

# NEWSLETTER



mineio-horizon.eu

December 2025



## A HOLISTIC DIGITAL MINE 4.0 ECOSYSTEM

### RECAP OF THE PROGRESS MADE IN THE YEAR 2025, JULY THROUGH DECEMBER

**MINE.IO at the**  
**MINEARC Webinar 3**  
Water, Tailings and Circular Economy  
November 25–26, 2025

**Dr. Raul Mollehuara Canales**

1. Concerning the dots in Circular Mine...
2. Electrokinetic assisted tailings management...

**Co-organiser**

**WATER** **TAILINGS** **CIRCULAR ECONOMY**

**AVANTIS** **EXCEED**

**Establishing security throughout interconnected systems**



#ProgressWorkCampaign

**MINE.IO**

Co-financed by the European Union

**Article**

**Applying Deep Electrical-Resistivity Tomography Techniques for the Exploration of Medium- and Low-Geothermal Energy Resources**

This study uses geoelectrical methods to investigate medium- to low-enthalpy geothermal resources in southern Spain, identifying a fractured carbonate formation as a promising reservoir.



**READ MORE**



**ENERGETAB 2025**  
Mining Meets Digital Innovation



**Predictive Maintenance in Mining**

#ProgressWorkCampaign

Follow us on our LinkedIn Account

## 2nd Review Meeting and next General Assembly

August and September was the time of preparation for *2nd Review Meeting*, which summarised the second year of The MINE.IO Project. The meeting happened on 18th of September, which served as a review of the previous months and helped set our goals for the rest of the year.

We look forward to the next General Assembly in Porto, which will take place on 27-28 January, 2026. The assembly will focus on progress made throughout the year, as well as the next phase of The Project. The gathering will also be chance to discuss and invite partners to the Final Event taking place in May 2026 in Turin.

To find out more about events planned for 2026 follow Mine.io's social media accounts and our website.



# Peer-reviewed publications campaign

A focused effort to showcase recent scientific outputs and knowledge dissemination activities

**Article**

## Application of Magnetometer-Equipped Drone for Mineral Exploration in Mining Operations

This study investigates the geological composition and material distribution within the Lavrion repository located in Greece through an aerial magnetometry survey using a novel aerial drone, CERBERUS, coupled with advanced data ...



READ MORE →

**Article**

## Applying Deep Electrical-Resistivity Tomography Techniques for the Exploration of Medium- and Low-Geothermal Energy Resources

This study uses geoelectrical methods to investigate medium- to low-enthalpy geothermal resources in southern Spain, identifying a fractured carbonate formation as a promising reservoir.



READ MORE →

**Article**

## Development Indexes, Environmental Cost Impact, and Well-Being: Trends and Comparisons in Italy

In 1990, the United Nations (UN) presented the Human Development Index (HDI) as a measure of human development that considers three fundamental dimensions: a long and healthy life, being knowledgeable, and having a decent standard of living. This paper proposes some considerations about human well-being factors based on HDI analysis, also introducing some ...



READ MORE →

In our previous Newsletter we mentioned a campaign established to gradually showcase and promote scientific articles published since the start of the Mine.io project. These publications reflect our research activities and address key project topics. The campaign will continue as new papers are released.

[click for more](#)

## Publications

See the updated list of peer-reviewed publications featuring MINE.IO

[click for more](#)

**Published articles**

Title of the publication Publication Link, Authors	Place of publication / Conference / Journal	Download PDF
*3-D microrheological inversion in the exploration of cavities and low-density fractured zones*  László Balázs, <sup>1,*</sup> Gábor Nyitrai, <sup>1,*</sup> Gergely Surányi, <sup>1</sup> Gergo Hamar, <sup>1</sup> Gergely Gábor Barnaföldi, <sup>1</sup> and Dezső Varga <sup>2</sup> <sup>1</sup> Wigner Research Center for Physics, Konkoly-Theg M. u. 29-33, 1121 Budapest, Hungary; <sup>2</sup> Department of Geophysics and Space Sciences, Eötvös Loránd University, Pázmány P. s. 1/C, 1117 Budapest, Hungary; <sup>3</sup> Budapest University of Technology and Economics, Műegyetem rkp. 9, 1111 Budapest, Hungary  *Mineral resources depletion, dissolution and accessibility in LCA: a critical analysis*	Published in "Geophysical Journal International" – Volume 236, Issue 1, January 2024, Pages DOI: <a href="https://doi.org/10.1093/gji/gqad428">https://doi.org/10.1093/gji/gqad428</a>	

# Progress Work Campaign

## Check Out the articles from WP5 Campaign!

We have successfully finished our Campaign WP5

***"Mine.io integration processing and digital mine solution."***



NEWS | PROGRESS WORK CAMPAIGN  
**Predictive Maintenance as the emerging maintenance paradigm in the mining sector**

By [Communication Manager - Innovation & Work](#)  
In the mining sector, equipment maintenance requirements are required to account for maintenance costs, downtime costs and 20% to 30% of operational expenses. Rather than being viewed merely as a routine operational

NEWS | PROGRESS WORK CAMPAIGN  
**Mining Without Blind Spots: How a Smarter Workflow Engine is Redefining the Industry**

By [Communication Manager - Innovation & Work](#)  
What if mine operations could run more smoothly, with fewer delays, higher compliance and better efficiency? What if mining vehicles could drive to exactly where they need to go without having to rely on GPS? What if the goal of the **Machine Automation** Project (MAA), a powerful new platform...

[view article](#)



**A methodological framework for evaluating the societal impacts of Mine.io mining innovations**

#ProgressWorkCampaign

 **MINE.IO**  Co-funded by the European Union

The Remote Sensing Edge Computing/Continuum Decentralized Communication System is a software component aiming to assist in the modernization of mining operations.

[click for more](#)

A methodological framework for evaluating the societal impacts of Mine.io mining innovations.

An assessment of the social sustainability of Mine. io solutions and pilots.

[click for more](#)



**Smart Mining Edge Communication: Real-Time Data Flow for Safer, Smarter Operations**

#ProgressWorkCampaign

 **MINE.IO**  Co-funded by the European Union



**Establishing security throughout interconnected systems**

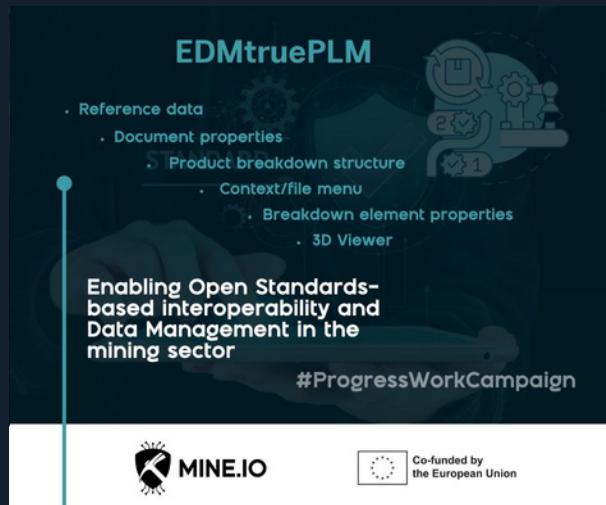
Establishing security throughout interconnected systems. Increasing the cyber-security and resilience of digital systems of systems.

[click for more](#)

# Progress Work Campaign

“Managing and exchanging data across multiple formats can be complex and time-consuming. That’s where EDMtruePLM an ISO 10303 Repository, steps in – streamlining data interoperability and making integration seamless.”

[click for more](#)



EDMtruePLM

- Reference data
- Document properties
- Product breakdown structure
- Context/file menu
- Breakdown element properties
- 3D Viewer

Enabling Open Standards-based interoperability and Data Management in the mining sector

#ProgressWorkCampaign

 MINE.IO

 Co-funded by the European Union



Seamless Data Management in Mining

#ProgressWorkCampaign

 MINE.IO

 Co-funded by the European Union

In the mining sector, equipment maintenance expenses are reported to account for approximately 40% to 70% of total setup costs and 20% to 60% of operational expenses.

[click for more](#)

The Mine.io Big Data Platform is an efficient, customized solution designed to address the complex data management needs of the contemporary Mining Industry.

[click for more](#)



Predictive Maintenance in Mining

#ProgressWorkCampaign

 MINE.IO

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Mining Without Blind Spots: How a Smarter Workflow Engine Is Redefining the Industry

#ProgressWorkCampaign

 MINE.IO

 Co-funded by the European Union

What if mine operations could run more smoothly, with fewer delays, tighter compliance, and better coordination between teams – without drowning in emails, spreadsheets, or siloed systems?

[click for more](#)

# Progress Work Campaign

Mine.io continues to publish News on the Official Website about development being made in the Progress Work Campaign.

In addition to our completion of the WP5 Campaign we have also started WP3 - ***“Eco-efficient technological solutions for exploration, electrification and extraction. “***

Check Out the posts from WP3 Campaign!



**A New Way to Explore Flooded Mines Using Muon Imaging and Underwater Robots**

#ProgressWorkCampaign

 **MINE.IO**

 Co-funded by the European Union

MINE.IO offers a new way to explore flooded mines. It combines a special type of imaging using particles called muons with smart underwater robots. This makes it possible to safely and effectively explore underwater parts of mines.

[click for more](#)

MINE.IO project tries to bring more efficient and sustainable ways to study and track drilling data.

Innovative technologies under the MINE.IO project introduce modern solutions to traditional drilling techniques.

[click for more](#)

**Smarter Ways to Study Rocks, Drill Cores and Use Drilling Data**

#ProgressWorkCampaign

 **MINE.IO**

 Co-funded by the European Union

# Progress Work Campaign

Read all articles from  
our Progress Work  
Campaign

[click for more](#)



## Enabling Open Standards-based interoperability and Data Management in the mining sector

By Communication Manager • October 26, 2023

"Managing and exchanging data across multiple formats can be complex and time-consuming. That's where EDMtruePLM an ISO 10303 Repository, steps in – streamlining data interoperability and making integration seamless."

To achieve the above objective in the MINE.IO project, [Jotne Connect](#) delivered its interoperable solution – EDMtruePLM, a client/server application built on the ISO 10303 (STEP) standard.



## A New Way to Explore Flooded Mines Using Muon Imaging and Underwater Robots

By Communication Manager • November 24, 2023

Exploring flooded mines is extremely difficult. Traditional tools like sonar scans, electrical testing, and ground-penetrating radar often don't work underwater. Sending people or machines into these environments is risky, expensive, and limited. Because of this, it's hard to study the structures of these mines, find remaining minerals, or figure out how to mine them.

Mine.io's new solution. It combines a special type of imaging using particles called muons with smart underwater robots. This makes it possible to safely and effectively explore underwater parts of mines.

### What is Muon Imaging?

Muon imaging uses naturally occurring particles from space called muons. These particles pass through rock and other materials. By tracking how they move and where they're absorbed, we can create 2D and 3D images that help us locate the groundwater veins of the mine. This is much safer than traditional methods like sonar or radar. The muons are natural and don't need much equipment. It's also more accurate and less invasive than older methods.

### How It All Works Together

The project uses specially designed mine-drones created by the University of Twente (UT) (Figure 1, L). These drones are carried through the mine by an underwater robot (Figure 2, R) called Muon, built by INESC-TEC (Figure 3, R). The underwater environment is too explored previously by another ARI, the UR3 (Figure 3, L). These underwater robots can move through the mine on their own and place the detectors where they're work best.

## POLAND



## GERMANY



## GREECE



## HUNGARY



## CYPRUS



## PORTUGAL



## SPAIN



## FINLAND



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<https://mineio-horizon.eu>

[info@mineio-horizon.eu](mailto:info@mineio-horizon.eu)



Co-funded by  
the European Union

MINE.IO has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No 101091885.



# New cooperations with other projects

## MINE.IO Collaborates with AVANTIS and EXCEED project

Mine.io's collaboration with the AVANTIS and EXCEED projects resulted in the co-organization of the third MINEARC webinar entitled "Water, Tailings, and Circular Economy." During the webinar...

[click for more](#)



### PRESS RELEASE

MINE.IO joins forces with AVANTIS and EXCEED to co-organize MINEARC Webinar 3

## Third meeting on standardisation within the Smart EcoMine Hub



On November 20<sup>th</sup>, 2025, the third online workshop in the Smart EcoMine Hub cluster was held. Representatives from the four sister projects in the cluster (MASTERMINE, DINAMINE, NETHELIX and MINE.IO) met to align their...

[click for more](#)

## MINE.IO has joined the Battery Cluster Hub

The Mine.io project is proud to be part of the Cluster Hub "Production of raw materials for batteries from European resources", a dynamic European initiative that brings together over 20 EU-funded projects and more than 120 organizations across ...

[click for more](#)

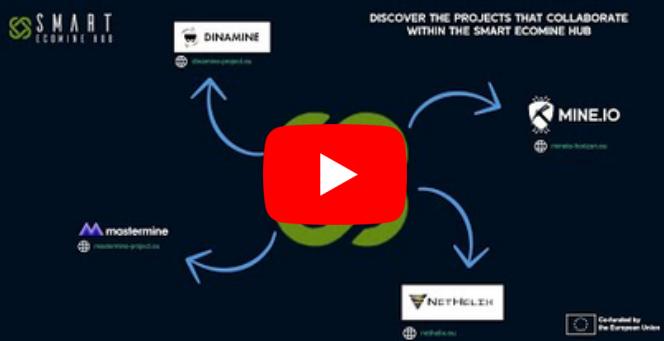


TUBAF



The MASTERMINE, DINAMINE, MINE.IO, and NETHELIX projects have joined forces to establish the Smart EcoMine Hub, a dynamic mining cluster dedicated to amplifying impact.

Digital Mining: TU Freiberg Equips Drill Rig with Sensors | Mine.io EU Project As part of the EU-funded Mine.io project, TU Bergakademie Freiberg is researching how to digitalize analogue mining equipment.



In this episode, Dr. Norbert Zajzon, professor and head of department at the University of Miskolc, talks about the underwater robot built as part of the UNEXUP project, which has proven itself in several special missions in recent years and is currently being further developed in the Mine.io Horizon Europe project.

This video shows an exhibition of the PIT system, which took place in the laboratory of the Łukasiewicz Research Network - Tele and Radio Research Institute.

The second part of the video shows an excerpt from the first tests of selected elements of the system in a pilot industrial environment in KGHM (Poland).



# New Media Coverage

## MINE.IO Mine.io in German press media: Mining Challenges

As one of our partners TUBAF has done great strides in sharing and spreading information about the MINE.IO project.

### Online Newspapers

**TUBAF – news:** Intelligentes Bohrgerät für den digitalisierten Bergbau der Zukunft



[click for more](#)

**Extra journal:** Bergbau-Forschung: Die KI gräbt sich unter die Erde



[click for more](#)

[click for the full list of newspapers](#)

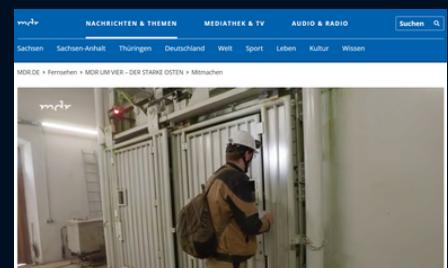
### TV Channels

**ARD1 channel:** Mit KI unter Tage: Zukunftsprojekt an der “Reichen Zeche”



[click for more](#)

**MDR TV channel:** Mit KI unter Tage: Zukunftsprojekt an der “Reichen Zeche”



[click for more](#)

## Press Release MINEARC Webinar3

The Horizon Europe project MINE.IO, in collaboration with fellow EU-funded initiatives AVANTIS and EXCEED, is proud to co-organize the third edition of the MINEARC Webinar Series, titled “Water, Tailings, and Circular Economy”.



## Updates from Mine.io about MINEARC Webinar3 on other LinkedIn channels

[“Grupo de investigación TIDOP” Channel](#)

[“FrontierInnovations” Channel](#)

[“Oulu Mining School” Channel](#)



## Mention of Mine.io in Stone-Ideas magazine



In the Mine.IO research project, scientists from across Europe, from Finland to Greece, have joined forces to rethink mining across its entire value chain – from exploration, extraction, and processing of resources to the recycling of residues and the restoration of sites.

[click for more](#)

# New Media Coverage

## MINE.IO Mine.io in Hungary\_press media: Updates from Mine.io on UNEXMIN GEOROBOTICS Press Media



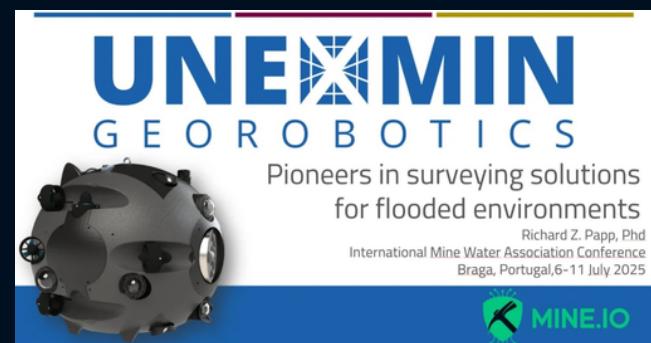
### Podcast talk hosted by UGR

Underwater robots deep underground – upgrades, missions and special abilities ...

## Mine.io in IMWA conference, Braga, Portugal

A central part of the presentation focuses on the Horizon Europe MINE.IO project, within which significant robotics research and development activities are currently ongoing...

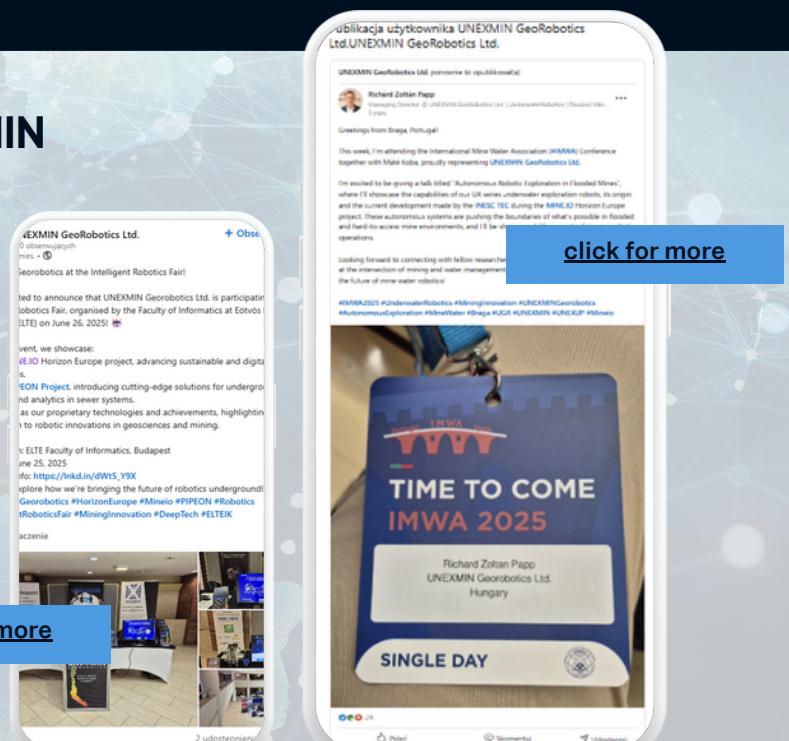
[click for more](#)



## • Updates from Mine.io on UNEXMIN GEOROBOTICS LinkedIn.

UNEXMIN GEOROBOTICS, has shared updates from the Mine.io project on its LinkedIn channel. The posts highlight project progress and its contribution to sustainable industrial innovation.

[click for more](#)



## MINE.IO AT ENERGTAB 2025

### ENERGTAB 2025

On 16–18 September we joined the 38th edition of ENERGTAB in Bielsko-Biała – the biggest energy fair in Poland

At our booth in we showcased the MINE.IO Horizon project – the “Holistic Digital Mine 4.0 Ecosystem”, bringing Industry 4.0 solutions into mining: digital twins, cloud platforms, predictive analytics, automation & robotics.

[click for more](#)



## Mine.io at Mineral Engineering Conference (MEC 2025)

On 22-24th of September we joined the 7th edition of MEC - Mineral Engineer Conference in Targanice.

Representatives of the [MINE.IO](#) project had the opportunity to present the results of their scientific research during Session IV: New technologies and process digitalization. .



[click for more](#)

# Events

## MINE.IO at SysTol2025 – Driving the Future of Mining Automation

We're proud to share that the MINE.IO project was prominently featured at the 6th International Conference on Control and Fault-Tolerant Systems (SysTol2025), held on October 6–8 in Ayia Napa, Cyprus.

SysTol2025 provided a powerful platform to exchange ideas on resilience, fault-tolerance, and cyber-physical security – core themes that align with MINE.IO's mission to modernize mining in extreme environments.

[click for more](#)



Process monitoring and operational control in the flotation process supported by AI methods  
Prof. Jacek Galas PhD.  
Lukasiewicz – Tele and Radio Research Institute

## MINE.IO at GeoEarth-2025: Artificial Intelligence for Sustainable Mining.

On September 29–30, 2025, Berlin hosted the sixth edition of the World Congress on Geology & Earth Science – GeoEarth-2025, one of the leading global events dedicated to geology and Earth sciences.

Prof. Jacek Galas delivered a presentation titled “Process monitoring and operational control in the flotation process supported by AI methods”, showcasing advanced solutions developed within the MINE.IO – A Holistic Digital Mine 4.0 Ecosystem project.

[click for more](#)

## MINE.IO AT MINEARC Webinar 3

On November 25–26, 2025, the third edition of the MINEARC Webinar, titled “Water, Tailings, and Circular Economy,” took place online. This event served as a vital platform for exchanging knowledge on sustainable water management and mining waste. The Mine.io project played a central role, represented by Dr. Raul Mollehuara Canales, who delivered two key presentations and served as one of the event’s moderators.

[click for more](#)



## Mine.io Partners at the XI Meeting of the Polish Research Group on Machine Learning Systems (PL-SIGML)

On 27–28 November 2025, the city of Szczecin hosted the XI Meeting of the Polish Research Group on Learning Systems (PL-SIGML). The event brought together experts from leading scientific centers across Poland, creating an important forum for exchanging knowledge and experience in machine learning, computer vision, and robotics.

[click for more](#)

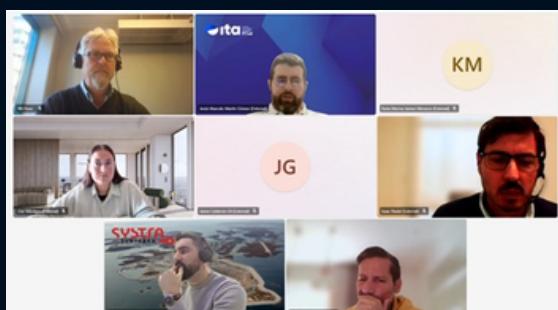
# Events

## Mine.io at the 2025 Cluster Hub Workshop: Powering the Future of European Batteries

The MINE.IO project continues its mission to bolster European raw material sovereignty. In late November 2025, MINE.IO representatives actively participated in the 4th Annual Cluster Hub Workshop: "Production of raw materials for batteries from European resources."

The event brought together innovation leaders, industry representatives, and policymakers to chart the course for Europe's battery sector.

[click for more](#)



## Shaping Future Standards: Highlights from the 3rd Smart EcoMine Hub Workshop

The 3rd Smart EcoMine Hub workshop was a focused, results-oriented session. Partners from across the cluster met to align their efforts on a critical objective: creating a collaborative document that summarizes the standardization activities and contributions relevant to the modern mining industry.

[click for more](#)

# HAPPY NEW YEAR



Partners

**25**



Duration

**42 months**



Budget

**€ 14M**



Demonstrations

**7 Pilots**



Co-funded by  
the European Union

MINE.IO has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No 101091885.