# SONOBUOY SEISMIC DATA COLLECTED DURING 1982 IN THE BERING SEA

ALAN K. COOPER and MICHAEL S. MARLOW
U.S. Geological Survey
345 Middlefield Road, MS 99
Menlo Park, Ca. 94025

THOMAS OBRIEN
Gulf Oil Corporation
Center for Marine Crustal Studies
Gulf Research and Development Company
1 Blue Hill Plaza
Pearl River, N.Y. 10965

Open-File Report 82-625

This report is preliminary and has not been reviewed for conformity with U.S. Geological Survey editorial standards and stratigraphic nomenclature. Any use of trade names is for descriptive purposes only and does not imply endorsement by the USGS.

Menlo Park, California

1982

In July-August 1982, the U.S. Geological Survey participated in a government-industry cooperative project for reflection/refraction profiling (GICORP), co-directed by the Center for Marine Crustal Studies, Gulf Oil Corporation. During the cruise (L9-82-BS) aboard the U.S.G.S. research vessel S.P.Lee, 53 seismic sonobuoy profiles, as well as other seismic and geopotential data, were recorded over the Bering Sea continental shelf and abyssal Aleutian basin. This report includes microfilm copies of the sonobuoy seismic monitor records, logsheets, and navigation collected during the cruise. Sonobuoy data have also been recorded on magnetic tape.

The seismic sonobuoy data from the Bering Sea (Figure 1) were recorded using a 5-airgun source array with air displacement that varied from 1311 to 2300 in3 (Table 1). Two types of sonobuoys were used, military (U.S.Navy-type 41B) and commercial (Ref Tek 1-type 176 mhz). Detailed procedures for the shipboard recording and display of the sonobuoy data are described in Childs and Cooper(1978). Briefly, the sonobuoys were deployed with hydrophone depths of 60-65 feet and were recorded on ship on both analog magnetic tape and paper monitor records. Data displayed on the monitor records were read from the analog magnetic tapes, rather than directly from the sonobuoy receiver, to verify that good sonobuoy data were being recorded on the magnetic tape. Later, the sonobuoy tapes were replayed with variable bandpass filter settings and different vertical time scales to produce additional paper monitor records. The microfilm includes two monitor records for each sonobuoy profile, a 10-second record that was generated during the actual sonobuoy run (useful for reflection/ refraction velocity determinations) and a 32-second record that was replayed from the magnetic tape (useful for monitoring the direct arrival and refraction arrivals). For two sonobuoy stations (242 and 243), the same procedures were followed and sonobuoy data were also recorded digitally on a shipboard multichannel seismic recording system.

Shipboard navigation was done by computer with inputs from TRANSIT satellite, Loran C-hyperbolic, Loran C-rho rho, gyro, and a water speed indicator. Firing of the airgun array was controlled by the navigation system and was done on either a time basis (17 to 22 seconds) or a distance basis (50m or 100m). Multichannel seismic-reflection, high resolution seismic-reflection, gravity, magnetic, and bathymetry data were recorded simultaneously with the sonobuoy seismic data.

Two points concerning the sonobuoy operations are noteworthy:

1. Sonobuoys recorded in the St. George Basin (buoys 192 to 197), Bristol Basin (buoys 198 to 205), and Navarin Basin (buoys 225-228 and 233-241) areas often have high seismic noise levels caused by other seismic boats operating nearby. Consequently, the data in these areas are degraded and reflectors/refractors are more difficult to identify.

2. On many sonobuoy profiles, especially those recorded in very shallow water (25-40 m), the direct arrival (ship to buoy through the water) is noticeably curved, rather than being straight, at large offsets (20-40 km). Because the direct arrival is curved and the refraction arrival at similar offsets is usually not curved, ship speed changes or buoy drift do not appear to be the explanation for the curved direct arrival. The explanation is unclear but may be related to velocity variations in the water column along the sonobuoy profile. Surface-water temperatures have been measured for each sonobuoy (see logsheets), however these temperatures are uniform and do not suggest variations in the surface-water velocity.

Seismic sonobuoy data from the GICORP project are slated for digital processing at the Center for Marine Crustal Studies, Gulf Oil Corporation. Analog magnetic tapes will be converted to digital tapes and processing done from the digital tapes. Full size copies of seismic sonobuoy monitor records are available for inspection at USGS, 3475 Deer Creek Road, Rm B112, Palo Alto, California. For information concerning the inspection of these records and the availability of the analog and digital (available when converted) tapes contact:

Dr. Alan Cooper
U.S. Geological Survey, MS 99
345 Middlefield Road
Menlo Park, Ca. 94040
415-856-7094

Copies of the microfilm data and digital navigation data are available from:

Dr. Michael Loughridge
Chief, Marine Geology and Geophysics Division
National Geophysical and Solar-Terrestrial Data Center
NOAA/EDIS/NGSDC, Code D64
325 Broadway
Boulder, Colorado 80303
303-497-6338

REFERENCES:

Childs, J.R., and Cooper, A.K., 1978, Collection, reduction, and interpretation of marine seismic sonobuoy data, U.S. Geol. Survey Open-File Report 78-442, 219 p.

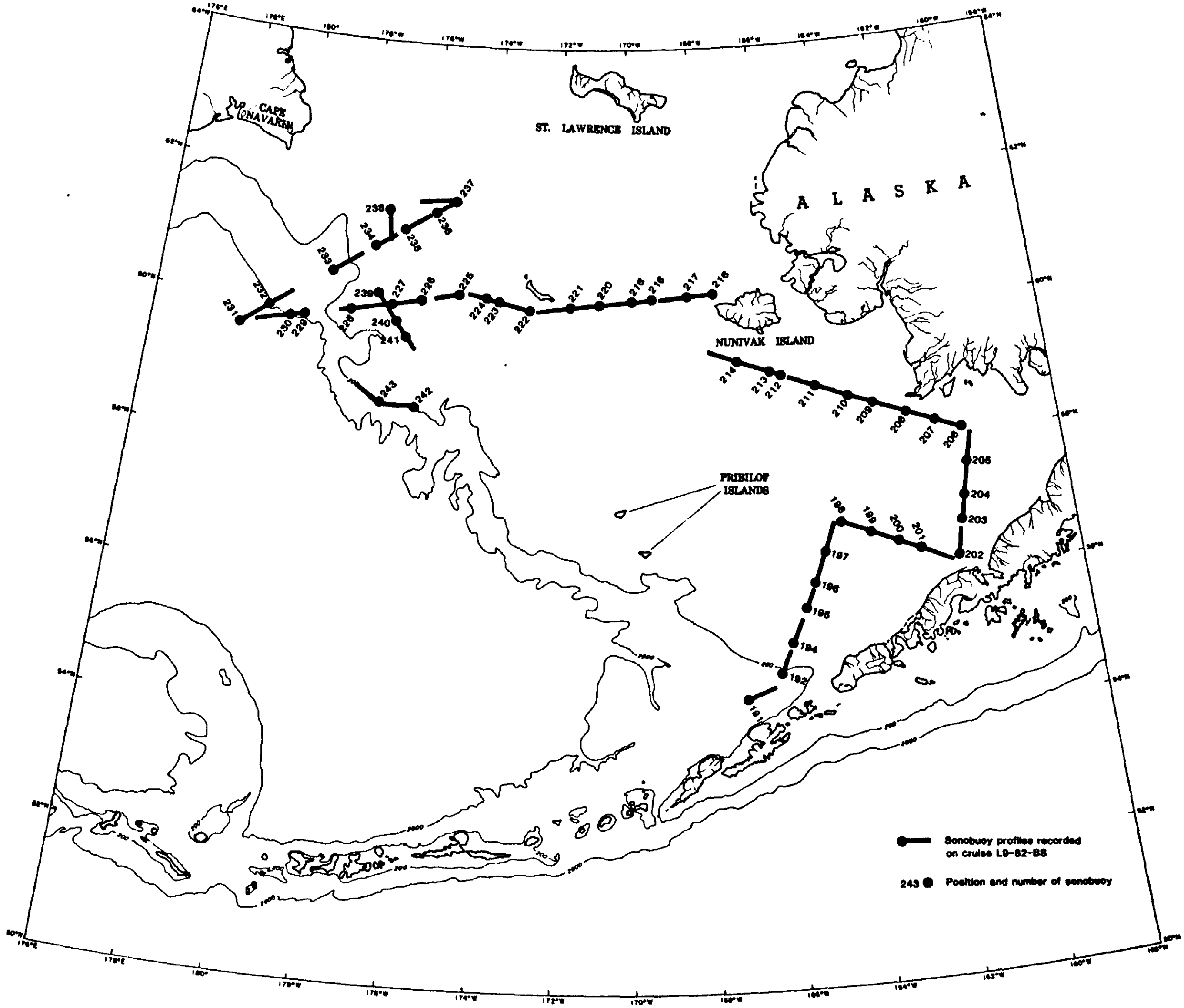


Figure 1 Index map of the Bering Sea showing location of sonobuoy profiles recorded in 1982 on cruise L9-82-BS.

Table 1: Sonobuoy information

| Sonobuoy No. | | Line | Shot Point | Water Depth (m) | Time JD | Time Hour | Latitude | Longitude | Sono Type | Source (in$^3$) |
|---|---|---|---|---|---|---|---|---|---|---|
| 191 | START | 1 | 515 | 731 | 193 | 1842.0 | 54 20.51 | -166 59.21 | R | 1311 |
| 191 | END | 1 | 1352 | 504 | 193 | 23 6.0 | 54 28.60 | -166 22.69 | | |
| 192 | START | 2 | 427 | 292 | 194 | 129.0 | 54 41.23 | -166 10.08 | R | 1311 |
| 192 | END | 2 | 1340 | | 194 | 548.0 | 55 2.76 | -165 53.93 | | |
| 194 | START | 2 | 1560 | 124 | 194 | 650.0 | 55 8.35 | -165 49.74 | M | 1311 |
| 194 | END | 2 | 2435 | | 194 | 1058.0 | 55 29.12 | -165 31.10 | | |
| 195 | START | 2 | 2808 | 110 | 194 | 1249.0 | 55 37.93 | -165 22.73 | M | 1311 |
| 195 | END | 2 | 3535 | | 194 | 1633.0 | 55 55.35 | -165 10.52 | | |
| 196 | START | 2 | 3692 | 95 | 194 | 1722.0 | 55 59.33 | -165 7.64 | M | 1311 |
| 196 | END | 2 | 4729 | | 194 | 2240.0 | 56 27.14 | -164 47.02 | | |
| 197 | START | 2 | 4808 | 77 | 194 | 23 4.0 | 56 29.21 | -164 45.49 | M | 1311 |
| 197 | END | | 5788 | 70 | 195 | 350.0 | 56 52.38 | -164 28.52 | | |
| 198 | START | 3 | 119 | 70 | 195 | 5 3.0 | 56 52.96 | -164 18.56 | M | 1311 |
| 198 | END | 3 | 1140 | 74 | 195 | 1010.0 | 56 41.50 | -163 32.57 | | |
| 199 | START | 3 | 1193 | 74 | 195 | 1026.0 | 56 40.88 | -163 30.12 | M | 1311 |
| 199 | END | 3 | 2107 | | 195 | 15 5.0 | 56 30.42 | -162 50.26 | | |
| 200 | START | 3 | 2148 | 75 | 195 | 1517.0 | 56 29.95 | -162 48.64 | R | 1311 |
| 200 | END | 3 | 2926 | | 195 | 1926.0 | 56 21.41 | -162 16.34 | | |
| 201 | START | 2 | 3038 | 40 | 195 | 1945.0 | 56 20.78 | -162 13.86 | M | 1311 |
| 201 | END | 3 | 4280 | 40 | 196 | 158.0 | 56 7.32 | -161 24.87 | | |
| 202 | START | 4 | 208 | 42 | 196 | 4 3.0 | 56 12.29 | -161 14.10 | M | 1311 |
| 202 | END | 4 | 1067 | 69 | 196 | 835.0 | 56 35.01 | -161 5.40 | | |
| 203 | START | 4 | 1276 | 67 | 196 | 940.0 | 56 40.49 | -161 3.19 | M | 1311 |
| 203 | END | 4 | 2153 | 59 | 196 | 1351.0 | 57 3.51 | -160 53.91 | | |
| 204 | START | 4 | 2177 | 59 | 196 | 1359.0 | 57 4.22 | -160 53.62 | R | 1311 |
| 204 | END | 4 | 3110 | 60 | 196 | 19 0.0 | 57 28.66 | -160 43.57 | | |
| 205 | START | 4 | 3257 | 59 | 196 | 1953.0 | 57 32.55 | -160 41.98 | R | 1311 |
| 205 | END | 4 | 4269 | 50 | 197 | 211.0 | 57 59.13 | -160 30.15 | | |
| 206 | START | 5 | 475 | 41 | 197 | 4 9.0 | 58 3.89 | -160 41.79 | R | 2300 |
| 206 | END | | 2465 | 44 | 197 | 932.0 | 58 13.20 | -161 23.64 | | |
| 207 | START | 5 | 2513 | 38 | 197 | 949.0 | 58 13.71 | -161 25.85 | R | 2000 |
| 207 | END | 5 | 3406 | | 197 | 1530.0 | 58 22.84 | -162 7.95 | | |
| 208 | START | 5 | 3458 | 46 | 197 | 1553.0 | 58 23.40 | -162 10.57 | R | 2100 |
| 208 | END | 5 | 4580 | | 197 | 2220.0 | 58 34.81 | -163 3.77 | | |
| 209 | START | 5 | 4607 | 25 | 197 | 2230.0 | 58 35.07 | -163 5.13 | R | 2100 |
| 209 | END | 5 | 5403 | 30 | 198 | 331.0 | 58 42.80 | -163 43.36 | | |
| 210 | START | 5 | 5463 | 29 | 198 | 352.0 | 58 43.37 | -163 46.31 | R | 2100 |
| 210 | END | 5 | 6543 | 27 | 198 | 10 0.0 | 58 54.35 | -164 38.05 | | |

| Sonobuoy No. | | Line | Shot Point | Water Depth (m) | Time JD | Time Hour | Latitude | | Longitude | | Sono Type | Source (in$^3$) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 211 | START | 5 | 6593 | 27 | 198 | 1017.0 | 58 | 54.82 | -164 | 40.36 | R | 2100 |
| 211 | END | 5 | 7590 | 25 | 198 | 1632.0 | 59 | 4.51 | -165 | 28.28 | | |
| 212 | START | 5 | 7704 | 25 | 198 | 1714.0 | 59 | 5.76 | -165 | 34.29 | R | 2130 |
| 213 | START | 5 | 8132 | 23 | 198 | 1926.0 | 59 | 9.94 | -165 | 55.10 | M | 1900 |
| 212 | END | 5 | 8824 | | 198 | 23 6.0 | 59 | 16.60 | -166 | 28.93 | | |
| 213 | END | 5 | 9163 | 26 | 199 | 115.0 | 59 | 19.68 | -166 | 45.77 | | |
| 214 | START | 5 | 9261 | 27 | 199 | 2 3.0 | 59 | 20.84 | -166 | 52.22 | R | 2100 |
| 214 | END | 5 | 10230 | 31 | 199 | 751.0 | 59 | 29.99 | -167 | 41.73 | | |
| 215 | START | 6 | 161 | 25 | 200 | 2231.0 | 60 | 21.60 | -167 | 22.10 | M | 1800 |
| 215 | END | 6 | 420 | 26 | 200 | 55.0 | 60 | 21.53 | -167 | 26.27 | | |
| 216 | START | 6 | 340 | 25 | 200 | 23 1.0 | 60 | 21.51 | -167 | 27.27 | M | 1800 |
| 216 | END | 6 | 1139 | 30 | 201 | 432.0 | 60 | 19.75 | -168 | 15.87 | | |
| 217 | START | 6 | 1210 | 31 | 201 | 457.0 | 60 | 19.62 | -168 | 19.85 | R | 2100 |
| 217 | END | 6 | 1987 | 39 | 201 | 930.0 | 60 | 17.02 | -169 | 7.76 | | |
| 218 | START | 6 | 2328 | 41 | 201 | 1010.0 | 60 | 16.76 | -169 | 15.35 | M | 2130 |
| 218 | END | 6 | 3328 | 54 | 201 | 15 0.0 | 60 | 15.50 | -170 | 8.82 | | |
| 219 | START | 7 | 127 | 50 | 202 | 7 7.0 | 60 | 16.06 | -169 | 53.12 | R | 2130 |
| 219 | END | 7 | 1123 | 64 | 202 | 1255.0 | 60 | 13.40 | -170 | 47.31 | | |
| 220 | START | 7 | 1199 | 64 | 202 | 1322.0 | 60 | 13.15 | -170 | 51.84 | M | 2100 |
| 220 | END | 7 | 2134 | 62 | 202 | 1830.0 | 60 | 10.05 | -171 | 42.51 | | |
| 221 | START | 7 | 2168 | 61 | 202 | 1840.0 | 60 | 9.94 | -171 | 44.17 | M | 1900 |
| 221 | END | 7 | 3262 | 58 | 203 | 045.0 | 60 | 5.84 | -172 | 42.30 | | |
| 222 | START | 8 | 127 | 58 | 203 | 142.0 | 60 | 6.73 | -172 | 51.43 | M | 1900 |
| 223 | START | 8 | 1292 | 87 | 203 | 9 8.0 | 60 | 14.30 | -173 | 52.64 | R | 1900 |
| 222 | END | 8 | 1450 | | 203 | 10 0.0 | 60 | 15.21 | -174 | 0.91 | | |
| 223 | END | 8 | 2329 | | 203 | 1119.0 | 60 | 16.82 | -174 | 14.00 | | |
| 224 | START | 8 | 1717 | 97 | 203 | 1125.0 | 60 | 16.94 | -174 | 15.00 | M | 1900 |
| 224 | END | 8 | 2329 | | 203 | 1440.0 | 60 | 20.78 | -174 | 47.60 | | |
| 225 | START | 9 | 296 | 106 | 203 | 1625.0 | 60 | 19.38 | -175 | 4.36 | M | 1700 |
| 225 | END | 9 | 5620 | | 203 | 2035.0 | 60 | 14.90 | -175 | 45.40 | | |
| 726 | START | 9 | 1570 | 128 | 203 | 2311.0 | 60 | 11.85 | -176 | 11.28 | M | 1311 |
| 226 | END | 9 | 2412 | | 204 | 346.0 | 60 | 7.38 | -176 | 58.68 | | |
| 227 | START | 9 | 2453 | 135 | 204 | 358.0 | 60 | 7.10 | -177 | 0.83 | M | 1311 |
| 227 | END | 9 | 3657 | 142 | 204 | 10 0.0 | 60 | 0.59 | -178 | 1.52 | | |
| 228 | START | 9 | 3888 | 139 | 204 | 1110.0 | 59 | 59.37 | -178 | 13.23 | M | 1311 |
| 228 | END | 9 | 4180 | | 204 | 1240.0 | 59 | 57.65 | -178 | 29.50 | | |
| 229 | START | 9 | 5401 | 2670 | 204 | 19 7.0 | 59 | 50.20 | -179 | 33.26 | M | 1311 |
| 230 | START | 9 | 5886 | 2850 | 204 | 2222.0 | 59 | 47.16 | -179 | 57.75 | R | 1311 |

| Sonobuoy No. | | Line | Shot Point | Water Depth (m) | Time JD | Time Hour | Latitude | Longitude | Sono Type | Source (in$^3$) |
|---|---|---|---|---|---|---|---|---|---|---|
| 229 | END | 9 | 6160 | | 204 | 2359.0 | 59 45.37 | 179 47.75 | R | 1311 |
| 230 | END | 9 | 7043 | | 205 | 445.0 | 59 40.16 | 179 2.23 | | |
| 231 | START | 10 | 50 | 3555 | 205 | 10 3.0 | 59 35.34 | 178 33.69 | M | 1311 |
| 231 | END | 10 | 1132 | | 205 | 1618.0 | 59 53.06 | 179 19.50 | | |
| 232 | START | 10 | 1631 | 2598 | 205 | 1631.0 | 59 53.70 | 179 21.20 | M | 1311 |
| 232 | END | 10 | 2112 | | 205 | 2131.0 | 60 8.81 | -179 58.25 | | |
| 233 | START | 10 | 3571 | 281 | 206 | 5 8.0 | 60 32.00 | -178 53.58 | M | 1311 |
| 233 | END | 10 | 4727 | 152 | 206 | 1048.0 | 60 49.86 | -178 2.14 | | |
| 234 | START | 10 | 5200 | 136 | 206 | 1311.0 | 60 57.12 | -177 40.67 | R | 1311 |
| 234 | END | 10 | 5988 | 122 | 206 | 1726.0 | 61 9.10 | -177 4.64 | | |
| 235 | START | 10 | 6278 | 116 | 206 | 19 0.0 | 61 13.37 | -176 51.13 | M | 1311 |
| 235 | END | 10 | 7300 | | 207 | 026.0 | 61 28.58 | -176 3.26 | | |
| 236 | START | 10 | 7370 | 98 | 207 | 048.0 | 61 29.56 | -176 0.02 | M | 1311 |
| 236 | END | 10 | 8223 | | 207 | 525.0 | 61 41.99 | -175 19.53 | | |
| 237 | START | 11 | 43 | 80 | 207 | 821.0 | 61 42.06 | -175 16.81 | M | 1311 |
| 237 | END | 11 | 1291 | | 207 | 1440.0 | 61 40.04 | -176 27.26 | | |
| 238 | START | 12 | 247 | 100 | 207 | 21 9.0 | 61 30.67 | -177 23.07 | R | 1700 |
| 238 | END | 12 | 1275 | | 208 | 238.0 | 61 3.58 | -177 14.51 | | |
| 239 | START | 14 | 47 | 139 | 208 | 1227.0 | 60 15.45 | -177 27.67 | M | 1700 |
| 240 | START | 14 | 550 | 137 | 208 | 1511.0 | 60 4.57 | -177 11.81 | R | 1700 |
| 239 | END | 14 | 1142 | 136 | 208 | 1831.0 | 59 51.73 | -176 52.74 | | |
| 241 | START | 14 | 1153 | 136 | 208 | 1834.0 | 59 51.55 | -176 52.44 | M | 1400 |
| 240 | END | 14 | 1805 | 136 | 208 | 22 7.0 | 59 39.07 | -176 33.02 | | |
| 241 | END | 14 | 2234 | 135 | 209 | 1 0.0 | 59 28.43 | -176 17.60 | | |
| 242 | START | 28 | 43 | 152 | 213 | 545.0 | 58 37.94 | -176 10.90 | M,R | 2000 |
| 242 | END | 28 | 590 | 142 | 213 | 11 0.0 | 58 38.99 | -177 8.50 | | |
| 243 | START | 29 | 42 | 142 | 213 | 1112.0 | 58 39.32 | -177 10.68 | R | 2000 |
| 243 | END | 29 | 499 | | 213 | 1530.0 | 58 52.11 | -177 51.60 | | |

M = Military sonobuoy - U.S. Navy type 41B

R = Commercial sonobuoy - REF TEK 1