

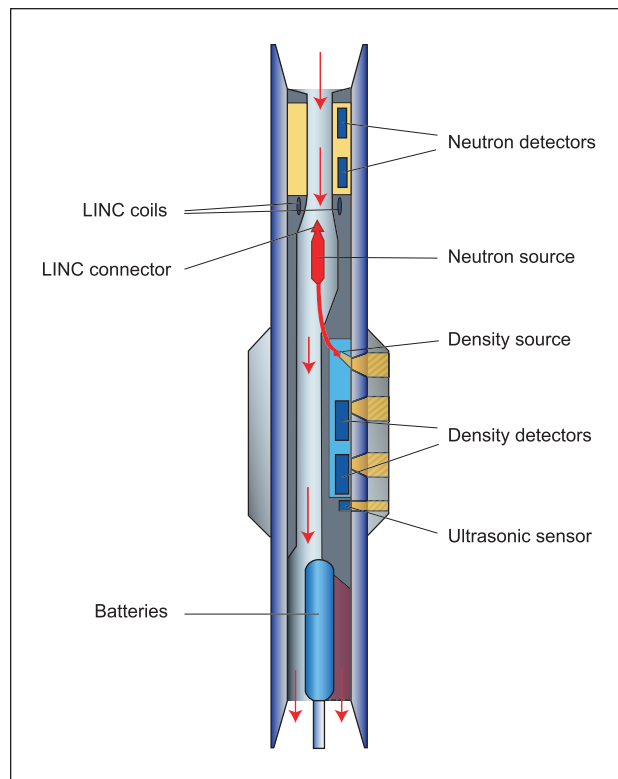
Logging-While-Drilling Azimuthal Density Neutron Tool

Description

The Azimuthal Density Neutron tool (LWD-ADN) is the latest generation density/neutron LWD tool offered by Schlumberger Drilling & Measurements. Similar to its predecessor, the Compensated Density Neutron tool (CDN), it is combinable with other LWD tools. Unlike the CDN, however, the ADN can be configured to provide real-time apparent neutron porosity, formation bulk density and photoelectric factor data to characterize formation porosity and lithology while drilling. These nuclear measurements are borehole compensated for improved accuracy, standoff, and photoelectric factor measurements while drilling.

Applications

- ◆ *In situ* estimation of bulk porosity and permeability
- ◆ Estimation of fluid pressure
- ◆ Lithology estimation and rock chemistry characterization
- ◆ Provides information regarding the spatial variation of physical properties around the borehole



Schematic illustration of the Azimuthal Density Neutron tool (LWD-ADN).



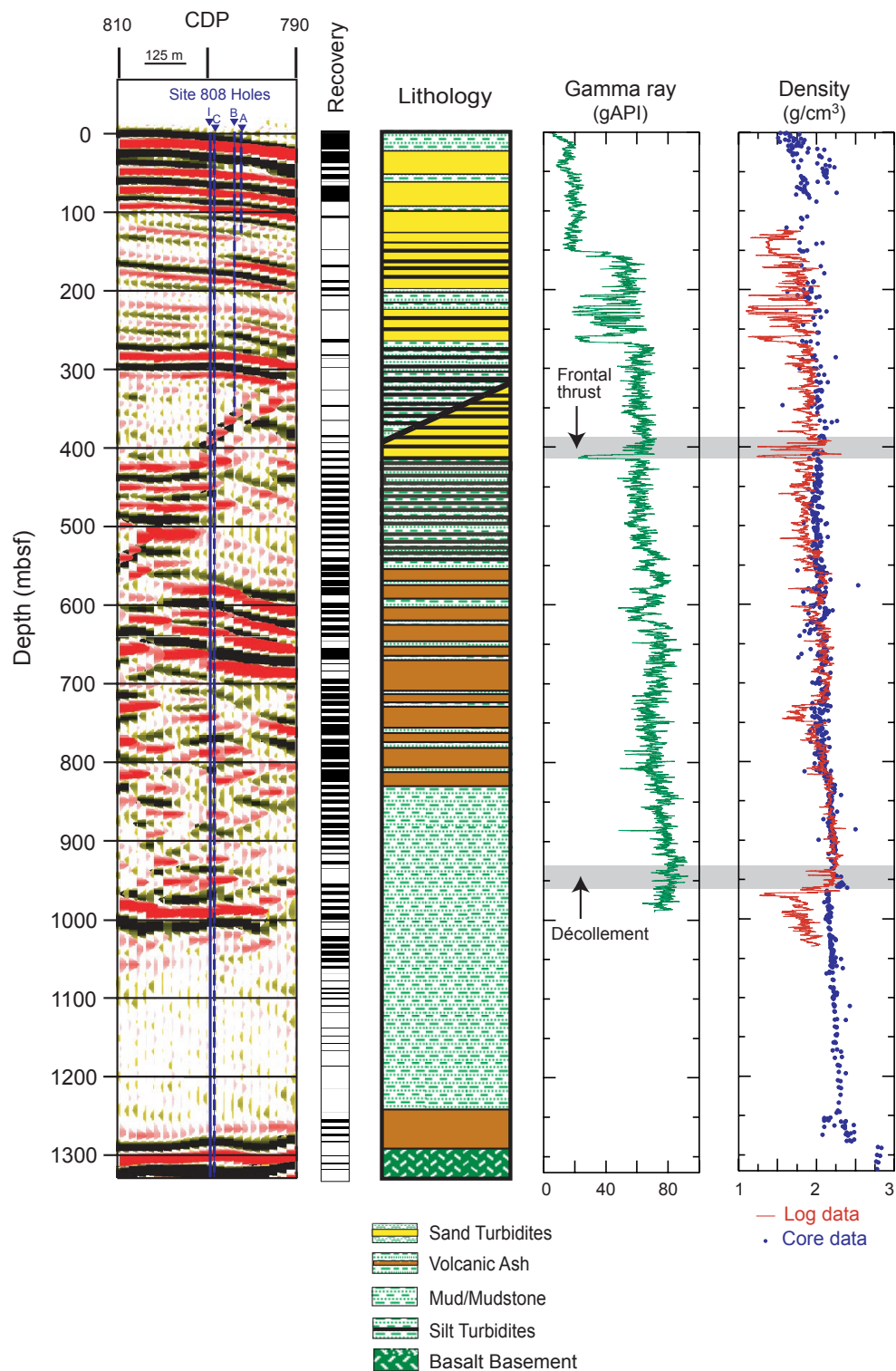
Assembly of the ADN tool aboard the JOIDES Resolution.

Specifications

Tool weight:	2000 lbm (907 kg)		
Tool length:	21.7 ft (6.62 m)		
Temperature range:	-13° to 300° F (-25° to 150° C)		
Collar OD:	6.75 in. API tolerances		
Stabilizer OD:	8.25 - 9.875 in.		
Maximum rotary torque:	16,000 ft-lbf		
Measurement specifications (8.5-in. hole, with stabilizer)			
	<i>Accuracy</i>	<i>Statistical repeatability* at 200 ft/hr</i>	<i>Vertical resolution</i>
Density, avg.	+/- 0.015 g/cm ³	+/- 0.006 g/cm ³	6 in.**
Neutron porosity, avg.	+/- 0.5 p.u. +/-5%	+/- 1.5 p.u.	12 in.**
PEF, avg.	+/- 5%	+/- 0.25 unit	2 in.**
Maximum weight on bit:	F= 74,000,000/L ² lbf (where L is the distance between stabilizers in feet)		
Max. overpull (no bending):	330,000 lbf		
Max. operating pressure:	20,000 psi		
Maximum flow rate:	800 gal/min		

* Repeatability due to counting statistics at 2 samples/ft using 3-point averaging.

** Sensor specifications. Actual data resolution depends on sampling rate.



Summary diagram showing combined results from a variety of measurements. From left to right: depth-converted seismic reflection data, core recovery, lithology, log gamma ray, and core and ADN density. (Figure courtesy of the ODP Leg 196 shipboard scientific party.)