

DEEP MINING- 2030

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ABSTRACT

Surface and sub-surface mines are getting depleted and for increasing requirements of essential and strategic minerals by 2030, in the European countries the mines will be going deep and deeper.

Currently mines at 2-3 miles depth have closed up or facing technical problems to maintain the human miners and related infra structures underground. The time to travel in and out coupled with blast cycle and also rest period is 30-40% of working hours. Further added to it are the cost of underground life support system of air,water,transportation of the ore to surface and bringing down of tailings for back fillings as stringent environmental laws makes it uneconomic to store them on surface.

For major mineral mining in Europe it is envisaged that the solution in designing a complete new system of underground mining principally by robots aided by human with robotic exoskeleton to withstand the temperature of 150-250 C and high humidity. Non explosive mining by mechanical means by tele-controlled robots will crush the ore and extract the leached metals by bio-extraction will be sent to the surface by small pods which will bring in limited provisions and the biomining requirements of bacteria and nutrients. Hot water will be sourced from the hydrothermal fluids that may also provide local power.

In October 2009, a conference at Lulea, Sweden on sustainable mineral resources within the European Union was held under the title "European higher education and research on metallic

and mineral raw materials”. It emphasizes the necessity of a common agenda concerning research and higher education in the field of sustainable supply of metallic and non-metallic raw materials to meet future challenges by excellence in research through EU-funding.

A sustainable supply of minerals and metals also involves balancing the impact on the environment and climate. This could be reached by improvement of resource and energy efficiency and by increased use of secondary raw materials.

The principal project requirements are:

- Ø Robots; designed with new carbon composite material, self –repairing and – replicating with plug and execute multitasking appendage with shielded tera-byte memory and tera-flops processor,
- Ø new underground equipment with sensors for real time data capture and decision making,
- Ø exo-skeleton covered mines for limited and crucial tasks
- Ø new sources of power to operate mining, ore processing and bioleaching, mini nuclear power plants?
- Ø Presently only 25% copper is extracted by post processing of chalcopyrite ores, while gold can be bio extracted only from chloride solution. New form or modified bacteria/fungus that can breakdown or extract metals will have to be developed, there being no known time frame.
- Ø Broad band and ultra high speed secured and shielded communication facility both in underground and for surface communication.
- Ø New software for interactive deposit modeling, mine planning and production control on real time basis for tele -operated mining.

To identify, design and integrate the above mentioned technology EXTRACT-IT is funded by the European Commission’s 7th Framework Programme “Challenges of mineral extraction under extreme geo-environmental conditions.” The EXTRACT-IT Partnership is as follows: VITO (Vlaamse Instelling Voor Technologisch Onderzoek), La Palma Research Centre for Future Studies and Agency for International Minerals Policy).

EXTRACT-IT will define and develop a series of research topics that will provide foundational ICT knowledge on ultra-deep underground mining where the external conditions (humidity, dust, heat, etc) and the confined spaces represent some rather complex challenges for future ICT. This objective will be reached with the help of a foresight exercise to define, develop and describe 6-8 prospective future FET Proactive Calls for Proposals that will support

exploratory ICT research corresponding to the future needs of the extractive industry that is already targeting mineral resources located in deep geological formations.

This is challenge for the mankind to save the environment vis-à-vis meet the material requirement for a better quality of life for generations to come where you are welcome to participate.