

Earth observation and Earth GNSS data acquisition and processing platform for safe, sustainable and cost-efficient mining operations

Platforma de achiziție și prelucrare a datelor din observarea Pământului și GNSS pentru operațiuni miniere sigure, durabile și eficiente din punct de vedere al costurilor

PRO INVENT 2021
20-22 Octombrie 2021
ediția a XIX-a, ONLINE

GOLDENEYE 

CUPRUMIN-UTCN

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GOLDENEYE: proiect finanțat EU H2020

- Coordonator VTT (Finlanda) 10.7 mil.€ proiect de Acțiuni Inovatoare H2020
- Durata Proiectului 3,5 ani
- Consorțiul din 16 parteneri include:

3 furnizori de tehnologii miniere

7 companii producatoare de senzori

4 companii miniere

3 universități

1 Institut de cercetare (coordonator)



Proiectul **GOLDENEYE** project

SCOP:

- Dezvoltarea unei platforme de **DATE DE OBSERVARE A PĂMÂNTULUI** pentru resurse minerale pentru a **ÎMBUNĂTĂȚI**
 - Securitatea minieră,
 - Amprenta ecologică asupra mediului &
 - Rentabilitatea
- Platforma este un **TOOLKIT** a exploatărilor miniere pentru a **MONITORIZA**
 - Stabilitatea pantelor în CARIERE
 - Stabilitatea haldelor de steril minier
 - Stabilitatea iazurilor de decantare
 - Activitatea in lucrările miniere subterane (in Finlanda)
- Platforma este un **TOOLKIT** a exploatărilor miniere pentru a **ÎMBUNĂTĂȚI**:
 - Cartografierea mineralogică a suprafețelor terenului din perimetrul minier
 - Analiza mineralogică a carotelor de foraj exploratoriu și a minereului procesat
 - Analiza mineralogică a puțurilor miniere subterane (in Finlanda)



Tehnologiile **platformei GOLDENEYE**

Detectare satelitară:

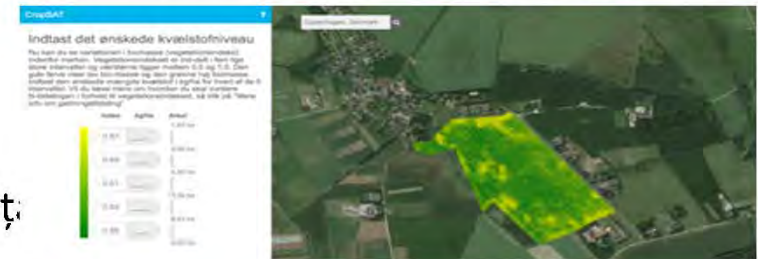
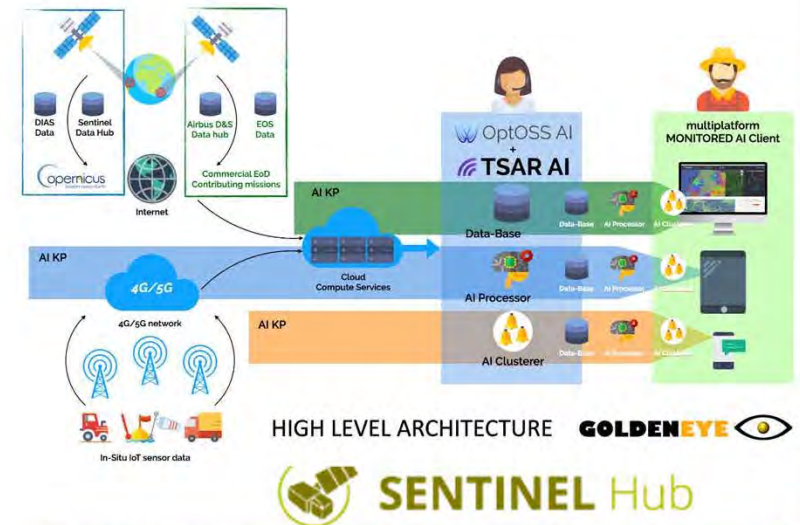
- Sentinel-1 Synthetic Aperture Radar Imagery
- Sentinel-2 Multispectral Imagery
- Sentinel-3, Sentinel-5P, Landsat-8, MODIS
- Airbus / Plejades Satellite Imagery & DEM
- TerraSAR-X Radar Imagery

➤ **SIGURANȚĂ/SECURITATE MINIERĂ:**

Deformarea terenului și analiza stabilității taluzurilor în carieră, haldelor de steril și a iazurilor de decantare

➤ **AMPRENTA ECOLOGICĂ DE MEDIU:**

Modificări ale solurilor/subsolurilor și apelor de suprafață:



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No [869398]

Tehnologiile platformei **GOLDENEYE**

Detectare bazată pe vehicule aeriene fără pilot - Unmanned Aerial Vehicles (UAV):

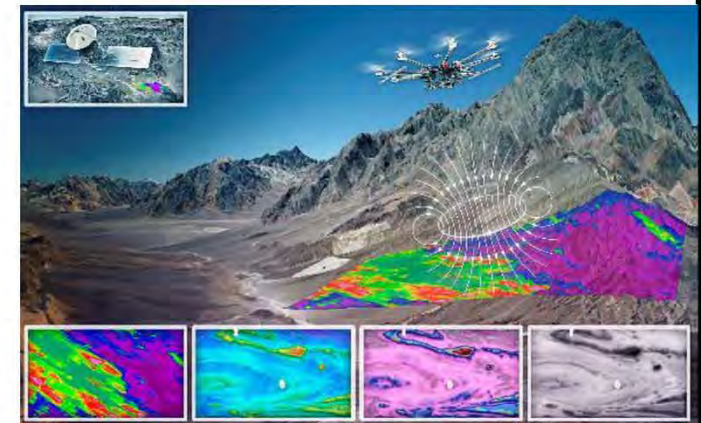
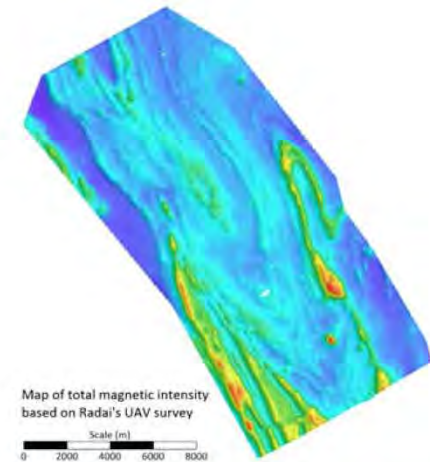
- Analiza geofizică folosind dispozitive precum drone cu aripi fixe
- Măsurători de Câmp Electromagnetic (EM)
- Imagistică multispectrală

➤ **AMPRENTA ECOLOGICĂ DE MEDIU:**

Detectarea terenurilor și a vegetației contaminate
Modificări ale cotei terenurilor

➤ **EXPLORARE MINERALOGICĂ :**

Datele geofizice vor calibra senzorii satelitari pentru o acuratețe și o predicție mai mare a geologiei 3D a perimetrului minier



Tehnologiile **platformei** **GOLDENEYE**

Detectare proximală:

- Spectrometrie Raman Time-gated
- Imagistică spectrală activă
- Geolocalizare GNSS pe baza poziționării celulare

➤ **SIGURANȚĂ/SECURITATE MINIERĂ:**

Localizare precisă a activității la suprafață și subteran

➤ **EXPLORARE MINERALOGICĂ:**

Locația precisă a datelor colectate de senzorii dronelor

Locația precisă a datelor colectate de senzorii subterani (in Finlanda)

Analiza mineralogică in-situ a carotelor în timpul forajului de explorare / exploatare

Analiza mineralogică la fața locului ca referință pentru datele satelitare și cele colectate de drone



Platforma GOLDENEYE

Încercări pe teren

Explorare în Germania:

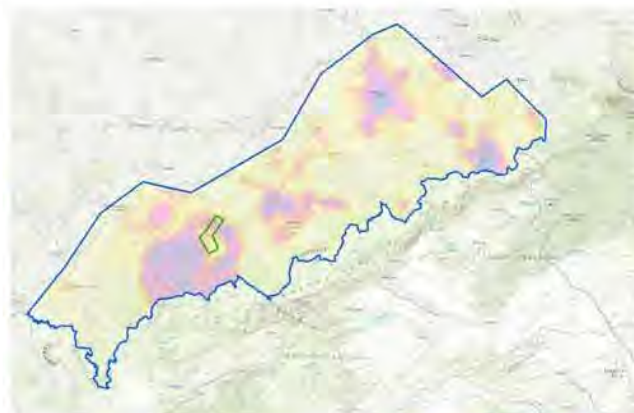
- Districtul Erzgebirge
- Mineralogic, cantonat sub o cupolă de granit
- Ținta explorării este mineralizația de Sn cantonată în scarn
- Locația exactă a forajelor de explorare nu a putu fi identificată datorită lipsei datelor de înaltă rezoluție

SCOP: cunoașterea mineralogică

- Integrarea datelor UAV de înaltă rezoluție cu date satelitare pentru a ajuta la identificarea forajelor țintă

Informații existente:

- Hărți geologice
- Model geologic 3D
- Migrarea geochemică a sedimentelor
- Geofizică aeriană



Platforma GOLDENEYE

Încercări pe teren

Explorare în Bulgaria:

- Districtul minier Panagyurishte
- Ținta explorării sunt ocurențele de porphyry-copper și aur epitermal
- Cartarea țintă este deficitară în date de înaltă rezoluție pentru a identifica și/ori dovedi geometria mineralului alterat și controlul zăcămintului

SCOP: cunoașterea mineralogică

- Datele IR și multispectrale UAV vor fi produse împreună cu hărțile GIS bazate pe ansamblul mineralelor alterate pentru fiecare țintă

Informații existente:

- Hărți geologice
- Geochimia sedimentelor și a rocilor
- Date geofizice



Platforma GOLDENEYE

Încercări pe teren

Exploatare la zi în România:

- Perimetrul Minier Roșia Poieni
- Extragerea zăcămintului cuprifera
- Extragere țintă: mineralizația cu conținut foarte mic de cupru delimitat de conținutul 0.1% Cu
- Precizia exactă 3D a depozitului/conținuturilor de Cu nu este prezentă datorită costurilor mari de foraje de explorare

SCOP: cunoașterea mineralogică

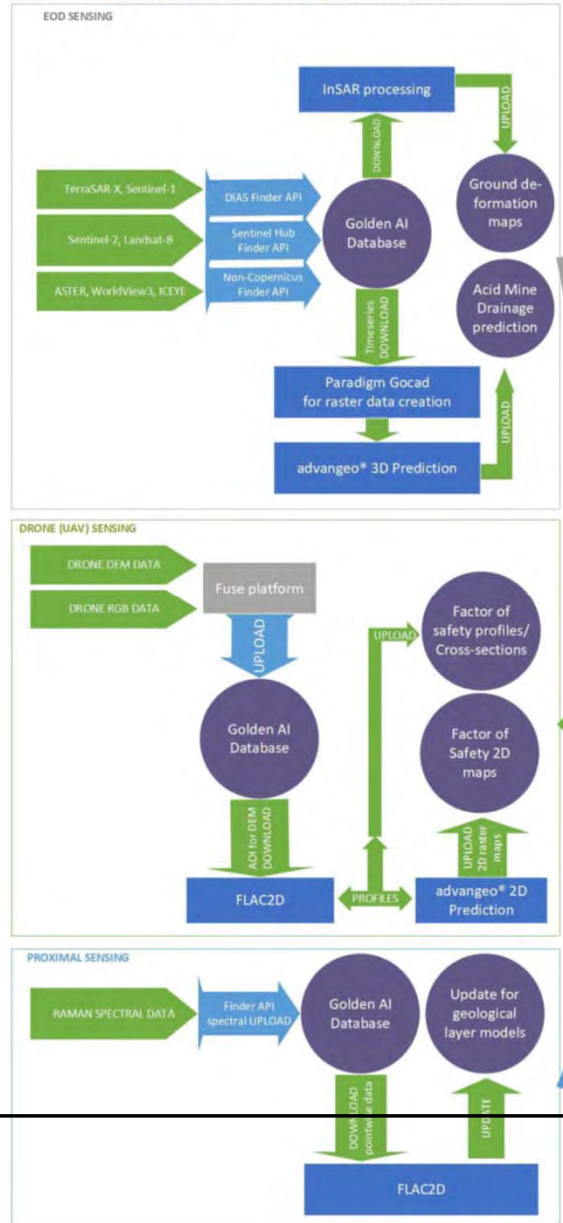
- Integrarea datelor satelitare și a dronelor de proximitate pentru a îmbunătăți predicția mineralogică. Model 3D al depozitului. Îmbunătățirea factorilor de siguranță a taluzurilor. Reducerea costurilor de explorare/exploatare

Informații existente:

- Harți geologice 2D
- Model 2D al corpului depozitului
- Geochimia rocilor



FIELD TRIAL WORKFLOW in Romania



GOLDEN AI platform



DATA FUSION for exploration intelligence



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The object of activity of SC CUPRU MIN SA ABRUD

Exploitation and delivery in specific forms of copper ore resources / reserves from the Roşia Poieni mining perimeter, CAEN code 0729

Production of class A quarry aggregates from andesitic rocks:

- rough stone - broken stone > 25 mm

- sieve: 8 - 16 mm; 16 - 25 mm - sort: 0 - 4 mm; 4 - 8 mm

Exploitation of the deposit:

- it is made in a quarry on descending steps with a height of 15 m each step

Partner CUP holds an exploitation licence for a total industrial surface of 11,210 km². The extraction of the copper ore in the Roşia Poieni quarry is done in 24 slopes with a height of 15m and width of 12m, with a depth of 360 m. The operation requires drilling with blasting.



Description of the field trial

- CUPRUMIN





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Data:
 A large dataset is already available for the area of the Roşia Poieni comprised of geological maps, 2D geological model, stream sediment geochemistry, which will be complemented by satellite, drone and other proximal data feeds during the project of **GoldenEye**.
Maps of risks analysis (slopes, tailing ponds, dumps, chemical migrations of the elements, etc.)



Tailing Pond Valea Şesei



Tailing dump Valea Ştefancei I



Tailing dump Valea Ştefancei I

Table 1. Surfaces and volumes occupied/designed - 2011

Crt. no.	Tailing pond	Designed surface (ha)	Occupied surface (ha)	Designed volume (m ³)	Occupied volume (m ³)
1	Ştefancei Valley I	26	11.5	5400000	2100000
2	Ştefancei Valley II	50	12.5	11000000	1650000
3	Şesei Valley	221	153	66000000	35850000
			177	82400000	39600000

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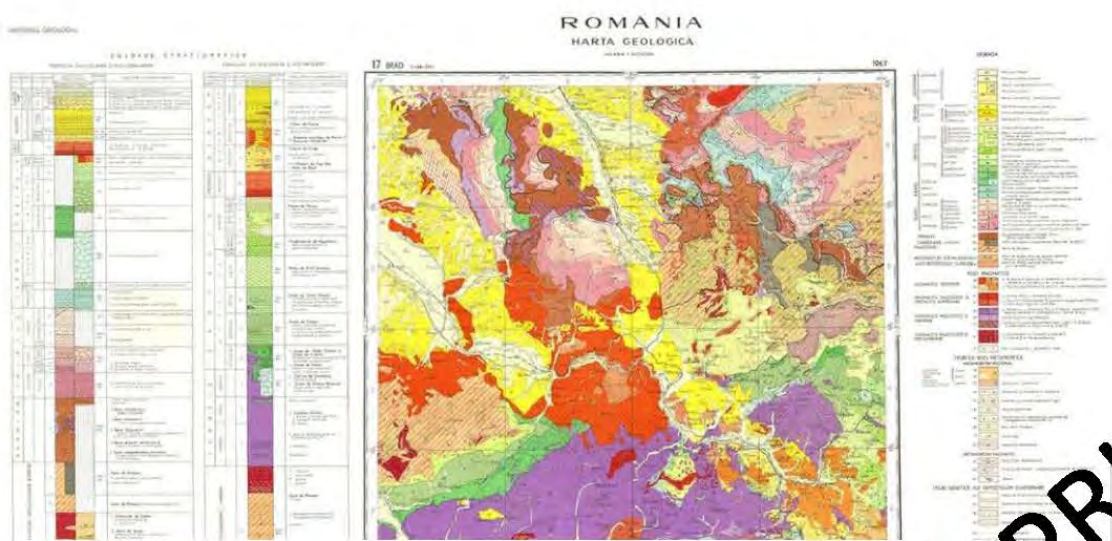
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What information/data is already available regarding to the trial?

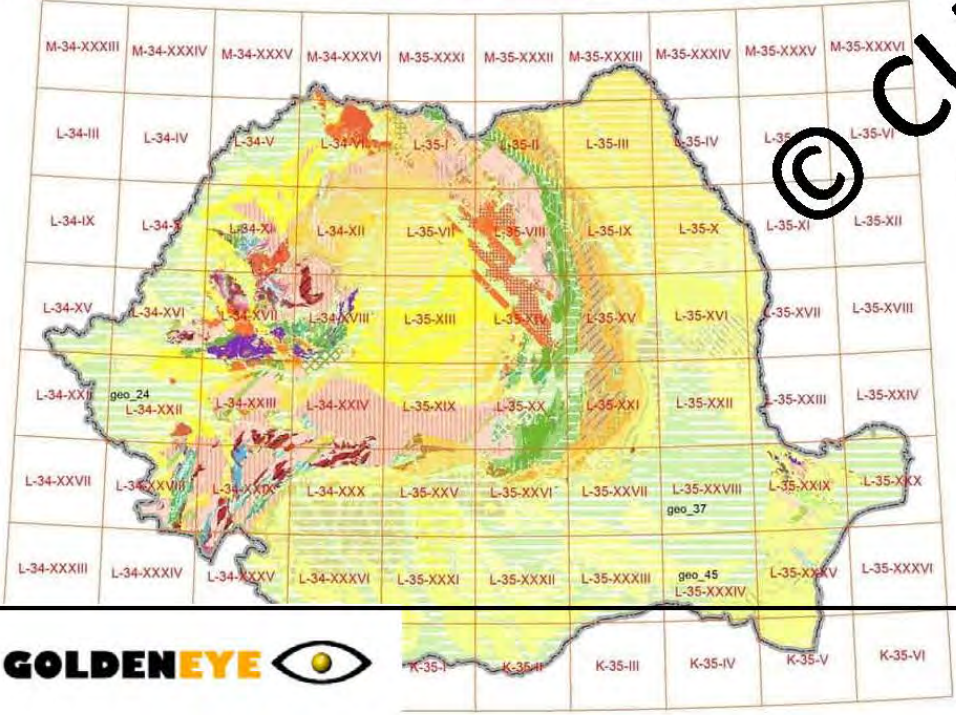
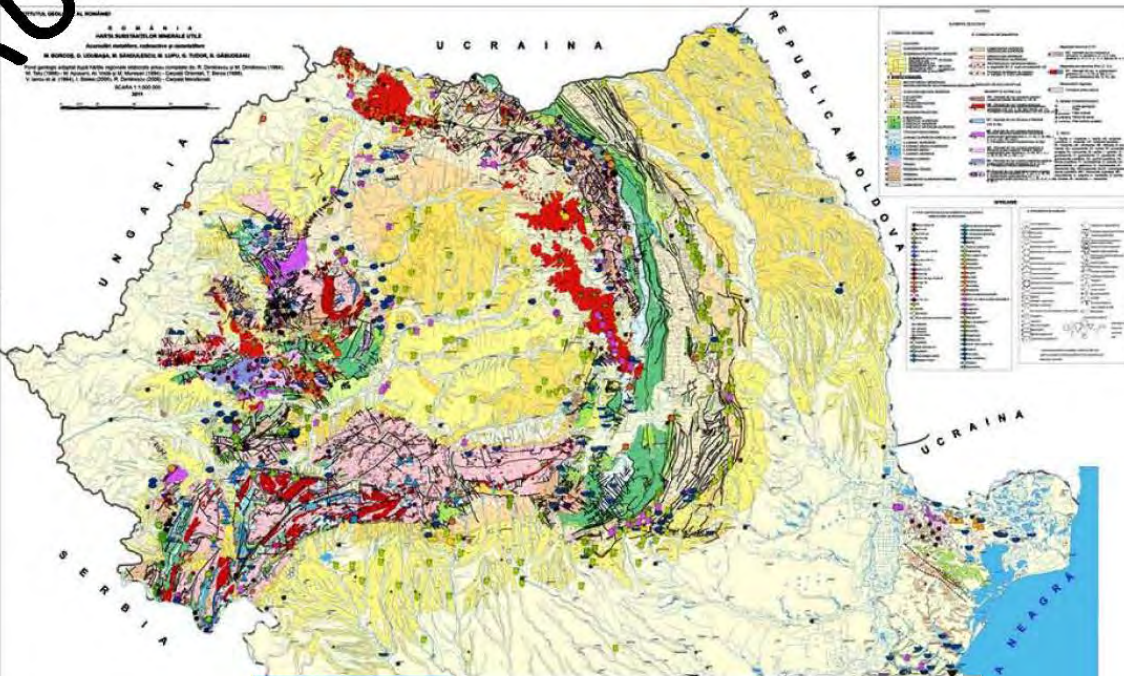
Publications:

- Existed internal reports, scientific publications, labs. analysis, data bases, maps a.s.l.

NEDEED to be collected together in 1 data base/platform



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K. Todor, Operatori Software S. R.L., Bucuresti, R. Prida

Table 1. Trace element contents in minerals from Roşia Poieni porphyry copper deposit using EMPA method (Cioacă et al., 2014)

Mineral (no. of measurements)	Au (ppm)	Ag (ppm)	Te (ppm)	As (ppm)	Bi (ppm)	Se (ppm)
Pyrite (9)	20	<10	<20	50	nm	21
Chalcopyrite (2)	<200	125	<200	<20	nm	250
Bornite (6)	412	1477	247	45	720	165

Table 2. Trace elements content in minerals from Roşia Poieni porphyry copper deposit using LA-ICPMS method

Mineral (no. of measurements)	Au (ppm)	Ag (ppm)	Te (ppm)	As (ppm)	Bi (ppm)	Se (ppm)	Pb (ppm)	Zn (ppm)	In (ppm)	Ge (ppm)
Chalcopyrite (3)	0.05	43.53	4.98	9.48	57.15	389.60	22.58	60.59	10.49	7.61
Bornite (5)	0.37	301	65.54	6.32	1686.98	833.19	61.58	16.86	0.10	3.34

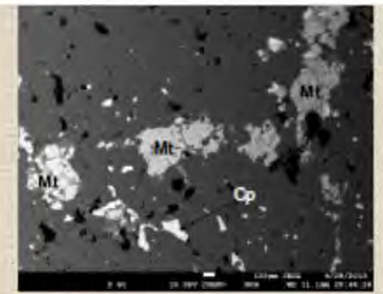
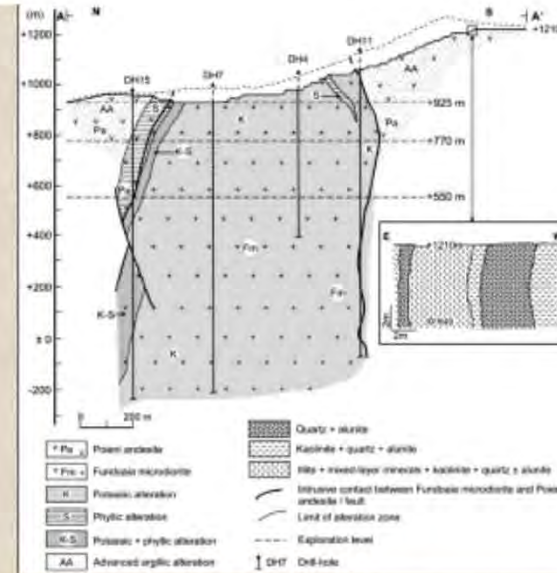


Fig. 2. Mineral assemblage of copper mineralization from Roşia Poieni (backscattered electron image) Abbreviation: Cp-chalcopyrite, Mt – magnetite.

Fig. 3 North-south cross section A-A through the Roşia Poieni system (Milu et al., 2004)

• DISTRIBUTION OF TRACE ELEMENTS IN SULFIDE MINERALS FROM ROŞIA POIENI PORPHYRY COPPER DEPOSIT (ROMANIA). CIOACĂ M.E. 1, MUNTEANU M.1, WÄLLE M.2, COSTIN G.3, MARINCEA Ş.1, DUMITRAŞ D.1. DOI: 10.13140/2.1.5130.6886

• **Geology of ore deposit** Roşia Poieni is located in the Neogene Metallogenic Subprovince, known also as the Golden Quadrilateral (Fig. 1) and is the largest porphyry Cu deposit in Romania, with a tonnage estimated to 431Mt at 0,55%Cu and 0.25g/tAu (Kouzmanov et al., 2005). The deposit is related to the Fundoia andesitic/microdioritic subvolcanic body, which intruded the Poieni andesite (Fig. 2). The Fundoia intrusion consists of plagioclase, quartz, biotite and hornblende. The mineralization is of two types:

- (1) *the porphyry copper mineralization*, with magnetite – chalcopyrite - bornite (covelite) ± pyrite - molybdenite mostly within the potassic alteration zone; in the upper and marginal parts of the intrusion, affected by phyllic and argillic alteration, the pyrite is the main metallic mineral;
- (2) *centrimetric veins* with pyrite, sphalerite, galena, tetrahedrite, chalcopyrite, enargite, tellurides and germanium minerals cross the porphyry-type mineralization.



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Table 1. Statistical parameters for pH, EC, trace elements, major cations and anions concentration in the Aries River (n=5)

Parameter	Unit	Min	Max	Average	Median	Standard deviation
pH		7.45	8.05	7.81	7.84	0.22
EC	$\mu\text{S/cm}$	139	163	150	153	10.2
Ni	$\mu\text{g/L}$	7.0	20.0	13.2	15.0	5.5
Cu		9.0	151	63.2	69.0	68.2
Zn		8.0	74.0	38.4	46.0	26.8
Cd		1.0	2.0	1.4	1.5	0.55
Pb		22	38	28.4	29.0	6.2
Mn		5.0	270	133	194	121
Na	mg/L	2.4	3.2	2.8	2.7	0.29
K		0.70	1.4	1.0	1.1	0.30
Ca		18.7	22.2	20.1	20.4	1.5
Mg		2.1	3.4	2.6	2.6	0.51
Fe		0.19	4.0	1.3	1.1	1.6
Cl ⁻		4.0	5.4	4.6	4.9	0.60
NO ₃ ⁻		2.5	3.2	2.9	2.8	0.33
SO ₄ ²⁻		6.0	48.5	21.6	20.5	15.1

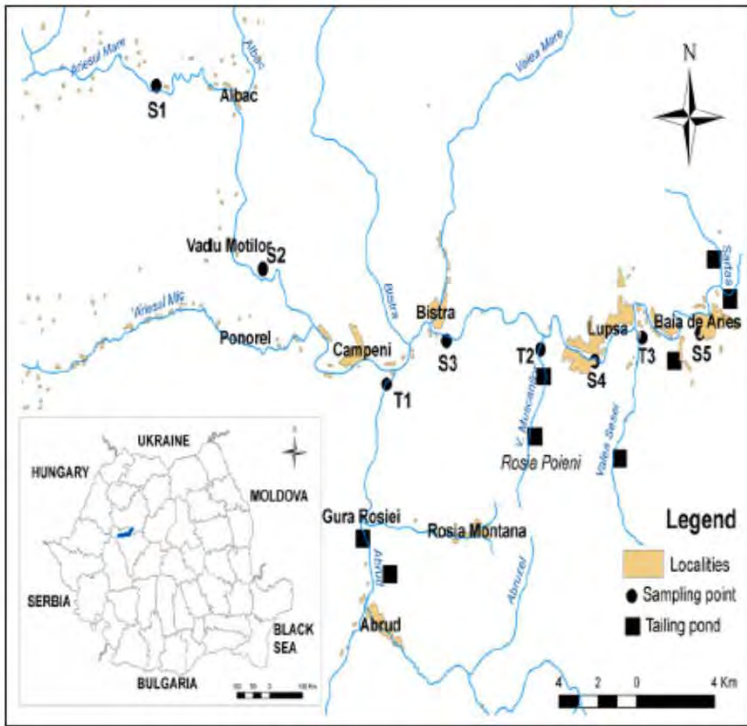


Fig. 1. Location map of Aries River catchment with the sampling points and the main pollution sources

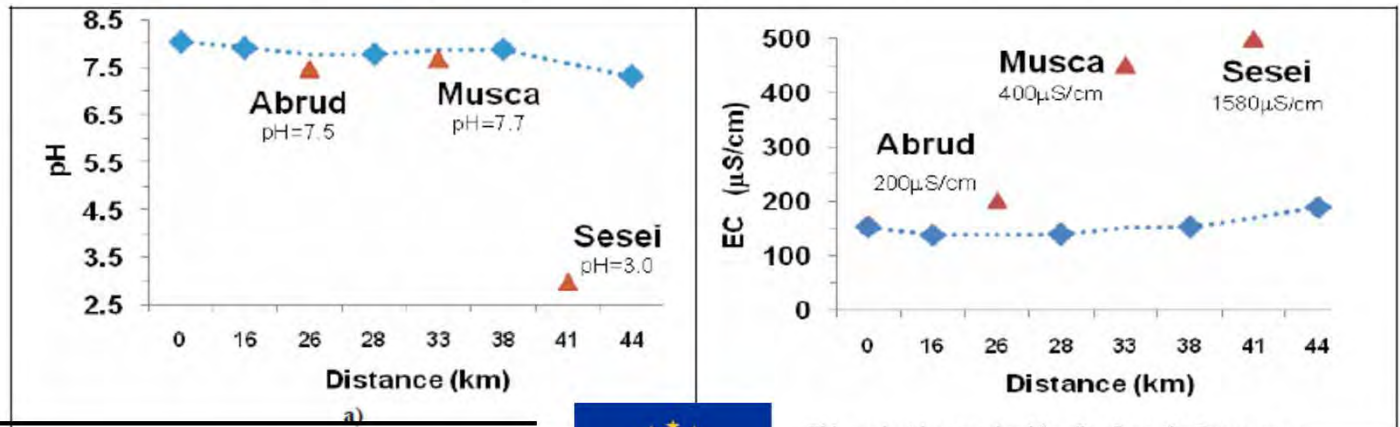


Fig. 2. Downstream concentration profiles of pH (a)



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tributaries

Table 1. Mechanical characteristics of the Roşia Poieni copper deposit

Crt no.	Rock	Hydrothermal transform.	Value	Specific weight	Appar. specif. weight	Compr. strength	Tensile strength	Double shear strength	Internal frictional angle	Cohesion
				kN/m ³	kN/m ³	kN/m ²	kN/m ²	kN/m ²		kN/m ²
1	Andesite of Poieni	Silicified and cloritised	min.	26.4	25.5	524	7 200	14 300	29	920
			av.	27.5	25.7	173	9 500	20 300	-	-
			max.	28.5	26.2	1 189	11 300	26 500	39	1 750
2	Andesite of Poieni	Weakly altered hydrotherm.	min.	25.9	22.6	20 200	2 100	7 000	26	420
			av.	27,5	24.0	35 500	5 500	10 700	-	-
			max.	28.8	25.0	51 400	7 000	13 800	33	2 000
3	Andesite of Poieni	Argillitised	min.	26.0	19.8	6 500	1 500	1 300	27	280
			av.	27.6	22.4	14 800	2 200	4 900	-	-
			max.	29.1	23.8	19 900	2 500	7 000	28	400
4	Andesite of Poieni	Intensively altered and disintegrated	min.	26.7	17.0	-	-	-	11	6
			av.	27.5	20.0	-	-	-	-	-
			max.	28.5	22.0	-	-	-	18	9
5	Andesite of Fundoiaia	Silicified and cloritised	min.	25.9	25.8	51 400	51	22 100	33	1 400
			av.	27.2	25.9	77 300	73	23 100	35	2 000
			max.	28.2	26.6	125 800	100	24 200	38	2 000
6	Andesite of Fundoiaia	Weakly altered hydrotherm.	min.	22.7	23.0	14 000	2 400	5 800	27	450
			av.	27.3	23.8	31 200	3 100	10 100	-	-
			max.	29.1	25.4	49 900	4 500	18 300	33	650
7	Andesite of Fundoiaia	Argillitised	min.	22.8	22.6	6 400	1 100	2 400	26	260
			av.	26.0	22.8	9 500	1 300	4 200	-	-
			max.	27.7	23.0	10 700	1 800	5 800	28	400
8	Andesite of Fundoiaia	Non-altered	min.	25.5	21.5	34 600	5 000	-	33	650
			av.	26.0	25.2	93 200	7 900	-	-	-
			max.	26.2	27.0	184 300	16 000	-	37	2 400
9	Andesite of Vârşi		min.	26.0	24.7	35 700	10 300	16 700	33	90
			av.	26.6	25.5	95 300	9 500	19 200	-	-
			max.	27.2	26.4	191 500	13 300	23 000	39	2 700
Andesite of			min.	25.9	25.8	63 000	13 000	24 000	33	1 400
			av.	27.2	25.9	95 000	18 000	42 000	-	-
			max.	28.2	26.6	107 000	24 000	58 000	38	2 000

MINING PARAMETERS DETERMINATION IN THE CASE OF THE OPEN PIT AND UNDERGROUND MINING OF THE ROŞIA POIENI COPPER DEPOSIT
 ONEŢ VALERIU DAN*
 COZMA EUGEN**
 ONICA ILIE**

Table 2. Elastic characteristics of the Roşia Poieni copper deposit

Sample no.	Rock characterisation	Elasticity modulus, E (10MPa)			Elasticity modulus at the initial loading, E (10MPa)	Elasticity modulus at the elastic limit, E (10MPa)	Poisson constant (m) and Poisson ratio (μ) at the elastic limit		
		Min.	Max.	Average			m	μ	
I-1	Andesite silicified and sericitised	144.41	350.33	273.82	144.41	278.53	7.57	0.132	
I-2	Andesite silicified and sericitised	-	-	193.93	193.93	193.93	62.85	0.00159	
II-1	Andesite silicified and kaolinised	304.00	758.37	550.87	304.00	758.37	108.56	0.0092	
III-1	Andesite silicified and sericitised	110.64	289.97	200.30	112.69	289.97	11.90	0.09	
IV-2	Andesite sericitised, silicified and pyritised	90.21	223.46	157.11	90.21	220.15	73.23	0.013	
		57.58	400.54	237.34	243.47	392.99	47.28	0.021	
		-	-	91.80	91.80	91.80	6.66	0.15	
IV-3	Andesite sericitised, silicified and pyritised	-	-	-	-	-	-	-	
IV-5	Andesite sericitised, silicified and pyritised	-	-	-	-	-	-	-	
Andesite of		min.	25.9	25.8	63 000	13 000	24 000	33	1 400
		av.	27.2	25.9	95 000	18 000	42 000	-	-
		max.	28.2	26.6	107 000	24 000	58 000	38	2 000



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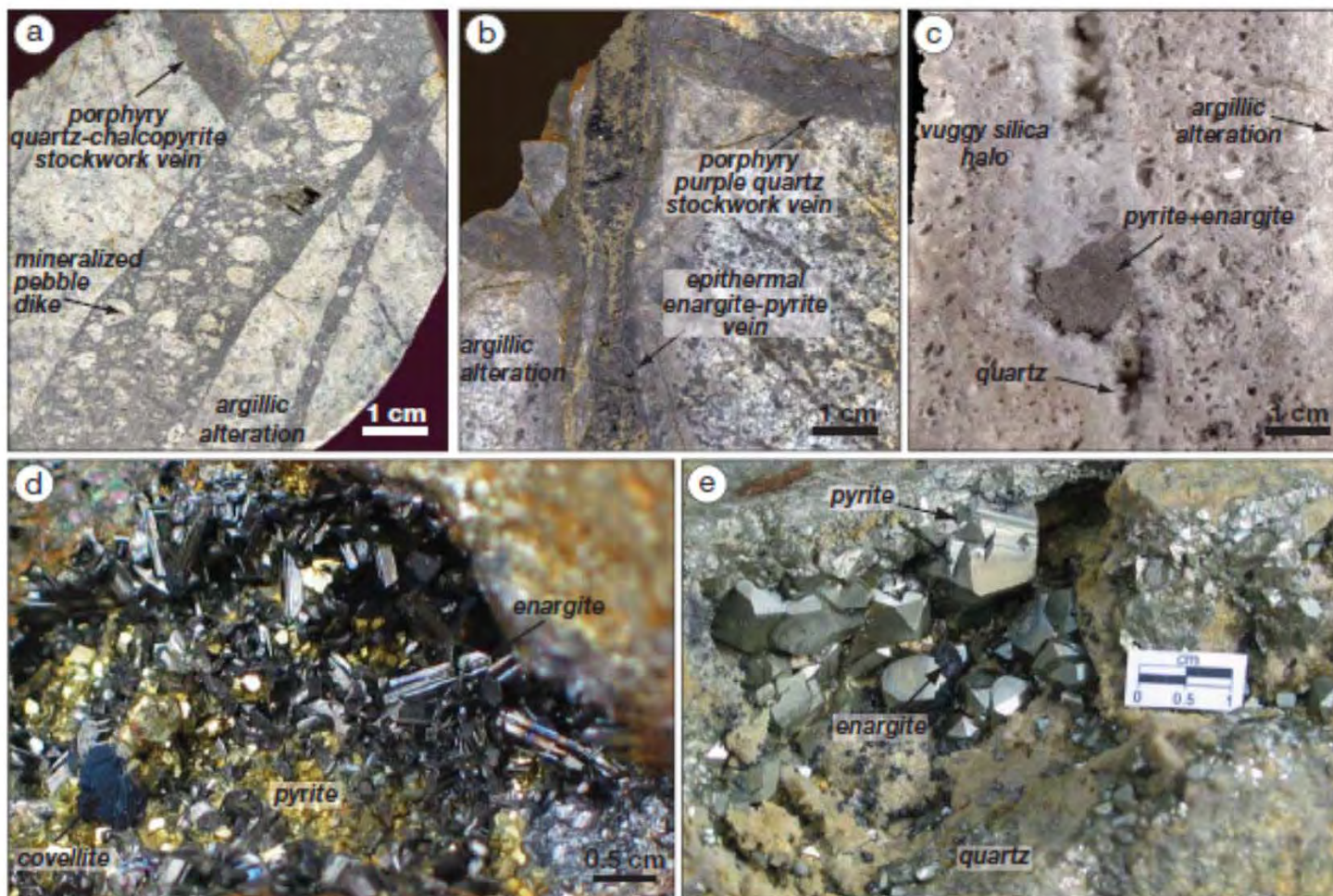


FIG. 1. High-sulfidation epithermal veins at Rosia Poieni: (a) Tiny, mineralized pebble dike offsetting a porphyry quartz-chalcopyrite stockwork vein. Rock fragments are altered to advanced argillic assemblage. (b) Thin, enargite-pyrite high-sulfidation vein with argillic alteration halo offsetting a porphyry purple quartz stockwork vein. (c) Typical zoning of the alteration halo along a high-sulfidation quartz-pyrite-enargite vein. (d) Drusy texture of enargite indicating open space filling. (e) Euhedral pyrite crystals overgrown by quartz and enargite in a vug.

Direct Analysis of Ore-Precipitating Fluids: Combined IR Microscopy and LA-ICP-MS Study of Fluid Inclusions in Opaque Ore Minerals
 KALIN KOUZMANOV,^{1,2}† THOMAS PETTKE,^{1**} AND CHRISTOPH A. HEINRICH¹

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²Department of Mineralogy, University of Geneva, Rue des Maraichers 13, 1205 Geneva, Switzerland

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Economic Geology, v. 105, pp. 351–373

Safety, Geo-hazard and Environmental Monitoring

- Monitoring slope stability for open pit mines
 - UTCN
 - Rosia Poieni



What information/data is already available regarding to the trial? / Selecting in the field with Open Pit Manager
Eng. Mircea Goia of the sampling location (February 2021). Visiting the dumping area



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What information/data is already available regarding to the trial?

Publications:

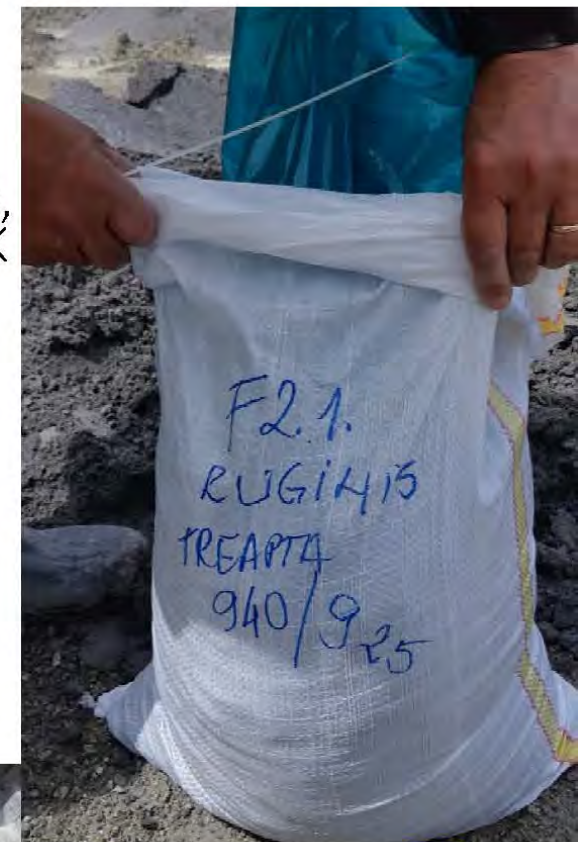
- **Existed internal reports**, scientific publications, labs. analysis, data bases, NEDEED to be collected together in 1 data base/platform IN TEAM WORK

➤ Technological flow at Roșia Poieni Quarry:

- - drilling works;
- - blasting with explosives;
- - transport of mining mass with dump trucks of 55, 91t;
- - pushing sterile mass to the dump;

➤ Deposition of sterile mass in dumps:

- - Obârșia Muntari dump
- - Cueva Valley dump
- - Geamăna dump



WP6 – Task 6.3 – Field Work (18. – 19.05.2021)/ Environmental impact assessment of the blasting works (boreholes positioning, gases with environmental impact a.sl.)

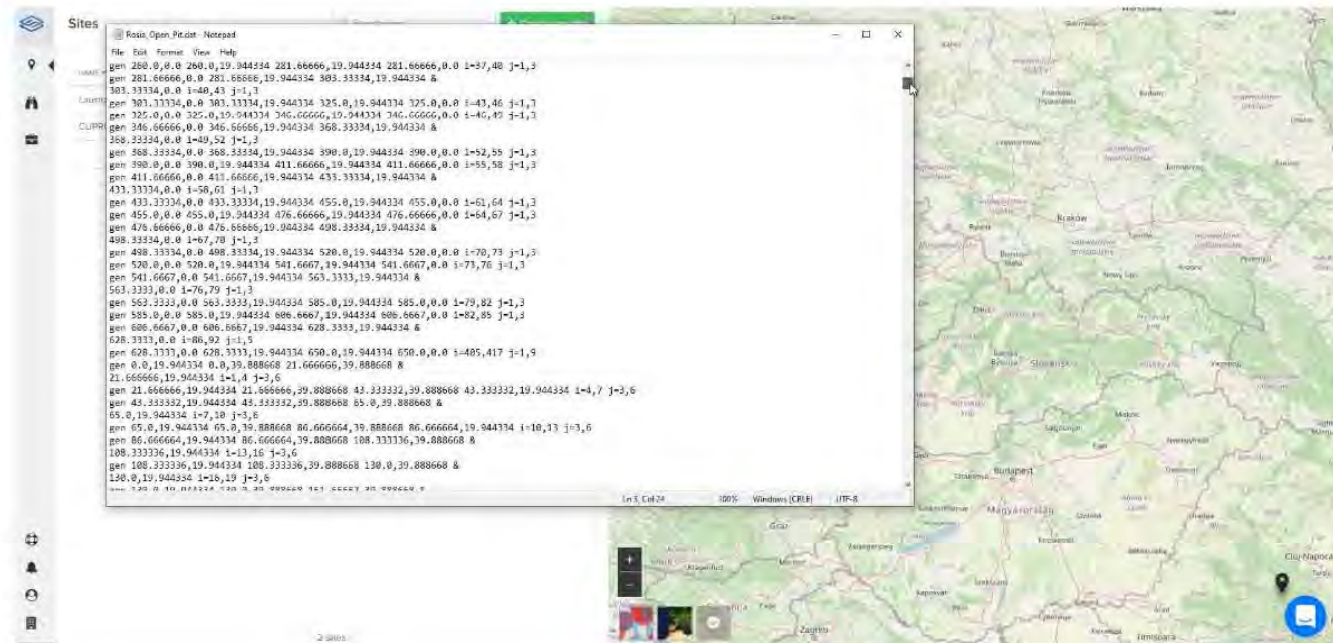


Field Work (18. – 19.05.2021)/ Sampling material for Mr. Maunu(SANDVIK) and Mr. Mikhail (VTT)
 The Romanian STEREO70 Coordinates will be Transformed in ETRS89 therefor the elevation level also.



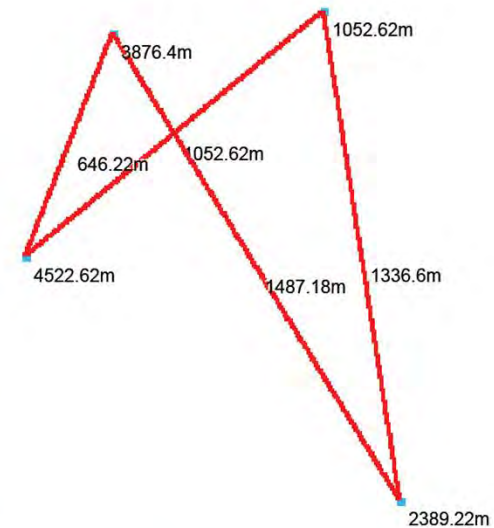
Safety, Geo-hazard and Environmental Monitoring

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Safety, Geo-hazard and Environmental Monitoring

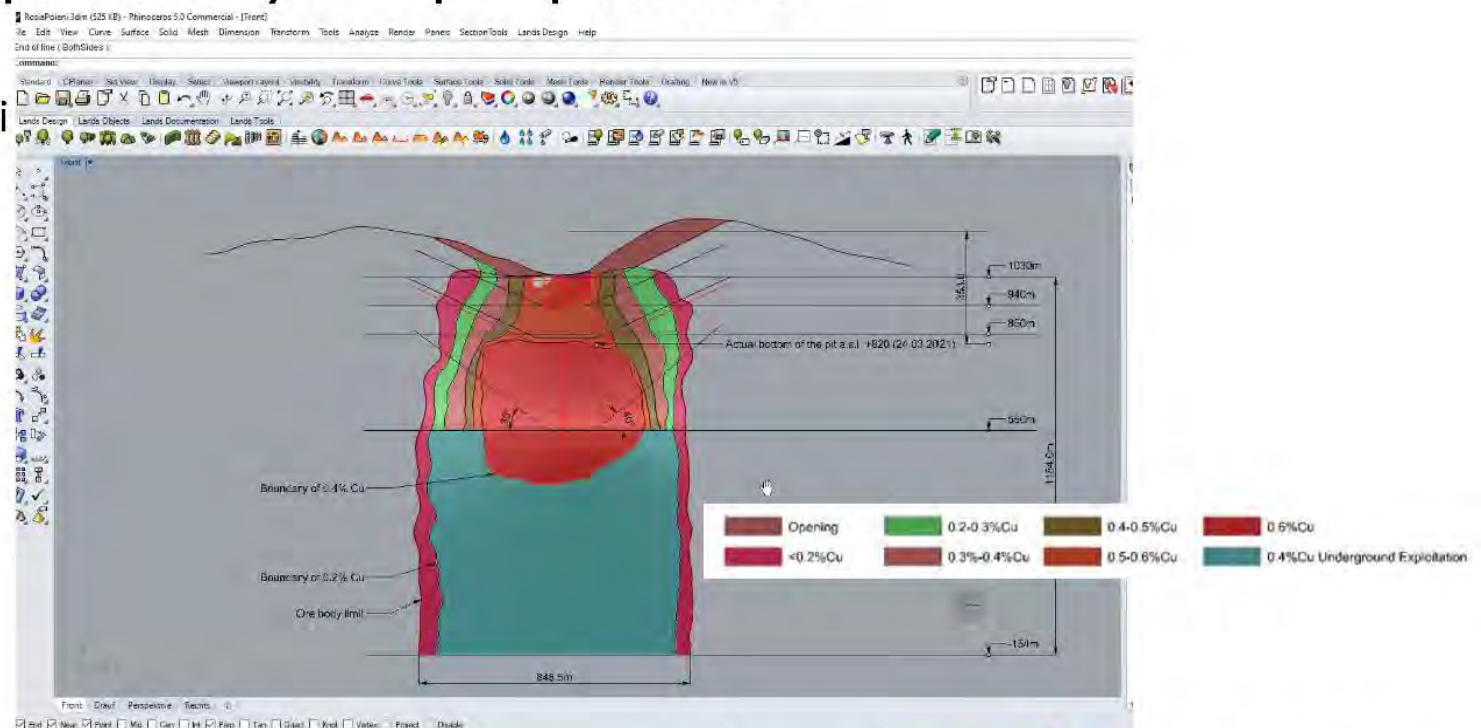
- Monitoring slope stability for open pit mines
 - UTCN
 - Rosia Poieni



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Safety, Geo-hazard and Environmental Monitoring

- Monitoring slope stability for open pit mines
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Rock mechanical simulation of the general angle of the open pit

As soon as the overburden is excavated, the material is removed and dumped. Modelling in 2D with the mechanical parameters of the rock suggest an analysis of the general open pit angle between 35° and 40° [3,4,7,8,9,10].

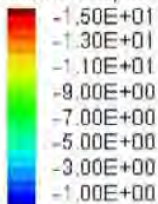
The 2D numerical calculations/simulations of the berms has been carried out with the software FLAC-2D. The figure bellow shows the geometry generated in FLAC-2D for a general open pit angle of 35° with 24 berms and a resulted Maximum principal stress for a depth of 360m around of $\sigma_1=8.7\text{MPa}$.

FLAC (Version 8.10)

LEGEND

9-Nov-20 21:59
 step 27374
 $-3.812\text{E}+01 <x< 8.863\text{E}+02$
 $-1.052\text{E}+02 <y< 8.171\text{E}+02$

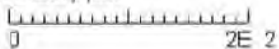
Maximum principal stress



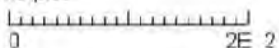
Contour interval= 1.0000E+00

Extrap. by averaging

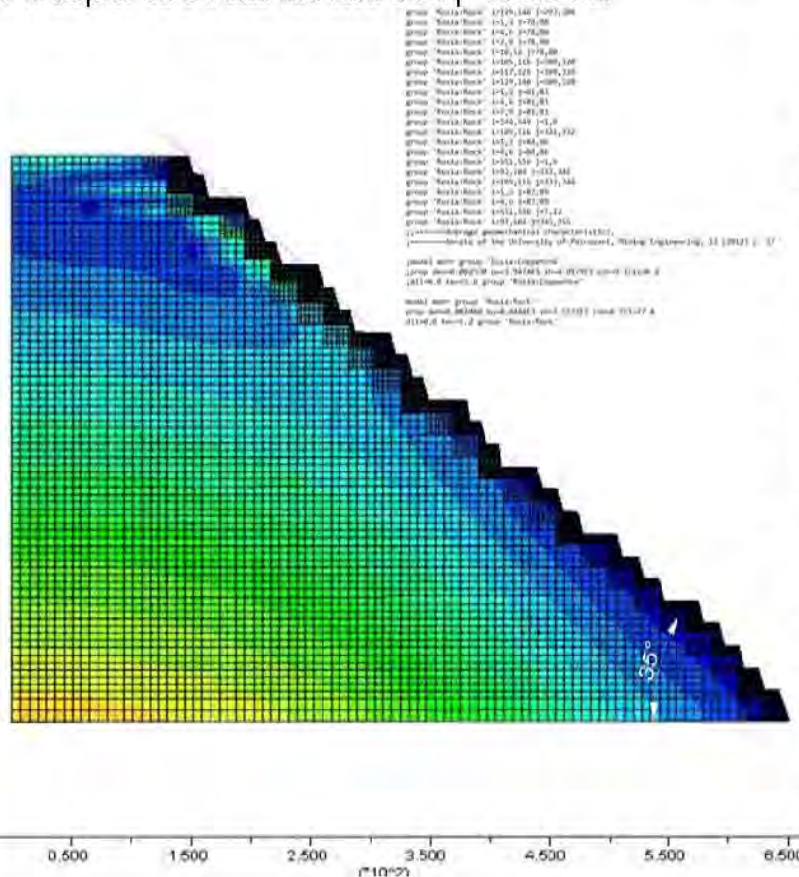
Boundary plot



Grid plot



Technical University of Cluj Napo
 GoldenEye/869398/2020



The geotechnical evaluation has been carried out with geomechanical parameters taken from [V. D. Onet, et all; I. Onica, et all; V. Arad]. During the project, a RMR characterisation of the rock mass will be conducted in order to apply the rock mass properties instead on laboratory results, which normally will indicate a higher values.

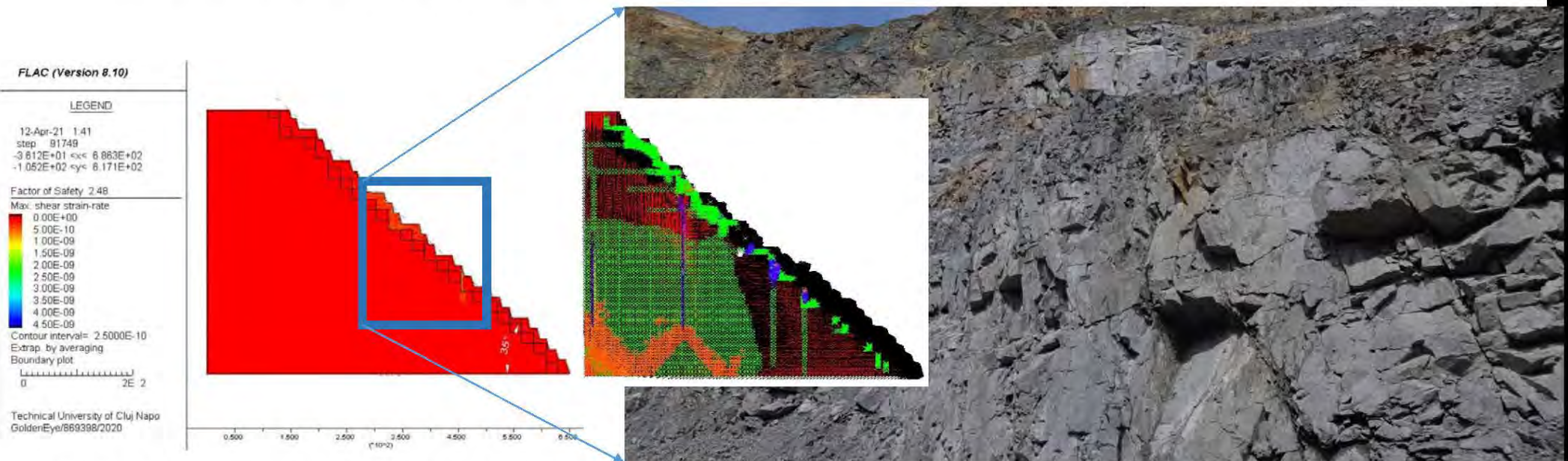
The used density was unsaturated. For the geomechanical simulation it was assumed that a dewatering of the open pit Rosia Poieni is completely under control. For a more precise evaluation, the influence of the water level on the stability will be analysed by adding in the system the water level. Also, the distribution of the faults and cracks will be included in the model. Therefore the Mohr-Coulomb material law, describing the elasto-plastic material behaviour of the rock, can be used since the mechanical load is caused by the overburden pressure and the formation of the benching in the mining area.



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FoS=2.48 and Max. Shear strain-rate (24 berms)

It can be observed, that in some part of the benches, additional simulations are needed to be performed.

Results and conclusions in Factor of Safety assessment

For the generated mesh and geometry, a simulation of Factor of Safety was performed using the geomechanical characteristics described in [V. D. Onet, et all; I. Onica, et all; V. Arad]. Additional geomechanical data will be added after the field/lab work. Here, we can observe a $FoS=2.48$ for a system of 24 berms and a general pit angle of 35° .

The created FLAC 2D batch files will be used, and a real geometry of the benches will be imported after the field work (performing drone flying for DMT and topo measurements).

A development of the open pit bellow 720 m asl should be analysed in detail according to new geomechanical sampling and laboratory investigations of the rock sequence (triaxial compressive tests and the existing underground excavations). These changes of the general open pit will dramatically increase the volume to be excavated and consequently the costs of overburden removal as well.

The used density was unsaturated. For the geomechanical simulation it was assumed that a dewatering of the open pit Rosia Poieni is completely under control. For a more precise evaluation, the influence of the water level on the stability will be analysed by adding in the system the water level. Also, the distribution of the faults and cracks will be included in the model.

The present geotechnical evaluation does not consider **the additional stresses caused by the dump sites** near the open pit, have not been simulated. Information regarding the mass of these dumps and their position will be evaluated during this project. This can be included in future evaluations also by the Boarding Members of the CUPRUMIN ABRUD.

The authors would like to thank to European Union for the project GoldenEye Nr. 869398 Type Horizon 2020.



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Platforma GOLDENEYE

Încercări pe teren

Exploatare subterană în Finlanda:

- Depozitul Pyhäsalmi
- Mineralogie: sulfuri de cupru-zinc
- Una dintre cele mai adânci mine din Europa
- Se află la sfârșitul ciclului de exploatare

SCOP: securitate în re-utilizarea minei

- Integrare de date UAV de înaltă rezoluție cu date din satelit pentru a monitoriza stabilitatea golurilor de la suprafață și a iazurilor de decantare
- Geolocalizarea GNSS pentru a asigura siguranța reutilizării minei

Informații existente:

- Hărți geologice
- Model geologic 3D al minei
- Date aeriene geofizice



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No [869398]

Platforma GOLDENEYE

Încercări pe teren

Post-închidere în Kosovo:

- Complexul minier Trepča
- 8 iazuri de decantare deținute de guvernul din Kosovo
- Ținta extragerii secundare din aria depozitelor/iazurilor
- Sistemul legal al deșeurilor toxice

SCOP: Monitorizarea siguranței și a mediului

- Monitorizarea stabilității sterilului și evaluarea gradul de scurgeri acide miniere

SCOP: Cunoaștere mineralogică

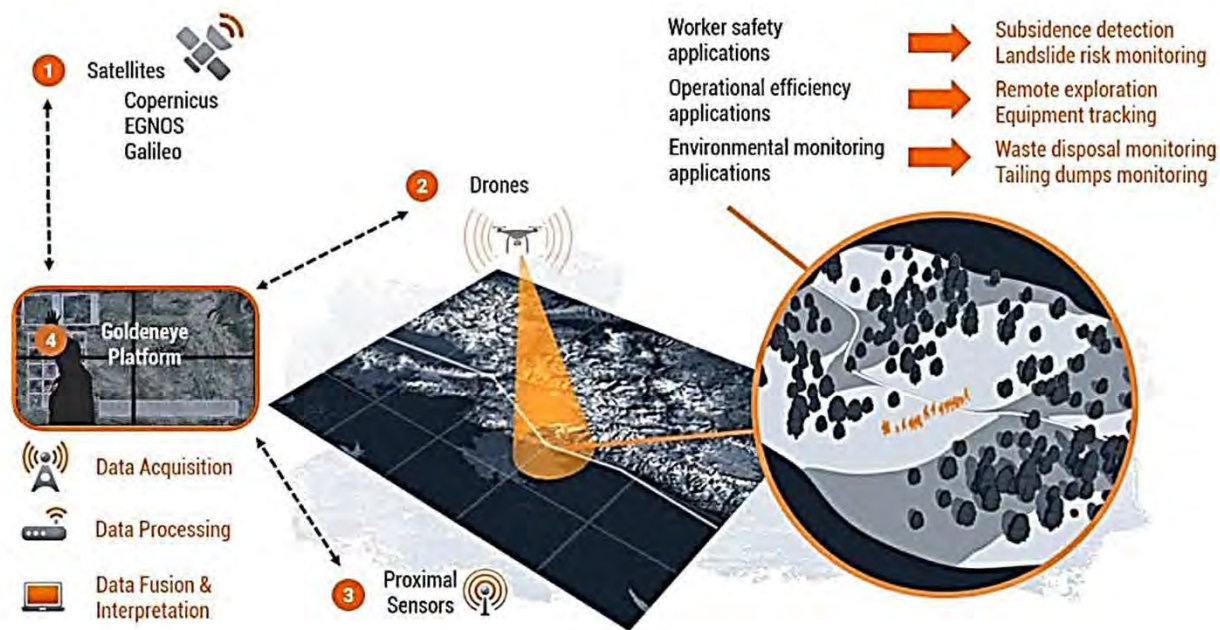
- Evaluarea potențialului extragerii secundare din iazurile de decantare

Informații existente:

- Hărți geologice
- Geochimia sedimentelor
- Geofizica aeriană



Platforma GOLDENEYE



Proiect:

- Dezvolta noi tehnologii de detectare și integrare a datelor
- Oferă date noi ale site-urilor miniere pe teren
- Oferă o platformă de analiză pentru a adăuga datele noi și integrare a celor existente ale site-urilor descrise
- Oferă o soluție cloud pentru clienții și autoritățile miniere pentru a extrage informații despre site-urile miniere

Thank you for your attention



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