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## THE BIRDS OF THE TEES VALLEY.

W. E. ALMOND, J. B. NICHOLSON and M. G. ROBINSON.

This list of the birds of the Tees Valley and the accompanying notes are based primarily upon the Bird Records of the Darlington and Teesdale Naturalists' Field Club. These manuscript Records were originally compiled, in 1931-33, by W. E. Almond, who drew upon all available sources of information, both old records and recent observations; and they have since been supplemented from time to time by the notes of other ornithologists.

The principal authorities which have been consulted are T. H. Nelson's invaluable *Birds of Yorkshire* (1907), J. Hancocks *Catalogue of the Birds of Northumberland and Durham* (1874) and, for more recent records, *The Vasculum* and *British Birds* ; while the arrangement and nomenclature are based on H. F. Witherby's *Check-List of British Birds* (1924).

A brief description of the drainage-area of the River Tees may be of interest to readers unacquainted with the district.

For most of its course the Tees forms the boundary between Durham and Yorkshire, but its source on Cross Fell, in the heart of the Pennines, is on the border of Cumberland and Westmorland. It flows at first through wild moorlands, slackening its pace and deepening its waters to form the long, lake-like Weel, then pouring over the cataract-waterfall of Cauldron Snout, skirting the cliffs of Falcon Clints and Cronkley Scars and the pastures of Widdy Bank, and over the 78 ft. drop of High Force, until, bordered by meadows, it reaches Middleton-in-Teesdale. This may be said to mark the lower limit of Upper Teesdale, a region for the most part the domain of moorland and hill-stream birds, though hedgerow, meadow and woodland species penetrate above Middleton in the neighbourhood of river, hamlet and the valley-road.

Downstream as far as Barnard Castle and Rokeby, a stretch conveniently referred to as Mid-Teesdale, the valley becomes increasingly wooded and the zone of cultivation extends more widely on either side of the river, although the higher ground is still moor-clad. The tributary dales of Lune and Balder, of Deepdale and Greta, all on the Yorkshire side, share with the central valley the

characteristic avi-fauna of wooded streamside, hedgerow and meadow, marsh and moor. From the meeting of Tees and Greta at Rokeby downstream to Croft Spa-Lower Teesdale--the moors left behind, vale gradually merges into plain, but neither in its general character nor in its bird-life does this region differ essentially from the middle dale

At Croft, the Tees receives its principal Durham tributary, the Skerne. Unlike the Tees, this is a slow-flowing, lowland stream, much polluted by refuse from collieries near Sedgefield and by Darlington's surplus sewage. The Darlington Sewage Farm, lying between the Darlington-Croft road and the Skerne, is a spot of outstanding interest to local ornithologists. Here are birds in plenty throughout the year; but it is most prolific during the spring and autumn migrations, when avian travellers from distant countries break their journey for a few hours, or a few days, or even weeks, to rest and feed. On the initiative of the Field Club, the Darlington Corporation has recently agreed to prohibit shooting here. The projected modernisation of the sewage-disposal plant may, however, adversely affect its bird-life.

Below Croft, the river gradually changes its character, becoming wider, deeper and slower, and winding through a pastoral country-side until it reaches tidal water as it nears Yarm. Thence its course lies past the towns of Stockton and Middlesbrough until at last it approaches the open sea.

The bird-life of the Tees-mouth district has inevitably suffered from the encroachments of industrialism-and less warrantably from the activities of local gunmen-but the birds cling to their old haunt as long as possible and the ornithologist can still find a wealth of interest, varying with the season of the year. Mud-flat and marsh, creek and fleet, sand-dune and foreshore, estuary and coastal waters, even the ballast embankments, each contributes its quota to the bird- population of the river-mouth.

The area thus briefly surveyed is of so varied and extensive a character that it is not easy to describe in a few words the status and distribution of each species. In the case of many species more precise information is still required on these points and we would emphasise that there is scope for a much closer ecological study of the bird-life *of* the Tee Valley than has yet been undertaken.

For advice and information generously placed at our disposal in the preparation of this list, we are indebted to several experienced

ornithologists, and especially to Messrs. Bentley Beetham, Joseph Bishop, W. K. Richmond and G. W. Temperley, to whom, as well as to our Field Club colleagues for their willing co-operation, we take this opportunity of expressing our warmest thanks.

**Raven** *Corvus corax corax* L.

Frequently seen in Upper Teesdale, where it still attempts to breed; but it is ruthlessly persecuted by game-keepers. Elsewhere it is a rare, casual visitor.

**Hooded Crow** *Corvus cornix cornix* L.

Winter visitor in small numbers to the Tees-mouth district; occasionally seen inland, both near Darlington and further up the dale. Formerly it came in much greater numbers.

**Carrion-Crow** *Corvus corone corone* L.

Common resident; probably also a winter visitor. More numerous than formerly, and occasionally seen in large parties, as for example, a flock of about 200 birds near Darlington during the winter of 1929-30.

**Rook** *Corvus frugilegus frugilegus* L.

Common resident, A census taken in 1931, covering an area of 60 square miles in the vicinity of Darlington, revealed a total of 2,376 nests in 36 rookeries.

**Jackdaw** *Colceus monedula speemologus* (Vieill.).

Common resident, especially numerous in the nesting season about the cliffs along the Tees.

**Magpie** *Pica pica pica* (L.).

Common resident, having increased in numbers in recent years. It is sometimes seen in small flocks after the breeding season, as when fourteen birds were seen feeding together near Darlington in December, 1926.

**Jay** *Garrulus glandarius rufitergum*. Hart.

Resident; not so numerous as the Magpie, but more plentiful than formerly, especially in wooded districts.

**Starling** *Sturnus vulgaris vulgaris* L.

Common resident, winter visitor and passage migrant. It has greatly increased in numbers and has extended its range to all parts of the dale. In autumn and winter, flocks may be seen arriving at the Tees-mouth from the east or north-east. Birds ringed in Sweden, Denmark, Holland and northern Germany have been recovered within our area.

**Rose-Coloured Starling** *Pastor roseus* (L.).

Rare, casual visitor, thrice recorded by Nelson: at Coatham Marsh (Redcar) on August 28th, 1851; at Middlesbrough, on August 12th, 1855; and at Redcar on November 23rd, 1889.

**Golden Oriole** *Oriolus oriolus oriolus* (L.).

Rare spring visitor. One was observed near Croft Spa (Yorks.) on May 17th, 1925 (H. A. Inness); and another two miles south of West Hartlepool on May 4th, 1929 (G. W. Temperley).

**Hawfinch** *Coccothraustes coccothraustes coccothraustes* (L.).

Uncommon and very local resident, its chief haunts being Mid-Teesdale (Bentley Beetham) and the district between Middlesbrough and the Cleveland Hills (J. Bishop).

**Greenfinch** *Chloris chloris chloris* (L.).

Common resident ; also a winter visitor and a passage migrant, flocks appearing on spring passage at the Darlington Sewage Farm towards the end of April.

**Goldfinch** *Carduelis carduelis britannica* (Hart.).

Resident. Its numbers have increased greatly during recent years.

**Siskin** *Carduelis spinus* (L.).

Winter visitor in varying numbers.

**Twite** *Carduelis flavirostris flavirostris* (L.).

Breeds, very sparingly, on the high fells in Upper Teesdale. A nest was seen on Mickle Fell in 1935 (Bentley Beetham). Winter visitor to the Tees-mouth, where a flock was seen on several occasions in January, 1936.

**Mealy Redpoll** *Carduelis linaria linaria* (L.).

Irregular winter visitor in small numbers. Present with Siskins and Lesser Redpolls at Blackwell (Darlington) during the winters of 1926-27 and 1927-28 (W. K. Richmond and M.G.R.).

**Lesser Redpoll** *Carduelis linaria cabaret* (P. L. S. Müll.).

Resident and winter visitor. It appears to be increasing as a breeding species, favouring plantations in the dale country, certainly up to 1,000 ft. and probably higher; it nests in the Darlington district also.

**Linnet** *Carduelis cannabina cannabina* (L.).

Common resident and winter visitor.

**Bullfinch** *Pyrrhula pyrrhula nesa* Math. & Ired.

Resident, somewhat local, but increasing slightly in numbers.

**Crossbill** *Loxia curvirostra curvirostra* L.

Visitor from late summer to early spring, irregular and in varying numbers.

**Chaffinch** *Fringilla coelebs coelebs* L.

Common resident, winter visitor and passage migrant.

**Brambling** *Fringilla montifringilla* L.

Fairly common winter visitor, though in varying numbers.

**House-Sparrow** *Passer domesticus domesticus* (L.).

Common resident.

**Tree-Sparrow** *Passer montanus montanus* (L.).

Local resident, frequently found in small colonies. Flocks are noted at Darlington Sewage Farm in winter and spring.

**Corn-Bunting** *Emberiza calandra calandra* L.

Resident, much less common than formerly, decreases being reported from all parts of the area.

**Yellow Hammer** *Emberiza citrinella citrinella* L.

Common resident and winter visitor.

**Little Bunting** *Emberiza pusilla* Pall.

Very rare straggler. One was shot a.t Seaton Snook (on the Durham side of the Tees-mouth) on October 11th, 1902, this being only the second record for the species in Britain (Nelson).

**Reed-Bunting** *Emberiza schreniclus schreniclus* (L.).

Fairly common resident, though some migrate south in winter; also a passage migrant and winter visitor. Passage migration at Darlington Sewage Farm is most marked during the first week of April.

**Lapland Bunting** *Calcarius lapponicus lapponicus* (L.).

Scarce passage migrant, the only record being of one seen on the Yorkshire side of the Tees-mouth in mid-winter, 1936-37 (W. K. Richmond).

**Snow-Bunting** *Plectrophenax nivalis* (L.).

Common winter visitor to the Tees-mouth and also, in smaller numbers and less regularly, to Upper Teesdale.

**Wood-Lark** *Lullula arborea arborea* (L.).

"On the coast line it is a very rare migrant," according to Nelson, who mentions a small flock near Redcar in January, 1891. No recent records.

**Sky-Lark** *Alauda arvensis arvensis* L.

Common resident, winter visitor in considerable numbers, and passage migrant. Probably some breeding birds move south in autumn.

**Shore-Lark** *Eremophila alpestris flava* (Gm.).

Winter visitor in small numbers to the Tees-mouth, where it is very faithful to a single locality.

**Tree-Pipit** *Anthus trivialis trivialis* (L.).

Common summer visitor, arriving during the third week of April.

**Meadow-Pipit** *Anthus pratensis* (L.).

Resident, especially common on the moors; also a winter visitor and passage migrant. Large parties are seen on migration at Darlington Sewage Farm towards the end of March, and again about the end of September, but comparatively few winter there.

**Rock-Pipit** *Anthus spinoletta petrosus* (Mont.).

Passage migrant and winter visitor at the Tees-mouth, but is not known to nest there.

**Blue-Headed Wagtail** *Motacilla flava flava* L.

Rare visitor on spring migration. Three birds were noted at the Tees-mouth, consorting with a flock of Yellow Wagtails, on May 6th, 1900 (C. E. Milburn); and it has also occurred at Darlington Sewage Farm in spring (W K. Richmond).

**Yellow Wagtail** *Motacilla flava rayi* (Bp.).

Fairly common summer visitor, most numerous in the upper dale and in S.E. Durham. It arrives about the third week of April and leaves in mid-September. It is plentiful on migration at Darlington Sewage Farm.

**Grey Wagtail** *Motacilla cinerea cinerea* Tunst.

Fairly common resident, nesting in Teesdale (as far down the river as Dinsdale) in the neighbourhood of streams. Local migration takes place

after the breeding season, numbers appearing in the Darlington district in August and being seen during the winter months until March, when there is evidence of return passage.

**Pied Wagtail** *Motacilla alba yarrellii* Gould.

Common resident and passage migrant; some emigrate. Spring passage is noticeable at Darlington Sewage Farm from the end of February to the beginning of April, autumn passage in August and, to a less extent, in September.

**White Wagtail** *Motacilla alba alba* L.

Passage migrant, in varying numbers. In spring, the passage of the White Wagtail is at its height towards the end of April, when that of the Pied Wagtail is on the decline. In autumn, it is probably overlooked in the parties of young and old Pied Wagtails, with which it consorts at the Sewage Farm. Nelson records an instance of its nesting at the Tees-mouth in 1899.

**Tree-Creeper** *Certhia familiaris britannica* Ridgw.

Fairly common resident, especially in wooded districts; wandering during the winter months, sometimes in company with parties of Titmice.

**Nuthatch** *Sitta europaea affinis* Blyth.

Local resident, approaching the northern limit of its range within our area. It breeds regularly, in small numbers, in Mid- and Lower Teesdale and at Darlington.

**Great Titmouse** *Parus major newtoni* Prazak.

Common resident and, according to Nelson, an autumn immigrant (presumably the continental form, *Parus major major* L.).

**Blue Titmouse** *Parus caeruleus obscurus* Prazak,

Common resident. According to Nelson, immigration takes place in autumn; one was observed on the slag-walls at the Tees-mouth on November 2nd, 1933 (J. Bishop). These immigrants presumably belong to the continental form, *Parus caeruleus caeruleus* L.

**Coal-Titmouse** *Parus ater britannicus* Sharpe & Dress.

Fairly common resident, especially favouring fir woods.

**Marsh-Titmouse** *Parus palustris dresseri* Stejn.

Fairly common resident, less frequently noticed in open country than the Willow-Tit,

**Willow-Titmouse** *Parus atricapillus kleinschmidti* Hellm.

Fairly common resident, not much less plentiful than the Marsh-Tit, from which it has only recently been distinguished. It was first recorded for the Darlington district near Neasham on August 1st, 1930 (W. E. A. and M. G. R.).

**Long-Tailed Titmouse** *Aegithalos caudatus roseus* (Blyth).

Resident. Its numbers have decreased in recent years, but it is still far from rare in Lower and Mid-Teesdale.

**Golden-Crested Wren** *Regulus regulus anglorum* Hart.

Common resident, fir woods being its favourite haunt. It is also a winter visitor; immigrants may be observed at the Tees-mouth in autumn and these are presumably of the continental form, *Regulus regulus regulus* (L.).



**Great Grey Shrike** *Lanius excubitor excubitor* L.

Scarce autumn and winter visitor. One was observed about three miles north of Darlington, on October 20th, 1931 (J. Burgess), and one at Haverton Hill, on October 31st, 1936 (J. Bishop).

**Red-Backed Shrike** *Lanius collurio collurio* L.

This species has been recorded as nesting at Newbiggin, near Middleton- in-Teesdale, prior to 1,885 (Backhouse), near Redcar in 1870 and near Marton-in-Cleveland in 1898 (Nelson), but it does not appear to have been observed in recent years.

**Waxwing** *Bombycilla garrulus* (L.).

Irregular winter visitor, in some years altogether absent. It was reported in the winters of 1927-28, 1931-32, 1932-33, 1935-36 and 1936-37.

**Spotted Flycatcher** *Muscicapa striata striata* (Pall.).

Common summer visitor, often not arriving until the second week of May.

**Pied Flycatcher** *Muscicapa hypoleuca hypoleuca* (Pall.).

Summer visitor, arriving about the last week of April; uncommon in the low country, but fairly plentiful in Mid-Teesdale and by the Greta. Passage migrant on the coast.

**Chiffchaff** *Phylloscopus collybita collybita* (Vieill.).

Summer visitor in small numbers: also seen on passage in spring and late summer. One of the earliest arrivals, it usually appears in the last week of March or early in April.

**Willow-Warbler** *Phylloscopus trochilus trochilus* (L.).

Common summer visitor, arriving about mid-April. This is probably the most plentiful of all our Warblers.

**Wood- Warbler** *Phylloscopus sibilatrix sibilatrix*. (Bechst.).

Summer visitor, usually arriving about the first week in May. More local in its distribution than the Willow-Warbler, it shows a preference for the wooded riversides of the dale and its range extends up to High Force.

**Grasshopper-Warbler** *Locustella naevia naevia* (Bodd.).

Uncommon and local summer visitor, and probably a passage migrant, arriving about the second week of May. It usually haunts thickets and marshy ground.

**Sedge-Warbler** *Acrocephalus schoenoboenus* (L.).

Common summer visitor, nesting in marshy ground, by riversides, and also in drier situations offering good cover.

**Garden-Warbler** *Sylvia borin* (Bodd.).

Common summer visitor, arriving towards the end of April, or early in May.

**Blackcap** *Sylvia atricapilla atricapilla* (L.).

Summer visitor, decidedly less plentiful than the Garden-Warbler. A solitary female was seen at the Tees-mouth on November 1st, 1937 (M. G. R.).

**Whitethroat** *Sylvia communis communis* Lath.

Common summer visitor, arriving the last week in April or the first in May.

**Lesser Whitethroat** *Sylvia curruca curruca* (L.).

Rather uncommon summer visitor, but perhaps increasing.

**Fieldfare** *Turdus pilaris* L.

Common winter visitor, arriving in October (the actual date varying greatly), and leaving about the end of April, though stragglers sometimes reported in May.

**Mistle-Thrush** *Turdus viscivorus viscivorus* L.

Common resident, also a winter visitor.

**Song-Thrush** *Turdus philomelos clarkei* Hart.

Common resident.

**Redwing** *Turdus musicus* L.

Common winter visitor, arriving in the middle of October and departing about the end of March. Its arrival is usually signalled by its nocturnal flight-call; and occasionally, just prior to leaving in spring, a party may be heard singing in concert--a low, varied and continuous warble.

**Ring-Ouzel** *Turdus torquatus torquatus* L.

Summer visitor in small numbers, arriving as early as the third week of March. It is of very local distribution, nesting in glens on the edge of the moors, and is only seen in the lowlands on migration. One was seen at the Tees-mouth on November 7th, 1937 (M. G. R.).

**Blackbird** *Turdus merula merula* L.

Common resident; also a winter immigrant.

**Wheatear** *Oenanthe oenanthe oenanthe* (L.).

Common summer visitor and passage migrant, arriving during the last week of March. Breeds chiefly in the upper dale, but also at the Tees-mouth, and occasionally near Darlington. One was observed at Sadberge (Co. Durham) on November 27th, 1930 (W. E. A.).

**Greenland Wheatear** *Oenanthe oenanthe leucorrhoa* (Gm.).

Regular passage migrant in small numbers. First observed at Darlington Sewage Farm on April 23rd, 1928; in 1930, a bird was observed as late as May 10th. It is thus considerably later than the Common Wheatear on the spring migration. Also seen at the Tees-mouth (J. Bishop).

**Black-Eared Wheatear** *Oenanthe hispanica melanoleuca* (Gill.).

Very rare straggler, the only record being of a male bird, of the eastern form, seen in a quarry at Roseberry Topping, near Great Ayton, on June 6th, 1915 (W. S. Medlicott).

**Whinchat** *Saxicola rubetra rubetra* (L.).

Fairly common summer visitor and passage migrant, arriving in late April or early May. Often abundant in the Darlington Sewage Farm in autumn.

**Stonechat** *Saxicola torquata hibernans* (Hart.).

Scarce resident, breeding sparingly in the upper dale and on the coast-line. It is sometimes seen in the Darlington district in autumn.

**Redstart** *Phoenicurus phoenicurus phoenicurus* (L.).

Summer visitor, not uncommon in Mid-Teesdale and by the Greta, less plentiful about Darlington and Stockton. Also seen on passage towards the end of April and, at the Tees-mouth, in autumn.

**Black Redstart** *Phoenicurus ochrurus gibraltariensis* (Gm.).

Rare, casual visitor. An immature male was shot on the north bank of the river, near the Tees-mouth, on October 28th, 1903 (Nelson).

**Nightingale** *Luscinia megarhyncha megarhyncha* Brehm.

A summer visitor of extremely occasional occurrence, despite periodical rumours. A well-accredited instance however, was its appearance near Normanby (Yorks.) in May, 1932; unfortunately the crowds attracted by the publicity it received caused it to be driven away (J. Bishop).

**Norwegian Bluethroat** *Luscinia svecica gaetkei* (Kleinschm.).

Rare passage migrant. An immature specimen was shot, and another seen, at Seaton Carew on September 19th, 1903 (J. Bishop); and a young bird was observed near the Tees-mouth, on the Durham side, on August 16th, 1929 (W. B. Alexander).

**Robin** *Erithacus rubecula melophilus* Hart.

Common resident; also a winter visitor, the immigrants presumably belonging to the continental form, *Erithacus rubecula rubecula* (L.).

**Hedge-Sparrow** *Prunello modularis occidentalis* (Hart.).

Common resident.

**Wren** *Troglodytes troglodytes troglodytes* (L.).

Common resident. Occasionally seen Oil migration at the Tees-mouth in late autumn.

**Dipper** *Cinclus cinclus gularis* (Latham).

Common resident, breeding along the Tees, and its tributaries, as far down-stream as Dinsdale.

**Swallow** *Hirundo rustica rustica* L.

Common summer visitor, though less numerous than formerly. It arrives about mid-April (the first birds usually being seen between the 10th and the 15th) and leaves towards the end of September and the first half of October, though later stragglers are frequently reported. South-ward passago is observed at the Tees-mouth in mid-September and earlier (J. Bishop).

**House-Martin** *Delichon urbica urbica* (L.).

Common summer visitor, though less numerous than formerly in Upper and Mid-Teesdale (Bentley Beetham). It arrives during the latter part of April and usually leaves during the first fortnight of October, though odd birds may be seen later.

**Sand-Martin** *Riparia riparia riparia* (L.).

Common summer visitor, though it, too, has decreased in numbers during recent years. Arrives during April, the date varying widely from year to year, and leaves during September.

**Swift** *Apus apus apus* (L.).

Common summer visitor; this species has increased in numbers during- recent years. Arriving at the beginning of May, most of our birds leave about mid-August; but stragglers may be seen even in September, especially on the coast, where passage migration may be noticed both in spring and autumn.

**Nightjar** *Caprimulgus europaeus europaeus* L.

Summer visitor, not numerous and of local distribution, favouring the country on the edge of the moors. It has occurred very sparingly on felled woodland in the neighbourhood of Darlington in recent years.

**Hoopoe** *Upupa epops epops* L.

Rare straggler. One was identified near Marton-in-Cleveland in September, 1932 (J. Bishop).

**Roller** *Coracias garrulus garrulus* L.

Rare straggler. An immature female was recorded from Acklam-in-Cleveland in September, 1901 (Nelson).

**Kingfisher** *Alcedo atthis ispida* L.

Fairly common resident, found along the Tees and its tributaries, wandering from its nesting-haunts after the breeding season.

**Green Woodpecker** *Picus viridis virescens* (Brehm).

Somewhat local resident, preferring well-wooded districts and apparently increasing.

**Great Spotted Woodpecker** *Dryobates major anglicus* (Hart.).

Resident, rather more numerous than the Green Woodpecker, and apparently increasing. Probably a number of winter immigrants are referable to the northern form, *Dryobates major major* (L.).

**Lesser Spotted Woodpecker** *Dryobates minor comminutus* (Hart.).

A pair nested at Darlington in 1934 (A. Stainthorpe).

**Wryneck** *Jynx torquilla torquilla* L.

Formerly a regular summer visitor, and described by J. Hogg, in 1845, as not uncommon. Now only known as a rare passage migrant on the coast; Nelson records one at Middlesbrough in September, 1905.

**Cuckoo** *Cuculus canorus canorus* L.

Common summer visitor, arriving during the latter part of April. It is seldom heard to call after the end of June, but young birds are sometimes seen as late as September.

**Tengmalm's Owl** *AEgolius funereus funereus* (L.).

Very rare straggler. One was shot in November, 1861, at Cowpen, near the Tees-mouth (J. Hogg).

**Little Owl** *Athene noctua vidalii* A. E. Brehm.

Local resident, having reached this district in its northward spread about 25 years ago, since which time it has been found nesting in several localities not far from Darlington.

**Eagle-Owl** *Bubo bubo bubo* (L.).

Very rare straggler, only once recorded—a bird observed near Redcar in October, 1915 (C. E. Milburn).

**Long-Eared Owl** *Asio otus otus* (L.).

Uncommon resident, much scarcer than formerly; thirty years ago it was regarded as common, especially in wooded districts. Occasionally seen at the Tees-mouth as a winter visitor (Nelson).

**Short-Eared Owl** *Asio flammeus flammeus* (Pontopp.).

Scarce resident, breeding sparingly on the moors; occasionally seen as a winter visitor at the Tees-mouth.

**Tawny Owl** *Strix aluco sylvatica* Shaw.

Common resident

**Barn-Owl** *Tyto alba alba* (cop.),

Resident, much scarcer than the Tawny Owl, and apparently diminishing in numbers.

**Peregrine Falcon**, *Falco peregrinus peregrinus* Tunst.

Tries almost yearly to nest in Upper Teesdale, but the birds are usually shot (J. Bishop). Only one known eyrie (G. W. Temperley). Seen occasionally, after the breeding season, in other parts of the district, as, for example, at the Tees-mouth.

**Hobby** *Falco subbuteo subbuteo* L.

Very rare straggler. There are two old records for this species-at Streatlam Park, near Staindrop (Hancock), and at Norton-on-Tees (Hogg).

**Merlin** *Falco columbarius oesalon* Tunst.

Resident, nesting sparingly on most of the higher fells where the heather is long (Bentley Beetham), but receiving no mercy from the gamekeepers. It is seen at the Tee -mouth every winter.

**Kestrel** *Falco tinnunculus tinnunculus* L.

Common resident. Numbers migrate after the breeding season, returning to their haunts usually in the first half of March.

**Rough-Legged Buzzard** *Buteo lagopus lagopus* (Briinn.).

Irregular autumn migrant in very small numbers, the most recent record being of one seen at the Tees-mouth on October 23rd, 1936 (J. Bishop).

**Common Buzzard** *Buteo buteo buteo* (L.).

Nests sparingly just outside our area (Upper Teesdale); two young were successfully reared in 1938. Visitors from the Lake District are occasionally seen in Teesdale and on September 8th, 1931, one was observed over the Darlington Sewage Farm.

**Marsh-Harrier** *Circus aeruginosus aeruginosus* (L.).

Formerly nested on the Teesdale moors; in 1821., a nest with four eggs was taken on the moors at Wemmergill, in Lunedale (Hancock). In 1829, a bird was killed in the marshes near Greatham (Backhouse). Not recorded recently.

**Montagu's Harrier** *Circus pygurgus* (L.).

Probably bred on the Teesdale moors in former days; now a rare visitor on passage. An immature bird was shot on the Tees marshes, near Port Clarence, on September 2nd, 1932 (J. Bishop).

**Hen-Harrier** *Circus cyaneus cyaneus* (L.).

Formerly bred on the moors of Upper Teesdale; now a rare visitor on passage. One was seen near Barningham (Yorks.) on October 31st 1938 (W. K. Richmond).

**Goshawk** *Accipiter gentilis gentilis* (L.).

Rare straggler. An immature bird was seen near Grangetown station on January 2nd, 1934 (W. K. Richmond and M. G. R.).

**Sparrow-Hawk** *Accipiter nisus nisus* (L.).

Resident, not common. Frequently seen at the Tees-mouth in the winter months.

**Kite** *Milvus milvus milvus* (L.).

Very rare straggler. The only record during the last century at the Tees-mouth in September, 1883 (Nelson).

**White-Tailed Eagle** *Haliaeetus albicilla* (L.).

Rare casual visitor near the coast. A pair appeared at the Tees-mouth in late October, 1915 (*Vasculum*, Vol. II.), and one was observed between Great Ay ton and Kildale on December 1st, 1915 (*British Birds*, 1916).

**Honey-Buzzard** *Pernis apivorus apivorus* (L.).

Rare passage migrant, recorded by Nelson at Redcar on September 4th, 1896, and October 3rd, 1903. One was picked up, injured, at Acklam, near Middlesbrough, on June 1st, 1924 (G. W. Temperley).

**Osprey** *Pandion haliaetus haliaetus* (L.).

Rare passage migrant. One was seen by Sir Alfred E. Pease on September 24th, 1932, over Guisbrough Park, "disappearing in the direction of the Tees-mouth." A bird circling over Stockton-on-Tees on July 5th, 1933, was probably of this species (J. Bishop).

**White Stork** *Ciconia ciconia ciconia* (L.).

Rare, casual visitor. One was killed at Great Ay ton, about 1855 (Nelson); and another shot at Morton Tinnmouth, near Gainford, on February 14th, 1884, by T. Robson. The only recent record is of one seen for several weeks in the neighbourhood of Middlesbrough and Great Ay ton in late October and early November, 1938 (M. G. R.).

**Black Stork** *Ciconia nigra* (L.).

Very rare straggler. Hancock mentions a specimen near Hartlepool, in August, 1852.

**Spoonbill** *Platalea leucorodia leucorodia* L.

Very rare straggler. A specimen killed some years previously on the Tees marshes" was recorded in 1845 (Nelson).

**Glossy Ibis** *Plegadis falcinellus falcinellus* (L.).

Very rare straggler. An immature bird was shot at Billingham, November, 1900 (J. Bishop).

**Heron** *Ardea cinerea cinerea* L.

Local resident and autumn and winter immigrant. The sole heronry is situated in the Gainford district; its site has been changed several times during the last twenty years in consequence of tree-felling, and odd nests are also reported. The number of breeding pairs in recent years has averaged about 10. A bird ringed here on June 22nd, 1928, was recovered near Wooler, Northumberland, on March 21st, 1929.

**Little Bittern** *Ixobrychus minutus minutus* (L.).

Very rare straggler. Nelson records specimens at Redcar in 1852 and at Mickleton-in-Teesdale in 1885

**Bittern** *Botaurus stellaris stellaris* (L.).

Rare winter visitor and passage migrant. The remains of a Bittern were found on the Durham bank of the Tees above High Force in May, 1926 (G. W. Temperley); a bird was taken alive at Aycliffe in the early spring of 1929; one was shot near Haverton Hill on October 26th, 1932 (J. Bishop); and another near Sedgfield on February 8th, 1937 (A. Todd). In former days, it was recorded at "Four Riggs Bog," Darlington, and Tunstall, in 1784, remarked that there were many in the neighbourhood of Wycliffe.

**Whooper Swan** *Cygnus cygnus* (L.).

Uncommon winter visitor, usually in severe weather.

**Bewick's Swan** *Cygnus bewickii bewickii* Yarr.

Rare winter visitor. Three at the Tees-mouth on March 3rd, 1925 (C. E. Milburn). An adult bird, together with two first-year Whoopers, was obtained out of a mixed flock at Croft-on-Tees at the beginning of November, 1930 (H. A. Inness). One was present for a short period on the Darlington Park Lake on January 1st, 1939 (W. K. Richmond).

**Mute Swan** *Cygnus olor* (Gm.).

Resident, semi-domesticated.

**Grey Lag-Goose** *Anser anser* (L.).

Rare winter visitor. Of a flock of "Grey Geese" seen at the Tees-mouth on December 27th, 1938, three were undoubtedly Grey Lags (W. K. Richmond and M. G. R.).

**White-Fronted Goose** *Anser albifrons* (Scop.).

Rare winter visitor (Nelson).

**Bean-Goose** *Anser fabalis fabalis* (Lath.).

Rare winter visitor (Nelson).

**Pink-Footed Goose** *Anser brachyrhynchus* Baillon ,

Winter visitor. Numerous reports of "Grey Geese" passing over in the winter months probably refer to this species. A goose which frequented the Darlington Sewage Farm in December, 1932, and which allowed a close approach, was certainly a "Pink-foot" (M. G. R.).

**Red-Breasted Goose** *Branta ruficollis* (Pall.).

Very rare straggler. One was taken alive near Wycliffe, about 1776 (Tunstall); and two were seen (one of them shot) on the Durham side of the Tees estuary, in 1845 (Hogg).

**Barnacle-Goose** *Branta leucopsis* (Bechst.).

Very rare winter visitor to the Tees-mouth; not recorded since 1883, but formerly not uncommon (Nelson).

**Brent Goose** *Branta bernicla bernicla* (L.).

Winter visitor to the Tees estuary, chiefly in severe weather, and then only in small numbers. The immense "packs" once seen are now things of the past.

**Sheld-Duck** *Tadorna tadorna* (L.).

Resident, passage migrant and winter visitor. Breeds in small numbers at the Tees-mouth, nesting in holes in the slag walls; it has increased in recent years (J. Bishop). In some autumns it is recorded on Darlington Sewage Farm, and on December 22nd, 1938, a drake was seen on Darlington Park Lake.

**Mallard** *Anas platyrhynchos platyrhynchos* L.

Common resident and winter visitor.

**Gadwall** *Anas streperus* L.

Rare winter visitor. Five were seen on the Crag Pond, Lartington (Yorks.), in September, 1926 (W. K. Richmond); and one on the Saltholme Marshes, north of the Tees-mouth, on September 3rd, 1929 (W. B. Alexander).

**Teal** *Anas crecca crecca* L.

Local as a resident, common as a passage migrant in autumn and as a winter visitor.

**Garganey** *Anas querquedula* L.

Breeds very occasionally near the Tees-mouth and is also seen sparingly on passage.

**Wigeon** *Anas penelope* L.

Autumn and winter visitor at the Tees-mouth, where birds may be seen as late as May (J. Bishop), and occasionally in the Darlington district.

**Pintail** *Anas acuta acuta* L.

Formerly a numerous, now a scarce, winter visitor and passage migrant at the Tees-mouth, where birds are seen every spring (J. Bishop). A female frequented Darlington Park Lake during January, 1938 (M. G. R.).

**Shoveler** *Spatula clypeata* (L.).

Breeds regularly in small numbers at the Tees-mouth, where it is also a winter visitor and passage migrant. Occasionally observed in autumn and winter at Darlington South Park and Sewage Farm.

**Red-Crested Pochard** *Netta rufina* (Pall.).

Very rare straggler. The only record is of a male killed on the Coatham Marshes, near Tees-mouth, on January 20th, 1900 (Nelson).

**Pochard** *Nyroca ferina ferina* (L.).

Very local as a breeding species; fairly common as a winter visitor; and there is a well-defined passage in spring and autumn.

**Ferruginous Duck** *Nyroca nyroca nyroca* (Güld.).

Very rare straggler. Not recorded since October 3rd, 1878, when two were seen, and one shot, on Coatham Marshes (Nelson).

**Tufted Duck** *Nyroca fuligula* (L.).

Uncommon, and very local, as a breeding species; fairly numerous as a winter visitor; well-defined passage in spring and autumn. In spring, drakes appear to predominate.

**Scaup** *Nyroca marila marila* (L.).

Winter visitor to the Tees-mouth in smaller numbers than formerly. Most numerous after severe weather, as on December flock of over a hundred was observed. Two drakes were seen on the lake at Darlington Park on December 24th, 1936, and a duck on December 31<sup>st</sup> 1938, and the following day (M. G. R.).

**Golden-Eye** *Bucephala clangula clangula* (L.).

Winter visitor, in small numbers. It is seen every winter at the Tees estuary, occasionally in flocks; one or two usually occur on the Darlington Park Lake and occasionally on the Tees near Darlington. An adult male was seen at the Tees-mouth on June 22nd, 1933 (J. Bishop).



**Long-Tailed Duck** *Clangula hyemalis* (L.).

Winter visitor to the coast off the Tees-mouth; somewhat uncommon. During December, 1931, a drake frequented an inland pond, near Billingham (J. Bishop); and another, apparently injured, was observed drifting down the swollen Skerne at Darlington Park on January 8th, 1939 (M. G. R.).

**Eider Duck** *Somateria mollissima mollissima* (L.).

Casual winter visitor on the coast off the Tees-mouth.

**Common Scoter** *Oidemia nigra nigra* (L.).

Winter visitor on the coast off the Tees-mouth, appearing in varying numbers; most plentiful in severe seasons. Also a passage migrant, most noticeably so in early August. Occasionally observed on inland waters.

**Velvet Scoter** *Oidemia fusca fusca* (L.).

Regular autumn passage migrant and winter visitor at the Tees-mouth.

**Goosander** *Mergus merganser merganser* L.

Winter visitor, most common in severe winters. It occurs inland, as well as on the coast, having been seen on the Tees above Yarm, at Neasham, and near Gainford.

**Red-Breasted Merganser** *Mergus serrator* L.

Winter visitor to the Tees-mouth, chiefly in severe weather. Brown and grey birds are to be seen in most winters and adult drakes are not infrequent. Noted as late as April 20th. 1933 (W. K. Richmond).

**Smew** *Mergus allbellus* L.

Uncommon winter visitor at the Tees-mouth. A drake was seen at Billingham on February 10th. 1937 (J. Bishop).

**Cormorant** *Phalacrocorax carbo carbo* (L.).

Common resident at the Tees-mouth. its nearest nesting-site being at Huntcliffe. There is a marked southward movement in winter. Exceptionally, it is seen in land; one took up quarters at the Darlington South Park Lake for several weeks in May, 1932.

**Shag** *Phalacrocorax aristotelis aristotelis* (L.).

Uncommon winter visitor to the Tees-mouth, and also seen on passage.

**Gannet** *Sula bassana* (L.).

Occasionally seen off the coast as a bird of passage. One was captured on Cross Fell in the spring of 1887 (Backhouse).

**Storm-Petrel** *Hydrobates pelagicus* (L.).

Occasionally driven into the Tees-mouth, or even inland, after severe winter storms. Two were observed flying hither and thither over the mud-flats of the estuary on October 29th, 1927, following a westerly (!) gale.

**Leach's Fork-Tailed Petrel** *Oceanodroma leucorhoa leucorhoa* (Vieill.).

Occasionally picked up on the coast, or inland, after severe storms; for example, one near Middlesbrough on September 27th, 1932 (J. Bishop), and another at Middleton-in-Teesdale on October 19th, 1935 (Bentley Beetham).

**Manx Shearwater** *Puffinus puffinus puffinus* (Brunn.).

Passage migrant off the coast (Nelson).

**Great Shearwater** *Puffinus gravis* (O'Reilly).

Late summer and autumn visitor off the coast, of rare occurrence. Two birds were observed some three miles out from the Tees-mouth on July 18th, 1931 (W. E. A.).

**Sooty Shearwater** *Puffinus griseus* (Gm.).

Uncommon autumn visitor to the coast, occasionally seen off the Tees-mouth.

**Fulmar** *Fulmarus glacialis glacialis* (L.).

Huntcliff'e (Saltburn) is its nearest nesting-site. Uncommon in autumn and winter.

**Great Crested Grebe** *Podiceps cristatus cristatus* (L.).

Autumn and winter visitor, rare inland, somewhat more frequent on the coast, especially in severe weather. A disabled bird remained on the ornamental lake at the South Park, Darlington, from November, 1924, to May, 1925 (M. G. R.); in February, 1937, one frequented a pond at Billingham for several days (J. Bishop); and one was seen on the lake at Halnaby, near Croft, in August, 1937 (H. A. Inness).

**Slavonian Grebe** *Podiceps auritus* (L.).

Uncommon winter visitor to the coast and inland. One was observed on a pond near Billingham in December, 1931, and again, apparently the same bird, in November and December, 1932 (J. Bishop). One at Branksome Mere, Darlington, on May 19th, 1938 (F. Williams and E. W. Markham).

**Red-Necked Grebe** *Podiceps griseigena griseigena* (Bodd.).

Uncommon winter visitor to the Tees-mouth. A shot bird was picked up near Greatham Creek on February 5th, 1937 (J. Bishop).

**Black-Necked Grebe** *Podiceps nigricollis nigricollis* Brehm.

Winter visitor and passage migrant at the Tees-mouth, recorded at rare intervals during the last century.

**Little Grebe** *Podiceps ruficollis ruficollis* (Pall.).

Resident, local as a nesting species: local migration takes place after the breeding season. It is a regular autumn and winter visitor to the Skerne at Darlington, first appearing early in August, most numerous in early October, and leaving for its nesting haunts before the end of March. In 1936, however, a pair nested in the South Park and young were still being brooded on August 21st. In hard weather it visits the coast.

**Great Northern Diver** *Colymbus immer*· Brunn.

Rare winter visitor off the Tees-mouth; one was seen there on April 20th, 1933 (W. K. Richmond), and other on December 28th, 1938, and January 5th, 1939 (M. G. R.).

**Black-Throated Diver** *Colymbus arcticus arcticus* L.

Rare winter visitor to the coast during the last century.

**Red-Throated Diver** *Colymbus stellatus* Pontopp

Common winter visitor to the Tees-mouth, first appearing early in August and most numerous in December and January. One observed on December 28th, 1938, was almost in full summer plumage.

**Wood-Pigeon** *Columba palumbus palumbus* L.

Common resident and an autumn and winter immigrant in great numbers.

**Stock-Dove** *Columba aenas* L.

Fairly common resident, though somewhat local in its distribution, preferring old woodland. Many move south in autumn, their places being taken by autumn and winter immigrants. In the winter months numbers of this species habitually associate with Wood-Pigeons at communal roosting-places. The summer residents return to their nesting-haunts at the South Park, Darlington, early in March.

**Rock-Dove** *Columba livia livia* Gm.

So far as we are aware, there are no truly-wild Rock-Doves resident in the area.]

**Turtle-Dove** *Streptopelia turtur turtur*

Summer visitor in very small numbers. It has occurred at Darlington Sewage Farm in August.

**Pallas's Sand-Grouse** *Syrrhaptes paradoxus* (Pall.).

Very rare straggler. Occasional invasions in large numbers were recorded during the last century, the last in May, 1888 (Nelson).

**Stone-Curlew** *Burhinus oedicnemus oedicnemus* (L.).

Extremely rare straggler in former days.

**Oyster-Catcher** *Haematopus ostralegus ostralegus* L.

Fairly common passage migrant and winter visitor at the Tees-mouth; most numerous in August and September, few being present in mid-winter. A pair stayed to nest in May, 1933, but their three eggs were taken and no further attempt at breeding has been made (J. Bishop).

**Dotterel** *Charadrius morinellus* L.

Scarce summer visitor. Cross Fell is its traditional breeding-site, and it probably still nests there, but very sparingly. It visits the Tees-mouth, chiefly on the spring migration (J. Bishop); and three were observed at the Darlington Sewage Farm on September 3rd, 1929 (W. K. Richmond).

**Ringed Plover** *Charadrius hiaticula hiaticula* L.

Resident, passage migrant and winter visitor at the Tees-mouth; most abundant in August and September, return migration being noticeable in spring. Also observed, in smaller numbers, at Darlington Sewage Farm on both spring and autumn passage, chiefly the latter, being most numerous about mid-September.

**Kentish Plover** *Charadrius alexandrinus alexandrinus* L.

Very rare passage migrant on the coast, the most recent record referring to two observed at the Tees-mouth on May 11th, 1924 (C. E. Milburn and J. Bishop).

**Southern Golden Plover** *Charadrius apricarius apricarius* L.

Common resident and passage migrant. It breeds plentifully on the moors, most of the birds arriving in March and leaving in August for the lower lands and the coast, though some few remain on the moors throughout the winter. There is, too, a great southerly movement in the autumn.

**Northern Golden Plover** *Charadrius apricarius altifrons* Brehm.

Winter visitor and passage migrant. To this form probably belong the flocks of very black-breasted birds seen in the district in March and April, continuing to pass north after our own stock of Southern Golden Plover is already established in pairs on their local breeding-grounds (G. W. Temperley).

**Grey Plover** *Squatarola squatarola squatarola* (L.).

Winter visitor and passage migrant, usually in small numbers, at the Tees-mouth. On the autumn passage, it appears about the end of July, some still retaining their breeding plumage, which is also to be noticed on the northward migration in spring. Some remain through the winter. Odd birds have been recorded at the Darlington Sewage Farm in October on two occasions.

**Lapwing** *Vanellus vanellus* (L.).

Common resident, whose numbers have increased in recent years; also abundant as a winter visitor and passage migrant. On two occasions, birds ringed near Barnard Castle in early summer have been recovered in Ireland during the winter.

**Turnstone** *Arenaria interpres interpres* (L.).

Fairly common passage migrant at the Tees-mouth; and also a winter visitor, though in smaller numbers. In the spring, parties may be seen up to mid-June; in the autumn, it is most numerous in August, when parties of fifty or over are not an uncommon sight.

**Ruff** *Philomachus pugnax* (L.).

No longer a breeding species at Tees-mouth (where, according to Nelson, it nested on the Durham side of the river in 1901, 1902 and 1903), but still observed on the spring and autumn migrations, more especially the latter. It occurs regularly at Darlington Sewage Farm on the autumn passage, the first arrivals appearing in mid-August. On one occasion a bird wintered here, being seen several times from December 9th, 1928, to April 22nd, 1929.

**Sanderling** *Crocethia alba* (Pall.).

Plentiful as a passage migrant at the Tees-mouth, particularly in August and September; and remains, usually in smaller numbers, during the winter months.

**Knot** *Calidris canutus canutus* (L.).

Passage migrant and winter visitor at the Tees-mouth. Formerly seen in immense flocks, it now comes in much smaller numbers. Once recorded at Darlington Sewage Farm: a party of a dozen birds which stopped to rest for a few hours on September 10th, 1928 (W. E. A.).

**Southern Dunlin** *Calidris alpina schinzii* (Brehm).

Summer visitor and passage migrant. An uncommon breeding species, in the upper dale and on the Barningham moors. A few pairs used to nest at the Tees-mouth, but not since 1907; though a few non-breeding birds linger there during the summer months (J. Bishop). Passage is observable on the coast from the end of July onwards, and again in the spring from February to May.

**Lapland Dunlin** *Calidris alpina alpina* (L.).

Numbers of this form are doubtless present in the large flocks which arrive at the Tees-mouth in October. Small parties of this, or the preceding, species have been observed at Darlington Sewage Farm all every month from July to May.

**Curlew-Sandpiper** *Calidris testacea* (Pall.).

Passage migrant at the Tees-mouth, in varying numbers. several times recorded at Darlington Sewage Farm in September, and on one occasion, during severe weather, in winter: a party of ten birds on December 9th, 1928 (W. E. A.).

**Little Stint** *Calidris minuta* (Leisl.).

Uncommon passage migrant at the Tees-mouth, chiefly seen in the autumn. Recorded on one occasion at the Darlington Sewage Farm: a single bird, consorting with a small company of Dunlins and Curlew-Sandpipers, on September 30th, 1928 (W. E. A.).

**Purple Sandpiper** *Calidris maritima maritima* (Brünn.).

Passage migrant and winter visitor in small numbers, haunting the long reefs off the shore at Redcar and the sides of the South Gare break-water at the Tees-mouth.

**Common Sandpiper** *Tringa hypoleucos* L.

Common summer visitor, arriving during the third week in April and nesting on the banks of the Tees and its tributaries throughout the dale and at Tees-mouth. Also a passage migrant.

**Wood-Sandpiper** *Tringa glareola* L.

Rare passage migrant. One was observed closely at the Darlington Sewage Farm on September 8th and 9th, 1935 (M. G. R.).

**Green Sandpiper** *Tringa ochropus* L.

Fairly common passage migrant, more often noticed on the autumn than on the spring passage. The Darlington Sewage Farm is a favourite halting-place for this species, which may be seen in varying numbers from July to December, and again in March and April.

**Redshank** *Tringa totanus totanus* (L.).

As a breeding species, the Redshank has increased during recent years in the upper dale but has decreased at the Tees-mouth. It is also seen on spring and autumn passage and as a winter visitor, both near the coast and, in smaller numbers, at Darlington Sewage Farm.

**Spotted Redshank** *Tringa erythropus* (Pall.).

Uncommon passage migrant, more frequent in autumn than in spring, observed at the Tees-mouth and at Darlington Sewage Farm.

**Greenshank** *Tringa nebularia* (Gunn.).

A regular, but not numerous, autumn passage migrant at the Tees-mouth and at Darlington Sewage Farm, and occasionally by the Tees, as at Neasham.

**Grey Phalarope** *Phalaropus fulicarius* (L.).

A rare and irregular autumn and winter visitor, recorded by Nelson near Redcar in 1854 and 1874, but not noted since.

**Red-Necked Phalarope** *Phalaropus lobatus* (L.).

A rare and irregular autumn and winter visitor, the most recent record being of one picked up dead at Tees-mouth, on October 23rd, 1891 (Nelson).

**Avocet** *Recurvirostra avosetta* L.

Rare vagrant, the only recent record being of three birds observed near Greatham Creek on May 22nd, 1931 (J. Bishop).

**Bar-Tailed Godwit** *Limosa lapponica lapponica* (L.).

Fairly numerous spring and autumn passage migrant and winter visitor at the Tees-mouth. One, in summer plumage, was seen on the Darlington Sewage Farm on August 20th, 1936.

**Black-Tailed Godwit** *Limosa limosa limosa* (L.).

Spring and autumn passage migrant, more especially at the latter season, but much less frequent than the Bar-tailed Godwit at the Tees-mouth. Inland, it is of more frequent occurrence than that species and has been noted on the Darlington Sewage Farm in three autumns.

**Curlew** *Numenius arquata arquata*. (L.).

Common resident, nesting in damp fields in the low country about Darlington, as well as on the moors. Abundant as a passage migrant and winter visitor at the Tees-mouth.

**Whimbrel** *Numenius phaeopus phaeopus* (L.).

Spring and autumn passage migrant at the Tees-mouth, usually in small numbers.

**Great Snipe** *Capelia media* (Lath.).

Autumn passage migrant. A bird of solitary habits, it is more frequently met with in the marshes about Croft than on the Sewage Farm (H. A. Inness).

**Common Snipe** *Capelia gallinago gallinago* (L.).

Common resident, nesting on the moors and in lowland marshes, including those at the Tees-mouth. Abundant passage migrant and winter visitor.

**Jack Snipe** *Lymnocyptes minimus* (Brüun.).

Winter visitor, usually in small numbers, in some winters more plentiful than in others. Occasionally recorded in autumn.

**Woodcock** *Scolopax rusticola rusticola* L.

Resident, local in its distribution, breeding sparingly near Darlington and in the middle dale. Fairly common winter visitor.

**Black Tern** *Chlidonias niger niger* (L.).

Uncommon spring and autumn visitor to the Tees-mouth. It has also been observed at the Darlington Sewage Farm in autumn on two occasions, the more recent being August 19th, 1936 (M. G. R.).

**White-Winged Black Tern** *Chlidonias leucopterus* (Temm.).

Very rare straggler. The only record is of one killed near Port Clarence, on the north side of the Tees, on May 15th, 1869 (Nelson).

**Sandwich Tern** *Sterna sandvicensis sandvicensis* Lath.

Common spring and autumn passage migrant at the Tees-mouth. In June, 1931, a nest was found on the Durham side of the estuary, but the three eggs were destroyed by gulls (J. Bishop); and in view of the extensive reclamation schemes being undertaken there is now little prospect of its establishing itself as a breeding species.

**Roseate Tern** *Sterna dougallii dougallii* Mont.

The only authority for its occurrence is W. Backhouse, who wrote in 1846, that "it occurs in the Tees Bay. but rare."

**Common Tern** *Sterna hirundo hirundo* L.

Summer visitor, breeding in small numbers on the north side of the Tees-mouth, where it arrives about the last week of April. It was first

recorded as a breeding species in County Durham in 1922, since which date the colony has experienced considerable fluctuation in size. Its most successful season was 1928, when about forty pairs nested, but more recently it has declined to less than half this number. It is plentiful as a passage migrant on the coast in autumn, at which season birds are also occasionally seen at Darlington Sewage Farm; on the spring passage it occurs in smaller numbers,

**Arctic Tern** *Sterna macrura* Naumann.

Passage migrant on the coast. It is probably much commoner than the comparatively few definite records would suggest.

**Little Tern** *Sterna albifrons albifrons* Pall.

Summer visitor, breeding in small numbers on both sides of the Tees-mouth; also a spring and autumn passage migrant, being more numerous at the latter season. It was first recorded as a breeding species on the Yorkshire side of the river in 1909, but was not found nesting on the Durham bank until 1922. Its most successful season was 1931, when there were some thirty breeding pairs; its present strength is considerably less than this.

**Sabine's Gull** *Xema sabini* (Sabine).

Casual visitor, last recorded at the Tees-mouth in September, 1904 (Nelson).

**Little Gull** *Larus minutus* Pall.

Irregular autumn and winter visitor to the Tees-mouth. An immature bird, flying steadily southwards, was observed there on October 25th, 1928 (W. E. A.).

**Black-Headed Gull** *Larus ridibundus ridibundus* L.

Common resident, passage migrant and winter visitor. It nests in small numbers at the Tees-mouth and at the Darlington Sewage Farm, where also many non-breeding birds are to be seen during the summer. (More populous colonies are known in Swaledale.)

**Common Gull** *Larus canus canus* L.

Common winter visitor to the coast; also inland, especially in hard weather. As a passage migrant, it is more numerous in autumn than in spring on the coast, whereas overland migration is more noticeable in spring.

**Herring-Gull** *Larus argentatus argentatus* Pont.

Common resident and winter visitor. It is plentiful inland in autumn, winter and spring and, to a less extent, chiefly immature birds, in summer. Huntcliffe (Saltburn) is its nearest nesting-site.

**Lesser Black-Backed Gull** *Larus fuscus affinis* Reinh.

Very local as a resident; it has been found breeding in Upper Teesdale on several occasions (Bentley Beetham). Fairly common passage migrant and winter visitor. It is observed regularly inland (e.g., at Darlington Sewage Farm) on spring and autumn passage. On four occasions, birds ringed at Foulshaw, Westmorland, have been recovered within our area.

**Great Black-Backed Gull** *Larus marinus* L.

Common passage migrant and winter visitor at the Tees-mouth, where small numbers of non-breeding birds are seen in the summer months. Occasionally observed inland, usually in severe weather, when odd birds visit Darlington Park and Sewage Farm.

**Glaucous Gull** *Larus hyperboreus* Gunn.

Casual visitor, last recorded at Redcar on April 8th, 1903 (Nelson).

**Iceland Gull** *Larus glaucoides* Meyer.

Casual visitor, last recorded at Tees-mouth on February 1st, 1902 (Nelson).

**Kittiwake** *Rissa tridactyla tridactyla* (L.).

Fairly common winter visitor to the Tees-mouth, also observed in small numbers on passage. Noted at Darlington Sewage Farm on August 18th, 1937 (A. Stainthorpe).

**Ivory-Gull** *Pagophila eburnea* (Phipps).

Rare casual visitor to the coast, last recorded at Redcar on November 21nd, 1879 (Nelson).

**Great Skua** *Stercorarius skua skua* (Briinn.).

Uncommon visitor to the Tees-mouth on autumn passage. Two birds were seen on August 8th, 1928 (W. E. A.), and one on August 2nd, 1931 (M. G. R.).

**Pomatorhine Skua** *Stercorarius pomarinus* (Temm.).

Passage migrant in autumn off the coast; in the past large flocks have occurred at irregular intervals (Nelson), but we have no recent records.

**Arctic Skua** *Stercorarius parasiticus* (L.).

Regular autumn visitor, in small numbers, to the Tees-mouth. The dark and light forms both occur, the former being the more frequent in August and the first half of September, whereas the latter predominates in late September and October.

**Long-Tailed Skua** *Stercorarius longicaudus* Vieill.

Rare autumn visitor to the coast. An immature bird was observed between Redcar and the Tees-mouth in November, 1937 (W. K. Richmond).

**Razorbill** *Alca torda* L.

Autumn visitor to the coast; parties may frequently be seen out at sea, off the Tees-mouth, in autumn and winter. A small party was observed inside the "bar" for several days from July 16th, 1933 (J. Bishop).

**Guillemot** *Uria aalge albionis* With.

Passage migrant and winter visitor on the coast. Small parties, apparently moving southwards, are seen off the Tees-mouth in autumn; in winter, flocks of varying numbers, according to the weather, may be seen; and it has also been observed in some numbers in summer.

**Little Auk** *Alle alle* (L.).

Irregular winter visitor to the Tees-mouth, usually following strong gales, as in the case of half-a-dozen off the end of the South Gare breakwater on February 8th, 1931 (W. E. A.) and one picked up in a dying condition at Stockton on November 4th, 1933 (J. Bishop).

**Puffin** *Fratercula arctica grabae* (Brehm).

Casual winter visitor to the coast; one was observed at the Tees-mouth on January 12th, 1929, and another on January 2nd, 1934.

**Crane** *Megalornis grus grus* (L.).

Very rare straggler. The Hancock Museum contains a specimen shot on the Hart estate (near West Hartlepool) in May, 1865 (G. W. Temperley).



**Corncrake** *Crex crex* (L.).

Summer visitor, formerly abundant, decreasing suddenly during the war years (1914-18) and now extremely scarce.

**Spotted Crake** *Porzana porzana* (L.).

Rare passage migrant. The Tees-mouth marshes were formerly a favourite resort of this bird (Nelson). A male bird was picked up in an injured condition on May 21st, 1933 (J. Bishop).

**Baillon's Crake** *Porzana pusilla intermedia* (Herm.).

Very rare straggler. The only record is of one shot on the Durham side of the Tees-mouth on September 16th, 1882 (Nelson).

**Water-Rail** *Rallus aquaticus aquaticus* L.

Passage migrant, most frequently observed in autumn. Possibly breeds in one or two suitable localities near Darlington, and at the Tees-mouth, where a nest was found on the Durham side in June, 1883 (Nelson).

**Water-Hen** *Gallinula chloropus chloropus* (L.).

Common resident. Large numbers congregate in certain haunts, e.g., Darlington Park and Sewage Farm, in winter, most of these dispersing in spring to their nesting quarters, for almost every pond has its water-hen's nest. In severe weather it has been observed perching in hedgerows and feeding on the haws.

**Coot** *Fulica atra atra* L.

Resident, not nearly so plentiful as the Water-Hen and favouring larger stretches of water; it congregates in a similar way in winter.

**[Capercaillie** *Tetrao urogallus urogallus* L.

Long extinct in our area, but in the distant past it was evidently resident in the forests of the upper dale, for its bones were found in the Teesdale Cave, near Forest-in-Teesdale.]

**Black Grouse** *Lyrurus tetrix britannicus* With. & Lönn.

Resident on the moors, though local in its distribution, breeding in suitable localities in the upper dale.

**Red Grouse** *Lagopus scoticus scoticus* (Lath.).

Common resident on the moors.

**Pheasant** *Phasianus colchicus* L.

Reared in considerable numbers on various estates.

**Quail** *Coturnix coturnix coturnix* (L.).

Rare and irregular summer visitor. A nest was found near Piercebridge in July, 1927 (W. E. A.); and a bird was seen near Manfield (Yorks.) in June, 1929.

**Red-Legged Partridge** *Alectoris rufa rufa* (L.).

Introduced into this country as a game-bird, it is by no means common, but has been noted for some years in the Manfield district.

## THE STREAM SANDS OF THE NORTH OF ENGLAND AND THE SOUTH OF SCOTLAND.

J. A. SMYTHE, D.Sc., PH.D.

Some years ago I recorded the finding of a rich garnet-bearing sand on the sea-shore at Budle Bay.<sup>1</sup> This observation was followed up by a close study of the whole of the Northumberland shore and it was shown that similar natural concentrates of heavy minerals, that is, minerals like garnet, zircon, tourmaline, the specific gravity of which exceed appreciably that of siliceous sand, occur in half a dozen places along the shore. The degree of concentration of the heavy minerals was, on occasion, of the order of 90 per cent., such sample thus containing only about 10 per cent. of the quartz grains and shell fragments which normally constitute the sand of the sea-shore.<sup>2</sup>

The preliminary examination of some inland sands, from the beds of streams, yielded results of promise; thus a sample from the Tees near the Langdon Beck contained fluorspar, which must have travelled several miles. On consideration, it appeared likely that the systematic examination of stream-sands might be of use for purpose of prospecting, and particularly for sampling a tract of country with a view to determining the heavy minerals present in the rock. The usual method of doing this is most laborious, small samples of the rock being crushed and the heavy constituents separated and examined; trustworthy sampling in this way of a large area is almost impossible. Many other possibilities of acquiring useful information from such a study presented themselves and some of these will be referred to in the sequel.

The stream-sands of the county of Northumberland were first examined in detail, then the field enlarged, though not investigated in quite the same detailed manner, until it covered the greater part of the four northern counties of England and the Scottish border and Southern Uplands, including parts of Wigtonshire, Kirkcudbright hire, Roxburghshire, the Lower Tweed and the Lammermuirs. The results detailed in this paper rest on the examination of more than 300 samples from this area. Some work has also been done,

as the occasion presented itself, in other areas further afield, but this, though valuable for comparative purpose, need not be considered here.

The method of working was as follows: About half a pound of fine stream-sand was taken, well sampled at the source where possible, though often in upland streams it is difficult to find sand of the right degree of fineness. After drying, the sample was sieved and the part passing through the 80-mesh sieve taken for further treatment. Ten grams of this was separated with bromoform, S.G. 2.8, the heavy crop taken off and weighed, and both heavy and light crops examined microscopically. The identification of the minerals has been carried out entirely by Dr. L. Hawkes.<sup>3</sup> to whom the author would express his grateful thanks.

Tests carried out on the sand of the Redewater at Woodburn, which contains zircon, rutile, tourmaline, mica and garnet, show that the sample under 80-mesh is the most suitable for the study of mineral-content. The coarser grades are more highly siliceous and, indeed, often lacking in the heavier minerals, whilst in the grades still finer, say, under 120-mesh, garnet does not appear. There are also practical difficulties in the manipulation of the very fine grades owing to the slow rate of sinking of the grains in the heavy liquid.

The *Light Crops* consist in the main of quartz, sometimes almost pure, but often containing turbid, weathered rock-particles. Micro-cline, or other felspar, is fairly frequent, often accompanied by muscovite. Carbonate is infrequent (in the case of the Newton Burn it is present as aragonite) even when the country rock is largely limestone: anything approaching a limestone sand is definitely absent.<sup>4</sup> In some areas, however, quartz is conspicuously absent. The Cheviot lavas and ashes yield a light sand of potash felspar; Silurian rocks yield mainly chlorite; the volcanics of Borrowdale, chlorite and indeterminate, turbid material.

The *Heavy Crops* contain in addition to the transparent or translucent heavy minerals, opaque constituents, often in large amount, which consist of fragments of igneous rock and iron ores. In drift-covered areas, these rock-fragments can often be identified from their appearance as ice-borne materials. The high proportion of these opaque constituents in some of the sands renders the identification of the heavy minerals a matter of some difficulty.<sup>5</sup> A similar

difficulty is met with in the mining fields of South Tynedale, Weardale, Teesdale and the Pennines, arising here from contamination of the natural sands with large quantities of spar, usually barytes and fluorspar, thrown out from the mines. In the estimates of the proportion of the heavy minerals which follow, such contaminated sands are omitted.

The average of heavy crops, i.e., heavy minerals together with rock-fragments, in all the sands examined (the samples being under 80-mesh in grain-size) is 2 per cent. The great areas of the Fell Sandstones give the lowest values, viz.: 1 per cent, the coastal burns, 1·6 per cent.; Tees, Wear, South Tyne, Pennines and Cheviots, 1·8 to 2·3 per cent. Silurians are higher, viz. 4 per cent. In the mining fields, as already mentioned, high values are met with, e.g., Rundle Beck (Escarpment), 80 per cent., chiefly barytes; Settlingstones Burn, 50 per cent. witherite; South Tyne at Williamston, 34 per cent. mainly fluorspar.

#### THE FREQUENCY OF OCCURRENCE OF THE HEAVY MINERALS.

The following list gives the number of cases, expressed as a percentage value of the total number of sands examined, in which each of the specified minerals occurs.

Zircon	91	Hypersthene	11
Tourmaline	67	Hornblende	5
Apatite	55	Epidote	4
Garnet	55	Anatase	
Rutile	53	Monazite	2
Mica	29	Chiastolite	
Augite	24	Amphibole	1
Chlorite	13		

The outstanding position of zircon in this table is apparent; it is the one mineral which seldom fails; tourmaline is present in two out of three sands, apatite, garnet and rutile in one out of two. Other minerals observed, the frequency of which is less than 1 per cent. are: Sphene, (Sandwich, Ullswater; Houxy Burn); staurolite, (Castle Eden Burn, Durham); allanite (Smithy Beck, Ennerdale); vesuvianite (Caldew Beck, Cumberland).

The frequency of recurrence of some of the most important minerals in relation to certain drainage basins or geographical areas is given in the following table.

## STREAM SANDS OF N. ENGLAND AND S. SCOTLAND

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	Whole Area.	South Scotland.		Lake District.	Upper Teesdale.	Lower Teesdale.	Pennine Escarpment.	South Tyndale.	North Tyndale.	Coquetdale.		Coastal Strip.
		West.	East.							Igneous.	Sedimentary.	
Zircon ...	91	100	100	55	75	75	100	100	100	87	100	95
Tourmaline ...	67	7	65	10	88	75	84	76	90	14	100	95
Apatite ...	55	64	90	35	12	0	37	29	74	87	54	70
Garnet ...	55	43	80	35	0	0	26	29	96	14	100	100
Rutile ...	53	0	10	0	12	100	68	84	93	0	91	77
Augite ...	24	21	50	5	12	0	16	53	15	0	27	50
Hypersthene ...	11	28	25	0	0	0	5	6	4	100	18	0

Certain relationships are clearly displayed in this table: the relative paucity of zircon in the Lake District is noteworthy, and of tourmaline, rutile and augite in Silurian and Ordovician country. Hypersthene occurs universally in the Cheviot volcanics, moderately often in the south of Scotland, and is rare elsewhere. Tourmaline and garnet are common in the sedimentary areas as a whole; garnet, however, shows a persistent rise in frequency when traced towards the north and east; it is apparently absent in the upper reaches of Tees and Wear, comes in on the Escarpment and South Tynedale and occurs universally in North Tynedale, Lower Coquetdale and along the coast.

A more precise formulation of some of these mineral occurrences is given later

#### THE ORE MINERALS AND SPARS.

The frequency of occurrence of the chief of these is: barytes, 26; fluorspar, 10; blende, 1 per cent. Barytes abounds in all the becks on the Pennine Escarpment from Castle Carrock to Brough, except at the heads of Ardale and High Cup becks. It is common in the South Tyne feeders on the left bank, rare in those on the right bank and dies out further east in the Devil's Water. Its range extends much beyond the lead-mining districts, as in many tributaries of the North Tyne and some of the Redewater and Coquet, where isolated veins of the mineral (such as those at High Green and Redpath) are not known.

Fluorspar is found where it is to be expected from the known position of the veins.<sup>6</sup> It is the characteristic spar of the Weardale sands and is common in the Tees, South Tyne, Allen and Derwent. In the Tees area it is not so common as barytes. Apart from the actual sands of the South Tyne and Tyne proper, no fluorspar has been detected north of this river. The spar wears well on transportation and is abundant in the Wear at Durham and (with barytes) the Tyne at Tynemouth; also in the Eden at Armathwaite, though only barytes was found at Carlisle.

Zinc Blende does not occur in the sands without fluorspar, though the reverse is not the case, as in Weardale and Teesdale. It is restricted to the Allen and the South Tyne below the Nent and suffers transportation better than might be expected, since it is present in the Tyne as far down as Ovingham.

Galena has not been observed in the sands of Tyne, Wear or Tees, where the mineral is common in the larger pebbles. It is evidently floured by attrition.

Witherite is abundant in the Settling tones burn, being derived from the washing plant at the mine.

Haematite is found in the Trout Beck and in the Tees below its junction with that beck, and is clearly derived from the Silverband Hush, where the mineral can be seen in place.

Many of the burns in the coal-field are polluted with sludge from the coal-washeries. The detailed examination of one of these, the Hartley Burn, showed it to be charged with iron pyrites and ankerite. It contained barytes, probably also derived from the coal.<sup>7</sup>

No ore-minerals or spars have been found in any of the Cheviot sands. This confirms the general absence of mineralisation which has long been recognised in this region.

#### ASSOCIATION OF HEAVY MINERALS WITH ROCK FORMATION.

*Granite.*-The streams flowing over the Cheviot granite form sands containing zircon and tourmaline in abundance. The tourmalinisation of the northern part of the granite area has been established by the recent work of the Geological Survey. Washings of highly-weathered granite from the Hazeley Burn gave large quantities of greenish-brown tourmaline, along with some zircon and brookite.<sup>9</sup> Brookite has not previously been recorded from the Cheviots; it is common in the stream-sands from which rutile (and garnet) are completely absent. The Galloway granites yield zircon and hornblende, the latter being characteristic of these granites. Skiddaw granite yields only zircon.

Of other acidic rocks, the Carrock Fell granophyre is characterised by zircon and brookite, the Ennerdale syenite by zircon and apatite.<sup>10</sup> No minerals specific to the rhyolitic lavas of the Cross Fell inlier have been observed.

*Andesite.*-The Cheviot andesitic lavas are characterised by abundance of hypersthene, and they carry also much apatite, often in idiomorphic form, along with zircon and, in the southern parts, biotite. Tourmaline, so common in the granite area, is completely absent.

The Borrowdale volcanics are characterised by chlorite and epidote; zircon and apatite are common, garnet occasional, rutile and tourmaline absent. The Eycott lavas yield augite in addition to these.

*Dolerite.*-The doleritic sills and dykes yield abundance of augite (and iron ore-minerals). The influence of the Whin Sill in supplying augite to the sands can be traced far and wide; it is only seldom, however, that it is a position to give a characteristic sand, not greatly diluted by material from other source. Perhaps the most favourable place is at the head of the Chineley Burn, where this flows through Shepherd's Gap, just after leaving Crag Lough; the sand here gave a heavy crop of 5·8 per cent. of which 4·6 per cent. was augite, the other constituents being hypersthene, zircon and apatite. To illustrate the effect of dilution from other sources and, possibly, destruction of the mineral by transportation, a determination made at Chesterholm, a mile lower down the burn, gave: heavy crop 1·2 per cent.; augite 0·06 per cent.; other minerals, rutile, tourmaline, monazite; hypersthene was not found. The neighbouring Knag Burn, just east of Borcovicus, is also rich in augite.

The High Cup Beck where it springs from the screes at the Nick, gave the following results: heavy crop 3·4 per cent., augite 1·2 per cent. Two miles below, at Harbour Flatt, the corresponding figures are 2·3 and 0·64 per cent.; still lower, at Bampton, augite could not be found.

An interesting augite-rich sand is that of the Newton Burn (Coquet) at a position four miles below where it cuts the Whin Sill and the Hampeth Dyke. The heavy crop weighs 1·6, the augite 1·2 per cent. The burn is full of boulders of whinstone, partly drift-borne, partly washed down, and it is doubtless to this source that the abundant augite in the sand is largely to be referred.

*Sedimentary Rocks.*-Those of Silurian and Ordovician age are relatively poor in heavy minerals.<sup>11</sup> The Skiddaw slates yield chlorite and epidote. The Galloway Silurians show greater variety, though this may be partly ascribed to the influence of glacial drift. Zircon occur universally, chlorite, epidote, apatite and garnet are fairly common, augite and hypersthene not infrequent. Passing eastward over the Southern Uplands, zircon and apatite persist, chlorite and epidote, though present. in Liddisdale, are absent from the Lammermuirs. Over this long stretch of country, rutile has



only been observed in two places, viz., in the Hermitage Water, Liddisdale and at Edenmouth on the Tweed. Chiastolite is restricted in range to the metamorphic aureole around the Skiddaw granite, but is there very abundant.

The sands from rocks of Carboniferous age are much richer. Widely spread among these are the six minerals: zircon, tourmaline, apatite, garnet, rutile and, in less degree, augite, though both their frequency of occurrence and their relative abundance vary, not only in the divisions of the system (Fell Sandstones, Bernicians, Coal Measure), but also in each division according to geographical position. Perhaps the most striking feature is the increase in the abundance of garnet in the coastal area. Neither the Cheviot nor the Tweed glacial drift seems to be competent to supply this mineral.<sup>12</sup> The examination of a number of prominent sandstones, ranging upwards from the Fell Sandstones to the Grindstone Sill and topographically from Cross Fell to the coast shows that though they all contain zircon, rutile and tourmaline, only those near the coast contain garnet. Much more work on these sandstones and the glacial sands must be done before a positive statement on the point can be made, but the evidence, so far as it goes, seems to indicate the locally-occurring sandstones as the chief source of the garnets in the stream-sands and, possibly too, in the rich concentrates of heavy sands on the sea shore.<sup>13</sup>

The streams of north east Durham yield a rich assemblage of heavy minerals; in the Castle Eden Burn, for example, the following have been identified: zircon, tourmaline, apatite, garnet, rutile, augite, mica, staurolite, fluorspar, carbonate and, in addition, mellilite and glassy material. Mellilite occurs in all the burns in this area (as well as in the Ure at Ripon). The origin of this mineral, puzzling at first, was traced to the blast furnace slag from Middlesbrough, which is largely used as road-metal in County Durham. A sample of dust from the road near Boldon gave 50 per cent. of heavy crop, almost entirely composed of mellilite and there was much glassy material in the light fraction. It is possible that some of the augite in the sands of East Northumberland comes from road-metal, derived from the Whin Sill and the dolerite dykes.

The heavy mineral content of the Carboniferous rocks of this Durham area has been investigated in detail by Kellett,<sup>14</sup> who finds the chief minerals to be zircon, garnet, rutile, and tourmaline; in

subsidiary amount are apatite, chlorite and epidote. No noteworthy differences in content were observed throughout the whole of this series. The Permian Yellow Sands in the same area have been studied, with respect to heavy mineral content, by Burtont<sup>15</sup> and very thoroughly by Hodge.<sup>16</sup> Zircon, garnet, rutile and tourmaline are again abundant and universally distributed; anatase, apatite and staurolite are rare. These rocks seem competent to supply most of the minerals in the stream-sands, though the presence of fluorspar and augite in the latter points to contributions from the glacial drift.

*Glacial Drift.*-The dispersal by ice of minerals characteristic of a particular formation is quite analogous to that of rocks, though the problem is more complicated owing to the ease of destruction of some minerals by chemical and mechanical agencies. Perhaps the best mineral to use as an indicator of the direction of ice movement is fluorspar, by reason of its hardness and chemical stability, but unfortunately it is only of limited applicability. Its occurrence in the Whittle Dene, Willington, Beamish, Skerne and Castle Eden burns undoubtedly marks the course of ice from the West, along the Tyne valley, to the Durham coast, and the barytes in the morainic mounds of Plawsworth tells the same tale Augite in Northumberland is more frequent east of the outcrop of the Whin Sill, in accordance with the general carry of drift. Garnet on the Skiddaw Slates is probably drift-borne from the neighbouring Borrowdales where it is abundant.

The movement of ice from the Cheviot granite is indicated by the occurrence of brookite in all the burns flowing north and east from the outcrop, between the College and the Breamish. No brookite occurs south of the Breamish and its absence along the coast is suggestive of its easy destruction.

Hornblende from the Galloway granite is widely spread over the neighbouring Silurians but dies out towards the east, being last encountered in the Kershope burn, Liddisdale. Hypersthene so abundant in the streams from the Cheviot andesites, occurs in diminished amounts in those flowing over the adjacent sedimentaries, and again dies out towards the east, and is absent near the mouth of the Coquet. Although this is evidence of the destructibility of brookite, hornblende and hypersthene yet most of the minerals appear to be fairly stable.

The question of the actual contribution of the drift to the minerals of the stream-sand cannot yet be decided, owing to our ignorance, almost complete, of the mineral content of the drift over the area in consideration. The only information bearing on the subject comes from the careful and suggestive work of Raistrick<sup>17</sup> on the boulder clays and associated sands at Dimlington on the Yorkshire Coast. Here are three clays, the Basement, of Scandinavian origin, the middle Purple Clay from the Pennines and the top Hesle Clay, of Cheviot and Scotch provenance. In mineral content the Basement Clay is sharply marked off from the others. The Hesle and Purple Clays are alike in their abundance of zircon, rutile, garnet, but differ in that tourmaline and hornblende are abundant in the Hesle, rare in the Purple Clay, while auzite shows the reverse relationship. The absence of apatite in both is striking. It is possible that the wealth in heavy minerals of the east of county Durham, is partly, at least, to be ascribed to the glacial drift, for this region was the meeting-ground of ice from all points between west and north. It seems clear from the evidence presented in this paper, that the stream-sands from many geological formations, both igneous and sedimentary, bear the heavy minerals characteristic of these rock formations, and that these minerals can be used as indicative of ice-movement during the glacial period in much the same way as boulders of the rock themselves. Incidentally, the examination of the sands seems to be the only effective way of sampling the rocks over a wide area with a view to their content of heavy mineral. There is also evidence that some great sedimentary formations show progressive changes in mineral-content, both vertically and horizontally. Considering the complexity of the subject, there is not much indication of what one might term a haphazard distribution of the minerals; there are, however, some cases in point which deserve mention.

Monazite has been detected in the Ouseburn and the Stocks field, Chineley, Jenkins, Grasslees and Bateinghope burns. There is no definite order observable in these occurrences, but the derivation of the mineral from sandstone in the neighbourhood is suggested by its presence in the Millstone Grit of Cross Fell,<sup>18</sup> the Blackstone Edge sandstone of the escarpment and the Grindstone Sill at Benton.

Brookite, characteristic of the Cheviot granite and the Carrock Fell granophyre, has been found in the Houxy and Hareshaw burns near Bellingham; this is west of the limit of Cheviot drift<sup>19</sup> and probably north of the limit of Lake District drift. It is possibly derived from a local sandstone and has been found in two sandstones widely apart, viz., at the Shaftoe Crags and in considerable amount, at King's Law (Rowley Burn).

Anatase occurs in the North Tyne at Bellingham and Deadwater and in the Lewis and King burns and also in the three Cheviot burns, Deerbush, Tofts and Wreigh all in the andesite area. It is not possible to state the origin of this mineral.

The Cottonshope burn is the only one in Redewater which contains relatively large quantities of big, rounded apatites. The rock-formations within the drainage-area are Fell Sandstones, Basalt and Drift. If derived from the sandstones the mineral should occur in the neighbouring burns, but it is absent from these. It does not appear in the microscope sections of the basalt,<sup>20</sup> and a washing of the boulder clay showed this to be free from apatite. The origin of the mineral is thus unexplained.

Finally, it is worthy of note that in the stream-sands there is never any natural concentration of heavy minerals comparable in the least degree with that observed in the sands of the sea-shore. On the great haughs of the Coquet, about Thropton, there are streaks of fine sand, much lighter in colour than is normally the case, but examination shows that both light and dark sand contain the same heavy mineral, in about the same proportions, and the difference in colour is apparently due to a slight difference in content of the specifically-lighter felspathic constituents.

I wish to express my thanks to Miss Mabel Johnson, O.B.E., and Mr. C. E. Pearson, M.Met., who have generously and often provided me with the means of transport, without which the carrying out of this work in reasonable time would hardly have been possible. Also to Dr. A. Raistrick for reading the paper in manuscript and for his constructive criticism of the subject-matter.

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(1) *The Vasculum*, xiv., p. 17. 1927.

(2) L. HAWKES and J. A. SMYTHE. *Geol. Mag.*, lxviii., pp. 345-361. 1931.

It may be mentioned here that since this paper was published, heavy mineral sand has been found in one more locality, viz.: a little north of Foxton Hall, Alnmouth.

- (3) Dr. HAWKES writes: "Only those minerals are returned which could be determined beyond doubt. Grains are often seen whose determination would demand too great an amount of time. Thus it is particularly difficult to make sure of minerals like epidote and olivine."
- (4) There are some small accumulations of coarse limestone sand in the sikes which drain the outcrop of saccharoidal limestone on Widdybank Fell, but this material is more in the nature of a talus from the bank-sides than a water-borne sand. The fine-grained white sand of the Gilpin Beck (Lancashire), a mile or two above its entry into the Kent estuary, is highly calcareous, but this material is not detrital, although massive limestones occur within the drainage area. The carbonate is present as foraminifera and shell fragments (aragonite), as in the estuary sand itself.
- (5) An example may be given in illustration. The Trows Burn, which flows over Cheviot andesites, gave a heavy crop weighing 3.20 per cent. of the sand under 80-mesh. Of this, 2.72 per cent. consisted of rock-fragments. A count of grains showed that 85 per cent. were opaque, 25 per cent. consisting of the heavy minerals proper, viz., apatite, hypersthene and mica, in the proportion 3/1/1.
- (6) See map of North Pennine Ore Deposits. K. C. Dunham. *Quart. Journ. Geol. Soc.*, xc., pp. 689-720. 1934.
- (7) L. HAWKES, J. A. SMYTHE. *Min. Mag.*, xxiv., pp. 65-75. 1935.
- (8) The Geological Survey (1932) panned the alluvium from several burns in the tourmalinised area of the Cheviot granite and examined the concentrates for ores but with negative results v. *The Geology of the Cheviot Hills*, p. 95.
- (9) It has been shown by Brammal, *Proc. Geol. Ass.*, xxxix., p. 47, 1928, that brookite is a product of the tourmalinisation of titaniferous biotite.
- (10) The accessory minerals in the acidic rocks of the Lake District have been investigated by R. H. Rastall and W. H. Wilcockson. *Q.J.G.S.*, lxxi., pp. 592-620. 1915.
- (11) Though outside the area under consideration here, it may be mentioned that many samples of sand from Wales, taken over the country between the Upper Dee and the River Ystwyth, were found to be quite barren in the common heavy minerals, yielding only chlorite (with but little quartz).
- (12) It is possible, however, that an early ice-sheet of more northerly origin, of which there is some evidence, may be the source of this mineral, for it is extremely abundant in all the rocks of Carboniferous age in the Midland Valley of Scotland v. T. O. Bosworth. *Proc. Geol. Ass.*, xxiv., pp. 57-61. 1913.
- (13) It is significant that the garnets from the shore-sands have been proved to have the same chemical composition as those from the Shaftoe Crags. Hawkes and Smythe, *op. cit.*

- (14) J. G. KELLETT. *Univ. Durham Phil. Soc.*, vii., pp. 208-232. 1926-7.
- (15) R. C. BURTON. *Geol. Mag.*, pp. 299-306. 1911.
- (16) M. B. HODGE. *Univ. Durham Phil. Soc.*, pp. 410-458. 1932.
- (17) A. RAISTRICK. *Geol. Mag.*, lxvi., pp. 337-344. 1929.
- (18) Monazite is of almost universal recurrence in the Millstone Grit of Yorkshire, v. A.. Gilligan, *Q.J.G.S.*, lxxi., pp. 251-292. 1919.
- (19) J. A. SMYTHE. *The Vasculum*, xvii., pp. 83-88. 1931.
- (20) S. I. TOMKEIEFF. *Proc. Geol. Ass.*, lxii., p. 266, 1931, gives an analysis of the basalt which shows 0.28 per cent. at  $P_2O_5$ , the apatite in sections is in the usual form for such rocks.

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