# Surface water pollution with heavy metals in Certej mining basin

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## 1. Abstract

The Certej basin is situated in the North of Deva town, in Apuseni Mountains and was an important nonferrous mining region. In present the mining activities were stopped, but the acid mine drainage is still affecting the underground water quality. Acid Mine Drainage takes place where sulphide-bearing material is exposed to oxygen and water. This drainage water is characterized by low pH, high specific conductivity and high concentrations of metals known to be toxic for living organisms. Mine drainage includes generally drainage from mines (underground and open pit), stockpiles, dumps, mined-rock piles and tailings impoundment. It is important to note that sulfides oxidation and natural acid drainage occurs as well in the absence of mining in numerous localities world-wide.

## 2. Introduction

Mining activity in Apuseni Mountains is known since the roman time and continued up to the present. Certej mining area, situated in North from Deva town, is famous for its precious and base metal resources; being a part of the so called Golden Quadrilateral region (Kraft et al., 2006). Three important ore deposits have been exploited in Certej region: Sacaramb, Hondol and Magura. In 1982 was created the Coranda open pit and the exploitation was continued also in Baiaga and Sacaramb underground mines. The wastes were discharged at Miresul and especially at Mialu tailing dam (Serban et al., 2004). After 2004, the unprofitable underground mining and the ore processing activities were ceased, but the pollution problems caused by open pits and tailings were not solved. The Certej river (18 km) is a northern affluent of the Mures river, and is one of the most polluted river from the region. The Certej catchment (78 sq. km) contains the following main tributaries in mountain area: Bocsa Mare, Bocsa Mica and Noiag from the northern part, respectively Faeragu and Miresului from the southern part. The Mialu stream is also a small tributary of Certej river. The tributaries especially from the Coranda open pit region are polluted with heavy metals due to uncontrolled acid mine drainage. Acid mine drainage takes place where sulphide - containing ores are exposed to oxygen and water. This drainage is characterized by low pH, high specific conductivity and high concentrations of metals.

The objective of this study was to evaluate the Certej River pollution with copper, zinc, cadmium and iron, and to establish the main pollution source.

## 3. Methods

In July 2005, eight surface water samples were collected from Certej river and from the Noiag and Mialu tributaries. The map of the area and the sampling points are presented in figure 1.

On site, water samples (approx. 100 cc.) were filtered through cellulose acetate membrane filter (pore diameter 0,45 μm) and 2 ml 65% nitric acid (Merck) were added. For total metal determination, unfiltered water samples (approx.100 cc.) were preserved in the same way. The pH, temperature and conductivity were measured on site, with WTW MultiLine P4 universal Pocket Meter. The unfiltered water samples were digested with nitric acid 65% (Merck).

The iron concentration from water samples were measured using inductively coupled plasma optical emission spectrometer (ICP-OES) Spectroflame D. The copper, zinc and cadmium concentrations from water samples were measured using inductively coupled plasma mass spectrometer (ICP-MS), Perkin Elmer Elan DRC II.

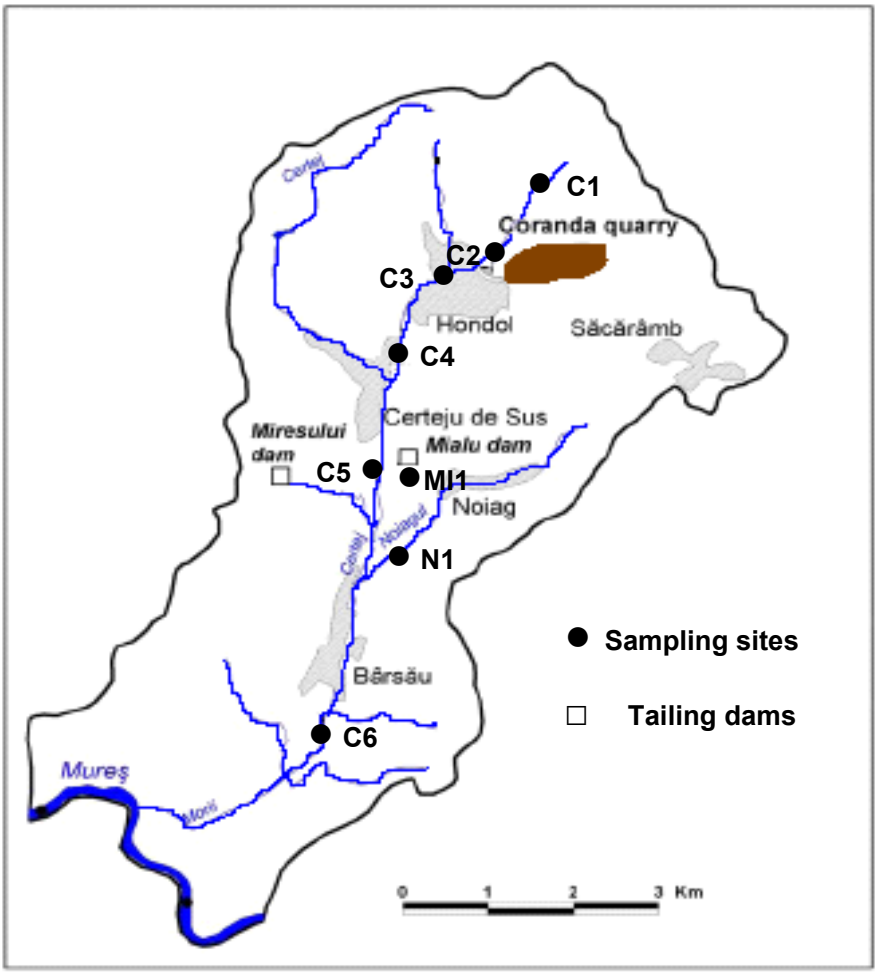


**Figure 1 Sampling sites**

## 4. Results and discussion

The variation of total (T) and dissolved (D) metal concentrations, pH and conductivity along Certej river are presented in figure 2.

The upper part of the Certej river (C 1 sampling point) was unpolluted, the pH, conductivity and the total and dissolved metal content were at normal level. After the confluence with northern tributaries from Coranda quarry (C2 sampling point) Certej rivers acidity, conductivity and heavy metal content increased. The maximum pollution level of the Certej river was reached after the confluence with acidic mine water spills (C3 sampling point) coming from the underground mines. After that, the pollution level slightly decreased (C4 and C5 sampling points) due to the dilution and natural neutralization processes.

The Mialu (MI1) and Noiag (N1) tributaries physical-chemical characteristics are presented in table 1.

**Table 1 Total (T) and dissolved (D) heavy metal, pH and conductivity in Mialu and Noiagu tributaries**

| Sampling point | pH | Conductivity | Fe T | Fe D | Cu T | Cu D | Zn T | Zn D | Cd T | Cd D |
|---|---|---|---|---|---|---|---|---|---|---|
| | pH unit | ms/cm | mg/L | mg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L |
| MI 1 | 6,86 | 2,59 | 16 | 5 | 2450 | 15 | 3490 | 1450 | 4,9 | 1,5 |
| N 1 | 7,80 | 1,18 | 2,6 | 0,03 | 22 | 21 | 33 | 21 | 0,48 | 0,21 |

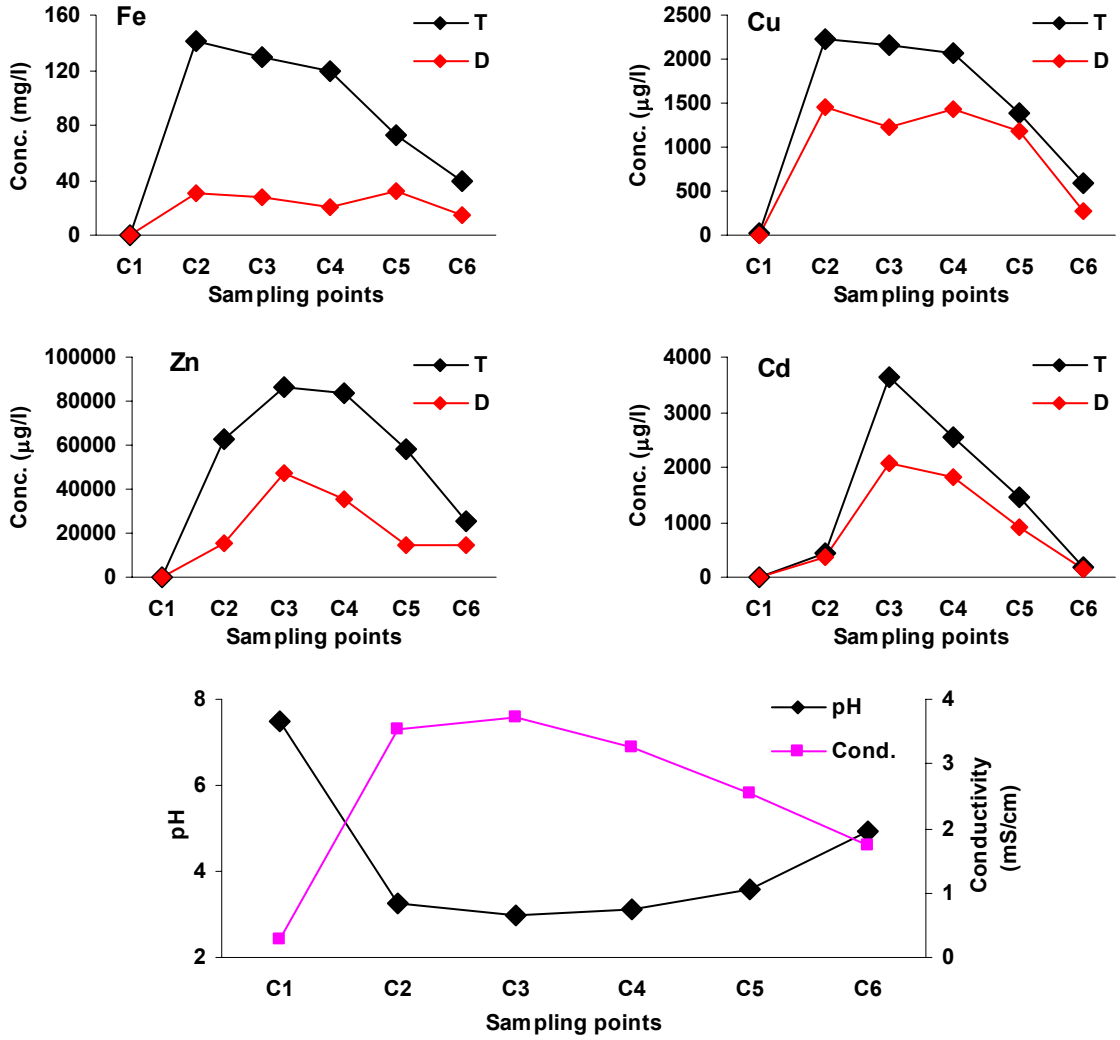


**Figure 2 Metals, pH and conductivity variation along Certej river**

Due to the relatively high pH (6.86) and low dissolved metal contents the Mialu rivers had a small contribution to the pollution of Certej river.

The Noiag tributary (N 1 sampling points) was not polluted and due to its high pH generated an increase of the pH value of Certej river and decreased its dissolved metal content. The Certej river, after the confluence with Noiag tributary was still very polluted, but the pollution showed an decreasing trend

The main pollution sources of Certej river are the acid mine drainages from the closed underground mine Hondol and the open pit Coranda quarry. The rehabilitation of Certej river can be realized by capture and chemical treatment of acid mine drainage from open pits and underground mines.

## 5. Aknowledgement

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## 6. References

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