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NOTES ON MANITOBA.

NOTES ON THE PHYSICAL PHENOMENA OF MANITOBA AND THE NORTH-WEST TERRITORIES.

From Observations made during Explorations in 1872, 1875, and 1879.

BY JOHN MACOUN, M.A.

The region to which the following remarks will mainly apply is bounded on the south by parallel of Lat. 49°; on the north by parallel of Lat. 60°; on the east by meridian 95°; on the west by the line of the Rocky Mountains. An area, in round numbers, of 667,600 square miles.

For many years this vast region was almost a blank on our maps—little was known of it, either by Englishmen or Canadians, beyond the fact that furs were obtained therefrom. It was not so, however, with the Americans. More than twenty years ago they recognized its value, foretold its great future, and even described it as the prospective granary of the world.

In 1857, Capt. Palliser was commissioned by the British Government to examine the country south of the 54th parallel. Commencing his examination at the international boundary, in the vicinity of the Red River, he made a few traverses and reached Fort Ellice late in season. Proceeding up the right bank of the Qu' Appelle to its head, he crossed the South Saskatchewan and proceeded northward to Carlton, where he wintered. In June, 1858, he turned to the southwest and spent the summer on the Great Plains, wintering that year at Edmonton. In the following spring he again proceeded south to the boundary, but afterwards passed to the west into British Columbia.

He reported in very favorable terms of the northern portion of the country that he had traversed, but of the southern portion he spoke much less favorably—alleging that running water was very scarce; that no wood was to be seen except in the river valleys; and, that owing to the enormous herds of buffalo which covered the plains at that time, feed in many places was poor.

As far as public opinion was concerned the only immediate result of this exploration was that a certain district in the north became known as the "Fertile Belt" and that the southern part about which so little was said, was set down, or assumed, to be arid and of slight value; an opinion still generally prevalent and mainly fostered by writers whose views have been based on a misinterpretation of Capt. Palliser's remarks.

The survey of the International Boundary and the establishment of the Mounted Police Force in 1874, tended in some degree to dispel the cloud which hung over the south. Their frequent journeys have done much since then in the same direction, yet in the minds of the general public, and even of many others who should be better informed, the old prejudice, in a measure, exists against it.

In this position of the question the past only repeated itself. How many are the instances of wealth unknown having passed for centuries under the eye of the dwellers on the spot unappreciated and untouched?

In our day the growth of the Dominion, demanding a through communication from east to west, and the exigencies of the over-populated countries of the old world, have brought it about, that we should be the means of enlightening the world as to the extent of the resources of the "Great North-West," and in so doing, possibly of acting as special agents, fulfilling the beneficent intentions of the all-wise Creator.

Explorers have traversed its length, and settlers have here and there dotted the new land and the reports of one and the other only stimulate us to further research.

Amongst those sent out to explore, I was first commissioned by Mr. Fleming, in 1872, to examine the flora of the prairies between Winnipeg and Edmonton. The same year I was despatched in company with Mr. Charles Horetzki to explore the Peace River and examine the country on its banks. The results were the discovery of the low passes through the Rocky Mountains and of an extensive tract of fertile country, since known as the Peace River District.

In 1875, I accompanied Mr. Selwyn, Director of the Geological Survey, in the capacity of botanist, to British Columbia and from thence by the Peace River Pass to the east of the Rocky Mountains. Circumstances compelled me to descend the Peace River from the Rocky Mountains to Lake Arthabaska and I was thus enabled to see the country as far north as lat. 59°. Turning eastward at this point a journey of 1,200 miles brought me to Winnipeg.

The general conclusions which I arrived at from my explorations of 1872 and 1875 were: 1st, That as there was but one flora common to the region extending through from eight to twelve degrees of latitude, or as far north as 60°, and as that flora required a high summer temperature for its existence, the thermometer would be found to show a correspondingly even distribution of heat throughout the whole region.

2nd. That exceptional or special conditions must exist to produce that high and even distribution of heat discovered as ranging over so great an area.

These conclusions have since been established as facts by the recorded observations sent in from the Meteorological Stations at Winnipeg, Fort McLeod, and Fort Calgarry in the south, and Fort Rae and Fort Simpson in the north. (See Meteorological Report for 1878.)

In 1879 my attention was mainly directed to an investigation of the causes of the supposed aridity of the district lying to the south. I found a parched surface, dried and withered grasses, and in short, every appearance of the existence of such aridity; but closer examination showed that these indications were illusory. At the point, "Blackfoot Crossing" lat. 50° 43′ where the consequences of aridity appeared the strongest, I came upon ground, broken up in the spring, bearing excellent crops of all kinds—oats being four feet high, while on the land outside the fence the grass was burnt up and all other vegetation withered. From this I argued that the rainfall in the district was evidently ample for the requirements of vegetation, but that, until the baked crust was broken, it could not percolate the ground as rapidly as it fell and so a great *portion* was evaporated by the dry atmosphere and lost. Thus the apparent aridity vanishes before the first efforts of husbandry. Next to the question of aridity was that of the high and even temperature of climate. On this point I simply accumulated data bearing on the observations of former years, all of which tended to prove that the great plain to the north-westward, and north of lat. 49°, extending along the Saskatchewan and other rivers between the 100th and 115th meridians, and the narrow strip of coast north of Montery, California, present decided features of difference from other districts of the American continent. These differences and peculiarities I shall now deal with *seriatim*.

TEMPERATURE.

It was long ago asserted as a principle by Geologists that, "land in quantity situated to the southward of lat. 40° north very materially raises the temperature of lands lying so the north of such parallel." (Sir C. Lyell.) To the expression "land in quantity," I would add *when its character is that of a desert or arid nature.* Another maxim has been laid down by a well known writer on American Climatology (Blodgett) "that high arid plains are indicative of great summer heat, of an arid atmosphere, and of little rain or snowfall. Now the conditions required to test the accuracy of both these propositions are presented in the position occupied by the North-West Territory. South of our boundary within the United States lies a vast tract of land, generally arid or desert, of which at least 500,000 square miles are embraced in a plateau which has a general level of 6,000 feet. At Laramie City, in lat. 42° it is about 7,000 feet above sea level, from thence northward it rapidly falls off so that when it reaches our boundary in lat. 49° at Pembina, it is considerably under 1,000 feet. At the base of the Rocky Mountains it is under 4,000 feet. From the boundary the plain extends far to the north and only terminates at the Arctic Sea. In such a wide range of latitude it might well be expected that a considerable difference of temperature would be found. The following Table, however, shows the temperature as being wonderfully uniform :—(See Metereological Report, 1878.)

PLACE.	Lat.	Long. W.	May.	June.	July.	Aug.	Mean of Summer Months.
Winnipeg	49.53	97.07		59.2	65.8	63.3	62.8
Fort McLeod..	49.39	113.42		60.6	63.3	57.0	60.3
Norway House.	54.00	98.00		54.9	63.5	61.2	59.9
Fort Simpson..	61.52	121.25		58.8	63.4	63.2	61.8

In the same parallels of lat. in Europe the temperature is recorded as follows: (See Blodgett.)

PLACE.	Lat.	May.	June.	July.	Aug.	Mean of Summer Months.
Penzance, S.W. England	50.08		59.5	62.1	61.1	60.9
Cracow, in Poland	50.04		64.0	65.8	64.9	64.9
Konigsberg, in Prussia..	54.42		57.4	62.6	61.7	60.6
St. Petersburg, in Russia	59.56		58.2	62.7	60.8	60.6

We therefore see that the summer temperature of the North-West Territories is exceptional, and may be taken as confirmatory of the views quoted. Believing, however, that in addition to the quoted causes, there are others which contribute to this result of exceptional temperature, I purpose, for the present, to treat it simply as a fact to be noted for further comment, and pass on to the subject of isothermals. The recorded lines of equal temperature show that the various lines of heat, as they make westing from the eastern coast of the continent, tend in summer to curve upwards from the Gulf of Mexico in a north-westerly direction to a point in lat. 50° long. 110° west. At this point the mean summer temperature is 70° F., while at Winnipeg, on the same parallel of lat., but 15° farther east, the temperature is but 65°. Tracing these isothermals still further north, the line of greatest heat passes near Fort Vermillion in lat. 58° 24′ and long. 116° 30′ W. I may mention that at this point I found barley cut on August 6th, 1875, and wheat almost ripe. Still farther north and west, the table shows that Fort Simpson has a mean summer temperature of 61°.8 F. Turning to the west coast, the isothermal lines commence to turn northward from the Gulf of California, and for a time skirt the western side of the Rocky Mountains. On reaching the low point of the chain between lat. 41° and 45° they turn to the east, cross the mountains, and strike the Dominion boundary on the 115th meridian. These westerly currents, named the "Chinooks," have been known to cause a rise in the temperature of 60° in a few hours. When in that country I enquired from a half breed about their effect on the snow. His reply was, "the Chinook licks up snow, water and all."

After crossing the Rocky Mountains the thermometric current of the west meets that of the east at or about Hand Hills in lat. 51.20°, long. 112°. There, in 1879, I found that for days together, during August, the thermometer in the shade registered from 87° to 92° F. From the Hand Hills the united currents following their resultant direction carry the temperature (of latitude extending almost to New Orleans) over the plains of the North-West, and confer on it the blessing of a climate, not only exceptional as regards character, but productive of results to the agriculturist, which, I believe, are unsurpassed in any other part of the world.

Returning, however, to the course taken by the east and west currents before their union at the Hand Hills, it is a matter for consideration, why that from the east should depart, not only, from the natural law which would give to it an eastward, in place of a westward, bend as it rises northward from the Gulf of Mexico, but also from that of the western current which follows the natural law and bends to the eastward.

The answer to this question is *the key and the solution of almost every climatological peculiarity of the North-West.*

The data which we have for the investigation of the question: Why does the eastern current of heat proceeding north-westward from the Gulf of Mexico bend to the west? are:

1st. Recorded observations which show that land of a desert character is heated to a greater degree than that without its bounds.

2nd. Recorded observations which show that currents of air are constantly on the move to the spots where the land is most heated.

3rd. The fact that to the westward of the tract running northward from the Gulf of Mexico lies the "Great American Desert," which, from the preceding statements, must exercise an influence on the air around it.

To my mind, no argument is needed to show that the cause of the divergence of the eastern thermometric current to the westward is solely due to the position and effect produced by the American Desert. A confirmation of this inference is offered in the eastern hemisphere where the south-east trade winds are drawn out of their course by the heated atmosphere of Western Indies, and result in the South-West Monsoon, and further by the north-eastern trend of the isothermals in Northern Asia. In the transition from summer to winter we find the Desert losing its temperature (terrestrial and atmospheric), and consequent attractive influence on air currents warmer than its own, the first effect of which is that the isothermals pass away from their northern altitude and sink southward next, when freed from the desert influences, they no longer trend to the westward, but to the eastward. On the withdrawal of the southern warm currents, other currents from the north and from the west follow them up, particularly on the east side of the Rockies, and establish the prevailing north-west winter winds, which, being affected by the temperature of the Arctic Regions on the one hand, and by the Mountains on the other, bring the minimum line of cold so far to the south. Were the American Desert an inland sea, the summers of our plains would lose their exceptional character, and our winters would be like those of Eastern Europe.

In a paper like the present, however, it would be out of place to discuss the climate of the eastern hemisphere; but it could be shown that precisely similar causes to those which I have specified can be traced as existing there, and as being productive of the same results.

HUMIDITY.

The rainfall of the North-West offers as favorable a contrast to that of other districts as the temperature has shown. Rains come just when they are wanted and cease when vegetation not only no longer requires them, but when their continuance would be injurious and detrimental to harvesting. Formerly the rainfall of a country was judged by the average for the whole year. Such a comparison, however, is misleading. What we want to know is the quantity that may be expected to fall:

(*a*) During the period of vegetation and its distribution month by month. (*b*) During the harvest months.

The period of vegetation in the North-West embraces May, June, July and August. The harvest months are September and October. To show how favorably these two conditions are determined for the North-West I append the following tabularly arranged statements of rainfall:

TABLE I.—FOR THE FOUR MONTHS OF VEGETATION.

PLACE.	Position.		Rainfall in Inches.				Total for 4 Months.
	Lat.	Alt.	May.	June.	July.	Aug.	
Winnipeg, N. W. T.	49·53	7·40	2·17	3·42	2·68	7·11	15·37
Toronto, Ontario....	43·39	3·50	2·98	3·04	3·72	2·81	12·55
Fort Riley, Kansas..	9·03	13·00	4·14	3·08	1·08	2·99	11·29
Rochester, New York	43·07	5·06	3·04	3·25	3·01	2·60	11·90

TABLE II.—FOR THE TWO MONTHS OF HARVEST.

PLACE.	Position.		Rainfall in Inches.		Total for 2 Months.
	Lat.	Alt.	Sept.	Oct.	
Winnipeg, N. W. T.	49·53	70·40	0·73	0·03	0·76
Toronto, Ontario....	43·39	3·50	4·45	2·96	7·41
Fort Riley, Kansas .	39·03	13·00	4·13	0·02	4·20
Rochester, New York	43·07	5·09	3·05	3·39	6·41

Having stated what the recorded facts as to rainfall are, I will give my reasons for asserting that these facts are but the necessary consequences of the physical conditions existing in the West of the North American Continent.

In the early part of this paper I referred to the position of the Great American Desert and pointed out one of its effects on the air currents rising northward from the Gulf of Mexico—viz,, its power to attract and draw them to itself, and to the westward of their natural course. Another effect, now first mentioned, is that arising from the heat given off from the surface by radiation during the summer months. The Gulf air currents, laden with moisture, when drawn over the desert are met by the rarified and heated air ascending from its surface, and that rainfall which in the ordinary course they would shower down (being prevented from falling) passes on and is wafted by the prevailing winds in the direction of our North-West, where, being removed from the effects of the desert heat, they give forth their long borne and priceless load in the form of our summer rains.

Having shown cause for the summer rains, I may, now, state that the simple "suspension of those desert effects which gave the summer rains" is the cause of the almost total absence of rain in the autumn and winter periods.

It was shown when writing on the winter temperature that as the desert cooled down the main air currents from the Gulf of Mexico no longer pursued a westward course but passed to the eastward. This change of direction takes them over the region of the Canadian Lakes where they deposit that rainfall which in summer fell on the plains of the North-West.

AGRICULTURAL OPERATIONS.

The progress of the seasons and the labours of the husbandman may be summarized as follows:

Early in April the hot and unclouded sun clears from the lands the last of its light snow-covering—thaws, and at the same time dries the ground sufficiently to fit it for the plough—and almost simultaneously for seeding. Germination quickly follows and the young roots, moistened by the thawing of the subsoil, follow the pores opened out by the disintegrating power of the winter frosts, and penetrate to a depth inconceivable to those who have not put the matter to the test. By the time that the rains of May and June come the roots have a firm hold of the ground, and growth is extraordinary. The July and early August rains nourish and swell the ear of the now ripening crops, and complete the promise of the early spring. Towards the end of August the winds change and the almost rainless period sets in and continues all winter. The Farmer harvests his crop without loss and in the highest possible condition; stacking it in the open without even the necessity of thatching it for the winter.

TO STOCK BREEDERS

The advantages are equally great. Storms of sleet or wet snow are unknown on the Western Plains. Such snow as does fall is always dry and light, hence cattle and horses may be left out the whole winter without the possibility of suffering from wet. Intense cold they may experience, but stock-raisers know that where such cold is dry their cattle take no harm. Hence cattle can be, and are raised, on the North-West Plains without the necessity for buildings for wintering them.

SOME OBSERVATIONS ON THE PHILEBUS OF PLATO,

THE POSITION OF THE ROWERS IN THE WAR-SHIPS OF THE ANCIENTS, &c.

BY W. D. PEARMAN, M. A.
Classical Tutor and Dean of Residence in University College, Toronto.

Euripides, *Iphigenia in Aul.* v. 808. In this line, Dindorf and others have taken exception to the word ἄπαιδες—for which some read with Bothe εὔπαιδας, while others adopt Musgrave's conjecture καὶ παῖδας. Properly understood, ἄπαιδες seems to me preferable, not only as being the MSS. reading, but also in point of sense.

Achilles states that the men of the expedition, chafing at their detention at Aulis, are not all similarly situated: Some, like himself, ἄζυγες γάμων Οἴκους ἐρήμους ἐκλιπόντες, others ἔχοντες εὔνιδας Ἄπαιδες. Here he pauses in his enumeration—τοὐμὸν μὲν οὖν κ.τ.λ., "others may speak for themselves, he will state his own case." As I take it, ἔχοντες εὔνιδας κ.τ.λ. should be rendered "others, although they have wives, have no children." These, then, would belong to the class specially exempt from military service, under the Mosaic dispensation (cp. Deuteronomy, ch. XX. v. 7; XXIV. v. 5). Hence the force of the following parenthesis—οὕτω δεινὸς ἐμπέπτωκ' ἔρως κ.τ.λ., "so constraining a desire for this service hath befallen Hellas."

Ibid. v. 1143.

Those who have adopted Porson's alteration of κάμνῃς into κάμῃς, seem to have overlooked the fact that the imperative force is neither absolutely necessary nor, as I think, desirable. Agamemnon, dumbfoundered at finding his designs discovered, lets falls the exclamation, "I am lost! my secret is betrayed!" While he is hesitating and thinking what to say next, Clytemnestra sarcastically resumes, "I know all! your very silence amounts to a confession, *so that you need not weary yourself* with a long and idle story." Of course, if we retain κάμνῃς, the period after πολλά must be removed.

Homer, Iliad, B. XVIII. v. 119. ἀργαλέος χόλος suggests itself to me as the original of Horace's "*splendida bilis*" (Sat. II. iii. 141). I have never been able to persuade myself that such a master of epithets, as Horace undoubtedly was, would have allowed himself to use such an apparently meaningless epithet as *splendida*, without some special reason. Now this verse of Homer's would seem to have passed into a proverb (the description of χόλος, in the verses immediately preceding it, is quoted by Plato, *Phileb.* 47 E.); and it is probable that Horace, with this phrase of Homer's floating idly in his memory, wrote *splendida* as a translation of ἀργαλέος, not stopping to reflect that this word was from a different root than the similar sounding derivatives of ἀργός "bright and glistening." Horace himself tells us, in more than one passage, that he repeatedly conned the Homeric poems; and we frequently find scraps from the Iliad and Odyssey, literally rendered and introduced, apparently, quite as much for the purpose of displaying Horace's archæological lore, as from the appositeness of the quotation. If this assumption of mine be correct, it curiously illustrates Pindar, *Pyth.* IV. v. 109. λευκαῖς πιθήσαντα φρεσίν—where it has been suggested (Donaldson's note *ad locum*) that Pindar has miscopied Homer's φρεσὶ λευγαλέῃσι πιθήσας. Apropos of derivations, I find, in the Lexica, the word ἀμυδρός variously derived from ἀμαυρός and from an Indo-European *madra*. A much simpler derivation would be from the Homeric ἄμυδις "all together," *i.e.*, *confusus* as opposed to *distinctus*.

Xenophon, *Anab.* V. vii. 25. καὶ ἐπνίγετο ὅστις νεῖν μὴ ἐτύγχανεν ἐπιστάμενος. This passage illustrates, in the most striking manner, the necessity for attention to the distinctions of tense in the Greek verb. I have never seen it correctly translated. Xenophon is deploring a tumultuous spirit which had developed itself among the soldiers. He says that, owing to their menacing behaviour on a certain occasion, many people had been so much alarmed that they had cast themselves into the sea in their efforts to escape, "and whoever did not happen to know how to swim *was in a fair way for being drowned.*" If ἐπνίγετο had signified "*was drowned*," as it is usually rendered, Xenophon would not have failed to dwell upon the loss of life occasioned by this outrage.

Livy, B. IX. cp. 16, furnishes an example of a far more amusing, but perhaps more excusable, mistranslation than the above. Writers of Roman history gravely tell us that Papirius Cursor was such a martinet that, according to Livy, when his troopers applied to him for some relaxation of their discipline, he replied: "Yes, I will relieve you from the obligation of giving a pat to *your horse's* back when you dismount." The words are "*ne nihil remissum dicatis, remitto, 'inquit,' ne utique dorsum demulceatis, quum ex equis descendetis.*" If any one, who has ever ridden without a saddle, will recall his first instinctive movement on dismounting, *equo lassus ab indomito*, he will have no doubt either as to the nature of the action or the owner of the *dorsum.*

Plato, *Repub.* B. X. 615. D. I cannot see why ἂν ἥξει should be retained (as one of the exceptions to the rule against ἄν with Fut. Indic.), when the sense plainly requires ἀνήξει—*i.e.* "*neque adest neque adfuturus est ex inferis.*" The speakers have ascended, Ardiæus is still below, *cp.* 615. E.

Plato, *Philebus*, 17. B. καὶ οὐδὲν ἑτέρῳ γε τούτων κ.τ.λ. It has been objected to this reading, that the sense requires οὐδετέρῳ. I am inclined to think that the original was οὐδενὶ ἑτέρῳ, and that the letter ι has suffered elision at the hands of the copyist.

Ibid. 18. B. μὴ ἐπὶ τὸ ἓν εὐθὺς ἀλλ' ἐπ' ἀριθμόν αὖ τινὰ πλῆθος ἕκαστον ἔχοντά τι κατανοεῖν, τελευτᾶν τε ἐκ πάντων εἰς ἕν. Stallbaum says that all the MSS. agree in exhibiting this reading; however, as he finds it unintelligible, he concludes that there is a mistake somewhere. He would read ἑκάστοτε, in which sense some commentators have wished to explain ἕκαστον. If it does not savour too much of presumption, I should say that the error arose from their not perceiving that ἕκαστον was in construction with ἀριθμόν—not with πλῆθος. I consider πλῆθός τι as the object of ἔχοντα, and the sentence πλῆθος ἕκαστον ἔχοντά τι as a parenthesis; ἕκαστον then would mean each of the subordinate *genera*—("each" of the "two or three, &c.," 16. D.). The rest of the construction might be explained thus: δεῖ βλέποντα . . . κατανοεῖν αὐτὸν (τὸν ἀριθμόν *scil.* ὁπόσα).

Ibid. 19. C. ἀλλὰ καλὸν μὲν τὸ ξύμπαντα κ.τ.λ. I am surprised that Stallbaum has not noticed a manifest reference to the old proverb, "*primus qui ipse consulit, &c.*" Cp. Hdt. VII. 16; Sophocles, *Antig.* v. 720; Livy, XXII. 29.

Ibid. 20. D. ἀναγκαιότατον. The meaning of this word is obviously "*the least one could say.*" This sense of ἀναγκαιότατος is frequently lost sight of, *e.g.*, in the Gorgias 505. E., where (as I pointed out, in the Journal of the Canadian Institute for 1872) the idea conveyed is that the dialogue, if carried on by Socrates alone, would be a very poor affair, cp. Repub. 369. D.

Ibid. 30. E. *νοῦς ἐστὶ γενούστης τοῦ πάντων αἰτίου λεχθέντος τῶν τεττάρων ὧν ἦν ἡμῖν ἓν τοῦτο.* This is indeed a much vexed passage; Stallbaum defends *γενούστης*, which is evidently a play upon the jingle *νοῦς* and *γένους*, on the ground that Hesychius and Suidas both mention it as a word used by Plato, as a synonym for *γεννήτης* or *συγγενής*, but gives up the latter part of this passage as a "*locus manifesto corruptus.*" For my own part, I cannot see the necessity for despair. In 30. B. the four *γένη* are enumerated: *πέρας καὶ ἄπειρον καὶ κοινὸν καὶ τὸ τῆς αἰτίας γένος, ἐν ἅπασι τέταρτον ἐνόν*; and, as far as I can see, the two statements are exactly parallel.

Ibid. 40. E. *τί δέ; πονηρὰς δόξας καὶ χρηστὰς ἄλλως ἢ ψευδεῖς γιγνομένας ἔχομεν εἰπεῖν.* For the omission of *καὶ ἀληθεῖς*, in addition to other parallels, one might compare the customary ellipse with *ἐν μέσῳ*, *e.g.*, Aristophanes, *Av.* v. 187. *ἐν μέσῳ δήπουθεν ἀήρ ἐστι γῆς*, and Euripides, *Phœniss.* v. 583.

Ibid. 44. D. *δυσχεράσματα.* This word, which Pollux mentions with disapproval and Lobeck condemns, although manifestly a reading of the highest antiquity, is, I am tempted to believe, a corruption arising from the confusion of *δυσχερείας* with the *μετά* of the following sentence. The bastard *δυσχεράσματα* would, I think, be the natural offspring of *δυσχερείας μετά*. The union of the two words being brought about by the feeling that a neuter plural, agreeing with *τἆλλα*, would suit the construction much better than the somewhat awkward *δυσχερείας*.

Ibid. 46. E. Stallbaum reads *ἀμηχάνους ἡδονάς, τότε δὲ τοὐναντίον τοῖς ἔντος πρὸς τὰς τῶν ἔξω λύπας ἡδονὰς ξυγκερασθείσας κ.τ.λ.*; but says "*προστάττων* Bodl. Ven. II. *Dein libri omnes ἡδοναῖς, quod de coniectura Schützii in ἡδονάς mutavimus.*"

I am inclined to think that *προστάττων* is really *πρὸς τὰ τῶν*, it being a frequent practice in MSS. to represent double letters by a letter of larger type. Hence recurrent letters are often omitted, and *vice versa*, according as the eye of the copyist was attracted by a difference in the size of the letter. Here I believe that the original reading was—*τοὐναντίον τοῖς ἔντος πρὸς τὰ τῶν ἔξω, λύπας ἡδοναῖς ξυγκερασθείσας κ.τ.λ.* I consider *τοὐναντίον—ἔξω* as a parenthesis, and would translate thus: "Sometimes inconceivable pleasures, and at others (*the contrast between the internal and the external* *sensations*) pains mingled with pleasures." With regard to the construction, τούτοις πρὸς ἐκείνους is the ordinary mode of expressing enmity or opposition between two parties.

Ibid. 47. C. περὶ δὲ τῶν ἐν ψυχῇ σώματι τἀναντία ξυμβάλλεται. Here, as Stallbaum says, "*deest aliquid ad loci integritatem.*" Buttmann conjectured ἐν ψυχῇ καὶ σώματι, ὅταν ψυχὴ σώματι τἀναντία ξυμβάλληται, which suits the sense admirably, but is too violent a remedy. Ast imagines that ᾗ has fallen out after ψυχῇ; but, as Stallbaum says, this would hardly suit the sense. I am inclined to think that the most natural remedy would be to supply ᾗ, which would readily be absorbed in the final syllable of ψυχῇ (see note on 46. E.), and would suit the sense equally with Buttmann's reading. I would render—"But concerning those in the soul, where it contributes (to the mixture) opposite sensations to those of the body, viz., pain in immediate contrast with the body's pleasure, &c."

The Trireme.

In a series of papers, which have appeared, from time to time, in the Revue Des Deux Mondes, entitled "La Marine De L'Avenir Et La Marine Des Anciens," M. le Vice-Amiral Jurien de la Gravière, well known as a naval officer holding high command in the Crimean and Mexican campaigns, has examined historically the naval expeditions of the Ancients, with a view to their bearing on the tactics likely to be adopted by modern navies. In the course of his remarks, he finds it necessary to refer to the much vexed question of the *Trireme.* Was the *Triremis* or *Τριήρης*, of the Ancient Greeks and Romans, a vessel with three banks of oars, one above the other, as the Dictionaries tell us? The answer, which he gives to this question, is that which has been given by every practical seaman, from the old Sieur Barras de la Penne, Capitaine des galères du Roi, down to the present time. All seem to agree that, even if a vessel so constructed might manage to move in smooth water, it would be almost impossible for it to manœuvre in a rough sea, or in the rapid alternations of a naval combat. How then can we credit the existence of such monstrosities as *quinqueremes* and *naves sedecim ordinum*, not to speak of the τεσσαρακοντήρης of Ptolemy Philopator?

Plainly some other solution must be found; for the fact that there were vessels so named is too well attested to admit of dispute. The first idea, which would naturally occur to one, is that these vessels received their names, not from the number of their oars, but from the number of men at each oar; and this is the view taken by most of the opponents of the theory of three or more tiers of oars. A very strong argument in its favour is derived from the practice on board the war-galleys of the 16th and 17th centuries, in which each oar was worked by five rowers: *quinqueremes* they are called by the advocates of this view of the question. But, reply the others, in this case, how do you account for the terms θρανίτης, ζυγίτης and θαλαμίτης, which, say they, were unmistakably applied to the upper, middle and lower tiers of rowers respectively, and to the oars used by them? Barras de la Penne (following the Scholiast on Aristophanes, *Ranae*), thinks that they received these names from their position, fore, aft or amidships. The θρανίτης, who sat nearest to the stern, was placed higher than the θαλαμίτης, used a longer oar and received higher pay. In his opinion, the confusion has arisen from a failure to realize the well known fact that *remus* is often used with the signification of *remex;* just as we say "a good oar" for "a good oarsman." Certainly many passages, in the Ancient Classics, admit of this explanation; but there are others, in which the supraposition of the one class of rowers seems to be too clearly indicated to be disposed of thus easily. Lastly, the great difficulty has always been the fact that, although, in the great majority of pictures representing war-ships, only one tier of oars is to be seen; still in a few coins and some monuments, notably in the figures on Trajan's column, vessels are depicted, in which we apparently distinguish *two* tiers of oars.

Here, I think, lies the way out of this last difficulty. Why only *two?* "Because there was not room for more on the coins," say the apologists; but this does not apply to the marbles. It has been remarked that, where there are two tiers visible, the oars in the lower tier do not exactly resemble those in the upper tier; and it has been suggested that one of these tiers consists of dummies—possibly, guards to prevent one oar from interfering with the other. It may be objected that such dummies would have materially impeded the vessel's progress, against a wind or through rough water. After reading M. de la Gravière's vigorous protest against the admission of what he has stated to be a practical impossibility—whatever history or the monuments might say to the contrary—I was led to the conclusion that there must be some mode of reconciling fact with tradition; and the following suggested itself to me as not improbable.

One has often noticed in old wood cuts, and in most pictures drawn by children, an attempt to exhibit two opposite sides of an object, without regard for the perspective. Now one way of doing this—one sometimes sees it done intentionally in drawings of machinery—is to raise the outer side above the other. As I take it, in the few instances in which we find a second tier of oars, the artist, knowing that a spectator would see the oars only of the rowers nearest to him, the rowers themselves being partly hidden by the bulwarks, while the rowers on the other side, being further from the intervening bulwarks, would be more conspicuous, wished to bring their oars also into view. No doubt this error in the perspective, once introduced by the original artist, would be carried still further by the copyist, who possibly never saw such a vessel in his life; and this too would explain some of the strange comments which are to be found in later writers. With regard to the supraposition of the rowers, I cannot but think that, especially in very large vessels, where each oar was manned by ten or sixteen rowers, it would be necessary for the men at the upper extremity of the oar to be placed higher than those nearer to the thole pin; otherwise they would hardly have been able to reach the end of the oar when it was dipped in the water. As the upper part of the oar would necessarily describe a greater curve than the lower, it would be natural that the pay of the *Thranite* should be higher than that of the *Thalamite*. In the case of Ptolemy's ship, it is probable that the rowers relieved one another, and did not all row at the same time. When I had arrived at the above conclusion, it occurred to me that the term *θαλαμίτης* admitted of a very significant derivation (it is ordinarily supposed to be connected with *θάλαμος*, *i.e.* "the man who sits in the hold"). The aperture through which the oar projected was called *ἡ θαλαμία scil. ὀπή*; and, as I take it, both these words are derived from *σκαλμός*, "the thole pin" to which the oar was fastened; *σκαλμός* naturally passes into *σκαλαμος*. On calculating the probabilities in favour of this derivation, I came across one or two other words for which it seemed to me more natural to assume a parallel phonetic change, than to assign them to the roots to which they are ordinarily referred: *e.g.*, *θώπτω* is suggestive of *σκώπτω*, *θάπτω* of *σκάπτω* (cp. *τάφρος*). Accordingly *ὁ θαλαμίτης* would be the rower who sat nearest to the thole pin. As I thought that the probabilities were in favour of this view, I ventured to communicate it to the Admiral, who had expressed his anxiety to obtain some solution of the difficulty; and he, in acknowledging my letter very politely, has condescended to express his satisfaction with my explanation. About a fortnight after the despatch of my letter, I received a very curious confirmation of this derivation, at least in part, from some remarks, which appeared in a following number of the Revue, by M. le Contre-Amiral Luigi Fincati, of the Italian navy, who has criticised M. de la Gravière's statements. M. Fincati, speaking of the Venetian navy, says that the rowers were protected by vertical shields placed above the "armatures" (outriggers) on which the oars worked. These shields, he says, were successively called *talamii, talari, ali* and *morti;* and the θαλαμίτης was so called, because he sat nearest to the *talamii.* M. Fincati's view, although pronounced impracticable by the French Admiral, is remarkable. He maintains that, until the latter half of the 16th century, the war-ships of the Mediterranean were always, *par excellence,* triremes. The crew was composed of two hundred men; of whom one hundred and fifty were rowers, seated three and three on the twenty-five benches placed on either side of the vessel; he thinks that these benches were arranged obliquely, and that each man had a separate oar; so that the oars reached the water in groups of three, at intervals corresponding with the distance between the benches: but he adds that, about the middle of the 16th century, this arrangement was altered, and the three men rowed with one oar. He cites as his authorities the *Historie del mio tempo* of Natal Conti, the *Armata Navale* of Pantero Pantera, Cristoforo da Canale, and other writers to which I have not access. However, the probabilities seem to be decidedly in favour of M. de la Gravière, who is even less disposed to allow the possibility of this arrangement than of the old one. Just imagine what would happen, with three men on a bench, each having a good long oar in his hand, if one of them chanced to "catch a crab," or was knocked over at a critical moment! his swinging oar would throw the whole equipage into a state of disastrous confusion. In one of the early numbers of the Revue, M. de la Gravière mentions the fact that the Maritime Statutes, of the 14th century, speak of the galleys as *armatae ad tres remos ad banchum* "equipped for three oars to a bench;" and such passages as this are, in all probability, the source of what I cannot help calling the error of M. Fincati and his authorities. Barras de la Penne has warned us that we must not suffer ourselves to be misled by the word *remus.* And, besides, a passage from Zosimus (*flor.* A.D. 420) which has often been cited on the opposite side, expressly tells us that, although Polybius had described the Romans and Carthaginians as using vessels with six banks of oars, they had ceased to construct even triremes long before his time.

Doletus, indeed, the virulent adversary of Erasmus of Rotterdam, tells us (A.D. 1537) that he saw such a *quinquereme*, at Venice, "*prima adolescentia;*" but, unfortunately, he tells us also that the rowers were placed in tiers, one above the other: an arrangement of which M. Fincati himself admits the impossibility. Now Doletus may be easily disposed of: he is defending himself against a charge of ignorant appropriation from a work by the learned Bayfius; and it is absolutely necessary for him to bring out something original. Bayfius has ended by declaring his doubts as to the possibility of three or more tiers of oars: Doletus finds no difficulty in saying that he has *seen*. No one, who has waded through the foul torrent of invective in which Doletus indulges, would take his word for anything. Moreover, he says "*prima adolescentia:*" let us trust that he had forgotten. After examining with some care the numerous passages cited by Bayfius, Meibomius, Opellius, Scheffer and Voss, I have come to the conclusion that most of them may be satisfactorily explained. Considerable latitude must, of course, be allowed in the case of quotations from the poets—although there is one passage, in particular (Arrian, *Exped. Alexand.* VI. 5), which can only be accounted for on the theory that some interpolator has been at work. Finally, we must not lose sight of the fact that Ancient war-ships were not constructed on such rigidly scientific principles or with such exact workmanship, that barely *possible* positions and *intricate* combinations may be assumed for seating the men and adjusting their oars: on the contrary, the doubt must be given against such; and no arrangement but the simplest and most feasible can be accepted, if we are to believe that, in the First Punic war, the fleet of Duillius was ready to sail within sixty days of the felling of the timber, or that, in the Second, Scipio's was built in still less time. Moreover, we must bear in mind that intricate combinations require absolute order; and however much this might have been observed (and Xenophon tells us that it was observed, adding that the trireme was crowded with men σεσαγμένη ἀνθρώπων) on ordinary occasions; yet, with a shower of darts falling on the men and the waves leaping up against the oars, it must occasionally have been impossible to avoid confusion, and that too at the critical moment.

In conclusion, I will examine one or two of the most notable passages, which present considerable difficulty at first sight.

Xenophon, *H. G.* II. i. 28, where Conon is surprised at Ægos Potamos: the crews, which had dispersed on shore, rush hurriedly to their ships; but the enemy is upon them, before the vessels can be manned; and they have to push off in the following condition: *αἱ μὲν τῶν νεῶν δίκροτοι ἦσαν, αἱ δὲ μονόκροτοι, αἱ δὲ παντελῶς κεναί* (we find elsewhere *δίκροτος* and *διήρης* used as synonyms). It has generally been assumed that this must mean that some of the vessels had only *one* or *two* of their *three banks* of oars manned. But we know, from other sources, that each rower had his proper station at a particular oar; and it is much more likely, in my opinion, that instinct would be supreme in the confusion; so that, as each man hurried up, he would rush to his particular oar (whether his station was fore or aft, below or above), and proceed to cast it loose, without waiting for his comrades of the same bench or (for the sake of argument) "*tier*." I would explain thus: "Some of the ships had but two men to an oar, others but one, &c."

Lucan, *Pharsal.* III. v. 536, foll.:

> "Validasque triremes,
> Quasque quater surgens exstructi remigis ordo
> Commovet, et plures quae mergunt aequore pinus,
> Multiplices cinxere rates: hoc robur aperto
> Oppositum pelago. Lunata fronte recedunt
> Ordine contentae gemino crevisse Liburnae.
> Celsior at cunctis Bruti praetoria puppis
> Verberibus senis agitur, molemque profundo
> Invehit et summis longe petit aequora remis."

Here we have *biremes, triremes, quadriremes, quinqueremes*, and the *hexeris* of Brutus.—*Exstructi remigis:*—As I have said before, in these huge vessels, the men nearer the upper extremity of the oar must have been placed higher than those nearer to the thole pin; but, if each man had a separate oar, how long and awkward the highest must have been! The *Liburnae*, which were light, swift sailing vessels, are said to have been content "*ordine gemino*"—naturally, as the *Liburnae* did not stand so high out of the water, their oars would be shorter and more easily managed. Whereas the *praetoria puppis*, which towered above all the others (*celsior, &c.*), would, necessarily, have longer and heavier oars; hence each was plied by six men. Scaliger's objection, that the words "*summis remis*" suggest that this vessel had other oars nearer to the water, may be met, I think, with the answer that these oars are not *summi* as compared with others in the same ship, but in comparison with those of the other vessels. Again Bayfius cites passages in which we are told, incidentally, that the *quinqueremes* breasted a rough sea better than the *triremes;* and this could hardly have been the case if their oars, necessarily longer and heavier, had been manned by a single rower.

Æschylus, *Agam.* v. 1618.

σὺ ταῦτα φωνεῖς νερτέρᾳ προσήμενος
κώπῃ κρατούντων τῶν ἐπὶ ζυγῷ δορός;

Here, *οἱ ἐπὶ ζυγῷ* are supposed to be *οἱ ζυγῖται*—and Paley renders "those on the upper benches." But it is more natural to understand here, the officers and fighting men; who occupied a higher position, in both senses, than those who "sat at the oar below." The haughty taunt of Ægisthus is shorn of half its sarcasm, if he merely contrasts himself with fellow workers, who occupied a position but one grade lower than his own.

Aristophanes, *Equites*, v. 545. *Αἴρεσθ' αὐτῷ πολὺ τὸ ῥόθιον, παραπέμψατ' ἐφ' ἕνδεκα κώπαις κ.τ.λ.*

Although this passage does not bear directly upon the subject of my remarks, I cannot help noticing, as I have not seen it elsewhere, a curious explanation which Isaac Voss gives of the phrase *ἐφ' ἕνδεκα κώπαις*: he says that the speed at which a galley was going, was roughly calculated by the number of benches which were passed at a stroke; fast travelling, in his day, was a stroke which drove the galley a distance of seven benches. According to his view, "with an eleven oar stroke," would mean that the distance between eleven benches was passed at each stroke. Scheffer quotes Silius, where a light Liburnian galley is said to have passed more than its own length at each stroke. *Pun.* XIII. v. 240.

"Quanta est vis agili per caerula summa Liburnae,
Quae, pariter quoties revocatae ad pectora tonsae
Percussere fretum, ventis fugit ocior, et se,
Quam longa est, uno remorum praeterit ictu."

Of course, the actual speed would depend upon the time of the stroke. Voss tells us that twelve hundred *stadia* (about 140 miles) a day, was considered very fast sailing for a Liburnian, whereas the modern galleys went much faster—often covering a distance of 1,400 *stadia* in that time.

ASIATIC TRIBES IN NORTH AMERICA.

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In a former paper on the Algonquins I directed attention to the difference between the grammatical forms of that people and those of the nations by which they are surrounded, or whose territory borders on the Algonquin area. I also indicated that the Algonquin dialects exhibit traces of Turanian influence, which I referred to the proximity of tribes speaking languages whose structure is largely Turanian. This Asiatic influence appears, even more strikingly, in the arts and exercises, dress, manners and customs of the Algonquins. The birch-bark canoe and wigwam, the modes of warfare and hunting, the skin dress and lodge, the snowshoe, ornamentation with porcupine quills, the calumet, are not in any sense Polynesian. Neither are they aboriginal, or adaptations made first upon this continent to the necessities of the country. They existed, as in a measure they still exist, in northern Europe and Asia, before the time of Herodotus, when the Scythian took the scalp of his slain enemy. The Malay Algonquin adopted the implements, dress and customs of the people who occupied the country at the period of his immigration; but retained his soft, liquid speech, with much of his oceanic construction of language, and most of the traits of the Polynesian character. His quiet reserve is as unlike the manners of the rude, boisterous and fun-loving Athabascan as is the silent dignity of the Malay compared with the noisy childish ways of the Papuan. By nature indolent and caring little for power obtained by bloodshed, he fell before the restless and warlike Iroquois. That the Algonquins held their own, and did not become incorporated with tribes of Asiatic origin, is doubtless owing to the large numbers that at one period must have established themselves upon this continent. This adaptation of an oceanic population to continental modes of life, with all the differences of climate and productions, and the preservation of their identity for many ages, is one of the most remarkable phenomena known to ethnological science.

Although I must apologize for the scantiness of my materials, I feel that I am in a position to indicate the origin of three important Indian families, with which the Algonquins have long been in contact; these are the Tinneh or Athabascans, the Iroquois, and the Choctaws. The first named are the neighbours of the Algonquins on the north, but appear also as an intrusive people as far south as Mexico. The Iroquois are scattered among the Algonquins; and the Choctaws and Cherokees, who are simply disguised Iroquois, were originally situated to the south of the Algonquin area. The Tinneh family I associate with the Tungusians of Siberia and Northern China; and the Iroquois and Choctaws, with the populations of north-eastern Asia, classed by Dr. Latham as Peninsular Mongolidae. It is to these immigrants that we owe the peculiar features of American Indian life.

The Tinneh are the Chipweyans of Mackenzie, Carver and the older travellers, the Athabascans of many writers, the Montagnais of Father Petitot and others who have copied his statements. In the number of their tribes they exceed those even of the large Algonquin family, and they occupy a similarly extensive area, but one upon which civilization has little encroached. Among the more important tribes may be mentioned the Chipweyans or Athabascans proper, the Coppermines, Beavers, Dogribs, Tacullies, Tlatskanai, Koltshane, Atnah or Nehanni, Sursees, Nagailer, Tenan-Kutchin, Kutcha-Kutchin, Yukon or Ko-Yukon, Digothe or Loucheux, Sicanni, Unakhotana, Kenai or Tehanin-Kutchin, Inkulit, Ugalenzes, Umpquas, Hoopas, Wilacki, Tolewah, Apaches, Navajos, Mescaleros, Pinalenos, Xicarillas. In reference to their habitat I cannot do better or more briefly than by quoting the words of Mr. W. H. Dall in his "Report on the distribution and nomenclature of the Native Tribes of Alaska and the Adjacent Territory." This great family includes a large number of American tribes, extending from near the mouth of the Mackenzie south to the borders of Mexico. The Apaches and Navajos belong to it, and the family seems to intersect the continent of North America in a northerly and southerly direction, principally along the flanks of the Rocky Mountains. The northern tribes of this stock extend nearly to the delta of the Yukon, and reach the sea-coast at Cook's Inlet and the mouth of the Copper River. Eastward they extend to the divide between the watershed of Hudson's Bay and that of Athabasca and the Mackenzie River. The designation (Tinneh) proposed by Messrs. Ross and Gibbs, has been accepted by most modern ethnologists. The northern Tinneh form their tribal names by affixing to an adjective word or phrase, the word *tinneh* meaning "people," in its modifications of *tinneh*, *tina* or *tena*, or in one group the word *kutchin*, having the same meaning. The last are known as the Kutchin tribes, but so far as our knowledge yet extends are not sufficiently differentiated from the others to require special classification by themselves." Mr. Dall gives in the Appendix to this report a vocabulary of the Yakutats about Mount St. Elias, whom he classifies as Koljush or Thlinkeets, but whose language is plainly Tinneh. They differ also from the Thlinkeets by the absence of the lip-ornament and the totemic system, and by eating the blubber and flesh of the whale, which the Thlinkeets regard as unclean.

The word "Tinneh" in its various forms *dinnie*, *dene*, *dinay*, *toene*, *tana*, *ttyannij*, *tine*, *tineze*, *tingi*, *tenghie*, *tinday*, *tinlay*, &c., answers to the *lenni*, *ilenni*, *renoes*, *ililew*, *irirew*, *inini*, *eyinew* of the Algonquin, and should be a guide more or less to the affiliation of the people so designated. Such a form is not very rare, nor is it, on the other hand, very common. Of similar forms in America, as among the Nootkans, Algonquins and some non-Tinneh Mexican tribes, I need not speak. The Celtic *dyn*, *duine* are nearer than any other known to me, and the Celtic languages in their non-Aryan features, which are few and evidently ingrafted, belong to the Ural-Altaic class. In Africa we find such forms as *tna*, *tkohn*, among Bushmen and Hottentots, with *iden*, *dim*, &c., in the Niger region. The Hebrew *adam* appears not only in the Semitic area, but also among non-Semitic Africans, in the Caucasus, and further east, as a monument, perhaps, of Mahomedan Semitic influence. In Polynesia forms like *tangata*, *tamata* present some resemblance, but I am not aware that those who employ these terms, any more than the people above mentioned, designate themselves by any such name. It is different with the Altaic family with which I have associated the Tinneh. The Tungusians call themselves *Tungus*, *Donki*, and are termed *Tung-chu* by their Chinese neighbours, the former being also in several tribes the words for *man*. Inasmuch as the Mantchu dynasty in China is Tungusian, there is every reason to respect the Chinese appellation. The Loucheux *tenghie*, and the Tenan-Kutchin *tingi*, like the Beaver *tineze*, are our Tungusian *tungus* and *donki*. Similarly the Tungus *akee* and the Mantchu *cheche* are the Umpqua *ekhe*, and the Tacully *chaca*, woman. The Tungus *tirgani*, day, is the Koltchane *tiljcan; tog*, fire, the Ugalenze *takak; dzsho*, house, the Kutchin *zeh; okat*, river, the Tacully *okox; chukito*, belly, the Ugalenze *kagott; gal*, hand, the Tlatskanai *kholaa; oyot*, nose, the Navajo *hutchih; amai*, father, the Tlatskanai *mama;* and *anya*, mother, the Kenai *anna*. In the accompanying vocabulary a comparison is instituted between a collection of Tinneh words derived from various sources and part of the material of the Tungusic languages furnished by Klaproth.

The Tinneh languages exhibit their Northern Turanian character in the absence of true gender, and the substitution for it of a distinction between nouns as intelligent or unintelligent, noble or ignoble, animate or inanimate. This it has in common with the Tungus. The formation of the plural by affixing an adverb of quantity marks equally the Tinneh languages and the Mantchu. The adverb of quantity thus employed, which is *lau* in certain tribes, is like the Turkish plural in *ler*. There is the closest affinity between the Tungus and the Tinneh languages in regard to the innumerable modifications of the verb to express variety and quality of action found in each. Both groups agree in prefixing the pronoun to the verb, thus differing from the Ugrian and Turkish order of pronominal affixes. Occasionally, however, the temporal index is infixed between the pronoun and the verbal root in Tinneh, while, as far as known to me, it is final in the Tungusian languages, as it is in several tenses of the Tinneh. In Tungus and Tinneh, equally, the accusatives precede the verb. The formation of the genitive by preposing the noun possessor, followed by the third personal pronoun, to the object possessed, characterizes both families. They agree, also, in employing post positions only instead of prepositions. The Mautchu adjective is generally prefixed to its noun, but in some, at least, of the Tinneh dialects it follows. Yet the possessive adjective precedes as in Matchu. The above mentioned grammatical relationships of the Tinneh and Tungus, although far from exhaustive, are sufficiently important to give weight to any other evidence linguistic or ethnological that may be adduced.

Various writers, generally, however, in seeking to account for the origin of the Esquimaux, have referred to the pressure northwards and eastwards of Tartar tribes in the fourteenth and previous centuries; and, among the nations whom they supposed the Yakuts and other Tartars to have displaced, enumerate the Tungus. This is exceedingly probable, and so far agrees with the Tinneh traditions reported by Mackenzie and Father Petitot. These state that the enemies of the Tinneh, who were very wicked men, dwelt to the west of their nation; that, fleeing from them, they crossed a shallow sea, passing from island to island in a bitterly cold climate, and at last found the sea to the west of them and their enemies to the east. Such traditions plainly indicate the northern Asiatic origin of the Tinneh, and, together with their vocabulary and grammar, limit them to an original home in the neighborhood of Siberia. Mr. Dall and other observers bear testimony to their love of a gipsy, vagabond life, which Martin Sauer, in his account of Billing's expedition, has similarly remarked upon in speaking of the Tungus. The latter stated in reference to this customary moving continually from place to place that the Tungus did so to avoid the contraction of disagreeable odours; and the traveller Hearne, in his "Voyage to Hudson's Bay," mentions a similar dislike to bad smells among the Tinneh tribes. In regard to personal appearance nothing can be said of stature, for, while some writers describe the Tungus as tall, athletic and straight, others speak of them as generally below the middle size. The same apparently contradictory statements are made regarding the Tinneh, showing that both Tungus and Tinneh present much variety in this physical characteristic, although the writers on both sides are agreed that neither in the one family nor in the other is there any tendency to corpulence. The small eyes, high cheekbones, low forehead and coarse black hair of the Tungus are alluded to by Santini and Sauer, and identical features are ascribed to the Tinneh by Hearne, Mackenzie and later writers. Although both peoples are generally in the habit of depilation, it is not universal among either the Tungus or the Tinneh. Some of the Tungus tribes, such as the Tshapojirs, tat-too their faces after the prevailing Siberian fashion with bars or straight lines on the cheeks and forehead, and so, according to many authorities, do the Chipweyans and other Tinneh tribes.

The Tungus is inclined to be demonstrative, mirth-loving, communicative, and the contrast in this respect between the undignified, fun-making and talkative Athabascan and the reserved, grave and silent Cree, his neighbour, has escaped few travellers in the North-West. The docility of the Tinneh is a frequent subject of favorable comment; and Martin Sauer in this respect accords the palm to the Tungus over all the Siberian peoples he met with in his journeyings. By this feature the Tinneh are separated from the Tartar Yakuts, in spite of the Yakutats being Tinneh, and from the Peninsular tribes represented by the Koriaks and Ainos. The latter, especially, are fierce, intractable warriors, which the Tinneh are not, for, although cruel enough in their conduct towards the feeble Esquimaux, they stand in wholesome dread of the Algonquin Cree, who, though of a widely different race, reminds them of their ancient foe, the Yakut. Mongolian craft and cunning mark the Athabascan, who, with all his docility, is wanting in the savage nobility, the regard for truth and honor, that characterize equally the Algonquin and the Iroquois. He is in no sense the typical red-man of history and romance, but affords an opportunity for novel portraiture of Indian character to the Coopers and Mayne Reids of the North-West.

In domestic and social relations there is absolute identity of custom among Tungus and Tinneh. Government and laws they have virtually none, and are thus incapable of any combination for purposes of conquest. In this respect, however, the Mantchus, a Tungusic people, present a notable exception. The understanding among them relative to property in game, berries and personal effects coincides on both continents. The marriage ceremony is a simple act of purchase in either case, the only difference being that the modern Tungus having domesticated the reindeer, barters that animal for his wife, while the Athabascan must needs offer some other equivalent. Polygamy characterizes the two peoples, who are equally jealous in regard to their wives. But they agree, also, in the absence of chastity among the unmarried, and in the un-American custom of lending their daughters, sisters and female slaves to those whom they honor with their hospitality. The first wife occupies the highest position among Tungus and Tinneh, and, although the place of the married woman is as in most barbarious nations, one of subjection, a larger share in domestic and even in public counsels is granted her in both nations than is generally accorded to American Indian matrons. In matters of religion there is much resemblance, both families being demonolators and sacrificing to evil spirits, the dog being an object of reverence, and their festivals and religious dances partaking of the same character. They agree in consulting young men who have previously prepared themselves by a process of fasting in the interpretation of dreams, and in a species of divination by means of the shoulder-blades of the deer, a practice common to the Tinneh and Tungus with the Lapps and other northern nations of the eastern hemisphere, but unknown, so far as I am aware, among other American tribes.

One of the most remarkable resemblances between the customs of the two peoples appears in their funeral rites. The Tungus, as reported by Santini and Sauer, place their dead in wooden boxes, which they leave above ground and sometimes suspend to the branches of trees. Mr. Dall, in treating of the Unakhotana and Tehanin Kutchin, uses almost the same language as the Asiatic travellers in referring to the mode of sepulture of these tribes. Abernethy, with Santini and Sauer, inform us that the Tungus bury with their dead all their arms and implements, and that their mourning, which is at first violent, lasts generally for a whole year. Mackenzie, Hearne and Father Petitot bear witness to the similar violence and long duration of mourning for the dead among the Tinneh, and to the burying of all the personal effects of the deceased.

The Tungus live in tents made sometimes of skins, at others of birch-bark, as do the Tinneh, who have separate words to denote an ordinary house of the latter character and a skin-lodge. Both peoples are great fishers, hunters and berry-gatherers, while the Algonquins and other Indian tribes confine their attention largely to hunting. The use of the bow is characteristic of Tungus and Tinneh. More remarkable is the presence in the Tinneh area, as attested in Washington Irving's "Astoria," Pickering's "Races of Man," and Dr. Gibbs' "Report on the Tribes of Western Washington and North-western Oregon," of the corslet of pliable sticks interwoven with grass and sinews, which Abernethy found among the Tungus. It is supposed to be the only kind of defensive armour known in America. The Tungus, in common with other Ural Altaic tribes, use the snowshoe; but I am not able to compare its formation with that of the Tinneh tribes which Mackenzie and Hearne characterize as being of superior workmanship. The birch canoe, generally regarded as peculiarly American, is Tungusian in its origin. "The Tongusi," says an author quoted by Mr. Mackintosh, whose book on "The Discovery of America and the Origin of the North American Indians" was published at Toronto in 1836, "use canoes made of birch-bark, distended over ribs of wood and nicely sewed together.

The Canadian and many other American nations use no other sort of boats. The paddles of the Tongusi are broad at each end; those of the people near Cook's River and of Onalaska are of the same form."

Sauer and Mackenzie refer to the insensibility to cold of the Tungus and Tinneh respectively. The former, referring to the dress of the Tungus, says: "Their winter dress is the skin of the deer or wild sheep, dressed *with the hair on;* a breast-piece of the same which ties round the neck and reaches down to the waist, widening towards the bottom, and neatly ornamented with embroidery and beads; pantaloons of the same materials, which also furnish them with short stockings, and boots of the legs of rein-deer, with the hair outward; a fur cap and gloves. Their summer dress only differs in being simple leather *without the hair.*" Referring to the Chipweyans or Athabascans, Mackenzie writes: "There are no people more attentive to the comforts of their dress, or less anxious respecting its exterior appearance. In the winter it is composed of the skins of deer and their fawns, and dressed as fine as any chamois-leather, *in the hair.* In the summer their apparel is the same, except that it is prepared *without the hair.* Their shoes and leggings are sewed together, the latter reaching upwards to the middle, and being supported by a belt. The shirt or coat, when girded round the waist, reaches to the middle of the thigh, and the mittens are sewed to the sleeves or are suspended by strings from the shoulders. A ruff or tippet surrounds the neck, and the skin of the head of the deer forms a curious kind of cap. A robe made of several deer or fawn skins sewed together covers the whole." The same author, speaking of the Dogribs, refers to the elaborate ornamentation of the breast-piece and other parts of their dress; and other travellers have described it in like terms. Santini dwells upon the fanciful and tasteful designs wrought with coloured percupine quills in which the Tungus indulged, and their coronet or head-band of leather, ornamented with embroidery and feathers. To the latter, Mackenzie makes reference also in connection with the Dogribs; and many writers have celebrated the ingenuity in quill-work of the whole Tinneh family, who were probably the teachers of this art to the populations of North America. Finally, although this is a matter not of dress, but of food, both the Tungus and the Tinneh are in the habit of eating the undigested food, principally lichen, in the stomach of the deer, which they mix with berries and other ingredients, as Sauer and Hearne respectively testify. Such a collection of parallel facts has rarely been presented for the connection of one or more peoples of unknown derivation, and would be impossible as mere coincidences. The only characteristics in which the Tungus may be said to differ from the Tinneh are the truthfulness of the former and the complaining ways of the latter. But the evidence of Sauer to the first of these is not conclusive as to its characterizing the whole Tungus family,* nor can it be said that all the Tinneh tribes are equally unreliable. In docility the two families agree. The Tungus of Sauer were cheerful, and so are the Tinneh in general, although inveterate grumblers, at least in certain tribes, as may be the case with some of the Tungus were more known concerning them. Certainly, no two families representing the old world and the new present closer affinities in name, vocabulary, grammar, physical appearance, dress, arts, manners and customs than do the Tungus of Asia and the Tinneh of America.

Before dealing with the Iroquois, who should in geographical order next claim our attention, I prefer to take up the origin of the Choctaw-Cherokee family, which shows its Asiatic connections more clearly, and which will tend to illustrate and confirm the Iroquois relationships. The original area of the Cherokee-Choctaw confederacy extended from Tennessee southward to the Gulf of Mexico. The Cherokees and Choctaws are generally regarded as distinct peoples, although their languages have much in common. The tribes included under the generic name Choctaw, are the Choctaws proper, the Chickasaws, Creeks or Muskogees, Hitchitees and Seminoles, all of whom are famous in history. They were originally a warlike, encroaching population, of a proud, fierce spirit, differing alike from the reserve of the Algonquin and the childishness and docility of the Athabascan. The character of the Iroquois is that of the Choctaw, and these are the great warrior tribes of North America who brought into the continent its peculiar arts of warfare as the Tinneh family gave to it its peculiar arts of peace. The Choctaws, we are told by Dr. Latham, Catlin, and others, used to flatten the head, and may thus be supposed to connect with the Salish or Flathead family of Oregon. But for the present we seek to discover their old world relationships rather than those of the new. The northern Asiatic people who flatten the head are the Koriaks, who inhabit the extreme

* Wood, in his "Uncivilized Races," characterizes the Tungus as good-natured, but full of deceit.

west of Siberia to the north of the peninsula of Kamtschatka, to the centre of which certain tribes extend. Their languages are allied with the Kamtchatdale, Corean, Aino, Japanese, and Loochoo, and partake more or less of a Mongolian character, being, however, well differentiated from any Ural-Altaic division such as the Ugrian, Tartar, Mongol or Tungus. It is with these Koriaks that I find good evidence for associating the Cherokee-Choctaw confederacy.

In the first place identity of name, although in itself apt to be fallacious, may, as in the case of the Tungus-Tinneh connection, lead to truth. The Koriaks exist in two great divisions, a northern, known as the Tchuktchi, and a southern, the Koriaks proper or Koraeki. The former call themselves Tshekto, men or people, and they are the original Choctaws; the latter, who bear the name Koraeki, are the parent stock of the Cherokees. This looks so exceedingly plain that the question may be asked why was it not discovered before. The answer seems to be, that investigators have been so long theorizing and refining that they managed to overlook plain facts lying upon the surface. Koriaks in Alaska have been looked for, but Tchuktchis in Tennesee and Mississippi would have been regarded as very much out of place. The Koriaks are of good stature, with features more pleasing and prominent than the Mongol. Dr. Latham mentions "their general resemblance in respect to physical conformation to the American Indians." They are warlike and independent, and have encroached upon the Yukagirs and Kamtchatdales, as the Choctaws and Cherokees did upon the southern tribes of the United States. Abernethy states that among the Koriaks the mothers give, as they imagine, a decorous form to their children when infants by applying three boards, one on the top to give them a flat head, and one on each side to give them a sharp forehead." This is the Choctaw process of which Catlin speaks. Sauer relates that the Tchuktchis had a game resembling "prisoner's bars," and at the same time mentions the facility with which they threw stones from a kind of sling. The game popularly known as Lacrosse, common to the Choctaws and Iroquois, must, I think, be referred to, and I regret that I have no work treating fully of Koriak manners and customs by which this may be confirmed.* The Tchuktchis and the Choctaws are alike fond of such athletic sports as

* A game identical with our American Lacrosse is played in Japan. See Wood's Uncivilized Races.

running and wrestling, and in this respect present a marked contrast to neighbouring Asiatic and American tribes. They are equally noted for manual dexterity and mechanical skill, with capabilities for self improvement, as the present civilization of the Cherokees and Choctaws attests, and as is evident from the fact that the highly civilized Japanese are nearly related to the Koriaks. A Choctaw tradition, reported by Catlin, states that, a long time ago, the Choctaws "commenced moving from the country where they then lived, which was a great distance to the west of the great river and the mountains of snow, and they were a great many years on their way." It is worthy of note that the Tuhuktukis (? Tchuktchi) are mentioned as members of the Cherokee confederacy.

In treating of the Choctaw language I find it necessary to compare ts dialects with those of the Peninsular family in general, owing to the paucity of my collection of Koriak and Tchuktchi terms, and to the fact stated by Dr. Latham, that of the Peninsular languages the grammatical structure of only one of them, the Japanese, is known. The same writer adds that "the Peninsular languages have a general glossarial connection with each other," and "in the opinion of the present writer, the Peninsular languages agree in the general fact of being more closely akin to those of America than any other." The Choctaw word for man *hatak* is the Japanese *otoko*, and the Muskogee *chauheh* is the Loo Choo *chu*. The Choctaw *tike*, *tekchi* woman is the Loo Choo *tackki*. Boat is *peni* in Choctaw, and *fune* in Japanese: and bone is *foni* in Choctaw and *fone* in Japanese. The two Tchuktchi terms for father, *annaka* and *attuka*, are represented by the Choctaw *unke* and the Cherokee *chatokta*. The Cherokee *agaula* and the Choctaw *kullo*, fish, are equally derived from the Tchuktchi *ikhalik*. The Tchuktchi name for god is *istla* and the Choctaw *hoshtahli*, while the Muskogee god, *efeekeesa*, is not unlike the Japanese *jebisu*. The Tchuktchi *aganak* woman is the Cherokee *ageyung*; the Tchuktchi *unako* to-morrow, the Choctaw *onaha*; the Tchuktchi *nouna*, water, the Cherokee *omma*. But I must refer to the accompanying vocabulary for the lexical evidence thus introduced.

In regard to grammatical forms, absence of gender characterizes the Choctaw and Peninsular languages, and the same may almost be said in regard to number. Case is marked in both groups by post positions. The form of the genitive is worthy of special note. In the case of each the possessor, with an affix originally representing the third personal pronoun, precedes the object possessed; in other words the Choctaw and Peninsular languages practice the post-position of the nominative. Thus in Japanese "the bone of the man" is rendered

otoko no fone,

and in Choctaw hatak in foni.

Similarly, "the finger of the woman" is in Loo-Choo—

tackki noo eebee,

and in Choctaw tekchi in ibbak-ushi.

These forms, which give us the English, *man's bone, woman's finger*, and in which *in, no, noo* represent the possessive inflection *'s*, together with the close resemblance in the actual words employed, illustrate the nearness of the Choctaw to the Peninsular idiom, and render a reference to Tchuktchi grammar unnecessary. The personal pronouns precede the verbal root in Loo-Choo and Japanese as well as in Choctaw, and the temporal index of the verb is final. For the past tense *ta* is the Japanese and *tee* the Loo-Choo index, while in Choctaw it is *tuk, tok*. The Choctaw futures in *ching, he* and *ashki* are like the Mongol in *'ya, ho* and *sogai*. In the formation of the passive the Choctaw sometimes inserts an *l* like the Turkish, but in other cases simply changes the final vowel, as in Japanese. The Choctaw negative, *k* or *ik*, combined with the initial pronoun, is the prefixed Mantchu *ako*. In Choctaw, Japanese and Loo-Choo the accusative precedes the governing verb, and the place of the adjective seems in either case to be sometimes before, at others after the noun it qualifies. According to Santini, the Koriak verb, like the Tungus, is susceptible of all the modifications denoting variety and quality of action which characterize the American families of language. The Choctaws are undoubtedly the Tshekto, and the Cherokees the Koraeki.

A family more important in many respects, at any rate to the Canadian student of American ethnology, is that known as the Wyandot, which, in general terms, includes the Hurons and Iroquois. These fall into two divisions, a northern and a southern, the latter being, in the historical period, natives of North Carolina, and thus in proximity to the Choctaws. The most important of the southern tribes were the Tuscaroras and Nottoways. The northern tribes were, and are still in part, in the neighborhood of the great lakes—Huron, Ontario and Erie. The Huron, or Wyandot confederacy, embracing many tribes comparatively unknown to fame, occupied the more northern, and the Iroquois or Five Nations, the southern part of the area. In the latter confederacy, said to be from three to five centuries old, were included the Mohawks, whose real name, according to Dr. Oronhyatekha, himself a distinguished Mohawk, is Kanyenkehaka, "the flint people," the Oneidas, Onondagas, Cayugas and Senecas. The Tuscaroras, migrating northward, united with them at a comparatively recent period to form the Six Nations, now found on the Bay of Quinte and on the Grand River. An Iroquois tribe originally inhabited the site of Montreal, and were known as the Hochelagas; and another still exists at Caughnawaga on the opposite side of the St. Lawrence. The Caughnawagas, St. Regis Indians and other scattered tribes, are generally known by the generic name Iroquois. A body of Hurons or Wyandots still exists in the neighbourhood of Quebec, where, in the days of warfare between them and the Iroquois, they sought French protection. Of the great nation that once occupied the extensive Lake Huron country, scattered fragments only remain. Some, with their ancient foes and relatives, the Iroquois, are found in the Western States, but the most important band is that found at Amherstburg on the Detroit River, whose history has been written in a somewhat rambling but amusing fashion by one of their number, Peter Dooyentate Clarke.

A peculiarity of the Wyandot-Iroquois dialects is the absence of labials, *w* being the nearest approach to the sound of these letters. In this they differ not only from the Algonquin tongues but from their related forms of speech, the Choctaw-Cherokee. The Mohawk makes a free use of the letter *r*, which in many cases possesses a certain virile force. This is sometimes replaced by *l* in Oneida, and in Onondaga, Cayuga and Seneca, by a breathing. Thus boy is *raxha* in Mohawk, *laxha* in Oneida, *haksaah* in Onondaga. The Tuscarora forms though differing from those of the five nations, agree with the Mohawk in presenting a recurrence of the harsh *r*, so little known to Algonquin speech. As far as I am able to judge, the affinities of the Wyandot proper or Huron are with the Tuscarora, which, from its resemblance to the Cherokee, I am disposed to regard as the oldest and purest form of the Wyandot-Iroquois language. The resemblance that exists between many words of the Tuscarora and Cherokee has been noted in the Mithridates, and is capable of large illustration. For instance, arrow is *kanah* in Tuscarora, *gahnee* in Cherokee; dog *cheeth* Tuscarora, *cheer* Nottoway, *keethlah, keira* Cherokee; Fire *ocheeleh* Mohawk, *otcheere* Tuscarora, *cheela, cheera* Cherokee; man *itaatsin* Minekussar, *atseeai* Cherokee; woman *ekening* Tuscarora, *ageyung* Cherokee; boy *doyato* Huron, *atsatsa* Cherokee; child *yetyatsoyuh* Tuscarora, *oostekuh* Cherokee; death *guiheya* Iroquois, *choosa* Cherokee; face *ookahsa* Tuscarora, *issokuh* Cherokee; father *aihtaa* Huron, *tawta* Cherokee; mother *nekets* Tuscarora, *akatchee* Cherokee; good *ayawa'te* Huron, *seoh-staqua* Cherokee; girl *yaweetseutho* Wyandot, *ayayutsa* Cherokee; mountain *onondes* Seneca, &c., *naune* Cherokee; tongue *honacha* Iroquois, *yahnohgah* Cherokee; water *aouin* Huron, *ohneka* Iroquois, *ommah* Cherokee. The following are a few instances of the agreement of Choctaw and Wyandot-Iroquois words. The Iroquois *entiekeh* and the Choctaw *neetak,* day; the Mohawk *ojistok* and the Choctaw *phitchek,* star; the Iroquois *onotchia* and the Choctaw *noteh,* tooth; the Cayuga *haksaah* and the Choctaw *ushi,* boy; the Seneca *hanec* and Iroquois *johnika* and the Choctaw *chinkeh, unky,* father; the Iroquois *nenekin* and the Choctaw *nockene,* man; the Iroquois *kninonk* and the Choctaw *kanchi,* to buy, are not accidental coincidences, but indications of that relationship which a similarity of character and modes of life render probable.

A curious instance of the transference of a word from one meaning to another is afforded in the Choctaw numeral three, *tukchina.* Now, there can be no doubt that this is the Mohawk *techini,* the Caughnawaga *tekeni,* the Cayuga and Onondaga *dekenih,* which however denote two, instead of three. That *tukchina* and *techini* are the same word is evident from the fact that eight, which in Choctaw is *untuchina,* is in Mohawk *sa-dekonh,* in Caughnawaga *sa-tekon* and in Onondaga *dekenh.* I am disposed to think that the Choctaw form is the true one, as the relation of eight to three gives five, the unit generally employed in compositions under ten. The Choctaw ten, *pocole,* is the Oneida *oyelih,* the absence of the initial labial being a necessity of Iroquois language.

What the Cherokee-Choctaws are, such in a great measure must be the Wyandot-Iroquois judging from the specimen of lexical or glossarial connection already given. What their relation is to the Peninsular family of Asia may easily be shown by comparison, although in philology it is not always true that languages which resemble the same language resemble one another. There may also be several degrees of resemblance. In some languages the words are so feeble, consisting largely of vowels, that the comparison of any two such languages in different parts of the world gives but unsatisfactory results, unless some law governing the variation of vowel-sounds could be discovered. In Iroquois, Choctaw, and in the Peninsular tongues words are generally strong, with a good deal of the bold Koriak-Cherokee character and Tchuktchi-Choctaw independence, so that the framer of a comparative vocabulary, into which one of these languages enters, will find little difficulty in deciding questions of likeness. There are, however, two things which render comparison less simple in the case of the Iroquois languages than in that of the Choctaw. The first of these has already been alluded to—it is the absence of labials, and, in this connection the uncertain power of *w* in English and French renderings of Iroquois words. If it were always the equivalent of a labial, as it sometimes undoubtedly is, much of the difficulty would be removed. At times it seems to represent the liquid *m*, which is also a labial. The second hindrance is found in the additions to the original root which appear in the Iroquois as we compare it with the Choctaw and Peninsular languages, and which is evident even in comparing the older with the newer Wyandot forms. The Iroquois word has grown uncomfortably by means of prefix, affix and reduplication of syllables, sometimes apparently for purposes of euphony, at others, it would seem in a retrogade direction to evolve by synthesis a concrete out of a comparatively abstract term. Were I better acquainted with the less known members of the Peninsular family of languages with which the Iroquois stands in the closest relation, I might have to modify this opinion.

I am not at present aware of any Asiatic names with which to associate those of the Wyandot family. The word Wyandot, like Oneida, Onondaga, Nottoway, may relate to the Esquimaux term *innuit* and the Samoied *ennete,* meaning man. In Arrapaho, one of the Algonquin dialects, man is *enanitah.* The Wyandot forms for man are oonquich, ungouh, aingahon, ungue, nenekin, (r)onkwe, (l)onque, hajinah, hauj-eenoh, onnonhoue, aneehhah, nehah, eniha, aineehau, (r)aniha—etschinak, ita-atsin, entequos, agint, (r)atsin, (r)atzin, &c. Still, Esquimaux and Samoied forms appear—the Esquimaux *enuk* and Samoied *nienec.* But the Aino *aino* and the Japanese *hito, otoko,* may be found in the second and third groups.

The Wyandot family has undoubtedly miscellaneous Asiatic affinities in point of language. The remarkable term *kanadra*, denoting bread, is the Magyar *kunyer*, just as *wish* (five) is the Esthonian *wiis*. Rain in Mohawk is *ayokeanore*, a peculiar form, and this is the Turkish *yaghmur;* and the Turkish *besh* (five) is also the Cayuga *wish* and the Mohawk *wisk*. The Magyar *kutya* is the Tuscarora *cheeth* (dog) and the Lapp *oadze* is the Huron *auoitsa* (flesh). The Mohawk negative *yagh* is the Turkish *yok*, and *waktare*, an Iroquois word meaning "to speak," is the Yakut *ittare*. Stone is *odasqua* in Iroquois and *tash* in Turk, and tooth is *otoatseh* in Tuscarora, *dish* in Turk. To hide is *kasetha* in Iroquois and *kistya* in Yakut, and field is *kaheta* in Iroquois and *chodu* in Yakut. The Onondaga word *jolacharota* (light) is the Lapp *jalakas*, with an increment. Two is *ohs* Mohawk, *ausuh* Tuscarora, and *uch* Turk, *ews* Yakut. while seven is *jadah* in Mohawk, Oneida and Onondaga, and *yeddi* in Turk.

It may be asked why, when the Ugrian and Tartar languages relate so closely to the Iroquois by unmistakable roots, I turn aside to the Peninsular. I do so for various reasons: First, because certain peculiarities of Turkish and Ugrian grammar, such as personal and possessive prononinal affixes to verbs and nouns, are wanting in Iroquois. Second—Because the Peninsular languages are at least as near in lexical affinity to the Iroquois as are the Ural-Altaic: and, thirdly, because the Choctaw-Cherokee dialects, which are undoubtedly of Peninsular origin, are too like the Iroquois to admit of separation.

The Koriak origin of the Iroquois is given in the identity of the Koriak war-god, Arioski, with the Iroquois Areskoui. The resemblance of these names has often been noted, but it has been regarded as a coincidence similar to that which exists between them and the Greek Ares, curious, but of no scientific value. Mr. Mackintosh, in the little book to which I have already alluded, draws many parallels between the manners and customs of the Koriaks and the American Indians, several of the latter being Iroquois customs. Unfortunately this industrious author regarded the American aborigines *en masse*, and mixed up Koriaks and Tungus in his comparisons. Still, his facts, to which I cannot now refer, are valuable. Arioski is not the only Iroquois word in Koriak. The Koriak or Tchuktchi *khatkin, guetkin* are the Iroquois *hetken*, bad;

agwat is *oohuwa*, boat; *rinaka* and *iegnika* are *ronwaye* and *aqueianha*, boy; *aghynak* is *eghnisera*, day; *nutenut*, *nuna*, are *ononentsia*, *neujah*, earth; *atta*, *annak* and *illiguin* are *ato*, *hanec* and *lahkeni*, father; *annak* is *yoneks*, fire; *gitkat* is *atchita*, foot; *kaaguk* is *kowa*, great; *nujak* is *onuchquira*, hair; *khigan*, *kihiguin* are *kiunyage*, heaven, sky; *gailigen* is *kelanquaw*, moon; *anak* is *aneheh*, mother; *ekigin* is *agwaghsene*, mouth; *chynga* is *yuungah*, nose; *kiuk* is *joke*, *kaihyoehakouh*, river; *anighu* is *ouniyeghte*, snow; *guluk* is *otoatseh*, tooth; *utut* is *ohotee*, tree; *mok* and *nouna* are *ohneka* and *nekahnoos*, water; *aganak* is *ekening*, woman; *acik* is *osae*, young; *ainhanka* is *eniage*, *eninya*, finger; *unako* is *eniorhene*, to-morrow; *kanujak* is *kanadzia*, copper; and *kulle* is *oyelih*, ten. In some of these words, the increment of which I have spoken, will be observed. Thus, aghynak becomes eghnis-*era*; nujak is lengthened to onuchqui-*ra*, anighu to ouniyegh-*te*; unako, the Choctaw onaha, to-morrow, takes an interpolated *r*, which is probably a mere strengthening of the vowel *a*, and adds *ne*, eniorhe-*ne*. The strength of the Iroquois words comes out well in the Japanese and Loo-Choo. Thus we have *kuru*, Japanese, *karo* Mohawk, come; *kurrazzee*, Loo-Choo, *arochia*, Huron, hair; *kokurro*, Jap., *hahweriacha*, Iroquois, heart; *atcheeroo*, Loo-Choo, *otorahawte*, Huron, hot; *korossu*, Jap., *kerios*, Iroquois, kill; *sheeroosa*, Loo-Choo, *kearagea*, Mohawk, white; *teeroo*, Loo-Choo, *atere*, Iroquois, basket. Terms for man, woman and child are fairly represented in this group:—*Hito*, *otoko*, Jap., give *ituatsia*, *etschinuk*, *hatgina*, man; *tackki* and *innayo*, Loo-Choo, give *otaikai* and *yonkwe*, woman; *kodoma*, Jap., is *kotonia*, and *wocka*, Loo-Choo, *woccanoune*, child. The Aino, which furnishes in its ethnic term for man, an equivalent to *aineehau*, *eniha*, in *zia* sister adds the original of the Iroquois *tsiha*, *akzia*. Its *oondee*, arm, is the Iroquois *aonuntsa*; *cahani*, boat, is *gahonhwa*; *kounetsou*, moon, *kanoughquaw* and *eghinda*; *wakha*, water, *auweah*; *askippi*, finger, *oosookway*; and *o*, *yes*, *io*. The Kamtchatdale is also fairly represented in Iroquois. Its form for axe, *kuisqua*, is the nearest I know to the Iroquois *askwechia*; *adkang*, bad, is the Iroquois *hetken*; *ktshidzshi*, brother, finds its analogues in *yatsi*, *atsiha*; *koquasitch*, come, in *kats*; *kossa*, dog, in *cheeth*; *kwatshquikotsh*, see, in *atkahtos*; *quaagh*, face, in *ookahsah*; *chtshitshoo*, girl, in *yaweetseutho*, *caidaizai*; *settoo*, hand, in *chotta*; *kisut*, house, in *ganasote*; *koschoo*, sister, in *akchiha*, &c. The Iroquois third personal pronoun *ra*, *re* is the

Japanese *are*, and the Loo-Choo *aree*. The Iroquois numerals are more Ugrian and Tartar than Peninsular, so far, at least, as my vocabularies enable me to judge. The presence of many Ugrian and Tartar words in common Iroquois speech is a phenomenon for which I cannot at present account. The same phenomenon appears in the Quichua of Peru.

The Iroquois grammar might be Mongol or Tungus as well as Japanese or Peninsular. It is neither Ugrian nor Tartar. It marks a distinction between nouns as virile and non-virile, similar to that of the Koriak. It possesses a plural in final *ke*, like the Magyar in *k* and the Mantchu in *sa*. It has also a dual like some of the Ugrian languages. It forms the genitive in the same way as the Ural Altaic and Peninsular languages in general, by preposing the genitive, followed by the third personal pronoun, to the nominative. The pronoun in the accusative, or regimen of the verb, precedes it as in Japanese, Mongol, &c., but this does not seem to be always the case with the accusatives of nouns. Another peculiarity of Iroquois grammar is that the small number of proper adjectives in the language follow the noun they qualify, while, in the Ural-Altaic languages, and sometimes in the Peninsular, they precede. Still the possessive adjectives are preposed as well as the word *akwekon*, all, and similar terms. The personal pronouns precede the verbal root, and the temporal signs follow it, as in Mongol, Tungus and Japanese. The Iroquois also agrees with the Ural-Altaic and Peninsular languages in employing post-positions only. Like the Mantchu, Northern Chinese and Choctaw, the Iroquois possesses the exclusive and inclusive plural of the first personal pronoun. It also has separate terms for elder and younger brother and sister, in common with all the Turanian languages. The Iroquois grammar is thus in its main features Choctaw and Peninsular.

The ball-play or lacrosse of the Iroquois, like that of the Choctaws, must be traceable to an Asiatic region, and may relate to the* well-known game of the Basques in Western Europe. A large family of nations and languages has yet to be recognized, that, with the Ural-Altaic class, shall include the Basque in Europe, the Berber, Haussa and Kashna in Africa, the Tinneh, Iroquois, Choctaw, and, perhaps, the Dacotah and Aztec of North America,

*The Basque game, as I learn from my colleague, Professor Coussirat, who has frequently witnessed it, is all but identical with that of the Iroquois.

and the Aymara and Quichua of the Southern Continent; and, intermediate between the Asiatic and American divisions, the Peninsular languages of Asia will occupy an important position. The Altaic languages least in sympathy with this family are the Mongol, whose affinities are largely Dravidian. At the base of this large family the Accad stands, whose relations are probably more Peninsular than anything else; and next to the Accad in point of antiquity and philological importance is the pre-Aryan Celtic, which lives in the Quichua of to-day, as I showed in a contribution to the Societé Americaine de France, and in a list published by Dr. Hyde Clarke in the Journal of the Anthropological Institute. Dr. Hyde Clarke had long before connected the Accad and the Quichua-Aymara, and had linked the Houssa with the Basque. He has also directed attention to Basque similarities in Japanese and Loo-Choo. Most of the tribes composing this family were known to the ancients as Scythians, so that the ancestors of our modern Iroquois may have over-run Media and plundered the Temple of Venus at Ascalon, tantalized the army of Darius or talked with Herodotus in the Crimea. Types of mankind, in a savage state, do not greatly change, as may be seen by comparing the Tinneh or Algonquin tribes with the Iroquois and Choctaw. Languages long retain their earliest forms, as is apparent in the Japanese *somots* and Loo-Choo *shimutzi*, which are just the old Accadian *sumuk*, *samak*, a book, that were spoken in ancient Babylonia perhaps four thousand years ago. This continent may yet furnish materials in philology and kindred departments to lay side by side with the literary and art treasures of the ancient seats of empire on the Euphrates and Tigris, by which to restore the page of long-forgotten history. At any rate there is a path from the Old World into the New by the Asiatic Continent, as well as by the islands of the sea. Discouragements enough have been placed in the scholar's way by one-sided minds and students of a single language or science. It is time to treat them with the contempt that all narrowness deserves, and to aim at making ethnology more than a statement of unsolved problems.

It would be well for all who hold the essential diversity of American from other grammatical forms, to ponder the statement of one, who, himself no mean philologist, has generally shown little favour to any attempts that have been made to reconcile the Old World and the New in point of language. I allude to M. Lucien

Adam, who, after a comparison of Algonquin, Iroquois, Dacotah, Choctaw, Tinneh, Maya-Quiche, Aztec, Muysca, Carib, Guarani, Quichua and Kiriri grammars, adds this important note: "In fact the preceding languages are all more or less polysynthetic, but this polysynthesis, which essentially consists in suffixing subordinate personal pronouns to the noun, the postposition and the verb, equally characterizes the Semitic languages, the Basque, the Mordwin, the Vogul, and even the Magyar." As far as American philology is concerned the question of the unity of the human race remains where it has been fixed by Revelation. I close this paper with a sentence from Dr. Daniel Wilson's address before the American Association: "The same lines of research (as those which have demonstrated Aryan unity) point hopefully to future disclosures for ourselves, helping us to bridge over the great gulf which separates America from that older historic and prehistoric world; and so to reunite the modern history of this continent with an ancient past."

I.—COMPARATIVE VOCABULARY OF THE TINNEH AND TUNGUS LANGUAGES.

The material of this and the following vocabularies has been derived from English, French and German sources, with variant orthography. I have not thought fit to make any other alteration than that of replacing the German *j* with *y*, as such English vowel sounds as *ah*, *ee* sufficiently attest their origin.

	TINNEH.	TUNGUS.
arm	ola, T. (Taculty)	ngala
axe	taih, K. (Kutchin)	tukka
	shashill, T.	shuko
bad	tschoolta, Kn. (Kenai)	kamult
bear	sus, T.; yass, C. (Chipweyan)	keki, kuti
beard	tarra, D. (Dogrib)	tshurkan
bed	kaatsch, U. (Ugalenze)	sektau
belly	kagott, U.	chukito
bird	kakashi, Kn.	gasha
	tsoje, Ko. (Koltshane)	doghi
black	tkhlsune, Tlt. (Tlatskanai)	sachalin
blood	sko, T.	shosha
	shtule, Um. Umpqua)	sugal
boat	tsi, T.	djaw
boy	kaha, B. (Beaver)	kuakan
bread	kliuthchu, K.	kiltora
brother	chah, K.; echill, T.	aki
bull	chasska, U.	chjukun
	ahkik, K.	etsche
child	beye, T.	unja, bujadjui
	quelaquis, C.	u.., aljukan
	ischynake, Kn.	kunga
clothes	thuth, C.; togaai, Kn.	tetiga
cold	nikkudh, K.	inginikde
	hungkox, T.	inginishin
	oulecadze, B.	yullishin
come	chatchoo, L. (Loucheux)	tschi
copper	thetsra, K.	tschirit
day	tiljcan, Ko.	tirgani
daughter	nitchit, K.	unadju
deer	batshish, Ko.	buchu
drink	esdan, Mo. (Montagnais)	undau
	chidetleh, L.	koldakoo
ear	xonade, Klt.	schen
	szulu, K.	korot

	Tinneh.	Tungus.
earth	no, Na. (Navajo); nanee, Um.	na
eat	beha, L.	bishui
eye	eta, Mo.	esha
father	mama, Tlt.	ama
fire	tenck, At. (Atnah); takak, U.	tona, tog
fish	uldiah, C.	olda
	lue, Mo.	ollo
forehead	sekata, Y. (Yukon)	onkoto
girl	getsi, K.	asatkan
	kernihl, Tol. (Tolewah)	ghoorkan
give	hamiltu, C.	omuh
go	antonger, Y.	genigar
good	sutchon, T.	ssain
great	unshaw, C.	ekzsham
	choh, K.	choydi
green	dellin, Mo.	tschurin
hand	kholaa, Tlt.; hullah, Na.	gala
	inla, Mo.	nala
head	edzai, D.	udjoo
heaven	jujan, Kn.	njan
house	zeh, K.	dzsho
husband	ahoteey, C.	edee
	etsayoh, B.	oddin
	deneyu, Mo.	edin
ice	ttatz, U.	djuko, dschuche
iron	shlestay, T.	sele
knife	teish, T.	utsch
	tlay, L.	sele
leaf	chitun, K.	awdanna
life	anna, T.	inni
lightning	nahtunkun, K.	talkian
lip	edanne, Mo	aodjun
man	tengi, K.; tingi, Tn. (Tenan-Kutchin); tenghie, L.	tungus, donki
	sykka, U.	chacha
	payyahnay, P. (Pinaleno)	bey
mother	anna, Kn.	enie
	an, Mo.	ani
mountain	schhell, T.	tscholkon
	tauri, Mo.	urra
no	aume maw, B.	umi
nose	neuzeh, At.	nigsha
	huntchu, H. (Hoopah)	onokto
old	saiyidhelkai, K.	sagdi
pipe	tekatski, T.	tagon
rain	naoton, T.; tsin, K.	oodan, uddun
	tchandellez, Mo.	tukdol
red	delicouse, C.	cholachin
river	okox, T.	okat
salt	tedhay, Mo.	tak
see	eshi, Mo.; utschtschiilia, U.	itschetschim
serpent	nadudhi, Mo.	nogai
sleep	azut, U.	adjikta
small	astekwoo, Tlt.	adsighe
	nacoutza, Y.	ujuktschukan
son	tsiah, K.	dsui
spoon	schitl, U.	kuili
star	kumshaet, L.	omikta
	klune, Y.; shlum, T.	haulen
stone	tschayer, P.	djollo
sun	chokonoi, Na.; chignonakai, Co. Coppermine.	schigun
	shoonnahaye, M. (Mescalero)	shun
thunder	idi, Mo.	addi
thread	mo, Mo.	umi
tongue	tsoola, T.	tschola
tooth	egho, X. (Xicarilla); shti, Tol.	ikta
wife	sak, T.	ashi
	jarcooey, C.	sarkan
wind	atse, Y.	edyn
wolf	yess, C. T.	gusko
woman	ekhe, Um.; chaca, T.	heghe, cheche
write	edesklis, Mo.	dokli

The Tinneh numerals do not agree with the Tungus, but seem intimately related to those of the Koriaks, Tchuktchis and Kamtchatdales. This must be the result of intercourse between the Tinneh and these peoples in an Asiatic home, as the general vocabulary of the Tinneh shows comparatively little likeness to those of the so-called Peninsular family.

	TINNEH.	PENINSULAR.
1.	tahse, A. (Apache); taşhte, Co.; tashayay, M.	dysak, *Kamtchatdale*
	etscha, T.; titskoh, Tol.	atashek, *Tchuktchi*
	tihlagga, K.; aitsehla, Um.; tathlai, Na.	attajlik, T.
	kisslekka, I. (Ingalik)	
2.	natoke, Tlt.; inteka, I.; nateakcha, At.	nitakaw, *Koriak*
	techa, Kn.; gatte, U.	hyttaka, ytahgau, K.
	nach, H.; nekai, K.; nacheh, Tol.; nakhe, C.	niochtsh, K.
	nahke, D.; onghaty, B.	
3.	tokchke, Kn.; tock, W (Wilacki); taak, Um.	tschok, tsook, Ka.
	tahek, H.; tiik, K.; taakei, At.; tauh, Na.	
	kahyay, M.	gineh, K.
4.	teucheh, Tol.; tuntschik, Um.; tectutye, Si. (Sicanni)	tschak, tschaak, tschaaka, Ka.
	dine, D.: tin, Na.; tang, K.	ishtama, T.
5.	inla, lakken, D.	monlon, myllygen, K.
	swoila, Tol.; schwullak, Um.; chwola, H.	(sombula, sahljak, shumblia, sumula, *Samoied*)
	sesunlase, Mo.; skunlai, T.	sewinlak, T. (6)
6.	cooslac, W.; ulkitake, T.	gylkoch, kylkoka, Ka.
7.	tluzuddunkhe, C.	tscholudunug, Ka. (8)
	etsedetsenekai, K.	etachtanu, Ka.
	ookaidingkee, Si.	ahdanuth, etuchtunuk, Ka.
	hoitahee, Um.; tauatee, B.; tsaytch, Tol.	itatyk, Ka.
8.	coostak, W.	tshookotuk, Ka.
	elkedinghe, C.	tscholudunug, Ka.
9.	tahgeeahttah, C.	tschuaktuk, Ka.
	coostenekha, W.	tschaaktanak, Ka.

II.—COMPARATIVE VOCABULARY OF THE CHEROKEE-CHOCTAW AND PENINSULAR LANGUAGES.

axe	gahlooyahste, *Cherokee.*	galgate, *Koriak;* algatta, *Tchuktchi.*
bad	ooyohee, "	ashiki, *Japanese.*
	okpulo, *Choctaw;* hooloowako, *Muskogee*	achali, K. (Koriak)
bear	yonung Ch. (Cherokee)	keingin, T. (Tchuktchi)
beard	ahhahnoolunghunge, Ch.	elun, *Kamtschatdale*
belly	ikfuka C. (Choctaw)	fuku, J. (*Japanese*); piigi, Ka. (Kamtschatdale)
	innhalkay M. (Muskogee)	kaltki, Ka.
belt	uskofachi, C.	obee, *Loo-Choo*
bind	takchi, C.	toji, J.
bird	hushi, C.	hotu, L. (Loo-Choo)
black	kungnahgeh, Ch.	kunni, *Aino*
	loosah, C.	luulklek, K.
blood	homma, C.	kehm, A. (Aino)
	chata, M.	ketsu, J.
	issish, C.	chi, L.
boat	peni, C.	fune, J.
body	ahyahlunge, Ch.	gylgin, K.
bone	foni, C.	pone, A.
bow	itchukkatoxy, M.	edzak, Ka.
boy, son	pooskoos, C.	poo, A.; patscha, Ka.
	chahpozhe, M.	tungpoka, *Corean*
	nokkene, C.	iegnika, T.
	ushi, C.	ekik, K.
broad	hoputha, C.	habba, L.
brother	taychokkaduy, M.	otoko-kiyodai, J.; tyga, Ka.
	chotchilchwauh, M.	djalatscha, Ka.
	unggenele, Ch.	eninelan, eninelcha, ninelek, K.
	nocksish, C	eninichse, ninichsi, K.
	imunni, C.	emtschanhi, K.
burn	hukmi, C.	yuku, J.
buy	kanchi, C.	kau, J.
child	hokosy, M.	chigazi, A.
	hopohvyah, M.	bofoo, A.
	pooskoos, C.	wocka, L. (young)
clod	kupussa, C.; kussupe, M.	feesa, L.; tschapchunak, T.

day	neetak, C.	nitchi, L.
death, die	illi, C., ilzah, M.	wiillagyn, K.; haiulwa, A.
devil	askina, Ch.	akuma, J.
dog	ophe, C.	stahpu, A.
drink	ishko, C.	igu, A.
ear	istehuchtsko, M.	tschiftuchk, T.
	cheelane, Ch.	welolongen, C.
eat	pa. impa, C.	ippah, imbi, A.
	ahlestahyunghungskaw, Ch.	allotlonim, Ka.
egg	akang, C.	kuga, L.
evening	oosunghe, Ch.	aigomkje, T.
	yhofkosuy, M.	yube, J.
eye	tolltlowah, M.	lilet, K.
	mishkin, C.	manako, J.
far	hopiyi, M.	yempo, J.
father	aki, C.	chichi, J.; iseh, K.
	unke, aunkke, C.	una, A.; annaka, T.
	tawta, Ch.	teteoya, J.
	ilhky, M.	illgin, T.
female	tek, C.	taekki, L.
fight	bohli, C.	pilluak, T.; buchi-ai, J.
finger	ibbak-ushi, C.	yubi, J.; eebee, L.
fish	atsatih, Ch.	etschuda, Ka.
	agaula, Ch.; kullo, C.	ikahluk, T.
	nune, C.	ennen, K.
flesh	ahpisoebah, M.	tubish, Ka.
fox	choola, C.	tehasalhai, Kr.; gitgalgin, K.
fruit	uni, C.	ewynak, K.
girl, daughter	take, C.	taekki, L.
	chuchhoostee, M.	chtshitshoo, Ka.
go	ahe, C.; aguy, M.	iku, yuka, J.
	foka, C.	apkas, A.
god	hoshtahli, C.	istla, T.
good	chito, C.; heetla, M.	hota *Corean*; kuwodai, J.
goose	shilaklak, C.	lachlach, T.
grass	hasook, C.	kusa, J.; ewuk, T.
great	tlakkeh, M.	lukuklin, K.
	chito, C.	chytschin, Ka.
green	etsahe, Ch.	ichtschitschi, K.; sjiu, A.
	pahuyhlammyomuy, M.	aplela, K.
hail	gahnasookha, Ch.	kannik, T.
hair	gitlung, Ch.	kitigir, K.
	pase, pache, C.	bode, *Corean*; feejee, L. (beard)
	nutakhish, C. (beard)	nujak, T.
head	skoboch, *Chickasaw*	schaba, A.; kobe, J.
	nishkubo, C.	naskok, T.
	ecau, M.	kashko, T.
heart	chunkush, C.	shin, J.
	effaga, M.	sampeh, A.
	oonche, Ch.	minjugu, Ka.
heaven, sky	gullungluddee, Ch.	keilak, T.
hot	ukanawung, Ch.	kikang, Ka.
house	chookka, C.	ke, uchi, J.
ice	okte, C.	tschikutu, T.
life, live	okchaya, C.	kakowa, Ka.
light	egah, Ch.; hiyiaguy, M.	choigychei, K.
lightning	anahgahleske, Ch.	kumylgilat, K.
love	immuyuyhluy, M.	okmukulingin, K.
man	hottok, C.	otoko, J.
	nockene, C.	ningen, J.
	chauheh, M.	chu, L.; chujakutsch, K.
moon	teenœnentoghe, Ch.	tankuk, T.
	halhasie, M.	jailgat, K.
morning	onnihile, C.; sunahlae, Ch.	emukulas, Ka. (unhaiel, *Yukagir*)
mother	ichskie, M.; akachee, Ch.	okkasan, J.
mountain	nunichaha, C.	naju, K.; naigak, T.
mouth	tsiawli, Ch.	zehylda, Ka.
	chaknoh, M.	sekiangin, K.
neck	innokewau, M.	ingik, K.
night	ninnok, C.; nennak, M.	nigynok, K.; unjuk, T.
nose	kohyoungsahli, Ch.	kajakan, Ka.
old	suppokne, C.	gepinowli, K.
prince	miko, C.	miko, J.
rain	ema, C.	ame, J.
	omba, C.	apftu, A.

	aski, M.; aguskah, Ch,	azgutsch, Ka.
red	keekahgeh, Ch.	akai, J.
	chahti, M.	kawachtuk, T.
river	hucha, C.	gychi, Ka.
	bok, C.	bez, A.
	equonih Ch.	gojem, K.
run	chuffa, C.	shuppon, J.
	sitkuscha, M.	chikuten, J.
salt	hupi, C.	schipoo, A.
sea	amaquohe, Ch.	umi, J.; mok, imah, T.
	wehuta, *Hitchitee*	atui, A.
sick, sickness	abeka, C.	biyoki, J.
sister	unggedo, Ch.	onna-kiyodai, J.; tschagado, K.
	nocksishtike, C.	najahak, T.
skin	bakschup, C.	kawa, J.
sleep	gahlehah, Ch.	keilkat, K.
	nusi, C.	netsuki, J.
	nogobuscha, M.	soibushi, J. (sleep together)
small	chotgoose, M.	chiisai, J.
snow	ungnawtsi, Ch.	anighu, K.
	tilligue, M.	hlhlgwuh, K.
star	owohchikea, *Hitchitee*	hoshi, J.
	phoutchik, C.	foshi, J.
summer	miski, C.	natsu, J.
	kohkee, Ch.	ka, J.; kuiga, T.
	tomepulleh, *Chickasaw*	adomplis, Ka.
sun	neetak-husih, C. (Day-star)	nichi, J. (day) hoshi, J. (star)
	neetahusa, M.	matschak, T.
	kalesta, Ch.	kulleatsch, K.
take	ishi, C.	oku, A.
throat	ahgelega, Ch.	igliak, T.
thunder	hiloha, C.	kyhal, kyigala, kihihelau, K.
	jyrajaa, C.	rai, J. urgirgerkin, T.
to-morrow	onaha, C.	unako, T.
tongue	soolish, C.; istetolahswah, M.	etschilla, K.
tooth	innotay, M.	wuttinka, T.
tree	iti, C.; itta, *Chickasaw*; uhduh, Ch.	utut, K.; uttu, T.; uuda, Ka.
walk	yahkahbuscha, M.	hakobu, J.
water	uckah, C.	waku, A.
	ahmah, Ch.	emuk, T.; mima, K.
white	hatki, M.	haku, J.; attych, Ka.
wolf	yahah, M.	haigugeh, K.
woman	choyo, C.	jo, J.
	ageyung, Ch.	aganak, T.
	tike, tekchi, C.	tackki, L.
1.	humma, M.	onnon, K.
2.	tuklo, C.; toogalo, *Chickasaw*	tzogelsch, Ka. (3)
3.	tsawi, Ch.; totcheh, M.; tukchina, C.	tsook, Ka.
4.	ushta, C.	ishtama, T.
	nunggih, Ch,	nijach, K.
5.	tahlapi, C.	tachlima, T.
6.	hannali, C.	nunmalan, onnamyllangan, K.
7.	untuklo, C.	nitachmallangga, K.
8.	untuchina, C.	tschooktunuk, T.
9.	ostabah, M.	stammo, T.
10.	pocole, C.	kulle, T.

III.—COMPARATIVE VOCABULARY OF THE WYANDOT-IROQUOIS AND PENINSULAR LANGUAGES.

above	ehneken, *Iroquois*	uyeni, *Japanese*
arm	onentcha, I.	oondee, *Aino*
axe	askwechia, I.	kvasqua, koshcho, *Kamtchatdale*
	nokeuh, *Tuscarora*	inggako, *Koriak*
	ahdokenh, *Mohawk*	adaganu, K.
basket	atere, I (*Iroquis*) [M. (Mohawk)	teeroo, *Loo-Choo*; zaru, J. (*Japanese*)
bear	oochereuh, T. (*Tuscarora*); ooquharlee,	akliak, *Tchuktchi*
bad	hetken, I.	chaitkin, K. (*Koriak*)
	washuh, T.	wasa, *Loo-Choo* [egchka, T. (*Tchuktchi*)
belly	kwichta, I.	ksuch, Ka. (Kamtchatdale); aktscha-
	unagwenda, M.	nanchiin, T.
below	ehtake, I.	jechtok, T.
belt	ontagwarinchta' I.	ririt, irit, T.
black	hontsi, I.	nudchen, T.
	tetiucalas, O. (*Oneida*)	natchala, T.; kytyhalu, K.

blood	cotnuh, T.; gatkum, N. (*Nottoway*)	ketsu, J.
	hotkwensa, I.; otquechsa, On. (*Onondaga.*	
body	gu-ierongue, oicronta, I.	gilgin, K.; karada, J.
bone	onna, H. (Huron)	hone, J.
	hechtienda, I.; akstiyeh, I.	kotsu, J.
bow	awraw, T.	erit, K.
boy, son	laxha, O.	laki, K.
	ronwaye, M.	rinaka, T.
	haksaah, On.; eawook, S. (*Seneca*)	akek, jakak, K.
brother	ataquen, H.; jattatege, On.	otoko-kiyodai, J.; tyga, Ka
	haenyeha, H.	eninichse, K.
	teetoteken, S.	itschamitugin, T.
	teeahgattahnoonduelih, M.	tschamdakal, K.
	yatsi, H.	ktshidzshi, Ka.
burn	gatchatha, I.	yatta, L.
child	kotonia, I.	kodomo, J.
	cheahhah, H.	chigazi, A. (Aino)
	woccanoune, T.	wocka, *Loo-Choo* (young)
cold	wathorats, I.; turea, H.	kiyetaru, J.
come	karo, M.	kuru, J
copper	quennies, M.; kanadzia, I.	akagane, J.
day	entiekeh, I.	nitchi, L. (*Loo-Choo*)
	ennisera, I.; eghnisera, M.	nichi, J.; aghynak, T.
	yorhuhuh, T.	halui, K.; hallugg, Ka.
do	konnis, I.	okonai, J.
dog	yunyenoh, H.	inu, J.
	cheeth, T.	getten, T.; sheda, A.
	erhar, M.; cheer, N.; tschierha, On.	atar, chatalan, K.
death, dead	kenha, I.	gang, L.
drink	ichnillkeeuh, M.	igyletsch, Ka.
duck	soluck, M.	galle, K.; galgagalach, T.
ear	ohuchta, On.	tschiftuchk, T.
	suntunke, N.	tschintak, T.
earth	ohetta, I.	ttati, *Corean.*
	onouentsia, I.	nutenut, K.
	uenjah, S.; ahunga, O.	nuna, T.
eat	higuech, I.	ku, J.
	tehatskahons, M.	tekitschgyn, T.
egg	onhonchia, I.	nohk, nuku, A.; nyhach, Ka.
end	koktha, I.	hate, J.
evening	yougarlahsickhah, M.	aigaweroe, K.
	tetemret, H.	aathin, Ka.
eye	acoina, H.	gan, J.
	kaka, S.; okaghha, C. (Cayuga)	shigi, A.; ik, T.
father	ionniha, I.; ihani, C.	una, A.
	aihtaa, H.; ata, T.	atta, T.
	rakeni, M.; lahkeni, O.	illigin, T.
feather	onasa, I.	hannee, L.
field	kaheta, I.	tahata, hatake, J.; getschigyn, K.
fingers	eyingia, H.	aihanka, T.
	sahhuguehlahgheh, M.	tschilgit, K.
fire	ontchichta, I.	undji, A.
	yoncks, T.	annak, eknok, T.
fish	otschionta, On.	etschuda, Ka.
	yeentso, H.	entschudu, Ka.
	kenyuck, S.	annegui, T.
foot	saseeke, N.	shaku, J.
	oosa, T.	assi, J.
	ochsita, On.; achita, H.	gitkat, T.
forehead	akentstara, I.	kytshal, K.
	oyeutsa, H.	kuitschitsch, Ka.
fox	iitsho, M.	iuchka, T.; hitschkat, K.
frog	skwarak, I.	gayeru, J.
girl, daughter	kaunuhwukh, T.	ngewek, K.
	kayung, O.	suwingh, Ka.
	ikhehawog, C.; keawook, S.	gufikuku, K.
give	keyahwe, wahetky, I.	katchu, Ka.
go	hugue, I.	yuku, J.
	yehateatyese, M.	utashish, Ka.
god	ocki, H.	egeg, K.
	tezhuskahau, H.	duzdeachtschitsch, Ka.
good	oogenerle, M.; ioyanere, I.	gemelewli, K.
great	kowa, I.	ko, okii, J.; kaaguk, T.
	tatchanawihie, N.	chytschin, Ka.

hair	arochia, H.	lauchshach, K.; ruh, A.
	ahwerochia, I.	tscheracher, Ka.
	onuchquira, On.	kytyhuir, kitigir, K.; kar-nu, A.
	ononkia, C.	nujak, T.
hand	osnonsa, I.	soan, C. (Corean)
	chotta, I.	syttu, Ka.
hare	tahhoot-ahnaykuh, M.	whl-huta, K.
he	ra, I.	are, J.
head	noatsheera, H.	kashira, J.
	nontsi, I.; anoonjee, M.	naskok, T.
heart	hahweriacha, I.	kokoro, J.
heaven, sky	quaker-wutika, N.	goku-raku. J; rikita, A.; kochall, Ka.
	kiunyage, I.	chain. Ka.; khigau, K.
	garonhiague, I.	cherwol, K.
horn	kanagaa, I.	tscheonok, T.
hot, heat	otarahaute, H.	hoteru, J.
	yoonaurihun, T.	nomling, K.
house	kanosiod, C.; kanoughsode, M.	kisd, kishit, Ka.
	anonchia, H.	ennit, T.
hunger, hungry	cautsore, O.	katsuyeru, J.
	cadagcariax, O.	shandageri, A.
kill	kerios, I.	koroshi, J.
knife	kainana, C.	ko-katana, J.
life	yonhe, M.	inochi, J.
	konnhe, I.	kyjunilin. T.
lip	hechkwaa, I.	kkovan, Ka.
love	enorongwa, M.; aindoorookwaw, H.	(anurak, *Yukagir*)
male	hatgina, I.	otoko, J.
man	nenekin, I.; aingahon, H.	ningen, J.
	itaatsin, *Minckussar*	chojatschin, T.; hito, J.
	eniha, N.; anecbah, T,	ainuh, A.
	oonquich, M.	kengitsch, Ka.; oikyo, A.; ickkeega, L.
	lookque, O.	luka, T.; elku, Ka.
moon	kanaughkwaw, C.	(kininsha, *Yukagir*); kounetsou, A.
	kelanquaw, M.; karakkwa, I.	gailigen, K.
mother	ena, N; aneheh, H.; eanuh, T.	aingga, anguan, Ka.
	ikillnoha, M.; ahkenolha, O.	ella, elhi, K.; illia, Ka.
mountain	kaunatauta, C.	kimita, A.
	onontah, H.; onontes, On.	enshida, namud, Ka.; neit, T.
mouth	chigue, I.	kuchi, J.
	yasook, O	syeksye, saaxxa, Ka.
	sishakaent, C.	sekiangin, K.
	oosharuuwah, T.	gikirgin, djekergen, K.
	agwaghsene, M.	ekigin, T.
much	eso, I.; aysoo, M.	osa osa, J
	awquayakoo, M.	oowhoko, L.
nail	ohetta, I.	wegyt, T
	oocheelah, M.	wachelang, K.
name	osenna, I.	ninna, K.
navel	hotchetota, I.	hozo, J.; katkatschik, T.
neck	oneaya, M.	onnajan, K.
night	sonrekka, I.	ukuru, anzkari, A.; unnjuk, T.
	kawwassonneak, O.	kyunnuk, Ka.
	nehsoha, S.	nikita, T.
nose	yaunga, H.	enku, K.; hana, J.
	oteusag, N.	tatuk, T.; ahdum, idu, A.
	oojyasa, T.	echaech, yachchaya, T.
	kakondah, S.	kaakang, Ka.
	geneuchsa, M.	chyngak, T.
	enuchsakke, C.	enigytam, K.
place	kiterons, I.	kakeru, J.
rain	iokennores, I.	(yagmur, *Turk*)
red	quechtaha, S.	kawachtuk, T.
	guwenta-rogon, I.	nitschel-rachen, K.
	tucotquaurauyuh, T.; oniquahtala, O	tshatshalo, Ka.
river	kihade, C.; geihate, On.	kiha, Ka.; knigutt, T.
saliva	wtchera, I.	yodare, J.
shoes	onokqua, T.	hunginn, C.
silver	hwichtanoron, I.	elnipel-wychtin, K.
sister	tsiha, I.; akzia, On.; auchtchee, T.	ahtschitsch, kutchaan, Ka; tchakyhetch [K.
skin	hoserochia, I.	rus, A.
	hnonk, I.	nakka, T.
sleep	wakitas, I.	kangwitkis, K.
small	ostonha, I.	uitschenan, Ka.

snow, to snow	wakerens, I.	yuki, yukigafuru, J.
	ogera, On.	korjel, Ka.
	onyeiak, S.; ouniyeghte, M.	anighu, T.
speak	atakea, H.	idakuwa, A.
spring (season)	kungweeteh, M	auchtoha, T.
star	ojechsoondan, S.	agajin, Ka.
	ojishonda, C.	ashangit, Ka.
stomach	utskwena, I.	ikuwan, J.
stone	owrunnay, T.	whrangon, K.
summer	akenha, M.; kayahneh, S.	sakan, A.; kegmu, T.
sun	kelanquaw, M.	galenkuletseh, Ka.
	karakkwa, I.	kulleatsch, Ka.; tirkiti, T.
	ladicha, H.	laatsch, T.
	onteka, I.	matschak, T.
	heetay, T.; aheeta, N.	tida, L.; tyketi, K.
	kachquaw, S.; kaaghkwa, C.	koatsch, Ka.
tongue	ennasa, I.	entsel, Ka.
tooth	onouweelah, C.; onawira, I.	wannalgu, K.
	otoatsch, T.	gutuk, T.
throat	niarigue, I.	reguzy, A.
thunder	kaweras, I.	kyhal, kyigala, ikigigrihan, K.
village	kanata, I.	guina, K.
walk	enai, H.	hiroi, I.
	ahteatyese, M.	ita, J.; atehoong, L.
water	auweah, T.; awwa, N.	wakha, A.
	ohneka, I.; oneegha, *Minekussar*	inh, K.; mok, emak, T.
weep	garkentat, I.	terugatirkin, T.
white	kearagea, M.	sheroosa, L; shiroi, J.
	kenraken, I.	nilgachen, K.; rata-gaunep, A.
	keaankea, C.	genggahlan, Ka.
winter	koashlakke, O.; kosera, I.	kollealas, Ka.
	oxhey, H.; kooschhea, T.	achsachsaan, K.
wolf	ahquohhoo, M.	aigugeh, chgahuwu, K.
woman	yonkwe, M. O.; ekening, T.	innago, L.; aganak, T.
	otaikai, H.	taekki, L.
write	khuatons, I.	katchoong, L.
year	osera, I.	gytscharudo, Ka.
yellow	hotgikkwarogon, I.	nuutelgrachen, T.
	cheenaguarle, M.	duchl-karallo, Ka.
young	osae, N.	atschik, T.
1.	unji, T.; unti, N.	ingsing, K.
	uskot, M.	dyshak, Ka.
2.	techini, M.	ni-techaw, K.
	nekty, T.	niechtsch, K.
	teghia, O.	ytechgau, K.
3.	shegh, S.; segh, C.; ahseh, M.	tsook, Ka.; giuch, T.
	ahsenh, O.; aushank, H.	sang, L.
4.	kayerih, M.	gyrach, K.
	kayelih, O.	tsagelch, Ka.
	huntak, T.	niyach, ngshakaw, K.
5.	wisk, M., &c.	asheki, A.
7.	tehoatak, On.; tsatak, M.	itatyk, Ka.
8.	nakruh, T.	angrotkin, T.
	tagheto, O.	tshookotuk, Ka.
9.	tutonh, M.; tiohton, *Caughnawaga*.	tschachatonoh, tchauatana, Ka.
	tiohto, C.	tschuaktuk, Ka.
10.	oyelih, O.	kulle, T.

ADDENDUM.

THE DACOTAH FAMILY.

It is only since writing the foregoing article that I have found the relations of this important family. The Dacotah languages differ so widely in their vocabulary, or rather in their vocables, from the Iroquois, that, in spite of grammatical construction, and the equally warlike character of the two people, it was hard to imagine a community of origin. In the labials that are wanting in the Wyandot dialects, the Dacotah is peculiarly rich. So complete is the compensation made by the Dacotah dialects for Wyandot shortcomings in this respect, that labials utterly unknown to the original root start up everywhere, as terminal, medial, and even initial sounds. On the other hand, the strong Mohawk *r* is almost absent in Dacotah; the Upsarokas, Minetarees and Mandans, who sometimes employ this letter, being very sparing in its use. Nor, can it be said, save as a rare exception, that there is an *l* in Dacotah to atone for the comparative absence of *r*, with which, in the Iroquois dialects, it is at times interchanged. The general vocabulary has miscellaneous Siberian affinities, largely with the Samoied, and many with the Ugrian languages. (I may say that I use the word Ugrian to denote the Finnic-Magyar family of languages as opposed to the Altaic, which includes the Tartar, Mongol and Tungus, since I cannot see the propriety of extending it, as has often been done, to the whole Ural-Altaic division). I was thus upon the point of making the Dacotahs a Samoied colony, and had, indeed, communicated the likelihood of such a relationship to correspondents interested in American philology, when light broke upon the subject in connection with the terminations of verbal forms, which, being followed up by other coincidences, settled the matter in favour of a Peninsular origin for the Dacotahs, as well as for the Iroquois and Choctaws. The Hon. Lewis H. Morgan has shown that the Dacotah and Iroquois dialects are allied, and that the latter separated from the parent stock at a much earlier period than the former.

The Dacotahs, better known as the Sioux, and the Nadowessies of Carver and other older writers, are a warlike, intrusive people, of good stature, and generally pleasing appearance, with capabilities of no mean order, and exhibiting, as in the case of the Mandans, a considerable advance in culture beyond the neighbouring tribes. They occupy a great portion of the centre of the continent, being essentially an inland people like the Wyandots and Choctaws. Their hunting-grounds extend from the Red River to the Saskatchewan southwards to the Arkansas, and are chiefly found between the Mississippi on the east and the Rocky Mountains on the west. They are thus the neighbours of many Algonquin tribes, with which they are more or less intermixed. The principal tribes of this family are the Sioux or Dacotahs proper, the Yanktons, Winnebagoes, Assineboins, whose name is Algonquin, Mandans, Upsarokas or Crows, Minetarees, Ioways, Osages, Ottoes, Omahas, Quappas, Konzas and Hidatsas. Their warlike and independent character is well known, especially in connection with their recent encounter with the American troops and the subsequent withdrawal of some of them to Canadian territory.

The Dacotah word for man, male, is *wika*, *wicasta*, and this is the Tchuktchi *uika;* while other terms, such as *hihna* and *oeeteka*, relate to the Aino *aino* and the Japanese *otoko*. Similarly, the words for woman, *wingy*, *winnokejah*, *wakka-angka* and *tawiku*, represent the Loo Choo *innago*, the Tchuktchi *aganak*, and the Loo Choo *tackki*. The general lexical resemblances of the Dacotah and Peninsular, within the limits, at least, of my somewhat defective vocabularies, are not by any means so close as between the Choctaw and the Peninsular. Still, there are some striking forms. Such are the Dacotah *echong*, make, and the Loo Choo *oochoong; dowang*, sing, and the Loo Choo *ootayoong; yazang*, sick, and the Loo Choo *yadong; cangte*, heart, and the Japanese *sing*, &c. The Kamtchatdale connects intimately with some of the Dacotah dialects, particularly with the Assineboin. The Dacotah *wahcheesh*, child, is the Kamtchatdale *pahatshitsh; matsi*, knife, is *wattsho; toka*, sevant, is *tshequatsh; isto*, arm, is *settoo; ataki*, white, is *attagho*, &c. The Tchuktchi necessarily is connected; and we have the Dacotah *ceneek*, *eejinggai*, *cinglcsi*, boy, in the Tchuktchi *iegnika; cang*, day, is *gaunak; nijihah*, hair, is *nujak; nahsso*, head, is *naskok; ecat*, small, is *ekitachtu; neah*, *mini*, water, is, *nouna; tehha*, lake, is *tonga; onkahuh*, finger, is *ainhanka*, &c, Of the few Corean words known to me, several answer to the Dacotah equivalents; thus the Dacotah *akhui*, ear, is the Corean *qui; uohta*, good, is *hota; paykee*, hair, is *bode; cezi*, tongue, is *chay;* and *pezi*, grass, is *phee*.

I have mentioned verbal terminations as my guides to the affiliation of the Dacotah languages. In Dacotah a common termination for verbs is that variously rendered *ang*, *ong*, *ung*, as in *yatkang*, eat, *nahong*, hear, *pahmung*, spin, *tongwang*, see, *echong*, make, *manong*, steal. Captain Clifford, in his vocabulary of the LooChoo language appended to Basil Hall's voyage, draws attention to a similar termination of the verb. He says: "I have, throughout the vocabulary considered the termination *oong* to denote the infinitive and have translated it as such, even when the sense points to another word, merely to preserve consistency; there are, however, a few exceptions to this, and some of the verbs will be found to terminate in *ang*, *ing*, *awng*, *ong* and *ung*." The Japanese infinitive in *mi*, to which there are many exceptions, does not resemble this termination, but connects with the Turkish infinitive in *mek* and the Magyar in *ni*. Neither does the common LooChoo and Sioux form resemble the Mantchu in *re*, or the Mongol in *ku*. We are thus, I think, justified in holding that the Dacotah verbs *echong*, make, *dowang*, sing, and *yazang*, be sick, are the same words as the LooChoo *oochoong*, *ootayoong* and *yadong*, having meanings identical. But a confirmation of the Peninsular origin of the Dacotahs even more interesting is afforded by a comparison of the Assiniboin infinitive, or at least verbal termination, with that of the Kamschatdale. The Assiniboin verbs in their simplest form end in *atch*, *itch*; thus we have *passnitch*, *tusnitch*, to love, *wunnaeatch*, to go, *eistimmatch*, to sleep, *aatch*, to speak, *wauktaitch*, to kill, *waumnahgatch*, to see, *aingatch*, to sit, *mahnnitch*, to walk, &c. Similarly in Kamtchatdale we meet with *kasichtshitch*, to stand, *koquasitch*, to come, *kashiatsh*, to run, *ktsheemgutsh*, to sing, *kassoogatsh*, to laugh, *koogaatsch*, to cry &c. It is true that the Kamtchatdale *kowisitch*, to go, and *kwatshquikotsh*, to see, are unlike the Assiniboin *wunnaeatch* and *waumnahgatch*, except in their terminations; but, as I have already indicated the connection of the Dacotah and Kamtchatka vocabularies, this is an objection that fuller knowledge of Kamchatdale would probably remove. It was the verbal terminations of Sioux in *ng* and of Assiniboin in *tch* that decided the question in my mind of the Old World relations of the Dacotah family of language and tribes. Those who are better acquainted with the Peninsular languages may be able to account for diversities in the Dacotah dialects by corresponding differences in them. That two such unusual forms as the LooChoo and Kamchatdale should occur in one American family is very strong presumptive evidence in favour of that family's Peninsular derivation.

The grammatical construction of the Dacotah languages may be said, at least, to interpose no obstacle in the way of a Peninsular origin. The absence of true gender, and a distinction between nouns as animates and inanimates; the formation of the genitive by simple prefix to the nominative, with or without the third personal pronoun; the use of pronominal prefixes, and of post positions; the place of the regimen before the governing verb, are all in favour of such an origin. The post position of the adjective, which my knowledge of the Dacotah dialects does not enable me to say is universal, finds its analogue in some Japanese and Loo Choo forms. The inclusive and exclusive plural belongs to the Siberian area, and is Turanian. The post position of the negative *sni* answers to the post position of *nang* and *nashee* in Loo Choo. And the use of two tenses only, a present-past and a future, reminding the philologist of the Semitic and Celtic languages, presents no barrier to the relationship, inasmuch as the temporal index follows the verbal root, while the pronoun precedes it. It is worthy of note that while there is a general agreement in grammatical forms among the Iroquois, Choctaw and Dacotah languages, they specially coincide in marking the difference between transitive and intransitive verbs by the use of distinct pronominal particles. Judging from the identity in form of the Sioux and Assiniboin verbs to the Loo Choo and Kamtchatdale respectively, I would be inclined to regard the Dacotah family as a far more recent off-shoot from the Peninsular stock than the Iroquois or the Cherokee-Choctaws, a view which is favoured by the geographical position of the several tribes.

The ball play or lacrosse of the Choctaws and Iroquois is practised by the Assiniboins, whose method of boiling by dropping heated stones into a skin substitute for a cauldron, has, according to Catlin, gained them their Cree name of "Stone Indians." Pottery was extensively manufactured by the Mandans; and the large, handsome skin lodges of the whole Dacotah family present a marked contrast to the wigwams of the Tinneh and Algonquin tribes. The Mandan lodges, excavated to a slight distance and covered with earth, with the exception of a hole in the centre, are the same as those of the Koriaks and Tchuktchis.* The lascivious dances of many Dacotah tribes resemble those of the Kamtschatdales. One physical peculiarity of this family is the long hair of the warriors which often sweeps the ground. My limited knowledge of the inhabitants of the Peninsular area does not enable me to say whether this feature characterizes any of its populations. The Sioux have a story of a maiden's leap from a precipice into the water, the "Lover's Leap" of Catlin, which recalls the tradition of the Leucadian Rock and the Hyperborean practice alluded to by many ancient writers. If this be a

* According to Klaproth, the Koriaks call the Tchukichis Mainetang, which may be the original of the name Mandan.

Koriak tradition, the Leucadian Corax, and Charaxus, the brother of Sappho, may be terms of ethnical significance. I have little doubt that the ancient Koriak habitat and centre of diffusion was the Caucasus, where the Coraxi and Cercetae dwelt. The Assyrian in-inscriptions should shed light upon this important family, which finds such large representation on the North American Continent.

A few of the Dacotah numerals show their Peninsular connection by agreeing with those of the Iroquois and Choctaws. Thus the Dacotah *onje*, *eyungkae*, *yonke*, *wonge*, one, are the Iroquois *anji* and *enskat*; while *amutcat*, another form of the same number, is like the Iroquois *onskat*. The Otto *tekeni*, two, is the Iroquois *techini*. I can hardly think that it is a borrowed word, inasmuch as the Sioux *sahdogang*, eight, is the Iroquois *sahdekonh*, and the relation of two and eight was exhibited in the Choctaw *tukchina* and *untuchina*. The Dacotah *weckeechem*, *wikchemma*, ten, are probably the same as the Iroquois *wasenh*; and *chechoh*, *kakhoo*, five, agree with the Muskogee *chahgkie*. While a more extensive comparison than the materials at my disposal have enabled me to make would be very desirable, it will, I think, be confessed by competent judges, that, for the purposes for which the paper has been written, it is not necessary. It will be a simple matter for other students to follow out the lines of research that I have indicated and in a measure illustrated, and either confirm the conclusions arrived at, or otherwise account for the phenomena on which they are based.

COMPARATIVE VOCABULARY OF THE DACOTAH AND PENINSULAR LANGUAGES.

arm	ada, *Hidatsa*; arda, *Mandan*	ude, yeda, *Japanese*
	isto, *Dacotah*, *Yankton* [(*Dacotah*)	settoo, *Kamtchatdale*
arrow	mahha, M. (*Mandan*); ma, mong, D.	mechim, Ka. (*Kamtchatdale*)
	minja, Os. (*Osage*)	machmiuche, K. (*Koriak*)
axe	ashpaw, D.; oceopa, A. (*Assiniboin*)	kvasqua, Ka.; kal-kapak, T. (*Tchuktchi*
	ahuna, ongspe, D.	ono, J. (*Japanese*)
bad	schicha, D.; ishia, H. (*Hidatsa*)	ashiki, J.
beard	iki, H.; eshaesha, U. (*Upsaroka*)	hige, J.; uika, T. [piigi, K.
belly	ikpi, D.	fuku, J.; pai, *Corean*; ksucb, Ka.
	chesa. Os.	aksheka, T.
	bare, U.	hara, J.
belt	ipasaki, H.; ipiyaka, D.	obi, J., L. (*Loo-Choo*); tapshi, T.
bind	kashka, D.	kuku-ru, J.
bird	dikkappe, U.	tzkepf, A. (*Aino*)
	tsakaka, H.	tac, C. (*Corean*)
black	chippushaka, U.	nufsunke, K.
	eeokhpazee, D. [*Winnebago*	achkuropech, A.
blood	uoai, Y. (*Yankton*), wahcehah, W.	auku, T.
	wanee, Om. (Omaha)	kehm. A.
	idi, H.; eda, U.	ketsu, J.
boat	wata, D.	agwat, K.; attuat, hetwutt, Ka.
	mati, H.; maheshe, U.	maachdylum, Ka.
bone	hidu, H.	kotsu, J.; kutsi, L.; kotham, Ka; ha-
bow	etazeepa, D. [hnopah, M.	edzak. Ka. [tamfa, K.; atitaam, T.
	beerahhah, Min. (*Minetaree*); ware-	faru, C. [nika, T.

boy, son	ceneek, W. ; cejinggai, Min. ceingai, Ot.	oongua, L. ; yeg-
	chahinks, A. [(Otto).	okaijeno-bompo, A.
	disi, H.	doji, J.
	shekanja, Min.	shisong, J.
	weeshinga, Os.	bosang, J.
	cingksi, D. ; shinzoshinga, Os.	shoni, shisoku, J.
	meetshingshee, D.	musuko, J.
brother	sonkakoo, D.	tschangkuon, C. ; kamgoyak, T.
	boocouppa, U.	yubi, yobu, A.
buffalo	tahtungkah, D.	tschimga, K.
	sha, Os.	shao, C.
	bisha, U.	wooooshe, L.
burn	adahahe, H.	taku, J. ; yaddee, L.
	ghu, D.	yaku, J., akka, L.
child	wahcheesh, D.	wocka, L (young) ; wasaso, A.
	bakkatte, U.	pahatshitsh, Ka. ; bogotschi, A.
	shinga-shinga, Om.	shoni, J.
clothes	sheena, D.	ching, L. ; choongay, C.
cold	oisnaitch, A.	koenetsch, Ka.
	tasaka, D.	tschachtschen, K.
	ceereeai, Min.	syrriam, A.
	hootshere, U. [neehee, W.	kiyetaru, J.
	sinnee, D. ; snee, Y., Ot., Om., see-	samui, kan, J. ; kanjukukok, T.
come	hi, kuwa, D.	ki, ku-ru, J. ; kokwasitch, Ka.
day	caug, D. ; hangwai, Ot.	gannak, T.
death, die	tha, D. ; tehe, H.	tokok, T.
	carrasha, U.	rai, rairosiwo, A.
do	hidi, H. [hah, W.	itashi, J.
dog	shong, A. ; shonk, D. Y. ; chonke-	ching, inu, J.
drink	hi, H.	kuiki, Ka.
	smimmik, U.	samgam, K.
	meeneatgauch, A.	migutschi, T.
	heeiatekaupeteka, D. [naughta, Os.	tapatken, K.
ear	neetah, Om. ; nottah, Q. (*Quappa*) ;	tschintak, T.
	akuhi, H.	kui, C. ; igiad, Ka.
	lahockee, Min.	ilyud, Ka. ; wilugi, K.
earth	mahnah, W. [Om. ; mongka, Y.	nunna, T.
	maka, D. ; maha, Ot., Os. ; moneeka,	mok, C.
eat	yuta, D. ; duta, H.	etsyh, Ka.
	bahbooshmekah, U.	ippah, imbi, A.
	utahpee, D.	tabe-ru, J.
enemy	toka, D.	teki, J.
evening	tassetoo, D.	tangkitti, tyngfouti, K.
	ohpai, Min. ; appah, U.	yube, J. ; aibyngit, T.
eye	esa, U.	iik, T.
	eshtike, D. ; ishehuhsuhha, W.	sik, shigi, A.
father	ate, H. ; atag, D. ; dadai, Om. ; ateueu, Y.	atta, attaka, T.
	menoomphe, U.	enpitsch, Ka.
fight	kastaka, D.	tatakau, J. (kogdak *Yukagir*).
finger	onkaha, M.	aihanka, T
	shake, D. ; shagah, Os. ; shagai, Om.	sokora, C. ; keko, gyhgek, Ka.
	buschie, U.	pkotsha, Ka
	napchoopai, Y. ; shantee-ichpoo, Min.	jubi, A. ; yubi, J. ; eebee, L.
fire	pytshi, W. ; pechae, I. (*Ioway*) ; pajah,	apeh, A. ; pangitsch, Ka. ; fi, L.
	beerais, Min. ; wareday, M. [Os.	pol, C. ; bryuumchitsch, Ka.
fish	hoahug, D. ; haugh, Os. ; hohhah, W. ; hoho, Om. ; ho, Ot. ; huh, Q.	co, L. ; koki, kuki, C. ; giyo, J.
	poh, M. ; boa, Min. ; booah, U.	uwo, J.
	hoghang, D. ; hohung, Y.	sakana, J.
flesh	cehpi, D.	tubis, Ka.
	tado, Y. ; tahyuh, Q. ; tatookai, Ot. ; tando, D. ; taudocah, Os.	taat, tatchal, Ka.
	curuetshittee, Min.	korattal, K.
	chahhah, W.	koki, C.
flower	odakapaki, H.	ibuiki, sipoike, A.
	hka, D. [sih, K. (*Konzas*)	ku, C.
foot	siha, D. ; sih, Q. ; si, W., Ot., Om., Os ;	ashi, shake, J.
forest	ochaw, D.	hayashi, J. ; ooda, Ka.
fox	soheeda, D.	tschkuada, Ka
fruit	waskuyeca, D. [hoongshee, D.	kuwashi, J. ; isgatesitch, Ka.
girl, daughter	meyakatte, U. ; macath, Min. ; meets-	math, A. ; newekik, T.
	meeyaikanja, Min.	neuweku, T.
	sookmeha, M.	shuguina, Ka.
	cejonggai, On.	ungua, L. ; suwing, Ka.

girl, daughter	heenukhahhah, W.	kanaz, A.
	shemashinga, Os.	shinzo, J
give	khu, aceuje, D.; ku, H.	qui-ung, L.: katchu, Ka.
go	dah, U.; de, D.	tout, tent, Ka
good	itsicka, U.; tsaki, H.	matschinka, T.
	tonhai, Os.	itainoktok, T.
	nohta, D.	hota, C.
grass	pezi, D.; beka, U.; mika, H.	phee, C.; wuk, wehei, T.
hail	makkoupah, U.	yobu, J. (to hail)
hair	nijihah, Q; masheah, U.; natoo, Ot.	matihushi, C; nujak, nujet, T.
	arra, Min.	ruh, A.; tseracher, Ka.
hand	shantee, Min. [shagai, Om.	syttu, sotong, Ka.
	sake, D; saki, H.; shagah, D;	*ki, L*; *chketsch*, chkatsch, Ka.
he	na, U.; nee, Min; neeah, W.; ount, M	oan, onno, unin, K
head	naso, Ot; nahsso, W.; nanthu, I.	nashko, naskok, T.
	pa, D.; pah, Y.; pahhih, Q.	gpa, A; bosi, L
hear	kikua, H.	kiku, J.
heart	nasse, U; nochteh, Q.; natah, Min.	nokguek, nunjugu, Ka.
	cangte, D.	shing, J.
heaven, sky	ammahhe, U.; mahagh, Os.	ame, J.
hot	choustungatch, A.	kuinitschkit, K.
	ahre, U.; arraise, Min.	karai, J.
	dsasosh, M.	attisa, L.
	dindita, D.	danki, J.
house	tshe, I.; assua, U.; cheehah, W.	uche, ke, J; zise, A.
	tipi, D.; teepee, Y.; teib, A.	zibu, tschap, tschibi, C.
	ote, M.; ati, H.; tea, D; tshe, I.;	katchi, L.; yado, taku, J.
	attee, Min.; teeah, Os	
I	be, U.; vieh, Q.; veca, Os.	wu, T.
ice	cagha, D.	cigu, K.
knife	matsi, Min.; mitsa, U.; mahee, Ot, Om	wattshoo, Ka: majiddi, A.
lake	tehha, W.	to, A.; tonga T.
leaf	ape, wapa, D.	wha, L. (jipan, *Yukagir*)
	moneyahpe, U.	niep, A.
life, live	niya, D.; nee, Os.	inochi, J.
	ti, D; itshasa, U.	itchitchee, L.
light	thieshe, U.; edayhush, M.	atchat, Ka.
	ohjajo, Y.	choigychei, K.
love	wahtscheeng, D.	eiwatschim, K.
	ahmutcheshe, U.	aksmatjen, K.
make	echong, D [Y	oochoong, L.
man	wica, D.; wahsheegae, Ot.; weechasha,	ickkeega, L.; okkai, A.; uika, T.
	wongahah, W.; wineha, A.; neka, Os;	ningen, J.; kenge, Ka.
	mattra, Min [nikkah, Q.	nutaira, K.
	hickechewechasta, D.	oyachutsch, T.
	hihna, D.	ainu, A.
	oeeteka, D.	otoko, J.
	kida, H	hito, J.
moon	hangeta-wi, D (night-sun)	tangkitti, K. (night); fi, hi, J. (sun)
	minnatatche, U.	man-getsu, J. (full-moon)
mother	ina, hung, D.; enaugh, Os.	ainga, T; anguan, Ka.
mountain	khyaykah, D.; haiaca, Y.; ohai, T.	oka, J.; gyeigoi, K. [*kagir*).
	paha, D.; avocavee, Min.	pehguktsch, Ka; bukkon, K. (pea *Yu-*
	mahpo, ahmahabbe, U.	fuufa, tenup, K.
mouth	iiptshappa, Min.	jeep, C.
nail	shaka, D; shakahaugh, Os; saki, H.	kugi, J.; kukuh, Ka.
near	askahaah, D.	kakio, T
neck	shuah, U.	kuiich, Ka.
	doti, H.; dote, D.; tashai, Ot.	iityg, T.; hutdehn, K.
	apeeh, Min.	kubi, J., L
night	hangyetu, D.	tyngfouti, K.; unnjuk, T.
	estogr, M.	atziroo, L.
no	honkosha, Os.	ninge, K.
	barnetkah, U.	biinakitlin, Ka.
	ea, D.; eah, A.	iya, J.
pouch	wozuha, D.	foosa, L.
rain	maghazu, D.; mahajon, Y; nezuma, Os.	[ta, T
	naunshee, Om.; neezhuh, W.	muchemuks, K.; neptshuk, imaguach-
	hkahoosh, M.	azgatsch, Ka.
	haunah, U.	ame, J: kantsch, Ka.
	harai, Min. [hecat, U.	furi, J.
red	hishi, H: ishshee, Min; sha, D.; his-	akassa, L.; akai, J.
river	wakpa, D; wacopa, Y. [U.; azi, H.	woyampih, K.
	passahah, M.; watishka, Om.; ahesu,	peth, fez, bez, bezu, A.

robe	mahetoh, M.	makak, T.
run	doozakon, D.	tschasgoa, A.
	akharoosh, Os.	hashira, J.
salt	miniskuya, D.; amahota, H.	mashoo, L.
sea	tehha, tehchuua, W.	ta, C.; atui, aducka, A.
servant	toka, D.	tshequatsh, Ka.
sew	kikaki, H.	kuke-ru, J.
shoe	hangpa, D.; honpeh, Q.	hunginn, C.; angesuf, K.
	opah, Min.; hupa, H.	sabock, L.
shoulder	idaspa, H.	tapsut, tapfka, A.; tschilpit, T.
	hiyete, D.	kutta, L.; kata, J.
	amdo, D.	oondee, A. (arm).
sick	yazang, D.	yadong, L.
sing	dowang, D.	utau, J.; ootayoong, L.
sister	wetonga, Os.	ichtum, Ka.
	itakisa, H.	tschakyhetsch, K.
sit	aingatch, A.	ecoong, L. [kotschi, C.
skin	uka, koku, D.; aduaka, K.	ka, L.; kawa, J.; kooogh, Ka.;
sleep	ishtingma, D.	tungykushih, Ka.
	mughumme, U.	mo, aru, A.; milchamik, K.
	eistimmatch, A.	miichateu, T.
small	tscheestin, tonana, D.	takine, takoni, A.; uitschenan, Ka.
	ecat, U. [Min.; wahhah, W.	ekitachtu, T.
snow	beah, U.; pau, Os.; pah, Ot; mahpai,	upas, A.; pangopag, K.
speak	ide, H.	idakuwa, A.
	ia, D.	ii, iu, J.
star	wickangpi, D.	ashangit, Ka.
	peekahhai, Ot.	fosi, L.
	hkaka, M.; icka, H.; eekah, Min.	hoshi, J.
steal	ki, D.	ikka, A.
stone	eeyong, Y.	uigum, T.
	eengro, Ot.	whraugon, K.
storm	tattasuggy, Os.	techtok, T.; tschitchutscha, Ka.
sun	meeneajai, On.; menahkah, M.	matschak, T.
	wee, D.; pee, Ot.; weehah, W.	fi, J.
sword	magasagye, D.	magiddee, A.
tail	tsita, H	dzoo, L.
take	ichu, eyaku, D.	eechoong, L.; uke-ru, J.; uhk, oku, A.
they	eonah, M.	oanas, K.
think	echin, D.	shiang, kangaye, J.
thou	de, U.; deeah, Os.; dieh, Q. [ne, M.	tu, Ka.
	nish, D.; nehe, Min.; ney, W.; nea, A;	eanny, A.; nanji, J.
thunder	walkeeang, D.	yegilkegie, T.
to-morrow	hayahkaytseehah, D	haiedsai, C.
tongue	dezi, H.; tshedzhi, D.; theysi, Min.; dehzeehah, W.; dehzeh, Q.	dytschil, Ka.
tooth	hi, D., H.; he, I., W., Ot; hih, K.; hee, Y.; ea, U.; ii, Min.	ha, J., L.; ji, C.
tree	nahnah, W.	nan, C.; nih, A.
village	otoe, D.	atanym, Ka
	ameteh, Min.	machi, J.
warrior	ahkitshutah, D.	shisotsu, J. (soldier)
	aukedaugh, Os.	gunsotsu, J. (soldier)
	nassa-battsats, U.	bushi, J. (soldier)
wash	yuzaza, D.	yusugu, J.
water	nih, Q.; neah, Os.; ninah, W.	iuh, K.; nouna, T.
	mini, D.; meenee, Y.; minne, U.	nouna, mok, T.; mimel, K.
	passahah, M.	peh, A.
	midi, H.	mese, L.
we	bero, U	warera, J.; muru, K.
	onkia, D.; ungeaip, A.; unguar, Os.	wankuta, T.
weep	cheya, D.	kia, T.; tschisgoa, A.
white	ataki, H.; hoteechkee, Min.	attych, Ka.
	sang, D [chose, U.	chein, C.
	ska, D., Ot., Om.; skah, W., Q., Os.;	haku, J.
wife	moorse, M.	maroo, A.
	moah, U.; mega, I.	mazy, A.
wind	hootsee, U. [mia, H.	kyteg, K.; kyttych, tschichutsha, Ka.
woman	meha, M.; meyakatte, U; meeyai, Min;	math, A.
	wingy, winnokeja, D.; nogahah, W.	innago, L.; mennokoosi, A.
	wakka-angka, D.	aganak, T.
	tawicu, D.	tackki, L.
	unah, D.; euauh, Os.	newem, T.
wood	tschang, D.	tschitschini, A.
	money, U.	nammo, C.

write	akakashi, H.	kaki, J.
yellow	tsidi, H.	dsadsal, Ka.
yesterday	tanneehah, D.	cheenoo, L.
you	dero, U.	turi, T.
1.	duetsa, H.	tizi, L.; dysak, Ka.
	wajitah, D.	hitotsu, J.
	jungihah, W.; eyunkae, I.; onje, D.	ahnelm, ingsing, inshingyan, K.
2.	dopa, H.	tupu, C; tup, A.
	nopa, D.; noopah, Min; nopi, W.	yhnap, inipf, A. (4)
	noue, Ot.; nowae, I.	ni, J.
	tekeni, Ot.	nitakaw, K.
3.	rabeenee, Om.; laubenah, Os.	liep, raph, A.
	tana, Ot.; tanye, I.; tahni, W.	sang, L.; san, J.
4.	topa, H., D.; topah, Min,, Y.; toba, [Om.; tobah, Os.	tupu, C.; tup, A. (2)
	tome, A.	ishtama, T.
	tuah, Q.; toua, Ot.	tsaak, Ka.
5.	satsch, W.; sattou, Q.; sahtah, K; sahtsha, Min.; thata, I.	itsutsu, J.
	kihu, H.; kakhoo, M.; cheehoh, Min.	asheak, A.; goo, L.; go, J.
6.	ahkewe, H; shaque, Ot.; kohui, W.	iishu, C.
	akama, H.; kemah, M.; acamai, Min.; ahcamacat, U.	ihguaen, ywam, A.
	schappeh, Q.; shappeh, K.; shapah, Os.	juwambe, A.
7.	shaheo, D.; shakoee, Y.; shagoa, A.; shako, W. [napah, Q.	iikii, C.; shichi, J.
	painumbe, Om.; panompah, Os.; pen-	aruwambi, A.
8.	dopapi, H.; kela-tobaugh, Os.	duhpyhs, tubishambi, A.
	pehdaghenih, Q.	pigayuk, T.
	tatucka, M.	tschookotuk, Ka.; yatsu, hatchi, J.
	shahendohen, D.; shakundohu, Y.	tschonutonu, Ka.
	kraerapane, I.; kraerabane, Ot.; krairabaini, Om.	
	perabine, Om. (rabeence = 3). 5+3.	raph, A. (3).
.	schunkkah, Q.; shanke, Ot.; shonka, Om.; shankah, Os	chonatschinki, K.
	nowassapai, Min; napchingwangka, D.	sylmahpyhs, sinesambi, sinobsam, A.
	nuhpeetchewunkuh, Y.	
	mahpa, M. 5+4	yhnap, A. (4).
10.	wiket-shimani, D.; weekchee-minuh, Y.	mie-gitke, K.; tschom-chotako, Ka.

AN ANCIENT HAUNT OF

THE CERVUS MEGACEROS:

OR, GREAT IRISH DEER.

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The following notes of a tourist's observations in a brief visit to a locality of great interest alike to the palæontologist and the archæologist, were originally prepared with no further object in view than the contribution of a paper to be read at one of the evening meetings of the Canadian Institute, in the winter following the Irish explorations to which they refer.

The reconstruction of the geography of the Palæolithic Age, and the re-animating its haunts with the extinct mammalia known to us now only by their fossil remains, furnish materials for a romance of science more fascinating to the thoughtful student than all the fanciful creations of fiction. The geologist speaks of that time as recent when the temperature of southern France was such as to admit of the reindeer and the musk-ox, or sheep, haunting the low grounds along the skirts of the Pyrenees. But the term *recent* is used not in a historical, but a geological sense; and is employed in the full recognition of the evidence of enormous revolutions, by which changes have been wrought, the results of which are now seen in the climate, the physical geography, the fauna and flora of modern Europe. Nor have these revolutions been limited to the Eastern Hemisphere; though some of the climatic phenomena of the North American continent still perpetuate characteristics that help us in the interpretation of the strange disclosure of Europe's pleistocene era. Within the preceding geological age the whole northern hemisphere experienced an enormous climatic change, which attained its maximum in the glacial period. Far to the south of the British

Islands Europe presented a condition similar to that of Greenland at the present time; and during the prevalence of this period of extreme cold the glacial drift, boulder clay, and stratified sands and gravels, were deposited over the whole of Northern Europe, and over North America, as far south as the 39th parallel, during prolonged submergence under an arctic sea. Then followed the changes of that subsequent period, during which the physical geography acquired its latest development, and the present continents gradually assumed the characteristics fitting them for existing conditions of life.

Of nearly a hundred species of mammals recognized in the post-glacial deposits of Europe, fifty-seven still occupy the same localities; whilst others, such as the reindeer and the musk-sheep have withdrawn to northerly areas. A continuous chain of life, however, is indicated by the prolongation of about twelve pliocene species into the post-glacial fauna of Great Britain. But, along with those, numerous new species appear; and changes of an altogether novel character are inaugurated by the presence among them of man.

The revolution wrought in physical geography, in climate, and in all the accompanying conditions of life, during the pleistocene age are most clearly illustrated by the character and distribution of the mammalia, of which fifty-three species are represented in the remains found in the gravels and cave deposits. The *Elephas primigenius*, or mammoth, common both to Europe and America, has become extinct in the old world, subsequent to the advent of man. It is still an open question whether in the new world man coexisted with the mastodon; but in the eastern hemisphere at least, more than one species of proboscidian abounded, and in vast herds overspread the northern plains of Europe and Asia. Along with those there were three or four species of rhinoceros, a large hippopotamus, and other forms of animal life pointing to a condition of things widely differing from anything known within the historic period. The herbivora included both deer and oxen, some of which still survive in more limited northern areas; and those, along with the mammoth, woolly rhinoceros, Irish elk, and reindeer, were preyed upon by numerous carnivora, including the extinct cave lion and great cave bear, the *ursus ferox*, or grizzly bear,—now the strongest and most ferocious of all the carnivora of the American continent,—and the cave hyæna, which has still its living representatives in South Africa.

In the variations of temperature which marked the retrocession of the expiring glacial influences in central Europe, throughout the region extending between the Alps and the mountain ranges of Scotland and Wales, the winter resembled that which even now prevails on the North American continent, in latitudes in which the moose, the wapiti, and the grizzly bear, freely range over the same areas where during a brief summer of intense heat enormous herds of buffalo annually migrate from the south. A similar alternation of seasons within the European glacial period can alone account for the presence, alongside of an arctic fauna, of animals such as the hippopotamus and the hyæna, known only throughout the historical period as natives of the tropics. The range of temperature of Canadian seasons admits of the Arctic skua-gull, the snow-goose, the Lapland bunting, and the like northern visitors, meeting the king-bird, the humming-bird, and other wanderers from the gulf of Mexico.

Such conditions of climate may account for the recovery of the remains of the reindeer and the hippopotamus in the same drift and cave-deposits of Europe's glacial period. The woolly mammoth and rhinoceros, the musk-sheep, reindeer, and other arctic fauna, may be presumed to have annually retreated from the summer heats, and given place to those animals, the living representatives of which are now found only in tropical Africa. No class of evidence is better calculated to throw light on some of the obscure questions relative to primeval man, than that which exhibits him associated with the long displaced or extinct mammals of that transitional period. Man, it is no longer doubted, was contemporaneous with the mammoth before its disappearance from southern France; and occupied the cave-dwellings in the upper valleys of the Garonne, while the reindeer still abounded there. In fact, the palæolithic hunter of central Europe, and the extinct carnivora of its caves, alike preyed upon the numerous herbivora that then roamed over fertile plains and valleys reaching uninterruptedly, northward and westward, beyond the English Channel and the Irish Sea; just as the Buffalo—now hastening to extinction,—still ranges over the vast prairies of the North American continent.

Among the fauna of this transitional period in Europe's prehistoric era, one animal, the magnificent deer, known as the *Cervus megaceros*, the *Megaceros Hibernicus*, or Great Irish Elk, occupies in some respects a unique position, and specially invites study. In its limited endurance as a species it contrasts with the reindeer, along side of the fossil remains of which its horns and bones repeatedly occur; and its circumscribed area gives a peculiar interest to any indications of its co-existence with man. The evidence furnished by the abundance of its remains in certain localities tends to suggest the idea that, at a time when the British Islands were only the more elevated portions of the extended continent of Europe,—which then included in one continuous tract the English Channel, the German Ocean, and the Irish Sea, with a prolongation westward, embracing the Atlantic plateau now submerged to the extent of about one hundred fathoms:—the favourite haunts of the *Cervus megaceros* were in plains and fertile valleys which, throughout the historic period have been mostly buried under the sea.

In the ingenious speculations of the late Professor Edward Forbes on the migrations of plants and animals to their later insular habitats, he assumed a land passage to Ireland, consisting of the upraised marine drift which had been deposited on the bottom of the glacial sea. Over this he specially noted the presence of numerous remains of the fossil elk in the fresh water marl of his own native Isle of Man. In Scotland, on the contrary, where the reindeer existed apparently from the time when it was the contemporary of the mammoth, to a period, historically speaking, recent, authenticated examples of the Cervus megaceros are extremely rare; whereas its designation alike as the *megaceros Hibernicus*, and Irish elk, is based on the occurrence of its skeletons more frequently in Ireland than elsewhere. It has indeed been assumed that there now lie submerged beneath the Irish Sea, the once fertile plains which, towards the close of its existence, constituted the favourite haunt of this magnificent fossil deer.

It is not until the newer pliocene period is reached that the palæontologist encounters the amply developed horns of the gigantic bisons and uri; and that a corresponding size characterises for the first time the antlers of the *Cervus Sedgwickii*, the *Cervus dicranios*, and of the *Cervus megaceros*, pre-eminently noticeable for the enormous dimensions of its spreading antlers. Along with the remains of the latter, or in corresponding postpliocene deposits, those of the reindeer, which still survives both in Northern Europe and in America, are also found, at times in considerable abundance.

At the meeting of the British Association, at Dublin, in 1878, an intelligent local naturalist, Mr. Richard J. Moss, of the Royal

Dublin Society, took advantage of one of the excursions organized for the purpose of visiting the special attractions of the neighbourhood, to invite a party to explore an ancient habitat of the Irish fossil deer, at the Ballybetagh Bog, in the parish of Kilternan, about fourteen miles south of Dublin. The encouragement to research was great, for on two previous occasions the bog had disclosed numerous remains of the *Cervus megaceros*, and during the earlier excavations a fine specimen of the horns of the reindeer, now preserved in the Museum of the Royal Dublin Society, was also found.

Excavations made preparatry to the arrival of the excursionists revealed enough to furnish ample encouragement for further exploration. Saturday (August 17th) was devoted to a tentative examination, with disclosures that abundantly encouraged renewed research : and on the following Monday a small party revisited the spot, under the efficient guidance of Mr. R. J. Moss, and his brother, Dr. Edward L. Moss, R. N., who most liberally undertook the entire charge of the exploration. The results of this renewed investigation of the ancient lacustrine depository of the remains of the fossil deer, though necessarily limited to the labours of a couple of days, proved highly satisfactory ; and prepared the way for a systematic exploration of the site at a later date. Meanwhile a brief notice of the subject may possess some interest for others besides those who shared in the exciting operations of a busy but most pleasant holiday.

Ballybetagh Bog lies at the bottom of a glen about 600 feet above the sea, with hills of slight elevation on either side. Here some forty years ago, in making a cutting through the bog for the purpose of turning the water of a spring, known as the White Well, into a stream that flows through Kilternan, the first discovery of the remains of the fossil deer was made ; but as the excavations were then carried on with no scientific object in view the chief value resulting from them was the demonstration of the existence there of abundant remains of the great extinct deer.

In 1875, attention was anew directed to the locality ; Professor A. Leith Adams and Mr. R. J. Moss visited Ballybetagh Bog, and the latter gentleman undertook a systematic investigation, in concert with Dr. Carte, of the Dublin Society. No record had been preserved of the precise spot where the previous remains had been found, and considerable labour and research had to be expended before the proper site for renewed exploration could be determined.

An account of this exploration was contributed by Mr. Moss to the Royal Irish Academy in which he thus describes the formation under which the fossil remains lay: "The first foot of material removed consisted of peat; under this there was a stratum of sand of an average depth of about two feet. The sand lay upon a brown coloured clay which extended for about two feet, and lay upon a bed of granite boulders. The spaces between the lower parts of the boulders were filled with a fine bluish-grey clay." Here amongst the boulders, and surrounded with the brown clay, nineteen skulls, with many broken pieces of horn and bones were found; and the result in all was the recovery of thirty-six skulls with antlers more or less imperfect, mostly belonging to young deer, along with detached horns and bones, representing in all about fifty individuals of the Cervus megaceros. Among the specimens recovered at the earlier date about thirty individuals of the same gigantic fossil deer had been represented; although both explorations involved only a very partial examination of this remarkably rich lacustrine depository. But the result of Mr. Moss' careful investigation was to determine the precise locality where research might be renewed to like advantage at any future time; and here it was accordingly that a party of members of the British Association were invited to join him in hunting the Irish elk in its ancient habitat among the Wicklow meres.

The scene of this interesting exploration is the site of an ancient tarn, where for ages the moss has been accumulating, till a peat formation of varying thickness overlies a sandy clay intermingled with forms of vegetable matter, and at times with fallen trunks of trees. The whole rests on a bed of clay interspersed with granite boulders, as already described. Among these, but not below them, the bones of the fossil elk occur. But before describing the incidents of the recent exploration, it may be well to make some general reference to the gigantic deer once so abundant in the range of mountains which extend there in a north-westerly direction from the south coast of Dublin Bay, and to the general bearing of the evidence as to the probability of its co-existence with man.

An examination of the detritus and included fossils, the accumulations of fossiliferous caves, and the disclosures of peatmosses, shows that when the earliest ascertained colonists entered on the occupation of the British Islands—whether then insular or continental,—the low grounds were extensively traversed by a net-work of lakes, and the surrounding country was covered with forest, and overrun by animals known to us now chiefly by the researches of the palæontologist. But also it is among the glimpses which that prolonged transitional period furnishes, that we catch, towards its prehistoric close, evidence not only of the presence of man, but of the introduction of the domesticated animals of Europe. Among its fossil mammalia the true *Cervidæ*, to which the Irish elk belongs, appear to be, geologically speaking, of recent origin. No remains of extinct genera of the deer family thus far discovered in either hemisphere have been found to extend farther back than the upper mioscene; and Mr. A. Russel Wallace recognises the whole family as an Old World group which passed first to North America, and subsequently to the Southern continent. The remains of many extinct species belonging to existing genera occur in the post-pliocene and recent deposits both of Europe and America; but no representative of the deer family has thus far been found in South Africa or Australia.

Of the numerous ascertained fossil deer many forms are known only by fragmentary remains; but few great collections of Natural History fail to possess a well preserved skeleton of the Irish elk. Strictly speaking the *Cervus megaceros* is not a true elk, like the living Moose (*Alces palmatus*). It takes its place intermediately between the Reindeer and the Fallow deer (*Dama vulgaris*), and has its living analogues in the European Red Deer (*Cervus elaphus*), and the Wapiti (*Cervus Canadensis*) of the American Continent. The abundance of its remains in some localities, as in the Ballybetagh Bog, their high state of preservation, and their position generally in bogs and lacustrine deposits, overlaid by bog oak and other remains of the latest forests; and at times by actual evidences of human art: all tend to suggest the idea of this gigantic deer having co-existed with man. It was contemporaneous, not only with the mammoth, the woolly rhinoceros, and other extinct European mammalia of a like unfamiliar type, but also with an important group of wild animals which not only survived into that transitional period in which the geologist and the archæologist meet on common ground; but some of which have still their living representatives. Of the former the gigantic Urus (*Bos primigenius*) is the most notable, with its recognized relationship to the larger domesticated cattle of modern Europe. Of the latter the most interesting is the Reindeer.

It bears a near affinity to the Irish elk; they co-existed under similar circumstances, and even at times in the same localities. All three were contemporaneous with the *Ursus spelæus*, the *Felis spelæa*, and other great post-pliocene carnivora; and their remains abound in the ancient cavern haunts of those extinct beasts of prey.

The cave-bear and the Irish elk appear to have been limited to a temperate range, and have both become extinct; and the remains of the latter occur in such abundance in recent deposits that there is a strong temptation to assume the occurrence of some sudden change, climatal or otherwise, which abruptly exterminated this great fossil deer. The Urus and the Reindeer were both in existence in Britain within historic times; whereas the evidence thus far adduced in proof of the co-existence there of the fossil elk with man, pertains exclusively to the palæolithic period; and in so far as Ireland is concerned, where its remains occur in greatest abundance, the conviction is reluctantly forced on us that the great Irish deer had finally disappeared from its fauna before man made his appearance there. This, however, as will be shown, is not an opinion even now universally accepted, either by archæologists or geologists.

In the post-pliocene age the cave lions, bears, and hyænas, of Germany, France, and the British Isles, preyed on the Irish elk, along with the reindeer, mammoth, wooly rhinoceros, the fossil horse and ox; and the bones of all of them occur among the cave deposits in which traces of primitive art reveal the early presence of man. Professor Boyd Dawkins in his record of researches in the Somerset caves, in 1862-3, mentions the remains of the Irish Elk as 35 in number, where those of the Mammoth, the Reindeer and the Bison numbered 30 each, the Rhinoceros 233, the Horse 401, and the cave Hyæna 467; while thirty-five implements or other evidences of human art suggested the contemporaneous presence of man. Remains of the Megaceros have in like manner been identified in the Devonshire Caves; and especially in Kent's Hole Cave in the same strata with flint and bone implements. Its bones are included among the specified contents of the famous sepulchral cave of Aurignac, at the northern foot of the Pyrenees; and its remains have been recognized in seventeen different cave deposits to the north of the Alps; in eleven of which there are indications of the presence of palæolithic man.

So far as evidence thus far points no traces of human art suggest the presence of man either in Scotland or in Ireland, at the period of palæolithic art, so abundantly illustrated in the contents of the caves and river gravels of southern England. But the Irish elk is not only the latest among the extinct mammalia of Europe's palæolithic period; it is recognized as surviving into its neolithic period. Its remains occur in the caves of the reindeer period in southern France, as in those of Laugerie Basse and Moustier; and artificially worked and carved bones of the reindeer have been recognized in more than one of the Swiss caves. Their presence has excited special attention in that of L' Echelle, between the great and little Salève, from its close vicinity to Geneva, owing to the proof it affords of the coexistence of man and the reindeer within the area which subsequently formed the hunting ground of the lake-dwellers of Switzerland; whilst no trace of either the megaceros or the reindeer has been found among their abundant illustrations of the arts alike of the neolithic, and of the bronze period.

The weight of evidence thus tends to favour the idea that the fossil elk was coexistent with the men of Europe's Palæolithic age, by whom the reindeer was so largely turned to account, alike for food and the supply of material for their primitive arts; while it became extinct long before the more enduring reindeer withdrew entirely beyond the temperate zone. In Ireland, however, as hereafter noted, the abundant remains of its great fossil deer occur, geologically speaking, so nearly upon the horizon of its prehistoric dawn, and so little removed from some of the primitive evidences of man's presence there, that it will excite little surprise should further evidence of a wholly indisputable character demonstrate the survival of the Cervus megaceros within the Neolithic period, and contemporaneously with man; as in the remoter age of the Drift Folk of southern England it is now believed to have been an object of the chace, and a source of food, clothing, and tools.

When once it is admitted that the great fossil deer was contemporaneous with the men of central Europe, in its Reindeer period; and has to be included among the fauna familiar to the Drift Folk of southern England: this special question as to its survival in Ireland within any period of the presence of man has its chief value in relation to his own advent there; for this is not a mere question of geographical distribution, but deals with the relative age of prehistoric man in Central Europe, in Southern England, and in the later post-pliocene areas of Northern Europe. Meanwhile it will suffice to note some of the discoveries which have already been advanced in favour of the idea that the great fossil deer of Ireland was not unknown to its earliest inhabitants as one of its living fauna.

Professor Jamieson and Dr. Mantell long ago noted the discovery, in the County of Cork, of a human body exhumed from a depth of eleven feet of peat bog. It lay in the spongy soil beneath. The soft parts were converted into adipocere, and the body, thus preserved, was enveloped in a deer-skin of such large dimensions as to lead them to the opinion that it belonged to the extinct Irish elk.

At the meeting of the British Association, at Newcastle, in 1863, Professor J. Beetes Jukes exhibited a right tibia, with a portion of one of the antlers of a Cervus megaceros, recovered from a bog near Logan, County Longford. They were found along with other remains of the skeleton, embedded in shell-marl two or three feet thick, resting on blue clay and gravel. A deep indentation on the tibia, about two inches broad and a quarter of an inch deep, was exactly fitted to receive the antler-tyne. "They looked," says Professor Jukes, "as if they had been each chipped out with some sharp instrument," and he added, "The impression left on my mind from a first inspection was that these indentations were the best evidence that had yet turned up in proof of man having been contemporaneous in Ireland with the Cervus megaceros, and having left his mark upon the horns of an animal soon after its death, which he had himself probably killed." * I was present in the section at the Newcastle meeting, and examined with much interest this supposed lethal weapon of the men of the era of the great Irish deer, adduced on such credible authority as seemingly determining the question of their coexistence in Ireland. But more careful observations, added to the apparent fact that the indented bones and antler had lain alongside of other portions of the skeleton embedded in the marle, has since led to the conclusion that this supposed primitive weapon was the chance product of natural processes still in force. Such seemingly artificial indentations and abrasions are now found to be by no means rare, as will be seen from specimens now produced, of similarly marked bones of the *Cervus megaceros*

* *Dublin Quarterly Journal of Science*, iv. 212.

from Loch Gur, County Limerick.* The opinion which is now generally accepted is that these abrasions and indentations are due to the juxtaposition of the sharp point or edge of one bone and the side of another, while subjected to a prolonged immersion in the moist clay or marl. But to this it is further assumed must be superadded the combined action of friction with pressure consequent on the motion of the bogs in which such bones are embedded. The boggy ground in which they chiefly occur is subject not only to a perpendicular oscillation, consequent on any vibration from passing weights shaking the ground, or even from the wind; but also it undergoes a periodical contraction and expansion by the alternate drying and saturating with moisture, in the summer and winter months; and thus indentations and cuttings, like those ordinarily ascribed to a flint knife or saw, are of frequent occurrence on the bones of the great fossil deer. To this subject Dr. A. Carte drew the attention of the Royal Geological Society of Dublin, in 1866, in a paper, entitled: "On some Indented Bones of the Cervus megaceros, found near Lough Gur, County Limerick," and I am now enabled to exhibit for your own inspection additional illustrations from the same locality illustrative of this phenomenon, furnished to me by Mr. Pride, Assistant-Curator of the University Museum.

In some of those the indentations are such as few would hesitate at first sight to ascribe to an artificial origin; and so to adduce them as evidence of the contemporaneous presence of man. But they occur, not on separate bones, but on portions of fossil skeletons recovered from the lough under circumstances which wholly preclude the idea that they had been detached and carried off for purposes of art; or that the indentations upon them can have been the work of human hands.

Professor Jukes was present when Dr. Carte's paper was read, and referred to former statements of his opposed to the idea of the contemporaneous presence in Ireland of man and the Cervus megaceros. "They knew," he said, "that man did exist contemporaneously with that animal in England; and then arose the geological question, was Ireland at that time already separated from England and the continent? Was the great plain which formerly connected the British

* The principal bones of a nearly complete skeleton of the *Cervus megaceros*, from Loch Gur, were exhibited to the Canadian Institute; and the various characteristic indentations, on what must have been an undisturbed skeleton in situ, were pointed out.

Islands with the continent already worn away, or had man already crossed over from England to Ireland? They knew that man had existed in England probably before England was separated from the continent."

But, whatever be the final determination on this interesting question of the co-existence of Man and the Cervus megaceros in Ireland, the bones of the latter are recovered there in enormous quantities, not infrequently in a condition admitting of their being even now turned to account for economic uses; and examples have undoubtedly been found there bearing unmistakeable evidence of human workmanship. One of the most interesting of these was an imperfect Irish lyre dug up in the moat of Desmond Castle, Adare, and exhibited by the Earl of Dunraven, at a meeting of the Archæological Institute in 1864. The relic was of value as a rare example of the most primitive form of the national musical instrument; but greater interest was conferred on it by the opinion pronounced by Professor Owen that it was fashioned from the bone of the Irish Elk.

In weighing such evidence it is manifestly important to keep prominently in view the fact already referred to, that the bones and horns of the fossil deer are recovered in a condition not less fit for working by the modern turner and carver than the mammoth ivory or the bog oak, which are now in constant use by them. In the Goat Hole Cavern at Paviland, Glamorganshire, Dr. Buckland noted the discovery of large rings or armlets and other personal ornaments made of fossil ivory, lying alongside of a human female skeleton, and in near proximity to the skull of a fossil elephant. The tusk of another fossil elephant, recovered at a depth of twenty feet in the boulder clay of the Carse of Sterling, is now preserved in the Edinburgh University Museum, in the mutilated condition in which it was rescued from the lathe of an ivory turner. This, so far as Scotland is concerned, is an exceptional example of the manufacture of fossil ivory, but we are very familiar with the fact that the tusks of the Siberian mammoth have long been an article of commerce.

In a paper "On the Crannoges of Lough Rea," by Mr. G. H. Kinohan, of the Geological Survey, read before the Royal Irish Academy in 1863, he describes a fine head of the Cervus megaceros found, along with abundant evidences of human art, in a large crannoge on Lough Rea. It measured thirteen feet from tip to tip of its horns; but Mr. Jukes suggested the probable solution of its discovery under such circumstances to be, not that the megaceros had been hunted and killed by the crannoge builders, but that they had found the gigantic deer's head, "and put it up for an ornament or trophy, as is done at the present day."*

So far, at least, it thus appears,—notwithstanding the indisputable proofs of the employment of the bones and horns of the Cervus megaceros by primitive manufacturers of the Neolithic age; and the survival of this gigantic deer throughout the Palœolithic age of human art:—that evidence is still wanting to satisfy the scientific enquirer as to the co-existence of man and the great fossil deer in Ireland, where, more than in any other locality, this might be expected to occur. The primitive lyre found in the moat of Desmond Castle was undoubtedly fashioned from the bones of the extinct deer; but the material may have been recovered, as in modern times, from the marle of some neighbouring bog, and turned to account like the bog oak so abundantly used in modern art; rather than have been wrought by the Neolithic craftsman from the spoils of the chase.

In 1859, Sir W. R. Wilde read a lengthened communication at two successive meetings of the Royal Irish Academy, "Upon the unmanufactured animal remains belonging to the Academy." In arranging its collection of Irish Antiquities his attention was drawn to numerous crania and bones, chiefly of carnivora and ruminants, from river beds, bogs and crannoges; including sixteen crania, and upwards of seventy detached fragments of skeletons of the Cervus megaceros. The circumstances under which they were recovered have not been in all cases preserved, and no distinct evidence tends to confirm the idea of their contemporaneity with man. In remarking on the then novel recognition of the remains of Irish fossil deer in the tool-bearing gravel drifts of Abbeville, Sir W. R. Wilde observes: "As yet we have not discovered any Irish name for it. If the animal was here a contemporary of man, it certainly had become extinct long before the Irish had a knowledge of letters." † It is, however, altogether consistent with the evidence of a succession of races in the British Isles, and throughout Europe, to find that this era of the long extinct fossil mammalia pertaining to the Palæolithic, or even to the Neolithic age of primitive art, has no record in the oldest of the living languages. The same is true of others of

* *Dublin Quarterly Journal of Science*, iv., 125. † Proceedings of R. I. A. vii., 195.

the extinct mammalia, of which evidence of their familiarity to the men of the Neolithic period is abundant. It is indeed worthy of note that, while the ingenious artists of central Europe's Reindeer period have left wondrously graphic carvings and drawings of the mammoth, the fossil horse, and of the reindeer and other cervidæ, no very clearly recognizable drawing of the great fossil deer has been found. It has indeed been assumed to be the subject of more than one representation of a large horned deer, but the identification is at best doubtful. This is all the more noteworthy, as the characteristics of the great deer are such as could not fail to attract the notice of an artist capable of so successfully representing the salient features of the reindeer, as illustrated in familiar engravings of it, such as that from the Kesserloch, Schaffhausen, traced on a piece of one of its own antlers. If the engravings assumed to represent the Cervus megaceros are indeed efforts at its depiction, their less definite character may be due to the rarer opportunities for studying an unfamiliar subject.

But if, as Sir W. R. Wilde, says, no native Irish name has been discovered for the great fossil deer, an ingenious identification of it has been assumed with one of the objects of the chace referred to in the Niebelungen Lied. There, after the hunter has slain a bison, an elk, and four strong uruses, he crowns his feats with the slaying of a fierce *schelch*. It is no sufficient argument against such identification that the poem abounds with allusions to fire-dragons, giants, pigmies, and other fanciful creations. The "lusty beaver," the elk, "the ravin bear," and other contemporary, though now extinct, animals of Scotland, are introduced in the fanciful vision of "The King's Quair:"

"With many other beasts diverse and strange."

But any reasons adduced for identifying "the fierce schelch" of the Niebelungen Lied as the Cervus megaceros are sufficiently vague and slight; and so far the matured opinions of archæologists appear to coincide with those of the geologists, that this extinct deer did not coexist with man in Ireland.

But, whatever be the ultimate conclusion as to the period of its final disappearance there, no doubt is entertained as to this extinct deer having been contemporaneous with palæolithic man in western Europe, and even in England. Only two or three traces of its remains have been found in Scotland; and if in Ireland—seemingly its latest special habitat,—it had finally disappeared before the advent of man there; the results are significant in reference to the period of its extinction; as well as to the order of a succession of events in the prehistoric dawn. Indications of the presence of man must be looked for as following in natural sequence to the geological reconstruction of specific areas, and their evidences of climatic changes in the post-glacial period. Sir John Lubbock remarks in his "Prehistoric Times," when referring to the *Cervus megaceros*: "Though there is no longer any doubt that this species coexisted with man, the evidence of this has been obtained from the bone-caves, and from strata belonging to the age of the river-drift gravels. No remains of the Irish elk have yet been found in association with bronze; nor indeed are we aware of any which can be referred to the later, or Neolithic Age." When the subject was under discussion at the meeting of the British Association at Dublin, Professor W. G. Adams affirmed most definitely the co-existence of palæolithic man and the fossil elk; while admitting the absence of any such evidence where the remains of the latter are now found in greatest abundance. "There is," he said, "no evidence that in Ireland man existed contemporary with the *Megaceros*, or had any thing to do with its extinction; whereas we have authentic evidences of the coexistence of man with this animal in England."

This conclusion, however consistent with the proofs thus far obtained, cannot as yet be recognized as one so absolutely settled as to render further research superfluous. Whistles formed of phalanges of the reindeer are among the most characteristic implements of the more ancient French caves; and one found by M. E. Piette, in 1871, along with various flint implements, in the Cavern of Gourdan (Haute-Garonne), pierced not only with a mouth-piece, but with finger-holes along the sides, is aptly described by him as a neolithic flute. There is nothing therefore in the mere design or workmanship of the primitive Irish lyre incompatible with its execution at the period when the Irish elk survived; if it can be shown that it was coeval with man in Ireland. Professor Boyd Dawkins when drawing attention to the fact that out of 48 well ascertained species living in the palaeolithic period, only 31 are found surviving into the neolithic period, adds: "The cave bear, cave lion, and cave hyæna had vanished away, along with a whole group of pachyderms; and of all the extinct animals, but one, the Irish elk, still survived." There is indeed something peculiar and exceptional in this magnificent deer which so specially claims a place among the extinct mammalia of prehistoric Ireland. Its range, alike in place and in time, appears to have been more circumscribed than that of most, if not all of the animals with which it is found associated in post-pliocene deposits. Traces of it, indeed, have not only been noted to the south of the Alps, but Professor Brandt has identified its remains among the cave disclosures of the Altai Mountains. But on both continents it had a similar temperate range; and no remains of it have been discovered in the extreme north of Europe. To this the nature of its food may have contributed; while the mammoth and the reindeer were able to subsist within the Arctic circle, as well as in temperate ranges common to them and to the gigantic elk. But circumscribed though the range of the latter appears to have been, its enormous dimensions, conjoined with seemingly gregarious habits, were incompatible with limits so greatly restricted as the Isle of Man, if not indeed with those of Ireland; and hence the probability of the assumption that its extinction preceded, or speedily followed the period when the British Islands became detached from the Continent of Europe.

The *Cervus megaceros* attained a height of nearly eleven feet, and bore an enormous pair of antlers, measuring at times nearly fourteen feet from tip to tip. The head, with its ponderous pair of antlers, is estimated to have exceeded 100 lbs. in weight when living. To this the frequent miring of the deer in the lakes and bogs, where their remains abound, has been ascribed; nor is it improbable that the ultimate extinction of the species may have been due to the abnormal development of such head-gear, while its large antlered contemporary, the Reindeer, still survives.

Mr. R. J. Moss was led from his former careful observations to conclude that Ballybetagh Bog occupies the site of an ancient lake or tarn which stretched along the bottom of the glen. The west side of the glen is flanked by the southern side of a hill, and another of less elevation hems it in on the east. The embouchure of the lake appears to have been at the southern end; and whether we assume that the deer when swimming across the lake got entangled in the stiff clay at the bottom, and so were drowned; or that they resorted to the lake to die, it would seem that their bodies drifted with the current to the outlet of the lake, and hence the enormous accumulation of their remains in one place. In describing one of the trenches opened by him, Mr. Moss says; "At the north end the stony bottom was reached at a depth of only four feet; it dipped towards the southern end, where it was about five feet from the surface. The northern half of this trench did not contain a single fragment of bone or horn; the southern half was literally packed with them." * The remains found in the course of this exploration represented about fifty individuals, the majority of the bones being those of young deer.

The result of the more hasty excavations recently made, was the discovery of two skulls and several portions of horns on the first day. On the second day a trench was opened, and cut through an accumulation of 27 inches of peat, resting upon about 22 inches of sandy clay, intermingled with roots and traces of various forms of vegetation. Underneath this among granite boulders, three fine heads were found; one of them of the largest size, and in nearly perfect preservation, with antlers measuring about eleven and a half feet from tip to tip.

There was something startling in the success of our expedition: thus setting out from the busy scenes of Dublin, with all the bustle of its crowded thoroughfares, and not less crowded scientific sections; and landing among wild uncultured bogs, to dig down, and at once light upon the remarkable evidences of an extinct fauna once so abundant. There were not even wanting sceptical doubters ready to hint at previous preparations having facilitated a too easy discovery. In this, however, we profited by the careful and intelligent labours of Mr. Moss at an earlier date; and all who put themselves under his guidance were amply rewarded by the results.

It is worthy of note that, neither on this occasion, nor in the older excavations was a true marl found underlying the peat, or clay. The rock of the district is granite; being part of a band of granite five miles broad, which extends from Dublin Bay in a south-westerly direction into the County of Waterford. A granite sand was found in some places to a depth of three feet; and Mr. Moss, after careful examination, describes the underlying clays as almost entirely free from calcium carbonate, and having every appearance of a granitic origin. But a little to the north of the section thus described, a light-coloured marl, rich in calcium carbonate, makes its appearance almost under the turf.

* Proceedings R. I. A., 2nd Ser., Vol. II.

Thus far about eighty individuals of the great fossil elk, and one reindeer, are represented in the remains recovered from the Ballybetah Bog, without any traces of the co-existence of man having been observed. But no better locality could be chosen to test the question. Lying though this interesting locality does, in such near vicinity to the Irish metropolis, it has been left nearly untouched by the hand of man within the whole historic period, during which cathedral and castle, college, mart, and wharf, have crowded the banks of the Liffy. The traces of the primitive architecture of remoter eras have thereby escaped defacement. The general contour of the district remains little changed. The aspect is wild and savage; and it requires no very great exercise of the fancy to restore the ancient mere, reclothe its shores with forests, the buried trunks of which abound in the underlying peat, and reanimate them with the magnificent herds of the great fossil deer. Here are still the unefaced memorials of primitive art. On the rising ground on the south-east margin of the bog stands a large chambered cairn, which has been rifled; and the exposed chamber shows the megalithic structure characteristic of the most ancient works of this class. There is also a circle near it formed by an enclosure of stones and earth, which is regarded by the natives with superstitious awe. According to the belief of the peasants, if their cattle stray into this enclosure they will die.

Here, then, it is probable that the bed of the neighbouring tarn or bog must contain some evidences of the primitive arts of the Cairn-builders, with means for determining the relative date of their presence there, as compared with the true age of the *Cervus megaceros*. A report of the successful operations which rewarded the brief labours of the excursion party was made to the executive council of the British Association, and steps were taken with a view to a systematic and thorough exploration of this favourite haunt of the great fossil Irish elk, one of the most remarkable among the fauna of Europe's Palæolithic period.

ON THE OCCURRENCE OF

PETROLEUM IN THE NORTH-WEST TERRITORIES,

WITH NOTES ON NEW LOCALITIES.

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The existence of petroleum at several places on the Athabaska River has long been known. Numerous details on the subject are to be found in Sir John Richardson's Journal of a Boat Voyage in 1848. Some of these localities are also described by Professor Macoun, Botanist to the Geological Survey, who passed through the same region in 1875, and noticed an additional locality on the Peace River, about 10C miles west of its junction with the Slave River. Last autumn I was informed of the occurrence of petroleum in some new localities further north than those hitherto known, by Mr. Hardisty, formerly resident at Fort Simpson, who kindly gave me particulars in regard to them. In 1877, I was able to establish the Devonian age of the rocks lying to the south of James' Bay, and one of my assistants discovered indications of petroleum in these strata about fifty miles from Moose Factory.

All these oil regions have certain geological relations in common. Having collected together all the notes by explorers who have written about such matters, as well as any information which I could gain from other travellers, I propose to offer a few remarks upon the subject. I shall first refer to the localities in the Athabaska-McKenzie Valley, enumerating them in their order from south to north.

In following the ordinary route of travel from the southward, this valley is entered by a sudden descent of 600 feet to the Clear-water River at the north end of the Methye Portage, which leads across from the head-waters of the Churchill River. The Clear-water is a small stream flowing westward to the Athabaska. The first known locality for petroleum is met with on this river ten miles from its junction with the main Athabaska, at which distance, Professor Macoun says, "the men pointed out a tar-spring in the stream, at which they very often got tar."

He also states that tar oozes from the black shales, 150 feet thick, at the forks of these two rivers. Sir John Richardson says these shales are underlaid by soft limestone, "which forms the banks of Athabaska River for thirty-six miles downwards" (from the forks). "The beds vary in structure, the concretionary form rather prevailing, though some layers are more homogeneous and others are stained with bitumen." Limestones, occupying a similar position, re-appear on the Peace River near the oil-spring, already referred to, and are there described by Professor Macoun as "almost wholly made up of those branching corals (*Alveolites*) so common in Devonian rocks, intermixed with a species of *Zaphrentis* in great abundance, some of the higher strata being largely made up of these." When at a part of the river about midway between the forks and Athabaska Lake, a distance of about one hundred miles, the same gentleman remarks: "I found below a light grey sandstone, partly saturated with the tar, and overlying this, there was at least fifteen feet of it completely saturated, and over this again, shale largely charged with alkaline matter. This was the sequence all the way, although at times there was much more exposed. Where we landed the ooze from the bank had flowed down the slope into the water and formed a tarred surface extending along the beach over one hundred yards, and as hard as iron; but in bright sunshine the surface is quite soft, and the men when tracking along shore often sink into it up to their ankles." Sir John Richardson says: "About thirty miles below the Clearwater River the limestone-beds are covered by a bituminous deposit upwards of one hundred feet thick, whose lower member is a conglomerate having an earthy basis much stained with iron and colored by bitumen. * * Some of the beds above this (conglomerate) stone are nearly plastic from the quantity of mineral-pitch they contain. Roots of living trees and herbaceous plants push themselves deep into beds highly impregnated with bitumen; and the forest where that mineral is most abundant does not suffer in its growth. * * Further down the river still, or about three miles down the Red River (of the Athabaska), where there was once a trading establishment, now remembered as 'La Vieux Fort de la Rivière

Rouge,' a copious spring of mineral pitch issues from a crevice composed of sand and bitumen. It lies a few hundred yards back from the river in the middle of a thick wood. Several small birds were found suffocated in the pitch." * * At the deserted fort named 'Pierre au Calumet,' cream-colored and white limestone cliffs are covered by thick beds of bituminous sand. * * A few miles further on the cliffs for some distance are sandy, and the different beds contain variable quantities of bitumen. Some of the lower layers were so full of that mineral as to soften in the hand, while the upper strata, containing less, were so cemented by iron as to form a firm dark-brown sandstone of much hardness. * * The whole country for many miles is so full of bitumen that it flows readily into a pit dug a few feet below the surface. In no place did I observe the limestone alternating with these sandy bituminous beds, but in several localities it is itself highly bituminous, contains shells filled with that mineral, and when struck yields the odor of *stinkstein*." Elsewhere, this author describes these bituminiferous sands as resting unconformably upon the limestones, and, indeed, they must be of much more recent age, as he states that "in one of the cliffs not far below the Clear-water River, the indurated arenaceous beds resting on the limestone contain pretty thick layers of lignite, much impregnated with bitumen, which has been ascertained by Mr. Bowerbank to be of coniferous origin, though he could not determine the genus of the wood."

In approaching Athabaska Lake the banks of the river of the same name become low and consist of gravel and reddish earth, then sand and finally only alluvial soil. The last evidence of the bitumen consists of rolled balls on pebbles of sand cemented together by the tar, which have been carried down by the river. According to Prof. Macoun, these balls are very abundant and in places form beds of "tar conglomerate" in the river banks often two feet thick. Mr. Hardisty, who passed up this river last summer (1878), informs me that the banks on both sides are frequently composed of sand cemented by pitch, which softens in the sun and renders the walking very disagreeable. Masses of the more hardened varieties lie about on the river shores like lumps of coal.

At its western extremity, Athabaska Lake discharges its waters northward by the Slave River into Slave Lake, receiving the Peace River from the west, a short distance below the outlet. Fort Chipewyan is situated on Athabaska Lake where Slave River leaves it and Fort Resolution is built on the south shore of Slave Lake where the same river enters it. Sir John Richardson says that on this river, thirty miles from Fort Chipewyan, there is a limestone cliff "the lower beds of which have a compact structure, a flat conchoidal fracture and a yellowish-grey color. Some of the upper beds contain mineral pitch in fissures" and they also hold Devonian fossils.

The western extremity of Slave Lake is about 115 miles west of Fort Resolution and here it discharges its waters by the McKenzie River. Numerous islands occur in this part of the lake, the largest of which is Big Island, so celebrated in the writings of northern travellers for its productive fishery. The next localities for petroleum which I shall notice are two of those about which I was informed by my friend Mr. Hardisty. One of them is situated about ten miles north-eastward of the Big Island Fishery. Here the oil rises from the bottom of the lake in about five feet of water, in a bay, and at a distance of a mile and a half from the shore. This bay is the one most nearly opposite to Big Island. The petroleum is of a dark color and in calm weather in summer it spreads itself over the surface of the lake, but in winter it keeps the water open directly over the source from which it rises, forming a round hole in the ice, in which it accumulates to a sufficient depth to be easily dipped out. It has the ordinary smell of petroleum, is very liquid and when thrown upon a fire it explodes. In many places along this part of the north shore of the lake petroleum oozes out of the earth and its smell is quite noticeable to the traveller in passing by the coast. On the main shore of the next bay east of the one above referred to, there is a copious spring or puddle of tar and pitch mixed with leaves and sticks, which, if cleared out, would no doubt fill up with liquid oil. This spring was discovered by Mr. John Hope, of the Hudson Bay Company. The western part of Slave Lake is shallow and its bottom and shores are underlaid by bituminous limestone and dark, bituminous shales of Devonian age. Mr. Woodward in referring to some of the corals from these limestones mentions that their cysts are filled with bitumen.

Perhaps the most remarkable locality for petroleum in the North-West Territories is one described to me by Mr. Hardisty as occurring about seventy miles eastward of Fort Simpson, which is situated on the McKenzie River at the junction of the Liard. This locality is in the depths of the forest, near no lake or stream of sufficient size to mark the place. The oil issues from springs in the form of great holes in the ground, down which poles may be plunged as far as they will reach without meeting with any resistance beyond that of the slimy liquid. The Indians fill tight boxes with the partially inspissated petroleum at these springs and haul it to Fort Simpson on sleighs in winter. Here it is boiled down to a proper consistence and used for pitching boats.

In giving a general description of the geology of the McKenzie River, Richardson says, "a shaly formation makes the chief part of the banks and also much of the undulating valleys between the elevated spurs. It is based on horizontal beds of limestone and in some places of sandstone which abut against the inclined strata of the lofty wall-like ridges or rests partially on their edges. The shale crumbles readily and often takes fire spontaneously, occasioning the ruin of the bank, so that it is only by the encroachment of the river carrying away the *debris* that the true structure is revealed." At a high point below Fort Simpson, known as "The Rock by the River's Side," the bituminous shales are described as having a very great similarity to those at the junction of the Clear-water and Athabaska Rivers. The same author describes thick beds of bituminous shale as occurring on the western shores of Great Bear Lake, which discharges westward by a comparatively short river into the McKenzie River. Below the confluence of these great streams the same shale is seen running down the banks of the one last mentioned. "Underlying the shale, horizontal beds of lime are exposed for some miles along the McKenzie and from them issue springs of saline sulphurous waters and mineral pitch." In approaching the Artic Ocean the McKenzie River is hemmed in to a width of only about one-third of a mile by rocks which, from their forms, have given the locality the name of "The Ramparts." Here Richardson says, "the cliffs have been denuded of the covering of shale which exists higher up the stream, but the limestone of which they are chiefly formed is stained with bitumen either in patches or whole layers."

From the foregoing it will be perceived that I have traced a highly bituminous character in the rocks of the Athabaska-McKenzie Valley all the way from the Clear-water branch to the Ramparts, a distance of no less than one thousand miles in a straight line. The continuation of the same rocks is known to extend to the northward and to the southward of the above limits far enough to give a total length of two thousand miles. They belong to the Devonian system and have a strong resemblance to the petroleum-bearing strata of Western Ontario. The corals of the Corniferous formation are often filled with bitumen like those of the limestones of the Athabaska and McKenzie Rivers; and the pyrites and carbonaceous matter of the black shales of Kettle Point, on Lake Huron, under the influence of air and moisture, have given rise to a sort of spontaneous combustion like that of the shale of the McKenzie. Southward of the Clear-water River the petroleum-bearing formation strikes across the Saskatchewan, between Cumberland House and The Forks, and, passing through lakes Winnipegosis and Manitoba, it continues southward up the Red River valley, and is lost in the United States. On the shore of Lake Winnipegosis, brine springs issue from these rocks, and salt is also found in abundance near Slave River and between Slave Lake and Great Bear Lake. Petroleum may be looked for all along the strike of this great Devonian formation in our North-West Territories, including the tract at the eastern base of the high grounds on the west side of the lakes of the Winnipeg basin.

I shall conclude by referring very briefly to the indications of petroleum found to the south of James' Bay. In this region the limestones have a strong resemblance to those of the Athabaska, being of a yellowish color, and more or less of a bituminous character. The fossils which I collected in 1875 and 1877 on the Moose River and its branches have established the Devonian age of the formation. Gypsum and carbonate of iron occur in it in quantities of economic value. In 1877, on the Abittibi branch of the Moose, thirty-nine miles from its mouth, Mr. A. S. Cochrane, a member of my party, found a brownish-black shale, like that of the Athabaska, which emits a bright flame and an odor of sulphur when strongly heated. This shale is underlaid, as on the Athabaska, by soft bituminous yellow limestone, at one place impregnated with petroleum, which extends for ten miles up the river. In this district, as well as in the North-West Territory, these rocks consist of pure carbonate of lime, while the underlying Silurian strata, in both regions, are dolomitic.

NOTES ON RELATIVE MOTION.

BY JAMES LOUDON,
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1. Motion of a point in a plane.

At time t let the moving axes be $O\xi$, $O\eta$, and P a point (ξ, η) in their plane. At time $t + \delta t$ let these axes coincide with $O\xi'$, $O\eta'$, and P with P'; then the ξ and η components of the displacement PP' are $-\omega\eta\delta t$, $\omega\xi\delta t$, respectively, if ω is the rate at which the axes turn round $O\zeta$. Let a moving point be at P at time t, and at Q at time $t + \delta t$, the co-ordinates of Q referred to $O\xi'$, $O\eta'$ being $\xi + \dot{\xi}\delta t$, $\eta + \dot{\eta}\delta t$; then the absolute velocity of the moving point is ultimately $\frac{PQ}{\delta t} = \left(\frac{PP'}{\delta t}, \frac{P'Q}{\delta t}\right)$, the ξ and η components of which are $\dot{\xi} - \omega\eta$, $\dot{\eta} + \omega\xi$, respectively.

Putting $\dot{\xi} - \omega\eta = u = OA$, and $\dot{\eta} + \omega\xi = v = OB$, the component velocities at time $t + \delta t$ become $u + \dot{u}\delta t = OA'$ along $O\xi'$, and $v + \dot{v}\delta t = OB'$ along $O\eta'$. Hence the absolute acceleration ultimately $= \left(\frac{AA'}{\delta t}, \frac{BB'}{\delta t}\right)$, the components of which are

$$\dot{u} - v\omega = \ddot{\xi} - 2\,\omega\dot{\eta} - \eta\dot{\omega} - \omega^2\xi \text{ along } O\xi,$$
$$\dot{v} + u\omega = \ddot{\eta} + 2\,\omega\dot{\xi} + \xi\dot{\omega} - \omega^2\eta \text{ along } O\eta.$$

2. Motion of a rigid body round a fixed axis $O\zeta$, the axes $O\xi$, $O\eta$ being fixed in the body.

At time t the whole momentum is $-M\omega\eta = OA$ along $O\xi$, and $M\omega\xi = OB$ along $O\eta$, where ξ, η are co-ordinates of the centre of inertia. At time $t + \delta t$ the momentum is $-M\eta\,(\omega + \dot{\omega}\delta t) = OA'$ along $O\xi'$, and $M\xi\,(\omega + \dot{\omega}\delta t) = OB'$ along $O\eta'$. The changes of momentum per unit time are, therefore, ultimately $\frac{AA'}{\delta t}$, $\frac{BB'}{\delta t}$, whose components are

$$-M\eta\dot{\omega} - M\omega^2\xi \text{ along } O\xi,$$
$$M\xi\dot{\omega} - M\omega^2\eta \text{ along } O\eta.$$

At time t the whole moment of momentum is (employing OA, OB in a new sense)

$$-\beta\omega = OA \text{ along } O\xi,$$
$$-\alpha\omega = OB \text{ along } O\eta,$$
$$C\omega \;.\;.\;.\;. \text{ along } O\zeta,$$

where $\qquad \alpha = \Sigma m\eta\zeta, \quad C = \Sigma m\,(\xi^2 + \eta^2)$, etc.

At time $t + \delta t$ the moment of momentum becomes

$$-\beta\,(\omega + \dot{\omega}\delta t) = OA' \text{ along } O\xi',$$
$$-\alpha\,(\omega + \dot{\omega}\delta t) = OB' \text{ along } O\eta', \text{ etc.}$$

Hence the changes per unit time of moment of momentum are ultimately $\dfrac{AA'}{\delta t}$, $\dfrac{BB'}{\delta t}$, $C\dot{\omega}$, the components of which are $-\beta\dot{\omega} + \alpha\omega^2$ along $O\xi$, $-\alpha\dot{\omega} - \beta\omega^2$ along $O\eta$, and $C\dot{\omega}$ along $O\zeta$.

These, it will be observed, are of the same form as when the axes are fixed in space.

3. To measure the absolute velocity and acceleration of a point referred to axes moving in space round O.

Let the motion of the axes be due to rotations θ_1, θ_2, θ_3 measured along themselves. Then, proceeding as in § 1, the displacements of a point P (ξ, η, ζ) due to these rotations are $(\zeta\theta_2 - \eta\theta_3)\,\delta t$ along $O\xi$, $(\xi\theta_3 - \xi\theta_1)\,\delta t$ along $O\eta$, and $(\eta\theta_1 - \xi\theta_2)\,\delta t$ along $O\zeta$. These added to the relative displacements $(\dot{\xi}\delta t, \dot{\eta}\delta t, \dot{\zeta}\delta t)$ of the moving point give the absolute displacements. Hence the components of the absolute velocity are

$$u = OA = \dot{\xi} + \zeta\theta_2 - \eta\theta_3 \text{ along } O\xi,$$
$$v = OB = \dot{\eta} + \xi\theta_3 - \zeta\theta_1 \text{ along } O\eta,$$
$$w = OC = \dot{\zeta} + \eta\theta_1 - \xi\theta_2 \text{ along } O\zeta.$$

Again, let the velocities at time $t + \delta t$ be $OA' = u + \dot{u}\delta t$ along $O\xi'$, etc.; then the absolute accelerations are ultimately $\dfrac{AA'}{\delta t}$, $\dfrac{BB'}{\delta t}$, $\dfrac{CC'}{\delta t}$, whose components are

$$\dot{u} - v\theta_3 + w\theta_2 \text{ along } O\xi,$$
$$\dot{v} - w\theta_1 + u\theta_3 \text{ along } O\eta,$$
$$\dot{w} - u\theta_2 + v\theta_1 \text{ along } O\zeta.$$

These become, on reduction,

$$\ddot{\xi} - 2\,\theta_3\dot{\eta} + 2\,\theta_2\dot{\zeta} + \zeta\dot{\theta}_2 - \eta\dot{\theta}_3 - (\theta_1^2 + \theta_2^2 + \theta_3^2)\,\xi + (\xi\theta_1 + \eta\theta_2 + \zeta\theta_3)\,\theta_1$$

along $O\xi$, etc.

Note.—These resolutions are most readily effected as follows: AA' is equivalent to AD along $O\eta$, DH along $O\zeta$, and HA' along $O\xi$; and similar resolutions are effected for BB', CC'. The values of AD, DH, etc., are at once derived from the displacements in time δt of the points $(1, 0, 0)$, $(0, 1, 0)$, $(0, 0, 1)$. The latter are, respectively,

$$\begin{array}{ccc} 0\ , & \theta_3\ , & \theta_2\ , \\ -\theta_3\ , & 0\ , & \theta_1\ , \\ \theta_2\ , & \theta_1\ . & 0\ , \end{array}$$

each multiplied by δt; from which the values of AD, DH, etc., are obtained by multiplying the first set by OA, the second by OB, and the third by OC. Moreover, the parts HA', etc., remain unchanged in magnitude when resolved along $O\xi$, $O\eta$, $O\zeta$, if infinitesimals above the first order be neglected. Thus, in the present case, $HA = \dot{u}\delta t$, $AD = u\theta_3\delta t$, $DH = -u\theta_2\delta t$.

4. If, in the previous case, the origin moves, its acceleration must of course be added to the expressions found in § 3. These formulas may be tested by the following well-known example. Let O be on the earth's surface in latitude λ, and let $O\xi$ be drawn south, $O\eta$ east, and $O\zeta$ vertical. Then ω being the earth's rotation and r its radius, the accelerations of O are

$$\begin{array}{ll} -\omega^2 r \cos\lambda \sin\lambda \text{ along } & O\xi, \\ -\omega^2 r \cos^2\lambda \qquad \text{“} & O\zeta. \end{array}$$

Also, $\theta_1 = -\omega\cos\lambda$, $\theta_2 = 0$, $\theta_3 = \omega\sin\lambda$, and $\dot{\theta}_1 = 0 = \dot{\theta}_2 = \dot{\theta}_3$. Hence the acceleration of m at (ξ, η, ζ) are

$$\begin{array}{l} \ddot{\xi} - \omega^2 r\cos\lambda\sin\lambda - 2\,\omega\dot{\eta}\sin\lambda - \omega^2\xi\sin^2\lambda - \omega^2\zeta\sin\lambda\cos\lambda, \\ \ddot{\eta} + 2\,\omega\dot{\zeta}\cos\lambda + 2\,\omega\dot{\xi}\sin\lambda - \omega^2\eta, \\ \ddot{\zeta} - \omega^2 r\cos^2\lambda - 2\,\omega\dot{\eta}\cos\lambda - \omega^2\zeta\cos^2\lambda - \omega^2\xi\sin\lambda\cos\lambda, \end{array}$$

along $O\xi$, $O\eta$, $O\zeta$, respectively.

5. To measure the changes in the rotation of a rigid body with one point fixed, the axes moving as in § 3. Let the rotations to which the displacement of the body is due be at time t, $\omega_1 = OA$, $\omega_2 = OB$, $\omega_3 = OC$ measured respectively along $O\xi$, $O\eta$, $O\zeta$. Then since at time $t + \delta t$ these become $\omega_1 + \dot{\omega}_1\delta t = OA'$, etc., along $O\xi'$, $O\eta'$, $O\zeta'$, the absolute changes per unit time in the rotation are ultimately

$$\frac{AA'}{\delta t}, \frac{BB'}{\delta t}, \frac{CC'}{\delta t}.$$

Resolving these, we get for the required components

$$\dot{\omega}_1 - \omega_2\theta_3 + \omega_3\theta_2 \text{ along } O\xi, \text{ etc.}$$

6. To measure the change in the whole absolute momentum of a rigid body, one point of which is fixed at O, the axes moving as in §§ 3, 5. Since the absolute momentum of m in the position (ξ, η, ζ) at time t is

$$m\left\{\zeta(\omega_2 + \theta_2) - \eta(\omega_3 + \theta_3)\right\} \text{ along } O\xi, \text{ etc.},$$

it follows that the whole absolute momentum at that time is

$$z(\omega_2 + \theta_2) - y(\omega_3 + \theta_3) \text{ along } O\xi,$$
$$x(\omega_3 + \theta_3) - z(\omega_1 + \theta_1) \text{ along } O\eta,$$
$$y(\omega_1 + \theta_1) - x(\omega_2 + \theta_2) \text{ along } O\zeta,$$

each multiplied by M, where (x, y, z) is the position of the centre of inertia. Calling these components $\mu_1 = OA$, $\mu_2 = OB$, $\mu_3 = OC$, respectively, it follows that at time $t + \delta t$ they become $\mu_1 + \dot{\mu}_1 \delta t = OA'$ along $O\xi'$, $\mu_2 + \dot{\mu}_2 \delta t = OB'$ along $O\eta'$, $\mu_3 + \dot{\mu}_3 \delta t = OC'$ along $O\zeta'$. The changes in the whole momentum per unit time are, therefore, $\frac{AA'}{\delta t}$, $\frac{BB'}{\delta t}$, $\frac{CC'}{\delta t}$, whose components are

$$\dot{\mu}_1 - \mu_2\theta_3 + \mu_3\theta_2 \text{ along } O\xi,$$
$$\dot{\mu}_2 - \mu_3\theta_1 + \mu_1\theta_3 \text{ along } O\eta,$$
$$\dot{\mu}_3 - \mu_1\theta_2 + \mu_2\theta_1 \text{ along } O\zeta.$$

Since $\dot{x} = z\omega_2 - y\omega_3$, etc., these expressions become, on reduction, M times

$$z(\dot{\omega}_2 + \dot{\theta}_2) - y(\dot{\omega}_3 + \dot{\theta}_3) + \omega_1\left\{(\omega_1 + \theta_1)x + (\omega_2 + \theta_2)y + (\omega_3 + \theta_3)z\right\}$$
$$+ (\omega_1 + \theta_1)(\theta_1 x + \theta_2 y + \theta_3 z) - x\left\{(\omega_1 + \theta_1)^2 + (\omega_2 + \theta_2)^2 + (\omega_3 + \theta_3)^2\right\}$$

for the first, with similar values for the other two.

7. To measure the changes in the whole absolute moment of momentum under the same circumstances as in § 6. Since the absolute moment of m's momentum at time t is m times

$$(\omega_1 + \theta_1)(\eta^2 + \zeta^2) - (\omega_2 + \theta_2)\xi\eta - (\omega_3 + \theta_3)\zeta\xi \text{ along } O\xi,$$

with corresponding components along $O\eta$, $O\zeta$, it follows that the components of the whole moment of momentum at that time are

$$A(\omega_1 + \theta_1) - \gamma(\omega_2 + \theta_2) - \beta(\omega_3 + \theta_3) \text{ along } O\xi,$$
$$-\gamma(\omega_1 + \theta_1) + B(\omega_2 + \theta_2) - a(\omega_3 + \theta_3) \text{ along } O\eta,$$
$$-\beta(\omega_1 - \theta_1) - a(\omega_2 + \theta_2) + C(\omega_3 + \theta_3) \text{ along } O\zeta,$$

where $A = \Sigma m(\eta^2 + \zeta^2)$, $a = \Sigma m\eta\zeta$, etc.

Let these components be called $\nu_1 = OA$, $\nu_2 = OB$, $\nu_3 = OC$, respectively. Then at time $t + \delta t$ they become $\nu_1 + \dot{\nu}_1\delta t = OA'$ along $O\xi'$, $\nu_2 + \dot{\nu}_2\delta t = OB'$ along $O\eta'$, and $\nu_3 + \dot{\nu}_3\delta t = OC'$ along $O\zeta'$. Hence the changes of the moment of momentum per unit time are

$$\frac{AA'}{\delta t}, \frac{BB'}{\delta t}, \frac{CC'}{\delta t},$$

whose components are

$$\dot{\nu}_1 - \nu_2\theta_3 + \nu_3\theta_2 \text{ along } O\xi,$$
$$\dot{\nu}_2 - \nu_3\theta_1 + \nu_1\theta_3 \text{ along } O\eta,$$
$$\dot{\nu}_3 - \nu_1\theta_2 + \nu_2\theta_1 \text{ along } O\zeta,$$

Now, since $\xi = \zeta\omega_2 - \eta\omega_3$, etc., it follows that

$$\begin{aligned}
\dot{A} &= 2\,\Sigma m\,(\eta\dot{\eta} + \zeta\dot{\zeta}) \\
&= 2\,(\gamma\omega_3 - \beta\omega_2) \\
\dot{B} &= 2\,(a\omega_1 - \gamma\omega_3) \\
\dot{C} &= 2\,(\beta\omega_2 - a\omega_1) \\
\dot{a} &= \Sigma m\,(\eta\dot{\zeta} + \zeta\dot{\eta}) \\
&= (C - B)\,\omega_1 - \gamma\omega_2 + \beta\omega_3 \\
\dot{\beta} &= \gamma\omega_1 + (A - C)\,\omega_2 - a\omega_3 \\
\dot{\gamma} &= -\beta\omega_1 + a\omega_2 + (B - A)\omega_3.
\end{aligned}$$

Hence the above values for the component changes of moment of momentum become

$$\begin{aligned}
&A\,(\dot{\omega}_1 + \dot{\theta}_1) - \gamma\,(\dot{\omega}_2 + \dot{\theta}_2) - \beta\,(\dot{\omega}_3 + \dot{\theta}_3) + 2\,(\omega_1 + \theta_1)\,(\gamma\omega_3 - \beta\omega_2) \\
&\quad - (\omega_2 + \theta_2)\,[-\beta\omega_1 + a\omega_2 + (B - A)\,\omega_3] - (\omega_3 + \theta_3)\,[\gamma\omega_1 + \\
&\quad (A - C)\,\omega_2 - a\omega_3] - \theta_3\,[-\gamma\,(\omega_1 + \theta_1) + B\,(\omega_2 + \theta_2) - a\,(\omega_3 + \\
&\quad \theta_3)] + \theta_2\,[-\beta\,(\omega_1 + \theta_1) - a\,(\omega_2 + \theta_2) + C\,(\omega_3 + \theta_3)]
\end{aligned}$$

for the first; with similar expressions for the other two.

CANADIAN INSTITUTE.

REPORT OF THE COUNCIL FOR 1880-81.

The Council of the Canadian Institute in presenting their Thirty Second Annual Report, are gratified in being able once more to congratulate the Institute on another year of satisfactory work throughout the Winter Session.

The advantages resulting from the admirable accommodation for all the ordinary meetings of the Institute which the new building supplies, fully justify the action of the Council in recent years in incurring an outlay necessarily involving a burden of debt, which must continue for some time to hamper the action of the Institute in various ways; and especially to absorb to a large extent the funds which would otherwise be available for the important object of the printing proceedings. So important has it appeared to the Council to reduce the debt as speedily as possible, that however reluctant to delay the issue of their printed proceedings, they have allowed a year to elapse without any new issue. This has enabled the Treasurer to devote the money to the reduction of the debt, and the Council have accordingly the satisfaction of reporting a diminution of the capital sum due, and a corresponding reduction of the annual charge payable on the mortgage effected on the building.

The debt remaining at the close of the last financial year amounted to $5,500, involving an annual payment of interest of $440. Since then the Treasurer has made a further payment of $500 in reduction of the mortgage debt, reducing it to $5,000; and also has effected an arrangement whereby the annual interest is reduced from 8 per cent. to 7 per cent., making the amount of present annual interest $350.

It is inevitable that the existence of a debt involving an annual charge which absorbs to so large an extent the annual surplus over and above ordinary expenditure, must hamper the exertions of the Council and of all the members of the Institute; and greatly diminish its efforts in the cause of Canadian Science and Letters. The Council accordingly recommend to their successors and to the members at large, a renewed effort for the reduction of this debt, so as to place at their disposal an annual revenue adequate for the printing of the proceedings, and the carrying out on an adequate scale the legitimate work of the Institute.

Appended to this Report are abstracts showing—(1) The present condition of the membership, including 124 ordinary and life members; (2) The Papers communicated at the meetings during the year; (3) The additions to the Library during the same period, and (4) The Treasurer's balance sheet, with a report of the receipts and liabilities of the Institute at the present date.

All which is respectfully reported.

DAN. WILSON,
President.

FINANCIAL STATEMENT.

REPORT OF TREASURER ON INCOME AND EXPENDITURE FROM 1ST APRIL, 1880, TO 1ST APRIL, 1881.

1880. *Debtor.*	
To Summary.	$ cts.
" Annual Subscriptions	362 00
" Government Grants	1,500 00
" Journals sold	7 13
" Subscriptions to Building Fund	213 00
" Rent from Warehouse	83 00
	$3,165 13

1880. *Creditor.*	
By Summary.	$ cts.
" Amount due to Treasnrer	153 86
" Express Charges	7 35
" Gas Supply	5 96
" Water Supply	17 25
" Advertising	31 00
" Postage	3 87
" Lecture Fee	4 00
" Honsekeeping Contingencies	6 10
" Repairs	6 12
" Fuel	68 75
" Taxes	11 39
" Magazines	82 45
" Salary to Secretary	336 00
" Binding of Books	7 20
" Reduction of Mortgage	500 00
" Interest on Mortgage	412 50
" Cash in hand	511 33
	$2,165 13

COPY OF CERTIFICATE FROM AUDITORS.

We Certify to having compared the vouchers of the above entries of expenditure, and find the same correct. The amount of receipts is properly added, shewing balance in Treasurer's hands of five hundred and eleven $\frac{33}{100}$ dollars.

WM. HENDERSON.
GEORGE MURRAY.

COMMENTS.

It will be seen that two annual Government Grants appear in this year. This results from the earlier meeting of the Legislature in 1881 and earlier obtainment of the Grant.

The total amount of receipts from subscriptions to the Building Fund is $1,347.00, of which $1,000.00 has been applied to the reduction of debt, said debt being now $5,000.00, and the interest has been reduced from 8% to 7%, by permission of the Mortgagee.

COMMUNICATIONS.

The following valuable and interesting papers and communications were read and received from time to time at the ordinary meetings held during the Session 1880-81:

April 3, 1880.—By T. H. Monk, Esq., on "Vital Statistics." Prof. Ramsay Wright, described some West Indian Flukes, exhibited by Mr. Troutman, L.D.S.

April 17, 1880.—Prof. Jas. Loudon, M.A., "Investigations in Relative Motion." Dr. Daniel Wilson, LL.D., on the "Imitative Faculty as a Race Distinction."

May 1, 1880.—Prof. Macoun, M.A., on the "Climate of Manitoba and the North-West Territory."

October 30, 1880.—Dr. Daniel Wilson, LL.D., Inaugural Address, on the "Independent Origin of Written Language on the American Continent."

November 27, 1880.—Dr. Daniel Wilson, LL.D., on the "Mare Crisium," illustrated by telescopic views, illustrative of Lunar Physics. Prof. R. Ramsay Wright, exhibited a series of wax models, illustrative of Natural History. Dr. Jos. Workman, on "Marco-Elepsia."

December 11, 1880.—Dr. Jos. Workman, on "Moral Insanity; What is it?"

January 8, 1881.—A communication from the Director of the Imperial Observatory of Poulkova, on the "Proposal for establishing a Prime Meridian," by Sandford Fleming, C.M.G. Dr. Daniel Wilson, LL.D., on the "History of the Calendar."

January 22, 1881.—John Notman, Esq., on "Meteors." A. Elvins, Esq., on the "Mare Imbrium, and Lunar Crater Copernicus," illustrated by Photographic views taken by the author.

February 19, 1881.—C. B. Biggar, Esq., on the "Climate of South Africa." Wm. Oldright, M.A., M.D., on "Sanitary Legislation."

March 5, 1881.—A. H. Elwin, C. E., on "Some of Faraday's theories of Electricity."

April 2, 1881.—Rev. Dr. Scadding: "A Boy's Books; Then and Now—1818-1881."

April 16, 1881.—Dr. Daniel Wilson, "Some Notes on Ben. Jonson and his Orthography."

April 23, 1881.—Rev. Dr. Scadding, "A Notice of the late Elstow Edition of Bunyan." Professor Loudon, "Acoustic Experiments."

MEMBERSHIP.

Members at the commencement of Session 1880-81		134
Members elected during the Session		8
		142
Deaths	1	
Members retired	15	
		16
Total Membership, March 31st, 1881		126

Composed of:

Honorary Members	2
Life Members	17
Ordinary Members	107
	126

UNITED STATES :

Annual Report of the Museum of Comparative Zoology at Harvard College.

Bulletin of the Museum of Comparative Zoology at Harvard College, Nos. 1–11.

Bulletin of the Essex Institute, Salem, Massachusetts.

Proceedings of the Academy of Natural Sciences, Philadelphia, 1880.

Penn. Magazine of History and Biography, Philadelphia, No. 1-4, Vol. 4.

Contributions to the Geology of Eastern Massachusetts from the Boston Society of Natural History.

Proceedings of the American Antiquarian Society. Nos. 74-5.

Transactions of the Academy of Science of St. Louis.

Bulletin of the Buffalo Society of Natural Sciences.

Harvard University Library Bulletin.

Annals of the New York Academy of Sciences, 1880.

Report of the Director of Central Park Menagerie, New York, 1880.

Annals of the Lyceum of Natural History of New York.

Thirteenth Annual Report of Peabody Institute, Baltimore.

Publications of the Missouri Historical Society of St. Louis. Nos. 1-4.

Publications of the Boston Society of Natural History, part 3.

Journal of Speculative Philosophy of St. Louis, 1880.

Bulletin of the Philosophical Society of Washington. Vol. 1-3, 1880.

Annual Report of New York State Museum of Natural History, 1875-79.

Brief of a Title of the Seventeen Townships of County of Luzerne, by Henry M. Hayt, Harrisburg.

Variable Stars of Short Period, by E. C. Pickering, Cambridge.

American Journal of Science, 1880.

Journal of the Franklin Institute, 1880.

ENGLAND :

Proceedings of the Geological Society of London, No. 136-141, 1878-1880.

Proceedings of the Royal Geographical Society, London, 1880.

Journal of the Royal Microscopical Society, Vol. 3.

Quarterly Journal of the Geological Society, London.

Transactions of the Manchester Geological Society, Vol. 15 to pt. 2 Vol. 16.

List of the Geological Society of London, 1878-1879.

Annual Report of the Leeds Philosophical and Literary Society, 1879-1880.

Journal and Transactions of the Victoria Institute, 1880.

Journal of the Royal Geographical Society, London.

The Relation between Science and Religion, by Bishop of Edinburgh.

The Annealed Jaws from the Wenlock and Ludlow Formations, by G. J. Hinde, F.G.S.

SCOTLAND :

Transactions and Progress of the Botanical Society of Edinburgh, Vol. 13, part 3.

Report of Temperature,. Winter 1178-1879, Edinburgh.

Transactions of Geological Society of Edinburgh, 1880.

Transactions of Royal Society of Edinburgh, 1877-8-9.

IRELAND :

Annual Report of the Belfast Naturalist Field Club.

Transactions of the Royal Irish Academy, Dublin, 1879-1880.

Scientific Progress of the Royal Irish Academy, Dublin, 1878-9-80.

Journal of the Royal Dublin Society, 1878.

Scientific Transactions of the Royal Dublin Society, 1878-9-80.

The following additions and donations have been made to the Library of the Canadian Institute during the past year :

CANADA :

The Canadian Naturalist, Montreal.

The Canadian Journal of Medical Science, 1880.

The Canadian Pharmaceutical Journal, 1880.

Journal of Education, Quebec, 1880.

Annual Report of the Entomological Society, Ontario, 1880.

Descriptive Catalogue of the Economic Minerals of Canada, Montreal, 1880.

Canadian Entomologist, 1880.

Report of Meteorological Service of Canada, 1880.

Annuaire de l' Institut Canadien, Quebec, No. 7, 1880.

Report of the Toronto Water Works, 1880.

Report of Progress Geological Survey of Canada, 1878-1879.

La Revue Canadienne of Montreal, Janvier, 1881.

FRANCE :

Memoirs de la Societé Ingenieurs Civils, 1880.

Catalogue of the National Society of Natural Sciences of Cherbourg, 1878.

Bulletin of the Geological Society of France, 1880.

Memoirs of the National Society of Natural Sciences of Cherbourg, 1877-8.

Annales Des Mines, 1879.

Eloge de M. Louis. By M. J. Beclard, 1874.

Extracts D'un Memoire sur les Moyens De Prevenir Les Dissetts par le C. A. Hugo.

TORINA :

Cosmos. By Guido Cora, for 1880.

ITALY :

Atti della Societa Toscana di Scienza Naturale, 1880.

WIEN :

Jahrbuch der K. K. Geologischen Reichsanstadt, 1879-80.

Mittheilungen der Kais. und Kon. Geographischen Gesellschaft, 1879.

Verhandlungen der K. K. Zoologisch-Botanischen Gesellschaft, 1879.

MUNCHEN :

Sitzungsberichte der K. b. Akademie der Wissenschaften, 1878-9-80.

Ignatius Von Loyola der Romischen Curie, 1879.

Meteorologische und Magnetische Beobachtumgen der K. Sternwarte bie München, 1879.

DRESDEN :

Sitzungs-Beritchte Nat. ges Gesellschaft. Isis in Dresden, 1879-80-1.

GOTTINGEN :

The Royal Association of Sciences, Naritchten, 1879.

HANOVER :

Erster Jahr't Geographische Gesellschaft zu Hannover, 1879.

INDIA :

Memoirs of the Geological Survey of India, 1879-80

Records of the Geological Survey of India, 1879-80.

NEW SOUTH WALES :

Journal and Proceedings of the Royal Society, New South Wales, 1878.

Transactions and Proceedings of the New Zealand Institute, 1879.

MEXICO :

Annales del Museo Nacional De Mexico, 1878-80.

BONN :

Verhandelungen der Natur'chen Vereines der Prusischen Rheinland, Westfalens, 1879-80.

HAMBURG :

Association of Natural Sciences, 1880.

AMSTERDAM :

Verhandelungen der Koninklijke Akademie, Von Wetenschappen, 1879.

Verslagen en Mededulungen, der Koninklijke Akademie, Van Wetenschappen, 1879.

Jaarboek Van de Koninklijke Akademie, Van Wetenschappen, 1878.

COPENHAGEN :

Royal Danish Society of Sciences, Oversigt, part 3, 1879, part 1-2, 1880.

HARLEM :

Archives Neulandaises Sciences Exactes et Natur's : per Holland Society of Sciences at Harlem, Tome XIV-XV, 1879-80.

Archives du Musee Teyler, Vol. V. 1880.

BREMEN :

The Association of Natural Sciences of Bremen : Abhandlungen, 1879-80.

Beilage, No. 7, of Natural Sciences of Bremen : Abhandlungen, 1879-80.

PRAG :

K. K. Sternwarte zu Prag : Beobachtungen, 1879.

UTRECHT :

Meteorologisch Jaarboek, 1879.

MADRID :

Annuario de Observatorio de Madrid, 1877-8.

Resumen de la Observaciones Meteorlogicas, 1875-8.

BRAUNSCHWEIG :

Jahresbericht des Vereines fur Naturwissenschaft, zu Braunschweig, 1879-80.

The following publications are subscribed for by the Institute :

The Contemporary Review.
The Nineteenth Century.
American Journal of Medical Science
Medical Science.
Hardwick's Science Gossip.
Popular Science Monthly.
Scientific American.
Scientific American Snpplement.
English Mechanic.
Nature.
Medical Times and Gazette.
Blackwood's Magazine.
London Quarterly Review.
British Quarterly Review.
Edinburgh Review.
Westminster Review.