

NOTES ON SECTION IN THE NEW HAYMARKET TUNNEL. 119

XVIII.—*Notes on the Section in the New Haymarket Tunnel.*

By HENRY M. CADELL, B.Sc., F.R.S.E., F.G.S.

(Read 2nd May 1895.)

THE new Haymarket Tunnel, which runs parallel to and alongside of the original tunnel, has a length of about 1000 yards between the Haymarket Station at its western and St Cuthbert's Churchyard at its eastern end. The excavation was a work of great engineering skill, as the crown of the arch had at places to be constructed in soft, loose soil, a very few feet below the buildings above. At other places the whole of the excavation was in the solid rock, and while the work was in progress I had, through the kindness of Mr W. Laing, one of the engineers in charge, an opportunity of paying several visits and examining the sections as they were opened up during the winter and spring of 1893. The exigencies of the case necessitated the building in of the ring as the cutting advanced, so that the section was closed in a very short time after it was opened up. I was thus only able to catch a series of glimpses of the parts that were open at the time of my visits, and may well have missed interesting parts between. I saw, however, good samples of most of the rock that had been excavated as it was carted away, so that I was enabled to judge pretty accurately of the nature of the rock all the way along the excavation. Since this section is now quite concealed I think that perhaps some useful purpose may be served by placing on record the few observations that were then made.

Throughout the whole length of the tunnel the rocks were of a sedimentary character, and so far as I have been able to ascertain, no igneous intrusions or ash beds were met with. The general dip was to N.W. or W.N.W. At the Haymarket end there was a set of well bedded gray fakes, sandy shales, and blaes dipping to N.W. at 35°. A rib of coal, varying from 1 to 3 inches in thickness, was found about 170 feet in from the mouth of the tunnel, and a few other coal ribs were met with under Dalry Road and Morrison Street, but beyond these no other seams of coal, oil shale, or other economic rocks were found, so far at least as I was able to ascertain. The section all the way to the Lothian Road consisted of gray carbonaceous fakes, sandy ribs, blaes, and thin sandstones, with occasional hard "kingle" beds. These beds had a tolerably uniform dip to

N.W. of  $35^{\circ}$  to  $49^{\circ}$  all the way along to the Caledonian Station, under the centre of which the tunnel was carried. Here and there I was also able to measure the dip of the beds exposed in excavations on the surface. At the south end of Palmerston Place, a short distance to the north of the line of the tunnel, the shales were found dipping to N.W. at  $35^{\circ}$ .

At the Caledonian Railway Station a large fault was clearly revealed on the surface, and in the tunnel beneath another dislocation a short distance to the north of the former was also exposed. The fault first mentioned runs parallel to the railway, right through the turntable east of Morrison Street Bridge, and thence in a N.E. direction through the centre of the goods station. It has a downthrow to N.W., and the black blaes at each side have been much smashed and are tilted up at an angle of  $50^{\circ}$ . In the tunnel a parallel fault was crossed running underneath the west end of the new passenger station, and close to this dislocation the shales were nearly vertical in position, and much disturbed. This line of dislocation may be either a separate fault or a branch from one of the great faults that have been traced for miles across the country to the west of Edinburgh. These have the effect of bringing up deeper parts of the calciferous sandstone series along their southern side, and were probably connected with the movements accompanying the upheaval of the Pentland ridge. Hitherto only one main line of dislocation has been clearly traceable on the surface in this locality. It runs along Fountainbridge, and was clearly seen when the cutting for the suburban railway was made at Craiglockhart Station. The dark shales of the Wardie series were there found to be faulted down against the red conglomerates and sandstones that are now regarded as the upper members of the Old Red Sandstone. When such large dislocations traverse a district it is usual to find several parallel faults instead of a single one, and it seems to me probable that the fault at the Caledonian Railway Station is a secondary fault of perhaps lesser magnitude than the larger one to the S.E.

At the east end of the tunnel, under St Mark's Chapel in Castle Terrace, the beds were of hard freestone and red marl, with a dip to W.N.W. of  $40^{\circ}$ . To the east of Castle Terrace the excavation was partly made through silt, deposited, no doubt, in the marsh that once occupied the upper end of the Nor' Loch valley. The only important remains of an organic nature exhumed in the section were obtained during the gruesome operation of tunnelling through St Cuthbert's graveyard, one of the coffins having been found buried 20 feet below the surface!