CHAPTER IV

SOFTWARE TESTING AND FIELD EXAMPLES

The objective of this study is to develop a computer software for processing data obtained from the seismic reflection survey. The software comprises of several modules as explained in Chapter III. Algorithms used in the software are checked for their continuation since the data processing must be performed continuously from module to module. The software must also be checked for its reliability. In this Chapter, the software testing will be described. There are 2 objectives in the testing : to test for the operation of the software and to verify the results processed by the software. The methods of testing included model data test and field data test.

Model data test was performed to verify the result of data processing under the specified conditions assuming that there is no noise.

The field data test was carried out on selected areas where the conditions cannot be specified.

Model Data Test

The model testing began with calculating the 2 way travel time of 5 layer models (non dipping and

arbitrary dipping) which are shown in Appendix A, the calculation used the algorithm of Gangi and Yang (1976) and Settlegger (1965). Acoustic impedance of each interface was calculated and convolved with 150 Hertz Ricker wavelet. The result are shown in Figure 4-1 for the non dipping model and Figure 4-2 for arbitrary dipping model. These data were subjected to processing modules ; the results are as follow :

CDP The seismic model data which is shown in Figure A-1 and Figure A-2 were stored on diskette and CDP module was applied. The output data is stored on diskette and is shown in Figure 4-3 for non dipping model and Figure 4-4 for arbitrary dipping model.

NMO The NMO module was applied to the CDP sorted data with the velocity to first reflector of 1750 M/S. 6 traces in CMP record were NMO corrected and stacked together and stored on a diskette. The result of this module is shown in Figure 4-5.

VEL The VEL module were applied to CDP sorted data. The beginning velocity is 1600 M/S and the final velocity is 2300 M/S with increment velocity of 50 M/S. The flatten event are selected and shown in Figure 4-6.

STA The STA module can not be tested because the testing model is a flat surface.

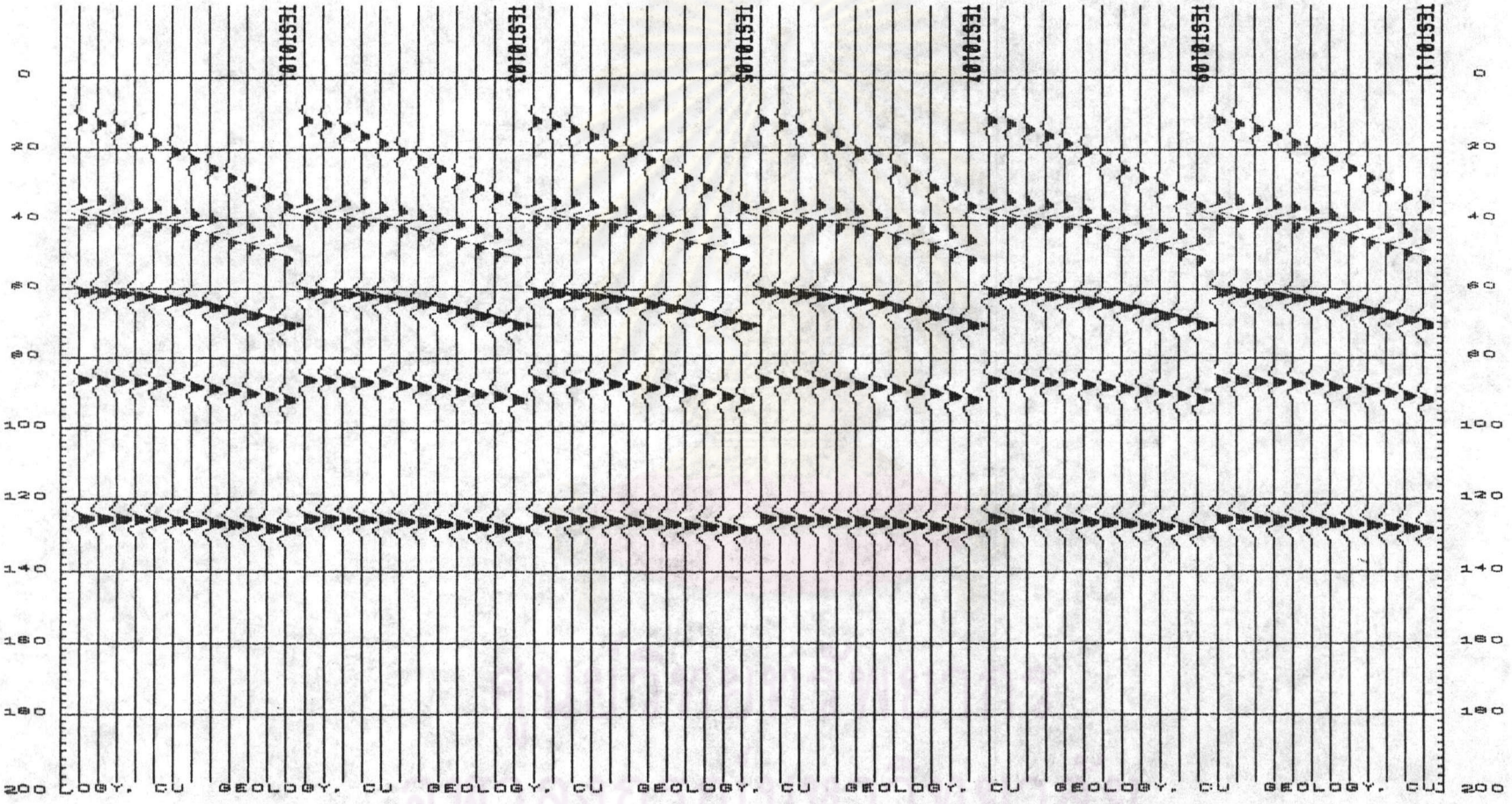

Figure 4-1 Synthetic reflection seismograms of non dipping model in Figure A-1 with 5 meters offset and 5 meters station interval.

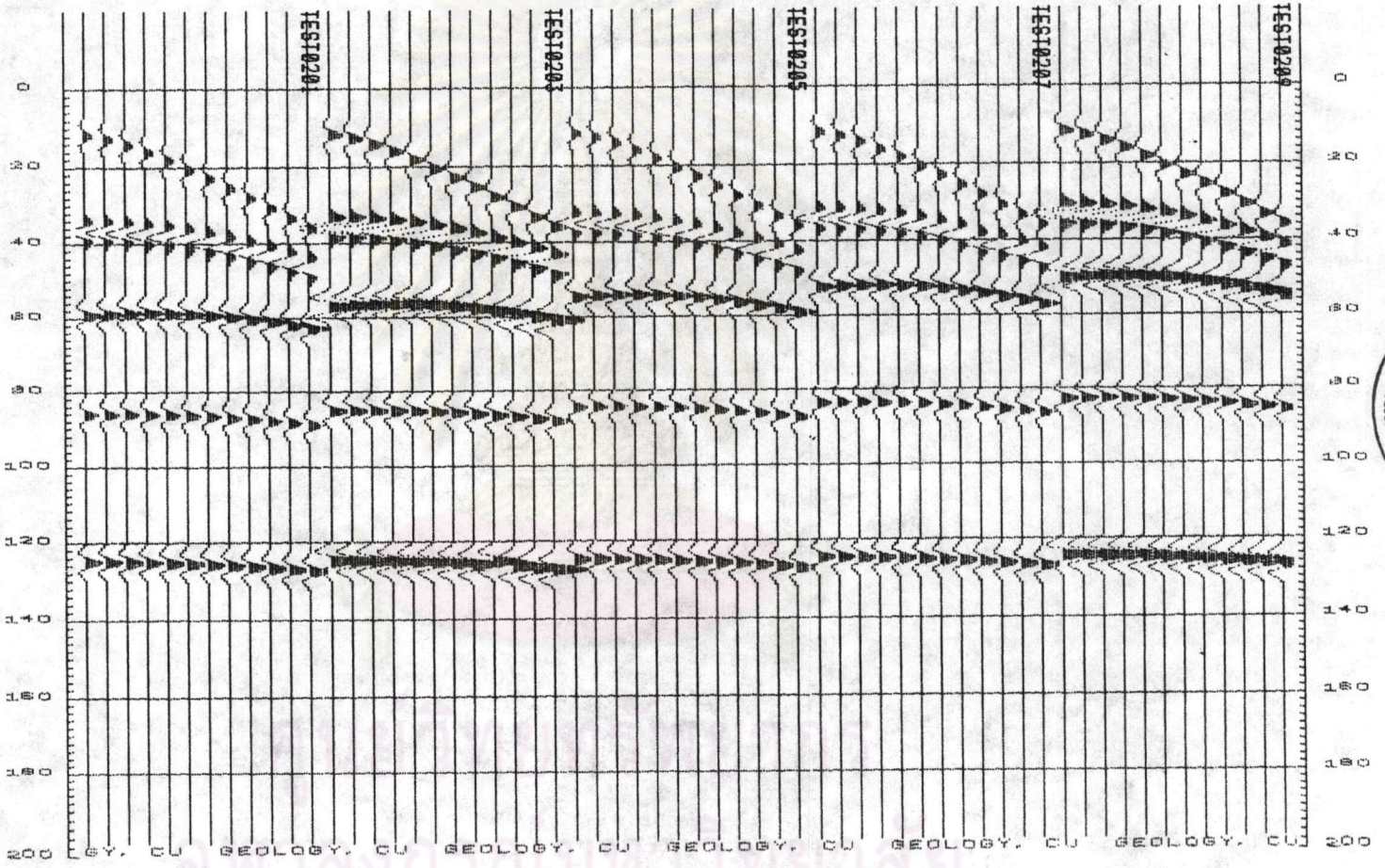

Figure 4-2 Synthetic reflection seismograms of arbitrary dipping model in Figure A-2 with 5 meters offset and 5 meters station interval.

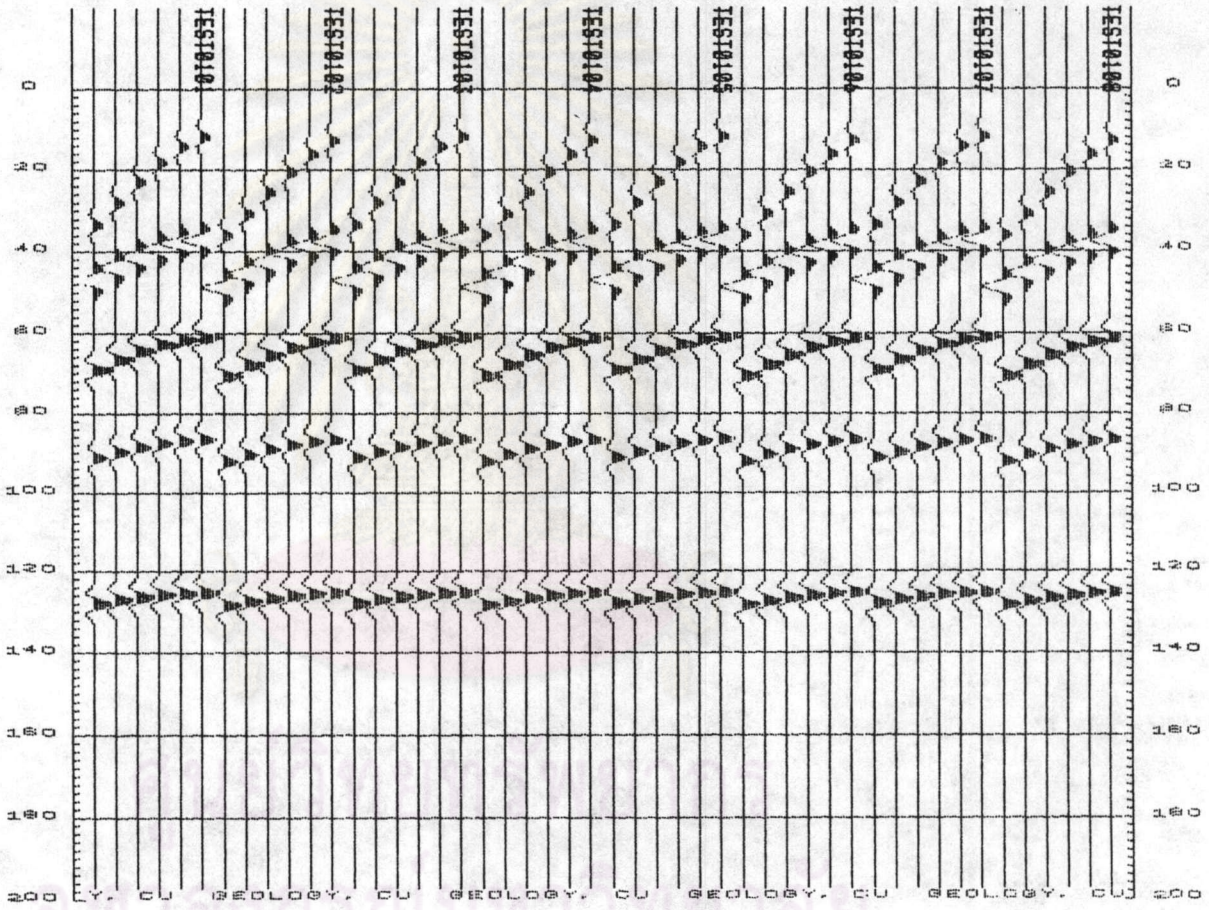

Figure 4-3 6-fold CMP gathered data from Figure 4-1.

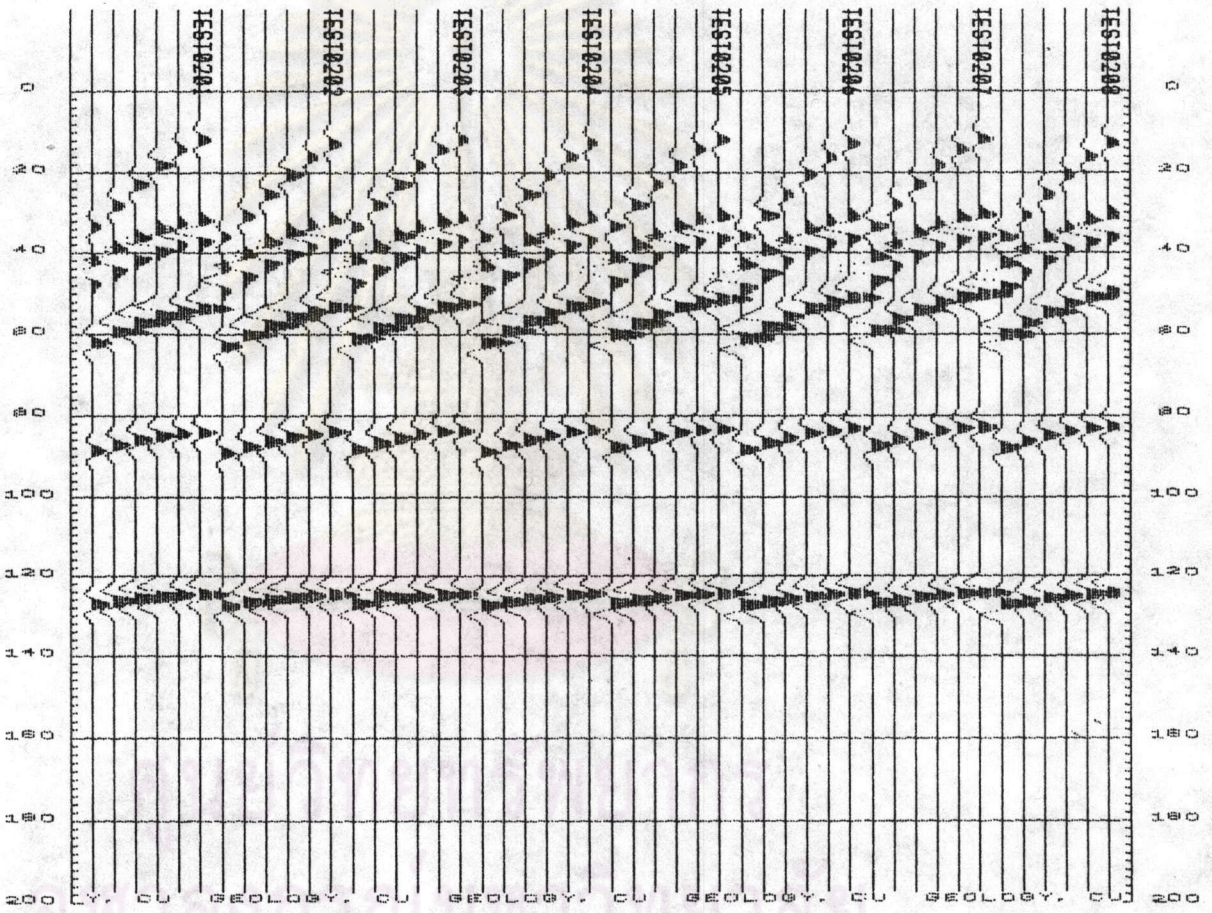

Figure 4-4 6-fold CMP gathered data from Figure 4-2.

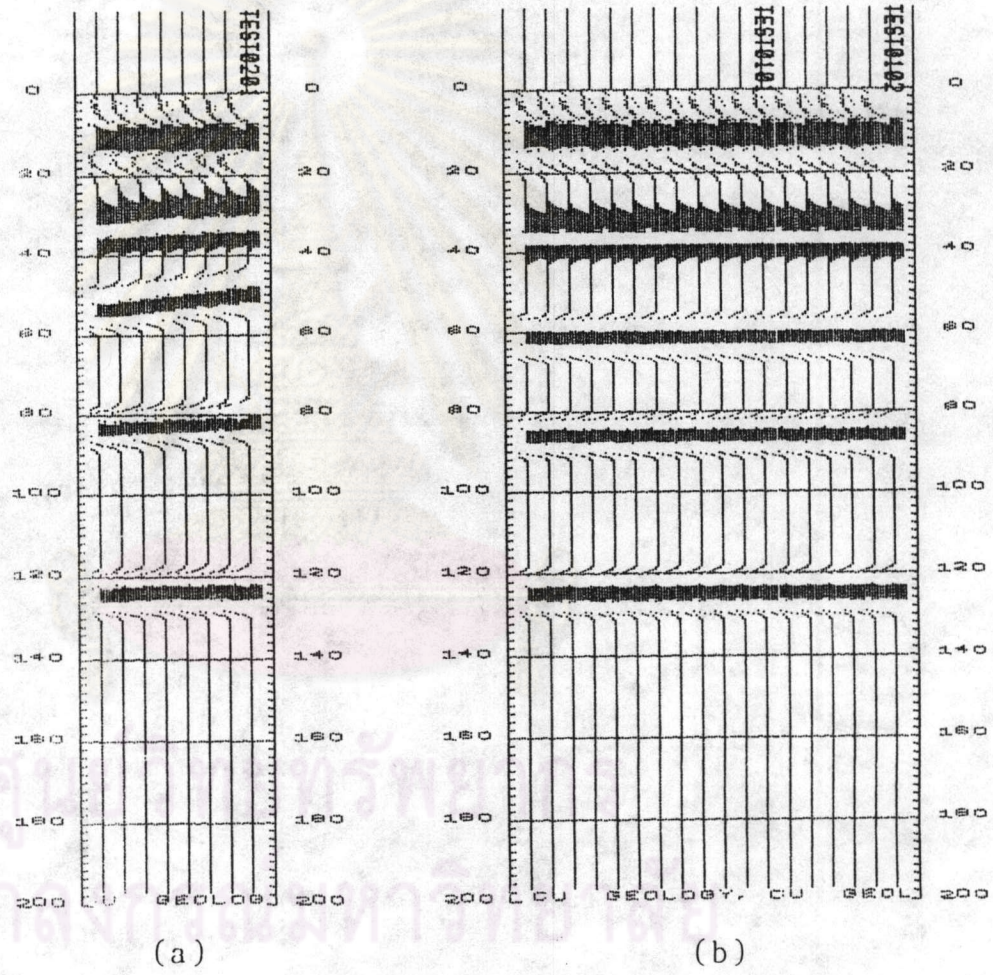

Figure 4-5 NMO corrected data for
(a) arbitrary dipping model
(b) non-dipping model.

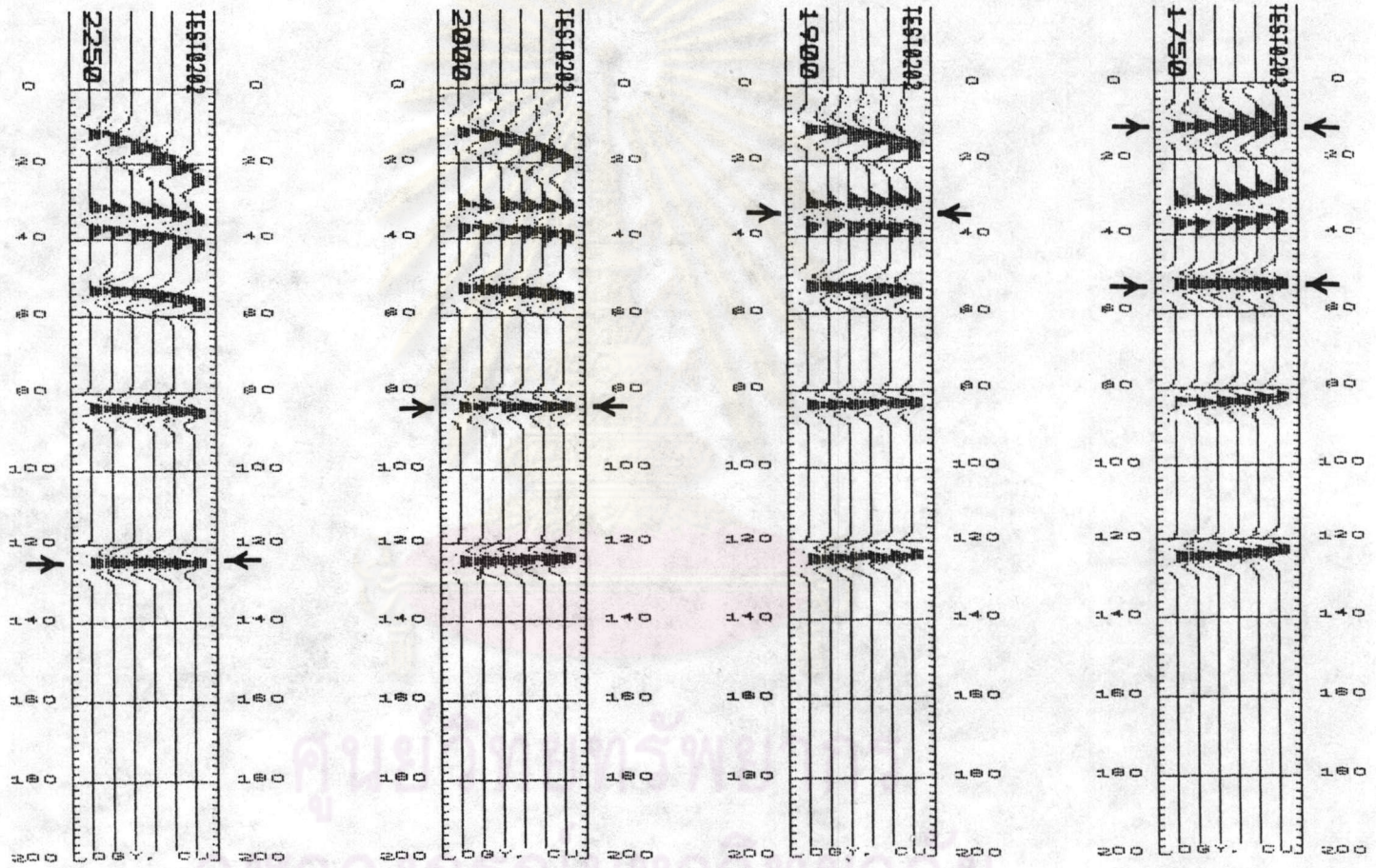

Figure 4-6 Output of VEL module.

The output of NMO shows the same reflector as the model : therefore, it is concluded that the software functions as expected.

Field Data Test

The field area are located in the north of Chiengmai Province at Ban Rong Wua and Ban Huai Kieng (Figure 4-7) about 8 kilometers and 25 kilometers from Chiengmai respectively. The data collection was carried out during 15 January - 15 February 1987. 5 seismic lines with station interval of 5 meters were selected for both area. On each line, both common mid point and common offset data were acquired. Totalling 1500 line-meter of common mid point and common offset data were collected.

Geology of Field Area Both field areas lie on Mae Num Ping flood plain which is characterized by lacustrine and fluvialtile sediments of Quaternary age (Kaewyana, 1985).

Ban Rong Wau lies on the eastern rim of Mae Num Ping flood plain. The study area is partially located on the natural levee and partially on a back swamp of Mae Num Ping. Further to the east are oxbow scars (Figure 4-8). Natural levee sediments here were described by Kaewyana (1985) as "consisting of sand and silt deposited as shallow sheets during flood stages. The sand dispersed in the silt is fine grained, well sorted

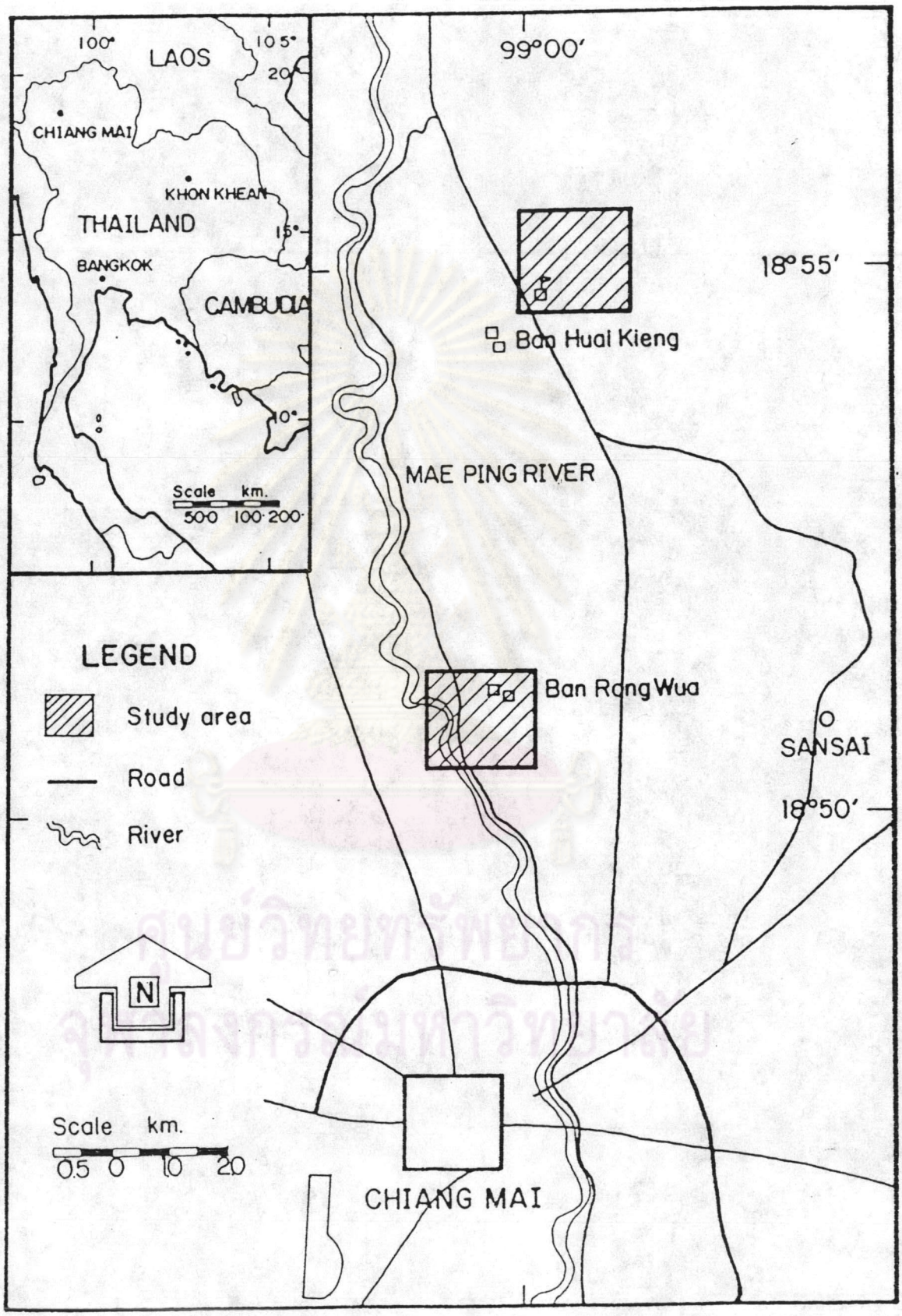

Figure 4-7 Location of field area.

Figure 4-8 Aerial photograph at Ban Rong Wua area shows natural levee. Contours are elevation in meter above sea level.

and subangular. Natural levees sands and silts were found to overlie channal sand and gravels."

Ban Huai Kieng lies on the high terrace of Mae Num Ping (Figure 4-9). To the south and to the west of study area are gravel pits that are being mined for construction material. The gravel appear to be thining toward the west and northwest. Kaewyana (1985) described the high terrace as "consisting of silt and sand at the top. The sand varies in grain size from fine to coarse and is gradually, subangular and poorly sorted. Underlying the silt and sand are gravel beds. Sandstone, Quartzite, Quartz, and Chert make up the majority of the gravel components. The thickness of silt and sand on the high terrace is more than 7 meters."

Survey Planning

Survey Area Both areas were selected based on refraction survey tests as well as accessibility. Ban Rong Wua is a flat lying area covered by paddy field. The shallow sand layer is known from shallow bore hole to be at approximately 6 meters. 3 seismic lines cover area of approximately 800 square meters. Study area at Ban Huai Kieng is a smooth hill of gravels covered by scrub. Gravel pits at the south and west of study area show sand layers of approximately 6 meters above gravel bed. The gravel bed itself is probably more than 8 meters thick. 2 seismic lines cover

Figure 4-9 Aerial photograph at Ban Huai Kieng area shows the Mae Nam Ping Terrace. Contours are elevation in meter above sea level.

area of approximately 400 square meters. Data acquisition was done using both 6 fold CDP technique and common offset techniques on each line. Three weeks were spent for field data acquisition.

Positions and Directions of Seismic Lines

Since the general direction of Mae Num Ping is running in the North-South direction. The seismic lines were chosen to run in the approximately East-West direction in order to observe lateral variation of depositional sequences. The location of seismic lines are illustrated in Figure 4-10 and Figure 4-11.

Field Equipments Though some discussion concerning seismic sources and reciever for shallow reflection survey were given previously, the set of equipments used in this work is the one that is already available. It comprises

- ABEM Terraloc Mk II seismograph with 12 channels.
- Seismometer cable with 12 take-out at every 12.5 meters
- 50 meters extension cable
- 13 geophones with 10 Hertz resonance frequency
- trigger cable
- 14 and 16 lbs hammers and a shock plate

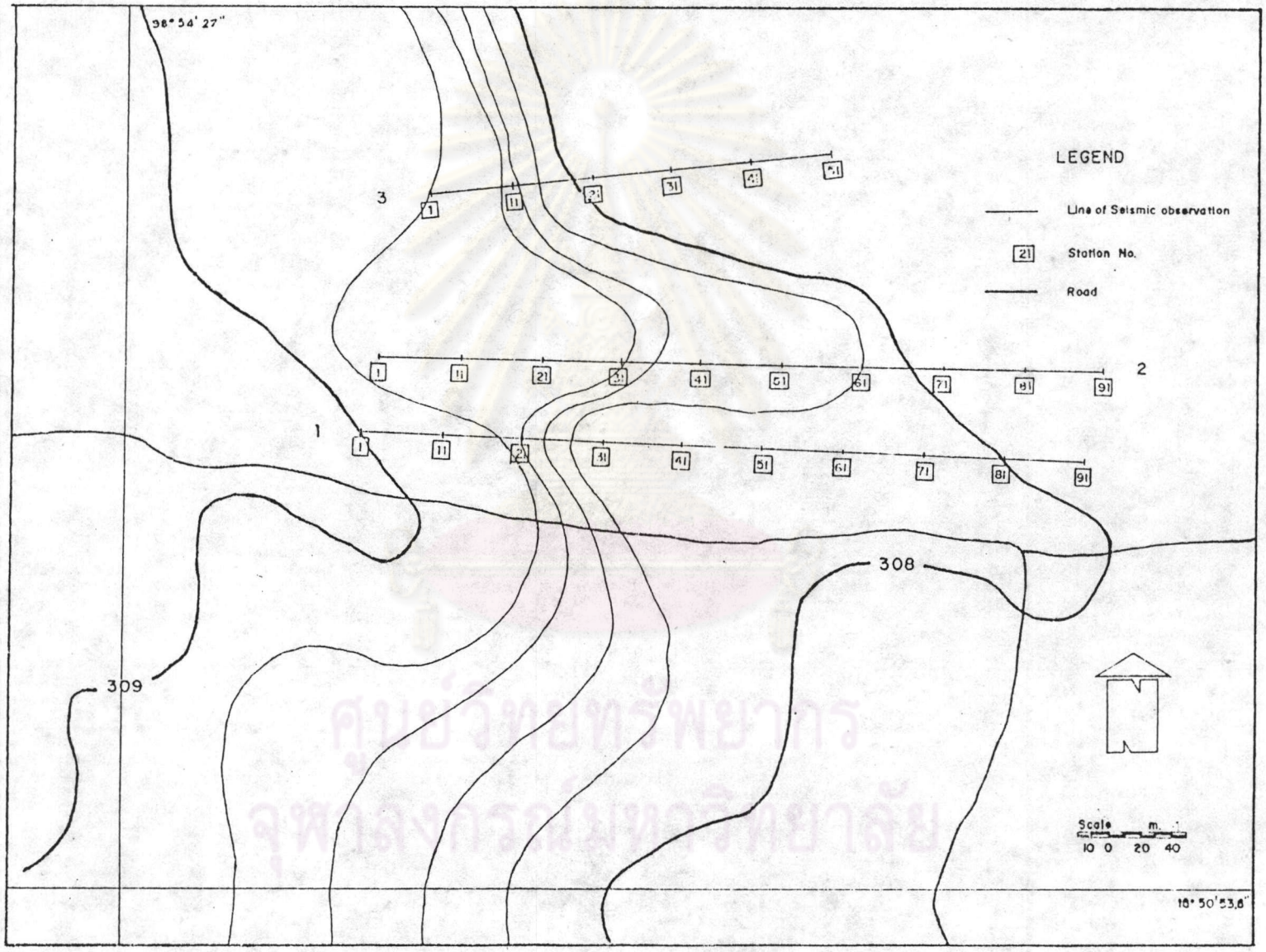

Figure 4-10 Survey area and seismic line at Ban Rong Wua.

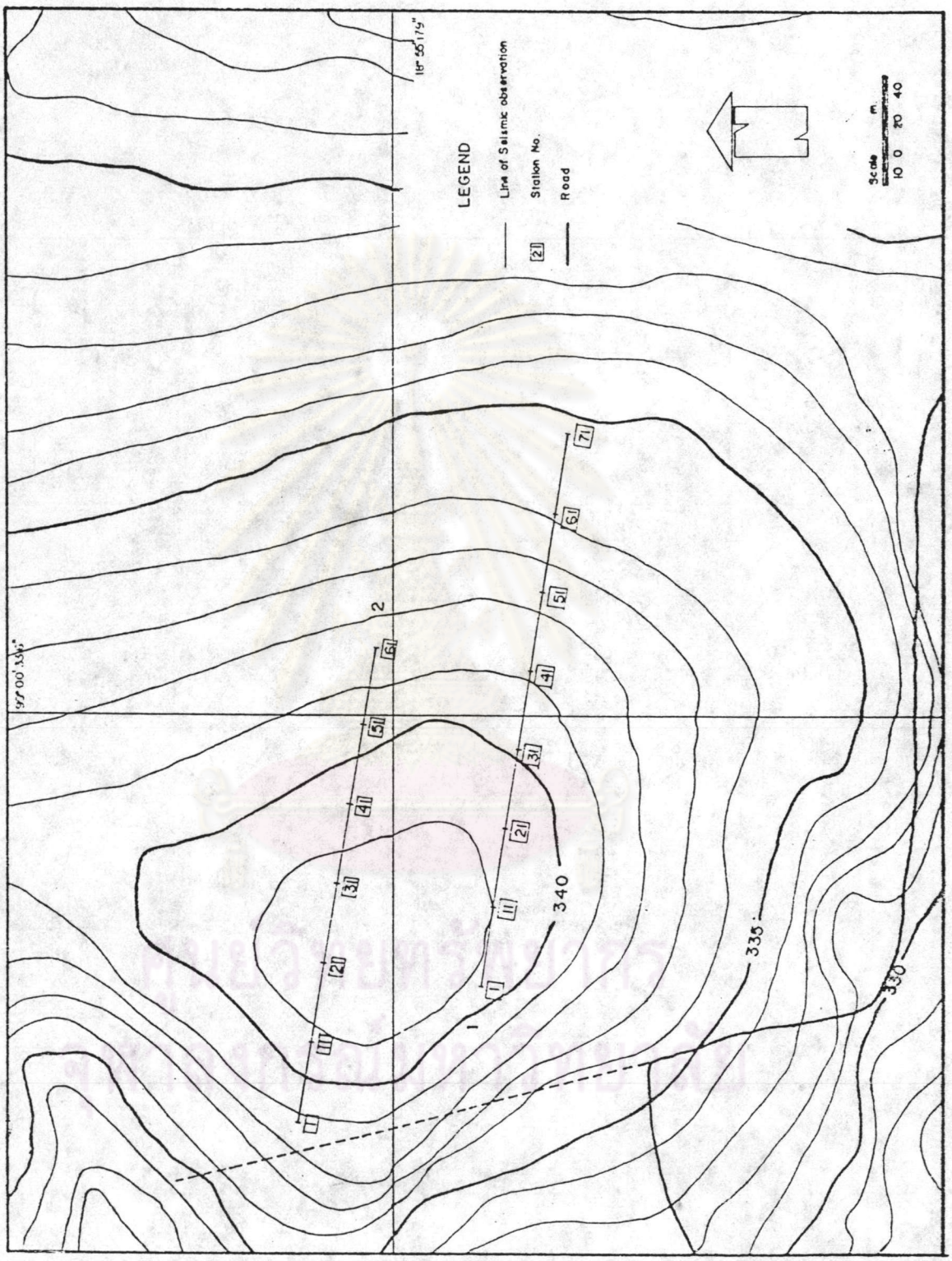

Figure 4-11 Survey area and seismic line at Ban Huai Kieng.

Field Techniques Since the aim of this survey is to compare the results obtaining by common depth point technique with common offset technique, field data were acquired using both techniques on each line.

Common Offset Technique The optimum offset has been selected at 30 meters at Ban Rong Wua and 35 meters at Ban Huai Kieng by the refraction survey during site selection. Figure 4-12 show the reflector which is the depth target and the optimum window of line 1, 2, and 3 at Ban Rong Wua. Figure 4-13 shows the reflector which is the depth target and the optimum window of line 1 and 2 at Ban Huai Kieng. The field configuration as shown in Figure 4-14 is used with shot point being to the west of the geophone.

Common Depth Point Technique The 6-fold CDP shooting was applied on each line. The field configuration as shown in Figure 4-15 is used. The spread length, geophone spacing, shot offset were 55 meters, 5 meters and 5 meters respectively. The source and the spread were moved together 5 meters ahead after each shot has been done. Signal to noise ratio was enhanced by vertical stacking until the reflected event was easily identified on the CRT screen. The signals were then recorded on a digital tape recorder and were later transfered to a microcomputer.

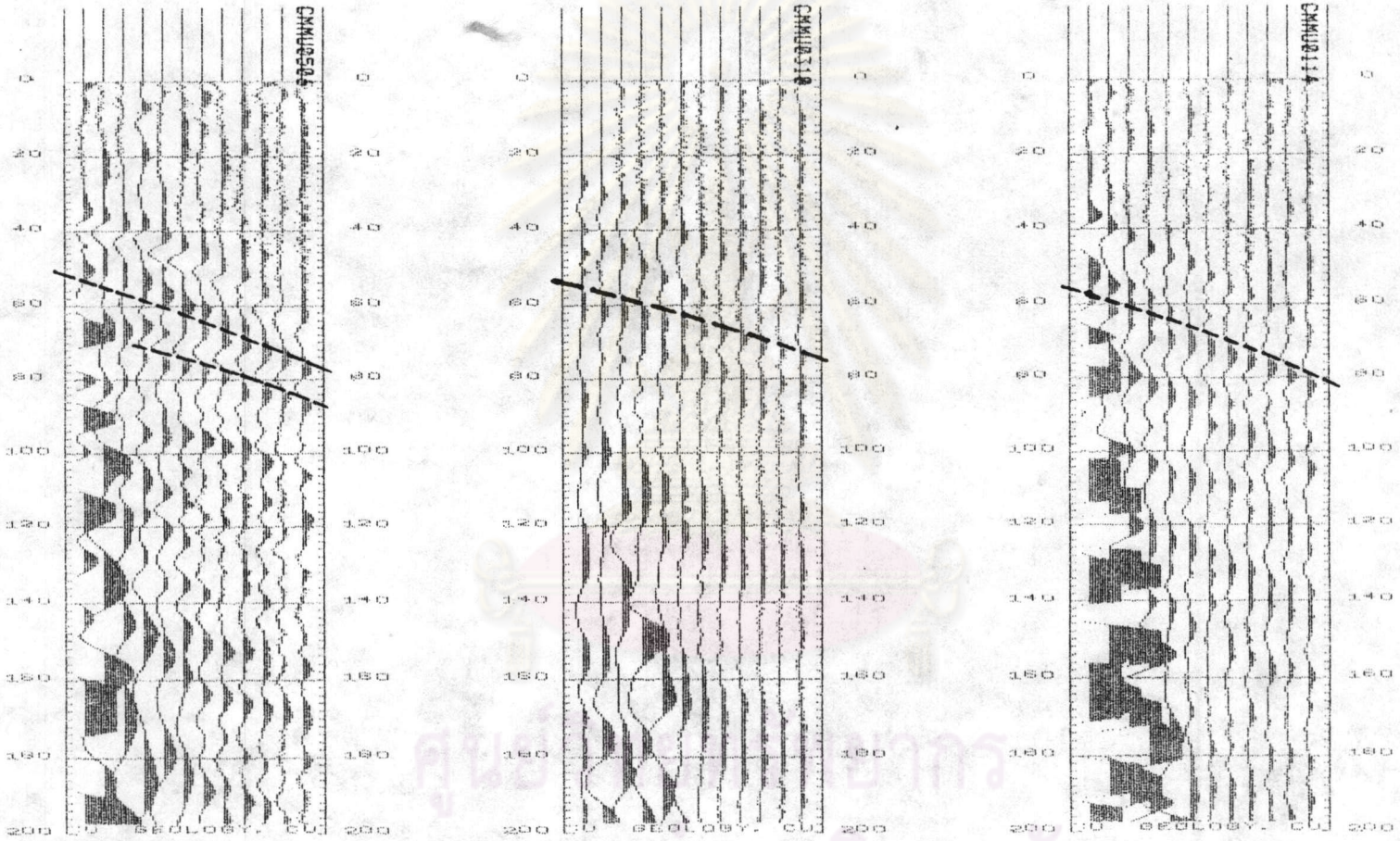

Figure 4-12 Depth target reflector at Ban Rong Wua area. (a) line 3 (b) line 2 (c) line 1

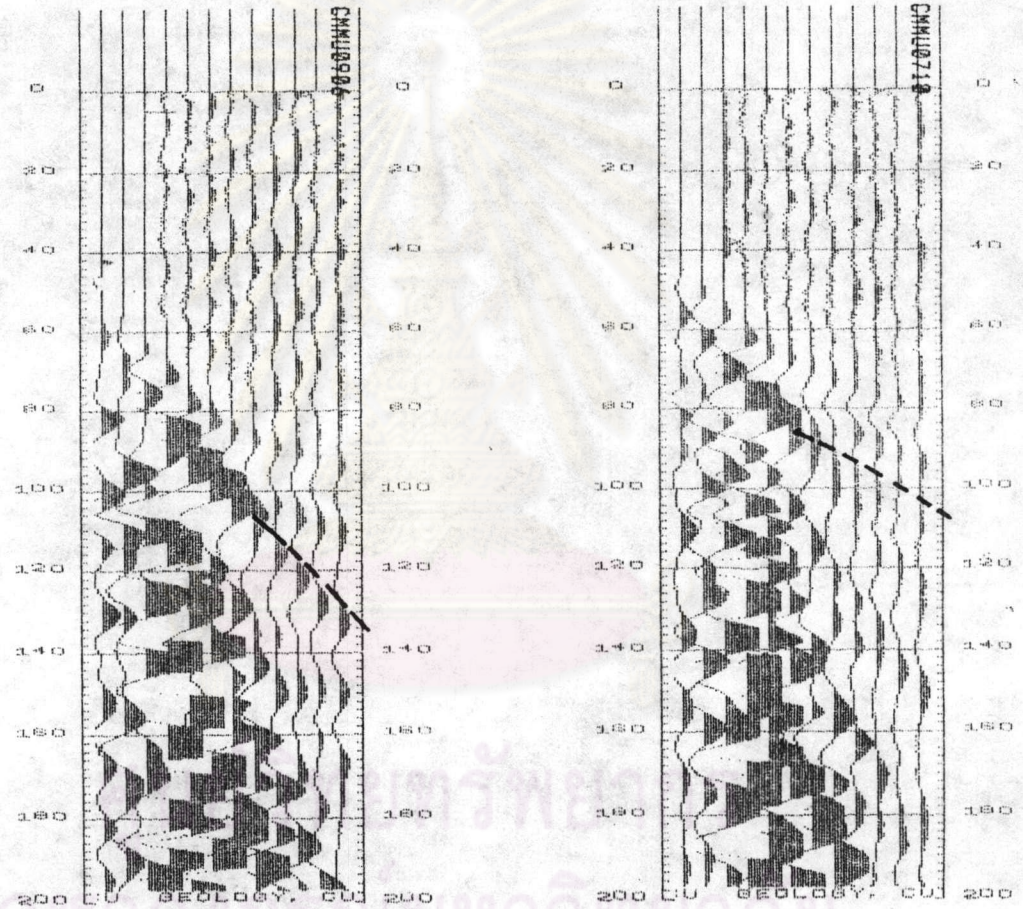

Figure 4-13 Depth target reflector at Ban Huai Kieng area. (a) line 1 (b) line 2

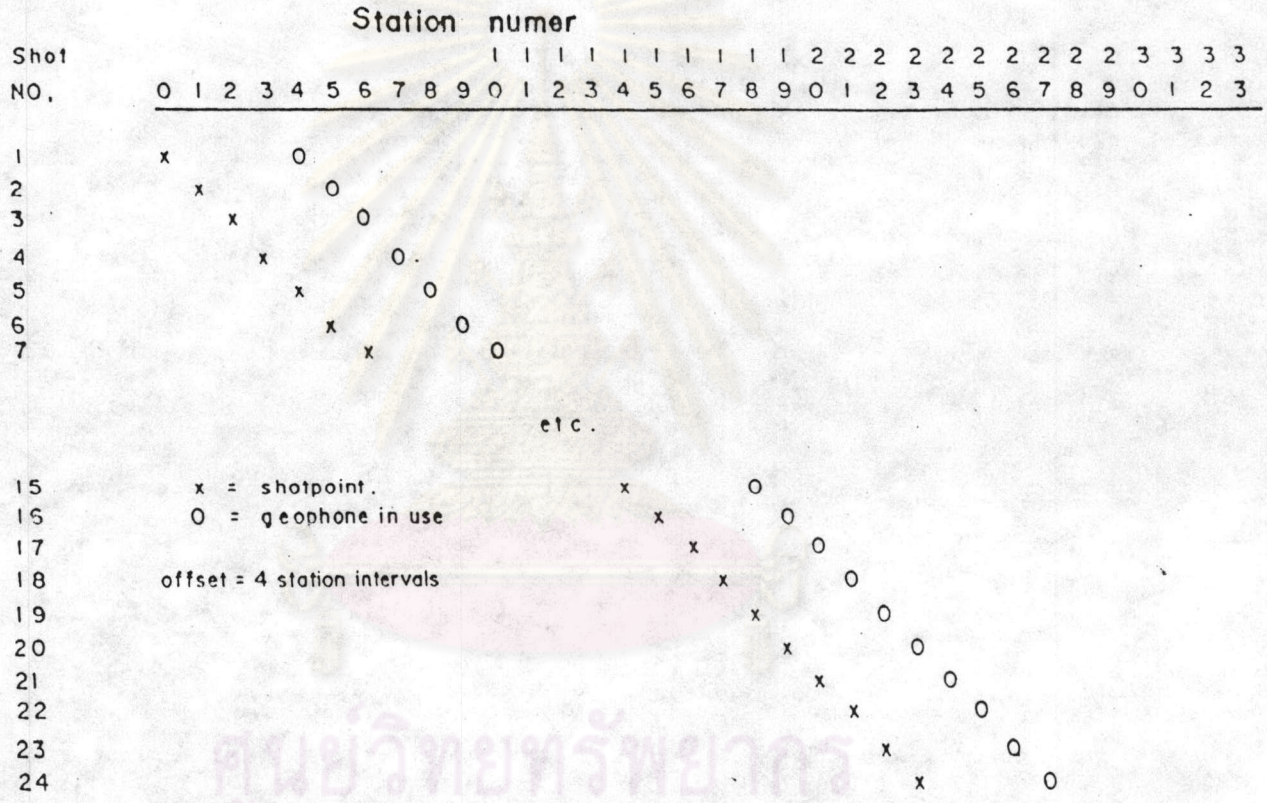

Figure 4-14 Layout of shots and geophones for common offset measurements. A record is made every 12 shots.

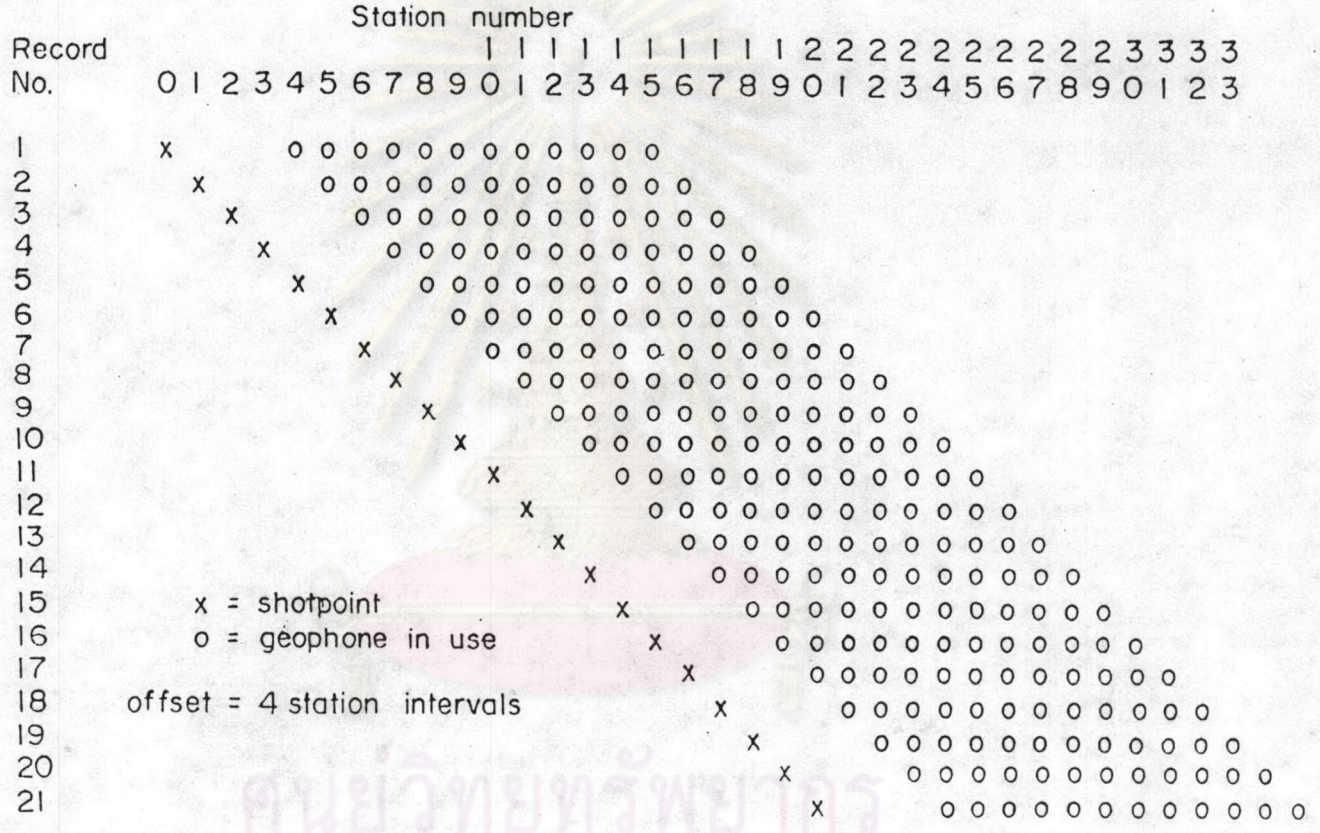

Figure 4-15 Layout of shots and geophones for 6-fold CMP measurments.

Levelling Levelling survey was done on the every seismic line. The results is presented in Appendix B.