

MEDIA KIT

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ROBOMINERS researchers test robotic prototype for mineral extraction from deposits that are small or difficult to access

During the last week of April, researchers from the Tallinn University of Technology (TalTech, Estonia) and the Royal Belgian Institute of Natural Sciences (RBINS, Belgium) gathered in Han-Sur-Lesse and Ave-Et Auffe (Belgium) for a series of trials with the ROBOMINERS 'RM3' prototype. Alongside the RM3 trials which were conducted in an ancient mine gallery, the scientific teams also tested new types of underground 3D geophysical sensors.

The EU-funded <u>ROBOMINERS project</u> aims at facilitating EU access to mineral raw materials - including those that are

considered as strategic or critical for the energy transition - from domestic resources, and thus decreasing the European import dependency. To do so, ROBOMINERS is developing a bio-inspired robot for mining deposits that are small or difficult to access.

The Belgian test site is an <u>18th-century former baryte and lead mine gallery</u>. The exploitation follows a vein-type mineralisation (Mississippi Valley Type deposit) hosted In Mid-Devonian limestones. This type of deposit with a highly concentrated, small-scale vein-type orebody is particularly relevant for ROBOMINERS' small mining footprint and selective mining abilities.

The ROBOMINERS RM3 prototype is a lightweight (50 kg) locomotion/sensor testing platform built by the TalTech Centre for Biorobotics. Its purpose is the development and testing of ROBOMINERS' subsystems, including propulsion, localisation, and environmental sensing, in field conditions corresponding to Technology Readiness Level (TRL) 5. In the meantime, a drilling tool which will be mounted on the RM1 prototype is being tested in the lab facilities of the Montanuniversity of Leoben (Austria). The first components of the RM1 robot are being manufactured and tested at Tampere University (TAU, Finland) and robot on-board intelligence is being developed at the Centre for Automation and Robotics (CAR) of the Universidad Politécnica de Madrid (UPM).

The prototype deployed in Belgium was equipped with a four-motor screw locomotion and an innovative "blind" localisation and sensing system: 48 tactile "whiskers" coupled with onboard inertial measurements units. Two miniature reflectance/fluorescence spectrometers completed the setup. A set of depth-cameras (one on the robot and one for robot tracking) were also used for visual localisation and mapping ground-truthing. The prototype and all its sensors are operated under a Robotic Operating System (ROS2) using three onboard computers and two microcontrollers.

In addition to the RM3 tests, underground geophysical measurements methods were also deployed in the mine. The teams used a 3D electrode mesh mounted on an aluminium frame scaled to fit the mine









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Underground geophysical measurements.

gallery and conduct electric resistance (ER) and induced polarisation (IP) tomography measurements. Two electrode designs were tested for bare stone/mud conductivity efficiency.

The trials were a great success, with more than 110 GB of sensor data collected during the campaign on several trial runs outside and inside the mine gallery. The ROBOMINERS teams currently review this data carefully. It will be invaluable to advance robotic designs for extreme mining environments.

To share more information on its research, the ROBOMINERS project is also organising a seminar on <u>"Innovation in Selective</u> <u>Mining: new trends and technological advances to reduce the</u> <u>environmental footprint of mineral extraction</u>" which will take place on **8 June 2022** in Brussels.

Follow us:

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DEVELOPING RESILIENT BIO-INSPIRED MODULAR ROBOTIC MINERS

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ABOUT ROBOMINERS

ROBOMINERS is a 54-months Horizon 2020 project funded by the European Commission that started on 1 June 2019. ROBOMINERS will develop a **bio-inspired**, **modular and reconfigurable robot-miner for small and difficult to access deposits**. The aim is to create a prototype robot that is capable of **mining underground**, **underwater in a flooded environment**, and can be delivered in modules to the deposit via a large diameter borehole drilled from the surface to the mineral deposit.

ROBOMINERS aims at delivering a proof of concept for the feasibility of this technology line at Technology Readiness Level (TRL) 4. The technology could **enable the EU to access mineral raw materials from domestic sources that are otherwise inaccessible or uneconomic**.

CONCEPT

- $\oslash\,$ Robot parts (modules) are sent underground via a borehole
- They self-assemble to form a fully functional robot
- Using specialised sensing devices, they detect ore
- Using ad-hoc production devices, they produce slurry that is pumped out
- They can re-configure on-the-job





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CONCEPT IMAGE





Watch our movie to learn more about the ROBOMINERS concept!

https://youtu.be/BlcnObHfCyA





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