

GANNET
Sula bassana (Linnaeus)

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THE GANNETS OF BONAVENTURE ISLAND.*

By P. A. TAVERNER.

Of the great Gannet colonies that at one time dotted both east and west coasts of the North Atlantic but few now remain. There are several surviving colonies around the British Isles, notably on the Bass Rock from which the species obtains its specific name, *Sula bassana*, and Iceland still has a rookery or so but in the new world the species is now reduced to two localities, Bird Rock, near the Magdalen Islands, and Bonaventure Island, off the Bay of Chaleur side of the Gaspé Peninsula. The Bird Rock rookery lying out in the middle of the gulf is difficult of access, but Bonaventure Island within three miles of the mainland and the village of Perce is easily reached and is one of the natural wonders of eastern Canada.

Any small scale map shows the great indentation of the Bay of Chaleur in the south shore of the Gulf of St. Lawrence. The land projection separating it from the main body of the gulf is the Gaspé Peninsula and just inside the extreme tip lies the village of Perce with Bonaventure Island just off the coast and forming a partial shelter to its anchorage.

Perce is noted for several reasons. As one of the oldest settlements on the coast, it was the headquarters of an old and important fishing company and hence the supply centre of the surrounding country before the railroad came, reorganizing old systems of distribution. With Mount Saint Anne towering behind it and flanked by the giant walls of the Murailles rising from the sea, it is one of the few spots in eastern America where sea and mountain scenery combine in a single landscape and, whilst the heights are not as overpoweringly impressive as in the mountains of the far west the scene is vigorous and satisfactory to eastern eyes. Just off shore from the village lies Perce Rock a striking monument to geological history. A great

lone rock mass sheer and straight on every hand, some twelve hundred feet long by three hundred high; pointed and highest at the shore end and no more than eighty feet through for the rest of its length, recalling the hull of a great ship that has just left the ways and is taking its initial plunge into the sea. In the centre of the seaward half is the great arch that has given it and the adjoining village its name. Eighty feet from spring to spring and of an equal height, it pierces clear through the rocky mass and frames a view of blue sea and sky beyond.

With these scenic advantages alone Perce should be famous, but adjoining is Bonaventure Island and the bird rookeries on its outer or seaward face. The island itself is roughly circular in outline and about three miles across in its greatest dimension. On part of the main land side the steep shores are broken down to the sea level but everywhere else they are steep unbroken rocky cliffs rising on the seaward face some three hundred feet straight from the sea. Here are the bird rookeries.

Approaching this side from the sea, one is aware that every ledge and shelf is covered with white as though snow had piled in drifts upon them allowing only the overhangs to show dull red between the glistening surfaces. A wind seems to stir the white masses, and they blow off in eddies and clouds of drifting flakes that finally resolve themselves into great white birds that swirl about the cliff faces and circle round the intruder amid a pandemonium of hoarse cries. These are the Gannets, the Solon Geese of older authors, each as large as a goose, pure white with black wing tips and a slight creamy wash on crown and hind neck. The air is filled with their waving wings. They fill it like a swarm of giant midges circling in the sun.

The rocks from which they came come down straight into the sea with white surf breaking at their feet. Here and there in calmer moments good boatsmanship and agility effects a landing on some

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Photographs by the author, through the courtesy of the Geological Survey.

of the shelving bottom ledges from which a sure foot and steady head gives access to some of the nesting ledges above. As the investigator jumps ashore more of the birds leave the ledges over head, stopping but momentarily to relieve themselves of the weight of the last meal, and a shower of partially digested fish that they disgorge falls all about with squashy flops making the moment interesting and not a little apprehensive to the intruder until the worst of the shower ceases.

The rock is a coarse conglomerate of innumerable pebbles of all sizes in a matrix of brick red sandstone. The binding material has weathered away leaving the stones protuberant and more or less loose. While this roughness gives good foot hold there is the constant and well founded fear of their loosening under the tread and precipitating the explorer a hundred feet or more into the sea or on the jagged rocks below. Good hob-nails, stocking feet or thin rubber soles are absolutely necessary on such ground and are sources of considerable satisfaction when by dint of strenuous climbing one arrives at an upper ledge and greater height increases apprehension.

Many of the ledges wind along the face of the cliff for considerable distances narrowing here to mere toe holds with steeply rounded edges, widening there to shelves several feet across blocked occasionally by fallen boulders from above or rendered still more treacherous by the slippery wet ooze seeping down from upper levels. Everywhere is the dazzling wash of white guano, and the strong acrid smell mingled with that of decayed fish liberally scattered about and steaming in the hot sun makes even hardened enthusiasts catch the breath. The great white birds fill the air fanning the cheek as they pass by at one side of a great circle, the other segment lying far out over the water. On the ledge ahead are many more, some breeding young or eggs, on their nests of matted seaweed, others sitting gravely watching the intruder. When approached too closely they lumber awkwardly down from the nest, scramble to the inclined edge and throw themselves over to catch the air on their broad pinions and join the protesting ever passing throng.

Though the Gannets are the most conspicuous form of bird life on the ledges they are not the only one. Here and there are long horizontal cracks extending ten or fifteen feet back into the heart of the rock. The floors of these are covered well with red mud, mixed with guano puddled and padded by the feet of Murres, Razor-billed Auks and Puffins whose eggs can be seen scattered here and there on the bare floor. When approached hundreds of these birds rush out from the bowels of the

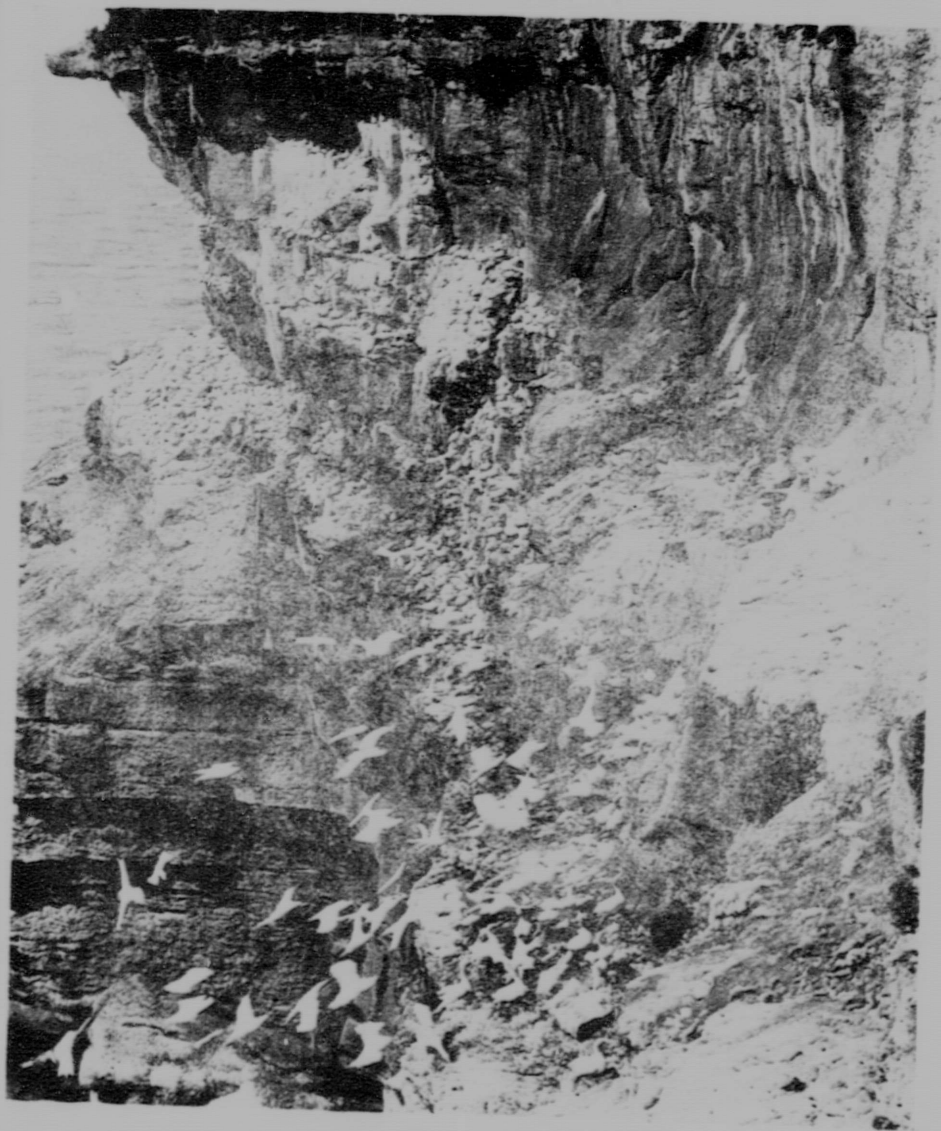
earth towards the light, hurl themselves into the air regardless of obstructions, and so off to sea. Caution must be used in investigating such places, and the story is current and easily to be believed, that one uncautious intruder had both eyes pierced by the sharp bills of the escaping birds. When the first rush is over one can look back into the depths of the creases and, lined against the wall at the back, see rows of young or lingering Murres lined up like soldiers on parade their white breasts gleaming in the shadows. The Murres show little inclination to return when disturbed by uninvited humans, the Puffins, however, keep going and coming continually along the ledges just beyond the danger zone. An interesting fact seems to be that though these birds are not particularly wild on the breeding ledges they seem to have absolutely no fear of danger coming at them from the depths of the cliff itself. One can crawl into one of these deep cracks and squeeze along on the stomach, if the stomach permits and revels not; and so worming along can come to the mouth where the Puffins are disporting themselves on the outer ledge. They look inquisitively at the queer invaders of their stronghold but seemingly fail to connect him with danger and can be watched at nearly arm's length for hours at a time. With their great gaudy coloured bills, small staring eyes and funny waddling little motions they are indescribably quaint while the absolute gravity of their manner and unconsciousness of their comedy makes the humour of their bearing almost irresistible.

Out on the ledges during this retirement many of the Gannets return. On reappearing a few of the nearest reluctantly lumber off and their single egg, or the black-faced, white down-wrapped young can be examined at leisure. The nests are conical piles of weed some six to ten inches high when new, merged into the surrounding ground with guano. The saucer-shaped depression on the top contains the single egg stained red with the mud from the rock, like all other eggs on these red cliffs. Older nests containing young have been tramped flatter and flatter by the growing young and the parent bird that seems to cease the constant construction, adjusting and repairing indulged in previously as soon as the young are hatched. Finally, when the young are ready to leave, the nests are mere flat mounds with little form or shape.

In rougher weather the ledges can only be reached from the top of the cliffs but the approach from thence is as interesting in its way as from below. Landing on the shoreward side at the village of Bonaventure one proceeds along the grass grown road between quaint fisher-folk houses and garden

patches through fields bright with daisies, meadows purple with iris and dotted with cattle, trimmed balsam and spruce groves between which cow pads wind like paths in a Japanese garden. We climb steeper hills, skirt rock shoulders, finally plunge into

testing at the intrusion so near their nesting ledges, perch on the tree tops and hoarsely scream as we pass. Finally, the last declivity is surmounted and open meadow at the head of the Gannet rookeries is reached.



General view of cliffs; birds leaving ledges.

the heavier evergreen woods and follow along the wooded cliff verge, the sea showing between the tangle and tree trunks at the right and the dark, mossy woods, damp with sea mists, mounting the rise on the left. At one place the Herring Gulls, pro-

At first nothing is seen but the green sward kept to an emerald hue by the damp gulf air and the sharp line where it drops off against the blue sea or sky. A low murmur of hoarse cries rises up from innumerable throats hidden over the crest and

an occasional breeze wafts a whiff of acrid guano odour from below. Going out on a small projecting point, a spot is found where a long line of cliff face can be enfiladed and a wonderful sight greets the eye. Looking down on the upper surfaces, tiers of irregular white shelving are seen, peopled with hundreds of birds, the din of raucous voices increase and hundreds of great white gannets launch out into the air. They circle out over the sea and return to leeward, sailing by and passing the cliff edge at almost arm's length against the wind. They pause as they reach a strong salient point of the cliff beyond and meet the full strength of the breeze, pause a moment, and then fall off seawards to circle a quarter of a mile out and return and repeat indefinitely. As each bird passes it turns its ivory bill and blue circled silvery eyes full upon the intruder, follows him with calm impersonal stare until well past and then straightens away on its course to be replaced in a moment by the next one that repeats the motions to a nicety. Bird follows bird so fast that they cannot be counted. Each the exact duplicate of the last until one is finally almost forced to turn the eyes away from the confusing repetition to prevent dizziness in a situation where dizziness may be fatal.

There is nearly half a mile of these cliffs peopled by Gannets, ending at the far point in Great Gannet Ledge where the most spectacular view is obtained. Every here and there are small salients where one can closely approach the edge and, reclining on the grassy margin, view the scene at ease. After a few minutes the birds begin to return to their stations and with them one sees Murres, Puffins and Razor-billed Auks hurrying to and from their nesting crevices throughout the height of the cliff. The Puffins with their quick bee-like buzz of wings, and the Murres and Auks with rather slower wing-beat fly with the business-like directness of aerial torpedoes. The Gannets crowd the ledges until it seems that there is no room for more, but still they come. Occasionally one skirts a shelf a considerable distance before finding unoccupied foothold then it forces its way between adjoining birds sometimes knocking several off with its broad wings as it alights. One holds his breath almost expecting to see these so unceremoniously treated dashed on the rocks three hundred feet below, but no, before descent begins the ample wings open and the victim glides off in safety, calling back protesting grunts as it joins the circling flock. The new arrival looks around, eyes its nest further back on the ledge and measures the crowd between, then with an awkward waddle, makes straight for its objective amid a shower of blows of bill and wing from disturbed

neighbours en route. Arriving at its own nest site it exchanges challenges with all surrounding it. At first threatening these interchanges become more formal and end at last with a sort of conventionalized ritual in which the head of opposing birds is thrown straight up in the air and the bill opened and closed, then the head is held at right angles to the neck and pumped up and down several times as if bowing. This is repeated several times, becoming more and more prefunctionary until it dies away. But even after all are at rest this series of conventional courtesies is exchanged occasionally between sitting birds. When a bird desires to leave the nest formality is dispensed with. Though it may be well at the back of the ledge and separated from the verge by numbers of other birds it suddenly makes straight for the edge, wabbling, flopping and sliding irrespective of who or what is in the way. By a sudden dash it takes all by surprise and almost before a bill can be brought against it or a blow driven home it is over the edge and away leaving a wake of upset and protesting birds who momentarily turn their weapons against each other and then philosophically resume their places and comparative quiet reigns again.

A steady head can reach some of the occupied ledges nearer the top unaided, but a rope and stout helping hand at the top are of great assistance and insure confidence. There one can scramble about amongst the sitting birds. They are not very wild on the less accessible ledges and when they have young can even be caught in the hand, but their bills are powerful, finely saw-edged and can make a nasty wound, and it is better to take the obvious fact for granted than to demonstrate it. The young when first hatched are shapeless, moist, gray, slug-like creatures that can barely raise their heads unsteadily from the ground and then let them fall again with helpless weakness. Later a white down comes out over all the body except the face, which has a black shivelled appearance, like that of an old, old negro with features surrounded with white wool. They are extremely quaint as they stand or sit up with the gravity of judges. The adult as mentioned before is pure white with black wing tips and a golden creamy wash over crown and nape. The bird of the year when able to shift for itself is smoky brown covered over all with fine white V-shaped spots. In between this latter plumage and the adult is every intermediate stage of pied spotting. Contrary to what would naturally be expected such birds are comparatively scarce in the neighbourhood of the rookery perhaps averaging in the total population less than one in fifty. The only explanation that can at present be advanced is

that the majority of the juveniles remain out at sea until maturity and only the breeding adults come in to them in the nesting season, accompanied by a few juveniles that can be regarded more or less as accidentals.

Many pages could be covered with the results of the study of these birds on their nesting ledges. It is to be noticed that through the day all birds have the bill closed, while flash-lights at night show them with mouths wide open. A night visit to the cliff well repays the trouble. The continual chorus of harsh voices is subdued and there is little movement

hauntingly by. It is strongest in the vicinity of certain cracks in the ground and the clefts under large stones scattered about the level. Weird voices are heard in the air and soft black shapes sweep by. They are Leach's Petrels, and the not unpleasant odor proceeds from them. They nest in cavities in the ground where they spend the day and are only seen over land at night. Then they sweep around beating up and down the aisles of the spruce clumps or over the grassy meadows and the night is filled with them and their little low, weird song.

Such is the great bird colony of Bonaventure



A Family Group.

on the ledges. However, there always seems to be a few uneasy spirits abroad even at night. Occasionally one returns and, in the darkness against the glow of the sea, glides across the view like a pale ghost. Where it alights, off in the darkness, there is an awakened chorus of voices and then silence comes again. From the sea in front come soft questioning *mu-u-u-r-r-r*'s of the Murres taking their young off to sea before they are fledged, for none linger in the neighbourhood of the rocks once they take to the water. A sweetish pungency, different from the sharp reek of the ledges, wafts

Island. During our visits in 1914 and 1915, we estimated that there were in the neighbourhood of about eight thousand birds there. Economically they are of no importance either way. No one thinks of eating them, and they probably would be less than indifferent for this purpose. Their food is fish, mostly herring, though other fish of similar size and squid are taken. Their effect on the fisheries is nil. When herring are caught by the boat load expressly for fertilizer, or their eggs are shovelled up from windrows on the beach for the same purpose, the inroads these birds can make in the

countless numbers is unappreciable. They are magnificent birds and their presence adds considerably to the interest of all the coast whilst the presence here of this great rookery makes a sight that should prove a constant asset in attracting visitors to the neighbourhood. The Gannets are looked upon by most of the local fishermen with favour. To the fish-wise ones their actions indicate when the squid and herring, much sought for for bait, come and where they are and about how deep they lie. In foggy weather the cries of the birds act as a natural fog horn warning mariners away from the dangerous rocks of the rookeries and many a shipwreck has been avoided by the hearing of their timely warnings. Yet in spite of the uselessness of the dead birds, their obvious beauty, and some slight practical usefulness, I regret to say that they are shamefully persecuted. I have seen a boat containing eight to ten guns with unlimited ammunition, repair to the ledges for a day's sport (?) The results were seen later when the rocky base was littered with dead and wounded birds and their sodden remains washed back and forth in the adjoining sea. At one point on the mainland beach some five miles from the scene of the slaughter, within a hundred yards a dozen or more birds were to be seen where they had been stranded by the tide, but the saddest sight of all, was up on one of the lower ledges where pot-shots had been taken of the crowded sitting birds. Here for some distance lay a trail of dead birds still on the nests where they had been shot with the young pinned beneath the cold bodies of their parents. Other young stood disconsolately about until a humane heel or blow of a gunstock put an end to their hunger and cold. Below on rocks just above the swirl of the sea where they had managed to clamber were numerous wounded adults patiently awaiting death that lingered in its coming.

There is a movement under way by the Conservation Commission to reserve this wonderful spot as a perpetual bird reserve under the control of Dominion or Provincial authorities, but such is the conservativeness, to call it by its mildest name, of the local population that considerable objections have had to be overcome and it is still doubtful after three years of effort, whether the plan will succeed or not. Some day the local population will realize that these rookeries are a source of attraction to strangers and too valuable a local asset to be wantonly destroyed. Until some such light breaks upon the community, and awakens public opinion and a spirit of protection, the senseless destruction will proceed. It is to be hoped either that the protective measures will be completed or this awakening will come before it is too late.

NOTES.

It is reported* that the fields over which the battle of the Somme raged during the late summer and autumn of 1916 were thickly carpeted with blooming plants less than a year later. July of 1917 saw vast stretches of scarlet poppies, interspersed with acres of chamomile (*Matricaria chamomilla*, L.) and large patches of yellow charlock, glorifying what had been but a dreary waste of mud and water throughout the preceding winter. Half-hidden within this luxuriant growth white crosses mark the graves of the dead. Where shells left yawning holes, water has gathered and formed ponds, which are rendered more or less permanent by the nature of the soil. In and around these flourish the annual rush (*Juncus bufonius*), the smartweed (*Polygonum persicaria*), and numerous water grasses. Dragon flies hover about the pools, which teem with water beetles and various other forms of pond life. The woods which once covered the uplands have been destroyed almost entirely by the heavy shelling. Only at Aveluy Wood a few badly broken trees still live, and these rise from a dense growth of rosebay willow-herb (*Epilobium angustifolium*). The extraordinary method of cultivation of the soil apparently has increased its productive power. The underlying chalk formation has been broken up, mixing with the subsoil and the old surface soil, thus forming a new and very fertile combination, from which the various seeds, many of them perhaps long buried deep in the ground, have sprung with great vigor. Patches of oats and barley and occasionally of wheat are to be seen. These may have been sown by the Germans, or they may have lain dormant in the ground since before the war when this land was all under cultivation. Along the roadsides are traces of the old permanent flora; while here and there remains of currant and other bushes show where a cottage stood with its garden.—*The American Museum Journal*, May, 1918.

A Check List of North American Amphibians and Reptiles, by Leonard Stejneger and Thomas Barbour, issued by the Harvard University Press, is a work for which there existed an urgent need. The list has been prepared generally upon the lines of the American Ornithologists Union Check List of Birds. As Dr. Stejneger and Dr. Barbour are the foremost herpetologists in North America, students of the subject will have the greatest confidence in the book.

*Capt. A. W. Hill, Assistant Director Royal Botanic Gardens, Kew, England, in the *Kew Bulletin of Miscellaneous Information*, Nos. 9 and 10, 1917.

ON THE REMAINS OF A SELACHIAN FROM THE EDMONTON CRETACEOUS OF ALBERTA.*

BY LAWRENCE M. LAMBE, F.R.S.C., VERTEBRATE PALÆONTOLOGIST,
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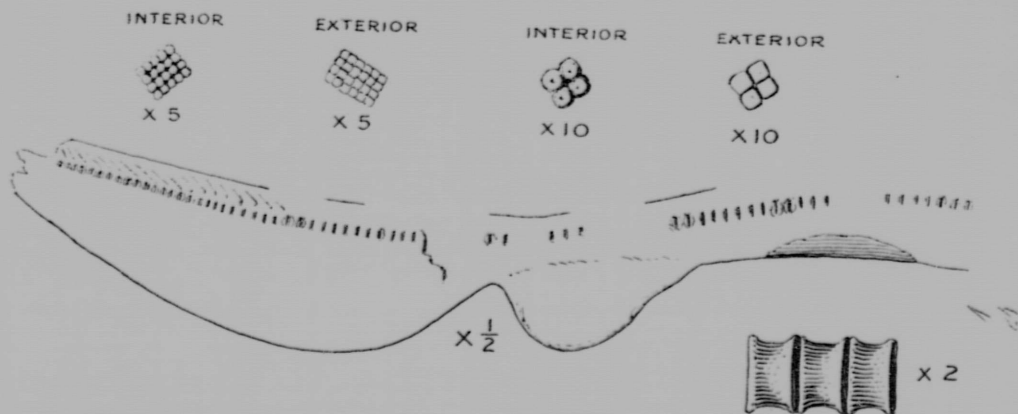
The subject of the following remarks consists of the caudal and hinder abdominal regions of a selachian tentatively referred to the genus *Palaeospinax* of the family *Cestraciontidae*.

The specimen (field No. 5) is included in the Geological Survey collection of 1915 from the Edmonton formation on Red Deer river, Alberta, and was obtained on the east side of the river, three miles north of Tolman, at about 350 feet above the river level. Its discovery was made by Mr. George F. Sternberg in charge of the Vertebrate Palæontological field party working in the beds of the above formation during the season of 1915.

These remains of a small shark occur on the

It continues forward to near the anterior end of the specimen where it is lost. Above it is clearly indicated at intervals in the caudal region and for some distance in advance of it, but is not seen farther forward.

The tail occupied about one-half the length of the specimen and was preceded closely by the anal fin of which the outline is clearly shown. At the extreme anterior end of the specimen inferiorly there are obscure indications of the pelvic fins and certain fragments that may be the remains of claspers, but they are too indefinite to allow of a satisfactory conclusion being reached as to their nature.



Central figure.—Outline of type of *Palaeospinax ejunclidus* from the Edmonton formation of Alberta. One-half natural size.
Upper figures.—Shagreen granules; interior and exterior surfaces. Five and ten times natural size.
Lower figure.—Restoration of three vertebrae from front half of specimen to shew general proportions only. Twice natural size.

weathered surface of a thick layer of hard grey sandstone. About half the length of a slender fish is represented, from the neighbourhood of the pelvic fins to near the end of the tail, the tip not being preserved. About 80 vertebræ had been present, following each other in natural sequence in a lengthened sigmoid curve, 245 mm. long, but only 30 of them now partially remain; many of the remainder are represented merely by their impressions, and of some no trace is left. The vertebræ extended throughout the length of the specimen. See text figures.

The outline is well preserved below, especially along the lobe of the tail where it is clear and sharp.

The body and fins were enveloped in shagreen of which the granules were minute. The shagreen is preserved throughout the tail except in its upper front portion. In advance of the tail its continuity is broken, but it is principally seen along the line of the vertebral column, and dorsally and ventrally defining the outline.

The specimen lies with its left side in the rock and it is the inner surface of the shagreen for the most part which is exposed to view, and on which the remains of vertebræ or vertebral impressions are left.

The vertebræ were apparently cyclospindylid in character. They were higher than long, cupped at either end, and constricted at the middle. The parts that have resisted erosion consist principally of the

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left rim of the ends; in no case is there anything remaining of the constricted middle portion, so that what is present is made up of a series of partial ends in couples, each pair being contributed to by an anterior vertebral end and a posterior end of the vertebra next in front. Where the vertebræ have been fully removed their impressions are left in the shagreen, or where erosion has been most severe the shagreen itself has disappeared.

Toward the anterior end of the series the vertebræ are about 5 mm. high, and 3.5 mm. long, with ten in a space of about 35 mm. There is a gradual diminution in size posteriorly in the series, until, in the hinder half of the tail, there are thirteen vertebral bodies in an equal space.

The granular shagreen tubercles are minute, of one size, nearly square with rounded angles, and fit closely together, four occurring in a space of 1 mm. As seen from within they are decidedly convex or tumid, and have the appearance of being nearly circular in outline. Each tubercle has, in this aspect, a central, circular opening or depression. In what appears to be an external view they are somewhat more regularly four-sided, convex, and apparently devoid of sculpture.

The anal fin is subtriangular in lateral aspect, nearly twice as long as deep, and broadly rounded below. In it the shagreen is preserved mainly along the basal line, and the free edges. The caudal lobe is long, with a maximum depth about equal to that of the anal fin. Its length is over five times its depth, and throughout the shagreen is present, sharply defining the sweeping curve of the lower margin. Above the base of the caudal lobe the shagreen in the specimen, passes up behind the spinal column and ends dorsally in a definite longitudinal line a short distance (about 6 mm. at the midlength of the tail) above the vertebræ. In the shagreen surface above the posterior caudal vertebræ obscure parallel markings, directed obliquely upward and backward, may indicate the presence of fin-supports, apparently one to each vertebra. Superiorly, above the anal fin, an indefiniteness in the dorsal outline suggests the possible position of a dorsal fin which might be expected in this neighbourhood. From slightly in advance of here to the forward end of the specimen the dorsal outline is not preserved.

This specimen has much the same size and proportions as *Palaeospinax priscus* (Agassiz) as described and figured by Smith Woodward from the Lower Lias of Dorset.* It differs from that species in having the anal fin close to the caudal, in the vertebræ being smaller, and the granules of the

shagreen of one size only. For the very slender species represented the name *ejuncidus* is proposed.

In view of the fact that this interesting specimen supplies no information regarding the dorsal fins, and therefore as to whether they have spines or not, the assignment of the species to the genus *Palaeospinax* is a provisional measure only until we have further knowledge of its structure.

UNUSUAL NESTING MATERIAL USED BY PURPLE MARTINS.

The birds, like human beings, have in their midst eccentric individuals that deviate from the path of custom to do the unusual. In some cases no doubt these unusual acts, induced by various causes, gradually become more usual and eventually customary. For instance, man-made sites, from being the unusual, have become the usual nesting places of the Purple Martins; and furthermore it appears that these birds are about to take another step in their evolution by adopting man-made nesting material. As evidence I submit the following list of material taken from one compartment of my martin house:

36 bits of window glass.

33 flat bits of rock.

9 pieces of clam shell.

4 scraps of tin roofing.

6 nails—1 to 4 inches.

1 slate pencil.

1 bit of dry orange peel.

1 safety pin.

1 pint of the usual twigs, dead grass and green leaves—elm in this case.

Probably one or both builders of this unusual nest had been hatched or had formerly nested in some congested city where the usual nesting material was not procurable, only such as listed above being available, and in spite of the fact that grass, twigs and green leaves were plentiful in my neighbourhood, this inherited or acquired conception of nest building had persisted.

The male bird of this 20th century couple, which built a home of stone and glass and furnished it with a safety pin and a slate pencil (evidently intended sending their "little troubles" to school), had not attained the age of purple plumage, still being light breasted.

CLYDE L. PATCH.

Ottawa.

*Cat. Fossil Fishes Brit. Mus. pt. 1, 1889, p. 323, pl. VII, fig. 1.

THE ECONOMIC VALUE OF BATRACHIANS AND REPTILES.*

BY CLYDE L. PATCH.

The Batrachians in Canada comprise the Toads, the Frogs and the Salamanders; the Reptiles, the Turtles, the Lizards and the Snakes. These two groups of animals, which include all cold-blooded vertebrates other than fishes, differ in many important respects.

The Batrachians lay their eggs in the water, where they hatch; and the young, which differ greatly from the adults in form, breathe by means of gills very much as do fishes. Most species undergo a metamorphosis during which the gills disappear and the tadpole assumes the form and structure of its parents and leaves the water to breathe air and spend a greater or lesser portion of its life on land. The skin of batrachians is not provided with scales, but may be either smooth or warty and often contain glands that secrete a sticky fluid which, although somewhat acrid, is harmless.

The Reptiles never lay their eggs in the water—even the marine turtles come on land for this purpose. Their young do not breathe by means of gills, but are hatched or born (some species give birth to young) with the form and structure of the adult. The skin, except of some turtles, is covered with scales.

The first vertebrate animals that could live upon land were the primitive, frog-like batrachians, which first ventured out of the water millions of years ago, in the middle of the Palæozoic or second great period of the earth's history. Though it is believed that the reptiles, birds and mammals are derived from these slow-crawling, cold-blooded batrachians, the fossil remains found in the rocks of the various geologic ages do not form a complete record of the successive stages of the descent.

Many million years ago, in the middle of the Mesozoic Era, which was the third great period of

the earth's history, the reptiles were the rulers of the earth as the mammals are to-day. Huge monsters, more than one hundred feet in length and most grotesquely fashioned, roamed over the land, while equally weird reptiles inhabited the seas, and in the air were creatures whose wings measured twenty feet from tip to tip. There were also smaller reptiles, including Crocodiles and Turtles not so very different from their modern descendants.

Birds are in many respects very similar to reptiles in structure and the two are thought to be closely related in their origin.

It was not until long after the huge reptilian monsters had become extinct that the first ape-like human

beings appeared, therefore the statements of fiction writers who portray men of the Stone Age battling with dinosaurs are to be considered merely as fiction and not as facts. Also, the theory that our fear of reptiles is inherited from our arboreal ancestors seems rather far fetched. Personal observation has led the writer to believe that this dread is acquired in childhood when our

elders tell us untrue things about the batrachians and reptiles, and teach us to avoid them. With the exception of Rattlesnakes, which so far as records show are confined to the central southern plains and to a few localities in southern Ontario, the batrachians and reptiles of Canada are quite harmless and are as beautiful and interesting as birds, flowers and insects—probably more interesting, as there are yet many unrecorded facts regarding their life histories.

During past ages these creatures have mistakenly been credited with many mysterious powers. Shakespeare calls the toad "ugly and venomous" and informs us that it "wears a precious jewel in his head." The salamander according to fable retained life when cast into fire and was able to extinguish the fire by the chili of its body. Pliny tells us that he made the experiment once, but the creature was



Photograph by Clyde L. Patch.

An ally of the gardener, the American Toad.

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burnt to a powder. Our Iroquois Indians believe that lizards bring on paralysis, while the Green Snake, if allowed to coil about a paralyzed part of the body, will cure it. Many misinformed people believe that toads make warts, that snakes charm birds and squirrels, that "Hoop Snakes" take their tails in their mouths and roll after their victims and that the Milk Snake milks cows, as it is often seen about barns and farm yards, to which it is not attracted by the cows but by the rats and mice which infest such places. Prof. Cope once observed a snake of this species which had captured a family of field mice; one of these it had swallowed, another was being swallowed, and the remaining two were so tightly held in two turns of the snake's body that they were incapable of biting their captor. A meadow mouse is estimated to do damage to the extent of fifty cents a year in field and orchard, therefore this snake at one meal virtually put two dollars in a farmer's pocket, but owing to ignorance combined with prejudice the average farmer in return would have crushed the useful creature's head with a rock had he seen it half an hour before.

A snake is a better rat destroyer than a cat or a dozen traps as it can enter cracks and holes and destroy entire families of rodents. The Fox Snake, which feeds chiefly on rats and mice, is often found about farm buildings and in some localities is called "house snake" or "rat snake". The Corn Snake is so called because it frequents corn fields in search of mice.

Many of Canada's seventy-five or more species of batrachians and reptiles enhance their value by preying on stink bugs and ants—insects which are not much subject to the attacks of birds. The salamanders inhabit rotting logs which act as incubators and breeders for the noxious grubs on which they feed. The frogs, which are found in the trees, meadows and ponds, destroy vast numbers of flying, crawling and swimming insects, which if allowed to exist would do thousands of dollars' worth of damage to farm products. The turtles and lizards also feed chiefly on insects, and just as the horned lizards of the arid southwest are of tremendous importance to agriculture, so the common toads are of greater value in the better watered regions. It is estimated that in three months a common toad will eat 9,936 injurious insects, and that of this number 1,988 are cutworms. Placing a bounty of one cent each on cutworms, the potential value of a single toad is at least \$19.88 per year. If additional toads were introduced into every garden and boards placed in shady corners under which they might hide during the day, the gardener's loss due to insects would be greatly reduced. Toads

should also be placed in greenhouses and propagating frames.

According to the United States Department of Agriculture, the yearly food loss in the United States from the ravages of insects exceeds one billion dollars, and from house rats and mice (not including wild rodents) the loss amounts of \$400,000,000; and without doubt proportionate losses occur in Canada. Protection should therefore be given to toads, frogs, salamanders, turtles, lizards and snakes, some of which destroy rodents and all of which prey on such pests as potato, squash and cucumber beetles and bugs; click beetles, parents of the wireworms; slugs and plant-lice, that live on the lettuce; Tussock, tent and armyworm caterpillars; sowbugs, that destroy plant roots; crickets, grasshoppers, locusts, grubs, worms, mosquitoes, flies, ants and moths.

NOTE ON INVERTEBRATES COLLECTED BY THE SOUTHERN PARTY OF THE CANADIAN ARCTIC EXPEDITION.

The Marine and Freshwater Invertebrates, collected by the Southern Party of the Canadian Arctic Expedition during 1913-16, at various points on the northwest and north coast of the continent from Port Clarence, Alaska, to Bathurst Inlet, N.W.T., have been sorted out and distributed to about fifty different specialists in Canada and the United States to report upon. The following is a short summary covering the six groups which have thus far been worked over.

The Freshwater Worms (Oligochaeta) comprise about 10 species, of which two are new and all are recorded for the first time from the American Arctic.

The Echinoderms, Isopod and Decapod Crustacea include no new species, but the known ranges of distribution of the various forms have been greatly extended and gaps filled in.

The Parasitic Copepods (Crustacea) comprise five different species found on fishes and marine annelids.

The Molluscs represent 115 species, of which six marine and one freshwater are new to science. Those taken east of the Mackenzie delta are particularly valuable, being the first specimens collected in that region.

FRIJS JOHANSEN.

REVISION OF SOME PHACOPID GENERA.*

BY F. H. McLEARN, GEOLOGICAL SURVEY, OTTAWA.

INTRODUCTION.

In the preparation of a monograph on the fauna of the Silurian Arisaig series, it has been found necessary to revise the interpretation of several Phacopid genera; for the definitions now used are not considered to be in accord with the evolution of this trilobite family. *Dalmanitina* Reed, *Phacopidella* Reed and *Phacops* Emmrich are redefined. The equivalent of *Acaste* Goldfuss and *Acaste* Salter is pointed out. *Portlockia* McCoy is revived and emended, with subgeneric rank, for the Silurian ancestors of Devonian *Phacops*, s. str. The generic name *Clockeria* Wedekind is found to be untenable. *Phacopina* Clarke is not considered to be a true Phacopid and is placed in the subfamily Dalmanitinae.

In order that the proposed definitions of the above genera may be established on a genetic basis, the evolution of that portion of the family Phacopidae concerned is treated first.

EVOLUTION.

Both Hoernes (1880) and Reed (1905) recognize in such Ordovician forms as *Dalmania socialis* Barrande a generalized and primitive expression of this family. The cephalon is characterized by well-marked pentamerism, all the glabella furrows being fully developed. The glabella is relatively high and narrow, with the lateral borders subparallel, or at most only slightly diverging. The genal angles are rounded off or produced merely into short spines. The pygidium has few segments and is rounded on the posterior border. This generalized stock continues into the Silurian. It is represented there by forms like *Phacops (Acaste) constricta* Salter and *Calymene downingiae* Murchison which show no important modification of either the cephalon or pygidium except rarely the slight mucronation of the latter. Closely associated with the parent line are a number of forms slightly modified in the direction of the Phacopinae by obsolescence of the two anterior pairs of glabella furrows. But the glabella is still high, its borders are not conspicuously divergent and the third pair of side lobes are not greatly reduced. They cannot be regarded as Phacopinid. This slight modification reoccurs in the Ordovician, Silurian and Devonian. In the Ordovician this departure from the primitive type is exhibited by *Dalmania phillipsi* Barrande and *D. solitaria* Barrande. The only important modification here is

the obsolescence of the two anterior furrows. In the Silurian a similar modification is shown in the Arisaig *Dalmania logani* Hall, but since it exhibits all gradations with a primitive form *D. logani* var. *conservatrix*, n. var., it is thought to be independent of the Ordovician forms and not derived out of them. A Devonian departure from the primitive stock of the same nature is to be found in such species as *Phacops braziliensis* Clarke and *P. anceps* Clarke, which Clarke has incorporated into his genus *Phacopina*. The change here is not much more than in *D. logani* or the similar Ordovician species and cannot be compared with the profound modification of the Phacopinae.

Several Ordovician species show a slight modification of the normal *Dalmanitina* type by a broadening anteriorly of the glabella, but retaining the primitive pentamerism. The third pair of glabella lobes, although small, are not markedly reduced and are tuberculose at the extremities as in the Phacopinae. Such forms are *Phacops (Acaste) alifrons* Salter (1864, p. 33) and *Phacops jamesii* Portlock (Salter 1864, p. 32). Another modification of the generalized line in the Ordovician is exhibited by the species *Phacops brongniarti* Portlock (Salter 1864, p. 34) which while retaining the primitive pentamerism of the glabella shows a considerable broadening anteriorly of the latter and a very considerable reduction of the third pair of side lobes with tuberculation of their extremities. In the last character this is a very near approach to the Phacopinae. This subfamily, however, does not appear until the early Silurian.

In very late Ordovician or earliest Silurian time the generalized line of the Phacopidae gave rise to two quite far removed groups, both of which are very distinct from the coeval primitive stock. On the one hand, as Reed has noted (1905, pp. 176, 224), arose *Dalmanites* Barrande and related genera, in which the frontal lobe becomes semi-detached from the remainder of the glabella by the broadening of the anterior pair of furrows, the genal angles become produced into spines, the pygidium has numerous segments, its axis becomes more slender and it is nearly always mucronate or produced in a spine. An intermediate form, *Dalmanites weaveri* (Salter) appears in the early Silurian (Upper Llandovery) in which the pygidium is not mucronate and the genal angles are not produced into spines. In the Devonian in particular this stock becomes highly differentiated in spinescence, modification of glabella, etc.

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The true Phacopid characters appear in the Silurian. There takes place, as Reed (1905, p. 176) has shown, a partial loss of pentamerism, a shortening and broadening anteriorly of the glabella, so that it is no longer high with subparallel sides, but wide with markedly diverging lateral borders. The third pair of side glabella lobes become greatly reduced and are often nodular at the extremity. There is a general absence of spines, the genal angles being rounded off and the pygidium nonmucronate with few segments. In addition to the smaller eyed *Trimeroccephalus* forms, these modifications take place in two distinct, though closely related, Silurian groups, the one characteristic of the Tethys (Bohemia) realm, and the other widely spread, but typical of the northern Atlantic realm. For the present, the former may be referred to as the group of *P. glocheri* Barrande and the latter as the group of *P. stokesii* (Milne-Edwards). In the *P. glocheri* group the anterior glabella furrows are broadened and deepened in a characteristic manner, so that the frontal lobe is almost detached as in *Dalmanites*. The segregation of this group was recognized by Wedekind (1911) who incorporated it under the name of his genus *Glocheria*. It will be shown, however, that this name cannot stand. In the other group, apparently not represented in the Tethys (Bohemia) realm the first and second pairs of glabella lobes are almost completely fused with the frontal lobe leaving only faint furrows, while the third pair is profoundly reduced and at its extremities becomes characteristically nodular. In the earlier Silurian this group includes *Phacops orestes* Billings, *Trilobites elegans* Sars and Böeck and *Phacops (Portlockia) marklandensis*, n. sp. In the later Silurian it embraces *Calymene stokesii* Milne-Edwards. While the group of *P. glocheri* becomes extinct at the end of the Silurian, the second group gives rise to numerous forms in the Devonian. But as already noted by Wedekind (1911) the Silurian forms are considerably unlike their descendants. They differ in their smaller size, poorer development of tuberculate surface, especially of the glabella, and much more depressed, never overhanging anterior surface of the glabella. The last character is very diagnostic and of stratigraphic value.

SYSTEMATIC RELATIONS.

Phylum ARTHROPODA.

Class CRUSTACEA.

Subclass TRILOBITA WALSH.

Order PROPARIA BEECHER.

Family PHACOPIDAE CORDA.

Subfamily DALMANITINAE REED.

Genus DALMANITINA REED.

1843. *Acaste* Goldfuss (non Leach) (partim), Neues Jahr. Min., etc., 1843, p. 563.
 1845. *Dalmania* Emmrich (non Desvoidy) (partim), Neues Jahr. Min., etc., 1845, p. 40.
 1852. *Dalmania* Barrande (partim), Syst. Sil. du Centre Boheme, 1, p. 528.
 1852. *Dalmanites* Barrande (partim), Syst. Sil. du Centre Boheme, 1, p. 934.
 1864. *Acaste* Salter, Mon. Brit. Tril., Pal. Soc., 1864, p. 14.
 1905. *Dalmanitina* Reed, Geol. Mag., (5), 2, p. 224.
 1905. *Phacopidella* Reed (partim), Geol. Mag., (5), 2, p. 173.
 1906. *Phacopidella* Reed, Lower Pal. Tril. Girvan, III, Pal. Soc., p. 156.
 1913. *Dalmanitina* Raymond, Zittel - Eastman Textb. Pal., 2nd ed., p. 726.
 1913. *Phacopidella* Raymond (partim), Zittel - Eastman Textb. Pal., 2nd ed., fig. 1409.

The genus *Dalmanitina*, proposed by its author (as a subgenus of *Dalmanites* Barrande) for the primitive generalized Ordovician types, is now extended to include what are here interpreted as similar generalized forms in the Silurian. The generic characters are: well-marked pentamerism of the glabella without semi-detachment of the frontal lobe; genal angles rounded off or only produced into short spines; pygidium with few segments and rounded posteriorly or rarely produced in a short mucronation. It includes *Dalmania socialis* Barrande, *Calymene downingiae* Murchison, *Phacops (Acaste) constricta* Salter, and *Dalmanitina logani* var. *conservatrix*, n. var. The Ordovician *P. apiculata* (Salter) apparently also belongs here.

As here interpreted *Dalmanitina* is considered to replace *Acaste* Goldfuss and in particular Salter's use of it. *Acaste* was erected by Goldfuss in 1843 for forms with the pentamerism of the glabella retained. It thus included forms now referred to *Dalmanitina*, but of course was given a broader interpretation than is now proposed for the latter genus. Salter's use of *Acaste* was more restricted and practically coincides with that of *Dalmanitina* as here emended. Under it he places all the Silurian forms listed above with the exception of the then unknown Arisaig variety. Salter gave *Acaste* only subgeneric rank, under the genus *Phacops*.

Reed includes the Silurian forms now referred to *Dalmanitina* in his broad subgenus *Phacopidella*, for he did not extend the scope of *Dalmanitina* beyond the Ordovician. He designated the *Acaste* forms as falling within it and in 1906 referred *Calymene downingiae* Murchison to the subgenus (of *Phacops*) *Phacopidella*.

Two independent and slight departures from the unmodified *Dalmanitina* line showing obsolescence of the anterior furrows are here provisionally retained within it. They embrace in the Ordovician forms like *D. phillipsi* Barrande and in the Silurian the species *D. logani* Hall.

Other slight departures from the primitive stock, exhibiting a considerable broadening anteriorly of the glabella, are retained under *Dalmanitina*. They include *Phacops (Acaste) alifrons* Salter and *P. jamesii* Portlock, both from the Ordovician. The Ordovician *Phacops brongniarti* Portlock is probably a more considerable modification of the normal *Dalmanitina*, but without actual study of specimens of this species, it would not be wise to determine its affinities in any detail. It is apparently the nearest approach to the Phacopinæ in the Ordovician in one character at least, reference to which has been made on a previous page.

In a more extended revision of the Phacopidæ it may be found wise to erect subgenera for these slightly modified *Dalmanitina*-like forms. A new subfamily might also be erected to include *Phacopina* Clarke, *Dalmanitina* Reed and the new subgenera. Such a subfamily would then embrace the entire primitive or little modified stock of the Phacopidæ.

Genotype: *Dalmania socialis* Barrande.

Dalmanitina logani var. *conservatrix*, n. var.

(*conservatrix*, preserve).

This variety only differs from *Dalmanitina logani* (Hall) by having all the glabella furrows well impressed but all gradations exist between them. Compared with *Dalmanitina downingiae* (Murchison) the frontal lobe is a little higher, the third side lobes slightly smaller, and the glabella surface variably tuberculose. The pygidium is mucronate and with a proportionately more slender and tapering axis. The cephalon is a little more than twice as wide as high. The maximum width is about 22 m.m. The average pygidium is 13 m.m. wide and 8 m.m. long.

Horizon and Locality. Rare in the Moydart and Stonehouse formations, Arisaig, N.S.

Collections. Victoria Memorial Museum, Yale University collections.

Genus *Phacopina* Clarke.

1890. *Phacops* Clarke, Archiv. do Mus. Nac. do Rio de Janeiro, 9, pp. 15-16, est. 1, figs. 1-3.
 1905. *Phacopidella* Reed (partim), Geol. Mag., (5), 2, p. 226, footnote 1.
 1913. *Phacopina* Clarke, Mon. Serv. Geol. E. Min. do Brasil, vol. 1, p. 151.

Dalmanitids in which all but the third pair of lateral glabella lobes are fused together. They lack

the broad expanding glabella with greatly reduced third pair of side lobes of the Phacopinæ. They also differ from the coeval Phacopinids by having a much more depressed and non-tuberculose glabella. It probably represents an early Devonian or late Silurian modification of the *Dalmanitina* stock. The genus is, therefore, placed in the subfamily *Dalmanitinae*.

Genotype: *Phacops braziliensis* Clarke.

Genus *Dalmanites* Barrande.

1852. *Dalmanites* Barrande (partim), Syst. Sil. du Centre Boheme, 1, p. 934.
 1904. *Dalmanites* Reed, Geol. Mag., (5), 2, p. 224.
 1913. *Dalmanites* Raymond, Zittel - Eastman Textb. Pal., p. 726.

Genotype: *Trilobus caudatus* Brunnich.

Subfamily Phacopinæ Reed.

Genus *Phacopidella* Reed s. str.

1852. *Phacops* Barrande (partim.), Syst. Sil. du Centre Boheme, 1, pp. 525-528.
 1905. *Phacopidella* Reed (partim), Geol. Mag., (5), 2, p. 173.
 1911. *Glocheria* Wedekind, Zeitschr. Deutsch. Geol. Ges., vol. 63, p. 323.

Phacopidella Reed was erected in 1905 as a subgenus of *Phacops* Emmrich and was given a very broad interpretation. As already noted it was made to include the generalized Silurian forms which above have been placed under *Dalmanitina* Reed. Its author also included in it the Silurian group of *P. stokesii*, for he restricts *Phacops* Emmrich to the Devonian assigning all intermediate Silurian forms to *Phacopidella* and in 1906 refers *Trilobites elegans* Sars and Boeck to subgenus (of *Phacops*) *Phacopidella*. In addition he placed it in the Devonian group of *P. braziliensis* Clarke, which above has been shown not to be Phacopinid and for which Clarke created his genus *Phacopina* Clarke. The last and fourth group was that of *P. glocheri* Barrande. Since the genotype chosen by Reed (not *P. downingiae* as supposed by J. M. Clarke, 1913, p. 150) lies within this group, *Phacopidella* is now restricted to it. This confines it in time to the later Silurian and geographically to the Tethys (Bohemia) realm. In 1911 Wedekind proposed the generic name *Glocheria* for this group. *Phacopidella* having priority, Wedekind's name of course cannot stand.

Phacops glocheri Barrande, *P. trapeziceps* Barrande, and *P. bulliceps* Barrande are referred to the genus as restricted. The glabella of the last named species is not so broad and is more rounded anter-

iorly than in the other two species. They are all large-eyed Phacopinids with the characteristic modifications of the subfamily. The diagnostic feature that separates this group from the coeval Silurian *Phacops* forms is the retention of the first pair of glabella furrows which are of a characteristic form and give rise to a partly detached frontal lobe somewhat as in *Dalmanites*.

Genotype: *Phacops glockeri* Barrande.

Genus *Phacops* Emmrich s. str.

1819. *Somatrhelion* McMurtie, Sketches of Louisville and the falls of the Ohio; Louisville, 1819, pp. 74-75 (not sufficiently defined to be clearly recognizable).
1839. *Phacops* Emmrich (partim), De Trilob. Dissert., p. 18.
1843. *Phacops* Goldfuss (partim), Neues Jahr. Min., etc., 1843, p. 564.
1845. *Phacops* Emmrich (partim), Neues Jahr. Min., etc., 1845, p. 38.
1846. *Portlockia* McCoy (partim), Sil. Fossils Ireland, p. 50.
1852. *Phacops* Barrande (partim), Syst. Sil. du Centre Boheme, I, p. 498.
1864. *Phacops* Salter (partim), Mon. Brit. Tril., Pal. Soc., p. 14.
1866. *Phacops* Hall, Pal. N.Y., 7, p. XXVII.
1905. *Phacops* (= *Somatrhelion*) Reed, Geol. Mag., (5), 2, pp. 226, 228.
1911. *Phacops* Wedekind (partim), Zeitschr. Deutsch. Geol. Ges., vol. 63, p. 317.
1913. *Phacops* Raymond, Zittel-Eastman Textb. Pal., 2nd ed., p. 726.

As here restricted and based upon the genotype, the genus includes all of *Phacops* Wedekind with the exception of the Silurian group of *P. stobesii*. Although the author of *Phacops* did not choose a genotype for it, *P. latifrons* Bronn has been so designated by Barrande. He practically selected it in 1852 defining the usage of *Phacops* by referring to the type of *P. latifrons*.

The status of *Somatrhelion* McMurtie requires consideration, since, if established, as a synonym of *Phacops* s. str., it would have priority. McMurtie (1819) described a new genus and species, *Somatrhelion megalomaton*, from a specimen found in "a block of limestone from the falls [of the Ohio]". In the diagnosis given, it is said to have a corrugated (segmented), tripartite, convex body, the axis arched, with a row of tubercles on either side, and the head subrotund with very large eyes. The "mouth" is said to be "formed like that of a snapping turtle". It may possibly have a tuberclose surface, for the statement is made that there is "not the smallest

tubercle or wrinkle but what is preserved in its original form". The author must be referring to something more than the tubercles at the extremities of the axial thoracic segments or he would not make use of the superlative. Only one specimen was known. The tripartite and corrugated (segmented) body suggests a trilobite. The large eyes point to either a *Proetus* or a *Phacops*. Both are present in the Devonian at the falls of the Ohio. The very large eyes and the possibly tuberclose surface suggests a *Phacops*. Three forms are found in the vicinity. *Phacops rana* Green occurs in the Jeffersonville limestone and Sellersburg beds (Onondaga and Hamilton).^{*} *P. cristata* Hall is in the Jeffersonville limestone and just above the hydraulic beds of the Hamilton,^{*} while its var. *pipa* Hall is found in the upper Onondaga.^{*} They are all pronouncedly tuberclose, especially on the glabella. Indeed if we were certain of this character, *Somatrhelion megalomaton* McMurtie could be identified as a *Phacops* and as one of the three forms mentioned.

Vogdes (1893, p. 163) has listed McMurtie's species as a synonym of *Phacops rana* Green and Reed (1905, p. 226) suggests the possible use of *Somatrhelion*, but does not discard *Phacops* for it (1905, p. 226). The evidence certainly does not justify any decided conclusion. Therefore, since McMurtie's description although suggesting a *Phacops* is not at all conclusive, since only one specimen ever existed and that apparently is now lost, and as no one has adopted it although recognized by Vogdes, the writer prefers to regard it as having a doubtful status. As Vogdes observed long ago the generic name is very unsuitable anyway, applying as it does to the Trilobita as a whole.

Genotype: *Phacops latifrons* Bronn.

Subgenus *Portlockia* McCoy emend.

1839. *Phacops* Emmrich (partim), De Trilob. Dissert., p. 18.
1843. *Phacops* Goldfuss (partim), Neues Jahr. Min., etc., 1843, p. 564.
1845. *Phacops* Emmrich (partim), Neues Jahr. Min., etc., 1845, p. 38.
1846. *Portlockia* McCoy (partim), Sil. Fossils Ireland, p. 50.
1852. *Phacops* Barrande (partim), Syst. Sil. du Centre Boheme, I, p. 498.
1864. *Phacops* Salter (partim), Mon. Brit. Tril., Pal. Soc., p. 14.
1906. *Phacopidella* Reed (partim), The Lower Palaeozoic Tril. Girvan, III, Pal. Soc., p. 154.
1911. *Phacops* Wedekind (partim), Zeitschr. Deutsch. Geol. Ges., vol 63, p. 317.

*Personal communication, E. M. Kindle.

As already noted, the Silurian group of *Phacops stokesii* (Milne-Edwards) is ancestral to the group of *P. latifrons* Bronn and differs from the latter by having the glabella more depressed anteriorly, so as not to overhang the anterior margin, the size is smaller, and the surface less tuberculose. They are here placed under the subgenus *Portlockia* McCoy emend., with *P. stokesii* as the genotype. Among the species referred to it are:

Calymene stokesii Milne-Edwards.

Trilobites elegans Sars and Boeck.

Phacops orestes Billings.

Phacops (Portlockia) marklandensis, n. sp.

As described and applied by McCoy in 1846, *Portlockia* McCoy had a rather wide interpretation and included both Silurian and Devonian forms with the typical Phacopid structure. It fell within *Phacops* Goldfuss and was practically equivalent to subgenus *Phacops* Salter, embracing both the *P. stokesii* and *P. latifrons* groups. McCoy (1846: 50) states that "this genus includes *Calymene tuberculata* and *C. macrothalma* of the Silurian system [= *Phacops latifrons* Bronn and *P. stokesii* Milne-Edwards according to synonymy of Salter (1864: 18, 21)]; *Phacops tuberculata* of Captain Portlock's Report; *Calymene nupera* Hall; *Calymene bufo* Green, etc." In 1846 he (1846, p. 51) described and placed in this genus *Portlockia sublaevis* McCoy. Salter considers this a synonym of *P. stokesii* (1864, pp. 21, 22). Later he (1855: 162) says: "The *Calymene bufo* of Green, *C. macrothalma* of Murchison [= *P. stokesii*], etc., being the types of the genus". Since *P. latifrons* is the type of *Phacops* Emswiler and *Calymene bufo* Green is a similar Devonian form, *Phacops* should be restricted to that group, while the group of *P. stokesii* is now separated under the subgenus *Portlockia*.

Genotype: *Calymene stokesii* Milne-Edwards.

Phacops (Portlockia) marklandensis, n. sp.
(Markland, Nova Scotia in Scandinavian mychology).

Compared with *Phacops (Portlockia) elegans* (Sars and Boeck) this species has a still more reduced basal (third side pair) lobe and smaller tubercles at its extremities. It differs in a similar manner from *P. (Portlockia) stokesii* Milne-Edwards and in addition in the presence of well developed, although not highly elevated, tubercles at the extremities of the thoracic axial segments. Compared with *P. (Portlockia) orestes* Billings, the basal lobe and tubercle are much more reduced, the thoracic-axial tubercles are more strongly developed and the axial segments relatively more slender. The glabella is somewhat depressed, with first pair of side

furrows short, weakly impressed, and come anteriorly. The second pair are short, weakly impressed, and almost straight. The pygidium has four pairs of ribs on the pleural lobes, divided distally by a median sulcus. The fourth pair are faint. The axis of pygidium is divided into about eight rings.

Dorsal shield width 14 m.m., length 20 m.m.

Cephalon " 14 m.m., " 6 m.m.

Pygidium " 9 m.m., " 5 m.m.

Horizon and Locality. Rare in the Ross Brook formation, Arisaig, N.S.

Collections. Victoria Memorial Museum, Yale University collections.

CONCLUSIONS.

The results of the foregoing discussion may now be summarized.

(1). A generalized primitive line ranging from the Ordovician into and through the Silurian is recognized. The genus *Dalmanitina* Reed is extended to include all of these unmodified forms. Thus interpreted it is considered to be practically synonymous with Salter's use of *Acaste* Goldfuss (non Leach) and in a broad way with *Acaste* as used by Goldfuss.

(2). A constant tendency to partial fusion of the two anterior lobes and the frontal lobe, but without the profound modification of the subfamily Phacopinæ Reed, is observed. Such Devonian forms are recognized in the species for which J. M. Clarke has proposed the generic name of *Phacopina*. But these forms are not Phacopid and exhibit none of the profound specialization of the cephalon as seen in that subfamily. Slightly modified species of a similar nature are recognized in both the Ordovician and Silurian but are thought to be evolutions independent of *Phacopina* Clarke. They are provisionally left under *Dalmanitina*. Another slight modification is shown by some forms in which the glabella is broadly expanded anteriorly, but which retain the primitive pentamerism of *Dalmanitina*.

(3). The subfamily Phacopinæ Reed became differentiated at the very beginning of Silurian time and thereafter remained entirely distinct from the primitive generalized line. The profound modifications of this subfamily have been described by Reed and have been reviewed above. Probably the most diagnostic is to be found in the great reduction of the third pair of glabella lobes and the tuberculation of their extremities. Two stocks of this subfamily are of present interest.

(4). One of these Phacopid stocks is of wide distribution in the Silurian and continues into the Devonian, giving rise there to *Phacops s. str.* The more primitive and ancestral Silurian forms of this

stock are placed under *Portlockia* McCoy, which is emended with subgeneric rank to receive them.

(5). The other Phacopid stock is that of the group of *Phacops glocheri* Barrande. *Phacopidella* Reed is now restricted to it. This confines it to the later Silurian stratigraphically and to the Tethys (Bohemia) realm geographically. Wedekind's generic name of *Glocheria*, also applied to this group, is untenable, being preoccupied by *Phacopidella* Reed.

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INSTINCT MINUS EXPERIENCE.

The more we study nature the more obvious it becomes that the mysterious intuition called instinct is not as perfect as some of the old school observers imagined. Just what this inherited memory is we are as far from thoroughly understanding as ever; but study, observation and experiment are bringing

to light some of its limitations. We know that it does not spring into being, perfect and complete, like Minerva fully armed from the head of Jove, but is often only a starting point, a suggestion or a natural aptitude requiring experience and practice for the full development of its possibilities. This was admirably illustrated by a nest built by a pair of Baltimore Orioles in a garden in Ottawa South last spring.

The nest was hung from near the end of a long horizontal bough of Manitoba maple. When first started the nest was some ten or twelve feet from the ground, but the subsequent weight of the foliage brought it down until almost within reach of the hand and with the added weight of the first rain, it almost trailed on the ground; whilst a twist given to the branch by unequal loading spilled out the contents. The nest itself was very shallow and so poorly constructed that it could be seen through in every direction and the contained eggs were visible from below. Attempts were made to prop up the branch and correct its twisting but without effect and after three eggs had been spilled out as fast as deposited the nest was deserted.

The illuminating part of the episode lay in the fact that this pair seemed to be young birds and probably this was their first attempt at nest building. The male was certainly a yearling as was indicated by his dull colour. The age of the female could not be ascertained by her plumage, but her association with a juvenile mate makes it probable that she too was in her first breeding season.

To these familiar with the beautifully woven and deeply pocketed Oriole's structure hung from the pendant tips of high flexible branches, this slovenly, ill-judged nest is a curiosity. Fundamentally it followed oriole tradition but in execution it violated every principle of oriole construction. It was hung from a horizontal instead of a pendant branch; it was shallow instead of being deeply pocketed, and thin and open instead of being thick and densely woven and indicated that whilst the inherited ideal was there the fault lay in poor judgment and the lack of technical ability. It is to be regretted that absence from the city prevented the observer from discovering where the new nest, that was immediately started, was located and comparing it with the first abortive attempt to see what advance in skill, if any, had been made, and what had been learned by experience.

P. A. TAVERNER.

Geological Survey,
Ottawa, Ont., Aug. 10, 1918.

BRIEF NOTES ON THE FAUNA OF LAMBTON COUNTY, ONT.

By M. Y. WILLIAMS.

With the passing of the primeval swamps, have vanished the deer, wild turkey, and passenger pigeon which formerly abounded in Lambton and the adjacent counties of the Ontario peninsula. To-day wild life is inconspicuous, especially to passengers in the automobile. However, a few species of birds and mammals, either because of their size, color, numbers, or special liking for the roadside, can scarcely be overlooked.

To the visitor from Northern Ontario, or the Ottawa valley, perhaps the most conspicuous bird along the roadside and in the woods as well, is the tri-colored beauty, the red-headed woodpecker. His striking and contrasting coloring, of red, black and white, attracts attention, whether the bird is clinging to a tree limb, or telegraph pole, whether it is pursuing its undulating flight across the open fields or whether it is flying from tree to tree among the glades of the hardwood forest.

Although much rarer than the preceding species, the mourning dove may be frequently seen rising from near a bridge over a shallow stream, or clinging to a telephone wire, which seems unduly small for a bird of this size. The mournful wooing of this dove is a weird sound indeed and its origin along with the call of the cuckoo is rarely recognized by the casual observer. In coloring and general appearance the mourning dove recalls the extinct passenger pigeon, which formerly swarmed over the country in countless myriads. Unlike its more noted relative, the mourning dove is a solitary bird during the early summer, and moves about only in family parties later on.

The one straggling survivor of the fine game birds of the early days, is the quail or bobwhite as it is appropriately called. In the early evening the low but distinctly whistled "bob—white," with a long pause between the syllables, may occasionally be heard from the open fields, and the fortunate observer may once or twice during the summer see a clean-cut cock quail sitting on the top of a fence post by the roadside. The brown and white markings and modified chicken-like appearance of this little "friend of the farmer" serves readily to distinguish it. Its insectivorous habits during much of the season should secure its protection, but its fine game qualities have kept it in the sportsman's eye and even now under nominal legal protection it is to be feared that it is still being persecuted by those who should be its best friends. If quail are again to become numerous, absolute protection for a term

of years is essential. So far as could be learned, the quail of Lambton county are descendants of the native quail. I heard of no quail having been introduced.

The sight of turkey vultures circling low over the woods in the vicinity of Oil City and Oil Springs during the first week of August, suggested strongly a more southerly latitude. These large chocolate-brown birds, with naked, turkey-like head, follow the woodlands on regular beats, searching intently for carrion which is their favorite food.

Some years ago, Mr. Fletcher, who formerly kept the Fletcher House at Petrolia, now kept by Mrs. Fletcher and her daughter, Mrs. Bain, received two fluffy, white young turkey vultures from a farmer, and raised them successfully. They were quite tame and followed their owner about the town or perched on the roofs of the buildings. "Moses and Aaron," as they were called, were interesting specimens of domesticated wild life, but both suffered untimely deaths.

Of other birds of prey, the marsh hawk and sparrow hawk are the most commonly seen. A great-horned owl was disturbed one afternoon in the woods near Oil Springs, and was followed to its new roosting place by a noisy flock of robins. Either a long-eared or a short-eared owl was observed one evening near Wyoming.

Although there is little suitable water for waders and shore birds in the interior of the county, the great blue heron, American bittern, killdeer, and spotted sandpiper are fairly common. The black tern was observed along the lake Huron shore near Perch.

Of the smaller birds, the meadow lark is especially numerous, as have been the bobolinks. The horned-larks are fairly common, and the vesper is the commonest of the sparrows. Night-hawks and purple martins are very numerous at Petrolia.

Large flocks of bronzed grackles fly into Petrolia to roost at nights, to the discomfort and annoyance of the citizens near where they take up their quarters. Shooting has not driven them out successfully.

Black squirrels are occasionally seen in the woods of Lambton county and grey squirrels are reported; but the story related by one nature lover accounts for the scarceness of these fine, distinctive squirrels. He said "formerly the woods back of my farm contained a number of grey squirrels, but one day about two years ago a number of hunters came over from Sarnia and I haven't seen a grey squirrel there

since." The natural increase of years wantonly destroyed in an afternoon!

Mr. Sam Lucas, who resides near Wyoming, keeps a fur farm and miniature zoological garden. Fishers, black foxes, rabbits, pheasants, etc., make up most of his stock in trade. In addition, however, he has two bald eagles brought when young from Manitoulin Island, and two sand-hill cranes, one of which, he states, has now been in captivity for more than fifty years. The cranes are in an enclosure where they stay voluntarily as their wings are not clipped. On request from their master, they throw back their heads and give the peculiar cry so familiar to those who have seen them on the plains of Saskatchewan. About the 20th of June one was sitting on hen eggs in an excavation in the ground which served for a nest. Her own infertile eggs, Mr. Lucas had removed. The two seen were about the size of turkey eggs, and were splashed with brown markings on a dirty blue ground.

N.B.—On the 19th of July the writer saw a yellow-bellied Sapsucker in the woods at Eugenia Falls, Grey County, Ont.

BOHEMIAN WAXWING AT OTTAWA.

On February 15, 1917, late in the afternoon, I saw a Bohemian Waxwing in a tree near my residence. It was surrounded by a group of curious sparrows. It flew to another tree, and the sparrows returned to their roof and held an animated discussion no doubt as to the identity of the stranger. Finally two of the hottest debaters flew to the second tree to make further observations of the waxwing. They inspected him quietly until he flew away, and then they returned and reported in calmer tones to the other expectant sparrows. I trust they agreed that it was "Bohemian" and not "Cedar." On March 16, and again on March 27, I saw a flock of Cedar Waxwings and three Bohemian Waxwings with them. On the latter date the Bohemian Waxwings sat quietly and nearly hidden among the brown leaves of a small beech at the Experimental Farm, while the Cedar-birds flew about on the nearby shrubs and trees. These are the first Bohemian Waxwings I have seen in Ottawa during ten years. A. L. Gormley reports one recently at Arnprior, (April 28, 1917, OTTAWA NATURALIST, XXXI, p. 32).

RALPH E. DELURY.

LEAST BITTERN NESTING AT LONDON, ONT.

(READ BEFORE THE MCLLWRAITH ORNITHOLOGICAL CLUB.)

At "The Pond", two miles south of London, where many productive visits are made by the members of the McIlwraith Ornithological Club, in the seasons of migration, a red letter day occurred on May 30, 1917, when a Least Bittern, the first record for the pond, and the first local view for any of the members, gave them a leisurely display of his colors and actions.

Farther on, an unknown song was heard, which proved to emanate from a Prairie Warbler, the first County record, and a new bird for all the party.

Nothing further was heard from either of these birds in the spring of 1918, and apparently the visit was not repeated. What was our surprise, then, on the morning of August 2, 1918, while silently skirting the edges of the pond in a canoe, to find a fuzzy Least Bittern, perched on a dead twig, three feet above the water. Eventually we found all four of the young, as well as the two old birds, and during that, and subsequent mornings, they were invariably found roosting, where they seemed to have passed the night, from one to four feet above the water on the twigs of water-killed bushes, in which we thought they should be very safe. The young still had the whitish down of the nestling adhering in places, that on top of the head being very conspicuous.

Generally speaking, we would miss finding the parents, but would find the young, though occasionally, only one or two of the latter would be seen. For the benefit of those who have similar chances it may be remarked that we began the morning with a paddle around the pond at daylight, and found the time very propitious.

W. E. SAUNDERS, LONDON, ONT.

NOTE.

The Ontario Department of Agriculture has recently published Bulletin No. 263, on "Mushrooms of Ontario", the author being Dr. R. E. Stone. This publication of 24 pages emphasizes the importance of using wild mushrooms as food, particularly at the present time when a world shortage of food is threatened. Illustrations are given of twenty species. Descriptions of the various common kinds are given in brief as well as other useful information. Recipes for using mushrooms are also included, as well as directions for the growing of mushrooms.