



SUSMIN

- Tools for sustainable gold mining in EU

ERA-MIN Stakeholder Forum meeting

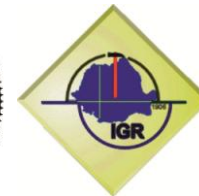
26th of March, 2014

Budapest, HUNGARY



TRINITY COLLEGE DUBLIN
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- Tools for sustainable gold mining in EU



Timetable: 1.1.2014-31.12.2016

Budget: 1.9 ME

Partners: Geological Survey of Finland (GTK), Wrocław University of Technology (WUT), Geological Institute of Romania (GIR), University of Babes-Bolyai (UBB), Luleå University of Technology (LTU) University of Porto (UP) and Trinity College Dublin (TCD)

NEEDS

- Sustainable supply of gold is crucial to revitalise Europe's industry and economy to meet increasing demand without compromising the social and environmental issues of gold mining
- Gold mining has challenges in eco-efficiency and extraction methods (e.g. cyanide)
- Novel sustainable methods and technologies for mineral processing, water treatment and management of environmental and social impacts are needed

APPROACH

- New geophysical techniques for gold exploration
- Eco-efficient ore beneficiation methods and alternatives to cyanide leaching
- Novel water treatment solutions by advanced adsorbents
- Solutions for monitoring, characterising, predicting and preventing environmental effects of mining
- Tools for enhancing the corporate social responsibility, community engagement and management of the stakeholder relations
- Case studies in Finnish, Swedish, Portuguese and Romanian mines



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BENEFITS

- Supports environmentally, socially and economically sustainable gold production in EU
- Technologies and solutions to manage economical and environmental risks related to gold mining
- Achieve sustainability and long term development of the mining areas
- Enhance mechanisms of the corporate social responsibility in gold mining areas

USERS & COMPETITION

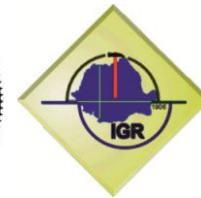
- Global mining industry (e.g. RMGC, MedGold, Agnico-Eagle, Dragon Mining), technology companies (e.g. Kemira Oyj, Oulu Water Alliance Ltd, Outotec Finland Oyj), equipment suppliers, consults and authorities in EU
- Direct and significant economic benefits



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RESEARCH AREAS

- 1) Gold exploration
- 2) Mineral processing
- 3) Mine water treatment technologies
- 4) Mine waste management
- 5) Environmental monitoring, modelling and risk assessment
- 6) Sosio-economics of gold mining
- 7) Synthesis, communication, coordination

Case study sites

Romania

Rosia Montana, Brad-Certej



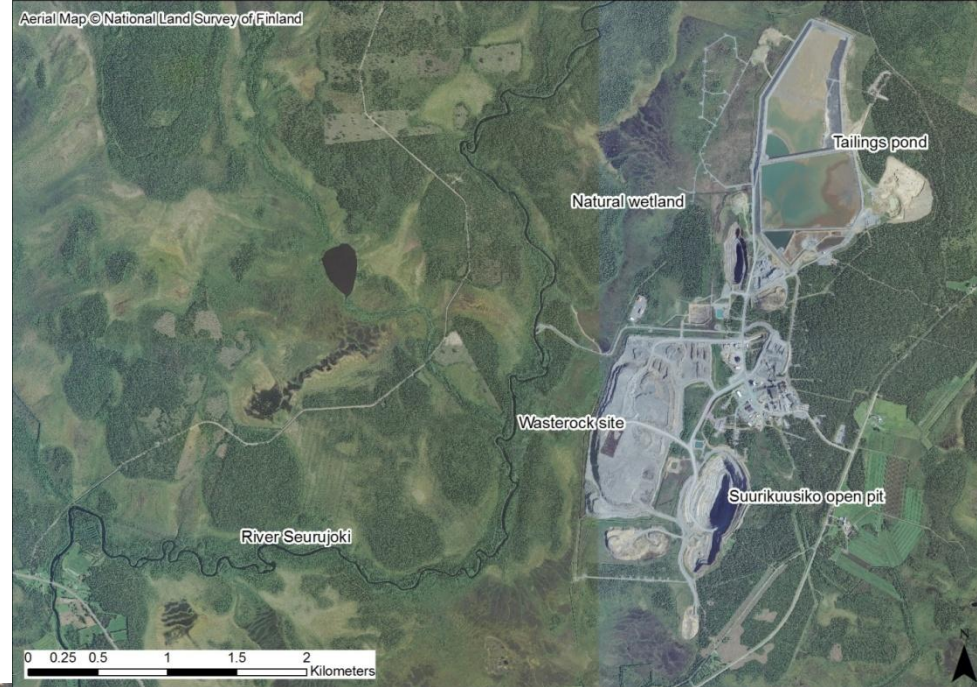
Portugal

Castromil and Lagoa Negra

Case study sites

Finland

Agnico-Eagle Kittilä Mine



Finland and Sweden

Dragon Mining,
Several sites

WP1: Gold exploration

Partners: UP and GIR WP leader Alexandre Lima



- **OBJECTIVES**

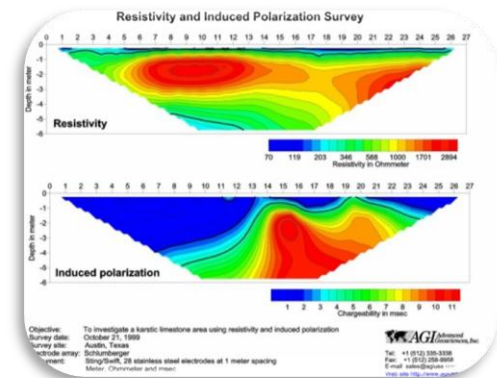
- Obtain information on the geology of the ore deposits and geochemical behaviour of different elements during gold deposit genesis
- Develop **Geographical Information System** (GIS) for the inventory, characterization and prediction of gold ores
- Enhance the use of mineral **mapping and 2/3D modelling using spatial data analysis** → Produce potential and predictive maps and assess far-field geochemical characteristics of gold deposits
- Develop and test best suitable **geophysical techniques** or combination of methods **for gold exploration** at the study sites

- **EXPERIMENTAL WORK**

- Geophysical techniques and core samples

- **OUTCOMES**

- Recommendations for the exploration programmes to enhance sustainable exploration and exploitation of important mineral resources



WP2: Mineral processing

Partners: UP, GTK, GIR

WP Leader António Fiuza



- **OBJECTIVES**

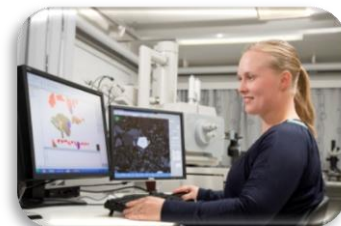
- Develop mineral processing to concentrate selectively different gold bearing minerals
- Develop cost effective recovery of gold from selected waste materials
- Investigate alternatives to cyanide leaching
- Characterize process chemical residues and their surface chemistry in flotation
- Investigate energy efficient magneto-electrowinning techniques

- **EXPERIMENTAL WORK**

- Mineralogical and chemical characterization of ore and gangue
- Lab-scale beneficiation test work e.g. comminution, flotation, leaching
- Verification tests

- **OUTCOMES**

- Valuable information about the type of occurrences of gold and their relationship with the other identified mineral of the mineral assemblages
- Eco-efficient and selective recovery of gold with decreased environmental impacts
- Mining companies can use the developed processes in mineral processing and technology companies in technology commercialization



WP3: Mine water treatment technologies



Partners: UP, WUT, GTK

WP leader: Małgorzata Szlachta

- **OBJECTIVES**

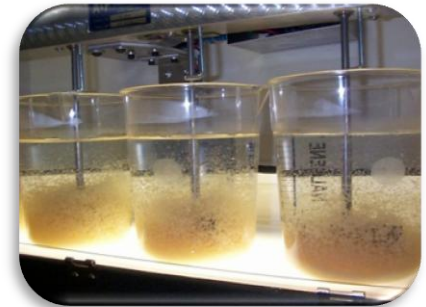
- Investigate adsorptive materials applicable for treatment of As-contaminated effluents
- Improve available techniques and solutions for the robust and cost-effective treatment of mine waters

- **EXPERIMENTAL WORK**

- The approach is to investigate and compare advanced adsorbents
 - Existing materials (e.g. AC, natural and modified minerals, biopolymers) provided by technology partners
 - Selected porous media (e.g. recycled materials) will be modified by impregnation/loading with metal oxides
 - Nanoparticles such as NZVI (Nano Zero Valent Iron), can also be incorporated in macroporous materials
- Methods include: Characterization of adsorptive materials, batch adsorption and fixed bed column experiments, modelling of the data, pilot tests

- **OUTCOMES**

- Recommendation of use of different adsorbent in cost-effective treatment of mine waters at gold mines



WP4: Mine waste management



Partners: UP, LTU, GIR

WP leader Raluca Maftai

- **OBJECTIVES**

- Assemble information of European legislation of waste management at gold mines
- Geochemical characterization, leaching behavior and long-term stability of tailings
- Influence of additives on the mobility of arsenic in cemented paste backfill (CPB)
- Study long-term stability and impermeability of dam structures
- Investigate the performance of multilayer cover structures

- **EXPERIMENTAL WORK**

- Geochemical characterization of tailings by static and kinetic tests and long-term assessment of physico-chemical stability of secondary precipitates
- Geological and geophysical studies regarding permeability of tailings dams and ground beneath the dams → slope stability assessment
- Field tests to characterize time-evolution of the drainage from by paste deposition
- Characterization of waste materials produced in water treatment with adsorbents (WP3) by using the direct magneto-electrowinning cell developed for WP2

- **OUTCOMES**

- Recommendations for mine waste management, multilayer cover structures,
- safe tailing dams and stabilisation of mine wastes by paste deposition to prevent formation and seepage of contaminated drainage from gold mine wastes



WP5: Environmental monitoring, modelling and risk assessment



- Partners: GTK, UBB, GIR WP leader Soile Backnäs

- **OBJECTIVES**

- Evaluate and test new methods for environmental monitoring, modelling and risk assessment → Enhance environmentally sustainable mining by characterizing and evaluating the anthropogenic emissions compared to the background, modelling reactions and pathways of contaminants, and assessing the risks

- **EXPERIMENTAL WORK**

- Testing of new water quality monitoring and field analysis methods
- A new approach of geochemical and isotope methods for assessing migration of harmful substances from mining sites and waste areas
- Use of hydrogeochemical modelling tools for the prediction of chemical transformation and long-term impacts of mining
- Geochemical characteristics and bioavailability of metals and metalloids in soils → Integrated risk assessment of ecological and health risks

- **OUTCOMES**

- Recommendations for environmental monitoring and risk assessment of gold mine environments



WP6: Sosio-economics of mining



Partners: UP, GTK, UBB, GIR

WP leader Calin Baci

- **OBJECTIVES**

- Analyse the socio-economic context of modern gold mining in relation to environmental issues
- Identify the nature of conflicts and solutions to increase level of mutual confidence benefits to the community and stakeholders
- Develop and enhance the mechanisms of CSR (corporate social responsibility), community engagement and management of the relations with the stakeholders
- Analyse the post-operational development of mining sites, based on proper mine closure procedures and post-mining land-use, use of the environmental bonds, and the identified opportunities for socio-economic development

- **EXPERIMENTAL WORK**

- Questionnaires of a series of relevant social and economical indicators and questions of public perception (A comparative study between sites)

- **OUTCOMES**

- Achieve sustainability and long term development of the mining areas
- Recommendations to characterize the socio-economic environment of gold mines and to design the post-operational development of the gold mining areas



Outcomes and impacts of the research

- Project provides technologies and methods for sustainable mineral processing, water treatment and management of environmental and social impacts
- Results will be combined to reports and recommendations for mine industry, environmental authorities as well as consultants
- Through the case studies, the results have direct positive impact to sustainability on gold mines in participating partner countries
- After the project, the results and recommendations can be implemented also in other EU countries for enhancing the socio-economical and environmental sustainability in gold mining
- Result will be disseminated through workshops in participating countries





Thank You for Your Attention!

Contact: soile.backnas@gtk.fi

More info from SUSMIN webpages: <http://projects.gtk.fi/susmin/>

