1987/53. An experimental seismic reflection survey on Bruny Island.

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Abstract

An experimental seismic reflection survey on North Bruny Island showed that the technique is applicable to the area studied. The recording parameters included 14 Hz geophones, 30 m group and shot interval, wideband reading, 1.0 to 1.5 kg charges, and 2.6 m deep shot holes. Despite the presence of a dolerite sill under much of the area, good quality reflections were obtained from below the dolerite.

INTRODUCTION

At the request of Conga Oil a test seismic reflection survey was undertaken on North Bruny Island (fig. 1). The Department has, for a number of years, been investigating the applicability of the reflection technique in a wide range of geological environments (Leaman, 1978) and the Bruny project represented an opportunity to integrate a number of previously developed techniques.

The near-surface geology included Permian sandstone, mudstone and limestone, and Jurassic dolerite. It was anticipated from other data that at least part of the area would be underlain by a dolerite sill. Shot holes were drilled to an average depth of 2.6 m using an airtrack, and most finished in slightly weathered or unweathered rock. Approximately 60 additional holes were drilled near the north and south ends of the traverse for testing different shot-receiver combinations. Shot holes were at a 30 m interval.

An Input-Output DHR 1632 eight-channel seismic system was used with a group interval of 30 m. This system offers 12 bit conversion, rudimentary signal processing on playback to the analogue plotter, and digital magnetic tape for data storage. The available geophones were 14 Hz, 28 Hz, and 40 Hz. A 500 Hz sample rate was used with no input filtering.

RESULTS

The test shots fired at the southern end of the traverse on the first two days of the project were, unfortunately, subject to very strong wind noise. Charges varying from 0.125 kg to 3 kg of gelignite were fired and recorded using all available geophone types. Although various replay filter bandwidths, automatic gain controls, and programmed gain controls were tried, the records were uniformly depressing (e.g. fig. 2). Perhaps the only consistent feature was the low amplitude zone between 750 and 1300 milliseconds.

At the northern end of the traverse the test shots were fired in quiet conditions and showed a number of coherent arrivals (fig. 3). Once again a low amplitude zone was present, but between 1900 and 2400 milliseconds. After testing with a range of shot sizes, geophones and playback parameters, the optimum conditions were found to be a shot size of between 1.0 and 1.5 kg of gelignite, 14 Hz geophones, a playback passband from 30 Hz to 120 Hz, and a programmed gain increase of 6 dB per second. Recording was wideband.

Recording of the traverse was from Shotpoint 210, at the northern end, to Shotpoint 1 at the southern end. With the 30 m shotpoint and trace interval a four-fold coverage was obtained. The topography varied from almost level to changes in elevation of up to eight metres between shotpoints. Figures 4 and 5 show typical field plots of data from channel 4 only. The low amplitude zones continue to be present, although they are not ubiquitous, and there are a number of coherent arrivals visible over groups of adjacent traces. Without processing, to correct at least for the topographic variation, little further information is expected.

Single fold expanded spreads were fired near both ends of the traverse (e.g. fig. 6) and showed a number of coherent arrivals. Once again there is a low amplitude zone.

CONCLUSIONS

The test survey showed that the seismic reflection technique can be used successfully in the area of North Bruny Island that was covered. The area consists of a number of fault blocks and it is inferred, from other geological and geophysical data, that energy is being transmitted through the dolerite, and the low amplitude zone corresponds to essentially homogenous Precambrian units.

Any production survey should use a wideband recording system with 14 Hz geophones and at least a 16 bit conversion. If a gelignite source is used shot holes should be drilled to a depth of six metres and cased with rigid PVC pipe.

REFERENCE

LEAMAN, D. E. 1978. Use of the reflection method in Tasmania. Part 1: Equipment, techniques and problems. *Geophys. spec. Rep. Dep. Mines Tasm.* 7.

[28 October 1987]

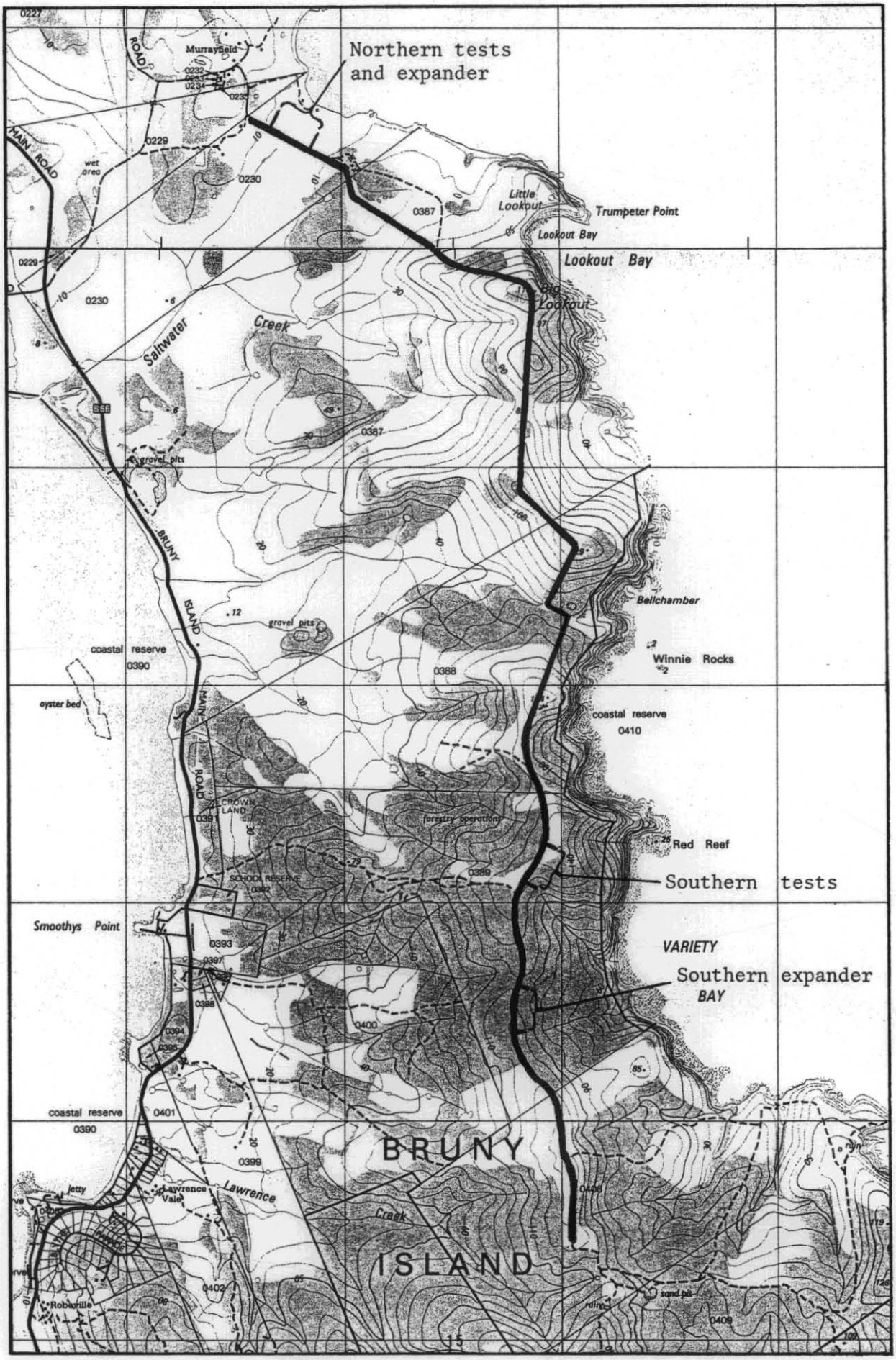

Figure 1. *Location of traverse.*

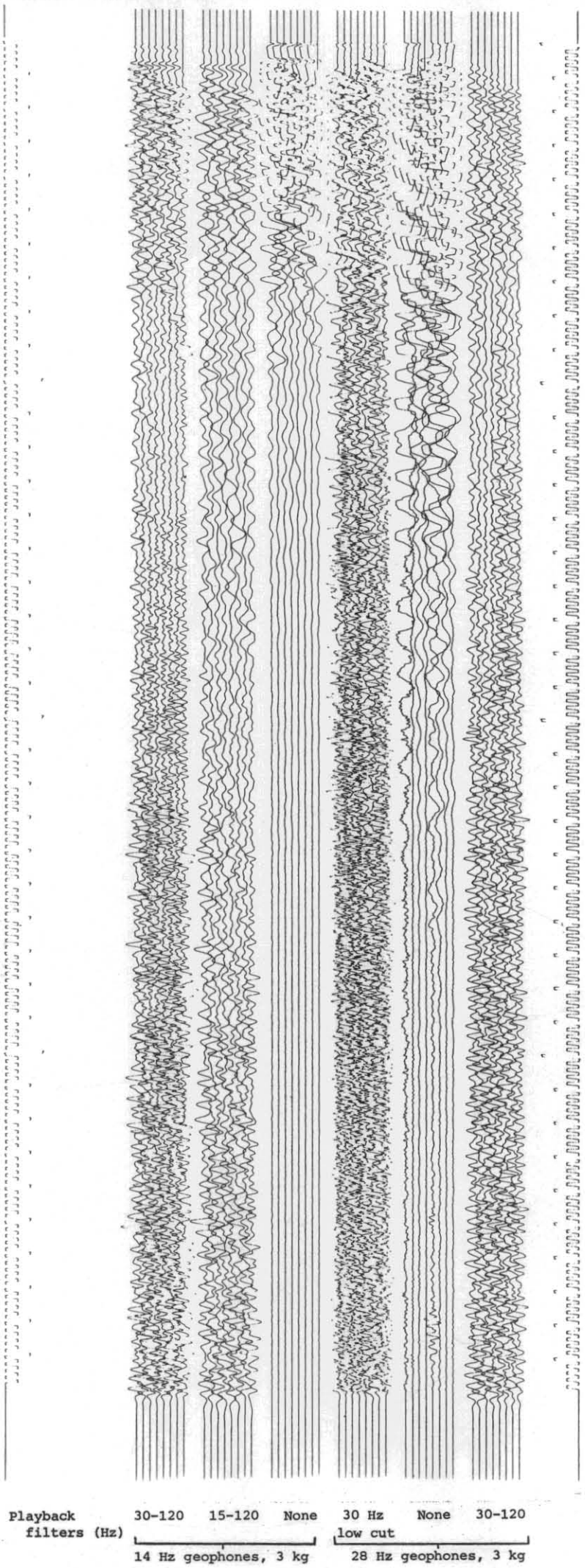

Figure 2. *Shotpoint 59*

5 cm

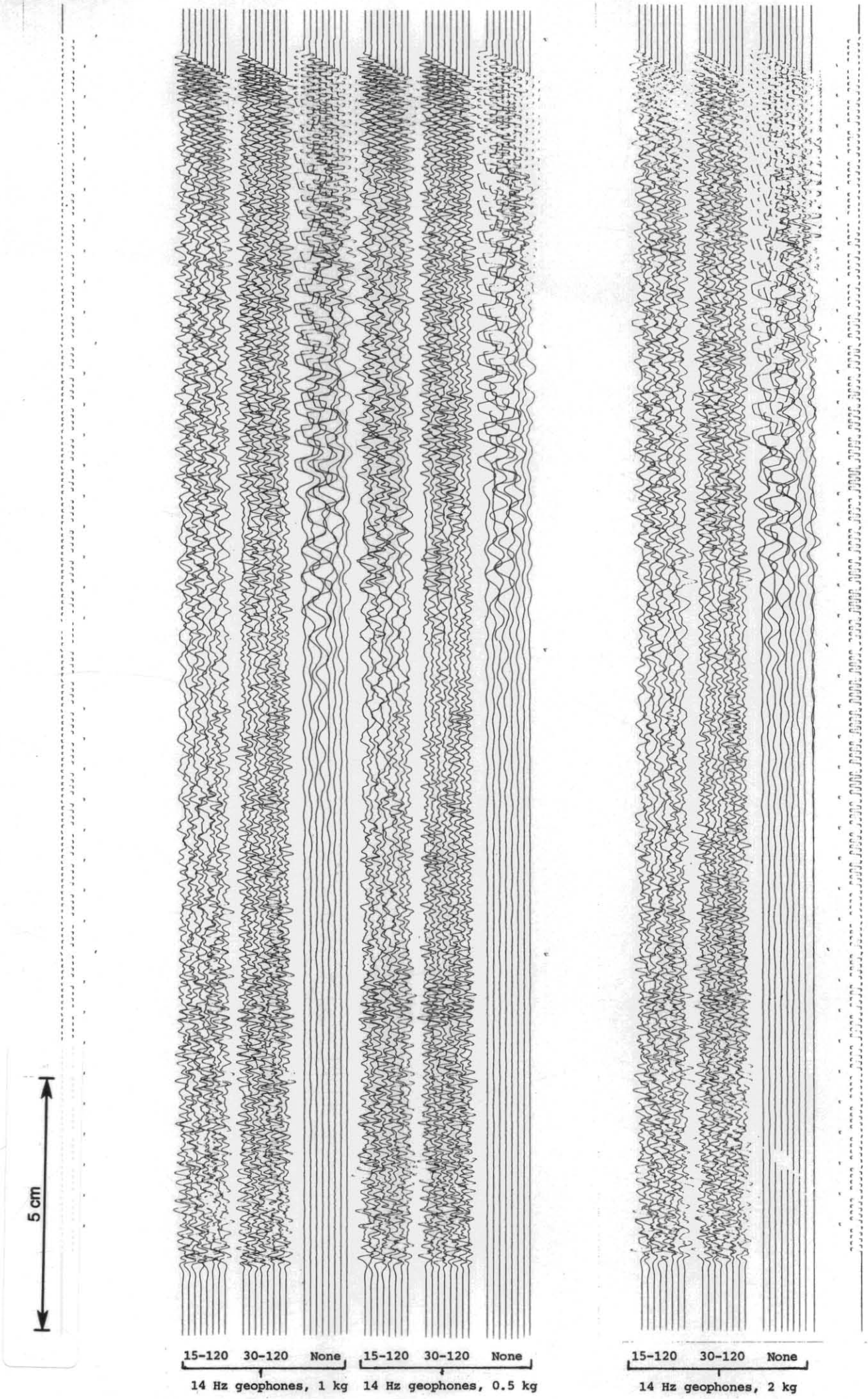

Figure 3. *Shotpoint 198 and 199.*

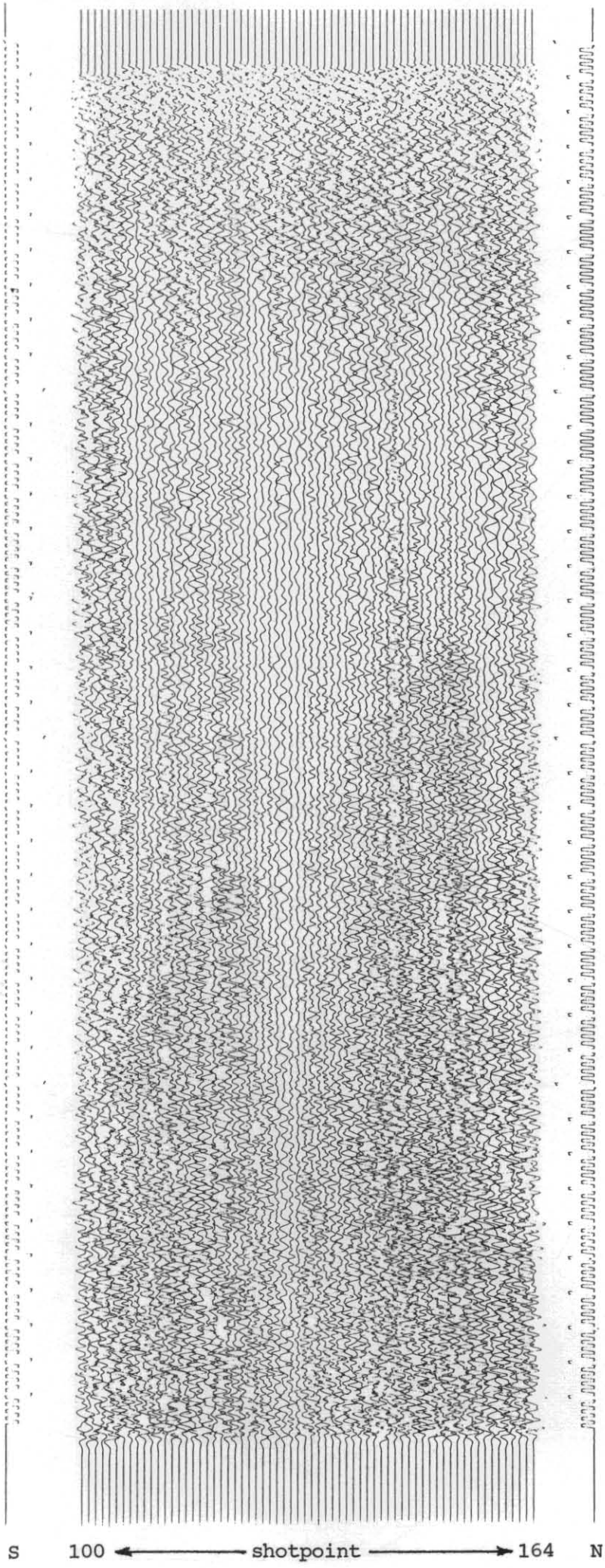

Figure 4. *Field plot - Channel 4*

5 cm

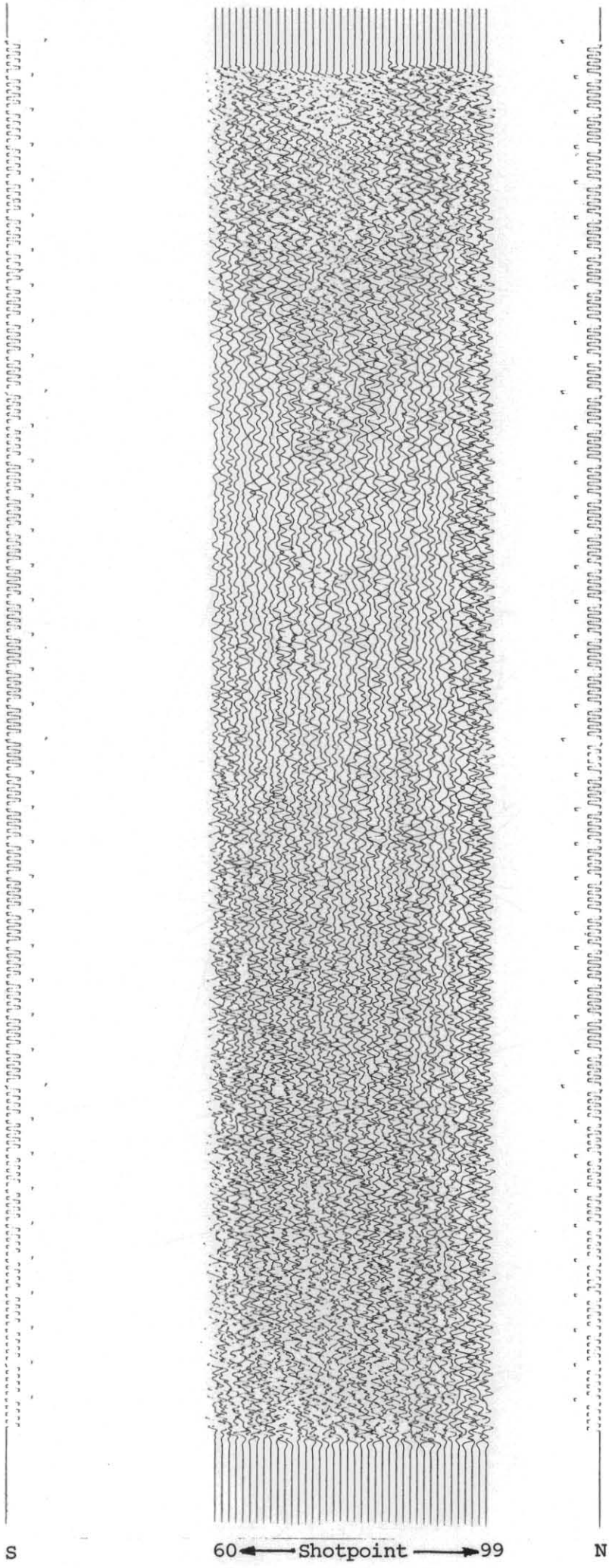

Figure 5. *Field plot - Channel 4*

5 cm

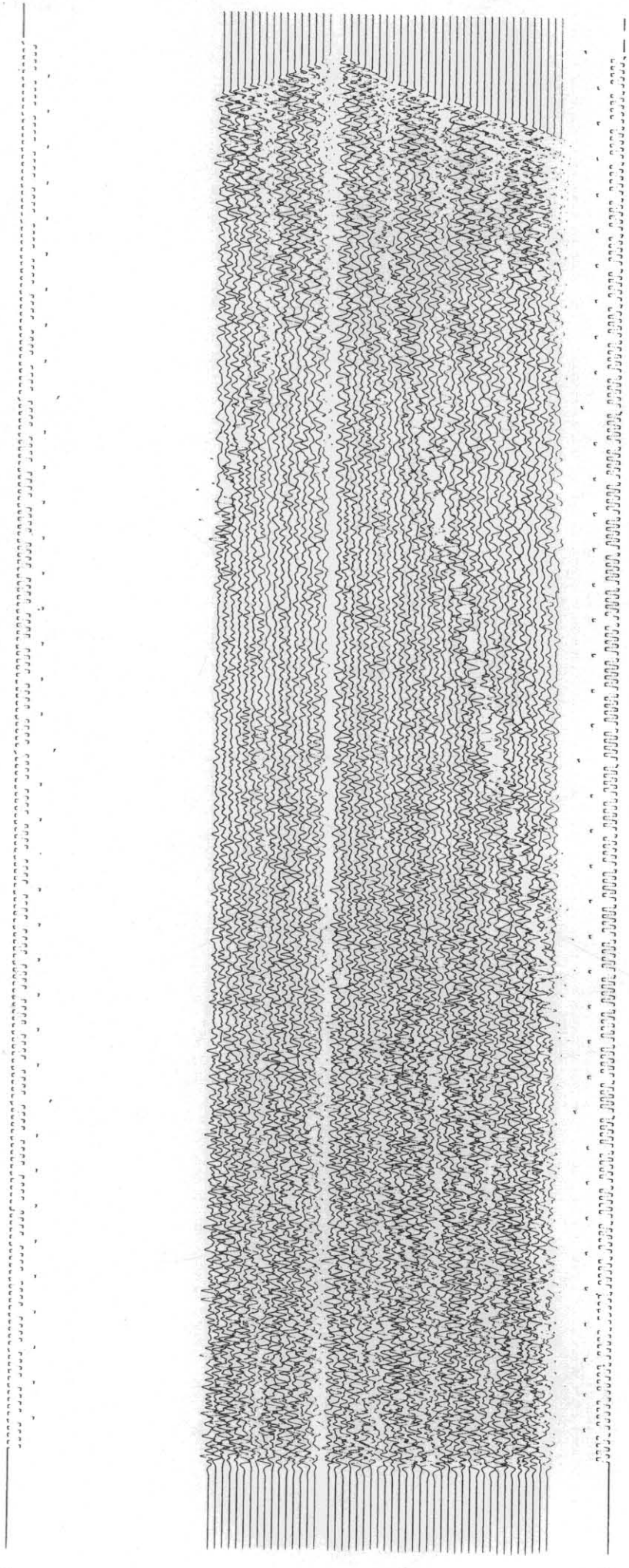

Figure 6. *Southern expanded spread*