

Annual Report, 2000  
on  
**Analysis of the Mid and Lower Crust From LARSE II Data**

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### **Introduction**

The LARSE field experiment was concluded in Oct, 1999. A preliminary version of the data was made available to the participating scientist in March of 2000, with a final version completed in Nov, 2000. With the preliminary data we did some quick scans to discover that Moho reflections were not an obvious feature in the data (except in 2 cases) and that a detailed analysis of the structure of the upper crust was need to remove the rather large lateral velocity variations present. Hence, the efforts to date have concentrated on that velocity analysis which has reveled some interesting structure in the Santa Susanna Mtns.

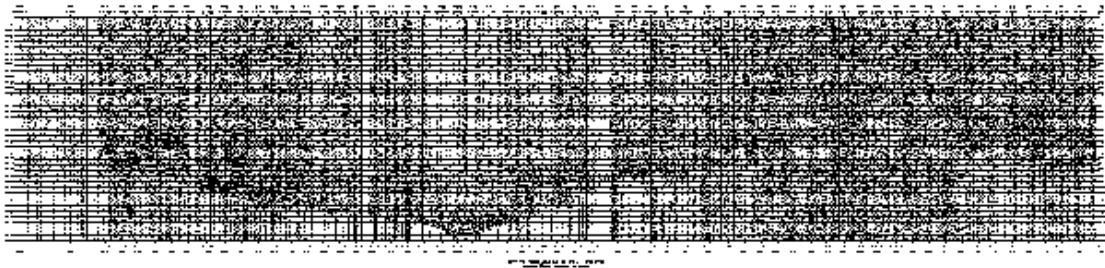


Figure 1. An example of the shot gather from the LARSE experiment. The reproduction here makes the data look a lot worse than is actually is.

### **Analysis of Refracted Waves**

A typical shot from the LARSE II survey is shown in Figure 1. It is difficult to see details at this scale of reproduction (better images are available on the SCEDC Web pages), but the first-arrival branch generally consists of three segments. The first is due to a slow sedimentary layer that is prominent in the San Fernando Basin, with a velocity of 2.0-2.5 km/s. The second is due to basement rocks and has a velocity of about 4.0 km/s. The final arrival segment has a velocity of 6.0 km/s which is the normal mid-crustal velocity in S. California.

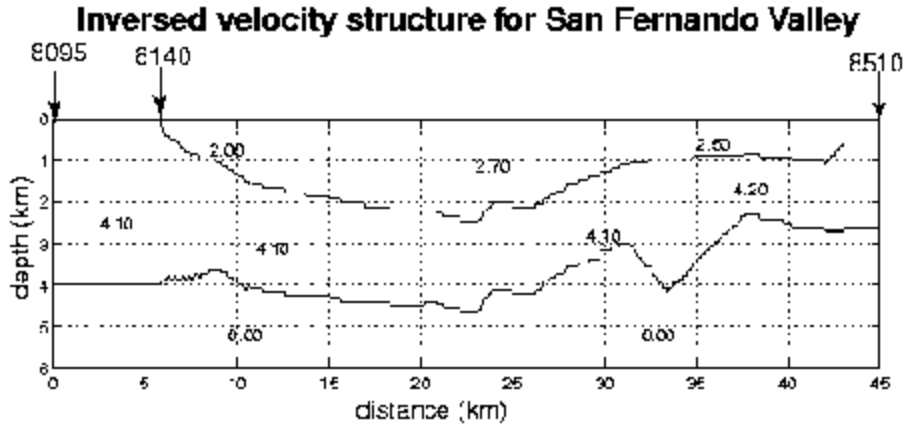


Figure 2. A model for the San Fernando Basin derived from refracted waves.

To analysis these refractions we have picked the first arrival branch out to a distance of about 25 km on all shot gathers with a reasonable signal to noise level. These picks were then used to construct simple 2 or 3 layer velocity models under the assumptions that the geometry is locally flat for each shot gather. This is a similar assumption to the one made in processing CMP gathers from seismic reflection surveys. A model is then constructed by placing each 1D model result at the shot location and laterally joining the layers to form a 2D model. This method should do a good job of determining the longer wavelength structure on the upper crust. The result is the model shown in Figure 2. The major slow zone on the center of the model is the San Fernando Basin.

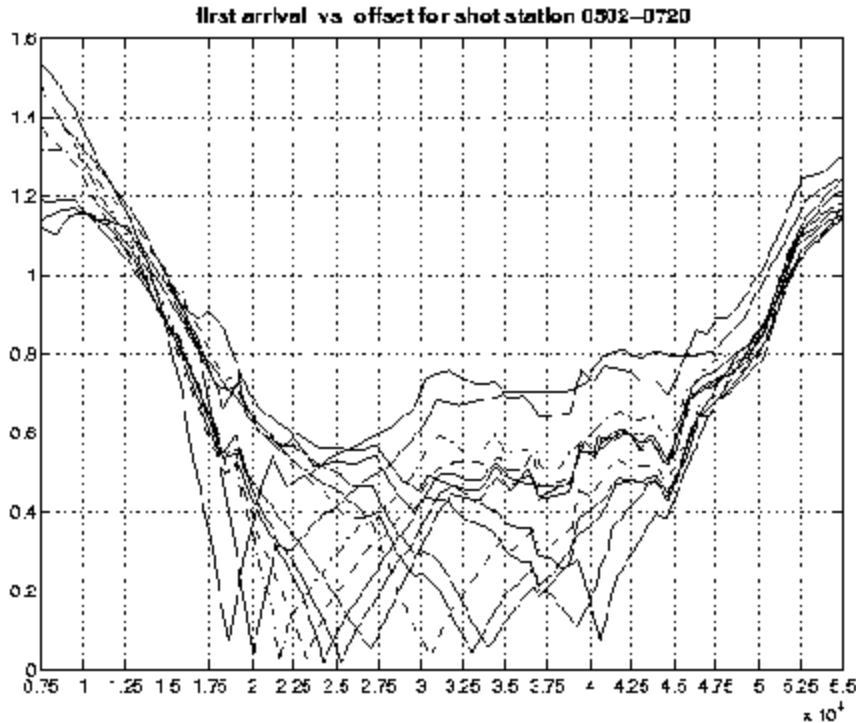


Figure 3. The picks of first arrivals for a suite of 12 shots between the Bouquet Canyon Fault (1.75 on the x-axis) and the San Andreas Fault (at 4.5 on the x-axis). The observation that all the branches show a low-velocity zone at the same points on the x-axis indicates the presence of the two faults.

### Refracted Waves in the Santa Susanna Mtns

In looking at the refracted waves as described in the previous section, we noticed a somewhat peculiar structure to the first arrival branches in the Santa Susanna Mtns. A suite of first arrivals from 12 sequential shot points between the Bouquet Canyon Fault and the San Andreas Fault are shown in Figure 3. In that figure, the travel times have been reduced by 6.0 km/s, which means that horizontal branches are traveling at 6.0 km/sec while upper sloping branches are moving slower (typically around 4.0 km/s). Note that a common feature of the shot gathers is that they consist of 3 branches, with the last branch representing a regression in velocity back to around 4.0 km/s. Both the break-over points for the branch occur at about the same point on the earth. For the north-of-shot branches, this occurs at the San Andreas Fault, while for the south-of-shot branches it is at the Bouquet Canyon Fault. One simple explanation for this behavior is the between these two faults is a high velocity zone. A model determined from modeling this type of geometry is shown in Figure 4. The geologically interesting aspect of this model is that the Pelona Schist lies in between these two faults. The tectonically interesting aspect is that the high velocity zone may mean that the zone between the faults has been uplifted. More analysis is needed to confirm this hypothesis.

### Velocity structure for Liebre-Sawmill Mtns

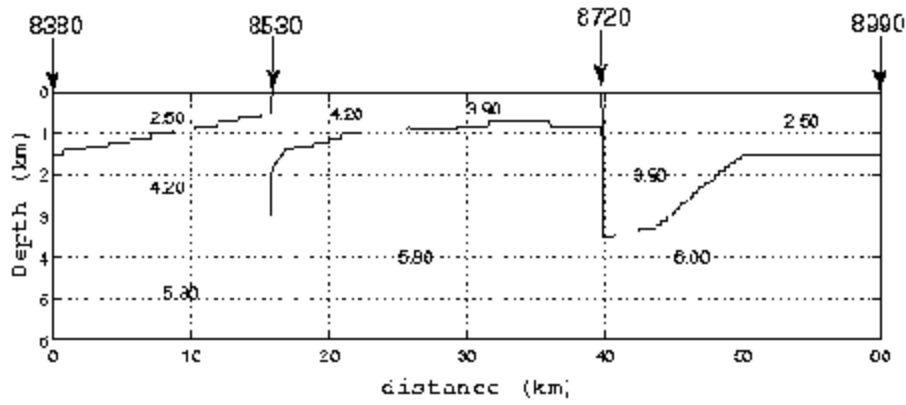


Figure 4. Model for the region of the Santa Susanna Mtns between the Bouquet Canyon Fault (shot point 8630) and the San Andreas Fault (shot point 8720).