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# North Berwick Excursion A—North Berwick to Canty Bay (Route: (Map 9))

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## 1. North Berwick Harbour: basaltic lavas

The excursion starts from the Harbour near the centre of North Berwick [NT 554 856]. Round the point on which are the ruins of the pre-reformation kirk of St. Andrew's with St. Ninian's Aisle, the four lowest lavas in the volcanic sequence are exposed, each lava being of a different type of basalt or trachybasalt. Forming the west wall of the Harbour and Swimming Pool area is the topmost of these lavas, an olivine-basalt of Markle type some 17 m thick. The dark grey or purple basalt has numerous large labradorite phenocrysts and small brown iddingsite pseudomorphs after olivine (in these lavas the olivines are rarely found fresh). Towards the point the basalt is scoriaceous with vesicles and large calcite amygdaloids. Below the Markle basalt is a flow about 10 m thick of pale purple-grey mugearite with sparse feldspar phenocrysts. The top of this flow is autobrecciated and scoriaceous with horizontally elongate vesicles. Calcite veins and prominent concentric iron-banding, produced by segregation of iron oxide into layers, have been picked out by differential weathering. Underlying the mugearite and forming the east wall of the harbour area is a 7 m flow of dark purple to grey Dunsapie basalt, resting on red bedded tuff. This has large phenocrysts of labradorite, augite and olivine, and also rare gabbroic xenoliths a few centimetres across.

## Offshore islands

Visible from North Berwick are several islands of igneous origin. Due north, the rounded Craigleith is an Essexite laccolith, the joints in which indicate that erosion has uncovered the original shape of the intrusion. Famous as a home of the gannet, *Sula bassana*, and infamous historically as a prison, the Bass Rock, seen to the east, is a vertical volcanic plug of resistant phonolite. To the west, Fidra with its lighthouse and the Lamb are parts of a basalt sill. Excursion and charter boats sail to these islands from North Berwick, but permission should be obtained before landing.

## 2. Paddling Pool: kulaite lava, red tuffs, cryptovent

Forming a low feature north from the west end of the Paddling Pool, and separated from the Dunsapie basalt by a few metres of red tuff, is the lowest lava in the volcanic sequence, a trachybasalt, a leucite-kulaite. It is a purple altered highly vesicular lava, some 4 m thick with a reddened autobrecciated top. Altered hornblende and augite phenocrysts occur in a groundmass containing analcime secondary after leucite (Bennett 1945). North-east of the Paddling Pool the rocky foreshore is formed of red bedded tuffs, agglomerates and marls with green reduction spots dipping at 150 to the north-west under the lavas. These beds accumulated in shallow lagoons during the early stages of volcanicity. At The Lecks the red tuffs are cut by a small cryptovent, a vent produced by volcanic gases (see Dunbar excursion for discussion on formation). This can be picked out by the presence of steep dips and large blocks of red tuff set in a matrix of red and green agglomeratic tuff. Small intrusions of dark analcime-basanite occur within the south-west margin of the vent. Beyond the vent there are further outcrops of undisturbed red bedded tuffs.

## 3. Leckenbane and Yellow Craig: tuff sequence and intrusion

Crossing the intervening sand, make first towards the wave-cut platform of Leckenbane. Here a 3 m thick series of grey nodular cementstones with possible algal growths, and mudstones, separates the red tuffs and marls from green bedded tuffs below. Yellow Craig, a prominent rock near High Water Mark (H.W.M.), is a small oval plug of olivine-basalt intruded into the tuffs. The fresh centre of the intrusion is dark with small plagioclase and augite phenocrysts, whereas the chilled margin is pale and glassy. The intrusion continues to the north-east as thin basalt and agglomerate dykes. Three small cryptovents, one round the north of the intrusion, the other two cut by the dykes, contain disoriented blocks of red tuff, green tuff and cementstone.

#### **4. Milsey Rocks: green tuffs, sandstone**

Across the sand towards Low Water Mark (L.W.M.) lies an area of fine green bedded tuffs. Prominent outliers of massive pale sandstone, terminated to the south by a fault, lie on the tuffs. A porphyritic basalt dyke, some 1.5 m wide, possibly a continuation of the Yellow Craig dykes, is displaced by several small faults and is split at its west end. Back across the sands towards H.W.M. green bedded tuffs are again exposed, their dip steepening as the Partan Craig Vent is approached. An area of disturbed blocks adjacent to this vent, possibly another cryptovent, has provided many granulitic blocks of deep-seated origin, taken as evidence of the rocks underlying the Midland Valley (Graham and Upton 1978).

#### **5. Partan Craig Vent**

This is one of the largest agglomerate-filled volcanic vents exposed along this coast. Seawards along its west margin the vent forms a feature, standing higher than the bedded tuffs lying outside the vent. The west-facing cliff of Partan Craig gives a fine section of the material filling the vent. A bedded reddish agglomeratic tuff near the base, containing large blocks of red-green bedded tuff and tuffaceous sandstone, represents a thick debris flow. Other agglomerates contain small blocks of red siltstone and pale cementstone, and bombs of nepheline-basanite, a lithology found locally only in intrusions. In the cliff the tuffs lie in a shallow collapse syncline, continued on the foreshore to the north as a prominent basin cut by intersecting thin calcite veins. Towards The Leithies low cliffs afford further sections through the vent agglomerate which has numerous angular blocks and bombs, and is cut by anastomosing calcite veins. The youngest rocks exposed in the north-east are tuffaceous sediments, probably deposited in a late-stage crater lake.

#### **6. The Leithies: basanite sill**

These small tidal islands, connected by a sand spit, are the dissected remains of an irregular basanite sill with columnar jointing. The sill has a veined amygdaloidal base, and the underlying green bedded agglomeratic tuff can be discovered in the intervening boulder-strewn ground. Remnants can be seen of the dolomitic agglomerate which formed the roof of the sill and in places altered the basanite to white trap. South of The Leithies the margin of the Partan Craig Vent can be traced near H.W.M. cutting coarse green bedded tuffs. A small north-east trending basin of cementstone lies on the tuffs. Just east of this an agglomerate and basanite dyke can be followed north-east across the tuffs. The crag backed by a golf green on the post-Glacial raised beach is a small basanite plug.

#### **7. The Yellow Man Vent**

Beyond the basanite plug lies a small vent notable for the large size as much as 3 m across of the red-green tuff blocks and basanite bombs embedded in its coarse green tuff matrix. These rocks are unbedded in the east but form a basinal structure in the west where coarse layers may represent debris flows into a surface tuff ring. Two basanite dykes cutting the vent form upstanding stacks; the larger of these varies from 2 to 6 m wide, changes its direction across the vent and splits into off-shoots. At its east margin the Yellow Man Vent cuts the earlier Horseshoe Vent.

#### **8. Horseshoe Vent**

Leckmorán Ness is a wave-cut platform formed of coarse green bedded tuffs with basanite bombs about to cm in diameter. The Ness is crossed by arcuate joints and intrusive brown tuffaceous sandstone dykes. The Horseshoe Vent agglomerates consist of poorly bedded green tuffs in a broadly basinal structure. The tuffs contain basanite bombs and blocks of sandstone, mudstone and bedded tuff, commonly 30 cm across, and are quite distinct from the finer grained tuffs outside the vent. The vent margin is excellently exposed along the shore towards Horseshoe Point, a locality where basanite bombs within the vent are particularly numerous.

#### **9. Quarrel Sands and Canty Bay**

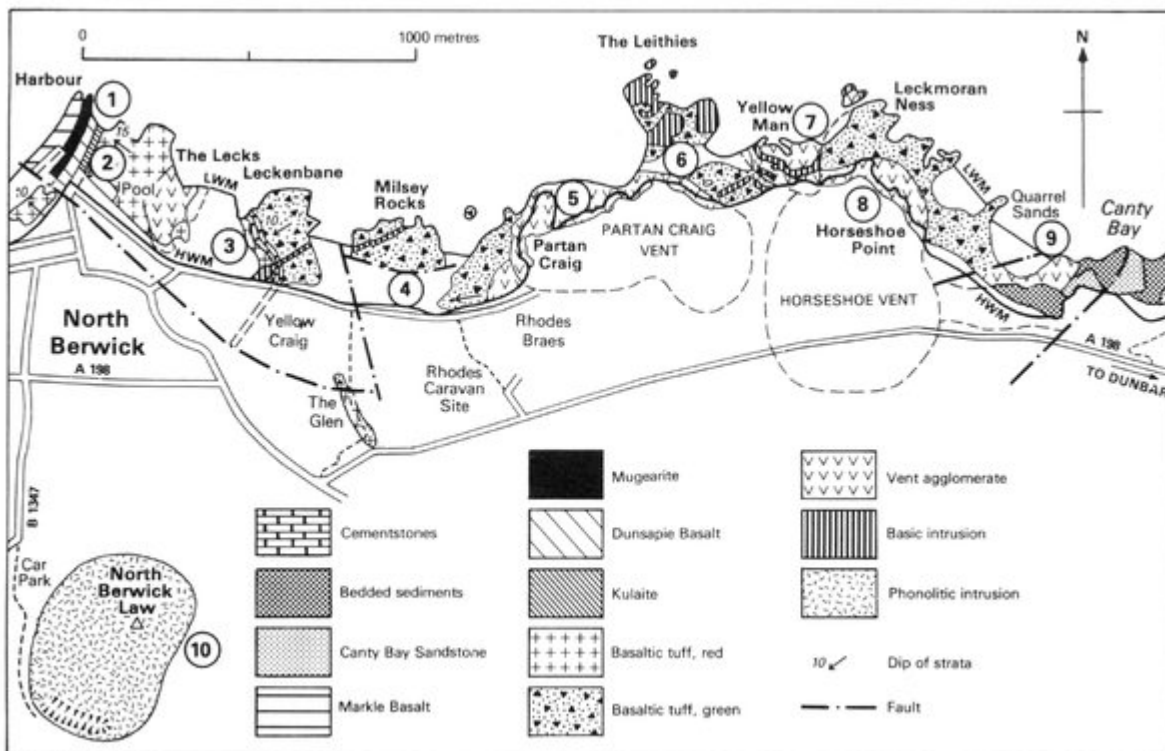
Further outcrops of green bedded tuffs and tuffaceous sediments at the west of Quarrel Sands lie in a shallow syncline. Reddish-green agglomerates forming ridges in the middle of the sands belong to a small vent, whose south margin is seen abruptly truncating upstanding sandstones. These red and brown sandstones, with interbedded red siltstones and mudstones and a porphyritic basalt dyke, are cut by a complex of small faults, one near H.W.M. striking east-west, the others striking north-west or north-east away from it. A landslip at the east end of the sands has carried massive blocks of sandstone on to the shore. Behind the landslip reddened cementstone facies sediments are seen overlying the Canty Bay Sandstone. a massive white, red and brown carious-weathering cross-bedded and contorted sandstone, which forms cliffs between the two bays and upstanding fault-bounded blocks on the foreshore. Red mudstones and siltstones crop out in the intervening low ground. On the foreshore east of Canty Bay red and green bedded tuffs are abruptly cut by the Gin Head Vent (North Berwick Excursion B).

The excursion can be completed by returning along the clifftop path which starts at Horseshoe Point, or up the road at Canty Bay and via the A198 road and Rhodes Caravan Site or The Glen to North Berwick. observing the spectacular glacial crag-and-tail feature of the Law.

## 10. North Berwick Law: phonolitic trachyte plug

The Law, a conical volcanic plug, forms an impressive crag and tail feature south of North Berwick. Access is gained from a car park to the west of the Law [NT 553 843]. A track leads south to the quarry which provided the stone that gives many North Berwick buildings their warm hue. This weathered red-mottled non-porphyritic medium-grained feldspathic rock is a phonolitic trachyte. The quarry has been partly infilled. Fresher rock can be obtained near the top of the Law. On a clear day the steep climb to the summit is further rewarded by a panoramic view of the Lothians, Fife and beyond. The main landmarks are pointed out by an indicator, and to the west. Arthur's Seat, the sleeping lion, bids one return to Edinburgh.

### References



(Map 9) North Berwick to Canty Bay.