Particulate matter in mines and mining environments (PARMAT)

Mining consists of a long chain of actions starting from exploring suitable mineral deposits, building up the mine infrastructure and finally initiating and conducting the production. Every step has own environmental concerns. Besides the environmentally adverse effects, mine production may affect nearby population and pollute the working environment. The main categories of particles in mines are mineral dust (coarse particles), combustion products of explosives and diesel engine emissions (fine particles). Both mineral dust and diesel engine emissions have serious health concerns. In this project we focus on different issues in mining environments, which help in making the future mines more sustainable and environmentally sound.

The objectives of PARMAT are:

1. to **develop an inexpensive particulate matter (PM) sensor** which is able to detect both coarse and fine particle fractions of PM. Sensor has ability for wireless communication and networking and in this project we will demonstrate that a PM sensor network can be used for better control of PM levels in different mine types.
2. to **conduct new chemical characterization of particulate matter** using high time-resolution instruments. This enables detection of combustion products of explosives, PM emissions of diesel engines (fuel, lubricating oil) and secondary particle formation from emissions' gaseous precursors.
3. **to measure particle optical properties** to estimate potential albedo changes of surfaces due to particle deposition and subsequent glacier smelting.

Research methods

WP1: Chemical and physical characterization and sources of PM in an underground mine (FMI + TUT)

- Field study of a two weeks campaign. The instruments will be located in a maintenance area of the mine (provisionally at – 500 m; Figure 1).

WP2: Development of sensors suitable for air quality control in mines (TUT+FMI)

- Sensor tests in an underground mine for two months

WP3: PM from mining area and their influences on environment (CMMCh+FMI+TUT)

- The spatial distribution of PM from the mine using a sensor network (Figure 2) and size distribution measurements of PM
- The sensor network operates two months and a two week intensive campaign

WP4: Networking and researcher exchange, (FMI, MMC, TUT)

- Video meetings, face-to-face meetings, student exchange

Table 1. Timetable for the PARMAT.

	2016	2017	2018	2019
PM sensor development and testing				
Field campaign in underground mine (Finland)				
Field campaign in open pit mine (Chile)				
Data evaluation and publishing				
Student exchange (from Chile to Finland)				
Student exchange (from Finland to Chile)				
Workshop in Finland				

Consortium:

- **Finnish Meteorological Institute (FMI)** has long experience on characterization of atmospheric aerosol, and is contributing this project by online chemical characterization skills.
- **Tampere University of Technology (TUT)** is experienced of measurement and instrument development for aerosols and characterization of particles from vehicular engine emissions.
- **Centro Mario Molina Chile (CMMCh)** and **University of Santiago de Chile (USACH)** teams have long experience of studies on atmospheric photochemical processes and characterization of pollutants in air of industrial areas.

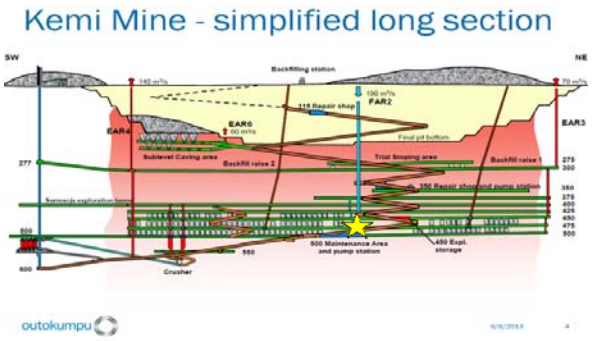

Figure 1. Schematic picture of Kemi underground Mine. Envisioned measurement location, 500 m below ground marked with a star.

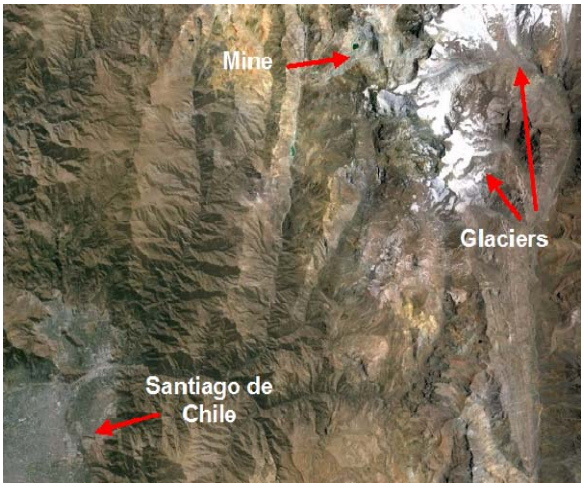

Figure 2. Measurement location in Chile. Spatial distribution of mining emissions (PM, BC) are measured near the Mine.