UNDERWAY GEOPHYSICAL DATA COLLECTED ON U.S.G.S. CRUISE S4-76, SOUTHERN BERINGIAN SHELF

by

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INTRODUCTION

The seismic reflection data included with this report were gathered during the U.S. Geological Survey cruise S4-76 of the R/V SEA SOUNDER in the St. George basin area of the southern Bering Sea. Gravity and magnetic data were collected, but have not as yet been reduced. If the quality is good, then that data will be released in a subsequent report. Descriptions of sediment samples and a dredge haul also will be released at a later date.

The data are open-filed for the convenience of others working in the southern Bering Sea. Several projects are currently underway using these data and, in order to avoid duplication of efforts, we ask that potential users check with us before any major project is undertaken.

Cruise S4-76 was divided into two legs. Leg I departed Kodiak, Alaska on August 2, 1976. Leg II departed Dutch Harbor on August 22 and returned there on September 14. Leg I was a geophysical transect, simultaneously using either a 90 or 60 KJ sparker, 3.5 kHz profiler, Uniboom system (2.5 kHz peak frequency), magnetometer, and 2-axis gravimenter. Leg II was primarily a sampling leg, but we continued to run the seismic reflection equipment between stations. However, whenever stations were closer than about two hours, the sparker system was not operated.

The tracks for Leg I were oriented northeast-southwest to cover the St. George basin and other parts of the outer shelf between the Aleutian and Pribilof Islands. Line spacing is approximately 50 km. The tracks for Leg II were run northwest southeast to complement the Leg I tracks, but were positioned so that a sampling grid would be maintained and outcropping sediment that forms seismic reflectors could be sampled.

Table I summarizes the number of line kilometers of seismic data collected on cruise S4-76. The varying number of line kilometers for the different equipment is the result of restrictions in the use of the sparker during Leg II and of certain systems that were not operated in deep water.

TABLE 1. LINE KILOMETERS OF SEISMIC DATA COLLECTED

DATA TYPE	DOMINANT FREQUENCY	KILOMETERS
3.5 kHz	3.5 kHz	8118
2.5 kHz Uniboom	2.5 kHz	5848
Sparker	100 Hz	6773
Gravity		8118
Magnetics		4642

NAVIGATION

Navigation of the R/V SEA SOUNDER was by a Magnavox Integrated Loran C and satellite navigation system. The system utilizes an HP21MX computer to integrate a Magnavox MX702A satellite receiver, Teledyne TDL601G Loran-C receiver, gyro, and Bendix speed log. This integrated system gave precision positions averaged from 25 satellite updates, of ± 0.0789 km long-course offset, ± 0.0891 km crosscourse offset, and ± 0.1341 km radial offset. The Loran-C system operated in the integrated rho-rho mode throughout the cruise. Figure 1 is a plot of the ship's tracks.

GEOPHYSICAL EQUIPMENT

The 3.5 kHz system consists of a hull-mounted 12-transducer array (Raytheon TRI09) using a Raytheon PTR#105B, Raytheon CESP II auto-correlator, and an EPC 4100 recorder. The maximum power output is 2000 watts. The E.G. and G. Uniboom system uses four hull-mounted plates, with E.G. and G. Model 234 energy sources and Khron-Hite filters. The hydrophone array is a standard E.G. and G. high-resolution streamer. The sparker system consists of multiple banks of 30 KJ (kilojoule) energy sources and a Teledyne single-channel hydrophone array that is towed approximately 100 m behind the ship. These are coupled to a Geospace Model 1 amplifier filter for signal processing and a Raytheon Model 1900 graphic recorder. Typically, two banks were used on cruise S4-76, which gave 60 KJ of energy.

DATA

In general, the quality of the 3.5 kHz data is only fair, but the 2.5 kHz Uniboom data are fair to good and the low-resolution seismic-reflection data are fair to excellent. The 3.5 kHz system generally penetrated only to the first subbotom reflector (0.005 sec; approximately 4 m), but in a few places it penetrated to 0.05 sec (approximately 35 m). The 2.5 kHz Uniboom system typically penetrated to 0.05 sec or less. The low-resolution, single channel seismic-reflection profiling system penetrated to a maximum of about 2.0 sec.

Factors which affect the quality of the seismic data can be grouped in two broad categories: (1) the types of seismic systems used and their environments, and (2) the surface and subsurface geology. The environment of the seismic system includes the sea-state at the time of recording, ambient acoustic interference generated by the vessel, depth of water, and the watchstander overseeing the system. The first two factors affect the high-resolution systems much more than the low-resolution systems. Sea-state conditions during which most data were collected ranged between calm and Force 8, but were typically between Forces 1 and 4. Rough sea states result in decoupling of hydrophones and/or transducers from the water column, thus seriously reducing the quality of high-resolution records. Ambient acoustic interference generated by the vessel added further to the noise level on all data. The depth of water affects the high- and low-resolution systems in opposite ways. On the low-resolution single-channel systems, shallow water depths influence the records by producing a first harmonic (multiple) that on many records obliterates the signals beneath it. As the water depth increases, the interference by the first harmonic is at deeper levels on the records, thus allowing more geologic information to be recorded. The high-resolution systems performed well in shallow water because of the high repetition rates of the outgoing signals (generally 1/4 to 1 sec), but they did not perform well in deep water because of their relatively low power output (attenuation and divergence). Reverberations create a "ringing" that also tends to mask out some information.

Microfilm copies (u rolls) of the seismic data are available, for the cost of reproduction, from: Mr. Tom Chase, Marine Technical Data Center, Pacific-Arctic Branch of Marine Geology, 345 Middlefield Road, Menlo Park, California 94025.

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