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Washington, DC

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Subject: January, February, and March, 1980  
Quarterly Progress Report Contract  
No., NRC-04-76-323 Modification #4

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During the quarterly period of January, February and March of 1980, progress has been made on all aspects of the current contract. During this period, special emphasis has been placed upon the reduction, compilation, synthesis, and analysis of the data sets to prepare for the oral presentation to the NRC New Madrid Seismo-tectonic study group in Bloomington, Indiana in early April and the preparation of five oral papers that are planned for presentation at the North-Central Section meeting of the Geological Society of America on 9 April, 1980.

The reduction of the gravity data collected during the 1977, 78 and 79 field seasons has been completed and a Bouguer gravity anomaly map prepared from these data. This preliminary map is shown in Figure 1 and is the subject of one of the papers to be presented at the North-Central section of the GSA. The Bouguer gravity data set between approximately  $82^{\circ}\text{W}$  and  $92^{\circ}\text{W}$  and  $35^{\circ}\text{N}$  to  $39^{\circ}\text{N}$ , which comprises some 75,000 gravity stations, has been gridded at a 2 km interval and a 5 mgal Bouguer gravity anomaly map has been prepared from that data at a scale of  $1:10^6$ . A reduced copy of this map is shown in Figure 2. A document describing the origin and reduction of the data and compilation and preparation of the map has been prepared and submitted to the Nuclear Regulatory Commission for publication as a Nuclear Regulatory Commission Report.

Similarly, the magnetic data available for approximately the same area has been gridded at a 2 km interval and also prepared into a 100 gamma contour total magnetic intensity anomaly map at a scale of  $1:10^6$ . A reduced version of this map is shown in Figure 3. A document describing the characteristics of the magnetic surveys used to acquire the data for this map and the preparation of the map itself has been prepared and submitted to the Nuclear Regulatory Commission for publication as a Nuclear Regulatory Commission Technical Report.

Nine seismic refraction profiles which have been recorded in the Wabash Valley Area to investigate the structure of the crust in the area of a possible northeastern extension of the New Madrid Fault Zone have undergone preliminary analysis. The location of these lines are shown in Figure 4. A significant aspect of the recorded data is that much of the energy is found to be propagated as direct, refracted, and reflected shear waves. Compressional waves also are recorded, but with relatively smaller amplitudes. Interpretation is based on both shear and compressional waves. Models derived for lines 3, 4, 5, 6, and 7 are shown in Figure 5. These are preliminary models and continued data analysis may result in refinement of velocities and depth. Shear waves and compressional wave velocities for the interpretative third layer on these models are considered to be anomalously high at the depth indicated by the data. However, these data are consistent with previous interpretations of crustal seismic and surface wave data in the Mississippi Embayment. The preliminary results of this study are the subject of another paper to be presented at the North-Central Section of the Geological Society of America.

Research relating to the up-grading of the basement geological map has been continuing. Special emphasis has been placed upon mapping the distribution of the pre-ift. Simon sedimentary rocks in the deeper parts of the Illinois basin. Studies on the mafic and ultramafic intrusions of the area with K-AR age determinations of these rocks also are continuing. In addition, the physical property study of basement rock samples including normal remanent magnetization, magnetic susceptibility, and density measurements, are continuing.

A considerably expanded version of the progress to date and specifically the progress during the last quarter is included in the Progress To Date section of the proposal that has been prepared for the continuation of the current contract during the period 7/1/80 to 6/30/81.



Figure 1. Bouguer gravity anomaly map of southern Indiana-1980. Contour interval is 2.5 mgals. Reduction based on I.G.S.N. 1971, G.R.S. 1967 and a density of 2.67 gm/cc.

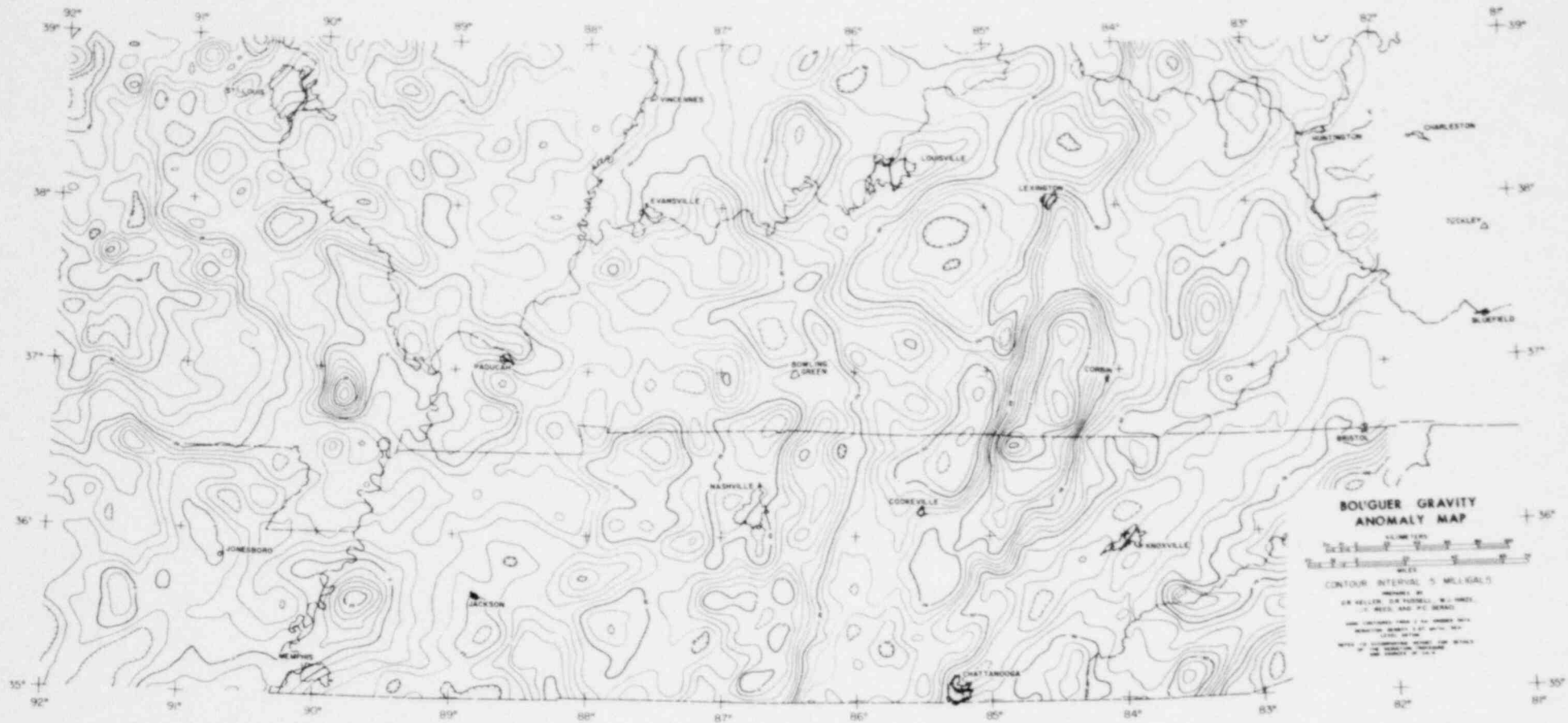


Figure 2. Bouguer gravity anomaly map prepared from a 2 km interval grid of existing data. Contour interval is 5 mgals. Reduction based on I.G.S.N. 1971, G.R.S. 1967 and a density of 2.67 gm/cc. Terrain corrections have not been applied to data.

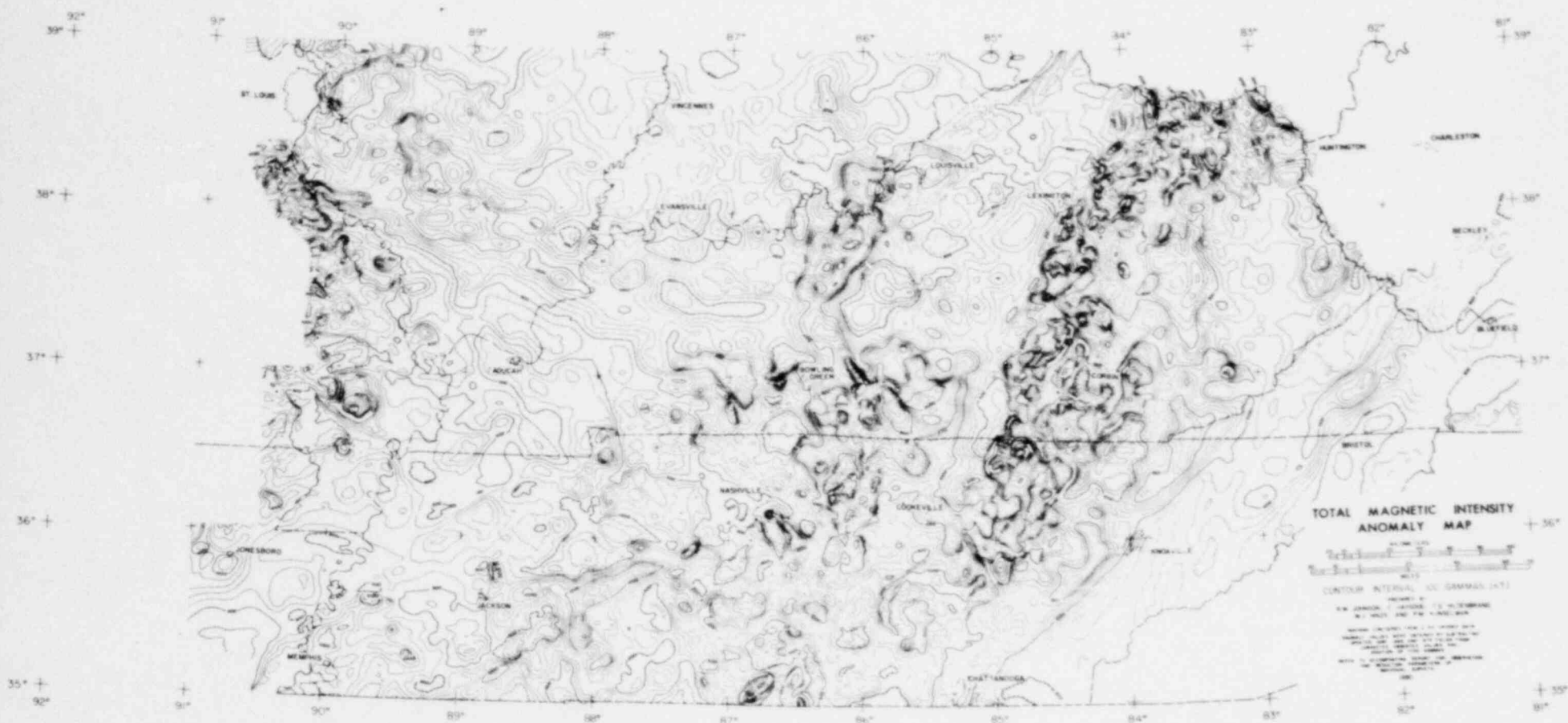


Figure 3. Total magnetic intensity anomaly map prepared from a 2 km interval grid of existing data. Contour interval is 100 gammas (nT). A constant 1000 gammas was added to all values to minimize the negative contour labels.

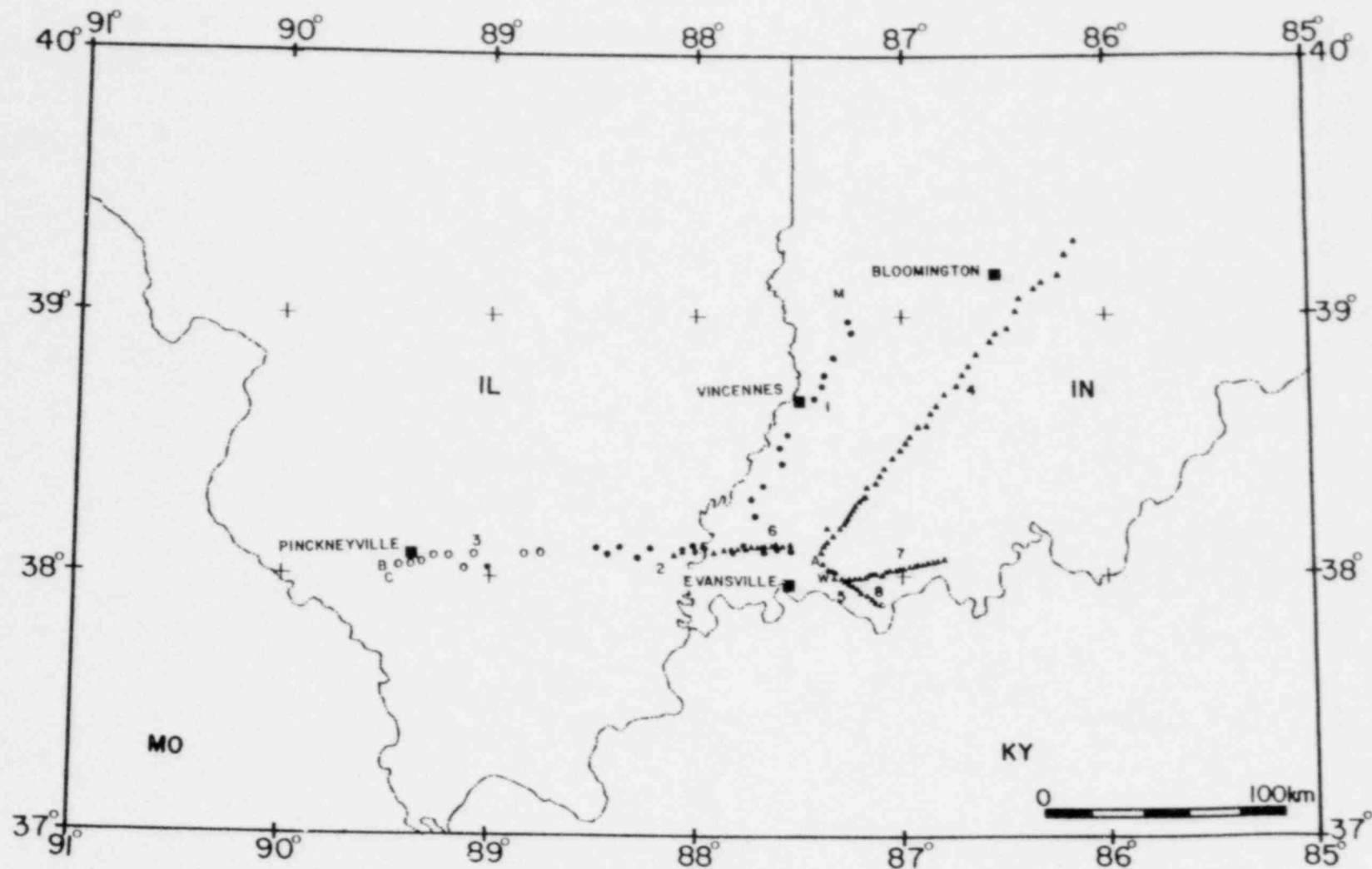


Figure 4. Seismic refraction site locations. Triangles and circles represent seismograph site locations for different years, (Circles-1978, triangles-1979). Numbers are line numbers. Squares represent cities. Letters represent mines used as sources (A-Ayrshire, W-Wright, M-Minnehaha, B-Burning Star #4, C-Captain).

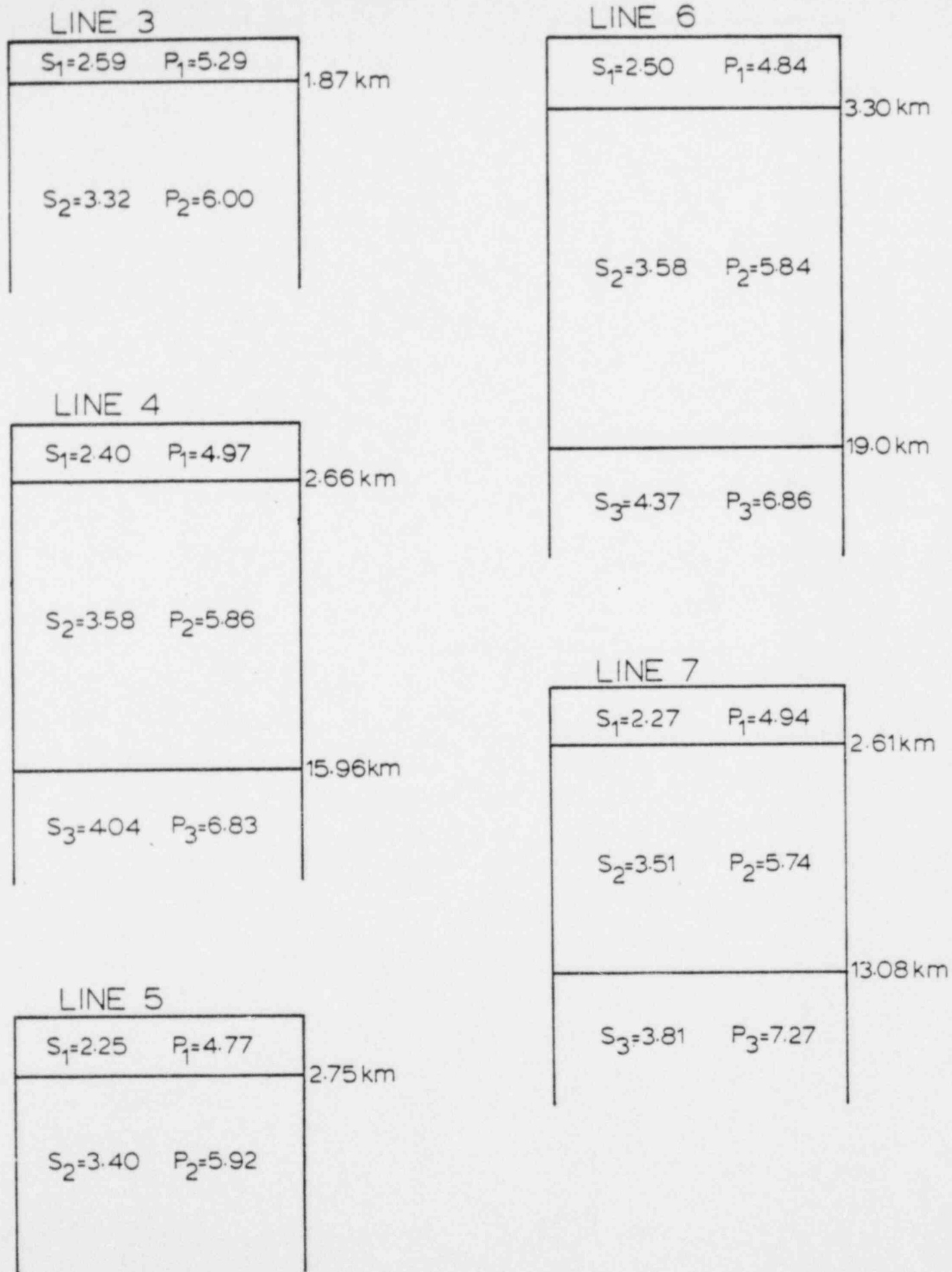


Figure 5. Crustal models derived from refracted compressional and shear waves for lines 3, 4, 5, 6, and 7.