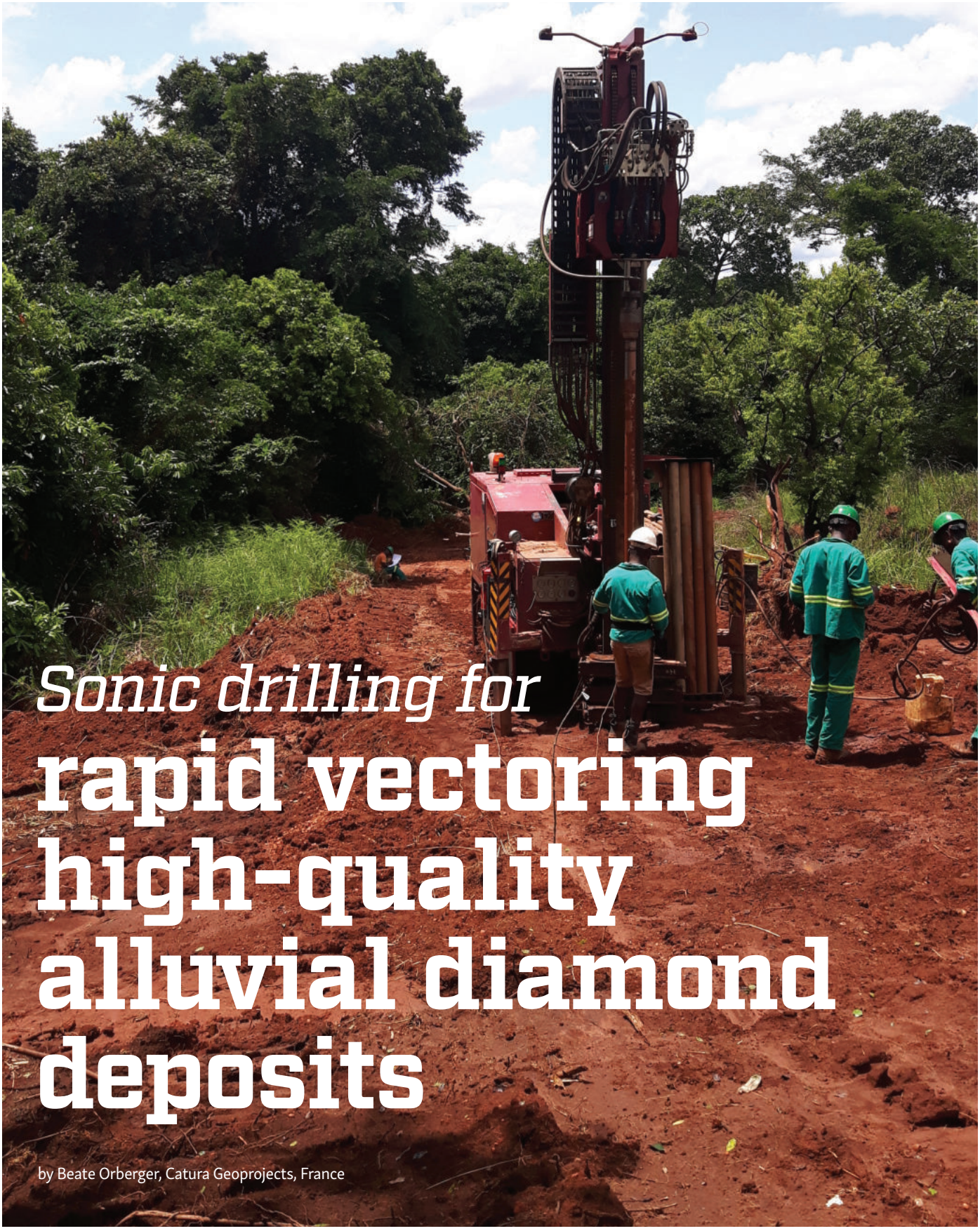

Sonic drilling for rapid vectoring high-quality alluvial diamond deposits

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Eijkelkamp SonicSampDrill is based in the Netherlands, developing and manufacturing sonic drill rigs and drilling tools. The company's equipment is tailor-made for each customer's challenges to speed up their exploration drilling campaigns by ensuring optimal core recovery and core quality.

Background

Alluvial diamond deposits are of low and variable grades and sizes (0.5 – 2 carats/diamond). They are characterized by high heterogeneous diamond distribution (tens to hundreds of metric scales), which is related to fine- and coarse-grained gravel and sand bars. Alluvial diamonds are deposited in dynamic fluviatile, marine or Karsts environments, being influenced by the bedrock, host rocks and regional morphologies of the landscape.

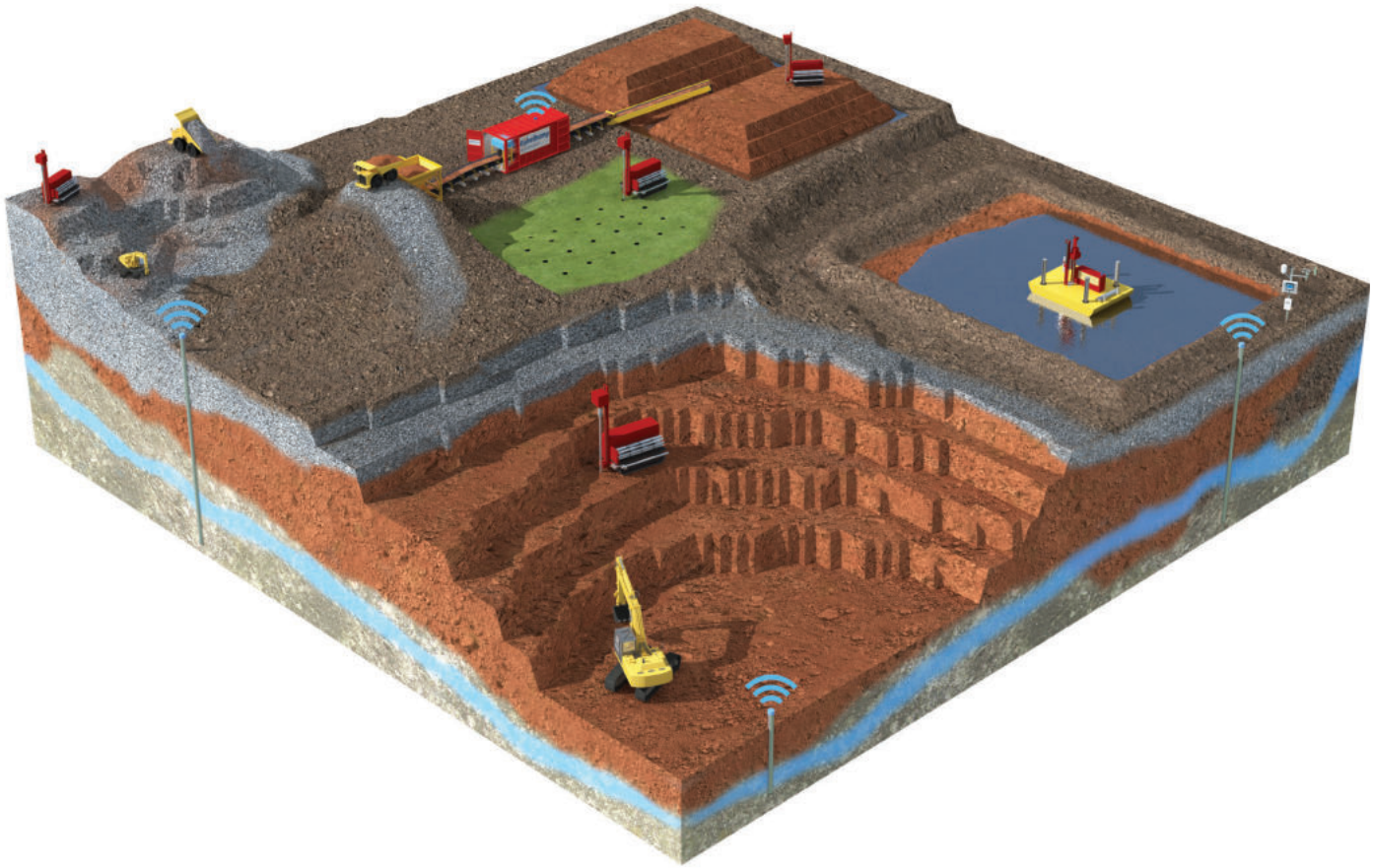
Subsurface alluvial diamond properties are thus difficult to evaluate. No unique method for target selection exists, as each alluvial diamond province has its own climate and geomorphic history. Knowledge of the paleo drainage system and the lithologies composing the overburden and the diamond-hosting gravel beds is therefore crucial to establishing a 3D geomodel.

Narrow sampling is also necessary. Drilling is the only method that can access alluvial deposits covered by variable thicknesses of overburden.

These unconsolidated rocks are difficult or impossible to drill by conventional diamond-drilling methods. Fine grain-size sands and clays are often lost but can host diamonds. Incomplete sampling will lead to a serious lack of knowledge of the subsurface diamond field and its variabilities. This in turn will result in erroneous models and erroneous resource and reserve calculations and delays the decision-making.

Challenges in the north-eastern Angola alluvial diamond fields

North-eastern Angola provides high-quality diamonds to the market. These diamonds were eroded from kimberlites in the north-west part of the country. The diamonds occur in gravel beds of the Calonda formation. At deposit scale, these gravel beds are complex as they belong to a channelized paleo river system. Diamond-bearing gravel beds are of variable thicknesses (0 m – 5 m) and may form lenses. The diamonds vary from low to high grade at different locations, with variable quality. The paleo channels are covered by variable thicknesses of overburden related to the hilly landscape and on slopes and in valleys. The overburden



Eijkelkamp SonicSampDrill's equipment is tailor-made to speed up exploration drilling campaigns

The CompactRotoSonic Crawler

The samples made with Eijkelkamp's sonic drilling technique

lithologies are clay and sand layers. The underlying bedrock is present at 3-meter depths down to 50-meter depths.

In order to provide a reliable geomodel, sonic drilling was performed, aiming first to locate diamond-bearing gravels, secondly, determine the thickness and depth below the surface, thirdly, determine the thickness of the gravel beds and fourthly, determine the diamond grades and quality.

In this project, the CompactRotoSonic Crawler (CRS-V) type drill rig was used to drill a grid with spacing of 200 m to 100 m in the target areas. After this was done, when the potential gravel beds were found, the drill grid spacing was reduced to 50 m or less. Drilling rates reached 1500 m – 2000 m per month working 12-hour shifts over a five-day week. Borehole depths ranged between 5 m and 25 m.

The drilling results obtained using Eijkelkamp's sonic sampling equipment and methods led to the accurate measurement of overburden, the thickness of the diamond-bearing gravel to the bedrock, and their compositions.

This method facilitates the successful and preferential targeting of high-grade diamond channels. Thanks to Eijkelkamp's sonic drilling equipment and performance, a complete geomodel was established, optimizing exploration and mining (predictive and directed). The profitability of

The samples made with Eijkelkamp's sonic drilling technique

diamond field was thus maximised, and the mining block life can be extended (prospective).

Sonic drilling under continuous development

Sonic drilling, when performed at the highest technological standards, is the solution for complex unconsolidated diamond deposits. This technology provides high-quality drill cores (recovery rates > 90 % and complete lithologies) in a short time span (≈50 m/day). Failure rate, waste production and environmental impacts are low. Compared to rotary drilling, sonic drilling includes an oscillator motion additional to the rotary motion at the drill head. These motions generate high vibratory forces (50 Hz – 150 Hz) which are translated into up and down movements, pushing down while rotating. The combination of the three forces (vibratory, rotary, and axial) speeds up the drilling and produces continuous, full core samples. The drilling fluid is specially composed to optimize sample output and minimize environmental impact. In general, 70 % – 80 % less waste is produced. Sonic drilling is also performed where there is hydraulic fracturing, borehole erosion and vulnerable structures.

For unconsolidated, alluvial environments, recent developments use vibrational and axial forces without rotation, and only small quantities of drill fluids. This technology has the advantage of achieving minimal disturbance of the cores. Eijkelkamp SonicSampDrill develops rigs and tools to reduce friction on drill strings and the drill bit. This friction is caused by liquefaction, inertia effects, and a temporary reduction of porosity of the soil. Depending on the climate and geological environment different types of sonic drills are operated (e.g. LargeRotoSonic (LRS), or CompactRotoSonic (CRS)).

Eijkelkamp SonicSampDrill continuously develops drilling equipment to achieve optimal results in these complex environments. Furthermore, Eijkelkamp's sonic drill rigs are easy to operate in dense forests because of their maneuverability, without harmful environmental impact. Competent and experienced staff train the customer's staff to be highly productive in the field.

References

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