Diamond Core Drilling for Mineral Exploration

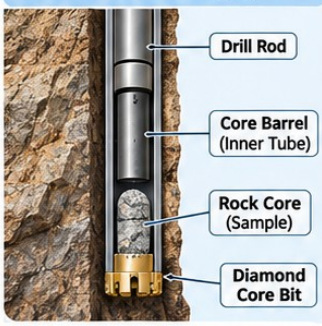
Diamond core drilling is an advanced drilling technique used in mineral exploration to extract continuous cylindrical rock samples (called core samples) from beneath the earth's surface. These samples help geologists identify, evaluate and quantify mineral deposits such as copper, gold, silver, iron ore, lithium, nickel and other valuable minerals.



How It Works

1. Rotating diamond bit cuts through rock.
2. Water circulates to cool the bit and remove cuttings.
3. Rock cores enter a hollow core barrel.
4. A wireline system retrieves the core samples.
5. Samples are examined and laboratory-tested to determine mineral content and grade.

Diamond Core Drilling System



Core Samples



Common Drilling Sizes

Size	Hole Dia. (mm)	Core Dia. (mm)
BQ	60.0	36.5
NQ	75.7	47.6
HQ	96.0	63.5
PQ	122.6	85.0

Key Applications

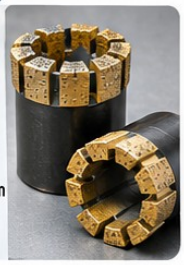
- Copper and gold exploration
- Geological mapping and rock assessment
- Identifying mineralisation depth and thickness
- Determining mineral grades and resource potential

Diamond Core vs RC Drilling

Parameter	Diamond Core Drilling	RC Drilling
Sample	Continuous rock core	Rock chips
Geological detail	High and reliable	Limited
Drilling speed	Generally slower	Generally faster
Cost per metre	Higher	Lower
Best use	Resource evaluation and detailed studies	Initial exploration and large coverage

Key Equipment

- Diamond drilling rig (high torque)
- Wireline core barrel and overshot
- Diamond core bits
- Drill rods (NO/HO/PQ)
- Hydraulic feed system
- Mud/water pump and circulation system
- Rod handling equipment





Application in Pakistan

Particularly relevant to copper–gold exploration in:

- Reko Diq
- Saindak
- Chagai Mineral Belt



Key Performance Indicators

- ✓ Drilling depth
- ✓ Penetration rate (ROP)
- ✓ Core recovery
- ✓ Torque and pullback capacity
- ✓ Cost per metre

Our Capability | We are capable of diamond core drilling upto **1,500 metres** depth in inclined holes.

Illustrated overview of diamond core drilling, equipment, core samples and exploration applications.

1. How does diamond core drilling work?



Typical diamond core drilling rig operating in a mineral exploration area.

A diamond-impregnated drill bit rotates and cuts through rock. Water circulates through the drill rods to cool the bit and remove cuttings. A cylindrical rock sample enters the hollow core barrel. The barrel is retrieved, the core is removed and labelled, and the samples are placed in core boxes for geological examination and laboratory testing.

2. Main components of a diamond core drilling system

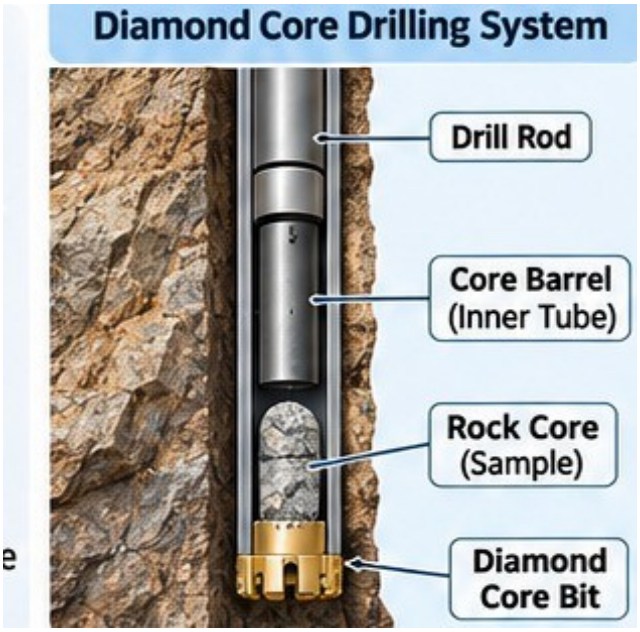
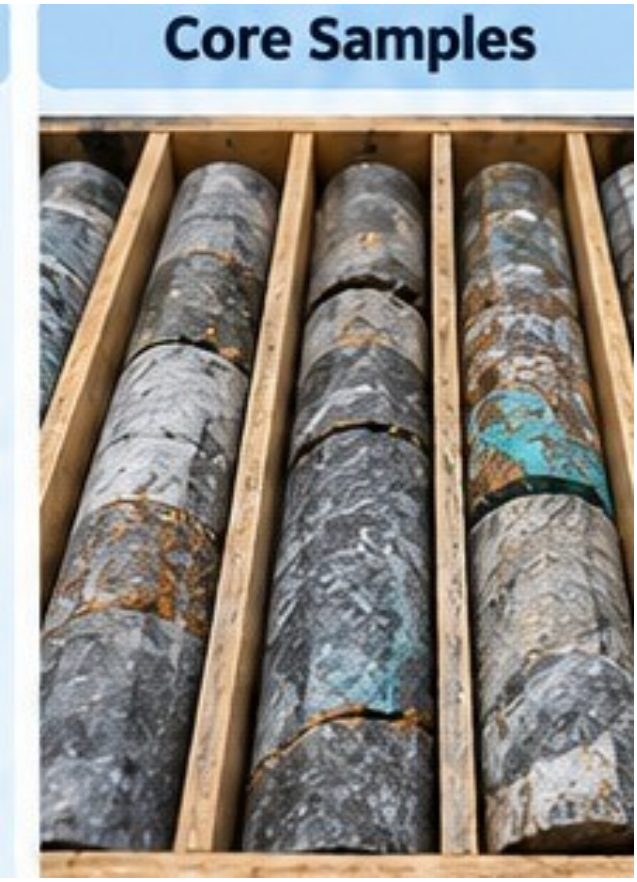


Illustration of the core drilling assembly and sample path.

Drilling rig	Provides rotation, torque and feed pressure.
Diesel engine	Supplies power.
Hydraulic system	Controls drilling operations.
Drill rods	Transfer rotation and torque.
Diamond core bit	Cuts the rock formation.
Core barrel and inner tube	Collect and retain the rock core.
Wireline and overshot	Retrieve the inner tube without pulling out the complete rod string.
Mud/water pump	Circulates drilling fluid.
Rod handling system	Handles and connects drill rods.

3. Common diamond core drilling sizes



Examples of recovered mineral exploration drill core.

The commonly used wireline sizes are BQ, NQ, HQ and PQ. Approximate standard dimensions are:

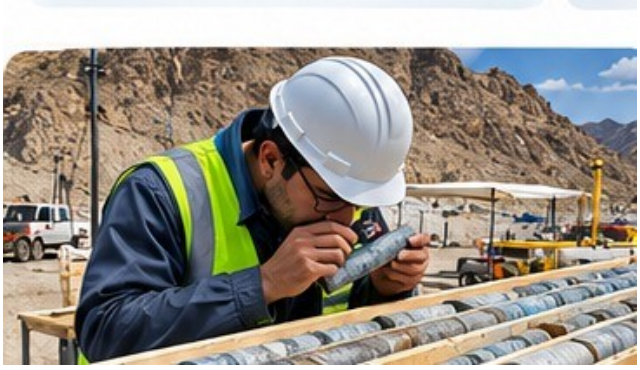
Size	Hole diameter	Core diameter
BQ	60 mm	36.5 mm
NQ	75.7 mm	47.6 mm
HQ	96 mm	63.5 mm
PQ	122.6 mm	85 mm

NQ is commonly used for exploration and deeper drilling; HQ provides a larger core; PQ is selected when larger samples are required. Actual selection depends on geology, depth, sample requirements and project economics.

4. Wireline diamond core drilling

Modern mineral exploration commonly uses wireline systems. When the inner tube is full, an overshot is lowered through the drill rods on a wireline cable and connects to the inner tube assembly. The inner tube is pulled to the surface, the core is removed, and the tube is lowered again. This avoids pulling the entire drill string for every core run, saving considerable time, particularly in deep holes.

5. What information does diamond core drilling provide?



Geological inspection and logging of recovered drill core.

- Geology: rock types, formations, faults, fractures and alteration zones.
- Mineralisation: the presence and distribution of copper, gold, silver, sulphides and other minerals.
- Ore grade: laboratory assays establish the concentration of valuable minerals.
- Deposit geometry: information on the depth, thickness and continuity of mineralised zones.

For example, copper assay results may be reported as 0.35%, 0.85% or 1.25% Cu. These results are interpreted alongside geological information; grade alone does not establish commercial viability.

6. Diamond core drilling versus RC drilling

Parameter	Diamond core drilling	RC drilling
Sample	Continuous rock core	Rock chips
Geological detail	Very high	More limited
Speed	Generally slower	Generally faster
Cost per metre	Generally higher	Generally lower
Typical use	Detailed investigation and resource evaluation	Initial exploration and rapid sampling

7. Applications in Pakistan

Diamond core drilling is relevant to copper-gold and other mineral exploration in Pakistan, including the Reko Diq and Saindak areas and the wider Chagai mineral belt. A drilling programme may use multiple boreholes to investigate the extent, continuity and grade of mineralisation. Programme depths and hole numbers depend on the exploration objectives and geological model.

8. Key performance parameters for a drilling rig



Diamond-impregnated core bits used to cut hard-rock formations.

Maximum drilling depth	Capacity by hole size (NQ, HQ and PQ).
Engine power	Available power for drilling and auxiliary systems.
Torque and RPM	Ability to rotate the bit under different formation conditions.
Pullback capacity	Ability to retrieve rods and core-barrel assemblies.
Feed force	Ability to apply controlled weight on bit.
Pump capacity	Adequate circulation for cooling and hole cleaning.
Rod handling and wireline system	Productivity, reliability and operational safety.

9. Typical drilling operation

1. Mobilisation of the drilling rig and preparation of the drill pad.
2. Collaring and setting up the borehole.
3. Drilling and continuous core recovery.
4. Core handling, marking and geological logging.
5. Core cutting, sample preparation and laboratory assays.
6. Geological interpretation and resource modelling.

Core recovery is an important quality indicator. For example, recovering 2.85 metres of core from a 3-metre run gives 95% recovery. Recovery can be affected by fractured or weak formations and drilling practices.

10. Commercial opportunity for a drilling contractor

Our drilling capability: We are capable of undertaking diamond core drilling in inclined holes to depths of up to 1,500 metres.

Potential revenue streams include per-metre drilling, mobilisation and demobilisation, drilling consumables, mud engineering, core orientation, borehole surveying and complete exploration drilling packages.

Indicative configuration: A modern wireline rig with around 1,000 metres NQ capacity and suitable HQ capability can be a useful starting point for mineral exploration contracts. The required configuration should be checked against actual torque, pullback, feed force, rod specifications, formation conditions and the planned hole diameter. A stated 1,000-metre NQ capacity does not mean the rig can drill 1,000 metres in HQ or PQ.

OUR CAPABILITY
DIAMOND CORE DRILLING UP TO 1,500 METRES
IN INCLINED HOLES