

DRILLING AND CORE LOGGING

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Introduction

- ▣ *Drilling is a cutting process that uses a **drill bit** to cut or enlarge a hole of circular cross-section in solid material.*
- ▣ *There are **four** main methods for drilling rocks :percussion drilling, churn drilling, diamond drilling and rotary drilling.*
- ▣ *In percussion-compressed air is used*
- ▣ *In churn(cable tool drilling)- heavy chisel like steel is repeatedly jerked up and down by a cable wire.*
- ▣ *In diamond – core is cut by rotating annular drilling bit impregnated with diamonds*
- ▣ *In rotary – a special non coring bit is rotated at the end of a length of steel rod*

Percussion drilling

- ▣ *It consists basically of a **hammer unit** which is driven by compressed air. This **hammer unit** imparts a series of short, rapid, blows to the drill steel or rods and at the same time slowly rotates them.*
- ▣ *Two main types of percussion drill:*
 1. ***down-the-hole hammer.***
 2. ***Top hammer.***

Down-the-hole hammer drills

- ▣ *As the name implies the hammer unit is lowered down the hole at the end of the rods.*
- ▣ *The bit on the end of the hammer unit consists of a large number of tungsten carbide inserts either button shaped or chisel ended.*
- ▣ *The percussive action is supplied to the bit by the hammer unit.*
- ▣ *Rotation of the rod is accomplished by a rotating unit on the rig itself.*
- ▣ *Mainly used for water well drilling and not commonly used in mineral exploration.*

Top hammer drill

- ▣ *In this type of drill both percussive action and rod rotation are provided by a hammer unit which is truck mounted on the rig and is moved up and down by a chain feed.*
- ▣ *The holes drilled by top hammer are smaller varying in diameter from 38-45 mm.*

Churn Drilling

- ▣ *First used for drilling oil wells in 1860's.*
- ▣ *Cheap and reliable way to drill water wells.*
- ▣ *It is a drilling technique in which a sharpened steel bit attached to rope or cable is repeatedly raised and lowered at the rate of 30-60 strokes/min and crushing the rock and making the hole deeper.*
- ▣ *The crushed rock and sludges are removed by a bailer to the bottom of the hole every 1-1.5 m of advance.*
- ▣ *Pouring of water is required both for drilling and bailing.*
- ▣ *Useful in exploration work for sampling soft formations upto a depth of 100-150 m.*



- ▣ *Main disadvantage is that churn drilling is very slow.*
- ▣ *A common fault is that the bailer does not clean out all the cuttings, and improper bailings may result in false increase of values with depth*
- ▣ *It is important to case off any overburden to avoid contamination.*

Diamond Core Drilling

- ▣ *Designed specifically for mineral exploration and is the most important type of drilling .*
- ▣ *Recovery of the core drill enables details of the geology, ground conditions and mineralogy to be obtained that is not possible with any other method.*
- ▣ *It was built by a Swiss Engineer in 1862 and by in 1900's , it became well established technique.*
- ▣ *The sample is cut by a diamond armored bit recovered in the inner barrel of the core barrel and brought to the surface.*



- ▣ *The hollow drill rod passes through a tube in the swivelhead and are held firmly in the place by a chuck.*
- ▣ *The swivelhead rotates the rod and has a feed mechanism for advancing the rods as drilling proceeds.*
- ▣ *The feed mechanism may be achieved by a screw fed through a system of gears, it may be hydraulic.*
- ▣ *They have gear boxes so that drilling speed can be varied according to the rock being drilled.*

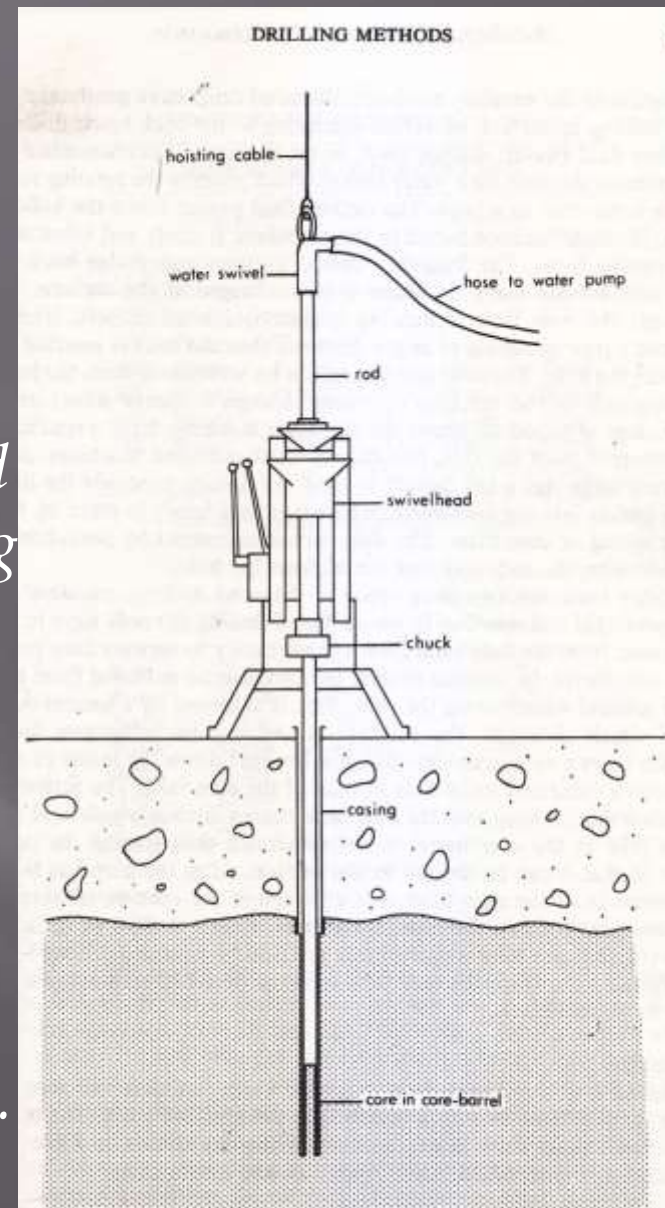
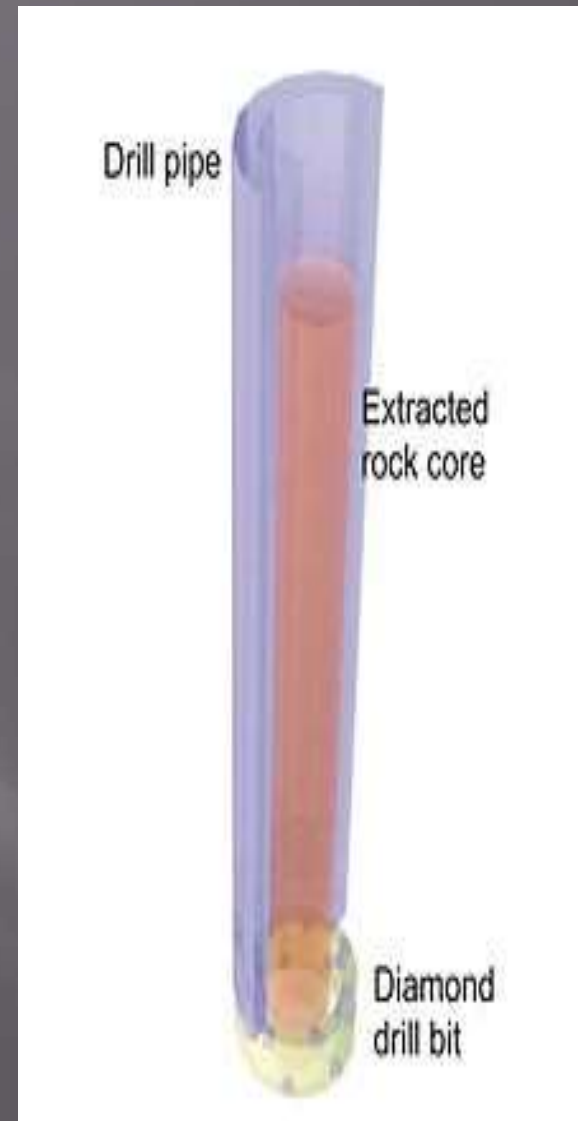


FIG. 7.4. Sketch showing the main working parts of a diamond drill.

- ▣ *Today there are two main types of diamond drilling; conventional and wire line.*
- ▣ *In conventional drilling the rods have to be removed from the hole each time. It is necessary to recover core from the Core barrel.*
- ▣ *In wire line drilling the core can be removed from the hole without withdrawing the rods.*





***DIAMOND CORE DRILING MACHINE AT HUTTI
Model-LT575 drilling***

Rotary Drilling

- ▣ *A mechanical device on a drilling rig that provides clock wise rotational force to the drill string to facilitate the process of drilling a bore hole.*
- ▣ *Much like a common hand drill, the spinning of the drill bit allows for penetration of even the hardest rock.*
- ▣ *Faster and cheaper than diamond drilling.*
- ▣ *Extremely high rate of penetration and the larger machines used in oil well drilling can drill over 100m/hr*



- ▣ *It can obtain sample fragments by chopping its way through almost any kind of ground- unconsolidated, heterogeneous, hard, or completely fractured.*
- ▣ *Casing can be driven into the hole a short distance behind the bit so that walls in loose rock will not cave in.*
- ▣ *The sample is collected in a bailer whenever enough broken rocks accumulate at the bottom of the hole.*

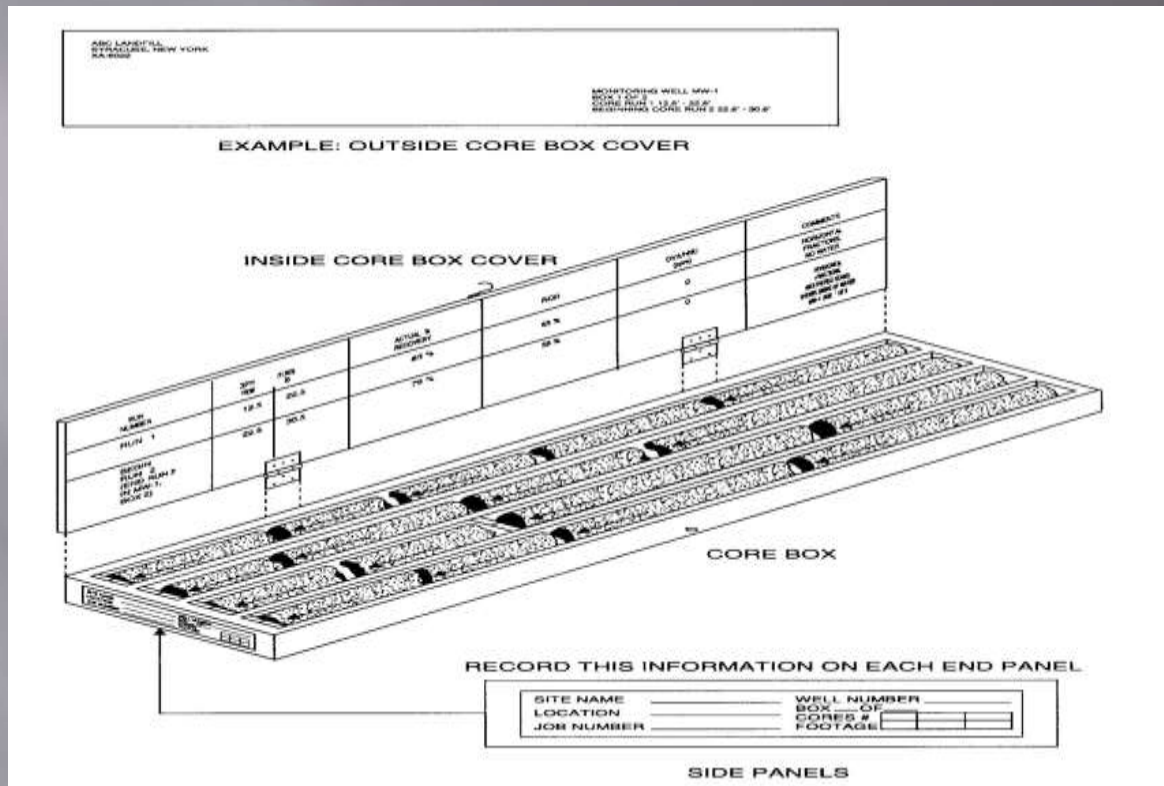
Other Methods

- ▣ **Jet Drilling**: It is a placer sampling method where a casing and chisel-pointed bit are advanced by percussion while water is forced ahead to loosen the material and to flush out and bring the sample to the surface.
- ▣ It is replacing churn drilling in many placer mining districts where minerals other than gold are involved.
- ▣ **Auger drills**: They are important in soil sampling, beach placer sampling, and in evaluating clay deposits. In any event, auger drilling stops at the first boulder.

Core Logging

- ▣ *Core – A cylindrical section of rock, or fragment thereof, taken as a sample of the interval penetrated by a core barrel and brought to the surface for examination and for analysis.*
- ▣ *All drill hole data gathering is called logging.*
- ▣ *For logging, the geologist will require a notebook, or logging sheets, pen, tape measure, penknife, clinometer or protractor, and ruler for measuring angles.*
- ▣ *For easy identification of rock types its best to look at wet core*





- ❑ *After the core has been recovered from the core hole and the core barrel has been opened, the core should be placed in a core box.*
- ❑ *The core should always be examined in good light, preferably natural light.*
- ❑ *No other skills are required other than the ability to make competent mineral and rock identification.*

- ▣ *The core boxes should be laid out in correct order.*
- ▣ *Small wooden blocks with the depth clearly written on with a marker pen*
- ▣ *The core that has been correctly placed in the Boxes should run from left to right with the shallowest depth in the top left-hand corner and the lowest Depth in the bottom right hand corner.*
- ▣ *The core samples are then studied carefully and all the important rocks and structures are noted along with the depth of formation.*



Conclusion

- ▣ *There are four methods of drilling: percussion drilling, churn drilling, diamond core, rotary , jet and auger drilling.*
- ▣ *Diamond core is the most efficient method of mineral exploration.*
- ▣ *There is much confusion in distinguishing between rotary and diamond drilling as both involve both a purely rotary action and diamond coring bits are also used in rotary rigs and non coring bits are also used often in diamond drilling.*
- ▣ *The distinguishing factor is that rotary motion in diamond drilling is imparted to the rods by a chuck, whereas in rotary, it is applied by a device called the rotary table.*
- ▣ *Rotary rigs are much bigger and powerful than diamond drilling machines.*

- ▣ *As drilling is an expensive undertaking , detail study of the area must be made before starting the project.*
- ▣ *Core logging forms an important aspect of an exploration geologist job and Important stage in the follow up work to an exploration target.*

Reference

- ▣ *Techniques in mineral exploration- J.H. Reedman. pg322-371. 1979*
- ▣ *Exploration and mining geology- William C. Peters. Pg no:431-460.*
- ▣ *en.wikipedia.org/wiki/drilling.*
- ▣ *en.wikipedia.org/wiki/core_drill.*
- ▣ *www.rems.de/diamond-core-drilling.aspx*



THANK YOU