

ICELAND

The Joint Lamont-National Energy Authority of Iceland
South Iceland Seismic Refraction Experiment of 1990

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This report describes seismic waveform data for the South Iceland Refraction Experiment that was conducted by the Lamont-Doherty Geological Observatory of Columbia University (Palisades, NY) and the National Energy Authority of Iceland during July through September, 1990.

The experiment design was a linear profile of 210 receiver points and 11 shot points crossing the Western Volcanic Zone and South Iceland Seismic Zone of south Iceland (Figure 1). The profile is oriented northwest-southeast and is about 170 km long. The 11 shot points are named ak, bf, hf, sv, tv, uv, hv, ta, yr, er, jl, from west to east. The receiver points were in five deployments, a01, a02, ..., e45, e46, from west to east. The general intent was to have the shot and receiver spacing uniform along the profile, but this was only achieved very approximately.

The main scientific goals of the project were:

To image the upper 10-15 km of the crust with a resolution of 1 km vertically and 5-10 km horizontally, in order to detect tectonically important structures such as magma at the ridge axis and the subsurface signature of the South Iceland Transform zone.

To measure crustal thickness through the measurement of moho reflection (PmP) travel times and to determine upper mantle seismic velocities through observations of the Pn phase.

Both of these goals have been successfully realized, with the results being describe in the paper:

Bjarnasson, I., W. Menke, O. Flovenz and D. Caress, Tomographic Image of the Spreading Center in Southern Iceland, submitted to J. Geophys. Res., 28 May 1992.

The authors are currently in the process of performing a tomographic inversion for shear wave velocity, using this data set.

The data quality is generally very good, with about 1200 three-component seismograms having been collected. Figure 2 shows vertical component shot point gathers for the two end shot points, ak and jl.

The archival tape is in UNIX TAR format. The 'tar x' command will produce a directory named 'iceland_ref' containing the data and auxiliary information. The directory is about 100 Mbytes in size. The data are archived in LDGO 'AH' VERSION 1 format, as single trace files in shot point gather directories. Hence the file:

iceland_ref/ak/statlink/a01.z

is the vertical component of shot point ak, receiver point a01. The suffices .r and .t refer to the radial and tangential components of the horizontal, respectively.

The AH header have been filled in as best as possible, except that the poles-and-zeroes of the instrument response has been left blank. Users of the data can assume that the station name, shot and station times and locations have been filled in correctly. The recorder and geophone types and serial numbers are also specified in the AH header.

The LDGO AH programs have been included in the 'ah' directory so that some record of the format of the data is preserved along with the dataset. The program ah2asc will produce an ascii dump of the files.

Instrumentation consisted of:

10 REFTEK Model 72A digital recorders with AMP01 electronic modules and Omega radio timing (from IRIS), with cable reels to allow two widely separated geophones

23 Sintrex PRS-4 digital recorders with timing set from a Nanometrics Field Clock that was synchronized to Omega (10 from LDGO, 5 from IRIS, 5 from USGS, 3 from U. Colorado).

Mark Products L22-D and L28 3-component geophones (15 from Lamont, the rest from IRIS).

Shots were dynamite in water (ocean, lakes, rivers) and were timed by a Nanometrics Field Clock synchronized to Omega.

Shot and station locations were determined by either or both:

GPS location with a Trimble Transpack GPS hand-held receiver (Selected availability was off during the experiment)

Measurement from a geodetic quality air photograph.
Location errors are believed to be about 20 m

For the users convenience, we have included shot and station tables. These tables are redundant, since the data they contain are also in the AH headers, and are merely provided for convenience:

The file iceland_ref/shot.tab describes the shots:

- column 1: shot name
- columns 2 and 3: Hjorsey Lambert coordinates
- column 4: elevation above sea level, meters
- column 5: depth in water, meters
- column 6: kg of dynamite
- column 7: shot time
- column 8: comment, including deployment number

The file iceland_ref/stat.tab describes the receiver points:

- column 1: receiver point name
- columns 2 and 3: Hjorsey Lambert coordinates
- column 4: elevation above sea level, meters
- column 5: (for internal use)
- column 6: instrument type, r=REFTEK 72A p=PRS-4

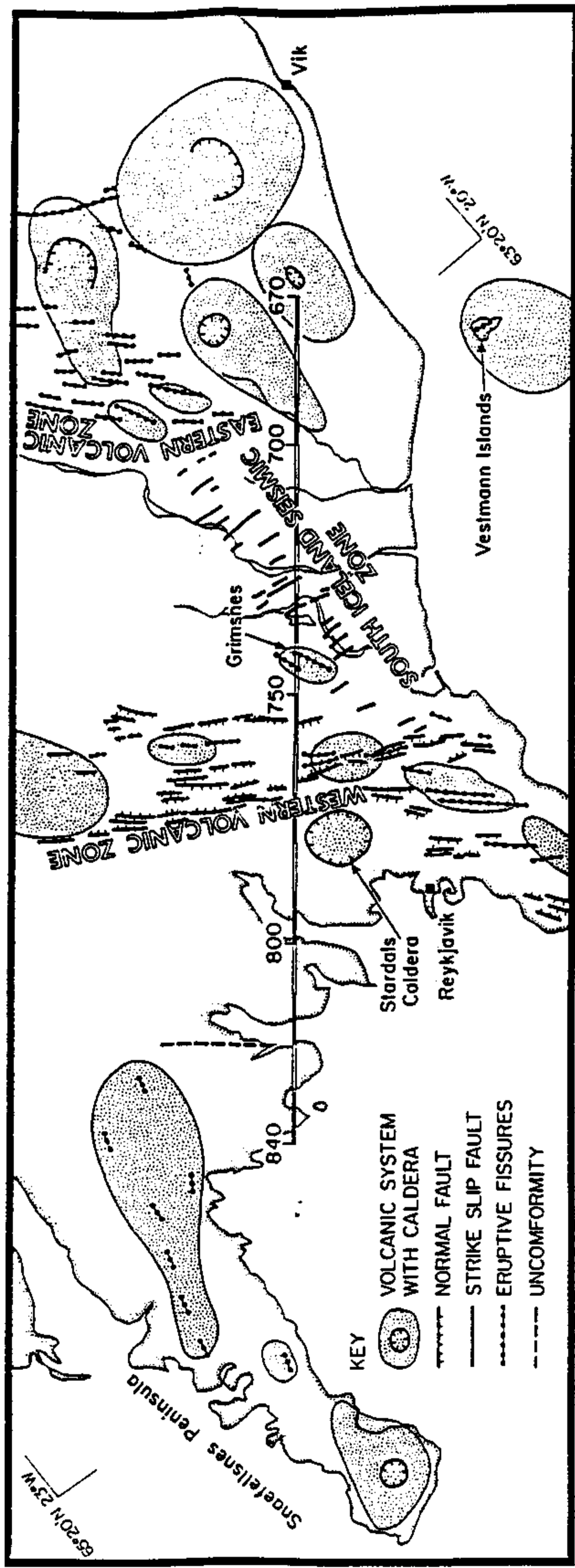
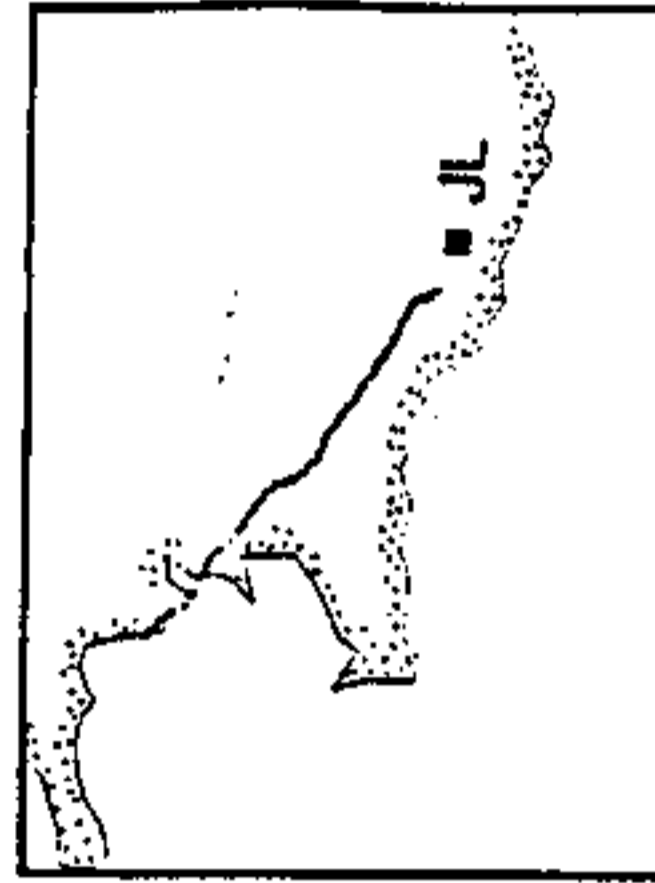
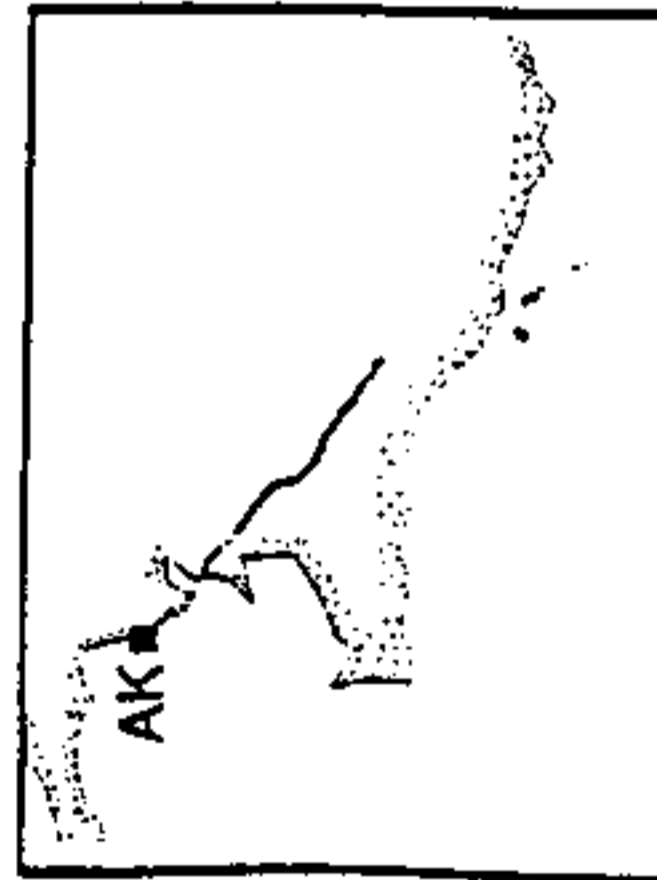
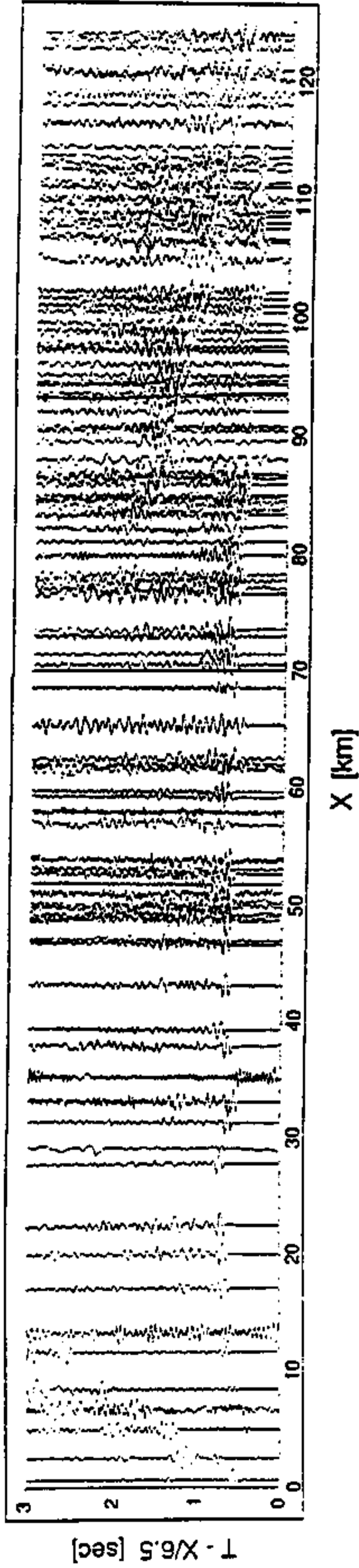


Fig. 1 The location of the South Iceland Seismic Tomography (SIST) profile is shown as a measuring stick overlain on top of volcanic and tectonic features. The profile's location is the best fit line to all receiver and shots. Distance along the profile are measured in km, with the origin chosen to follow the Hjörsey Lambert projection used in Iceland. All displayed volcanic systems, with the exception of the Stordals Caldera, have experienced recent volcanism [Einarsson and Sæmundsson, 1987]. The Western Volcanic Zone (WVZ) and Eastern Volcanic Zone (EVZ) are overlapping spreading centers. The gap between them in the South Iceland Lowlands is bridged by the South Iceland Seismic Zone (a transform at a nascent stage of development).

AK, WEST END SHOT



JL, EAST END SHOT

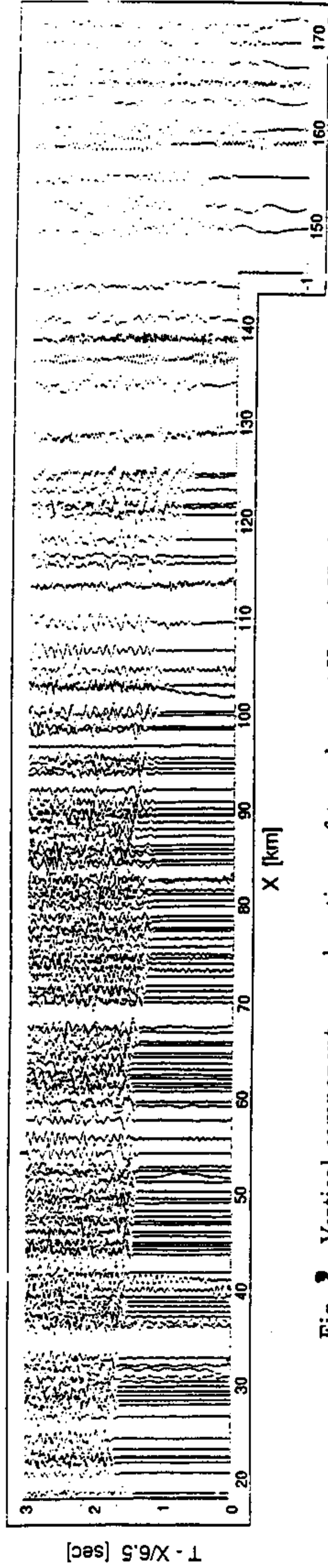


Fig. 2 Vertical component record sections of two shots, AK and JL, located at the extreme ends of the profile. Shot and receiver locations are displayed in the inset maps. These two record sections, plus nine others that are not shown, compose the raw data for the tomographic inversion. Note the clear first arrivals. The wide angle mocho reflection is visible as a clear second arrival between ranges 80-125 on the AK record section and 85-100 on the JL record section.