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- Tools for sustainable gold mining in EU

ERA-MIN Stakeholder Forum meeting
26th of March, 2014
Budapest, HUNGARY
SUSMIN
- Tools for sustainable gold mining in EU

Budget: 1.9 ME

Partners: Geological Survey of Finland (GTK), Wroclaw 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 Maftei

• 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 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 Baciu

• **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!

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