

Has the geological mystery of the Northeast been solved?

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GTK Bulletin

In the drilling of the Northeast Deep Hole project, a depth of 1,500 meters was reached on 1 December 2020. Just before this depth, the rock type changed from a reddish rather common granite to a dark, greenish deep rock. The rock type of the drill core sample probably represents the cause of the gravity deviation that has preoccupied researchers for decades.

Geological mystery survives?

Located in the deep parts of the bedrock, a gravity deviation of about 60 km has preoccupied geologists for decades. There have been no physical samples from the deep object, so the interpretation of the object has been based on various geophysical measurements and modeling.

The Northeast Deep Hole project has now received a drill core sample of this mysterious site.

The sample material drilled from the bedrock lumen turned out to be a magnesium-rich ultra-mafia rock, peridotite.

"What makes the discovery special is that the collected sample material is one lost piece in the puzzle of the Finnish bedrock," says specialist researcher **Jukka Konnunaho from GTK**.

The rock type identified during drilling may represent the same geological units as the rocks in the Näränkäväära and Syötte areas. What is interesting is that similar rock species are known to contain ore deposits enriched in platinum group elements, nickel and copper, as well as chromium, vanadium, iron and titanium.



Similar peridotite rocks occur in numerous places around the globe and also in Finland. It is not a rarity, but for geologists it tells a lot about geological processes and related phenomena. These peridotite rocks were formed billions of years ago and tens of kilometers deep from material melted in the interior of the earth. At that time, the molten rock penetrated the earth's crust, forming magma reservoirs there, or erupted on or near the surface in the form of lava or plot-like formations. These events are part of the ancient history of Finnish geology more than 2,000 million years ago.

"We are really excited about the preliminary results. The Northeast Deep Hole project has already proven that with modern technology it is also possible to study the deeper parts of the bedrock in a completely new way," says specialist researcher Tuomo Karinen from GTK.

In addition to completing the drilling, the next steps in the studies are a more detailed examination of the sample material and, for example, the determination of the age of the rock type and the determination of the composition of the stones by analytical methods.

Drilling a deep hole is challenging

"The broken bedrock was challenging during the first kilometer," says project manager **Aleksi Salo from GTK**.

Cracks and broken parts can cause the pipes to wedge or the water pressure to drop during drilling. Water pressure flushes the hole clean of aggregate, ensuring continuous lubrication of the diamond blade and free rotation of the tubes. Over a distance of three kilometers, a total of more than 20 tons of pipes will accumulate to be supported by the drilling machine. Drilling such a deep exploration hole is a unique project globally.

As the drilling progresses, the hole has been stabilized with cement to keep it open for as long as possible for further



research and to ensure the smoothness of the last two kilometers of drilling.



"To date, more than 1.5 km of the core core has risen to the surface," says project manager Aleksi Salo. Photo: GTK

The best equipment to use

"We are switching to the deep hole site in the Northeast to complete our latest and most efficient drilling machine, the hole. With this K10 drilling machine, a drilling depth of up to 3,500 meters can be achieved, "says **Alexi Autti**, CEO of Arctic Drilling Company (ADC) .



No such deep hole has been drilled in Europe in the past with traditional diamond drilling equipment. All components of the machine are designed to be significantly stronger than the average drill. The K10's drilling machine uses new technology's lower-emission diesel technology. The interiors are also designed for more ergonomic and safer work. The development of drilling technology will enable even deeper explorations with a smaller carbon footprint.

The ADC has previously drilled a hole 1714 meters deep. Every meter after this depth is a step into the unknown.

"Records have been broken and new solutions must be tried," says **Pasi Heino**, head of the unit at GTK.

"Significant pioneering work is being carried out here and the power of Finnish know-how is being demonstrated," confirms Autti.

Diverse research

"Geological research is a long-term, multidisciplinary job and requires curious mind and courage. The achievement of the Northeast Deep Hole project also shows that there is strength in cooperation, "says **Olli Breilin** , GTK's Chief Operating Officer .

The deep hole provides a diverse internationally significant research and development environment for the study of geoenergy, geophysical methods, rock buildability and mineral systems. Above all, it brings new information about the geology of Finland and thus the Fennoscandian shield area.

"A multidisciplinary approach to deep bedrock research provides an opportunity for our partners to demonstrate and develop research technology and expertise in this new test environment," Breilin continues.

In September 2020, the Northeast Deep Hole project began drilling a research hole that can reach a depth of up to three



kilometers. Drilling will last at least until March 2021. Currently, a diamond drill advancing at a depth of 1,500 meters crumbles the bedrock at its best at 45 meters a day, but drilling is constantly slowing as you go deeper.

More information: GTK

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