Can you tell us about yourself and your company?
I am Anders Sivard, co-founder of BitSim, a Swedish SME company. I have worked in the electronics industry for many years holding various positions in R&D, sales and management in Europe and the US for companies such as Ericsson and Sun Microsystems. BitSim is an electronics design house founded in 2000 and based in Stockholm, Sweden. We focus on imaging and data acquisition applications of big data and streaming.

What role do you play in Smart Exploration?
Within the project, we have developed new downhole exploration equipment for water-filled slim boreholes of NQ sizes.

We previously developed an advanced system for deepwater exploration and have had a long relationship with the excellent group of geophysicists at Uppsala University. During the discussions with the Uppsala geophysicists, we realized that we could utilize our knowledge into new leading-edge technology for the mineral exploration industry.

What are the unique characters or advantages of this new system?
The potential of deep exploration, with several thousands of metres-deep slim boreholes, together with designing a low power solution and our existing data communication blocks in a smart way, is a unique combination for creating a new exploration product. This prototype provides a much simpler system that can be frequently used by mineral explorationists.

Figure 1 Small diameter (approximately 35 mm) circuit and acquisition designs of the slimhole system.

Figure 2 Field photo taken during the so-called backyard test in a known hydrological borehole near the city of Uppsala, Sweden (June, 2020).

The slimhole geophysical system (Figure 1), currently mainly seismic, is easy to handle and can be expanded to 100s of hydrophone sensors sampling at 4 KHz. Measurements can be recorded ‘live’ and even be run together with similar equipment in neighbouring boreholes for multi- and cross-hole measurements. There is a lot of bandwidth to handle the measured data, and the sensor data should be synchronized to under a microsecond accuracy and precision.

From the environmental and safety point of view, thanks to our low power solutions, we have developed a system that have fewer safety requirements in terms of the electrical environment and EU regulations, using only a sub-75 volt power feed.

What is the main difference of this prototype compared to other systems available in the market?
There is currently no existing exploration system for slimholes that we know of that allows measurements in deep holes with low noise digitized data transfer and that are modular. While there are sophisticated systems available, they are often for wide-diameter boreholes and any available for slimholes are limited in the
Can you elaborate on the collaboration?
We had to understand the typical needs while developing the prototype for this specific usage of mineral exploration. We have teamed up with Uppsala University because of their knowledge in the field, data scrutinization and applications in particular. This collaboration of an academic expert group and our engineering team worked very well to ensure that the system we develop fits the mineral exploration purpose.

Have you experienced any challenges during this development?
Development of such a system cannot be done without extensive planning and proper understanding of the main motive. We have spent a considerable amount of time to find and develop the best methods for downwards and upwards data communications. The data transfers are done in a new, inventive way that took some time to get working with minimal power consumption. The high pressure, mechanical bottles and assemblies also took some time to complete. Having a diverse team working from different technical backgrounds helped us to overcome these challenges.

What would you describe as breakthrough of this system?
Thanks to the modularity, the end user can select the number of nodes in a borehole (multiple of 4 sensors, up to 100 sensors per hole) and in addition simultaneously measure nearby holes. The system can record in real-time, with near noise free data recorded and transferred, with excellent synchronization and large data capacity.

The system is developed to serve the mineral exploration industry market but it could potentially be used in geothermal and geotechnical applications. Waste-storage site characterization and CO₂ sequestration are among other potential applications.

Has the system proven to be successful?
We aim to complete the validation phase by the end of this year. The current version of the system goes down to 500 m. So called backyard tests of the boreholes at Uppsala University (Figure 2) have been completed with promising results (Figure 3). Further tests are planned at our partner Nordic Iron Ore’s mine in Ludvika. In the autumn 2020, the system will be fully validated at the exploration boreholes in the Blötberget mine of Ludvika given prior knowledge and all the surface data available from this site thanks to Nordic Iron Ore.

Will the system be available for others to use or designed only for the project?
We are looking forward to the validation stage of the project to get first-hand market feedback from the work. This will be important for us to show that the system can be used in the mineral exploration industry and will help us to enhance our TRL (Technology Readiness Level). We have taken measures to protect the IPs generated from this work. Future marketing work will rely on new services and manufacturing the system for purchasing and possibly making a more robust version of the system to be delivered to mining and exploration companies. We are looking for investment and business partners for this stage. There have been some early contacts with interested companies. There are number of companies awaiting the outcome of the validation work. Besides these contacts, we also have a market strategy which we are keeping updated as we progress. We are looking at hiring and selling equipment and also providing services through our partnership with Uppsala University.