



FIGURE 2

and (3) that Dr. Tempest Anderson observed pillow structure forming where a lava stream from Montavanu volcano, in the island of Savaii in the Samoan group, flowed into the sea. He states that the corded structure is ".....formed in the usual manner above the water. Where, however, it falls direct into the sea, the surface is chilled before there is time for it to be wrinkled up into the corded structure, and it becomes consolidated into the characteristic form of one variety of pillow-lava."*

It may be concluded, therefore, that although

* *The Geographical Journal*, 39:129, 1912.

it is not established that extrusion into water is necessary for the formation of pillow structure, it has almost certainly been an important factor in its development in most of its occurrences.

The pillow structure shown in Figure 2 occurs in a mass of greenstone (variety, andesite) outcropping about three-quarters of a mile northwest of the Waite-Ackermann-Montgomery mine, in Duprat township, Abitibi county, Quebec. The structure may also be observed in many other localities, however, in the greenstones of north-western Quebec and in numerous similar greenstone belts in other parts of the Canadian Shield.

A STUDY OF KUMLIEN'S GULL (*Larus kumlieni* Frewster)*

By P. A. TAVERNER

EVER SINCE it was first noted, Kumlien's Gull has been somewhat of a puzzle to ornithologists. At first, due to its pale grey wing tips and our incomplete data on distribution, occasional specimens were identified as *Larus glaucescens*. In 1883 Brewster recognized and described it as a distinct species, *Larus kumlieni*. In 1906 Dwight studied the species and

(Auk, 23:26-43, 1906) described and figured in colours what we now acknowledge to be the second year plumage. Later, (The Gulls of the World, 1925) in convincing argument on specimens and data then available, he advanced the theory that *L. kumlieni* is a hybrid between *L. argentatus thayeri* and *L. leucopterus*, and therefore not entitled to specific recognition. In 1930, the A. O. U. Committee adopted this view and embodied it in the fourth edition of its Check-List.

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Since Dwight's researches, however, a good deal of evidence contradictory to that available to him has come to light, and a reconsideration of the question seems advisable.

Larus kumlieni is of the Herring Gull type, a little smaller than *L. argentatus*; the adult with very slightly lighter grey mantle and wing tip pattern washed out to grey and greatly reduced in area. In all other characters it seems indistinguishable from that species. The difference in size and in mantle colouring are only in average and may not hold in every individual, so that the wing pattern of the adult is practically the most certain criterion of diagnosis from that species. Even this character is quite variable and sometimes leads to confusion. The wing markings may be reduced to mere traces or even to absence, producing practical identity with those of the white-winged group of the genus; or they may be deepened in colour and extended in area until they approximate the wing pattern of the more extreme examples of the *thayeri* form of *L. argentatus*. This variation has no correlation with sex; whether it has any with age or distribution is uncertain. In juvenile and sub-adult, *kumlieni* is still more difficult to recognize. Juveniles of sure identity have never been positively demonstrated and specimens so designated have been named more by process of elimination and careful judgement (neither of which I care to question here but suggest possibilities of doubt) than by evidence of parentage. In all probability, juveniles are practically identical with those of *argentatus* of any race, follow the same plumage sequence and are to be distinguished with certainty from them only in the later stages of adolescence.

The hybrid theory of *kumlieni* is based upon the following assumptions:

1. The apparent intergradation with *L. leucopterus* on one hand and *L. argentatus thayeri* on the other.
2. The extreme variability of *kumlieni* in the specimens examined.
3. The supposed origin of the form where the two postulated parents breed.
4. Analogy with known gull hybrids raised in captivity in Europe.

The first of these two postulates can be accepted though it is to be noted that a series of eleven summer adults taken on their breeding grounds in southwestern Baffin Island do not show the same wide variation as is exhibited by the collected occasional migrants along the Atlantic coast that were hitherto available for examination. This suggests that there may be a more definite wing pattern for full breeding maturity than was sus-

pected or that there may be a geographical variation yet to be discovered.

The fourth postulate leaves something to be desired, though it can not be arbitrarily dismissed. It acknowledges that *kumlieni* can not be the result of a first generation crossing but must arise from subsequent ones. While it is a characteristic of first generation crossing that it often produces offspring of remarkably consistent characters, those of subsequent generations show great and confusing diversity. Though it is admitted that *kumlieni* is variable, the variation is not so extreme as would be anticipated from succeeding generation hybrids. That the birds of the southern Baffin Island breeding communities show comparative stability of essential characters introduces doubts as to their mixed ancestry.

In any event the third postulate, an essential one to the hybrid hypothesis, proves quite contrary to fact. Recent trips of J. Dewey Soper and others to the higher regions of the north and his intensive work from 1924 to 1930 in southern Baffin Island have shown:—

1. That Kumlien's Gull breeds commonly on the southwestern Baffin Island coast, single, in pure communities and in association with *L. argentatus smithsonianus* and *L. hyperboreus* but having no contact with either *L. a. thayeri* or *L. leucopterus*. To date, this, Cape Wolstenholme across the straits (Sutton 1826) and Cumberland Sound (Kumlien in 1877, not Soper in 1923 who spent two seasons there) are the only known breeding localities for the species and in none of them are the two supposed parental forms known to occur in breeding season. A specimen of *kumlieni* from Beechy Island, Devon Island, in August suggests a more northern distribution and the possibility of occurrence within the breeding range common to the postulated parents, but does not obviate the necessity within the theory for the presence of those parents in the more southern actively breeding communities.

2. That the southern breeding limit of *L. argentatus thayeri* is considerably higher north than was supposed, not below northern Baffin Island, the *argentatus* of Hudson Strait being typical of the form recognized in the Check-List as *smithsonianus*. *Thayeri* therefore cannot be a parent of *kumlieni* raised in that locality.

3. Records have been searched in vain for substantiating evidence of *L. leucopterus* breeding in the western Arctic or west of Greenland. The probabilities are that it does so in high latitudes but definite evidence to that effect is lacking. Such occurrences are noted in literature and have been generally accepted at their face value but such as have been possible of investigation have

proved to be confusions with *L. hyperboreus* that breeds commonly throughout the region, and the others are at the best doubtful. Until more definite proof to the contrary is produced the Iceland Gull must be relegated to the American hypothetical breeding list. *Leucopterus* is so like *hyperboreus* that confusion between them is very natural. When we consider the condition of high northern ornithology up to a very recent date, the personality of the actual observers on the old voyages and the conditions under which they worked, such mistakes are not only to be expected, but seem inevitable.

In eastern North America *L. hyperboreus* is fairly constant in its large size, but even there a few small birds occur that require some discrimination with specimen in hand to separate from *L. leucopterus*. In the west, a small form of *hyperboreus*, the so-called *barrovianus* type, occurs, closely approximating *leucopterus* in size as in all other observable characters. It is these small *hyperborea* that Dwight, consistently refusing to recognize *barrovianus*, referred to *leucopterus*, and formed the grounds for the Iceland Gulls that he attributed to the western Arctics. I do not wish to raise the question here of the validity of *barrovianus*, but to point out the possibility that all the so-called *leucopterus* from western localities may be small *hyperboreus*. As far as the writer knows no certainly and unmistakably identifiable *leucopterus* or *kumlieni* have ever been produced from the western Arctics or the Pacific coast of North America. All that he has seen or seen described are young or faded birds whose identity is a matter of balanced judgement rather than of unquestionable demonstration. I do not wish seriously to question any particular record but to point out that a residual doubt is attached to all of them.

The rare *L. nelsoni* is just an enlarged *kumlieni* and may, or probably does, intergrade with that species as *hyperboreus* apparently intergrades with *leucopterus*. But too little is known of this species to warrant any but the most generalized of speculation. It seems to be a western representative of *kumlieni* bearing the same genetic relation to it that *hyperboreus* does to *leucopterus*, and that is about as far as we can conservatively postulate. It was an attractive theory that *nelsoni* is a hybrid between *leucopterus* and *argentatus vegae* as *kumlieni* is between *leucopterus* and *argentatus thayeri* but unfortunately one case falls to the ground

with the other and, by analogy, if *kumlieni* is reinstated as a species, *nelsoni* should be also.

Larus argentatus thayeri presents some interesting complications and can stand further study when critically pertinent specimens are available. Although there has been considerable recent observational activity in the southern Arctic, yet the race has escaped detection under probable breeding conditions south of Pond's Inlet, northern Baffin Island, and at present we have no authority for extending its breeding range south of that point in the eastern Arctic. In the west, however it breeds on Victoria Island, the adjacent main coast, and probably even southward along Alaska; but the blood strains east and west are not identical. Characters that are essentially stable in eastern birds break up into wide variation in the western group. A series of ten specimens from the west side of Baffin Bay from Pond's Inlet northward, show a quite constant similarity of characters with little or no evidence of intergrading with *smithsonianus*. On the other hand, specimens from the western Arctics and the Pacific coast intergrade with the *smithsonianus* of the region so perfectly that hardly two individuals can be found alike, and it is difficult to tell where one form begins and the other leaves off. It seems a case of two subspecies blending into each other along a line of intergradation but meeting at their extremes with all the appearance of specific distinction.

There are many other questions regarding American Laridae that still lack evidence for elucidation but whatever may be the real relationship between the puzzling grey-winged gulls intermediate with a number of other well characterized forms, it seems evident that *kumlieni* should be reinstated as a definite and individual species.

It may be advanced that the *kumlieni* hybrid was produced by a cross-breeding in the past that has become fixed and capable of independent continuation through natural processes as our domestic mixed breeds have by artificial selection. It does not seem that this, interesting as it would be if demonstrable, alters the nomenclatural or taxonomic facts that it presents today. Origin of species by hybridity, mutation or gradual evolution are controversial subjects that are outside the limit of the present paper. The question here is not the origin of Kumlien's Gull but its present specific relation to other factors of the biotic complex.



Taverner, P. A. 1933. "A Study of Kumlien's Gull (*Larus kumlieni* Brewster)." *The Canadian field-naturalist* 47(5), 88–90. <https://doi.org/10.5962/p.339477>.

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