where the fossiliferous beds of the Potsdam rest horizontally on the upturned edges of the Keweenian, and are made up, in part, of its ruins. Parts 1 and 6 of the third volume of the Geology of Wisconsin (1880) will show the accumulation of evidence with regard to the stratigraphical relations of the Keweenian; and few will be found to-day to question the propriety of the conclusion announced by me in 1873, and subsequently by Major Brooks in 1875, that the copper-bearing rocks of northern Michigan constitute, in his words, "a distinct and independent series, marking a definite geological horizon," which has been designated the Keweenan series, Keweenawan, or, more euphoniously, Keweenian.

These rocks, so carefully studied by Brooks and Pumpelly on the south shore of Lake Superior, and largely displayed on Isle Royale, Michipicoton Island, Mamainse, and Pointe Aux Mines, on the north shore, were by Logan supposed to be the same with the red and white sandstone and marls, with dolomites and brine-springs, found along Nipigon Bay, Black Bay, and Thunder Cape. He recognized beneath these, in this region, the black slates, etc. (1 of Selwyn), which Logan supposed to form a lower subdivision of what he called the upper copper-bearing series, to distinguish it from the lower copper-bearing or Huronian series, which is overlaid unconformably by these black slates.

This lower subdivision, which I have called the Animikie group, though seen at Thunder Cape between the Huronian and the Nipigon series, is wanting in Black Bay, where Logan found the latter to rest directly upon the Laurentian; and also, according to Bell, on Lake Nipigon, where the Nipigon series reposes on Laurentian and Huronian. Apart from the evidence of its distinctness deducible from the absence of the Animikie in this area at the base of the Nipigon series, I have described a locality near Silver islet, where the basal beds of the Nipigon, resting upon the Animikie, hold pebbles of the characteristic rocks of the latter.

The mineralogical and lithological characteristics of the Nipigon rocks differ so much from the Keweenian as to create a suspicion that they may belong to two distinct series. In this connection an observation of Macfarlane is important. He found the true Keweenian at Mamainse to be uncomformably overlaid by a series of bluish sandstones and shales unlike those of the St. Mary series, and, on the contrary, closely resembling those of the Animikie group, to which he compares them. A summary of the evidence regarding these rocks will be found in my Azoic rocks (*2d geol. survey of Penn*, report E, pp. 230–241).

Meanwhile, it may be regarded as established that we have, in the Lake Superior basin, (1) the Keweenian or cupriferous series, resting unconformably upon the Huronian and other crystalline rocks, and (2) lower Cambrian (Potsdam) strata lying unconformably upon the Keweenian. We have, moreover, (3) the Animikie and (4) the Nipigon group, — two series of strata distinct from each other, and apparently from both of the preceding divisions. The observation of Macfarlane makes it probable that the Animikie belongs to a series newer than the Keweenian; in which case the lithological unlikeness of the still younger Nipigon group both to the Cambrian and the Ordovian (Siluro-Cambrian) rocks of the Lake Superior basin, would, as I have remarked in the report just cited, raise a suspicion that these red and variegated sandstones and marls, with dolomites and brine-springs, which we have called the Nipigon group, may belong to a higher geological horizon.

The name of the Quebec group was, as is well known, given by Logan to what, under the name of upper Taconic, had been long before described by Emmons as a great development of strata of the age of the calciferous and Potsdam divisions of New York. In the disturbed belt where this series is displayed, from the lower St. Lawrence to the Hudson-river valley, and beyond, it is now well known that there are included, besides rocks of this horizon, others of Trenton-Loraine (Ordovian) and of lower Helderberg age, together with older rocks, embracing the lower Taconic of Emmons and the still more ancient crystalline (Huronian) schists called by Logan 'altered Quebec group.' So far as known, there is nothing in this belt of disturbed, faulted, and often inverted strata which can be taken to represent the great Keweenian series. Logan, however, assumed the St. Mary sandstone to be of the age of the Chazy division of the New-York series, and then proceeded to call the underlying Keweenian calciferous or Quebec group, suggesting that the Kamanistiquia slates (Animikie series) might represent the Potsdam. These references, so far as regards the Chazy and calciferous, are embodied in Logan's maps of 1864 and 1866.

This view, which was never any thing more than a crude speculation, was soon shown to be untenable by the establishment of the Potsdam age of the sandstones overlying the Keweenian, both in Wisconsin, as we have already seen, and in northern Michigan, where Rominger finds these upper sandstones to be overlaid by calciferous and Chazy beds.

Unless we assume that every thing uncrystalline below the Trenton group is to be relegated to the Cambrian, there is no ground as yet for extending this name to the Keweenian; while the convenience of having a distinctive appellation for this vast metalliferous series will assure the name Keweenian a distinct and permanent place in geological nomenclature.

T. STERRY HUNT.

Montreal, March 3, 1883.

THE AINOS OF JAPAN.

THE following is an extract from an article on Yezo, in the transactions of the Berlin *Gesellschaft für erdkunde*, 1883, No. 1. The article was written by Professor Dr. Brauns of Halle, who, during his recent geological excursion to Yezo, visited the large settlement of Saghalin Ainos, in the neighborhood of Sapporo.

The Aino race belongs to a type entirely different from that of the Japanese, to whom they are now subject. The fear that the number of the Ainos is diminishing, in consequence of the immigration of the Japanese into Yezo, to an extent that would soon lead to their extinction, is not well founded. According to the estimate of the Japanese government, the total number of Ainos in Yezo, Saghalin, and the Kurile islands, is less than 18,000. While some authors have accepted this estimate, others have set the number of Ainos in Yezo alone as high as 50,000, which, with the addition of those now living under Russian control in Saghalin (from 10,000 to 12,000), and in the southern part of Kamtschatka, would give a total of from 60,000 to 70,000. Although the latter estimate, which is based on a number of reports from different sources (e.g., the missionaries of Hakodate), comes nearer the mark, still the number of Japanese who have settled in Yezo is already greater than that of the Ainos. The Japanese government reports 100,000

Japanese in Yezo, which, making the usual allowance for official exaggeration in matters of this kind, must probably be reduced to about 80,000. Be this as it may, it is certain that the fertile island of Yezo, which is appreciated in a certain way by the Japanese, but which is very irrationally and imperfectly utilized, is very thinly populated. The island has an area of nearly 80,000 □ kilometres, and a population of only about two to the square kilometre.

The Ainos — whose unsophisticated artlessness, love of truth, peaceful disposition, hospitality, and discreet, modest, and sober deportment, by contrast with other orientals, strike one all the more agreeably — show, in their short but well-proportioned body, thick and beautiful hair, and physiognomy, particularly in the deep-set eyes, unmistakable agreements with people of more western countries, say, central Asia. In language, as well as customs and traditions, they are decidedly strangers to the Japanese; but, so peaceful are they, they submit freely to the yoke that has been placed upon them, without ever plotting mischief. Whether for them, as well as for the rich natural advantages of the island of Yezo, a colonization in European fashion would be a great benefit in comparison with that of the Japanese, who have much to learn and much to do for a long time to come in their own country, may here be left undecided. However, such a wish will certainly appear natural to all those who have gained a more intimate acquaintance with the island of Yezo and its inhabitants.

INFLUENCE OF THE VAGUS NERVE UPON THE HEART.

In continuation of his studies upon the physiology of the frog's heart, Löwit confirms[1] Gaskell's discovery, that in normal diastole the cardiac muscle is not completely relaxed, but in a state of slight tonic contraction: this, Löwit finds, is abolished during vagus inhibition. The powerful beats which usually follow a period of inhibition must be due to some change in the heart-muscle, and not in its motor-nerve centres; for Kronecker has proved that every cardiac contraction is maximal. Their cause Löwit finds in the more complete diastolic expansion; and he also explains similarly the more vigorous pulsations sometimes seen during a vagus stimulation not powerful enough to alter the heart's rate of beat. He confirms Schiff's usually ignored discovery, that stimulating the pneumogastric sometimes quickens the pulse; but, after a careful study of the circumstances under which this phenomenon occurs, he rejects Schiff's hypothesis, that the vagus contains only one set of heart nerve-fibres, whose action varies with degree of stimulation, etc. We must assume two distinct sets of fibres, — a cardio-accelerator and a cardio-inhibitory: the latter are more irritable, but more easily injured, bearing thus the same relationship to the accelerator fibres as do the vaso-constrictory nerves to the vaso-dilator, according to Goltz. By exposing the frog's vagus to the action of substances, as nitre, which are known to diminish nerve irritability, one can turn the vagus into a pulse-quickening nerve: on washing out the nitre, it again becomes pulse-slowing; and so, back and forth, several times, until death-changes commence. In mammalia the phenomenon cannot be reproduced with the same certainty; but occasionally one can succeed in getting the vagus into a condition in which its inhibitory fibres are not irritable, while the accelerator are. During vagus acceleration the frog's ventricle becomes paler, indicating a contracted condition of its musculature even in diastole. This abnormal state of tonic contraction is not the cause of the acceleration, for the pallor may precede the pulse-quickening, or last after it; and weak stimuli sometimes cause acceleration with no pallor. The small pulsations usually seen during the acceleration are due to the increased tonicity of the heart-muscle usually present at the same time, and preventing diastolic relaxation of normal extent. The accelerator fibres probably act on motor-nerve centres in the heart, arousing processes, which, when feeble, merely alter the rate of beat; when more powerful, also increase the tonus of the heart-muscle.

H. Newell Martin.

[1] Pflüger's archiv, xxix. 469.

THE EXTINCT LAKE AGASSIZ.

In the recently published Tenth annual report of the geological and natural-history survey of Minnesota, for 1881, Prof. N. H. Winchell gives an abstract (p. 5) of Mr. Warren Upham's observations on the shore-lines of the great sheet of water that once flooded the valley of the Red River of the North, and overflowed southward into the Minnesota. "The lake had three stationary periods, forming three beaches. They all ascend above a given datum level toward the north, the rate increasing in going toward the north. The highest beach-line ascends 125 feet in about 150 miles, the beach being one continuous shore-line. The northern portion of the lake fell at intervals from this high beach-line, . . . while the water-level in the extreme southern part stood nearly stationary, the northern fractional beaches converging into one toward the southern extremity of the lake. The next distinct beach, found in the southern part of the region, ascends toward the north 70 feet in 150 miles. . . . The fall of the lake had therefore been sixty feet more at the northern than at the southern end. . . . The third beach-line, formed when the outlet had been excavated to the level of Lake Traverse, is known along a distance of 135 miles; and its northward ascent was at first 50 feet, and afterwards only about 25 feet. . . . The fall of Lake Agassiz from the highest beach level to the third at Lake Traverse was about 80 feet, and, in the vicinity of Maple Lake, 165 feet. . . . These phenomena seem inconsistent with that hypothesis which supposes an elevation of northern land as a barrier to contain this vast inland lake, inasmuch as these beaches would have to present a slope in the opposite direction, in order to change the outlet from Lake Traverse to Hudson's Bay. . . . They have been ascribed to the operation of the glacial period in the epoch of its decline, when the ice still existed toward the north as a barrier to prevent northern drainage; . . . and in the opinion of Mr. Upham, its attraction was sufficient to move the mass of water toward itself, and to cause an ascending shore-line in that direction. . . . Lake Agassiz probably covered Red Lake under 50 or 100 feet of water above its present level, Lake of the Woods under about 200 feet, the Red River Valley at St. Vincent 450 feet, and Lake Winnipeg about 600 feet." The area thus flooded is much larger than heretofore supposed.

LETTERS TO THE EDITOR.

Movement of the arms in walking.

It seems to me I can best lay this ghost of our animal origin by drawing attention to the fact that the swinging of any part that is sufficiently free may be