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HOW THE GREAT NORTHERN SEA-COW (RYTINA) BECAME EXTERMINATED.

BY LEONHARD STEJNEGER.

THE conclusions in regard to the extermination of the Great Northern Sea-Cow (*Rytina gigas*) and the causes which led to it, arrived at by the Russian naturalists, Von Baer and Brandt, and by them discussed in numerous publications, were regarded as final, and were generally accepted, until Prof. A. E. Nordenskiöld recently made the startling announcement that, during his five days' stay at Bering Island with the "Vega," he discovered incontrovertible evidence that at least one sea-cow had survived the general slaughter, and had been seen alive as late as 1854, or more than eighty years after the last one was supposed to have been killed. This statement of Professor Nordenskiöld was based upon his interpretation of an account of a strange sea-animal which two Bering islanders claimed to have seen some time previously. Nordenskiöld gave no details to speak of, merely asserting that the description of the animal by the natives tallied so completely with Steller's description of the sea-cow as to leave no doubt that they had really seen a living Rytina; but, notwithstanding this meagreness of the account, the weight of Nordenskiöld's name was then so great that his assertion would probably have been generally accepted. It was my good fortune to spend a year and a half on Bering Island three years after Nordenskiöld's visit, and, as the readers of the "Proceedings of the United States National Museum"<sup>1</sup> will know, I succeeded in bringing to light a number of facts which

<sup>1</sup> Vol. vii., 1884, pp. 181-189.

prove conclusively—as I have published even the minutest details, any one can make up his mind as to the weight of the evidence—that the animal seen by the men was *not* a sea-cow, but that, in all probability, it was a stray female narwhal. To this Nordenskiöld has had no other reply than a reprint of his former assertion, without even an attempt to give any further details or to refute my arguments. The only new point in his answer is an effort to throw discredit on the accuracy of Sauer's "Account of Billing's Expedition in the Years 1785 to 1794," in which Sauer expressly states that the last sea-cow was killed at Bering Island in 1768, twenty-seven years after the island had been discovered by man. In a paper published in the *Bulletin of the American Geographical Society*<sup>1</sup> I have already been able to vindicate Sauer. In the present paper I shall, therefore, only try to demonstrate how easy it is to account for the rapid extermination of this huge animal, if we take all the known facts into consideration. To any one familiar with the literature on the subject such an undertaking might be supposed to be superfluous, so well has the task been performed long ago by the great Russian scientists already referred to; but I may perhaps be able to elucidate the subject a little further,—a labor apparently not quite unnecessary, in view of the following remarkable statement of Professor Nordenskiöld (*Bull. Amer. Geogr. Soc.*, 1885, p. 281): "It cannot very well be supposed that in a sea so rarely visited in the last century as the northern part of the Pacific Ocean the last specimen of the genus *Rytina* should have been slain by the harpoon of the hunter. I even imagine that the hardly accessible coasts of Bering and Copper Islands have been very rarely visited by hunters since Steller's day, 1741." As will be seen from the following pages, there was no need of "imagining" anything of the kind, when the facts, as related in the literature, so amply prove the contrary.

As everybody knows, Bering and his unfortunate comrades, among them the immortal Steller, in the autumn of 1741, discovered the then uninhabited island which afterwards received its name from Bering, who died there shortly after. The survivors of the expedition wintered on that island, and when they landed there they saw the first living sea-cows (*Rytina*) ever beheld by white men.

<sup>1</sup> 1886, No. 4, pp. 317-328.

Unfortunately, Steller, in describing this animal and its habits, only says that he found it numerous and in herds, without stating exactly how numerous or in how large herds. We are thus left to guess at their probable number when first found; and from what he says in regard to their habits and the places they frequented, and from what I know of the natural conditions of the island, I should regard fifteen hundred as rather above than below the probable number. It must be remembered that the sea-cow was an extremely bulky animal, twenty-four to thirty feet long, which lived chiefly near the mouths of the rivulets, feeding on the sea-weeds, especially the large *Lamellarias*. There are hardly more than fifteen places on the island which could afford them suitable grazing-grounds, and if each of these were regularly visited by an average of one hundred animals, one would easily be impressed by their number, especially if divided up into five to ten herds of from ten to twenty individuals.

There can hardly be any doubt that these animals were the last survivors of a once more numerous and more widely distributed species, which had been spared to that late date because man had not yet reached their last resort. It is, then, pretty safe to assume that this colony was not on the increase, and that, under the most favorable circumstances, the number of surviving young ones barely balanced the number of deaths caused by the dangers of the long winters. Under this supposition, every animal killed by a new agency—in this case by man—represents one less in the total number.

No sooner did the survivors of Bering's expedition return to Kamtschatka, in 1742, than hunting expeditions were fitted out; for already, in 1743–1744, we find Bassoff and his crew wintering on Bering Island, and from that year and until 1763 hardly a winter passed without one or more parties spending eight or nine months in hunting fur-animals there, during which time the crews lived almost exclusively on the meat of the sea-cow. But that is not all, for more than half of the expeditions which wintered there did so for the express purpose of laying in stores of sea-cow meat for their farther journey, which usually lasted two to three years more.

In order to substantiate the above assertion, I shall give a detailed list of the expeditions which are *known* to have wintered on Bering Island during the twenty years in question. The old

records are very defective, and it is extremely probable that many more of the expeditions which left Kamtschatka in order to hunt and trade on the Aleutian Islands and in America stopped at Bering Island, as was the usual custom; but we shall only enumerate those of which the records expressly say that they wintered there. The number of men employed on the vessels is not given in all instances, but, as it varies between thirty and fifty, I have estimated it to be thirty in most cases of which we have no definite record. In the few instances in which the length of time spent on the island is not given I have estimated it to be eight months, which is shorter than the shortest time actually recorded:

Winter.	Name of Owner or Captain of Vessel.	Men.	Months.	Remarks.
1743-1744..	Basoff.....	(30)	(8)	Numbers in parentheses estimated. Months, only approximate figures. There is some uncertainty about the time Yugoff spent on Bering Island. He is said to have wintered from 1751 to 1754 on Bering and Copper Islands,—about thirty-two months. It is not probable that he spent less than half of this time on Bering Island.
1745-1746..	Basoff.....	(30)	12	
1747-1748..	Kholodiloff...	50	9	
1748-1749..	Bakhoff.....	(30)	11	
1749-1750..	Tolstykh.....	50	8½	These four men belonging to Drushinin's crew were left behind. Krassilnikoff's crew and four of Drushinin's.
1751-1752..	Yugoff.....	26	(16)	
1752-1753..	Kholodiloff...	34	10	
1753-1754..	Drushinin....	(30)	(8)	
1754-1755..	Durneff.....	(40)	(8)	
1754-1755..	Krassilnikoff.	(30)	9½	
1754-1755..	Jakovleff.....	33	(6)	
1755-1756..	.....	4	.....	
1756-1757..	Krassilnikoff.	(34)	(8)	
1756-1757..	Tolstykh.....	38	9	
1757-1758..	Shilkin.....	39	(8)	
1758-1759..	Paikoff .....	45	9½	
1760-1761..	Tolstykh.....	(38)	8½	
1762-1763..	Korovin .....	45	9½	
1762-1763..	Medvedeff....	45	(9)	

It will be seen that there wintered in 1754 to 1755 about one hundred and thirty-three men, and in 1762 to 1763, ninety men.

In addition to the above, we know of a number of expeditions wintering on Copper Island, and many more which passed by the Commander Islands on their way east. Besides, how many were there of which we know nothing? And yet Professor Nordenskiöld imagines that these islands "have been very rarely visited by hunters since Steller's day,—1741"!

Some of the records in regard to the above expeditions are

very interesting as having a direct bearing on the question before us. Thus, it is said, *à propos* of Krassilnikoff's wintering on Bering Island, that "it had already become customary for all vessels intending to hunt sea-otters on the more distant islands to winter there [Bering Island] in order to provide sufficient stores of the meat of the sea-cows (*Manati*)."<sup>\*</sup> These expeditions lasted usually three to four years, and it is safe to assume that they laid in provision for not less than twelve months. Of the expeditions enumerated in the above list, ten, with an aggregate of about four hundred men, belong to this category.

Still more valuable are the details which have been recorded in regard to Jakovleff's expedition. He was a mining engineer, consequently a man of education and intelligence, as his reports also testify, sent out by the Russian government in order to investigate the alleged occurrence of native copper on Copper Island. The records show, beyond dispute, that when this island was first visited (1745 to 1746) sea-cows occurred along its beaches (and I myself have found remains of them on that island); but in 1754, when Jakovleff was to explore Copper Island, he was obliged to winter on Bering Island, *because at that early date, nine years after the first visit, the sea-cows had been extirpated on Copper Island by man!*

Including his crew, there wintered that year, on Bering Island, hardly less than one hundred and thirty-three men, one of the chief occupations of whom it was to procure, during eight months, as much sea-cow meat for their future expeditions as they possibly could. This was done regularly by harpooning the animal from a boat manned with eight oarsmen, and when killed it was immediately towed to the shore to be hauled up on the beach and cut up at once, as the meat would spoil if left unattended until the next day. This was the method for securing provisions for the vessels, but a much more wasteful manner was pursued in killing the animals which served as food for the hunters during their sojourn on the island. From Jakovleff's diary we learn that the hunters were scattered all over the northern (*i.e.*, northern and eastern) shore of the island by twos and threes for the sake of catching foxes and other fur-animals, while sea-cow meat was the only food available.<sup>†</sup> These

<sup>\*</sup> It is even probable that Jakovleff refers to a more or less regular population of hunters, in addition to the crews of the wintering vessels.

men, in order to obtain food, had to secure their sea-cow single-handed, and whenever they got an opportunity—what they often did—they would sneak up to an animal lying close to the shore or in shallow water, and wound it mortally by thrusting the iron-shod pole into it. The animal, which was hardly ever killed outright, sought the high sea and died there. If it drifted ashore the same day, well and good; but in most cases it came in unfit to be eaten, if it was not carried away altogether. So impressed was Jakovleff with the extreme wastefulness of this method that he predicted the speedy extermination of the sea-cow unless some precautions be taken against this senseless slaughter; and when, in 1755, he returned to Kamtschatka, he presented a petition to the authorities there that it be prohibited by an ukas to kill sea-cows in this manner, “in order that Bering Island may not be devastated in the same manner as Copper Island.” Of course, nobody heeded this eminently wise suggestion, and the result became as he had predicted it: the last sea-cow was killed within thirteen years.

Can anybody who contemplates the fact that the sea-cow was an exceedingly stationary animal, which was bound to the kelp-fields near shore; that it was extremely stupid and sluggish; that it was deprived of the faculty of diving; and that the island offers absolutely no shelter or concealment for it,—can anybody, after having read Jakovleff's report and petition, possibly entertain a doubt that the last specimen of the genus *Rytina* was slain by the harpoon of the hunter?

But let us attempt a calculation, based upon the former guess as to the original number of living sea-cows when Bering Island was first visited, and upon the facts as they have been presented above. Before doing so we will have to estimate the number of animals wastefully slaughtered, and from the statements made by Jakovleff I should think it no exaggeration to say that there were killed five times as many animals as were actually utilized. From Jakovleff's report we learn that one sea-cow would furnish food sufficient for thirty-three men during a whole month, and, although it is probable that he made his party utilize each animal in a higher degree than the other hunters, we shall take the above figures as indicating the average. It will be seen that we do not take into account Burdukovski's statement, that only the kidneys were eaten, for he only had his knowledge from hearsay,

while from Jakovleff's diary it seems evident that all the meat was eaten. This is an additional reason why no weight should be attached to the rest of Burdukovski's story.

Now, to supply the six hundred and seventy men which we know wintered on Bering Island between 1743 and 1763, during an average time of ten months, it required, in round figures, about two hundred and five animals. According to the same method of calculation, we find that the four hundred men who laid in provisions for protracted journeys would require about two hundred and ninety animals for an average time of twenty-four months,—together, four hundred and ninety-five animals. If five times as many cows were wantonly killed as were utilized, we have a grand total of two thousand four hundred and seventy-five sea-cows slaughtered up to the year 1763, or nearly one thousand in excess of our estimate of the original number. We can therefore either admit that there were more than two thousand living sea-cows when Steller discovered them, or else that only twice as many animals were wasted as were properly utilized; but, whatever conclusion we choose, it is manifest that our estimates have been very reasonable.

From 1763 the visits to Bering Island seem to grow scarcer; at least, the records contain nothing definite that I am aware. This is probably due to the very fact that sea-cows had now become so nearly exterminated that the few left were insufficient to maintain any wintering and foraging expedition, while, at the same time, the fur-bearing animals were also so badly decimated that it would not pay for a large party to hunt them. The smaller animals, as we know, would recuperate when left undisturbed for a few years, and it was probably by a party who went out to Bering Island in 1767 or 1768—possibly on one of Popoff's vessels—in order to catch blue foxes that the last sea-cow was mercilessly killed. Four years after, in 1772, Dmitri Bragin again wintered on Bering Island, and, from the fact that in the list he gave of the animals of the island he omitted the sea-cow, it is reasonably safe to conclude that not one was left to be recorded by him.

After all, there is nothing surprising in the speedy extermination of this clumsy animal, which could not dive, and which had actually no means of defence or escape. It is too well known that it did not emigrate, and the theory that it was driven off to

other places is not only directly disproved, but is quite unnecessary in order to explain the sudden disappearance of the Great Northern Sea-Cow from the shores where it was first discovered.

I think it will be admitted that we have succeeded in materially strengthening Sauer's assertion, that the Rytina was exterminated in 1768, and that the above is a fair exposé of the causes which led to its final extirpation. It was simply due to man's greed, and he accomplished it within the short time of twenty-seven years.

## THE MATERIALS OF THE APPALACHIANS.

BY E. W. CLAYPOLE.

(Concluded from page 962.)

### THE FOUR GREAT SANDSTONES OF PENNSYLVANIA.

IN the former part of this paper I dwelt on the fact of the existence of several thick sandstones and quartz conglomerates in the massive palæozoic deposits of Pennsylvania. I further showed that these rocks indicate a supply of quartz far greater than could be furnished from any existing source; and, thirdly, that the nature of this quartz is such that the only known origin for it is the quartz-ledges of the South Mountains. Hence I inferred the former extension of these strata over a greater extent of country than at present.

In this second part I propose to try and give a more definite shape to this conclusion, and to at least suggest where and when this palæozoic land existed.

Excluding, for various reasons which it is not necessary here to mention, the Potsdam Sandstone, there remain four great sheets of sandstone, more or less conglomeratic, in the immensely thick palæozoic deposits of the Eastern States. Between them there lie massive, softer deposits of shale and limestone. In descending order these beds are as follows, omitting all minor and insignificant layers:

	Fect.
Shale, coal, sandstone.....	Variable.
4 Sandstone and pebbles (Pottsville Conglomerate).....	1500
Shale (Mauch Chunk).....	1500
3 { Sandstone and pebbles (Pocono Conglomerate).....	2000
{ Sandstone and pebbles (Catskill Sandstone).....	6000