High-performance geoscientific computing in multi-scale mineral potential studies

Eevaliisa Laine[1]*, Jan Westerholm[2], Soile aatos[3], Mats Aspnäs[2], Johan Grönroos[2], Suvi heinonen[1], Kimmo Korhonen[1], Mira Markovaara-Koivisto[1], Ilkka Suppala[1],

[1] *Geological Survey of Finland, Espoo,*
*(*correspondence: eevaliisa.laine@gtk.fi)*
[2] *Åbo Akademi, High Performance Computing*
[3] *Geological Survey of Finland, Kuopio*

A central task in mine site evaluation and 3D mineral potential studies is to collect data on multiple spatial scales and then use inverse methods to infer the location and extent of commercially interesting mineral deposits. Datasets comprise, for example, geophysical data measured from the air, the surface or along drill holes, geological data from geological cross sections, maps, drill core logs and geochemical data. Directly observed geological information is often sparse (e.g. drillholes) and subsurface geology has to be inferred through inversion of measured geophysical data. In order to be able to handle the huge data sets coming from mine sites and mineral potential field mapping areas in an organized manner, a good workflow is needed. 3D models and all geoscientific data should be included in the same 3D grid, also called CEM ('Common Earth Model').

The increasing amounts of data has led to the need to use of high performance computing techniques in geosciences, with parallel computing and the use of modern accelerator technologies like graphical processing units GPUs to speed up calculations. In project Gecco, financed by the Academy of Finland during 2015-2019, we aim to advance the CEM concept in mineral exploration by utilizing high performance computing in geomodelling of heterogeneous areas where limitations of computing power have previously prevented the use of detailed CEM grids with e.g. unconstrained meshes and the use of all available information simultaneously. This project combines expertise in high performance computing and geomodelling, and aims to develop tools for faster geological modelling in an effective computing environment. The two test areas Mullikkoräme near Pyhäsalmi Zn mine and Vuonos from Outokumpu mining area, Finland, will be used.