Drilling Rates through Oceanic Crust

Introduction

Composition, structure, fracturing, and other factors may influence the length of time required for drilling through oceanic crust. The drilling rate can be determined by noting the distance drilled, the length of time it took to drill, and calculating the ratio between them. Drilling rates are one of many indicators used by drillers and engineers to make important decisions about equipment choices and changes. Good decision-making by the driller provides the highest quality cores for scientific study.

Learning Objectives

Students will be able to:

- Calculate drilling rates over a three-day period during Expedition 309 by using the data provided.

National Science Education Standards

Standard D: Earth and Space Science

Standard G: History and Nature of Science for grades 9-12

Ocean Literacy Principles

1. Earth has one big ocean with many features.
2. The ocean and life in the ocean shape the features of Earth.
7. The ocean is largely unexplored.

Target Age: Grades 9-12, undergraduates

Time: One class period

Materials

- Calculators
- Additional paper

Vocabulary

Use a dictionary to define the following terms.

- Rate of Change
- Military time scale

What To Do

1. Complete the drilling rate table below by filling in the missing data for cores 75 to 89.

Hints:

Core top depth = core bottom depth minus length cored;

Drill time = time elapsed between dropping the core barrel and the time it was brought back on deck;

Drilling rate = length cored divided by drill time;

Analysis

1. Why is it important to keep track of the drilling rate?
2. What factors could slow the drilling rate?
3. How could a driller increase drilling rates?
4. List some natural factors that could increase the drilling rate.
5. Calculate the average drilling rate for cores 75R and 89R.

Extensions

Four related careers – driller, tool pusher/core technician, offshore installation manager, and operations superintendent – can be downloaded and read from the Deep Earth Academy career interactive at *www.oceanleadership.org/education/deep-earth-academy/students/careers*.

Watch the Tripping Pipe video (*www.oceanleadership.org/education/deep-earth-academy/resources/videos/*) and the Drilling Operations 24/7 video at *http://joidesresolution.org/node/776*.

Drilling Rates Table for Cores 75R – 89R

Expedition 309 Site/Hole 1256D

Core #	Core barrel dropped	Time on deck	Core top depth (mbsf)	Core bottom depth (mbsf)	Length cored (m)	Length of core ecovered (m)	Drill time (hr)	Drilling Rate (m/hr)
75R	09:45	14:25		752.0	1.9	1.28		
76R	14:25	20:30		753.9	4.8	1.23		
77R	20:30	04:30		758.7	4.8	1.65		
78R	04:30	11:15		763.5	6.1	2.90		
79R	11:15	17:05		769.6	9.6	2.65		
80R	17:05	21:00		779.2	9.6	3.11		
81R	21:00	05:50		788.8	3.4	0.68		
82R	05:50	09:30		792.2	7.0	1.20		
83R	09:30	15:35		799.2	2.6	1.28		
84R	15:35	01:25		801.8	9.6	2.04		
85R	01:25	06:35		811.4	9.6	7.11		
86R	06:35	18:10		821.0	9.6	3.65		
87R	18:10	04:25		830.6	9.6	3.26		
88R	04:25	11:10		840.2	9.6	1.32		
89R	11:10	13:55		849.8	9.6	0.60		

A roughneck on the JOIDES Resolution *helps guide the drill pipe using the drawworks during the pipe tripping process. (image courtesy IODP-USIO)*

Roughnecks aboard the JOIDES Resolution *guide the drill bit through the rig floor and towards the seafloor to begin drilling for cores. (image courtesy IODP-USIO)*