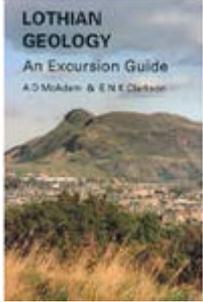


# Dunbar - an excursion, introduction

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By E.H. Francis. From [Lothian geology: an excursion guide](#). Edinburgh : Edinburgh Geological Society, 1996.

O.S. 1:50000 Sheet 67 Duns & Dunbar B.G.S. 1 :50000 Sheet 33E Dunbar

Excursion A: [Dunbar, Belhaven and the Parade](#)

Excursion B: [Dunbar](#)

The main object of the excursions is to study volcanic necks (pipes) exposed in the cliffs and on the intertidal wavecut platform. These structures mark the sites of former underground channels which fed early Carboniferous (Dinantian) volcanoes. Erosion has since removed the volcanoes and some thickness of the rocks beneath them so that the pipes are now seen at various levels below the original surface of eruption. The rocks in them consist mainly of lithified volcanic ash (tuffs), with subordinate agglomerates and alkali-basaltic intrusions, and they are surrounded by the sediments of Upper Old Red Sandstone and Lower Carboniferous age through which the original feeder channels penetrated. At the time of the volcanism, these sediments were probably so young that they still contained water. Moreover, the volcanoes were erupted on a surface covered by shallow sea or lagoon, so that water from surface or sediments gained access to the ascending molten magma column and gave rise to violently explosive (phreatomagmatic) activity. Modern comparison is thus with maars or ash-rings like early Surtsey (Walker and Croasdale 1972) rather than with Strombolian basaltic cinder cones found in inland areas.



The Harbour, Dunbar, East Lothian. Cliffs cut into volcanic vent agglomerate of Calciferous Sandstone Measures age. Ruins of

Dunbar Castle, on a raised beach platform. [P001088](#)

Two processes have been recognized in the emplacement of the pipes at Dunbar (Francis 1962). In the first eruptive phase the pipes are assumed to have been drilled through the sediments by a gas-propelled stream advancing above the molten magma column and containing fragments of ragged-edged, chilled basalt and of sediments broken by the stream from the walls of the channels. Remnants of the process are now to be seen at pipe margins where adjacent sediments are shattered and intimately penetrated by the gas-driven ash and where blocks and fragments show flow-orientation, process is also seen in small ring-structures (crypto-volcanic) representing upward drillings which were arrested before reaching the surface. In the second phase, which followed when eruption ceased, bedded ash (now tuff) at or near the contemporaneous surface subsided into the feeding channels, sometimes to depths of hundreds of metres. The bedding structures provide evidence not only of ash-fall at the surface, but also of flow ranging from lateral base-surge engendered by violent eruption to mass debris flows down inner flanks of the original sub-aerial ash-rings. The eventual preservation of the layering ranges from relatively intact to wholly collapsed, depending partly on how loose the ash was at the time and partly on the depth to which it subsided. Because of the subsidence the margins of such pipes are commonly ring-faults, and the process of down-drag is also reflected in the attitude of the sediments adjacent to those faulted margins. Thus, two different kinds of ash from the same volcanoes are brought together at one level-the material subsided from the surface at the centre of the pipes-and the deeper-seated intrusional material still in place at the margins.



Oblique aerial view of Dunbar, looking from the west-north-west. East Lothian. [P001296](#)

The sediments and pipes are traversed by a group of ENE quartz-dolerite dykes of Stephanian age, best seen at Belhaven and forming offshore skerries farther east. The dykes and the earlier tuffs are reddened to greater or lesser degree, reflecting the colouration of the surrounding sediments. This feature at Dunbar, and elsewhere, has been attributed by Lorenz (1972) to circulation of ground-water from the sediments, leading to oxidation of the iron content in the volcanic rocks.

The itinerary for Dunbar is designed for two excursions, one from Belhaven to the Parade and the other around Dunbar itself. However, if only one day is available it is suggested that they can be combined by starting at Belhaven Point (Localities 1, 2), traversing the Parade Neck at the foot of the cliffs (Localities 4, 5, 6), ascending by steps to the road, walking from there to the harbour area (Localities 7, 8, 9) and thence south-eastward near high water mark (H.W.M.) (Localities 11, 12, 13). The total walking distance is about 6 km, ending a similar distance by road from the starting point. In a race against the tide, this sequence might be varied in the knowledge that some of the harbour

exposures (7. 8) can be seen when most others are covered by the sea.

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