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CORE DRILLING TOOLS USED IN OIL AND GAS PROSPECTING IN SLOVAKIA

1. INTRODUCTION

Some methods and techniques, verified in day-by-day practise, are commonly used for qualitative withdrawal of a core in Slovakia. The paper presents describing these methods, techniques and division of the splitting of a rock mass onto a sample form.

2. TECHNICAL MEANS FOR CORING

Coring in deposit conditions (good core with deposit fluid, not affected by drilling fluid, not damaged by pressure in rock cavities/pores – so in situ sampling (Fig. 1) is done by the system In Situ Data Gathering System (IDGS).

The core barrel Coremaster 6 $\frac{3}{4}$ " \times 4" reinforced to 7 $\frac{1}{4}$ " before and after stabilizer is used for coring in heavily deflected wells (standard length of core of 9 m, with the option of 4,5 m) can be multi-connected to allow coring of up to 118 m long cores (upper part of the core barrel is made of nonmagnetic material for oriented coring). The core barrel CoreDrill is meant for sampling during drilling. One of special coring techniques is coring by submersible motor (Fig. 2) in vertical, inclined or horizontal wells.

Drive is provided by the submersible motor Mach 1 or Mach 2. Special transition piece is inserted between motor and core barrel (to allow fitting of return valve ball to the core barrel after previously flushing the well). Some of the name and core barrels or systems are shown in Figures 3, 4 [1, 3].

On many other manufacturers of core barrels, we can mention Diamax and Security DBS. Security DBS manufactures a core barrel very similar to the one by Christensen P 250. Composition and operation of the core barrel are identical. The company also offers a special service – coring with high requirements.

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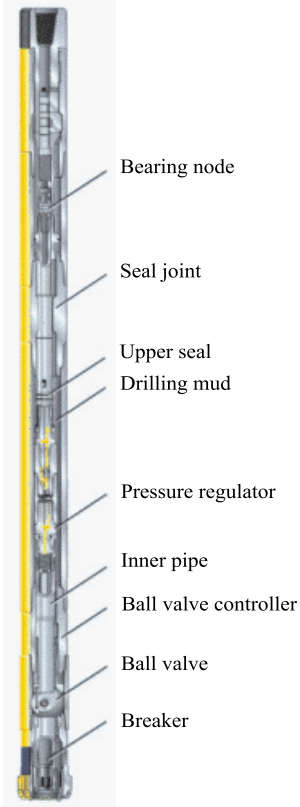


Fig. 1. Core barrel for in-situ coring

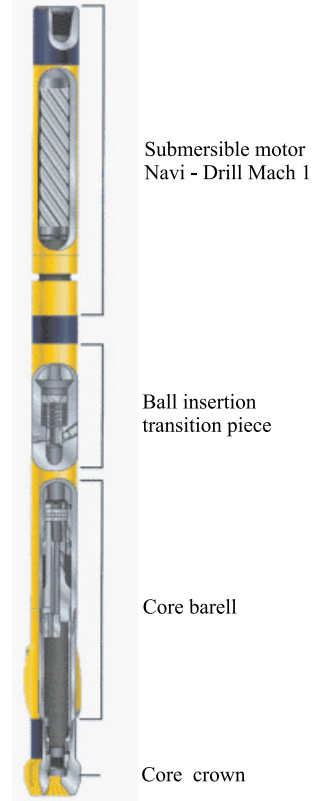


Fig. 2. Assembly for coring with submersible motor

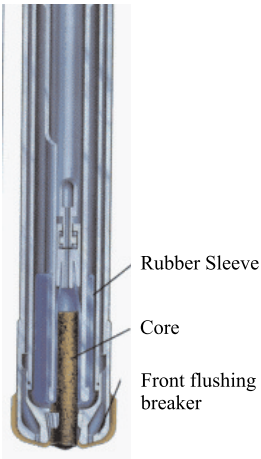


Fig. 3. Core barrel

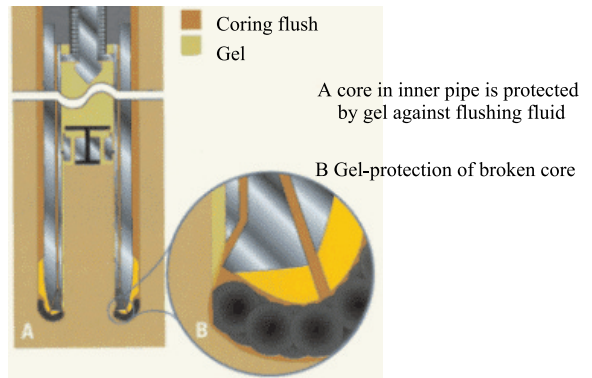


Fig. 4. Gel Coring system principle Rubber Sleeve

It is for example the system PosiClose™ for coring in unconsolidated or disturbed rock, the system Sponge Coring™, coring with minimum influence by dreading fluid and maintained deposit fluids, oriented coring, Slimhole coring, continuous coring by the system Latch-Les™ With wire-line technique, coring from high-pressure formations without damaging the core during pulling out of the core barrel. Another option is coring of horizontal wells and getting cores up to 110 m. They offer adjustable safety joint for quick adjustment of coring pipe clearance. It's not only coring crowns and core barrels (their principle or design) what has impact on success of coring. Considering the replaceable parts, it's especially inner coring pipes, coring pipe shoes, core breakers, stabilizers and bearings of inner coring pipe, cooler barrel stabilizers, measuring systems for oriented coring (Fig. 5).

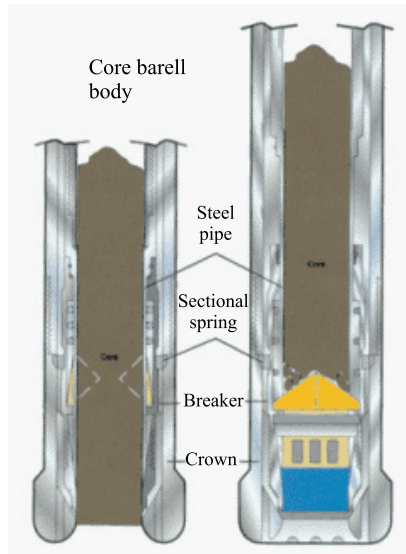


Fig. 5. Core breakers for full closing of Hydro-Lift core barrel

Further on, there are auxiliary equipment (wire-line method tools Slimhole and Core-Drill™), releasing and coring hydraulic scissors Christensen (type FC), surface technical equipment for coring by means of the system IDGS, new types of threads, equipment for taking samples from core, special portable core analyzer, and others.

The inner coring pipes are made of materials like glass fiber, aluminium and synthetic plastic materials PVC/ABS; they allow smooth insertion of the core to the pipe, cutting and keeping the core in the coring pipe, and its transport to laboratories. They have a lower friction coefficient, hence, they are reducing the friction between outer and inner coring pipes, they do not corrode, reduce or eliminate induced cleavage of core and increase its safety. They are usable with several times of core barrels with the length of 9 m, plus they can be multi-connected up to 36 m. The pipe made of glass fiber is usable in temperatures up to 95–120°C, plastic pipe can be used to 60°C. Special adapter (Fig. 6) is used for connection to conventional core barrel P 250 5 3/4" × 3 1/2" and more.

The company Security DBS uses, in addition to smooth pipes, also specially modified aluminium pipes. One type is modified by internal grooves which are reducing the area of contact with core, reducing its friction and allowing easier insertion of the core to the pipe (Fig. 7). Second pipe has inner ribs filled by sponge (Fig. 8). This allows coring readout losing of deposit liquids, as they are absorbed by the sponge when the core is extracted [1, 4].

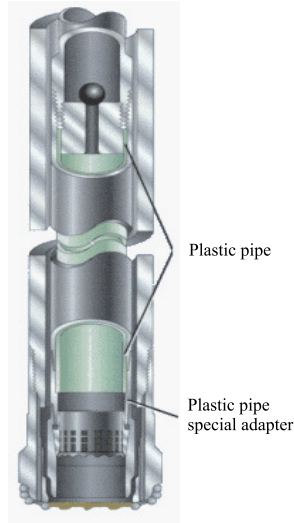


Fig. 6. Special adapter



Fig. 7. Internal grooves

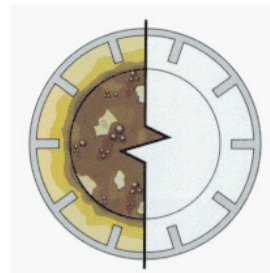


Fig. 8. Sponge section

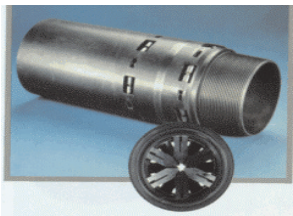


Fig. 9. Core breaker Christensen X-97

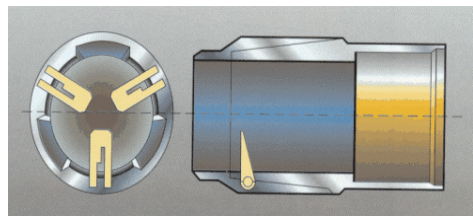


Fig. 10. Core breaker Slip&Dog made by Christensen

Coring pipe shoes and core breakers are usually used together; the core breaker is screwed to the shoe. The shoe is used to extend the inner coring pipe, e.g. after thread repair, The core breaker detaches the core from formation after coring has been finished and keeps the core inside the coring pipe during extraction of the core barrel (limiting influence of drilling fluid on the core). Breakers can have various designs: single-latch, double-latch, slip-socket, spring-type with welded fine hard-metal, combined, core breakers for full closing of coring pipe (Fig. 5), a core breaker being part of a special plastic pipe adapter (Fig. 6), Heavy Duty core breaker by Security DBS (Fig. 7).

Some types of core-breakers are shown in Figures 9–16 [2, 4].

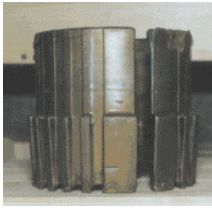


Fig. 11. Core breaker Christensen – spring



Fig. 12. Core breaker Christensen – spring and combined

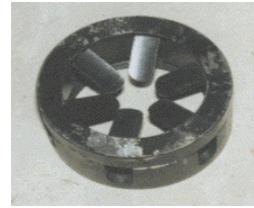


Fig. 13. Latch core breaker Nafta a.s. Gbely

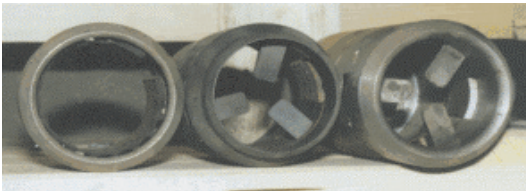


Fig. 14. Core breakers Nafta a.s. Gbely and Christensen core breaker (in the middle)



Fig. 15. Core breakers Christensen (spring and combined)

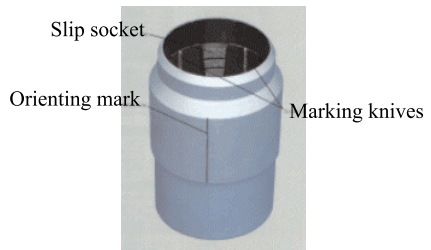


Fig. 16. Christensen core breaker for oriented coring

Extension guiding shoe (Fig. 17) is used in coring systems CoreGard and Gel Coring. It allows direct insertion of core to coring pipe right after coring; this ensures minimum impact of drilling fluid on the core.

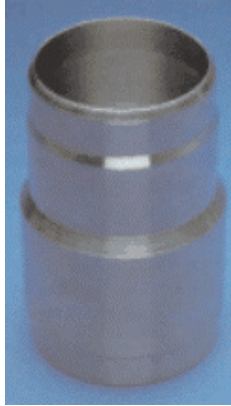


Fig. 17. Extension guiding shoe Christensen

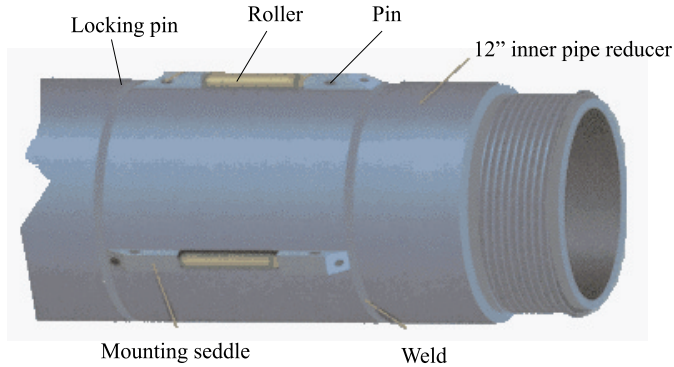


Fig. 18. Inner coring pipe roller

For coring in heavily deflected and horizontal wells it is necessary to eliminate friction between inner coring pipe and the core barrel housing, to prevent rotation of the inner pipe, to limit/eliminate overhanging and process movement of the inner pipe, in order to allow smooth insertion of core into coring pipe (avoiding any secondary mechanical damaging of the core in the pipe). To eliminate these undesirable events, the company Christensen manufactures inner coring pipe stabilizers (Fig. 20), inner coring pipe roller bearings (Fig. 18), and inner coring pipe above-bit bearing (Fig. 19).

This equipment/tools are successfully (with similar effect) used also for stabilization of coring assembly in case of long sample coring. They are used with steel, aluminium and glass-fiber pipes for coring by drilling string and submersible motor [3, 4].

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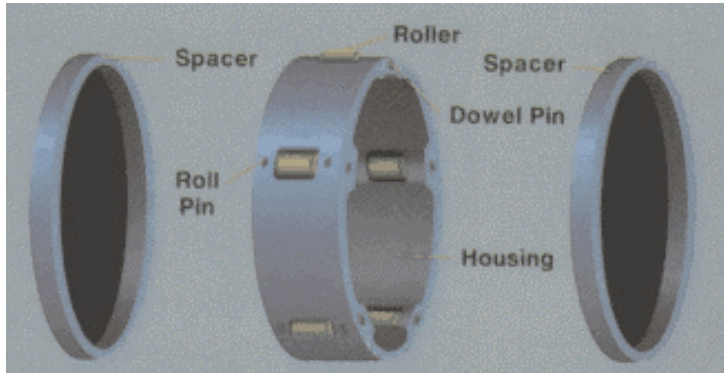


Fig. 19. Coring pipe above-bit bearing

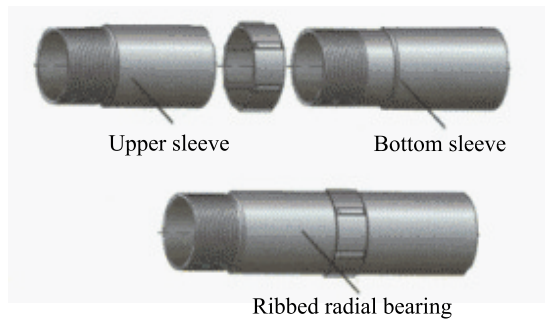


Fig. 20. Coring pipe stabilizers

3. SIDE CORING EQUIPMENT

Side coring is usually carried out using an equipment suspended on logging cable, similar to perforator. Special shaped jet charge (shot) is attached to a „dish“ which is (by explosive energy) launched against wall of the well. As the dish hits the wall, rock is pressed in; by moving the perforator up/down, the dish is released from the rock (it remains hanging on safety wires on the body of the sampler. Quality and efficiency of this coring is relatively low, as part of the core is made of flushing crust, dishes can be filled with debris or empty. This coring method is shown in Figure 21.

The company Halliburton Energy Services developed a special side coring equipment with a diamond crown, called Rotary Sidewall Coring Tool (RSCT). Up to 30 core samples can be taken per on insertion; it can take samples from where required. Diamond bit performs coring as ordered by operator (without distortion of core data). Cores dimensions are: $15/16'' \times 1 \ 3/4''$ [3].



Fig. 21. Side coring equipment

4. CONCLUSIONS

A core from the drilling operation is possible to get undamaged, in mechanical or physical sense, according to the technical tools and chosen technology of coring. Nowadays, different devices and some basic methods are used for the core withdrawal.

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