REF: Kauppila, P.M., Karlsson, T., Korhonen, T., Lehtonen, M., Taskinen, A., Tornivaara, A. & Heino, N. 2016. Mining Waste Management Methods (KaiHaMe). In: Sarala, P. & Eilu, P. (Eds) 12. Geokemian Päivät 2016 – 12th Finnish Geochemical Meeting 2016, 21.-22.4.2016, Åbo Academi, Turku, Finland: Tiivistelmät - Abstracts. Vuorimiesyhdistys, Sarja B 98, pp. 10-11.

Mining Waste Management Methods (KaiHaMe)

Päivi M. Kauppila[1], Teemu Karlsson[1], Tero Korhonen[2], Marja Lehtonen[3], Antti Taskinen[2], Anna Tornivaara[1] and Neea Heino[2]

[1] Geological Survey of Finland, P.O. BOX 1237, FI-70211 Kuopio, Finland

[2] GTK Mintec, Tutkijankatu 1, FI-83500 Outokumpu, Finland

[3] Geological Survey of Finland, P.O. BOX 96, FI-02151 Espoo, Finland

E-mail addresses of corresponding author paivi.kauppila@gtk.fi

Management of mining wastes is one of the primary challenges of sustainable mining due to their large amounts and potential long-term generation of low quality mine drainage. Only a small part of excavated metal ores can usually be utilized and the rest of the material is disposed as a waste, i.e. as waste rocks or tailings. The uncontrolled drainage from sulphide mine tailings and waste rocks may deteriorate downstream water bodies and cause harm to aquatic biota and human health. During the last twenty years, notable research has focused on understanding the reactions leading to the generation of mining influenced waters and how to prevent or mitigate the negative impacts. The primary cause for the low quality mine drainage is the oxidation of sulphide minerals in the wastes when they are exposed to atmospheric oxygen and water. The strategies to control this reaction include removal of one of the agents that promote oxidation that is water, oxygen, ferric iron, bacteria or the sulphides themselves (e.g. Lottermoser 2010). However, despite the research efforts, the management of mining wastes faces challenges even today and the amounts of wastes are expected to further increase with the exploitation of lower grade ores in the future. Therefore, new research and technologies are needed to secure the long-term management of extractive wastes.

The project “Mining waste management methods” aims at decreasing the negative impacts of mining waste disposal and promoting sustainable mining by enhancing material ecoefficiency already from the beginning of the mining operations. Ultimate goal of the project is to increase raw material value of excavated ores and to decrease the amount of disposed hazardous wastes. To reach these objectives utilization and raw material potential of waste materials are evaluated through mineralogical and geochemical characterization, and waste processing and optimization are used to increase usage level of wastes. During the project, beneficiation tests to decrease As and sulphide content of tailings materials are carried out, and applicability of the generated tailings as a waste cover material will be assessed using filled in lysimeter tests. An operational model for the optimal use of waste will be developed to enhance material ecoefficiency. The developed procedure will combine raw material aspects and environmental properties of waste materials.

The project also seeks new options for the characterization and use of waste rocks. Waste rocks are typically used at mine sites in earth construction, such as in roads or in dams or basal structures of tailings facilities. However, only small part of waste rocks fulfil the environmental criteria set for the use at mine site construction, namely those rocks that are classified as inert or with low sulphide content, whereas elevated contents of environmentally harmful elements and sulphide minerals limit their usage. To increase the usage level of these types of rocks and to validate common characterization methods, field lysimeter tests are used to test weathering behaviour of waste rocks and applicability of the rocks in structures where oxygen ingress is limited (Fig. 1).

As a result of the KaiHaMe project, sustainability and viability of mining activities will increase through enhanced use of materials and a decrease in the environmental footprint of operations. The results will benefit mining industry, environmental consultancies, technology providers, environmental and permitting authorities, societal decision making, research organizations and people living within the sphere of influence of mines. The project is funded by European Regional Development Fund, Geological Survey of Finland, FQM Kevitsa Mining Oy, Kemira Oyj and Endomines Oy.

Fig. 1. Filled in lysimeters to study leaching behaviour of waste rocks in varying conditions. Photo © Teemu Karlsson, GTK.

References

Lottermoser, B.G. 2010. Mine Wastes. Characterization, Treatment and Environmental Impacts. Third Edition. Springer-Verlag, Berling Heidelberg. 400 p.