Chapter 3
Seismic Interpretation

This Chapter describes geological interpretation of the seismic data. Selected horizons were interpreted throughout the seismic grid covering the study area. These grids were used to construct structural contour maps and isochron maps that showed the structural geometry and evolution of extensional faults in the area. The following description is in terms of geometry, whereas the structural development is discussed in Chapter 4.

3.1 Interpretation of Seismic Profiles

Six seismic horizons (A-F) were interpreted in six E-W and four N-S seismic sections (Figure 3.1-3.10). These horizons were selected because they comprise strong and continuous reflections. The intervals between horizons are defined as unit 1 to unit 5 successively upward. Continuous reflection characterizes the interval between horizon F and D. Below horizon D, reflections are less continuous and dip to the east. Gentle curved and planar normal faults are common. All faults are numbered for easy reference. The order of fault numbers does not imply the sequence of fault development. In-lines 96, 107, 116, 122 and 128 show normal faults forming a horst structure. The horst is an uplifted block bounded by faults 7 and 8. Uplifted and down-dropped fault blocks result in alternating horst and half-graben structures. In each of these lines, most faults in the area have comparable characteristics and orientation.

In describing geological features, two-way travel times are converted to depth using average interval velocities in table 3.1 derived from a time-depth conversion of EH-1 well function shown in Figure 3.11. Travel times to six horizons were picked from cross-line 490 seismic section at a location projected from the well EH-1. Then the depths to each horizon were converted using time-depth conversion function of EH-1 well data. Thus the average interval velocities of unit 1-5 were determined from differences in depth (thickness) and differences in time (interval two-way travel time). These average interval velocities were applied to the same units throughout the study area whereas the depth to each horizon was accumulated.

Horizon	Unit	TWT time (ms)	Depth (m)	Interval Velocity (m/s)	Average Velocity (m/s)
	Above 5	0	-	1836	
F		940	863		1836
	5	220	247	2245	
E		1160	1110		1914
	4	200	255	2550	
D		1360	1365		2007
	3	420	690	3286	
C		1780	2055		2309
	2	200	340	3400	
B		1980	2395		2419
	1	160	272	3400	
A		2140	2667		-

Table 3.1 This table shows interval and average velocities of unit 1-5 at the projected location of EH-1 well on cross-line 490. The velocities are computed using the tine depth curve of EH-1 well, Figure 3.11.

3.1.1 In-line 96

This profile is perpendicular to the regional strike and show six horizons and normal faults forming a horst structure. Six horizons consist of horizons A to F successively upward (Figure 3.1).

Faults are commonly parallel and most major faults dip to the west and meet with east-dipping faults in the central part of the profile. The largest east-dipping planar fault (number 8, brown line) crosses horizon A to horizon F dividing the profile into two parts. The western part has five planar faults dipping to the west (blue lines). The throw of fault 4 increases from about 30 ms (34 m) at horizon D to about 70 ms (119 m) at horizon A. The throw on fault 7 is about 20 ms (33 m) at horizon C and about 70 ms (119 m) at horizon A. The horizontal spacing between faults 2, 4 and 6 is about 780 m and they cut across different stratigraphic intervals.

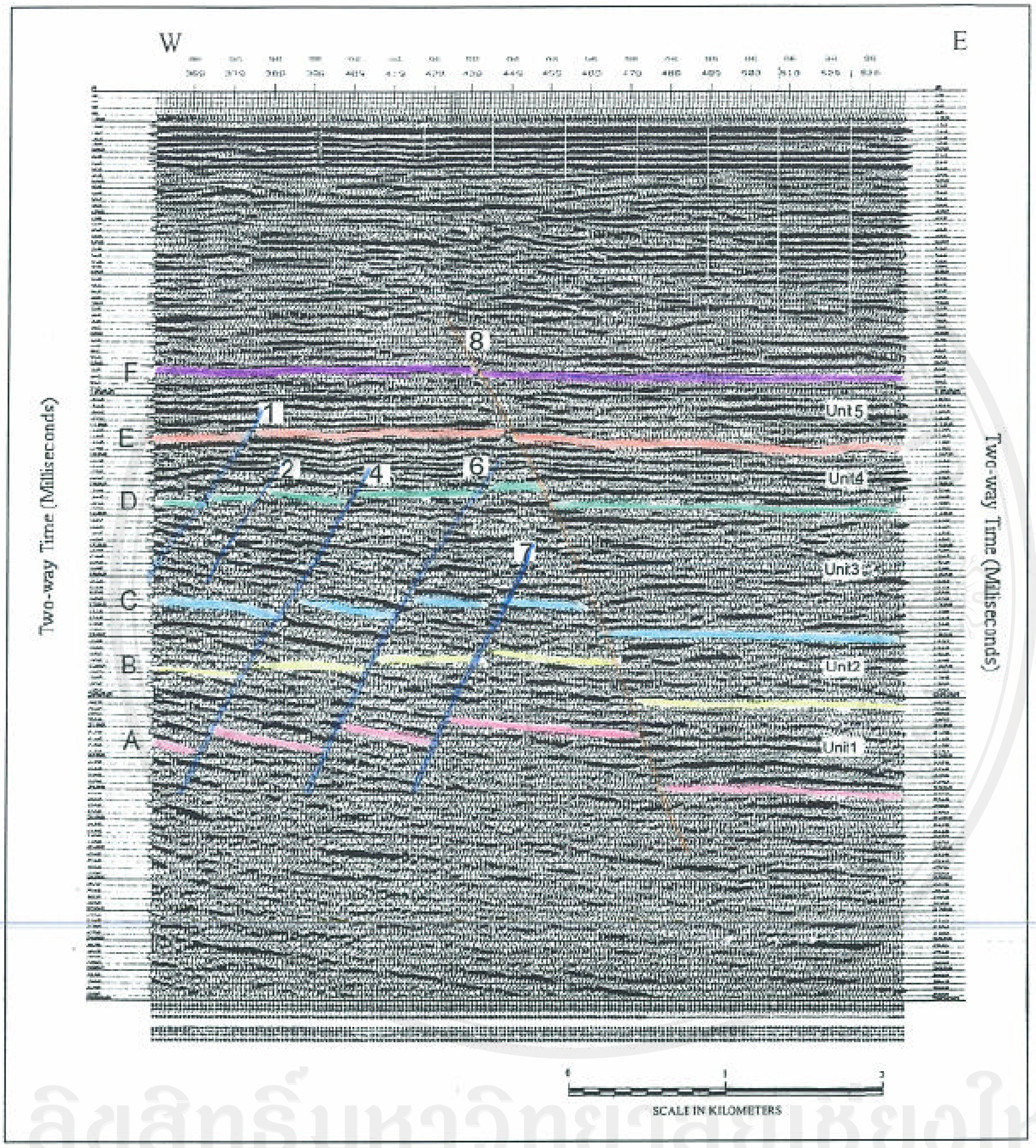

Figure 3.1 Seismic interpretation of In-Line 96. Six horizons were interpreted including horizons A to F, successively upward. Units 1 to 5 are intervals between seismic horizons. West-dipping planar normal faults are parallel and meet with an east-dipping normal fault in the center of the profile. Normal faults are numbered 1 to 8, which do not imply any sequence of fault development.

In the eastern part, almost all reflectors are sub-parallel. The throw on fault 8 is about 10 ms (9 m) at horizon F and about 180 ms (306 m) at horizon A. Characteristic variations of reflections on the upper horizon D are horizontal and the lower reflectors incline to the east direction.

The thicknesses of stratigraphic intervals are smaller in the eastern part of the profile. For example, the interval between horizon E and F is about 200 ms (225 m) in the western part of the profile and about 250 ms (280 m) in the eastern part.

3.1.2 In-line 107

Faults 1, 2, 4, 6, 7 and 8 in the In-line 96 continue southward and are depicted in the In-line 107 (Figure 3.2). The east-dipping fault 8 is shorter here and crosses horizons A, B and C. The throw on fault 8 increases from about 80 ms (131 m) at horizon C to about 160 ms (272 m) at horizon A. The six west-dipping faults (faults1, 2, 4, 6 and 7) in the profile are parallel. The spacing between faults averages 740 m. Faults change in vertical length from that in In-line 96. The upper part of west-dipping fault 1 extends upward to about 680 ms (624 m). Fault 6 lengthens upward to horizon E at about 1040 ms (975 m), whereas fault 4 is shorter. West-dipping fault 4 is interpreted between fault 3 and fault 6 and crosses horizons C and D. The throw on fault 7 is about 20 ms (33 m) at horizon C and about 70 ms (119 m) at horizon A.

3.1.3 In-line 116

Figure 3.3 has six horizons and the normal faults (Faults 1, 2, 3, 4, 6, 7 and 8) continue southward from the In-line 107. Another west-dipping normal fault (fault 5) that is not interpreted in the north is interpreted between fault 4 and fault 6 in the In-line 116. Fault 5 crosses horizons A, B, C and D. The sub-planar geometry and orientation of faults are similar to these in the north. West-dipping fault spacing is about 650 m and they change in vertical length from that in In-line 107. Fault 6 is shorter and crosses horizons A, B, C and D but faults 2 and 4 lengthen upward to about 1120 ms (1070 m) and 1280 ms (1265 m) respectively. The throw on fault 4 is about 30 ms (26 m) at horizon C and about 30 ms (51 m) at horizon A. The throw on

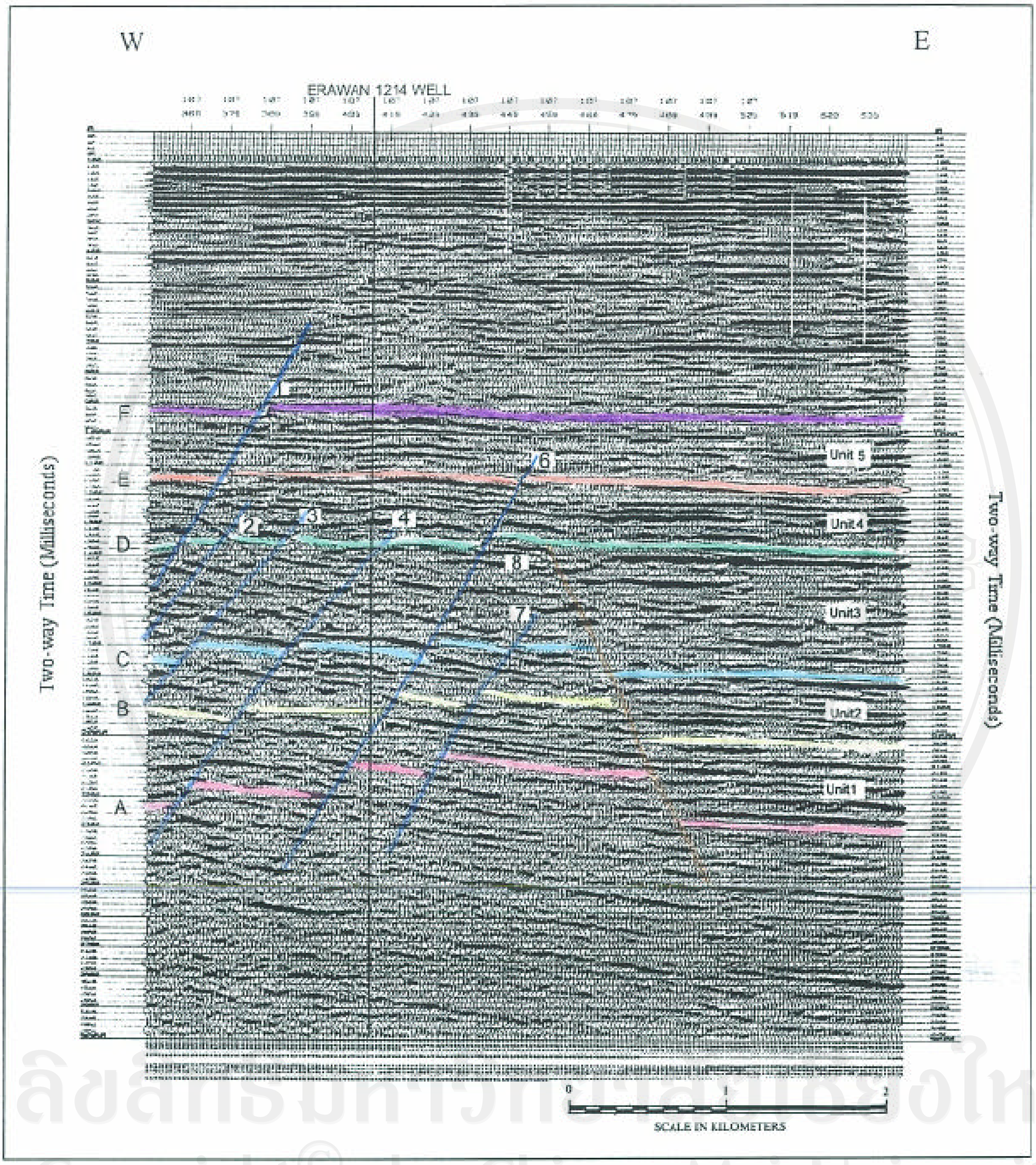

Figure 3.2 Seismic interpretation of In-Line 107. Six horizons were interpreted including horizons A to F, successively upward. Units 1 to 5 are intervals between seismic horizons. West-dipping planar normal faults are parallel and meet with an east-dipping normal fault in the center of the profile. Normal faults are numbered 1 to 8, which do not imply any sequence of fault development. Notice that fault 1 and 6 are longer than they are in In-line 96, whereas fault 8 in shorter.

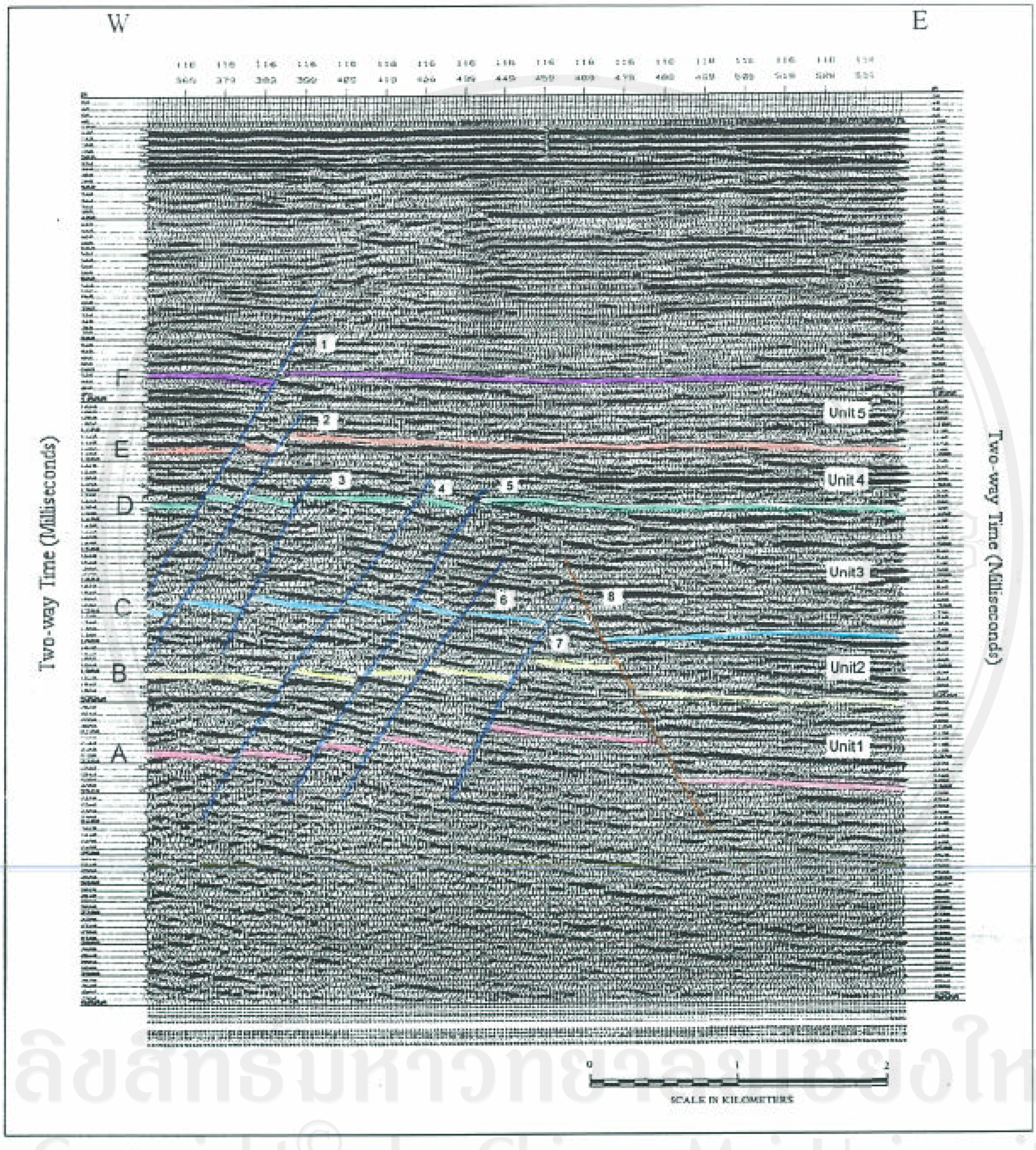

Figure 3.3 Seismic interpretation of In-Line 116. Six horizons were interpreted including horizons A to F, successively upward. Units 1 to 5 are intervals between seismic horizons. West-dipping planar normal faults are parallel and meet with an east-dipping normal fault in the center of the profile. Normal faults are numbered 1 to 7, which do not imply any sequence of fault development. Notice that fault 1 and 2 are longer than they are in In-line 107, whereas fault 6 is shorter.

fault 7 is about 20 ms (33 m) at horizon C and about 90 ms (153 m) at horizon A. The throw on fault 8 increases from about 60 ms (99 m) at horizon C to about 130 ms (221 m) at horizon A.

3.1.4 In-line 122

Seven normal faults (Faults 1, 2, 3, 4, 6, 7 and 8) continue southward from the In-line 116 (Figure 3.4). Gently curved fault 3 and fault 7 are longer than they are in In-line 116. Fault 3 crosses horizons B, C, D and fault 7 crosses horizons A, B, C and D. Fault 2 is shorter and crosses horizons C and D. The geometry of faults 1, 4, 5 and 6 is similar to that in In-line 116, although fault 4 and 5 are gently curved here. The horizontal spacing between west-dipping faults is more regular at about 521 m. The throw on fault 7 is about 20 ms (26 m) at horizon D and about 90 ms (153 m) at horizon A. The throw on fault 8 is about 70 ms (115 m) at horizon C and about 110 ms (187 m) at horizon A. The throw of fault 4 increases from about 10 ms (13 m) at horizon D to about 60 ms (102 m) at horizon A.

3.1.5 In-line 128

Faults 1, 2, 3, 4, 6, 7 and 8 in the In-line 122 continue southward and are depicted in the In-line 128 (Figure 3.5). Fault 2 and fault 5 are shorter than they are In-line 122. Fault 2 crosses only horizon C and fault 5 crosses horizon A and B. Fault 3 is longer and cuts upward to horizon E. The throw on fault 7 is about 30 ms (38 m) at horizon D and about 100 ms (170 m) at horizon A. The throw on fault 8 is about 80 ms (131 m) at horizon C and about 110 ms (187 m) at horizon A. The throw on fault 4 increases from about 20 ms (26 m) at horizon D to about 60 ms (102 m) at horizon A.

The horst structure grew wider southward from In-line 122. At horizon ms, it is 1217 m wide in In-line 122 and it is 1609 m wide in In-line 128.

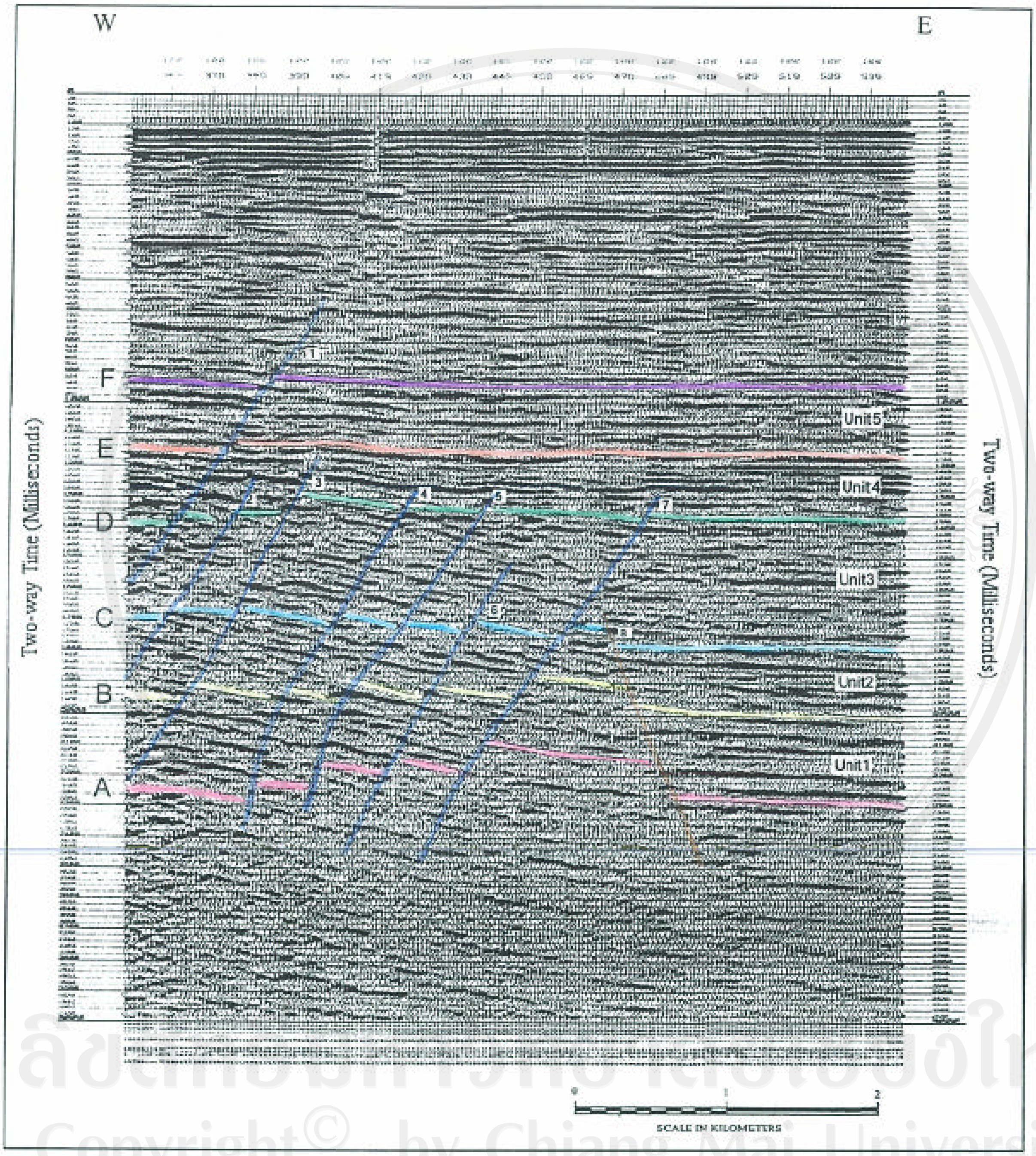

Figure 3.4 Seismic interpretation of In-Line 122. Six horizons were interpreted including horizons A to F, successively upward. Units 1 to 5 are intervals between seismic horizons. West-dipping planar normal faults are parallel and meet with an east-dipping normal fault in the center of the profile. Normal faults are numbered 1 to 8, which do not imply any sequence of fault development. Notice that fault 3 and 7 are longer than they are in In-line 116, whereas fault 2 is shorter.

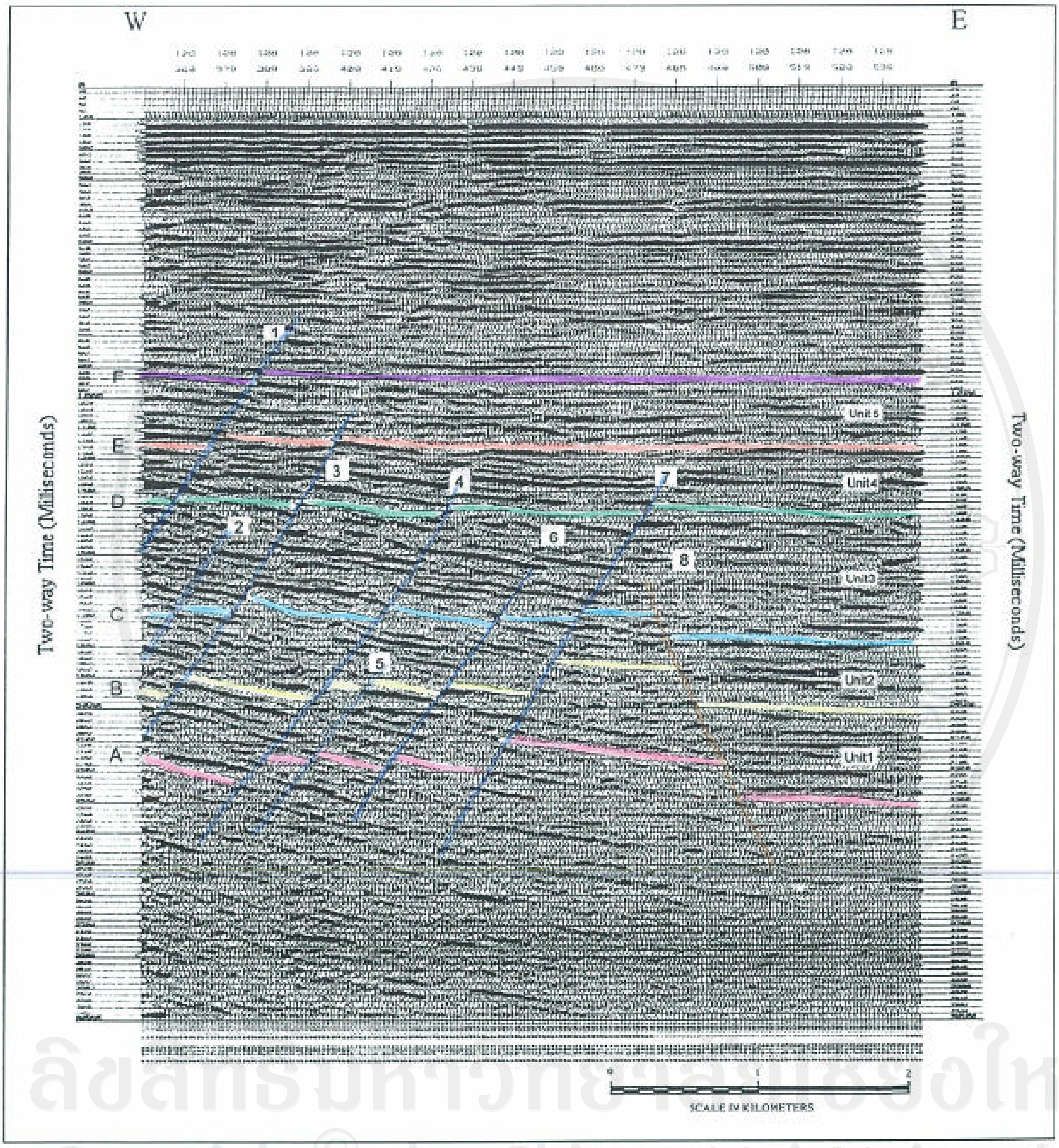

Figure 3.5 Seismic interpretation of In-Line 128. Six horizons were interpreted including horizons A to F, successively upward. Units 1 to 5 are intervals between seismic horizons. West-dipping planar normal faults are parallel and meet with an east-dipping normal fault in the center of the profile. Normal faults are numbered 1 to 8, which do not imply any sequence of fault development. Notice that fault 2 and 5 are longer than they are in In-line 122, whereas fault 3 is longer.

3.1.6 In-line 138

Since continuity of reflections in this profile is poor, only three horizons were interpreted, including horizons D, E and F (Figure 3.6). This profile comprises five west-dipping parallel faults: faults 1, 2, 3, 4 and 6. Fault 1 cut upward as far as horizon F. The exact extent of the faults was not determined due to the inferior seismic resolution. The throw of fault 3 is about 20 ms (18 m) at horizon F and about 60 ms (102 m) at horizon B.

3.1.7 Seismic Interpretation of Cross-lines

These profiles show six horizons that are depicted in the In-lines and the thicknesses of intervals between horizons are nearly constant. In Cross-line 400, faults 1, 3, 4, 5 and 6 appear as linear and curve lines (Figure 3.7). The thickness of unit 1 changes from about 270 ms (459 m) in the north to 200 ms (340 m) in the south. Faults 4, 5, 6, 7 and 8 appear as points and curved lines in Cross-line 440 (Figure 3.8). The interval between horizon A and B thickens from 230 ms (391 m) in the north to 270 ms (459 m) in the south. The interval between horizon A and B in Cross-line 490 is thinned from the northern part at about 280 ms (476 m) to 170 ms (289 m) in the southern part (Figure 3.9). Cross-line 520 has strongly continuous reflectors and the thickness of seismic intervals is constant and no fault is interpreted (Figure 3.10).

3.2 TWT Structure maps

A two-way travel time (TWT) structure map is a surface with contour lines depicting depth variation of a seismic horizon. The regional orientation of faults is N-S and NNW-SSE. Most faults dip to the west with one fault dips to the east. The Cross-line 138 contains poor data, thus the structure and isochron maps were not constructed in this region for horizons D, E and F. Hot colors correspond to smaller depths and cool colors greater depths. The variation in elevation at horizon A is the largest among all interpreted horizons while at horizon F it is smallest.

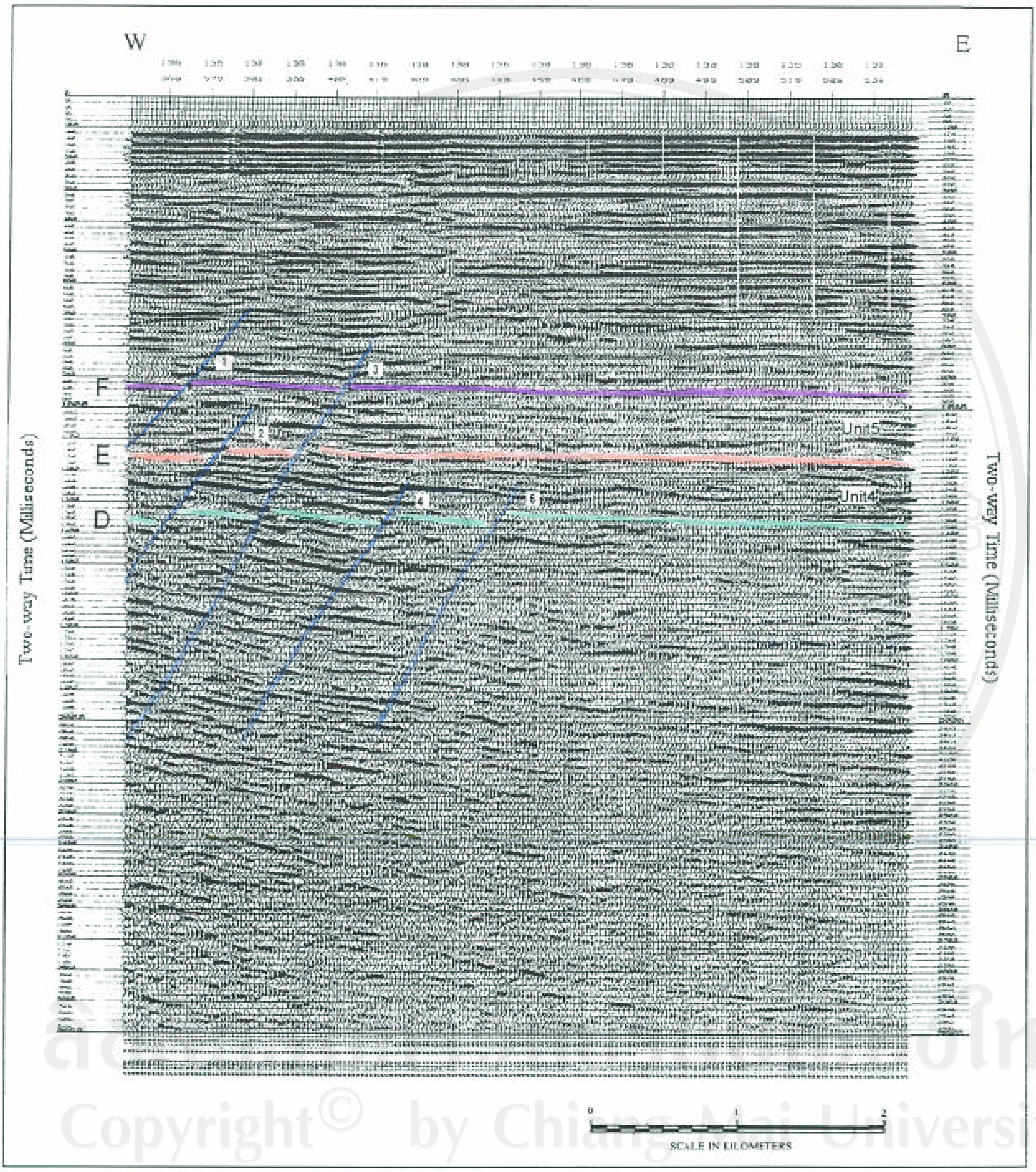

Figure 3.6 Seismic interpretation of In-Line 138. This line has poorly continuous reflector, three horizons were interpreted including horizons D to F, successively upward. Units 4 to 5 are intervals between seismic horizons. West-dipping planar normal faults are parallel. Normal faults are numbered 1, 2, 3, 4 and 6, which do not imply any sequence of fault development.

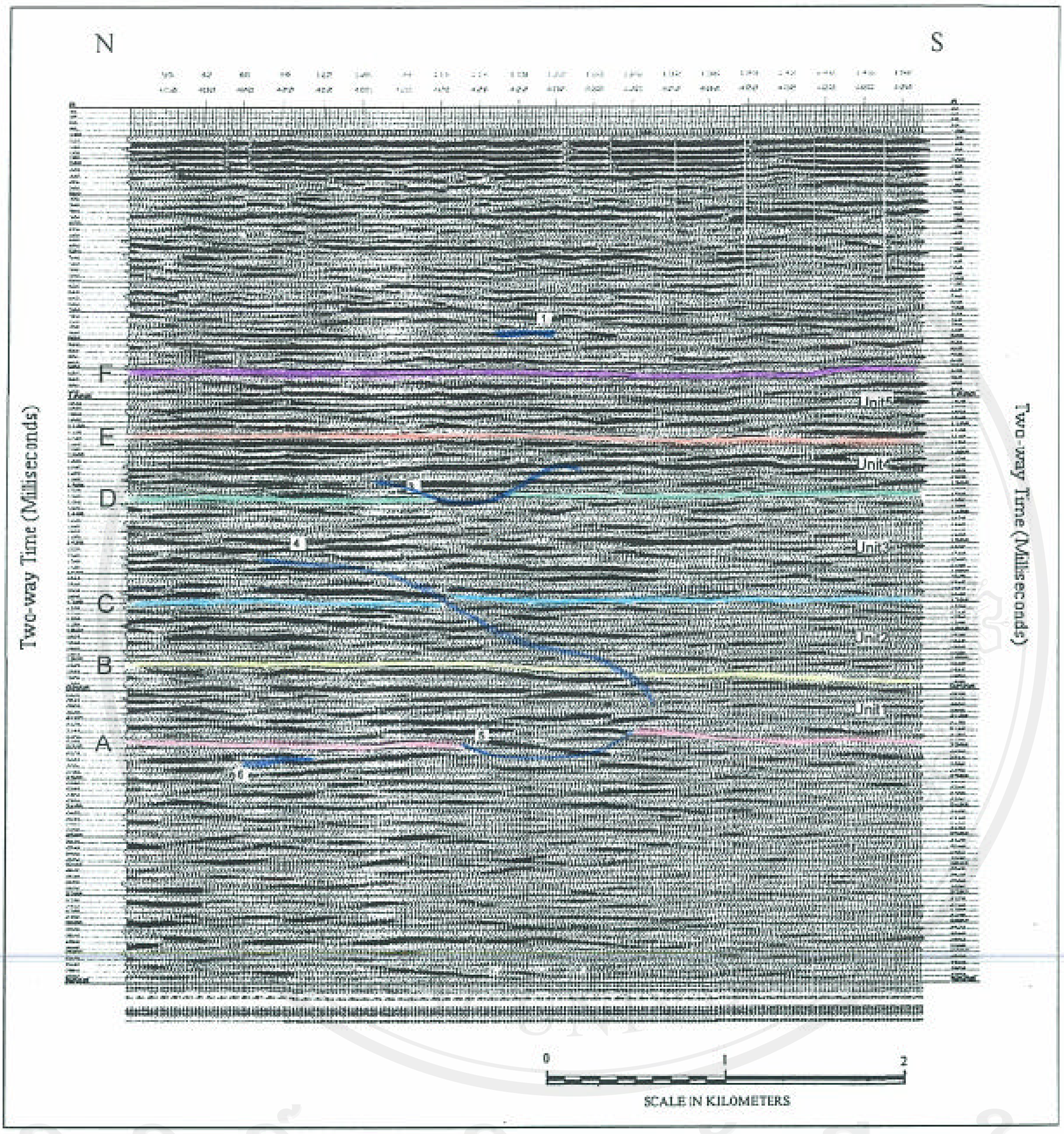

Figure 3.7 Seismic interpretation of Cross-Line 400. Six horizons were interpreted including horizons A to F, successively upward. Units 1 to 5 are intervals between seismic horizons. West-dipping planar normal faults (faults 1, 3, 4, 5 and 6) are appeared. Numbers of normal faults do not imply any sequence of fault development. The thickness of the intervals between each horizon are nearly constant. The western part of unit 1 is thicker than the eastern part.

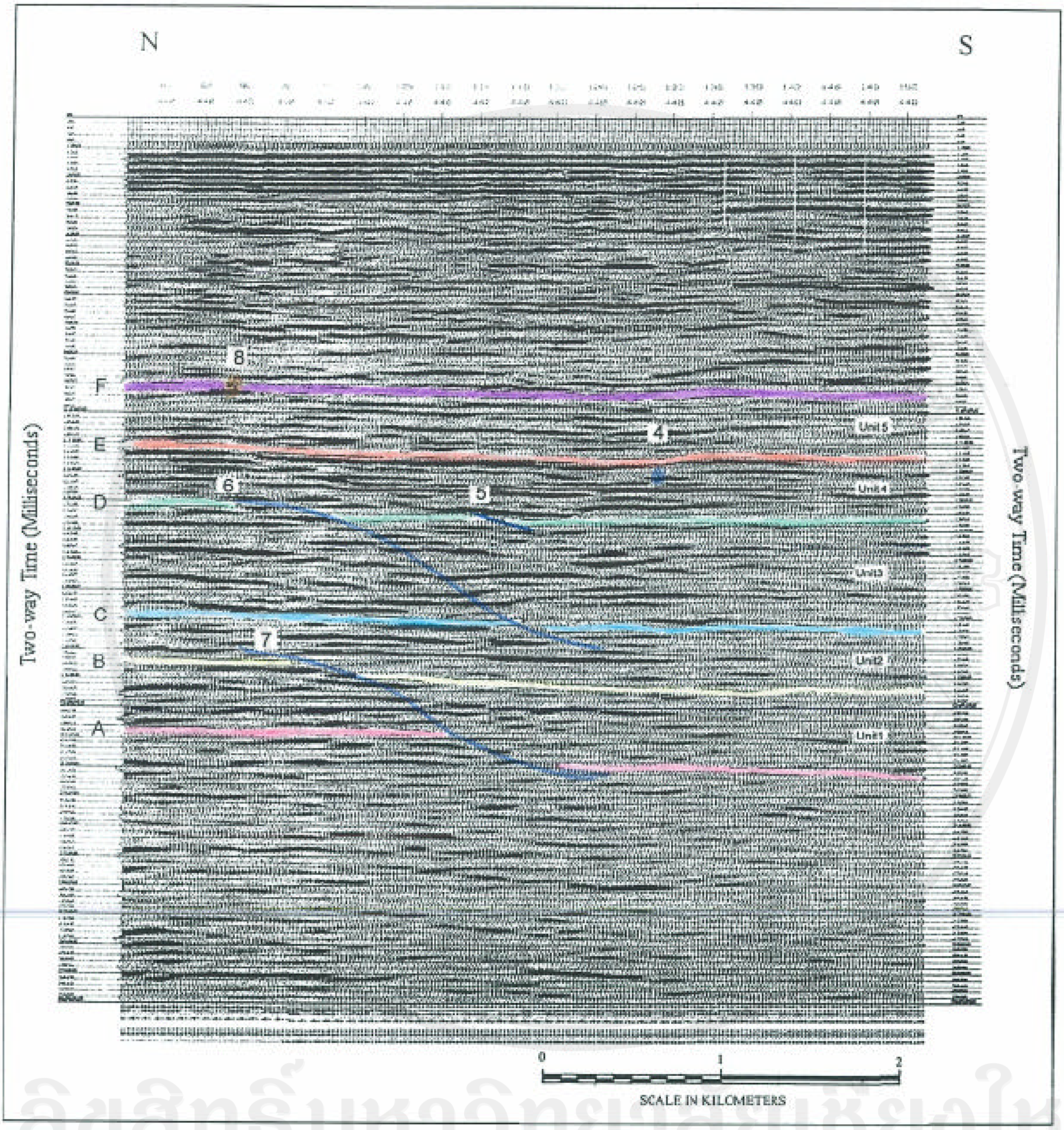

Figure 3.8 Seismic interpretation of X-Line 440. Six horizons were interpreted including horizons A to F, successively upward. Units 1 to 5 are intervals between seismic horizons. West-dipping planar normal faults (faults 4, 5, 6 and 7) are appeared and one east-dipping normal fault. Numbered of normal faults do not imply any sequence of fault development. The thicknesses of all seismic intervals are nearly constant. The western part of unit 1 is thinner than the eastern part.

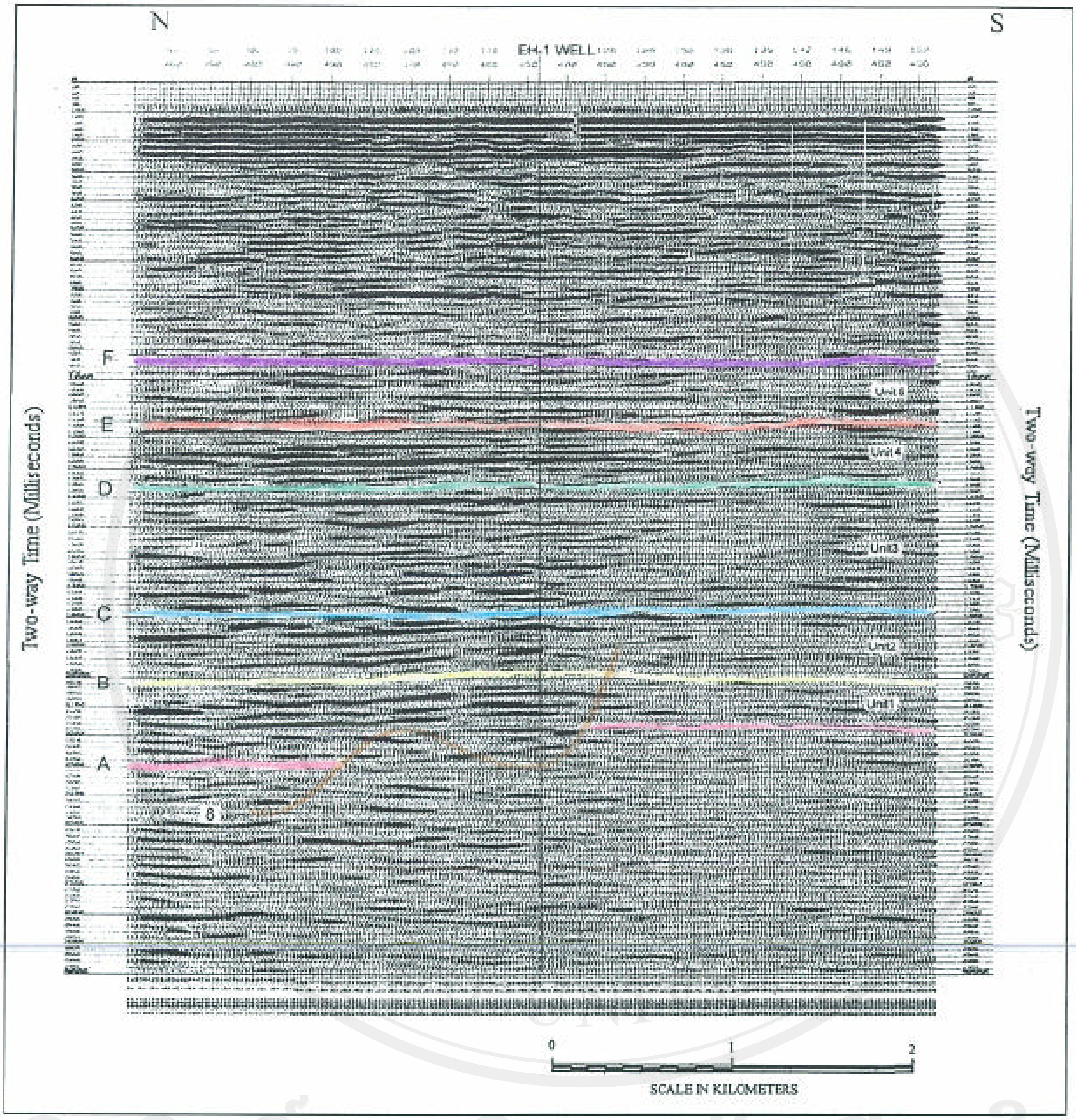

Figure 3.9 Seismic interpretation of Cross-Line 490. Six horizons were interpreted including horizons A to F, successively upward. Units 1 to 5 are intervals between seismic horizons. Normal faults are numbered 1 to 8, which do not imply any sequence of fault development. An east dipping fault truncates on horizons A and B. The thickness of unit 1 in the west is thicker than the eastern part.

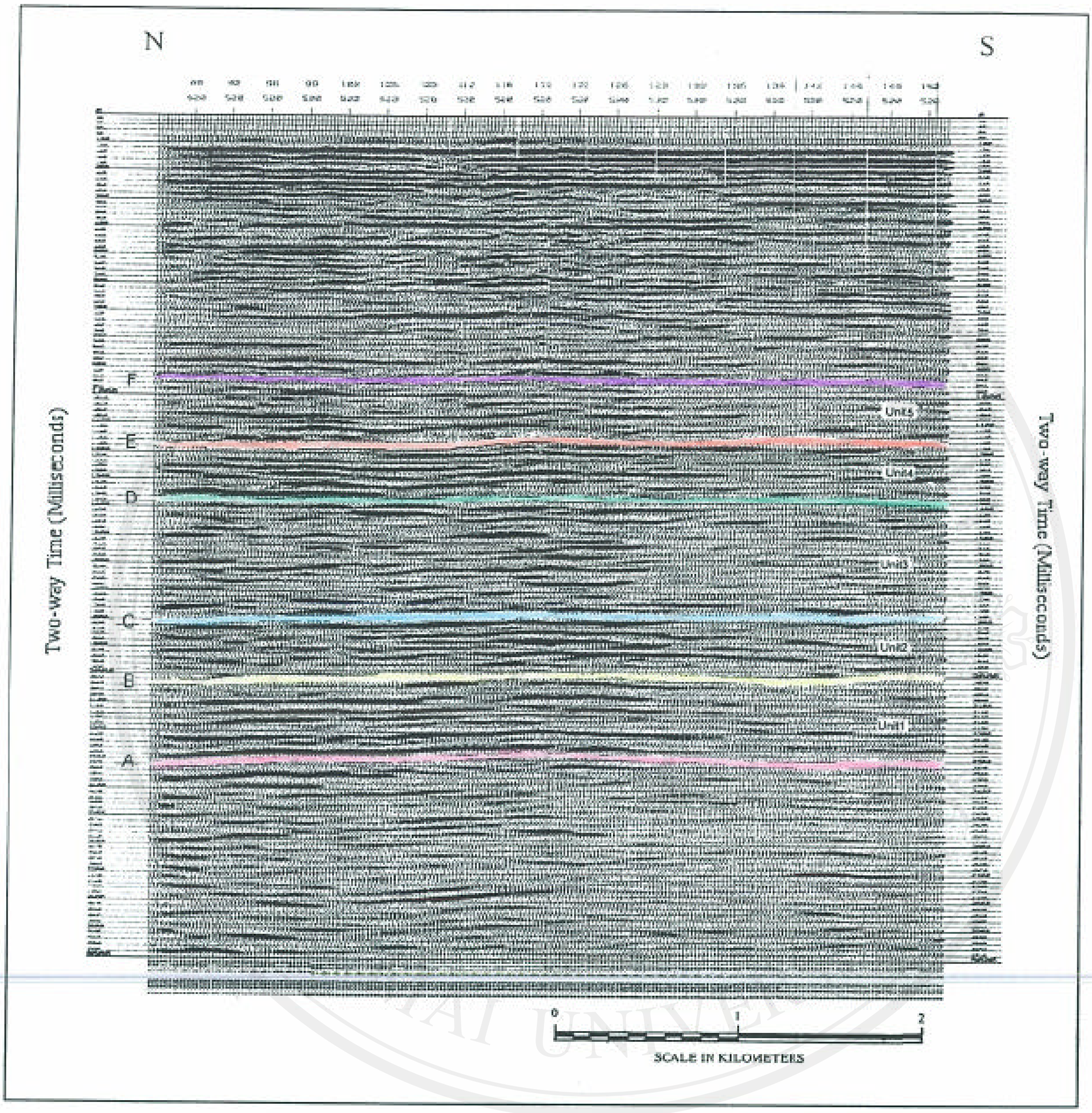

Figure 3.10 Seismic interpretation of Cross-Line 520. Six horizons were interpreted including horizons A to F, successively upward. Units 1 to 5 are intervals between seismic horizons.

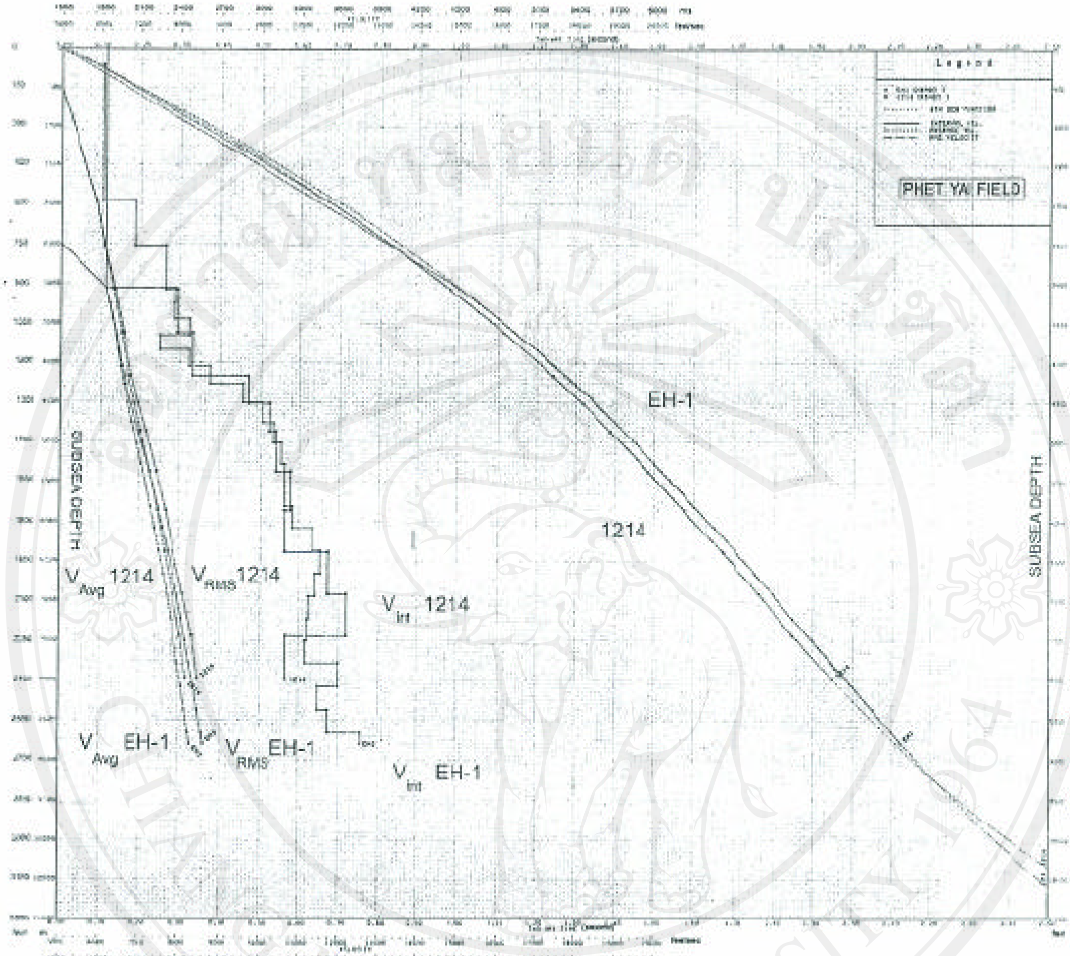

Figure 3.11 Seismic time-depth conversion in the Phet Yai field, Pattani Basin, Gulf of Thailand. This was used to estimate depths and sizes of geologic features interpreted from seismic data in table 3.1.

3.2.1 Structural map of Horizon A

The TWT structure map of horizon A comprises five faults that are faults 4, 5, 6, 7 and 8 (Figure 3.12). These faults are N-S and NNW-SSE trending.

There are two fault sets that are west-dipping and east-dipping. Faults 4, 5, 6 and 7 are west-dipping. The average length of faults 4, 6 and 7 is 3.27 km extending almost throughout the area. Fault 5 is about 1.73 km long and located in the southern part of the area. The spacings between major faults are between 500-1000 m. The east-dipping fault 8 changes in strike from N-S in the north to NW-SE in the south.

This map shows that the highest area at about 2060 ms two-way travel time (2553 m in depth) is located in the footwall of fault 7, whereas the lowest area about 2320 ms (2961 m) is in the hangingwall of fault 8. The area to the west of fault 4 is undulating and steep. The contour lines at the tip of fault 8 indicate steep areas, which may signify that the fault 8 continues beyond the northern and southern boundaries of the study area. The structural closures can be observed in certain footwall areas indicated by arrows.

3.2.2 Structural map of Horizon B

The TWT structure map of horizon B (Figure 3.13) illustrates that faults 3, 4, 5, 6, 7 and 8 continue upward from horizon A. These faults are N-S and NNW-SSE trending. Average length of faults 4, 5, 6 and 7 is about 3.8 km, whereas fault 3 and 5 are about 1.8 km long. The spacings between major faults are between 440-800 m.

The contours depict the highest areas about 1850 ms (2184 m) in the footwalls of faults 6 and 7, and the lowest area about 2040 ms (2485 m) in the hangingwall of fault 8. The contour lines at the northern tip of fault 8 indicate steep areas, which may signify that the fault 8 continue beyond the northern boundary of the study area. Anticlinal closures developed in the footwalls of faults 3, 6 and 7 and the hangingwall of fault 8.

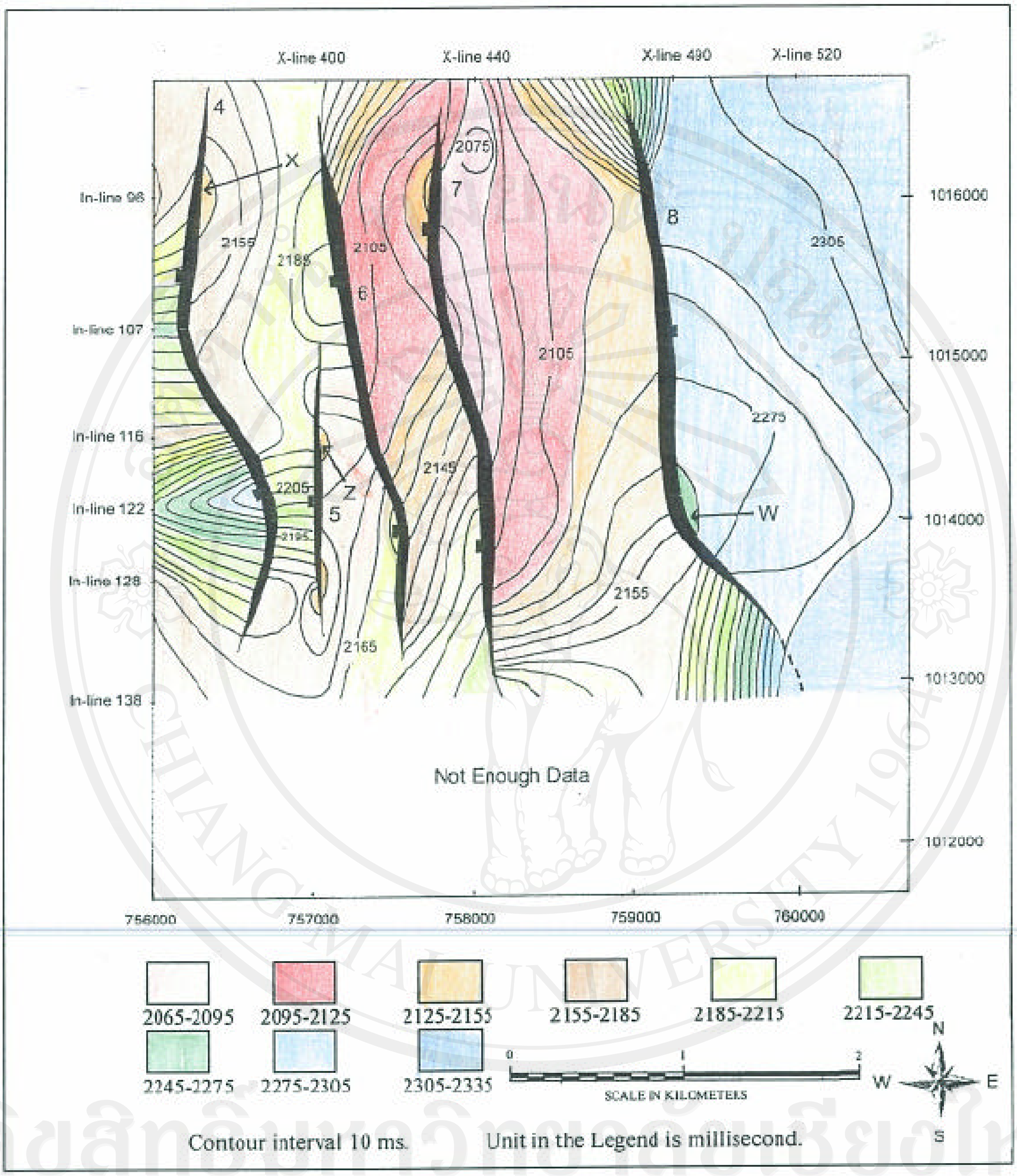

Figure 3.12 TWT structure map of horizon A. Hot colors represent high areas and cool colors low areas. Fault traces are black thick lines and black rectangles indicate fault dip directions. UTM grid reference Zone 48 North. The east-dipping fault trace (fault 8) in the south switches strike from N-S direction to NW-SE in the sourth of fault 8. The highest area is in the footwall of fault 7 whereas the lowest area is in the east of fault 8. The area west of fault 4 is undulate and steep.

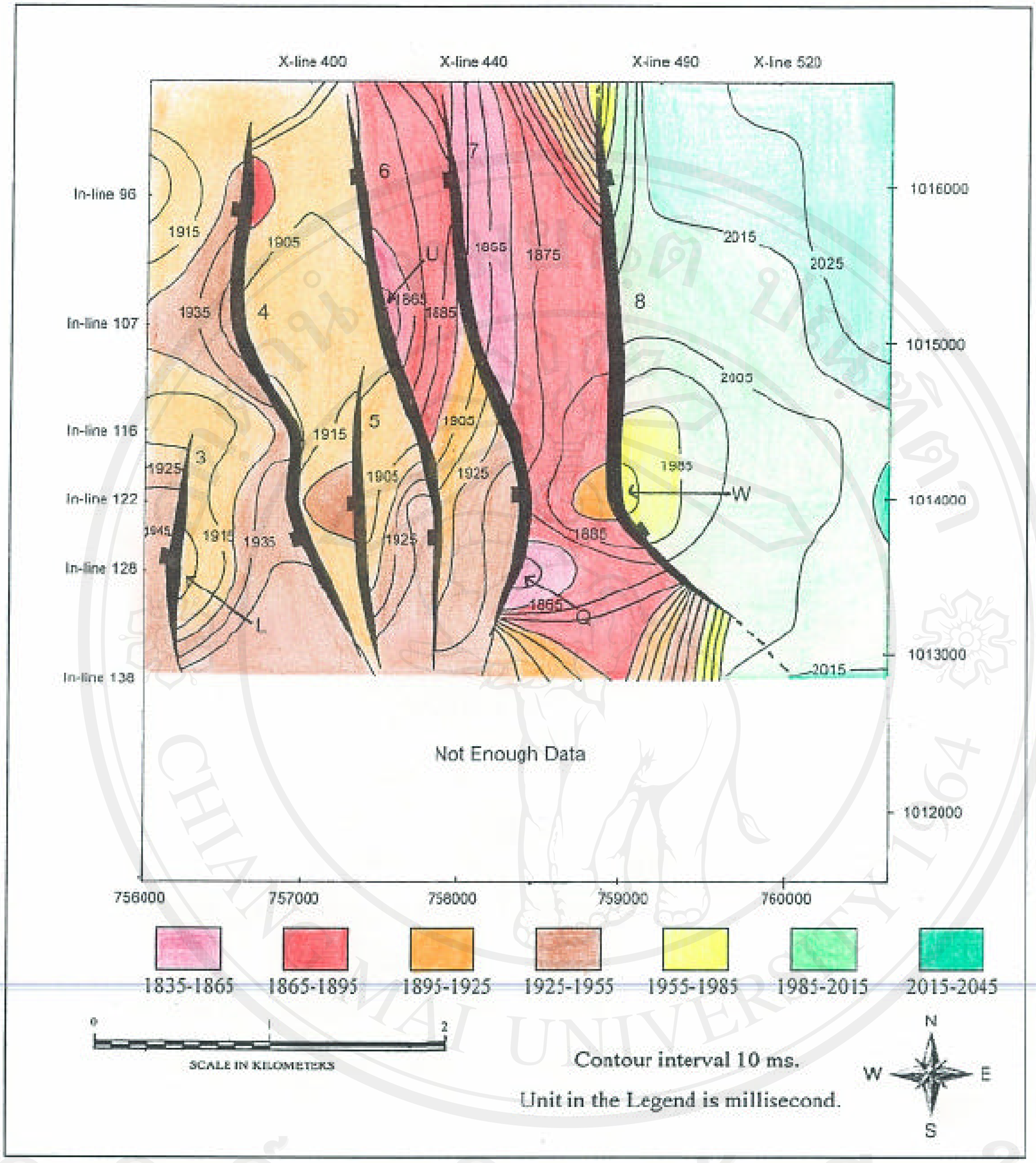

Figure 3.13 TWT structure map of horizon B. Hot colors represent high areas and cool colors low areas. Fault traces are black thick lines and black rectangles indicate fault dip directions. UTM grid reference Zone 48 North. The highest area is in the footwalls of faults 6 and 7 whereas the lowest area is in the northeastern part of area.

3.2.3 Structural map of Horizon C

Horizon C (Figure 3.14) has similar contour and fault patterns to that of horizon B. Faults 3, 4, 5, 6, 7 and 8 continue upward from horizon B and fault 2 is interpreted at this level. Faults 4, 6, 7 and 8 are about 3 km long and faults 2, 3 and 5 about 1.5 km. The east-dipping fault 8 in the south switches strike from N-S to NW-SE in the south. Fault spacings are between 320-720 m.

The highest areas about 1640 ms (1842 m) are located in the footwalls of faults 2 and 3 and the lowest area about 1800 ms (2077 km) is in the hangingwall of fault 8. The contour lines at the tips of fault 8 show steep areas which may signify that the fault 8 continues beyond the northern to southern part of the study area. Anticlinal closures developed in the footwalls of faults 2, 3, 4 and 7.

3.2.4 Structural map of Horizon D

Figure 3.15 illustrates the structural map of horizon C. The main fault direction is N-S. Based on their lengths, the faults can be divided into three groups: faults 1 and 4 (4.23 km), faults 2 and 5 (2.77 km) and faults7 and 8 (1 km). The spacing of these faults is 400 m. The highest area about 1300 ms (1299 m) is in the footwall of faults 1, 2, 3, 4 and 5, whereas the lowest area about 1380 ms (1394 m) is in the footwall of fault 1, 4 and 5. Anticlinal closures in the footwalls of faults 1, 2, 3, 4 and 8 and the hangingwall of faults are indicated by arrows.

3.2.5 Structural map of Horizon E

The TWT structure map of horizon E (Figure 3.16) illustrates that faults 1, 2, 3, 4, 5 and 8 continue upward from horizon D. The density of faults and contours is smaller than those at horizon D. Fault 1 is the longest at about 4 km, whereas fault 2, 3, 5 and 8 are 1 km long. The highest area about 1120 ms (1069 m) is located between fault 1 and fault 8 and the lowest areas about 1180 ms (1132 m) are in the

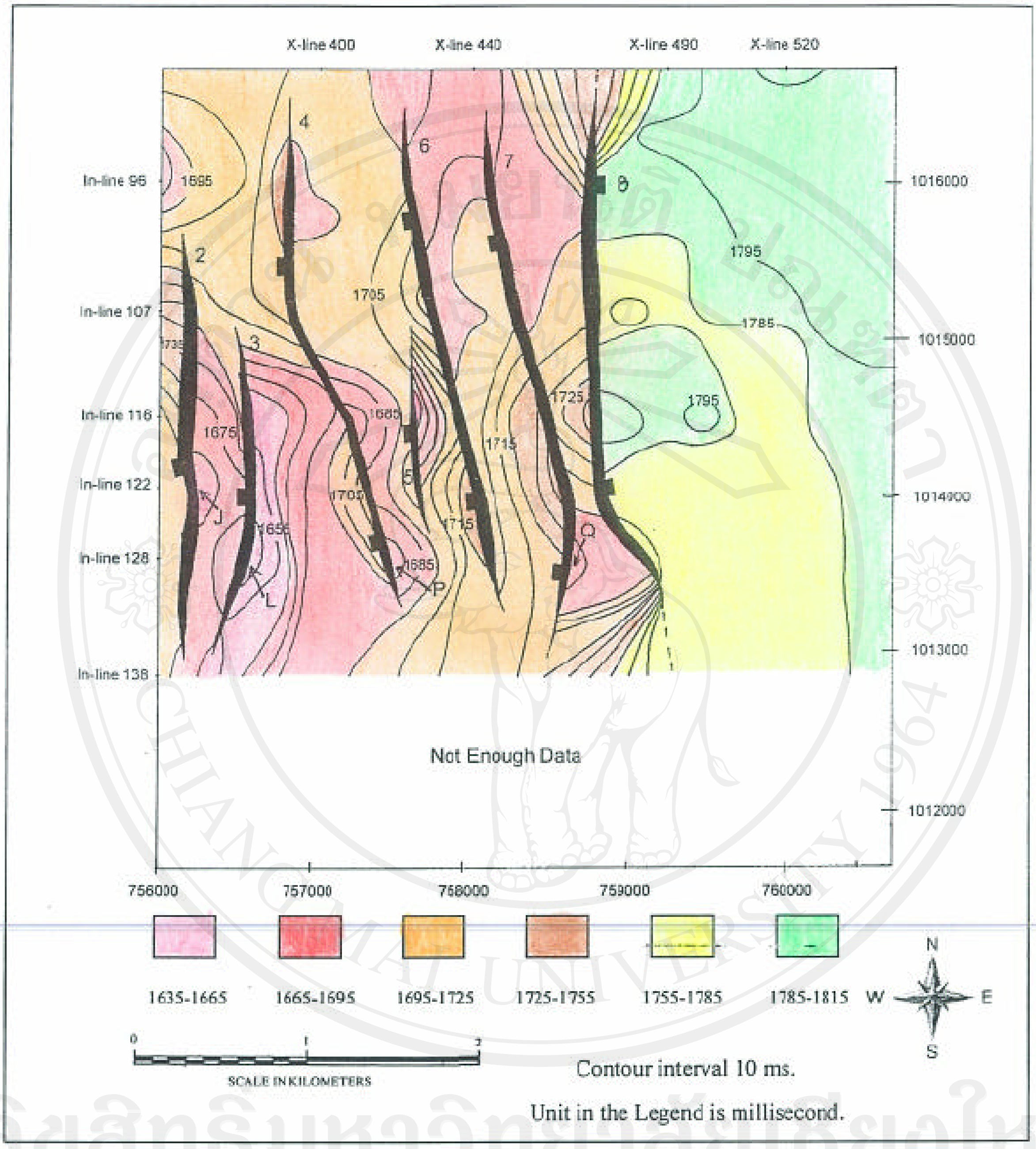

Figure 3.14 TWT structure map of horizon C. Hot colors represent high areas and cool colors low areas. Fault traces are black thick lines and black rectangles indicate fault dip directions. UTM grid reference Zone 48 North. The highest area is in the footwalls of faults 2 and 3 whereas the lowest area is in the hangingwall of fault 8.

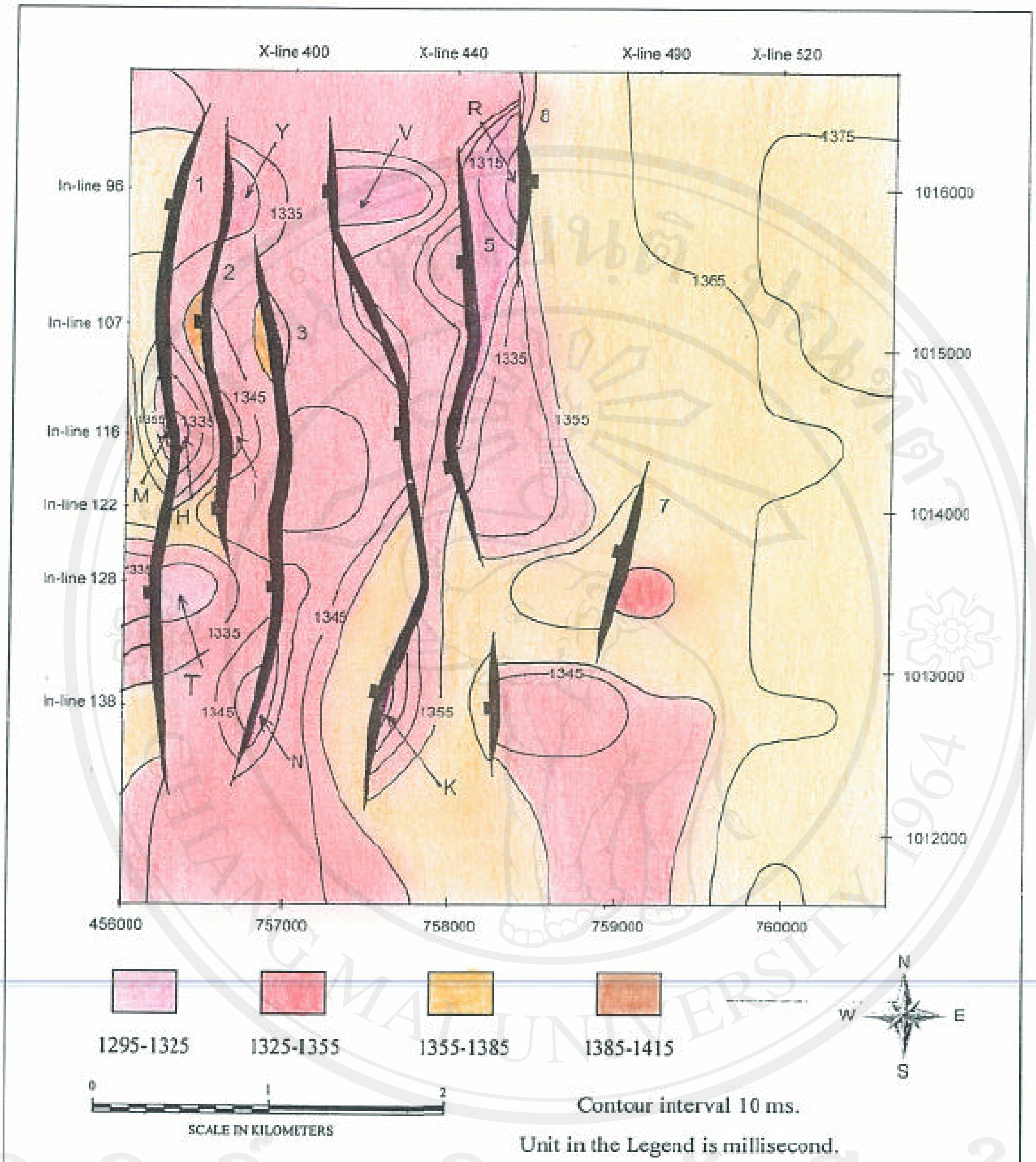

Figure 3.15 TWT structure map of horizon D. Hot colors represent high areas and cool colors low areas. Fault traces are black thick lines and black rectangles indicate fault dip directions. UTM grid reference Zone 48 North. The east-dipping fault (fault 8) lies N-S trending and is about 1 km long. The highest area is in the footwalls of faults 1, 2, 3, 4 and 5 whereas the lowest area is in the western rim of the area.

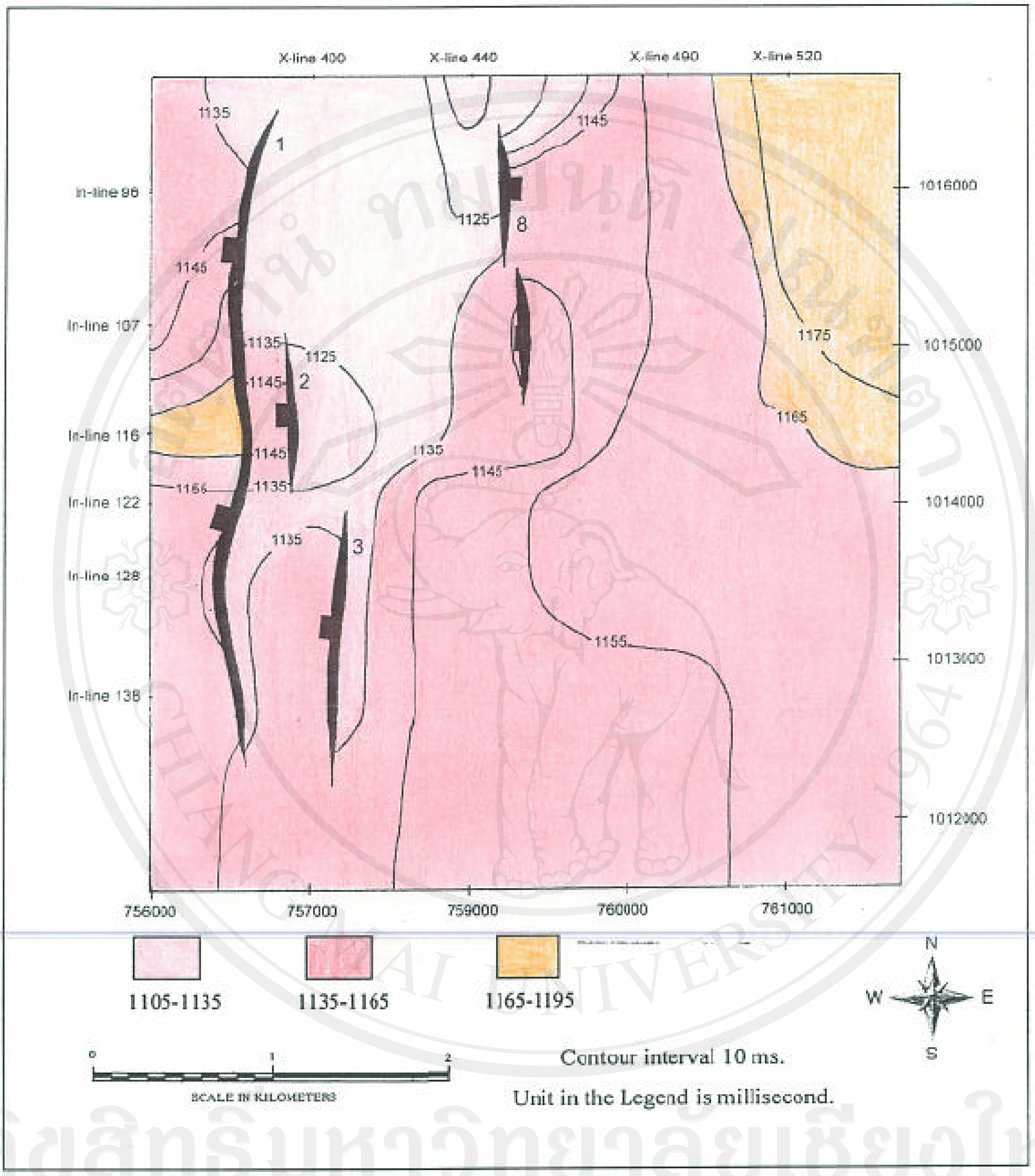

Figure 3.16 TWT structure map of horizon E. Hot colors represent high areas and cool colors low areas. Fault traces are black thick lines and black rectangles indicate fault dip directions. UTM grid reference Zone 48 North. The high region is in the middle between fault 1 and fault 8 and most areas are flat. There is no structural closure at this horizon.

hangingwall of fault 1 and northeastern part of the study area. Structural closures are not depicted at this horizon.

3.2.6 Structural map of Horizon F

Horizon F (Figure 3.17) has similar fault pattern to horizon E and comprises three faults that are faults 1, 3 and 8. They are N-S trending. Fault 1 is gently curved and about 3.2 km long extending throughout the western part of the area. East-dipping fault 8 in the north is about 1 km. Fault 3 in the southern part is also 1 km long. The region between fault 1 and fault 8 is higher than surrounding area which is almost flat. The variations in elevation and density of contours are smaller than those at horizon E. No structural closure is interpreted at this horizon.

3.3 Isochron maps

An isochron map is a two-way travel time thickness map of an interval between two horizons. Five isochron maps were created by hand and illustrated in figures 3.18-3.22. To show the relationship between structure and strarigraphic thickness, fault traces were overlain on the isochron maps (Figures 3.23-3.27). The contour lines near these faults show thickening of seismic units in the hangingwalls. The variation in thickness is most prominent in the isochron map of Unit 1 and least in the isochron map of Unit 5.

3.3.1 Isochron map of Unit 1 with fault trace overlay from horizon A

The isochron map between horizons A and B is overlain by fault traces from horizon A (Figure 3.23). The contour pattern depicts N-S trending elongated sedimentary wedges. The thickness of this unit ranges from about 110 ms (187 m) in the northeast to about 370 ms (629 m) in the southwest. The unit in the central part of the area is thin. Western dipping faults (faults 4, 5, 6 and 7) trend N-S and NNW-SSE. East-dipping fault 8 lies N-S along the study area but the southern part of the fault bends eastward. The thinnest of sediment is located along the footwall of fault 8

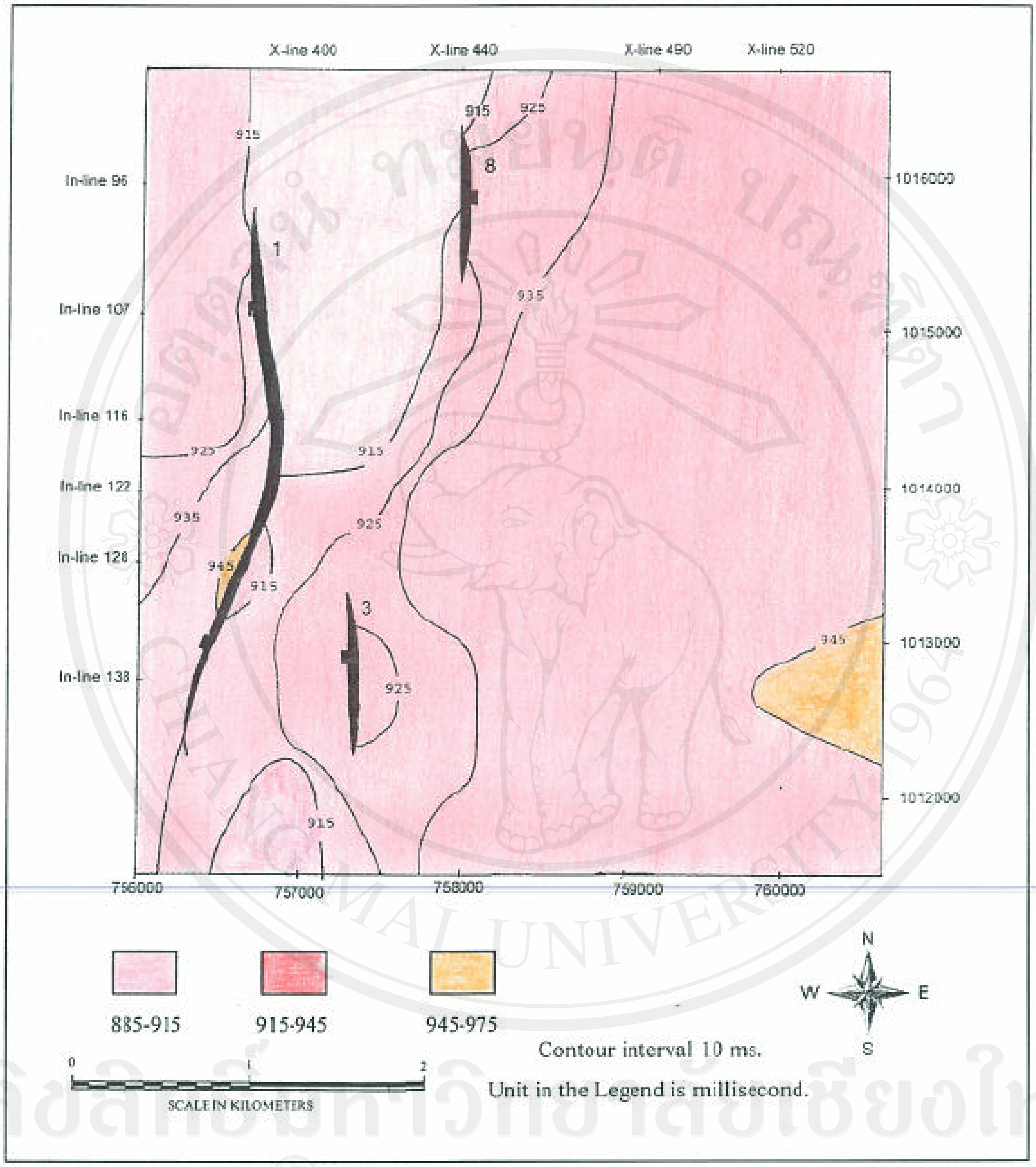

Figure 3.17 TWT structure map of horizon F. Hot colors represent high areas and cool colors low areas. Fault traces are black thick lines and black rectangles indicate fault dip directions. UTM grid reference Zone 48 North. There are three faults (fault 1, 3 and 8) that lie in N-S trend. The region between faults 1 and 8 is higher than the surrounding areas which are almost flat.

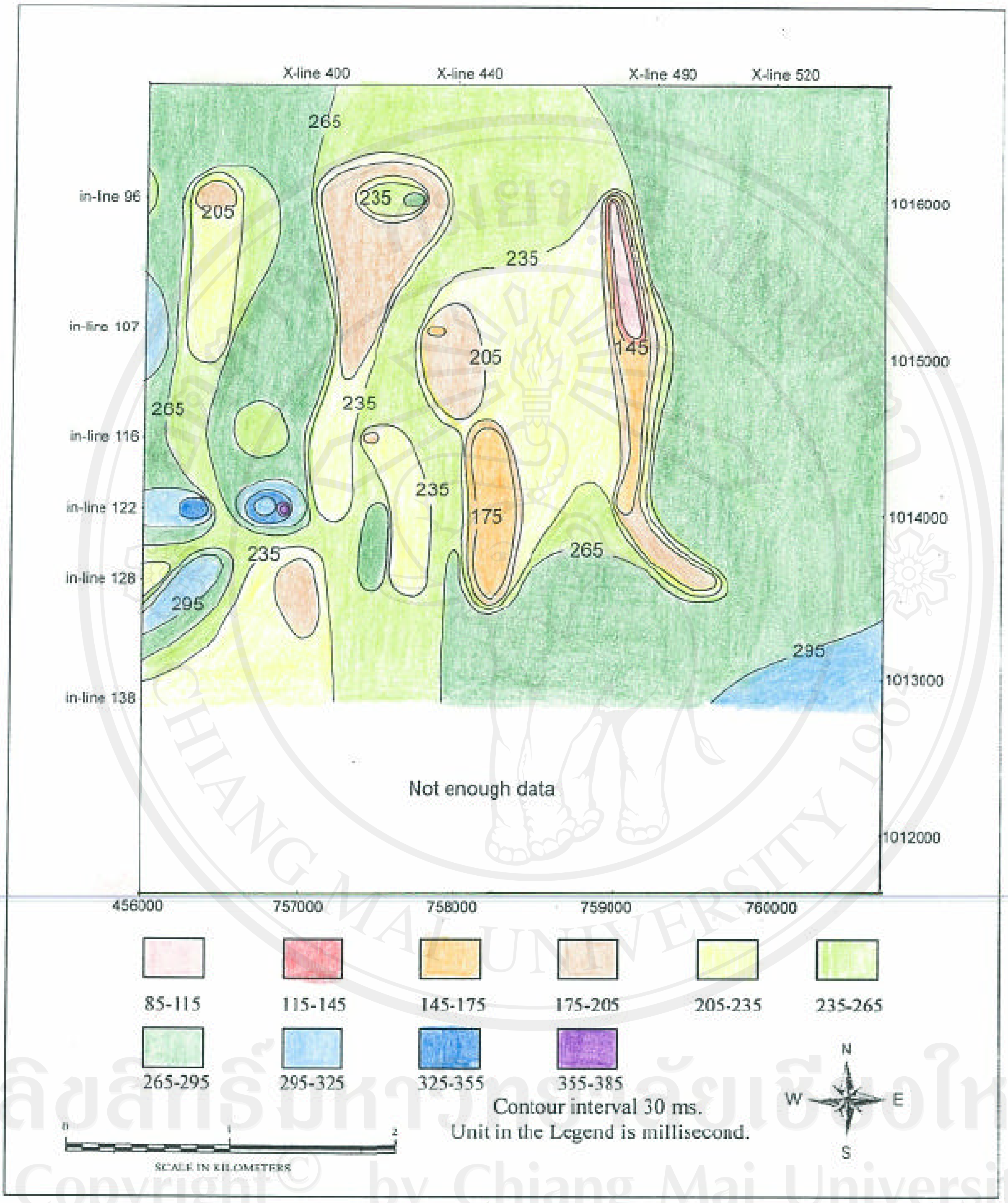

Figure 3.18 Isochron map of the interval between horizons A and B (Unit 1). Hot colors depict thick interval and cool colors thin interval. UTM grid reference Zone 48 North. The contours patterns are N-S trending. The thickness of sediment in the central part of the area is thinner than that on either side.

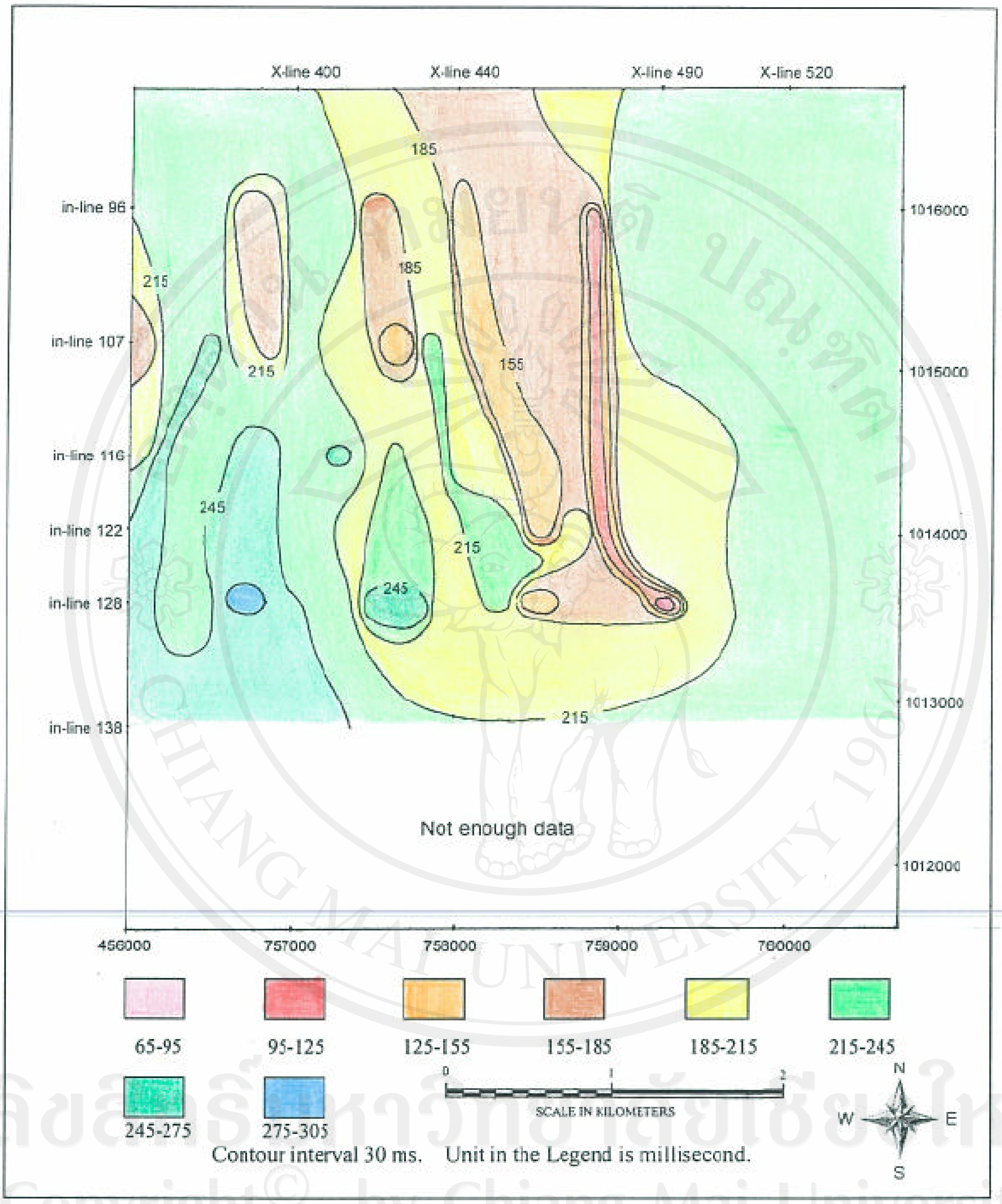

Figure 3.19 Isochron map of the interval between horizons B and C (Unit 2). Hot colors depict thick interval and cool colors thin interval. UTM grid reference Zone 48 North. The contour patterns are along N-S and NNW-SSE trend. The thickness of sediment in the central part of the area is thinner than that on either side. The variations in thickness of this unit are smaller than that of Unit 1.

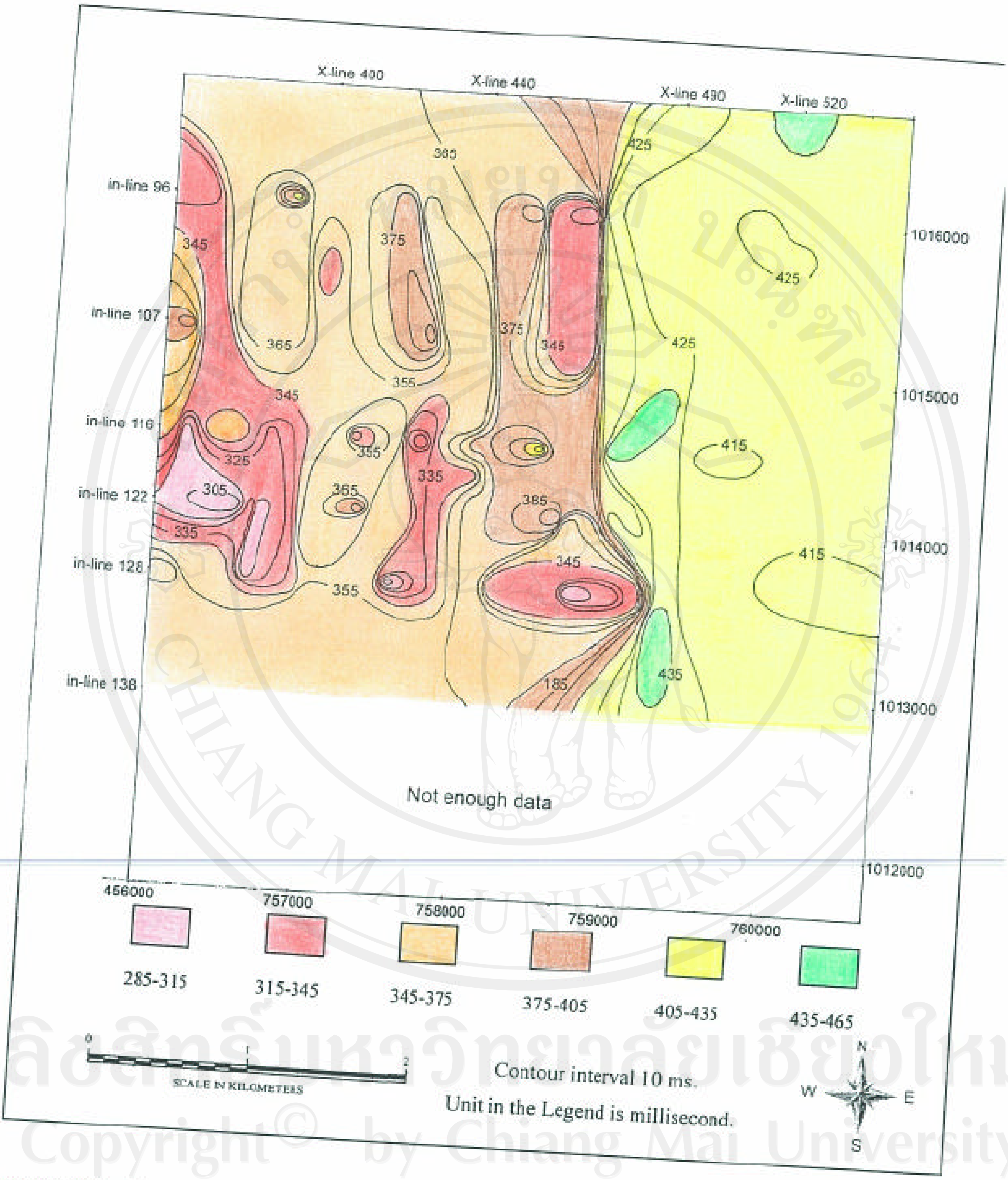

Figure 3.20 Isochron map of the interval between horizons C and D (Unit 3). Hot colors depict thick interval and cool colors thin interval. UTM grid reference Zone 48 North, The contour patterns are N-S, NNW-SSE and NNE-SSE trend. The thickness of sediment in the western half of the area is thinner than the eastern half. The variations in thickness of this unit are smaller than that of Unit 2.

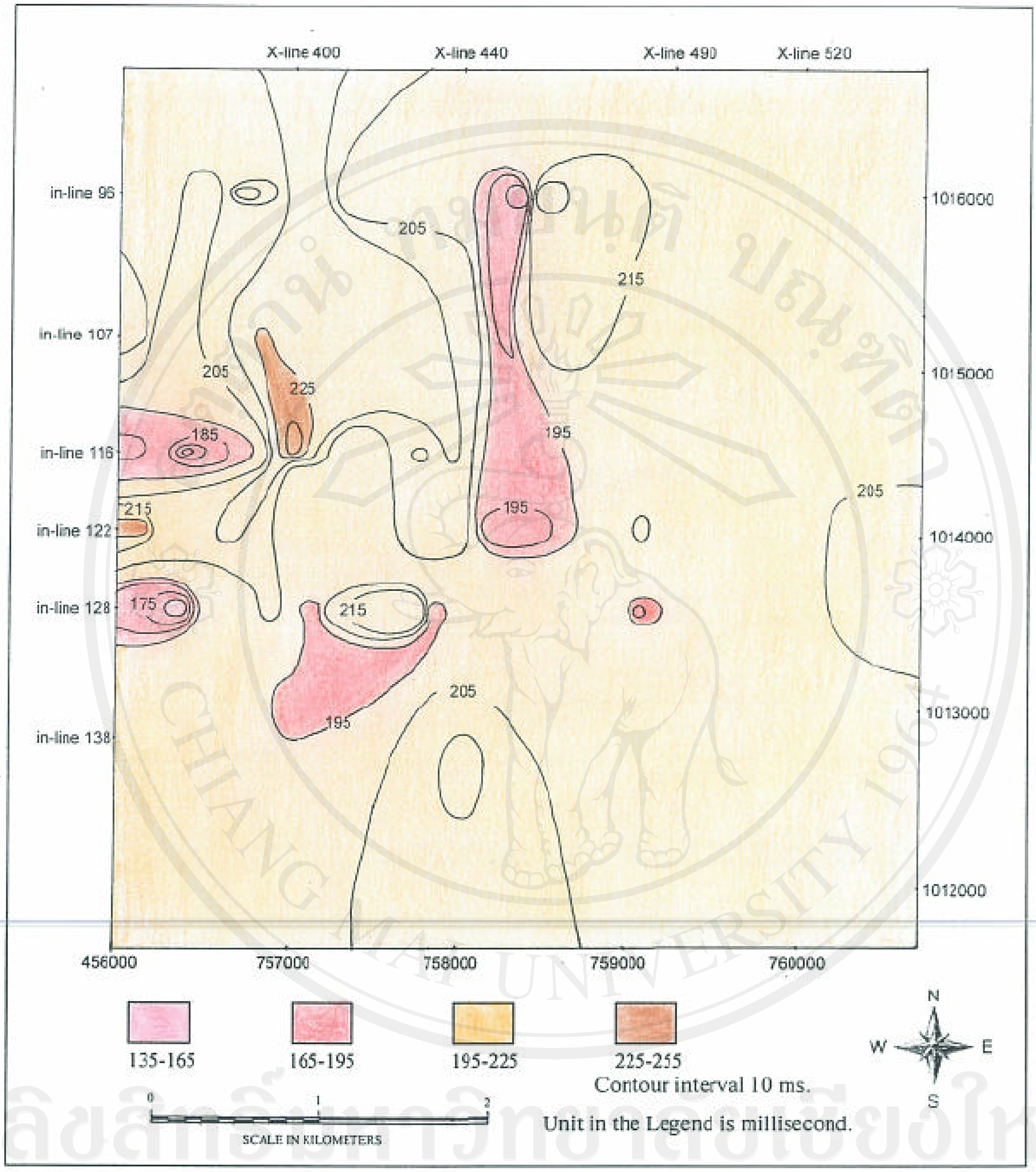

Figure 3.21 Isochron map of the interval between horizons D and E (Unit 4). Hot colors depict thick interval and cool colors thin interval. UTM grid reference Zone 48 North. The contour patterns are N-S, NNW-SSE and NNE-SSE trend. The variations in thickness of this unit are smaller than that of Unit 3.

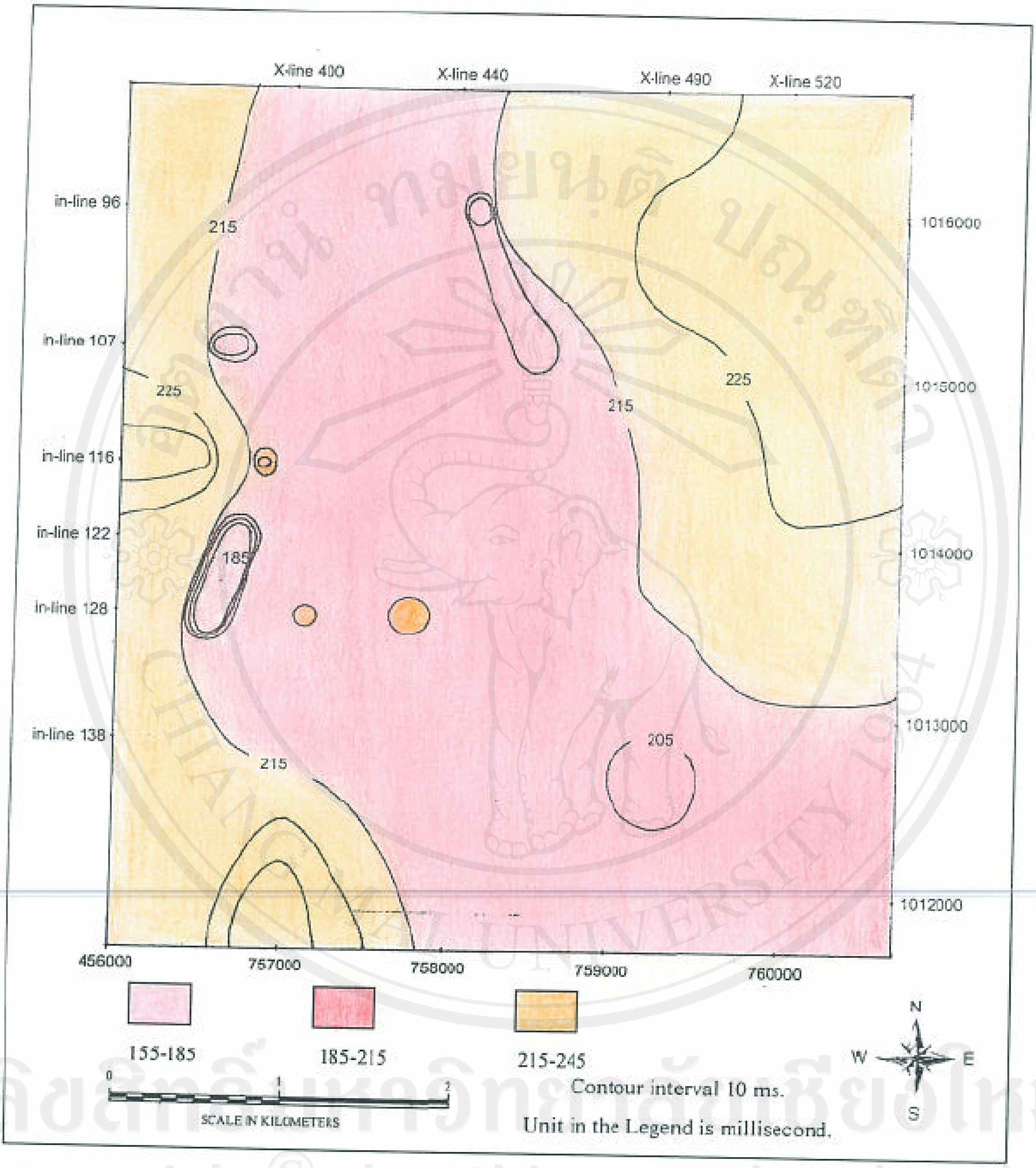

Figure 3.22 Isochron map of the interval between horizons E and F (Unit 5). Hot colors depict thick interval and cool colors thin interval. UTM grid reference Zone 48 North. The contours are NNW-SSE and NNE-SSE trending. The thickness of sediment in the central part of the area is thinner than that on either side. The variations in thickness of this unit are smaller than that of Unit 4.

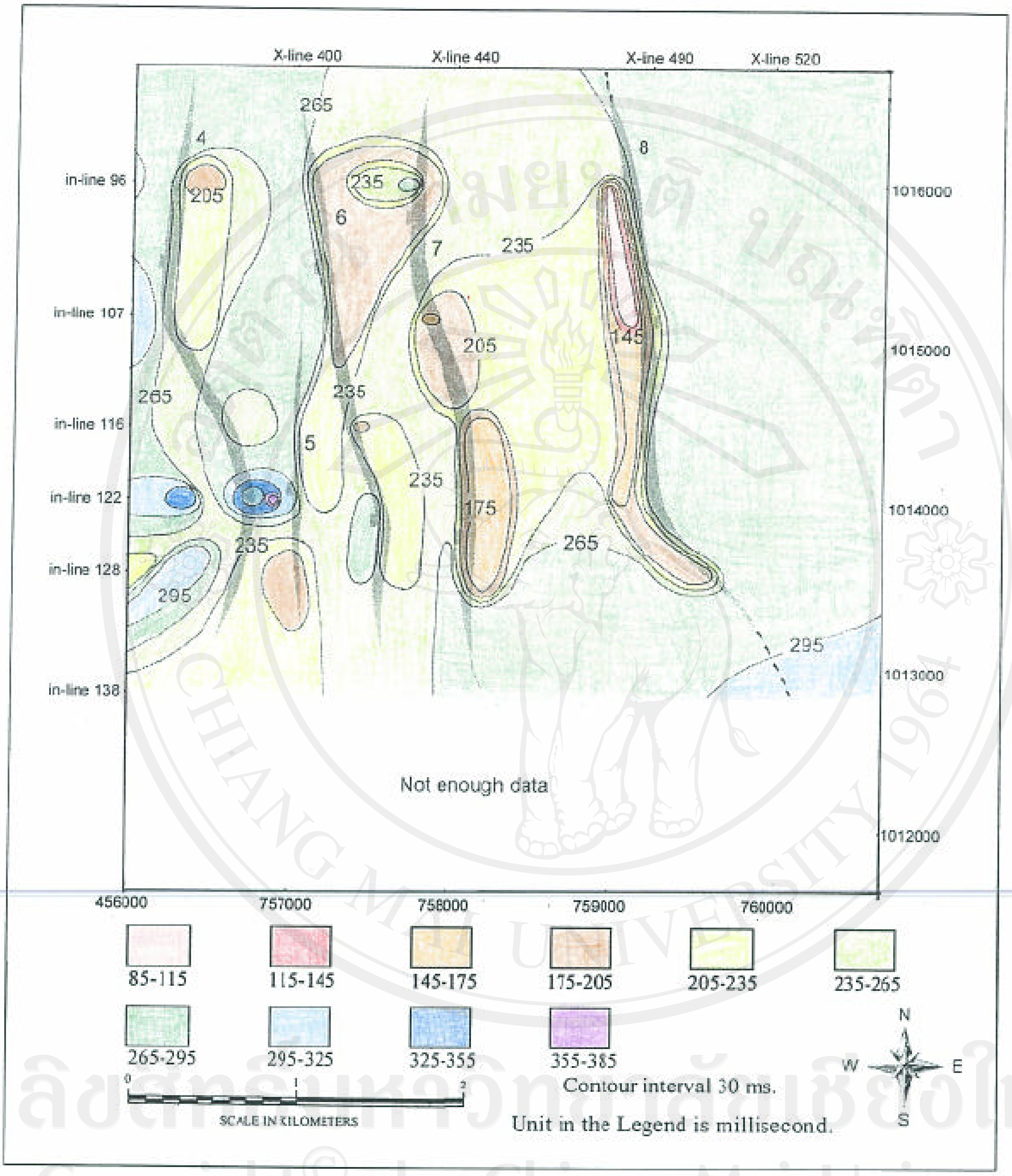

Figure 3.23 The Isochron map between horizon A and B (unit 1) overlain by fault traces interpreted at horizon A. Fault traces are in gray with gray rectangles indicating fault dip directions. UTM grid reference Zone 48 North. The thinnest of sediment is located along the footwall of fault 8. The thickest is located at the southwest part of the study area. The change in sedimentary thickness between footwalls and hanging walls is the largest in this unit.

and the thickest is located in the footwall of fault 4. The maximum change of the thickness between footwall and hanging wall ranges from 60 to 100 ms (102 to 170 m).

3.3.2 Isochron map of Unit 2 with fault trace overlay from horizon B

Fault traces from horizon B is overlain on isochron map of Unit 2 (Figure 3.24). West-dipping faults trend N-S and NNW-SSE and lie on the western half of the area. Fault 8 lies N-S along the study area but bends eastward in the south. The contours show N-S and NNW-SSE trending patterns. The thinnest of sediment (90 ms) (153 m) is located along the footwall of fault 8. The thickest area (290 ms or 493 m) is located at the southwestern part of the study area. It lies between fault 3 and fault 4 and has a ring shape. The maximum change of the thickness between footwall and hangingwall ranges from 30 to 80 ms (51 to 136 m).

3.3.3 Isochron map of Unit 3 with fault trace overlay from horizon C

Figure 3.25 illustrates the isochron map of Unit 3 with fault trace overlay from structure map of horizon C. The contour pattern is N-S, NNW-SSE and NNE-SSE trending. The thickness of this unit ranges from about 290 ms (476 m) in the south to about 450 ms (739 m) in the eastern part. The thickness of sediment in the western part of the area is thinner than that of the eastern part. West-dipping faults trend N-S and NNW-SSE and lie on the western part of the area. Fault 8 lies N-S along the study area. The thinnest of sediment are located in the footwalls of faults 2, 3, 4 and 7. The thickest are located in the hangingwall of fault 8. The contour lines near these boundary faults show thickening of the seismic unit in the hanging wall. The maximum change of the thickness between footwall and hanging wall ranges from 20 to 80 ms (33 to 131 m).

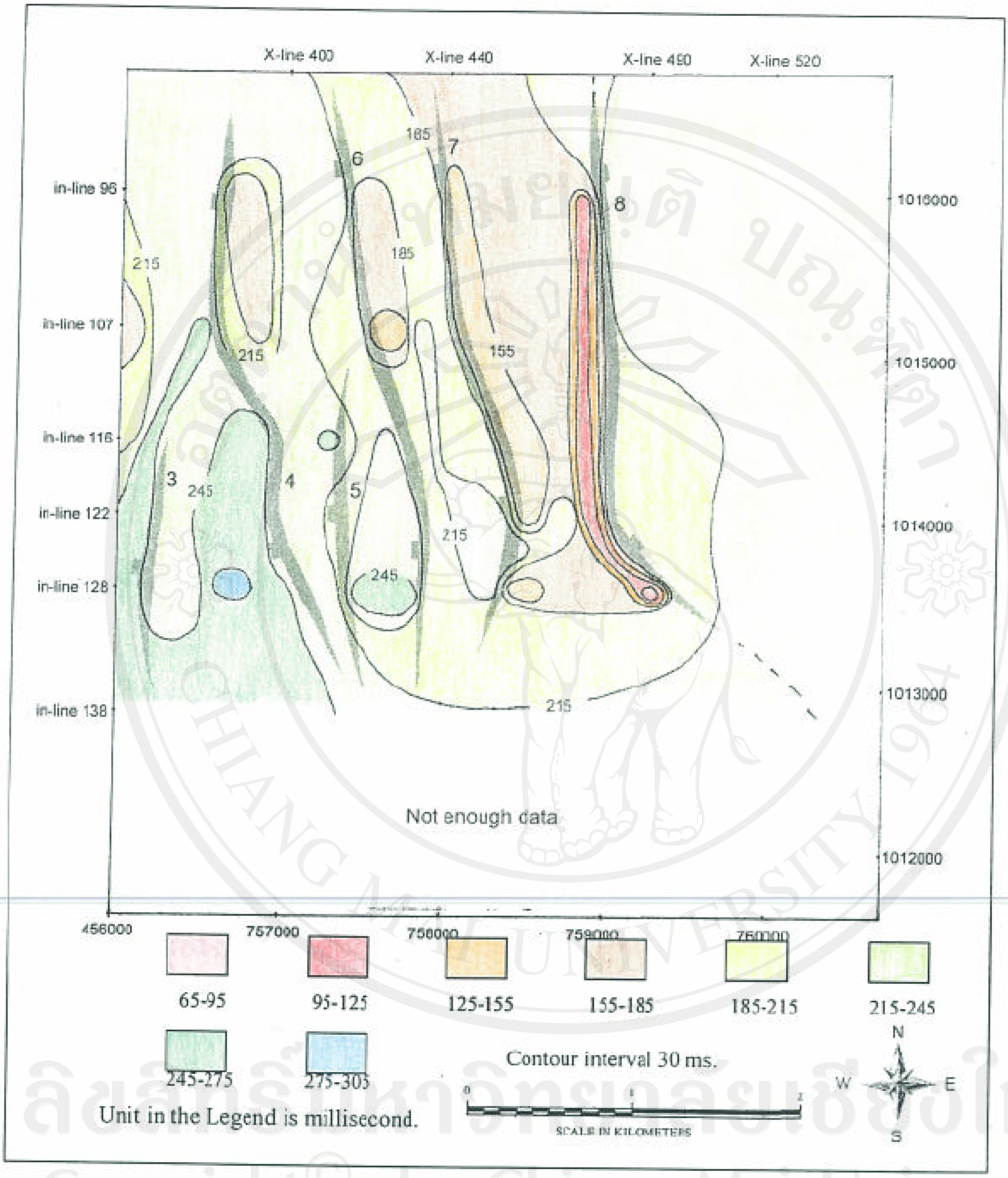

Figure 3.24 The Isochron map between horizon B and C (unit 2) overlain by fault traces interpreted at horizon B. Fault traces are in gray with gray rectangles indicating fault dip directions. UTM grid reference Zone 48 North. The thinnest of sediment are is located along the footwall of fault 8. The thickest is located in the southwest part of the study area. The change of sedimentary thickness between footwalls and hangingwalls are smaller than that in Unit 1.

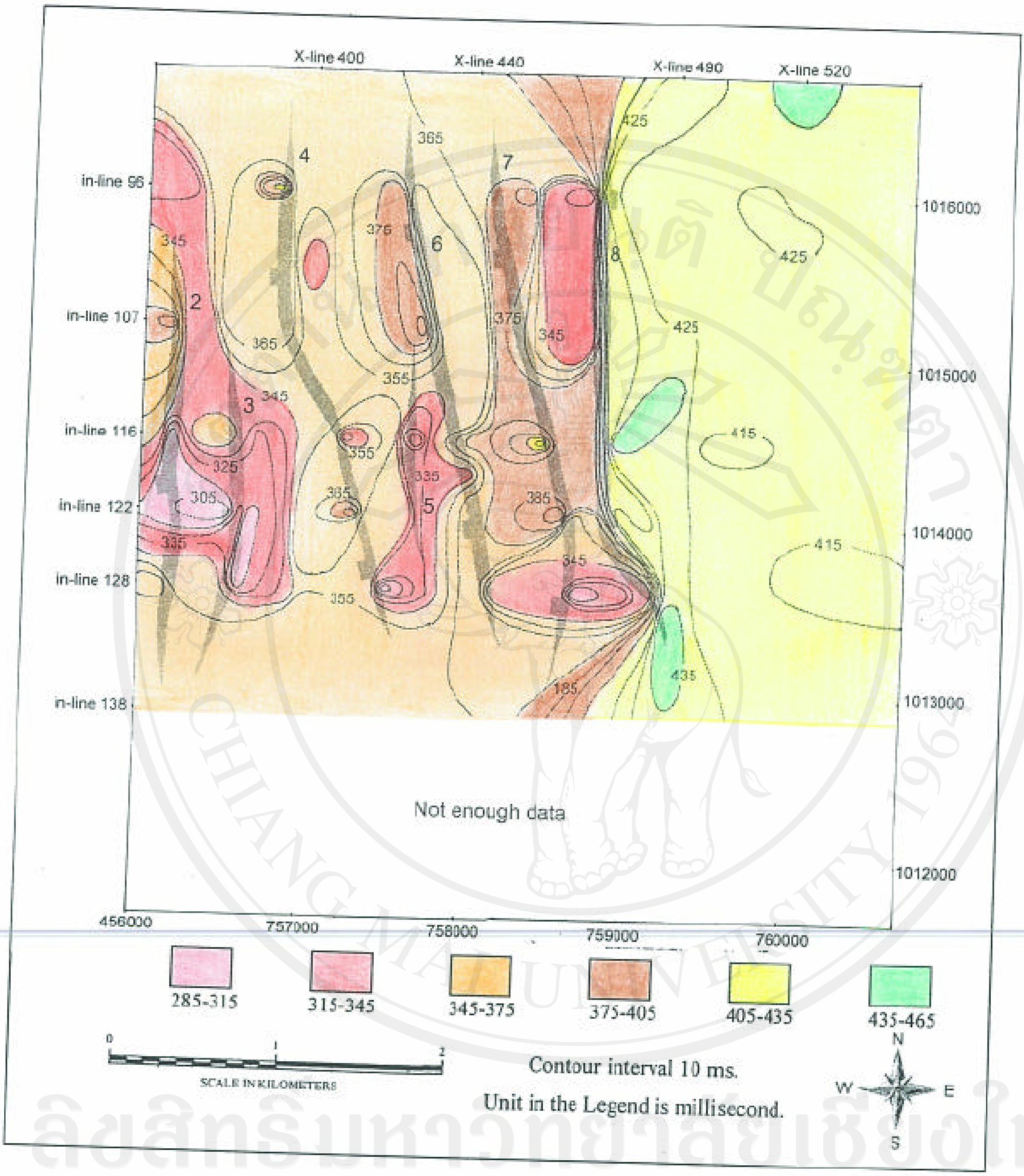

Figure 3.25 The Isochron map between horizon C and D (unit 3) overlain by fault traces interpreted at horizon C. Fault traces are in gray with gray rectangles indicating fault dip directions. UTM grid reference Zone 48 North. The areas with thin sediment are located in the footwalls of faults 2, 3, 4 and 7. The thickest sediments are located at the eastern part of the study area. The change in sedimentary thickness between footwalls and hangingwalls are smaller than that in Unit 2.

3.3.4 Isochron map of Unit 4 with fault trace overlay from horizon D

The isochron map between horizon D and E is overlain by fault traces from horizon D (Figure 3.26). The contour pattern is N-S, NNW-SSE and NNE-SSE trending. East-dipping fault 8 is shorter than it is in Unit 3 and is about 1 km long. West-dipping faults (faults 1, 2, 3, 4, 5 and 7) are N-S and NW-SE trending. The thinnest (160 ms / 204 m) of sediment are located in the footwalls of fault 1 and 8.

The thickest (230 ms / 293 m) are located in the hanging wall of fault 3. The maximum change of the thickness between footwall and hanging wall ranges from 15 to 40 ms (17 to 51 m).

3.3.5 Isochron map of Unit 5 with fault trace overlay from horizon E

Fault traces from horizon E is overlain on the isochron map between horizon E and F (Figure 3.27). West-dipping faults trend N-S and are located in the western part of the area. East-dipping fault 8 trends N-S and is about 1 km long. The contour patterns show NNW-SSE and NNE-SSE trending elongated sedimentary packages. The thickness of this unit ranges from about 180 ms (202 m) to about 240 ms (269 m) in the west. The thinnest of sediment is located in the footwall of fault 1. The thickest are located in the hangingwall of fault 1 and northeastern part of the study area. The contour lines near faults show thickening of this unit in the hangingwalls. The maximum change of the thickness between footwall and hanging wall ranges from 10 to 20 ms (11 to 22 m).

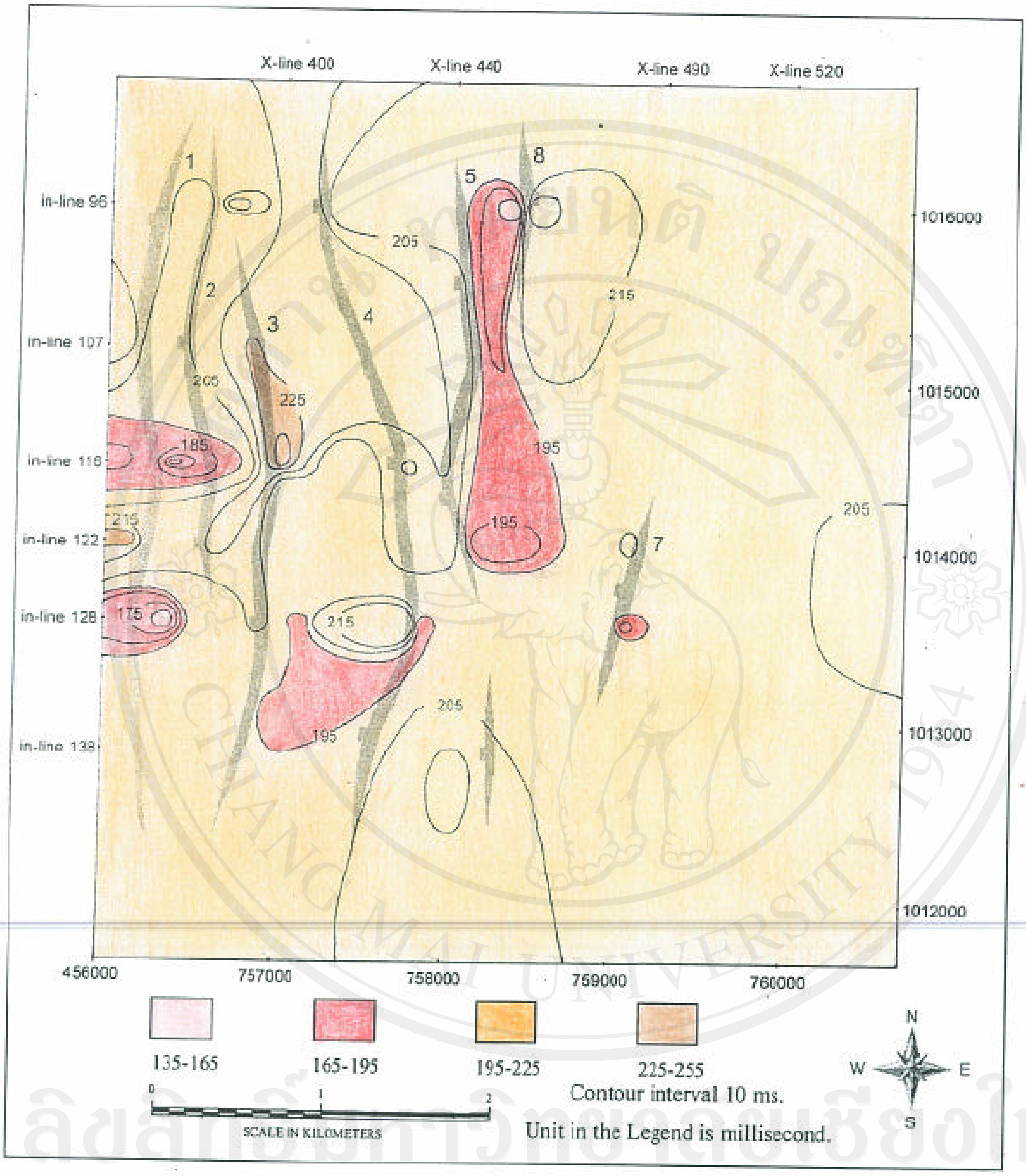

Figure 3.26 The Isochron map between horizon D and E (unit 4) overlain by fault traces interpreted at horizon D. Fault traces are in gray with gray rectangles indicating fault dip directions. UTM grid reference Zone 48 North. The thinnest of sediment is located at the footwalls of faults 1 and 8. The thickest of sediment are located at the footwall of fault 3. The change in sedimentary thickness between footwalls and hangingwalls are smaller than that in Unit 3.

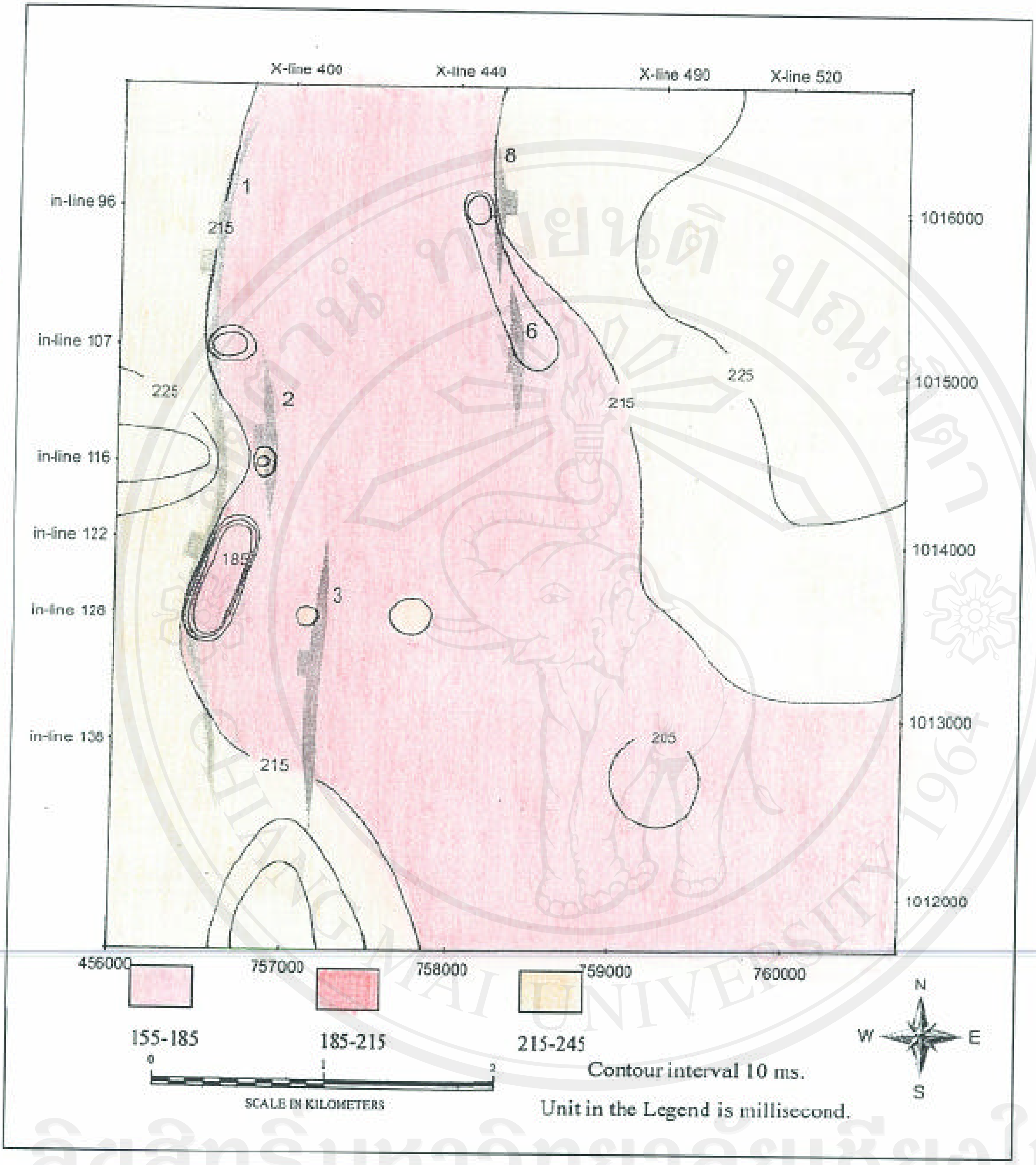

Figure 3.27 The Isochron map between horizon E and F (unit 5) overlain by fault traces interpreted at horizon E. Fault traces are in gray with gray rectangles indicating fault dip directions. UTM grid reference Zone 48 North. The thinnest sediment is located at the footwall of fault 1. The thickest sediment are located at the eastern and western part of the study area. The change of sedimentary thickness between footwalls and hangingwalls are smaller than that in Unit 4.

Change in stratigraphic thickness from footwall to hangingwall / Faults number	Unit 1 (ms)	Unit 2 (ms)	Unit 3 (ms)	Unit 4 (ms)	Unit 5 (ms)
3	-	30	20	15	10
4	60	40	40	30	-
5	70	30	20	15	-
6	70	40	40	-	-
7	80	60	40	20	-
8	100	80	80	40	20

Table 3.2 The change in stratigraphic thickness from hangingwall to footwall of faults in each isochron map. The unit of thickness is millisecond.

Change in stratigraphic thickness from footwall to hangingwall / Fault number	Unit 1 (m)	Unit 2 (m)	Unit 3 (m)	Unit 4 (m)	Unit 5 (m)
3	-	51	33	19	11
4	102	68	66	38	-
5	119	51	33	19	-
6	119	68	66	-	-
7	136	102	66	26	-
8	170	136	131	51	22

Table 3.3 The change in stratigraphic thickness from hangingwall to footwall of faults in each isochron map. The unit of thickness is meters.

The comparison of the change in stratigraphic thickness from hangingwall to footwall of faults is shown in table 1.1. The maximum change is at the lowest level (horizon A) and the minimum change is in the upper most level (horizon F). Fault density increases from horizon A to a maximum at horizon C and D and decreases upward. The change in stratigraphic thickness is prominent from unit1 to unit 2. While the thickness change in Unit 2 to Unit 3 is subdued.