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(Plate 6) Photomicrographs of metamorphic rocks of the Walls Peninsula Fig. 1. Slice No. [\(S47741\)](#) [HU 285 580]. Magnification $\times 16$. Crossed polarisers. Garnet in hornblende-schist with small aligned inclusions, of which all but the outermost are aligned at a high angle to the external fabric. The internal (Si) fabric may be of M1P age, the outer (Se) fabric was developed during the M2P phase. Note the limited deflection of the Se fabric by the garnet. East coast of Neeans, 1235 yd (1130 m) N15°W of Brindister Broch [HU 283 584]. Fig. 2. Slice No. [\(S49322\)](#) [HU 308 605]. Magnification $\times 31$. Plane polarized light. Garnet in micaceous gneiss with concentrically arranged penetration inclusions. These were probably formed by the preferential resorption of unstable zones in the garnet. Vementry Island, north-west shore of Uyea Sound, 700 yd (640 m) NNW of Vementry House [HU 304 603]. Fig. 3. Slice No. [\(S47761\)](#) [HU 269 591]. Magnification $\times 16$. Plane polarized light. Hornblendic gneiss, with large hornblendes enclosing garnets. The growth of the large amphiboles appears to have taken place during a late stage of static growth (probably M2P) and its orientation may be mimetic after D_2 fabric. Neeans peninsula, 280 yd (255 m) N42°W of NE corner of Lang Loch [HU 270 592]. Fig. 4. Slice No. [\(S49298\)](#) [HU 222 578]. Magnification $\times 16$. Plane polarized light. Amphibolite with garnets which show no trace of rotation and have not significantly eyed the external (Se) fabric. Sphenes are aligned parallel to the hornblende and mica. The coarsening of amphiboles and garnets is of M2P age. West coast of Geo of Bousta, 230 yd (210 m) NW of Muckle Bousta [HU 223 577]. Fig. 5. Slice No. [\(S30728\)](#) [HU 286 612]. Magnification $\times 42$. Crossed polarisers. Sheared garnet-oligoclase-gneiss, with thin lenses and bands of mylonite. The garnet is rotated and peripherally altered to chlorite. Vementry Island, 250 yd (230 m) SSE of Head of Corbie Geo [HU 286 613]. Fig. 6. Slice No. [\(S47806\)](#) [HU 283 612]. Magnification $\times 38$. Plane polarized light. Granulitized quartz-oligoclase-gneiss. Garnet rotated and largely altered to chlorite by post-M2P shear movements (S3). Vementry Island, near west coast, 800 yd (720 m) N18°E of SW tip of Hein Head [HU 283 612].

(Plate 7) Photomicrographs of metamorphic rocks of the Walls Peninsula Fig. 1. Slice No. [\(S47786\)](#) [HU 257 571]. Magnification $\times 42$. Plane polarized light. Tremolite-schist, composed largely of euhedral laths of tremolite, flakes of phlogopite and subrounded crystals of epidote. East shore of West Burra Firth, 200 yd (180 m) S47°E of Broch at head of West Burra Firth [HU 257 571]. Fig. 2. Slice No. [\(S33779\)](#) [HU 223 579]. Magnification $\times 42$. Plane polarized light. Crystalline limestone with calc-silicate bands, with calcite (bottom), clinozoisite, hornblende and quartz with zoisite inclusions. Skinhoga peninsula, 380 yd (350 m) SSE of Skerry of Stools [HU 223 579]. Fig. 3. Slice No. [\(S31005\)](#) [HU 271 589]. Magnification $\times 16.8$. Plane polarized light. Epidote-amphibolite. Bluish green hornblende (with cleavage), subrounded crystals of epidote, interstitial calcite and rare small sphenes. Concentrations of epidote and hornblende occur in roughly alternate bands. Neeans Peninsula, 70 yd (64 m) N of Lang Loch [HU 272 589]. Fig. 4. Slice No. [\(S30589\)](#) [HU 208 578]. Magnification $\times 42$. Plane polarized light. Hornblende-schist with symplectic intergrowth of zoisite and quartz. Norby, 550 yd (502) N10°E of west end of Loch of Collaster [HU 207 578]. Fig. 5. Slice No. [\(S50811\)](#) [HU 300 599]. Magnification $\times 42$. Plane polarized light. Epidote-quartz rock composed of large euhedral epidote laths set in base of quartz full of tremolite needles. Vementry Island, near south-east shore of Suthra Voe, 1000 yd (910 m) S7°W of summit of Muckle Ward [HU 295 602]. Fig. 6. Slice No. [\(S49316\)](#) [HU 291 617]. Magnification $\times 42$. Plane polarized light. Flinty crush rock with new growth of radiating needles of fibrous amphibole due to late thermal metamorphism. Vementry Island, east shore of Swarbacks Head, 900 yd (820 m) NNW of summit of Muckle Ward [HU 293 618]. Fig. 7. Slice No. [\(S49319\)](#) [HU 295 595]. Magnification $\times 16$. Plane polarized light. Muscovite-chlorite-schist with phylloblastic minerals folded by F_3 movements. New chlorite plates developed sub-parallel to axial planes of folds and tourmaline prisms (seen in section) parallel to fold axes. Vementry Island, west shore of Cribba Sound, 1520 yd (1400 m) N of SW corner of Muckle Head [HU 296 595]. Fig. 8. Slice No. [\(S49294\)](#) [HU 216 581]. Magnification $\times 17.6$. Crossed polarisers. Mylonitized quartz-mica-schist composed of alternate streaks of quartz with mortar texture and mylonite containing newly-grown phlogopite and muscovite. South-east shore of Bay of Garth, 1020 yd (930 m) NE of Muckle Bousta. [HU 215 580].

(Plate 8) Photomicrographs of metamorphic rocks, microgranite and sandstone of Ve Skerries and Foula Fig. 1. Slice No. [\(S29982\)](#) [HU 103 658]. Magnification $\times 16.8$. Crossed polarisers. Granulitized granite with large crystals of albite-oligoclase, sieved with muscovite. Adjacent feldspar crystals are in optical continuity and separated by streaked out mosaic-quartz. Small near-euhedral crystals of epidote are abundant in the quartz network. Ve Skerries, North Skerry,

west coast [HU 103 658]. Fig. 2. Slice No. [\(S29989\)](#) [HU 104 656]. Magnification $\times 31$. Crossed polarisers. Coarse poorly-foliated granite-gneiss composed of quartz, large clear plates of potash-feldspar and albite-oligoclase full of inclusions of white mica, and small grains of epidote. Ve Skerries, Ormal, north coast [HU 105 656]. Fig. 3. Slice No. [\(S29898\)](#) [HT 975 401]. Magnification $\times 8$. Plane polarized light. Garnet-kyanite-staurolite-gneiss, with muscovite and quartz. Large stumpy plates of kyanite with close parallel cleavage (bottom and top centre), smaller plates of golden-yellow staurolite, and subrounded garnets are set in a base of biotite, muscovite, quartz and andesine. Foula, Swaa Head, 860 yd (790 m) NNE of Sloag. [HT 976 401]. Fig. 4. Slice No. [\(S50823\)](#) [HT 973 388]. Magnification $\times 20$. Plane polarized light. Strongly foliated and sheared quartz-biotite-schist composed of lenses of quartz with mortar texture alternating with streaks composed of feldspar, muscovite and reddish brown biotite. Scattered porphyroblasts of oligoclase (left-centre). Foula, south shore of Ham Voe, 110 yd (100 m) E5°N of Brae [HT 974 387]. Fig. 5. Slice No. [\(S29900\)](#) [HT 975 401]. Magnification $\times 16$. Crossed polarisers. Dyke of porphyritic microgranite, with granulitized matrix between phenocrysts of albite-oligoclase. Foula, Swaa Head, 880 yd (800 m) NNE of Sloag [HT 976 401]. Fig. 6. Slice No. [\(S50829\)](#) [HT 963 407]. Magnification $\times 16$. Crossed polarisers. Coarse-grained arkose with subrounded to subangular grains. Ratio of quartz to feldspar grains is 50:50. Some interstitial flakes of muscovite. Matrix forms 15 per cent of total volume, composed mainly of carbonate. Foula, shore of Whiora Wick, 520 yd (470 m) E20°S of Freyars [HT 966 412].

(Plate 9) Geological sketch map of the Sandness Formation

(Plate 10) Lithological variation within the Sandness Formation

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(Plate 11B) Wats Ness, looking north at north shore of Trea Wick [HU 172 507]. Steeply inclined, but relatively undeformed sediments of Walls Formation. (D963).

(Plate 12) Major stratigraphic and structural features of the Old Red Sandstone sediments and volcanic rocks of the Walls Peninsula

(Plate 13) Photomicrographs of sedimentary and volcanic rocks of the Walls Sandstone Fig. 1. Slice No. [\(S52737\)](#) [HU 296 581]. Magnification $\times 20$. Plane polarized light. Fine-grained flaggy sandstone, Sandness Formation, showing alternate quartz-feldspar and micaceous laminae. Scattered small grains of epidote throughout. West shore of Muckle Head. [HU 297 581]. Fig. 2. Slice No. [\(S52738\)](#) [HU 299 577]. Magnification $\times 20$. Crossed polarisers. Medium-grained arkose, Sandness Formation. Well-graded subangular to subrounded grains. The ratio of quartz to feldspar grains is 60:40. Matrix forms less than 10 per cent of total volume and is composed predominantly of carbonate. North shore of Voe of Clousta, 1225 yd (1100 m) WNW of Clousta School. [HU 298 577]. Fig. 3. Slice No. [\(S49343\)](#) [HU 266 551]. Magnification $\times 40$. Plane polarized light. Part of ignimbrite clast in lapilli-tuff in Clousta Volcanic Rocks, showing flattened and welded shards. Note the bending of shards around quartz clasts. Hillside, 710 yd (650 m) SW of western end of Loch Hollorin [HU 267 552]. Fig. 4. Slice No. [\(S30773\)](#) [HU 328 596]. Magnification $\times 38$. Plane polarized light. Basalt flow in Clousta Volcanic Rocks. Flow-aligned laths of sodic labradorite set in matrix composed largely of secondary amphibole with subordinate grains of epidote and a dusting of iron ore. Aithness peninsula, 220 yd (200 m) SE from north-west corner of peninsula [HU 327 597]. Fig. 5. Slice No. [\(S51496\)](#) [HU 276 498]. Magnification $\times 16$. Plane polarized light. Fine-grained feldspathic sandstone in Walls Formation with laminae of heavy mineral concentrates. Black grains are predominantly iron ore, other heavy mineral grains are apatite, sphene, epidote and tourmaline. North shore of Scutta Voe, 520 yd (475 m) WSW of Lee of Houlland [HU 275 498]. Fig. 6. Slice No. [\(S52748\)](#) [HU 317 564]. Magnification $\times 100$. Plane polarized light. Microfolded sandy siltstone, Walls Formation. Roadside, close to west shore of Loch Vaara [HU 316 565]. Fig. 7. Slice No. [\(S53696\)](#) [HU 278 499]. Magnification $\times 100$. Plane polarized light. Silty shale with F_1 slaty cleavage (horizontal) refolded by F_2 minor folds with incipient fracture cleavage developed along some fold limbs. Walls Formation. North shore of Scutta Voe, 520 yd (470 m) WSW of Lee of Houlland [HU 275 498]. Fig. 8. Slice No. [\(S53688\)](#) [HU 261 503]. Magnification $\times 100$. Crossed polarisers. Microfolded dark grey shale with axial-planar strain-slip cleavage inclined at 44° to bedding. West shore of Voe of Browland, 1620 yd (1480 m) S4°E of Browster [HU 261 503].

(Plate 14A) Fidlar Geo, south-west shore of Walls Peninsula [HU 190 494]. Thinly bedded siltstone and mudstone of Walls Formation, showing relationship of convolute lamination to cleavage. (D956).

(Plate 14B) Fidlar Geo, south-west shore of Walls Peninsula [HU 190 494]. Thinly bedded siltstone and mudstone of Walls Formation, showing relationship of convolute lamination to cleavage. (W.M.)

(Plate 14C) Fidlar Geo, south-west shore of Walls Peninsula [HU 190 494]. Thinly bedded siltstone and mudstone of Walls Formation, showing relationship of convolute lamination to cleavage. (W.M.)

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(Plate 15B) East shore of Gruting Voe [HU 275 493]. Intense F_1 folds in flaggy sandstone and siltstone of the Walls Formation (W.M.).

(Plate 15C) East shore of Gruting Voe [HU 275 493]. Close-up of intense F_1 folding in fine-grained sandstone and siltstone of Walls Formation (W.M.).

(Plate 16A) South shore of Sound of Papa, 350 yd (320 m) N5°E of Huxter [HU 175 574]. Planar cross-bedded purple sandstone underlying Lower Melby Fish Bed in Melby Formation. (D891).

(Plate 16B) South shore of Sound of Papa, 150 yd (140 m) W of Melby House [HU 184 577]. Purple sandy siltstone with irregular buff sandstone laminae with ?bioturbation structures. (W.M.).

(Plate 16C) South shore of Sound of Papa, 150 yd (140 m) W of Melby House [HU 184 577]. Purple sandy siltstone with irregular buff sandstone laminae with ?bioturbation structures. (W.M.).

(Plate 17) Photomicrographs of Melby Formation and Papa Stour volcanic rocks Fig. 1. Slice No. [\(S49338\)](#) [HU 173 575]. Magnification $\times 16$. Crossed polarisers. Pink medium-grained sandstone below Melby Fish Bed, Melby Formation. Feldspathic sandstone with bi-modal grain size distribution. Quartz-feldspar ratio 70:30. Among large subrounded grains quartz predominates. Accessory grains are garnet, zircon, tourmaline and apatite. Lithic clasts are composed mainly of altered acid lava and form less than 10 per cent of the total grains. Most grains are covered by a thin reddish film of iron ore. South shore of Sound of Papa, 340 yd (310 m) N of Huxter [HU 174 575]. Fig. 2. Slice No. [\(S30602\)](#) [HU 191 586]. Magnification $\times 31$. Crossed polarisers. Thin flow of basalt within tuff sequence in Melby Formation. Ophitic basalt with rare phenocrysts of sodic labradorite. Vaguely flow-aligned laths of calcic andesine are partly enclosed in ophitic augite. Matrix is a deep olive-green amorphous aggregate. Holm of Melby, west coast [HU 191 586]. Fig. 3. Slice No. [\(S54285\)](#) [HU 185 580]. Magnification $\times 32$. Plane polarized light. Poorly welded or non-welded tuff near base of Ness of Melby rhyolite. Partially flattened devitrified glass shards and small potash feldspar plates and laths, set in matrix of microlite rods. North-west corner of Ness of Melby, 240 yd (220 m) NW of Melby House [HU 185 580]. Fig. 4. Slice No. [\(S30944\)](#) [HU 167 619]. Magnification $\times 31$. Plane polarized light Coarse ophitic dolerite with plates of cloudy plagioclase set in ophitic pyroxene. Papa Stour, 560 yd (500 m) SSE of Skerry of Lambaness, 1850 yd (1690 m) NW of Gardie [HU 167 620]. Fig. 5. Slice No. [\(S30930\)](#) [HU 177 613]. Magnification $\times 32$. Crossed polarisers. Spherulitic rhyolite. Spherulites are composed of radiating fibres of brownish-stained potash feldspar. Small patches of quartz between adjoining spherulites. Papa Stour, south shore of West Voe, 550 yd (500 m) NW of Gardie [HU 176 612]. Fig. 6. Slice No. [\(S30931\)](#) [HU 175 615]. Magnification $\times 32$. Plane polarized light. Spherulitic rhyolite. Spherulites composed of tightly packed clusters of irregularly radiating laths of orange stained potash feldspar, set in large interstitial areas of clear quartz. Quartz forms a small central nucleus in some spherulites. Papa Stour, east shore of West Voe, 920 yd (840 m) NW of Gardie [HU 175 616]. Fig. 7. Slice No. [\(S30933\)](#) [HU 183 620]. Magnification $\times 31$. Crossed polarisers. Spherulitic rhyolite showing two contrasting types of spherulites. The large spherulites consist of radiating fibres of quartz and potash feldspar and are set in a groundmass of small near-spherical spherulites of consistent size (with black cross). Papa Stour, Doun Helier, 1220 yd (1100 m) NNE of Gardie [HU 183 620]. Fig. 8. Slice No. [\(S30962\)](#) [HU 166 591]. Magnification $\times 16$. Plane polarized light. Porphyritic rhyolite, with stumpy euhedral plates of slightly kaolinized potash feldspar, set in an irregular banded matrix of microlites of orange-stained potash feldspar and irregular patches of quartz. Papa Stour, south-west coast, close to Shepherd's Geo, 800 yd (730 m) SW of Bragasetter [HU 165 592].

(Plate 18) Geological sketch-map of Papa Stour.

(Plate 19) Horizontal sections across Papa Stour.

(Plate 20A) North shore of Hirdie Geo, south-west shore of Papa Stour [HU 132 606]. Lower Rhyolite resting on eroded top of rhyolitic tuff at right of picture. Foreshore rocks at left of picture are amygdaloidal basalt. Islands and cliffs in background are rhyolite. (D920).

(Plate 20B) South side of Aesha Head, on west shore of Papa Stour. [HU 148 611]. Lower Rhyolite on rhyolitic tuff which, in turn, rests on irregular surface of basalt rubble. (D922).

(Plate 20C) North shore of Papa Stour, 98 yd (90 m) SE of Cribbie [HU 157 624]. Rhyolite with large spherulites (lithophysies) and vertical banding, which is normal to the dip of the flow. (D928).

(Plate 21A) Wilson's Noup, Northmaven [HU 302 716]. Brecciated basalt in granite and granodiorite. (D1345).

(Plate 21B) Wilson's Noup, Northmaven [HU 302 716]. Brecciated partly permeated basalt cut by a stream of granodioritic material full of elongate, variably assimilated basaltic enclaves. (D1347).

(Plate 22) Photomicrographs of rocks of the Northmaven–Muckle Roe Plutonic Complex Fig. 1. Slice No. (S44284). Magnification $\times 25$. Plane polarized light. Early basic dyke, thermally altered. The plagioclase (An 50%) phenocrysts are recrystallized at their margins to interlock with the recrystallized base consisting of microgranular andesine and small idiomorphic prisms of hornblende and biotite; small ferromagnesian phenocrysts are recrystallized to compact aggregates of interfering micropirisms of hornblende. West side of Egilsay [HU 316 695]. Fig. 2. Slice No. [\(S30016A\)](#) [HU 332 732]. Magnification $\times 14.5$. Plane polarized light. Bytownite-peridotite. Numerous small crystals of olivine are enclosed poikilitically in large plates of bytownite and clinopyroxene. The relative proportions of these minerals are variable; orthopyroxene and reddish brown hornblende and biotite are variable minor constituents. South-east shore of Glusdale Water [HU 332 734]. Fig. 3. Slice No. [\(S30017A\)](#) [HU 332 733]. Magnification $\times 11.5$. Plane polarized light. Gabbro. Large plates of augite enclose prisms of calcic labradorite ophitically; brown hornblende margins augite and also forms smaller ophitic plates. A late crystallization of deep brown biotite is moulded on plagioclase. West shore of Glusdale Water [HU 332 734]. Fig. 4. Slice No. [\(S55647\)](#) [HU 341 682]. Magnification $\times 10$. Plane polarized light. Hornblende-gabbro (bojite). Large partly uraltized plates of brown and green hornblende enclose zoned plagioclase (An 65–45 %) prisms ophitically. Deep brown biotite is moulded on plagioclase. Cliva Hill, 150 yd (130 m) SSE of Mavis Grind [HU 340 682]. Fig. 5. Slice No. [\(S30023\)](#) [HU 315 742]. Magnification $\times 10$ –5. Plane polarized light. Hornblende-augite-quartz-diorite. Prisms of augite are subophitic to plagioclase; brown hornblende is moulded on plagioclase and idiomorphic against quartz. Plagioclase prisms are zoned from acid labradorite core to oligoclase margin. South shore of Gunnister Voe [HU 315 742]. Fig. 6. Slice No. [\(S55665\)](#) [HU 300 725]. Magnification $\times 12$. Plane polarized light. Biotite-hornblende-quartz-diorite. Tables of zoned plagioclase (An 55–15 %) interfere with hypidiomorphic brown and green hornblende which show good crystal forms against quartz (top centre). Peninsula 195 yd (180 m) WSW of Nibon [HU 304 730]. Fig. 7. Slice No. [\(S45034\)](#) [HU 343 643]. Magnification $\times 14$. Plane polarized light. Scapolitized gabbro. On the left, gabbro of unaltered plagioclase, hornblende and augite resembles that of Figs. 3 and 4; on the right, plagioclase is completely, hornblende partially replaced by xenomorphic, coarsely crystalline scapolite. East coast of Muckle Roe, 435 yd (400 m) NNE of Scarfa Taing [HU 334 639]. Fig. 8 Slice No. [\(S29505\)](#) [HU 314 674]. Magnification $\times 14.5$. Crossed polarisers. Granophyre. Muckle Roe, west side of Roda Geo [HU 314 674].

(Plate 23A) Roadside quarry, south of Mavis Grind, Northmaven [HU 342 682]. Scapolite vein in diorite-granite complex. (D1344).

(Plate 23B) East shore of Cow Head, Vementry Island [HU 309 607]. Straight clean-cut junction between Vementry granite (pale) and metamorphic rocks. (D904).

(Plate 24) Vementry Granite and related acid minor intrusions

(Plate 25) Geological Sketch map of the Sandsting Granite–Diorite Complex

(Plate 26) Photomicrographs of the Sandsting Granite–Diorite Complex Fig. 1. Slice No. [\(S51550\)](#) [HU 328 514]. Magnification $\times 16$. Crossed polarisers. Granophyre sill in Walls Sandstone, composed of graphic intergrowth of quartz and potash feldspar and scattered subrounded crystals of microcline and albite-oligoclase. West shore of Bixter Voe, 240 yd (225 m) SSE of Mosshouse [HU 328 514]. Fig. 2. Slice No. [33678](#) [HU 299 438]. (Analysed specimen No. 1066, Guppy and Sabine 1956, p. 14, No. 653.) Magnification $\times 16$. Crossed polarisers. Diorite, with plates of andesine rimmed with oligoclase, subordinate hornblende, biotite and rare sphene. Interstitial microcline, microperthite and quartz. 1400 yd (1280 m) ESE of Wester Skeld, near Loch of Arg [HU 299 438]. Fig. 3. Slice No. [\(S51509\)](#) [HU 253 461]. Magnification $\times 16$. Crossed polarisers. Microadamellite. Clusters of near-euhedral plates of zoned plagioclase (andesine rimmed by oligoclase) form 40 per cent of the total feldspar. Large irregular plates of microperthite and interstitial microcline form the remaining 60 per cent. Quartz forms 10 per cent of the total volume. The mafic minerals hornblende and biotite are present in equal proportion. Apatite is an abundant accessory. Coast of Scurdie, 470 yd (425 m) SE of Green Head [HU 253 459]. Fig. 4. Slice No. [\(S28878\)](#) [HU 296 427]. Magnification $\times 17$ –6. Crossed polarisers. Fine-grained hornblende-diorite. Near-euhedral plates of calcic andesine rimmed with calcic oligoclase. Interstitial microcline and quartz. Hornblende and greenish brown mica are present in equal volume. Sphene and small needles of apatite are abundant accessories. Brunt Hamar, 830 yd (760 m) NE of Silwick [HU 299 426]. Fig. 5. Slice No. [\(S51523\)](#) [HU 271 441]. Magnification $\times 42$. Plane polarized light. Melanocratic microdiorite. Irregular decussate laths of sodic andesine set in interstitial base of ragged plates of deep green biotite forming 30 per cent of total volume. Clusters of small crystals of hornblende. Abundant accessories are sphene and small specks of iron ore. South-east side of Stead of Culswick, 550 yd (500 m) S32°E of south end of Sand Water [HU 272 442]. Fig. 6. Slice No. [\(S51535\)](#) [HU 309 457]. Magnification $\times 16$. Plane polarized light. Ultrabasic rock resembling harrisite. Olivine is sheathed in serpentine. Pyroxene (augite and enstatite) forms large in part poikilitic plates. Also subhedral plates of labradorite-bytownite and plates of reddish brown mica (?lepidomelane) enclosing skeletal iron ore. 190 yd (175 m) W20°N of Stump Farm [HU 307 457]. Fig. 7. Slice No. [\(S51514\)](#) [HU 252 452]. Magnification $\times 16$. Crossed polarisers. Pegmatite vein in diorite. Large crystal of micropegmatite (quartz-microcline intergrowth) set in matrix of irregular plates of microcline and quartz with grains and veinlets of epidote. South shore of Taing of Koelkifield, 530 yd (480 m) N18°W of Culswick Broch [HU 252 452]. FIG . 8. Slice No. [\(S51528\)](#) [HU 293 454]. Magnification $\times 16$. Crossed polarisers. Part of ovoid of pyroxene-monzonite in microdiorite. Characterized by large euhedral sphenes, and smaller euhedral crystals of colourless pyroxene set in base of near-euhedral crystals of clear orthoclase, plagioclase and microcline. West slope of Hestinsetter Hill, just east of road, 340 yd (310 m) S18°E of Giant's Grave [HU 293 455].

(Plate 27) Photomicrographs of the thermal aureole and hydrothermal mineralization in the Sandsting Granite–Diorite Complex. Fig. 1. Slice No. [\(S51515\)](#) [HU 255 452]. Magnification $\times 42$. Plane polarized light. Hornfelsed sandstone in sedimentary enclave within diorite. Quartz and feldspar grains are welded together. The interstitial matrix is recrystallized into granular epidote, brown biotite and subordinate hornblende. The larger dark patches consist partly of ophitic hornblende. Koelkifield, 500 yd (450 m) N8°E of Culswick Broch [HU 254 452]. Fig. 2. Slice No. [\(S51782\)](#) [HU 255 466]. Magnification $\times 42$. Plane polarized light. Dark grey hornfelsed silty mudstone close to junction with Sandsting Granite. Serrate quartz grains set in matrix of stumpy brown biotite. The darker areas are spongy, highly ophitic crystal aggregates of green hornblende which are up to 0.5 mm in diameter. North-east shore of Bight of Selistack, 650 yd (590 m) E37°N of south point of Green Head [HU 256 466]. Fig. 3. Slice No. [\(S52534\)](#) [HU 241 464]. Magnification $\times 42$. Crossed polarisers. Indurated mud-stone overlying limestone, within thermal aureole of Sandsting Complex. Fine-grained hornfelsed calcite-mudstone with oval poikiloblasts (white) of cordierite. The mudstone contains small patches of clinozoisite. Island of Vaila, west shore of Easter Sound, 650 yd (590 m) WNW of Ram's Head Lighthouse [HU 242 463]. Fig. 4. Slice No. [\(S52536\)](#) [HU 241 464]. Magnification $\times 22$. Plane polarized light. Hornfelsed impure limestone within thermal aureole of Sandsting Complex. Composed largely of intensely sieved grossularite enclosing minute grains of diopside. The opaque bands consist almost entirely of finely granular diopside. The white lens in the bottom right of the picture consists of feldspar with diopside grains. Elongate crystals of clinozoisite near bottom left. Island of Vaila, west shore of Easter Sound, 650 yd (590 m) WNW of Ram's Head Lighthouse [HU 242 463]. Fig. 5. Slice No. [\(S51502\)](#) [HU 265 472]. Magnification $\times 16$ –8. Crossed polarisers. Junction of scapolite vein with Walls Sandstone. The scapolite forms irregular laths which intersect the vein-margin at an angle of 45°. South shore of Gruting Voe, 820 yd (750 m) E19°N of Hogan [HU 272 473]. Fig. 6. Slice No. [\(S31121\)](#) [HU 304 421]. Magnification $\times 16$. Crossed polarisers. Sheared and partly mylonitized granite with small discontinuous, partly sheared veinlets of scapolite laths. Skelda Ness peninsula. Pundswell, 200 yd (180 m) NNW of summit of Longa Berg [HU 304 422]. Fig. 7. Slice No. [\(S28732\)](#) [HU 287 425].

Magnification × 31. Crossed polarisers. Sheared-out and partly mylonitized scapolite adjoining granite. Hillside, 200 yd (180 m) E of Wester Wick [HU 287 424]. Fig. 8. Slice No. [\(S31126\)](#) [HU 301 410]. Magnification × 31. Crossed polarisers. Intensely scapolitised sheared granite cut by faulted veinlet of potash feldspar. Skelda Ness peninsula, 1000 yd (910 m) SSW of summit of Longa Berg [HU 302 411].

(Plate 28) Basic, acid and intermediate minor intrusions in Western Shetland

(Plate 29) Photomicrographs of the basalt-granite breccia and minor intrusions Fig. 1. Slice No. [\(S55676\)](#) [HU 302 706]. Magnification × 14. Plane polarized light. Breccia-form basalt cemented by granodiorite. The basaltic rock has a microgranoblastic base of andesine, hornblende and biotite in which lie small phenocrysts of zoned calcic plagioclase, marginally recrystallized, and recrystallized groups of amphibole and biotite prisms pseudomorphous after ferromagnesian phenocrysts. The rock resembles the thermally altered dyke of (Plate 22), fig. 1. Lang Head, 49 yd (45 m) inland from Geo of Drengi [HU 303 704]. Fig. 2. Slice No. [\(S43772\)](#) [HU 320 726]. Magnification × 14. Plane polarized light. Hornblende-basalt. Tablets and stout prisms of zoned plagioclase (centrally An 70+) are subophitically related to xenomorphic green hornblende and cemented by pale green fibrous amphibole; minor augite (NW of centre) is ophitic to plagioclase. South-east shore of Soolmisvird Water [HU 320 726]. Fig. 3. Slice No. [\(S30598\)](#) [HU 219 581]. Magnification × 11. Plane polarized light. Basic pyroxene-porphyrity. Phenocrysts of labradorite (An₆₅₋₇₀) and of yellow augite lie in a base of strongly zoned plagioclase laths, subophitic to purplish augite, and minor magnetite which are cemented by a turbid mixture of chlorite, biotite, alkali-feldspar and some quartz. Near Skerry of Stools, 710 yd (650 m) NW of Bousta [HU 219 582]. Fig. 4. Slice No. [\(S49323\)](#) [HU 307 606]. Magnification × 65. Plane polarized light. Garnet in basalt. Small garnets, about 0.02 mm across, are enclosed in clear chlorite (centre) and turbid plagioclase (SE of centre). Grains in chlorite (SW corner) include one garnet and two epidotes. North shore of South Voe, Vementry Island [HU 305 605]. Fig. 5. Slice No. [\(S28885\)](#) [HU 327 627]. Magnification × 16. Plane polarized light. Feldspar-porphyrity and basalt. The basalt is chilled; its margin partly enwraps an alkali-feldspar phenocryst of the porphyry. Ness of Gillarona, Muckle Roe [HU 327 627]. Fig. 6. Slice No. [\(S30732\)](#) [HU 282 603]. Magnification × 14. Plane polarized light. Nodular felsite. The nodules consist of feldspar-phyric glass, variably devitrified. The base is microcrystalline to cryptocrystalline quartz-feldspar aggregate, variably sericitized, with frayed slivers of glass. Heill Head, Vementry Island [HU 282 605]. Fig. 7. Slice No. [\(S30711\)](#) [HU 302 604]. Magnification × 13. Plane polarized light. Quartz-feldspar-porphyrity with microporphyrity hornblende, biotite and ore. The feldspar phenocrysts include orthoclase (usually mottled) and more abundant albite (usually turbid). Hornblende is replaced by chlorite-calcite aggregate; biotite is pseudomorphed by chlorite. Egga Field, 83 yd (75 m) N of Maa Loch, Vementry Island [HU 301 604]. Fig. 8. Slice No. [\(S28908\)](#) [HU 300 633]. Magnification × 22. Plane polarized light. Allanite. One end of the zoned crystal is embedded in an idiomorphic crystal of hornblende (SE of centre; almost completely destroyed in grinding the section); the other end is held in a rounded crystal of quartz. Such a cumulophytic group, though cognate, is xenocrystic, possibly derived from an early drusy stage of crystallization. The rock is a hornblende-quartz-porphyrity. North of Murbie Stack, south-west shore of Muckle Roe [HU 303 630].

(Plate 30A) Crooie Geo, north-west coast of Vementry Island [HU 286 617]. Striated and ice-moulded pavement of metamorphic rocks. Direction of ice-flow from left to right. (D916).

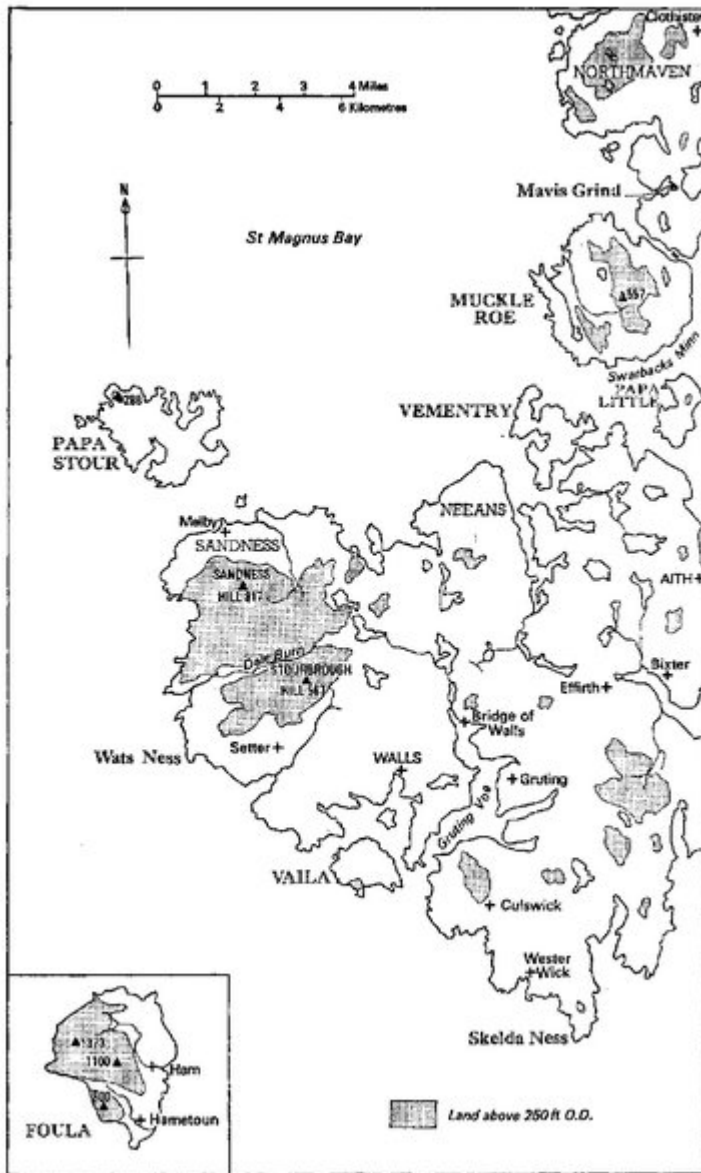
(Plate 30B) Interior of Papa Stour, looking south from hillside west of Culla Voe [HU 167 618]. Belt of morainic drift extending north-south across island from Culla Voe to Hamna Voe. Sandness Hill in background. (D931).

(Plate 30C) Western slope of Hill of Melby [HU 172 555]. Ramifying system of small meltwater channels. (D901).

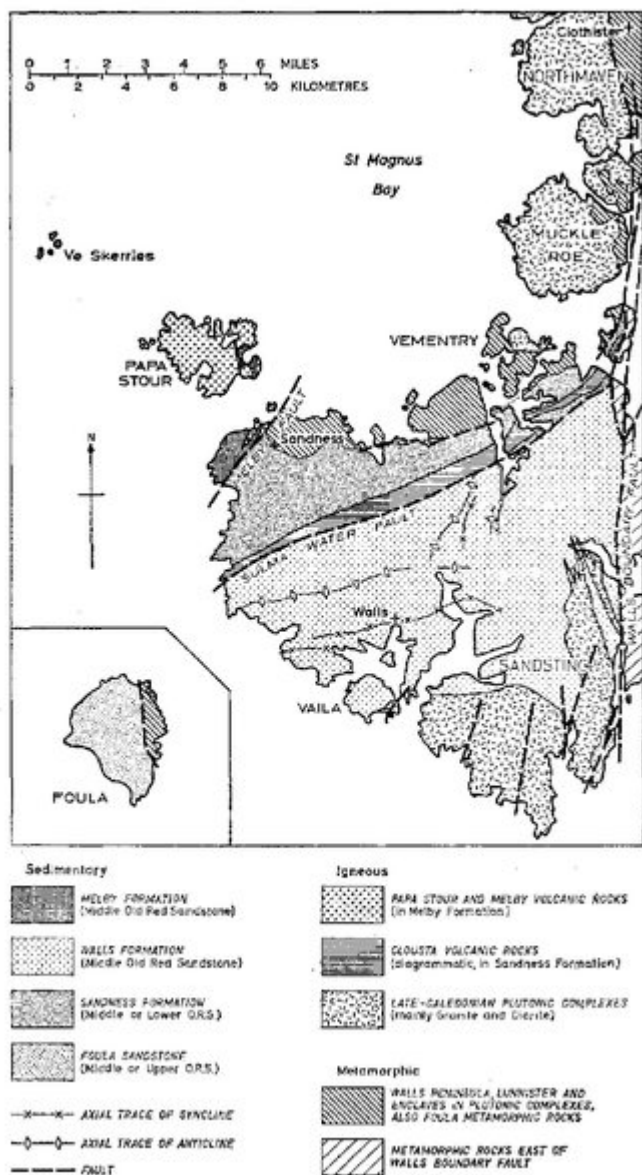
(Front cover)

(Rear cover)

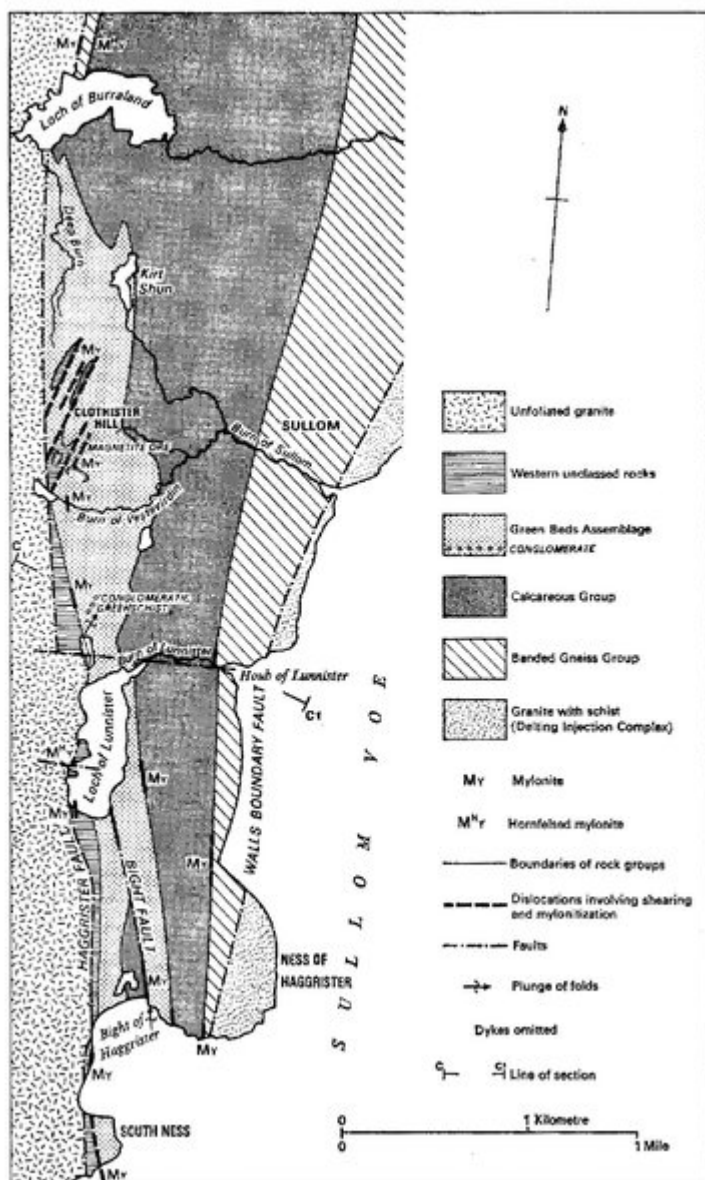
(Index map) Index map of the six-inch maps in the Western Shetland sheet.



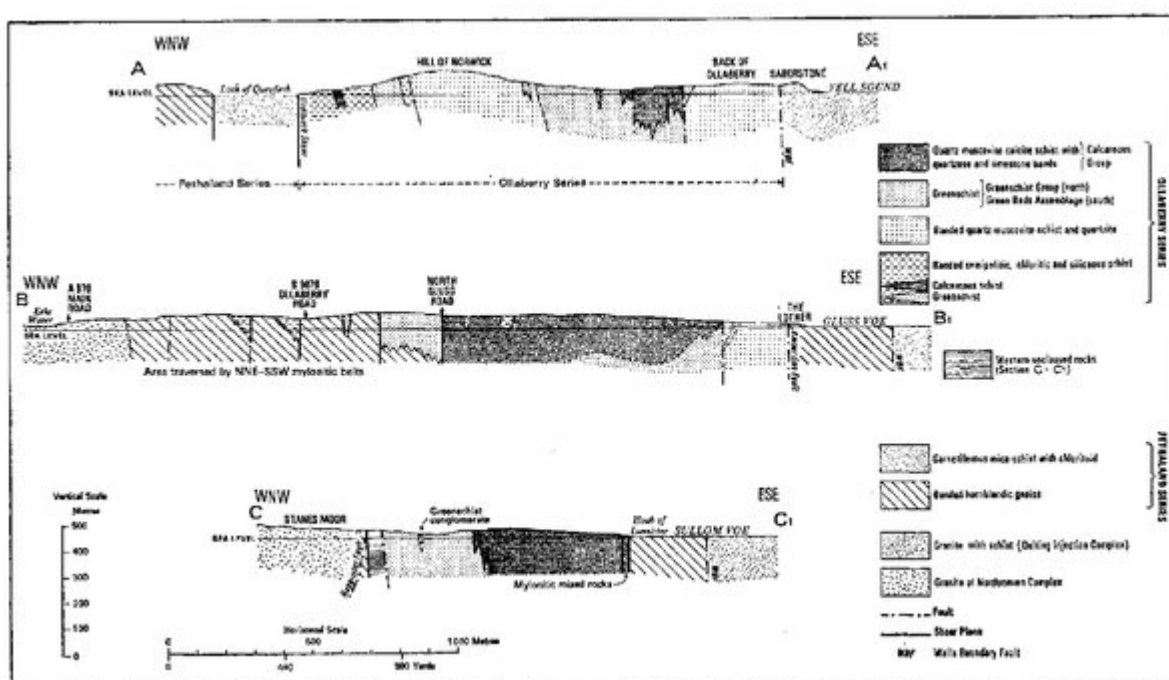
(Figure 1) Sketch-map showing the area covered by One-inch Geological Sheet Western Shetland.



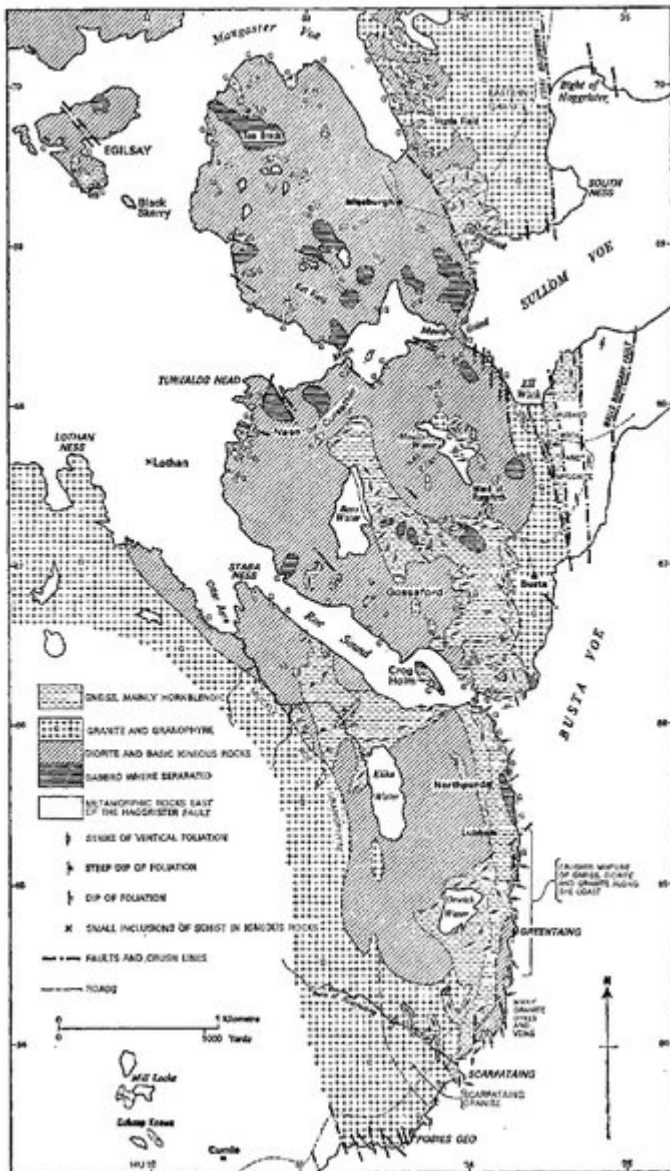
(Figure 2) Distribution of the principal rock groups in Western Shetland.



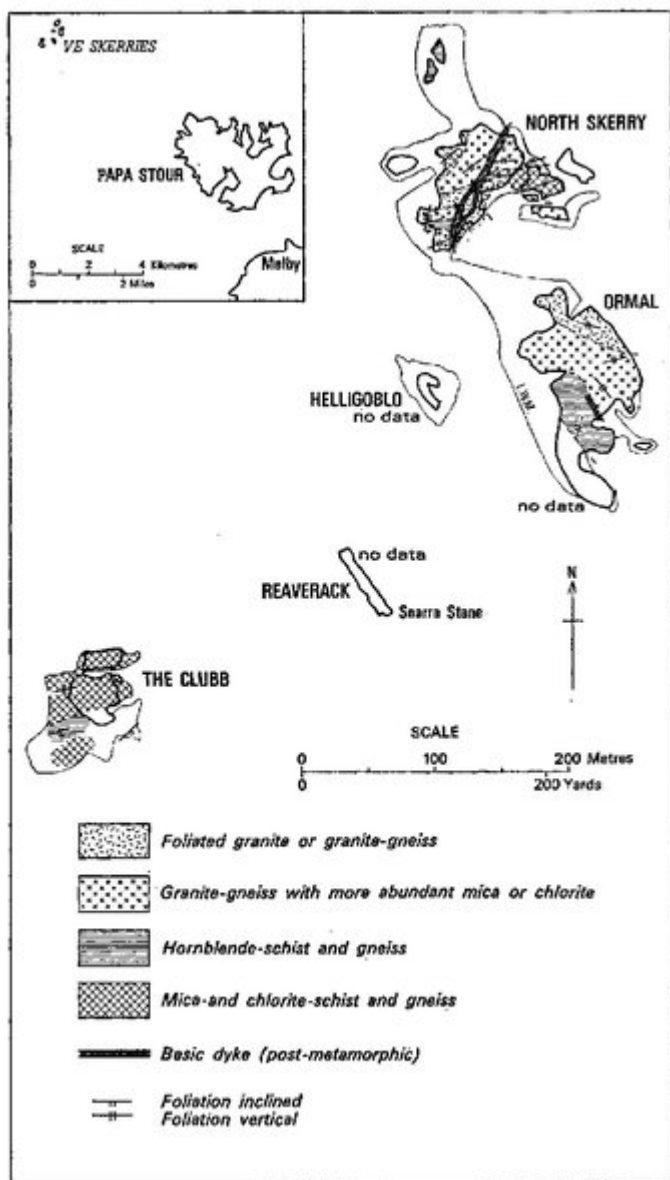
(Figure 3) Geological sketch map of the metamorphic rocks of the Lunnister area For section C-C1 see (Figure 4).



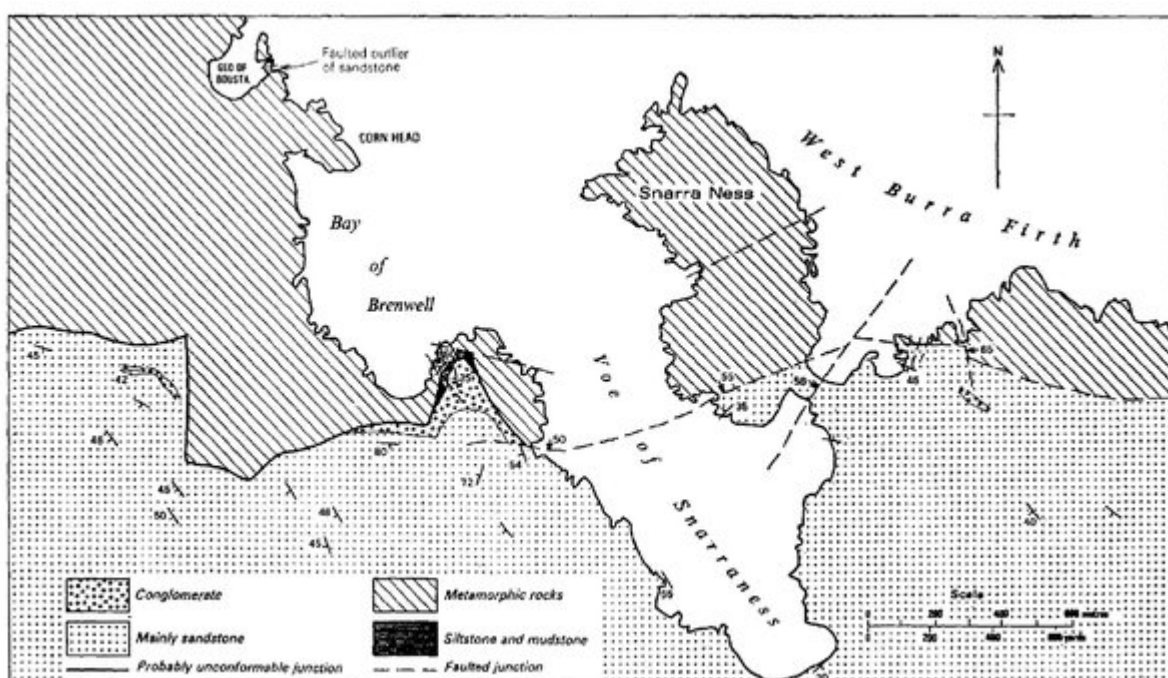
(Figure 4) Horizontal sections across the metamorphic rocks of Northmaven and the Lunnister area Sections A—A₁ and B—B' are entirely in the area north of the present sheet. (Locations: A = [HU 349 818], A' = [HU 377 808], B = [HU 335 793], B' = [HU 778 365]). The line of section C—C' is shown in (Figure 3).

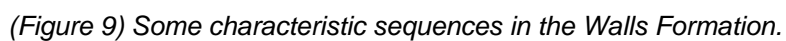


(Figure 5) Distribution of metamorphic rocks in the Muckle Roe–Mangaster Yoe area.

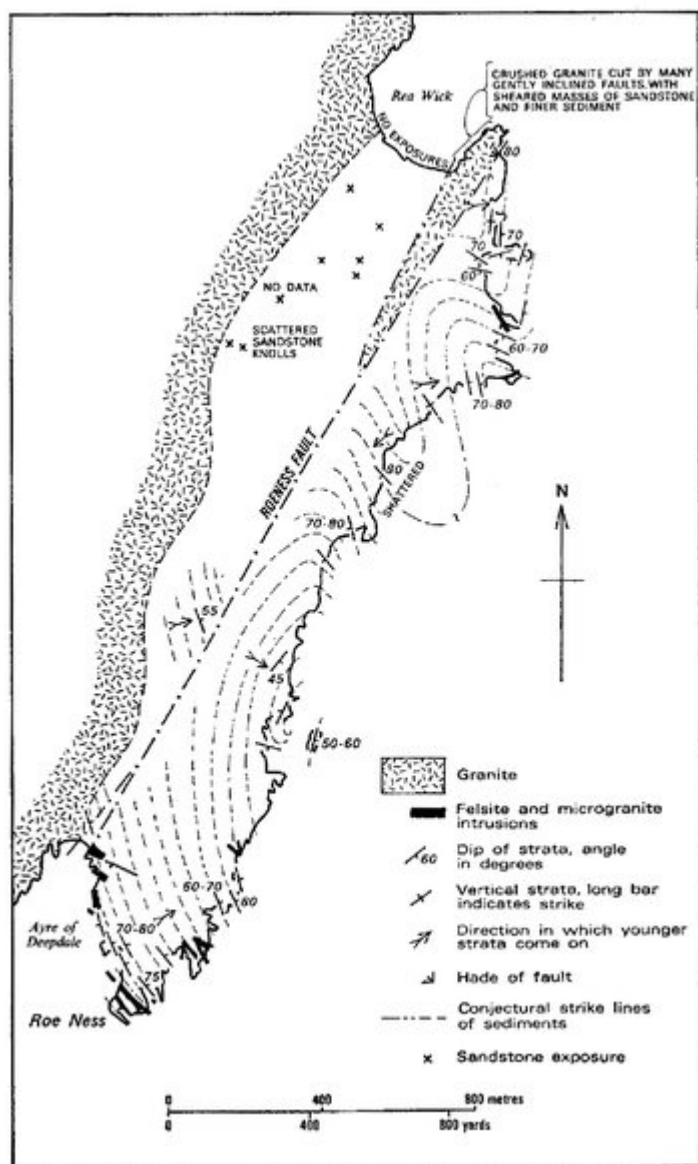


(Figure 6) Geological sketch-map of the Ve Skerries.

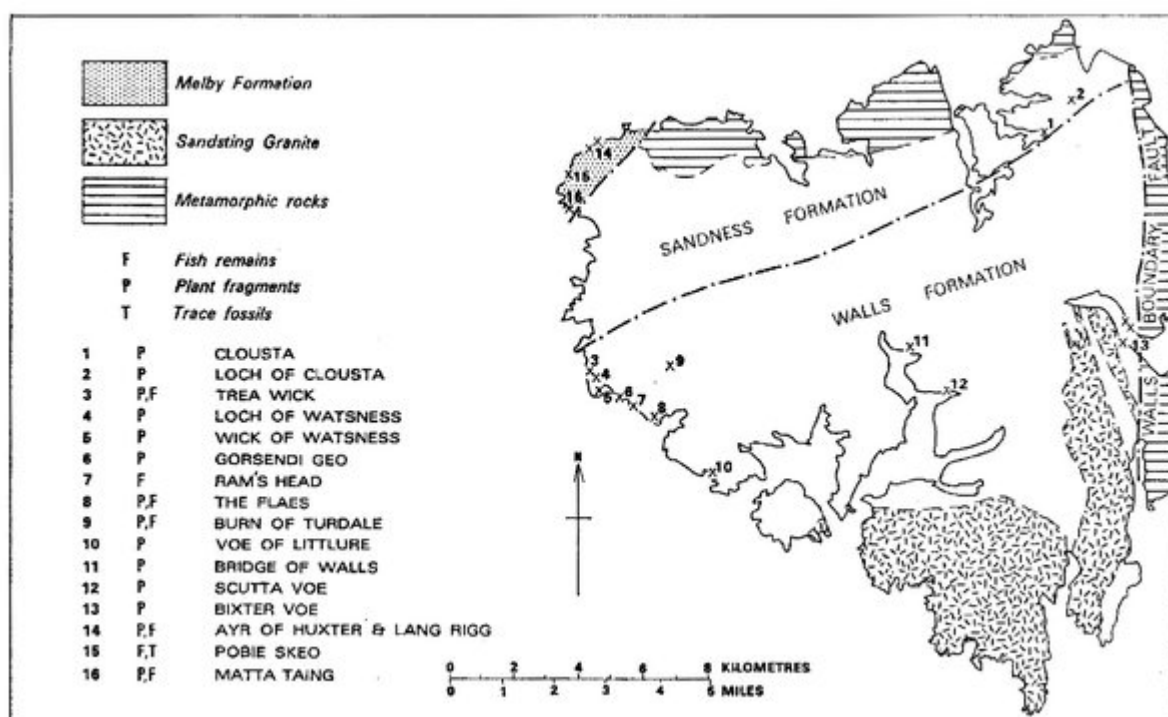




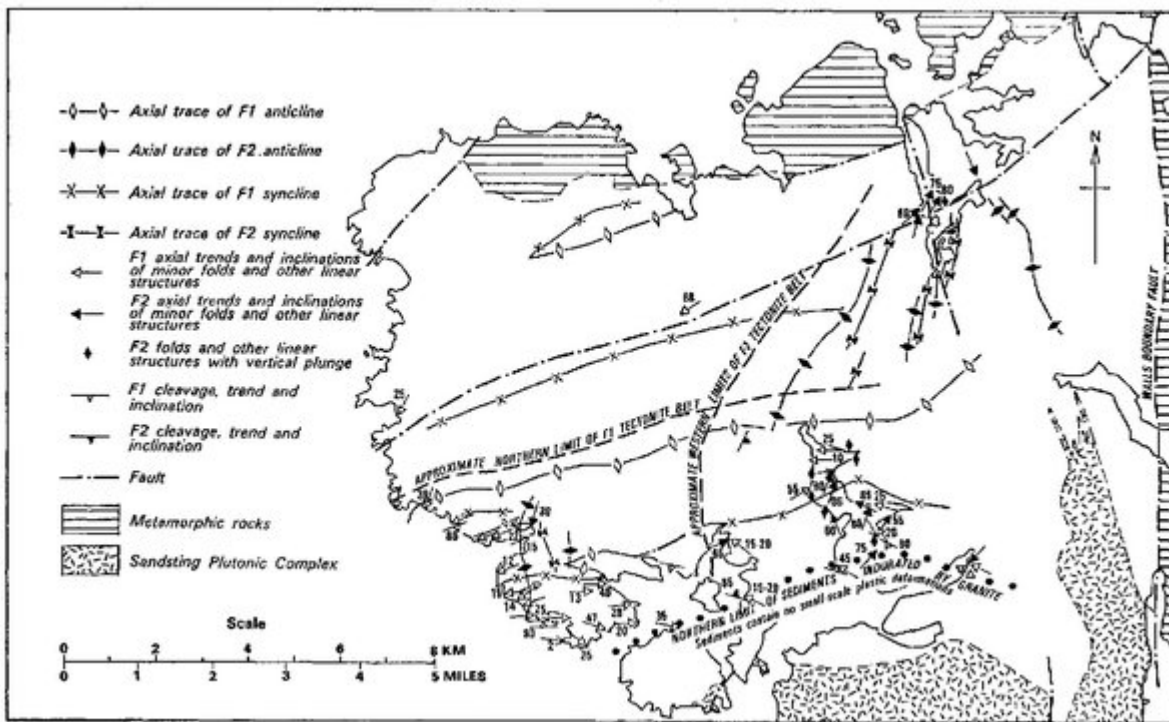
(Figure 9) Some characteristic sequences in the Walls Formation.



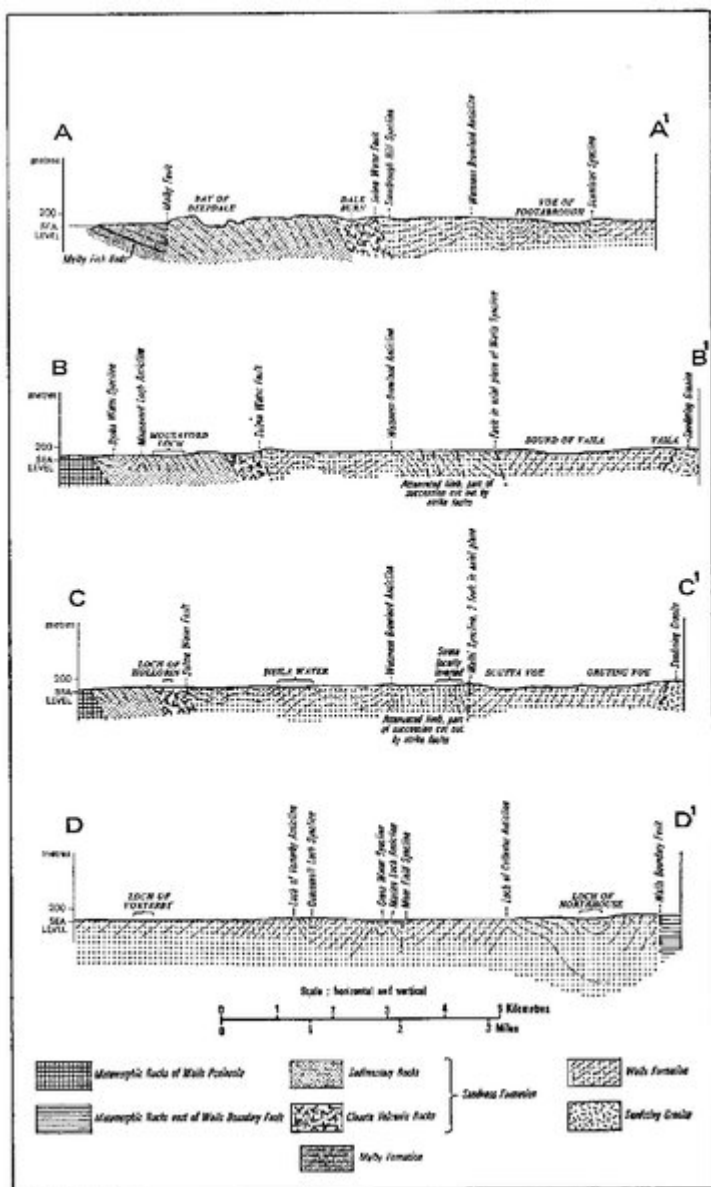
(Figure 10) Geological sketch-map of the Roe Ness–Rea Wick area.



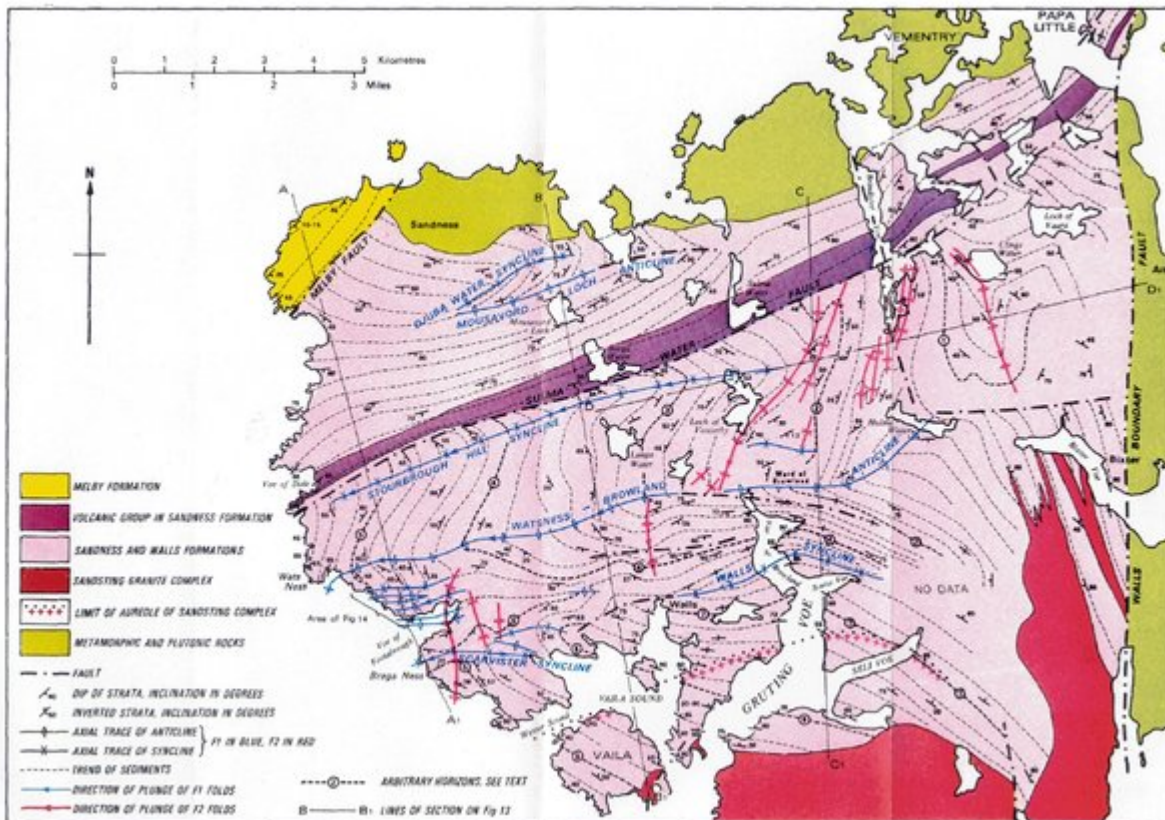
(Figure 11) Fossiliferous localities in the Old Red Sandstone of the Walls Peninsula.



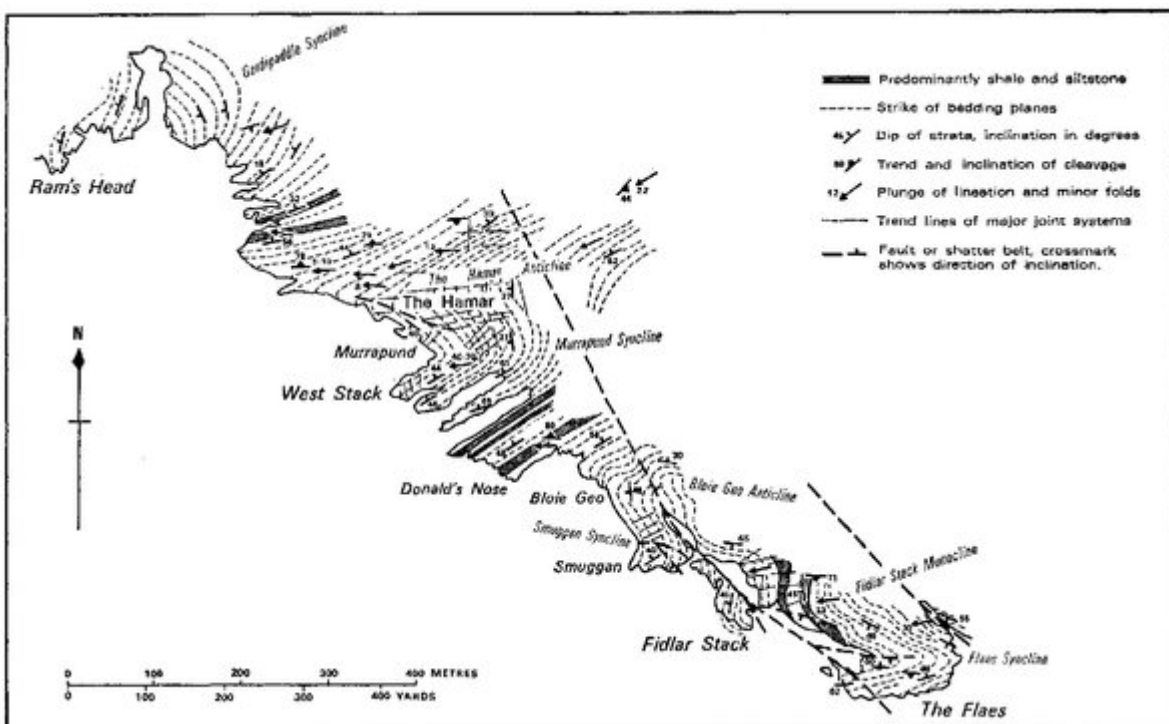
(Figure 12) Location of tectonite belts and prominent linear and planar structures in the Old Red Sandstone of the Walls Peninsula.



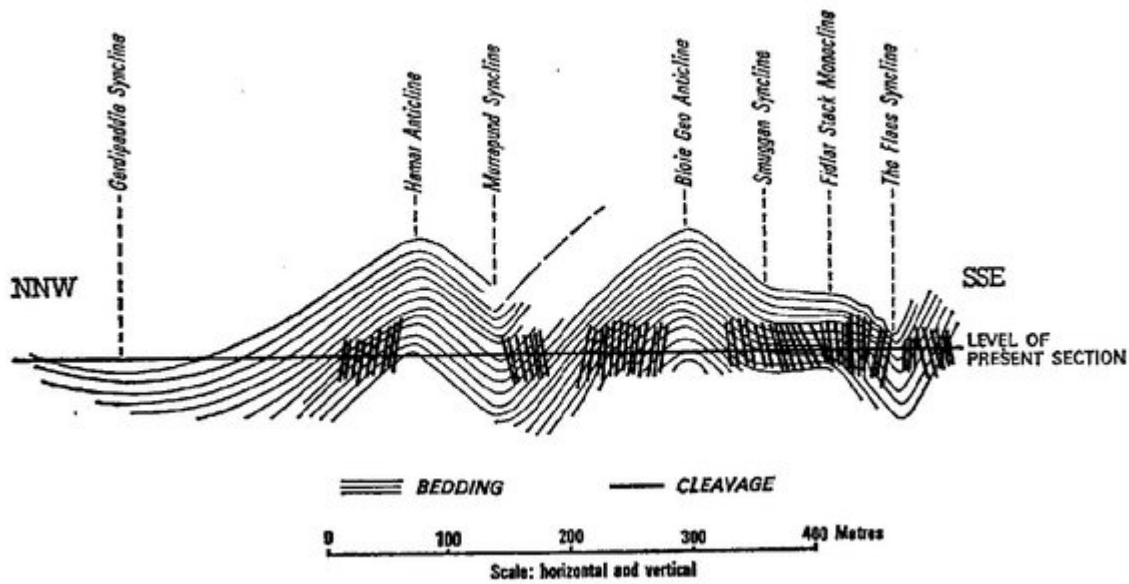
(Figure 13) Horizontal sections illustrating the major structural features of the Old Red Sandstone of the Walls Peninsula. Lines of sections are marked on (Plate 12).



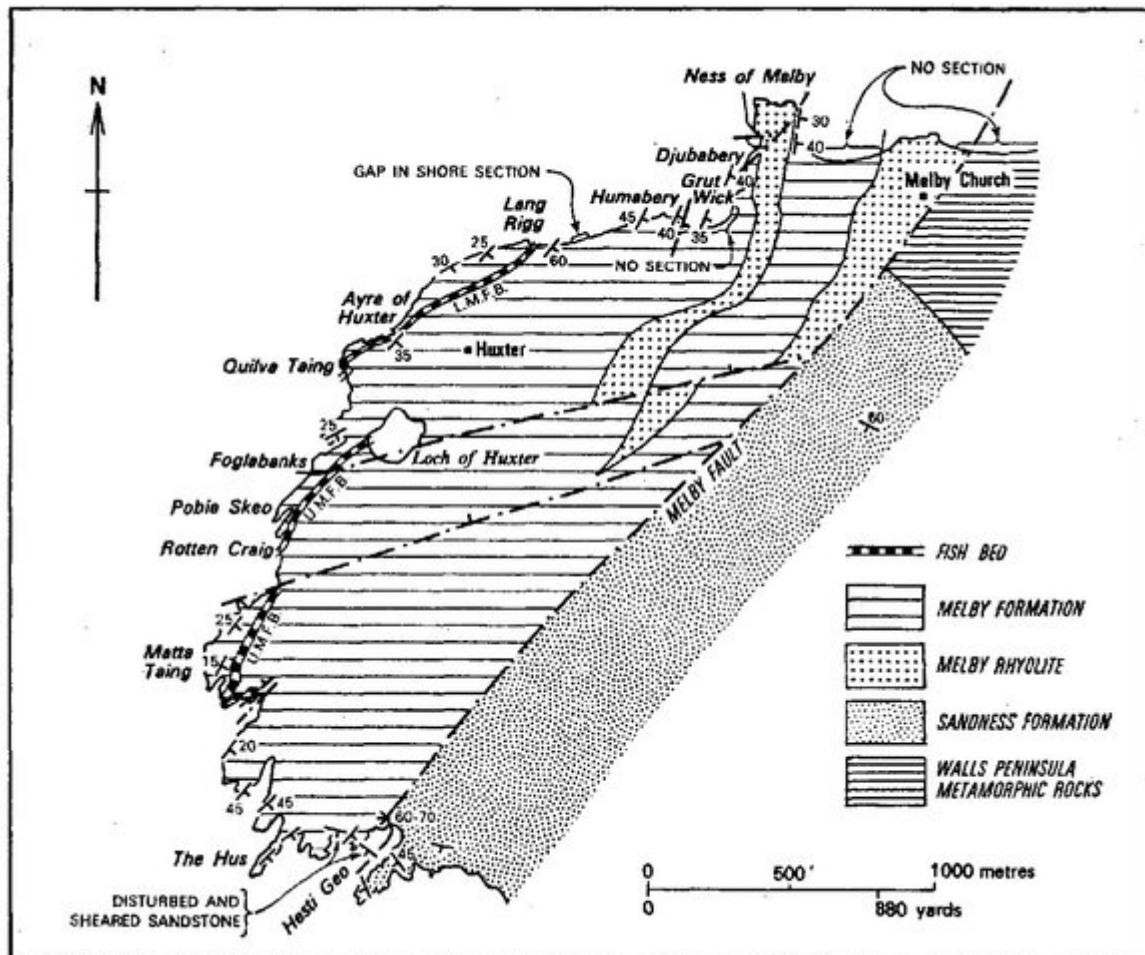
(Plate 12) Major stratigraphic and structural features of the Old Red Sandstone sediments and volcanic rocks of the Walls Peninsula.



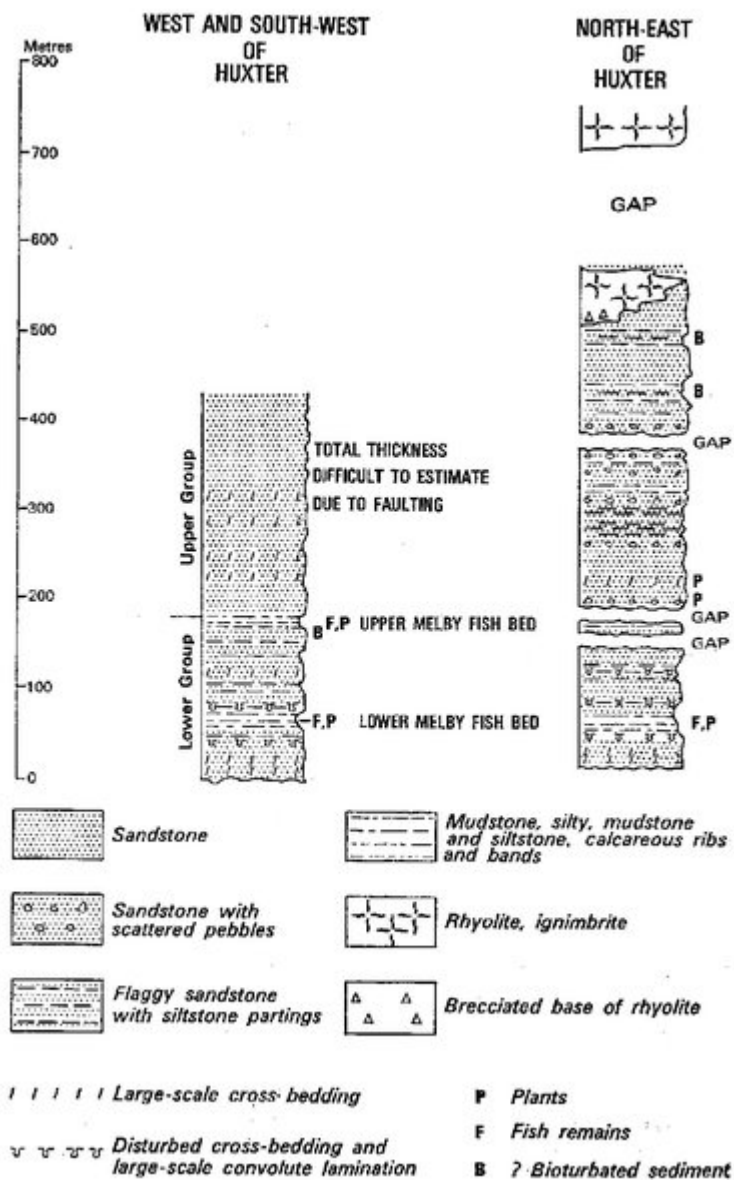
(Figure 14) Sketch-map showing the structure of the sediments of the Walls Formation exposed on the coast between Ram's Head and The Flaes.



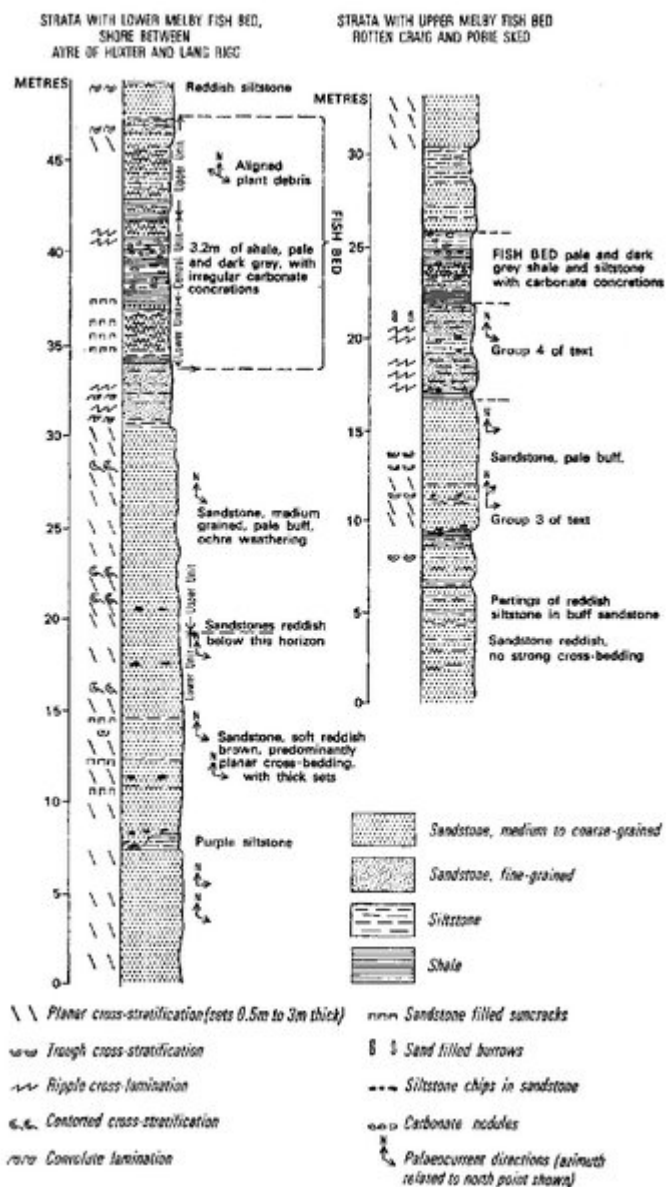
(Figure 15) Idealized horizontal section showing the structural pattern of the folded area along the coast between Ram's Head and The Flaes.



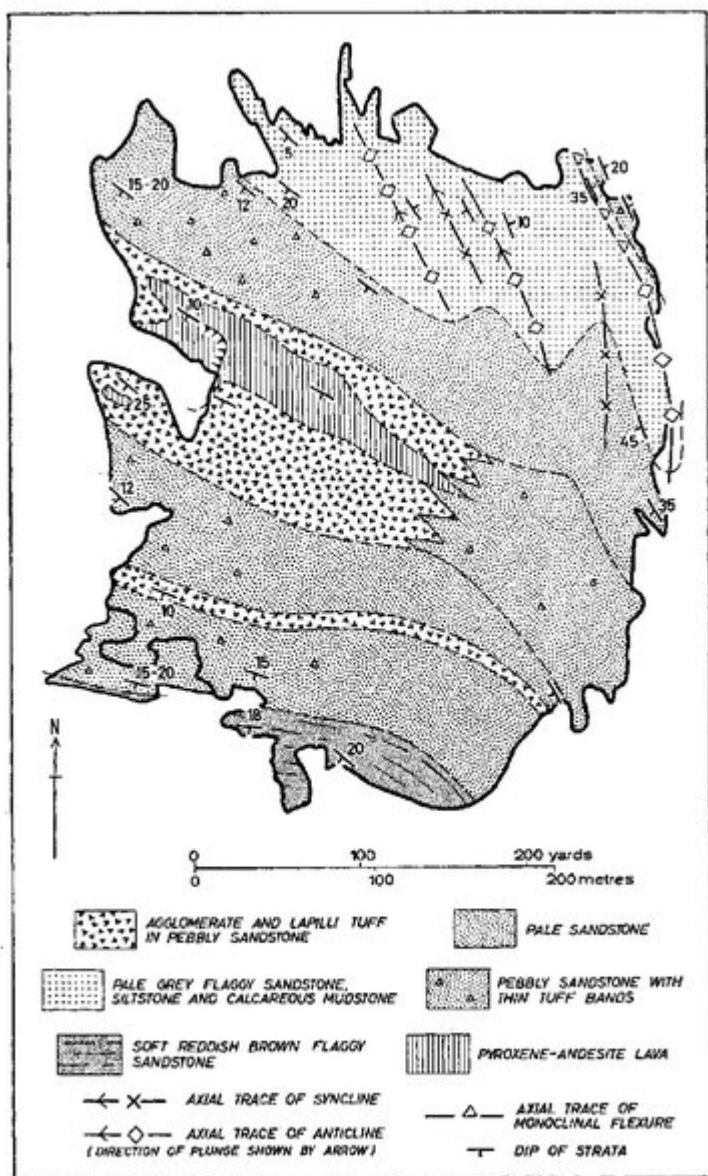
(Figure 16) Geological sketch-map of the Melby Formation on Shetland Mainland.



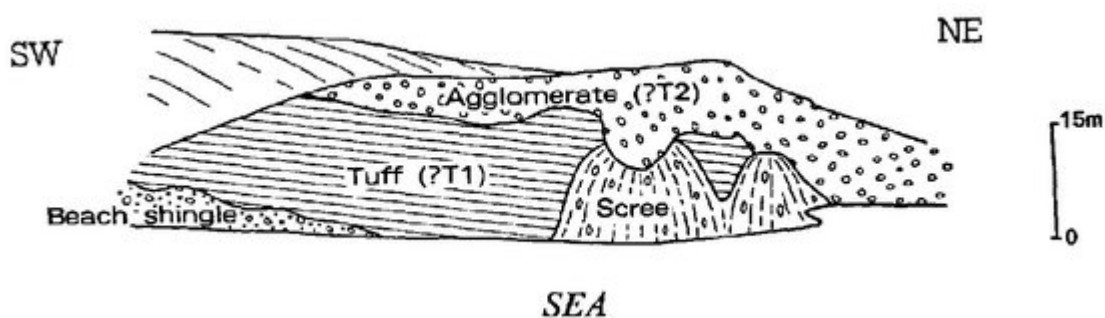
(Figure 17) Melby Formation: probable successions.



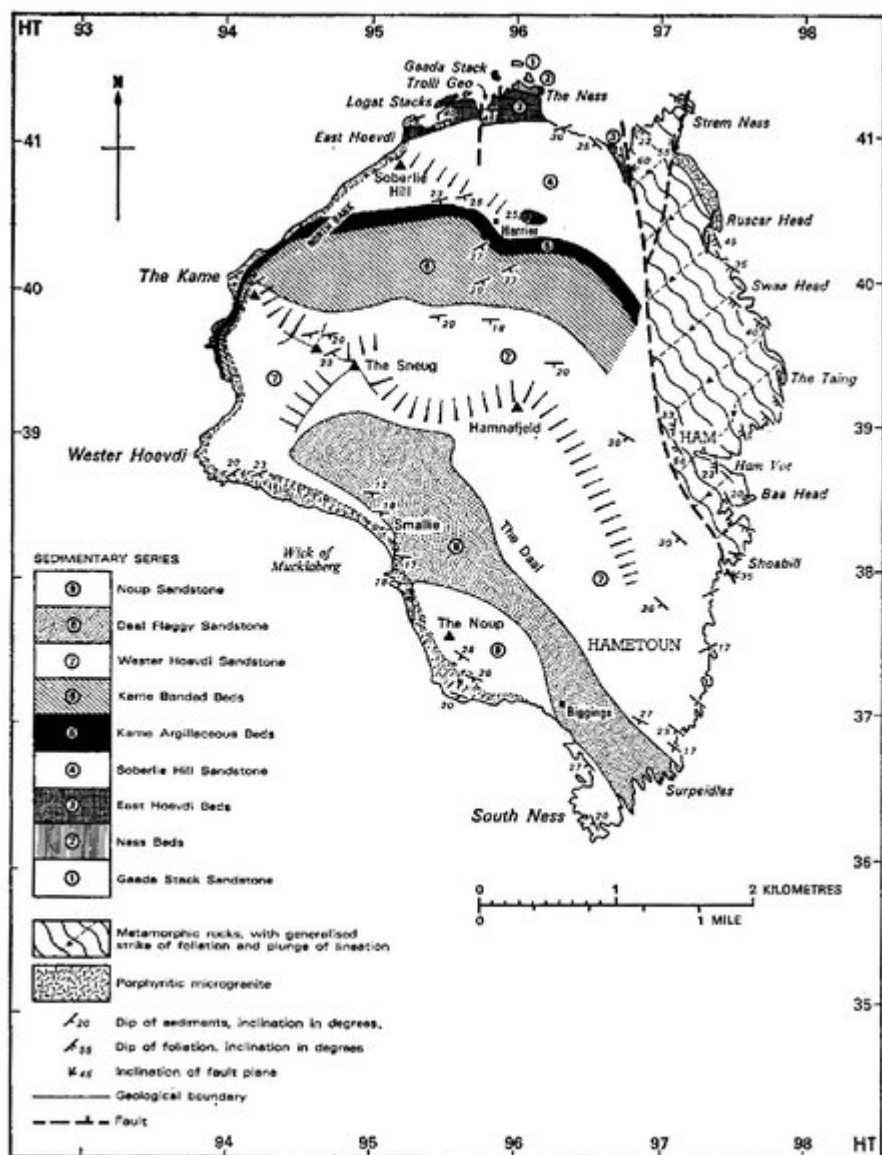
(Figure 18) Sections of the Lower and Upper Melby Fish Beds and adjacent strata.



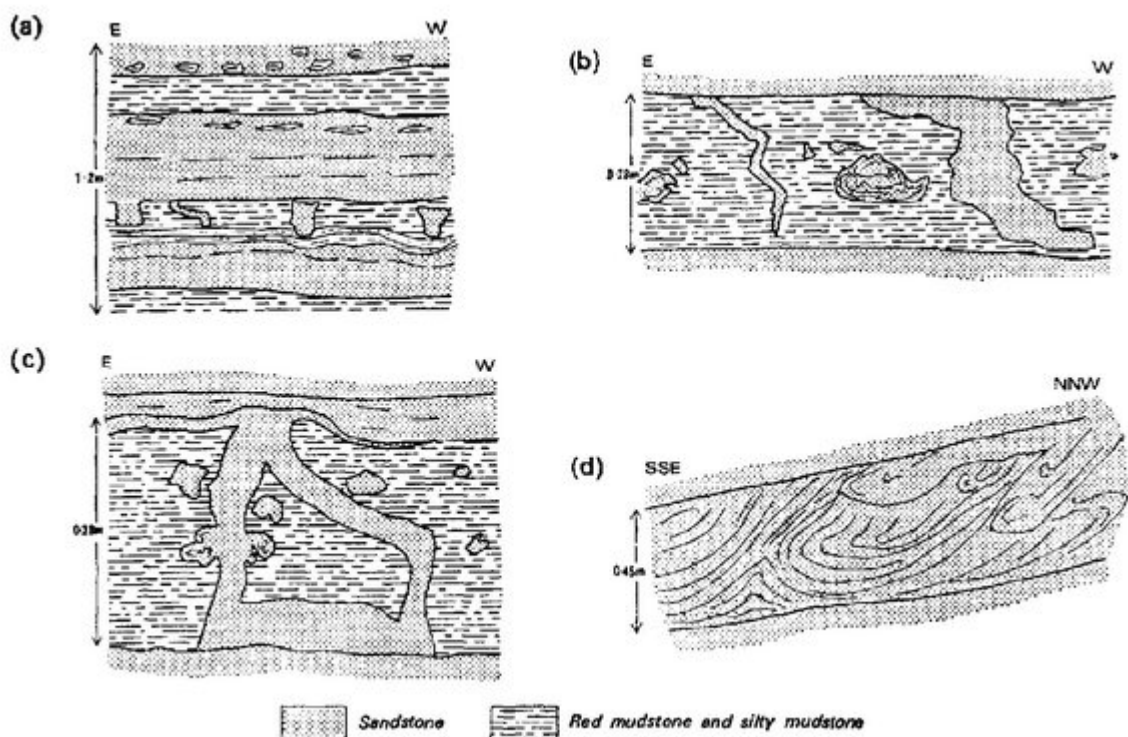
(Figure 19) Geological sketch-map of the Holm of Melby.



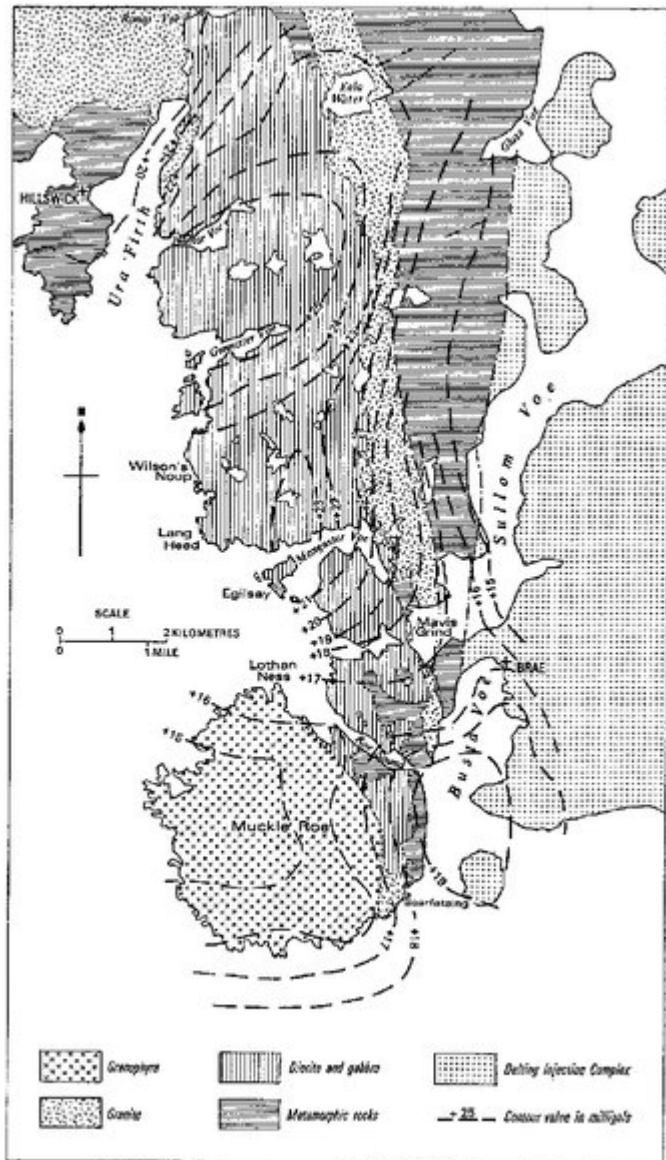
(Figure 20) Cliffs on north-west coast of Sholma Wick, Papa Stour, showing bedded tuff (?T1) overlain by agglomerate (?T2).



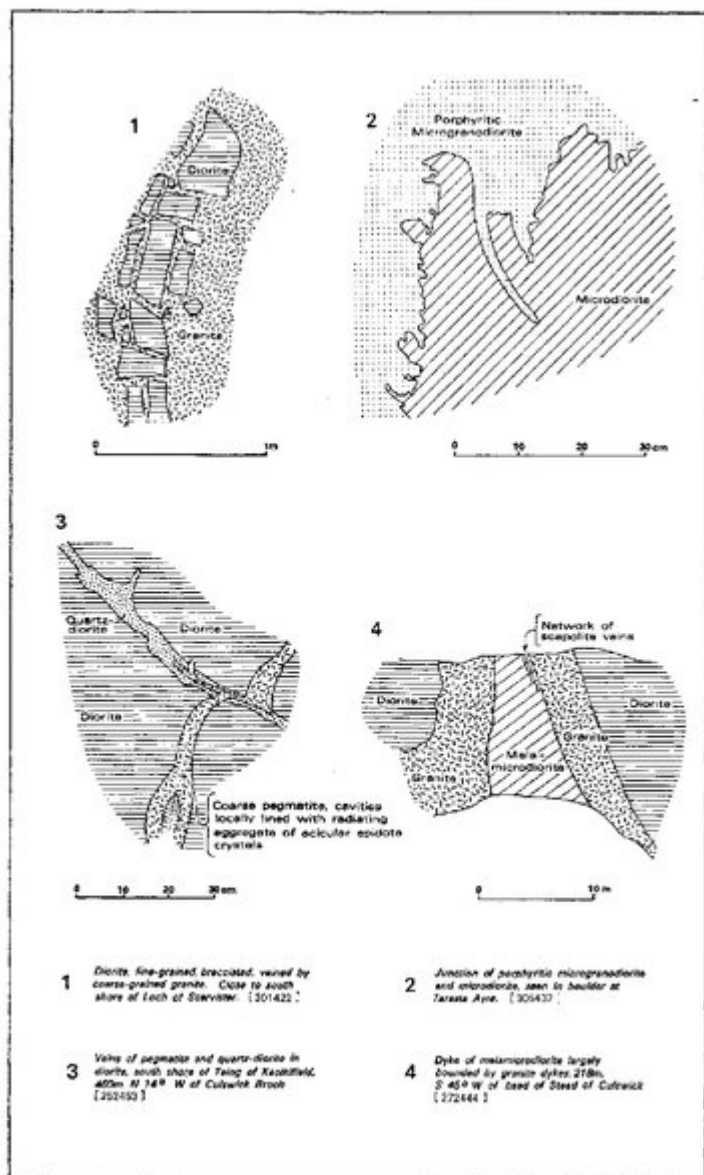
(Figure 21) Geological sketch-map of Foula.



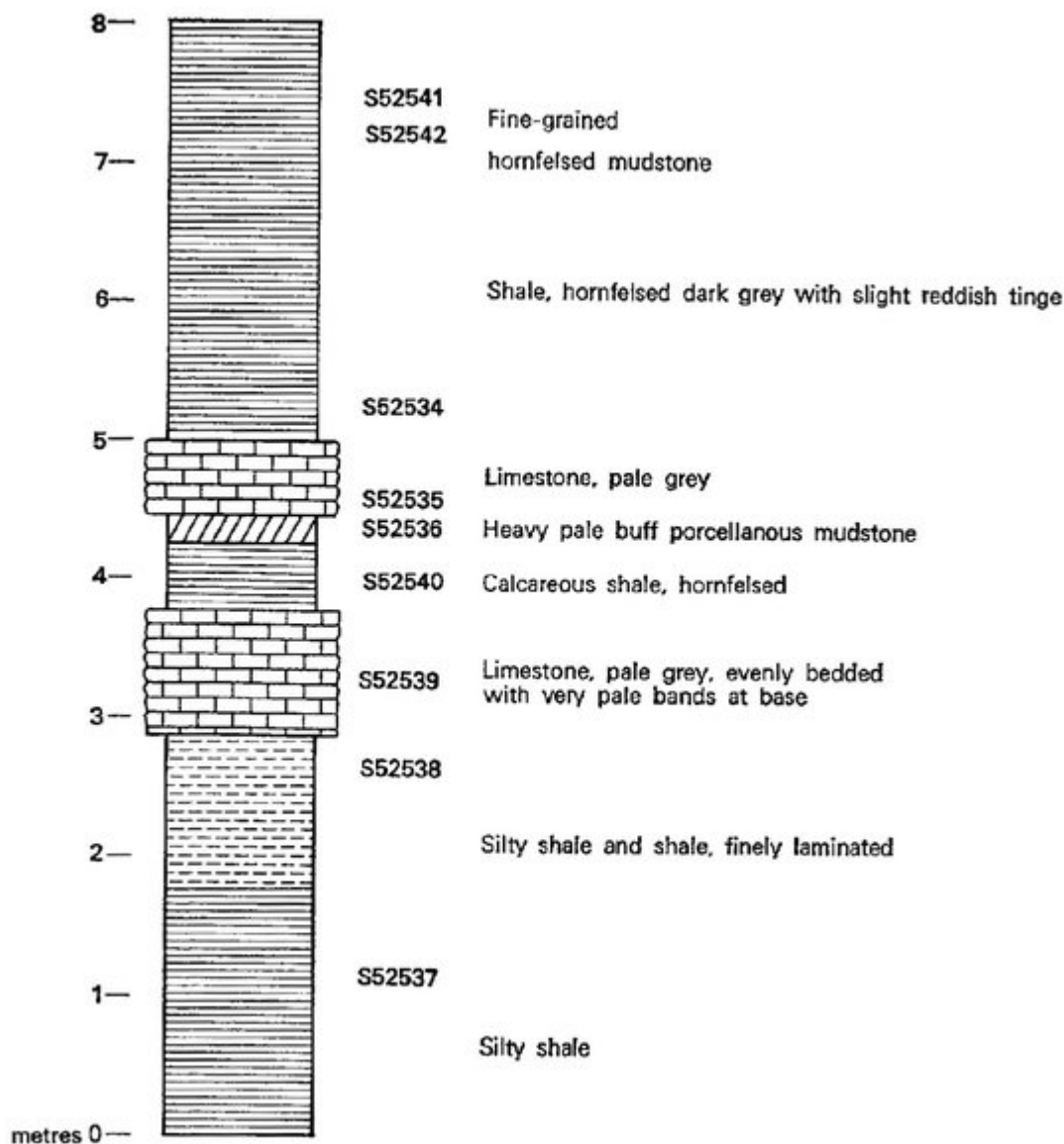
(Figure 22) Sedimentary structures in the Old Red Sandstone sediments of Foula a. North shore, opposite The Brough [HU 961 416]. Buff sandstone interbedded with red mudstone, with sand filled desiccation cracks in mudstone and mudstone chips in sandstone. (b) and (c) Locality as in (a). Distorted sandstone 'dykes' and slump-balls in red silty shale. (d) East shore, South Ness, 270 yd (250 in) SSW of Shoabill [HU 974 379]. Convolute bedding in sandstone.



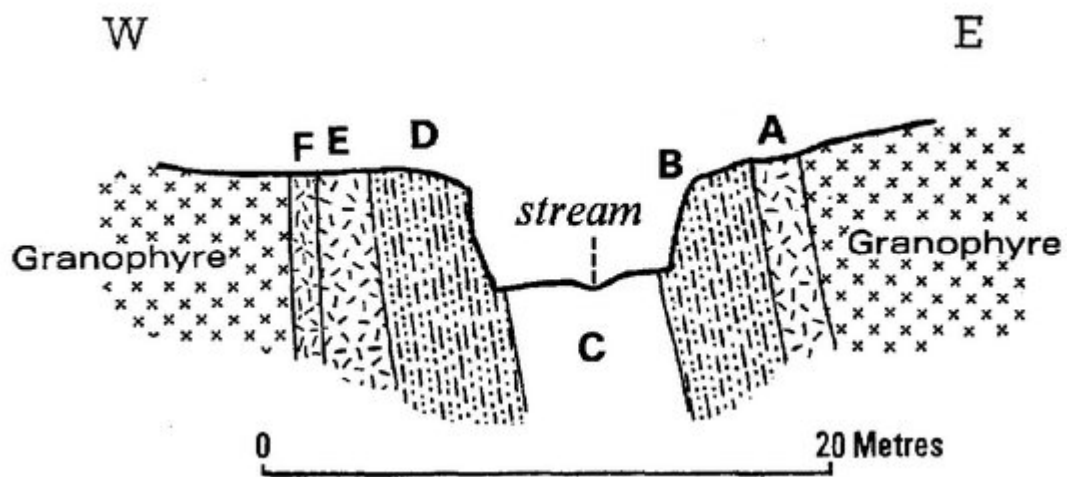
(Figure 23) Bouguer anomalies over the Muckle Roe–Ura Firth area.



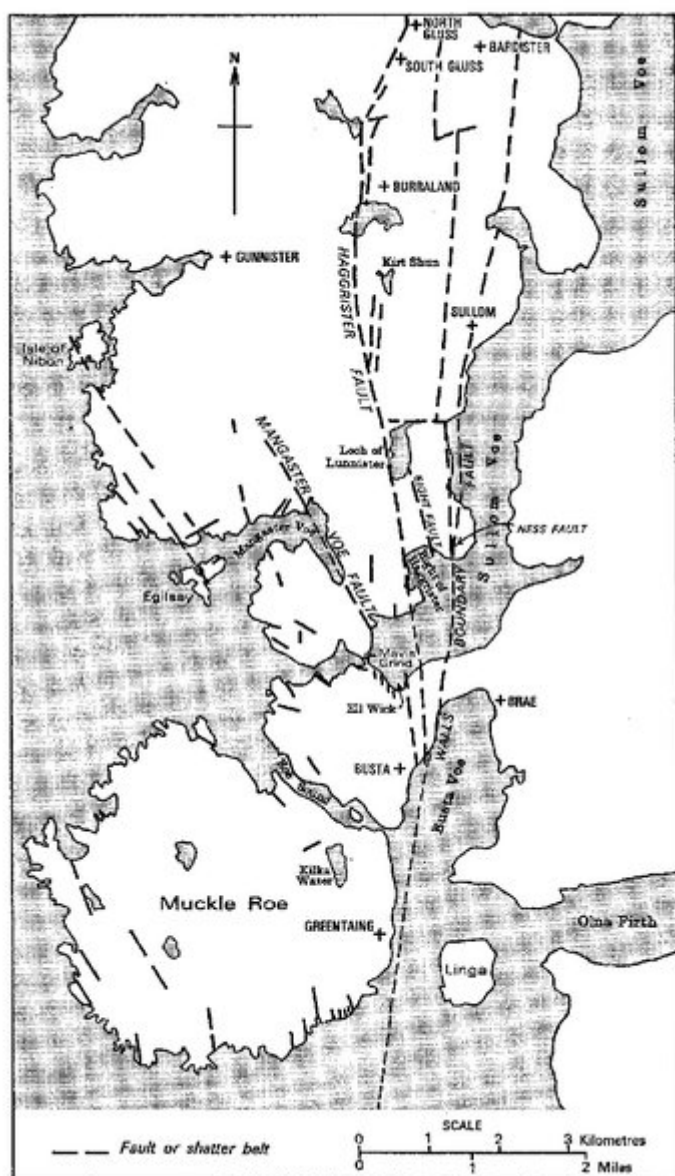
(Figure 24) Diagrams of igneous contacts, dykes and pegmatite veins in the Sandsting.



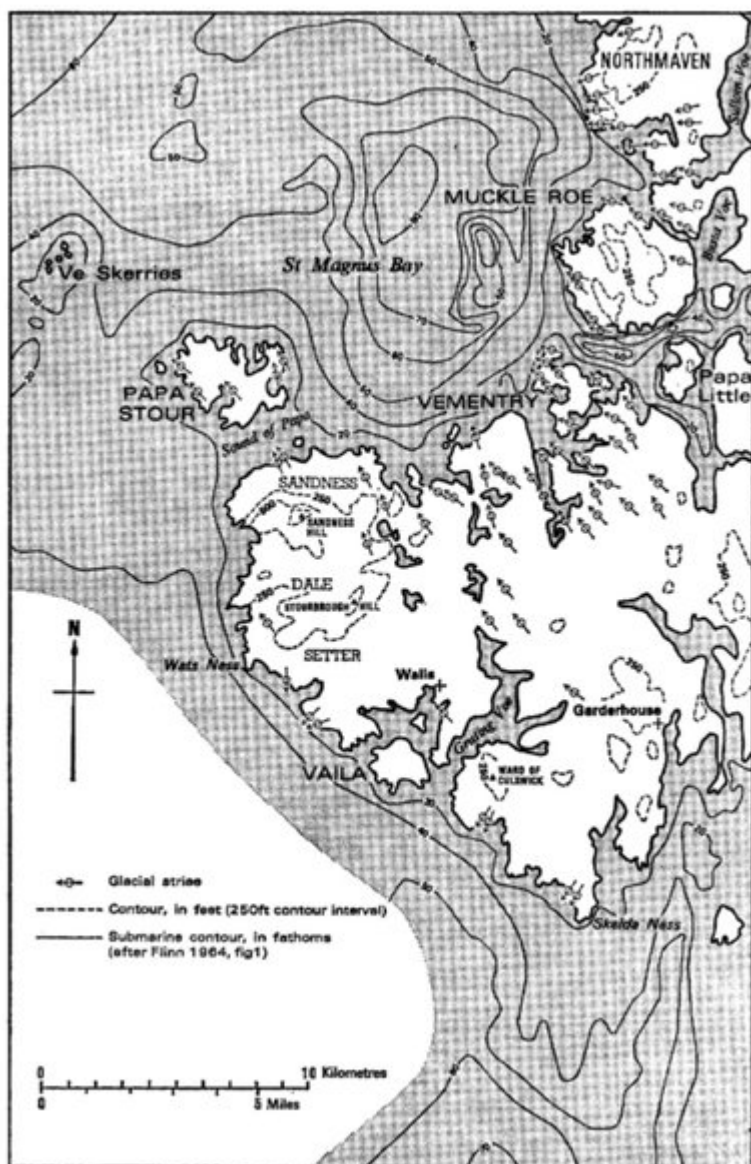
(Figure 25) Hornfelsed limestones and associated calcareous shales, east coast of Voila [HU 242 464]. Mineral composition of specimens: [\(S52541\)](#) [HU 241 464] finely granular diopside, zoisite-clinozoisite, poikiloblasts of calcic scapolite, acicular amphibole associated with zoisite; [\(S52542\)](#) [HU 241 464] finely poikiloblasts of calcic scapolite, acicular amphibole associated with zoisite; [\(S52542\)](#) [HU 241 464] finely granular diopside, veins and patches of zoisite-clinozoisite; [\(S52534\)](#) [HU 241 464] cordierite poikiloblasts, calcic scapolite, veins of clinozoisite, calcite and actinolite; [\(S52535\)](#) [HU 241 464] calcite, calcic scapolite diopside; [\(S52536\)](#) [HU 241 464] poikilitic grossularite and idocrase, finely granular diopside, veins and patches of zoisite; [\(S52540\)](#) [HU 241 464] calcite, calcic scapolite, idocrase, amphibole, veins of calcite and zoisite; [\(S52539\)](#) [HU 241 464] calcite, poikiloblasts of grossularite with diopside grains, calcic scapolite, veins of calcite; [\(S52538\)](#) [HU 241 464] shale; amphibole laths and poikiloblasts. biotite, clinozoisite; siltstone: diopside amphibole, zoisite, calcic scapolite; [\(S52537\)](#) [HU 241 464] poikiloblasts of calcic scapolite with finely granular diopside, veinlets of clinozoisite.



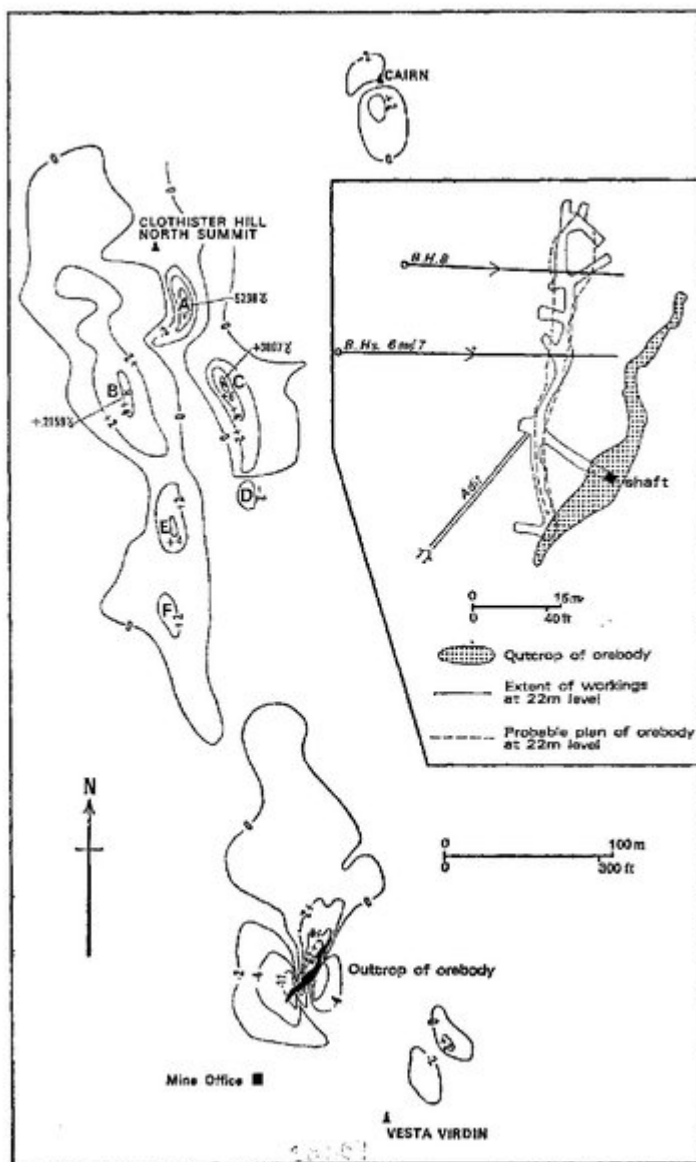
(Figure 26) Multiple dyke, west end of Raavi Geo, Muckle Roe.



(Figure 27) Major faults in the area north of Busta Yoe.



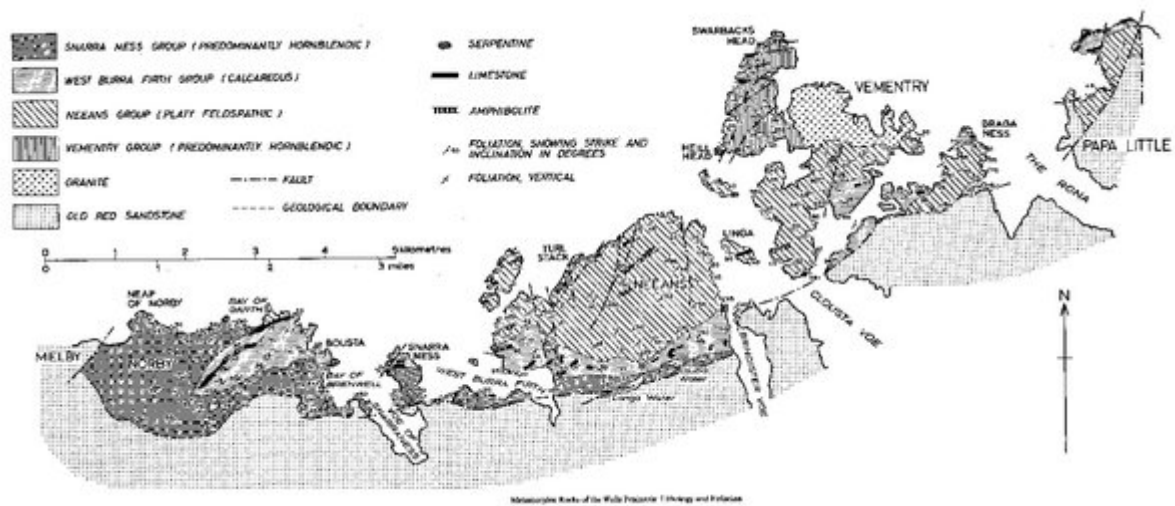
(Figure 29) Glacial striae in Western Shetland, also topography of land and surrounding sea floor.



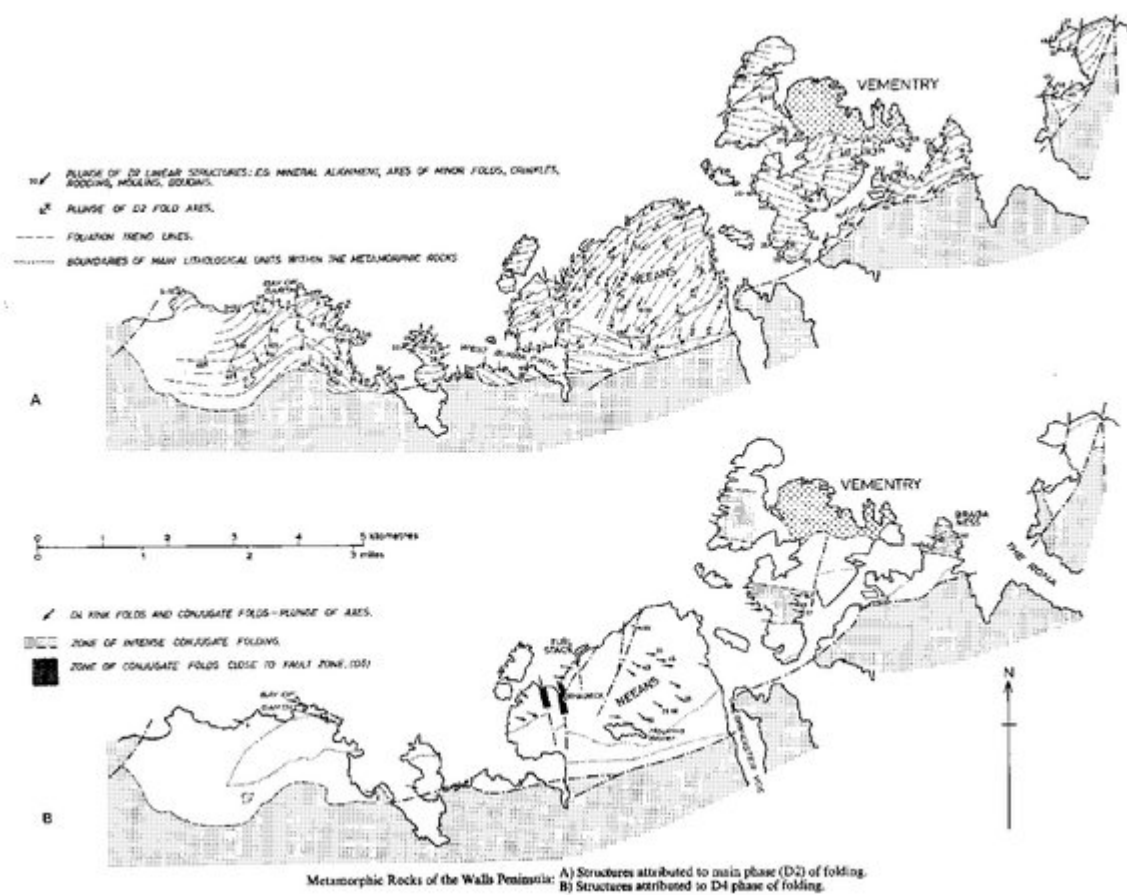
(Figure 30) Magnetic anomaly map (of the area around and north of Clothister Hill magnetite mine. Contour interval 2 gammas except in areas of high magnetic gradient. Inset: Plan of outcrop of orebody at surface and position of orebody at 22m level. Also positions of three inclined bores sunk to prove orebody at depth.



(Plate 1) Frontispiece. North-east shore of Geo of Bordie, Papa Stour. Rhyolitic tuff resting on irregular weathered surface of Lower Rhyolite. (D926).



(Plate 2) Metamorphic rocks of the Walls Peninsula: Lithology and foliation.



(Plate 3) Metamorphic rocks of the Walls Peninsula.



(Plate 4A) South shore of Bay of Garth. [HU 214 580]. D₂ lineation in mica-schist. (D977).



(Plate 4B) North shore of West Burra Firth at south-west corner of Crockna Vord peninsula. [HU 251 573]. D₂ fold in hornblende-schist, with mimetic granite veins along folded foliation planes. (D953).



(Plate 4C) South-west slope of Crockna Vord, just north of West Burra Firth. [HU 251 575]. D₂ fold in limestone. (D952).



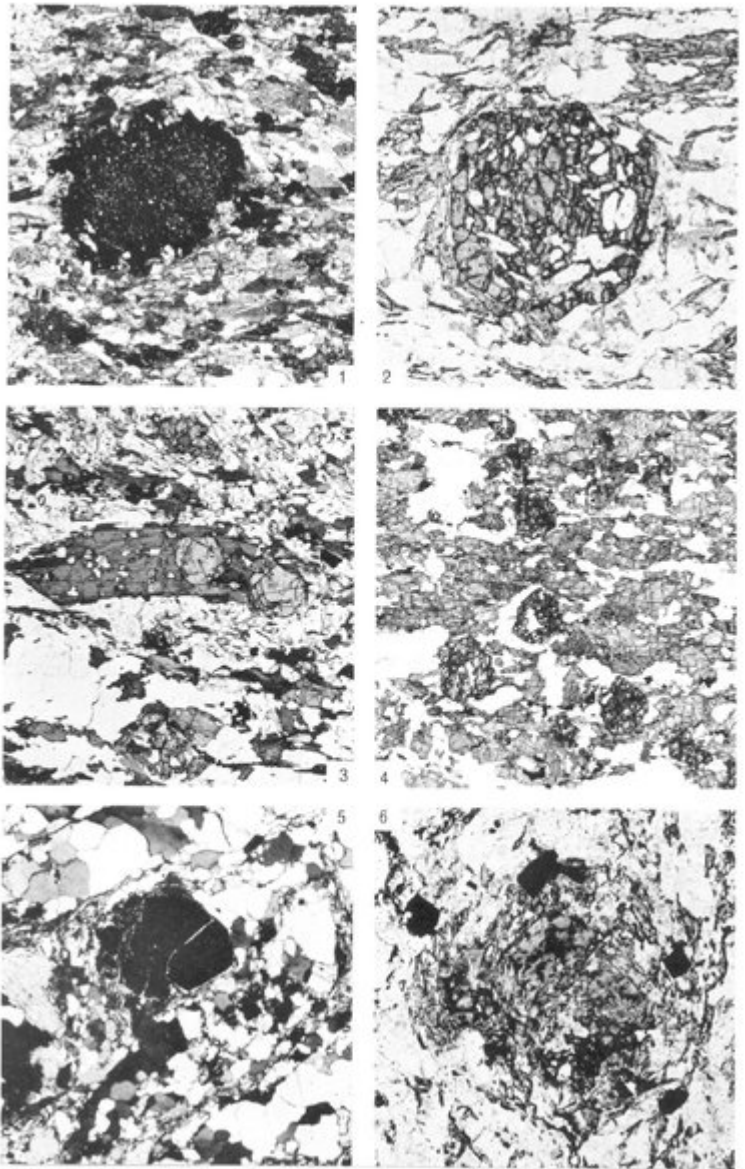
(Plate 5A) General view of Neeans, looking east from north-east slope of Crockna Vord. [HU 257 583]. Characteristic topography formed by the metamorphic rocks of the Neeans Group. (D950).



(Plate 5B) West coast of Vementry Island, 33 yd (30 m) N of Whal Geo. [HU 283 612]. Platy feldspathic gneiss with hornblendic bands, with tight D_2 folds, small normal faults and thin ptynmatically folded granite veins. (D913).

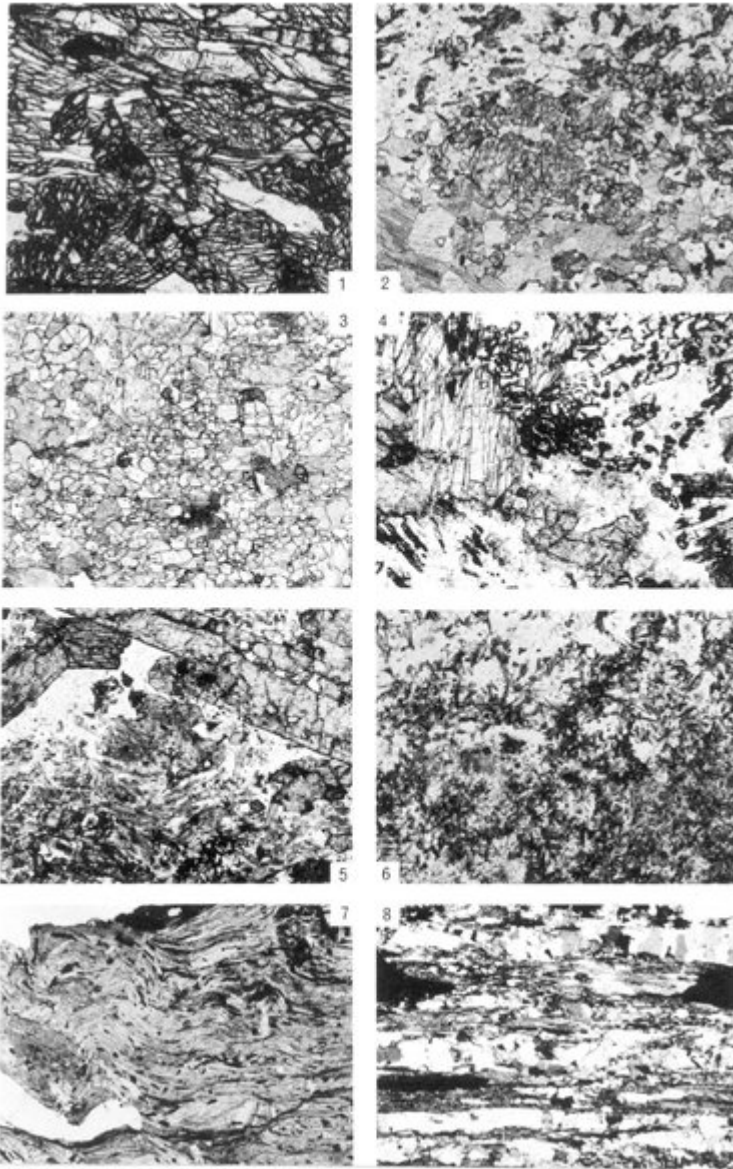


(Plate 5C) Summit of Muckle Hoo Field, Neeans peninsula. [HU 268 586]. Platy feldspathic gneiss with D_4 kink folds. (D943).



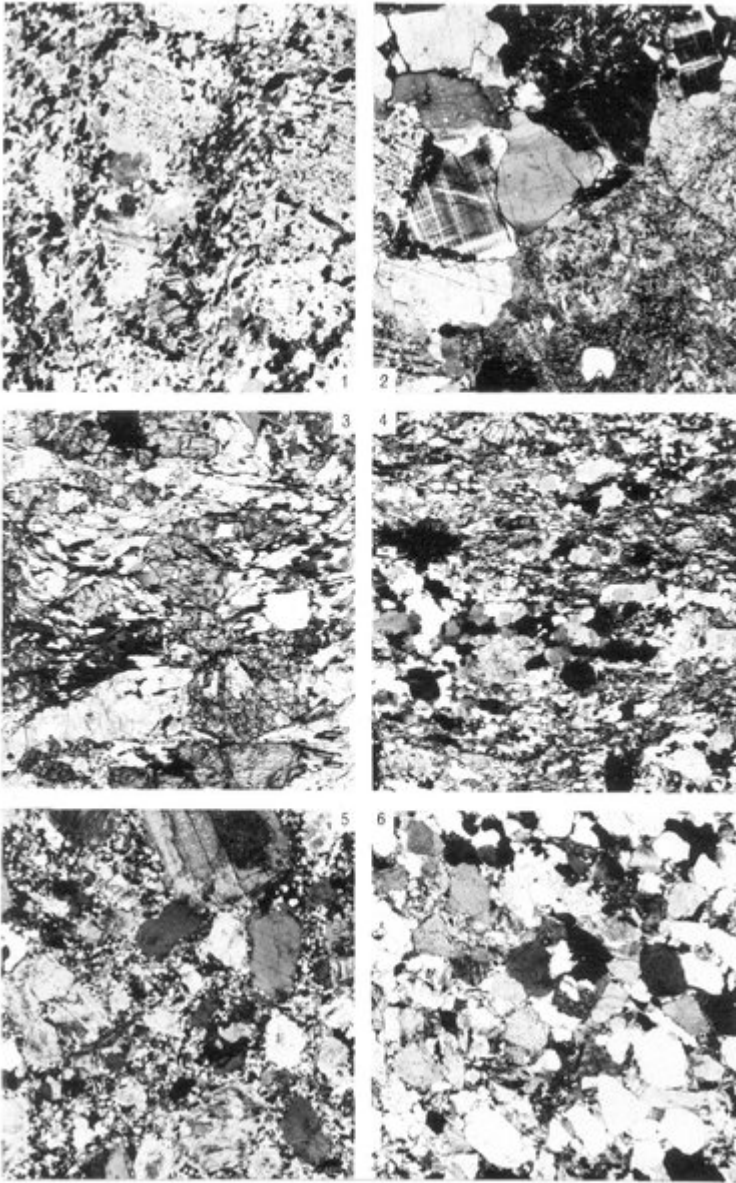
(Plate 6) Photomicrographs of metamorphic rocks of the Walls Peninsula Fig. 1. Slice No. [\(S47741\)](#) [HU 285 580]. Magnification $\times 16$. Crossed polarisers. Garnet in hornblende-schist with small aligned inclusions, of which all but the outermost are aligned at a high angle to the external fabric. The internal (Si) fabric may be of M1P age, the outer (Se) fabric was developed during the M2P phase. Note the limited deflection of the Se fabric by the garnet. East coast of Neeans, 1235 yd (1130 m) N15°W of Brindister Broch [HU 283 584]. Fig. 2. Slice No. [\(S49322\)](#) [HU 308 605]. Magnification $\times 31$. Plane polarized light. Garnet in micaceous gneiss with concentrically arranged penetration inclusions. These were probably formed by the preferential resorption of unstable zones in the garnet. Vementry Island, north-west shore of Uyea Sound, 700 yd (640 m) NNW of Vementry House [HU 304 603]. Fig. 3. Slice No. [\(S47761\)](#) [HU 269 591]. Magnification $\times 16$. Plane polarized light. Hornblendic gneiss, with large hornblendes enclosing garnets. The growth of the large amphiboles appears to have taken place during a late stage of static growth (probably M2P) and its orientation may be mimetic after D_2 fabric. Neeans peninsula, 280 yd (255 m) N42°W of NE corner of Lang Loch [HU 270 592]. Fig. 4. Slice No. [\(S49298\)](#) [HU 222 578]. Magnification $\times 16$. Plane polarized light. Amphibolite with garnets which show no trace of rotation and have not significantly eyed the external (Se) fabric. Sphenes are aligned parallel to the hornblende and mica. The coarsening of amphiboles and garnets is of M2P age. West coast of Geo of Bousta, 230 yd (210 m) NW of Muckle Bousta [HU 223 577]. Fig. 5. Slice No. [\(S30728\)](#) [HU 286 612]. Magnification $\times 42$. Crossed polarisers. Sheared garnet-oligoclase-gneiss, with thin lenses and bands of mylonite. The garnet is rotated and peripherally altered to chlorite. Vementry Island, 250 yd (230 m) SSE of Head of Corbie Geo [HU 286 613]. Fig. 6. Slice No. [\(S47806\)](#) [HU 283 612]. Magnification $\times 38$. Plane polarized light. Granulitized quartz-oligoclase-gneiss. Garnet rotated and largely altered

to chlorite by post-M2P shear movements (S3). Vementry Island, near west coast, 800 yd (720 m) N18°E of SW tip of Hein Head [HU 283 612].



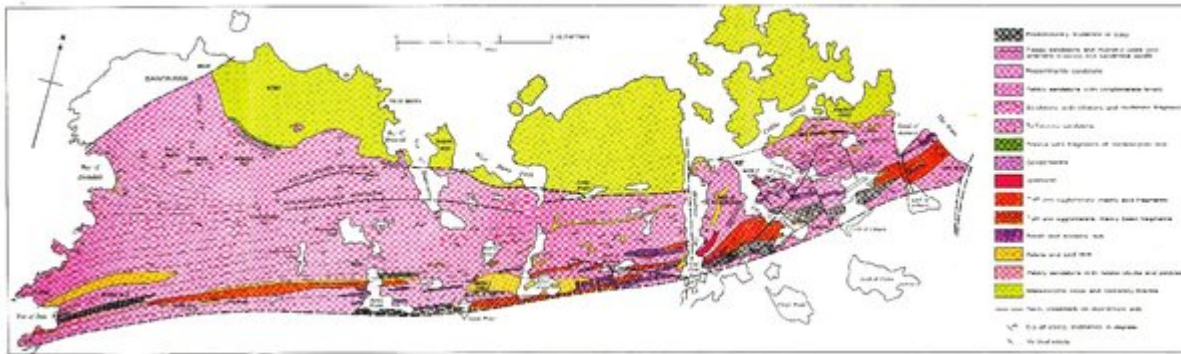
(Plate 7) Photomicrographs of metamorphic rocks of the Walls Peninsula Fig. 1. Slice No. [\(S47786\)](#) [HU 257 571]. Magnification $\times 42$. Plane polarized light. Tremolite-schist, composed largely of euhedral laths of tremolite, flakes of phlogopite and subrounded crystals of epidote. East shore of West Burra Firth, 200 yd (180 m) S47°E of Broch at head of West Burra Firth [HU 257 571]. Fig. 2. Slice No. [\(S33779\)](#) [HU 223 579]. Magnification $\times 42$. Plane polarized light. Crystalline limestone with calc-silicate bands, with calcite (bottom), clinozoisite, hornblende and quartz with zoisite inclusions. Skinhoga peninsula, 380 yd (350 m) SSE of Skerry of Stools [HU 223 579]. Fig. 3. Slice No. [\(S31005\)](#) [HU 271 589]. Magnification $\times 16.8$. Plane polarized light. Epidote-amphibolite. Bluish green hornblende (with cleavage), subrounded crystals of epidote, interstitial calcite and rare small sphenes. Concentrations of epidote and hornblende occur in roughly alternate bands. Neeans Peninsula, 70 yd (64 m) N of Lang Loch [HU 272 589]. Fig. 4. Slice No. [\(S30589\)](#) [HU 208 578]. Magnification $\times 42$. Plane polarized light. Hornblende-schist with symplectic intergrowth of zoisite and quartz. Norby, 550 yd (502) N10°E of west end of Loch of Collaster [HU 207 578]. Fig. 5. Slice No. [\(S50811\)](#) [HU 300 599]. Magnification $\times 42$. Plane polarized light. Epidote-quartz rock composed of large euhedral epidote laths set in base of quartz full of tremolite needles. Vementry Island, near south-east shore of Suthra Voe, 1000 yd (910 m) S7°W of summit of Muckle Ward [HU 295 602]. Fig. 6. Slice No. [\(S49316\)](#) [HU 291 617]. Magnification $\times 42$. Plane polarized light. Flinty crush rock with new growth of radiating needles of fibrous amphibole due to late thermal metamorphism. Vementry Island, east shore of Swarbacks Head, 900 yd (820 m) NNW of summit of Muckle Ward [HU 293 618]. Fig. 7. Slice No. [\(S49319\)](#) [HU 295 595]. Magnification $\times 16$. Plane polarized light. Muscovite-chlorite-schist with phylloblastic minerals folded by F_3 movements. New chlorite plates developed sub-parallel to axial planes of folds and tourmaline prisms (seen

in section) parallel to fold axes. Vementry Island, west shore of Cribba Sound, 1520 yd (1400 m) N of SW corner of Muckle Head [HU 296 595]. Fig. 8. Slice No. [\(S49294\)](#) [HU 216 581]. Magnification $\times 17.6$. Crossed polarisers. Mylonitized quartz-mica-schist composed of alternate streaks of quartz with mortar texture and mylonite containing newly-grown phlogopite and muscovite. South-east shore of Bay of Garth, 1020 yd (930 m) NE of Muckle Boust. [HU 215 580].

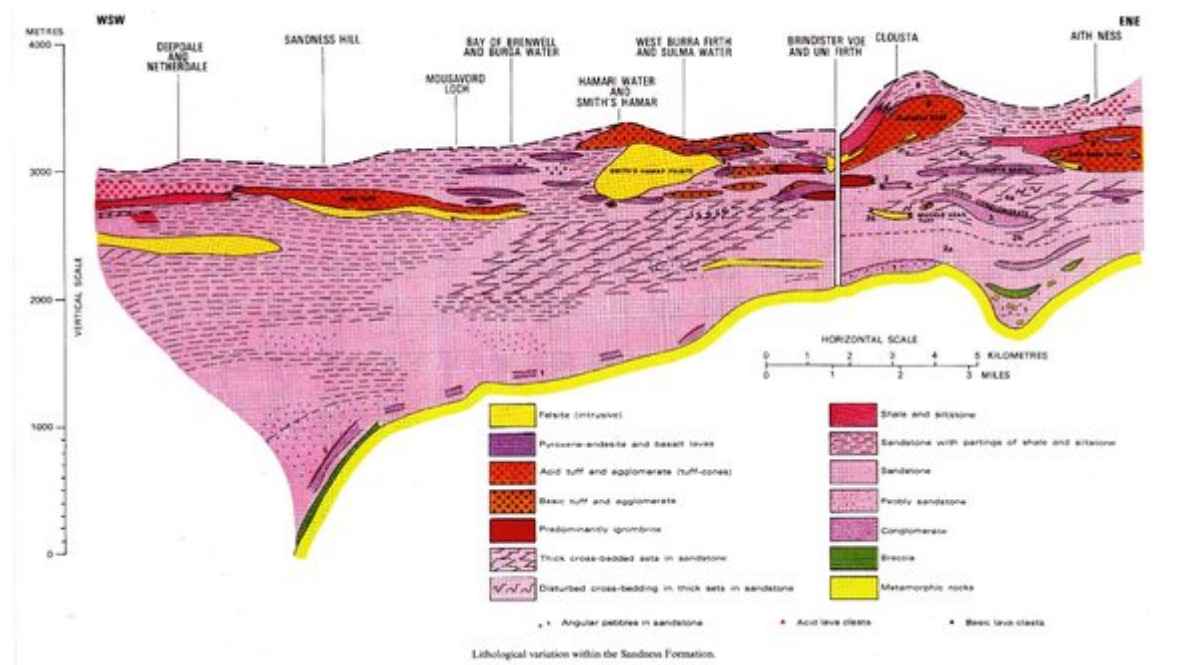


(Plate 8) Photomicrographs of metamorphic rocks, microgranite and sandstone of Ve Skerries and Foula Fig. 1. Slice No. [\(S29982\)](#) [HU 103 658]. Magnification $\times 16.8$. Crossed polarisers. Granulitized granite with large crystals of albite-oligoclase, sieved with muscovite. Adjacent feldspar crystals are in optical continuity and separated by streaked out mozaic-quartz. Small near-euhedral crystals of epidote are abundant in the quartz network. Ve Skerries, North Skerry, west coast [HU 103 658]. Fig. 2. Slice No. [\(S29989\)](#) [HU 104 656]. Magnification $\times 31$. Crossed polarisers. Coarse poorly-foliated granite-gneiss composed of quartz, large clear plates of potash-feldspar and albite-oligoclase full of inclusions of white mica, and small grains of epidote. Ve Skerries, Ormal, north coast [HU 105 656]. Fig. 3. Slice No. [\(S29898\)](#) [HT 975 401]. Magnification $\times 8$. Plane polarized light. Garnet-kyanite-staurolite-gneiss, with muscovite and quartz. Large stumpy plates of kyanite with close parallel cleavage (bottom and top centre), smaller plates of golden-yellow staurolite, and subrounded garnets are set in a base of biotite, muscovite, quartz and andesine. Foula, Swaa Head, 860 yd (790 m) NNE of Sloag. [HU 976 401]. Fig. 4. Slice No. [\(S50823\)](#) [HT 973 388]. Magnification $\times 20$. Plane polarized light. Strongly foliated and sheared quartz-biotite-schist composed of lenses of quartz with mortar texture alternating with streaks composed of feldspar, muscovite and reddish brown biotite. Scattered porphyroblasts of oligoclase (left-centre). Foula, south shore of Ham Voe, 110 yd (100 m) E5°N of Brae [HU 974 387]. Fig. 5. Slice No. [\(S29900\)](#) [HT 975 401]. Magnification $\times 16$. Crossed polarisers. Dyke of porphyritic microgranite, with granitized matrix

between phenocrysts of albite-oligoclase. Foula, Swaa Head, 880 yd (800 m) NNE of Sloag [HU 976 401]. Fig. 6. Slice No. (S50829) [HT 963 407]. Magnification $\times 16$. Crossed polarisers. Coarse-grained arkose with subrounded to subangular grains. Ratio of quartz to feldspar grains is 50:50. Some interstitial flakes of muscovite. Matrix forms 15 per cent of total volume, composed mainly of carbonate. Foula, shore of Whiora Wick, 520 yd (470 m) E20°S of Freyars [HU 966 412].



(Plate 9) Geological sketch map of the Sandness Formation.



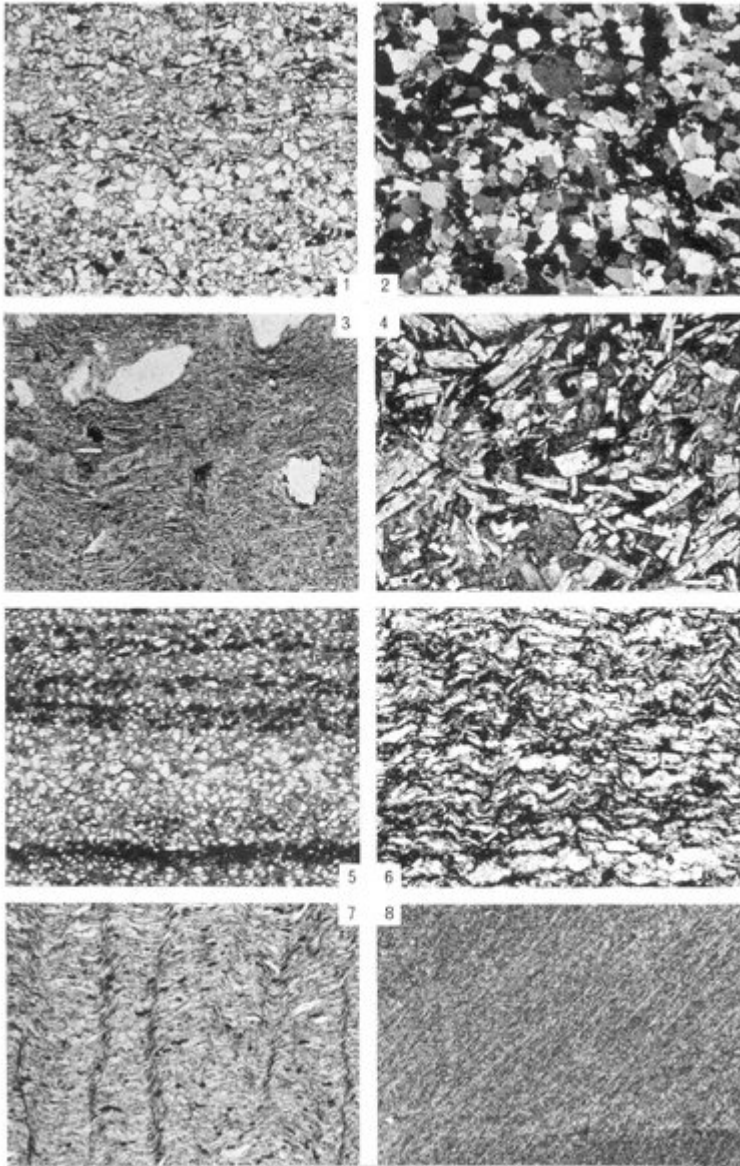
(Plate 10) Lithological variation within the Sandness Formation.



(Plate 11A) West coast of Walls Peninsula, looking north from Mu Ness [HU 166 524] towards Hill of Melby. Steeply inclined, predominantly planar-bedded sandstones of the Sandness Formation. (D964).



(Plate 11B) Wats Ness, looking north at north shore of Trea Wick [HU 172 507]. Steeply inclined, but relatively undeformed sediments of Walls Formation. (D963).



(Plate 13) Photomicrographs of sedimentary and volcanic rocks of the Walls Sandstone Fig. 1. Slice No. [\(S52737\)](#) [HU 296 581]. Magnification $\times 20$. Plane polarized light. Fine-grained flaggy sandstone, Sandness Formation, showing alternate quartz-feldspar and micaceous laminae. Scattered small grains of epidote throughout. West shore of Muckle Head. [HU 297 581]. Fig. 2. Slice No. [\(S52738\)](#) [HU 299 577]. Magnification $\times 20$. Crossed polarisers. Medium-grained arkose, Sandness Formation. Well-graded subangular to subrounded grains. The ratio of quartz to feldspar grains is 60:40. Matrix forms less than 10 per cent of total volume and is composed predominantly of carbonate. North shore of Voe of Clousta, 1225 yd (1100 m) WNW of Clousta School. [HU 298 577]. Fig. 3. Slice No. [\(S49343\)](#) [HU 266 551]. Magnification $\times 40$. Plane polarized light. Part of ignimbrite clast in lapilli-tuff in Clousta Volcanic Rocks, showing flattened and welded shards. Note the bending of shards around quartz clasts. Hillside, 710 yd (650 m) SW of western end of Loch Hollorin [HU 267 552]. Fig. 4. Slice No. [\(S30773\)](#) [HU 328 596]. Magnification $\times 38$. Plane polarized light. Basalt flow in Clousta Volcanic Rocks. Flow-aligned laths of sodic labradorite set in matrix composed largely of secondary amphibole with subordinate grains of epidote and a dusting of iron ore. Aithness peninsula, 220 yd (200 m) SE from north-west corner of peninsula [HU 327 597]. Fig. 5. Slice No. [\(S51496\)](#) [HU 276 498]. Magnification $\times 16$. Plane polarized light. Fine-grained feldspathic sandstone in Walls Formation with laminae of heavy mineral concentrates. Black grains are predominantly iron ore, other heavy mineral grains are apatite, sphene, epidote and tourmaline. North shore of Scutta Voe, 520 yd (475 m) WSW of Lee of Houlland [HU 275 498]. Fig. 6. Slice No. [\(S52748\)](#) [HU 317 564]. Magnification $\times 100$. Plane polarized light. Microfolded sandy siltstone, Walls Formation. Roadside, close to west shore of Loch Vaara [HU 565 316]. Fig. 7. Slice No. [\(S53696\)](#) [HU 278 499]. Magnification $\times 100$. Plane polarized light. Silty shale with F_1

slaty cleavage (horizontal) refolded by F_2 minor folds with incipient fracture cleavage developed along some fold limbs. Walls Formation. North shore of Scutta Voe, 520 yd (470 m) WSW of Lee of Houlland [HU 275 498]. Fig. 8. Slice No. [\(S53688\)](#) [HU 261 503]. Magnification $\times 100$. Crossed polarisers. Microfolded dark grey shale with axial-planar strain-slip cleavage inclined at 44° to bedding. West shore of Voe of Browland, 1620 yd (1480 m) S4°E of Browster [HU 261 503].



(Plate 14A) Fidlur Geo, south-west shore of Walls Peninsula [HU 190 494]. Thinly bedded siltstone and mudstone of Walls Formation, showing relationship of convolute lamination to cleavage. (D956).



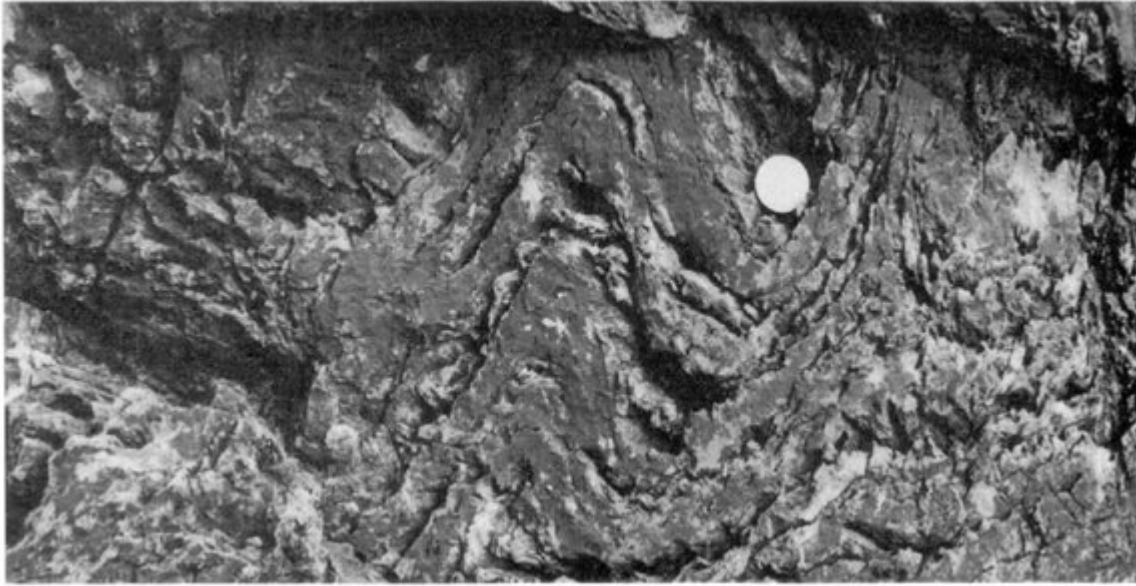
(Plate 14B) Fidlur Geo, south-west shore of Walls Peninsula [HU 190 494]. Thinly bedded siltstone and mudstone of Walls Formation, showing relationship of convolute lamination to cleavage. (W.M.).



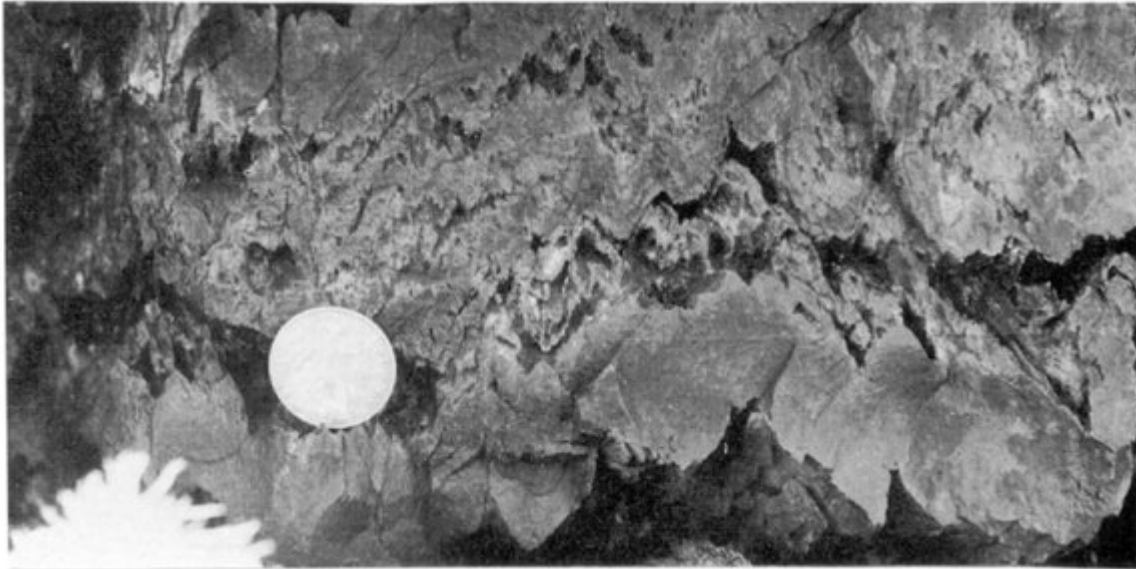
(Plate 14C) Fidlar Geo, south-west shore of Walls Peninsula [HU 190 494]. Thinly bedded siltstone and mudstone of Walls Formation, showing relationship of convolute lamination to cleavage. (W.M.).



(Plate 15A) Fidlar Geo, south-west shore of Walls Peninsula [HU 190 494]. Strongly lineated siltstone and mudstone of Walls Formation (W.M.).



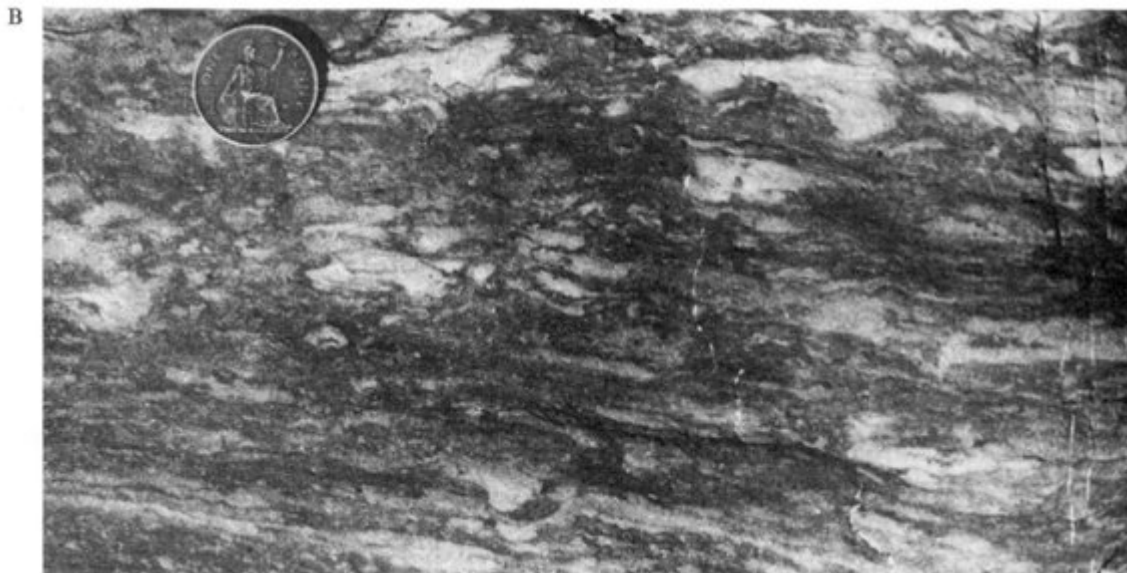
(Plate 15B) East shore of Gruting Voe [HU 275 493]. Intense F_1 folds in flaggy sandstone and siltstone of the Walls Formation (W.M.).



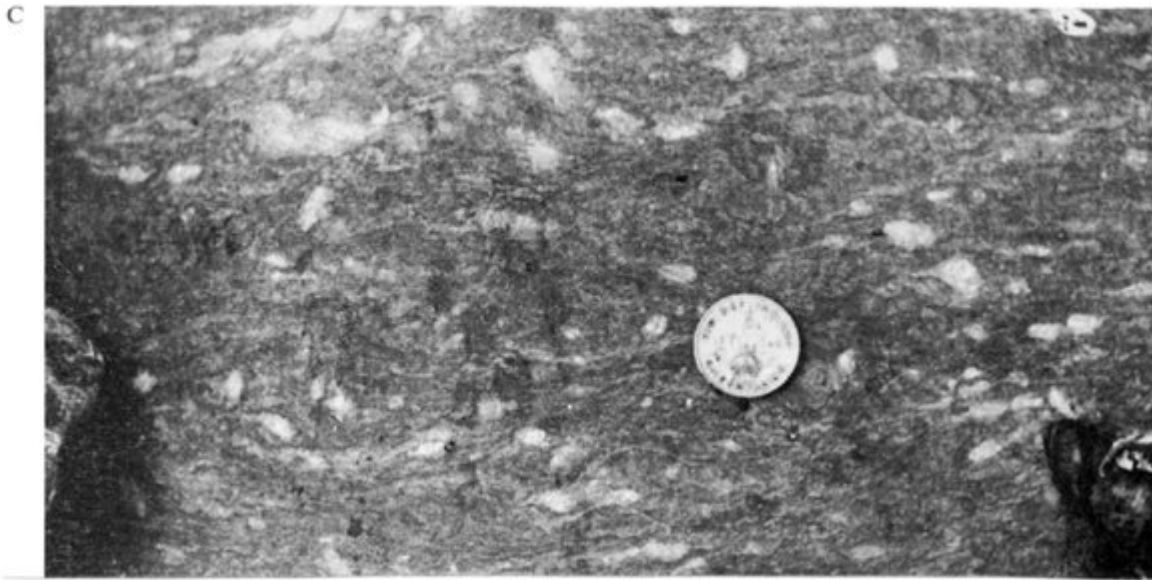
(Plate 15C) East shore of Gruting Voe [HU 275 493]. Close-up of intense F_1 folding in fine-grained sandstone and siltstone of Walls Formation (W.M.).



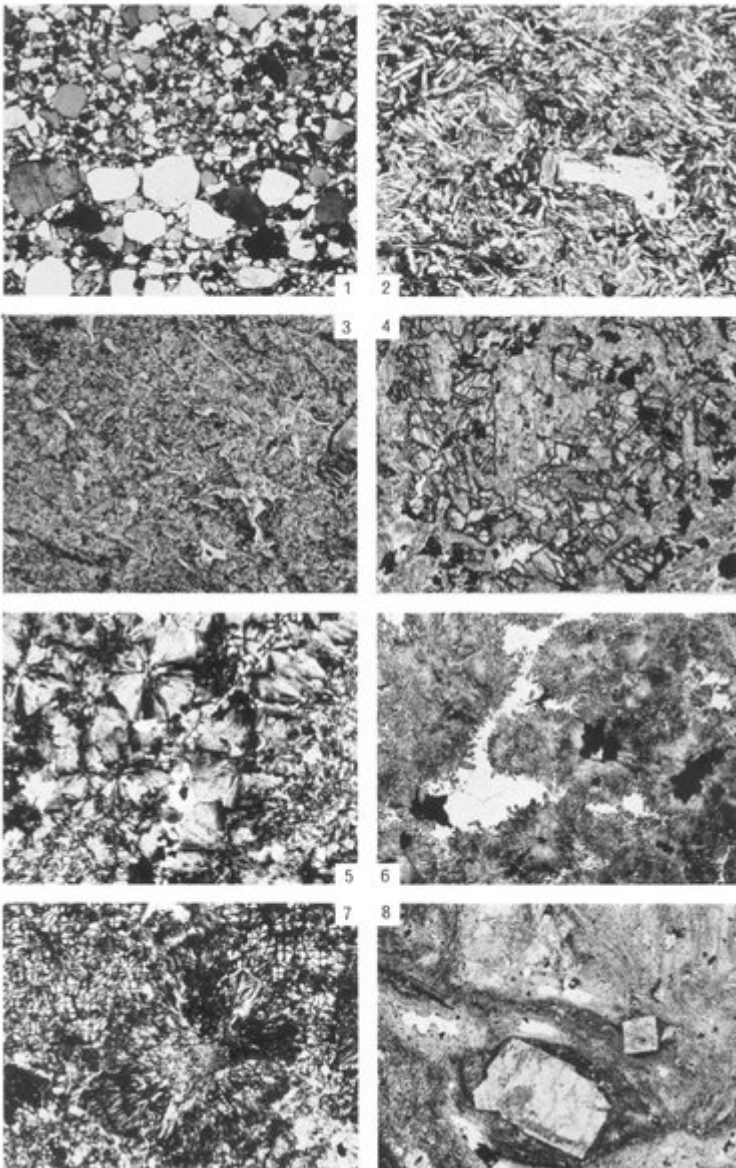
(Plate 16A) South shore of Sound of Papa, 350 yd (320 m) N5°E of Huxter [HU 175 574]. Planar cross-bedded purple sandstone underlying Lower Melby Fish Bed in Melby Formation. (D891).



(Plate 16B) South shore of Sound of Papa, 150 yd (140 m) W of Melby House [HU 184 577]. Purple sandy siltstone with irregular buff sandstone laminae with ?bioturbation structures. (W.M.).

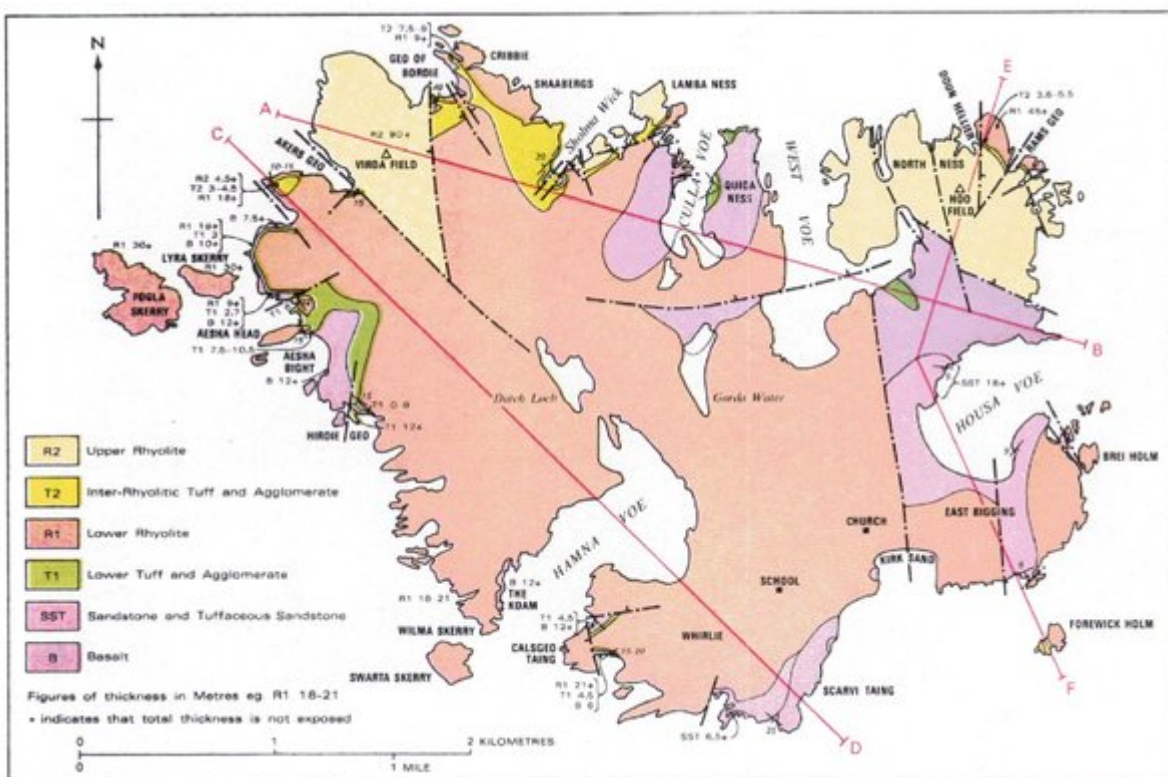


(Plate 16C) South shore of Sound of Papa, 150 yd (140 m) W of Melby House [HU 184 577]. Purple sandy siltstone with irregular buff sandstone laminae with ?bioturbation structures. (W.M.).

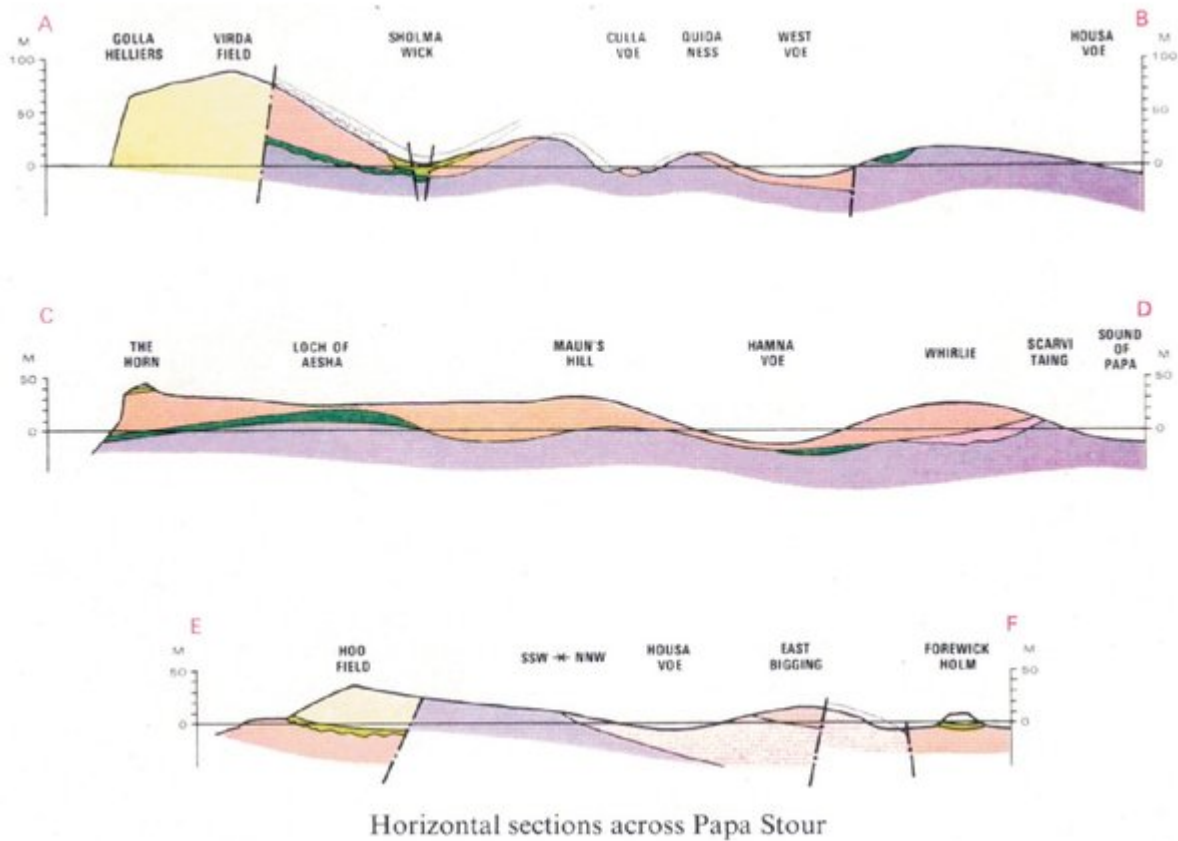


(Plate 17) Photomicrographs of Melby Formation and Papa Stour volcanic rocks Fig. 1. Slice No. [\(S49338\)](#) [HU 173 575]. Magnification $\times 16$. Crossed polarisers. Pink medium-grained sandstone below Melby Fish Bed, Melby Formation.

Feldspathic sandstone with bi-modal grain size distribution. Quartz-feldspar ratio 70:30. Among large subrounded grains quartz predominates. Accessory grains are garnet, zircon, tourmaline and apatite. Lithic clasts are composed mainly of altered acid lava and form less than 10 per cent of the total grains. Most grains are covered by a thin reddish film of iron ore. South shore of Sound of Papa, 340 yd (310 m) N of Huxter [HU 174 575]. Fig. 2. Slice No. [\(S30602\)](#) [HU 191 586]. Magnification $\times 31$. Crossed polarisers. Thin flow of basalt within tuff sequence in Melby Formation. Ophitic basalt with rare phenocrysts of sodic labradorite. Vaguely flow-aligned laths of calcic andesine are partly enclosed in ophitic augite. Matrix is a deep olive-green amorphous aggregate. Holm of Melby, west coast [HU 191 586]. Fig. 3. Slice No. [\(S54285\)](#) [HU 185 580]. Magnification $\times 32$. Plane polarized light. Poorly welded or non-welded tuff near base of Ness of Melby rhyolite. Partially flattened devitrified glass shards and small potash feldspar plates and laths, set in matrix of microlite rods. North-west corner of Ness of Melby, 240 yd (220 m) NW of Melby House [HU 185 580]. Fig. 4. Slice No. [\(S30944\)](#) [HU 167 619]. Magnification $\times 31$. Plane polarized light Coarse ophitic dolerite with plates of cloudy plagioclase set in ophitic pyroxene. Papa Stour, 560 yd (500 m) SSE of Skerry of Lambaness, 1850 yd (1690 m) NW of Gardie [HU 167 620]. Fig. 5. Slice No. [\(S30930\)](#) [HU 177 613]. Magnification $\times 32$. Crossed polarisers. Spherulitic rhyolite. Spherulites are composed of radiating fibres of brownish-stained potash feldspar. Small patches of quartz between adjoining spherulites. Papa Stour, south shore of West Voe, 550 yd (500 m) NW of Gardie [HU 176 612]. Fig. 6. Slice No. [\(S30931\)](#) [HU 175 615]. Magnification $\times 32$. Plane polarized light. Spherulitic rhyolite. Spherulites composed of tightly packed clusters of irregularly radiating laths of orange stained potash feldspar, set in large interstitial areas of clear quartz. Quartz forms a small central nucleus in some spherulites. Papa Stour, east shore of West Voe, 920 yd (840 m) NW of Gardie [HU 175 616]. Fig. 7. Slice No. [\(S30933\)](#) [HU 183 620]. Magnification $\times 31$. Crossed polarisers. Spherulitic rhyolite showing two contrasting types of spherulites. The large spherulites consist of radiating fibres of quartz and potash feldspar and are set in a groundmass of small near-spherical spherulites of consistent size (with black cross). Papa Stour, Doun Helier, 1220 yd (1100 m) NNE of Gardie [HU 183 620]. Fig. 8. Slice No. [\(S30962\)](#) [HU 166 591]. Magnification $\times 16$. Plane polarized light. Porphyritic rhyolite, with stumpy euhedral plates of slightly kaolinized potash feldspar, set in an irregular banded matrix of microlites of orange-stained potash feldspar and irregular patches of quartz. Papa Stour, south-west coast, close to Shepherd's Geo, 800 yd (730 m) SW of Bragassetter [HU 165 592].



(Plate 18) Geological sketch-map of Papa Stour.



(Plate 19) Horizontal sections across Papa Stour.



(Plate 20A) North shore of Hirdie Geo, south-west shore of Papa Stour [HU 132 606]. Lower Rhyolite resting on eroded top of rhyolitic tuff at right of picture. Foreshore rocks at left of picture are amygdaloidal basalt. Islands and cliffs in background are rhyolite. (D920).



(Plate 20B) South side of Aesha Head, on west shore of Papa Stour. [HU 148 611]. Lower Rhyolite on rhyolitic tuff which, in turn, rests on irregular surface of basalt rubble. (D922).



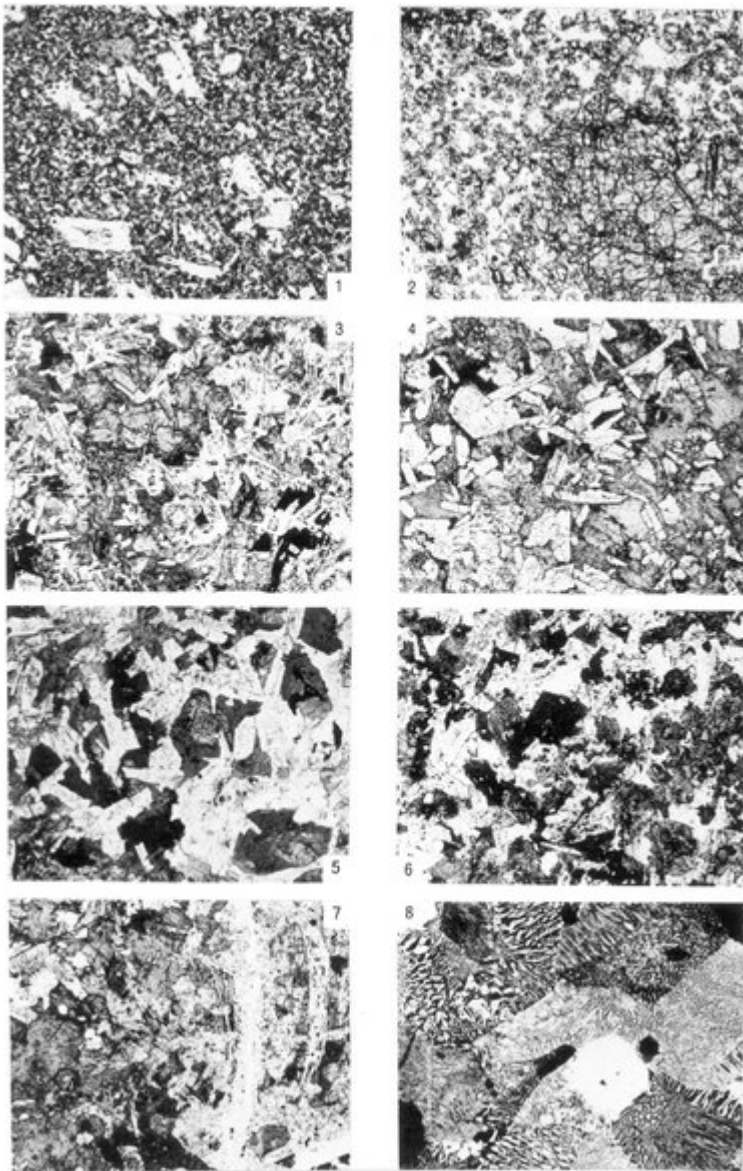
(Plate 20C) North shore of Papa Stour, 98 yd (90 m) SE of Cribbie [HU 157 624]. Rhyolite with large spherulites (lithophyses) and vertical banding, which is normal to the dip of the flow. (D928).



(Plate 21A) Wilson's Noup, Northmaven [HU 302 716]. Brecciated basalt in granite and granodiorite. (D1345).



(Plate 21B) Wilson's Noup, Northmaven [HU 302 716]. Brecciated partly permeated basalt cut by a stream of granodioritic material full of elongate, variably assimilated basaltic enclaves. (D1347).



(Plate 22) Photomicrographs of rocks of the Northmaven–Muckle Roe Plutonic Complex Fig. 1. Slice No. (S44284). Magnification $\times 25$. Plane polarized light. Early basic dyke, thermally altered. The plagioclase (An 50%) phenocrysts are recrystallized at their margins to interlock with the recrystallized base consisting of microgranular andesine and small idiomorphic prisms of hornblende and biotite; small ferromagnesian phenocrysts are recrystallized to compact aggregates of interfering microprisms of hornblende. West side of Egilsay [HU 316 695]. Fig. 2. Slice No. (S30016A) [HU 332 732]. Magnification $\times 14.5$. Plane polarized light. Bytownite-peridotite. Numerous small crystals of olivine are enclosed poikilitically in large plates of bytownite and clinopyroxene. The relative proportions of these minerals are variable; orthopyroxene and reddish brown hornblende and biotite are variable minor constituents. South-east shore of Glusdale Water [HU 332 734]. Fig. 3. Slice No. (S30017A) [HU 332 733]. Magnification $\times 11.5$. Plane polarized light. Gabbro. Large plates of augite enclose prisms of calcic labradorite optically; brown hornblende margins augite and also forms smaller ophitic plates. A late crystallization of deep brown biotite is moulded on plagioclase. West shore of Glusdale Water [HU 332 734]. Fig. 4. Slice No. (S55647) [HU 341 682]. Magnification $\times 10$. Plane polarized light. Hornblende-gabbro (bojite). Large partly unaltered plates of brown and green hornblende enclose zoned plagioclase (An 65–45 %) prisms optically. Deep brown biotite is moulded on plagioclase. Cliva Hill, 150 yd (130 m) SSE of Mavis Grind [HU 340 682]. Fig. 5. Slice No. (S30023) [HU 315 742]. Magnification $\times 10$ –5. Plane polarized light. Hornblende-augite-quartz-diorite. Prisms of augite are subophitic to plagioclase; brown hornblende is moulded on plagioclase and idiomorphic against quartz. Plagioclase prisms are zoned from acid labradorite core to oligoclase margin. South shore of Gunnister Voe [HU 315 742]. Fig. 6. Slice No. (S55665) [HU 300 725]. Magnification $\times 12$. Plane polarized light. Biotite-hornblende-quartz-diorite. Tables of zoned plagioclase (An 55–15 %) interfere with hypidiomorphic brown and green hornblende which show good crystal forms against quartz (top centre). Peninsula 195 yd (180 m) WSW of Nibon [HU 304 730]. Fig. 7. Slice No. (S45034) [HU 343 643]. Magnification $\times 14$. Plane polarized light. Scapolitized

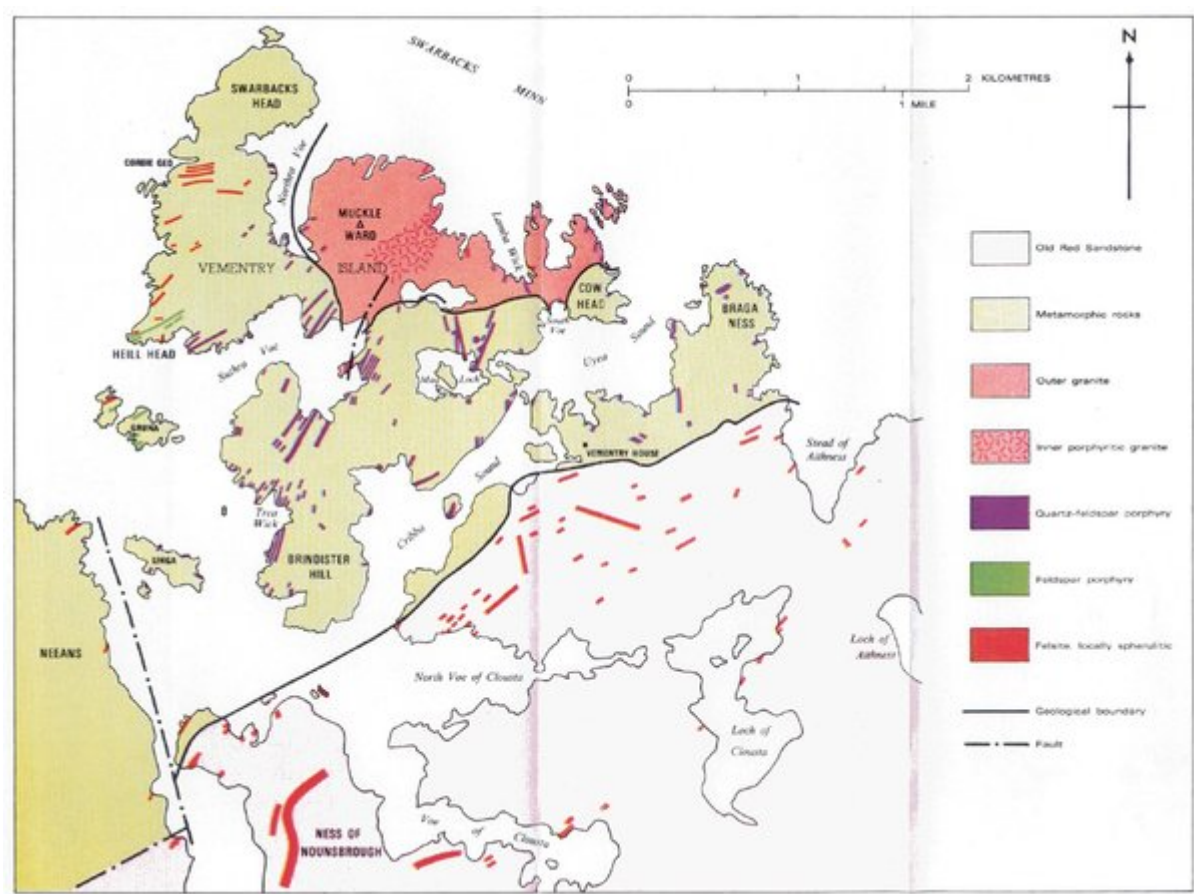
gabbro. On the left, gabbro of unaltered plagioclase, hornblende and augite resembles that of Figs. 3 and 4; on the right, plagioclase is completely, hornblende partially replaced by xenomorphic, coarsely crystalline scapolite. East coast of Muckle Roe, 435 yd (400 m) NNE of Scarfa Taing [HU 334 639]. Fig. 8 Slice No. [\(S29505\)](#) [HU 314 674]. Magnification $\times 14.5$. Crossed polarisers. Granophyre. Muckle Roe, west side of Roda Geo [HU 314 674].



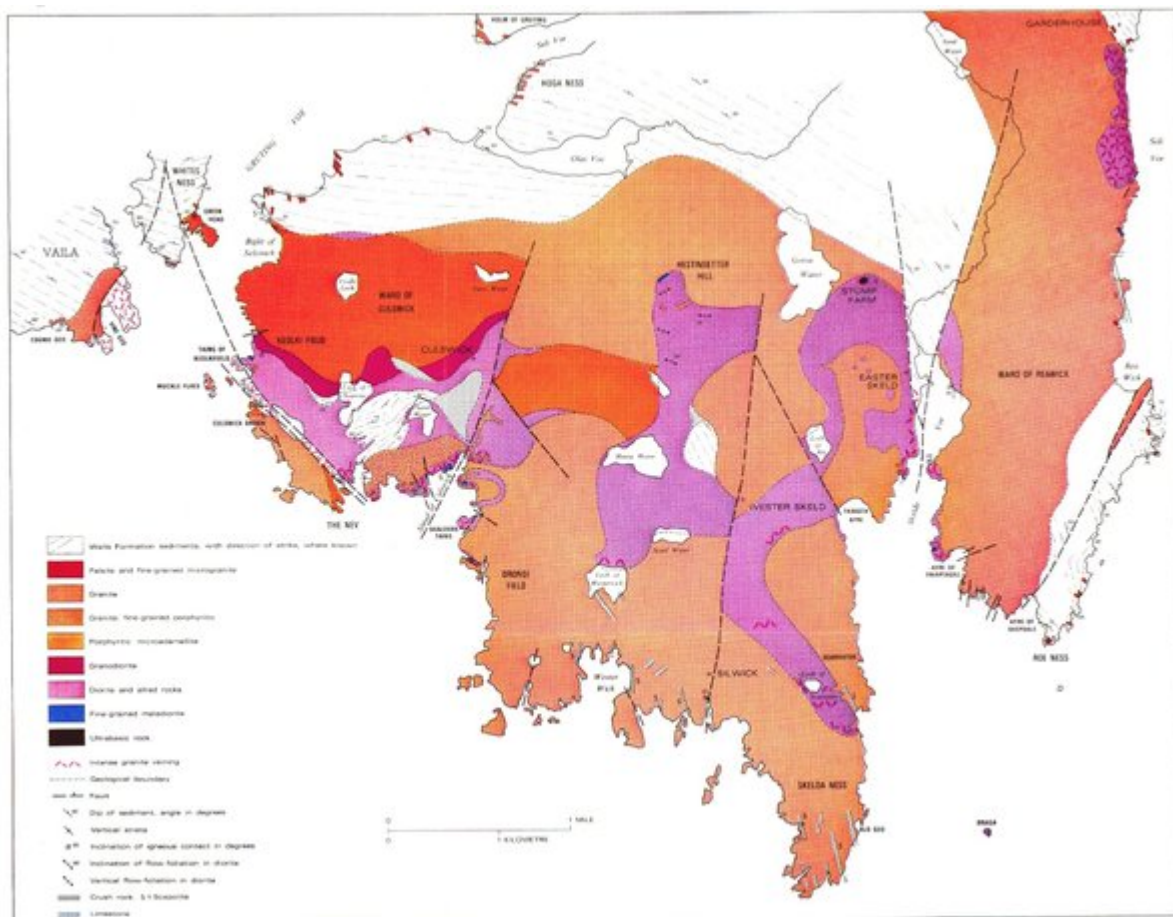
(Plate 23A) Roadside quarry, south of Mavis Grind, Northmaven [HU 342 682]. Scapolite vein in diorite-granite complex. (D1344).



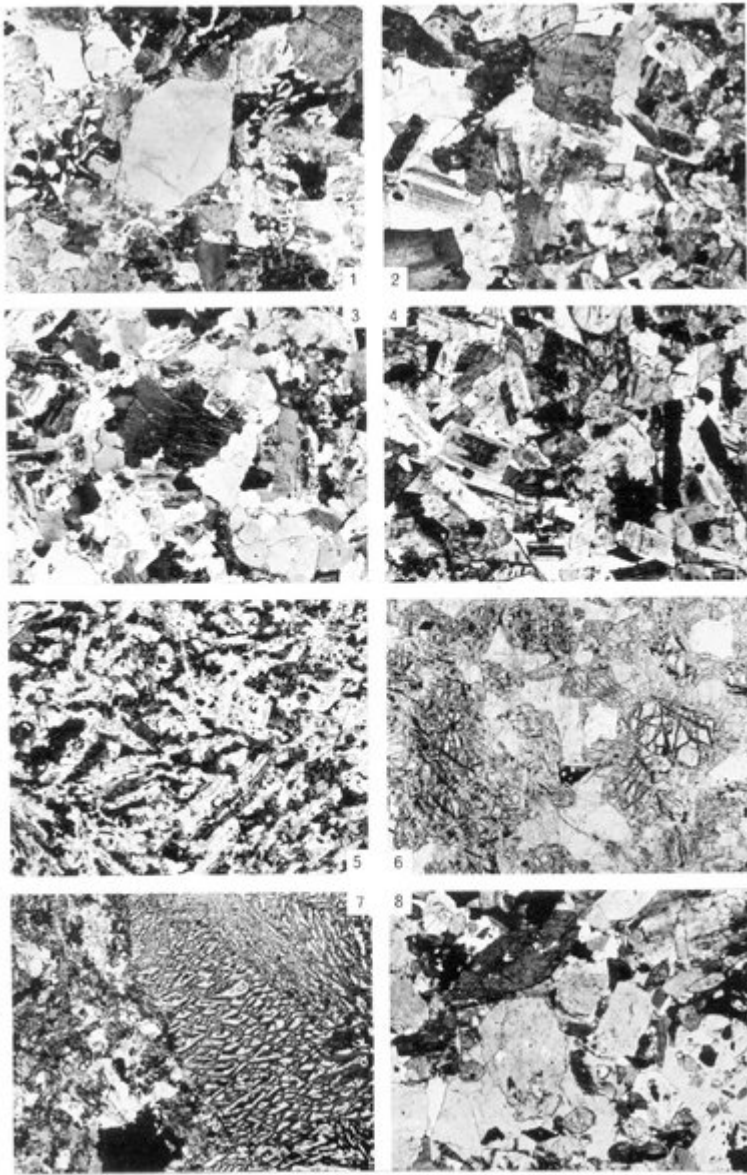
(Plate 23B) East shore of Cow Head, Vementry Island [HU 309 607]. Straight clean-cut junction between Vementry granite (pale) and metamorphic rocks. (D904).



(Plate 24) Vementry Granite and related acid minor intrusions.

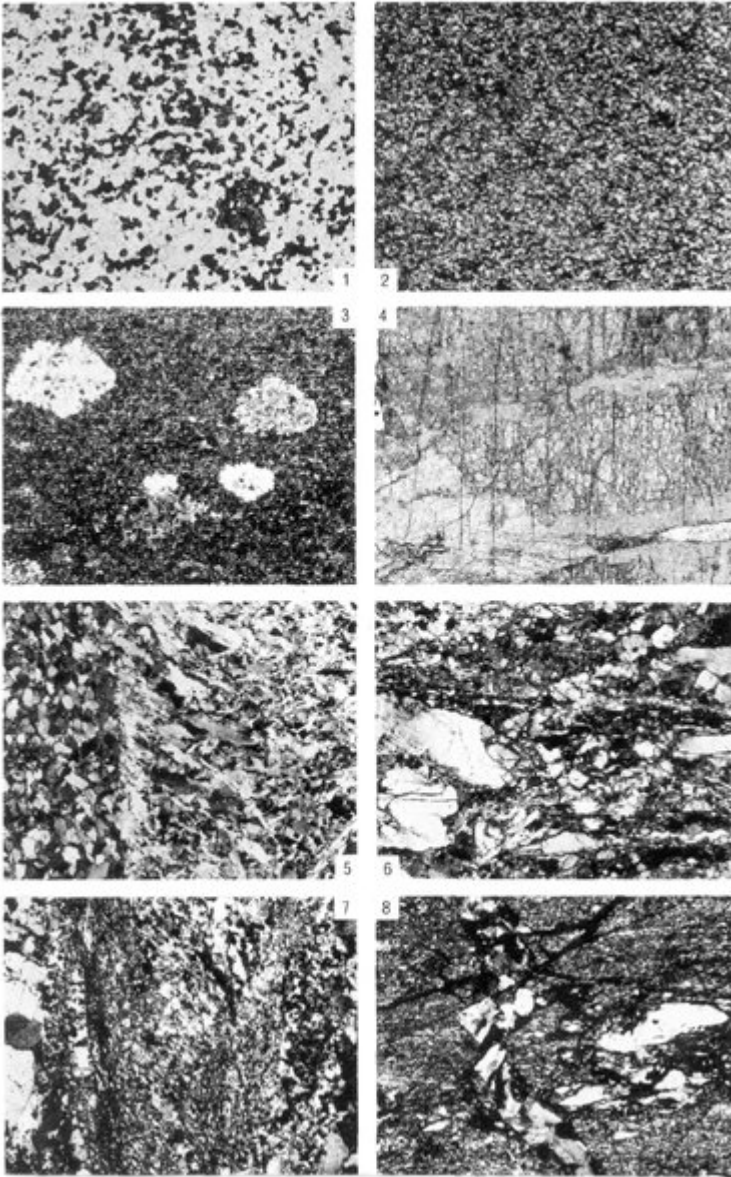


(Plate 25) Geological Sketch map of the Sandsting Granite-Diorite Complex.



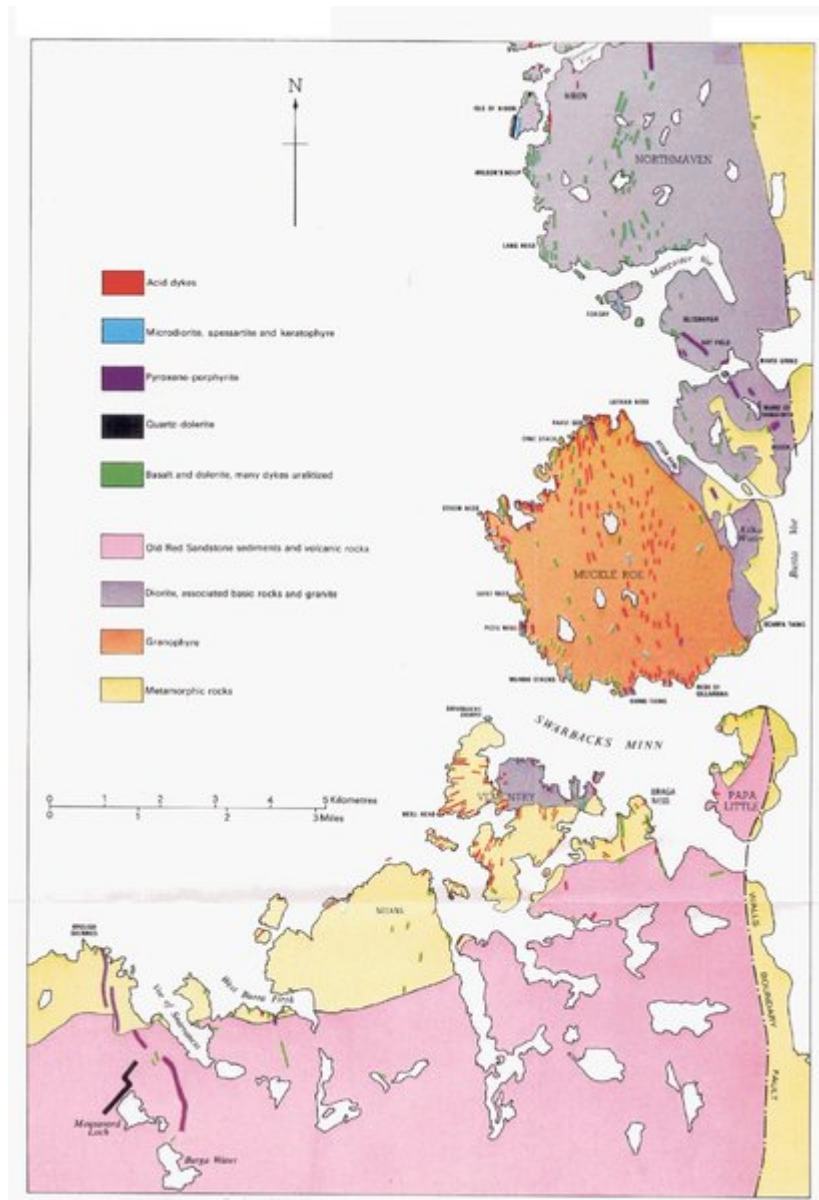
(Plate 26) Photomicrographs of the Sandsting Granite-Diorite Complex Fig. 1. Slice No. [\(S51550\)](#) [HU 328 514]. Magnification $\times 16$. Crossed polarisers. Granophyre sill in Walls Sandstone, composed of graphic intergrowth of quartz and potash feldspar and scattered subrounded crystals of microcline and albite-oligoclase. West shore of Bixter Voe, 240 yd (225 m) SSE of Mosshouse [HU 328 514]. Fig. 2. Slice No. [\(33678\)](#) [HU 299 438]. (Analysed specimen No. 1066, Guppy and Sabine 1956, p. 14, No. 653.) Magnification $\times 16$. Crossed polarisers. Diorite, with plates of andesine rimmed with oligoclase, subordinate hornblende, biotite and rare sphene. Interstitial microcline, microperthite and quartz. 1400 yd (1280 m) ESE of Wester Skeld, near Loch of Arg [HU 299 438]. Fig. 3. Slice No. [\(S51509\)](#) [HU 253 461]. Magnification $\times 16$. Crossed polarisers. Microadamellite. Clusters of near-euhedral plates of zoned plagioclase (andesine rimmed by oligoclase) form 40 per cent of the total feldspar. Large irregular plates of microperthite and interstitial microcline form the remaining 60 per cent. Quartz forms 10 per cent of the total volume. The mafic minerals hornblende and biotite are present in equal proportion. Apatite is an abundant accessory. Coast of Scurdie, 470 yd (425 m) SE of Green Head [HU 253 459]. Fig. 4. Slice No. [\(S28878\)](#) [HU 296 427]. Magnification $\times 17$ –6. Crossed polarisers. Fine-grained hornblende-diorite. Near-euhedral plates of calcic andesine rimmed with calcic oligoclase. Interstitial microcline and quartz. Hornblende and greenish brown mica are present in equal volume. Sphene and small needles of apatite are abundant accessories. Brunt Hamar, 830 yd (760 m) NE of Silwick [HU 299 426]. Fig. 5. Slice No. [\(S51523\)](#) [HU 271 441]. Magnification $\times 42$. Plane polarized light. Melanocratic microdiorite. Irregular decussate laths of sodic andesine set in interstitial base of ragged plates of deep green biotite forming 30 per cent of total volume. Clusters of small crystals of hornblende. Abundant accessories are sphene and small specks of iron ore. South-east side of Stead of Culswick, 550 yd (500 m) S32°E of south end of Sand Water [HU 272 442]. Fig. 6. Slice No. [\(S51535\)](#) [HU 309 457]. Magnification $\times 16$. Plane polarized light. Ultrabasic rock resembling harrisite. Olivine is sheathed in serpentine. Pyroxene (augite and enstatite) forms large in part poikilitic plates. Also subhedral plates of labradorite-bytownite and plates of reddish brown

mica (?lepidomelane) enclosing skeletal iron ore. 190 yd (175 m) W20°N of Stump Farm [HU 307 457]. Fig. 7. Slice No. [\(S51514\)](#) [HU 252 452]. Magnification $\times 16$. Crossed polarisers. Pegmatite vein in diorite. Large crystal of micropegmatite (quartz-microcline intergrowth) set in matrix of irregular plates of microcline and quartz with grains and veinlets of epidote. South shore of Taing of Koelkifield, 530 yd (480 m) N18°W of Culswick Broch [HU 252 452]. FIG . 8. Slice No. [\(S51528\)](#) [HU 293 454]. Magnification $\times 16$. Crossed polarisers. Part of ovoid of pyroxene-monzonite in microdiorite. Characterized by large euhedral sphenes, and smaller euhedral crystals of colourless pyroxene set in base of near-euhedral crystals of clear orthoclase, plagioclase and microcline. West slope of Hestinssetter Hill, just east of road, 340 yd (310 m) S18°E of Giant's Grave [HU 293 455].

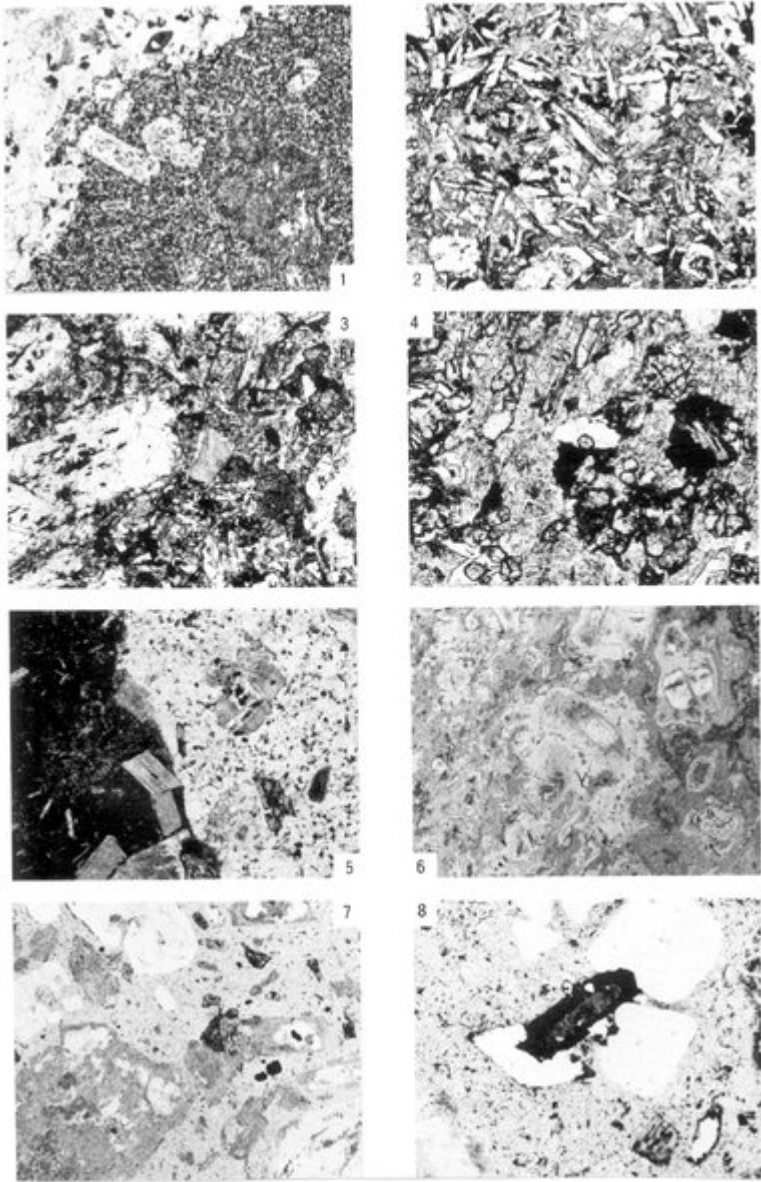


(Plate 27) Photomicrographs of the thermal aureole and hydrothermal mineralization in the Sandsting Granite-Diorite Complex. Fig. 1. Slice No. [\(S51515\)](#) [HU 255 452]. Magnification $\times 42$. Plane polarized light. Hornfelsed sandstone in sedimentary enclave within diorite. Quartz and feldspar grains are welded together. The interstitial matrix is recrystallized into granular epidote, brown biotite and subordinate hornblende. The larger dark patches consist partly of ophitic hornblende. Koelkifield, 500 yd (450 m) N8°E of Culswick Broch [HU 254 452]. Fig. 2. Slice No. [\(S51782\)](#) [HU 255 466]. Magnification $\times 42$. Plane polarized light. Dark grey hornfelsed silty mudstone close to junction with Sandsting Granite. Serrat quartz grains set in matrix of stumpy brown biotite. The darker areas are spongy, highly ophitic crystal aggregates of green hornblende which are up to 0.5 mm in diameter. North-east shore of Bight of Selistack, 650 yd (590 m) E37°N of south point of Green Head [HU 256 466]. Fig. 3. Slice No. [\(S52534\)](#) [HU 241 464]. Magnification $\times 42$. Crossed polarisers. Indurated mud-stone overlying limestone, within thermal aureole of Sandsting Complex. Fine-grained hornfelsed calcite-mudstone with oval poikiloblasts (white) of cordierite. The mudstone contains small patches of clinozoisite. Island of Vaila, west shore of Easter Sound, 650 yd (590 m) WNW of Ram's Head Lighthouse [HU 242 463].

Fig. 4. Slice No. [\(S52536\)](#) [HU 241 464]. Magnification $\times 22$. Plane polarized light. Hornfelsed impure limestone within thermal aureole of Sandsting Complex. Composed largely of intensely sieved grossularite enclosing minute grains of diopside. The opaque bands consist almost entirely of finely granular diopside. The white lens in the bottom right of the picture consists of feldspar with diopside grains. Elongate crystals of clinozoisite near bottom left. Island of Vaila, west shore of Easter Sound, 650 yd (590 m) WNW of Ram's Head Lighthouse [HU 242 463]. Fig. 5. Slice No. [\(S51502\)](#) [HU 265 472]. Magnification $\times 16$ –8. Crossed polarisers. Junction of scapolite vein with Walls Sandstone. The scapolite forms irregular laths which intersect the vein-margin at an angle of 45° . South shore of Gruting Voe, 820 yd (750 m) $E19^\circ N$ of Hogan [HU 272 473]. Fig. 6. Slice No. [\(S31121\)](#) [HU 304 421]. Magnification $\times 16$. Crossed polarisers. Sheared and partly mylonitized granite with small discontinuous, partly sheared veinlets of scapolite laths. Skelda Ness peninsula. Pundswell, 200 yd (180 m) NNW of summit of Longa Berg [HU 304 422]. Fig. 7. Slice No. [\(S28732\)](#) [HU 287 425]. Magnification $\times 31$. Crossed polarisers. Sheared-out and partly mylonitized scapolite adjoining granite. Hillside, 200 yd (180 m) E of Wester Wick [HU 287 424]. Fig. 8. Slice No. [\(S31126\)](#) [HU 301 410]. Magnification $\times 31$. Crossed polarisers. Intensely scapolitised sheared granite cut by faulted veinlet of potash feldspar. Skelda Ness peninsula, 1000 yd (910 m) SSW of summit of Longa Berg [HU 302 411].



(Plate 28) Basic, acid and intermediate minor intrusions in Western Shetland.



(Plate 29) Photomicrographs of the basalt-granite breccia and minor intrusions Fig. 1. Slice No. [\(S55676\)](#) [HU 302 706]. Magnification $\times 14$. Plane polarized light. Breccia-form basalt cemented by granodiorite. The basaltic rock has a microgranoblastic base of andesine, hornblende and biotite in which lie small phenocrysts of zoned calcic plagioclase, marginally recrystallized, and recrystallized groups of amphibole and biotite prisms pseudomorphous after ferromagnesian phenocrysts. The rock resembles the thermally altered dyke of (Plate 22), fig. 1. Lang Head, 49 yd (45 m) inland from Geo of Drengi [HU 303 704]. Fig. 2. Slice No. [\(S43772\)](#) [HU 320 726]. Magnification $\times 14$. Plane polarized light. Hornblende-basalt. Tablets and stout prisms of zoned plagioclase (centrally An 70+) are subophitically related to xenomorphic green hornblende and cemented by pale green fibrous amphibole; minor augite (NW of centre) is ophitic to plagioclase. South-east shore of Soolmisvird Water [HU 320 726]. Fig. 3. Slice No. [\(S30598\)](#) [HU 219 581]. Magnification $\times 11$. Plane polarized light. Basic pyroxene-porphyry. Phenocrysts of labradorite (An₆₅₋₇₀) and of yellow augite lie in a base of strongly zoned plagioclase laths, subophitic to purplish augite, and minor magnetite which are cemented by a turbid mixture of chlorite, biotite, alkali-feldspar and some quartz. Near Skerry of Stools, 710 yd (650 m) NW of Boustia [HU 219 582]. Fig. 4. Slice No. [\(S49323\)](#) [HU 307 606]. Magnification $\times 65$. Plane polarized light. Garnet in basalt. Small garnets, about 0.02 mm across, are enclosed in clear chlorite (centre) and turbid plagioclase (SE of centre). Grains in chlorite (SW corner) include one garnet and two epidotes. North shore of South Voe, Vementry Island [HU 305 605]. Fig. 5. Slice No. [\(S28885\)](#) [HU 327 627]. Magnification $\times 16$. Plane polarized light. Feldspar-porphyry and basalt. The basalt is chilled; its margin partly enwraps an alkali-feldspar phenocryst of the porphyry. Ness of Gillarona, Muckle Roe [HU 327 627]. Fig. 6. Slice No. [\(S30732\)](#) [HU 282 603]. Magnification $\times 14$. Plane polarized light. Nodular felsite. The nodules consist of feldspar-phyric glass, variably devitrified. The base is microcrystalline to cryptocrystalline quartz-feldspar aggregate, variably sericitized, with frayed slivers of glass. Heill Head, Vementry Island [HU 282 605]. Fig. 7. Slice No. [\(S30711\)](#) [HU 302 604]. Magnification $\times 13$. Plane polarized light. Quartz-feldspar-porphyry with microporphyritic

hornblende, biotite and ore. The feldspar phenocrysts include orthoclase (usually mottled) and more abundant albite (usually turbid). Hornblende is replaced by chlorite-calcite aggregate; biotite is pseudomorphed by chlorite. Egga Field, 83 yd (75 m) N of Maa Loch, Vementry Island [HU 301 604]. Fig. 8. Slice No. [\(S28908\)](#) [HU 300 633]. Magnification $\times 22$. Plane polarized light. Allanite. One end of the zoned crystal is embedded in an idiomorphic crystal of hornblende (SE of centre; almost completely destroyed in grinding the section); the other end is held in a rounded crystal of quartz. Such a cumulophyric group, though cognate, is xenocrystic, possibly derived from an early drusy stage of crystallization. The rock is a hornblende-quartz-porphyry. North of Murbie Stack, south-west shore of Muckle Roe [HU 303 630].



(Plate 30A) Crooie Geo, north-west coast of Vementry Island [HU 286 617]. Striated and ice-moulded pavement of metamorphic rocks. Direction of ice-flow from left to right. (D916).



(Plate 30B) Interior of Papa Stour, looking south from hillside west of Culla Voe [HU 167 618]. Belt of morainic drift extending north-south across island from Culla Voe to Hamna Voe. Sandness Hill in background. (D931).



(Plate 30C) Western slope of Hill of Melby [HU 172 555]. Ramifying system of small meltwater channels. (D901).

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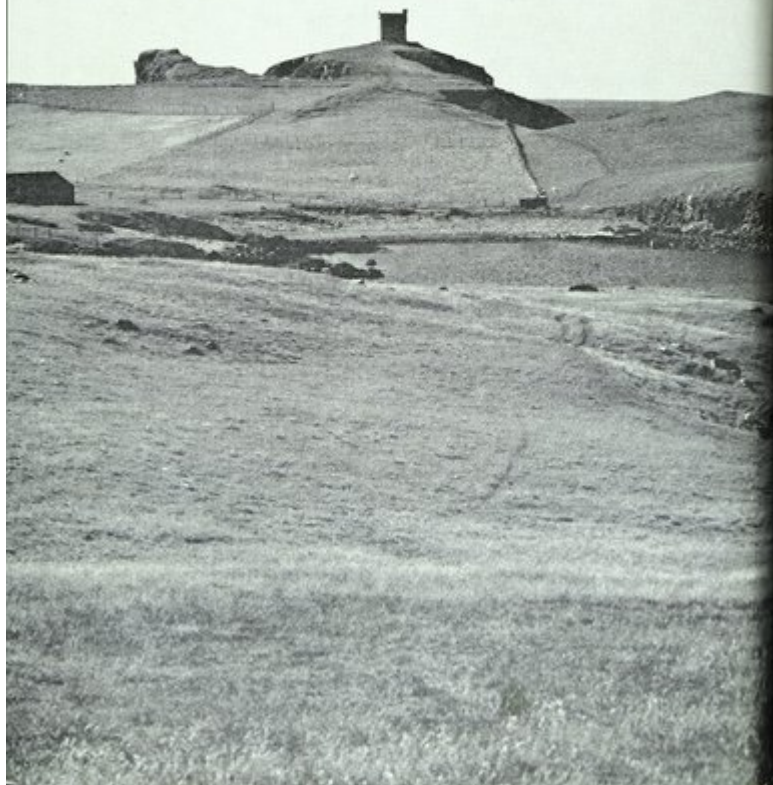
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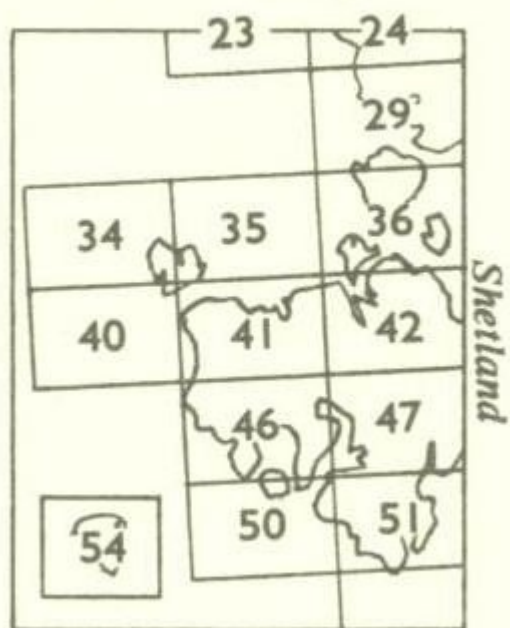
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