The limestones of Scotland: chemical analyses and petrography — Chapter 6 Petrographical descriptions of Scottish limestones

Lewisian

Argyll

GS1 (p. 17) Coccolite marble. Quarry 92 yd E. 31° S. of Balephetrish, Tiree. 1" sheet 42; 6" Argyll. 64 N.E. (Anal. C.O. Harvey).

An elongated mass of marble, 200 ft by 50 ft, enclosed on three sides by black hornblende-augite-gneiss; fourth side passes under drift.

(S31697) [NM 0141 4734]. Pink marble speckled with green clots. The section shows an aggregation of very fine-grained calcite in which numerous lens-shaped relics of larger grains are arranged parallel in shear-schistosity. Rounded crystals of pale green pyroxene, micacized scapolite, a negative alkali-feldspar and large grains of calcite form xenolith-like aggregates. Sphene, apatite and limonitic aggregate are accessory constituents which occur both as isolated grains in the calcite matrix and in association with the pyroxene clusters.

Limestone with calcsilicates, micrograined, pseudoporphyroblastic, grano-schistose, sheared.

Inverness

(SL 106) (p. 17) Marble. Old Quarry 250 yd S.W. of W. end of Loch an Sgor Ghaothair, Glen Urquhart. 1" sheet 73; 6" Inverness. 29 N.W. (*Lst. Scotland,* 1949, p. 116.)

(S34585) [NH 485 314]. Coarse crystalline marble with numerous phlogopite, calc-silicate and ore grains. Composed of interlocking large grains of calcite within and between which are scattered grains of quartz, prisms of tremolite and flakes of phlogopite. Quartz is more abundant in some bands and is then accompanied by large grains of zoisite, containing vermicular inclusions of quartz, and by muscovite. Sphene, oligoclase, apatite, rutile and pyrite are accessory. Sphene grains in phlogopite have pleochroic haloes.

Limestone with phlogopite and calcsilicates, coarse-grained, granoblastic, foliated.

Ross and Cromarty

(SL 258) (p. 17) Limestone. Old Quarry, E. bank of Allt Folais, 620 yd N. of Letterewe House. 1" sheet 92; 6" Ross. 58 N.W. (*Lst. Scot,* 1949, p. 166).

(S35262) [NG 952 719]. Massive, white, fine-grained limestone. The slide shows a limestone which has been sheared so that eye-shaped fragments about 0.3 mm in size and irregularly lenticular areas of medium-grained carbonate are set in a parallel arrangement in a finely granular matrix of about 0.02 mm grain. Colourless phlogopite is accessory and lies in the direction of lenticularity of the calcite. The carbonate is partly calcite and partly aragonite, the admixture being patchy and without regular pattern, but the eye-shaped fragments are all of calcite.

Limestone with aragonite, varigrained, sheared.

(S35263) [NG 952 719]. A pale cream-coloured limestone containing numerous small cavities; effervesces freely with cold dilute HCl. Composed of mixed finely and coarsely granular carbonate which, on test by refractive index methods, is essentially calcite; no aragonite but some dolomite is present.

The finer grained material is turbid and of grain-size about 0.02 mm. Phlogopite occurs as irregular flakes in the turbid carbonate and a small amount of quartz is present.

Dolomitic limestone, fine-grained, mesh-recrystallized, holey.

(SL 259) (p. 17) Limestone and dolomite. Old quarry, W. bank of Allt Folais, 690 yd N. of Letterewe House. 1" Sheet 92; 6" Ross. 58 N.W. (*Lst.Scot.,* 1949, p. 166).

(S35264) [NG 951 720]. Thinly and irregularly flaggy limestone with a reticulation of thin veins of calcite. The slide shows a rock in which angular grains of calcite about 0.05 to 0.3 mm across are scattered like grains of grit in a very fine matrix of carbonate of grain-size 0.01 mm. This is cut by thin veins containing calcite, quartz and barytes. The latter two minerals occur also in small aggregates throughout the rock. Phlogopite is present in flakes up to 0.5 mm long. The residue from solution in 1:3 HCl, cold, shows barytes, quartz, phlogopite and dolomite in that order of abundance. A sericitic clay aggregate is also present. Some curious small spheroidal growths of calcite in the rock seem to be of the same age as the formation of phlogopite.

Limestone with quartz, barytes, phlogopite and dolomite, fine-grained, pseudo gritty mortar-structure, sheared.

(S35265) [NG 951 720]. Whitish micro-nodular dolomite, with phlogopite coating divisional planes; effervesces slightly in cold dilute HCl. The rock is a crushed dolomite with a gritty appearance in thin section owing to the distribution of larger irregular grains of carbonate (up to 1.0 mm across) in a matrix which is of variable but very fine grain. Phlogopite, muscovite and tremolite are abundantly present and the latter occurs as incomplete prisms or relict shreds in fibrous carbonate. Tourmaline (elbaite) is an abundant accessory, forming stout, fractured prisms up to 0.2 mm long. Colourless in thin sections, it shows: O, faint green, E faint pink in separated grains; ■ =1.639. Tests in crush show dolomite as the main constituent, but calcite is abundant.

Calcareous dolomite with micas and tremolite; fine-grained, pseudo-gritty mortar-structure, crushed.

(SL 260) (p. 17) Limestone and dolomite. Old quarry, N. bank of Allt Coire nan Dearcaig, 50 yd upstream from junction with Allt Airidh a' Char. 1" Sheet 91; 6" Ross. 45 S.E.

(S35266) [NG 902 770]. A pale violet limestone with films of yellow-green phlogopite. Composed of irregular fragments of calcite in a matrix of turbid, very finely granular calcite. Contorted phlogopite, chlorite and spongy tremolite, partly replaced by the carbonate matrix, are abundant. The matrix invades the fragmental calcite along 'corrosion' embayments and cracks. The rock has clearly been crushed and there are some short lengths of shear lines. After shearing there seems to have been brecciation and more uniform pressure under which the fine matrix formed a plastic medium which showed no shear effects. The mean refractive index of the tremolite is β =1.620. Apatite and limonite are accessory.

Limestone with mica, chlorite and tremolite, medium-grained, pseudo-gritty mortar-structure, crushed.

(S35267) [NG 902 770]. White dolomite with greenish-yellow films. The rock scarcely effervesces with cold dilute HCl. In thin section it is seen to be composed of fractured carbonate fragments with close and often bent twinning, up to 1 mm across, in a matrix of granular clear carbonate of grain-size 0.02 to 0.1 mm. Plates of phlogopite, usually about 0.4 mm long, are numerous and are often concentrated along undulating laminae. The larger carbonate fragments are sometimes replaced spongily by granular carbonate, the detached pieces remaining in optical continuity. Colourless tourmaline is an accessory and is sometimes enclosed in phlogopite. Quartz and small aggregates of kaolin are accessory. No refractive index of carbonate other than that of dolomite was noted in the powdered rock.

Dolomite with phlogopite, fine-grained, pseudo gritty mortar-structure, foliated.

(SL 261) (p. 17) Dolomite. Old quarry 430 yd E. 14° S. of Sheildaig Lodge, Gairloch. 1" Sheet 91; 6" Ross. 56 N.W.

(S35268) [NG 811 724]. A white coarsely crystalline dolomite containing scales of pale brown mica. Composed of interlocking grains of carbonate up to 1.5 mm long and usually slightly elongated in the direction of foliation as shown by

the mica flakes. These are abundant, colourless, almost uniaxial highly birefringent phlogopite. Quartz is an abundant accessory or subordinate constituent and is arranged in lenticular groups of elongated twinned grains in which all the directions of elongation are parallel to the foliation. Colourless tourmaline is an abundant accessory, in stout prisms with rounded terminations, up to 0.5 mm long. The carbonate is locally slightly granulitized. In powder the refractive index of dolomite only was observed.

Dolomite with phlogopite and quartz, medium-grained, foliated.

(SL 262) (p. 18) Dolomite. Old quarry 260 yd N.W. of outflow from Am Feur Loch. 1" Sheet 91; 6" Ross. 57 N.W.

(S35269) [NG 8556 7223]. A pinkish massive dolomite. Composed of equidimensional but irregular fragments of carbonate, greatly cleaved and twinned and irregularly invaded by the matrix, which is of granular carbonate of average 0.05 mm grain diameter. The only other constituents are scarce flakes of phlogopite and streaks of oxidized iron ore with which small scarce aggregates of chlorite are associated. Only dolomite was noted by refractive index tests on the powdered rock.

Dolomite, fine-grained, pseudo gritty mortar structure.

(SL 263) (p. 18) Limestone. 650 yd N. 18° E. of outflow of Lochan Druim na Fearna. 1" Sheet 91; 6" Ross. 57 S.W.

(S35270) [NG 829 710]. A crystalline calcareous dolomite, foliated and with greenish laminae; traversed by pinkish ferruginous streaks and cracks. Composed of interlocking grains of twinned and cleaved dolomite slightly elongated in the direction of foliation, with finely granular calcite on the periphery, in irregular spaces within the dolomite grains and in irregular laminae through the rock. Phlogopite, partly chloritized, tremolite and quartz are subordinate minerals and are elongated in the direction of foliation. Colourless tourmaline and apatite are accessory, and a little rutile is present in small aggregates of irregular deep brown grains. Limonitized iron ore is intergrown locally with mica. The refractive index of dolomite only was seen in the crush and all the fragments tested were uniaxial.

Calcareous dolomite with phlogopite, quartz and tremolite, medium-grained, foliated and strained.

Moine

Inverness

(SL 107) (p. 18). Limestone. Rebeg Quarry. 1" Sheet 83; 6" Inverness. 11 S.W.

(S34586) [NH 563 422]. Coarse, flaggy banded white and grey crystalline limestone. Large grains of twinned calcite are closely interlocked and tend to be elongated parallel to the foliation. Small quartz grains and muscovite flakes are scattered sparsely through the calcite. In bands there is a considerable concentration of tremolite, patched by crocidolite, and phlogopite which are orientated with their long axes parallel to the plane of foliation. Grains of oxidized iron ore and trains of limonitic material occur; there are many small grains of yellow pyrite, and acute lozenges of sphene are accessory.

Limestone with phlogopite and tremolite, coarse-grained, foliated, grano-schistose.

Sutherland

(SL 169) (p 18). Limestone. Shinness Quarry, the Airde, near Lairg. 1" Sheet 102; 6" Sutherland 85 S.E. (*Lst. Scot.,* 1949, p. 192).

(S34852) [NC 47156 14307]. A coarse, grey-white crystalline limestone mottled with greenish calcsilicates. In thin section anhedral grains of calcite up to 5.0 mm in width are seen to interlock with one another and with diopside which forms thick prisms imperfectly developea and up to 6 mm in length. Tremolite is often present as small blades in the diopside and locally forms large prisms with replacing relations to the associated diopside.

Limestone with diopside and tremolite, coarse-grained, porphyroblastic.

(S34853) [NC 47156 14307]. White crystalline limestone. Composed of a mosaic of interlocking grains of calcite up to 6.0 mm across. Tremolite and phlogopite are present in only accessory proportions and rarely reach more than 1.0 mm in length. They lie along the interfaces of calcite grains and are only rarely enclosed in calcite. Apatite and sphene are accessory. *Limestone with phlogopite, coarse-grained, foliated.*

Shetland metamorphic

Shetland

(SL 184) (p. 18). Limestone. S. side of Bay of Fladdabister. 1" Sheet 126; 6" Shetland 59 N.E. (*Lst. Scot.,* 1949, p. 173).

(S34947) [HU 437 324]. A grey crystalline limestone with thin dark seams. Composed essentially of anhedral grains of calcite showing close glide twinning. The grains, which are about 1.0 mm long, interlock, or are cemented by finely granular calcite which is due to trituration by shearing; similar fine calcite cuts through the larger calcite grains and also forms thin parallel seams. Quartz in grains 04–0.2 mm across, and small flakes of muscovite are abundant accessories. A little finely divided opaque mineral is present, the larger grains being recognizable as oxidized iron-ore, probably pyrite. Apatite and tourmaline are accessory.

Limestone with some quartz and muscovite, medium-grained, sheared, granoschistose.

(SL 185) Tingwall Limestone. mile N. of Scalloway. 1" Sheet 126; 6" Shetland (p. 18) 56 N.W. (*Lst. Scot.,* 1949, p. 173).

(S34948) [HU 403 402]. A grey crystalline limestone with occasional micaceous films. Consists essentially of intricately sutured grains of calcite, about 0.5 mm across, together with about 25 per cent of quartz in grains which are usually distributed singly among the calcite but also form small aggregates with or without associated muscovite. Muscovite occurs also in irregular or streaky aggregates, with some, of which red biotite and alkali-feldspar are associated. A little dolomite is present in rhombs about 2 mm across. Pyrite, rutile and opaque mineral dust are common accessories; tourmaline is scarce.

Limestone, dolomitic, with quartz, muscovite, biotite and pyrite, medium-grained, foliated, heteroblastic.

(SL 186) (p. 19) Tingwall Limestone. Quarry, E. side of road 1 mile N.N.E. of Scalloway. 1" Sheet 126; 6" Shetland 52 S.E. (*Lst. Scot.,* 1949, p. 173).

(S34949) [HU 410 411]–(S34950) [HU 410 411]. A grey crystalline limestone: (S34949) [HU 410 411] shows a lamination in shades of grey and (S34950) [HU 410 411] is thinly flaggy. The rock is composed of anhedral interlocking grains of twinned calcite, with thin laminae of muscovite, or muscovite-graphite-schist. These laminae have been cut into schlieren by the flowage of calcite and show internal schistosity differing in direction from the parallel arrangement of the schlieren. Quartz is sparsely distributed among the calcite and graphite is disseminated on the grain surfaces in the calcite bands. Pyrite is accessory; apatite scarce.

(S34949) [HU 410 411] *Limestone with quartz and graphite-schist, medium-grained, foliated, heteroblastic.*

(S34950) [HU 410 411] *Limestone with graphite, quartz and pyrite, fine-grained, sheared.*

(SL 187) (p. 19) Tingwall Limestone. Girlsta Quarry, near shore of Wadbister Voe. 1" Sheet 128; 6" Shetland 48 N.E. (*Lst. Scot.,* 1949, pp. 173–4).

(S34951) [HU 429 509]. A pale grey, fine-grained crystalline limestone. The rock is composed of interlocking grains of calcite 0.5 mm across, which show glide twinning and a little peripheral granulation. Quartz is abundant, about 5–10 per cent by volume, in small grains, and occurs also as larger grains in quartz-clinochlore aggregates. Muscovite is in places a subordinate mineral and elsewhere is only accessory. Pyrite is accessory.

Limestone with quartz, chlorite and muscovite, medium-grained, grano-blastic, foliated.

(SL 188) Whiteness Limestone. W. of Whiteness Quarry, W. side of Loch of Strom. (p. 19) 1" Sheet 128; 6" Shetland 48 S.W. (*Lst. Scot.,* 1949, p. 173).

(S34952) [HU 393 476]. Coarse crystalline limestone. Composed of interlocking grains of calcite, 0.2 to fully 1 mm across, with subordinate quartz which tends to occur in more or less parallel, widely spaced streaks and clots of grains individually 0.2–0.5 mm across. A little pyrite, rutile and opaque mineral dust are present and muscovite is in places an abundant accessory.

Limestone with quartz, medium-grained, granoblastic.

(SL 189) (p. 19) Weisdale Limestone. Quarry on W. side of road half a mile S. of Flemington. 1" Sheet 128; 6" Shetland 43 S.W. (*Lst. Scot.,* 1949, p. 174).

(S34953) [HU 392 538]. A massive, pale grey, siliceous fine-grained, crystalline limestone. Composed of equidimensional grains of calcite, 0.5 mm across, with quartz occurring in interstitial aggregates of small grains, 0–1-0.2 mm across, and forming about 30 per cent by volume of the rock. Pyrite and muscovite are abundant. Zircon, rutile, tourmaline and apatite are accessory.

Limestone with quartz, muscovite and pyrite, medium-grained, hetero-blastic.

(SL 190) (p. 19) Weisdale Limestone. Sursetter, 1 ½ miles N. of Voe. 1" Sheet 128; 6" Shetland 37 N.E. (*Lst. Scot.,* 1949, p. 174).

(S34954) [HU 411 655]. A moderately coarse-grained, white, crystalline limestone. It is composed of coarsely sutured grains of calcite, about 1 mm long, which tend to be elongated in a direction of rather poor schistosity defined by a general parallel orientation of muscovite. The latter is a subordinate essential constituent forming flakes approaching, and rarely exceeding, 1 mm in length. A minor quantity of oligoclase and quartz is present, generally in association with muscovite. Prismatic zoisite, tremolite and a fibrous aggregate which develops into micaceous flakes, are minor essential constituents. Zoisite and muscovite form symplectitic intergrowths with quartz. Colourless tourmaline in small hexagonal prisms, leucoxene, pyrite and pyrrhotite are abundant; apatite, sphene and zircon are scarce accessories.

Limestone with zoisite and muscovite, medium-grained, granoschistose, porphyroblastic, foliated.

(SL 191) (p. 19) Limestone. 300 yd S. of Loch of Burraland, Sullom, 4 miles N. of Brae, North Maven. 1" Sheet 130; 6" Shetland 24 S.E. (*Lst. Scot.,* 1949, p. 175).

(S34955) [HU 344 744]. A grey, fractured, crystalline limestone. Composed of strained calcite in grains 0.5–1.5 mm across, traversed by narrow shear zones in which calcite is triturated, and along which muscovite and chlorite are abundant. Yellow tourmaline occurs along thin shear-zones in good prisms, which have been fractured by later movement. Oxidized pyrite occurs mainly in or near shear-lines.

Limestone with muscovite-chlorite-schist folia, coarse to medium-grained, granoblastic, foliated.

Dalradian

Ballachulish Limestone

Inverness

(SL 85) (p. 20) Ballachulish Limestone. Old Quarry, Creag Aoil, Torlundy. 1" Sheet 62; 6" Inverness. 140 S.W. (*Lst. Scot.,* 1949, p. 113).

(S34480) [NN 1800 7763]. Recrystallized limestone composed of interlocking grains (0.4 — 3mm) of closely twinned calcite, abundant accessory quartz forming small (0.1mm) grains enclosed in calcite, and accessory biotite and muscovite.

Limestone with some quartz, coarse-grained, granoblastic, slightly sheared.

(SL 229) (p. 20) Ballachulish Limestone. Quarry, 300 yd N.N.W. of Tom an Aoil, Spean Bridge. 1" Sheet 62; 6" Inverness. 141 N.W. (*Lst. Scot.,* 1949, p. 113).

(S35178) [NN 2492 8244]. A grey, crystalline limestone. Composed of a mosaic of equidimensional grains of closely twinned calcite, 0.4–1.0 mm across, between which small idioblastic quartz grains, about 0.1 mm across, are scattered. The quartz grains occasionally appear within the calcite grains. Mineral dust and granules of pyrite, rutile and possibly graphite granules are peppered sparsely and uniformly through the rock.

Limestone with some quartz, medium-grained, granoblastic.

(SL 230) (p. 20) Ballachulish Limestone. S. bank of R. Spean, 350 yd above railway bridge, Spean Bridge. 1" Sheet 62; 6" Inverness. 141 N.W. (*Lst. Scot.,* 1949, p. 113).

(S35179) [NN 2418 8157]. Grey crystalline limestone. Composed of granular calcite of average grain 0.7 mm, which is greatly twinned. Small quartz and feldspar grains, up to 0.1 mm across and of irregular but occasionally idio-blastic form, are scattered in small quantity between and within the calcite grains. Tiny opaque granules including pyrite are dusted irregularly through the calcite mosaic.

Limestone with some quartz, medium-grained, granoblastic.

Appin Limestone

Argyll

(SL 86) (p. 20) Appin Limestone. Marble quarry, Gleann an Fhiodh, Ballachulish. 1" Sheet 53; 6" Argyll. 30 S.E.

(S34481) [NN 0837 5720]. Fine-grained quartz-albite-granulite, with abundant calcite, accessory dolomite, rutile, apatite and muscovite. The portion from which the rock section has been made is much poorer in lime than is shown by chemical analysis from the bulk of the rock.

Calcareous quartz-albite-granulite.

(SL 87) (p. 20) Appin Limestone. Crag S. of road bend, E. of Duror station. 1" Sheet 53; 6" Argyll. 43 S.E. (*Lst. Scot.,* 1941, p. 56).

(S34482) [NM 9832 5421]. Granular dolomite of fine grain, 0.05 to 0.1 mm, containing subordinate quartz and albite-oligoclase, which are abundant in streaks, and accessory muscovite and pyrite.

Dolomite with quartz, feldspar and muscovite, varigrained, foliated and grain-foliated.

Inverness

(SL 35) (p. 20) Appin Limestone. Onich Limestone Quarry, North Ballachulish. 1" Sheet 53; 6" Inverness. 166 N.W.

Sample of crushed lime.

Lismore Limestone

Argyll

(SL 88) (p. 21) Lismore Limestone. Quarry just N. of Port Ramsay. 1" Sheet 45; 6" Argyll. 56 S.E. (*Lst. Scot.,* 1949, p. 56).

(S34483) [NM 8844 4558]. A dark grey, rudely flaggy limestone with a set of rectangular narrow calcite veins normal to the flag. Composed essentially of elongated grains of calcite darkened with dust, possibly graphitic, and containing subordinate alkali-feldspar and quartz. The calcite is of varying grain-size reaching 0.5 mm in length and is elongated parallel to the flagginess. A subordinate proportion of the calcite shows biaxiality. Apatite and tourmaline are accessory. Pyrite is common in euhedral crystals reaching 2 mm across.

Limestone, fine-grained, granoschistose.

Islay Limestone

Argyll

(SL 129) (p. 21) Islay Limestone. Leorin Quarry, 2■ miles N. by W. of Port Ellen, Islay. 1" Sheet 19; 6" Argyll. 231 N.E. (*Lst. Scot.,* 1949, p. 57).

(S34577) [NR 354 485]. Grey fine-grained limestone, laminated and cut by lines of calcite. Composed of schistose granular calcite, 0.05 mm grain, the schistosity being marked by elongation of the calcite grains, by trains of opaque dark mineral matter and by occasional elongated grains of quartz. Laminae of coarser granular calcite, 0.3 mm grain, appear parallel to the schistosity and show ellipsoidal swellings which occasionally contain large turbid grains of calcite with undulose extinction. These coarser laminae pass without change of the type of calcite into cross-cutting veins. Granular quartz occurs in the coarser laminae and idiomorplaic quartz in the veins. It seems likely that the coarse laminae were recrystallized at the time of the cross-cutting veins by permeation of the solutions along lines of weakness, perhaps produced by the presence of relict augen of coarser calcite.

Limestone, fine-grained, granoschistose, grain-foliated.

(SL 130) (p. 21) Islay Limestone. Lower Cragabus Quarry, 2¼ miles W. of Port Ellen, Islay. 1" Sheet 19; 6" Argyll. 231 S.E. (*Lst Scot.,* 1949, p. 57; where the reference number is misprinted as (SL 100)).

(S34578) [NR 329 452]. Fine-grained, grey crystalline limestone. Composed of granular calcite of irregular shape and size ranging from 0.01 to 0.4 mm and often with diffuse boundaries between neighbouring grains. Bedding is roughly marked by slightly greater and less concentration of opaque, black finely divided material which is mainly soluble in strong HCl and therefore must be largely iron oxides or sulphides. The insoluble residue consists mainly of quartz with an impregnation of black dust.

Limestone, fine-grained, grain-foliated.

(SL 131) (p. 21) Islay Limestone. Islay Estates Quarry, Bridgend, Islay. 1" Sheet 27; 6" Argyll. 208 N.E. (*Lst. Scot.,* 1949, p. 57).

(S34579) [NR 347 632]. Pale grey, compact crystalline limestone, cut by thin calcite veins. Composed of elongated grains of calcite 0.2 to 0.6 mm, with marked parallel orientation. Thin veins of coarser calcite cut across the schistosity. The vein calcite is intercrystallized with the rock calcite. A little opaque material, mainly pyrite, and some quartz are dusted through the rock.

Limestone, fine-grained, granoschistose.

(SL 132) (p. 21) Islay Limestone. In angle of main road and Persabus road, ¾ mile W.S.W. of Port Askaig. 1" Sheet 27; 6" Argyll. 198 N.E. (*Lst. Scot.,* 1949, p. 57).

(S34580) [NR 420 688]. Grey compact and crystalline banded limestone which seems to have a poor cleavage at a low angle to the banding. Numerous patches and wisps, often contorted but with a general parallel orientation, of dark, very

fine-grained limestone in a recrystallized granular base of calcite, illustrate palimpsest structure. The grain of the base is about 0.03–04 mm and small crystals of albite, about 0.1 mm across, are scattered through it. Small crystals and grains of pyrite appear in both the dark patches and the base.

Limestone, fine-grained foliated, palimpsest.

Tayvallich Limestones

Argyll

(SL 123) (p. 21) Tayvallich Limestone. Roadside quarry, 1 mile N. of Kilchrenan. 1" Sheet 45; 6" Argyll. 112 N.E. (*Lst. Scot.,* 1949, p. 55).

(S34571) [NN 0384 2447]. Grey limestone, laminated lighter and darker grey. Composed of calcite, subordinate quartz and micaceous carbonaceous films. The quartz is mostly in large composite grains, or aggregates of smaller grains, associated with granular calcite of about 1.0 mm grain-size. The quartz and this type of calcite, which is brownish and highly cleaved, form ellipsoidal nodules, or less regular lenticular aggregates round which sweep laminae composed of more fine-grained calcite, about 0.1 mm grain size, and streaked with carbonaceous matter. Small grains of quartz occur also in this matrix.

Limestone with quartz, coarse to fine-grained, granoschistose and grain-foliated.

(SL 125) (p. 22) Tayvallich Limestone. Quarry 270 yd S.E. of Baluachraig, 1¼ miles S. by W. of Kilmartin. 1" Sheet 36; 6" Argyll. 149 S.E. (*Lst. Scot.,* 1949, p. 55).

(S34573) [NR 8336 9685]. Dark grey, moderately crystalline limestone, containing numerous pebbles of vitreous quartz, pink feldspar and dark red material. In section, irregular areas of brownish oolite are seen to pass into a mosaic of clearer recrystallized calcite. Grains and aggregates of quartz and rounded crystals of microcline reaching 3.0 mm in length are numerous. The dark red pebbles appear to be microcline with much haematitic impregnation. The quartz probably originated as pebble grains, but shows considerable recrystallization. This can be observed as rims of regrowth, the old outline being marked by a zone of fine mineral matter, by intercrystallization of the grains among the new calcite and by partial inclusion of broken ooliths in quartz. The feldspars appear to have been pebbles in the oolitic limestone but are now bordered by a thin zone of recrystallized calcite where contact with oolitic rock would be expected. It may be invaded by calcite tongues and permeation aggregates of limonite and calcite. A little muscovite and albite, probably detrital, are present. Carbonaceous granules are disseminated in parts of the oolitic rock, trains of them being cut off against recrystallized calcite. Carbonaceous matter also occurs in streaks along small and irregular slip traces.

Limestone with pebbly quartz and microcline, blastopsephitic, blasto-oolitic.

(SL 126) (p. 22) Tayvallich Limestone. Fincharn Quarry, at S. end of Loch Awe. 1" Sheet 37; 6" Argyll. 139 N.W. (*Lst. Scot.,* 1949, p. 55).

(S34574) [NM 8988 0380]. Dark grey sparkling limestone, of medium grain, containing small aggregates of white calcite. Composed of granular dusty calcite, 0.4 mm grain, partially recrystallized to clear calcite, forming lenticular aggregates in a finer-grained rock, of mixed dusty and clear calcite grains 0.1 mm, showing foliation which curves round the lenticles. The foliation is shown by elongation of grains and by alternation of coarser and finer laminae with streaks of carbonaceous matter. Quartz occurs as an essential but subordinate constituent, as large grains partly recrystallized along with calcite, sometimes showing regrowth rims, partly as lenticular aggregates of smaller grains, and to a subordinate extent interstitial in the coarser dusty limestone.

Limestone with some quartz, grain foliated and granoschistose.

(SL 127) (p. 22) Tayvallich Limestone. Quarry E. of Eurach, near Ford. 1" Sheet 37; 6" Argyll. 138 S.E.

(S34575) [NM 8523 0085]. Dark grey, fine-grained crystalline limestone. The section shows irregular, diffuse relics of very fine-grained black-powdered limestone, in a recrystallized base of granular brownish calcite, among which small grains and aggregates of quartz are scattered. The form of the quartz indicates recrystallization. Black dust, graphitic or carbonaceous, and granules are distributed through the recrystallized calcite. One recrystallized oolith was observed and in one place the rock is oophasmic.

Limestone with some quartz, varigrained, partly granoblastic, oophasmic.

(SL 133) (p. 22) Tayvallich Limestone. Cairnban Locks, Crinan Canal. 1" Sheet 36;6" Argyll. 160 N.E.

(S34581) [NR 8397 9086]. Moderately coarse, pale grey, crystalline, gritty limestone, abundantly speckled with dark vitreous quartz grains. Composed of granular calcite forming a schistose matrix to numerous quartz and feldspar pebbles. Schistosity is marked by elongation of many calcite grains (up to 0.5 mm in length) and by streaks of dark matter, possibly carbonaceous. The pebbles include quartz, strained quartzite or composite quartz-blebs from granite, microcline, albite, perthite, and micro-pegmatite from granophyre. The quartz shows marginal granulitization and the margins, where not granulitized, are intercrystallized with the calcite. Much granulitic quartz among the calcite is evidently a crystallization of the same period as the latter. An albite pebble shows marginal regrowth. A little white mica is associated with feldspar.

Limestone with quartz and feldspar, blastopsephitic, granoblastic to granoschistose.

Shira Limestone

Argyll

(SL 124) (p. 22) Shira Limestone. Turnalt Quarry. 1" Sheet 36; 6" Argyll. 130 S.E. (*Lst. Scot.,* 1949, p. 55).

(S34572) [NM 8436 0856]. Dull grey, compact, but irregularly jointed limestone. Composed of granular calcite (0.05–0.14mm grain-size) and subordinate quartz and water-clear alkali-feldspar (0.1 mm grain). The grains have a tendency to be elongated parallel to a plane not recognizable in hand specimen. All minerals are recrystallized, but not to a high degree. Calcite-filled cracks cut steeply across the direction of elongation. Some thin streaks of turbid amorphous materials are present.

Limestone with quartz and feldspar, fine-grained, granoschistose.

Loch Tay Limestone

Argyll

(SL 128) (p. 22) Loch Tay Limestone. Askomill Quarry, ½ mile E.N.E. of Campbeltown. 1" Sheet 12; 6" Argyll. 258 N.W. (*Lst. Scot.,* 1949, p. 54).

(S34576) [NR 734 211]. Banded coarse- and fine-grained limestone. The coarse bands which show curved cleavage surfaces of blackish clacite are in thin section composed of large irregular grains of calcite with patchy and undulose extinction. The finer-grained bands are composed of grains of calcite of irregular size and shape, very numerous clear and dust-impregnated grains of albite, 0.1 mm, and abundant opaque granular material sometimes recognizable as pyrite. Quartz and potash-feldspar are also present. Scattered grains of feldspar and opaque granules occur also in the coarse-grained bands. The black residue from digestion in concentrated HCl is mainly dust-impregnated albite and shapeless black grains, many of which are pyrite. On prolonged roasting in a crucible the residue becomes pale grey and the discharge of colour indicates that much carbon is present.

Limestone with albite, foliated and grain-foliated, heteroblastic.

(SL 134) (p. 23) Loch Tay Limestone. 400 yd S.W. of Glensluan Cottage, 1 mile S. of Strachur. 1" Sheet 37; 6" Argyll. 141 S.W. (*Lst. Scot.,* 1949, p. 54).

(S34582) [NS 0926 9944]. Grey crystalline sparkling limestone. Composed of elongated twinned and cleaved grains of calcite 1.0 mm and over in length, of lens shape and arranged with the long axes in one plane. Small grains and aggregates of quartz, 0.5 mm across, and flakes of muscovite, sometimes with bent detrital appearance, are numerous and plagioclase feldspar grains are scarce. Opaque grains and granules of pyrite and probably carbon are numerous.

Limestone with quartz and muscovite, medium-grained, granoschistose.

(SL 147) (p. 23) Loch Tay Limestone. Quarry 1300 yd E. by S. of Ronachan House, West Loch Tarbert. 1" Sheet 20; 6" Argyll. 224 N.W. (*Lst. Scot.,* 1949, p. 54).

(S34649) [NR 7553 5499]. Sparkling grey medium-grained limestone. Composed of granular calcite of varying grain up to 2 mm, with scattered small quartz and albite grains and muscovite flakes. Some less limy bands are corn-posed of granulitic quartz and albite and irregularly prismatic crystals of clinozoisite cemented by granular calcite. The clinozoisite is charged with black powder (possibly carbon) and encloses also grains of pyrite. Pyrite occurs in large irregular grains, particularly in the quartz-feldspar bands of the rock, but is also present in small grains in the pure carbonate.

Limestone with quartz, albite, muscovite and clinozoisite, heteroblastic, foliated.

GS2 (p. 23) Loch Tay Limestone. 750 yd N. of Glendaruel House. 1" Sheet 29; 6" Argyll. 162 S.W. (*Lst. Scot.,* 1949, p. 54). (Anal. G. A. Sergeant).

(S35996) [NR 999 877]. Marmorized limestone with white mica, quartz and albite. Composed of elongated crystals of calcite, granulitized and arranged with their long axes parallel, and showing composite lamellar twinning; grain-size varying from 0.5–1.0 mm. The white mica occurs in"flakes up to 0.4 mm long, either distributed among the calcite or concentrated into streaks and bands. Quartz and albite reaching 0.5 mm in size but generally about 0.2 mm across, are abundant. Graphite is associated with muscovite and albite. Iron ore occurs fairly plentifully in aggregates or fine disseminations as pyrite, or oxidized to limonite or leucoxene.

Limestone with quartz, albite and muscovite, granoschistose, foliated.

Perth

SL 1 (p. 23) Loch Tay Limestone. Old quarry 550 yd W. of Dalveich Farm, Loch Earn. 1" Sheet 46; 6" Perth. 92 N.W. *(Lst. Scot.,*1949, pp. 155–6).

(S34426) [NN 609 202]. Dark grey, saccharoidal, crystalne limestone with broadly spaced micaceous laminae. Composed of twinned calcite grains up to 1.5 mm long, subordinate quartz, accessory graphite, iron ore (probably pyrite), colourless and pale brown micas and occasional large plates and small particle-filled grains of albite-oligoclase. Trains of graphite and elongation of calcite grains show some degree of schistosity.

Limestone with quartz, albite and micas, heteroblastic, granoschistose.

(S34427) [NN 609 242]. Dark grey and white mottled schistose limestone with micaceous partings producing a thinly flaggy fracture. Composed of elongated grains of calcite, up to 3 mm long, sieved with quartz, albite and opaque granules, foliated with granoblastic, clean calcite of about 0.5 mm grain. Quartz and albite are abundant along laminae of white mica. Some pyrite is present, and possibly graphite also.

Limestone with quartz, albite and muscovite, granoschistose, heteroblastic, grain-foliated.

SL 2 (p. 23) Loch Tay Limestone. Old quarry above Craignavie, ¾ mile W.S.W. of Bridge of Dochart, Killin. 1" Sheet 46; 6" Perth. 80 N.W. (*Lst. Scot.,* 1949, p. 155).

(S34428) [NN 559 321]. Pale grey, saccharoidal limestones composed of moderately coarsely granular twinned calcite, 0.5–1.0 mm grain, abundant quartz, albite, white and brown mica, graphite and iron ore (pyrite).

Limestone with quartz, albite and muscovite, medium-grained, grano-blastic.

SL 3 (p. 23) Loch Tay Limestone. East face, Dunbeag, Killin. 1" Sheet 46; 6" Perth. 80 N.W. (*Lst. Scot.,* 1949, p. 155).

(S34429) [NN 569 334]. Grey crystalline limestone composed of grains of closely twinned calcite, 2 to 0.5 mm grain, subordinate quartz and alkali-feldspars in nests with which graphite is associated. Zoisite is present locally, yellowish mica and a serpentinous mineral are accessory. One large grain, 1 mm across, of alkali-feldspar occurs in the slice and there is some pyrite and a little limonite.

Limestone with quartz, albite, muscovite and zoisite, medium-grained, heteroblastic.

SL 5 (p. 24) Loch Tay Limestone. Quarry at back of Clunie Cottage, 1 mile W. of Pitlochry. 1" Sheet 55; 6" Perth. 40 N.W. (*Lst. Scot.,* 1949, p. 155)

(S34431) [NN 921 581]. Grey crystalline limestone with micaceous partings; composed of equigranular calcite, 1 mm grain, and subordinate quartz, oligoclase and white mica. Accessory pyrite, a prismatic mineral which is probably zoisite, sphene and possibly some graphite are present. *Limestone with quartz, oligoclase and muscovite, medium-grained, heteroblastic.*

(SL 137) (p. 24) Loch Tay Limestone. Quarry, West Craig of Soilzarie, 3 miles E. of Kirkmichael. 1" Sheet 56; 6" Perth. 33 S.W. (*Lst. Scot.,* 1949, p. 154).

(S34623) [NO 115 598]. Pale bluish-grey, crystalline limestone. Composed of interlocking grains of twinned calcite (0.5–2.0 mm) with a small quantity of iron-stained chloritic material, and grains of quartz and albite scattered sparsely through the rock. Black granules, possibly of iron ore, are disseminated uniformly, but in small quantity.

Limestone, medium to coarse-grained, granoblastic.

(SL 138) (p. 24) Loch Tay Limestone. 1250 yd E. by S. of Dunie, 1 mile S.E. of Kirkmichael. 1" Sheet 56; 6" Perth. 32 S.E. (*Lst. Scot.,* 1949, p. 154)

(S34624) [NO 111 588]. Pale bluish-grey medium-grained limestone, discoloured along some bands by yellowish oxidized iron ore. Composed of interlocking grains of calcite (0.3–1.0 mm) among which a few quartz and albite grains (probably recrystallized) are distributed. Specks of black material are abundantly disseminated and are aggregated in scattered clots along with limonite and yellowish isotropic chloritic material. Flakes of muscovite and grains and prisms of apatite are accessory.

Limestone, medium-grained, granoblastic.

Blair Atholl Limestone

Perth

SL 4 (p. 24) Blair Atholl Limestone. Quarry north of White Bridge, 3 ½ miles S. by E. of Tummel Bridge. 1" Sheet 55; 6" Perth. 38 S.E. (*Lst. Scot.,* 1949, p. 158).

(S34430) [NN 776 541]. Bluish-grey schistose limestone of fine grain with abundant quartz and mica. Schistosity is marked by the elongation of closely twinned calcite and the attitude of mica flakes, and quartz, alkali-feldspar and white mica are concentrated in lenticles parallel to this direction. The calcite grains reach 3 mm in length by 0.8 mm width. The feldspar is turbid and is probably albite. Some pyrite, a little sphene and apatite and possibly graphite are also present.

Limestone with quartz, alkali feldspar and muscovite, coarse-grained, granoschistose, foliated.

(SL 11) (p. 24) Blair Atholl Limestone. Upper Strathgroy Quarry, 11 miles E. of Blair Atholl. 1" Sheet 55; 6" Perth. 21 S.E. (*Lst. Scot.,* 1949, p. 158).

(S34497) [NN 891 665]. A dove-grey, medium-grained limestone composed of interlocking grains of closely twinned calcite, about 1 mm grain-size, containing numerous small grains of quartz, 0.1 mm across, at the junctions of the calcite grains. Phlogopite, zoisite and sphene are accessory.

Limestone with quartz and cak-silicates, medium-grained, granoblastic.

(SL 12) (p. 24) Blair Atholl Limestone. 480 yd S.S.W. of Shierglass, 1 mile S.E. of Blair Atholl. 1" Sheet 55; 6" Perth. 30 N.E. (*Lst. Scot.,* 1949, p. 157)

(S34498) [NN 880 642]. A dove-grey, medium-grained limestone composed of interlocking grains of closely-twinned calcite of varying size (about 0.25–1.0 mm) with a little colourless mica, quartz and scarce turbid alkali-feldspar; accessory pyrite, graphite, limonite, and sphene.

Limestone with quartz and muscovite, medium-grained, granoblastic.

(SL 139) (p. 25) Blair Atholl Limestone. Gleann Beag ■ mile S.S.W. of Devil's Elbow.1" Sheet 65; 6" Perth. 15 N.W. (*Lst. Scot.,* 1949, p. 157).

(S34625) [NO 139 756]. Dove-grey limestone of medium grain. Composed of interlocking grains of twinned calcite (0.5–1.5 mm) arranged with slight elongation parallel to a single plane. Grains of quartz, often containing many black granules, and flakes of muscovite are uniformly but not very abundantly scattered through the rock. A few grains and many small granules of ore are disseminated throughout.

Limestone with some quartz and muscovite, medium-grained, granoblastic.

Limestone, Sandend Group

Aberdeen

(SL 71) (p. 25) Limestone, Sandend Group. Blackhillock Quarry, ¾ mile S. of Coachford and about 5 miles N.W. of Huntly. 1" Sheet 86; 6" Aberdeen. 16 S.E. (*Lst. Scot.,* 1949, p. 48).

(S34511) [NJ 4591 4482]. Grey crystalline limestone with dark micaceous partings. Composed of twinned granular calcite in interdigitating grains of varying size, 0.1 to 2 mm, the larger being elongated along the schistosity. Quartz, muscovite and chlorite are subordinate, and opacite including pyrite, leucoxene and perhaps graphite, accessory. The quartz is distributed as individual grains and as lenticles, the other constituents usually in contorted films swelling in places to small nests.

Limestone with quartz, muscovite and chlorite, medium-grained, grano-schistose, foliated.

Banff

(SL 68) (p. 25) Limestone, Sandend Group. Blackhillock Quarry, 1½ miles S. by E. of. Keith. 1" Sheet 85; 6" Banff. 20 N.W. (*Lst. Scot.,* 1949, p. 79)

(S34508) [NJ 439 482]. Mottled grey and white crystalline limestone, composed of large grains of calcite, 1 to 2 mm across, curvedly twinned. Quartz is accessory, and muscovite and opaque dust are scarce.

Limestone with quartz, coarse-grained, granoblastic, strained.

(SL 70) Limestone, Sandend Group. Parkmore Quarry, ¾ mile N.E. of Dufftown. (p. 25) 1" Sheet 85; 6" Banff. 25 N.W. (*Lst. Scot.,* 1949, p. 80).

(S34510) [NJ 3325 4078]. Pale grey crystalline limestone, with veins of coarse white, curvedly twinned calcite. Composed of sutured and locally granulitized grains of calcite with close curved twinning, 0.5–2 mm grain, traversed by lines of granulation. Quartz, muscovite and opaque, black, white and yellow granules are accessory.

Limestone with quartz, coarse-grained, granoblastic, strained.

(SL 72) (p. 25) Limestone, Sandend Group. Hillockhead Quarry, 2 ½ miles W. by S. of Keith. 1" Sheet 85; 6" Banff. 13 S.E. (*Lst. Scot.,* 1949, p. 78)

(S34512) [NJ 3915 4989]. Dove-grey, medium-grained crystalline limestone composed of interlocking grains of closely twinned calcite, 0.5 to 2 mm grain, with numerous small quartz grains at the junctions of the calcite grains. Locally large grains of quartz are elongated along the foliation. Muscovite is a subordinate mineral. Sphene, apatite and graphite are accessory; zoistic epidote is present in some laminae.

Limestone with quartz, muscovite and zoisite, coarse-grained, granoblastic, foliated.

(SL 73) (p. 25) Limestone, Sandend Group. Drumrnuir Quarry, 1¼ miles N.N.E. of Drummuir station. 1" Sheet 85; 6" Banff. 19 S.E. (*Lst. Scot.,* 1949, p. 79).

(S34513) [NJ 3895 4625]. Pale grey crystalline limestone, with thin veins of calcite. It is composed of curvedly twinned calcite of grain 0.5 to 3 mm, which is recrystallized in small clear grains along narrow fracture zones. Quartz is accessory.

Limestone, coarse-grained, granoblastic, strained.

(SL 74) (p. 26) Limestone, Sandend Group. Craibstone Quarry, 12 miles S. of Kirkton of Deskford. 1" Sheet 96; 6" Banff. 8 N.E. (*Lst. Scot.,* 1949, p. 78)

(S34514) [NJ 4965 5915]. Mottled grey and white limestone with wavy, dark laminae. It is composed of brecciated sheared limestone, recemented by vein calcite, in which quartz is present in small quantity and muscovite accessory. Graphite is present in the dark laminae.

Limestone with some quartz, sheared.

(SL 76) (p. 26) Limestone, Sandend Group. Craig Chailceach (Craighaulkie) Quarry 1 mile W.N.W. of Tomintoul. 1" Sheet 75; 6" Banff. 40 S.W. (*Lst., Scot.,* 1949, p. 80).

(S34516) [NJ 153 193]. Grey medium-grained crystalline limestone composed of interlocking grains of calcite, about 1.5 mm across, with abundant accessory quartz in small grains, 0.05 mm diameter. Muscovite, pyrite, black opaque granules and sphene are accessory.

Limestone with quartz, medium-grained, heteroblastic.

(SL 75) (p. 26) Limestone, Sandend Group. Quarry, Rinaitin, Glen Rinnes. 1" Sheet 85; 6" Banff. 30 S.E. (*Lst. Scot.,* 1949, p. 80).

(S34515) [NJ 263 328]. Banded pale and dark grey, crystalline limestone with micaceous films. Composed of elongated grains of calcite, up to 3 mm in length, showing a close, curved twinning and traversed by fracture veins in which both calcite and dolomite are present. Quartz is accessory as small grains enclosed in calcite. In the darker bands the calcite grains are enveloped by black graphitic and pyritous dust. Micas, partly chloritized, are present but scarce.

Limestone, dolomitic, with some quartz, granoschistose, sheared.

(SL 238) (p. 26) Limestone, Sandend Group. Glenisla Quarry, Keith. 1" Sheet 85; 6" Banff. 14 S.W. (*Lst. Scot.,* 1949, p. 78).

(S35271) [NJ 426 503]. Grey foliated crystalline limestone of medium grain. The twinned interlocking calcite grains of which the rock is composed are elongated in the plane of foliation and reach 4 mm in length. Quartz is present as a subordinate mineral and forms grains, often with crystal faces, usually about 0.3 mm but up to 0.5 mm across. The content of quartz is about 5–7 per cent, but is variable. Opaque black and yellow granular matter is also present and is certainly in part pyrite, but perhaps includes graphite. Muscovite and phlogopite are accessory; alkali-feldspar scarce.

Limestone with quartz and micas, coarse-grained, granoschistose.

(SL 239) (p. 26) Limestone, Sandend Group. Richmond Quarry, Dufftown. 1" Sheet 85; 6" Banff. 25 S.W. (*Lst. Scot.,* 1949, p. 80).

(S35272) [NJ 3315 3965]. Grey crystalline limestone, composed of closely twinned interlocking and often sutured grains of calcite, about 1.5 mm across, and subordinate quartz forming not more than 5 per cent, except in small pockets. The quartz grains reach up to 01 mm across. There are a little accessory opaque dust and scarce drops of sphene.

Limestone with quartz, coarse grained, granoblastic.

Limestone, Portsoy Group

Aberdeen

(SL 240) (p. 26) Limestone, Portsoy Group. Broadland Quarry, between Drumdelgie and Broadland, 3¼ miles W.N.W. of Huntly. 1" Sheet 86; 6" Aberdeen. 25 N.E. (*Lst. Scot.,* 1949, p. 48).

(S35273) [NJ 4797 4167]. Dark grey crystalline limestone, composed of calcite of varying grain, ranging from 3.0–0.5 mm across, and elongated in the foliation planes, with rather intricate interlocking between the calcite grains and between calcite and quartz. Quartz is present in subordinate amount (fully 5 per cent by eye estimation), in grains ranging from 0.5 to fully 2.0 mm in length. The large grains are intergrown with calcite. Phlogopite and opaque grains, which include pyrite, are abundant accessories.

Limestone with quartz, coarse- to medium-grained, granoschistose and grain-foliated.

Banff

(SL 67)Limestone, Portsoy Group. Limehillock Quarry, 11 miles N.E. of Grange (p. 27) station. 1" Sheet 86; 6" Banff. 15 S.W. (*Lst. Scot.,* 1949, p. 80)

(S34507) [NJ 5150 5181]. Dove-grey crystalline limestone, composed of equidimensional, 0.5 to 1 mm, grains of calcite, which are closely twinned. Quartz and muscovite are minor minerals, and pyrite and black granules accessory.

Limestone with quartz and muscovite, heteroblastic.

Boyne Limestone

Banff

(SL 69) (p. 27) Boyne Limestone. Boyne Bay Quarry, 1½ miles E. of Portsoy. 1" Sheet 96; 6" Banff. 4 N.W. (*Lst. Scot.,* 1949, p. 81).

(S34509) [NJ 6140 6610]. Grey-white crystalline limestone with dark laminae. Composed of granular twinned calcite, average grain 1 mm, with scarce accessory quartz and muscovite.

Limestone, granoblastic.

Deeside Limestone

Aberdeen

(SL 77) (p. 27) Deeside Limestone. Deecastle Quarry, ¼ mile N.E. of Deecastle, 5½ miles W. of Aboyne. 1" Sheet 66; 6" Aberdeen. 92 N.E. (*Lst. Scot.,* 1949, p. 47).

(S34517) [NO 4402 9692]. A banded, contact-altered calc-silicate rock composed of wollastonite, diopside, oligoclase, zoisite, epidote, prehnite and sphene.

Wollastonite-rock.

(SL 78) (p. 27) Deeside Limestone. Mains of Midstrath Quarry, 4 ½ miles E.S.E. of Aboyne. 1" Sheet 66; 6" Aberdeen. 93 N.E. (*Lst. Scot.,* 1949, p. 47)

(S34518) [NO 5890 9520]. Crystalline limestone composed of calcite, average grain 1.5 mm, with a subordinate, but considerable, content of calcic scapolite, diopside, orthoclase, albite and accessory tremolite, sphene, apatite and partly oxidized pyrite.

Limestone with scapolite, diopside and feldspars, coarse-grained, granoblastic.

(SL 79) (p. 27) Deeside Limestone. Gallowhill Wood Quarry. 1" Sheet 66; 6" Aberdeen. 93 N.B.

(S34519) [NO 5757 9607]. Crystalline limestone composed of calcite, 0.5 to 1 mm grain, with subordinate scapolite (mizzonite) diopside and orthoclase; accessory sphene, tremolite and iron ore.

Limestone with scapolite, diopside and feldspars, medium-grained, granoblastic.

Kincardine

(SL 80)Deeside Limestone. Woodhead Quarry, 300 yd S. of Woodhead Farm, (p. 27) 1½ miles E.S.E. of Banchory. 1" Sheet 66; 6" Kincardine. N.S. 9 N.W. (*Lst. Scot.,* 1949, p. 128).

(S34520) [NO 7165 9418]. Grey crystalline limestone, 1 to 1.5 mm grain, composed of calcite with abundant but subordinate albite, andesine, hornblende, zoisite, and accessory quartz, biotite, sphene, chlorite, pyrite and apatite.
Limestone with zoisite and feldspars, medium-grained, granoblastic.

Grantown Limestone

Moray

(SL 13) (p. 28) Grantown Limestone. 450 yd S.E. of Coldholme, Dulnain Bridge. 1" Sheet 74; 6" Moray (Elgin.) 32 S.E.

(S34499) [NJ 000 261]. Pale grey and yellowish grey banded, medium-grained crystalline limestone. Composed of granular calcite of varying grain, 0.2 to 3 mm, with bands rich in granular potash-feldspar, albite and decomposed plagioclase, together with numerous rounded and prismatic grains of diopside and tremolite and flakes of brown phlogopite. Apatite and sphene are accessory.

Limestone with feldspars, diopside, tremolite and phlogopite, foliated, granoblastic.

(S34500) [NJ 000 261]. As above, but plagioclase (oligoclase) is abundant. Diopside forms large ragged prisms. Pale brown phlogopite is an important constituent. Zoisite also is accessory.

Limestone with feldspars, diopside, tremolite and phlogopite, foliated, porphyroblastic.

Unclassified Dalradian

Aberdeen

(SL 66) (p. 28) Metamorphic Limestone. Quarry at Ladyleys, E. of Old Meldrum. 1" Sheet 87; 6" Aberdeen. 46 N.W.

(S34505) [NJ 8295 2925]. Dark grey banded rock, effervescing with HCl only in some bands. In thin section a banded granulite (hornfels) containing biotite, pyroxene, epidote, calcite, calcic plagioclase, oligoclase and albite, with subordinate muscovite, colourless hornblende and accessory pyrite and sphene, in varying proportions in different bands.

Calcareous calcsilicate-biotite-feldspar-granulite, foliated.

(S34506) [NJ 8295 2925]. Grey limestone of impure type, composed of calcite of varying grain, 0.05 to 1 mm, partly granulitized, with subordinate pyroxene, hornblende, epidote, accessory pyrite, sphene and biotite, scattered grains of plagioclase and small nests of quartz.

Limestone with calcsilicates and quartz, grain-foliated, granoschistose.

(SL 145) (p. 28) Metamorphic limestone. Old quarry 550 yd S.E. of Strichen station. 1" Sheet 87; 6" Aberdeen. 13 N.E.

(S34647) [NJ 9520 5455]. Grey, compact granulite with thin dull white limestone laminae. Composed of quartz and potash feldspar with alternate laminae rich in pale green tremolite and/or pyroxene. Biotite is abundant in ragged poikiloblastic plates in a few laminae. Sphene is usually an abundant accessory. Calcite is present both in quartz-feldspar laminae and in those rich in hornblende, but is confined to thin bands in the rock. Iron ore in irregular grains and aggregates is an abundant accessory.

Calcareous quartz feldspar granulite with talc-silicates, foliated.

(SL 146) (p. 28) Limestone. Old Quarry, ■ mile N. of Ardlethen. 1"Sheet 87; 6" Aberdeen. 38 S.W.

(S34648) [NJ 917 318]. Pale grey, fine-grained limestone with some thin calcite veins. Composed of a matrix of granular calcite (0.2–0-4 mm grain-size) containing a large number of phlogopite flakes and grains of diopside. The latter has a salite (001) cleavage in addition to the usual prismatic cleavage. The phlogopite flakes tend to be orientated parallel to one direction.

Calcite-diopside-phlogopite rock, fine-grained, granoblastic.

GS3 (p. 28) Limestone. Most southerly quarry immediately E. of the road, 200 yd. S. of the school, 3 miles N.W. of Kirkton of Glenbucket. 1" Sheet 75; 6" Aberdeen. 60 N.W. (*Lst. Scot.,* 1949, p. 48).

(S37487) [NJ 336 176]. Dove-grey crystalline limestone composed of interlocked, recrystallized calcite crystals up to 1.0 mm across and showing complex lamellar twinning. Granulitization occurs along ill-defined narrow bands. Small rounded quartz grains and white mica flakes are scattered through the rock. Pyrite and opaque black dust are accessory.

Limestone with quartz and phlogopite, medium-grained, grain-foliated, in part granoschistose.

Unclassified metamorphic

Inverness

(SL 14) (p. 28) Kinlochlaggan Limestone. Quarry near Post Office, Kinlochlaggan. 1" Sheet 63; 6" Inverness. 115 S.E. (*Lst. Scot.,* 1949, p. 114).

(S34501) [NN 55143 89751]. Greyish white, coarsely crystalline limestone, composed of large (4 mm) irregularly interlocking, often sutured plates of twinned calcite containing small grains of oligoclase, quartz, tremolite and sulphide ore as accessory minerals.

Limestone, coarse-grained, with peripheral granulation, diablastic.

(SL 15) (p. 29) Limestone. Quarry N. of Loch an Eilean, 2¾ miles S. by E. of Aviemore. 1" Sheet 74; 6" Inverness. 73 S.E. (*Lst. Scot.,* 1949, p. 115).

(S34502) [NH 937 082]. Whitish grey, moderately coarsely crystalline limestone composed of interlocking grains of twinned calcite (1 to 2 mm) with numerous subordinate minerals including quartz, alkali-feldspar, tremolite and small, 0.01 mm, grains of zoisite. Sphene and apatite are accessory.

Limestone with some quartz, feldspar and calcsilicates, coarse-grained, granoblastic.

(SL 241) (p. 29) Limestone. Glenlia Quarry, near Foyers. 1" Sheet 73; 6" Inverness. 41 S.E.

(S35274) [NH 504 204]. A dull, compact, grey, greenish and pinkish-mottled limestone. Composed essentially of calcite, calc-silicates, mica and feldspar, with accessory sphene. The calcite is in grains up to 0.5 mm across. The caic-silicates include zoisite, epidote, pyroxene, pale green tremo-lite, the total and relative abundance of which vary from place to place. The feldspar is chiefly potash-feldspar and shows microcline twinning occasionally. Some albite is also present. The mica is a brown phlogopite.

Limestone with feldspathic calcsilicate folia, foliated, granoschistose.

Lower Cambrian

Fucoid Beds

Sutherland

M 2926 (p. 29) Dolomite limestone in fucoid shales. Near Chrudaidh, Kyle of Durness. 1" Sheet 114; 6" Sutherland 14 N.E. (Anal. W. Pollard, in '*The Geological Structure of the North-West Highlands of Scotland*,' 1907, *Mem. Geol. Surv.,* p. 637).

(S8132) [NC 361 631]. Dark red fine-grained, crystalline dolomite: composed of a matrix of granular dolomite, of grain ranging down from 0.2 mm to minutely crystalline, in which are set numerous echinodermal fragments and long, structureless pieces of single-crystal carbonate which may in some cases be algal in origin, together with brachiopod shell fragments and opacized, laminar, thin sections perhaps of trilobite carapace. Angular to subangular, ill-sorted grains of quartz, chalcedonic silica and alkali-feldspar, and granular aggregates of sericite and streaks of chert are common. Oolitic carbonate grains, yellow tourmaline and colourless zircon are accessory.

Dolomite with quartz and chert, varigrained, zoichnic, clastichnic.

Durness Limestone: Group I (Ghrudaidh)

Sutherland

(SL 269) (p. 29) Dolomite. N. side of Allt a' Chalda Mòr, about 500 yd E. 15° S. of Ardvreck Castle and about 1¼ miles N.N.W. of Inchnadamph Hotel. 1" Sheet 107; 6" Sutherland. 71 N.W. (*Lst. Scot.,* 1949, p. 191. Note: the percentages of $CaCO_3$ and of $MgCO_3$ for (SL 269) [NC 24267 23635] and (SL 270) [NC 24424 23494] have been interchanged in error on p. 191).

Bulk sample.

Cambro-Ordovician

Durness Limestone: Group II (Eilen Dubh)

Inverness. (Skye)

(SL 252) (p. 29) Dolomite. Between road and shore, just N. of bridge, Ord. 1" Sheet 71; 6" Inverness. (Skye) 51 S.W. (*Lst. Scot.,* 1949, p. 123; see also present memoir, p. 6).

(S35352) [NG 617 131]. Grey compact dolomite, composed of interlocking grains or ill-formed rhombs of dolomite, 0.1–0.2 mm. across. The rock is traversed by very thin cracks which are filled with cherty silica, occasionally quartz, and lined with limonite or limonitic clay.

Dolomite, medium-grained, mosaic, fractured.

Ross and Cromarty

(SL 255) (p. 29) Dolomite. Roadside 680 yd S. of Tornapress Bridge, Kishorn. 1" Sheet 80; 6" Ross and Cromarty. 110 N.W. (*Lst. Scot.,* 1949, p. 167)

(S35355) [NG 836 415]. A pale, flesh-grey, compact dolomite with flinty fracture. It is traversed by thin cracks filled with white dolomite. In thin section the rock is seen to be composed of small grains of dolomite, 0.01–0.05 mm across, with veins and patches of coarser grain, up to 0.3 mm.

Quartz grains, 0.05 0.07 mm across, are numerous, but on the whole probably form less than 5 per cent by volume of the rock. There are occasional films of limonitic silt of stylolitic character.

Dolomite, luteous, fine-grained, breccioid.

(SL 256) (p. 30) Dolomite. Cliff on shore of Loch Kishorn, 350 yd S.E. of Seafield. 1" Sheet 81; 6" Ross and Cromarty. 110 N.W. (*Lst. Scot.,* 1949, p. 167)

(S35356) [NG 833 401]. A dove-grey, compact, structureless dolomite. Composed of grains of dolomite of uniform size, 0.01–0.04 mm, among which small grains, 0.01 mm, of quartz are common and occasionally concentrated in short narrow streaks. The grains of the dolomite are a little coarser in narrow, interrupted, vein-like courses.

Dolomite, luteous, micrograined, granular.

Sutherland

(SL 270) [NC 24424 23494] (p. 30) Dolomite. N. side of Allt a'Chalda Mix., about 500 yd E. 15° S. of Ardvreck Castle and about 1¼ miles N.W. of Inchnadamph Hotel. 1" Sheet 107; 6" Sutherland 71 N.W. (*Lst. Scot.,* 1949, p. 191; see note on (SL 269) [NC 24267 23635] above).

Bulk sample.

(SL 272) [NC 21843 10376] [NC 21673 10634] (p. 30) Dolomite. Amhainn a'Chnocain. N. side of stream, about 720 yd upstream from road-bridge over stream S. of Elphin.

(SL 273) [NC 21735 10559] (p. 30) Dolomite. As preceding, about 770 yd upstream from the bridge.

(SL 274) [NC 21763 10539] (p. 30) Dolomite. As preceding, about 800–850 yd upstream from the bridge.

(SL 272), (SL 273), (SL 274) (p. 30) Dolomite with some chert. Amhainn a'Chnocain; bulk sample from three preceding localities. 1" Sheet 101; 6" Sutherland 91 N.W. (*Lst. Scot.,* 1949, p. 191).

(S35797) [NC 21843 10376]. A bluish-white compact marble, traversed by thin fracture veins without definite direction. The thin section is composed of equidimensional grains of dolomite, 0.05–0.1 mm across, but is coarser (0.1–0.2 mm size) in patches. Narrow lines of trituration and iron staining traverse the rock and appear to be followed by nodular segregations of cherty silica. Chert also forms irregular masses with which the coarser dolomite is sometimes associated, and the coarser crystallization of the dolomite and the aggregation of this chert both appear to be earlier than the

fracturing of the rock.

Dolomite with chert, fine-grained, granular.

M 2892 (p. 31) Dolomite. A'Choil-sgeir, near Eilean Hoan, Durness. 1" Sheet 114; 6" Sutherland 6 N.W. (Anal. W. Pollard, in '*The Geological Structure of the North-West Highlands of Scotland',* 1907, *Mem. Geol. Surv.,* p. 637).

(S8283) [NC 432 671]. Pale reddish fine-grained dolomite composed of grains of dolomite, 0.05 to 0.2 mm across, with some ferruginous matter present in stylolitic films. An irregular network of healed fractures pervades the rock. Quartz occurs in thin veins some of which follow lines of fracture.

Dolomite, fine-grained, mosaic, fractured.

M 2893 (p. 31) Dolomite. Eilean Hoan, 2½ miles E. of Durness. 1" Sheet 114; 6" Sutherland 6 N.W. (Anal. W. Pollard, in '*The Geological Structure of the North-West Highlands of Scotland',* 1907, *Mem. Geol. Surv.,* p. 637)

(S8130) [NC 43 67]. Uniform, grey, moderately fine-grained dolomite; composed of interlocking grains, frequently rhomboid, of turbid dolomite, 0.2–0.3 mm across. This uniform mass is traversed by thin, impersistent films of ferruginous clay.

Dolomite, medium-grained, mosaic.

M 2900 (p. 31) Dolomite. Eilean Hoan, Durness. 1" Sheet 114; 6" Sutherland 6 N.W. (Anal. W. Pollard in '*The Geological Structure of the North-West Highlands of Scotland',* 1907, *Mem. Geol. Surv.* p. 637).

(S8131) [NC 441 671]. Uniform, grey, fine-grained dolomite showing small red flecks; composed of interlocking grains of clear dolomite, 0.1 mm across, among which minor quantities of angular quartz, 0.05 mm average grain, and granules of red iron oxide are uniformly distributed.

Dolomite, luteous, fine-grained, mosaic.

(SL 175) (p. 31) Dolomite. Stream 5/6 mile S. of Keoldale, about 75 yd upstream from road. 1" Sheet 114; 6" Sutherland 5 S.E. (*Lst. Scot.,* 1949, p. 188).

The analyses were made on composite samples of which the four specimens described below are representative, but the proportions of the various types may have differed in the samples supplied for Anal. M 23799 and Anal. GS1203 respectively.

(S34842) [NC 384 649]. A fine-grained, uniform dolomite of grain size about 0.1 mm. Local patches of coarser grain with occasional limonitic fillings along the cleavages occur. Stylolitic films of limonitic clay are present but scarce and there are traces of quartz.

Dolomite, fine-grained, mosaic.

(S34843) [NC 384 649]. Bedded dolomite, with alternating laminae of 0.01 to 0.05 mm grain containing numerous streaky impregnations of limonite and occasional laminae of chert and ferruginous material. Small angular grains of quartz are numerous and the rock probably contains some clay.

Dolomite, luteous, pelitomorphic to micrograined, taxichnic, thin-bedded.

(S34844) [NC 384 649]. Fine-grained, sandy dolomite with some bands of slightly coarser material; composed of grains of dolomite, about 0.03 mm average grain, with subordinate quartz and alkali-feldspar in angular grains up to 0.1 mm long, and some muscovite in small thin flakes. The rock is cut by thin veins of coarser dolomite.

Dolomite, duteous to arenaceous, fine-grained, taxichnic, mosaic.

(S34845) [NC 384 649]. Dolomite of grain varying between 0.03 and 0.3 mm. There is a local cement of limonite which is only enough to form coatings to the dolomite grains. Limonite is present also along lines of fracture. The variation in grain-size is abrupt so that the rock has a brecciated or nodular appearance in hand specimen, but enclosure of limonitic dust trains in the large dolomite grains suggests that recrystallization to coarse dolomite is later than the fracturing of the rock. Chert occurs in sporadic vacuoles.

Dolomite, varigrained, breccioid, mosaic.

(SL 177) (p. 32) Dolomite. Hillside, 780 yd N.18°E. of Eireboll House and 330 yd W. of Free Church. 1" Sheet 114; 6" Sutherland 24 N.W. (*Lst. Scot.,* 1949, p. 189). Composite samples.

(S34846) [NC 436 572]. Very fine-grained dolomite of grain-size ranging down from 0.05 mm. The rock contains accessory grains of quartz and flakes of muscovite and is traversed by thin impersistent streaks of chert. *Dolomite, micrograined, granular.*

Durness Limestone: Group III (Sailmhor)

Sutherland

(SL 176) (p. 32) Dolomite. Field about 350 yd S.S.W. of Sarsgrum, about 50 yd E. of the road. 1" Sheet 114; 6" Sutherland 5 S.E. (*Lst. Scot.,* 1949, p. 187). The analyses were made on composite samples, the most prominent components of which are represented by the specimens described below; but the proportions of the various types may have differed somewhat in the samples supplied for Anal. M23800 and Anal. GS1202, respectively.

(S34838) [NC 372 626]. Crystalline dolomite of grain-size varying from 0.2–0.6 mm and of a slightly brown colour in transmitted light. The grains, are interlocking and mostly of irregular shape but a proportion of them show rhomboid outlines. Ferruginous clay locally forms impersistent, inter-granular films.

Dolomite, medium-grained, mosaic.

(S34839) [NC 372 626]. A fine granular dolomite showing non-uniform distribution of grain-size. The slide includes parts with grain of about 0.1 mm, irregularly and transitionally mixed with coarser grained dolomite of about 0.4 mm grain-size. Ferruginous material is present in very small quantity as short films and intergranular pellicles.

Dolomite, varigrained, breccioid, mosaic.

(S34840) [NC 372 626]. Dolomite of grain-size about 0.3 mm traversed by a diffuse network of coarser grained dolomite (0.6–1.5 mm). All of it has a brownish tint. A little chert is present in thin veins which seem to replace the dolomite, pieces of which are left optically continuous on the opposite sides of the veins. Some granular quartz and ferruginous matter are also present.

Dolomite, medium-grained, breccioid, mosaic.

(S34841) [NC 372 626]. Dolomite of uniform grain-size, 0.5–1.0 mm. The grains are equidimensional and anhedral, no rhomboid outlines having been observed. Limonite is present in small quantity as granules and inter-granular films.

Dolomite, medium-grained, mosaic.

M 2895 (p. 32) Dolomite. Quarry 150 yd E. of Sango Bay, Durness. 1" Sheet 114; 6" Sutherland 6 N.W. (Anal. W. Pollard in '*The Geological Structure of the North-West Highlands of Scotland*', 1907, *Mem. Geol. Surv.,* p. 637)

(S8129) [NC 412 673]. Black and pale grey mottled, crystalline dolomite of medium grain ('Leopard Stone'); composed of interlocking grains of dolomite, 0.3 to 0.5 mm across, in which the only impurity is the dark dust, shown by Pollard to be carbon, which is uniformly present in the dark areas and patchily distributed in the grains of the grey areas.

Dolomite, medium-grained, mosaic.

Durness Limestone: Group IV (Sangomore)

Sutherland

M 2921 (p. 32) Dolomitic limestone. Limestone Skerry, Baile na Cille (Balnakeil) Bay [NC 38016 70241]. 1" Sheet 114; 6" Sutherland 5 N.E. (Rough analysis by W. Pollard in *The Geological Structure of the North-West Highlands of Scotland',* 1907, *Mem. Geol. Surv.,* p. 637, specimen No. M2921).

(S40167) [NC 381 704]. Dark and pale grey, thin bedded limestone. Clean limestone, made of fine calcite dust and thin, small shells, forms irregular fragments and slivers in a darker argillaceous limestone containing few shells. Small dolomite rhombs, up to 0.05 mm across, are common and angular quartz chips, of similar size, are sparse *in* both varieties; small cubes of pyrite are scarce.

Limestone, dolomitic, luteous, micrograined, fossiliferous,

Durness Limestone: Group V (Balnakiel) Inverness (Skye)

(SL 245) (p. 32) Altered limestone. Old marble quarry, 1½ miles N.W. of Broadford church and ¼ mile W. of the Sligachan road. 1" Sheet 71; 6" Inverness. (Skye) 40 S.E. (*Lst. Scot.,* 1949, p. 120).

(S35345) [NG 623 248]. A white, grey-mottled, altered limestone of aphanitic aspect. In thin section composed of interlocking grains of calcite, about 0.5 mm across, which enclose or interlock with aggregates of brucite. These aggregates are equidimensional and often show the sharp crystal edges of the mineral they pseudomorph (periclase). Forsterite is also present in small grains altered more or less to serpentine. Some grains of rutile and octahedra of periclase are present.

Limestone with brucite, medium grained, granoblastic.

(SL 248) (p. 33) Marble. Marble quarry 800 yd S.40°E. of Cill Chriosd (Kilchrist) church. 1" Sheet 71; 6" Inverness. (Skye) 46 S.E. (*Lst. Scot.,* 1949, p. 121)

(S35348) [NG 621 201]. A white translucent saccharoidal marble. Composed of interlocking grains of dolomite which are equidimensional but only rarely rhomboid and are usually about 0.5 mm across. There are a very few grains of forsterite, serpentinized along cracks.

Dolomite, medium-grained, granoblastic.

Durness Limestone: Group VI (Croisaphuill) Inverness. (Skye)

(SL 246) (p. 33) Limestone. Torran, end of side road to Dun Beag. 1" Sheet 71; 6" Inverness. (Skye) 46 S.W. (*Lst. Scot.,* 1949, p. 122).

(S35346) [NG 576 203]. A banded grey and white limestone. Composed essentially of fine, often elongated grains of carbonate, 0.5–0-3 mm across, the grey band being finer-grained than the white. There is an accessory proportion of small equidimensional grains of forsterite. Crushed rock dissolved in 1:1 cold HCl gives a small residue showing also dolomite, diopside, tremolite and muscovite or talc aggregate.

Limestone, medium-grained, grain-foliated, granoschistose.

(SL 247) (p. 33) Limestone. Torran, Dun Beag. 1" Sheet 71; 6" Inverness. (Skye) 46 S.W. (*Lst. Scot.,* 1949, p. 123.)

(S35347) [NG 575 198]. A darkish grey limestone with saccharoidal texture, which shows bedding by alternation of paler and darker grey tints. Composed of a mosaic of grains of carbonate, 0.1–0.2 mm across, often elongated in the direction

of bedding. Scattered among the carbonate are prismatic sections of a mineral almost wholly replaced by turbid calcite. In one place a relic of the original mineral suggests itself as tremolite.

Limestone, medium-grained, grain-foliated.

(SL 249) (p. 33) Limestone. Roadside 550–650 yd S.W. of Cill Chriosd (Kilchrist) Church. 1" Sheet 71; 6" Inverness. (Skye) 46 S.E. (*Lst. Scot.,* 1949, p. 121).

(S35349) [NG 613 203]. A grey, fine-grained saccharoidal limestone. In thin section shows patchily varying grain, being mostly of grain-size 0.05–02 mm, but in places 0.01 mm or less and elsewhere of coarse grain up to 1.0 mm. Associated with the coarser carbonate are small areas of microcrystalline aggregate consisting of clear grains of carbonate and dark finely granular calcsilicates which include pyroxene and tremolite. Curved areas of coarser grain than the groundmass represent shell fragments.

Limestone with calcsilicates, varigrained, zoophasmic.

Durness Limestone, unclassified

Sutherland

(SL 271) (p. 33) Marble. Roadside 430 yd E.N.E. of Ledbeg. 1" Sheet 101; 6" Sutherland 82 S.W. (*Lst. Scot.,* 1949, p. 191).

(S35796) [NC 24567 13320]. A massive, structureless, compact, white marble, with faint yellow patternless markings. Composed of an aggregate of shapeless interlocking grains of calcite, 0.05–0.15 mm in size. These are generally traversed by very close set cleavage and twinning planes. In places the rock shows a mottling due to angularly patchy distribution of clear and turbid calcite. The clear patches are composed of the small grains and the turbid patches seem to be relics of large crystals in which almost submicroscopic striations (due to cleavage or twinning or both) have been produced. The striations are subparallel throughout the patch and are interrupted where new small grains with broader twin lamellae have crystallized. The orientation of the lamellae in such grains is diverse. In places narrow lines of shear are shown by granulation and parallel orientation of calcite grains and by a lining of thin serpentine flakes. Pseudomorphs of olivine in serpentine are sporadic in the rock as individual crystals or clusters. Phlogopite also is present in small flakes and aggregates, the calcite associated with which is coarser in grain than elsewhere in the rock. The rock is a marble triturated by stress.

Limestone, serpentinous, varigrained, sheared.

Ordovician

Ayr

(SL 152) (p. 33) Craighead (Stinchar) Limestone. Craighead Limeworks, 1 miles N.N.E. of Old Dailly and 3½ miles N.E. of Girvan. 1" Sheet 14; 6" Ayr. 50 S.W. (*Lst. Scot.,* 1949, p. 61).

(S34654) [NS 234 012]. Compact limestone, pale green mottled with white. Large algal growths, in finely granular clear calcite, are embedded in a turbid, very fine textured aggregate of calcite granules probably with clay admixture and in places cemented by *Girvanella.* In this base the main fossils are echinodermal and polyzoan fragments and a few thin-walled shells. The base has a patchy appearance suggesting the break-up of a clean limestone followed by packing of more muddy limestone round the fragments. A few tiny quartz grains are scattered in the turbid limestone. The rock is traversed by calcite-filled cracks.

Limestone, luteous, pelitomorphic, algal, homoiolithic.

(SL 153) (p. 34) Stinchar Limestone (lower, dark portion). Tormitchell Quarry, 3 miles N.N.E. of Pinmore railway station. 1" Sheet 8; 6" Ayr. 56 S.W. (*Lst. Scot.,* 1949, p. 61).

(S34655) [NX 23 94]. Dark grey compact limestone, composed of finely granular clear calcite mixed with turbid, possibly argillaceous, calcite aggregate of fine grain, through which black carbonaceous specks are scattered loosely. The larger constituents include fragments of shells, small entire shells, round bodies with granular calcite, aggregates of *Girvanella* and wisps of limonitic clay.

Limestone, argillaceous, pelitomorphic to micrograined, zoichnic.

(SL 154) (p. 34) Stinchar Limestone (upper, grey portion). Locality as (SL 153).

(S34656) [NX 23 94]. Pale buff, or cream-coloured, compact limestone with semi-crystalline lustre. Composed of a matrix of clear calcite, of 0.05–0-3 mm grain, containing ooliths and numerous fairly well sorted calcareous pebbles, comprising subrounded fragments and knobby spheroids from 0.3–1.5 mm in size, perhaps of algal origin, subangular to rounded pieces of very fine-grained limestone containing ooliths and crinoid fragments but sometimes uniformly structureless, and rare crinoid ossicles. The rock is traversed by many thin calcite-filled cracks which show tensional rupture without lateral displacements. A few quartz grains are present in the matrix and in the semi-opaque limestone.

Limestone, fine-grained, oolitic, pseudo-oolitic.

(SL 266) (p. 34) Stinchar Limestone. Aldons Limeworks, 1½ miles S. of Pinmore station. 1" Sheet 7; 6" Ayr. 62 N.W. (*Lst. Scot.,* 1949, p. 62).

(S35504) [NX 197 897]. A dark grey compact limestone showing films of calcite coating irregular joints or fracture surfaces. Microscopically it is a calcilutite (calcite-mudstone) greatly recrystallized to clear granular calcite, 0.02–0.01 mm grain size. Numerous aggregations of algal tubes (*Girvanella*) are present and have in part resisted the recrystallization which has affected the matrix. Ostracods are common and parts of the rock are rich in crinoid columnals and shell fragments. A little quartz (about 3–5%) is present and pyrite in similar proportions occurs in small irregular grains and clots. In places clayey material is present in sufficient quantity to give the appearance of a calcite breccia with clay matrix. The rock contains fragments of pelitomorphic limestone and is veined and patched by coarsely crystallized calcite.

Limestone, varigrained, zoichnic, clastizoic, homoiolithic.

(SL 267) (p. 34) Stinchar Limestone. Kirkdominae Hill, Auchensoul Farm, 2 miles W. of Barr. 1" Sheet 8; 6" Ayr. 56 S.E. (*Lst. Scot.,* 1949, p. 64).

(S35505) [NX 251 929]. A fine-grained compact, dark grey limestone. Microscopically the rock is a calcilutite (calcite-mudstone) recrystallized so far that the matrix is an admixture of turbid brown carbonate and clear fine-grained calcite, but without the destruction of the numerous fossil remains of *Girvanella* and ostracods. Scarce fragments of crinoid, polyzoan and shell, possibly brachiopod, are present. Pyrite is scattered in small grains and clots through the rock as an accessory constituent, and there are stylolitic wisps of limonitic clay.

Limestone, argillaceous, pelitomorphic, microfossiliferous, zoichnic.

Lower Old Red Sandstone

Angus

(SL 27) (p. 34) Nodular cornstone. Old quarry 400 yd W.S.W. of Huntley Hill, 2½ miles N.E. of Brechin. 1" Sheet 57; 6" Angus 27 N.W.

(S34548) [NO 622 634]. Dark grey-brown compact limestone composed of finely divided turbid calcite, recrystallized along dessication cracks to a coarser grain. Angular grains of quartz and subordinate plagioclase, felsite with

microporphyritic quartz, chert and feldspathic siltstone are abundant and range from 1 mm downwards in length. Long slivers of muscovite, biotite, oxidized biotite and chlorite are present. Garnet and staurolite are scarce accessories.

Limestone, arenaceous, micrograinsd, in part clotted.

Middle Old Red Sandstone

Caithness

(SL 163) (p. 34) Flaggy limestone. Stream ½ mile E.S.E. of Halkirk station. 1" Sheet 116; 6" Caithness 17 N.E. *Lst. Scot.,* 1949, p. 83).

(S34850) [ND 13917 58274]. Black limestone flag with thin lamination in shades of grey. In thin section alternating bands are seen to consist of: (1) coarser bands containing rhombs of dolomite up to 01 mm across, angular quartz grains, usually in subordinate proportion but sometimes abundant, plagioclase and scarce muscovite flakes, in a matrix of shapeless calcite obscured by disseminated bitumen or bituminous clay; (2) thin bands and lenticles of finely granular carbonate containing rhombs of dolomite, but little quartz or bituminous matter; (3) films of reddish-brown almost opaque bituminous clay. In places these films almost coalesce to form thin bands of gritty, calcareous bituminous shale.

Limestone, dolomitic, luteous, bituminous, varigrained, laminar.

(SL 167) (p. 35) Limestone. Robbery Head, S. of Lybster. 1" Sheet 110; 6" Caithness 39 N.E. (*Lst. Scot.,* 1949, p. 83).

(S34851) [ND 222 333]. Dark fine-grained dolomitic limestone, thinly laminated in shades of grey. In thin section the rock has a micronodular appearance, smooth and corrugated lenticles of clear granular carbonate being swathed in a darker matrix lined with corrugated films of bituminous matter. The clear carbonate is predominantly dolomite with which some quartz is associated while the darker matrix consists of anhedral calcite, dolomite rhombs, bituminous clay and clastic quartz. The grain-size of dolomite and quartz may be 0 mm but is usually less. Small flakes of muscovite and biotite are present, mostly in the argillaceous laminae.

Limestone, dolomitic, luteous, bituminous, varigrained, micronodular.

(SL 282) (p. 35) Limestone. Quarry, 1450 yd S. by W. of Achvarasdal, Reay. 1" Sheet 115; 6" Caithness 10 S.W.

(S35911) [NC 993 613]. A pale buff compact limestone, composed essentially of rather turbid calcite in grains 0.01–0.15 mm across, with scattered larger grains. Angular quartz, up to 0.15 mm grain-size, white mica, in flakes generally 0.1 mm long, and potash-feldspar are abundantly distributed in the rock and are concentrated along thin laminae coloured dark by bituminous matter. In a concentration of minerals insoluble in cold dilute HCl, chlorite, hornblende and clay are found as accessory constituents, and it is seen that potash-feldspar has developed crystal faces during regrowth.

Limestone, luteous, fine-grained, with sapropelitic laminae.

Upper Old Red Sandstone

Angus

(SL 26) (p. 35) Gritty Limestone. Old quarry 200 yd W. 30° N. of Dubton station. 1" Sheet 57; 6" Angus 20 S.W.

(S34547) [NO 699 608]. White pink-speckled saccharoidal gritty limestone composed of granular calcite, grain-size about 0.25 mm, and subordinate but abundant quartz and some potash-feldspar in angular to subangular grains of fairly uniform size (0.15–0.4 mm). There are a few pebbles of corn-stone and pebbly grains of strained quartz, fine sandstone or greywacke and felsite. Chlorite is accessory; tourmaline, anatase, zircon and apatite scarce.

Limestone, arenaceous, medium-grained, subpoikilocrystallic.

Ayr

(SL 94) (p. 35) Cornstone. Craigdullyeart Limeworks, 3 miles E.N.E. of New Cumnock. 1" Sheet 15; 6" Ayr. 42 N.E. (*Lst. Scot.,* 1949, p. 65).

(S34560) [NS 663 153]. Dull cream-coloured rock which is much fractured. It is composed of a mixture of very fine-grained turbid carbonate and recrystallized granular carbonate of grain-size varying from 0.03–0.3 mm. Rarely short tubules in the fine, turbid component suggest that it is partly algal in origin. In recrystallization clay material is concentrated sometimes round the periphery of relict pieces of fine-grained carbonate, sometimes interstitially between the recrystallized grains. Angular quartz and subordinate alkali-feldspar grains, up to 0.5 mm long, occur abundantly in patches; clay is present as impersistent irregular films; flakes of chlorite and grains of chert are accessory.

Limestone, irregularly gritty and clayey, fine-grained, algal, clotted in part, breccioid.

(SL 155) (p. 35) Cornstone. Lannielane Limeworks, 5 miles W.S.W. of Straiton; band in stream below the main worked limestone. 1" Sheet 14; 6" Ayr. 51 S.W. (*Lst. Scot.,* 1949, p. 65).

(S34657) [NS 313 017]. Dense whitish limestone with calcite veins and aggregations divided into indistinct nodules. In section it is seen to be a finely granular limestone of even grain averaging 0.03 mm. Veins and less well-defined insertions of coarsely crystalline clear calcite ramify through the fine-grained component. A few quartz and feldspar grains up to 0.2 mm in length are present among the fine calcite.

Limestone, fine-grained, crook-veined, breccioid.

(SL 156) (p. 35) Cornstone. Lannielane Limeworks; main worked band. 1" Sheet 14; 6" Ayr. 51 S.W. (*Lst. Scot.,* 1949, p. 64).

(S34658) [NS 313 017]. Dense, pale buff limestone containing impersistent veins or segregations of white calcite. Composed of very fine-grained granular carbonate (0.01 mm or less) which is patchily recrystallized, sometimes to a granular aggregate of 0.02–0.04 mm grain-size, sometimes to quite coarse segregations of clear calcite. Small rhombs of dolomite or ankerite occur sporadically in the fine calcite and also line a vein of coarse calcite. These are destroyed by a late infiltration of yellow chert, the latter replacing the dolomite with ejection of limonite. Grains of quartz, up to 0.5 mm, are scattered sparsely through the fine-grained limestone and are coated with and enclose granules of opaque matter, probably limonitic clay.

Limestone, in part arenaceous, micrograined, clotted, breccioid.

(SL 170) (p. 36) Cornstone. Middlefield Quarry, 1½ miles N.W. of Muirkirk. 1" Sheet 23; 6" Ayr. 25 S.E. (*Lst. Scot.,* 1949, p. 65).

(S34854) [NS 6945 3006]. A brownish-grey limestone mottled in light and darker shades and of stony appearance. Composed of turbid fine-grained carbonate which is recrystallized along a diffuse network of channels to anhedral carbonate of grain-size 0.03–0.1 mm. This coarser clear carbonate (calcite) occupies extensive areas free from the turbid type. The latter contains numerous pellet structures which are sometimes uniformly almost opaque, sometimes composed of an opaque rind on a clear granular centre. Elsewhere the pellet structure is absent or forms only part of a more complex structural aggregate. Rarely irregular concentric structure suggests algal origin. It seems as if the carbonate had been originally deposited as a mud, in which perhaps worms worked faecal pellets, and that this had been brecciated and recrystallized. Streaks of opaque limonite are present.

Limestone, fine to micrograined, clotted, micronodular.

(SL 257) (p. 36) Cornstone. Right bank of Poldownie Burn, 600 yd E.N.E. of Glenmuir-Shaw. 1" Sheet 15; 6" Ayr. 37 N.W. (*Lst. Scot.,* 1949, p. 65).

(S35454) [NS 700 201]. A pale purplish, compact limestone containing marly red spots and nests of white, more coarsely crystalline, calcite. The rock is composed of finely granular calcite of grain-size 0.02–0.05 mm. Short films of clay are present but scarce. The grain of the rock increases over small areas and coarse-grained calcite occurs along indefinite nodose channels. Quartz is sparsely distributed as single and composite grains.

Limestone, subarenaceous, fine-grained, granular.

Fife

(SL 104) (p. 36) Cornstone. Vane Quarries, Benarty Hill. 1" Sheet 40; 6" Fife 26 S.E.

(S34587) [NT 1645 9850]. Banded greenish and grey limestone. The section appears to show a greenish band only and it is composed of subrounded quartz grains, with a low proportion of alkali-feldspar grains, cemented by calcite. Many quartz grains show regrowth rims which interlock with the calcite cement. Zircon and rutile are accessory. Alkali-feldspar includes microcline, albite and perthite.

Calcareous, feldspathic, sandstone.

Kincardine

(SL 24) (p. 36) Cornstone. Old limekiln at base of cliff, 400 yd N.N.E. of Seagreens, East Mathers. 1" Sheet 57; 6" Kincardine. 27 S.E. (*Lst. Scot.,* 1949, p. 128).

(S34545) [NO 742 635]. Purplish-grey, compact limestone with veins of clear calcite. Composed of granular calcite, the rock has the patchy distribution of fine, medium and coarse grains typical of cornstones, suggesting the original rock as of fine texture, 0.005 mm grain, with coarser material recrystallized or depositing in drying cracks. Relics of the original very fine semi-opaque carbonate-rock show pellet-structure and, rarely, a cellular structure which may indicate algal growths.

Limestone, fine-grained, pelleted, micronodular, breccioid.

Midlothian

(SL 180) (p. 36) Cornstone. Quarry 400 yd W. by N. of Selms, 1¼ miles S. of East Calder. 1" Sheet 32; 6" Midlothian 5 S.E. (*Lst. Scot.,* 1949, p. 141).

(S34901) [NT 0842 6608]. A nodular rock composed of larger buff nodules which effervesce freely in cold dilute HCl and greenish non-effervescent nodules, in a fine breccia-like base containing much recrystallized or infiltrated calcite. The slide appears to include only the greenish nodules and these are composed of silty micaceous argillite or mudstone, marginally replaced by prisms of calcite growing in from the infilling calcite. The latter is composed of coarse grains which show growth zones and in places two periods of growth separated by a period of silica deposition. Some of the vein-like infillings contain also a central deposit of chalcedonic quartz.

Mudstone, calcite-veined.

Moray

(SL 105) (p. 36) Cornstone. Cothall Limestone Quarry, 2½ miles S.W. of Forres. 1" Sheet 84; 6" Moray (Elgin.) 10 S.E. (*Lst. Scot.,* 1949, p. 148).

(S34584) [NJ 013 559]. Dull white and pale green limestone. Composed of finely granular calcite of patchily varying grain, recrystallized to coarser clear calcite along ill-defined channels. The granular calcite contains much brownish matter, possibly clayey, disseminated through it and locally sufficiently abundant to form a thin cement. Subangular quartz grains up to 0.5 mm across are scattered through the rock.

Limestone, subarenaceous, fine-grained, granular.

Upper Old Red Sandstone (near top)

Argyll

(SL 283) (p. 37) Cornstone. 250 yd N. of Toward Taynuill. 1" Sheet 29; 6" Argyll. 194 S.E. (*Lst. Scot.,* 1949, p. 39).

(S35912) [NS 134 685]. A whitish compact dolomite, saccharoidal on fresh fracture, composed of equidimensional, sometimes rhomboidal, grains of dolomite, 0.05 to 0.4 mm, which is considerably turbidized by mineral dust. Calcite occurs locally in pockets of shapeless grains with undulose extinction, and yellowish aggregates of clay fill cavities up to 0.5 mm in length.

Dolomite, calcareous, fine-grained, granular.

Bute

(SL 228) (p. 37) Cornstone. Old Quarry 700 yd S.E. of Kilchattan pier. 1" Sheet 21; 6" Bute. 215 S.E. (*Lst. Scot.,* 1949, p. 82).

(S35155) [NS 106 542]. A cream-white rock with grey and green mottlings, composed of fragments of dolomite-mudstone of very fine grain, 0.002 mm, in a matrix of quartz grit cemented by abundant fine-grained dolomite. A few largish flakes of brown biotite, and some grains of microcline and crushed quartz are present. Thin veins of calcite cut the rock.

Dolomite breccia, arenaceous, taxichnic.

Stirling

(SL 160) (p. 37) Cornstone. Gargunnock Burn, ¾ mile S. of Gargunnock. 1" Sheet 39; 6" Stirling. 16 N.E. (*Lst. Scot.,* 1949, p. 39).

(S34860) [NS 7067 9330]. A flaggy medium-grey compact dolomite, composed of turbid very finely granular dolomite, of grain-size about 0.005 mm, which is recrystallized irregularly along streaks and channels to clear dolomite of 0.03 mm grain-size. Obscure vermiform structure in the finer material suggests algal activity. Scarce secondary quartz is associated with good rhombs of dolomite in small lenticular spaces. Thin flakes of mica and angular grains of quartz are sparsely distributed and there are some relics of micro-fossils.

Dolomite, luteous, pelitomorphic, microzoichnic, clotted, bedded.

Carboniferous: Calciferous Sandstone Series

Cementstone Group (and probable equivalents)

Berwick

(SL 207) (p. 37) Limestone. Shore cliff close to Bathing Pool, ¼ mile S. of Sharper Head, Berwick-on-Tweed. 1" (Scotland) Sheet 26, (England) Sheet 2; 6" Berwick. 18 N.E., Northumberland N.S. 2 S.W.

(S35072) [NU 003 532]. A brownish-cream, compact, fine-grained crinoidal limestone, composed of a turbid mass of granular calcite, 0.01 mm, and small calcareous organic debris through which are scattered foraminifera, larger shell fragments, ostracod valves, crinoidal fragments and scarcer polyzoan and algal fragments. There are numerous spines and *Calcisphaera.* The rock is traversed by occasional calcite-filled fractures. Microgranular pyrites, limonite and possibly bituminous matter impregnate some of the fossil fragments.

Limestone, micrograined, microfossiliferous, clastizoic, stylolitic.

Dunbarton

(SL 91) (p. 37) Cementstone in Ballagan Beds (bulk sample). Murroch Glen, ¼ mile E.N.E. of Murroch. 1" Sheet 30; 6" Dunbarton. N.S. 18 S.W. (*Lst. Scot.,* 1949, p. 86).

(S34486) [NS 4083 7782]. Earthy grey, compact rock composed of fine-grained dolomite of grain size less than 0.02 mm, through which are scattered elastic grains of quartz up to 0.1 mm across, accessory yellow biotite and interstitial isotropic clay.

Dolomite, luteous, micrograined, uniform granular.

(SL 148) (p. 37) Marl in Ballagan Beds. Murroch Glen, ¼ mile E.N.E. of Murroch. 1" Sheet 30; 6" Dunbarton. N.s. 18 S.W. (*Lst. Scot.,* 1949, p. 86).

(S34650) [NS 4071 7780]. Grey fissile calcareous shale. Angular grains of quartz (up to 0.5 mm across) are abundant and potash feldspar and flakes of muscovite subordinate in a brown extremely fine-grained matrix which shows some parallel orientation of fine micaceous constituents in an isotropic clay base. Carbonate is present as sporadic idiomorphic crystals in the clay and as thin laminae of minute grains and rhombs.

Dolomitic gritty shale.

Dumfries

(SL 206) (p. 38) Limestone. N. bank of Liddell Water, 1 mile E. of Harelaw Hole. 1" Sheet 11; Dumfries. 54 S.W. (*Lst. Scot.,* 1949, p. 91).

(S35071) [NY 442 784]. A grey compact crinoidal limestone. Composed of finely granular (0.05 mm) clear calcite, calcareous organic debris and some turbid, probably slightly argillaceous, fine calcitic interstitial matter. In this are set numerous foraminifera, fragments of shells, small crinoid columnals and some ostracods and spines. Brown carbonaceous matter impregnates a few obscure fossil remains.

Limestone, fine-grained, microfossiliferous, clastizoic, granular.

Fife

(SL 28) (p. 38) 'Kirkby's IIIa Limestone'. Shore at Randerston. 1" Sheet 41; 6" Fife 16 N.W. (*Lst. Scot.,* 1949, p. 108).

(S34450) [NO 6113 1133]. Banded grey and buff close-grained dolomite with flinty fracture. Composed of finely granular dolomite 0.02–0.03 mm grain, the refractive index of which, ■ = 1.697 or slightly greater, indicates a content of about 20 per cent (CaFe)CO_3. The rock contains numerous thin tests of ostracods many of which are preserved in black material probably pyrite. Granules and tiny cubes of oxidized pyrite are scattered through the rock. Yellow phosphatic fossil fragments are very scarce.

Ferriferous dolomite, micrograined, microfossiliferous, taxichnic, bedded.

(SL 29) (p. 38) 'Kirkby's III Limestone'. Shore at Randerston. 1" Sheet 41; 6" Fife 16 N.W. (*Lst. Scot.,* 1949, p. 108).

(S34451) [NO 6099 1147]. A rudely platy, irony, shelly rock of lumachelle type. The shells are replaced by turbid coarsely granular ferriferous dolomite, and are embedded in a matrix of carbonate stained and cemented by limonite. This carbonate is in part very finely granular, in part recrystallized to a mosaic of irregular grain up to 0.1 mm across. Its ordinary refractive index mostly is 1.700 but varies upward, the highest value observed being 1.715, indicating a content of fully 20 per cent of ferrodolomite. Numerous fragments of small shells and scarce quartz and mica are scattered through the fine-grained matrix.

Ferriferous dolomite. limonitic, micrograined, zoichnic.

(SL 30) (p. 38) 'Kirkby's V Limestone'. Shore at Randerston. 1" Sheet 41; 6" Fife 16 N.W. (*Lst. Scot.,* 1949, p. 108).

(S34452) [NO 6125 1131]. Brownish-buff massive rock which in some bands is almost wholly composed of shells. In thin section the shells are seen to be cemented by a matrix of fine granular clear carbonate in which are set numerous granules of oxidized siderite (0.01–0.02 mm), angular quartz grains (0.1–0.5 mm) and a few yellow phosphatic fossil fragments. A few small cavities are filled with kaolin. The carbonate replacing the shells is an ankerite the refractive index of which is variable being generally between 1.690 and 1.700 but as high as 1.705, and the fine-grained carbonate of the matrix is similar.

Ferriferous dolomite, arenaceous, sideritic, micrograined, zoichnic.

(SL 31) (p. 38) 'Kirkby's VII Limestone'. Shore at Randerston. 1" Sheet 41; 6" Fife 16 N.W. (*Lst. Scot.,* 1949, p. 108).

(S34453) [NO 6133 1128]. Buff-grey, finely saccharoidal dolomite with cavities containing tiny crystals of ankerite, refractive index ■ = 1.715. In thin section the rock is seen to be completely recrystallized to a mosaic of irregular grains of carbonate, 01–0.2 mm across, which are partly turbid, partly clear. Ghosts of shells and of finely granular matrix are outlined and depicted by dust patterns and variations in grain persisting through the recrystallized carbonate, which is a ferriferous dolomite with refractive index varying slightly about 1.690. Perfect rhombs of carbonate in the fine-grained dolomite are probably ankerite similar to the crystals of the cavities.

Ferriferous dolomite, fine-grained, zoophasmic.

(SL 32) (p. 38) Dolomitic limestone. Muiredge, 2 miles N. of Anstruther. 1" Sheet 41; 6" Fife 22 N.B.

(S34454) [NO 5641 0707]. Flaggy earthy brown dolomite with streaks of calcite. Composed of a great number of small shells, preserved in turbid ferriferous dolomite, all lying parallel to the bedding and cemented by irregularly oil-stained fine-grained carbonate which is largely a ferriferous dolomite, with varying content of ferrodolomite but never pure dolomite. Scarce granules of sideritic carbonate of high refractive index are distributed through the fine-grained carbonate; finely divided clay material occurs in shell casts, and some phosphatic fragments and grains of pyrite are present. Heavy yellow oil is evolved from the powdered rock on heating in a closed tube.

Ferriferous dolomite, bituminous, micrograined, microzoichnic, bedded.

(SL 33) (p. 39) Dolomite. Carnbee Dean, 2½ miles N.N.W. of Pittenweem. 1" Sheet 41; 6" Fife 22 N.E. (*Lst. Scot.,* 1949, p. 108).

(S34455) [NO 5312 0668]. Dark grey dolomitized encrinital limestone. Composed of a mass of fragments of crinoid, some shells and scarce foraminifera replaced by granular dolomite in a base of finely granular dolomite and clay among which deeply yellow stained grains of sideritic carbonate are distributed. The dolomite replacing the fossil fragments is ferriferous with a variable content of ferrodolomite of about 20 per cent estimated from the refractive index, 1.700 and slightly less. Quartz in small angular grains, 0.05 mm, and pyrite in clusters of granules are common throughout the fine-grained matrix.

Ferriferous dolomite, luteous, micrograined, zoichnic.

(SL 40) (p. 39) Dolomite. Cameron Burn, near Lathockar. 1" Sheet 41; 6" Fife 15 N.W. (*Lst. Scot.,* 1949, p. 108).

(S34461) [NO 4914 1140]. Ochre-weathering, uniformly fine-grained saccharoidal dolomite. Composed of equigranular dolomite of grain 0.1–0.2 mm among which are sparsely scattered grains of quartz of similar size, small nests of kaolin, and granules of oxidized pyrite.

Dolomite, fine-grained, mosaic.

Kinross

(SL 157) (p. 39) Cementstone: 'Upper Cement Bed'. Devonshaw Old Quarry, 2½ miles E. of Dollar. 1" Sheet 39; 6" Kinross. 25 S.W.

(S40620) [NT 000 976]. Dull greyish-white, compact dolomite banded with less fine-grained, gritty cream-coloured calcareous dolomite. In thin section the compact dolomite is composed of a close aggregate of rhomboid granules, about 0.005 mm across, of dolomite among which calcite is abundant, and through which angular grains of quartz, up to 0.2 mm in size, shreds of colourless mica and fragments of pelitomorphic dolomite are irregularly distributed. The gritty portion is composed of angular grains of quartz, up to 0.5 mm, and numerous pseudo-ooliths of pelitomorphic dolomite which with subordinate microcline and fine-grained silica-rock are cemented by rhomboid dolomite of varying grain and by shapeless calcite.

Dolomite, arenaceous and dolomitic sandstone, interbanded, taxichnic.

(SL 158) (p. 39) Cementstone. 'Lower Sandy Bed'. Devonshaw Old Quarry, as preceding.

(S34858) [NT 000 976]. Compact, mottled grey-brown and cream dolomite. Composed of a base of dolomite in grains and rhombs of 0.02 to 0.1 mm size in which relic patches of very fine-grained pelleted carbonate rock are preserved. In this base irregular patches and single rhombs of coarsely crystallized dolomite about 1 mm across are numerous. Subangular grains of quartz are sporadically abundant in both the coarse and fine dolomite. Ferruginous clay films are common locally and their material has been pressed aside by the large dolomite crystals during their growth. *Dolomite, calcareous, arenaceous, fine-grained, porphyrocrystallic.*

Midlothian

(SL 181) (p. 39) Cementstone. Linhouse Water, 120 yd N.W. of the upper (south) railway viaduct, 2 miles S. of Mid Calder. 1" Sheet 32; 6" Midlothian 5 S.E. (*Lst. Scot.,* 1949, p. 141).

(S34902) [NT 0758 6486]. A dull compact grey rock, composed mainly of grains of carbonate, 0.005–0-01 mm across, which by refractive index tests is shown to be ferriferous dolomite. Slightly larger grains up to 0.02 mm much altered to limonite probably represent siderite. In thin seams rich in quartz and muscovite the carbonates are less finely grained and oxidized siderite up to 0.05 mm can be distinguished among clear finely granular carbonate. Fresh biotite is present but scarce in these seams and alkali-feldspar, muscovite and chlorite also are present. Contemporaneous brecciation of the fine-grained dolomite into the arenaceous seams suggest that the dolomite is an original precipitation or a lime-mud contemporaneously dolomitized.

Ferriferous dolomite, micrograined, with arenaceous laminae, taxichnic.

Roxburgh

(SL 200) (p. 39) Limestone. Thorlieshope Limeworks, 400 yd S. of Hob Knowe, 4 miles E. of Riccarton Junction. 1" Sheet 17; 6" Roxburgh. N.S. 36 S.W. (*Lst. Scot.,* 1949, p. 169).

(S35065) [NY 592 975]. A grey cavernous limestone of fine grain, the cavities in some cases represent shells dissolved away; small black pellets are numerous in patches. Composed of a large number of large fairly thin-walled shells, which enclose turbid calcite-mudst6ne in various stages of re-crystallization, in a partially recrystallized and dolomitized matrix. The less recrystallized portions show a clotted structure, contain fragments of thin shells and in places contain rolled or angular fragments of shelly calcite-mudstone, shell fragments coated with precipitated calcite and, more rarely, ooliths, together with fragments of hollow structures, perhaps spines. Refractive index tests show that both dolomite and ankerite are present.

Limestone, dolomitic, pelitomorphic, fossiliferous, clotted, pseudo-oolitic.

(SL 201) (p. 40) Limestone. Larriston Limeworks, Larriston Tower, 6 miles N.E. of Newcastleton. 1" Sheet 11; 6" Roxburgh. N.S. 38 N.E. (*Lst. Scot.,* 1949, p. 169).

(S35066) [NY 552 937]. Dark grey, compact fine-grained limestone; small round bodies are seen in places. The rock shows in thin section a very fine-grained brownish calcilutite containing fragments of thick and thin shells, ooliths, shell fragments coated with oolitic calcite, tiny grains of quartz, and pebbles of calcilutite similar to the matrix with and without shells and ooliths. In part of the slide the matrix is almost completely recrystallized to clear calcite.

Limestone, luteous, pelitomorphic, fossiliferous, clastizoic, oolitic.

(SL 202) (p. 40) Limestone. Junction of Tweeden Burn and Liddel Water, 1 mile S. of Newcastleton. 1" Sheet 11; 6" Roxburgh. N.S. 40 S.E. (*Lst. Scot.,* 1949, p. 168).

(S35067) [NY 481 864]. A dark, brownish-grey, nodular limestone. The thin section shows a mass of algal limestone in which radiating and bifurcating canals of clear fine-grained calcite penetrate a base of semi-opaque, extremely fine-grained calcite. Recrystallization has affected the rock in patches so that the organic structure is in places destroyed. The algal mass is coated and infilled by fine-grained shell limestone containing quartz grit and muscovite flakes.

Limestone, micrograined to pelitomorphic, algal.

(SL 203) (p. 40) Limestone. Muir Burn, 660 yd N.W. of Liddelbank House. 1" Sheet 11; 6" Roxburgh. N.S. 42. (*Lst. Scot.,* 1949, p. 168).

(S35068) [NY 453 802]. A granular dark brownish-grey limestone, showing small crinoid columnals. Composed of the debris of crinoid columnals, shells, ostracods, foraminifera, polyzoa and spines, the fine material being recrystallized to clear fine-grained calcite in which the polyzoan and foraminiferal fragments are prominently picked out by opaque bituminous impregnations in the cell walls. Angular grains of quartz up to 0.5 mm long, are abundant.

Limestone, arenaceous, fine-grained, clastizoic, microfossiliferous.

(SL 208) (p. 40) Limestone. Old quarry, 100 yd N. of Stobs Quarry, Limekilnedge, 9 miles S. of Hawick. 1" Sheet 17; 6" Roxburgh. N.S. 35 N.W. (*Lst. Scot.,* 1949, p. 170).

(S35073) [NT 538 013]. A whitish, nodular, argillaceous limestone. Composed of a mass of granular carbonate of which the grain-size is occasionally 0.03 mm but usually 0.01 mm and often less. This has a turbid appearance and there may be films of clay on the grains, but the apparent turbidity may be caused only by the small grain-size. Through this mass small angular quartz chips (0.2 mm down) are sporadically scattered. Re-crystallization to clear granular calcite (0.1 mm grain) has taken place along impersistent sinuous or irregular channels.

Limestone, luteous, micrograined, uniform granular, crook-veined.

(SL 220) (p. 40) Dolomite. Quarry on Nottylees Farm, 600 yd S.E. of Carham station. 1" Sheet 26; 6" Roxburgh. N.S. 7 S.W. (*Lst. Scot.,* 1949, p. 170).

(S35074) [NT 795 368]. A brownish-cream, fine-grained, compact, structureless dolomite. Composed of granular, occasionally rhomboid dolomite, grain-size 0.03 mm. There is a considerable quantity of opaque white material which usually occurs as clusters averaging 0.01 mm across, embedded centrally in the dolomite grains. As this structure seems unlikely to be original, it suggests that the dolomite, in spite of its small grain, is recrystallized. Argillaceous matter may be present as coatings on the dolomite grains. In places stylolitic films separate the rock into small irregular nodules.

Dolomite, micrograined, uniform granular, taxichnic.

(SL 221) (p. 40) Dolomite. S. side of railway, 400 yd W. of Carham station. 1" Sheet 26; 6" Roxburgh. N.S. 7 S.W. (*Lst. Scot.,* 1941, p. 170).

(S35075) [NT 790 368]. Pale cream, compact, very fine-grained dolomite with small-scale nodular structure. Composed of small, occasionally rhomboid grains (0.02 0.04 mm grain-size) of dolomite, probably coated with some argillaceous matter. The nodular structure is not seen in thin section but there is a weak banding of clearer and more turbid dolomite. The rock is cut by calcite-filled fractures which are faulted by narrow fractures also calcite-filled. Quartz grains, up to 0.5 mm long, are sparsely scattered through the rock.

Dolomite, micrograined, uniform granular.

Stirling

(SL 192) (p. 41) Cementstones, Ballagan Beds (bulk sample of 8 bands). Ballagan Burn, 530 yd N. of Ballagan House. 1" Sheet 30; 6" Stirling. 27 N.W. (*Lst. Scot.,* 1949, pp. 177–8).

(S34968) [NS 5221 8014]. Compact grey rock, composed of a mass of rhomboid dolomite crystals, 0.005–0.02 mm across, with very little turbid matter of any kind, argillaceous or calcareous. Angular grains of quartz, 0.1–0-5 mm across, are abundantly scattered through the rock along with scarce alkali-feldspar, secondary quartz-rock, chlorite and thin prisms of a mineral, occurring in cracks and in association with quartz, which is probably baryte. The presence of small prisms of gypsum was suspected, but not proved.

Dolomite, luteous, micrograined, uniform granular.

(SL 193) (p. 41) Cementstone, Ballagan Beds. Locality and references as for (SL 192).

(S34969) [NS 5221 8014]. A grey compact rock composed of granular and rhomboid carbonate, of average grain-size 0.005 mm, among which there are tiny patches of brownish argillaceous matter. Angular grains of quartz and flakes of muscovite are sparsely scattered through the rock.

Dolomite, luteous, pelitomorphic, clotted, taxichnic.

(SL 194) (p. 41) Marly shale, Ballagan Beds. Locality and references as for (SL 192).

(S34970) [NS 5221 8014]. Darkish grey very fine-grained rock, rough to the touch. Composed of grains and rhombs of dolomite, of average grain-size 0.005 mm, with some interstitial faintly brown isotropic material of refractive index close to that of canada balsam, possibly halloysite. Abundant angular grains of quartz, grain-size 0.1–0.01 mm and sparse muscovite are scattered through the rock.

Dolomitic siltstone.

(SL 195) (p. 41) Hard manly bed, Ballagan Beds. Locality and references as for (SL 192).

(S34972) [NS 5221 8014]. Dull grey compact rock, composed of granular and rhomboid carbonate, 0.005–0.02 mm grain-size, and accessory angular quartz and muscovite flakes. There is a small amount of interstitial isotropic material.

Dolomite, luteous, micrograined, uniform granular.

Note on specimens (S34968) [NS 5221 8014], (S34969) [NS 5221 8014], (S34970) [NS 5221 8014], (S34972) [NS 5221 8014]: Refractive index tests on powdered rock always show dolomite as the carbonate. No index for calcite was obtained in any of the rocks, the only variation being slightly on the ankerite side in some grains of (S34972) [NS 5221 8014]. Since all these rocks effervesce slightly in cold dilute HCl some calcite must be present as a fine dissemination. In powders immersed in oil a thin skin of apparently isotropic material of much lower refractive index is discernible on the dolomite rhombs when these are orientated so that their index is equal to that of the oil. This is the clay cementing material and is only rarely discernible in thin section (S34970) [NS 5221 8014]. When the powdered rock is treated with hot HCl a considerable clay residue is obtained. This does not lend itself to microscopical examination, the only identifiable minerals being quartz chips, and sericite fibres, the main constituent being an aggregate of minute granules in a feebly polarizing base of average refractive index 1.60–1.61.

GS10 Cementstone. Campsie Glen, at the waterfall, just below the junction of (p. 41) Cementstones with the Campsie Volcanic Group; 580 yd N. of Ballencleroch House. 1" Sheet 30; 6" Stirling. 27 N.E. (Anal. C. O. Harvey)

(S33200) [NS 610 799]. Dull grey rock composed of clear, granular and rhomboid carbonate, of grain 0.01–0.02 mm with irregular relics of turbid carbonate of still finer grain. Scattered grains of quartz, occasional yellowish micaceous material, alkali-feldspar and tiny films of white mica are also present.

Dolomite, luteous, micrograined, with pelitomorphic lattice.

Oil Shale Group (and probable equivalents)

Burdiehouse Limestone

Fife

(SL 171) (p. 41) Burdiehouse (Grange) Limestone. Newbigging Mine, 1 mile W. of Burntisland. 1" Sheet 40; 6" Fife 40 N.W.

(S34855) [NT 2155 8637]. Dull cream-grey, compact limestone showing numerous ostracods. Composed of a matrix of finely divided carbonate, 0.001–0.005 mm grain-size in which are set numerous ostracod shells and some fragments of thicker molluscan shells. The ostracod bivalves when complete are filled with more coarsely granular carbonate up to 0.2 mm. grain.

Limestone, pelitomorphic, microfossiliferous: microcoquinoid.

(SL 172) (p. 42) Dolomite vein in Burdiehouse or Grange Limestone. Newbigging Mine. 1" Sheet 40; 6" Fife 40 N.W. (*Lst. Scot.,* 1949, p. 100).

(S34856) [NT 2155 8637]. Brown dolomite with lustrous crystalline surfaces, composed of an aggregate of anhedral ankerite of uniform grain 0.1–0.2 mm size, and of a uniform pale brown tint. Sporadic, small oval areas of clear carbonate including calcite represent ostracods. The ankerite in the section and in powder appears to be homogeneous, ■ = 1.707 corresponding to about 12 per cent FeO. These figures agree well with the chemical analysis considering that free calcite is present. The rock has a small proportion of empty pore spaces. Small aggregates of pyrite granules are present.

Ferriferous dolomite, fine-grained, uneven mosaic.

(SL 216) (p. 42) Burdiehouse Limestone, 'Flooring'. Newbigging Mine. 1" Sheet 40; 6" Fife 40 N.W. (*Lst. Scot.,* 1949, p. 99).

(S35896) [NT 2155 8637]. A dull fawn-grey limestone, composed of very finely granular calcite recrystallized to grains reaching 0.06 mm across. In this matrix are scattered fragments of shells, mainly ostracod, and of cellular organisms and some quartz grains of 0.2 mm grain-size. Granules of pyrite are scarce, being occasionally concentrated in a shell fragment, and limonitic clay is thinly spread through some portions of the rock. The limestone is traversed by narrow and irregular cracks which are sealed by calcite.

Limestone, micrograined to pelitomorphic, microfossiliferous, clotted.

(SL 217) (p. 42) Burdiehouse Limestone, 'Bottom Bed'. (SL 216).

(S35897) [NT 2155 8637]. A dull fawn-grey limestone, containing scattered smooth-surfaced black bodies which include limestone. The rock is composed of very finely divided calcite, locally slightly and irregularly recrystallized, with sparse, small rhombs of dolomite reaching 0.2 mm size. Scattered through the rock are fairly numerous thin shells and shell fragments densely permeated by pyrite: many are of ostracods, either whole or broken and collapsed, and often filled with clear coarsely granular calcite. Quartz grains are small and few. Irregular, short veins of limonitic matter and cracks sealed by calcite are common.

Limestone, dolomitic, pelitomorphic, microfossiliferous, microclastizoic.

(SL 218) (p. 42) Burdiehouse Limestone, 'Middle Bed'. Locality and references as for (SL 216).

(S35898) [NT 2155 8637]. Dull fawn-grey limestone containing a few black bodies and laminated locally by indefinite dark brown laminae. The section shows extremely finely divided calcite, slightly and irregularly recrystallized, forming the matrix, and containing many small fragments of thin shells, some of which are impregnated with pyrites, and many tiny crystals and radiating grains of clear carbonate. Granules of partly oxidized pyrite and hydrocarbon streaks are present. Narrow anastomosing fractures filled with calcite are numerous.

Limestone, pelitomorphic, microclastizoic, fracture-veined.

(SL 219) (p. 42) Burdiehouse Limestone, 'Top Bed'. Locality and references as for (SL 216).

(S35899) [NT 2155 8637]. Dull pale cream-coloured limestone, containing in many places clear quartz grains, black bodies and scattered carbonaceous fragments. The rock is composed of very finely divided calcite slightly recrystallized. Ostracod valves are numerous, and when entire contain coarse-grained clear calcite. Pyrites impregnation is scarce and not intense. Quartz grains occur sporadically in the shelly pockets. Rhombs of pale brown dolomite or ankerite, about 0.05 mm across, are seen in parts of the thin section. Shreds of black, carbonaceous matter are present.

Limestone, dolomitic, pelitomorphic, microfossiliferous, fracture-veined.

Midlothian

(SL 16) (p. 42) Burdiehouse Limestone (top). Clippens Limeworks, near Straiton. 1" Sheet 32; 6" Midlothian 7 S.E. (*Lst. Scot.,* 1949, p. 143).

(S34524) [NT 2787 6727]. Fine-grained buff limestone with dark brown laminae. Composed of finely divided turbid calcite, irregularly recrystallized to clear calcite of grain 0.01–0.05 mm, in which crushed ostracod shells and fragments are set. Many shells are partly or wholly replaced by pyrite. *Limestone, micrograined to pelitomorphic, microfossiliferous, micronodular.*

(SL 17) (p. 43) Burdiehouse Limestone (middle). Locality and references as for SL 16

(S34525) [NT 2787 6727]. Compact buff limestone with widely separated dark brown laminae. Composed of a brown oil-stained matrix of calcite of fine

Locality and references as for grain in which are set numerous irregular patches or fragments of clear, granular calcite together with crushed ostracod shells, occasional small shapeless clots of collophane, small scattered aggregates of pyrite granules and small fragments of carbonaceous matter.

Limestone, bituminous, pelitomorphic, microfossiliferous, bedded, homoiolithic microbreccia.

(SL 18) (p. 43) Burdiehouse Limestone (base). Locality and references as for SL 16.

(S34526) [NT 2787 6727]. Compact limestone banded in darker and less dark brown shades. Composed of almost structureless finely granular yellow-stained calcite interbanded with layers to which the irregular mingling of clear and yellow stained rock gives a fragmental appearance as in

(S34525) [NT 2787 6727]. Ostracod shells are abundant in the coarser seams and collo-phane clots are present. Wisps of bitumen and carbonaceous fragments occur sparsely throughout the rock.

Limestone, bituminous, pelitomorphic, microfossiliferous, bedded, homoiolithic microbreccia.

(SL 54) (p. 43) Burdiehouse Limestone. Harburn Limestone Mine, 1 mile S. of Harburnhead. 1" Sheet 32; 6" Midlothian 11 S.E.

(S34449) [NT 0348 5973]. Compact earthy-brown, fine-grained limestone. Composed of minutely granular calcite, grain in general less than 0.002 mm, permeated by films of yellow bituminous matter. Complete and fragmentary ostracod shells, enclosing clear coarsely granular calcite are numerous. Grains of pyrite granules, occasional streaks of bitumen and traces of fossil phosphate are present. Some fine quartz grit occurs in certain laminae along with small aggregates of a radiating mineral which, in view of the chemical analysis, may be celestite. The rock powder on heating in the closed tube emits a little oily vapour.

Limestone, bituminous, pelitomorphic, microfossiliferous, bedded, homoiolithic.

(SL 198) (p. 43) Burdiehouse Limestone. Harburn Limestone Mine, ■ mile S. of Harburnhead and 2½ miles S.E. of West Calder. 1" Sheet 32; 6" Midlothian 11 S.E. (*Lst. Scot.,* 1949, p. 143).

(S35063) [NT 0348 5793]. A dark buff, fine-grained limestone containing numerous small dark grains, visible by hand lens. Composed of extremely finely divided turbid calcite containing a multitude of yellowish carbonate grains of all shapes up to about 1 mm across, and numerous fossil fragments. The latter include many thin shell fragments and scarce complete small ostracods. There are also some large, irregular-shaped pellets (up to 1 mm across) within which the carbonate occurs as grit in a turbid matrix; these are perhaps faecal pellets. Traces of quartz grit are present.

Limestone, pelitomorphic, microfossiliferous, microclastizoic.

West Lothian

(SL 173) (p. 43) Burdiehouse Limestone. Hopetoun Wood Quarry, Abercorn. 1" Sheet 32; 6" West Lothian 4 N.E. (*Lst. Scot.,* 1949, p. 196).

(S35986) [NT 0827 7806]. Almost black aphanitic rock, resembling bituminous mud-stone. Composed of a very fine calcite aggregate coloured brownish and yellowish by finely disseminated bituminous matter. In the larger pieces and long streaks the latter is mainly a homogeneous yellow isotropic material but is sometimes orange and almost opaque. Opaque material includes carbonaceous matter and pyrite. These constituents produce a parallel banding in the rock. There are occasional calcareous fragments of shells, and only a very few grains of quartz are recognizable. The rock powder, heated in a closed tube, evolves a heavy yellow oil and a more volatile colourless fraction.

Limestone, bituminous, luteous, pelitomorphic, subclastizoic, bedded.

Other limestones

Ayr

(SL 108) (p. 43) Broadstone Limestone. Disused quarry at Langside Farm. 1" Sheet 22; 6" Ayr. 8 N.E. (*Lst. Scot.,* 1949, p. 74).

(S34563) [NS 3690 5365]. Grey limestone with brachiopod shells. Composed of the debris, largely unworn, of large and small shells, polyzoan fragments, small crinoid ossicles, spines, ostracods, algal growths and foraminifera. The foraminifera, some shells and polyzoan cells have impregnations of blackish material, possibly bituminous. All these larger constituents are embedded in an extremely fine-grained base of semi-opaque calcite granules, which is recrystallized to clear calcite of small grain in an irregular manner. Irregularly shaped small pockets of kaolinite are present and are visible as white specks in the hand-specimen.

Limestone, pelitomorphic to fine-grained, clastizoic, in part zoophasmic.

(SL 122) (p. 44) Broadstone Limestone. Nettlehirst Quarry, 2¼ miles S.S.E. of Beith. 1" Sheet 22; 6" Ayr. 8 S.W. (*Lst. Scot.,* 1949, p. 74).

(S34570) [NS 3645 5057]. Grey limestone with microfossils and many crinoid plates. Large and small shell fragments, productid spines, polyzoan fragments, crinoid columnals and foraminifera are abundant in a turbid base of calcite granules 0.01 mm and less across. This base contains many pieces of calcite recognizable as chips of shell and the whole is derived from a shell mud. The canalicules of brachiopod shells and the chambers of foraminifera are sometimes filled with pyrites.

Limestone, pelitomorphic, fossiliferous, clastizoic.

(SL 135) (p. 44) Wee Post Limestone. Auchenmade Quarry, 600 yd W. of Auchenmade station and 3 miles E. by S. of Dalry. 1" Sheet 22; 6" Ayr. 12 N.W. (*Lst. Scot.,* 1949, p. 75).

(S34621) [NS 3380 4855]. Pale buff-grey limestone with many crinoid plates. Composed of crinoid columnals and ossicles, spines, large shell fragments, small shells, polyzoan skeletons with cells filled with dark carbonaceous dust, and occasional foraminifera. All these are set in a matrix of recrystallized granular carbonate containing many small fragments of shells and polyzoa, and scattered grains of pyrite.

Limestone, micrograined, clastizoic, in part zoophasmic.

(SL 136) (p. 44) Broadstone Limestone. Auchenmade Quarry, as above. 1" Sheet 22; 6" Ayr. 12 N.W. (*Lst. Scot.,* 1949, p. 75).

(S34622) [NS 3380 4855]. Grey argillaceous limestone with *Lithostrotion.* Composed of large and small fragments of crinoids and of shells, spines, large and small foraminifera, *Calcisphaera,* and occasional coral and polyzoan pieces in a bedded matrix of finely granular calcite mixed with small fossil relics, limonite shreds and opaque carbonaceous fragments and pyrite grains. Orange and opaque bituminous material forms undulating films and streaks along the bedding. The larger organic fragments are mostly arranged with their long axes parallel to the bedding.

Limestone, micrograined, clastizoic, bedded.

Dumfries

(SL 142) (p. 44) Dolomite. Barjarg Quarry, 440 yd N.E. of Barjarg Tower, 1 mile S.W. of "Closeburn. 1" Sheet 9; 6" Dumfries. 31 S.E. (*Lst. Scot.,* 1949, p. 88).

(S34628) [NX 880 904]. Bright, rose-coloured crystalline dolomite containing quartz grains, Composed of granular dolomite, 0.2–0.4 mm grain-size, powdered with ferric oxide dust and in places cemented by red ferric oxide aggregate. Composite quartz grains and grains of strained quartz up to 0.5 mm in size are scattered in small quantity throughout the rock. Ghosts of fossil fragments are outlined by varying concentration of ferruginous dust.

Dolomite, fine-grained, zoophasmic, uneven mosaic.

(SL 143) (p. 44) Limestone. Quarry 500 yd N.E. of Caldronlee Farm, 1½ miles E.S.E. of Waterbeck. 1" Sheet 10; 6" Dumfries. 52 S.E. (*Lst. Scot.,* 1949, p. 90).

(S34629) [NY 26 76]. Pinkish, sparkling, compact limestone, composed of fragments of shells and polyzoa, many and various foraminifera, productid spines, *Calcisphaera,* and ostracods cemented in a fine-grained base of shapeless calcite and recrystallized small organic fragments. A little pyrite and probably some clay are present.

Limestone, fine-grained, microfossiliferous, clastizoichnic.

(SL 144) (p. 44) Limestone. Quarry 100 yd N. of Cauldwellknowe Farm, nr. Kirtle Bridge station. 1" Sheet 10; 6" Dumfries. 58 N.W. (*Lst. Scot.,* 1949, p. 89).

(S34630) [NY 22 73]. Pale purplish-grey, compact, sparkling limestone, composed of fragmentary shells, foraminifera, polyzoan skeletons, crinoidal remains, spines and *Calcisphaera,* in a matrix of fine-grained calcite which is largely

recrystallized organic debris.

Limestone, fine-grained, microfossiliferous, clastizoichnic.

(SL 204) (p. 45) Lower Harelawhill Limestone. Quarry 150 yd N.W. of Harelawhill,3 miles N.E. of Canonbie. 1" Sheet 11; 6" Dumfries. 54 N.E. (*Lst. Scot.,* 1949, p. 91).

(S35069) [NY 427 789]. A compact brownish-grey limestone, with scarce small crinoid columnals visible. Composed of a fine-grained turbid matrix of calcite in process of recrystallization to clear granular calcite. Consisting essentially of finely comminuted molluscan, polyzoan and crin-oidal debris. Numerous foraminifera, spines, *Calcisphaera* and larger crinoidal and shell.fragments are present. Yellow bituminous matter is sparsely distributed through the rock.

Limestone, micrograined, microfossiliferous, clastizoichnic.

(SL 205) (p. 45) Upper Harelawhill Limestone. Quarry 300 yd. W. of Harelawhill. 1" Sheet 11; 6" Dumfries. 54 N.W. (*Lst. Scot.,* 1949, p. 91).

(S35070) [NY 427 789]. A dark grey, fine-grained, compact, structureless limestone. Composed of granular calcite (0.02–0.06 mm grain-size) with interstitial limonitic and bituminous clay cement. Fragments of shells and black carbonaceous specks are fairly abundant and there is a little pyritic impregnation of shell fragments.

Limestone, fine-grained, microfossiliferous, zoophasmic.

East Lothian

(SL 178) (p. 45) Limestone at base of the volcanic rocks. Quarry, 1100 yd W.10°S. of Howmuir Farm, about a mile E. of East Linton. 1" Sheet 33; 6" East Lothian 6 S.W. (*Lst. Scot.,* 1949, p. 95).

(S34899) [NT 6019 7669]. A dark flesh-coloured limestone composed of pisolitic and irregular masses and pellets of turbid fine-grained calcite cemented by clear calcite of grain 0.05 to 0.03 mm. The pisolitic masses, 0.2 to 4.0 mm across, are in part algal and show concentric or confocal growth structures in the centre of which chalcedonic replacement is common. Many of the smaller pisolites or pellets are structureless and may be faecal pellets or rolled fragments. Grains of radiating chalcedony occurring in the recrystallized matrix appear at times to be clastic. Ferruginous films are common around or within channels of recrystal-lization.

Limestone, algal, clotted, micronodular, homoiolithic, mesh-crystallized.

(SL 179) (p. 45) Dolomite. Left bank of Whittinghame Water, ¼ mile W.N.W. of Ruchlaw Mains. 1" Sheet 33; 6" East Lothian 11 N.W. (*Lst. Scot.,* 1949, p. 96).

(S34900) [NT 6127 7451]. A red colour-laminated rock, seen in thin section to be composed of a fine-grained aggregate of anhedral dolomite, the grains of 8 which are 0.1–0.01 mm across and are dusted with and separated by red limonite. The colour lamination corresponds to a greater or less concentration of limonite. Small rhombs of dolomite of larger size occur in sporadic cavities. Chen is abundant as irregular layers and as a pervasive infiltration; it is clearly a replacement deposit and not an infilling to fractures or cavities.

Dolomite, cherty, ferruginous, pelitomorphic to fine-grained, banded, taxichnic.

(SL 199) (p. 45) Limestone. Rhodes Quarry, 1 mile E. of North Berwick. 1" Sheet 41 6" East Lothian 2 S.E. (*Lst. Scot.,* 1949, p. 95).

(S35064) [NT 569 849]. A coarse grey limestone with calcite-filled fractures. Small aggregates of tarnished pyrite are present. The thin section shows turbid, finely divided calcite, extensively replaced by coarsely granular celestine and to a less extent by clear granular calcite. Where the original rock is preserved it seems to have been a calcite-mudstone containing small pellets. The white veins in the rock are calcite. The celestine is recognized by its similarity to baryte in its

optical properties and by imparting a crimson-coloured flame to the bunsen. The rock contains 25 per cent of matter which is insoluble in cold dilute HCl and practically all of this is celestine. There is also some possibly carbonaceous matter and a very little quartz and chalcedony. The celestine fragments have a blue tinge without appreciable change in absorption on rotation in polarized light.

Limestone, micrograined, extensively replaced by celestine.

Other specimens from Rhodes Quarry were analysed to determine the percentage of strontium sulphate with results as follows:—

a. S.E. face of quarry, 120 ft N.E. of S.E. corner. Lab. No. M27107; $SrSO_4$, 0.32%. The rock ((S35146) [NT 5700 8496]) is a brownish-grey dolomitic limestone in which large plates of calcite enclose and cement aggregates of dolomite grains. Celestine was not observed.

b. S.W. face, 120 ft from S.E. corner, bottom 3 ft. Lab. No. M27108; $SrSO_4$, 0.66%. A fine-grained, turbid calcilutite (S35150) [NT 5693 8497]. Celestine was not observed.

c. as (b); 6 ft from base and 11 ft from base.. Lab. No. M27109; $SrSO_4$, 7.45%. The rock from 6 ft above the base (S35151) [NT 5693 8497] consists of an extremely fine aggregate of calcite dolomitized along irregular channels which are frequently expanded into spaces the centres of which are either empty or filled with kaolin. There are also large cracks which are filled by calcite and celestine. Celestine sometimes is in idiomorphic tables or blades surrounded by calcite, sometimes forms bladed aggregates filling the vein. Less regular bodies of celestine and calcite enclose small pieces of the calcilutite bordered by dolomite and appear to be replacements, though doubtless connected with the veins. The rock from 11 ft above the base (S35152) [NT 5693 8497] is a turbid calcilutite containing fragments of very fine-grained rock of the same type. The matrix is patchily recrystallized and is permeated by a considerable quantity of celestine which seems to have replaced the recrystallized calcite and now encloses the turbid calcite.

d. As (b); 14 ft from base. Lab. No. M27110; $SrSO_4$, 14.03%. The rock (S35153) [NT 5693 8497] consists of a brown pelitomorphic aggregate of carbonate which develops perfect rhombic shapes against the numerous cavities and later fillings. Many of the cavities are filled by coarsely crystalline clear calcite and tables of celestine. The latter is always idiomorphic and presents sharp domal as well as basal faces to the calcite. Where calcite is absent the celestine moulds itself on the carbonate aggregate and develops good faces in the cavities. These coarsely crystalline minerals enclose spots of the brown carbonate aggregate which suggests that they are not only filling cavities but also replacing the pelitomorphic carbonate.

Carboniferous Limestone Series

Lower Limestone Group

Long Craig Upper, Hurlet, Main, &C.

Ayr

(SL 93) (p. 45) Hawthorn Limestone. Quarry at Glenmuir Limeworks, ½ mile N.E. of High Glenmuir, 4 miles E. of Cumnock. 1" Sheet 15; 6" Ayr. 36 N.W. (*Lst. Scot.,* 1949, p. 70).

(S34559) [NS 630 211]. Reddish-grey compact limestone. Composed of small debris of shells, crinoid columnals, spines, foraminifera and polyzoan fragments set in a matrix of very fine-grained calcite which is considerably recrystallized to larger grain of 0.02–0.03 mm. In this matrix small angular grains of quartz, shreds of white and bleached micas and traces of kaolinite are accessory. Small groups, 0.2 mm across, of small crystals of siderite with oxidized borders are scattered throughout the rock. *Limestone, luteous, sideritic, fine-grained, microfossiliferous, clastizoic.*

(SL 109) (p. 46) Dockra Limestone. Hessilhead Quarry, Lugton. 1" Sheet 22; 6" Ayr. 8 N.E. (*Lst. Scot.,* 1949, p. 74).

(S34564) [NS 3770 5325]. Whitish-grey limestone showing shells and spines of *Productus* and crinoid columnals. In thin section polyzoan zoaria, crinoid columnals, shell fragments and spines form the larger constituents in a base of fine-grained, turbid calcite which is extensively recrystallized to about 0.02–0.05 mm grain-size. A few entire ostracods, foraminiferal and thin-walled shells are present. Scarce stylolitic films with associated pyrite and traces of quartz are present.

Limestone, fine-grained, clastizoic.

(SL 114) (p. 46) Hawthorn Limestone. Crossflat Burn Quarry, Muirkirk. 1" Sheet 15; 6" Ayr. 31 N.W. (*Lst. Scot.,* 1949, p. 72).

(S34569) [NS 720 276]. Cream-coloured limestone, very fine-grained and composed of a pelitomorphic aggregate of calcite granules, about 0.001 mm diameter, in which very small shell and polyzoan fragments and a considerable number of foraminiferal tests are seen. The rock is traversed by im-persistent cracks which have been filled with clear calcite.

Limestone, pelitomorphic, microfossiliferous, subclastizoic.

(SL 149) (p. 46) Patna Limestone. Cairnshalloch Limeworks, 800 yd S.S.W. of Patna. 1" Sheet 14; 6" Ayr. 46 N.W. (*Lst. Scot.,* 1949, p. 67).

(S34651) [NS 408 100]. Compact buff-grey limestone with small crinoid fragments. Composed of a fine-grained base of granular carbonate (0.03 mm average grain-size) containing small, partly recrystallized organic debris. Opaque material occurs as grains of pyrite, pyritic replacement of minute fossils, and black bituminous or carbonaceous specks disseminated through the rock. Brownish calcareous clay is locally common. The organic remains include crinoid plates and many and various foraminifera, polyzoan fragments, brachiopod spines and thin-walled shells. *Limestone, fine-grained, microfossiliferous, clastizoic.*

Bute

(SL 82) (p. 46) Corrie Limestone. Corrie Harbour, Arran. 1" Sheet 21; 6" Bute. 238 S.E. (*Lst. Scot.,* 1949, p. 82).

(S34496) [NS 024 434]. Reddish-lilac, rather earthy limestone with large *Productus.* Composed of granular calcite, about 0.1 mm grain, and numerous shell fragments many of which are completely recrystallized and their presence shown only by a pseudomorphous residue of original impurities. Polyzoan fragments and spines are also present. Limonitic clay is common as intergranular pellicles and granules; quartz grains are scarce. *Limestone, argillaceous, fine-grained, zoophasmic.*

East Lothian

(SL 63) (p. 46) Long Craig Upper Limestone (probably). Quarry, Kiln Plantation, Blancc Bridge, ¾ mile E. of East Saltoun. 1" Sheet 33; 6" East Lothian 15 N.W. (*Lst. Scot.,* 1949, p. 94).

(S34552) [NT 4857 6797]. A pinkish-grey, compact limestone. Composed of debris of crinoids, shells, polyzoan zoaria and scarce spines and foraminifera in a matrix of calcite of grain 0.005 mm. Chalcedonic aggregates, limonitic replacements of siderite or ankerite and grains of quartz are sparsely distributed in the rock.

Limestone, micrograined, clastizoic.

(SL 64) (p. 46) Long Craig Upper Limestone (massive band in). Shore 100 yd E. of Garlic Rock, 1 mile W. of Aberlady. 1" Sheet 33; 6" East Lothian 4 N.E. (*Lst. Scot.,* 1949, p. 93).

(S34553) [NT 4497 8029]. A grey and buff dolomite of varying grain. Dolomitized relics of crinoids, polyzoa and shells are indicated by concentration of mineral dust and granules of pyrite. In the grey part of the rock ferruginous films are abundant. The buff part is coarser in grain and there are pellicles of brown limonite on the grains of dolomite; these have refractive index ■ about 1.690 indicative of a moderate content of iron carbonate. Aggregates of chalcedony occur

sparsely within the crinoid pseudomorphs.

Ferriferous dolomite, zoophasmic, uneven mosaic, taxichnic.

(SL 65) (p. 47) Long Craig Upper Limestone (probably). Quarry at Harelaw Limeworks, Longniddry station. 1" Sheet 33; 6" East Lothian 4 S.E. (*Lst. Scot.,* 1949, p. 93).

(S34554) [NT 4490 7625]. A compact, brownish-grey limestone composed of well-assorted fragments of crinoids, shells, polyzoa, spines and a few foraminifera and *Calcisphaera* in a fine matrix of calcite, 0.005–0.02 mm grain. Silica is present as chalcedonic filling in scarce, small limy pebbles. Pyritic replacement or infilling of polyzoan and foraminiferal tests is common.

Limestone, pelitomorphic to micrograined, microfossiliferous, clastizoic.

(SL 83) (p. 47) Long Craig Upper Limestone. Oxwell Mains Limeworks, 2½ miles S.E. of Dunbar. 1" Sheet 33; 6" East Lothian 7 S.W. (*Lst. Scot.,* 1949, p. 96).

(S34556) [NT 707 759]. Brownish-grey compact limestone. Fragmentary shells and polyzoa and foraminifera, ostracods and spines are embedded in a base recrystallized to granular calcite of grain 0.05–0.3 mm. The base is turbid with specks of opaque and brown materials much of which is residual from the tests and shells of fossils which have been obliterated by the recrystallization of the base. Pellicles of limonitic clay coat the recrystallized calcite grains.

Limestone, fine-grained, microfossiliferous, zoichnic, granular.

Fife

(SL 34) (p. 47) Charlestown Station Limestone. Old Quarry, W. side of Balneil Den, ¾ mile N.E. of Colinsburgh. 1" Sheet 41; 6" Fife 22 S.W.

(S34456) [NO 4848 0427]. Massive grey, crystalline dolomite with conspicuous crinoid ossicles. Composed of subhedral rhombs of dolomite, 0.1 to 0.5 mm grain, and larger irregularly bounded crystals representing crinoid remains which though only slightly recrystallized to small rhombs are entirely dolomite. The refractive index, ■ = 1.695 generally but occasionally rather higher, indicates that the dolomite is ankerite with a content of up to 10 per cent of ferrous carbonate. Limonitic matter fills interstices and in places coats the dolomite crystals. Grains of oxidized pyrite are present.

Ferriferous dolomite, medium-grained, zoophasmic, uneven mosaic.

(SL 37) (p. 47) Charlestown Station Limestone. Teassies Limeworks, 3 miles N. of Lundin Links station. 1" Sheet 41; 6" Fife 21 N.W.

(S34458) [NO 4054 0773]. A grey crystalline dolomite with crinoid ossicles. Consisting of grains and rhombs of ankeritic dolomite of 0.05–0.3 mm grain-size. The refractive index, ■ = 1.695, indicates about 20 per cent of the ferro-dolomitic component. Large grains of carbonate representing crinoid ossicles have shapeless boundaries owing to irregular replacement by smaller rhombs of dolomite but are nevertheless themselves converted to dolomite. Opaque pellicles, in part at least of pyrite, are frequent on the surface of the recrystallized carbonate grains.

Ferriferous dolomite, medium-grained, zoophasmic, uneven mosaic.

(SL 47) (p. 47) Charlestown Station Limestone. Old Quarries, Backfield of Ladeddie. 1" Sheet 49; 6" Fife. 14 N.E. (*Lst. Scot.,* 1949, p. 110).

(S34462) [NO 439 135]. A pale grey, compact limestone, slightly dolomitic, composed of fragmentary crinoid remains with abundant polyzoan relics and some granular carbonate and kaolin in the interstices. Dr. C. J. Stubblefield has recognized the polyzoa as Trepostomatous forms including the genus *Tabulipora.* The rock effervesces freely with cold dilute HCl and treatment in Lemberg's solution shows that the granular carbonate of the base is mostly calcite, but some

is probably dolomite. A little pyrite is present.

Limestone, dolomitic, fossiliferous: encrinite.

(SL 99) (p. 47) Charlestown Station Limestone. Longcraigs Quarry, West Lomond Hill. 1" Sheet 40; 6" Fife 19 N.W. (*Lst. Scot.,* 1949, p. 106).

(S34491) [NO 2044 0729]. Masive grey, fine-grained dolomite. Composed of granular turbid ankeritic dolomite, ■ about 1.695, grain 0.1–0.2 mm, in which are set large circular nests of clear granular dolomite representing crinoid columnals. Pyrite is abundant.

Ferriferous dolomite, pyritic, fine-grained, zoophasmic.

(SL 101) (p. 48) Charlestown Station Limestone (probably). N.E. Quarry, Bishop Hill, Lomond Hills. 1" Sheet 40; 6" Fife 19 S.W.

(S34493) [NO 1929 0515]. Grey and buff, medium-grained dolomite with many cavities. Composed of coarsely granular dolomite, 1–2 mm across, with fine-grained interstitial dolomite 04 to 0.2 mm grain. Calcite is distributed in accessory amount as is shown by steady diffuse effervescence with cold dilute HCl, but the section takes no stain in Lemberg's solution. Refractive index, ■ = 1.680 approx. shows that the dolomite is not an ankeritic variety.

Dolomite, varigrained, mosaic.

(SL 236) (p. 48) Pseudobreccia Limestone (Charlestown Station?). St Monans shore, E. of harbour. 1" Sheet 41; 6" Fife 22 S.E. (*Lst. Scot.,* 1949, p. 110).

(S35239) [NO 5375 0204]. Dark brownish-grey limestone with conchoidal fracture, speckled with small crinoid columnals and impregnated with pyrite in bulbous growths from which small bud-like aggregates extend. The limestone is composed of very fine debris through which foraminifera and fragments of shells and crinoid are scattered. The matrix is recrystallized in fine-grained calcite (0.02 mm grain-size), and the outlines of the fossils are in part lost. The pyrite appears as a spongy aggregate enclosing some unaltered fossil fragments and enters as an impregnation along with mainly carbonaceous matter, into some foraminifera and shell and polyzoan fragments. A crinoid columnal is seen in process of replacement by pyrite. Examination by reflected light shows organic structure in the opaque pyrite aggregate. The pyritic growths are thus replacement deposits in the limestone.

Limestone, pyritic, micrograined, microfossiliferous, clastizoic, partly zoophasmic.

(SL 237) (p. 48) 'White Coral or Hurlet Limestone' (Charlestown Station?). St Monans shore, E. of harbour. 1" Sheet 41; 6" Fife 22 S.E. (*Lst. Scot.,* 1949, p.110).

(S35240) [NO 5378 0205]. Upper 6 ft. A white limestone composed of *Lithostrotion.* In thin section seen to be composed of corals filled with clear, granular calcite and interstitially packed with fine debris, including shell and crinoid fragments and spines, which is considerably recrystallized. Rhombs of dolomite, probably an ankeritic variety, occur both within the corals and in the interstitial packing.

Limestone, dolomitic, fossiliferous: coral limestone, with pelitomorphic, clastizoic mesostasis.

(S35241) [NO 5378 0205]. Middle 3 ft, yellow. A white crystalline dolomite with many cavities. Composed of interfering rhombs of dolomite 0.03–0.3 mm across, mostly clear, but turbid in parts which probably represent the fine debris infilling between the corals. Circular outlines marked by a concentration of turbid dust represent coral walls, but no septa are preserved in this way.

Dolomite, varigrained, zoophasmic, mosaic.

(S35242) [NO 5378 0205]. Lower 6 ft or more. A white limestone with rough fracture. Composed of the debris of crinoids, thick and thin molluscan shells, ostracods, polyzoa, spines, occasional corals and foraminifera, embedded in a matrix of very fine-grained calcite which is partially recrystallized. *Limestone, pelitomorphic to fine-grained, clastizoic, zoophasmic.*

Lanark

(SL 174) (p. 48) Main Limestone. Bankend Limeworks, ½ mile S.W. of Bankend. 1" Sheet 23; 6" Lanark. 37 S.E. (*Lst. Scot.,* 1949, p. 138).

(S34905) [NS 8014 3302]. A dark buff-grey limestone showing numerous productid shells and spines in hand specimen. The thin section shows large shells which are mostly arranged flatly to the bedding, numerous spines and a few foraminifera and polyzoan fragments, in a matrix of fine granular calcite of about 0.03 mm average grain-size, scantily cemented by turbid brown argillo-calcareous matter.

Limestone, argillaceous, fossiliferous, clastizoic, bedded.

(SL 222) (p. 48) Main Limestone. 800 yd E.S.E. of Thorntonhall station, 3 mile W. of East Kilbridge. 1" Sheet 22; 6" Lanark. 16 N.E. (*Lst. Scot.,* 1949, p. 133).

(S35080) [NS 5953 5480]. A compact, brownish-grey limestone. Composed of the debris of shells, crinoids, productid spines and polyzoa, together with well-preserved foraminifera of various genera, in a plentiful matrix of calcite which is now crystallized in grains averaging 0.5 mm across, but of quite variable size in different portions of the rock. Bituminous, probably argillaceous matter and carbonaceous particles are widely disseminated interstitially to the calcite. The rock contains layers in which the shell and crinoid fragments are concentrated but foraminifera scarce, and the bituminous clay is gathered into fairly persistent sinuous and branching films. Foraminifera and polyzoa are usually heavily impregnated with opaque dust.

Limestone, fine-grained, microfossiliferous, clastizoic, bedded.

(SL 223) (p. 48) Main Limestone. Old Quarry 300 yd N.W. of Crosshouse Farm, 1½ miles S. of Hairmyres station. 1" Sheet 22; 6" Lanark. 16 S.E. (*Lst. Scot.,* 1949, p. 133).

(S35081) [NS 6066 5190]. A compact, dull brownish-grey limestone showing scattered small crinoid columnals. Composed of large and small debris of shells and crinoids, with many spines, scattered foraminifera and ostracods, scarce polyzoa and phosphatic fossil fragments, in a matrix of pelitomorphic calcite which is recrystallized to granular calcite of grain-size usually about 0.02 mm but varying up to about 0.15 mm in places. The section also contains one fragment of kaolin-filled cavernous limonite and two nodules of semi-opaque marl which may be faecal in origin. There is a considerable dissemination of ferruginous clay in the matrix and this is locally concentrated in thin black stylolitic films. Recrystalliz-ation has nearly obliterated many small organisms in the matrix and has affected some of the crinoid columnals.

Limestone, pelitomorphic, microfossiliferous, clastizoic.

Midlothian

(SL 19) (p. 49) Gilmerton Limestone, top (quarried). Ferniehill Quarry, Gilmerton. Sheet 32; 6" Midlothian 8 N.W. (*Lst. Scot.,* 1949, p. 144).

(S34527) [NT 2957 6920]. A dull grey, compact, fine-grained limestone composed of finely granular calcite, average grain-size about 0.02–0.04 mm, with recrystallized patches. There are a few bilabial sections of organisms and many tiny fragments of shell. Angular grains of quartz, granules of iron ore, and interstitial coatings of limonitic clay are present.

Limestone, luteous, micrograined, microclastizoichnic.

(SL 20) (p. 49) Gilmerton Limestone, bottom part (mined). Locality and references as for SL 19.

(S34528) [NT 2957 6920]. A brownish-grey, compact limestone. Composed partly of very fine-grained calcite as nodules of algal growth, partly of a compactly bedded mass of calcareous organic debris cemented by very fine-grained turbid calcite traversed by limonitic stylolitic films. The fossils present include crinoids, ostracods, polyzoa, shells, spines, and scarce phosphatic plates.

Limestone, algal, clastizoic, bedded.

(SL 46) (p. 49) Gilmerton (No. 1) Limestone. Common Hill Quarry, 670 yd S.W. of Middleton, 1" Sheet 32; 6" Midlothian 14 S.E. (*Lst. Scot.,* 1949, p. 147).

(S34535) [NT 3578 5765]. A grey and brownish, compact, fine-grained limestone with calcite-filled fractures. Composed of tiny calcareous fossils including foraminifera, spines, fragments of thin shells and pellets, accessory grains of quartz and granules of pyrite in a fine-grained turbid matrix of calcite, 0.01 grain, recrystallized extensively to clear calcite of grain 0.02 to 0.04 mm. In this base larger fragments of crinoid and shell and large spines are numerous.

Limestone, pelitomorphic to micrograined, microfossiliferous, clastizoic, zoophasmic.

Peebles

(SL 21) (p. 49) Gilmerton (No. 1) Limestone, upper part. Whitfield Limeworks, 600 yd N.W. of Deepsykehead, 1 mile S.E. of Carlops. 1" Sheet 24; 6" Peebles. 5 N.E. (*Lst. Scot.,* 1949, p. 151).

(S34542) [NT 171 543]. A dull dark grey, fine-grained limestone. Composed of small 0.02 mm, grains of calcite, chips of thin shell and small spines, quartz silt up to 0.05 mm grain, granules of iron ore, and streaks and blobs of hydrocarbon cemented by turbid, very fine-grained calcite. Heated in the closed tube the powdered rock emits a small amount of oil.
Limestone, luteous, bituminous, micrograined, microclastizoic, bedded.

(SL 182) (p. 49) Gilmerton (No. 1) Limestone, basal 8 ft (worked). Day level 200 yd S.E. of Whim Farm. 1" Sheet 24; 6" Peebles. 5 N.E. (*Lst. Scot.,* 1949, p. 152).

Cf. (S40470) [NT 216 531]. A pale grey, massive limestone consisting of a base of calcite, 0.05 mm and smaller grain, in which are scattered abundantly fragments of shell and polyzoa and numerous crinoid columnals, foramini-fera and spines. Pyrite-impregnated zones, sometimes superimposed on large bryozoan fragments suggest algal structures.

Limestone, micrograined, clastizoic.

(SL 183) (p. 49) Gilmerton (No. 1) Limestone, top 3 ft of lower part. Whitfield Limeworks. Locality and references as for SL 21.

Cf. (S40472) [NT 172 542]–(S40473) [NT 172 542]. Grey to dark 'grey compact limestone composed of round and angular grains of calcite, 0.02–0.05 mm across, with a cement of pelitomorphic calcite and clay. Fragments of shell are common, small crinoid columnals scattered, and pieces of phosphate scarce. Small angular quartz grains, granules of pyrite and drops of bitumen *are* present.

Limestone, luteous, fine-grained, clastizoichnic.

Stirling

(SL 159) (p. 50) Murrayshall (Hurlet) Limestone. Murrayshall Limeworks, Cambusbarron, 1½ miles S.W. of Stirling. 1" Sheet 29; 6" Stirling. 17 N.W. (*Lst. Scot.,* 1949, p. 177).

(S34859) [NS 7712 9217]. A black, compact, fine-grained limestone showing con-choidal fracture; specks of pyrite and crinoid columnals are sparsely distributed. Composed of a turbid, very fine-grained matrix of calcareous fossil debris, calcite granules, 0.005 mm, and probably some clay, in which are numerous fragmentary large and small shells, crinoid colum-nals, foraminifera, spines and polyzoa. Small opaque granules and wisps, fairly abundantly distributed, are largely

carbonaceous, but some are of pyrite. Shreds of bleached mica are present.

Limestone, argillaceous, pelitomorphic, fossiliferous, clastizoic.

Skateraw Middle, Charleston Green

East Lothian

(SL 62) (p. 50) Skateraw Middle (?) Limestone. Saltoun Limeworks, quarry south of road, ¾ mile N.W. of Saltoun. 1" Sheet 33; 6" East Lothian 14 N.E. (*Lst. Scot.,* 1949, p. 94).

(S34551) [NT 4702 6766]. A buff-grey limestone showing crinoid ossicles. Composed of the debris of calcareous organisms, including crinoids and shells with subordinate foraminifera and spines in a matrix of calcite of grain 0.020–0.1 mm. The shapes of the remains are becoming indefinite through general recrystallization, and are better preserved in an irregular, dark patch which is probably a faecal pellet.

Limestone, fine-grained, microfossiliferous, clastizoic.

(SL 84) (p. 50) Skateraw Middle Limestone. Shore at Skateraw. 1" Sheet 33; 6" East Lothian 12 N.E. (*Lst. Scot.,* 1949, p. 96).

(S34557) [NT 7466 7540]. Pale brownish-grey limestone, showing scattered cleavage faces of calcite and dull dark greenish specks. The rock is composed of the debris of shells, spines, occasional *Calcisphaera,* foraminifera, algae and scarce crinoidal remains in a very fine-grained base of calcite granules, 0.002–0.01 mm. Locally the base is recrystallized. The walls of many of the fossil fragments are impregnated with pyrite. Bituminous matter occurs sparsely in foraminifera chambers and in small clots.

Limestone, pelitomorphic to fine-grained, microfossiliferous, clastizoic.

Fife

(SL 100) (p. 50) Charleston Green Limestone (prob.). Wilkie's Quarry, West Lomond Hill. 1" Sheet 40; 6" Fife 19 N.W.

(S34492) [NO 2007 0677]. A blue-grey limestone, composed of granular calcite, in grains 0.02-0.05 mm across, among which the shapes of fragments of shell and crinoid are poorly preserved. Brown specks visible in hand specimen are composed of dolomite with disseminated limonitic matter.

Limestone, dolomitic, fine-grained, zoophasmic.

(SL 235) (p. 50) Limestone, 2 ft 6 in (Charlestown Green?). St. Monans Shore, E. of harbour. 1" Sheet 41; 6" Fife 22 S.E. (*Lst. Scot.,* 1949, p. 110).

(S35238) [NO 5372 0204]. A grey limestone with rough texture. Composed of rather coarse shell, polyzoan and crinoidal debris in a matrix of finely divided 'Calcite and small debris containing complete foraminifera, ostracods and spines and spotted with brownish probably bituminous matter. Many of the foraminifera and some shell fragments are deeply impregnated with opaque matter, which is pyritic in some cases. The powdered rock gives off heavy oil when heated in the closed tube, and in the thin section bituminous matter is abundantly distributed as short films and small clots.

Limestone, bituminous, microfossiliferous, clastizoic.

Kinross

(SL 103) (p. 50) Charlestown Green Limestone (prob.). White Craigs Quarry, S. shoulder of Bishop Hill. 1" Sheet 40; 6" Fife and Kinross. 18 S.E.

(S40337) [NO 1864 0302] and (S34495) [NO 1865 0301]. A grey and brown, crystalline dolomite with large cavities. Composed of interlocking grains of dolomite, of grain varying from 0.1 to 1.5 mm, between and among which limonitic dust is widely distributed. The sample contains bands of dolomitic chert in which whole and fragmentary crinoid plates, completely dolomitized, are numerous.

Dolomite, zoophasmic, uneven mosaic, and dolomitic chert, taxichnic

Charlestown Main, North Greens, Petershill

Fife

SL 8 (p. 51) Charlestown Main Limestone. Duloch Limestone Mine, Sunnybank, 1 mile N. of Inverkeithing. 1" Sheet 32; 6" Fife 39 S.W.

(S34442) [NT 1292 8450]. A grey-brown, finely granular dolomite, of grain-size 01 mm, in which numerous crinoid columnals remain recognizable as large crystals partly replaced by the fine-grained dolomite. Tests with acid and Lemberg's solution show that the large crystals as well as the small are dolomite. A few ghosts of other organic structure persist. Black and reddish dust frequently outlines these structures and is also concentrated where no organic structure is recognized.

Ferriferous dolomite, medium-grained, zoophasmic, mosaic.

SL 9 (p. 51) Charlestown Main Limestone. Roscobie Quarry and mine, 3 miles N. of Dunfermline. 1" Sheet 40; 6" Fife 34 N.W. (*Lst. Scot.,* 1949, p. 102; see also No. (SL 226) p. 121).

(S34443) [NT 0926 9286]. A very dark grey limestone containing numerous large crinoid ossicles. Unsorted complete and fragmentary crinoid ossicles, preserved in coarsely granular calcite, are embedded in a matrix of microgranular calcite and small recrystallized fossil debris. Black, carbonaceous matter is locally abundant interstitially to the calcite matrix. A small amount of dolomite is present in the larger, recrystallized shell fragments.

Limestone, dolomitic, varigrained, zoophasmic.

(SL 10) (p. 51) Charlestown Main Limestone, Chapel Quarry, about 2 miles N.W. of Kirkcaldy. 1" Sheet 40; 6" Fife 35 N.E. (*Lst. Scot.,* 1949, p. 104; also J. Phemister and A. G. MacGregor, *Mineralogical Mag., vol.* xxvi, 1942, pp. 275–282. See also Nos. (SL 210)–215 below).

(S34444) [NT 252 939]. Dark grey limestone mottled with white powdery material. (Specimen from about 6–8 ft above the quarry floor). Composed of granular carbonate, 01 mm grain-size, with debris of shells and crinoids. Nests of more coarsely granular carbonate have a dusky brown appearance. Lemberg's test shows that the carbonate is all calcite. Some bands of the rock are rich in tiny grains, giving square and six-sided sections, of garnet (grossular) and also in poorly shaped crystals of datolite. The largest garnet grains are about 0.08 mm across.

Limestone with calc-silicates, varigrained, zoophasmic.

E 34445. Pale grey limestone with pink and white patches. (Specimen from near the quarry floor). The rock is partly a limestone composed of organic debris with abundant echinodermal fragments. Throughout this portion grains of datolite and garnet are common. Part of the rock is more shaly, enclosing crinoid remains. This portion is brown and opaque, but near the edge of the slide it shows fibres and a multitude of minute grains and prisms with high extinction angle. 'Pectolite has been observed as the main constituent of two very thin sinuous and im-persistent veins in one of which the pectolite is locally replaced by apophyllite.' (Phemister and MacGregor, *op. cit.).*

Limestone with calcsilicates, fine-grained, zoichnic, bedded.

(SL 48) (p. 51) Charlestown Main Limestone, basal part. Cults and Pitlessie Limeworks, 4 miles S.S.W. of Cupar. 1" Sheet 40; 6" Fife 13 S.E.

(S34463) [NO 344 086]. A dark grey, compact limestone composed of fragments of crinoids, shells and polyzoa and of foraminifera, in a fine granular calcite base. The polyzoa are often outlined in opaque matter sometimes recognizable as pyrites, and local concentrations of black, possibly carbonaceous, matter are numerous. Bitumen is present in small quantity as tiny wisps and clots.

Limestone, varigrained, microfossiliferous, in part zoophasmic, clasti zoich-nic, bedded.

(SL 49) (p. 51) Charlestown Main Limestone, main seam workings. Cults and Pitlessie Limeworks. 1" Sheet 40; 6" Fife 13 S.E. (*Lst. Scot.,* 1949, p. 109)

(S34464) [NO 344 080]. Brownish-grey, compact, finely granular limestone composed largely of the debris of shells, polyzoa and foraminifera in a base of small grains of calcite. Treatment in Lemberg's solution shows that the carbonate is dominantly calcite, but some turbid foraminifera and shell fragments do not stain or stain only slightly. Brown interstitial films and scraps of bitumen are abundant and grains of pyrite sparse.

Limestone, fine-grained, microfossiliferous, clastizoic.

(SL 50) (p. 51) 'Thin Limestone above the Hurlet' (Charlestown Main?). Old West Quarry, Forthar Old Limeworks, 1 mile E.S.E. of Freuchie. 1" Sheet 40; 6" Fife 20 N.W.

(S34465) [NO 2952 0584]. A dark calcareous dolomite with *Lithostrotion.* The corals, completely recrystallized but occasionally showing traces of septa in the form of trains of mineral particles, are set in a matrix of granular carbonate, coloured brownish by carbonaceous matter, and clear shell fragments. A little pyrite is present. The dolomite is ferriferous, the ordinary refractive index varying about 1.697. Immersion in logwood stain failed to reveal calcite, and staining by the silver nitrate-potassium chromate method as modified by H. E. Wilson produced a general pinkish stain with numerous minute points of concentration. Since the chemical analysis indicates the presence of excess calcite over the proportions required for ferriferous dolomite, the failure of the staining method to reveal discrete crystals of calcite suggests that the excess carbonate is present in solid solution in the dolomite.

Ferriferous dolomite, fine-grained, zoichnic, taxichnic.

(SL 97) (p. 52) Charlestown Main Limestone (prob.). Easter Glasslie, 2½ miles N. of Leslie. 1" Sheet 40; 6" Fife 19 N.W. (*Lst. Scot.,* 1949, p. 107).

(S34489) [NO 2371 0524]. Grey, brownish weathering dolomite, composed of irregular, interlocking grains of turbid dolomite, 0.5–0.2 mm, with accessory pyrite and disseminated fine carbonaceous particles.

Dolomite, varigrained, zoophasmic, diacrystallic.

(SL 98) (p. 52) Charlestown Main Limestone. East Lomond Quarry, at base of East Lomond Hill, about 1¼ miles S.W. of Falkland. 1" Sheet 40; 6" Fife 19 N.E. (*Lst. Scot.,* 1949, p. 106).

(S34490) [NO 2383 0584]. Dark, grey, saccharoidal limestone composed of inequigranular calcite, 0.05–0.5 mm, with much opaque, argillaceous material, including oxidized pyrite and carbonaceous matter, distributed through the rock.

Limestone, argillaceous, medium grained, zoophasmic, granular.

(SL 121) (p. 52) Charlestown Main Limestone. Invertiel Quarry, 1 mile S.S.W. of Kirkcaldy. 1" Sheet 40; 6" Fife 35 S.E.

(S34594) [NT 2710 8981]. Pale grey, compact dolomite with argillaceous films. The thin section shows a mass of fossil fragments, mainly large and small crinoidal remains, spines, shells and thick-walled cellular structures in a finely granular cement of carbonate and opaque clay. A few thick siliceous spines, with carbonate-filled canal, are present. Granules of pyrite and shreds of carbonaceous matter are abundant.

Dolomite, argillaceous, clastizoic, bedded.

(SL 210) (p. 52) Charlestown Main Limestone, 22–23 ft from base of quarry face. Chapel Limestone Quarry, about 2 miles N.W. of Kirkcaldy. 1" Sheet 40; 6" Fife. 35 N.E. (*Lst. Scot.,* 1949, p. 104; also J. Phemister and A. G. MacGregor, *Mineralogical Mag., vol.* xxvi, 1942, pp. 275–282; see also (SL 10), p. 117).

(S35900) [NT 252 939]. Coarse, bluish dolomite mottled with duller, cream-coloured dolomite. The section shows dolomite in crystals up to 1.0 mm in size, mostly of irregular shape, but often showing rhomboidal angles. Interstitial between the grains is a patchy cement of clay aggregate, faintly yellowish-green in places and possessing a moderate birefringence. A little secondary quartz is present and pyrite occurs in small scattered grains. The dolomite usually shows undulose extinction.

Dolomite with clay aggregate, medium-grained, uneven mosaic, strained.

(SL 211) (p. 52) Charlestown Main Limestone, 12–22 ft above base of quarry face. Locality and references as for (SL 210).

(S35901) [NT 252 939]. Grey compact, translucent limestone, with numerous spots of a white fibrous mineral. The rock is composed of granular calcite, of 0.1–0.4 mm grain-size, together with larger grains, up to 0.5 mm long, in which the trabecular structure and axial canals of crinoids may be retained. Large plumose aggregates of prismatic and acicular pectolite are numerous. Garnet is uniformly scattered through the rock in small idio-blastic crystals up to 0.1 mm diameter, and datolite, in irregular grains, is scarce.

Limestone with calcsilicates, varigrained, zoophasmic, diacrystallic, in part granobiastic.

(SL 212) (p. 52) Charlestown Main Limestone, 9–12 ft above base of quarry face. Locality and references as for (SL 210).

(S35902) [NT 252 939]. Compact grey limestone permeated with and containing compact aggregates of greenish-yellow structureless clay and also some microcrystalline greenish-white aggregates. The limestone is composed of granular calcite of 0.1 mm grain-size and over, with occasional relict organic structures of which the most conspicuous are foraminifera, within the chambers of which the calcite is coarsely recrystallized. Spines and occasional crinoid ossicles are also obvious. Masses of an almost opaque, finely divided clay aggregate are abundant in patches. Garnet is locally developed in dodecahedra and in irregular grains or aggregates up to 0.2 mm across and the microcrystalline greenish aggregate seen in hand specimen is largely grossular. No datolite was found.

Limestone with calcsilicates, varigrained, zoophasmic, in part granoblastic.

(SL 213) (p. 53) Charlestown Main Limestone, 6–9 ft above base of quarry face. Locality and references as for (SL 210).

(S35903) [NT 252 939]. Dull grey limestone with numerous white spots and scarcer pale green spots, and with a band in which a greenish mineral is more abundant than calcite and is streaked out parallel to the band. The limestone is composed of granular calcite, 0.02 mm–0.6 mm grain-size, together with numerous large grains representing crinoid ossicles. Relict organic structures are preserved by outlines in clay, and shapeless masses of opaque clay are abundant. Also aggregates of translucent cryptocrystalline, moderately birefringent material are common. No datolite or garnet was seen. The white spots seen in the specimen are not pectolite, but a finely divided flaky aggregate of moderate birefringence, perhaps talc. (Note: talc or steatite was identified in other specimens; see J. Phemister & A. G. MacGregor, *Mineralogical Mag., vol.* xxvi, 1942).

Limestone with talc, varigrained, zoophasmic.

(SL 214) (p. 53) Charlestown Main Limestone, 3–6 ft above base of quarry face. Locality and references as for (SL 210).

(S35904) [NT 252 939]. Dark grey limestone with grey spots, passing to yellowish-grey overall with black streaks and a pale green mineral filling spaces lined with black material. The dark part is well crystallized to irregular granular calcite of varying size and uniformly permeated by brown dust or stain. This portion still contains crinoid ossicles and outlines of

shells in both cases recrystallized, though the former may still be of one piece and retain trabecular structure. The paler coloured limestone is little different, except in smaller grain-size and absence of brown coloration in the calcite. Garnet (grossular) is well distributed throughout the whole rock. Only a small quantity of fine-grained, almost opaque, aggregate is present in the section.

Limestone with garnet, varigrained, zoophasmic.

(SL 215) (p. 53) Charlestown Main Limestone, from base to 3 ft above base of quarry face. Locality and references as for (SL 210).

(S35905) [NT 252 939]. Grey limestone with patches of lustreless greenish clay. The rock is composed of slightly recrystallized granular calcite, 0.02–0.2 mm, in which crinoid ossicles (not recrystallized), shells and recrystallized ostracods are numerous. There are also several foraminifera whose walls are replaced by garnet. A semi-opaque, white, fibrous aggregate forms a patchy cement and minute garnets occur singly or in aggregates in considerable quantity scattered through the rock.

Limestone with garnet, fine-grained, zoichnic.

(SL 224) (p. 53) Charlestown Main Limestone, higher, dolomitic part. N. end of West Quarry, Charlestown, 3 miles S.W. of Dunfermline. 1" Sheet 32; 6" Fife 38 S.E. (*Lst. Scot.,* 1949, pp. 101–2; see also (SL 276), below).

(S35082) [NT 0656 8423]. A buff microcrystalline dolomite with many cavities which are surrounded by iron staining. Composed of turbid grains, rhomboid and irregular 0.1–0.25 mm across, of dolomite. Diffuse curved outlines of shells and crinoid columnals are preserved as single crystals of dolomite. There are a few small irregular grains of chert and secondary quartz and of composite granular quartz probably of detrital origin. The well preserved crinoid columnals can be seen in the hand specimen. They do not react with cold dilute acid but usually active effervescence can be seen on their borders or in the canal. No calcite can be distinguished in these positions in the section. Occasionally a crinoid columnal is considerably replaced by secondary quartz in which trabecular structure may be retained.

Dolomite, varigrained, zoophasmic, holey, uneven mosaic.

(SL 225) (p. 53) Charlestown Main Limestone, worked portion. Locality and references as for (SL 224).

(S35083) [NT 0633 8385]. A dull, compact brownish-grey limestone. Calcite occurs filling joints. Composed of a matrix of brown clay and calcite mud filled with a calcite sand, flattened fragments of thin shells and fragments of crinoids and of shelly crinoidal limestone which has been soft when incorporated in the deposit. These limestone fragments have probably been derived from layers of clay-free calcareous debris one of which is seen in the section. In the most clayey portion of the section there are stylolitic films of carbonaceous or bituminous matter. Larger fragments of crinoid and coral are scattered in the fine-grained argillaceous limestone.

Limestone, argillaceous, pelitomorphic, clastizoic, bedded.

(SL 226) (p. 53) Charlestown Main Limestone, 2–5 ft above dolerite sill. Mine, at N.W. end of Roscobie Quarry. 1" Sheet 40; 6" Fife 33 N.E. (*Lst. Scot.,* 1949, p. 103; see also SL 9 above).

(S35084) [NT 091 932]. A grey limestone with a greenish tinge, with rough fracture and altered aspect. Composed of a mosaic of clear granular calcite of varying grain-size (0.01–0.2 mm). In this are scattered numerous relics of crinoid columnals and shells. The shape of the columnals is retained but the plates are recrystallized to granular aggregates. The shape of the shells is very largely lost through recrystallization. There is a considerable quantity of clear interstitial substance amongst the calcite mosaic. This is an aggregate of very small fibres and scales insoluble in cold dilute HCl and appears as a greenish clay when the calcite is dissolved out. When thus separated the colour of the mineral is in general pale greenish, but often yellow and occasionally brown; from its optical properties it seems to be an antigoritic chlorite. Small black grains are scattered in accessory proportions in the rock and larger grains of pyrite are scarce.

Limestone with chlorite, clastizoic, zoichnic, granular.

(SL 234) (p. 54) Charlestown Main Limestone (?). St. Monans shore, E. of harbour 1" Sheet 41; 6" Fife 22 S.E.

(S35237) [NO 5367 0203]. A dull grey dolomite showing crinoid ossicles: these do not effervesce in cold dilute HCl, but a slight overall effervescence in the rock shows the dissemination of calcite. The section shows large crinoid columnals and shell fragments, the structure of which is destroyed by recrystallization, in a ground of dolomite, of grain-size 0.02–0.1 mm, coloured brown by disseminated bituminous clay. Stylolitic films separate bands of debris of differing grain-size. There are a few small brown isotropic phosphatic fossil fragments. The crinoid columnals are preserved in dolomite though generally retaining their single crystal structure and enclosing small rhombs of dolomite. The dolomite is ferriferous, the ordinary refractive index being 1.695.

Ferriferous dolomite, fine-grained, clastizoichnic, taxichnic.

(SL 276) (p. 54) Charlestown Main Limestone, top 7 ft in N.W. corner of West Quarry, Charlestown Quarries, 3 miles S.W. of Dunfermline. 1" Sheet 32; 6" Fife 38 S.E. (see also (SL 224) and (SL 225) above).

(S35799) [NT 0648 8424]. A brownish, compact dolomitized limestone, having a crystalline appearance due to the abundance of crinoid plates. It is composed of fossil debris consisting essentially of crinoidal and polyzoan fragments; subordinate fossil components include shells, spines, foraminifera, siliceous spicules and scarce phosphatic fragments. Parts of the rock are completely dolomitized; in other parts, while the matrix is recrystallized in dolomite and partly replaced by quartz, the larger fossil structures remain wholly or in part of calcite.

Limestone, dolomitic, fossiliferous, clastizoic.

(SL 277) (p. 54) Charlestown Main Limestone, top 1 ft 6 in. Bogie Mains Quarry, 1 mile N.W. of Kirkcaldy station. 1" Sheet 40; 6" Fife 35 N.E. (*Lst. Scot.,* 1949, p. 105).

(S35800) [NT 2645 9340]. Dark grey rock with white angular specks, showing a faint undulating lamination. In thin section, consists of a matrix of fine-grained silica and obscure opaque material, in which are embedded numerous bodies of round, rectangular or less regular shapes, sometimes showing relics of shell structure. These may be composed entirely of cherty silica, of silica and prochlorite, silica and dolomite, or of all three; or they may be entirely of chlorite or of dolomite. Only in one large dolomite-silica fragment was the trabecular structure of a crinoid recognized. The chlorite is pleochroic from yellow to colourless. The rock appears to be a silicified shale, originally calcareous and rich in fossil debris. The large amount of chlorite suggests that pyroclastic material formed part of the original sediment. The silica available for silicification may also have been of volcanic origin.

Dolomitic chert, bedded.

(SL 278) (p. 54) Charlestown Main Limestone, 1 ft 6 in-8 ft from top. Locality and references as for (SL 277).

(S35801) [NT 2645 9340]. A pale grey limestone with a coarse appearance due to the abundance of large crinoidal remains. Consists of large and small crinoid ossicles cemented by a matrix partly of very finely divided calcite, partly of clear granular carbonate, having the rhomboid shape of dolomite and with subordinate clay mineral. Small and extensive areas of silicification are numerous and black carbonaceous shreds are abundant in association with the clay.

Limestone, dolomitic, silicified, crinoidal: encrinite.

(SL 279) (p. 54) Charlestown Main Limestone, top 10 ft at E. end of quarry face. Glenniston Quarry, 1 mile N. of Auchtertool. 1" Sheet 40; 6" Fife 35 N. W., S.W., (*Lst. Scot.,* 1949, p. 105).

(S35802) [NT 2180 9250]. A compact, fawn-coloured dolomite with crinoid ossicles which effervesce slightly with cold dilute HCl. Composed of interlocking grains of dolomite, 01–0.2 mm across, amongst which there are single crystal dolomite replacements of crinoid ossicles and coarsely crystalline aggregates after shell casts. There is great variation in the degree of preservation of the original outline of the organic constituents, some ossicles and shell casts being perfect,

while others are mere indications. Calcite was not distinguished as such, but must be fairly uniformly present through the rock on the evidence of slight overall effervescence with cold dilute HCl.

Dolomite, calcareous, varigrained, zoichnic, uneven mosaic.

(SL 280) (p. 54) Charlestown Main (Seafield Tower) Limestone, lowest 3½ ft. Shore S. of Seafield Tower, Kirkcaldy. 1" Sheet 40; 6" Fife 40 N.E. (*Lst. Scot.,* 1949, p. 106).

(S35803) [NT 2794 8853]. A brown, compact, microcrystalline dolomite showing slight overall effervescence in cold dilute HCl. Crinoid ossicles unaffected by cold dilute HCl are scattered in the rock. In thin section the rock is a dolomite of very variable grain, parts being of 0.1 mm grain-size and cemented by limonitic clay, most being about 0.2 mm grain-size, but large areas show recrystallized dolomite of grain 0.5–1.0 mm across. In this rock there is much more disseminated limonite (or limonitic clay) than in (S35802) [NT 2180 9250] (see (SL 279) above), and because of original impurities having impregnated the carbonate of the crinoids, the trabecular structure is extensively preserved in spite of the dolomitization, which may have completely destroyed all other evidence, including shape. *Dolomite, varigrained, zoophasmic, diacrystallic, homoiolithic.*

Kinross

(SL 102) (p. 55) Charlestown Main Limestone. Clatteringwell Quarry, Bishop Hill, about 1 mile N.E. of Kinnesswood. 1" Sheet 40; 6" Fife & Kinross. 18 S.E. (*Lst. Scot.,* 1949, p. 129).

(S34494) [NO 1854 0370]. Pale brownish, greenish-mottle limestone composed of crinoid and shell fragments in a fine calcareous base in which finely divided chlorite is locally abundant and tiny crystals of pyrite are universally present. The fossil fragments are greatly recrystallized, but trabecular structure is commonly preserved, even when replacement by calcite-chlorite aggregate has occurred. The residue from solution in cold dilute HCl includes grossular, forsterite, diopside, opaque spinellid, and brookite, rutile and zircon.

Limestone with chlorite, pelitomorphic, clastizoic, zoichnic.

(SL 231) (p. 55) Charlestown Main Limestone, typical sample from working face. Clatteringwell Quarry. Locality and references as for (SL 102).

(S35470) [NO 1854 0370]. A blue-grey and whitish, fine-grained saccharoidal limestone, composed of granular anhedral calcite, varying irregularly in grain from 0.03 to 0.5 mm and in places showing regular changes in grain over areas which represent fossil structures. Small garnets, 0.05–0.15 mm across are common and there are some groups of small oxidized pyrite cubes.

Limestone, with garnet, varigrained, zoophasmic, in part granoblastic.

(SL 232) (p. 55) Charlestown Main Limestone, from lower half of quarry face a short distance above a 200-ft quartz-dolerite sill. Clatteringwell Quarry. Locality and references as for (SL 102).

(S35471) [NO 1854 0370], (S35472) [NO 1854 0370]. (S35471) [NO 1854 0370] is a whitish fine-grained and (S35472) [NO 1854 0370] a blue-grey and greenish-grey saccharoidal limestone. In thin section both show numerous pseudomorphs, in granular calcite, of crinoid columnals, trabecular structure being retained and picked out by impregnations of opaque dust around the pores (S35471) [NO 1854 0370]. Shell moulds and debris of productid spines, shelly and echinodermal material and possibly fora-minifera are present in (S35472) [NO 1854 0370]. In the latter specimen however, colourless garnets also are abundant and there is a large amount of cementing material composed of birefringent, semi-opaque fibrous aggregate from which garnet appears to be in process of development. The garnet is a lime-garnet with a refractive index indicating about 12 per cent of the andradite molecule. The fibrous aggregate is a mixture of minerals difficult to discriminate but including chlorite, muscovite, an antigoritic mineral, and a little diopside.

Limestone, with calcsilicates, varigrained, zoophasmic, granular to granoblastic.

Midlothian

(SL 41) (p. 55) North Greens (No. 2) Limestone, basal 15 ft. Middleton Limeworks, Middleton. 1" Sheet 32; 6" Midlothian 14 S.E. (*Lst. Scot.,* 1949, p. 146)

(S34529) [NT 356 583]. Compact, grey limestone composed of finely granular calcite, 0.01–0.1 mm grain-size, enclosing debris of small shells, foraminifera, vermiform algae encrusting crinoid and shell fragments, small bodies giving horned hemispherical sections, occasional larger fragments of crinoid and shell and thin-walled bodies, apparently ostracods. *Limestone, micrograined, microfossiliferous, clastizoic.*

(S34530) [NT 356 583]. Compact, darker grey limestone containing larger and less recrystallized organic remains than (S34529) [NT 356 583]. Fragments of crinoids, large shells, foraminifera, tubular bodies, small shells and some septate small bodies are numerous; polyzoa are present. The matrix is of granular calcite, averaging 0.5 mm grain, cemented by finely divided calcite and bituminous matter, and contains occasional faecal pellets. *Limestone, fine-grained, microfossiliferous, clastizoic.*

(SL 42) (p. 55) North Greens (No. 2) Limestone, upper 30 ft of bed. Middleton Quarry, 1100 yd S.W. of Middleton. References as for SL 41.

(S34531) [NT 353 575]. A fine uniform grained, fawn-grey limestone, composed of recrystallized grains of calcite (0.05 mm grain-size) cemented by limonitic clay which is locally abundant and impregnated with black matter. Isolated fragments of polyzoa, thin-walled valves and foraminifera are preserved.

Limestone, fine-grained, microfossiliferous, clastizoichnic.

(SL 55) (p. 55) North Greens (No. 2) Limestone, basal mined band. Quarry on left bank of Tyne Water, 200 yd N. of Currie Lee Limeworks, 3 miles E. of Gorebridge. 1" Sheet 32; 6" Midlothian 15 N.W. (*Lst. Scot.,* 1949, p. 147).

(S34536) [NT 3799 6236]. Compact, fawn-grey limestone composed of finely triturated debris of calcareous organisms with numerous fragments of small shells and many foraminifera and scarcer spines, *Calcisphaera,* polyzoan and algal fragments, and small faecal pellets, in a recrystallized base of finely granular calcite.

Limestone, micrograined, microfossiliferous, clastizoichnic.

(SL 56) (p. 56) North Greens (No. 2) Limestone. Quarry 400 yd N. 5° E. of D'Arcy Farm, 2¼ miles S.E. of Dalkeith. 1" Sheet 32; 6" Midlothian 8 S.E. (*Lst. Scot.,* 1949, p. 147).

(S34537) [NT 3602 6498]. Platy, dark grey, calcareous shale. The section shows a brown-stained, isotropic, argillaceous base in which are set very numerous fragments of calcareous organisms, including echinoderms and shells, prisms of calcite showing rectangular and occasional hexagonal sections, and small bodies giving circular sections. A few small grains of quartz are present and specks of carbonaceous and bituminous matter are abundant.

Calcareous shale, clastizoic.

(S34538) [NT 3602 6498]. The section shows a more intimate mixture of argillaceous and fine calcareous material enclosing many small crinoid columnals and some shell fragments.

Calcareous shale, clastizoic.

(SL 57) (p. 56) North Greens (No. 2) Limestone, top half of upper band. Quarry 160 yd N.W. of Northfield, Cousland Lime Workings, 2½ miles E.N.E. of Dalkeith. 1" Sheet 32; 6" Midlothian 8 N.E. (*Lst. Scot.,* 1949, p. 147–8).

(S34539) [NT 3761 6865]. A grey and brownish, earthy limestone. The section shows almost equal proportions of brown argillaceous and calcareous material, among which thin rectangular sections (possibly pieces of thin-walled shells) are prominent. Remains of crinoids, polyzoa, shells and spines can be recognized but for the most part the calcareous

material is small platy debris. Angular grains of quartz and shreds of muscovite and bleached biotite are common throughout the rock.

Calcareous shale, clastizoic.

(SL 58) (p. 56) North Greens (No. 2) Limestone, bottom half of upper band. Locality and references as for SL 57.

(S34540) [NT 3761 6865]. A dull grey, very fine-grained limestone composed of fine debris and fragments of calcareous organisms with a considerable amount of brownish argillaceous matter. A few small crinoidal and foraminiferal remains are scattered through the rock. Small angular quartz grains are present and specks of carbonaceous and bituminous matter are evenly disseminated.

Limestone, luteous, micrograined, microclastizoic.

(SL 59) (p. 56) North Greens (No. 2) Limestone, lower massive half. Locality and references as for SL 57.

(S34541) [NT 3761 6865]. Bedded limestone composed largely of fragments of calcareous organisms with cementing fine calcareous debris and some argillaceous and bituminous matter. Crinoids, foraminifera, shells and polyzoan fragments are numerous and lie with their flatter surfaces along the bedding.

Limestone, pelitomorphic, clastizoic, bedded.

(SL 81) (p. 56) North Greens (No. 2) Limestone. Upper Side Quarry, 100 yd S.S.W. of Fountainside, 2½ miles S.W. of Temple. 1" Sheet 32; 6" Midlothian 20 N.W. (*Lst. Scot.,* 1949, p. 146).

(S34555) [NT 2931 5589]. Compact, dark grey limestone. Partly recrystallized fragments of thin shells, scarce foraminifera, scarce small shells filled with clear granular calcite, numerous pyrite-impregnated straight and curved fragments and very scarce polyzoan fragments are embedded in a base of very fine-grained, granular calcite and probably clay. The grain of the base increases in places to 0.03 mm size. The rock is traversed by very thin impersistent calcite-filled fractures. A few small crystals of a yellow, highly refractive, isotropic mineral taken to be sphalerite occur in a shell and a spine.

Limestone, luteous, pelitomorphic, clastizoichnic.

Peebles

(SL 23) (p. 56) North Greens (No. 2) Limestone. Bents Quarry, 600 yd N. of Macbiehill House. 1" Sheet 24; 6" Peebles. 5 S.E. (*Lst. Scot.,* 1949, p. 152)

(S34544) [NT 184 519]. Fawn-grey, compact limestone composed of fragments of crinoids, shells and polyzoa in a turbid base partly of granular calcareous debris, partly pelitomorphic calcite. Foraminifera are present and these and polyzoan chambers are occasionally filled with glauconitic mineral aggregate. Pyrite and fossil phosphate are accessory. Thin calcite veins cut the rock.

Limestone, fine-grained, clastizoic.

West Lothian

(SL 51) (p. 57) Petershill Limestone, near top. Quarry 1000 yd N. 5" E. of north-east end of Petershill Reservoir, near Bathgate. 1" Sheet 31; 6" West Lothian N.S. 9 N.E. (*Lst. Scot.,* 1949, p. 195).

(S34446) [NS 9874 7078]. A brown, coarse-grained limestone composed mainly of whole and fragmentary crinoid ossicles with granular calcareous debris and rhombs of dolomite, scarce shell debris and a few ooliths in the interstices. There is a little pyrite and some phosphatic material. Bituminous matter is disseminated in the interstitial carbonate.

Limestone, crinoidal: encrinite.

(SL 52) (p. 57) Petershill Limestone, 10 ft from top. Locality and references as for SL 51.

(S34447) [NS 9874 7078]. Brownish-grey, compact limestone composed of calcareous debris including fragments of small shells and crinoids and numerous tests of foraminifera. A little bituminous matter is present. The matrix is of finely divided calcite in process of recrystallization.

Limestone, micrograined, microfossiliferous, clastizoic.

(SL 53) (p. 57) Petershill Limestone, lower part. Locality and references as for SL 51

(S34448) [NS 9874 7078]. A dark grey, coarse-grained limestone composed of crinoid and shell debris, the latter partly incorporated in the recrystallized base of granular calcite.

Limestone, crinoidal: encrinite.

Limestones of the Hosie Group

Fife

(SL 233) (p. 57) 'Hosie Limestone' (?). St. Monans shore E. of harbour. 1" Sheet 41; 6" Fife 22 S.E.

(S35236) [NO 5315 0180]. A dull brownish-grey fine-grained dolomite with many small cavities. The section shows numerous dolomitized fossil relics including shell and crinoid fragments, small gastropod shells, round bodies and scarce fragments of ostracods and possibly of polyzoa, in a matrix of fine debris which has been converted to dolomite of grain-size about 0.01 mm. Ferriferous dolomite of grain up to 0.2 mm occurs in irregular small patches. Pyrite impregnates some of the crinoids, gastropods and other shell fragments.

Ferriferous dolomite, micrograined, clastizoic, taxichnic

(SL 281) (p. 57) Mid-Kinniny Limestone (prob.) Old Limestone mine, Luscar, Garnock. 1" Sheet 40; 6" Fife 33 S.E. (*Lst. Scot.,* 1949, p. 103).

(S35804) [NT 0503 8982]. Dark grey crystalline limestone. In section seen to be a recrystallized limestone of grain-size 0.1–0.5 mm. The original structure is almost entirely destroyed, but in places trabecular structure is preserved by the presence of powdery impurities. The argillaceous and carbonaceous impurities of the limestone are not well segregated in spite of extensive recrystallization, and largely remain inside the new grains. A small aggregate of granular apatite was noted, perhaps from its long slender shape replacing a fish spine. A little pyrite is present. *Limestone, varigrained, zoophasmic, clastizoic, in part granoblastic.*

Midlothian

(SL 43) (p. 57) Bilston Burn (No. 3) Limestone, main quarried band. Quarry, Esperston Limeworks, 660 yd N.E. of Esperston. 1" Sheet 32; 6" Midlothian 20 N.E. (*Lst. Scot.,* 1949, p. 146).

(S34532) [NT 345 573]. Dark grey, fine-grained limestone containing fragments of small shells and polyzoa (outlined by pyrite) and foraminifera. The matrix is of granular calcite, 0.01 to 0.03 mm grain, and the more complete shells are filled with coarser calcite.

Limestone, micrograined, microfossiliferous, clastizoichnic.

(SL 44) (p. 58) Bilston Burn (No. 3) Limestone, 3 ft dolomitic band at top. Locality and references as for SL 43.

(S34533) [NT 345 573]. Dark grey, fine-grained, granular dolomite, of 0.05 mm grain-size, containing remains of small shells and crinoids. Treatment with Lemberg's solution and by the silver nitrate-potassium chromate reaction show no

calcite. There is much opaque carbonaceous matter, and perhaps pyrite also, apparently concentrated at the location of former microfossils. The dolomite is ankeritic with ■ = 1.690.

Ferriferous dolomite, fine-grained, zoophasmic, uneven mosaic.

(SL 45) (p. 58) Bilston Burn (No. 3) Limestone (?), deep seated, weathered limestone. Esperston Limeworks, as SL 43.

(S34534) [NT 345 573]. Pale buff, very fine-grained limestone with brown bituminous films. Composed of finely granular calcite (0.01 mm grain) enclosing numerous shell fragments which are often flat or flattened along the bedding. Clay is sometimes recognizable in small aggregates as kaolin. Quartz is rarely distinguishable as small grains, 0.01 mm, but many feebly birefringent aggregates may be more finely divided quartz. Shreds of bituminous and limonitic matter are common and limonite replaces scattered rhombs of siderite.

Limestone, argillaceous, micrograined, fossiliferous, clastizoic, bedded.

Peebles

(SL 22) (p. 58) Bilston Burn (No. 3) Limestone. In stream, 800 yd E. of Deepsykehead. 1" Sheet 24; 6" Peebles. 5 N.E. (*Lst. Scot.,* 1949, p. 151).

(S34543) [NT 182 541]. A dull dark grey, brown-mottled dolomite. Composed of granular and semi-recrystallized dolomite, of grain 0.01–0.1 mm, in which thin-walled shell fragments are present. Angular quartz grains are abundant; muscovite, biotite, iron ore, brown phosphatic fossil fragments, shreds of carbonaceous matter and grains of pyrite are accessory. A few large crinoid fragments are still calcite and enclose small rhombs of dolomite.

Dolomite, calcareous, arenaceous, fine-grained, clastizoic.

Lower Limestone Group, unclassified

Dumfries

(SL 264) (p. 58) Limestone. Quarry, Blackwoodridge Limeworks, 50 yd S. of Blackwoodridge Farm, 1 mile S. of Waterbeck. 1" Sheet 10; 6" Dumfries. 52 S.W. (*Lst. Scot.,* 1949, p. 90).

(S35468) [NY 24 75]. A reddish, compact limestone, effervescing moderately freely with cold dilute HCI, with duller red bands which effervesce freely. In thin section the more crystalline part is seen to be composed of anhedral grains of calcite about 0.05–0.1 mm across, among which are preserved relics of fossil structures. The duller red portion is composed of fossil debris, including foraminifera, shell and crinoid fragments, ostracod shells, productid spines, scarce algal nodules and coral. The matrix is recrystallized to fine-grained granular calcite, and red iron ore is abundantly disseminated through it. There may be a little dolomite in the matrix, as some grains give rhomboid sections.

Limestone, micrograined, microfossiliferous, clastizoic, in part zoophasmic.

(SL 265) (p. 58) Limestone. Quarry 400 yd S. of Blackwoodridge Farm. References as for (SL 264).

(S35469) [NY 24 75]. A compact, whitish-buff limestone, composed of the debris of shells and crinoids, many species of foraminifera, ostracod and polyzoan fragments, occasional productid spines and rhombs of oxidized ankerite cemented by scanty finely divided calcite which in places is entirely of algal origin.

Limestone, fine-grained, microfossiliferous, clastizoic.

East Lothian

(SL 60) (p. 58) Limestone. Quarry, Jerusalem Limeworks, 2 miles S. of Gladsmuir. 1" Sheet 33; 6" East Lothian 9 S.E. (*Lst. Scot.,* 1949, p. 94).

(S34549) [NT 4719 6716]. A dull brownish-grey argillaceous limestone composed of finely divided calcite debris and small organic fragments with probably some argillaceous admixture; occasional tiny pockets of kaolin and grains of quartz are seen. Specks of carbonaceous matter and grains of pyrite are sparsely distributed.

Limestone, argillaceous, pelitomorphic, microclastizoic.

(SL 197) (p. 59) Limestone (probably Long Craig Lower). Lennoxlove, 1 mile S. of Haddington. 1" Sheet 33; 6" East Lothian 10 S.W. (*Lst. Scot.,* 1949, p. 96).

(S35062) [NT 5142 7222]. Grey compact limestone, composed of small grains (0.02–0.05 mm grain-size) of carbonate, which are always coated, more or less thickly, with turbid argillaceous matter and cemented by more finely divided calcite. Specks up to 0.03 mm in size of opaque material are numerous, and are mainly of black carbonaceous matter but include pyrite.

Limestone, argillaceous, fine-grained, granular.

Upper Limestone Group

Index Limestone

Ayr

(SL 95) (p. 59) Index Limestone. 300 yd S. of High Polquhirter, 1 mile S.E. of New Cumnock. 1" Sheet 15; 6" Ayr. 42 S.W. (*Lst. Scot.,* 1949, pp. 69–70)

(S34561) [NS 633 125]. Dull, brownish-grey, fine-grained dolomite. Composed of granular dolomite, about 0.1 mm grain which is turbid with amorphous dust and speckled with opaque brown material, perhaps limonite. The dolomite is ankeritic with ■ = 1.690. The section shows a number of fragmentary fossils which have been recrystallized and filled in with coarse carbonate. Staining by the silver nitrate—potassium chromate method shows that this carbonate as well as coarse material in cracks is dolomite, calcite being present only as specks distributed abundantly in and throughout the dolomite of the matrix. A small quantity of bitumen is present, mainly along stylolitic films, and also a little pyrite.

Dolomite, varigrained, zoophasmic.

(SL 150) (p. 59) Index Limestone. Keirs Glen, just below Keirs Farm. 1" Sheet 14; 6" Ayr. 46 N.W. (*Lst. Scot.,* 1949, p. 67).

(S34652) [NS 431 081]. Dull grey argillaceous limestone. Fragments of medium and small shells, a few foraminiferal and crinoidal remains are enclosed in a turbid base composed of shapeless calcite, probably with a clay admixture and numerous small rhombs of ferriferous carbonate. Locally, small aggregates of scaly kaolinite can be distinguished. The small rhombs show by their acute form and their refractive index that the mineral approaches siderite in composition (probably about 80% $FeCO_3$). Pyrite, carbonaceous and bituminous matter, and some limonite and quartz are present.

Limestone, argillaceous, sideritic, micrograined, microclastizoic.

(SL 196) (p. 59) Index (Highfield) Limestone. Mine-mouth, 100 yd S.E. of Goldcraig, 1½ miles N.E. of Kilwinning. 1" Sheet 22; 6" Ayr. 12 S.W. (*Lst. Scot.,* 1949, p. 76).

(S34973) [NS 3190 4477]. A grey compact limestone, composed of finely granular calcite (0.01-0.02 mm grain-size) with some argillaceous and, in places, sparse bituminous cement. In this ground are scattered foraminifera, small polyzoan fragments, echinoid and shell chips, spines and scarce complete small ostracods. Many of the fragments are partially replaced by finely divided pyrite.

Limestone, micrograined, microfossiliferous, clasti zoichnic.

Fife

(SL 118) (p. 59) Index Limestone. Lochhead Quarry, 1½ miles north of Dunfermline. 1" Sheet 40; 6" Fife 33 S.E. (See *'Economic Geology of the Fife Coalfields, Area I', Mem. Geol. Surv.,* 1931, p. 133).

(S34591) [NT 0803 9044]. Brownish compact dolomite with cavities lined by dolomite rhombs. Composed of finely granular ankeritic dolomite, of grain 0.010.03 mm, and having the ordinary refractive index ranging about 1.70. Fragments of shells and crinoids are replaced by coarser dolomite. Angular quartz grains 0.1 mm in length are abundant, and shreds of muscovite, grains of pyrite and carbonaceous particles accessory. The section contains a thin convexo-concave lens of deep brown isotropic fossil phosphate.

Ferriferous dolomite, arenaceous, pelitomorphic, zoophasmic.

Lyoncross Group

Ayr

(SL 151) (p. 59) Keirs Limestone. Quarry 830 yd S.E. of Keirs Farm. 1" Sheet 14; 6" Ayr. 46 S.W. (*Lst. Scot.,* 1949, p. 68).

(S34653) [NS 435 078]. Dull grey compact limestone, composed of a matrix of fine-grained calcite, of minute grain and probably admixed with clay, in which fragments of shells are abundant and quartz grains are scattered. Small shelly and crinoidal fragments and rare foraminifera are the main larger constituents. Brown opaque streaks, carbonaceous or bituminous, are abundant, and pyrite is present in places.

Limestone, luteous, micrograined, microclastizoic, bedded.

Orchard Group

Ayr

(SL 112) (p. 60) Lower Linn Limestone. Caaf Water, Linn Bridge, Dairy. 1" Sheet 22; 6" Ayr. 11 N.E. (*Lst. Scot.,* 1949, p. 42).

(S34567) [NS 2869 4863]. Bluish-grey, compact limestone or limy mudstone. Consists of a base of clear and brown minutely granular calcite in which small, uniformly sized, chips of calcite and, occasionally, small crinoid columnals and shell fragments are set along with small grains of quartz, flakes of muscovite and bleached mica, specks of carbonaceous and bituminous matter and grains of pyrite.

Calcareous mudstone.

Calmy Group

Ayr

(SL 92) (p. 60) Calmy Limestone. Quarry at Benston Limeworks, 3 miles N.W. of New Cumnock. 1" Sheet 14; 6" Ayr. 41 N.E. (*Lst. Scot.,* 1949, p. 70).

(S34558) [NS 5820 1600]. Dull greenish-grey, very compact limestone. Composed of an intimate mixture of minutely granular calcite and recrystallized granular calcite (0.02–0.03 mm grain-size). Interstitial material, turbid brown in transmitted light but dirty white in reflected light, is abundant and is perhaps clay; the chemical analysis indicates that much of it must be silica of clay grade. Small crinoid columnals and shell fragments are sporadic and there are a few small grains of quartz. The rock is traversed by thin calcite-filled cracks.

Limestone, luteous, micrograined, microclastizoichnic.

(SL 111) (p. 60) Upper Linn Limestone. Lynn Quarry, Linn Spout, Dalry. 1" Sheet 22; 6" Ayr. 11 N.E. (*Lst. Scot.,* 1949, p. 75–6).

(S34566) [NS 2842 4855]. Grey compact limestone, containing *Spirifer.* Composed of uniformly grained calcite (0.05 mm grain-size) in which a few fragments of thick shells are embedded. The base has been completely recrystallized and the presence of former microfossils is indicated by some diffuse turbid outlines. There is local opaque white interstitial clay material. *Limestone, fine-grained, zoophasmic, granular.*

(SL 113) (p. 60) Blue Tour (Calmy) Limestone. At railway bridge, Garpel Water, Muirkirk. 1" Sheet 15; 6" Ayr. 30 S.E. (*Lst. Scot.,* 1949, p. 71).

(S34568) [NS 686 258]. Blue-grey, very compact limestone, very fine-grained, with calcite granules about 0.01–0.03 mm in size. The smaller granules have a general turbid appearance, while the larger grains are separated by interstitial brownish cement, probably calcareo-argillaceous in composition. Scarce shell and crinoid fragments are recognizable and some diffuse outlines of small fossils can be seen.

Limestone, micrograined, microclastizoichnic.

Fife

(SL 117) (p. 60) Jenny Pate Limestone. Sandydub old quarry, 1 mile W. of Saline. 1" Sheet 39; 6" Fife 33 N.W. (*Lst. Scot.,* 1949, p. 43).

(S34590) [NT 0046 9340]. Dull grey, compact dolomite. Small relics of shells, crinoids and foraminifera are scattered rather sparsely in a matrix of turbid granular dolomite of grain 0.01 mm. The foraminifera are preserved as casts the chambers being filled by pyrites while the walls are recrystallized as dolomite indistinguishable from the matrix. The shell and crinoid fragments, though partly replaced by pyrite, retain the original organic fabric and are probably still calcite. Angular grains of quartz, 0.05 mm across, and carbonaceous particles are scarce. The dolomite is ferriferous and its ordinary refractive index while generally between 1.685 and 1.690, may reach 1.695.

Ferriferous dolomite, luteous, micrograined, zoophasmic.

(SL 119) (p. 60) Jenny Pate Limestone. Foreshore immediately W. of Culross. 1" Sheet 39; 6" Fife 37 S.E. (*Lst. Scot.,* 1949, p. 43).

(S34592) [NS 9840 8585]. Grey, very fine-grained dolomite with conchoidal fracture. Composed of granular dolomite, of 0.01 mm grain, of a ferriferous variety with the ordinary refractive index variable and reaching fully 1.695, corresponding to about 20 per cent of ferrodolomite. The rock contains a few scattered fossil fragments, some of which are recrystallized while others retain the original organic fabric. Argillaceous matter renders the dolomite turbid; tiny pebbles and grains of quartz and carbonaceous particles are present.

Ferriferous dolomite, luteous, micrograined, zoophasmic.

Renfrew

(SL 140) (p. 61) Arden (Calmy Limestone, top post). The more southerly of Darnley Quarries, about 1 mile S.E. of Nitshill station. 1" Sheet 30; 6" Renfrew. 12 S.E. (*Lst. Scot.,* 1949, pp. 161–2).

(S34626) [NS 524 586]. Medium-grey, dull compact limestone, composed of a brownish semi-opaque base of carbonate (calcite) and clay material, sometimes patchily concentrated. In this lie scattered small calcareous fragments of fossils, scarce phosphatic fossil fragments and very numerous small rhomboid crystals, 0.02 mm across, of dolomite. A little pyrite and carbonaceous matter are present. The abundant residue after treatment with cold dilute HCl is mainly a mixture of amorphous clay with some kaolinite and muscovite.

Limestone, dolomite, luteous, micrograined, subclastizoic.

(SL 141) (p. 61) Arden (Calmy) Limestone, middle and bottom posts. Locality and references as for (SL 140).

(S34627) [NS 524 586]. Grey compact, uniformly fine-grained limestone with sharp angular fracture. Small shelly and crinoidal fragments are scattered rather sparsely through a very fine-grained turbid base composed of finely divided carbonate and clay and numerous small grains and rhombs of carbonate up to 02 mm across. These are possibly dolomite but because of the low proportion of MgO shown by chemical analysis it is possible that they are cleavage fragments of calcite. *Calcisphaera* and foraminifera are also present. Grains of pyrite and quartz are scarce. *Limestone, luteous, micro-grained, subclastizoic.*

Castlecary Limestone

Fife

(SL 36) (p. 61) Castlecary Limestone. Thomsford Bridge, Hatton, 1½ miles N. of Lundin Links station. 1" Sheet 41; 6" Fife 21 S.W. (*Lst. Scot.,* 1949, p. 43)

(S34457) [NO 4008 0437]. A buff-grey dolomite with many cavities. Crinoid columnals and shell fragments are numerous in a matrix of dolomite of 0.2 mm grain. The columnals are in general preserved as single crystals of dolomite but marginally recrystallized with the matrix. The dolomite is slightly ferriferous with ■ approx. 1.688. Bituminous matter is abundant along thin seams; pyrite also is present as strings along some bedding divisions and quartz is sporadic.

Dolomite, bituminous, varigrained, zoichnic, taxichnic.

(SL 115) (p. 61) Castlecary Limestone, upper leaf. Black Devon at North Shaw Wood, 1½ miles W. of Saline. 1" Sheet 39; 6" Fife 33 N.W.

(S34588) [NS 9985 9405]. Pale bluish-grey, dull, compact dolomite. It is composed of dolomitized fragments of large shells in a matrix of dolomite-quartz sandstone. The shells show so sharp a difference in coarseness of dolomite recrystallization, 0.2 mm grain size, from that of the matrix 0.04 mm, that they may represent a period of dolomitization prior to their accumulation as detrital grains in the present sediment. Some of the fragments look like dolomite-rock rather than shells. The matrix is composed of granular dolomite without rhomboid shape, small and angular grains of quartz, many streaks of dark material, probably de composed rock or feldspar, abundant pyrite and some pyritized carbonaceous material. The dolomite is ankeritic with ■ varying about 1.700 and reaching 1.712, the higher values being shown by the coarser clear carbonate.

Ferriferous dolomite, arenaceous, zoichnic, taxichnic.

(SL 116) (p. 61) Castlecary Limestone, lower leaf. Locality and references as for (SL 115).

(S34589) [NS 9985 9405]. Darkish grey sandy dolomite. In section the rock is seen to be a sandstone composed of subangular grains of quartz cemented by amorphous material containing small aggregates of pyrite granules. This gives place to dolomite in patches, the dolomite being optically continuous over small areas. Scarce alkali-feldspar grains are present; zircon and tourmaline are accessory. Pyrite is abundant.

Dolomitic sandstone, subpoikilocrystallic.

(SL 120) (p. 61) Castlecary Limestone. Caviehall old mine, 1 mile W. of Culross. 1" Sheet 39; 6" Fife 37 S.E. (*Lst. Scot.,* 1949, p. 43).

(S34593) [NS 9722 8572]. Brownish-grey, coarsely crystalline dolomite. Composed of granular and rhomboid dolomite of varying grain-size, 0.2–0.6 mm with ghost relics of organic fragments, some of which are large and equidimensional and probably represent crinoid plates; others are composed of opaque dust so arranged as to indicate the fibrous texture of shells. A typical stylolitic film traverses the rock and grains of dolomite grow across it. The dolomite is ferriferous with ■ = 1.690.

Ferriferous dolomite, varigrained, zoophasmic, uneven mosaic.

Kinross–Perth

SL 7 (p. 62) Vicars Bridge (Castlecary) Limestone. River Devon, 1¾ miles E. of Dollar. 1" Sheet 39; 6" Fife & Kinross. 24 S.W., Perth. & Clackmannan. 134 N.E. (*Lst. Scot.,* 1949, p. 43).

(S34441) [NS 9879 9829]. An even grained dolomite, pale brown in tint but with dark laminae. Composed of interlocking rhomboid grains of dolomite, 0.10.3 mm across, with some larger, irregular grains. The dolomite is turbid with minute mineral inclusions; shreds of limonite are common and very small grains of quartz are scarce. The dolomite is a ferriferous variety having the ordinary refractive index ■ = 1.695.

Ferriferous dolomite, medium-grained, zoophasmic, mosaic.

Coal Measures

Barren Red Measures

Ayr

(SL 96) (p. 62) Binney's *Spirorbis* Limestone. Right bank of River Ayr, 330 yd S. of Ballochmyle House, near Catrine. 1" Sheet 14; 6" Ayr. 29 S.W. (See '*Geology of Central Ayrshire', Mem. Geol. Surv.,* 1949, p. 94).

(S34562) [NS 521 262]. Pale, flesh-coloured, compact limestone. Fine-grained limestone, composed of a semi-opaque aggregate of calcite granules 0.005 mm grain-size, with small areas of coarsely crystalline calcite and thin impersistent calcite-filled fractures. Rarely the calcite-filled areas have the thin corrugated or the smooth walls of *Spirorbis* or ostracods respectively.

Limestone, pelitomorphic, subfossiliferous.

Jurassic

Rhaetic

Argyll

(SL 227) (p. 62) Calcareous sandstone. Allt na Teangaidh, 500 yd N.E. of Balmeanach, Gribun, Mull. 1" Sheet 43; 6" Argyll. 94 N.W. (*Lst. Scot.,* 1949, p. 52). (S35085) [NM 4527 3316]. A dark, fine-grained, rough rock, containing many small aggregates of finely divided pyrite. Composed of angular grains of quartz and subordinate, but abundant albite, in a matrix of brownish calcite which tends to form large irregular grains enveloping several grains of quartz. Orthoclase is an accessory constituent, as are muscovite and scarce phosphatic fossil fragments and grains of garnet, zircon and rutile. Thin-walled shell fragments are common. Pyrite and carbonaceous matter are abundant. The former is mostly in small grains and streaks, but locally forms large lumps enclosing many quartz grains. The carbonaceous matter is black in reflected light, brown in transmitted light and in some larger fragments looks like wood. Dolomite appears in minor amount as rhombs of 0.1 mm size, in the calcite, and may be a very early if not a primary constituent.

Limestone, arenaceous, fossiliferous, poikilocrystallic.

Liassic

Argyll

(SL 89) (p. 62) Lower Lias limestone, lower solid portion. Loch Aline Quarry at mouth of Allt na Samhnachain, E. side of Loch Aline. 1" Sheet 44; 6" Argyll.

70 N.E. (*Lst. Scot.,* 1949, pp. 57–8).

(S34484) [NM 6928 4597]. A dull, compact, blue-grey limestone composed of unsorted echinodermal and shell fragments in a matrix of fine-grained calcite, 0.005 mm across, containing numerous angular quartz grains and shreds of carbonaceous matter, some pyrite, and scarce fossil phosphate and muscovite, glauconite and biotite.

Limestone, luteous, micrograined, clastizoic.

(SL 90) (p. 62) Lower Lias limestone, upper fossiliferous portion. Locality and references as for SL 89.

(S34485) [NM 6928 4597]. A pale grey, compact limestone composed of fine-grained calcite, 0.005 mm across, in which numerous angular quartz grains, up to 0.1 mm across, and small shells and shell fragments are set. Long thin pieces of phosphatic shell, carbonaceous shreds, and granules of pyrite, often oxidized, are common.

Limestone, luteous, pelitomorphic, clastizoic.

Inverness. (Skye)

(SL 242) (p. 62) Lower Lias limestone. W. outcrop of limestone in Allt Eas Mhor, Sconser, Skye. 1" Sheet 71; 6" Inverness. (Skye) 35 S.W. (*Lst. Scot.,* 1949, p..123–4)

(S35342) [NG 512 315]. A dark grey limestone with a brecciated appearance in parts and veined by calcite. In thin section the rock is seen to be essentially a dark calcite-mudstone of very fine grain, about 0.003 mm, containing fragments of shells of very varying size down to embryo forms. The shells are considerably recrystallized, but the original fibrous structure is indicated by streaks of dust. Patches of coarsely recrystallized clear calcite represent in most cases fragments of large thick shells. *Limestone, argillaceous, pelitomorphic, fossiliferous, zoichnic.*

(SL 250) (p. 63) Lower Lias limestone. Just north of crossing of the Broadford–Heast road over the Allt a'Choire, Skye. 1" Sheet 71; 6" Inverness. (Skye) 46 N.E. (*Lst. Scot.,* 1949, p. 124).

(S35350) [NG 645 210]. A dull grey, compact limestone containing veins of brownish-grey carbonate which are cut by veins of white carbonate. The thin section shows numerous fragments of shell, around 02 mm long and of occasionally recognizable echinodermal plates, in a turbid groundmass of finely divided calcite through which angular quartz grains are scattered. Stylolitic films of dark clay are present. Fragments of carbonaceous matter, scarce, grains of zircon and a little pyrite are present.

Limestone, luteous, micrograined, microclastizoic.

Ross and Cromarty

(SL 253) (p. 63) Lower Lias limestone. Old quarry, 1100 yd S.E. of Applecross House 1" Sheet 81; 6" Ross & Cromarty 102 S.W. (*Lst. Scot.,*1949, p. 166)

(S35353) [NG 727 447]. A grey, compact oolitic limestone with a buf crust. In thin section the ooliths are found to be 0.5–1.5 mm in diameter and frequently have as kernels irregular pieces of shell or echinodermal plate and spine and, less commonly, earlier ooliths with limonitized or pyritized borders. They are embedded in a very fine-grained matrix of calcite containing a few thin-walled microshells and scarce tiny grains of quartz. Subordinate detrital constituents include rolled shell fragments and rolled pebbles of oolite.

Limestone, micrograined, oolitic.

Great Estuarine

Inverness. (Skye)

(SL 243) (p. 63) Great Estuarine limestone, marmorized near contact with granophyre. Allt Eoghainn, 200 yd S. of old main road. Strollamus, Skye. 1" Sheet

71; 6" Inverness. (Skye) 40 S.W. (*Lst. Scot.,* 1949, p. 124).

(S35343) [NG 597 263]. A patchily grey and white altered limestone, the grey part effervescing freely with cold dilute HCl, while the white part is insoluble and shows the fibrous character of wollastonite. In thin section the rock is seen to be composed of sutured grains of calcite and large aggregates of fibrous and prismatic wollastonite. Idiomorphic, birefringent grossular occurs in small crystals set both in the calcite and in the wollastonite. Colourless epidote forming small aggregates is rare. Clots of quartz act as centres for wollastonite growths and are traversed by many needles of wollastonite. Occasionally small prisms of diopside occur on the periphery of these clots.

Limestone with calcsilicates, varigrained, granoblastic.

(SL 251) (p. 63) Paludina limestone. Coast section, 800 yd N. of school at Elgol, Skye. 1" Sheet 71; 6" Inverness. (Skye) 50 S.W. (*Lst. Scot.,* 1949, p. 125)

(S35351) [NG 516 144]. A dark grey, compact, structureless rock composed of a carbonate-clay groundmass in which the carbonate granules are about 0002 mm across. In this, small grains of oxidized pyrite, quartz, and carbonaceous shreds are scattered in accessory proportions.

Limestone, luteous, pelitomorphic, microclastizoichnic.

Sutherland

(SL 161) (p. 63) Limestone in Brora Arenaceous Series, Ardassie Point, Brora. 1" Sheet 103; 6" Sutherland 98 S.W. (See *'The Geology of the Country around Golspie, Sutherlandshire', Mem. Geol. Surv.,* 1925, pp. 96–9).

(S34848) [NC 915 041]. A dull, dark grey compact limestone. Composed of a base of intermingled clear, finely granular calcite and pelitomorphic calcite in which are set angular grains of quartz, irregular granular groups of pyrite, splinters of coaly matter, accessory muscovite, biotite and siliceous pebbles, and a few 'galls' of calcareous grit. Echinodermal and shell fragments are present and small spherical bodies (see note below) are very numerous.

Limestone, arenaceous, fine-grained, clastizoic.

Note. The spherical bodies range in diameter from 0.05 to 0.12 mm. Many present smooth, continuous surfaces to the matrix and some appear to possess a thin peripheral shell. Many however present no definite boundary to the matrix and the carbonate sectors of which they are composed project to different amounts into the matrix. The radial or sectional arrangement of the carbonate within them is characteristic (Plate 3 Fig. 5), but examples built of a single carbonate crystal can be found, and spheres of the same range of size but composed entirely of chalcedonic silica are also present. The nature of these bodies is uncertain. They resemble the globular objects observed by Dunham and Stubblefield in the Cockhill Limestone (*Quart.Journ. Geol. Soc., vol.* C, 1944, p. 237), and the spherical bodies in calcarenite by N. D. Newell, *et al* (*The Permian Reef Complex of the Guadalupe Mountain Region,* 1953, p. 46 and p. 117) who compare them with 'sporangites' of Devonian black shales.

Kimmeridgian

Sutherland

(SL 162) (p. 63) Limestone in 'Boulder Beds' S.W. of the 'Fallen Stack', Portgower. 1" Sheet 103; 6" Sutherland 90 S.W. (see *'The Geology of the Country around Golspie, Sutherlandshire', Mem. Geol. Surv.,* 1925, p. 108).

(S34849) [ND 004 127]. A pale grey limestone containing numerous shells. In thin section large and small echinodermal and shell fragments and poorly assorted sand grains are cemented by calcite. Over most of the section quartz and cementing calcite are in approximately equal proportion. The calcite is partly fine-grained and turbid but more generally

coarsely recrystallized and often poikilitic. The sand grains are angular and rarely reach 1 mm in size. They are mostly of quartz which is often strained but include microcline and crushed quartz-rock, scarce chert and collophane.

Limestone, arenaceous, fossiliferous, poikilocrystallic.

Cretaceous

Inverness. (Skye)

(SL 244) (p. 64) Limestone. Allt Eoghainn, Strollamus, S. of old main road, at N.E. end of the outcrop. 1" Sheet; 6" Inverness. (Skye) 40 S.W. (*Lst. Scot.,* 1949, p. 124).

(S35344) [NG 5975 2620]. A dark grey, very fine-grained, compact limestone, composed of a groundmass of finely divided turbid calcite, of grain about 0.05 mm, in which are numerous small grains of clear calcite, usually shapeless and very rarely showing shelly and trabecular structures, and small circular grains representing microfossil parts. Pieces of thick shell are scarce. Stylolitic films are common.

Limestone, pelitomorphic, microclastizoic.

Recent

Shell Sand

Caithness

(SL 164) (p. 64) Shell sand. Just above highwater mark, ¼ mile E. of John o' Groats Hotel. 1" Sheet 116; 6" Caithness 3 S.W. (*Lst. Scot.,* 1949, p. 84).

(S35990) [ND 385 735]. Composed of shell fragments, from 1 to 5 mm across, with a small amount of rock grains. The slide is of the residue after dissolving out the carbonate. The material remaining is mainly argillaceous, feldspathic and micaceous sandstone and gritty mudstone, with subordinate quartz and a little quartzite and microcline, and scarce igneous and metamorphic rocks.

(SL 165) (p. 64) [ND 38939 73810]. Shell gravel. Just above highwater mark, Ness of Duncansby. 1" Sheet 116; 6" Caithness 3 S.W. (*Lst. Scot.,* 1949, p. 84).

The specimen is composed of shell fragments ranging in size from 1½ in. downwards.

(SL 166) (p. 64) [ND 38979 73622]. Shell sand. Ness of Duncansby, 200 yd inland and 2 ft below surface. References as for (SL 165).

The specimen is composed of well sorted, worn shell fragments, about 3 mm across, with a low proportion of rock pebbles of rather smaller size.

Inverness (Skye)

SL 6 (p. 64) Nullipore sand. Claigan, Dunvegan, Skye. 1" Sheet 80; 6" Inverness. (Skye) 15 N.W. (*Lst. Scot.,* 1949, p. 125).

(S35987) [NG 2245 5445]. Composed of rolled, minutely cellular nullipore growths and a few lamellibranch fragments.

Kirkcudbright

(SL 209) (p. 64) Shell sand. Comminuted shells in raised beach; 1 mile S. of Creetown. 1" Sheet 4; 6" Kirkcudbright. O.S. 42 S.E., N.S., 47 N.W. & S.W. (*Lst. Scot.,* 1949, p. 130).

Lake marl

Caithness

(SL 168) (p. 65) Lake Marl, Westfield Loch, 4 miles S.W. of Thurso. 1" Sheet 115; 6" Caithness. 11 N.W. (*Lst. Scot.,* 1949, pp. 84, 85).

(S35985) [ND 07 64]. The residue from solution in dilute acetic acid is a dark grey powder showing much brown and opaque vegetable matter, together with mineral dust which is mostly alkali-feldspar and quartz with chlorite, bleached biotite, carbonaceous clay, scarce opaline diatoms and spicules. In the mounted sections (S35985) [ND 07 64] A & B, scarce scales of fresh biotite are seen and rarely a flake of muscovite. Brown isotropic fragments of arthropods are common, and scarce sponge spicules are present. Heavy mineral particles include grains and rhombs of dolomite and possibly kyanite. The mount (S35985) [ND 07 64] of the dried marl consists mostly of calcite as equidimensional grains or stout prisms, mostly less than 0.01 mm long.

Cale tufa

Ross and Cromarty

(SL 254) (p. 65) Calcareous tufa. Roadside 680 yd S. of Tornapress Bridge, Kishorn. 1" Sheet 81; 6" Ross & Cromarty 110 N.W. (*Lst. Scot.,* 1949, p. 167)

(S35354) [NG 836 415]. A flesh-coloured, porous mass of tufa, composed of a turbid mass of very fine-grained calcium carbonate showing irregularly concentric growths from many centres. The open aggregate formed by these growths is partly filled by a brownish, slightly ferruginous marl containing small organic debris and scarce grains of quartz and feldspar. Tests on the material give the ordinary refractive index for calcite.

Vein deposit

Kincardine

(SL 25) (p. 65)Impure dolomitic limestone, in fault. N.E. corner of Craigeven Bay, 660 yd E.N.E. of St. Mary's Chapel, about 1 mile N.E. of Stonehaven. 1" Sheet 67; 6" Kincardine. O.S. 12 S.E.; N.S. 16 S.W. (*Lst. Scot.,* 1949, p. 128).

(S34546) [NO 8896 8757]. The rock consists mainly of a base of finely divided siliceous and kaolinitic material amongst which are scattered small clots of dolomitic carbonate with which opaque white material is associated. Veins of ankerite—about 15% $(FeCa)CO_3$—cut the rock.

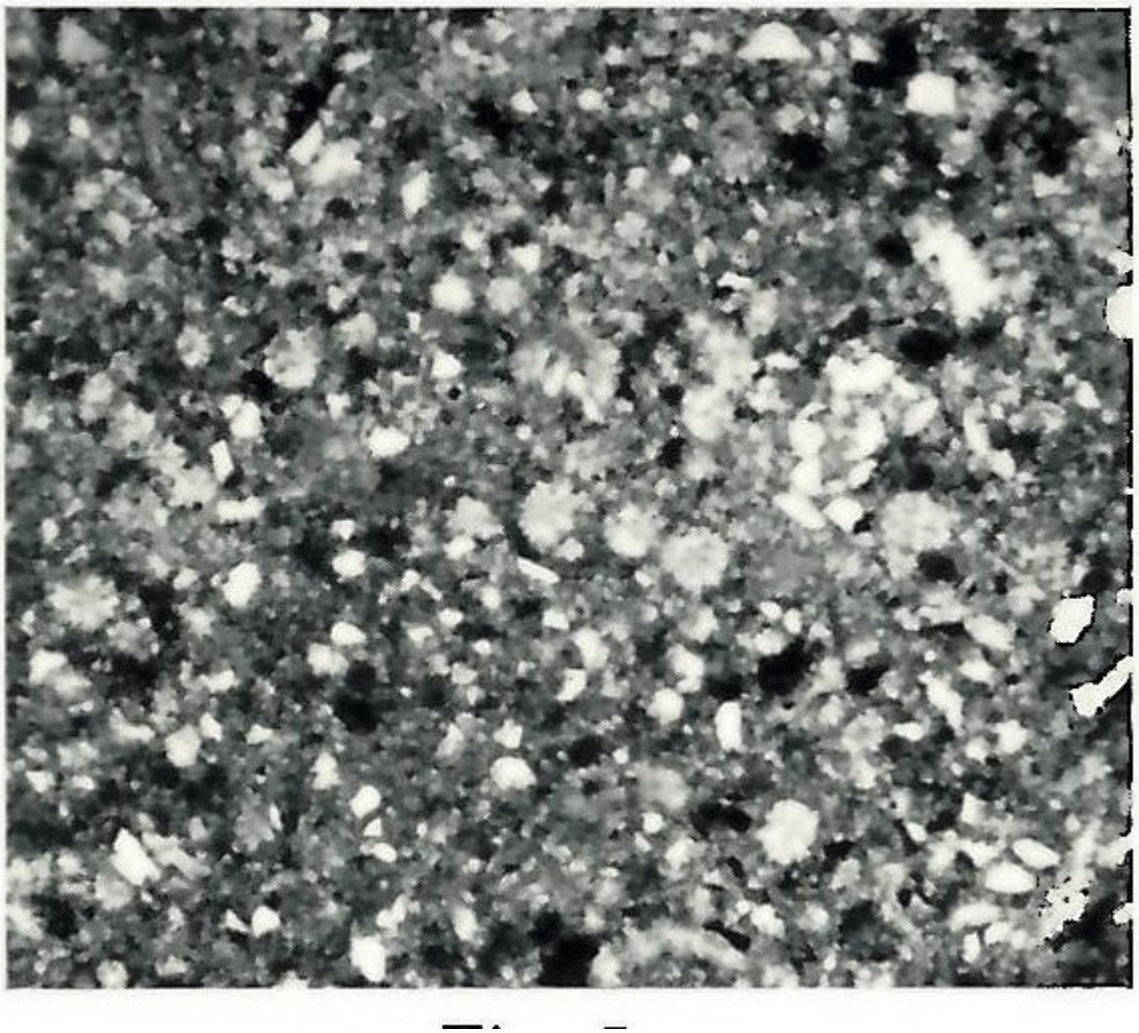

Plate 3 Photomicrographs of clastizoic limestones and calcilutites. FIG. 5. (S34848). SL 161, p. 133. Jurassic, Brora Arenaceous Series; Ardassie Point, Brora, Sutherland. Impure limestone or microcalcarenite, composed of pelitomorphic calcite admixed with silt of quartz, mica, coaly matter and pyrite, and containing microdebris of fossils together with numerous 'round bodies', possibly algal, composed of radially arranged calcite. Polarized light. x 23.