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NEXT shares findings of its new exploration technologies applied to the Rajapalot test site in Finland

The exploration company Mawson who owns permits for exploration at the Rajapalot test site in Finland is a partner in the EU funded Horizon 2020 New Exploration Technologies (NEXT) project. For this write-up we invited Nick Cook, Chief Geologist of Mawson to share the findings of the new exploration technologies which have been tested and validated in the Finnish test site.

Could you elaborate on your company's exploration activities prior to the start of the NEXT project?

As a company, we have been carrying out ground exploration activities for ore-body delineation, expansion of known prospect areas, and ore resource estimation since 2012. We employed traditional exploration technologies including high spatial resolution ground geophysical measurements such as magnetics, gravity and induced polarization, and also comprehensive drill-core geochemistry. The geophysical and geochemical data, together with the interpretation of the rock types and structural data, revealed that the formation of the mineralization in Rajapalot was driven by epigenetic-hydrothermal processes. This means that the geologic processes involved occurred close to the Earth's surface, and that the mineralization occurred later than the enclosing rock formations. Hydrothermal mineral deposits are accumulations of valuable minerals which formed from hot waters circulating in Earth's crust through fractures. At Rajapalot, this circulation eventually created the rich metallic fluids concentrated in a selected volume of rock, which became supersaturated and then precipitated as a high-grade gold-cobalt deposit.

What motivated your company to join the NEXT project?

The aim of developing more environmentally friendly exploration technologies is of great interest to us. In particular, the ambition to develop new exploration methods that do not leave any trace in the environment is highly supported by Mawson. The Rajapalot area, being a designated NATURA 2000 site, further accentuates our motivation to join the NEXT partnership. At the same time, it was only natural for the research teams in NEXT to welcome the fact that we could offer high-quality geoscientific datasets on which they could test and validate their new approaches and methodologies. Given the extensive ground exploration data available, the Geological Survey of Finland (GTK) considered the Rajapalot area as an ideal scenario to test their novel machine learning-based prospectivity modeling methods.

Could you guide us on the findings of these machine learning-based prospective modeling methods?

In an earlier interview, Bijal Chudasama (Postdoctoral Research Scientist), and Johanna Torppa (Senior Scientist) of the Information Solutions Unit within the Geological Survey of Finland (GTK), explained about their motivation to test whether the previously developed regional- and belt-scale prediction methods by GTK could also be used to guide the selection of drilling targets at the scale of a deposit.

From their knowledge driven approaches (FIS and ANFIS), the general NE-SW trend of the mineralization becomes evident, being shown as high prospectivity zones in the corresponding prospectivity map (Figure 1a). These trends conform to the structural settings that strongly control mineralization. For instance, the known prospects are located near the hinge of a kilometre scale open fold, with a NE-SW trending axial trace. These trends are mapped in the prospectivity results also along the hinge and the limbs of this fold. The clusters identified as prospective from the unsupervised SOM also point to geospatial domains of prospective mineralization zones (Figure 1b). In addition to this, the GTK's data-driven approaches identified localized high prospectivity areas near the, as yet, underexplored prospect areas.

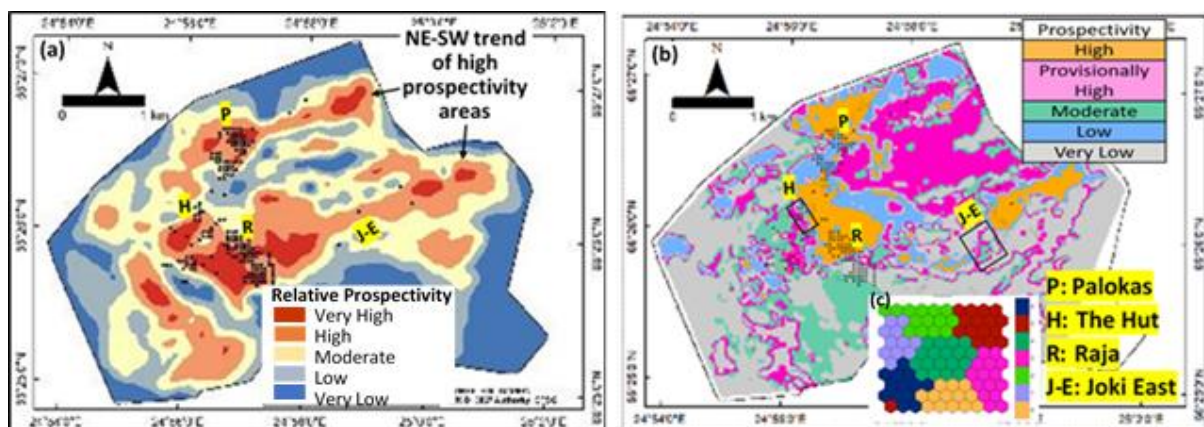


Figure 1: (a) FIS Results showing the NE-SW trend of high prospectivity areas; (b) Geospatial locations of the k-means clusters defined for SOM, (c) the corresponding k-means clusters on SOM.

The Joki East (J-E in Figure 1b) area shows moderate to high prospectivity in GTK's SOM results. This area also distinctly appears as a high prospectivity zone in GTK's ANFIS result (Figure 2). This was confirmed by us with the outcomes of targeted drilling [Mawson Discovers](#)

[High-Grade Gold At Joki East | Mawson Gold Ltd.](#), [Mawson Drills Further High-Grade Gold at Joki east | Mawson Gold Ltd.](#), [Mawson Drills 1.3 Metres @ 25.3 g/t gold at Joki East | Mawson Gold Ltd.](#), [Mawson Drills 5.5 Metres @ 6.9 g/t gold | Mawson Gold Ltd.](#)

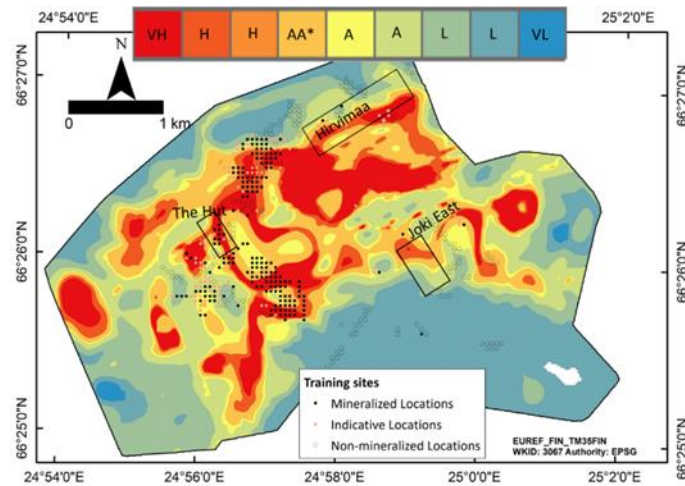


Figure 1: Identification of new possible mineralized areas for drilling. Base map: Prospectivity map from ANFIS model.

Similarly, the area around the hitherto less explored Hut prospect (H in Figures 1a and 1b) showed high prospectivity in GTK’s SOM, FIS and ANFIS results. Also here targeted drilling confirmed mineralized horizons ([Mawson Defines Two New Areas in Finland | Mawson Gold Ltd.](#)). Furthermore, our recent drilling activities at Raja confirmed GTK’s predicted mineralization horizons. All of these outcomes continuously add to the existing resources ([Mawson Drills 20.7 metres @ 7.4 g/t gold at Raja Prospect | Mawson Gold Ltd.](#)).

We understand the Rajapalot area was also a test site for the validation of remote sensing derived products and services developed by the company EFTAS in the NEXT partnership. Could you elaborate on the purpose and outcomes of this Earth Observation based approaches?

As a Natura 2000 designated site, the Rajapalot area hosts flora and fauna habitats which are accorded special protection. To this effect, the potential impact of any type of human activities, including those for mineral exploration purposes, on the environment is subject to monitoring and reporting obligations under EU legislation. For this reason, we were keen to learn more about the remote sensing based approaches developed by EFTAS which include, among other, the mapping of the vegetation type and the analysis of vegetation change over a period of time. As Sebastian Teuwsen, Project Manager in Research and Development;

Energy, Mining and Resource Management at EFTAS explained in your earlier interview, the Rajapolat areas has a completely closed vegetation canopy which presented itself as a major challenge to derive this information from satellite imagery.

However, we were able to give EFTAS a head-start by providing them with a dataset which contains some 40 categories of vegetation types that was obtained from field surveys. This information was used by EFTAS to determine which of these vegetation types occurred with a sufficient magnitude to be used as a training set for the interpretation of satellite imagery. EFTAS applied this machine learning approach for vegetation type mapping using Sentinel-2 imagery. Next, EFTAS proceeded to analyse whether vegetation change occurred over a given period of time. Vegetation change monitoring forms an integral part of our environmental monitoring obligations already during the permit application process and then of course also during the entire term of the mineral exploration permit. Figure 3 depicts the vegetation loss derived from the analysis of Sentinel-2 images on, respectively, 13 June 2017 and 16 June 2019. Aside from the visualization of a light decrease of biomass and/or vegetation vitality along the tracks used by vehicles and machinery for exploration purposes, the strongest decrease in vitality is observed in the top left of Figure 3 within and around a surface water body. This loss in vitality is likely to be induced by changes in water level and the distribution of aquatic plants and algae. Hence it can be attributed to the natural terrestrial surface water dynamics of wetlands rather than mining activities.

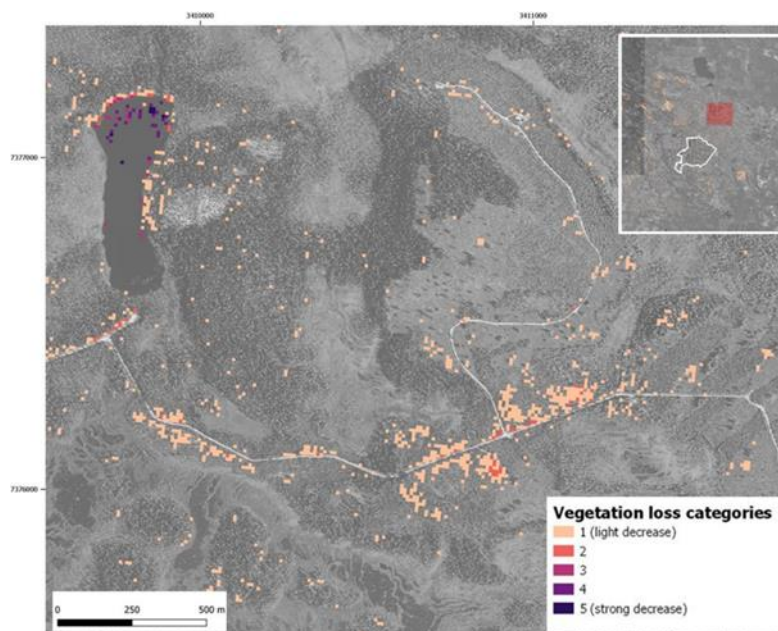


Figure 2 Vegetation vitality changes in the Rajapolat area derived from Sentinel-2 imagery

How would you describe your main appraisal of the novel approaches to mineral exploration developed in the NEXT project?

The mathematical modeling of prospectivity performed by GTK fully convinced us that these predictive tools can be used for selecting new drilling targets at the camp-to-target-scale. At the same time, our recent drilling activities enabled GTK to further improve the understanding of how these methods can lead to optimum results.

We also asked EFTAS whether their approaches could be used to identify land compensation areas. Once again, this was motivated by the fact that the environmental legislation in force requires us to find similar habitats to the ones at Rajapalot to compensate for the possible loss of some its habitats should the exploration proceed to the application for a mine development. Meeting our request, EFTAS provided us with a satellite image map (see Fig. 4), which covers a much larger area around the designated Natura 2000 site. The reddish areas indicate regions matching the reference pattern in terms of vegetation composition of the Rajapalot area which is shown in the centre of the map. Obviously, these areas would need to be ground truthed, but as with GTK's predictive tools, this map clearly gives us a head-start to identify suitable compensation areas.

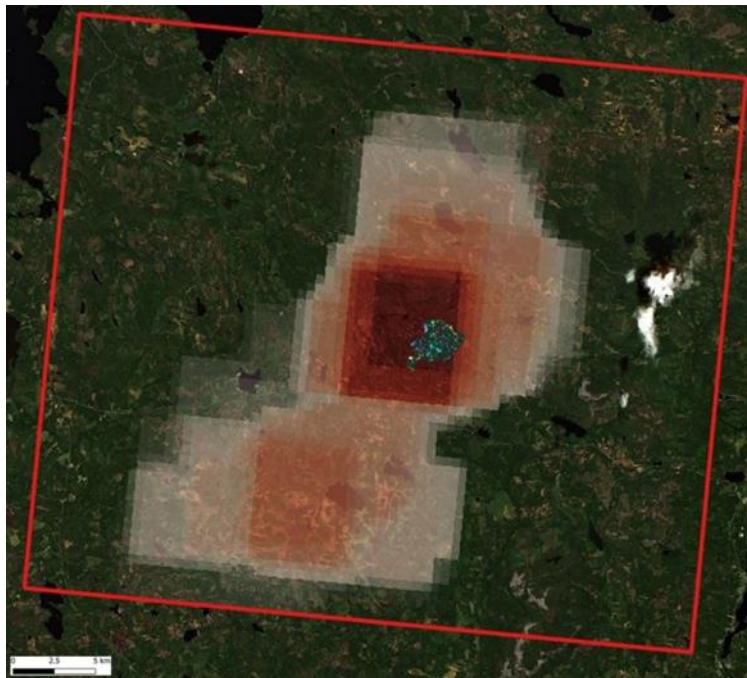


Figure 3 Identification of potential compensation areas derived from Sentinel-2 imagery

For updates on our exploration activities at the Rajapalot exploration site in Finland, please visit <https://mawsongold.com/projects/finland/rompas-rajapalot-overview>.

I am a keen hands-on geologist with a long history in Proterozoic terranes, both as an academic and exploration geologist. Currently, I am involved in leading the Finnish geological team in building the Paleoproterozoic Rajapalot Au-Co resources in Lapland. I am also heavily involved in cooperative research projects with the Geological Survey of Finland (GTK) including the EU-funded MinExTarget, and Business Finland funded BATCircle and BATTrace.

Nick Cook is Chief Geologist of Mawson Oy



More about NEXT:

www.new-exploration.tech

