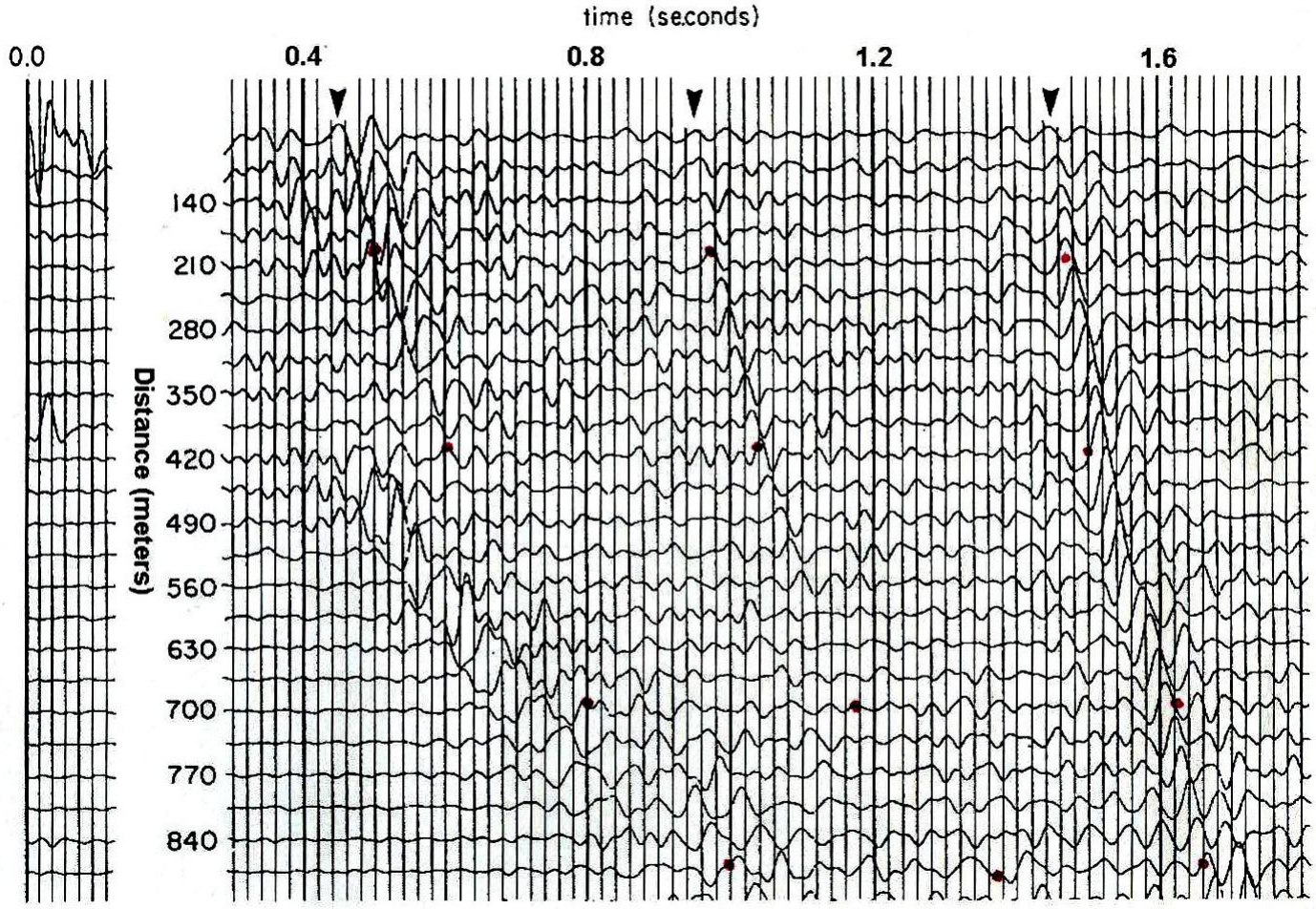
Exercise 8

- Calculate the interval velocities and layer thicknesses interpreting the attached seismogram recorded in an area of coastal plain sediments. Geophones were placed in a line at 35-meter intervals, and the source was located 70 meters from the first geophone. The t_0 times were determined assuming horizontal reflectors.
- From the velocities found above, what rock types you would expect to encounter in a drill hole?


time (seconds)
0.0
0.4
0.8
1.2
1.6
Distance (meters)
140
210
280
350
420
490
560
630
700
770
840

Solution

- Arrival times for the three reflections were read from the seismogram. They were used to prepare the x^2-t^2 graphs as shown in Fig. From the x^2 -t^2 graphs we obtain the zero-offset time of $t_{0,1}$ = s $t_{0,2}$ = s $t_{0,3}$ = s

  and from the slopes of the lines we calculate

$v_{1,rms} = v_1$ = m/s $v_{2,rms}$ = m/s $v_{3,rms}$ = m/s

- Using Dix Equation

  $v^2_n = (v^2_{n,rms} t_{0,n} - v^2_{n-1,rms} t_{0,n-1})/(t_{0,n} - t_{0,n-1})$

  we calculate interval velocities as

- v_2 = m/s v_3 = m/s
- and then from Equation

  $h_n = 0.5\, v_n\, (t_{0,n} - t_{0,n-1})$

  we calculate

- h_1 = m h_2 = m h_3 = m.

- The velocity values found above indicate that the study area consists of …. rocks. Because of overlap of velocity values, it is difficult to identify lithology from velocity alone. In the present case, it may be assumed that the first layer (v_1= km/s) consists of ……. rocks, the second layer (v_2 = km/s) consists of ……., and the third layer (v_3 = km/s) consists of …….