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# **Orkney — a field excursion. Edinburgh Geological Society field excursion Orkney May 1991**

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## **Golspie–Holm, Orkney — an excursion**

### **Locality 1 Berridale [ND 120 225]**

The spectacular Berridale gorge provides both a beautiful setting and an opportunity to examine the red bed facies of the Old Red Sandstone (ORS). The sequence is of Middle or possibly Lower ORS age.

### **Locality 2 Achanarras [ND 150 544]**

The Achanarras quarry was worked for flagstones for many years. The best flagstones were obtained from the fine grained, flat layered deposits which were laid down in the deepest and quietest waters of the Orcadian lake. The Achanarras lake was the largest and longest surviving lake of the Middle ORS period. The Sandwich Fish Beds of Orkney represent a more northerly facies and the Melby Fish Bed of Shetland may represent the most northerly extension of the lake at its highest level. Southwards the remains of the lake are found in marginal facies at Edderton, Cromarty, Nairnside, Clova, Tynet Burn, and Gamrie. Well preserved fish fossils are common. Many of the fish lived in shallower, near-shore waters and when they died the carcasses drifted and sank in deep waters where they were quickly buried in the stagnant bottom waters of the thermally stratified lake. The very fine lamination of the sediments represents seasonal, probably annual, layers and each lamina can be sub-divided into two or three seasonal variations.

### **Locality 3 Sandside Bay [NC 958 660]**

This well exposed section demonstrates a more marginal facies of the Orcadian basin lakes approaching the basement highlands to the west. Several complete cycles of lake transgression and regression are well exposed including lake shore and fluvial facies. A thick sequence of probable aeolian sands may represent a lake shore sand dune field similar to those found on the fringes of arid zone, transient lakes today.

## **Skerry of Ness, Warebeth, Skara Brae, Hill of Cruaday, Orkney — an excursion**

### **Locality 1 Skerry of Ness [HY 257 078] to Warebeth [HY 236 086]**

This section (Figure 2) displays the Lower Stromness Flagstones resting on a thin basal sequence which overlies metamorphic and granitic basement rocks. The top of the Lower Stromness Flagstones is marked by the abnormally thick Sandwich Fish Bed, the Orcadian equivalent of the Achanarras Fish Bed in Caithness. The lower most beds of the Upper Stromness Flagstones are exposed at Pulse Skerry [HY 235 083] but these are cut by the Warebeth Fault which down throws the Lower Stromness Flagstones (LSF). The LSF sequence is repeated in the shore section at Stenigar and The Sandwich Fish Bed is exposed in cliff top quarries near the farm of Breckness.

At the Skerry of Ness the basal beds of the Lower Stromness Flagstones rest on granites and gneiss which form part of an exhumed hill and which slopes gently to the south. Up to 20m of coarse breccio-conglomerates rest on, and fill hollows, on the basement surfaces. These pass up into conglomerates and arkosic pebbly sandstones with sun-cracked siltstone lenses. The sequence fines rapidly upwards and 25m above the base pebbles and coarse sands have all but disappeared. Some pebbles and cobbles show thin algal stromatolite coatings and above the conglomerates are well developed algal stromatolitic mounds, which show strong similarities to those found at present in Shark Bay, South

Australia.

Above, and away from the influence of the coarser basement sediments the more typical fluvio-lacustrine cycle is developed (Figure 3). The deepest water sediments of the lake deposits, formed under anoxic conditions, form the prominent massive black rhythmite beds which are taken as the base of each cyclic unit. These pass upwards into interbedded sands and silts, often showing evidence of soft sediment slumping, which were deposited under oxygenated shallow water with well developed wave and current ripples. Above these shallow water lake sediments evidence of exposure, in the form of desiccation cracks, as the lake margin migrated under climatic influences, becomes increasingly common. In some sections channel sandstones may be developed. The top of the shallowing sequence is then cut abruptly with the appearance of the massive black rhythmites representing the transgression as lake levels rose again to begin the next cycle of gradual shallowing.

Correlation between faulted sections is greatly aided by the development of these rhythmites, any of which may contain fish. The development also, however of two distinctive rhythmite beds containing large chert nodules, respectively 14m and 59m below the Sandwich Fish Bed, make useful marker horizons which further aid correlation [HY 246 078]. These chert rich beds also provide clear evidence of the peculiar water chemistry of the hypolimnion. The rhythmite laminae, which can be traced through the chert nodules, indicate compaction of up to 80% and confirm the very early diagenetic origin of the chert.

At the Warebeth the remains of a lead mine, which was worked around 1775, are still to be seen, and along the foreshore there are good exposures of NE trending breccia veins in the fault shatter zone with baryte, strontianite and galena.

### **Locality 2 Skara Brae [HY 231 188]**

A brief stop will be made at the Bay of Skaill to visit the stone age village of Skara Brae. The Sandwich Fish Bed also outcrops in the bay but is poorly exposed.

### **Locality 3 Hill of Cruaday [HY 246 217]**

The quarry at Cruaday has been a collecting site for fossil fish since the early 19th Century. The quarry is now only occasionally worked but still provides many excellent specimens of fossil fish and the spoil tips are well worth picking over.

The high quality of flagstones, for which the quarry was opened, are derived from the Sandwich Fish Bed which, on the basis of the faunas is correlated with the fish beds at Achanarras in Caithness and Melby in Shetland as well as several localities around Inverness. The Orkney sequences show that the Fish Bed represents the deep water facies of an unusually thick fluvio-lacustrine cycle which is repeated by faulting in at least ten localities along the west coast of Orkney. Stratigraphically the cycle is identified by its thickness (between 55 and 61m) and its position relative to the two chert marker horizons. Near the base of the cycle however a 30cm thick calcium carbonate rich horizon weathers pale blue, contrasting with the normally ochreous weathering of the ferroan dolomite cements of the flagstones, and forms a distinctive marker which can be traced throughout the west coast area. A thin ash layer about 3.5m above the base of the cycle occurs in the southern localities. The main fish bearing horizon occurs about 2.5m above the base of the cycle.

More significantly however the cycle is seen to split into two parts towards the north. This suggests that the shoreline, which presumable lay to the north of Orkney migrated southwards but never reached the most northerly localities before a rise in lake level pushed the shoreline northwards again. Thus in the southern localities the deep water sediments deposited in the de-oxygenated conditions of the hypolimnion of the lake formed rythmites and black silty mudstones between 15–20m thick. This unit thins northwards and passes into slumped and thinly laminated siltstones representing shallower, better oxygenated conditions. The reappearance of massive black rhythmites at the northern localities heralds the temporary return of the deeper water facies before the southwards shoreline migration eventually reached the southernmost localities.

## **Geo of Inganess, Point of Buckquoy, Whitaloo Point, Orkney — an excursion**

## **Locality 1 Geo of Inganess [HY 219 413] to Borwick [HY 220 167]**

Possible Lower ORS age sediments occur at Yesnaby and around the hill of Crua Breck [HY 220 150]. Two formations, of (?) Lower ORS age, the Harra Ebb Formation and the Yesnaby Sandstone Formation, are exposed around the flanks of an exhumed hill of granites, gneiss and schists. The Harra Ebb formation comprises breccias, conglomerates and pebbly, arkosic sandstones which formed as talus and scree deposits flanking the hill. On the northern side of the hill these are faulted against the Yesnaby Sandstone Formation. Both formations are unconformably overlain by Lower Stromness Flagstones with local conglomerates at the base. The Harra Ebb Formation/Lower Stromness Flagstone Formation unconformity, with an angular discordance of 6–10°, is well exposed at Kaellan Hellier [HY 219 145] and the Yesnaby Sandstone Formation/Lower Stromness Flagstone Formation unconformity (angular difference 10°) at the Old Millstone Quarry at the point of Qui Ayre [HY 217 155].

Two facies are recognized in the Yesnaby Sandstone Formation. The lower facies (Facies I), at least 30m thick, consists of rusty weathering (with ferroan calcium and magnesium carbonate cements) grey, fine-medium grained well sorted sandstones with well rounded grains. Large scale, mainly tabular cross bedding is developed and is well exposed (though inaccessible), on the cliff face. The foresets are steeply inclined and individual sets vary between 1–3m. Major bedding planes, originally believed to have been horizontal (and now dipping about 14°) are spaced 5–6m apart and truncate the cross bedding. These are believed to be aeolian deposits derived from the west or north west.

The well sorted and cross bedded aeolian sediments pass up into Facies II consisting of massive, flat and ripple bedded sandstones with thin suncracked horizons at least 25m thick. These are interpreted as beach and nearshore deposits representing a water body which advanced from the south and inundated the dunes. The whole succession can be seen around the Noust of Bigging [HY 219 158] but it is complicated by faulting.

At Harra Ebb there is a spectacular stack of breccia, composed of blocks of sandstone set in a matrix of comminuted calcareous gritty sediment. On the foreshore a further five oval shaped breccia masses are seen in plan. These appear to be small volcanic crypto-vents, formed by gas-fluxion, probably at the time when camptonite dykes of the area were emplaced.

The possible Lower ORS sediments are overlain by Lower Stromness Flagstones which are well exposed along the cliff top northwards towards the Hill of Borwick. The section includes spectacular beds of stromatolites known locally as 'Horse-Tooth' stone.

## **Locality 2 Point of Buckquoy [HY 247 283] to Broch of Birsay [HY 240 285]**

On the north shore of the Point of Buckquoy there is a continuous section from east to west (beds dip at 20° to WNW) from the highest beds of the Lower Stromness Flags through the Sandwick Fish Bed [HY 247 283] into the overlying "Hoy Cycles". The Sandwick Fish Bed contains two leaves of the deep-water 'laminar' facies within the cycle, indicating a temporary regression of the water in the extensive lake in the north-western corner of Orkney Mainland.

The lowermost deepwater rhythmite unit contains the thin calcium carbonate rich horizon, near the base, seen in the sections to the south. The main fish bearing horizon is also present approximately 2.5m above

the base of the cycle, again as in the southern localities. The rhythmites pass upwards into shallower water interbedded and commonly slumped siltstones and ripple bedded sandstones. Twenty metres above the base however the rippled sandstones largely disappear and slumped and interlaminated siltstones reflect the deepening water. The appearance of euxinic rhythmite deposits at about 30m indicated that stratified lake waters again covered the area, but the shallowing sequence quickly follows with the appearance of suncracked horizons and channel sandstones representing lake margin deposits.

The rhythmic unit containing the Sandwick Fish Bed is here about 60m thick and the four units making up the 'Hoy Cycles' average 16m. The latter contain some relatively thick channel sandstone phases. Fish Beds ascribed to the Upper Stromness Flags are well exposed on east shore of the Brough of Birsay (a tidal island), on which the remains of a

Celtic Monastery, a Viking settlement and an 11th Century Cathedral and Bishop's Palace can be seen. ENE-trending camptonite dykes form prominent features on the north shore of the Point of Buckquoy.

### **Locality 3 Whitaloo Point [HY 261 281]**

One of the best examples of a tight isoclinal fold ('ruck') within the Orkney Flagstone sequences is exposed at Whitaloo Point.

### **Locality 4 Earl's Palace [HY 247 277]**

If time permits a brief stop will be made at the remains of the Earl's Palace.

## **Island of Hoy, Orkney — an excursion**

### **Locality 1 Rackwick [ND 198 996] to Old Man of Hoy [HY 176 008]**

The island of Hoy is composed largely of Upper ORS with an area of Middle ORS flagstones at the northern end of the island. The end of Middle ORS times was marked by gentle folding and faulting and a period of significant erosion which resulted in down cutting of the Middle ORS so that in places the Upper ORS sediments rest directly on Stromness Flagstones.

Volcanic activity, first seen as a series of thin ash beds in the Stromness Flagstones, increased throughout the Middle ORS and the irregular surface of the Upper ORS unconformity is blanketed by ashy sediments and a partial cover of basalt up to 90m thick.

The overlying, almost horizontal, Hoy Sandstones are at least 1000m thick. They comprise red and yellow medium grained, massive and cross-bedded sandstones with thin grey or greenish marly partings. Cross sets are rarely more than one metre thick. Slumping and convoluted bedding is common in some places with intraformational conglomerates at the base of some cross-sets. The sandstones were probably laid down in a system of braided rivers.

From Rackwick a path leads westward via the south shoulder of Moor Fea to the cliff top opposite the Old Man of Hoy. A difficult path leads from the cliff top to the foot of the Old man. As this includes an exposed traverse it should be undertaken only in dry weather by the sure-footed and, with proper footwear. The exposures at the foot of the Old Man, include a base of gently inclined Upper Stromness Flags, here overlain directly by lava, which is, in turn, overlain by the reddish Hoy Sandstone. The lateral variations in thickness of the lava are well seen from here. Mud filled dessication cracks and mudstone chips are common along bedding planes at the base of the Old Man. Near the top of the cliff the sandstone shows large-scale, mainly planar, cross-bedding, suggesting deposition in wind-blown dunes.

### **Locality 2 Rackwick [ND 198 990] to Too of The Head [ND 190 988]**

In Rackwick Bay, looking south east, towards Craig Gate [ND 206 977] and across the Bring fault which forms the southern edge of South Burn valley, the massive and cross bedded red and yellow sandstones form spectacular cliffs. The fault downthrows the beds to the northwest by approximately 1000m.

At the western end of the bay [ND 196 990] soft yellow fine to medium grained cross bedded sandstones with thin marls and flags and rare pebbly lenses underlie the Upper ORS ashes. These beds are interpreted as Lower Eday Sandstones, but their age has not been proven.

Westwards, towards Too of the Head, these sandstones are seen to be overlain by ashes of Upper ORS age. Here the tuffaceous sediments appear to blanket the existing topography as an air fall deposit. Elsewhere they appear to have been deposited in, or redistributed by, water. The sediments are dominantly brown or reddish tuffaceous sandstones with blocks and pebbles of basalt. The ash layer is up to 15m thick but varies considerably with the local topography.

Overlying the ashes, around Too of the Head [ND 190 988], columnar basalts appear to fill an existing valley and disappear abruptly to the west. The lava is an olivine basalt with porphyritic crystals of feldspar and olivine in a ground mass of iron ores, augite and plagioclase and is up to 60m thick with a purple slaggy top.

### **Locality 3 Rackwick Bay [ND 200 988]**

A well developed storm beach forms the western end of Rackwick Bay with finer sediments forming the eastern end of the bay.

### **Locality 4 Moss of Whitestanes [ND 215 995]**

Hummocky moraine is well developed along the valley of the South Burn and towards Rackwick Bay mounds of fluvio-glacial outwash gravel and a conspicuous terrace with a flat kettled surface are seen.

### **Locality 5 Dwarfie Stane [HY 244 005]**

A unique rock-cut Neolithic tomb has been cut out of a single block of cross bedded Hoy Sandstone measuring 28ft x 14ft x 6ft.

### **Locality 6 Mo Ness [HY 246 040]**

The most southerly outcrop of the Sandwich Fish Bed is poorly exposed around Mo Ness and at the northern end of the Bay of Creekland [HY 237 048]. Time and tide permitting these will be examined.

## **Sarsquoy, Mill Sound, Dingieshowe and Taracliff Bay to Newark Bay — an excursion**

### **Locality 1 Sarsquoy [HY 500 097]**

A double ayre (gravel beach) encloses two brackish lagoons on the eastern side of the Bay of Inganess. Cloven Ayre, the inner beach, is now completely vegetated with a narrow gap at its eastern end. The outer spit, Long Ayre, is un-vegetated, more mobile and almost entirely encloses the lagoon.

Three Tills are exposed in the nearby cliffs. The colours are believed to reflect differing ice flow directions over different local lithologies and not distinct ice advances. The age of the till is unknown. The basal till is grey and is overlain by a brown till which in turn is overlain by a red till. The lagoon has been used as a harbour since Viking times and old moorings are found along the southern side of the outer lagoon.

### **Locality 2 Mill Sand [HY 517 080]**

Another well developed ayre can be seen at Mill Sands. This will be briefly examined depending on the state of the tide.

### **Locality 3 Dingieshowe [HY 550 035]**

Here a sandy ayre (tombolo) has extended to link what was the island of Deerness to the Mainland. The ayre is markedly asymmetrical with a steep southerly face and a narrow beach profile. On the north side there is an extensive area of sheltered intertidal sand flats. The ayre is composed of irregular dune mounds and ridges up to 9m high. At the eastern, down wind, end a vegetated machair area has developed.

### **Locality 4 Taracliff Bay [HY 554 034] to Newark Bay [HY 568 038]**

The coast between Taracliff Bay and Newark Bay exposes a fairly continuous, eastwardly dipping succession of strata from the Rousay Beds to the base of the Middle Eday Sandstone.

At the western end of the section, greenish-buff, silty sandstones belonging to the Upper Rousay Flags are exposed in vertical cliffs and on a 200m wide shore platform. The flags are much paler in colour than the underlying Stromness Flags and yield a slightly different fossil fauna. They are succeeded upwards by the Passage Beds which form a transition to the Lower Eday Sandstones; the Passage Beds are thickest in the south (260m in South Ronaldsay) and thin northwards until in Eday and Sanday the junction of the Upper Rousay Flags with the Lower Eday Sandstone is abrupt. The Passage Beds show an increasing coarsening upwards, the predominantly silty Rousay Beds eventually giving way to the arenaceous Lower Eday Sandstones.

The cliffs to the west of Muckle Castle, provide one of the best exposures of the Lower Eday Sandstones in Orkney and show over 175m of quartzitic, well-bedded sandstones displaying cross laminations and channelling. Near the Castle the junction of the Sandstones with the Eday Flags is faulted and obscured by igneous rock, originally thought to be a lava flow, but now recognised as an intrusive olivine dolerite. The Muckle Castle stack is composed almost entirely of this intrusion but bears a thin capping of sediment and the igneous rock can be seen in the cliffs opposite and traced for a short distance inland; to the west it is fault bounded and to the east it lies against sandstones contorted in its emplacement and overlain by a tuffaceous horizon with igneous blocks.

It has been interpreted as a volcanic plug of Middle Old Red Sandstone age.

The Eday Flags show their thickest development within the Taracliff section- from being 150m thick here they decrease northwards to 100m in Shapinsay, 50m in Stronsay, and only 10m in Sanday. To the east of Muckle Castle the Flags are exposed for almost 200m until at HY 563 033 they abut against a series of interbedded tuffaceous sandstones; at the same horizon lavas are exposed on the eastern coast of Deerness at the Point of Ayre, but only tuffs are exposed on the southern shore. Further to the east lies a sequence of Eday Flags in which a rhythmical pattern of sedimentation becomes more pronounced; the Flags continue to HY 566 036 where they give way to the coarser sediments of the Middle Eday Sandstone. As in the Stromness Flags, fish remains occur in the deepwater facies of the Eday Flags.

The red-yellow Middle Eday Sandstones form the cliffs on the western side of Newark Bay; they comprise a series of fining-upward cycles each made up of a sandstone unit 50cm — 2m thick overlain by deep purple, poorly laminated, sandy siltstones and sandstone with thin ribs of commonly convoluted sandstone. These beds grade upwards into massive bedded sandstones. They are well exposed in the cliffs but access to parts of the section is difficult.

### **Locality 5 Point of Ayre [HY 591 038] to Greenigeo Taing [HY 592 042]**

At the Point of Ayre there are two lava flows of alkaline olivine-dolerite with interstitial analcime and natrolite. One is very thin; the other is at least 7m thick and has a scoriaceous top, sand-filled fissures and pipe amygdalae. North of the Point, towards Greenigeo Taing there are some well exposed cyclic units of the lacustrine/fluviatile Eday Flags facies.

### **Locality 6 Tommy Tiffy [HY 591 050]**

The Transition Beds between the Rousay Flags and Lower Eday Sandstone, here about 21m thick, will be studied at Tommy Tiffy. They consist of alternating beds of purplish and yellowish siltstone and thin sandstone ribs. The sandstone ribs become progressively thicker and more closely spaced as the sequence is ascended. The highest fish bed in the Rousay Flags will be examined in this locality.

### **Locality 7 Gearsan [HY 595 078]**

'The Gloup' is a large isolated blowhole separated from the shore cliff by a 25m wide rock bridge. This is the best example of a blowhole in Orkney.

### **Locality 8 Highland Park Distillery [HY 452 095]**

An evening (7.30p.m.) visit for hardy folk for a tour and samples.

## **Island of Eday, Orkney — an excursion**

### **Locality 1 Fersness Bay [HY 534 338] to Sands of Mussetter [HY 544 333]**

The section provides a complete sequence of the Lower Eday Sandstone, the Eday Flags and the Middle Eday Sandstone along the western limb of the Eday Syncline. The Lower Eday Sandstone consists of a lower facies of predominantly reddish-purple trough-cross-bedded sandstone with pebbly lenses throughout and with conglomeratic channel fills approximately 30m above the base, and an upper facies of yellow sandstone with rarer pebbles and predominantly planar-cross-bedding. The yellow sandstone makes an excellent building stone which was in the past exported directly from the quarry at [HY 536 336] to various Scottish ports. Partly dressed freestone blocks are still to be seen in the quarry. The Eday Flags consist here of only two cycles with recognisable fish beds, though a further band of fish bearing calcareous siltstone appears at [HY 530 335], some 110m above the base of the Middle Eday Sandstone facies. The latter is a deep red pebbly and locally conglomeratic fluvial sandstone, with well developed trough-cross-bedding, scour and fill structures, ripple drift and convolute bedding. A feature of this section is the presence of abundant pebbles of porphyritic and spherulitic rhyolite and scoriaceous basic lava. Good sections of boulder clay overlain by blown sand, are seen on the shore east of [HY 543 334].

A fine section of till occurs both on the coast of Fersness Bay and along a deeply incised stream just west of the Sands of Mussetter. The section, described by Peach and Horne (1880) exposes at its western end some 8m of a tough red boulder clay containing erratics of predominantly local origin. The clay also contains shell fragments and rare exotic erratics. Where the stream has cut down to bedrock, sandstone surfaces bear striae with orientations generally between south-east to north-west and south to north. A large roche moutonnee near the mouth of the stream indicates a flow to the north. At the eastern end of the section, red till can be seen to overlie brown till.

The age of the till is not known with certainty although it is thought that the Shelly boulder clay of Caithness and Orkney may be of Devensian age, whilst an early Devensian age; based upon a radiocarbon date obtained from shells in the till at Mill Bay, Stronsay [HY 662 255] has been suggested. The significance of the Fersness locality lies in the exposure it provides of one of the extensive till sections in Orkney.

### **Locality 2 Bay of Newark [HY 554 364] to Greenan Nev [HY 550 370]**

The Eday marls are well exposed along this section. They comprise several fining-upwards cycles consisting of relatively thin channel-fill sandstones (<2m thick), overlain by thick overbank deposits (up to 15m) of bright red sandy micaceous siltstone with sun cracks, ripple marks and small scale scours. There are some hard calcareous bands and many pale calcareous concretions. The siltstone has been bioturbated by burrowing organisms, producing circular near-vertical burrows up to 50cm long. If time permits the Upper Eday Sandstone will be examined along the shore just north of Greenan Nev.

## **Italian Chapel, Lamb Holm to Hoxa, Orkney — an excursion**

### **Locality 1 Italian Chapel, Lamb Holm [HY 48835 00629]**

The Chapel was built from a Nissen hut by Italian POW's during the Second World War.

### **Locality 2 Echnaloch, Burray [ND 475 966]**

This is an excellent example of a bay-head ayre which has closed the inner portion of Echnaloch Bay impounding a freshwater loch (oyce).

### **Locality 3 Burray Links [ND 486 974]**

The links are formed of a well developed dune system which includes dune ridges, slacks, machair, sand hillocks and linear blow outs.

#### **Locality 4 Ayre of Cara [ND 478 952]**

This stretch of the Churchill Barrier is of particular geomorphological interest, as it demonstrates the considerable rate of beach accretion since the barrier was constructed in 1942, when the tidal current between the islands was halted. A sandy beach now stretches for 500m along the east side of the barrier and a large sand bank is forming offshore. The black carbonaceous siltstones of Eday Flagstone age, exposed at the Ayre of Cara contain some complex injection structures.

#### **Locality 5 Barthwick [ND 434 865] to The Kist [ND 434 870]**

At Barthwick a small, but spectacular vertical vent of sediment-breccia cuts the Rousay–Eday Transition Beds. It consists of angular, locally flow-aligned blocks of flagstone and sandstone up to 1.3m in diameter,

set in a matrix composed entirely of comminuted carbonate-rich sediment. 340m further north a poorly exposed plug of agglomerate contains many rounded to sub-rounded monchiquite clasts in a matrix composed largely of carbonate. Rhythmic sequences within the Transition Beds will be studied along this coast.

#### **Locality 6 Ossi Taing [ND 463 865] to Wind Wick [ND 457 870]**

A continuous section of Lower Eday Sandstone and Eday Flags is exposed. The Lower Eday Sandstone is of the medium-grained cross-bedded facies, with mud-flake breccias at the base of many units. Exposed bedding surfaces show parting-lineations and there are some aligned flute-casts.

#### **Locality 7 Sand Wick [ND 428 892]**

The cliffs along the north shore are composed of Middle Eday Sandstone, which is here a massive, bright red sandstone, devoid of pebbles, and with only rare green and red siltstone partings. Cross bedding is relatively rare, but slumping and convolution are common.

#### **Locality 8 Hoxa [ND 421 942]**

Camptonite dykes along this shore section are crowded with phenocrysts of augite and hornblende, some up to 12.5mm in diameter.

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## Maps

1:50,000 Topo Sheets 5,6,7,11,12,and 17.

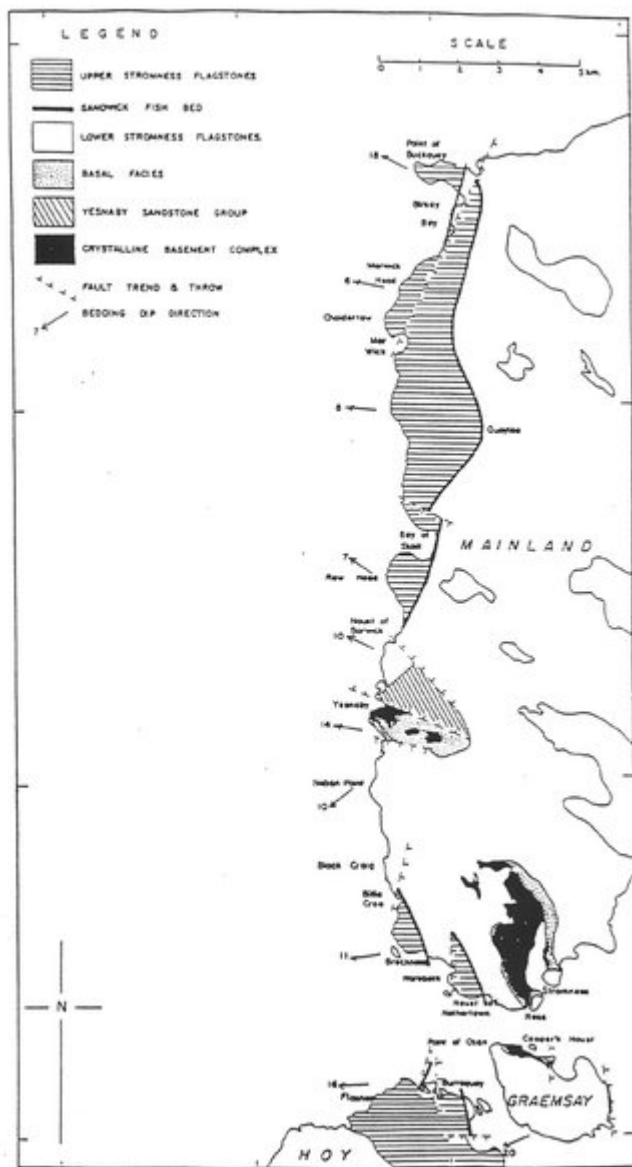
Geological Survey 1 inch to 4 inches, Sheet 3 (Orkney). This map appears also in a pocket in the Orkney Memoir (Wilson *et. al.* 1935.).

## Figures

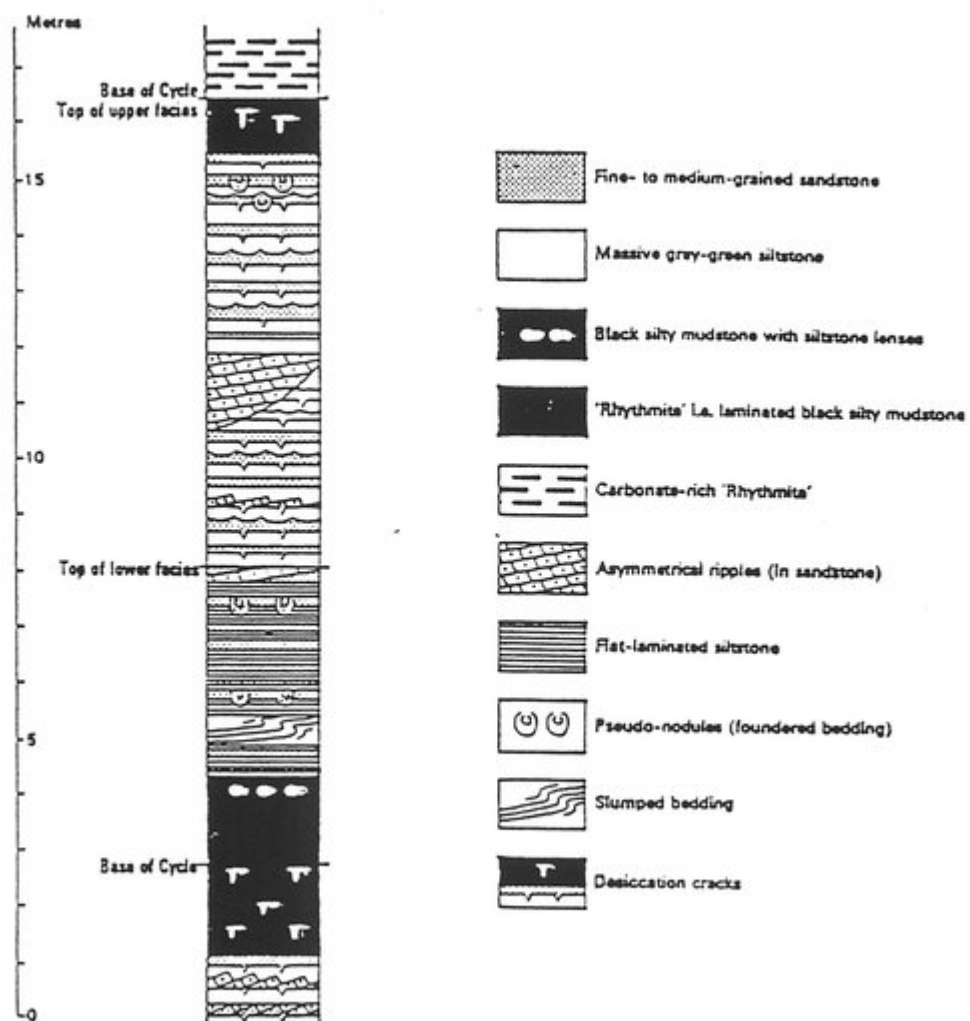
(Some figures are omitted due to issues with copyright)

(Figure 2) Simplified map of the geology of Western Orkney based on lithological logs of the coastal sections.

(Figure 3) A measured cycle in the Stromness Flags. Mykura, 1976.



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