

Název: Simultaneous automatic electrochemical detection of zinc, cadmium, copper and lead in environmental samples using thin-film mercury electrode and artificial neural network

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# HEAVY METALS

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- 1817 The term “heavy metals“ appeared, Gmelin divided the elements into nonmetals, light metals (density of 0.8–5 g/cm<sup>3</sup>) and heavy metals (density of 5.3–22 g/cm<sup>3</sup>).
- Commonly encountered heavy metals are cobalt (Co), nickel (Ni), copper (Cu), zinc (Zn), cadmium (Cd), lead (Pb), mercury (Hg), and silver (Ag).

# HEAVY METALS

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- Most environmental contamination and human exposure result from anthropogenic activities such as mining and smelting operations, industrial production and use, and domestic and agricultural use of metals and metal-containing compounds.
- Heavy metals can enter to the human body through food or drinking water.

# AIM OF STUDY

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Electrochemical detection of Zn, Cd, Pb, and Cu ion using carbon tip modified with thin-film mercury

# MATERIALS AND METHODS

- The carbon tip modified with thin-film mercury was employed as working electrode in this study. Ag/AgCl/3M KCl was reference electrode and counter electrode was platinum electrode.

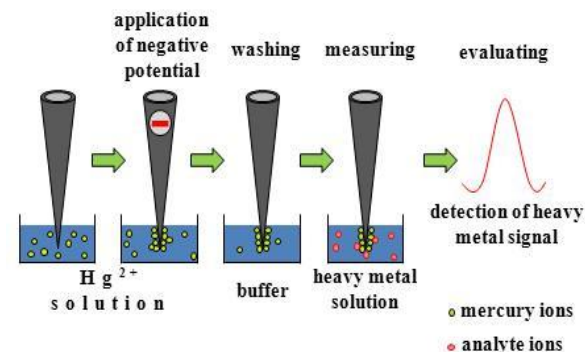


Fig. 1 Scheme of modification steps

- Differential pulse voltammetry (DPV) method was used. Buffer is acetate pH 5.

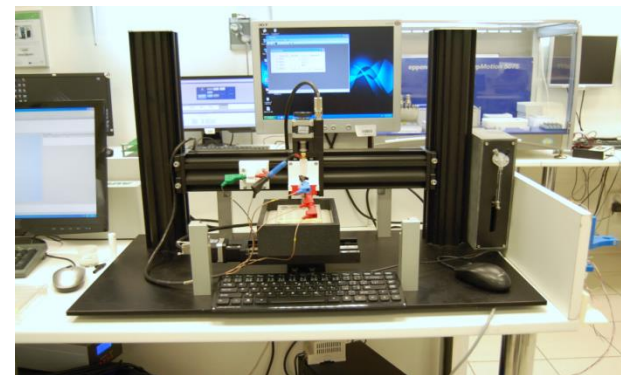


Fig. 2 Electrochemical detection system

# RESULTS AND DISCUSSION

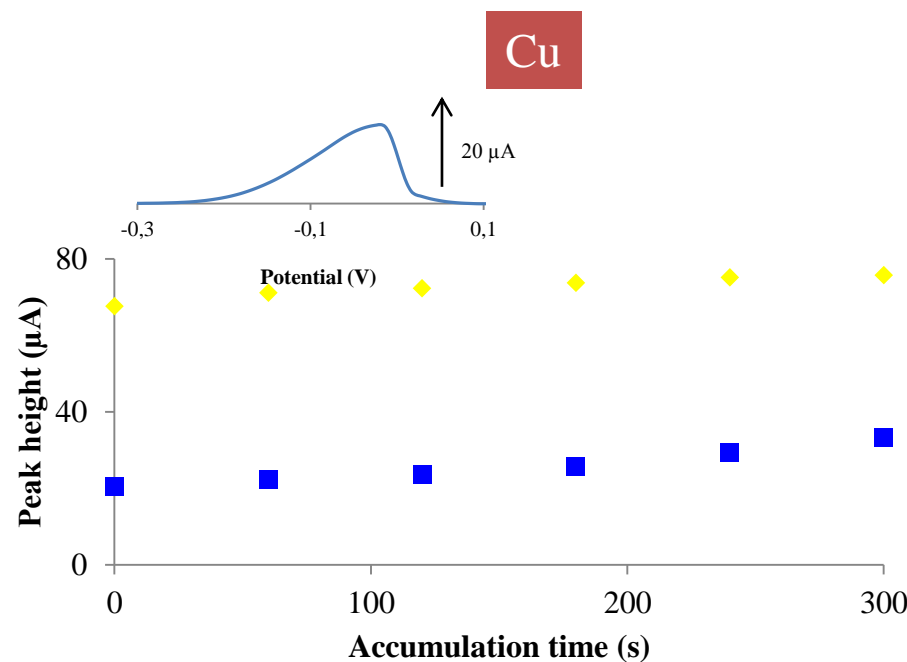
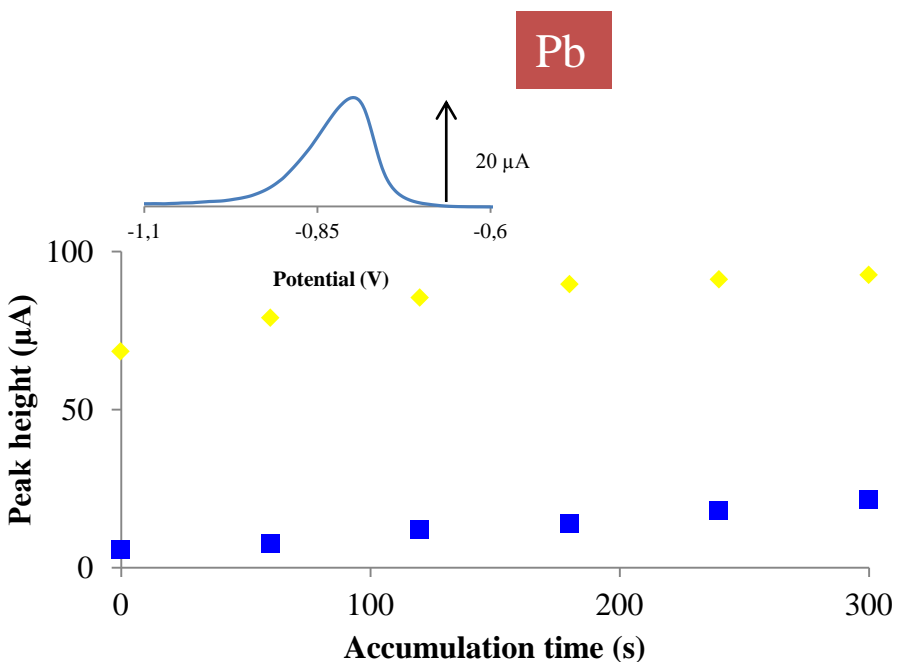
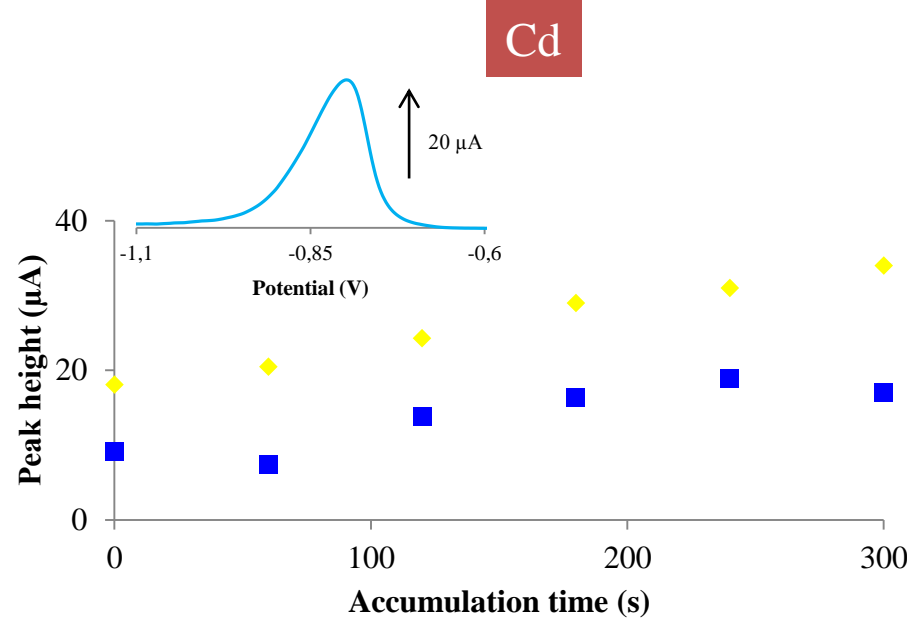
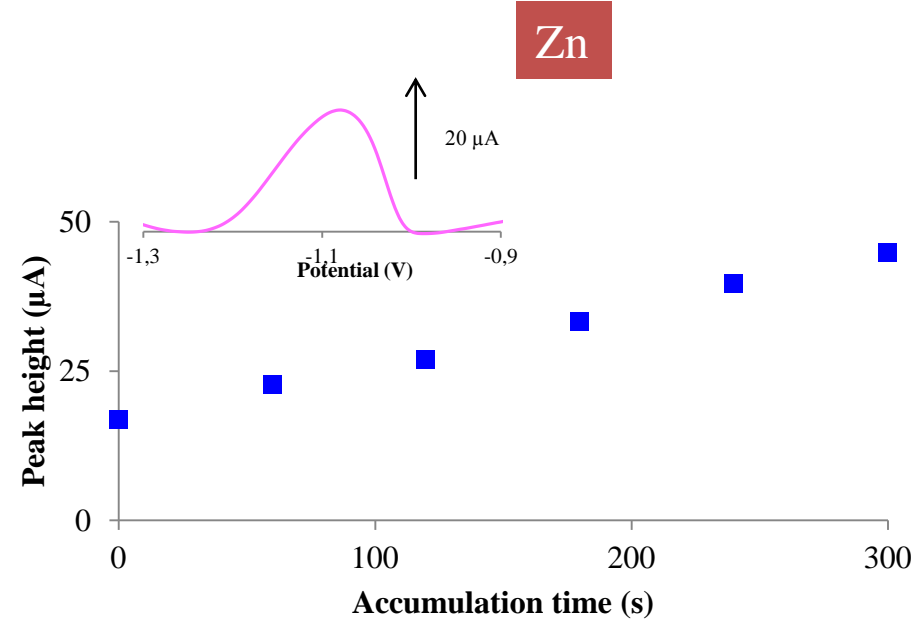


Fig. 3 Effect of accumulation time on peak height of Zn, Cd, Pb, and Cu ion measured by carbon tip electrode (yellow) and carbon tip electrode modified with thin-film mercury (blue).



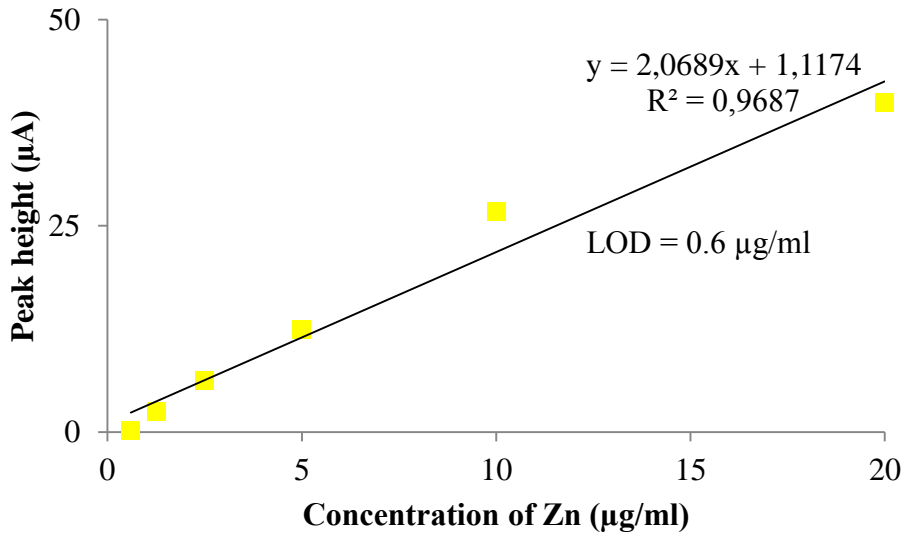
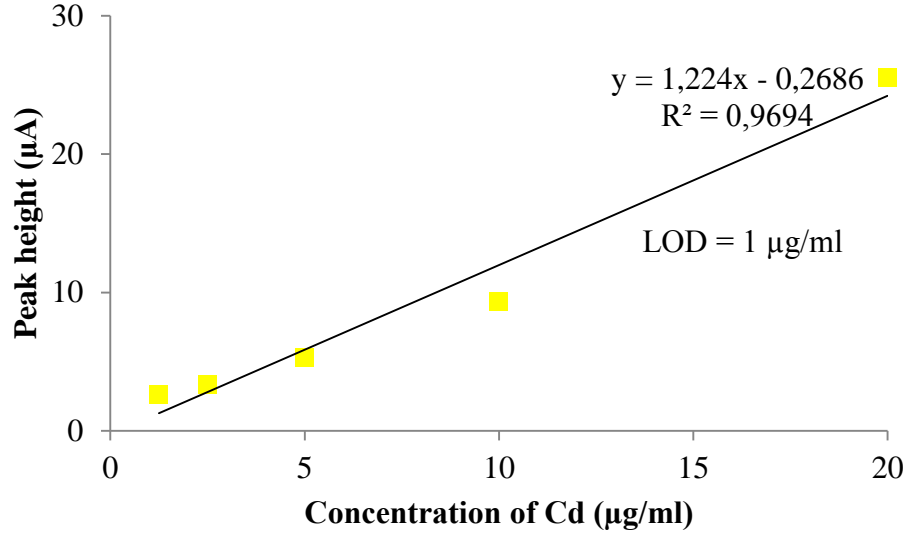
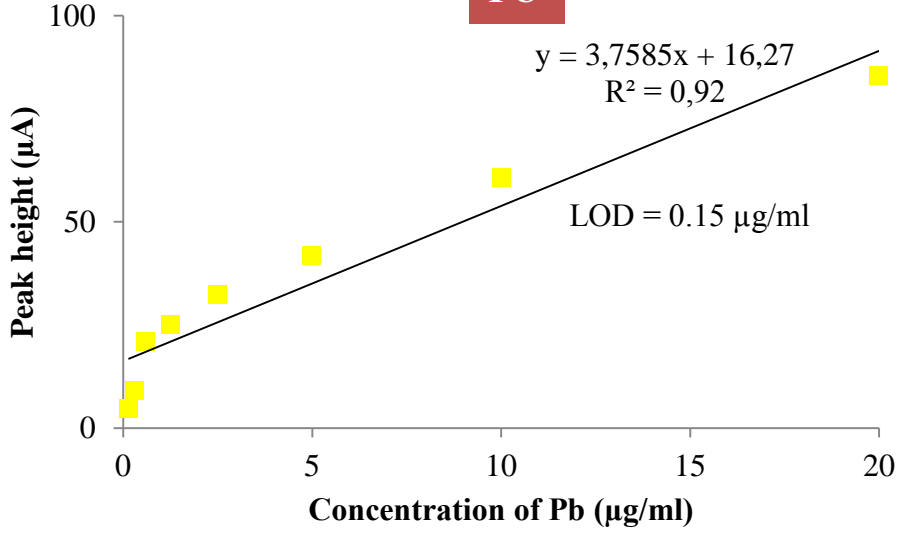
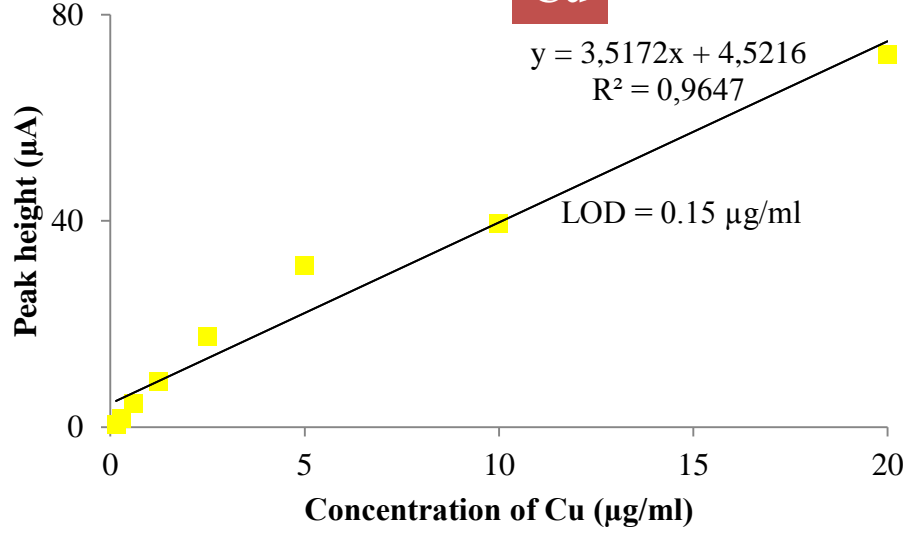
**Zn****Cd****Pb****Cu**

Fig. 4 Calibration curve of Zn, Cd, Pb, and Cu ion measured by carbon tip electrode modified with thin-film mercury.

# ELECTROCHEMICAL DETECTION OF HEAVY METALS IN THE MIXTURES

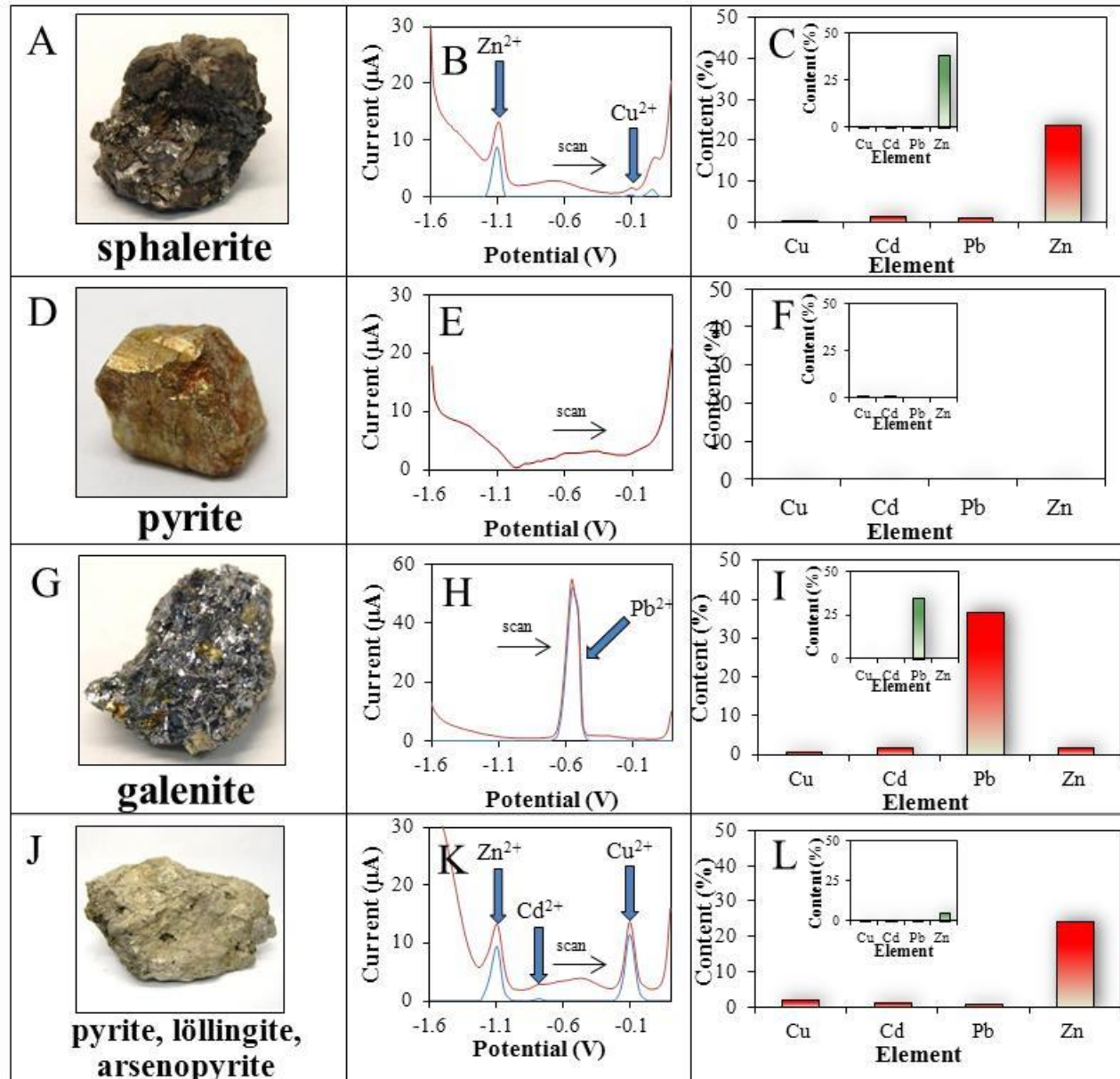


Fig. 5 (A) Photo, original (red) and (B) baselined voltammogram (blue), (C) the element content in the rock calculated by neuronal network from voltammograms and element content measured using XRF (inserts) of rocks containing (D, E, and F) sphalerite and pyrite; (G, H, and I) galenite; and (J, K, and L) arsenopyrite, pyrite, and löllingite.

# Conclusions

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- Commercial carbon tip electrode modified with thin-film Hg can be used for detection of heavy metals such as Zn, Cd, Pb or Cu.
- For detection of heavy metals such as Zn, Cd, Pb, and Cu in the environmental samples, carbon tip electrode modified with thin-film Hg coupled with artificial neural network were presented.

# Thanks to

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Hynek David, Ing. Ph.D

Tmejová Kateřina, Ing. Ph.D

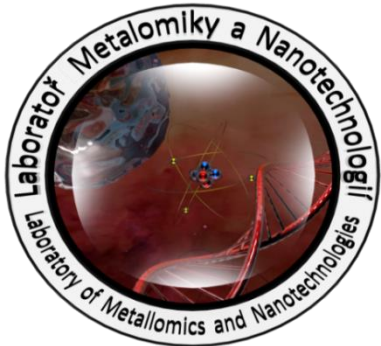
Gumulec Jaromír, MUDr

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Kudr Jiří, Ing

Zima Lukáš





Mendel  
University  
in Brno



# Thank you for your attention!



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