ONLINE WORKSHOP

DATE › THURSDAY,
NOVEMBER 12, 2020
09:30 AM WEST (UTC/GMT +1 HOUR)

›NEW CHALLENGES IN THE MINERAL RAW MATERIALS INDUSTRY:

Safety, Digitalisation, Technology & Innovation

ORGANIZED BY

MINERAL RESOURCES CLUSTER PORTUGAL

INESCTEC

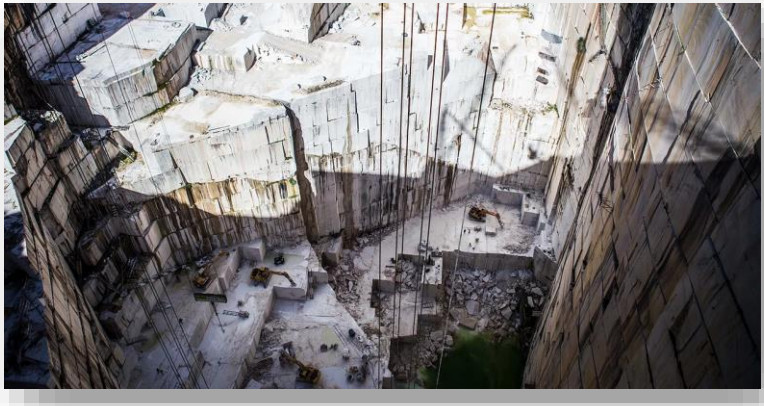
SUPPORTED BY

TECMSEA um laboratório no oceano atlântico

eit RawMaterials Connecting matters

This activity has received funding from the European Institute of Innovation and Technology (EIT), a body of the European Union, under the Horizon 2020, the EU Framework Programme for Research and Innovation

Cluster Portugal Mineral Resources Association



(Photos by Cluster)

+ info: www.clustermineralresources.pt/home-en

Cluster Portugal Mineral Resources Association Head Office
Praça Luís de Camões, nº 38
7100-512 Estremoz

geral@clustermineralresources.pt / marta.peres@clustermineralresources.pt

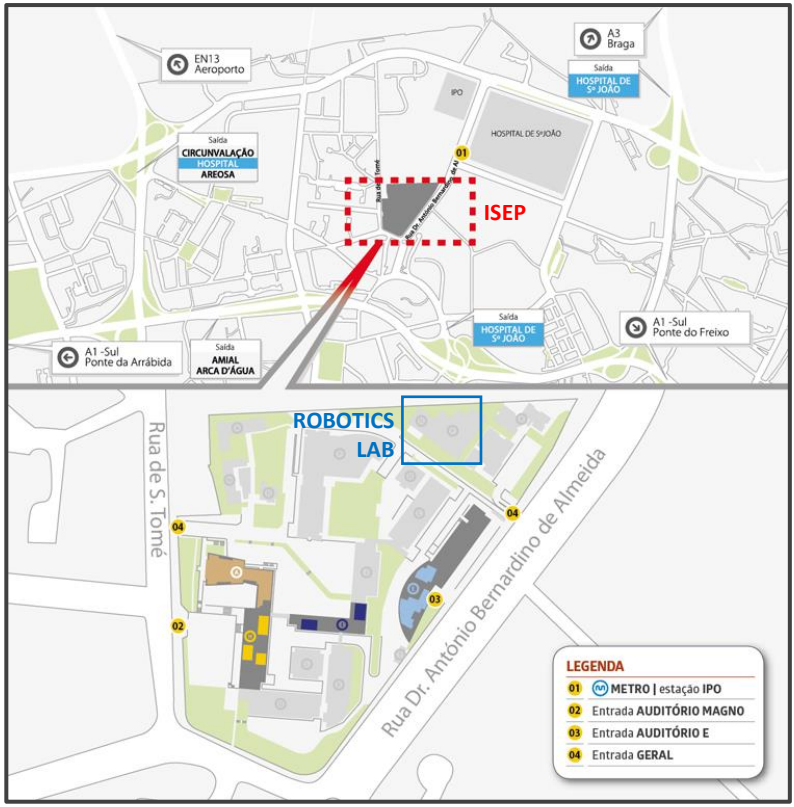
Robotics Laboratory

(Photos by Communication Service, INESCTEC)

INSTITUTO SUPERIOR DE ENGENHARIA DO PORTO
Rua Dr. António Bernardino de Almeida, 431
4249-015 Porto
Portugal

228340546

ana.c.pires@inesctec.pt / aplima@inesctec.pt
41.1787° N, 8.6077° W



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Events

↳ Thematic Workshop

↳ New Challenges in the Mineral Raw Materials Industry

Welcome Message

The Cluster Portugal Mineral Resources and the Centre for Robotics and Autonomous Systems|INESCTEC, with the support of EIT RAW MATERIALS & TEC4SEA, have joined forces to organize a Workshop online focusing on the *"New Challenges in the Mineral Raw Materials Industry: Safety, Digitalisation, Technology & Innovation*". This event will be expected to generate renewed momentum to the Raw Materials Community in general, strengthening networks, demonstrate mineral raw materials importance in our daily life and redefine future enabling strategies.

The Workshop will be a great opportunity to discuss the development and the challenges of projects related with raw materials, as well as, to learn from mining industry how to employ digital solutions in exploration, mining and mineral processing and to devise new smart solutions. This event is aimed at stakeholders of raw materials industry, major companies, SMEs or start-ups, universities, research & technology organisations, clusters, experts, and researchers.

We would like to invite you to participate in this event and to discover the new challenges in terms of digitalization, technology and innovation that are ahead of us!

THE ORGANISING TEAM OF THE THEMATIC WORKSHOP

Cluster Portugal Mineral Resources Team

Luís Martins
President of the Board
Cluster Portugal Mineral Resources
Business & Development (Fravizel)
lmartins@clustermineralresources.pt

Marta Peres
Executive Director
Cluster Portugal Mineral Resources
Grad. Marketing and Business Management
marta.peres@clustermineralresources.pt

Tânia Peças
Project Manager and Communication Service
Cluster Portugal Mineral Resources
MSc Business Management and Administration
tania.pecas@clustermineralresources.pt

INESC TEC Team

Eduardo Silva
Coordinator of TEC4SEA|INESC TEC
Professor at School of Engineering|ISEP
Researcher CRAS [Centre for Robotics and Autonomous Systems]
eduardo.silva@inesctec.pt

José Miguel Almeida
Coordinator CRAS|INESC TEC
Professor at School of Engineering|ISEP
Researcher CRAS [Centre for Robotics and Autonomous Systems]
jose.m.almeida@inesctec.pt

Ana Paula Lima
Project Manager, PhD
Research Fields: Biology, Natural Resources and Ecosystems
INESC TEC|CRAS [Centre for Robotics and Autonomous Systems]
aplima@inesctec.pt

Ana Cristina Pires
Researcher, PhD, MEng
Research Fields: Geosciences, Geotechnics and Mineral Resources
INESC TEC|CRAS [Centre for Robotics and Autonomous Systems]
ana.c.pires@inesctec.pt

Programme

Schedule

Start	End	Session		Speaker	Title
12th November / Thursday					
09:30	09:40	OS	Opening Session	Moderator: **Marta Peres** [Cluster Portugal Mineral Resources, Executive Director]	
09:40	10:00	KN	Keynote Speaker	**Peter Handley** [DG GROW, Head of Unit]	*The Raw Materials European Context*
10:00	11:15	S1	Session 1	**José Manuel Mendonça** Chairman of the Board and CEO of INESCTEC	*STAYAWAY COVID app: the technology and how it connects with the Raw Materials Sector*
				Norbert Zajzon University of Miskolc	*The UNEXUP project, an innovative solution for raw materials exploration and mining*
				Pedro Jorge CAP|Photonics Laboratory, INESCTEC	*INSite Project: Artificial Intelligence for a SMART LIBS development applied to Mineral Resources Exploration*
				João Pedro Veiga NOVA University of Lisbon	*Educational Challenges in Raw Materials. EIT Support to FCT NOVA initiatives*
				Inês Frazão Fravizel	*Digitalization and automation in the Portuguese mineral resources sector: the example of Fravizel*
11:15	11:20	Coffee break			
11:20	12:20	S2	Session 2	**Feven Desta** TUDelft	*Sensing and Data Fusion for Material Characterization in Mining*
				Agostinho Silva CEI	*Digitalization and automation in the Portuguese mineral resources sector: the example of CEI*
				Per Gisseloe SkyTEM	*Smart Exploration – Five new prototypes for deep exploration*
				Rui Andrade Waymotion	*Quarry-ON Project: a cutting-edge technology to integrate robotics, sensing technology, information, and geospatial knowledge*
12:20	12:30	CS	Closing Session	**Luís Martins** [Cluster Portugal Mineral Resources, President of the Board]	

Sessions & Speakers

OP	*Opening Session*

Marta Peres - Executive Director
Cluster Portugal Mineral Resources

Executive Director
Cluster Portugal Mineral Resources
Estremoz
Portugal
marta.peres@clustermineralresources.pt

Degree in Marketing and Advertising Graduate in Business Management.
Begins in CEVALOR-Technological Centre for the Use and Value of Natural Stone in 2000 in the Promotion and Marketing Area.
In 2002, she was responsible for the management of R&D and innovation projects. In 2009, accumulates this function with the management of Natural Stone Cluster.
In 2012, she is CEVALOR's Project Manager with the Executive Direction of the Portuguese Natural Stone Cluster and was nominated the Secretary-General of the Global event GLOBAL STONE CONGRESS.
Currently, she is the Executive Director of the CLUSTER PORTUGAL MINERAL RESOURCES.
Marta Peres is part of the Operational Group of "The European innovation partnership (EIP) on raw materials".
For 20 years in the sector, she has authored and co-authored several articles and communications at international congresses.

KN	*Keynote Speaker*

Peter Handley - DG GROW, Head of Unit

Head of Unit
DG GROW
Brussels
Belgium
Peter.Handley@ec.europa.eu

Peter Handley is, since September 2017, Head of the Energy-Intensive Industries and Raw Materials Unit in the European Commission's Directorate-General for Growth. He was previously Head of the Resource Efficiency Unit at the Secretariat-General, where he was responsible for coordination of Energy Union, 2030 climate and energy package, low emission mobility strategy and the circular economy.

The Raw Materials European Context

Abstract:

Peter Handley, Head of Unit responsible for raw materials policy in the European Commission, will speak about the EU policy context. He will present insights from the most recent criticality assessment, present the Action Plan on Critical Raw Materials and outline where digitalisation can help achieve the EU's strategic goals

S1	*Session I*

José Manuel Mendonça - Chairman of the Board and CEO of INESC TEC

Chairman of the Board
CEO INESC TEC
Porto
Portugal
jose.m.mendonca@inesctec.pt

José Manuel Mendonça is currently a Full Professor at the Department of Industrial Engineering and Management, School of Engineering, University of Porto, and Chairman of the Board and CEO of INESC TEC.
Graduated in Electrical Engineering at the School of Engineering, University of Porto, he obtained his Ph.D in Electrical Engineering at the Imperial College of Science and Technology, University of London. Presently he is a Fellow of the IC2 Institute of the University of Texas, Austin, and member of the High-Level Group of the European Technological Platform Manufuture.
He is the National Director of UT Austin Portugal Program and Chairman of the Board of ForestWISE CoLAB.
He was Vice-President of the Innovation Agency, CEO of the Ilídio Pinho Foundation and Chairman of the Board of three technology-based companies: Tech M5 SGPS, Fibersensing SA e Kinematix SA. In addition, he was Scientific Director of the University Technology Enterprise Network (UTEN), in the UTAustin Portugal Program, National Delegate to the Program Committee in various EC R&D Programs – Innovation and SME's (FP5), Growth (FP5), NMP (FP6) and ICT (FP7) – and Coordinator and Evaluator of several european projects within the scope of the ESPRIT Program (FP4 and FP5).

STAYAWAY COVID app: the technology and how it connects with the Raw Materials Sector

Abstract:

The STAYAWAY COVID is the Portuguese COVID-19 digital contact tracing app, available for iOS and Android mobile phones and completely free of charge. This presentation will highlight the importance of the use of the app in fighting against the pandemic, giving also an insight on the importance of raw materials in our daily life technologies, like the smartphones where so many apps are installed. Mobile internet and smartphones became an essential part of human life because they are much more than effective communication devices and they make our lives much easier.

INESC TEC coordinated the consortium in charge of developing the STAYAWAY COVID app, which rapidly became an effective tool complementing manual contact tracing processes and resources. In a simple, safe, and anonymous way, and assuring total data privacy, the app informs each user about high-risk exposures to the disease, through the monitoring of recent contacts. The application is voluntary and free to use, and it does not access the users' identity or any personal data at any time. The STAYAWAY COVID system will soon be integrated and interoperable with similar apps in other 15 European countries.

Norbert Zajzon - University of Miskolc

Associate Professor
Institute of Mineralogy – Geology
Faculty of Earth Sciences and Engineering
University of Miskolc
Hungary
nzajzon@uni-miskolc.hu

Norbert Zajzon completed his studies about mineralogy, geochemistry and solid mineral resources at the Eötvös Loránd University (MSc 2001, PhD 2006), Budapest, Hungary. His research subject was instrumental mineralogy and geochemistry related to global environmental crises, mass extinctions. Until now he is dedicated to numerous analytical techniques in the geoscience field.
He is currently an associate professor at the Institute of Mineralogy and Geology, and head of the Mineralogy – Petrology Department, University of Miskolc (Miskolc, Hungary), teaching instrumental mineralogy, ore deposits and astronomy and planetology and head of the microprobe laboratory (http://www.geology.uni-miskolc.hu/index.php/en/staff/13-munkatarsak/438-dr-norbert-zajzon), and co-leader of the 3D laboratory. He has experience in numerous H2020 projects, like Robominers, or UNEXMIN (unexmin.eu) where he was the coordinator. UNEXMIN project developed and proved the concept of an autonomous underwater robotic explorer (UX-1) capable to 3D map and deliver geo-scientific information by non-invasive methods from abandoned, flooded underground mines. The UNEXMIN results leaded to its continuation the EIT Raw Materials financed UNEXUP project (unexup.eu) from 2020 to 2023 where also he is the coordinator. UNEXUP aims to stabilize and develop the technology further bringing the technology closer to the market. He is also the scientific advisor of the UNEXMIN Georobotics Ltd, which was founded by the UNEXMIN consortium.
Nearby his university carrier, he also works for the geological society, as Co-president of the Hungarian Geological Society and fellow of the Society of Economic Geologists.

The UNEXUP project, an innovative solution for raw materials exploration and mining

Abstract:

UNEXUP (UNEXMIN "UP"scaling) is an EIT RawMaterials upscaling project (unexup.eu), which is developing further the UNEXMIN technology. UNEXMIN (2016–2019) proved the concept of robotic mapping of flooded underground mines (e.g. reopening for raw materials exploitation) by developing the UX-1 robots' series. During UNEXUP (2020–2022), more development and stabilization of the technology are the main targets, to bring it closer to commercialization as an exploration service.

UNEXUP is upgrading the UX-1 robots with the "UX-1Neo" and developing the "UX-2Deep", with improved hardware and software capabilities. The core focus is to strengthen development of scientific instrumentation and tools, extend exploration capabilities and improve operation support systems. The new robots will be more modular, with open frame and easily transported thanks to the lower weight in a similar dimension. With the increased functionalities - easily swappable batteries, quick data retrieval, additional cameras and new instruments (e.g. rock sampling unit) - the hardware will be more versatile and effective during the field operations. The operation support system development, like autonomous calibration modules, improvement in localization initialization procedures and mission control tools reduces the crew on the field, which makes the operations more productive and cost-effective.

The above improvements will be validated in field trials during the next three years. The commercial sites will be chosen from a continuously growing list.

The project has a strong focus to bring the service to the market, where UNEXMIN GeoRobotics Ltd. is the spin-off company making the technology commercially available.

Pedro Jorge - CAP|Photonics Laboratory, INESCTEC

PhD, Senior Researcher and
Area Manager INESC TEC
Invited Assistant Professor, FCUP
Porto
Portugal
pedro.jorge@inesctec.pt

Pedro A. S. Jorge was born in Braga, Portugal, in 1973. He graduated in Applied Physics (Optics and Lasers) at University of Minho in 1996 and received a MSc in Optoelectronics and Lasers by the Physics Department of the University of Porto in 2000. In 2006 he concluded his PhD program in

Physics at the University of Porto in collaboration with the Department of Physics and Optical Sciences at the University of Charlotte, North Carolina, USA, with work in luminescent quantum dots and its applications in optical fibre sensors for environmental and biomedical applications.

Pedro Jorge is currently working as Senior Researcher at INESC TEC - Institute for Systems and Computer Engineering, Technology and Science, a R&D institute affiliated to the University of Porto. He is the Leader of Biochemical Sensors Area, member of the coordination council of the Centre for Applied Photonics (CAP), and the coordinator for the CAP activities in TEC4Sea Infrastructure.

He is also working at the Physics and Astronomy Department of the Faculty of Sciences of the University of Porto (FCUP) as Assistant Professor.

Since 2007 Pedro Jorge leads the Biochemical Sensor group at INESC TEC, exploring the potential of photonic technologies in the development of new solutions for chemical and biological monitoring in environmental, biomedical and industrial applications. This activity is framed in a diversity of competitive national and International research projects with academia and Industry, where he acts as Principal Investigator (9), workpackage leader (14) or regular team member (9), supervising also the training of advanced human resources at PhD and Msc level. Photonics technologies such a optical fiber sensors, interferometry, fluorescence spectroscopy, optical trapping and Laser Induced Breakdown spectroscopy are being explored in a diversity of applications ranging from systems for real time evaluation of minerals for underwater mining, determination of dCO2 in Aquaculture, manipulation and diagnostic of single cells, and remote monitoring of water quality.

Since 1998 Pedro Jorge co-authored 82 peer-reviewed papers, 3 book chapters and more than 200 communications in international and national conferences in the field of optical sensors. He is the author of 1 patent, and three Patent pending (EP). In total, these publications have attracted 2531 citations according to Google Scholar (user: P. A. S. Jorge) with, h-index of 29; SCOPUS (ID 9740971900), 1888 citations, h-index of 24; on researcherID (user: G-4964-2011), 1704 citations, h-index of 23. Pedro Jorge is a member of SPIE and SPOF.

INSite Project: Artificial Intelligence for a SMART LIBS development applied to Mineral Resources Exploration

Abstract:

INSite brings together a multidisciplinary research team with a renowned spectroscopy company (Lasertechnik Berlin) to take to the market a new smart LIBS (Laser Induced Breakdown Spectroscopy) technology. LIBS is a powerful spectroscopy technique for element analysis with very promising features for real time assessment of composition. However, in spite of many systems already probing the market, its performance is only acceptable with simple samples and in controlled conditions. Its identification and quantification abilities rapidly decline with sample complexity and environmental roughness (e.g. underwater). To date no satisfactory system presents acceptable performance when facing complex mineral samples in harsh mining conditions. Solution on the market are plagued by inconsistent results and poor quantification performance. INSite introduces a new solution where innovative hardware is combined with the concept of information transfer coupled with advanced AI algorithms and a knowledge database of mineral spectra enabling true in-situ ore grading with a new generation of smart LIBS technology.

João Pedro Veiga - NOVA University of Lisbon

PhD, CENIMAT/i3N
Materials Science Department
Assistant Professor FCT NOVA
Lisbon
Portugal
jpv@fct.unl.pt

Assistant Professor and Member of the Executive Board at the Materials Science Department, Faculty of Sciences and Technology, NOVA University of Lisbon, Campus de Caparica, Quinta da Torre, 2829-516 Caparica, Portugal. Coordinator of the Master Program in Advanced Materials Innovative Recycling at FCT NOVA. Member of the Research Centre CENIMAT/i3N where he is responsible for the Structural Materials research group and the XRF-WDS Analytical Laboratory. His main scientific research activity and area of expertise is crystal chemistry and structural analysis, namely on the characterization of ceramic materials, nanostructured glasses and glass-based oxides, as well as ceramic, vitreous and petrous materials from cultural heritage, using X-rays. Techniques of expertise include X-ray diffraction and X-Ray fluorescence through laboratory equipment and the use of synchrotron radiation in large scale European research installations such as the ESRF (European Synchrotron Radiation Facility) for X-Ray absorption techniques (XANES and EXAFS). His collaborations in Materials Science include partnerships with National Institutes such as LNEG (Portuguese National Laboratory for Energy and Geology) and Hercules Laboratory of Évora University (Portugal) along with International partnerships with CNR/Italy, the University of Bordeaux/France and the Polytechnical University of Madrid/Spain.
He is author/coauthor of more than 60 papers in scientific journals and conference proceedings. Participant in several national and European projects, is the coordinator for the MineHeritage project EIT Raw Materials (European Institute of Innovation and Technology) and the responsible researcher for RawMatters@Schools and the AMIR-RIS projects, both funded by the EIT. Responsible researcher for the IN4SOC Erasmus + Project. Responsible researcher in the H2020 HERACLES project (ended in 2019). Co-Organizer of several conferences/symposia including 4 EMRS (European Materials Research Society) Symposia related to Cultural Heritage (Spring Meetings 2015, 2016, 2018 and 2019), the International congress Materiais2019 Responsible for the CENIMAT/I3N Materials Science dissemination activities on the European Researchers Night, Semana da Ciência Viva and EXPO FCT.
Member of the Editorial Board of the MDPI Heritage Journal and Guest Editor of 6 special issues in materials and characterization techniques applied to cultural heritage. Reviewer for several scientific journals and evaluator of National (ANI) and European (H2020 and Swiss science foundation) projects. Member of the Working Group in Cultural Heritage of E-MRS (European Materials Research Society).

Educational Challenges in Raw Materials. EIT Support to FCT NOVA initiatives

Abstract:

An overview will be given on the participation of FCT NOVA in educational programs and projects supported by EIT and EIT Raw Materials.

The impact of Raw Materials in society and the change of perspectives through education is the connecting thread in one of FCT NOVA participation trends in EIT projects. The concept of development through knowledge will focus in the Wider Society Learning project MineHeritage, relating to European mining heritage as a tool for the dissemination of Raw Materials, the RawMatters@Schools project relating to the dissemination of scientific culture in high schools, and the AMIR-RIS project, an European Master Program dealing with Advanced Materials Innovative Recycling.

Inês Frazão - Fravizel

PhD Management
Invited Professor at ISG and Lusófona
Marketing Manager (Fravizel)
Alcanede
Portugal
ifrazao@fravizel.pt

Inês Paulo Frazão. Has a degree in Marketing Management (ISCTE), and in Investment and Internationalization Strategies (ISG) and a PhD in Strategy from ISCTE. In her academic career study at Università di Bologna (Italy), was part of the Students' Association, was a founding member of a junior consulting company (ISCTE Junior Consulting) and a member of the Acredita Portugal Association (entrepreneurship). Is the Treasure of Portugal Mozambique Chamber of Commerce and an invited Professor at ISG and Lusophone. Exercise professional activity in the company Fravizel, engineering, in the areas of strategy, innovation and marketing. Fravizel SA is a leading Portuguese company in metalworking and engineering, with 36 years of history and around 100 employees, dedicated to the production of high quality machines and attachments for all types of earthmoving machines (earthmoving machinery), for the extractive sectors of mineral resources (quarries and mines), forestry, heavy earthmoving, construction, transport and cargo.

Digitalization and automation in the Portuguese mineral resources sector: the example of Fravizel

Abstract:

The research is focused on the market dynamics, clusters, technologies and competitiveness specialized in the Mineral Resources Sector.

The core is the Dynamic Capabilities, that means a company's ability to integrate, build and reconfigure internal and external competencies to address rapidly changing environments.

Companies need to develop their technology, internationalization, networking, and digital skills, remembering that the motivations are intended to respond to market challenges.

The technological progress and the digitalization are keys for the development of the processes in Mineral Resources Sector. For that is necessary to have the technology and to adapt the people skills in all the phases of extraction.

S2	*Session II*

Feven Desta - TUDelft

PhD researcher
Delft University of Technology (TUD)
Delft
The Netherlands
F.S.Desta@tudelft.nl

Feven Desta is a PhD researcher at Delft University of Technology (TUD). Her research was focused on investigating the use of sensor technologies and data fusion for the characterization of materials in mining. She has BSc. degree in Geology, MSc. degree in Geoenvironmental systems analysis and MSc. degree in Geoinformatics. Prior to TUD, Feven worked at different companies in the area of Geosciences. Her main areas of interest include geospatial data analysis, data and process modelling, spectroscopic data analysis, machine learning and sensors data fusion for automated material characterization. Feven is currently at the stage of finalizing her PhD and involved in the project entitled "In situ ore grading system using LIBS in harsh environments – INSITE".

Sensing and Data Fusion for Material Characterization in Mining

(Feven Desta, Mike Buxton)

Abstract:

The rising demands for mined products certainly lead to the extraction of materials in geologically complex regions. This calls for mining process changes and interventions driven by technology and advanced data analytics. This research aims to develop methods for the characterisation of raw materials using multiple sensor technologies and sensor combinations concept (data fusion at different levels), that can be potentially applicable to mining operations. The study involved the multispectral and hyperspectral imaging techniques, such as red-green-blue (RGB) imaging, visible and near-infrared (VNIR) and short-wave infrared (SWIR) hyperspectral imaging, and point spectroscopic techniques, such as mid-wave infrared (MWIR), long-wave infrared (LWIR) and Raman spectroscopy to acquire spectral information over a wider range of the electromagnetic spectrum. This research demonstrates the potential benefits of and opportunities for the use of sensor technologies and data fusion for the discrimination of ore and waste materials, mineral identification, mineral mapping, and semi-quantitative analysis of mineralogical and geochemical information in polymetallic sulphide deposit. The fusion of data blocks at different levels allowed for improved predictability and classification of materials than that of the individual data blocks models. The proposed approach can greatly benefit the productivity and efficiency of mining operations and can contribute to sustainability in mining.

Agostinho Silva - CEI

PhD Business Administration and Management
Member of Board of Directors
CEI-Zipor Group
Cluster Portugal Mineral Resources
São João da Madeira
Portugal
a.silva@zipor.pt

Agostinho da Silva has a B.S.'s degree in electromechanics engineering, marine engineering and chemical engineering, master in marine engineering, master Investment and Internationalization Strategies and, the Ph.D. degree in Management, played the role of prime research in 27 RD projects involving 172 companies and academic research units, and is co-trustee and board of directors member of CEI-Zipor group since 1995.

Digitalization and automation in the Portuguese mineral resources sector: the example of CEI

Abstract:

The balance of the digital transition in industrial structures in general will certainly be positive in the long term. However, the accelerated change will tend to induce uncertainties, tensions, and constraints, especially in Traditional and Fragmented industries, for which variability and randomness become the rule rather than the exception, because: (1) Supply chains (SC) tend to migrate rapidly to the integration of information flows, and for this very reason, access and use of information by all the actors of the SC, available in real time, becomes vital to their survival, (2) Integrated in digital SC, markets tend to operate supported by digital platforms in the form of open global networks. Access to markets will therefore require suppliers and customers to assume themselves as nodes of these networks, (3) in a digital marketplace environment, customers will tend to seek global solutions to their specific problems. This tends to require from supplier's simultaneous innovation, scale, flexibility, quality, delivery time and competitive price; (4) in a global market context, these simultaneous conditions will only be possible to satisfy if suppliers are integrated strategic alliances with their, thus complementing and mitigating their limitations in each of the opportunities; and, given the need to mitigate individual weaknesses, there are many practical examples in which groups of organizations have come together in strategic, one-off or long-term alliances, often referred to as ecosystems.

Per Gisseloe - SkyTEM

PhD Geosciences
Project manager
SkyTEM Survey ApS
Aarhus
Denmark
pgg@skytem.com

Per Gisselø is project manager at SkyTEM Survey ApS. He holds a PhD in Geosciences from the University of Aarhus obtained in 2001. He is engaged as an active team leader as well as professional specialist in organization of airborne surveys and the processing of airborne electromagnetic and magnetic data. Per is member of the Smart Exploration Executive board and the leader of WP2 handling the development of prototypes.

Smart Exploration – Five new prototypes for deep exploration

Per Gisselø[(1)], *Alireza Malehmir* [(2)], *Richard de Kunder* [(3)], *Henrik Johansson* [(4)], *Anders Sivard* [(5)], *& Tord Sjölund* [(6)]
[(1)] *SkyTEM Surveys ApS, Denmark*
[(2)] *Uppsala University, Sweden*
[(3)] *Seismic Mechatronics, The Netherlands*
[(4)] *SGU, Sweden*
[(5)] *BitSim, Sweden*
[(6)] *Mic Nordic AB, Sweden*

Abstract:

The developments of the five prototypes within the Smart Exploration programme has put forward new technologies to aid the future of exploration. The first prototype is an electric seismic source with broadband frequency. The E-vibe has been validated in both surface and underground settings. Secondly a GPS time transmitter system for shielded environments has been developed and validated for an underground seismic survey in the Neves-Corvo mine. The slimhole hydrophone system is designed to be able to be used in the typical mineral exploration drillholes. The fourth prototype UAV-borne EM system that had undergone very efficient development and testing of a low noise level UAV. The deep-probing helicopterborne EM system has been focused on optimizing the system to operate at very low base frequency of 6.25 Hz. The prototypes provide the possibility to expand the use of both seismic and electromagnetic surveys for the exploration industry in an environmentally sound manner and with improved data quality and depth penetration abilities.

Rui Andrade - Waymotion

Executive Director
Waymotion
Lisbon
Portugal
rui.andrade@waymotion.com

Rui is the executive director and founding partner of Waymotion (www.waymotion.com) since its creation in September 2014. Starting early as an entrepreneur creating his first company (Novageo Solutions) in the mid 90's, Rui has had, during his professional career and under his responsibility, the direction and management of numerous projects, including technical functions in the areas of consulting, software development and system's integration. With a background in Electrotechnics Engineering and Telecommunications (Instituto Superior Técnico, 1986), Rui has also a PostGraduation qualification in Science and GIS (Universidade Nova de Lisboa, 2005) and has completed a program in High Business Management at AESE/IESE Business School, 2011.

Quarry-ON Project: a cutting-edge technology to integrate robotics, sensing technology, information, and geospatial knowledge

Abstract:

There are about 2500 quarries in Portugal, many of them abandoned. If we look, for example, at the stretch of the marble area that includes Estremoz, Vila Viçosa and Borba, we find 157 quarries. Of these, only 46 are active. The vast majority are either abandoned or have their exploration suspended and / or flooded. The scenario in the rest of the country is not very different.

This has been recognized as a huge environmental liability, one which the QUARRY ON Project aims to address. Flooded quarries alone represent reservoirs of many millions of cubic meters of water even in the dry season.

The QUARRY ON Project recognized in this reality an opportunity to turn this otherwise wasted water into a valuable resource for purposes such as irrigation and wildfire combat. To create economical value from these environmental liabilities, QUARRY ON will implement an integrated system for real-time monitoring of the volume and quality of water available through robotic geotechnologies and multisensory remote sensing. This will be presented to the end users as an Observatory with a simple and intuitive interface for geospatial location and characterization of flooded quarries, including tools of augmented reality for a better understanding of each individual situation.

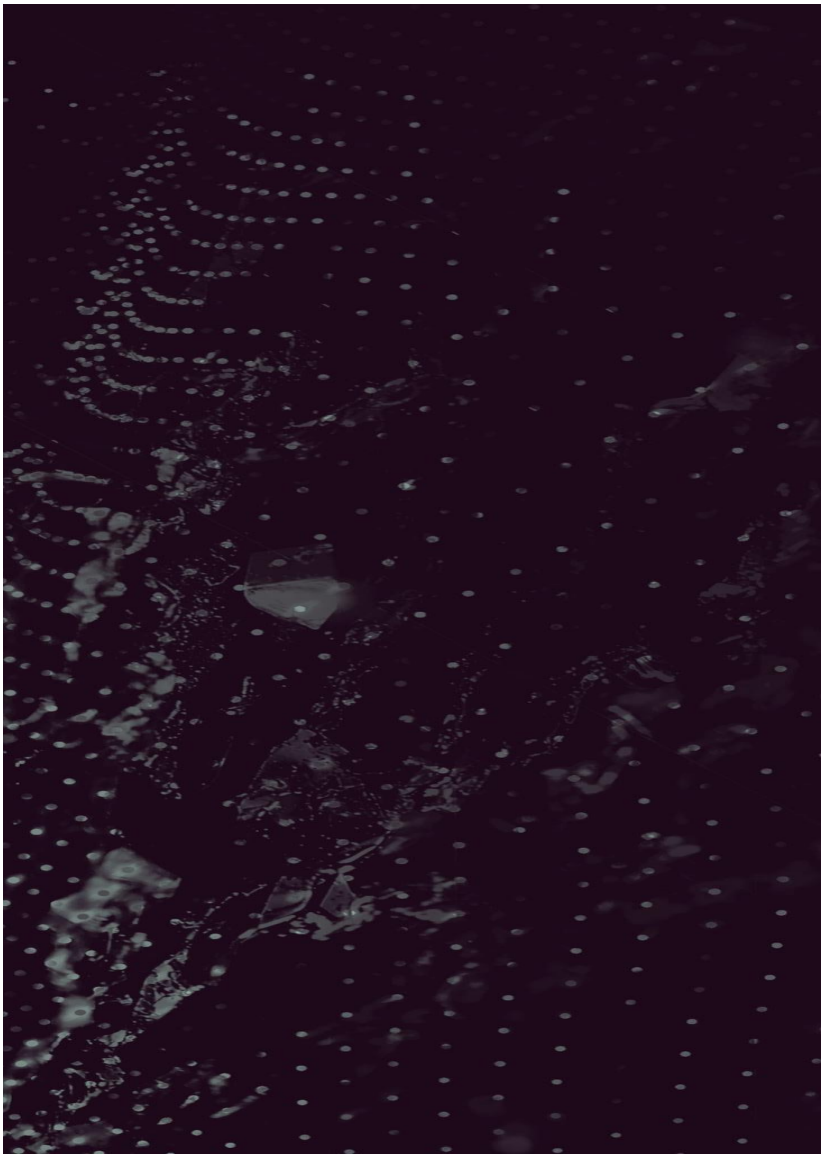
The various civil protection authorities and other entities with responsibilities in terms of fighting fires, minimizing extreme drought situations, and identifying risk situations are foreseen as the first interested in the solution being proposed. Furthermore, it will be of great interest for the local and central administrations, as well as for entities responsible for the management and monitoring of the quality of underground water resources (DGEG, APA), the remediation and rehabilitation of old degraded mining spaces (DGEG) and the national registry of occurrences of mineral resources (LNEG).

Luís Martins - Cluster Portugal Mineral Resources President of the Board

President of the Board
Cluster Portugal Mineral Resources
Business & Development (Fravizel)
Alcanede
Portugal
lmartins@clustermineralresources.pt

Luis Martins is a geologist with more than 35 years of experience in the exploration and mining sector. He graduated from the Faculty of Sciences of Lisbon (1973) and has a MsC in Economic Geology from the same faculty (1995) and also several national and international post-graduation courses. He was a former Director of the Mineral Resources Department at the Geology and Mining Institute (the Geological Survey) and a former Director of the Mines and Quarries Department at the Directorate-General of Energy and Geology (the Mining Authority). He was the Portuguese representative on the "Raw Materials Supply Group" of DG Enterprise and Industry of the European Commission (June 2010-August 2012) and coordinator of the CYTED Ibero-American Network "Land Use Planning and Mineral Resources". He has coordinated several national and international technical and research projects in the areas of mineral exploration, environmental geology and mining heritage.
He was also Colt Resources Inc. Vice-President Business & Development and CEO of Ozdogu Portugal Mining and Exploration Lda.

Currently is also President of the Cluster Portugal Mineral Resources. He is a member of the High-Level Group of the European Innovation Partnership on Raw Materials and an associate of the Portuguese Association of Geologists.
He has published 110 papers in peer review publications and presenting oral communications in about 400 national and international events.



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