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## **From exploration to desolation**

Romania. A medium-sized country in the central part of the European continent with a varied climate and landscape. There are many things that people know about our country, but one thing that does not know is about the ecological threat in the Apuseni Mountains.

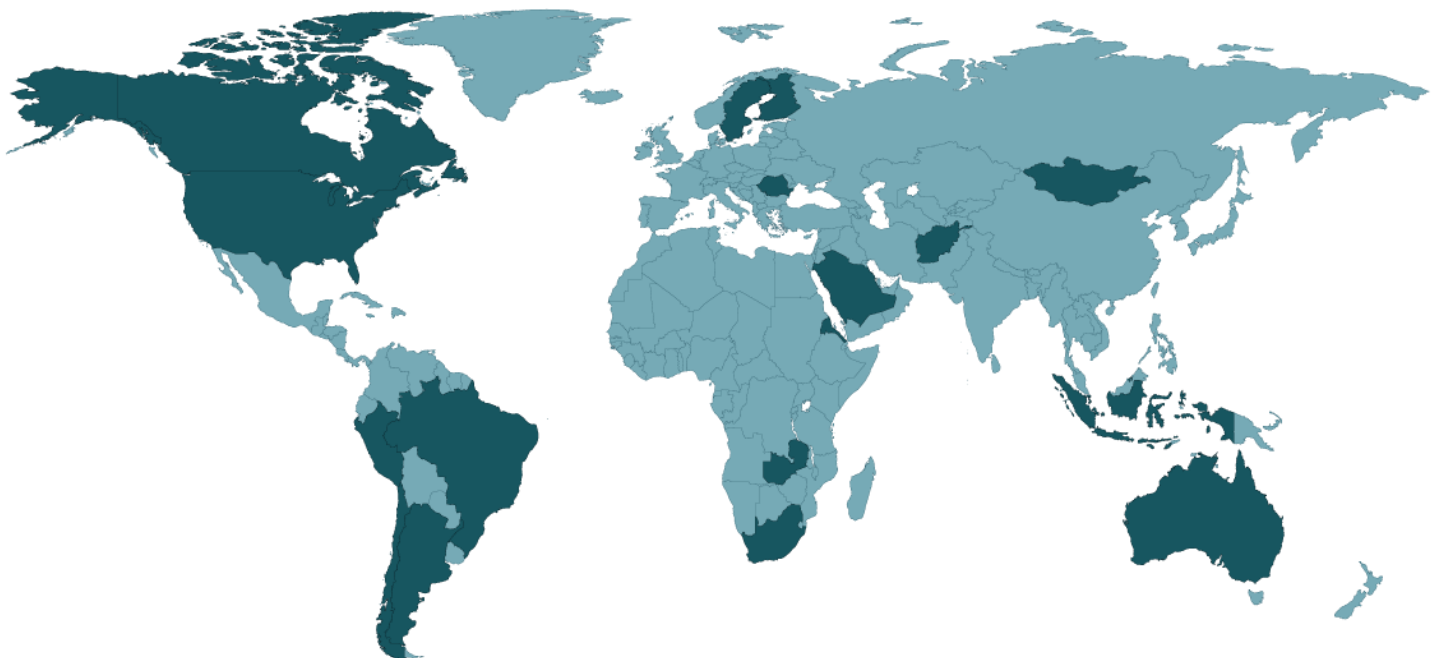
### **When the system is broken**

It is known that the twentieth century was a dark period for Eastern Europe. As for Romania. Why? Because people have been subjected to a reign of terror called communism. His print shave remained visible until now, 25 years after the regime change.

The dictator Nicolae Ceaușescu dreamed of transforming the Socialist Republic of Romania in the biggest copper mining center in Europe. The plan was implemented. Our country has become the center of the European metallurgy. Romania exported many steel products, being known even internationally. All with a price: sacrificing a whole area.

### **Global facts**

We searched all the countries around the world which are exploiting the copper ores and we found out that the Romania is still on the list. This environmental problem exists in every country which exploits copper ores, as we have shown on the map down below. This problem is a worldwide one which should make as wonder if money is more valuable than the nature itself. As technology evolves day by day, isn't there any less harmful solution of extracting copper ores? Is it necessary to destroy all that nature gave us? This is a hard question that makes us feeling palsied...a question which must appear on every single person who reads our article.



## What is it about?

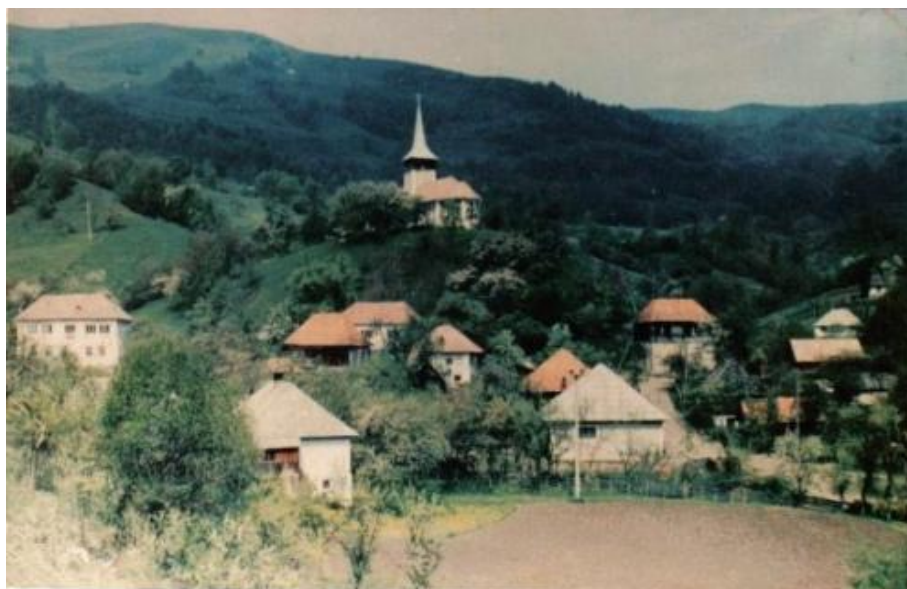
Geamăna village, a beautiful area within Apuseni Mountains, Carpathians, was sacrificed for this purpose. In this village the life began to change in 1977, when work began on creating a mine that would exploit an important ore of copper. This mine is called Roșia Poieni and it represents the largest copper reserve in Romania and the second largest in Europe having estimated reserves of 1.5 billion tons of ore grading 0.36% copper. The mine produces around 11,000 tons of copper a year and the mineral deposit represents 65% of the total copper reserves in Romania. It is owned by CupruMin, a state owned company.

A whole mountain was eradicated in the process. Residues normally would be stored in pits specially designed to protect the environment, citizens and living creatures surrounding them. In our case, heavy metal residues have been eliminated in nature with a painful indifference, along with a very toxic compound called sterile. What is sterile? Well, Sterile is the useless part that remains behind an ore exploitation, it cannot be used in any process so, at the end, it is thrown away. If not well stored, it leads to contamination of water, soil and air.

## Out of control?

36 years after the work has commenced, the tailings pond of the Roșia Poieni swallowed an entire village. What was once the Geamăna village is today is a very large area of mud and toxic waters. The concentration of metals in the water scared even the specialists. Researcher Melinte Ioana Laura tells us that in the south-west of the lake there is no dissolved oxygen in water, which means that water has an acidity so large and so great amounts of heavy metals that cannot sustain any body alive.

In this picture you can see the village in its original beauty. There are only Romanian peasant houses that represent the pride of our culture through their uniqueness and symbolism. The Romanian people have always been in a strong bound with the nature and the presence of this pond ruins the rural essence. The rupture with nature is hardly handled by the Romanians because it is their home, their universe.



Locals who remained on the pond bank continuously growing say that this water dissolves even metal. A local said: "I threw a caterpillar bulldozer in water and the water ate it". They also say that the water and mud engulfed the village's church, which in 1977 was 100 meters from center of the village, on a hill. Today, we can barely see the church's steeple in a sea of toxic sludge, shown in the picture down below.



Pond water has made great ravages, infiltrating the soil to groundwater, where water reaches the plants and fountains. Although people do not drink water from their wells, animals continue to drink this water. Various malformations occur due to consumption of contaminated water and grass.



Cows born calves with huge health problems. These birth defects occur because of cadmium poisoning, which is found in amazing amounts in the Geamăna lake waters. This toxic metal is ingested by cows grazing grass and remains in their organism. Milk and cow are so contaminated so they end up making people sick. Water toxicity is so high that can cause harsh forms of cancer and various incurable diseases.

## **It never stops**

Arieș River has one of its small tributaries a muddy river that starts in the heart of the toxic lake. The cycle does not stop there, because Arieș flows into a larger river called Mureș. This in turn flows into the Tisza, which in turn flows into the Danube, the largest river in Europe that forms a delta at the river mouth, unique in Europe. It is known as the lake drains slowly through a creek that carries with it a quantity of heavy metals over 1000 times higher than the legally admitted limit.

Arieș River was once the third river as fishing potential in Europe, but every few years all the fish die suddenly. In 2013 over a distance of 40km were found tons of dead fish. Authorities did not take responsibility and say that the fish died due to the high amount of mud and not because of the concentration of heavy metals from mining discharges. Romanian Waters confirm, however, that in the same period in which the fish died, there was an accidental discharge of large amounts of highly acidic water in the tailings pond at Geamăna.

As long as the operation continues, it generates the alkali substance which neutralizes acidity of sterile water. In the absence of this alkali substance, the acid would react with pyrite tailings and create sulfuric acid, which will degrade the dam that rein in the pond water and completely destroy cities Turda and Câmpia Turzii.

## **The problem graphically reproduced**

We realized a graphic to show you clearly the whole situation. It represents the cycle of the water from the pond into the nature. The first level shows the European continent and the location of our country. Next to the map, there is the Romania's map with the Apuseni Mountains pointed, in order to offer you an ensemble image of the area we are talking about.

The bound between the first and the second level consists in the mountains themselves. We made some research work and we found out what kind of minerals these mountains contain and we made up some little lists in their interior, to suggest practically the Roșia Poieni mine and the extracting process itself.

Leaving from the mine, the minerals and metals are transported, tons by tons, every day in order to be processed. You can see that we accentuated the flow of the toxic water into the nature, in an endless cycle. It starts here, in Geamăna village which has been totally covered by sterile mud and toxic water. We made some calculations and researches and we were able to represent graphically the data in a mini-graphic on the right side:

1. The height of the water from 1977 until now (red)
2. The water surface from 1977 until now (blue)
3. The number of villagers from 1977 until now (black)

In the left side, after some researches, we found out what the pond's water contains so we have written them down, specifying some of their negative effects on the human body.

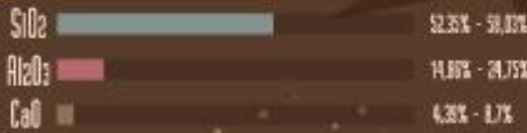
We have also searched the actual dimension of the lake and we found out that it's bigger than we have ever thought it would be: it has the same dimension as 130 football fields, more exactly 130 hectares, 1 hectare being the equivalent of 10.000 meters square.

As we wanted to demonstrate that the pond doesn't affect only the local area, we made a discovery which is more dangerous than someone could imagine. From the pond's water it has born a small river which flows into the Arieş River. From this river, we have shown in the graphic the course of the toxic water until it reaches the Danube's Delta. This last place is unique in Europe and in world because of its variety of flora and fauna. It houses the largest pelican colony in the whole world. All these Nature's wonders are in danger because of the pond's water cycle.

# Apuseni Mountains ROMANIA

"Rosia Poieni"  
Copper Mine

The "comunism's dream"  
became a real  
nightmare



pyrites  
magnetite  
bloodstone

chalcopyrite  
tetrahedrite  
tennantit

bornite  
enargite  
molybdenite

sphalerite  
galena  
covellite

calcozine  
pyrrhotite  
bismuth telluride



The EX  
"Geamana"  
village

The remaining  
"Geamana"  
village

This is what  
the water  
contains

**Cadmium**

kidney disease  
pulmonary edema  
chills  
bone disease  
breathing problems

**Chromium**

cancer  
heart failure  
infertility  
skin ulcers  
dermatitis

**Zinc**

can induce epilepsy

**Strontium**

heart disease

**Barium**

if ingested an amount  
between 1-15 g  
is deadly

**Thorium**

cancer  
alpha radiation

**Droanium**

radioactive



1 lake = 130 football fields

We estimated the area  
that could be affected  
by pollution from the lake,  
more or less damaged.



UNESCO World Heritage  
biosphere reserve  
millions of birds  
360 species of birds

Affected area  
in  
our country

toxic groundwater  
acid rain  
multiple diseases  
mutations



## **What can we do?**

Where you see this whole area full of toxic mud and water, we still see there is hope in reviving the lost nature. We thought there would be some solutions, which could help, not only the local area, but the entire country.

First of all, we found out that the most suitable treatment for the toxic water would be the lime. As it is an alkaline substance, it would balance the water's pH. The authorities had a plan to reduce the water's toxicity, but they reduced it at one big issue: the pecuniary aspect. The necessary quantity of lime for this large amount of toxic water is almost 70 tons per day; this would mean about 15 million euro. The lime, meaning calcium oxide, is obtained from calcareous rocks. Being an European Union member, we may access nonrefundable funds which may help us procure the necessary quantity of lime to balance the pond's water toxicity.

Another solution would be, as weird as it may sound the carbonized animal bones. The bones are heated to high temperatures—in the range of 400 to 500 °C (752 to 932 °F)— in an oxygen-depleted atmosphere to control the quality of the product as related to its adsorption capacity for applications such as de-fluoridation of water and removal of heavy metals from aqueous solutions. The quality of the bone char can be easily determined by its color. Grey-brownish bone char are the best quality chars for absorption applications. The quality of the bone chars is usually controlled by the amount of oxygen present in the charring atmosphere. It consists mainly of tri-calcium phosphate and a small amount of carbon. Bone chars usually have lower surface areas than activated carbons, but present high adsorptive capacities for copper, zinc, and cadmium.

If the pond would be cureless, at least we should protect the Arieș River by its own little affluent, born from the pond's "body". We have found out that the water has the capacity of self-purification: if it has several waterfalls in its course, the water should absorb a large quantity of oxygen. So at least the small water course flowing from the toxic water should be purified in order to minimize the toxicity cycle.

## **As a conclusion**

Although mankind has evolved greatly in the last century, it has abused what nature has to offer and began a process of constant degradation of it. This was immortalized by Sabin Bălașa in his mural painting, "Prometheus" (the picture down below), in the Hall of Lost Steps at the "Alexandru Ioan Cuza" University of Iași. In the sky there is Prometheus with the fire stolen from the Gods, which symbolizes the technological evolution of humankind. The woman crouching is Mother Nature who watches helplessly to human atrocities. Humanity is categorized as naive and immature in the transfiguration of two children: they are unaware about their action's effects on the environment. Nature is already in a degradation process, aspect surprised in the second plane of the painting, only in the final plain, in the left, remains a little oasis of hope.

