

Cruise Synopsis: *Oceanus* #270  
June 23-July 13, 1995  
New Jersey Shelf-Upper Slope

**High-Resolution Seismic Surveying for Neogene-Recent  
Sequence Stratigraphy, in Support of STRATAFORM and the  
Ocean Drilling Program's Mid-Atlantic Transect**

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Introduction

STRATAFORM's primary goal is to understand how the complex array of depositional processes on continental margins translates into the preserved stratigraphic record. The primary scales of interest are  $\sim 10^6$  years into the past, and  $\sim$ hundreds of meters into the seafloor. Nested arrays of geophysical data on the shelf and upper slope are the primary means to imaging stratigraphic successions and associated facies architecture. Low resolution (20-100 Hz) multichannel seismic and very high-resolution (500-3500 Hz) single-channel Hunttec profiles have already been collected offshore New Jersey. One objective of the recent *Oceanus* effort was to collect profiles in the intervening frequency band ( $\sim 30$ -500 Hz). The second objective was to complete detailed grid surveys and assess potential hydrocarbon hazards in the vicinity or proposed ODP drill sites. These sites will comprise a critical segment of the Mid-Atlantic Transect (MAT), that is designed to understand the history of Neogene sea-level on this margin. ODP drilling could also provide valuable ground truth for the geophysical profiles collected in support of STRATAFORM. All of these data support designation of this part of the New Jersey margin as a natural laboratory for marine geology/geophysics and shallow water acoustics.

Methods

The cruise was conducted on the Woods Hole Oceanographic Institution vessel *Oceanus*. The seismic acquisition and navigation systems were owned by John Chance & Associates, Inc. of Lafayette, LA, and operated by them under contract to Lamont-Doherty Earth Observatory. A single 90 cu. in. GI air gun fired at 2000 psi generated an extremely clean outgoing pulse. Both the gun and the 48-trace, 12.5 m group

streamer were towed at 7 feet for most of the cruise; during several extraordinarily calm days we reduced this to 4 feet to preserve especially high acoustic frequencies. Data were recorded at 0.5 ms sampling. The original goal was to shoot every 6.25 m along pre-plotted lines and process the data 48-fold. However, jitter in the differential GPS navigational system that fired the gun on distance over the seafloor, combined with the need to maintain at least 3.5 kt through the water for optimal streamer towing, dictated a 12.5 m shot spacing (24-fold stacking) for most profiles. After some discussion, the decision was made to collect analog 3.5 kHz profiles for the entire cruise; original plans called for 3.5 kHz acquisition only for site grids. That course of action proved beneficial; quality of the 3.5 kHz records (albeit non-heave compensated) is generally excellent.

## Results

We collected ~950 nautical miles of regional high resolution multichannel seismic (MCS) reflection profiles (~830 nmi were proposed) (Fig. 1) and surveyed 8 MAT sites of roughly 15 nmi each (7 were proposed) (Fig. 2). Superb weather and few equipment malfunctions resulted in only ~10% downtime (we had expected ~20%). With minor exceptions, the John Chance system performed extremely well. We stacked and migrated selected portions of the MCS data at-sea for both quality control and on-site evaluation of safety hazards in the grid surveys; though our assessment is preliminary, no obvious hazards were found. The data quality appears to be outstanding, particularly on the slope, where the water bottom multiple is too deep to interfere with primary reflections (Fig. 3A/B). Slope data will be used to put ODP Leg 150 results into a regional context, and will strengthen data exchange and discussion among investigators of the sequence stratigraphy and slope projects of STRATAFORM. On the shelf, multiple removal will be the primary processing challenge (Fig. 4); shorebased efforts are underway both at UTIG and L-DEO to deal with this issue.

The grid surveys will be processed first to meet ODP deadlines in fall, 1995. UTIG and L-DEO will prepare four grids each. The goal is to pass a site-by-site safety review by the JOIDES Pollution Prevention and Safety Panel in November, and then be assigned a position in the 1997 drilling schedule by the JOIDES Planning Committee in December. Safety assessment will be led by Dr. Peter Trabant, an industry consultant hired by ODP who also sailed with us on Oceanus 270. Processing, analysis and interpretation of the regional STRATAFORM data will take place during the spring and summer of 1996.

At the end of our cruise, we met with NRL personnel who were about to depart on a multi-disciplinary experiment offshore New Jersey aboard *Oceanus* and her sister ship, University of Rhode Island's *Endeavor*. We briefed NRL on logistics and results of our cruise, and provided them with copies of pertinent maps, 3.5 kHz profiles, and processed MCS sections. Further interaction is planned.

### Cruise Participants

Dr. James A. Austin, Jr., Steffen Sastrup, and Denise Kakas (UTIG), Dr. Gregory S. Mountain and Dr. Peter Buhl (L-DEO), Dr. Peter Trabant (independent consultant for ODP), six employees from John Chance, Lisa Molloy (UH), and William Handley (WHOI).

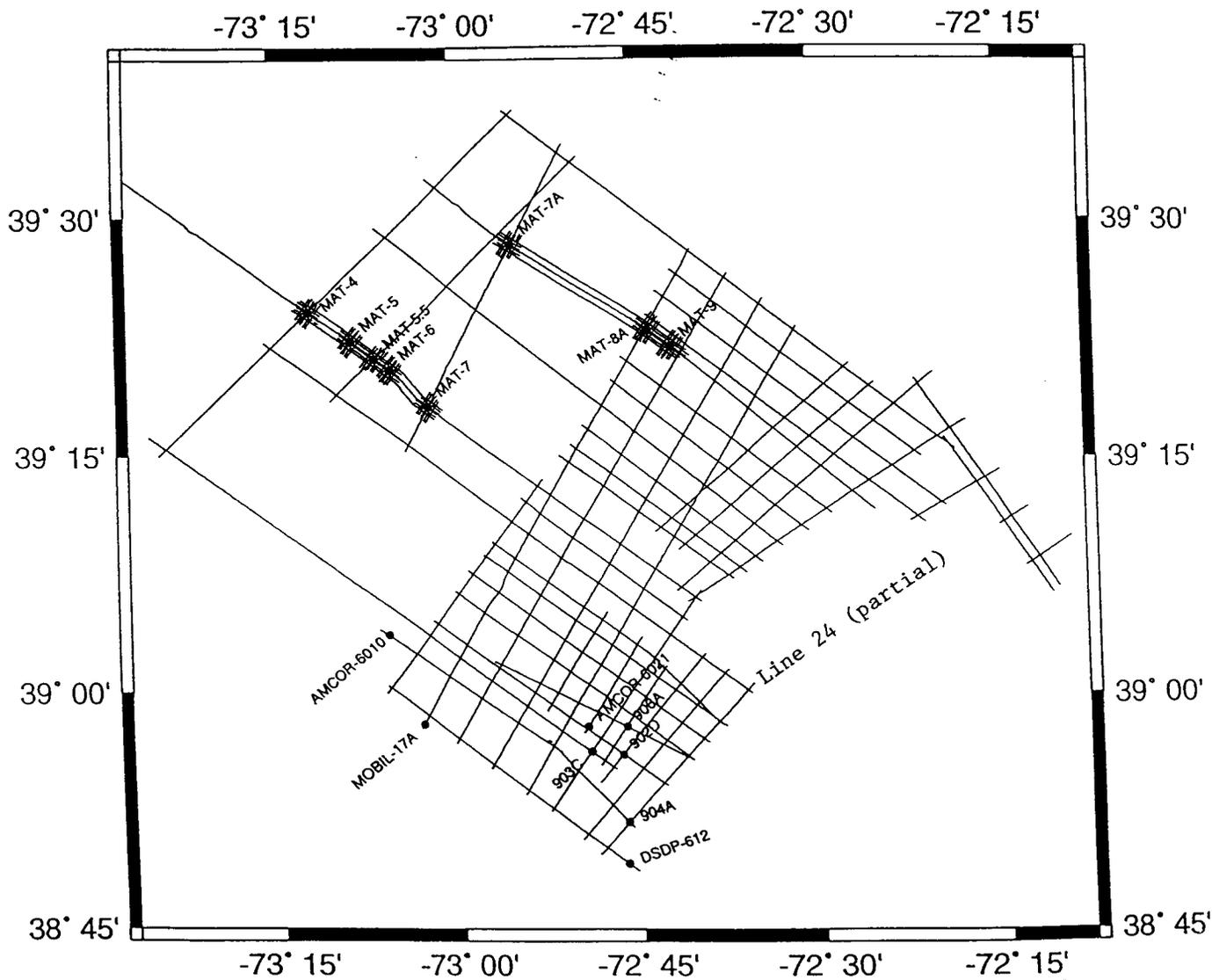
### Acknowledgements

The support of Dr. Joseph Kravitz of ONR, who has masterminded STRATAFORM, is gratefully acknowledged. Dr. Ellen Kappel, of Joint Oceanographic Institutions, Inc., supported part of the data acquisition at MAT sites under the JOI-USSSP Site Survey Augmentation Program. The Captain and crew of the *Oceanus* were superb, and the support of other WHOI personnel in mob and demob of the seismic system at the dock was also much appreciated.

# Oceanus 270 Lines

From John Chance navigation

13 July 1995



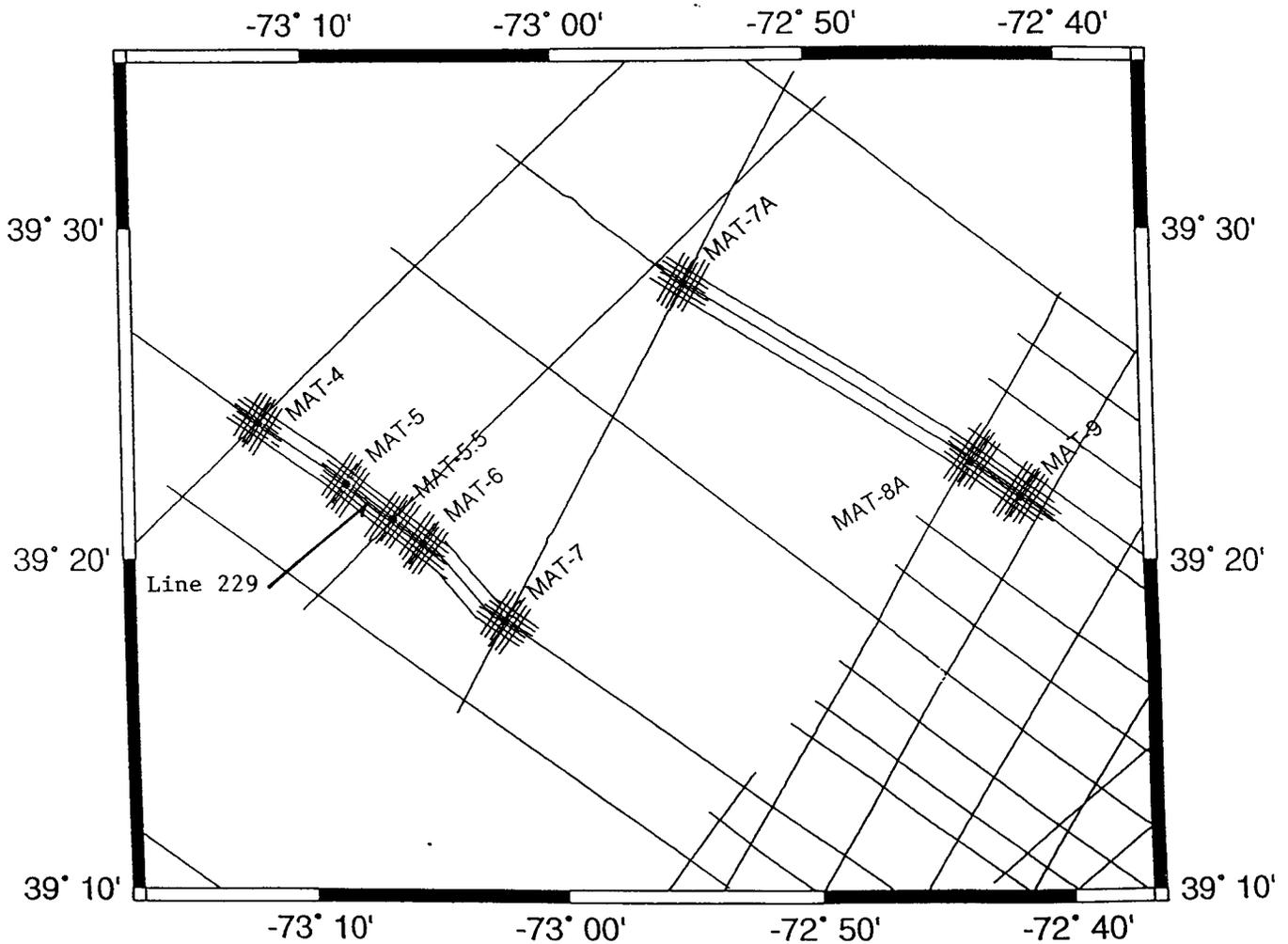
Shipboard plot by UTIG using GMT software

Figure 1.

# Oceanus 270 Site Surveys

From John Chance navigation

13 July 1995



Shipboard plot by UTIG using GMT software

Figure 2.

Figure 3A.

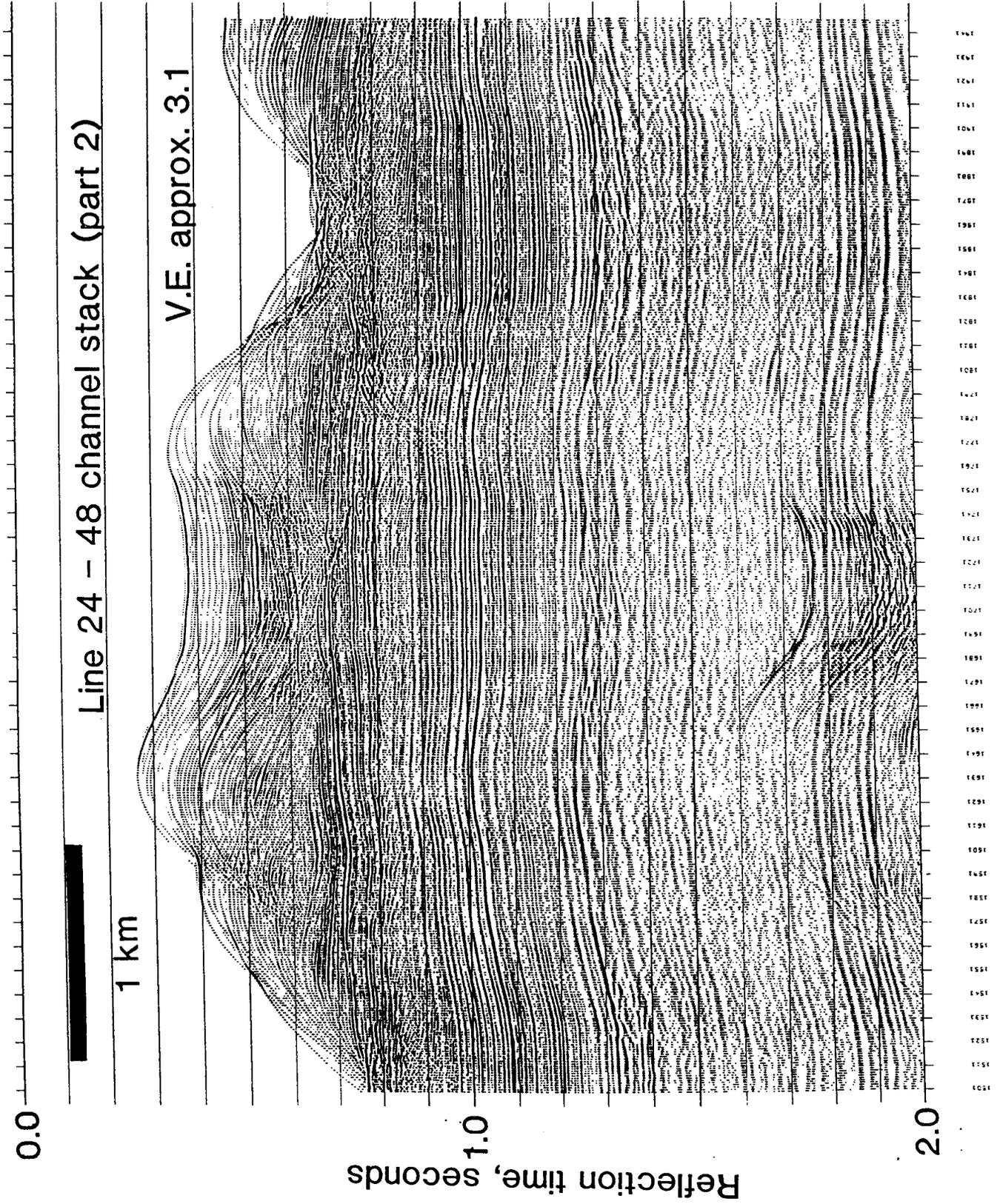
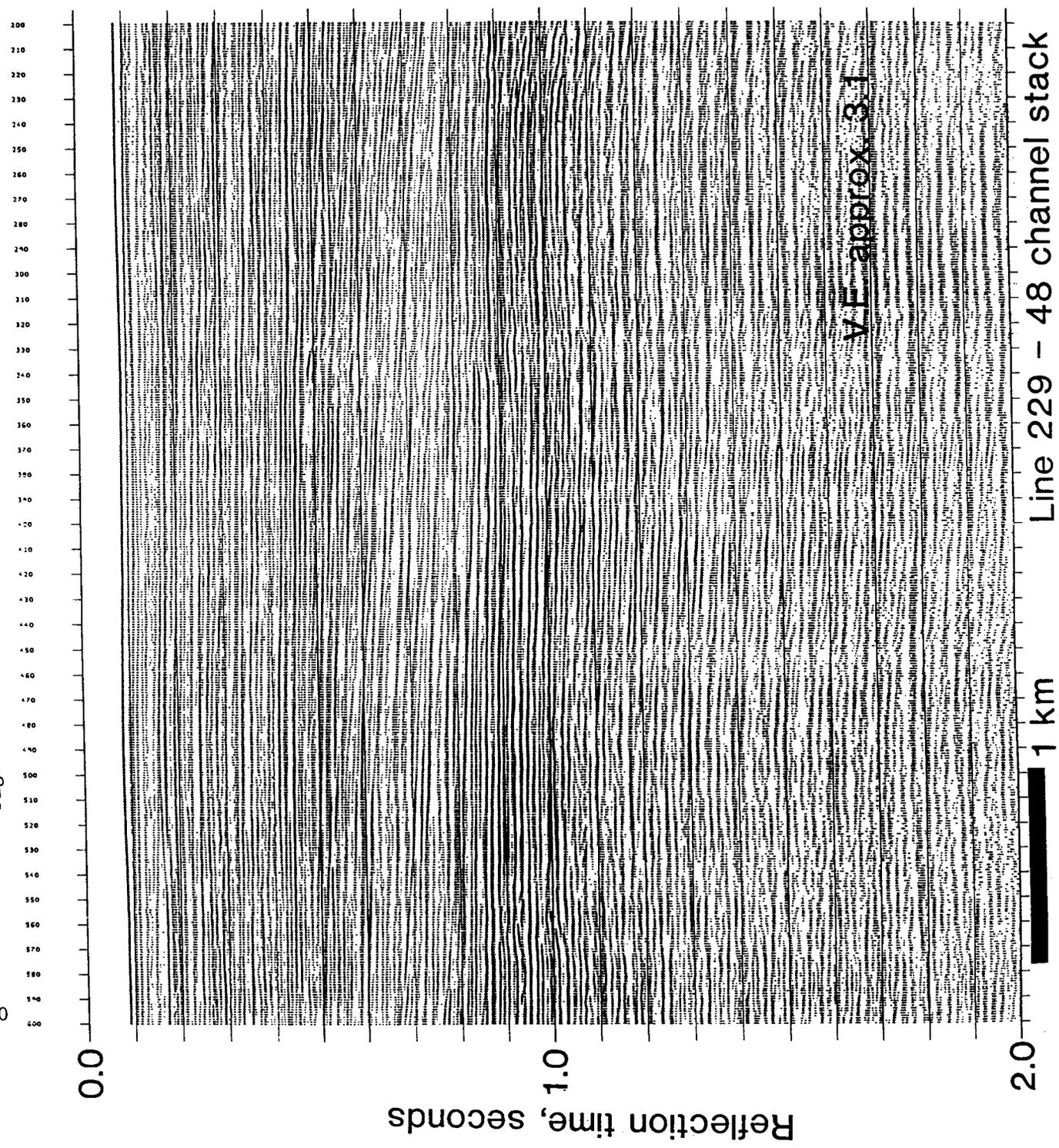




Figure 4.



Line 229 - 48 channel stack