MI5

Icefield MI5 Orientation Tool

JOIDES Resolution Science Operator

Scientific Application

The Icefield MI5 Multishot Orientation Tool orients Advanced Piston Corer (APC) cores by taking orientation measurements for a short period of time just prior to when the core is taken. During this time the drill string is kept steady while the tool measures and stores:

- azimuth
- inclination
- toolface gravity
- toolface magnetism
- total magnetic field strength
- magnetic dip angle
- probe temperature

The orientation tool contains triaxial accelerometers and magnetometers and is run on the APC bottom-hole assembly (BHA) within a nonmagnetic collar. The tool is synchronized with the Meazura™ MEZ1000 Palm device (yellow object in photo below) prior to deployment. After deployment, the recorded data are downloaded to the Palm device.

Operation

Earth's total magnetic field strength changes at any particular point on Earth and is characterized by several parameters: declination, inclination, and intensity. Magnetic field strength values increase toward the poles but only change minimally with borehole depth. Declination is the angular difference between true (geographic) north and magnetic north. Inclination is the angle that the lines of the magnetic field make with a horizontal plane. Near the Equator inclination is nearly horizontal (0°), but it steepens toward vertical (90°) at the poles.

The core orientation process determines the angular correction to apply to the core's declination values measured in the lab. The Icefield MI5 tool is connected to the core barrel in such a way that the double lines on the core liner are at a fixed known angle to its sensors. The Icefield MI5 tool records an azimuth to magnetic north for each core. This azimuth combined with the local magnetic declination values allow scientists to correct the measured core declinations back to true coordinates.

Icefield MI5 Orientation Tool.

Features

Rapid Data Collection

The Icefield MI5 tool can record core orientation as rapidly as every 10 seconds, adding only 5 min to each core barrel run.

Long Measurement Time

Each tool can run up to 24 hr (at shortest sampling interval) before downloading is required, but the tools are generally switched about every 12 hr.

Icefield Orientation Tool in sinker bar on the rig floor.

Specifications

Size

Bare Instrument

Diameter: 25.4 mm

Length: 1.16 m

Weight: 1.9 kg

Pressure rating: 300 m (H_2O)

Pressure Housing

Diameter: 33.4 mm

Length: 1.88 m

Weight: 8.6 kg

Pressure rating: 3500 m (H_2O)

Power Source

Six AA lithium batteries

Sensors

Inclination

Type: triaxial

Range: 360° (any orientation)

Accuracy: ±0.1°

Shock: 6000 g

Magnetometer

Type: triaxial

Range: 100,000 nT

Accuracy: ±0.5 nT

Temperature

Type: solid state

Range: –30°C to +85°C (–22˚F to +185˚F)

Accuracy: ±1°C

Operating Range

Temperature

Probe: –30°C to 85°C

Measurements

Azimuth: 0° – 360° ± 0.1°

Inclination from horizontal: ±90° ± 0.1°

Toolface magnetism: 0° – 360° ± 0.1°

Magnetic field strength: 0 – 100,000 ± 5 nT

Magnetic dip: –90° to 0° ± 0.1°

Limitations

The Operations Superintendent generally has the tool removed when the overpull reaches ~40,000 lb.