

## 20. SITE 230

The Shipboard Scientific Party<sup>1</sup>

### BACKGROUND AND OBJECTIVES

Site 230 was chosen from the *Glomar Challenger* seismic profile obtained on the approach to Site 229. The site lay at a point equidistant from Jebel at Tair and Zebayir Island (Figure 2) where the S reflector was apparently seen beneath about 0.15 sec of sediment. This identification of the S reflector at 15°19'N, if correct, would represent the southernmost known extent of Miocene evaporites in the central Red Sea, although some thousands of feet of evaporites were met in the Gulf well Secca Fawn-1 at 15°23'N, 40°10'E. Wells were also drilled in the Yemen by Mecom at Zaydiyah, Salif, and Hodeida, which lie between 15°20'N and 14°50'N, but the logs of these wells have not been published (Ahmed, 1972). Brown (1971), however, indicates salt diapirs at Zaydiyah and Salif. However, this occurrence of the S reflector was also remarkable in that the reflection extended right up to the west side of the axial trough where the reflector apparently cropped out.

Thus the objective of the site was to determine the nature of the S reflector.

Although this site was unscheduled and had therefore not been considered by the JOIDES Advisory Panel on Pollution Prevention and Safety, the general recommendations of this Panel for the Red Sea sites were followed.

### OPERATIONS

Site 229 had to be abandoned prematurely because of the increasing ethane/methane ratio encountered in the cores. Consequently, 4 days of Leg 23 remained without a scheduled site within the steaming range of *Glomar Challenger*. As a result, the Co-Chief Scientists had to choose a new site. Such a site was located between Jebel at Tair and the Zebayir Islands but just outside the 12-mile territorial limits.

Gear was streamed only about 15 km from the site because of the need to observe the territorial limit around the Zebayir Islands. The site was approached from the east at 5 knots at 1700 hours on 28 Apr 72 (Figure 3). On the run west the ship went almost as far as the 100 fathom

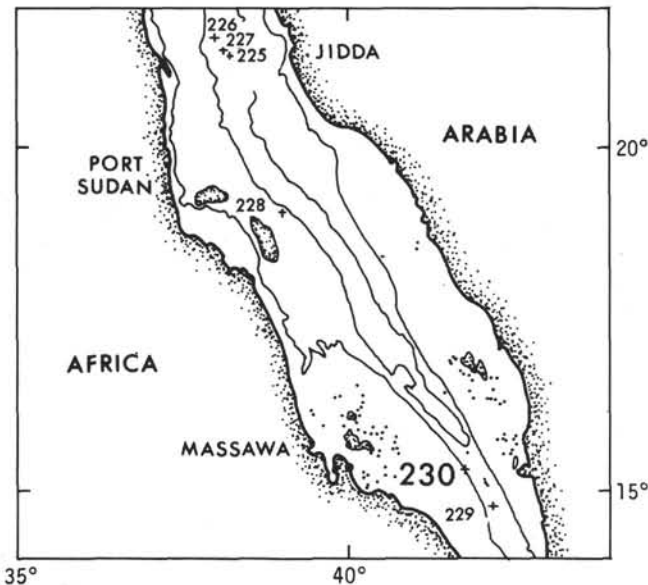


Figure 1. Position of Site 230 and other Leg 23 sites in the Red Sea. Contours at 200 and 1000 meters, from Laughton (1970).

### SITE DATA

Dates: 1530 28 Apr-0200 29 Apr 72

Time: 11 hours

Position (Figure 1): 15°19.00'N, 41°50.05'E

Holes Drilled: 1

Water Depth by Echo-Sounder: 832 corr. meters

Total Penetration: 9 meters

Total Core Recovered: 13.4 meters from 2 cores

Age of Oldest Sediment: Late Quaternary

Basement: Not reached

### ABSTRACT

A greenish Late Quaternary nanno ooze with thin beds of volcanic ash was recovered. The 59‰ salinity of the sediment pore water suggests the presence of halite not far below the sea bed.

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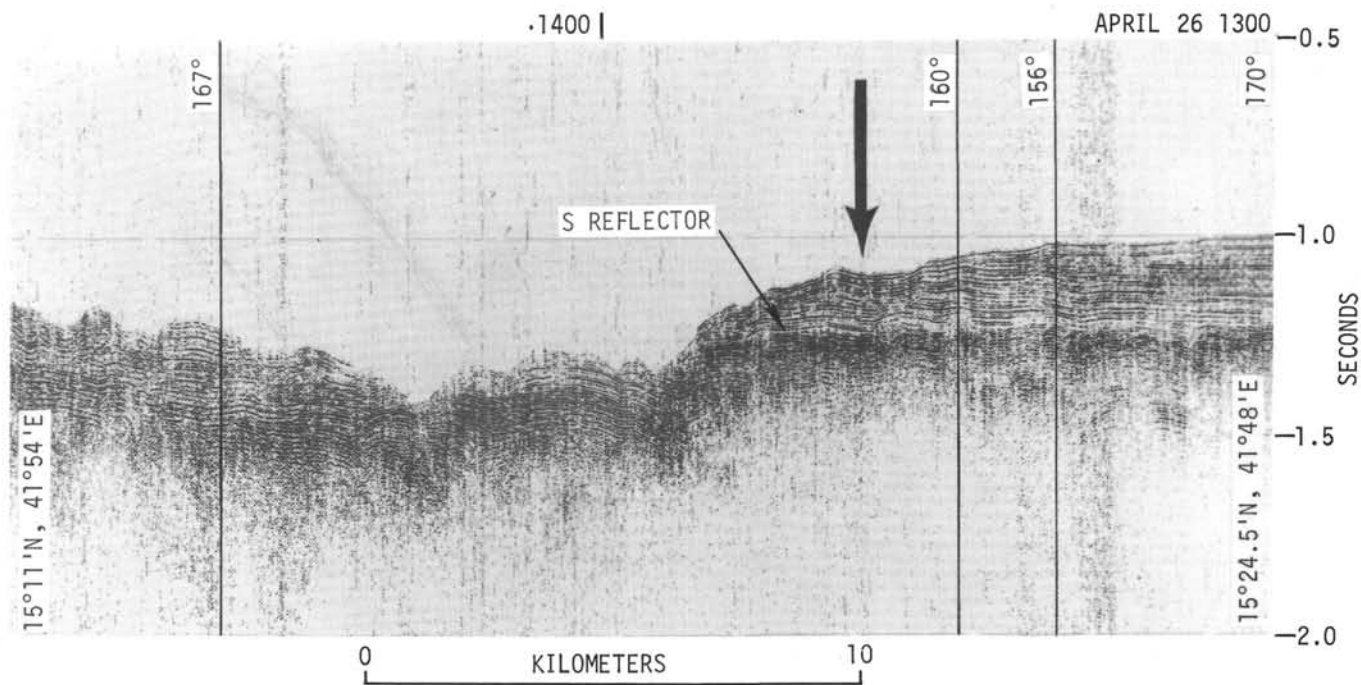


Figure 2. Seismic reflection profile obtained by Glomar Challenger while skirting the west side of the axial trough on passage to Site 229. The S reflector is visible in the right-hand half of the profile. The proposed site is arrowed. See Figure 3 for track.

(185 m) contour, then turned to port, and made directly for the position of the proposed site.

On this profile across the proposed site a water depth of 884 meters was found over at least 0.1 sec of sediment. A pair of dye markers was dropped overboard at 1805 hours and the gear immediately retrieved. Because of the high seas, the beacon had to be dropped while the ship was not underway. The dye markers could not be found in the failing light. The ship had presumably been set downwind (northward) because the bottom shoaled 55 meters. A 13.5-kHz beacon was dropped at this point and drilling operations began as soon as the ship was hove to.

Drilling at Site 230 was very difficult due to the poor weather conditions (60 mph winds, 15-18 foot waves) and the shallow water depth (832 m). After taking a punch core, we encountered difficulties in staying over the site, in part due to a poor signal from the beacon, and had to withdraw the pipe above the mud line. A new beacon was then dropped. While attempting to adjust our position, we accidentally spudded in again, due to the heave of the ship and obtained another, but disturbed, core. (See Table 1 for the Coring Summary.) The site was finally abandoned at 0230 hr because of the impossibility of keeping the ship within 40 feet (12 m) of the beacon. To stay on station, 170 revolutions per minute were needed on the ship's main screws, and aeration around the hydrophones caused the acoustic link with the beacon to often break.

Glomar Challenger departed from Site 230 at 0500 hours on 29 Apr 72 and headed south for the Straits of Babel Mandeb. Due to the shallow water depth, territorial problems, and the repetition of our earlier track, only the magnetometer was streamed.

LITHOLOGY

The stratigraphic section of 9 meters penetrated at this site consists of yellowish-green to pale olive carbonate

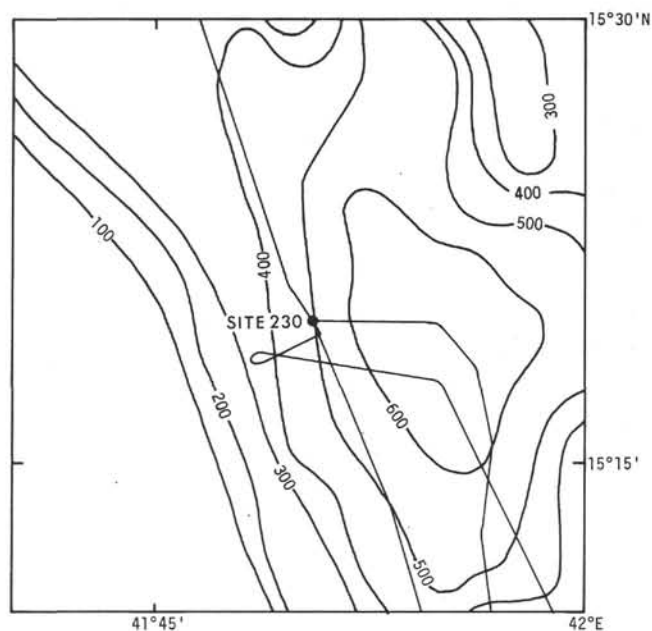


Figure 3. Bathymetric chart of the area around Site 230 with the tracks of Glomar Challenger. The passage track from which the site was chosen extends from north to south on the chart (see Figure 2). Contour interval 100 fathoms depths in corrected fathoms. Contours based on collected soundings too numerous to show clearly (after Laughton, unpublished).

nanno ooze. Tests of pteropods, foraminifera and nannofossils, fine carbonate particles, and zeolite are the major components. A single sample contained 80% calcium carbonate. Thin streaks of volcanic ash occur throughout the cored interval.

### BIOSTRATIGRAPHY

#### Foraminifera

The samples examined from Site 230 contain an abundant Late Quaternary fauna which is relatively diverse but dominated by *Turborotalita quinqueloba* and assorted juvenile specimens.

#### Nannofossils

Site 230 was drilled in sediments of Late Quaternary age. Nannofossils observed include *Gephyrocapsa oceanica*, *Gephyrocapsa protohuxleyi*?, *Helicopontosphaera kamptneri*, *Emiliania huxleyi*, *Umbilicosphaera mirabilis* and *Syracosphaera histrica*. Nannofossils are abundant and very well preserved in the only core recovered.

#### Radiolaria

No Radiolaria were recovered at this site.

#### Biostratigraphic Summary

Samples from Site 230 contain abundant Late Quaternary nannofossils and foraminifera. Radiolaria are absent.

TABLE I  
Coring Summary, Site 230

Core	Date/Time Core on Deck (Time Zone -3)	Subbottom Depth (m)	Cored (m)	Recovered (m)
1	28 Apr 2230	0-9	9.0	4.2
2	29 Apr 0430		0.0	9.2
Total			9.0	13.4

### GEOCHEMISTRY OF SEDIMENTS

A single resistivity/salinity measurement was made on the core from this site. Sample 230-1, CC has a resistivity,  $R_s$ , of 0.31 and a formation factor,  $F$  of 2.7. Pore water pH was 7.36, the corrected salinity 59.0‰, and the alkalinity 3.3 meg/kg. These measurements were made between 22.8 and 24.0°C.

### CORRELATION OF REFLECTION PROFILES AND LITHOLOGIES

The objective of this site was to determine the nature of reflector S which lay about 150 meters below the sea bed.

Reflection profiles obtained on the approach to the site showed that it lay over a probably slumped or downfaulted block situated about halfway down the west side of the axial trough (Figure 4). The drilled hole did not reach the reflector for operational reasons. However, the 59‰ salinity of the interstitial water in the only undisturbed core which was recovered strongly suggests, on the basis of experience gained from the other Red Sea sites, that the S reflector does represent the top of the evaporites here.

### DISCUSSION AND CONCLUSIONS

The site lay on the west side of the axial trough near the foot of a relatively steep slope leading up to the shallow shelf area of the southwestern Red Sea. A seismic profile oriented roughly north-south, obtained earlier on the approach to Site 229, had shown a distinct reflector similar to the S reflector seen further north (Figure 2). The east-west approach to Site 230 revealed that this reflector lay on the side of the axial trough and probably cropped out about 150 meters above the valley floor.

Due to operational difficulties, only a single core was obtained at this site (a second core was obtained inadvertently, when the bit had been pulled above the bottom, due to a combination of the ship's heave and the shoaling of the water as the ship drifted off station). The core consisted of a Late Quaternary greenish carbonate nanno ooze with tests of pteropods, foraminifera and nannofossils, fine carbonate particles, and zeolite. There are also thin streaks of volcanic ash in the core. The nearby young volcanoes of Jebel at Tair and Zebayir are likely sources of this ash.

The most interesting aspect of the core, however, was the salinity of the pore water. This water had a salinity of 59‰ which is a 50% increase over the normal salinity of Red Sea water. This discovery strongly suggests that the interpretation of the underlying reflector as the top of the evaporites (anhydrite?) is correct and suggests, too, that halite exists not far below the reflector. Assuming an average sediment velocity of 1.8 km/sec the reflector would be at a depth of about 110 meters below the sea bed.

### REFERENCES

- Ahmed, S. S., 1972. Geology and petroleum prospects in Eastern Red Sea: Am. Assoc. Petrol. Geol. Bull., v. 56, p. 707-719.
- Brown, G. F., 1971. Tectonic map of the Arabian Peninsular, U.S.G.S.: Saudi Arabian Project Rept. 134, Min. Petrol. Min. Res., Kingdom of Saudi Arabia.
- Laughton, A. S., 1970. A new bathymetric chart of the Red Sea: Phil. Trans. Roy. Soc. London, Series A, v. 267, p. 21-22.

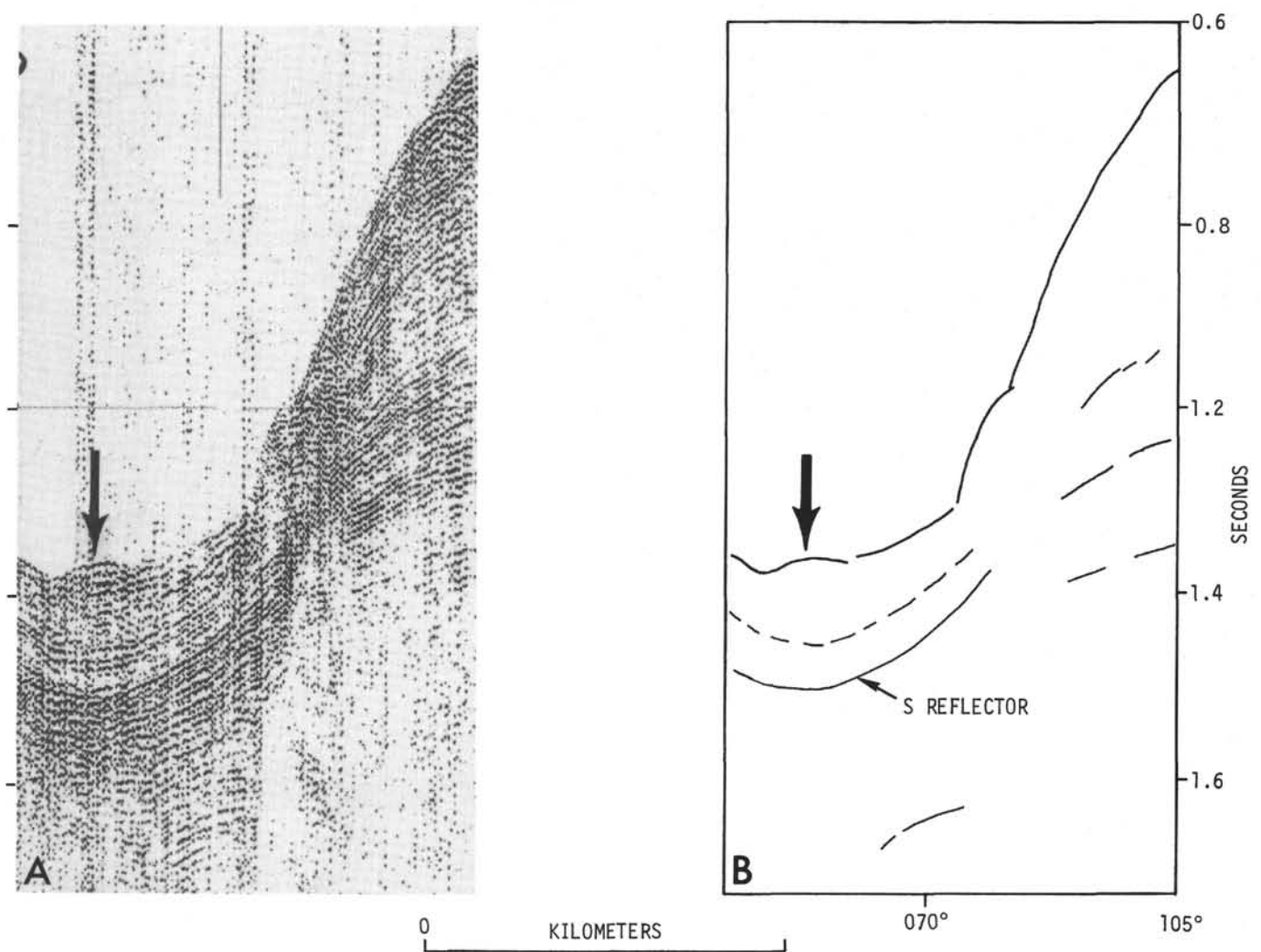


Figure 4. (a) Seismic reflection profile obtained on the approach to the site. The axial trough at this latitude is about 1.45 sec (1150 m) deep. The arrow marks the point where two dye markers were thrown into the sea. The final site position was a few hundred meters away. (b) Line drawing interpretation of Figure 4a showing the S reflection and other prominent reflections. Note the course change.