Reverse circulation drilling with new hammer concept

Accurate sampling

Reverse Circulation (RC) drilling is gaining recognition and is already the most common mineral exploration drilling method used in many regions of the world. Combined with the Secoroc RC 50 hammer it is unbeatable for obtaining accurate and uncontaminated rock samples at high speed and low cost. Atlas Copco produces the complete RC drill string including hammer, bit and pipes, for both in-pit grade control and exploration drillers. Mounted on a choice of Explorac 220RC, Explorac R50, ROC L8RC and RD10 rigs, the system is the most productive available.

RC hammer

With a conventional DTH hammer, there is a risk of contamination as the sample is transported between the hammer casing and the hole wall to the collector sub. Demands for cleaner samples were identified in the early 1990s, and the first true RC hammer was developed with sample collection at the face of the drill bit and removal of the cuttings through the centre of the hammer to the dual wall drill pipe. This technique provides a true sample from the bit face with minimum risk of contamination.

Higher air pressures were needed to achieve higher productivity, and to be able to drill deeper holes. The use of auxiliary compressors and high-pressure boosters resulted in air pressures up to 100 bar, leading to necessary advancements in all aspects of the RC system. RC drilling is now a common method used for surface mineral exploration drilling throughout the world, and it is gaining increasing acceptance. The method offers: representative samples with high recovery rate; more accurate samples in low-grade ores; continuous sampling from the hole bottom; uncontaminated samples; straighter holes in

The RC50 hammer from Atlas Copco Secoroc is designed for both deep hole exploration drilling and In-Pit grade control.

broken formations; high productivity; reduced drilling costs; large bulk sampling capability; and penetration of unconsolidated formations with cavities without loss of circulation.

In-pit grade control

Atlas Copco has focussed on two main applications: in-pit grade control and normal exploration drilling.

Gold processing techniques improved during the 1990s, making previously uneconomical ore grades viable, but with increasing costs for the entire process. "Mining operations had to improve their cost effectivness, the importance of knowing what grades to expect before the blast were identified. In Pit Grade Control returns an uncontaminated sample, providing needed knowledge of what grades to expect as well as the possibility to select what bench to blast next. This information makes it possible to to reduce waste rock in concentrator feed (dilution) as well as minimize the risk of transporting valuable ore to the waste dump." The importance of grade control and minimized dilution is increasing around the world. Dilution is defined as waste rock in concentrator feed, and can vary from 5–40% between different mines. The amount of waste raised from the mine is estimated by the geologists, but the actual process dilution is hard to measure. Dilution means not only lower grade ore, but also reduced profit.

One of the easiest ways to control dilution is to use in-pit grade control, where RC drilling is the most cost-efficient and accurate method available. In-pit grade control is used in existing operating mines to define and map boundaries between waste and ore, and variations in mineral content, in order to optimize ore recovery rates.

Another major application typical of, for example, iron ores, is to define the different ore grades in order to be able to mix them into set grades, giving increased efficiency of the ore process.

Mineral exploration

RC drilling has two shortcomings when compared to core drilling. Firstly, because dual wall pipes add a lot of weight to the RC drill string, most of the RC drill rigs used today have a limitation in depth of 200-400 m. Secondly, RC drilling yields less information regarding the geological structure of the orebody. This is quite an important factor when estimating the cost of extracting mineral from ore.

So, while coring yields a good physical sample on which the geologists can rely, RC drilling is faster and more flexible, affording economic sampling over longer distances in the hole.

As a result, the two methods are often used in combination by mine operators, using RC for drilling shallow holes and in-pit grade control, and core drilling for deeper holes to identify future resources. Furthermore, many exploration contractors drill the first part of their hole with RC, and then continue to the total depth with core drilling techniques.

The new RC 50 hammer

In recent years Atlas Copco RC technology has evolved, and the Secoroc RC 50 hammer concept has been tested and refined. The RC 50 was released in 2008, along with three new RC drill rig configurations known as Explorac 220RC, Explorac R50, ROC L8RC and RD10.

The RC 50 hammer has the following features: higher stroke frequency performance; simpler design and fewer parts; built on the efficient Quantum Leap air cycle.

These features give five main benefits for RC drillers: high productivity; high recovery rate; quick and easy service; low fuel consumption; and decreased cost per metre drilled.

The Secoroc RC 50 hammer is designed for the hole range 140-152 mm, and during tests has proven to be more productive than any other RC hammer available on the market. Another attractive feature that adds to the productivity of the hammer, as well as availability of the rig, is the outstanding service life of wear components.

Fredrik Gabrielsson

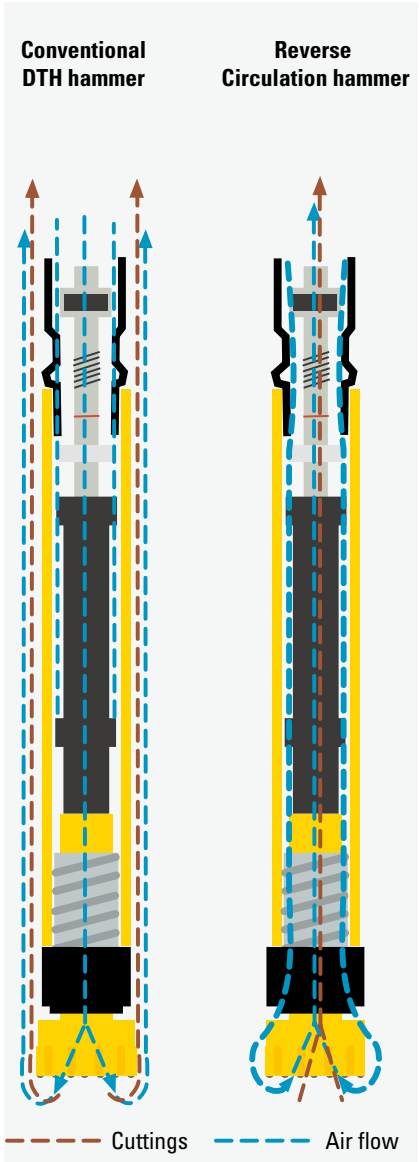

Fig 1: The DTH hammer flushes cuttings out of the hole on the outside of the hammer, while the RC hammer collects all cuttings through the centre of the hammer.