NEWSLETTER

Nº 3 | February 2022

ANOTHER MAJOR MILESTONE ACHIEVED!

Lousal Pilot Project Completed and Public Presentation in Portugal

LIFE RIBERMINE has put the **Lousal Restoration Plan** into practice by carrying out the **Lousal Pilot Project--PPLousal** (Lousal, Portugal), completed in early November 2021, as planned.

The work, which started on September 20th, consisted of applying the Best Available Techniques (BAT) in mining restoration currently available. PPLousal is a pioneer in Europe in the combination of physical and chemical methods for the correction of erosion and the Acid Mining Drainage (AMD), impacts caused by the mining of pyrite-rich massive sulphides, which affect the quality of the soil, water, and natural ecosystems in the region.

The Public Presentation of **LIFE RIBERMINE** in Portugal, took place on October 29th in the Lousal *Ciência Viva* Science Centre, with the work of PPLousal already well advanced, having a fantastic reception!

The **LIFE RIBERMINE** project has been funded with the support of the **LIFE Programme of the European Union**.

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Conclusion of the Lousal Pilot Project

PPLousal implementation required rigorous planning, the elaboration of a Restoration Plan and preparatory work: field reconnaissance with sampling of soil, water and plants; drone flights for detection of areas with higher concentration of iron oxides; prospection of the subsoil through Electrical Resistivity Tomography (ERT); and inventory of native flora and vegetation. The beginning of the works included a topographical survey and terrain marking for future implementation of the projected design, the removal of existing vegetation (rockrose bushes and eucalyptus) and the collection of rubbish in the headland area (former dump area, which had been landfilled).

In line with the LIFE Projects philosophy, with a strong social commitment to generate added value and foster the development of the region where they are located, the suppliers of materials and the contract of services were, whenever possible, local or from neighbouring municipalities.

The first phase consisted in the *GeoFluv*™ **Geomorphological Remodelling**, a physical method for topographic reconfiguration of soft topographic reliefs close to the natural ones, which "mimic" the characteristic undulations of the cork oak forest, aiming to renaturalize the landscape and reduce erosion. In some places, before modelling, pre-existing drainage ditches (resulting from a previous intervention carried out by *Empresa de Desenvolvimento Mineiro*, between 2010 and 2014) were filled with limestone gravel, subsequently covered with geotextile (to prevent contamination with the mobilized lands).

The tasks for **Chemical Stabilization** and **Edaphic Amendment** began with the coverage of the land with a mixture of limestone and clay with ‹10% smectite. On top of this material, the topsoil layer was reconstituted through a layer of organic matter, consisting of natural fertilizer (tanned horse and granulated poultry manure) and a compost based on vegetable soil (sterilized and seeded), which together acted as a substrate for the installation of vegetation.

In order to reduce the force and speed of water runoff (less erosion) and to promote chemical reactions to raise the pH of the water to values close to neutral, limestone was placed in the channels (valley bottoms).

Finally, the **Revegetation** aimed to establish bases so that a vegetation evolution can occur according to the natural ecological successions of the regional vegetation, thus not requiring a significant maintenance. It consisted in the manual sowing of twenty-one species of herbaceous and shrubby plants selected from the region's native flora, suitable for the conditions of the recreated "soil". Several dozens of acorns of holm oaks existing in Lousal were also harvested and sown. In addition to these species, it is expected that propagules of other native plants from the surrounding natural environment will colonize this area.

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Public Presentation of the Lousal Pilot Project

October 29th, 2021

*Public Presentation of the **LIFE RIBERMINE** Project - Lousal Pilot Project. It was attended by the Honorable Mayor of Grândola, António Figueira Mendes and the Vice-President, Carina Batista; **LIFE RIBERMINE** Project Coordinator, Javier de la Villa Albares; representatives of Spanish Partners; the President and the Executive Director of the Lousal Ciência Viva Science Centre, Jorge Relvas and Álvaro Pinto respectively; collaborators of the Lousal Ciência Viva Science Centre, participating in project; stakeholders involved in the requalification works in the Lousal Pilot Area; representatives of national mining companies; and representatives from municipalities interested in the project.*

With special emphasis on the implementation of the Lousal Restoration Plan, the *Mina de Ciência* – Lousal *Ciência Viva* Science Centre (CCVLousal) promoted, on October 29th, 2021, the public presentation of the **LIFE RIBERMINE** Project, in Portugal.

This important **LIFE RIBERMIE** event was attended by the Municipality of Grândola, represented at the highest level by President António Figueira Mendes and Vice-President Carina Batista, who together with the beneficiaries of this LIFE Project, received other delegates from municipalities in the region, namely from Sines and Aljustrel. Also present were representatives of companies involved in the recovery of degraded mining areas (e.g., *Constrotúnel – Construções, Projecto e Serviços, S.A.*) and distinguished representatives of the companies SOMINCOR, *Sociedade Mineira de Neves-Corvo* and Beralt Tin and Wolfram Portugal and concessionaires of two of the three active mines in Portugal for metallic resources, namely Neves-Corvo and Panasqueira. Also present were some of the companies that supplied raw materials (e.g., *Agregados Calcários das Sesmarias*, Lda), machinery and personnel essential for the physical intervention in Lousal. Researchers from various Universities (e.g., Lisbon University, Complutense University of Madrid (UCM) and University of Castilla-La Mancha), teachers of scientific areas of regular education and tourist agents were also present, giving expression to the enormous educational potential and tourist attraction contained in this Project.

LIFE RIBERMINE transfer training course to European mining companies

October 20th to 22nd, 2021

The transfer of techniques and the replication of the positive results obtained are among the most important objectives of the LIFE Environment projects supported by the European Union. In this context, aimed at disseminating knowledge throughout European mining sector, namely in northern Europe, the course entitled "From the real Lappland to the Spanish Lappland – in search of geomorphic-based mine restorations", was directed by the Complutense University of Madrid, the Zaragoza Generalitat Valenciana University, the *Junta de Comunidades de Castilla – La Mancha* and GEACAM, in a joint organization of the **LIFE RIBERMINE** and LIFE TECMINE projects

Participants in the training course.

The trainees belonged to several companies, including VAST (Swedish geomorphological restoration company, which is transferring the BAT used by **LIFE RIBERMINE** to Scandinavian countries), COPPERSTONE (a Swedish mining company that will start a new mining operation in northern Sweden), KJELLINS (an earthwork company, that will develop a Pilot Project based on LIFE RIBERMINE, at the Svappavaara mine, northern Sweden), LKAB (a Swedish state-owned mining company and the EU's leading iron producer, which will apply the **LIFE RIBERMINE** solutions in its Kiruna and Svappavaara mines), *CAOBAR – CONSTRUCCIONES FÉLIX MOYA* (Spanish partner of LIFE RIBERMINE), SAMCA (leading Spanish-owned exploitation company, which is following the proposed BAT), CINCLUS PLEGADIS (consulting company for ecological restoration in mining) and HOLCIM (a Swiss multinational aggregate exploitation company).

Exchange of knowledge

March 10th, 2021

The restoration project of Santa Engracia Mine, Peñalén (LIFE RIBERMINE) and "*La Chanta*" (Corpa, Madrid, LafargeHolcim company) share the geomorphological remodelling techniques of the **LIFE RIBERMINE** Project, through the application of the *GeoFluv*™ method.

*Members of LafargeHolcim and the **LIFE RIBERMINE** Project, during the visit to the Santa Engracia mine.*

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Kick-off of field visits in the Lousal Pilot Area!

Students and professors from the scientific area, Jorge Peixinho Secondary School (Montijo, Portugal).

After the conclusion of the intervention in the Lousal Pilot Area, the **LIFE RIBERMINE** started its field visits.

As a way of opening to the public, the **LIFE RIBERMINE** project participated in the Portuguese Science and Technology Week (November 22nd to 28th, 2021), with the visit of more than 50 students. It was preceded by the lecture "Science and Technology for the Environment: The case of Mining Areas", given by Mónica Martins (CCVLousal).

Although this was the first official visit to the project after the works concluded, the intervention area in the Mining Village of Lousal had already been visited in June, by the Master Programme of Geological Heritage, University of Minho.

In fact, the Lousal Pilot Project has been a subject of great interest for different courses and training in several areas of knowledge, as was the case of the Civil Protection course from Atlântica - University Institute, on December 8th 2021.

New weather station in Lousal contributes to local and regional climate knowledge!

December 14th, 2021

The Lousal *Ciência Viva* Science Centre installed a meteorological station in Lousal, planned by **LIFE RIBERMINE** project. This will allow the recording and analysis of several climatic variables, in particular precipitation and temperature, a very accurate knowledge of the local climate regime, and its correlation with several physical and geophysical aspects occurring in the intervened area (Lousal Pilot Project), namely the evolution of relief, the soil moisture, the vegetation development, forms of erosion, among others.

Lousal meteorological station – LIFE RIBERMINE, installed in the former "weighing-machine house".

Second phase of the Santa Engracia Mine Restoration

Aspect of the restoration work in December 2021, inside the open pit quarry of the Santa Engracia Mine (Peñalén, Spain) – 2nd phase, year 2021.

December, 2021

Conclusion of the second phase of the open pit quarry recovery in the Santa Engracia Mine, including significant earthworks (and the capture of images for a video on this task), the application of vegetation in the outer slag heaps, and the beginning of the *Talus Royal*® technical work. The systems for measuring erosion (dikes and ditches) are currently being installed.

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MEETINGS

Borja Domínguez, the EU monitor, visited the work already carried in the outer slag heaps of the Santa Engracia Mine, accompanied by members of the project (June 4th, 2021)

May 26th and August 7th, 2021

Technical training course "Invasive Plants Control" and theoretical-practical action "Eradication of acacias" (Portugal)

June 2nd, 2021

Fourth Monitoring Committee meeting (on-line, Spain and Portugal)

June 4th, 2021

Second visit of External Monitoring Team Monitor (NEEMO) (Spain)

October 20th to 22nd, 2021

Training course on results transfer to European mining companies (Spain)

ATTENDANCES

April 27th to June10th, 2021

LIFE RIBERMINE attends the **Technical Conference on Circular Economy in the Mining Sector** (Spain)

May 31st, 2021

LIFE RIBERMINE participates in the National Environmental Congress (**CONAMA**) (Spain)

September 24th, 2021

LIFE RIBERMINE participates in the **European Researchers Night** 2021 (Portugal)

November 17th to 19th, 2021

LIFE RIBERMINE in the **International Ecomining Summit** (Medellín, Colombia)

November 23rd, 2021

LIFE RIBERMINE participates in the **Science and Technology Week** (Portugal)

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LIFE RIBERMINE IN THE FIRST PERSON

RAMÓN SÁNCHEZ DONOSO

Geologist, University of Barcelona

Master in Environmental Geology and PHD Student in Geology and Geological Engineering, Complutense University of Madrid

"Together with the colleagues from CCVLousal, I participated in the entire process of preparation, execution and monitoring of the restoration works in the former mine of Lousal. From September to November 2021, I was involved in the supervision and construction of the new restoration topography, designed specifically for this area, using the *GeoFluv™* method, and in the design and placement of an edaphic cover for the treatment of the Acid Mining Drainage. With the tasks accomplished, we intend to address the problems arising from soil erosion and the transport of contaminating metals through the water and soils of the region. This type of restoration is to date, the first and only case in Europe where geomorphological restoration and chemical remediation techniques have been combined.

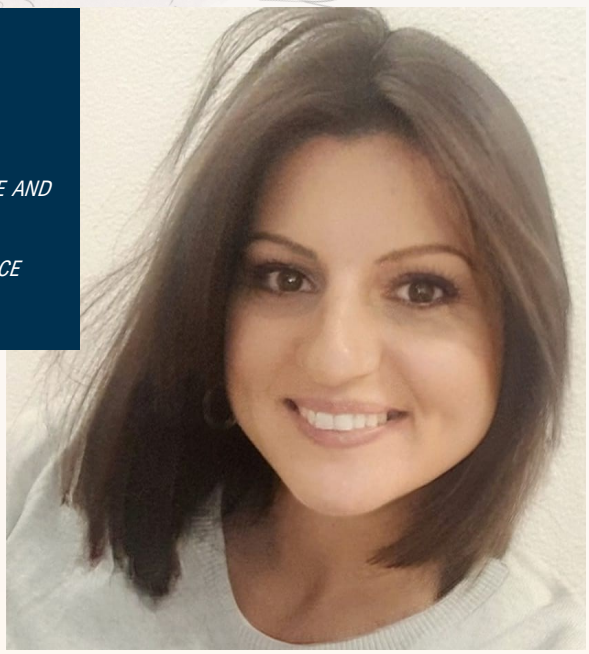
For me, participating in this Project has been a unique experience on a professional level, as I was able to work on a real mining restoration case, and on a personal level, for being part of the great team, which all of us involved in the Project, form together."

MÓNICA MARTINS

Biophysical ENg. And Master in Human Ecology, University of Évora

PHD in Physiscal Geography, Geographic Insitute and Spatial Planning (IGOT), University of Lisbon

Science Communicator, Lousal Ciência Viva Science Centre Association (SFRH/BGCT/150423/2019, Foundation for Science and Technology)



"To be part of the **LIFE RIBERMINE** Project since its beginning, observing and learning in practice with the Spanish colleagues (including some of the world's leading experts in this field), and being able to actively monitor all phases of an ecological mining restoration, a subject still little known or disseminated in Portugal, has been a great school and an enormous privilege. Despite being absolutely essential for human activities, mining in general, still carries an unfavourable public image, inherited from its recent past, when there were no significant environmental concerns or specific legislation to prevent its negative environmental impacts.

Through the Lousal Pilot Project, we implemented for the first time in our country, the Best Available Techniques in this field, creating in the former mine of this small town on the Alentejo coast, the first European case that combines geomorphological, physical and chemical processes, for the correction of Acid Mining Drainage and its effects on the soil, water and river ecosystems. This may be a relevant contribution to the restoration of other metallic exploitation mines in the Iberian Pyrite Belt and beyond, and a didactic example of how it is possible to make mining activity compatible with the safeguard of the environment and the conservation of nature"

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LIFE RIBERMINE IN THE FIRST PERSON

ÁLVARO M. MADUREIRA PINTO

Geolist and Master in Mineralogy, Crystalo Graphy and Metallogeny, University of Lisbon

Senior Technician, Faculty of Sciences of the University of Lisbon

Executive Director, Lousal Ciência Viva Science Centre Association

"When the Lousal *Ciência Viva* Science Centre was challenged to participate in this innovative project, I thought that our main task would communicating the science and technology involved. It was, therefore, from the beginning, a great challenge, and an excellent opportunity to learn and to communicate new knowledge. However, the progress of the application and the scope that the project assumed, in the old Lousal mine area, revealed its strategic importance and inevitably led to the planning of a Pilot Intervention in Lousal. This would allow to illustrate the results of these new techniques and to demonstrate its relevance to past and future mining activities. The restoration of areas negatively impacted by mining activity, through the construction of a new restoration topography using the *GeoFluv™* method and performing edaphic coverage for treatment of Acid Mining Drainage, represented the first experience of its kind in all of Europe and this had to be taken into consideration and pondered the way the Lousal *Ciência Viva* Science Centre and its team would get involved.

Assuming the leadership and coordination of the project on the Portuguese side represented the opportunity to embrace new and exciting challenges, which proved to be true on the ground. Conducting the project, the teamwork, involving the Portuguese and the Spanish teams (who, after all, knew the best practices to implement in the field), was a unique and very enriching experience. Day-to-day life in the field was not compatible with the plans on paper, and there were many situations in which daily monitoring and decision-making were required to allow the work to proceed and achieve the defined objectives. The coordination and management of raw materials suppliers and their delivery, as well as the coordination and cooperation between teams of different specialists, were challenges overcome only thanks to the high professionalism of all those involved and the mutual help of all elements, individually and collectively.

Equally important were the weather conditions prevailing during the period of intervention in the field. Since the machinery manoeuvrability and the execution of the plan depended on suitable but disparate weather conditions at different times, which could present completely opposite requirements. This is how the days started and ended, with eyes fixed on the weather report. But as in all things, luck protects the bold, and **LIFE RIBERMINE** being a bold project, was naturally blessed and was able to benefit from "tailor-made" weather conditions. The weather seemed to have a pact with the **LIFE RIBERMINE** Project. It was dry and warm when needed and it rained on the first day after the machines left, preparing the soil for the sowing that would follow. We couldn't ask for more and we could not be happier with the results achieved.

Currently, many entities and personalities are already interested in knowing more about these techniques and their future and applicability in other places. An example of this are the visits already carried out by those responsible for active and inactive mining operations, or even the sector's regulatory bodies. Society is also alert and aware of these evolutions of knowledge and techniques for restoring negative impacts in mining regions. An example of this are the visits already made by middle and high schools, to learn about the intervention carried out in the mining village of Lousal.

We are aware that this pilot intervention will have an enormous importance in the communication, dissemination and disclosure of the techniques used. The work performed in the mining village of Lousal will constitute a space for learning and demonstrating the future application of these techniques. It will not only be the already known mines that will demonstrate this importance. It will also be the future mines, those that have not yet started activity, or even those that have not yet been discovered, that will undertake the commitment to use these best practices, environmentally appropriate and socially responsible, in order to obtain authorization to open and operate."

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IN AGENDA (2022)

HOYA GRANDE INTERVENTION

Completion of the intervention in Hoya Grande, soil decompaction process and planting.

LIFE RIBERMINE EXHIBITION

Inauguration of the **LIFE RIBERMINE** travelling exhibit, at the Lousal *Ciência Viva* Science Centre.

VI NATIONAL AGGREGATES CONGRESS (OVIEDO, SPAIN)

Attendance in the VI National Aggregates Congress (Oviedo, Spain) to be held from 23 to 27 of May, 2022.

2ND CONGRESS OF THE IBERIAN SOCIETY OF ECOLOGY AND 21ST NATIONAL ECOLOGY MEETING OF THE PORTUGUESE SOCIETY OF ECOLOGY (SPECO)

Attendance in the 2nd Congress of the Iberian Society of Ecology (SIBECOL) and the 21st National Ecology Meeting of the Portuguese Ecological Society (SPECO) to be held from 3 to 5 of July, 2022.

CURIOSITIES

Flora

Flora is the set of vascular plant species of an ecosystem or geographical area. It includes herbaceous plants, shrubs and trees, which can be sorted in floristic lists. Vegetation comprises different plants communities which occur in a given territory according to their biotic and abiotic relationships. The occurrence and distribution of flora and vegetation are closely dependent on regional factors, such as climate, as well as local characteristics, such as soil type and the water availability.

For the final stage of ecological restoration, revegetation, the **LIFE RIBERMINE** project has selected plants native to the regions that were intervene in Portugal and Spain, so that they are perfectly adapted to the regional climates and local soil conditions recreated in each intervention.

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