Case History

Baroid Industrial Drilling Products

BAROID IDP ROC (Return of Circulation) Tool

- Field demonstration of borehole stabilization and return of circulation

Project Owner— Fresnillo PLC

Primary Contractor—Boytec

Project Objective— Fresnillo PLC is an operating Silver Mine with an active wireline exploration program coring (HQ/NQ) to ~2000 m.

- **Challenges**
  - Below ~80 m, circulation losses are nearly ubiquitous across all drill holes
  - Downhole tooling wear due to rod chatter
  - Difficulty directional drilling
  - High fluid costs

Geology

The Fresnillo base metal-silver ore deposit consists of replacement chimney and manto orebodies, disseminated sulfide orebodies, and vein orebodies hosted mainly in Cretaceous marine sedimentary and volcanic rocks (Figure 1.).

Figure 1. Cretaceous sedimentary rocks

Rig Info

Longyear—LF230

Rig—MX1-37

Coring HQ at –50° Depth 194m

Typical Drilling Fluid

Soda Ash	0.5 kg/1000L
QUIK-GEL GOLD™	15 kg/1000L
QUIK-TROL® GOLD	1.5 Kg/1000L

Lost Circulation Materials

- Drilling Paper
- DIAMOND SEAL

The Challenge

Rig currently drilling HQ at 194 m (Figure 2). Fluid returns began to decrease after ~80 m with 100% loss after 100 m. Lost circulation at the site is treated using a number of types of materials including drilling paper and DIAMOND SEAL.

While onsite drill crews mixed a 400 L "Pill" comprising 60 lb (27 kg) Drilling Paper and 15 lb (7 kg) DIAMOND SEAL. The Pill was pumped to bottom and resulted in gain of 15 m of static water level (~180 m) off bottom.

The mine currently employs ~20 surface coring rigs and when a reasonable static water level in the hole cannot be maintained the drills often use a rod grease to reduce downhole friction and chatter in the hole.

Figure 2. Surface core rig during Pill treatment for lost circulation

Figure 3. BAROID IDP ROC Tool

A Solution

The Baroid IDP ROC tool is designed to deliver a fixed volume of liquid or flowable material directly to or below the core bit. The ROC tool comes standard with a 1" thread on lower assembly so an extension tube or "Stinger" can be added. The Stinger can be as short as 6 in. or as long as customer desires. Discharging the material below the bit allows for a wide range of products to be utilized (LCM, cements, resins, grease).

The ROC tool comes in H and N sizes with adaptor landing shoulders allowing H and N tools to be compatible with P and H rods, respectively. A standard core inner tube is used as the LCM or product reservoir and the maximum volume placed is a function of the Inner Tube length.

H – 0.26 gal/ft (3.2 L/m) or 2.6 gal/10ft (9.6 L/3m) N – 0.14 gal/ft (1.8 L/m) or 1.4 gal/10ft (5.4 L/3m)

ROC Tool Usage

Figure 4. ROC Tool Assembly

The ROC tool was assembled (Figure 4.) around a standard 10 ft (3 m) HQ inner tube (Figure 5.) and filled with FUSE-IT (Figure 6.). The tool is lowered to core barrel using overshot and seats on landing ring (see landing shoulder in Figure 3.) so that no part of tool contacts core bit.

Release and extract overshot leaving the tool in core barrel. Make rod connection, and engage mud pump to charge/pressurize rods. As fluid pressure builds, landing indicator ball closes ports on lower housing (observed as short pressure spike). Once lower port is closed, pressure exerts on piston pushing product out of Inner Tube to open hole. When piston reaches bottom of its stroke, pressure continues to rise beyond normal operating pressure (for given depth) indicating tool is empty (Figure 7.). Reverse installation procedure to remove tool.

Figure 5. ROC Tool 3 m Inner Tube

Figure 6. Filling ROC Tool with FUSE-IT

Figure 7. Piston at bottom of its stroke in Inner Tube

The Result

The ROC tool was used twice in quick succession, each time delivering ~2.5 gal (9.5 L) of FUSE-IT to the open hole below the bit. After the first injection the static water level rose from ~180 m to ~130m . Following the second injection the static water level rose from ~130 to ~30 m below ground surface.

The customer was extremely pleased that in less than one hour, the hole had been transformed from having <15 m of static water in bottom of hole to a static water level <30 m below collar.

By retaining a high static water level in the hole, the crew was able to avoid rod chatter and not have to employ the dry hole kit during coring.

Performance and Economic Benefit

- Close to 200 m to static water level gain with two small treatments of FUSE-IT
- Decrease hole completion time by ~5 days
- Drilling in a dry hole is significantly slower than in a wet hole
- Hole vibration reduced, bit/reamer shell/rod life extended
- negate use of rod grease

Figure 7. Core at 222m following two injections of FUSE-IT

Customer Feedback

- "Extremely pleased with high water level. Much faster for my crews to advance hole without using dry coring kit". Marco Escalona (Operations Manager Boytec)