

Mineralogy and environmental stability of V-rich slags from the historical processing of Zn-Pb-V ores at Berg Aukas (Namibia)

Vojtěch Ettler¹, Martin Mihaljevič¹, Alice Jarošíková¹, Adam Culka¹
Bohdan Kříbek², Aleš Vaněk³, Vít Penížek³, Ondra Sracek⁴, Ben Mapani⁵
& Fred Kamona⁵



¹ Charles University, Czech Republic

² Czech Geological Survey

³ Czech University of Life Sciences

⁴ Palacký University, Czech Republic

⁵ University of Namibia

Processing of Zn-Pb-V ores in a Waelz kiln (1968-1980)

500 kt slag

@

5900 ppm V

3370 ppm Pb

3.78 wt.% Zn





pellets



fragments with vesicles

Berg Aukas slags

Mineralogy and V partitioning

Major carrier for V are **clinopyroxenes**
(up to 5 wt.% V_2O_3).

Other V-bearing phases are
(up to, wt.% V_2O_3):

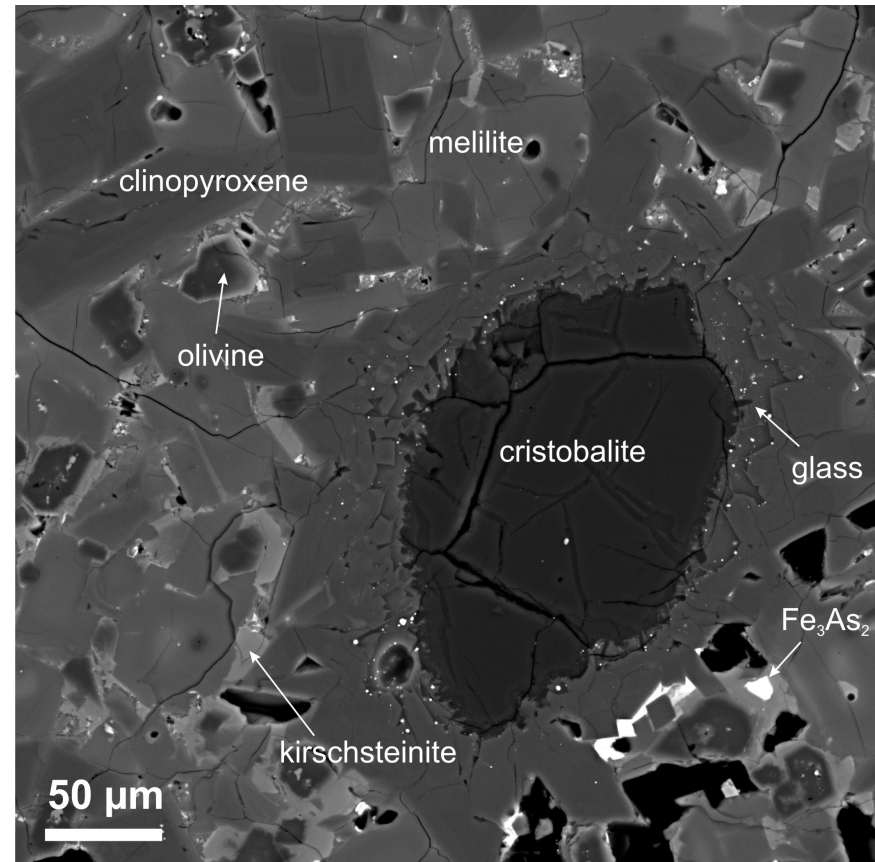
olivine (0.55)

oxides [zincite, spinels] (0.55)

glass (0.52)

melilite (0.36)

All silicates and oxides are Zn-rich.



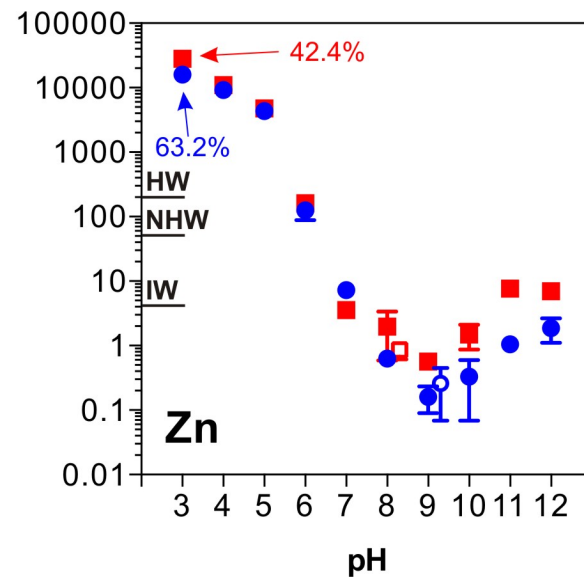
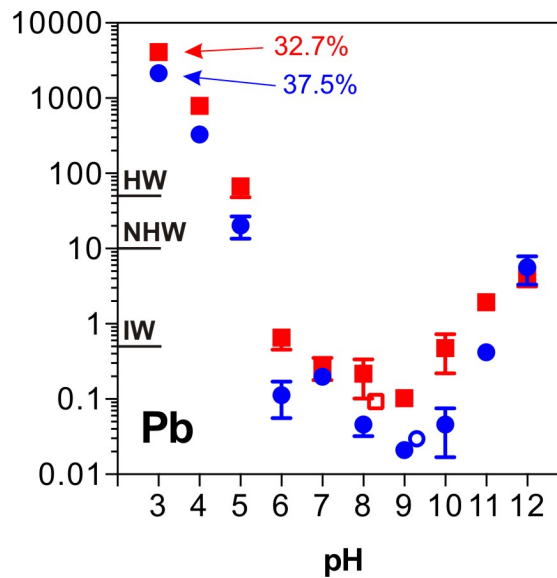
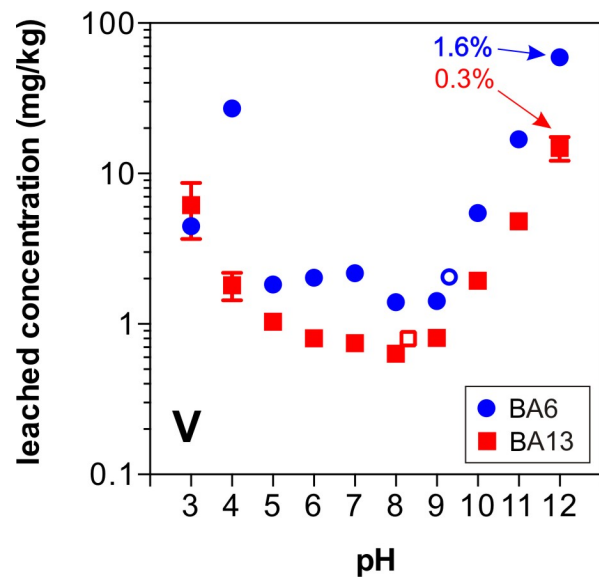
pH-dependent leaching behavior

Open symbols in graphs:

H: Hazardous waste

NH: Non-hazardous waste

IW: Inert waste

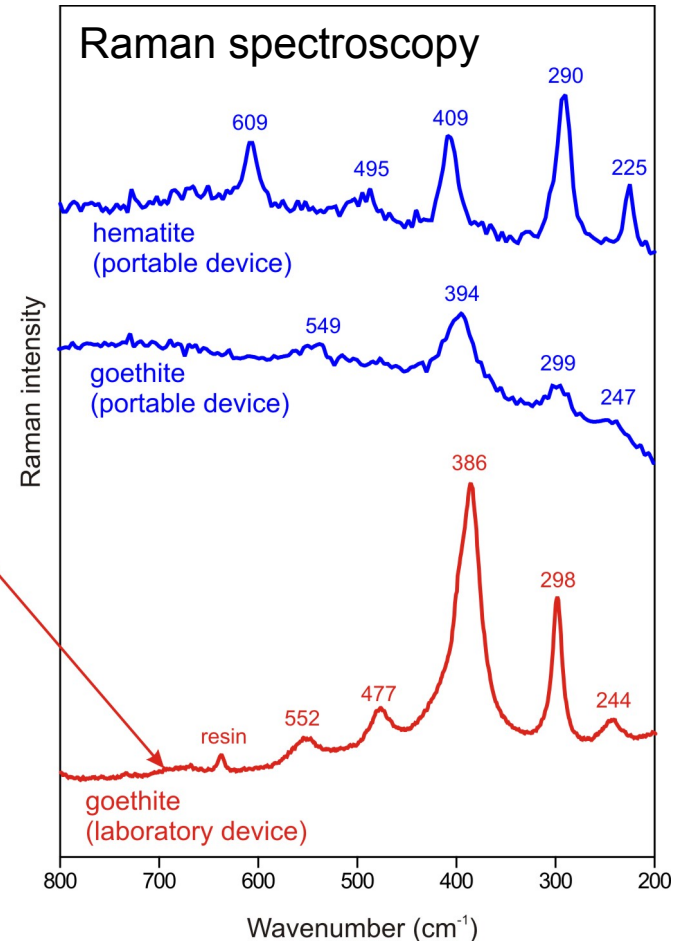
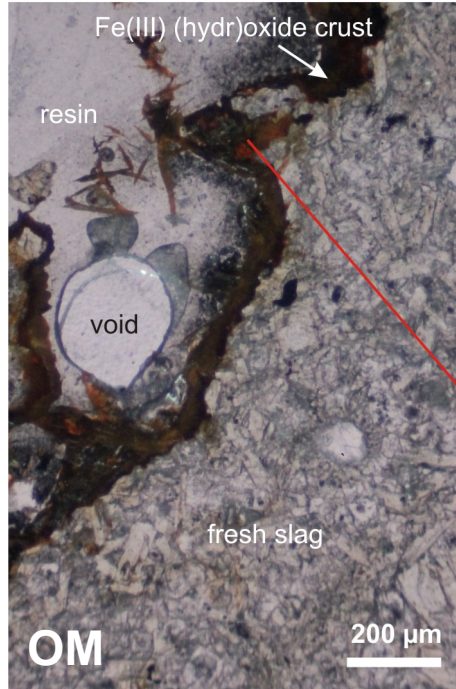
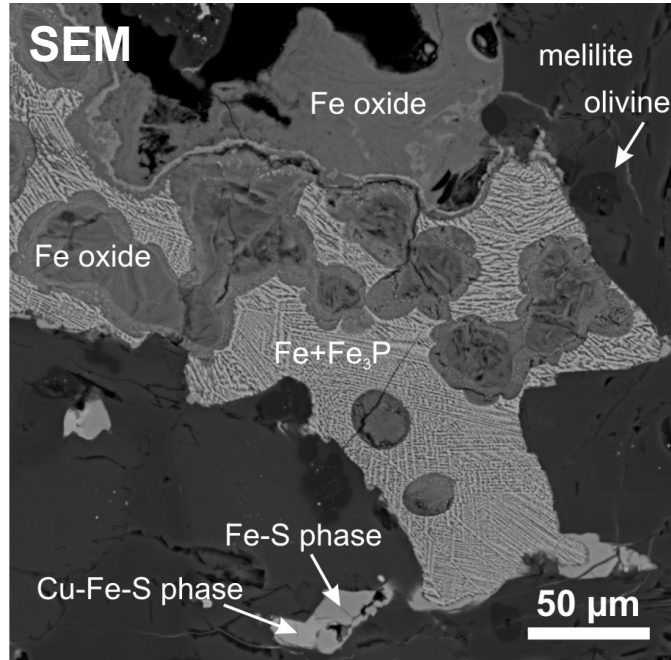


L/S = 10, 48 h (pH-static test), 24 h (regulatory EU test EN12457-2)

Relatively **low leaching of V** compared to other contaminants (Zn, Pb)

Secondary Fe(III) oxyhydroxides

Main weathering products and contaminant controls



Fe(III) oxyhydroxides contain up to (wt.% oxides):
0.22-0.29 (V, Zn, Pb), 2.41 (Sb), 5.22 (Cu), 7.97 (As)

Conclusions & potential recovery implications

- Berg Aukas slags are V- and Zn-rich
- Complex mineralogy: high temperature silicates and oxides
- Clinopyroxenes are main hosts for V
- Low leaching of V at low/high pH: limited potential recovery
- For V recovery ultra fine milling of slag needed

Thank you

Contact: ettler@natur.cuni.cz

More details in: Ettler et al. (2020): *Applied Geochemistry* **114**, 104473
<https://doi.org/10.1016/j.apgeochem.2019.104473>



Funding:
Czech Science Foundation (GAČR 19-18513S)