VELOCITY STRUCTURE OF THE NEAR-SURFACE SAN FERNANDO VALLEY FROM TOMOGRAPHIC INVERSION OF ACTIVE-SOURCE DATA

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In 1994 the Northridge earthquake ($M_W = 6.7$) struck the Los Ange causing significant damage to the San Fernando Valley of southern Cal existing active-source reflection data collected by Chevron prior to earthquake, we obtain both compressional wave (V_P) and shear wave (V_S information for the upper 500 m of crust. We do this by analyzing t different north-south trending seismic lines. To analyze the V_P velo refraction phases for V_P and apply the tomographic velocity inversio (1992) to calculate the first-arrival times. We further compare our sonic log data available for the area. To analyze the V_S velocities phases for V_S after applying banpass filtering to 12 Hz and apply th velocity inversion method of Hole to calculate the first-arrival time calculating Poisson’s Ratio (σ) based on the determined V_P to V_S rati to-V_S conversion factor applicable for the San Fernando Valley (SFV).

Our V_P models show velocities dipping south into the SFV as do t profiles obtained for all three lines. V_P velocity models for all th near-surface velocity range beginning at 1.3 km/s along the base of t Mountains (SSM) decreasing to roughly 1.0 km/s southward into the va overall average velocity convergence to 2.6 km/s at depths of approxi V_S model shows near-surface velocities beginning at 0.3 km/s just ben the SSM and remaining constant southward into the SFV. At depths of 300 m there is a convergence to 1.2 km/s beneath the SGM which decrea 0.8 and 0.9 km/s into the valley. Based on these findings, we calcul near-surface areas beneath the SSM and at depths greater than 200 m and 0.2 for near-surface depths of less than 200 m in the SFV.

INTRODUCTION

A major area of research for Group D (Subsurface Imaging and Tec Processes and Seismicity) of the Southern California Earthquake Cente 1998 is the integration of basin and regional velocity models. This compilation of and making compatible earth velocity structures at mar resolutions and scales. Existing active-source data already availabl information at different scales to contribute to this research goal.

Velocity measurements of seismic waves have become a useful way subsurface structures as well as the properties of subsurface rock fo deposits. In active-source seismology, the energy sources are both c moveable within a specific linear array of receivers. The basic tech seismic imaging consists of generating seismic waves via explosions or ground vibration to measure the time required for the waves to travel the receivers, or a group of geophones. The travel time of each wave physical properties of the rock through which it is traveling, the a the depth to which it attenuates. In calculating the velocity of a s its travel time (the time it took to get from the shot point to the traveled, we can obtain not only the wave velocities but identify th through which the waves traveled as well as structural features and a

In a seismic imaging experiment, it is the V_P first arrival data analyzed--specifically the reflected and refracted paths. Essentiall travels down into the earth, it breaks up into three different porti

different interfaces. A direct P-wave has a straight line travel dis
receiver just beneath the surface, however due to field methodology,
up in the data record. A reflected P-wave travels down into the eart
toward the surface equidistantly off of the underlying medium bounda
source and receiver. That is, the angle at which the wave reflects
reflection angle, is equal to the angle at which the wave initially
incidence angle. (Davidson, et al., 1997 and Telford, 1976) In the
times of reflected P-waves show up as hyperbolic curves. A refracte
along an interface (boundary) between different mediums or rock type
record, the travel time of refracted P-waves show up as linear.

We characterize near surface velocity information from active-s
contribute at fine-scaled granularity V_P velocity information to Gro
dimensional velocity structure for the Los Angeles Regional Seismic E
(LARSE), (2) to contribute accurate velocities and velocity structur
to the ground motion studies community, and (3) to obtain a more acc
conversion factor (i.e. Poisson’s Ratio) applicable for the San Fern
contribute to ground motion studies. The analysis method for this s
tomographic velocity inversion method after Hole (1992) whereby we p
phases out of active-source reflection data that was collected by Ch
project images the upper 500 m of crust along seismic reflection pro
resolution of 50 m. The industry dataset includes three (3) Chevron

SFV as well as sonic logs compiled by Brocher, et al. (1998) that are

data.

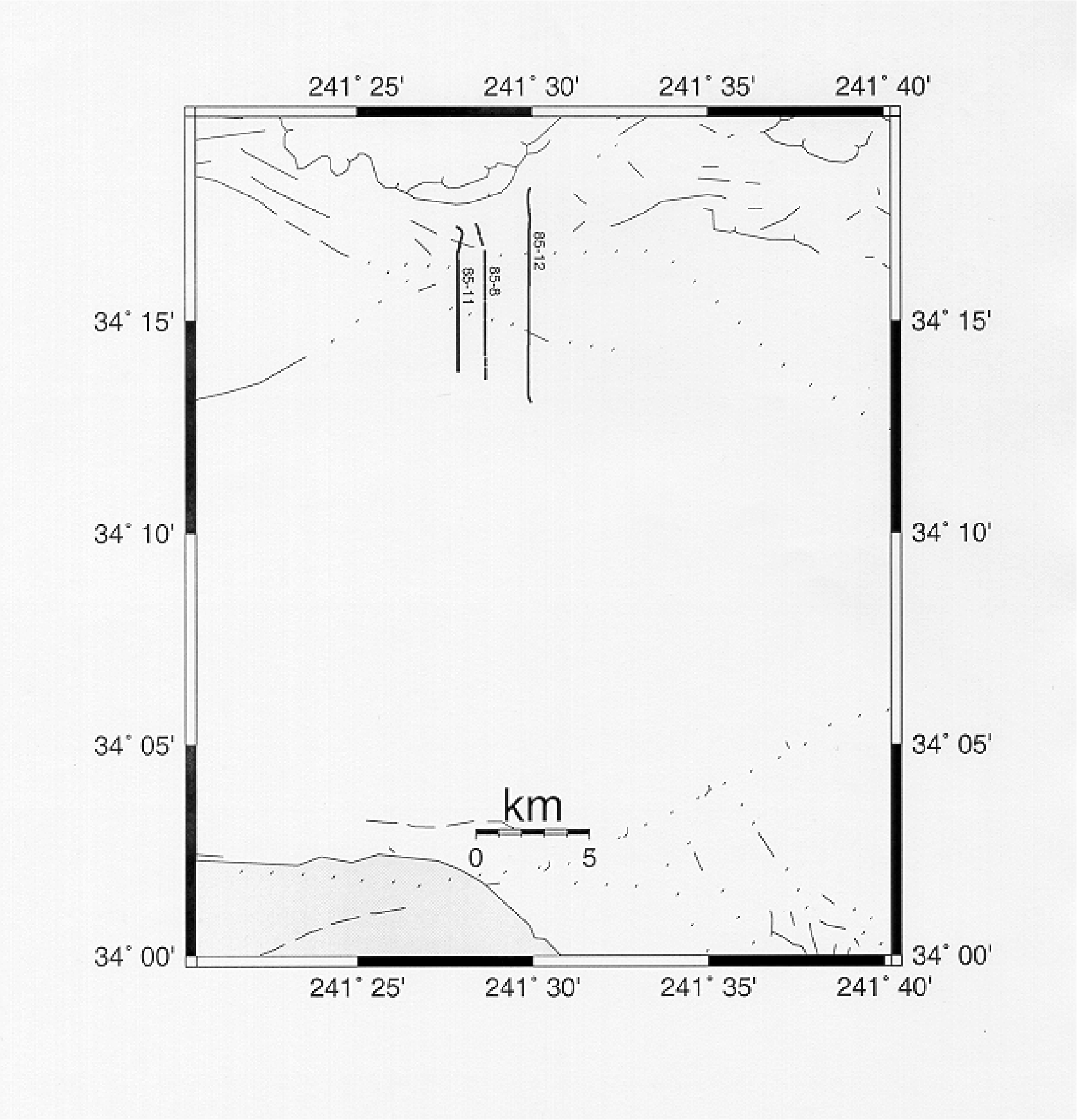

Figure 1. Map of San Fernando Valley and vicinity. Seismic lines are shown in bold. (North is toward the top.)

Figure 1 shows a map of the three seismic lines of reflection da

project. All three lines begin to the north barely in the foothills

Mountains (SSM) and progress southward into the SFV. Seismic source lines were generated by Vibroseis equipment using a shot interval of geophones spaced at 41 m (x km array). Line 11 is 6.3 km profile cor stations within which 120 shots were collected. (Appendix A). It h orientation and runs down Reseda Boulevard just to the west of the C University at Northridge campus. One km to the east lies Line 8, wh profile consisting of 166 stations. (Appendix B). Geophones record line. It has a north-south orientation and runs down Zelzah Bouleva of the California State University at Northridge campus. Two km to lies Line 12, which is a 9.3 km profile consisting of 228 stations. Geophones recorded 160 shots for this line. It has a north-south or down Balboa Boulevard. Figure 2 identifies the station numbers for shots and geophones were recorded.

EXPERIMENTAL METHODS AND PROCEDURE

Ultimately, our objectives were (1) to create V_P velocity struct and 12; (2) to compare our V_P velocity structures with well V_P sonic Brocher, et al. (1998); (3) to create a V_S velocity structure of the clearest S-wave arrivals, which turned out to be Line 12; and (4) to conversion factor applicable for the shallow SFV.

V_P and $_S$VVelocity Structures

To obtain V_P and V_S velocity structures, the procedure for each

essentially as follows:

⇒ Set up geometry files in UNIX by array and shot gather number. Th
shell files to calculate the radial distance (x) in km on a straig
coordinates (easting and northing) of the starting flag number for
the array as well as manually inputting the elevation (z) for each
No y-dimension was necessary because all three lines were straight

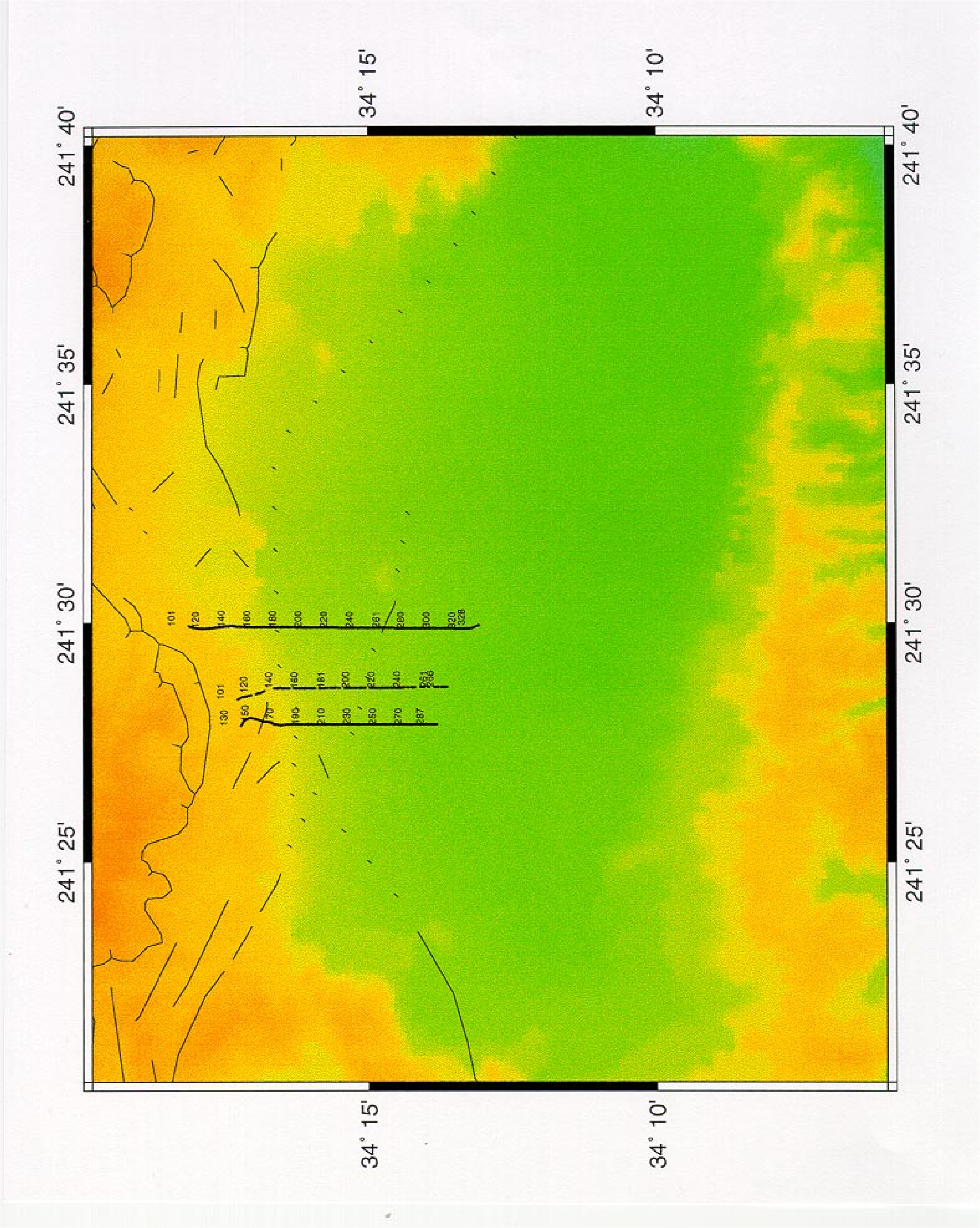

Figure 2. Topographic map of San Fernando Valley showing flag array detail of Lines 11, 8, and 12, respectively.