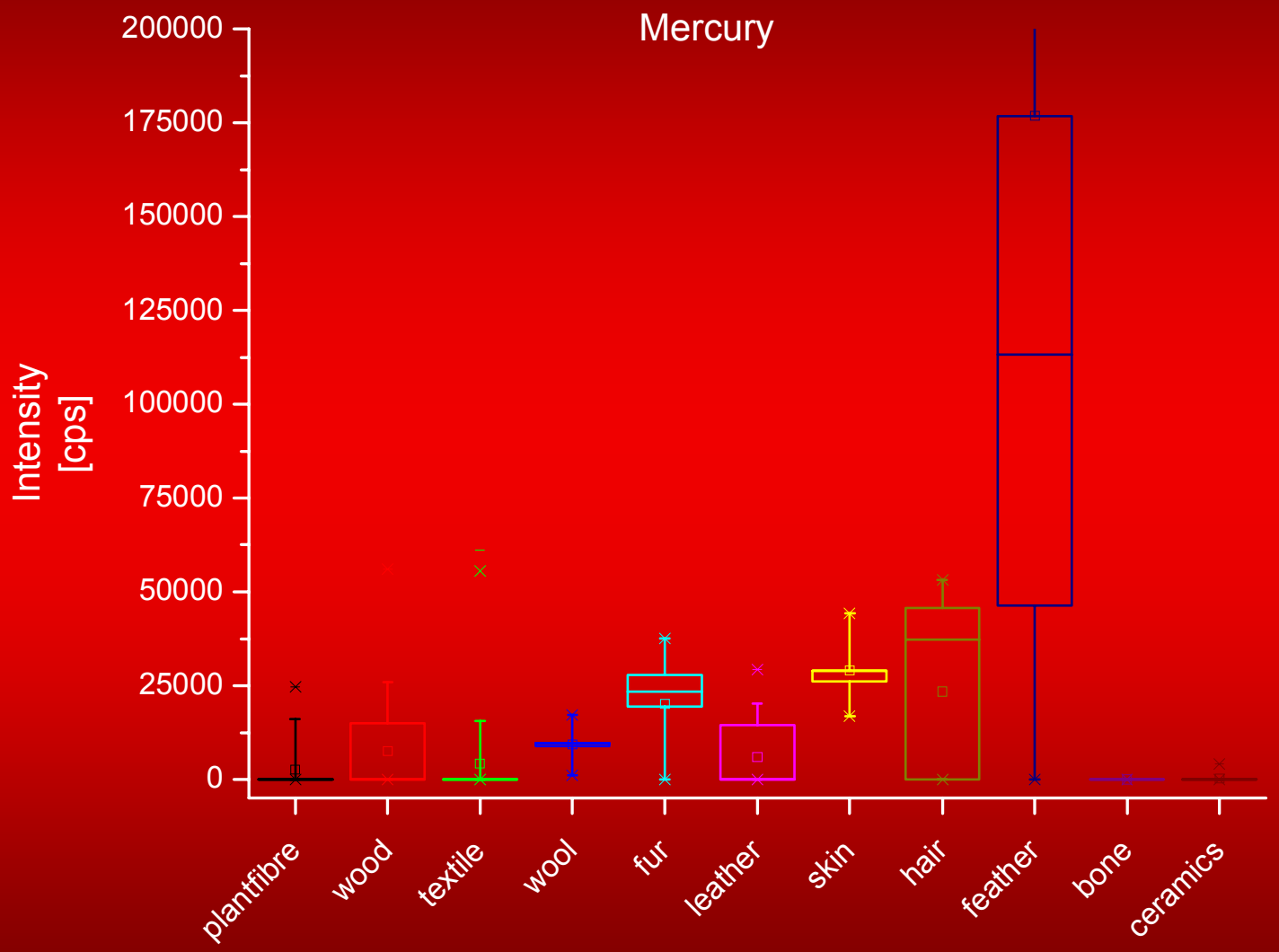
Results – mercury on surfaces of objects



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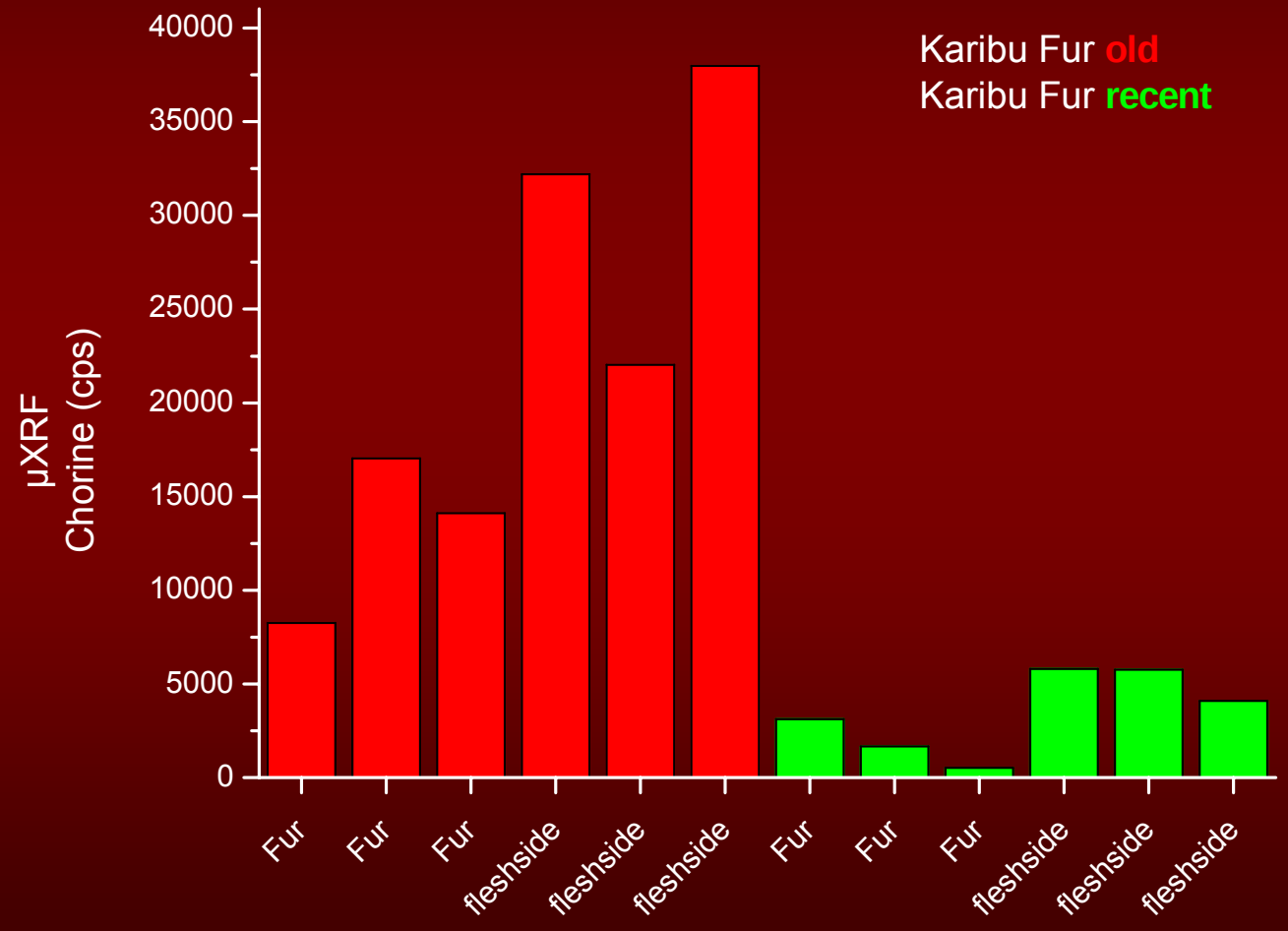
Distinction between contaminated and not contaminated surfaces



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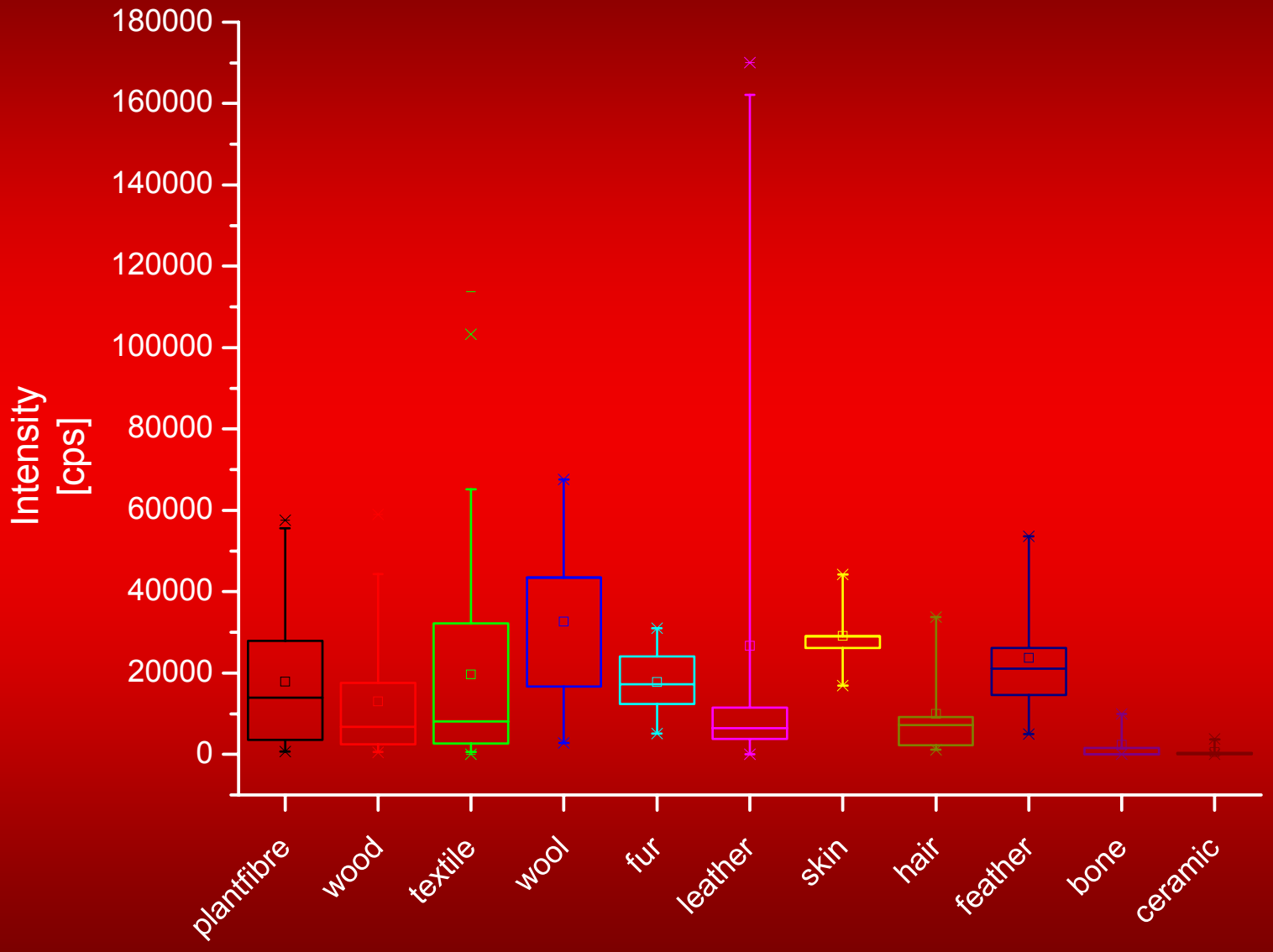
Results – chlorine on surfaces of objects



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Conclusion

Qualititative detection methods for **organo-chlorine** and **heavy metal** compounds

- µ-XRF
- TLC
- Swab-Test

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Conclusion

Qualititative detection methods for **organo-chlorine** and **heavy metal** compounds

- preliminary estimation and ranking of contamination rates possible
- enables to plan further actions.
- cannot replace quantitative analysis

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Summary

- organo-chlorine biocides and heavy metal compounds in storage areas (ALAB)

objects = sources? **Yes!**

- differences in contamination rates? **Yes!**

- research for fast and reliable measurement techniques and methods: µ-XRF and TLC

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Summary

µ-XRF:

-Powerful tool for detection of biocide decontamination of wooden surfaces

-Validation necessary for ethnological objects but preliminary estimation and ranking of contamination rates possible

Not applicable for dust analyses

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Summary

TLC:

- no consistent qualitative results for organo-chlorine compounds

ICP/MS:

- high values of mercury and arsenic in dust

quantitation: work in progress…

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