Exercise 9

- The travel time data for a reflected wave are given in the following table.

X (km)	t (s)	X (km)	t (s)
-1.2	1.252	+0.05	0.996
-1.1	1.222	+0.1	0.992
-1	1.193	+0.15	0.99
-0.9	1.165	+0.2	0.987
-0.8	1.14	+0.25	0.986
-0.7	1.115	+0.3	0.985
-0.6	1.093	+0.3473	0.9848
-0.5	1.072	+0.4	0.985
-0.4	1.053	+0.5	0.988
-0.3	1.036	+0.6	0.993
-0.25	1.029	+0.7	1
-0.2	1.022	+0.8	1.01
-0.15	1.016	+0.9	1.023
-0.1	1.01	+1.0	1.037
-0.05	1.005	+1.1	1.054
0.0	1	+1.2	1.073

- Determine approximately the overburden velocity and the reflector dip.
- Compute V_s and plot the dynamically corrected reflection section for the given data set.
- Transform graphically the reflection section into a migrated depth section and verify that the structural dip corresponds to that determined in 1.
- From the velocity found above, what rock types you would expect to encounter in a drill hole?

Solution

- 1. The normal moveout has been determined using the formula

  $\Delta t_n=(t_1+t_2-2t_0)/2$

where t_1 and t_2 are arrival times at the farthest geophones and t_0 is the zero-offset arrival time.

- The overburden velocity has been calculated as

  $v\approx(x^2/(2t_0\Delta t_n))^{1/2}$

  where x is 1.2 km.

- The reflector dip has been determined approximately using dip moveout ($\Delta t_d/\Delta x$) and the overburden velocity (v).

  $\text{Sin}\ \phi\approx(v/2)\ (\Delta t_d/\Delta x)$

- 2. The stacking velocity $v_s = v/\cos\phi$
- The dynamically corrected reflection section has been made using the normal incidence reflection time calculated as

  $t_n(x/2)=((t(x))^2-x^2/v_s^2)^{1/2}$

- 3. The reflection section has been transformed into migrated depth section by drawing arcs with

$d= t_n(x/2)\ v/2$ at points $-x/2$, 0 and $+x/2$. The tangent to these arcs is the reflector.

- It has been found that the structural dip corresponds to that calculated earlier using dip moveout.