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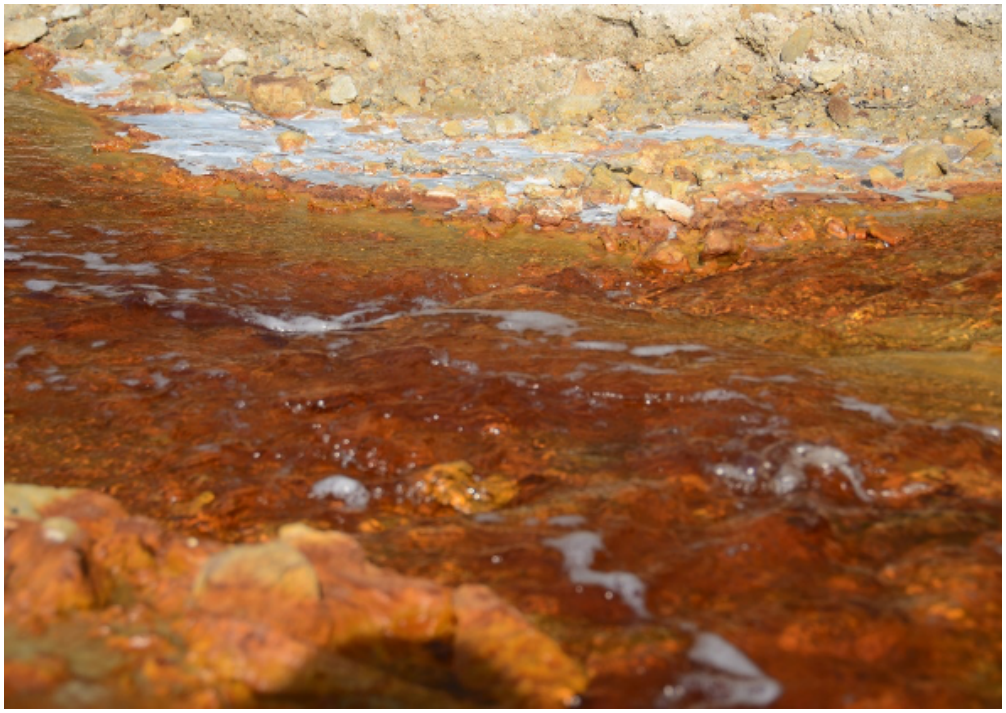
# Mine Remediation

*Backfilling of unstable old mines with simultaneous stopping of further Acid Mine Drainage*

Backfilling of old mines at the same time with biomineralization – static stabilization and permanent prevention of the formation of new acids.

## Summary

Stability problems and the drainage of abandoned mines damage the environment and health and strain the budgets of companies and municipalities. Stability problems cannot be solved without completely backfilling the mines. In turn, there has so far been no solution for a sustainable neutralization of the causes of acidic mine water escaping.



Together with partners, *ekolive* offers the appropriate technology: Backfilling old mines at the same time with a reverse *bioleaching* process that initiates metal precipitation (*biomineralization*) instead of dissolving metals – which simultanously leads to static stabilization and permanently prevents the formation of new acids.

# Old Mining sites

***Stability problems and the drainage of abandoned mines damage the environment and health and strain the budgets of companies and municipalities.***

### Stability Problems

All over the world, mining has left large underground excavation spaces. In the course of time, not only the relief of the earth's surface has changed, because where it is hollow, the mountain works, the earth can open up or sink, and residential areas are endangered. Ore and hard coal mining in particular have left large underground cavities. The German mining company RAG alone, for example, regulates 35,000 such cases of damage annually and has set aside more than four billion euros to pay for mining damage. Parts of the Ruhr area are 15 to 20 meters lower today than they were 200 years ago.

### Environmental Pollution

At the same time, former drainage tunnels, which allowed mining at greater depths, have changed the hydrogeological flow of the groundwater (underground drainage) and the qualitative chemical composition of the water, which in turn has led to the gradual formation of large amounts of acidic mining water and sediments containing toxic elements. This so-called *acid mine drainage (AMD)* occurs when oxidizing agents (oxygen) gain access to sulphide minerals due to mining work. The aeration of anaerobic sediments triggers a chain of reactions, the surface of the minerals is enlarged, inorganic and biological reactions promote the acidification and heavy metal contamination of water. Toxic elements find their way into underground and surface currents in both soluble and solid states and contaminate surface and groundwater. In addition, the solids settle in the riverbeds and gradually dissolve, which in turn leads to further environmental pollution.

### Solution Problems

Stability problems and the drainage of abandoned mines with acid mine water are the legacies of mining activities that not only damage our environment and health, but also put an enormous strain on the budgets of companies and municipalities. Stability problems cannot be solved without completely backfilling the mines. With so-called *backfilling*, which is used today in many modern underground mines worldwide, up to 40-60% of the residues or waste rock can be used for backfilling – otherwise, in many cases, expensive concrete is used, which is anything, but environmentally friendly, its manufacturing is irresponsible and wastes increasingly scarce primary resources. Both options, however, only solve the geotechnical stabilization of mining, not the environmentally harmful biochemical weathering processes.

The neutralization of the causes of acidic mine water escaping, in turn, can never be finally achieved by constantly adding lime or by constantly pumping out and cleaning the water. The global costs for the current and future treatment of acid mine water are estimated at more than 80 billion euros. So far there is no economical and effective final solution.

## Solution Approach

***The only sensible solution is to tackle both problems at the same time***

### Integrated Approach

The only sensible solution is to tackle both problems at the same time: to fill unstable old mines with natural materials and at the same time to stop the further drainage of acid mine water. There is therefore a need to find a simple and effective ecological method for the permanent stabilization (biochemical and static) of decommissioned mines.

### ekolive´s Solution

Together with partners, *ekolive* offers the appropriate technology: Backfilling old mines at the same time with a reverse *bioleaching* process that initiates metal precipitation (*biomineralization*) instead of dissolving metals – which at the same time leads to static stabilization and permanently prevents the formation of new acids.

So far, acid mine water treatment with bacteria has only been used ex situ. Our *microlive*® bacterial consortia, however, which can precipitate metals, are brought into the mines together with our specially balanced nutrients *ekocomplex*® and organic additives – bound in *liquid soil* made from natural materials. After the rapid solidification of the *liquid soil*, the underground rooms can be stabilized in one operation, the pH values neutralized, metals precipitated from the acids – and above all, further acid oxidation can be permanently prevented. This process has been applied for as an EU patent for environmental stabilization and backfilling of mines

For the production of the *liquid soil* as a carrier material, after a bioleaching cleaning process, which has also been registered for an EU patent, either the residues of the mines themselves (excavated material, minerals and other contaminated materials) or other contaminated as not-contaminated excavation floors are used.

## Imprint and Contact

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### Offering

*ekolive* is the first and leading provider of a new ecological *bioleaching* method for the ecological release of elements and the breakdown of organic contaminants.