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VIEW

OF

THE VICTORIA BRIDGE, MONTREAL.

on the

GRAND TRUNK RAILWAY.

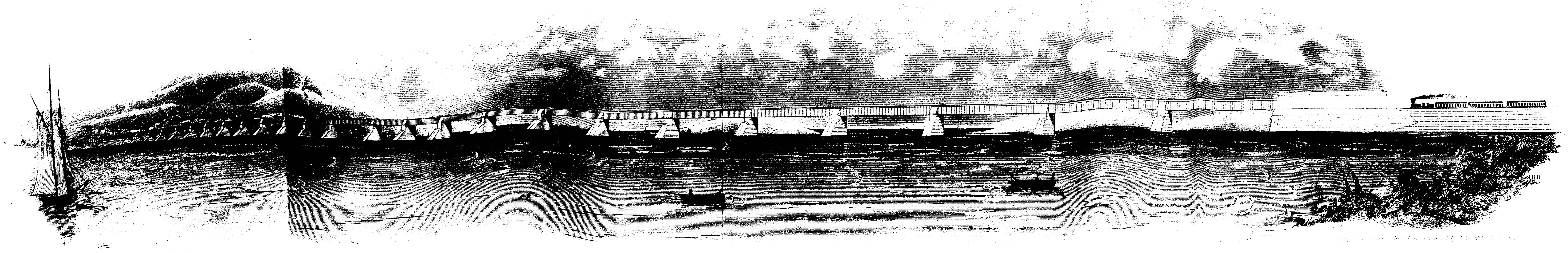
Robert Stephenson & A. M. Ross Esq.rs Engineers.

February 1854

Leading Dimensions

One Span of 330 feet over Navigable Channel 60 feet above Summer Water Level

24 Spans of 242 feet each. *Total length 7000 feet.*



The Canadian Journal.

TORONTO, JUNE, 1854.

Memoranda of Vesuvius and its Neighbourhood.

By the Rev. Henry Scadding, D.D., Cantab. Read before the Canadian Institute, March 25th, 1854.

Continued from page 241.

We shall now pay a rapid visit to the volcanic district westwards of Vesuvius—appropriately named the Phlegræan fields, "the fields of fire," if the Greek etymology of the name be the correct one. We shall tread on ground teeming with recollections of illustrious or remarkable men. I shall be pardoned, then, if here and there, though still looking at things in general in a volcanic point of view, I indulge in some brief historical notices as I pass. Traversing the whole length of the ever-lively Naples—where, doubtless, we have before our eyes a picture of an old Greek community, in modernized costume,—we arrive on its western side at a tunnel perforating the mass of ancient volcanic tufa, known as the hill of Posilipo. Here, before you enter, you may leave your carriage for a short time, and ascend by some steps on the left, and examine the dilapidated columbarium to which tradition points as once the receptacle of the ashes of Virgil. It is certain that the poet had a house on this hill, and that therein he composed his Georgics and Eclogues and the greater portion of his Æneid. It is a spot which harmonizes well with the poet's memory, having within view numerous localities whose names have become household words through his pen—a spot rendered in an additional degree venerable now, by reminiscences of illustrious men, who, from Statius and Petrarch, to Milton, Thomson, and Gray, with pious steps, have visited it.—Milton at the tomb of Virgil! Was it not there, while standing at the shrine of a kindred soul, that the inspiration, already stirring the fair young English bard, shaped the effectual resolve to leave words behind him which the world "should not willingly let die?"—It is curious to remember that in the middle ages the name of Virgil was popularly known only as that of a magician—doubtless from the assumed familiarity which he exhibits in his 6th Book with the world of spirits. It was from the prevalence of this idea, that Dante made him the conductor of himself through the realms below.—Dante in his turn was, for similar reasons, pointed at by the rustics of his day as the man who had visited the abodes of the dead. And to close the list of popular misunderstandings in respect to famous persons—Horace, by the peasantry in the neighbourhood of the Sabine farm, is at this moment believed to have been an Englishman, from the numerous English who take such pains to scramble to the spot.—But we must return to the tunnel below, which itself—though it bears to this day visible marks, not of the magician's wand, but of instruments more substantial —was once popularly attributed to the supernatural power of Virgil. It may be briefly described as 2244 feet long, 21½ feet wide, from 69 to 25 feet in height; gloomy, dusty, and unsavory. There are several other similar grottoes, as they are illusively called, in this neighbourhood—all artificial, and dating back before the Christian era. They are short cuts from town to town, made through the rather soft volcanic rock.—You are now on the road which leads to Pozzuoli. You are interested at observing evidences of the latitude in which you are. You notice in the hills specimens of the palmetto-palm. You perceive the stone-pine—the familiar object in Italian views—stretching out its flat peculiar top. You see the aloe and the cactus in profusion. You observe peasants under trees dancing to the sound of the guitar. You meet rude ass-drawn and ox-drawn vehicles loaded with strange tropical-looking fruits and vegetables.

You soon enter upon the Phlegræan fields in earnest. You arrive at the well known Lake Agnano—an irregularly-shaped ancient crater, three miles in circumference, filled with a sheet of water. From fissures in its walls issues sulphurous vapour of a temperature of 180° Fahrenheit, showing that a highly heated mass is not far off. Here you have exhibited to you the world-famous but rather insignificant *Grotto del Cane*—a small cell containing a spiracle from below, up which rushes carbonic acid gas, mingled with steam.—A little to the westward you come to another partially extinct crater—the Solfatara—an irregular oval plain, sounding treacherously hollow to the tread, and full of steaming and smoky fumeroles, which at night emit a glow as from a furnace, showing that they communicate immediately with red-hot material. Within the base of what was the ancient cone of the Solfatara, in the far depths, water is incessantly heard heard in the act of boiling, in which state it finds an outlet. It is stated to be an aluminous water containing iron, lime, and free sulphuric acid. Some of the hills which form part of this ancient crater are white with an aluminous efflorescence.

You next approach Astroni, a very perfect crater, four miles in circumference, bearing on its floor three small but deep lakes. It reminds you, on a small scale, of those circular valleys, which, with the aid of a good telescope, you see on the surface of the moon. Indeed I doubt not but that in these Phlegræan fields, we have by analogy many hints given of what we should meet with, were we permitted to take a stroll on the lunar disc.—Travelling still westwards, you come next to a very conspicuous and perfectly formed crater, three miles and a half in circumference—Monte Barbaro (the ancient Gaurus)—covered with vineyards producing the wine which Horace sings of as Falernian; and near by are two more similar craters, only smaller—Cigliano and Campana. Proceeding yet westwards, you come to Avernus itself, the dread entrance to Hades. In the old prehistoric era, this crater no doubt possessed some of the awfulness of the present interior of Vesuvius. The Cumæan colonists transplanted to this neighbourhood the myths of their native Greece, and easily established Campanian duplicates of their own Styx, Cocytus, and Acheron. Here is the scene of the well-known *Nekuia* of the 11th Book of the Odyssey, and of the descent of Æneas in the 6th Book of the Æneid. The ancient Italians must have enjoyed these references of the poets more keenly than modern readers can. They must have felt the Æneid to have been a *national* poem much more thoroughly than we do—the mere *naming* of a locality being sufficient to call up to their minds the often visited spot—with its brilliant colouring and historic and poetic associations.—Avernus is now a cheerful place; a beautiful lake, abounding with fish, lies in its basin, and over it and on it feathered fowl sport with impunity. The etymology of Avernns (quasi *Aornos*, "birdless") is now supposed to be fanciful, though Virgil, and Lucretius before him, adopted it. The true origin of the name appears to be in the Phœnician *Evoron*, denoting "gloom" or "darkness." But though the old composition of the name may not be true, still it is probable that in the ancient times birds would seldom be seen about the spot. Instinct would lead them to shun the breath of a volcano, as surely as it leads their congeners to revel so joyously, as we see them doing, in the wholesome spray of our Niagara.

The hills on the northern side of this lake—the walls of the ancient crater—are richly covered with chestnut trees and vines. The rim of the bowl on the southern side has been broken down, just as we have seen the southern side of the ancient crater of Vesuvius carried away. It is in consequence of a celebrated "cut" made by Agrippa—the bold engineer-statesman to whom Augustus owes so much of the eclat of his reign—that we see the lake of Avernus reduced to the limited dimensions of a mile and a half in circumference, and five hundred feet in depth. Between it and the sea, towards the south-east, we can see the famous *Lacus Lucrinus*, itself a crater, lower down on the flank of the ancient volcano. Into this Lake Agrippa admitted the sea by a canal; then by another canal he let down Avernus into Lucrinus—thus forming a magnificent double dock, where the Roman fleet, quadrupled, might float securely. This port, a grand topic with the poets and historians of the day, existed in good order until A.D. 1538, when the long dormant volcano over which the united lakes reposed suddenly awoke.—A short distance to the south-east, you may observe a conspicuous hill, resembling the cone of a volcano. This is the celebrated Monte Nuovo, which was thrown up in the space of forty-eight hours on the occasion now spoken of. After a succession of volcanic shocks a fissure took place near the Lucrine Lake ; from the aperture rose to a great height, first cold water, then hot;—then followed masses of ashes and lapilli, descending on the country in torrents of mud; then followed vollies of dry ashes and red-hot pumice stones. And in forty-eight hours a hill was formed 440 feet in height, and a mile and a half in circumference, filling up a large portion of the Lucrine Lake, and ruining Agrippa's harbour. On the top of the hill is a crater one fourth of a mile in circumference, and 419 feet deep. It is only of late years that the scoriæ on its surface have become sufficiently decomposed to admit of the growth of small trees thereupon. The line of the coast in the immediate neighbourhood was, during this explosion, elevated to such an extent that the sea seemed to have retired 400 paces.—The protrusion of the mountain of Jorullo, in Mexico, in A.D. 1759, is a well known parallel to Monte Nuovo. Both are interesting, as throwing light on the nascent condition of volcanic hills.—To the south-west of the Lucrine, you come to Fusaro (the old Acherusian), famous to this day for its oysters, another water-filled crater, and still further on is Mare Morte, another. To arrive at the latter, you pass through Elysium—the tract which is said to be the original and veritable prototype of that fair creation of the poets.

To the north of Avernus, I should have mentioned just now, one more crater is traceable in this region; and a fragment of its ancient walls constitutes the acropolis of the venerable Cumæ, the earliest Greek settlement in Italy.—The Lake Licola, to the north of Cumæ, which *looks* like one of the system of volcanic lakes, which we have been tracing out, is in reality, it is said, the remains of the canal which Nero is known to have commenced with the intention of carrying it through the Pontine marshes as far as Ostia.

From Mare Morte, or rather from the beach called Miliscola—corrupted from *Militis schola*, an ancient military parade-ground—we take the ferry and cross a narrow strait of two miles to the island of Procida, and from thence, over two miles more of sea, to Ischia. These two pyramidal masses—so impressed on the memory of the visitor to Naples, and so celebrated in song and history—are stated by those who have scientifically examined them, to be parts of one great volcanic mountain. Here, prior to the awakening of Vesuvius in A.D. 79, was the principal safety valve of this fiery region.—Homer, Pindar, Virgil, and Ovid celebrate the eruptions of Mount Epomæus in this identical Ischia; and here Typhoëus was fabled to be buried. Once only since the Christian era, has it exhibited activity. In 1302 great damage was done by an eruption of lava.

We now make the trajet back from Ischia to the mainland again. We pass the conspicuous promontory of Misenum—retaining, in accordance with the poet's prediction, "æternum per sæcula nomen." On the left we coast along by the once voluptuous and still beautifully situated Baiæ—the favorite watering-place of southern Italy in its old palmy days. As you gaze now into the sea two hundred yards from the shore, you see the sunken substructions of villas, temples, and baths—the former haunts of luxurious emperors, patricians, poets, and orators. This coast, too, has known the presence of Hannibal, Alaric, Genseric, and Totila.—You have Pozzuoli—the old Puteoli before you—covering the flanks and summit of a bold hill jutting out into the sea; the dark masses which you observe at regular distances above the sunny surface of the calm water, are the piers of its ancient mole, once surmounted by a light. We land on the west side of the hill. We are conducted at once to the Serápeon which stands near—a temple of the Egyptian Serápis—a ruin which has become memorable among physical observers—as proving to the eye, by the perforations of the marine borers called Lithodomi in its still erect columns, that the land, subsequently to the erection of the building, must have gently sunk and remained submerged for many years, and then that it must as gently again have been raised. The perforations on the columns are now seen at a height of twelve feet; they cover a space of nine feet; and then above them comes an uninjured space of twenty feet, which must have been the portion of the columns appearing above the surface of the sea, when the stratum on which they stand had sunk down to the lowest point. The shore is supposed to be again descending. In order to approach the pillars for close examination, you have to walk through an inch or two of salt water. The edifice has been large. Its exterior colonade was 140 feet long, 122 feet wide. Here was found the remarkable sitting figure of Serápis, having his hand on a three-headed dog, now to be seen in the Museum at Naples.

We must not delay in Puteoli, though its associations tempt one to do so. As the southern terminus of the Appian way—a high road to Rome—it was, before Naples existed, the principal focus of the Italian trade with the East. The Greek colonists from Cumæ called the place Dicæarchia; but the Romans preferred the appellation "Puteoli," as having, in sound at least, an allusion to the hot sulphureous "wells," which abound in this volcanic locality.—Here we tread in the foot-prints of St. Paul; and standing on the now solitary beach, we can perhaps more vividly realize the interesting fact than we do when surrounded by the mosaics and marbles which encrust his shrines in Rome. The Apostle, as we know from Acts xxvii. 13, landed at Puteoli a prisoner in chains, and after his perilous voyage was allowed to rest here for seven days.—On a neighbouring rising ground you may be conducted over a remarkably perfect amphitheatre [480 by 382 feet], where, in A.D. 66, Nero contended publicly with wild animals, and where, in the time of Diocletian, Januarius, the supposed patron of Naples, with other Christians, suffered martyrdom. Here you may also be conducted over no inconsiderable remains of the Villa Puteolana of Cicero—familiar to the reader of his letters to Atticus, and distinguished as the spot where he wrote his *Quæstiones Academicæ* and his work *De Fato;* and also as the place where the Emperor Hadrian died.

Passing through Puteoli towards the east, you come out on a noticeable stripe of land between the precipitous cliff and the sea. By the marine deposits here found, mingled with the remains of human workmanship, it appears that this stripe, like the shore westward of Puteoli, has been successively depressed and elevated. On the sides of the cliff, 35 feet above the present sea level, the borings of lithodomi may be observed, and on the summit of the cliff are substructions of villas which once overhung the sea.

As you leave this narrow stripe, the road by which you travel passes through a massive stream of solid lava, which, in prehistoric times, flowed down from the Solfatara already visited, and here entered the sea in a stream one-fourth of a mile in breadth, and seventy feet in thickness.

You pass, also, on the left, some stone quarries, in which, exposed to the hottest rays of the sun, you see—for the first time perhaps, in your life—unfortunate human beings working in iron fetters. Alas! that the clank of those degrading links should be associated for ever in the recollections of any one with the name of Italy!—The labourers in the stone quarries of Epipolæ—whom, perhaps, your imagination may summon up—were more happy. The fortune of war had placed them there. But what is it that, in the Neapolitan states, according to the testimony of Mr. Gladstone, causes men, and perhaps some of these, to be thus condemned to chains?

Proceeding by the coast road homewards towards Naples, you remark, to the westward of the heights of Posilipo, a few hundred yards from the shore. a small island. This is Nisida, the last volcanic object in the neighbourhood of Vesuvius, which we have to notice. It is a cone with an extinct crater, into which, on the south side, the sea finds an entrance by a breach in the rim. A convenient little harbour is thus formed.—You may gaze on the island of Nisida with interest, for several historical reasons. Here Lucullus, the celebrated conqueror of Mithridates, possessed a villa, which, a few years after his death, became remarkable as being the place to which Marcus Junius Brutus retired after participating in the assassination of Cæsar, and where he left his Portia, the daughter of Cato, when he departed for Greece, destined never to return. It was here, too, that the interview took place between him and Cicero, of which the latter has left a graphic account, wherein the orator declares that he found the patriot "nihil nisi de pace et concordiâ civium cogitantem." In yonder little volcanic isle we have, then, a memento of the final but unsuccessful struggle for Roman liberty. We, curiously enough, have before us in the same object the scene of the extinction of the Western empire itself in the person of its last chief.—In exile here, a pensioner on the generosity of Odoacer, the first king of Italy, lived and died the son of Orestes, Romulus Augustulus, the closing-member of that series of puppets who, from A.D. 455 to 476, filled the throne and brought contempt upon the name of the Emperors of the West.

Since the great explosion of Vesuvius in A.D. 79, the craters of the Phlegræan fields appear to have become for the most part quiescent. The interruptions of their repose have been three, already noticed in passing: one in 1198, when the Solfatara emitted a stream of lava; one in 1302, when Epomeo, in Ischia, did the same; the third in 1538, when Monte Nuovo was thrown up.

The intervals which have occurred between the fifty-two eruptions of Vesuvius, since that of A.D. 79, I make out to be respectively the following—124 (years), 269, 40, 308, 43, 13, 90, 167, 194, 131, 29, 22, 12, 2, 2, 3, 6, 5, 5, 3, 8, 2. 7, 14, 3, 4, 2, 6, 1, 3, 6, 3, 5. 2, 1, 6, 10, 1, 4, 3, 1, 4, 3, 2, 6, 3, 3, 4, 6, 2, 3 (1850).

In the earlier portion of the Christian era, some eruptions may not have been recorded. The generations of men who could forget the sites of considerable cities may have neglected to record the activity of a volcano. If there have been no omissions, the eruptions of Vesuvius appear to have become more frequent since the year 1631.—It has also been observed that there is a degree of alternation between the movements of Etna and Vesuvius. In no instance have the two mountains been in active eruption simultaneously. Hence they appear to be escape-valves to one connected mass of igneous matter—the upward pressure of the elastic gases with which it is charged finding relief by the one, when the other is obstructed.

While standing on the summit of Vesuvius, and contemplating the enormous column of steam which is generally in the act ot being blown off, one is inclined to rush to the conclusion that the molten rock which overspreads the surrounding scene far and wide, has been shot up by nothing more or less than the familiar force which, with such irresistible power, lifts the piston. But further reflection induces a correction of this opinion. It is likely that the steam is simply produced by the infiltration of sea-water on the heated mass within the base of the mountain.

When we consider the fact that the ground on which we tread is but the surface of a rind,—that by experiment this rind increases 1° Fahrenheit in temperature for every fifty-four feet of vertical depth,—that at the depth of twenty miles granite must be in a state of fusion—we cannot fail to see that it is probable that the seat of all volcanic energy is in some common central igneous mass with which all the volcanic vents more or less communicate; and that these vents are very possibly established and maintained in order that the globe may not one day fly to pieces like a Rupert's drop.

But what is it that determines the moment when those fierce ebullitions must occur which ruffle the surface of the Phlegethon below, and cause its molten waves to rise on high, and so rudely flout the roofs of the cavernous crypts over which men dwell, shaking them and their structures, "massy-proof," from their propriety? What generates those expansive gases whose excess from time to time thrusts up before them the fiery fluid through which they seek to force their way?

These are queries which remain unresolved. Like the storms which observers notice, but cannot explain, in the magnetic world—these movements in the inner abysses of the earth must still, for the present, be classed as mysteries.

We doubtless here have glimpses of the forces, whatever they are, which, in the old foretime of our planet's history, burst apart the primitive crust; which tilted its strata in divers directions, as the uneasy polar sea bursts up its ice; which exposed huge sections of those strata with their contents, to the view, the use, and the delight of men; superinducing, apparently, at first, a scene of ruin,—harsh, sharp, bare, and confused; a scene, however, which resolved itself at last into what we now call mountain, hill, and vale; interspersed with river. cataract, lake, and sea; softened in outline by abrasion and disintegration, by slopes of alluvion and surfaces of mould, and coloured warmly over by mosses, lichens, herbage, and woods, and blue etherial haze.

But though the seat of volcanic energy be at the core of the globe, and its force, as is most probable, supplied by chemical agency operating there on an enormous scale—may it not be possible to explain, in some instances, some of the visible phenomena on mechanical principles? May there not be, in the case of many volcanoes, rude natural channels and reservoirs within the stratified parts of the earth's crust, into or through which the fiery fluid may pass, on its rising towards the surface—channels which, having a certain amount of inclination, may cause liquid lava to act as water in the hydraulic ram, producing earthquake-shocks when the throes are ineffectual—and ejections of matter high into the air, when a passage has at last been cleared?—reservoirs, in the shape of huge natural caverns, which, gradually becoming filled with the rising fluid, produce, by atmospheric compression over its surface, a continuous stream for a time—like the air-box in the fire-engine?

I conclude with the remark that in Canada—in western Canada, at least—we appear to be happily situated outside the circle of dangerous volcanic influence. It is true we now and then hear of vague rumblings at St. Catherines and Dundas; of a sort of volcanic tide-wave in the Lake near Cobourg; of detonations on the north shore of Lake Huron. We are assured, also, that an undulation of the earthquake at Lisbon in 1755 was felt on Lake Ontario. We know that in 1663, in the lower portions of the Province, there was an earthquake with volcanic ashes, which lasted for six months; that in 1785, and again in 1814, at Quebec, there was pitchy darkness at noon-day, with black rain and volcanic ashes—due, it has been supposed, to a crater in the terra incognita af Labrador. We can see, moreover, that the basin of Lake Superior, in the far dim foretime of this continent, was a focus of volcanic action. We notice trap in the river Ste. Marie, and Gros Cap is porphyritic. Col. Fremont describes an extinct crater in the neighbourhood of the Great Salt Lake, and an active volcano, 70 miles to the north-east of San Francisco. Mount Elias, in the Russian territory, is an open volcanic vent. And Commander McClure, of the *Investigator*, reports lava along the American coast of the Polar Sea. But in Canada, on the whole, it is a matter of congratulation that we have thus far been permitted to acquire a strong confidence in the ground on which we tread, and that we are spared the presence amongst us of any of those points of communication between the upper and nether worlds—which in other lands are exceedingly interesting,—but also sometimes very inconvenient.

On the Chemical Composition of Recent and Fossil Linguke and some other Shells.*

By W. E. Logan, F.R.S., and T. S. Hunt.

In the Report of Progress of the Geological Survey of Canada for 1851-52, we have mentioned the existence of small masses, containing phosphate of lime, and having the characters of coprolites, which occur in several parts cf the Lower Silurian rocks. In a bed of silicious conglomerate towards the top of the calciferous sandstone, at the Lac des Allumettes, on the Ottawa, they are abundant in cylindrical and imitative shapes, sometimes an inch in diameter. The same material forms casts of the interior of a species of Holopea or Pleurotomaria, and often fills or completely incases the separated valves of a large species of Lingula, which Salter has referred to *L. parallela* of Phillips. The phosphatic matter is porous, friable, and of a chocolate brown color; it contains intermixed a large quantity of sand; and small pebbles of quartz are sometimes partly imbedded in it. The analysis of one specimen gave 36 per cent of phosphate of lime, with 55 per cent. of carbonate and fluorid, besides some magnesia and oxyd of iron, and 50 per cent. of silicious sand.

Similar masses occur in the same formation at Grenville, and in the lower part of the Chazy limestone at Hawkesbury, in both cases containing fragments of Lingula. Those from the latter place are rounded in shape, and from one-fourth to one-half of an inch in diameter, blackish without, but yellowish-brown within, and having an earthy fracture; the analysis of one of them gave:

Phosphate of lime, (PO_5, 3Ca O),	44·70
Carbonate of lime,	6·60
Carbonate of magnesia,	4·76
Peroxyd of iron, and a trace of alumina,	8·60
Insoluble silicious residue,	27·90
Volatile matter,	5 00
	97·56

From the color it is probable that the iron exists as a carbonate. When heated in a tube, a strong odor like burning horn is perceived, accompanied by ammonia, which reddens tumeric paper, and gives white fumes with acetic acid, showing that a part at least of the volatile matter is of an animal nature. The specimens from Lac des Allumettes lose 1·7 per cent. by gentle ignition, with a like production of ammonia, and an odor of animal matter; the same thing was observed with those from Grenville.

The existence in Lower Silurian rocks of these masses, whose characters leave no doubt that they are coprolites, and whose chemical composition is like that of the excrements of creatures feeding upon vertebrate animals, led us to examine the shells of the Linguke always associated with these phosphatic bodies. The result has been that all the specimens yet examined consist chiefly of phosphate of lime; they dissolve readily with slight effervescence in hydrochloric acid, and the solution gives with ammonia a copious precipitate readily soluble in acetic acid, from which oxalic acid throws down lime. With a solution of molybdate of ammonia there is obtained a quantity of the characteristic yellow molydo-phosphate, many times greater than the bulk of the shell.

We have thus examined *Lingula prima* and *L. antiqua*, from the Potsdam sandstone, *L. parallela* from the calciferous, and a species somewhat resembling *L. quadrata* from the Trenton limestone. It was desirable to compare with these the shell of a recent species, and for this purpose fine specimens of the *Lingula ovalis* of Reeve, from the Sandwich Islands, were furnished us by J. H. Redfield, Esq of New York. The shell of this species had the same composition as the fossil ones, and the thick green epidermis, which swelled up like horn when heated, gave a bulky white ash of phosphate of lime.

For a further analysis the shell was boiled in water to remove all soluble matters, the soft parts still adherent were carefully detached, and the shell, with its epidermis weighing ·186 grammes, was calcined over a spirit lamp. The brownish residue, weighing ·114 grammes, readily dissolved with slight effervescence, in dilute hydrochloric acid, leaving but a few light flakes of carbonaceous matter. Acetate of soda and perchloride of iron were added to the solution, which was boiled, and the precipitated basic salt separated by filtration, and decomposed by hydrosulphuret of ammonia. The filtrate from the sulphuret of iron having been concentrated, the phosphoric acid was thrown down by ammonia with a magnesian salt; there was obtained ·070 grms. of pyro-

* See page 195 for a previous notice of this discovery

phosphate of magnesia, equal to ·044 of phosphoric acid, or ·0978 of phosphate of lime, PO_5, 3CaO.

The lime was separated from the acetic filtrate, as an oxalate, and gave ·108 of carbonate, equal to ·0605 of lime, being an excess of ·0075 over the amount required to form the phosphate, and corresponding to ·0134 of carbonate; the small amount of material did not permit us to determine whether a portion of the lime exists as fluorid. There was also obtained ·0032 of magnesia; the results from the calcined shell of *Lingula ovalis* are then as follows:

Phosphate of lime,	·0978	=	85·79 per cent.
Carbonate of lime,	·0134	=	11·75
Magnesia, - -	·0032	=	2·80
	·1144	=	100·34

The proportion of phosphate of lime is that contained in human bones, after their organic matter has been removed.

The texture of the ancient Linguæ was observed to be unlike that of most other fossil shells, being more or less dark brown in color, brilliant, almost opaque, and not at all crystalline. These characters are also found in the allied genus *Orbicula*, and we therefore examined an undescribed species of it, from the Trenton limestone, beautifully marked in a manner resembling *Conularia granulata*, and another large species, also undescribed, from the Upper Silurian; both of these consist chiefly of phosphate of lime; and the shell of a recent species, *O. Lamellosa* from Callao, was found to be similar in composition. We have not yet been able to examine a specimen of the genus *Obolus*. The same dark color and brilliancy were also remarked in the genus *Conularia*, and the shell of *C. trentonensis* proved on examination to be composed in like manner of phosphate.

The similarity of composition in these genera is in accordance with the acute observations of Mr. Hall, who finds that *Conularia* is almost always associated with *Lingula* and *Orbicula*, and remarks that "these shells, so unlike in structure and habit, appear to have flourished under similar circumstances, and to have required the same kind of ocean bed or sediment."—Palæontology, vol. 1, p. 101.

For the sake of comparison, we have examined the following fossil shells: they have a common character, distinct from those already described, being lighter coloured, more translucent and granular in texture; *Atrypa extans*, *Leptæna alternata*, and *Orthis pectenella* from the Trenton limestone; *O. erratica* from the Hudson River group, and *Chonetes lata* (?) from the Upper Silurian, besides *Isotelus gigas*, and a species of *Cythere* from the Trenton. All of these consist of carbonate of lime, with only such traces of phosphate as are generally found in calcareous shells.

In the report already quoted we have given a description of some phosphatic bodies which resemble the coprolites of the calciferous sandstone, and are found at Rivière Ouelle in thin layers of a conglomerate limestone, which is interstratified with red and green shales, and belongs to the top of the Hudson River group or the base of the Oneida Conglomerates. The phosphatic masses are very abundant, and rounded, flattened, or cylindrical in shape, and from one-eighth of an inch to an inch in diameter; they sometimes make up the larger part of the conglomerate. Iron pyrites in small globular masses occurs abundantly with them, often filling their interstices, but is not found elsewhere in the rock. These coprolites are finer grained and more compact than those from the Ottawa, and have a conchoidal fracture; their color is bluish or brownish black; the powder is ash-grey, becoming reddish after ignition. They have the hardness of calcite and a density of 3·15 When heated they evolve ammonia with an animal odor, and with sulphuric acid give the reactions of fluorine. The quantitative analysis of one gave—

Phosphate of lime, PO_5, 3Ca O, -	40·34 p. c.
Carbonate of lime, with fluorid, -	5·14
Carbonate of magnesia, - -	9·70
Peroxyd of iron, with a little alumina,	12·62
Oxyd of manganese, - - -	*trace.*
Insoluble silicious residue, - -	25·44
Volatile matter, - - -	2·13
	95·37

The iron exists in part at least as carbonate, and its introduction in so large a quantity, giving color and density to the coprolites, is doubtless connected with the formation of iron pyrites by the de-oxydizing action of organic matters. The production of an equivalent of bisulphuret of iron, from a neutral protosulphate of iron, which alone could exist in contact with limestone, must be attended with the elimination of an equivalent of protoxyd of iron; for $2(SO_3 \, Fe\, O) - O_7 = Fe\, S_2 + Fe\, O$.

It is remarkable that no traces of Lingulæ or any other shells have been detected with these coprolites. Thin sections of them are translucent, and under the microscope are seen to consist of a fine granular base, in which are imbedded numerous grains of quartz, and small silicious spiculæ, like those of some sponges. In a bed of sandstone, associated with these conglomerates and slates at Rivière Ouelle, were found several hollow cylindrical bodies, resembling bones in appearance. The longest one is an inch and a half long, and one-fourth of an inch in diameter. It is hollow throughout, and had been entirely filled with the calcareous sandstone, in which it is imbedded, and whose disintegration has left the larger end exposed. The smaller extremity is cylindrical and thin, but it gradually enlarges from a thickening of the walls, and at the other end becomes externally somewhat triangulariform; the cavity remains nearly cylindrical, but the exposed surfaces are rough and irregular within.

The texture of these tubes is compact, their color brownish black with a yellowish brown translucency in thin layers. Analysis shows them to consist, like the coprolites, principally of phosphate of lime. One hundred parts gave—

Phosphate of lime, - - - -	67·53
Carbonate of lime, - - - -	4·35
Magnesia, - - - - -	1·65
Protoxyd of iron, - - - -	2·95
Insoluble silicious sand, - - -	21·10
Volatile, animal matter, - - -	2·15
	99·73

The microscopic examination of a section shows that the walls of the tube are homogeneous, unlike the coprolites, and that the silicious sand in the analysis came from the sandstone which incrusted the rough interior of the fossil. The phosphate is finely granular, and retains no vestige of organic structure. The chemical composition and the remarkable shape of the specimens, however, leave little doubt of their osseous nature, unless we suppose them to be the remains of some hitherto unknown invertebrate animal, whose skeleton, like those of Lingula, Orbicula, and Conularia, consisted of phosphate of lime, a composition hitherto supposed to be peculiar to vertebrate skeletons.

Montreal, January 5th, 1854.

Preliminary Account and Results of the Expedition of Dr. Richard Lepsius to Egypt, Ethiopia, and the Peninsula of Sinai. Scientific Results of the Expedition.*

The scientific results of the expedition have, in almost all respects, surpassed our own expectations. In confirmation of this it will be sufficient briefly to survey these results, which I shall do in the following pages, according to their principal objects, and by entering into some of the details.

The plan of the journey, as a whole, and in its individual parts, was founded principally with a historical purpose in view. The French-Tuscan expedition, compared with ours, was a journey of discovery, with all the advantages, but also with all the disadvantages, connected with such an undertaking. We were able from the commencement to aspire after a certain completeness, within the wide limits that were assigned us, not, however, failing in making new discoveries, which were as important as they were unexpected. The investigation of the most ancient Egyptian times, namely, the epoch of the first Pharaonic monarchy, from about 3900 to 1700 B.C., extending the history of the world almost two thousand years farther back, was left entirely unfathomed by Champollion. He only ascended the Nile valley as far as the second cataract, beyond which existed a great number of Egyptian monuments of all kinds, wholly unexamined, in which we must seek for an explanation of all those Ethiopian antiquities which are inseparable from the Egyptian.

The most important results we obtained, therefore, were in chronology and history. The pyramid-fields of Memphis gave us a notion of the civilization of Egypt in those primitive times, which is pictorially presented to us in 400 large drawings, and will be considered in future as the first section in that portion of the history of man, capable of investigation, and must be regarded with the greatest interest. Those earliest dynasties of Egyptian dominion now afford us more than a barren series of empty, lost, and doubtful names. They are not only free from every real doubt, and arranged in the order and the epochs of time, which have been determined by a critical examination, but by showing us the flourishing condition of the people in those times, both in the affairs of the State, civil affairs, and in the arts, they have received an intellectual and frequently a very individual historical reality. We have already mentioned the discovery of five different burial-places of the sixth dynasty in Central Egypt, and what we obtained from them. The prosperous times of the new monarchy, namely, the period of splendour in the Thebaid, as well as the dynasties which followed, were necessarily more or less completed and verified. Even the Ptolomies, with whom we appear to be perfectly acquainted in the clear narratives of Grecian history, have come forward in a new light through the Egyptian representations and inscriptions, and their deficiencies have been filled up by persons who were hitherto considered doubtful, and were hardly mentioned by the Greeks. Lastly, on the Egyptian monuments we beheld the Roman emperors in still greater and almost unbroken series, in their capacity of Egyptian governors, and they have been carried down since Caracalla, who had hitherto been considered as the last name written in hieroglyphics, through two additional later emperors, as far as Decius, by which means the whole Egyptian monumental history has been extended for a series of years in the other direction.

Egyptian philology has also made considerable progress by this journey. The lexicon has been increased by our becoming acquainted with several hundred signs or groups, and the grammar has received a great many corrections. Such copious materials have also been acquired for these purposes, especially by the numerous paper impressions of the most important inscriptions, that Egyptian philology must be essentially furthered by their being gradually adopted. For, owing to the strict accuracy of these impressions, they are almost as valuable, in many investigations, as an equally large collection of original monuments. In addition to this, the history of the Egyptian language, which, by the great age attributed to the earliest written monuments, embraces a period of time between five or six thousand years, becomes now of much greater importance in the universal history of the human language and writing. Among the individual discoveries we made, the one which attracted most attention was that of the two decrees on the Island of Philæ, which were bilingual, namely, written in hieroglyphics, and in the demotic character—one of which contains the decree belonging to the Rosetta inscription, referring to the wife of Epiphanes.

In spite of numerous writings upon Egyptian mythology, it has nevertheless been hitherto deficient in a fixed monumental basis. In the temple at Thebes we beheld a series of representations whose meaning has not hitherto been recognized, and which seem to me to afford new conclusions for the correct comprehension and development of Egyptian mythology. The series of the first arrangement of the gods mentioned by Herodotus and Manetho, which in modern investigations has been differently arranged in its details by all scholars, is at length placed beyond all doubt, and certainly differs in all essential points from what has been hitherto everywhere adopted. I will briefly allude here to another fact, important both in the history of mythology as well as in a purely historical point of view, and which was elicited by an attentive investigation of the monuments. The direct succession of the reigning royal family was interrupted towards the end of the eighteenth dynasty. Through the monuments we became acquainted with several kings of this period, who were not afterwards admitted in the legitimate lists, but were regarded as unauthorized cotemporary or intermediate kings. Among these, Amenophis 4th is to be particularly noted, who, during a very active reign of twelve years, endeavoured to accomplish a complete reformation of all secular and spiritual institutions. He built a royal capital for himself in Central Egypt near the present Tel-el-Amarna, introduced new offices and usages, and aimed at no less a thing than to abolish the whole religious system of the Egyptians which had hitherto subsisted, and to place in its stead the single worship of the sun. In all the inscriptions composed during his reign, there is not one Egyptian god mentioned except the sun; even in other words the sacred symbols were avoided. Indeed, the former gods and their worship were persecuted to such an extent by this king, that he erased all the gods' names, with the single exception of the sun god Ra, from every monument that was accessible throughout the country, and because his own name, Amenophis, contained the name of Ammon, he changed it into Bech-en-aten, "Worshipper of the Sun's disc." Therefore the fact, which has often been previously remarked, that at one particular period the name of Ammon was intentionally destroyed, forms only part of an event which had a much wider influence, and which unexpectedly reveals to us the religious movements of those times.

The history of art has never yet been considered in the point of view from which Egypt and all that concerns it is now regarded. This necessarily formed a particular object of our expedition, and

* Concluding extract from "Letters from Egypt, Ethiopia, and the Peninsula of Sinai." By Dr. Richard Lepsius. Henry G. Bohn, London.

most directly gained by the increased chronological knowledge we obtained concerning the monuments. For the first time we were able to pursue all its branches during the old Egyptian monarchy, previous to the invasion of the Hyksos, and accordingly to extend both it and the history of Egypt about sixteen centuries further back, and some tens of years lower down in time. The different epochs of Egyptian art now first appeared clear and distinct, each marked by its peculiar character, intimately connected with the general development of the people. They had so frequently been misunderstood, that no one believed in their existence: they were lost in the general uniformity. I must mention, as one of the most important facts connected with this, that we found innumerable instances on unfinished monuments of three different canons of proportions of the human body; one belonging to the most ancient Pharaonic monarchy; another later than the twelfth dynasty, when Thebes first began to flourish: a third, which appears at first in the time of the Psammetichi, with an entire alteration in the principle of the division, and which remained unaltered till the time of the Roman emperors. The last is the same which Diodorus expressly mentions in his first book. Among the separate branches of Egyptian art, architecture, which was almost unnoticed by the French-Tuscan expedition, was with us peculiarly attended to, by the extremely careful and circumspect labours of our architect Erbkam. This was befitting the important position occupied by this particular branch, in which grandeur, that element of art, peculiarly belonging to the Egyptian beyond all other nations, was capable of being developed, and has developed itself to the utmost. The study of the sculpture and paintings devolved upon the other artists who accompanied us, and the ability and fidelity with which they fulfilled their tasks must be recognized by every one. The Egyptian style, associated with the limited views characteristic of the infancy of art, nevertheless possesses a highly-cultivated ideal element, which must be acknowledged by every one. The genius of Greece could never have bestowed on art such a marked character, indicative of a period of prosperous liberty, if it had not received it as a severe, chaste, and carefully nurtured child from the Egyptians. The principal task of the history of Egyptian art is to point out wherein consisted this cultivation of art, peculiar to the Egyptians above all the primitive nations of Asia. In the next place, Egyptian archaeology, in the widest sense of the word, claimed a large portion of our time and attention, an extensive field, already examined, both successfully and diligently, by Wilkinson and Rosellini, which they were enabled to do by means of the inexhaustible number of separate objects belonging to every-day life, still in preservation, and by the representations of them which are found in all directions, far surpassing any other ancient remains.

On that account it was still more necessary to make a stricter investigation, and to regard it from a higher point of view, rather than accumulate a greater number of individual things, that, notwithstanding, obtruded themselves on all sides, and which, besides, we collected in large quantities as material to work upon.

Lastly, geography and chorography, which travellers are especially expected to promote, required to be more peculiarly prosecuted. We must particularly mention here, that besides the peculiar investigation of the pyramid-fields at Memphis, and in the Faiûm, which have been already alluded to, our records of the ruins of towns and ancient monuments in the Nile country, as far up as Sennar, are more perfect and exact than any hitherto made. With regard to the modern geographical names, which must always be viewed in comparison with the ancient, I have been most particular in obtaining the Arabic names, at least throughout the district we traversed, in order to counteract, as far as lay in my power, the insufferable confusion in the names which are marked down. During the journey I made special maps for the individual portions of the eastern mountains of Egypt and the peninsula of Sinai, and I collected geographical accounts from travellers concerning some remote districts which we did not enter, and which are but little known; and I had geographical drawings made of them. Our investigations of the historical places in the peninsula of Sinai have already been alluded to. The discovery mentioned above, of the most ancient Nilometer at Semneh has added, in a remarkable degree, also to the history of the physical condition of the Nile valley. Since it is quite evident, from the water just above the second cataract, standing at that time twenty-two feet higher than at present, and the height of the water in the Thebaid being contemporaneously twelve to fifteen feet lower, that the fall of the Nile in the intermediate country was thirty-five feet greater in those times than it is now. But this gradual levelling of the bed of the river must have had the most decided influence on the history of the cultivation of the valley and of the whole population, because the soil on the banks of the river in the district of Nubia, more especially owing to the considerable sinking of the water, being inaccessible to the natural overflowings, was laid dry, and could only be irrigated with great difficulty and imperfectly, by means of artificial water-wheels.

Considerable progress was made in the knowledge of the African languages, by the investigation which I was principally enabled to make in the southern part of our journey. I inquired into and noted down as much of the grammar and vocabulary of three languages as would enable me to give a distinct idea of them. First, Kongara, spoken at Dar-Fûr and the adjacent countries, a central African-Negro language. Secondly, the Nuba language, which is spoken in two chief dialects in one part of the Nubian-Nile valley and in the neighbouring countries situated to the south-west, and also appears to be derived from the interior of Africa. It had never hitherto been a written language, and I collected together for the first time a piece of written Nubian literature, for I made a Nubian sheikh, who was perfectly familiar with the Arabic language and writing, translate the fables of Locman, a portion of the Thousand and One Nights, and the Gospel of St. Mark, from the Arabian into the Nubian tongue, and write down, besides, nineteen Nubian songs, some of of them in rhyme, some only rhythmical, and translate them into Arabic. Unfortunately, these precious packets, and the Nubian gospel, were lost in Europe, with but little hope of recovery. The third language investigated by me was the Beg'a, which is spoken by the Bischari nation, who dwell between the Red Sea and the Nubian Nile. This language occupies an important position with reference to philology, since it seems to be a branch of the original Asiatic stock, of which the African offsets may be comprehended under the name of the Hamitic languages; and is, besides, particularly interesting in our study of the monuments, because, most probably, it was once the key to decipher the ancient Ethiopian inscriptions, numbers of which were discovered by us upon the Island of Meröe, and from that place in the Nile valley as far down as Philæ. These inscriptions are written in simple characters, from right to left, and derive their origin from the powerful nation of the Meroïtic Ethiopians, whose direct descendants we behold in the present Beg'a nations. By comparing those languages with the other languages of Africa, which are already better known, I think I shall be able to separate, according to fixed principles, these "Hamitic languages" of north and north-east Africa (which may still be referred to their native home in Asia) from the numerous other languages of this enigmatical continent; and I am now engaged in preparing these philological investigations for special publication.

I must finally mention, among the results of our journey, two collections of inscriptions. In the first place, all the Greek inscriptions in the countries we travelled through were carefully sought out, and impressions of them were taken upon paper; by which Græco-Egyptian archæology, and more particularly the learned collections of inscriptions which have lately excited such lively interest, will probably be completed, confirmed, or justified in a satisfactory manner. Secondly, in the peninsula of Sinai we made as perfect a collection as was possible of the so-called Sinaitic Inscriptions, which are found engraved on the rocks in different districts of the peninsula, but principally in the neighbourhood of the old town of Faran, at the foot of the mountain range of Serbal, and at a resting-place of the caravans in Wadi Mokatteb, situated further north, which is named after them.

We were only able casually to turn our attention to objects of natural science. Nevertheless I did not, however, neglect, especially during remote mountainous journeys, to collect specimens of stone and earth from the more remarkable localities. We not only visited the celebrated stone quarries in the chalk mountains of Tura, in the sandstone range of Selseleh, in the granite rocks of Assuan, and others situated in the Nile valley, but also those alabaster quarries of El Bosra, opposite Siut, which were discovered a few years ago by the Bedouins, in which last we found a rock inscription from the commencement of the 17th dynasty. They resemble those quarries of granite and brecciaverde at Hammamat, upon the road leading from Qeneh to the Red Sea, which have been worked from the earliest times, and also the porphyry and granite quarries at Gebel Fatireh (Mons Claudianus) and at Gebel Dochan (Mons Porphyrites), in the Arabian chain of mountains, celebrated in the Roman period. I had also an opportunity of purchasing an interesting ethnographical and natural history collection in Alexandria, obtained by H. Werne during Mohammed Ali's second expedition up the Nile, which penetrated as far as 4° north latitude, of which an account was published; and I received a valuable collection of Egyptian fishes for the Anatomical Museum in Berlin, from the celebrated French physician, Clot Bey.

On some new Genera and Species of Cystidea from the Trenton Limestone.

By E. Billings, Barrister at Law, Bytown, Canada West.

SECOND PAPER.

Read before the Canadian Institute, April 8th, 1854.

GENUS COMAROCYSTITES.

When deeply imbedded in the rock, and without the column, arms, or ovarian aperture being visible, the fossil for which the above generic name is proposed, might, upon a superficial examination, be readily mistaken for a coral. When entirely separated from the matrix, and not compressed, or otherwise distorted, it has the form and general appearance of a large strawberry.

It is of an oval shape, the smaller end being the base where the stem is attached, and the larger extremity the summit, in the centre of which is situated the elongated mouth. Two very young specimens are each about three quarters of an inch in length, and a large one pressed quite flat and lying embedded in the rock about two inches. The whole surface is covered over with hexagonal or pentagonal pits rounded at the bottom, each one of which marks the area of a concave or deeply depressed plate.

Upon the upper joint of the column stand three low but broad pentagonal plates, with serrated edges above. These form a narrow circular pelvis, and are so closely united at their sides that it is difficult to detect the lines of division between them. There are generally two rows of small irregular plates varying in size and number, in different specimens, between the pelvis and the commencement of the regular hexagonal plates.

Resting on two of the small plates on the ovarian side is the base of an upright row of four large ones, the lowest of which is heptagonal, the two next six-sided, and the fourth pentagonal. From the pointed apex of the latter the suture between two others proceeds to the lower side of the ovarian aperture. This arrangement is well marked in all the individuals in which the posterior side remains entire. It may therefore be regarded as a permanent character of the genus. A line drawn from the centre of the base upwards along these four plates, through the centre of the ovarial orifice, between the two arms hereafter to be described, and through the mouth to the opposite side of the summit, and thence to the base on the anterior side, would divide the fossil into two equal parts. It appears thus to have had a bilateral symmetry.

From each side of this upright column of plates on the ovarian side the principal plates of the body run round the fossil in rows nearly horizontal. There are from eight to eleven of those rows, including the pelvic series.

Near the summit is an opening closed by a valvular apparatus of five or six triangular plates—probably the ovarian aperture. In the specimen (Fig. 3) it is obtusely pentagonal, and three-sixteenths of an inch in diameter. In several other specimens there are six ovarian valves, but in this there are apparently only five. They all meet in the centre of the orifice and project a little outwards, so as to form a low dome-shaped prominence, through the apex of which there is a small perforation, which seems to be formed by the truncation of the apices of all the plates. This perforation is not visible in the two specimens figured, because in these the upper portions of the plates are in a mutilated condition in this particular part, but in several others not so perfect, in other respects, it can be seen.

A similar provision is described as forming a feature of the reproductive organ in several of the already known species of Cystidæ. Of *Spheronites* Von Buch states, "Lower down, but on the same hemisphere with the mouth, occurs a large pyramidal orifice, closed with five or more, rarely six valves, which is the ovarial opening; on the top of each of these valves is a small orifice piercing quite through the valve, and possibly the eggs were extruded from these orifices, since the valves themselves are never found open." (Quart. Jour. Geo. Soc., Vol. 2, page 30.) At page 39 in the same article in his description of *Cryptocrinites cerasus*, he says, "The mouth is proboscidiform, and covered with very small plates. The ovarial orifice is covered with five small valves, rarely preserved, arranged like a star, and in each of the valves is a small orifice open to the interior of the plates, as in *Spheronites*, but situated exactly in the middle of the valve, and probably serving for the protrusion of the eggs." Professor Hall has also figured this small orifice in the ovarian pyramid of *Apiocystites elegans*. (Pal. N. Y. Vol. 2, Plate 51, Fig. 13.)

Our fossil is closely allied to *Spheronites*, which are nearly spherical cystideans covered like this by a great number of plates, with the mouth also situated on the summit, and the ovarian aperture a little below. That genus, however, was unprovided with arms, and had six plates in the pelvis. In this there are but three plates in the pelvis, and besides it bears upon its summit certainly three, if not four, long tentaculated arms. In other respects it is nothing more than an elongated *Spheronite.*

The arms are each composed of a single series of large oblong joints loosely articulated upon each other. From each joint proceeds one long nearly cylindrical tentaculum, also composed of a single series of short joints. The large specimen, fig. 3, is deeply buried in a piece of limestone, and as only one side of the arm is above the surface, it cannot be determined whether another row of tentacula exists on the other side of it or not.

The tentacula are not perfectly cylindrical, but compressed to a sharp edge on one side, and on each side of this ridge a row of obscurely visible pits extends the whole length, as if here an appendage of some kind had been fastened.

The other specimen (Fig. 1) is detached from the matrix, and preserves its form, with the exception of a very slight compression. The summit shows the bases of three arms. Two of these are placed close together on the edge of the summit immediately over the ovarian aperture, and the other upon the side opposite. The summit is not circular, but elliptical, the pair of arms standing at one end of the ellipse and the single arm at the other.

Professor Forbes has figured three Cystideans from the Bala limestone of Shole's Hook and Reulas, with protuberances upon their summits very like the bases of the arms remaining on several specimens of this species. Of two of these, of the same species, *Caryocystites munitus*, he says, "They are both globular bodies, nearly smooth, except for the markings referred to, and especially distinguished by their summits being crowned with four tubercles, connected together by ridges, so as to form, as it were, a turretted wall and square fortification around the mouth." (Memoirs of the Geological Survey of England, Vol. 2, part 2, page 515, and plate 21.) The appearances exhibited by the fossils found here, when compared with Professor Forbes's figures, strongly induce the suspicion that some of the English Cystideæ were also provided with free arms.

It may be observed here that Von Buch was of opinion that the Cystidea were totally destitute of arms. Volborth supported the opposite view, and contended that they not only had arms like the Crinoidea, but that they were in fact true Crinoids. Afterwards several species were discovered with flattened appendages, which were turned downwards from the summit and attached to the sides, as in *Glyptocystites multipora.* Another, *Prunocystites Fletcheri*, was found at Dudley, in England, with the remains of several long tentacula, like those of the genus *Pleurocystites.* Professor Forbes describes it as "a small ovate cystidean, with a very large stem attached, and presenting the remarkable feature of possessing long tentacula, or filamentary arms, not folded back and lodged in grooves, as in the *Pseudocrinites* and its allies, but projecting directly from the oral aperture, around which they appear to have been attached. . . . They appear to be analagous to the fingers and not the arms of *Pseudocrinites.*" (Mem. Geo. Sur., page 503 and 504.) The specimen (fig. 3) is probably the first ever discovered with a true tentaculated arm rising free from the summit. It is not, however, on account of its being furnished with free arms, a Crinoid. In animals of this latter order the ovaries are said to have been borne aloft upon the arms and the eggs protected by the tentacula until the proper time arrived for casting them off; but in the Cystidea the organs of reproduction, according to the opinions of many of the best naturalists, open out to the exterior through the large aperture in the side beneath the summit.

It has been stated that the summit of this fossil is elliptical, and that a pair of arms stands at one end of the ellipse, and a single arm at the other. From the single arm a deep groove now filled with dark calcareous matter is seen in the specimen (Fig. 1) to extend to a point between the other two. This is without doubt the mouth. It follows the major axis of the ellipse, and is therefore elongated in an anterior and posterior direction, that is to say, it extends from a point directly over the ovarian aperture straight across the summit to the opposite or anterior side. There is some evidence to show that from the ends of the mouth grooves extend up the arms on the inside, as in the Crinoids; but the specimens are not sufficiently cleaned of the matrix to determine this point with certainty. Neither do they show positively that in any case there were only three arms. It appears to me that there must have been a pair at each end of the mouth, and that in some instances one of them has either been removed or cannot be seen. In the large specimen figured the arm is well preserved, but the upper part above the ninth joint is buried in the stone, so that its length cannot be determined.

On the right of the summit of the specimen Fig. 3 the impression of the other arm of the pair remains. These two arms appear to be placed further apart than in some other specimens.

The column is round, and composed of thin joints, so that it is nearly smooth, or only surrounded by very small rings close to each other.

Many specimens of this fossil in a more or less fragmentary condition, have been found by different persons within the last few years in the Trenton limestone of this locality, generally along the water's edge from the Rideau falls to the Chaudière. As neither the pelvis nor arms were preserved in any of these that came within my observation, I always supposed them to be portions of a new species of *Spheronites*, judging from the great number of plates. At length, in the month of June last, I had the good fortune to discover the magnificent specimen (Fig. 3) in a place where it is strange that it had not been previously detected. A large picnic party once assembled on this spot, and, as I am informed, the gentlemen and ladies danced upon the level surface of the limestone rock without discovering the sleeping form of this ancient inhabitant of the old Silurian ocean. This was ten years ago, and it is possible that during the period which elapsed the fossil became more exposed by the weathering of the matrix. During the last autumn I collected several others, not so perfect, but exhibiting parts not exposed in this specimen. Fig. 1 was found in the month of November last, by Mr. W. S. Hunter of this place, from whom I procured it. Nearly all the specimens that I have seen are unquestionably of the same species as this Fig. 1, and I have therefore selected it as the typical form. From its shape and the appearance of its surface, I beg to suggest as a name for the genus, *Comarocystites*, from the Greek *κόμᾰρον*—a strawberry. Its characters may be concisely summed up as follows:—

GENUS COMAROCYSTITES.

(Greek *κομαρον*, *arbutum*, and *κυστις*, *vesica.*)

Body ovate, the smaller extremity being the base, pelvis small, of three plates, above which are from eight to eleven rows of plates, mostly hexagonal, ovarian aperture near the summit, closed by a valvular apparatus, mouth apical, arms free, composed of a single series of joints and bearing tentacula, column round.

Comarocystites punctuatus.

Fig. 1.

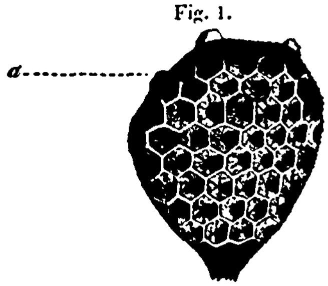


Fig. 2.

Fig. 3.

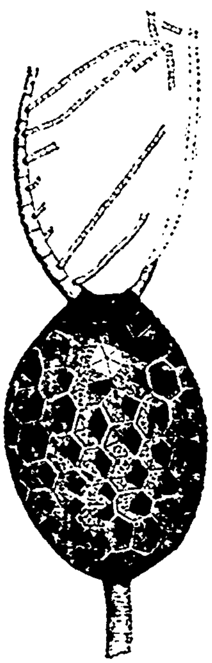


Fig. 1. *Side view of a specimen separated from the matrix. a—position of the ovarian aperture.*

Fig. 2. *The summit showing the direction of the supposed mouth with respect to the ovarian aperture.*

Fig. 3. *A large specimen of Comarocystites punctuatus, retaining an arm and several tentacula. The dotted lines on the right show the impression of another arm. The plates of the ovarian aperture are restored in the figure. They are shattered in the specimen.*

The general form of this species is somewhat oval, projecting largely on the ovarian side. Its greatest expansion is near the summit, whence it tapers to a point at the base of the diameter of the column or a little longer. The plates are deeply depressed in the centre, and thus the whole surface is covered with almost hemispherical pits, except near the base, where the small plates are but slightly concave. The surfaces of the plates are covered with small oblong punctuations. If lines be drawn from the centre of each plate to each of its angles, they will divide it into as many triangular spaces as it has sides. All the oblong punctuations in each of those spaces will be found parallel with each other, but not with those of the adjoining spaces. They are arranged in rows parallel to the edges of the plate, and the greatest axis of each pore is at right angles to the suture. In this respect they correspond to the striation usually seen on the plates of the Cystidæ, which generally cross the sutures at right angles from the centre of one plate to that of another. They do not penetrate but to a short distance below the surface, and when the plates are weather-worn they disappear altogether. On each of the ridges which mark the positions of the sutures between the plates, there is a single row of those pores which penetrate deeper, and are seen after they have been worn away from the interior of the plates. Nearly all the specimens have this character of surface. In the large one, however (Fig. 3), a small space in the depressed centres of each plate is smooth, and from the border of this space lammellar ridges cross over to the adjoining plate. These ridges are divided by other ridges crossing them parallel with the sutures. The effect produced is nearly the same. Near the ovarian aperture, also, in this specimen, from the bottom of each of several of the cavities arises a rough tubercle to the height of the surrounding ridges. Other individuals differ slightly in their surface markings, but perhaps only sufficient to constitute varieties. The specimen, Fig. 3, is crushed, and does not exhibit the true natural shape. A very large specimen pressed quite flat, and lying on a slab of limestone, has a portion of the upper side removed, so that the interior surface of the side below can be seen. The plates are thus found to be on their inside elevated in the centre, and covered with strong rounded ridges, radiating to the centres of the sides. They do not extend to the centres of the plates, but cross the furrows made on the inside by the elevation of the borders of the plates on the outside. The pelvic plates are low, broad and serrated on their upper sides. They are so firmly united to the upper joint of the column and to each other, that it is difficult to detect the division lines between them.

GENUS AMYGDALOCYSTITES.

This very curious and beautiful Cystidean differs from the former principally in the manner in which the arms are constructed. They are not free or springing upwards like the arms of a Crinoid, but consist of a short row of calcareous joints crossing the summit, and extending a short distance down the sides. From each of these joints a long tentacle arises, similar to those of the last species. As the specimens are deeply embedded in the rock, very little can be said about them at present The most perfect, Fig. 4, much resembles an almond, and I therefore propose for it the generic name *Amygdalocystites*. Its characters, so far as they can be determined, are as follows:—

Body ovate, pelvis of three (?) plates, above which are eight or more rows of plates, completing the cup, ovarian aperture near the summit, closed by a valvular apparatus, arms composed of a row of joints crossing the summit and articulated to the surface, each joint bears a tentacle, column round and of thin joints, mouth unknown.

Amygdalocystites florealis.

Fig. 4.

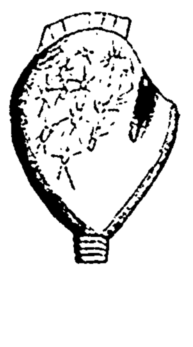


Fig. 5.

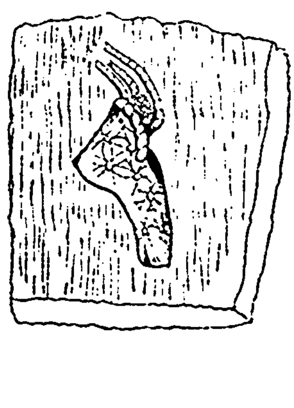


Fig. 6.

Fig. 4. A specimen with a part of the arm, ovarian aperture, and four joints of the column. Surface character of the plates not well preserved.

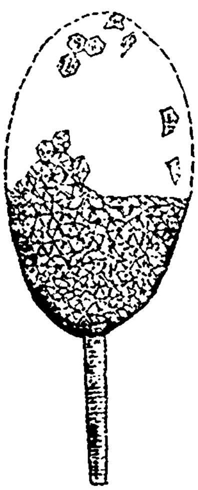
Fig. 5. A fragment from the same slab, showing the markings of the plates and three of the tentacula.

Fig. 6. A single plate.

In this species a low rounded tubercle is situated in the centre of each plate, from which ridges radiate to the angles. These ridges are scarcely elevated above the surface, where they leave the border of the tubercle in the centre of the plate, but increase in width and height as they depart from it. They are sharp above, and attain their greatest elevation at the angle of the plate. The ovarian aperture is situated close to the arm near the summit, and appears to be formed of six triangular plates. The short fragment of the column which remains is composed of four joints about the sixteenth of an inch in thickness. The fragment, Fig. 5, shows the form of the plates and three of the tentacula attached to the arm. The remainder of the specimen is concealed.

Amygdalocystites radiatus.

Fig. 7. Fig. 8.



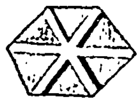


Fig. 7. Part of the body and column of a specimen.

Fig. 8. A plate enlarged.

This specimen consists of the lower part of the cup, and about one inch in length of the column of a Cystidean, which will probably be found to belong to the same genus as the last. The plates are somewhat convex exteriorly, and ornamented with strong rays, which extend from the centre to the angles. At the base a large six-sided pelvic plate is seen resting on the column. From the width of this plate in proportion to the size of the column, it appears that the pelvis is formed of three plates. The column is round and smooth. The impression upon the stone shows that this individual was of the size indicated by the dotted line in the figure.

Amygdalocystites tenuistriatus.

Fig. 9.

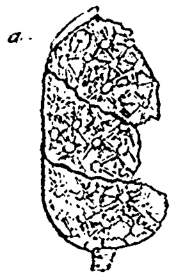


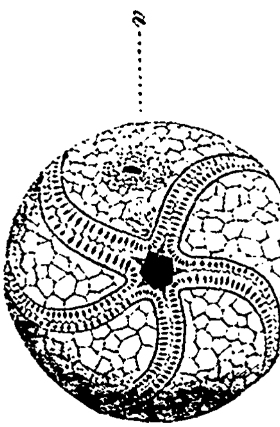
Fig. 9. A specimen separated from the matrix, but crushed quite flat, and broken into three pieces. a—the ovarian aperture.

Of this species I have only the single specimen figured. The plates are elevated and smooth in the centre. A low rounded ridge proceeds from the smooth space to each angle. Between these ridges fine striæ cross from one plate to the other, at right angles to the sutures. The pelvis consists of three broad pentagonal plates. The column is round, and formed of very thin plates. The ovarian aperture is nearly on the top of the summit. Neither arms nor mouth have been observed. The specimen is separated from the matrix, but crushed quite flat, and broken across in two places.

These three last described species appear all to belong to a genus different from *Comarocystites*, and I have therefore disposed of them as above, provisionally. When more becomes known about them, it may be necessary to make another arrangement.

Agelacrinites.

Fig. 10. Fig. 11.



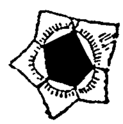


Fig. 12.

Fig. 10. Partly restored figure of Agelacrinite from the Trenton limestone, Bytown. a—supposed ovarian aperture.

Fig. 11. Plates surrounding the mouth, under side. These plates have all an elevated border on the side next the mouth, below, caused by the bending down of the plate, as seen in Fig. 12.

Fig. 12. Vertical section through the mouth.

This genus has been long known in Europe by a single specimen discovered about thirty years ago at the Chaudière Falls in this vicinity, by Dr. Bigsby, and by him taken to England. Another specimen was found by Mr. Gibbs (of the Geological Survey of England), near Yspetty Evan, in North Wales, in a mass of schistose rock, from a quarry associated with the Bala limestone, a formation which has furnished many species of Cystidea, and which appears to occupy the same palaeontological level as the Trenton limestone. In describing the last mentioned specimen Professor Forbes states:—

"One of the most remarkable Cystideans as yet discovered in British strata is a fossil which rewarded the exertions of the collectors for the Survey in North Wales during the summer of 1847. It is a hemispherical, many plated, spheronite-like body, but presenting the striking characteristic of possessing five serpentine grooves, radiating from its mouth, and occupied by as many appressed arms. Within one of the compartments formed by the surrounding arms is an ovarian pyramid. Thus it exhibits characters which in some degree link the very different types, *Pseudocrinites* and *Spheronites.*

"Although no similar European form had been described by any author, its aspect immediately called to mind a remarkable American fossil, figured and described by Mr. G. B. Sowerby, in the second volume of the Zoological Journal." The body in question was discovered by Dr. Bigsby in Canada, and Mr. Sowerby describes it as follows:—

"Upon examination of this fossil, we do not immediately recognise its affinities, for it bears so near a resemblance to the arms of an Asterias lying on an Echinus; we think, however, judging from the want of ambulacra, that it would be properly placed among the genera of the *Asteriadæ.* At the same time, its vicinity in general form to Say's family of *Blastoidea* renders it doubtful whether it ought not to be considered as a connecting link to be placed between the two families of *Crinoidea* and *Blastoidea,* and this suggestion obtains support from the apparently lateral situation of the mouth, in which it resembles some of the *Crinoidea.* This suggestion, however, involves the following consideration, namely, whether those rays in the *Blastoidea,* which, by Say, are called *ambulacra* (a term commonly applied to an apparently corresponding part in the Echinida), really serve the same purpose, or whether they be not arms, as in the other *Crinoidea.* And I venture to assert that there is nothing, either in their position or form, that militates against such an idea.

"I hope the following description, together with the figure by which it will be accompanied, will serve to give as correct an idea of the fossil in question as can be conveyed without the actual examination of the specimen.

"The general form, as far as we can judge from the specimen, in which none of the lower part is preserved, is a depressed spheroid, and it does not appear to have naturally any angular prominences, though, owing to the circumstance of its being divided into five sections, it might possibly be very obtusely pentagonal. It appears to have consisted of a number of irregular partly imbricated, crustaceous plates, and its upper half is divided into five sections or compartments, by five equal arms, which diverge from the centre, and are curved all in the same direction.

"The compartments are not equal in size; in the largest of them, and near its centre, is placed the mouth, which appears to have been surrounded by two or three rows of very minute, imbricated, crustaceous scales; the arms, five in number, all diminishing to a point at their outer extremity, and having their upper portion elevated above the body, seem, however, to be attached to it by their under side, and indeed partly bedded in it; each one is divided into two equal parts by a longitudinal groove, and each of these parts is again divided into a number of segments by transverse and deep grooves, which are close set, being about half their length distant from each other. I cannot ascertain whether there is any natural opening in the centre or not. The whole is changed into crystalline carbonate of lime, coloured by iron rust, and it lies upon a mass of limestone, containing a mass of Encrini and Madreporites; a single spiral univalve is also to be observed. From the Falls of the Chaudiere on the Ottawa River in Lower Canada."

In reference to these remarks of Mr. Sowerby, Professor Forbes observes:—

"Although the true affinities of this curious fossil are not recognised in this description, and many of the parts misinterpreted (as, for example, the ovarian pyramid is regarded as the mouth), still there can be no question, especially when the characteristic figure which accompanies the paper is examined, of its true position being among the Cystideans, and of its being generically allied to the British fossil we are about to describe."—*Mem. Geo. Sur.*, Vol. I., p. 519.

In one locality near Bytown in the Trenton limestone I found seven specimens of the fossil above described by Mr. Sowerby lying near each other, within a space of four square yards in extent, and partially imbedded in the surface of a stratum of limestone. Along with them were three new species of encrinites, the Cystidean last described, several tribolites, and a great quantity of the coral *Chetetes lycoperdon.* I succeeded in clearing from the matrix one specimen, consisting of three of the rays and four sides of the mouth, so that both sides of the shell can be seen.

It shows an important character not previously observed, and which appears to affect the zoological rank of the fossil very materially. The rays are not grooves for the reception of arms, as has been supposed, but appear to be ambulacra, resembling those of the *Echinidæ.*

They are composed each of two rows of oblong pentagonal plates, and are perforated between the joints by two single rows of very large pores, which open out on the interior in the same manner as on the exterior. The mouth is large and five-sided, as shown in the figure. The supposed ovarian aperture consists of a space between two of the rays, covered by a number of plates much smaller than the average size. They form an elevation, the apex of which has been shattered, so that it cannot be determined whether there was in this place an ovarian pyramid or not. This part is only preserved in one of my specimens, and it is from this that I have drawn the corresponding part in the figure. Another specimen shows the plates on the other side except in the centre, where there appears to have been a round opening three-eighths of an inch in diameter. It is much distorted, however, and the plates are obscurely seen, so that nothing can be asserted concerning it with certainty. In this one, also, it is remarkable that the rays turn to the right instead of the left, as in all the others.

The figure given above is a restoration, showing the structure of the fossil, as seen in the specimens in my possession, one of which is nearly as perfect as the figure itself.

All the appearances about this fossil negative the idea that these grooved rays were occupied by arms.

The grooves for the reception of the brachial appendages in the *Cystideæ* are shallow excavations in the surface of the regular plates of the body, and in *Glyptocystites multipora*, when the arms are removed, it would not be suspected from any indication remaining after the specimen has been slightly worn that they had ever existed. In this fossil, however, the radial furrows, supposed to be the grooves for arms, are formed of an arrangement of special plates, which constitute at the same time a part of the general covering of the body.

True arms have an ambulacral and an antambulacral side.* If the latter were placed downwards, resting on the bottom of the grooves, as is the position of the arms in the genera *Pseudocrinites, Glyptocystites* and others, then it would close all those pores in the rays, and they would be useless. But if, on the other hand, the ambulacral side of the arm be placed downwards, then all its own pores, if any, would either be closed or else open only into the interior of the body through the apertures of the grooves beneath.

Neither do those apertures in the rays appear to have been the openings of alimentary canals for the nourishment of rows of tentacula placed on the rays, like the tentacula which fringe the borders of the pseudambulacral-fields of the Pentremites. Their great size seems to preclude this idea, and again on the under side of the ray there are no traces of that peculiar tubular or reed-like apparatus (*Rohren Apparate*), described by Roemer as existing beneath the pseudambulacra.†

Each ray terminates at the mouth in a single plate, which forms one side of the mouth. When viewed from the under side these five terminal plates are seen to be pentagonal, and touch each other, as seen in Fig. 11. But on the upper side the sutures between them are concealed beneath five other plates placed upon them, and which form five elevated corners at the angles of the mouth. The pores which, in the rays beyond those plates, make their way between the joints, here seem to penetrate through the margins of the upper terminal plates, and one exactly over the corner of the mouth is larger than the others. In the body of the rays the pores can be clearly seen on the underside, but I cannot ascertain whether those on the upper series of the ten oral plates penetrate to the interior or not.

When these new characters are compared with those of *Agelacrinites*, the fossil certainly seems to constitute a different genus. Professor Hall defines the genus *Hemicystites* as follows:—

"Body circular, depressed at the margins, centre elevated, composed of an unequal number of imbricating plates; arms five, adhering, radiating from the centre, and composed of a double series of alternating joints; an ovarian orifice closed by triangular plates; an oral and an anal orifice, with a porous tubercle near the apex." Pal. N. Y. Vol. 2, page 245. He afterwards says in a note at page 355 of the same work, "This genus is apparently identical with *Agelacrinites* of *Vanuxem*, the description and figure of which I had overlooked at the time this volume was written."

If we take the above description of the genus *Hemicystites* as a definition of *Agelacrinites*, then the fossil now under consideration cannot readily be determined to be a species of the latter genus. The difference in the position of the mouth in the two is quite sufficient to separate them. In our specimen, the rays proceed as it were out of the mouth, whereas in *Agelacrinites* the mouth is situated on one side of the apex in one of the spaces between two of the rays.

It may be that *Agelacrinites* is the young of this species. About six years ago, I found a fossil almost exactly like that figured by Vanuxem, and last summer on the same spot a fragment of one of the rays of a specimen of this large kind. In the fall of 1852, I discovered another, also like Vanuxem's fossil, on a stratum of limestone, which projected from beneath another, and last spring, on returning to the place and removing the upper layer, and about three inches of shale, the seven specimens above mentioned were disclosed, with a prodigious number of fossils of other species.

Neither of the small specimens are in my possession, but judging from Vanuxem's figure and Professor Hall's description of *Hemicystites*, and also from recollection of the structure of the fossils, I have no doubt but that they are *Agelacrinites*. If so, then the circumstance of their having been found in two instances in association with the larger organisms, points to the conclusion that they are the young of the latter. *Agelacrinites* may therefore be, as Professor Hall has suggested, "the embryonic condition of a higher organization."

If we regard these two forms found here as distinct species of Cystidea, then there are certainly twelve species of this extinct order imbedded in the Trenton limestone in this locality, for besides those described in these two papers, there are the fragments of two others. One of these I have often met with in detached plates, containing half of a pectinated rhomb, and of the other I have a fragment of one side, consisting of about twenty plates. That they are parts of Cystideans there can be no doubt.

There are also several specimens of *Pleurocystites*, which appear to be different from those described in the first paper.

These new fossils were all discovered in the upper one hundred feet of the Trenton limestone, associated with between twenty-five and thirty new species of Crinoids, some of them beautiful forms. They belong principally to the genera *Heterocrinus, Glyptocrinus, Homocrinus, Lecanocrinus, Thysanocrinus*, and two or three new genera. The heads are mostly crushed, but sufficiently perfect to make out the form and arrangement of plates. It will be no doubt useful to those examining the rocks of the Ottawa, to know that nearly all the smooth round columns of Crinoidea, so abundant, may be referred to two fine species of *Thysanocrinus*. This encrinite has a branching root and a round, smooth, straight column, which, for a few inches below the head, becomes annulated by alternately larger and smaller joints, as shown in the fragment of the stem seen attached to the figure of *T. Liliformis*, in the 2d volume of the Palæontology of New York, Plate 42.

Nearly all the large moniliform columns are those of several magnificent species of Glyptocrinus, of which I have the heads. I believe that the discovery of two species of *Lecanocrinus* is the first appearance in our strata of Crinoids, with three plates only in the pelvis, so low down in the series as the Trenton limestone. These I found during the month of November last.

The Cystidea described in these two papers, although different even in genus, when viewed altogether as a group, resemble those

* "Arms are free radii with an ambulacral and antambulacral side." J. Muller. On the Structure of the Echinoderms. Annals of Natural History, January, 1854, page 8.

† See Roemer. Monographie der Fossilen Crinoiden familie der Blastoideen und der Gattung Pentatrematites im besondern; page 19, Taf. I., 2, 6.

of the Bala limestone and the Lower Silurian of Russia and Norway. Thus *Pleurocystites* is in general appearance like *Hemicosmites; Comarocystites*, and *Amygdalocystites*, closely resemble *Spheronites*, while our large supposed *Agelacrinite* is almost identical with *A. Buchianus* of the Geological Survey of England from the Bala limestone. In its open ovarian aperture and in the form of its pectinated rhombs, the genus *Glyptocystites* is similar to the Russian *Echino-encrinites*, but widely different from that group of species of the latter genus found in the upper Silurian rocks of Dudley.

The Bala limestone seems to be the equivalent of the upper part of the Trenton formation, judging from the general aspect of the Cystidea and the numbers in which they have been found. There is thus near the base of the lower Silurian a Cystidean zone which has been traced half round the world from Upper Canada to St. Petersburg.

That these two formations (the Bala limestone and the upper part of the Trenton) lie in the same geological horizon, is further borne out by other fossils.

At Knockdollian, in Ayrshire, Scotland, in rocks which Professor Sedgwick places in the lower Bala, and therefore below the Bala limestone, great numbers of *Maclurea magna* are found together with *Murchisonia angustata.* At Aldeans (also lower Bala) *Macluera magna*, and, it would appear, *M. Loganii* occur. On the Ottawa both these fossils are found occupying the same position immediately below the beds of Cystidea, as they do in Europe.

When we consider the restricted vertical range of *M. Magna* everywhere in America, it is not likely that in Europe it should be found in another formation, and it is therefore highly probable that the Scottish Silurians in which it occurs are the equivalents of the Chazy, Birdseye, Black river, and the lower part of the Trenton.*

On some Points connected with the Early History of Rome.

By the Rev. E. St. John Parry, M.A., Professor of Classics, University of Trinity College, Toronto.

Continued from page 219.

ON THE ITALIAN LANGUAGES.†

In the former part of this paper I considered some questions connected with the ethnology of Ancient Italy. We found the area of the peninsula originally occupied by Umbrians and Opicans, combined in different degrees with Pelasgians from the north-east. In Etruria these Pelasgians had established themselves as a distinct nation, in possession of an empire which the Umbrians could never throw off. In Latium, also, another family of Pelasgians had settled themselves; while a mixed population of Oscans and Pelasgians extended to the very south of Italy. Thus, independently of a Keltic substratum—which has been with much reason assumed—we have this admixture or juxtaposition of Umbro-Oscan and Tyrrheno-Pelasgian tribes constituting the population of ancient Italy. At the early dawn of history we saw foreign tribes gaining a footing in Italy on the north and the south; on the north the Rhætian tribe of Rasena or proper Etruscans; on the south, the maritime colonies of ancient Greece. And at this period of Etruscan invasion, we found a young state on the banks of the Tiber, which, together with the rest of the Latin name, after a period of humiliation, succeeded in driving back the tide of Etruscan invasion beyond the banks of the Tiber.†

We now pass to a consideration of the languages of ancient Italy, and of the earliest form of the Latin language, as an immediate compound of Umbrian, Oscan, and Etruscan elements. Latin is above all ancient languages a composite of many discordant elements. The philologer traces in it remains of an old Keltic element on the one hand, exhibiting itself in the Umbrian language, as preserved to us through the *Eugubine Tables.* The connection between these fragments and even our modern Keltic languages is so striking, that Professor Newman has considered himself justified in claiming the old Umbrian as a member of the general Keltic stock, or rather, to use his own words, "in extending the term Keltic so as to embrace this Italian tribe." (*Regal Rome*, p. 17.) The connection between the old Latin and the modern Gaelic is well shown by a comparison of their vocabularies, as instituted by Newman. (*Regal Rome*, pp. 19, 20, 61, &c.) An examination of the ancient Umbrian and Sabine words exhibits many striking points of resemblance to the corresponding words now in use in Welsh and Gaelic tribes; and it is, moreover, stated, as the result of a careful study of the affinities of these languages, that the words thus connected, while occupying in Latin an isolated position, appear in the Gaelic languages in the midst of cognate families. These considerations tend to show us that in one element of the Latin language, derived from the Umbrian population, we recognise a member of the same widely-spread Keltic tongue, which is still in use in Wales, Scotland, and Ireland. One point in Professor Newman's classification may admit of a doubt. He considers the Sabine language as generically identical with the Umbrian. No doubt the Sabine people were originally an Umbrian race, but yet we find them, at a later period, certainly as distinct from the Umbrian nation in general, as from the Oscans and Latins on the other hand. These Sabine conquerors, by a not uncommon fate, received their language from the conquered Ausonians; and the union of these two tribes is philologically represented by the Sabello-Oscan language, as preserved in the *Bantine Table*, the *Cippus Abellanus*, and the bronze tablet of *Agnone.* While, then, we admit the original affinity of the Umbrian and Oscan nations, we must be careful, at the same time, to recognize the historical existence of a secondary nation, formed by the agglutination of the Sabellians and the Oscans. It is a remarkable fact that no strictly-called Sabine inscriptions exist: all the individual words claimed as Sabine, with a very few exceptions, being found in the Oscan inscriptions. These facts will justify

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* See British Palæozoic Rocks, Sedgwick and M'Coy. List of Fossils, page 351; and Quart. Jour. Geo. Soc., vol. 7, page 176.

† In preparing this part of my paper for the Canadian Journal, I found that it would be necessary, in order to do justice to the question, to enter more fully into the details of the early Italian languages than I had been able to do in a short lecture. The publication of these pages has been delayed in consequence of unavoidable engagements.

† See Donaldson's "Varronianus," ch. 1, §10. In revising this part of my Lecture, I have had the advantage of consulting the "Varronianus," which contains abundant materials for the discussion of the interesting questions connected with the early nations and languages of Italy. It is gratifying to find that the views which I had independently put forward, in confirmation of Niebuhr's hypothesis of the relation of the Rasena to the Gothic family, are maintained by such an authority as Dr. Donaldson.

us in treating the Sabello-Oscan as a separate language from the Umbrian, though not on the same level with it, as a pure specimen of an original Italian tongue. (See *Varronianus,* chapter IV., § 1.)

Again, in the Roman language, we find many traces of an element derived from Etruria, and exhibiting a direct connection with Pelasgic idiom on the one side, and on the other with the oldest Low German or Scandinavian dialects. This is a part of our inquiry which will be attended with especial difficulty, in consequence of the imperfect state of Etruscan philology, and the deficiency of materials upon which to base a general conclusion with any likelihood of complete truth.

Lastly, we have still preserved to us some interesting remains of the old Roman language—the offspring of the Umbrian, Oscan, and Tuscan—as it was in its rude youth, before the influence of Greek literature had melted down the rugged *Saturnian* verse into the flowing cadence of the Homeric *hexameter.* Macaulay, in his preface to his exquisite *Lays of Ancient Rome,* has shown how the old literature was extinguished under the growing prevalence of foreign fashions. The consequence is, that our preserved remains of genuine early Roman records are but scanty, and relate chiefly to religion and law. The language of the Scipios, as exhibited in a series of famous epitaphs, differs but little from the classical style of the Augustan age, and shows that we are drawing near to a period when the conquered Greek had re-conquered his savage conqueror; and the triumph of Athenian verse and Athenian art had showed that Greece was still to rule the mind of the world, though the Roman sword might hew its way to a grander empire than Pericles had ever dreamed.

It will be interesting to examine in detail some specimens of each of the component elements of the Latin language, as well as of the earliest form of the Roman language itself. Such an investigation will enable us to trace the affinities of the present classical Latin language; while, at the same time, we shall obtain some insight into the civil and religious character of those ancient tribes from whom sprung the conquerors of the world—the ancestors of Cicero, Virgil, and Livy; of Scipio, Cæsar, and Pompey.

I. The Umbrian Language.

The Eugubine Tables, which present us with a specimen of the old Umbrian language, were discovered in the year 1444 in the neighbourhood of Gubbio (the ancient Iguvium). On the mountain which rose above the city stood the temple of Jupiter Appenninus—whence the city derives its name: Iguvium, *Umbrian* Jiovium = Jovium = Δῖον, Δίος πόλις. The Tables relate chiefly to matters of religion. The elucidation of these memorials of this indigenous Italian language is due to the exertions of Lepsius, Lassen, Aufrecht, and Kirchoff, from whom the chapter in Donaldson's *Varronianus* is mainly compiled. Within our present limits we must content ourselves with a brief selection, suited to show some of the characteristics of the Umbrian language. The following passage is taken from the first Eugubine Table, as quoted by Donaldson, who supplies the translation of the original into Latin:—

Umbrian Inscription.	*Latin Translation.*
Tab. 1, a.	
2. Pre-veres treplanes,	2. Ante portam Treblanam
3. Juve Krapuvi tre [f] buf fetie, arvia ustentu,	3. Jovi Grabovio tres boves facito, arvinâ ostendito,
4. Vatuva ferine feitu, heris vinu, heri [s] puni,	4. Fatuâ farinâ facito, vel vino, vel pane,
5. Ukriper Fisiu, tutaper Ikuvina, feitu sevum,	5. Pro monte Fisio, pro civitate Iguvina, facito severe,
6. Kutef pesnimu; arepes arves.	6. Caute precator, adipes advehens.

The inscription is thus rendered into English by Donaldson: "Before the gate by which the treblæ enter, sacrifice three oxen to Jupiter Grabovius, offer up the hard fat, sacrifice with unsalted meal, either with wine or bread, for the Fisian mount, for the city of Iguvium, sacrifice reverently, pray cautiously, holding forth the soft fat (of the victims)."

In this inscription it is easy to recognise the original of many Latin words. It may simplify the proof of this fact if we exhibit the Umbrian words with their corresponding Latin representatives in a tabular form, while we refer to Donaldson's elaborate criticism for a more complete analysis of their forms:

Umbrian.	*Latin.*	
pre.	præ.	
veres, abl. plural of *verus.*	foribus.	
treplanes.	trebla.	Noticed by Cato (R. R. c. 135) as a rustic carriage. The gates are designated, as in other cases, with reference to the species of carriage admitted at them.
Krapuvius.	Gra-bovius.	May be compared with Gradivus, but the etymology is uncertain.
tre.	tres *or* tribus	Etymologists are uncertain whether to refer these words to the accusative or ablative case. Both constructions would be admissible.
buf.	boves *or* bobus.	
feitu (*or* fetu).	facito.	Compare *ditu* for dicito.
arvia.	arvina.	
ustentu.	obstineto.	The old Latin for *ostendito.*
vatuva ferina.	fatuâ farinâ.	
heris vinu heris puni.	vel vino vel pane.	*Heris* derived from Sanscrit root *hir,* a hand=particle of *choice.* So *vel,* from root of *volo.*
ocriper Fisiu.	pro monte Fisio.	*Ocris* occurs in Greek ὄκρις. Hence the names of some Umbrian towns *Ocriculum* and *Interocrea.* *Fisius*= Fidius Sancus, the old Italian name of Jupiter.
tota per Ikuvina.	pro civitate Iguvinâ.	*Tota* (tuta) connected with the adj. *totus,* the idea of a *city* being that of *completeness.* So the Greek πόλις connected with πόλυς.
sevum. kutif.	severè. cautè.	
adipes arves.	adipes advehens.	In both these words tho prep. ar.=*ad* appears, as it commonly does in familiar Latin. The termination *eis* or *es* appears to be that of the Umbrian participle.

The remaining materials of the Umbrian language are tolerably copious, and have enabled philologers to form a fair conjecture of the declensions and conjugations of the nouns and verbs. The specimen already given is sufficient to show us the main points of resemblance between the Umbrian and the familiar Latin; though it must be confessed that the difficulties still besetting an explanation of the Umbrian philology must lead us to be cautious in applying these investigations to the support of any theory as to the extent of Umbrian influence in the formation of the Latin tongue.

II. The Sabello-Oscan Language.

The language of the ancient Oscans and Sabellians, consisting, in all probability, of a fusion of the Umbrian Sabines with the Oscan population whom they conquered, is preserved in several remarkable remains. The most important of these is the *Bantine Table.* This document, which seems to have reference to the Apulian city of Bantia, mentioned in the inscription, was discovered in the year 1793 at Oppido, on the borders of Lucania. It consists of thirty lines, more or less incomplete, and is in consequence only partially deciphered. The next fragment of importance is a stone tablet known by the name of the *Cippus Abellanus.* This inscription seems to have referred to an agreement between the neighbouring Campanian cities Abella and Noal. Its adventures are curious. In 1685 it was removed from *Avella Vecchia* to the modern village of that name, where it remained in use as a door-step until 1745, when it was remarked by Remondini, a professor in the Episcopal Seminary at Nola, and by him conveyed to the Museum in that seminary about 1750. The bronze Tablet of *Agnone,* the most recent contribution to our kgowledge of the Oscan language, was discovered at Fonte di Romito, between Capracotta and Agnone, 1848. It is, however, merely a series of dedications to different deities and heroes, and therefore does not add much to our vocabulary of the Sabello-Oscan language. We may add to these sources the fragments of the *Atellanæ,* the only remaining branch of Oscan literature. These tabulæ Atellanæ, we are told by Livy, were a species of farce, which were acted by the Roman youth in what we should call private theatricals; and their representation had the peculiarity of being permitted to citizens without any detriment to their civic rights.

As an example of this language, we will take a few lines from the Bantine Table:—

L. 11. . . . . . "Sudæ pis contrud eseik fafakust, auti komono hipust, molto etan—

" 12. to estud n. MM.; in suæ pis iok fortis meddis moltaum herest ampert minstreis aeteis

" 13. eituas moltas moltaum likitud."

This is translated by Donaldson as follows:—"Si quis adversus hæc fecerit, aut com-unum (*i.e.,* agrum publicum) habuerit, (*i e.,* possederit) multa tanta esto numi M.M., inde si quis eum validus magistratus multare voluerit, usque ad minores partes pecuniæ multas multare liceto."

In this passage we observe many words which throw some light upon etymological principles. Thus in L. 11. *eseik* points out the old neuter accusative plural of *is;* an important discovery in itself, as it enables us to account for such forms as *præter-eâ propter-eâ, inter-eâ,* and to identify the termination with that which appears in the words *posthâc, antehâc.* Again, *ionk,* in l., 12, exhibits the original form of the accusative case, corresponding to the ordinary Latin *hunc. Meddix,* again, represents a compound similar to *jud-ex,* and *vind-ex,* and seems to mean here *medium* dicens, or, according to another explanation, contains the root *med*+a merely formative ending x (= c-s). *Herest* is the perfect subjunctive of a verb *hero*="to choose" or "to take," (Sanscr. *hri*) from the root *hir,* "a hand," which we have already found, with a slightly different application, in the Umbrian Tables. *Am-pert* Donaldson considers to be equivalent to the Latin *usque ad,* from a comparison of *am* with the German *um,* also used in composition with other prepositions; while *pert* appears with several words in the sense of *ad. Minstreis* is used here in the sense of "less." The word *minis-ter* is, in fact, the correlative of *magis-ter,* the latter meaning a superior, the former an inferior functionary, contrasted as would be the consuls and prætors, and other higher Roman magistrates, with the subordinate attendants, such as were lictors and viators.

III. The Etruscan Language.

We now approach the great *crux philologorum,* the obscure problem of the origin and language of the Etruscans. In the former part of this Lecture, I have endeavoured to confirm the opinion of Niebuhr—that the pure Etruscans are to be considered as Northern Gothic invaders; as opposed to that theory (maintained by Dennis, and supported by Prof. Newman) which refers them to Lydia, and would class them among the Semitic family of nations. This question is so difficult, and a discussion of its merits so desirable, that I will here advance some further reasons of a positive character in confirmation of the negative reasoning by which I have above endeavoured to support the Gothic hypothesis.

1. It is acknowledged, I believe, by most philologers, that the Tyrrhenians and the Etruscans are two widely distinct people. The former name refers us at once to a Pelasgian race; the latter stands for a Northern tribe, who ultimately conquered this Pelasgian colony. Those who deny this distinction "have endeavoured, by a Procrustean method of etymology, to overcome the difficulties caused by the discrepancies of name."—(*Varronianus,* p. 16.) Those who can identify the names *Rasena* and *Tyrrheni* cannot expect to find any difficulties in ethnological or philological inquiries.

2. The express statement of Livy (v. 33), and that not in a hypothetical form, but in a chapter containing "one of the most definite expressions of ethnological facts to be met with in ancient history," goes to connect the Etruscans with the Rhæti, an Alpine tribe of Goths; an opinion confirmed also by Pliny and Justin, and by Stephanus of Byzantium. (See *Varronianus,* p. 18.)

3. The circumstances of the Etrurian invasion bear a striking resemblance to the later invasion of the Gauls; so much so, that it is hard to refer the different invaders to any but one and the same geographical source. The immigration of the various Germanic tribes into the West, accompanied in their gradual advance by a lateral expansion of portions of their force, drove the Rhæti in the first instance to invade the rich territory of the dominant Tyrrheno-Pelasgians, who had extended their rule over the old Umbrian population to the north and east of the Tiber. The same cause pushed the Gauls down from the old haunts of the Rhæti into the rich settlements of their precursors. Successfully establishing themselves in the vast plains of the Po, the territory afterwards named Cisalpine Gaul, they swept over Umbria and Etruria, and even sacked Rome. But again they were borne back to the old starting point of the Etrurians, and Italy was saved a second time by the city of Horatius and Camillus.

4. We find that there was a marked difference between the town language in Southern Etruria and that of the country, which can be accounted for only on the supposition that the conquerors established themselves in cities, leaving the cultivation of the fields to the old inhabitants, who occupied the position of the Saxons in England, and the periœci in Laconia.

In accordance with the historical facts of the successive occupations of the Etrurian territory, we find two main ingredients of the Etruscan language derived on the one hand from the original inhabitants and their Pelasgian conquerors, on the other from the Gothic tribe of Rasena, who conquered the Pelasgians in their turn. The Etruscan language, then, is partly a Pelasgian idiom, more or less corrupted and deformed by contact with the Umbrians, and in part a relic of the oldest Low-German or Scandinavian dialects. (*Varronianus*, chap. V.)

We may select for inspection a specimen belonging to each of these classes, as given by Donaldson. It is remarkable that the following inscription was discovered at Cervetri, the ancient Cære, the old stronghold of the Agylkeans, a race of marked Pelasgic character; and we should therefore expect a different style from that which marks the remains of Northern and Eastern Etruria, where the Umbro-Etruscan and Rasenic languages would prevail. Accordingly, in the following lines we immediately recognize not only Greek forms, but also the heroic metre which arose in Greece, and was afterwards fully naturalized in Italy by the poetic genius of Lucretius and Virgil, while there is, at the same time, a slight admixture of the Tuscan vocabulary.

> "Mi si kethuma, mi methu maram lisiai thipurenai;
> Ethe erai sie epana, mi nethu nastav helephu."

The meaning of this couplet is thus given by Donaldson: "I am not dust; I am ruddy wine on burnt ashes: When there is burning heat under ground, I am water for thirsty lips:"—a poetical description of the various uses of a drinking vase.

In the words *mi kethuma*, *methu*, *maram*, *erai*, we recognize the Greek *εἰμί*, *χθαμαλὸς*, and *χθαμαί*, Latin *humus*; *μέθυ*, *μάρων* (the grandson of Bacchus): compare *Ἴσμαρος*, and *μαίρω*: and *ἔρα*, the ancient root of a word meaning the earth. *Lisiai* and *thipurenai* seem to be connected, the former with *lix*, "ashes mixed with water," the latter with the root of *tepidus*, &c. *Epana*, *nastar*, *and helephu* are of doubtful etymology. *Nethu* seems very probably to be a Tuscan word for water. We find Neptune written *Nethuns*. The explanation of the words *nastav* and *helephu* is conjectural.

We pass on now to the other branch of Etruscan inscriptions; those which present the Rasenic type of the language, and claim affinity with the Scandinavian, old Norse, and Runic languages; suggesting a link between the famous king whose prowess spread terror to the gates of Rome, and the no less dreaded warriors who scoured the Baltic and German Seas, and startled with their piratical cry the sleeping peasant on the coast of Kent.

The Runic affinities of the Rasenic language are most fully exemplified by the great Perugian Inscription, which is critically examined by Donaldson. (*Varronianus*, V., § 10.) My space forbids me to do more than to refer to the elaborate researches of Donaldson on this point. One or two examples may be given of the resemblance between the ancient Etruscan and the northern dialects. Thus the word *clan* or *clen*, which occurs frequently in Etruscan in the signification of *child*, is illustrated by the Icelandic *klen* or *klien*, a synonyme of the German *klein*, but primarily in the instance of a child as opposed to a man. Icelandic explanations, too, are given of the words *phleres*, signifying a votive-offering; *ceca*=to build or to cause to be made—in Icelandic, *kasa*. These words appear in the following inscription upon a bronze figure representing Apollo crowned with laurel; where we meet with a singular union of Pelasgian and Scandinavian forms:

> Mi phleres epul aphe aritimi
> Phasti ruphura turce clen ceca.

which is translated, "I am a votive-offering to Apollo and Artemis: Fastia Rufria, the daughter of Tuscus, had me made."

Thus philological as well as ethnological considerations confirm the conclusions at which we arrived above; which may here be very briefly recapitulated. The Etruscans, in the largest sense of that term, may, without contradiction, claim both Pelasgian and Rhaetian affinities. The former may be represented by the Herodotean story of a Lydian colonization; the latter is confirmed by the express testimony of Livy and other ethnological authors.*

IV. The Old Roman Language.

The last division of our inquiry refers to the oldest remaining form of the Roman language, represented in its pure character as a rude compound of the Umbrian, Oscan, and Etruscan. Greek civilization had so changed the tone of the people and their language, that Polybius, speaking of the old treaty between Rome and Carthage (III., 22) tells us that in his time even the educated Romans could with difficulty interpret the existing memorials of the oldest form of their own language. Many interesting specimens of this ancient tongue have been preserved. Thus we are familiar with the existing remains of the XII Tables; with the Arvalian Litany; the Inscription on the Columna Rostrata; the Senatus Consultum de Bacchanalibus; and above all, with the Epitaphs of the Scipios. Besides these, we have the old Roman Law on the Bantine Table; certain fragments of laws, preserved by Festus; and copies from the Tiburtine Inscription, itself now unfortunately lost. The most interesting specimen which my space allows me to quote is the Epitaph on the flamen dialis P. Scipio, son of the elder Africanus, and adoptive father of the younger, whose praises are fully borne out by the soberer statement of Cicero. In the following arrangement we preserve the old Saturnian rythm, the peculiar metre of early Roman poetry:

> Quei apice' insigne dialis | flaminis gesistei,
> Mors perfecit tua ut essent | omnia brevia,
> Honos fama virtusque | gloria atque ingenium.
> Quibus sei in longa licuisset | tibi utier vita,
> Facile facteis superasses | gloriam majorum.
> Qua re lubens te gremiu, | Scipio recipit terra,
> Publi, prognatum | Publio, Corneli.†

* One objection must be here noticed—which was made by Professor Wilson on the occasion of this Paper being read at the Canadian Institute, viz., that the writing of the Etruscans points to a Semitic origin; in Etruscan as well as in Phœnician and other Semitic writing, the course of the lines being from right to left. This argument is valid with reference to Etruria exactly so far as it is valid for Greece. It is well known that ancient Greek was at first written from right to left; then indifferently either way; then alternately (a method which was termed "Boustrophedon," from its resemblance to the course of oxen in ploughing, first in one direction, then in the other); and lastly from left to right. Supposing its importation into Etruria at a period when it was written in the earliest manner, it will not appear strange that the colonists should have clung to the old fashion long after it had been altered in the mother country. A curious specimen of an inscription in Boustrophedon is given by Leake. ("Asia Minor," p. 239, 240, note.)

† The following is a literal, and, I fear, bald translation; but it may serve to give the reader an idea of the metre and meaning of the original:

> Thè sácred priéstly sýmbol | décked thy nóble fórehead;
> Yèt Déath lays lów thy hónor | fáme and vírtuous áctions,
> Búrying shórt-lived glóry and | súbtle mínd togéther.
> Hád it been thíne to fínish | à góod old áge and áctive,
> Líghtly thou hádst outstrípped | thy óld ancéstral glóries.

I have thus, as far as the present state of philological knowledge permits, endeavoured to represent the original languages of Italy, and to draw from the consideration of their remains, conclusions which seem to explain the ethnographical history of the races anciently inhabiting the peninsula. In advancing his speculations, a student must necessarily labour under a feeling of diffidence, the natural result of the difficulty and comparative uncertainty of such inquiries. Thus, whether we see reason to agree with, or to differ from, other scholars, we feel convinced that all parties are as yet only on the threshold of philological and ethnological truth, and that the door will not be opened but to the patient and modest inquirer. The secret storehouse of the great harvest of philology, and therefore of ancient history, is yet to find; we must content ourselves if we are allowed to glean a few scattered ears on the deserted field. Our aim must be to notice the position of these remains, the direction which the track of the harvesters seems to have taken; that with sure though unequal steps we may follow them from field to field, till we reach the great depositary itself, and are able surely to ascertain the relations of the great tribes of the old world with one another and with ourselves.

And nów the Eárth recéives thee | with lóving ópen bósom,
Scípio, greát Cornélius, | mighty són of Públius.

This ancient metre is well described by Macaulay (Preface to "Lays of Ancient Rome,") and by Donaldson ("Varronianus," ch. VI.). It seems to have existed in Italy from the earliest times, as it may be traced in the Eugubine Tables. Perhaps our children, when they sing the fame of the "Four and twenty blackbirds baked in a pie," are not aware that in some old Umbrian village, which,

"Like an eagle's nest, hung on the crest
Of purple Appennine,"

some good three thousand years ago, they hushed their children to sleep to the same tune.

A Lake Phenomenon.

The "Niagara Mail," of May 3d, describes at some length a remarkable phenomenon which occurred on the 25th of April at the head of Lake Ontario, near the mouth of the Niagara river. Below is the "Mail's" description of this singular occurrence:

"In alluding in our last to the remarkable case of two persons being drowned (one of whom was James Foster, an old sailor, and not a pensioner, as we heard), we had not time to do more than chronicle the bare fact, without enlarging on the singular phenomenon which caused their death.—Since then, however, we have made minute inquiries into the circumstances, and remain satisfied that the sudden and extraordinary overflow of the Lake, which occurred on the 25th ult., originated in some subaqueous convulsion, which took place in the bed of the Lake.

The facts of the event of the 25th, as far as noticed, seem to be as follows:—About a quarter or half-past six o'clock, P.M., a thunder storm came up from the north-west, with a few flashes of lightning, and a heavy shower, accompanied by a strong squall of wind for a few minutes, the weather being quite calm just before the gust, and the same after it. The fishermen who were on the beach, seeing the squall come on, hurried to get in their seine, when suddenly there appeared, rolling in upon them, an immense wave from the north-west. The height of this wave could not have been less, we judge, than from six to eight feet, although it is difficult to ascertain correctly. It came rolling on the smooth lake with great velocity, carrying all before it, and sweeping some of the fishermen into the Two-mile Pond, and dashing others of them high up against the bank, by which, as we related, two persons were unfortunately drowned. The water came and returned three times in succession, and then settled down quite calm, as it had been before this commotion. It was noticed, moreover, that the wave brought up and cast upon the beach a quantity of logs and sunken drift wood, which had apparently lain long at the bottom of the lake, showing clearly that the movement must have come from the bottom. There was no wind blowing to cause such an unprecedented and rapid swell of the water, the like of which had never been seen on this side of the lake, although something similar occurred at Cobourg some couple of years ago, and a similar phenomenon is related as having taken place in Mud Lake within a few years.

It is evident to us that there has been an earthquake in the bed of the Lake, at no great distance from land, although there was not the slightest tremour noticed on shore. These occurrences, taking place as they do, would seem to indicate that the bed of the Lake is nearer the seat of subterranean disturbance than the main land, and may undergo agitation at times, without the fact being noticed by dwellers on its margin; but when the earthquake was felt here about eighteen months ago, the rush of waves upon the shore for a short time was tremendous. But the disturbance in that case being, in all probability, further off, prevented a great and sudden rise of water like that on the 25th.

It has been shown, in support of a certain theory, that by far the greatest number of earthquakes have occurred about the new or full of the moon. This theory may receive another case in its support, by the consideration that the event above recorded took place within thirty-one hours of the new moon. We leave the matter as one worthy of philosophical consideration."

The subject of lake convulsions is one of acknowledged difficulty, and in the present state of our knowledge of those phenomena, we need not hesitate to record all events which may have some connection with such mysterious visitations, or in submitting to the consideration and discussion of scientific men theories which appear to involve the true explanation of their origin and recurrence.

As having a possible bearing upon the late lamentable event, we may record the occurrence of a whirlwind which was observed in the neighbourhood of Toronto, at a few minutes after one o'clock P.M., on the same day—the 25th April.

Attention was first drawn to the whirlwind by the falling of a vast number of dead leaves, on Dundas Street, about half a mile north-west of the Lunatic Asylum. A narrow belt of air, apparently not exceeding two hundred and fifty yards in width, was first observed to be filled, as it were, with innumerable dead leaves, tumultuously tossed about, chiefly in an upward direction, and at a considerable elevation. Above this moving stratum of leaves several yellowish coloured detached clouds, apparently of fine particles of sand and dust, were whirled on in the same direction as the leaves, which was from the north-west to the south-east. The leaves and clouds of dust had been noticed for three or four minutes before any signs of wind at the surface appeared. The first indication of the approaching vortical shaft of air was seen in the topmost branches of a number of large pine trees west of the Hon. S. B. Harrison's house, near Dundas Street. The motion produced in the uppermost branches was very violent, but it did not appear materially to affect the lower branches or smaller trees. The tops of small pines and cedars, two or three hundred yards east of the tall pines before noticed, were much twisted, but still comparatively little effect was observed at the surface until the chief force of the whirlwind had passed over the spot where these observations were made. The effect of the whirlwind was not distinguishable for a greater breadth at the surface than between two and three hundred yards; at a considerable elevation, however, after the passage of the vortical shaft at the surface, the air above seemed filled for a much greater breadth, and to a great altitude, with detached cloud masses of dust and leaves. The idea conveyed by the whole phenomenon was that of an enormous revolving inverted cone of air moving in an inclined direction with great rapidity and violence from north-west to south-east, the apex of the inverted cone being of small diameter (about 200 yards), the base of far more imposing dimensions.

This phenomenon, although frequent even in Canada during the summer months, acquires interest when considered in connection with the occurrence recorded by the editor of the "Niagara Mail," and if followed at a later hour of the day by another whirlwind of greater dimensions, might also afford an explanation of the remarkable and disastrous event which caused the death of two persons near the mouth of the Niagara river. We have not as yet heard of any other occurrence of a whirlwind or notable local variation in atmospheric pressure on the same day, and as the difference in point of time between the lake convulsion and the phenomenon just noticed, exceeds five hours, it seems scarcely probable that a *Seiche*, produced by sudden variation in atmospheric pressure, could have connected the events. (See Canadian Journal. Vol. II, p. 29, for an interesting paper on the Seiches of Lakes, by Colonel Jackson). We are indebted to the Director of the Provincial Magnetic Observatory for the following abstract from the Meteorological Journal of that establishment:—

APRIL 25TH, 1854.

Hour of observation.	Observed barometer.	Barometer reduced to 32°F.	Difference of Barometer from normal reading.	Pressure of dry air.	Humidity.	Temperature.	Difference of Temperature from normal	Direction of Wind.	Velocity of wind in miles per hour.	Direction of motion of clouds from	Cloudiness.	Remarks.
6 A.M.	29.584	29·509	—0·150	29·260	83	45·4	+6·7	SSW	2·4	None.	0·0	Hazy round horizon.
8 "	·574	·501	—0·177	·175	79	64·2	+10·6	ESE	2·9	W	0.4	Cirro-cum. generally dispersed.
2 P.M.	·514	·434	—0·205	·168	43	65·1	+13·9	SE by E	5·2	W	1·0	Overcast and hazy.
4 "	·470	·390	—0·236	·103	51	63·2	+12·3	SE by E	7·8	W	1·0	Do., heavy thunder-storm, with rain, from 5·50 to 6.45.
10 "	·436	·353	—0·287	·046	91	48·5	+7·0	NE by E	3·2	NW	1·0	Densely overcast.
Midnight	·452	·396	—0·263	·053	94	48·6	+8·0	NE by E	4·1	Not per.	1·0	Do., very dark, spitting rain occasionally.

Two interesting circumstances appear upon an examination of the above table—the first being the sudden diminution in the degree of humidity of the atmosphere; at 6 A.M., the humidity was represented by 83, the point of saturation being 100; at 2 P.M.—after the passage of the whirlwind—the humidity was reduced to 43; at 10 P.M.—after the thunder-storm—it rose, as might have been anticipated, to 91. At 2 P.M. the wind was from S.E. by E; at 10 P.M. from N.E. by E., the direction of the motion of the clouds being, at 2 P.M., *west*, and at 10 P.M., *north-west*.

Two nearly opposite currents of air are thus recorded as having been observed about the time of the whirlwind, and when these facts are associated with the very gradual fall of the barometer, we arrive at the conclusion that the whirlwind was the result of the meeting of the opposing currents of air—probably of different temperatures and different degrees of humidity—and did not exercise an appreciable influence a mile on either side of its track—the distance of the observatory from the line of its passage rather exceeding a mile.

By reference to the quotation from the "Niagara Mail," it will be seen that the editor of that paper considers the cause of the Lake convulsion to have been an earthquake, which is inferred "to indicate that the bed of the Lake is nearer the seat of subterranean disturbance than the mainland, and may undergo agitation at times without the fact being noticed by the dwellers upon its margin." In addition to this hypothesis, we may call attention to two geological features of this part of North America, which are not devoid of interest, and to say the least, afford material for speculation as to the connection with recent events of forces which operated with wonderful energy in times very remote from us now.

On page 27 of the Geological Report of Canada for 1845, the distinguished director of the Survey, in speaking of the origin of the Apalachian chain of mountains and the quiescent condition of the Illinois and Michigan coal fields, as compared with the disturbed condition of some portions of the Pennsylvanian deposits, remarks—"It does not seem improbable, however, that the broad low anticlinal arch which separates these two from the other (the Michigan and Illinois from the Pennsylvanian), may have some relation to the expiring effort of those forces; for, although its axis cannot be called precisely parallel to the Apalachian undulations, there are yet bends in it that seem to correspond with some of the curves of that chain of mountains. From Monroe County, in Kentucky, this axis takes a gently sinuous course, running under Cincinnati on the Ohio, to the upper end of Lake Erie; thence it curves to the upper end of Lake Ontario, where my assistant, Mr. Murray, has observed its influence in deflecting the strike of the strata in the neighbourhood of Burlington Bay. It then enters the Lake, under the waters of which it *probably* dies away towards the north shore."

The depth of Lake Ontario, between Toronto and the mouth of the Niagara river, exceeds 400 feet, and, in some parts of that line, is stated by mariners to be much greater. The bed of the lake, west of the Niagara river, is excavated in the Medina sandstone, which is known to be far thicker at the western extremity of the Lake than in its south-eastern development. Its thickness in the Niagara District is upwards of 600 feet, and borings have been made in this rock at St. Catherines to a depth of 480 feet below the level of Lake Ontario. It thins out and disappears in Oneida County, in the State of New York. The formations below the Medina sandstone, known by the names of Oneida Conglomerate and Grey sandstone, do not appear on the north side of the Lake. It is probable, in the supposed absence of the undulation described by Mr. Logan, that the Hudson River group would form the floor of the Lake a few miles north of a line drawn between Oswego and the Credit. This would be succeeded by a narrow band of the Utica slate, and then by the Trenton limestone and its associated rocks, reposing upon the metamorphic series displayed at the east end of the Lake. The existence, however, of the undulation before alluded to would have the effect of changing, in some measure, the subaqueous outcrop of these rocks. We may, perhaps, connect the phenomenon which has recently occurred at Niagara, with others of the same class recorded as having been witnessed at Port Hope, Cobourg, and Rice Lake, if we suppose that the anticlinal axis spoken of by Mr. Logan—persisting in those sinuosities which had already distinguished its progress—trended to the south shore, and died away in the direction of the middle of the Lake. The effect of this undulation would be to bring the Utica slate within the excavating influence of the waters of the Lake south of Niagara. An inspection of a chart of Lake Ontario shows how unequally this excavating process has gone on. Between Toronto and the Niagara river we find on Lieut. Herbert's chart the following depths:—At about five miles south of Toronto, 180 feet; 14 miles, 402 feet; 22 miles, 210 feet. In other parts of the Lake still greater unevenness in its floor occurs, which is scarcely to be explained by tertiary formations. Now, when we consider that the phenomenon at Grafton was accompanied by the " water boiling, as you see in the lesser rapids of the St. Lawrence," (See Canadian Journal, Vol. II., page 63.) the hypothesis becomes well grounded that these Lake convulsions arise from the sudden liberation of vast masses of carburetted hydrogen and other gases which result from the decomposition of immense accumulations of vegetab'e and animal remains, which distinguish the black bituminous shales of the Utica slate. The Niagara river daily exhibits the vast supply of carburetted hydrogen which the Niagara Limestone and other rocks over which it flows near the Falls, is capable of producing, and the Utica slate is especially distinguished by the presence of this gas in vast abundance.

The phenomena at Port Hope, Rice Lake, Grafton, and Niagara, become at once connected, if it be true that the Utica slate forms a portion of the bed of the Lake a few miles north of the mouth of the Niagara river, and that the suddenly liberated gases from that rock are capable of producing the effects observed. It is clear that, under such circumstances, the earthquake which occurred on March 13th, 1853, which was felt at Toronto, Niagara, &c., would assist the escape of the pent-up gases, and might, therefore, play a secondary part in occasioning the rush of waves on the shores noticed at Niagara, but not be the actual cause of the phenememon.

The boiling appearance of the Lake produced off Grafton, in 1847, is precisely what would be observed as the effect of the escape of gas from the floor of the Lake; and it is well known that deep wells and shafts sunk in the Utica slate in its exposures in the township of Whitby are rapidly filled, when left in a state of repose, with light carburetted hydrogen mixed with sulphuretted hydrogen. The same phenomena are observable in deep wells sunk in the Hudson river group at Toronto, and during the last summer a constant bubbling up of carburetted hydrogen occurred during many weeks in a well on Queen Street. The Utica slate, however, from its remarkable bituminous character, is particularly distinguished by the emission of gases when its strata are penetrated, and thus affords reasonable ground for the hypothesis that many violent Lake convulsions are caused by the sudden liberation of pent-up gases, resulting from the decomposition of the carbonaceous accumulations which characterize it.

Miscellaneous Intelligence.

Identity of Dynamic or Voltaic Electricity with Static or Frictional Electricity.—By Professor Faraday.*

The Friday evening meetings for the season commenced at the Royal Institution on Friday last, the opening lecture being delivered by Professor Faraday to a very crowded audience. The subject was the developement of electrical principles produced by the working of the electric telegraph. To illustrate the subject, there was an extensive apparatus of voltaic batteries, consisting of 450 pairs of plates, supplied by the Electric Telegraph Company, and eight miles of wire, covered with gutta percha, four miles of which in coils were immersed in tubs of water, to show the effect of submersion on the conducting properties of the wire in submarine operations. The principal point which Professor Faraday was anxious to illustrate, was the confirmation which experiments on the large scale of the electric telegraph have afforded of the identity of dynamic or voltaic electricity with static or frictional electricity. In the first place, however, he exemplified the distinction between conductors and non-conductors, impressing strongly on the audience that no known substance is either a perfect conductor of electricity or a perfect non-conductor, the most perfect known insulator transmitting some portion of the electric fluid, whilst metals, the best conductors, offer considerable resistance to its transmission. Thus the copper wires of the submarine electric telegraph, though covered with a thickness of gutta percha double the diameter of the wire, permit an appreciable quantity of the electricity transmitted to escape through the water; but the insulation is nevertheless, so good that the wire retains a charge for more than half an hour after connexion with the voltaic battery has been broken. Professor Faraday stated that he had witnessed this effect at the Gutta Percha Works, where one hundred miles of wire were immersed in the canal. After communication with a volatic battery of great intensity, the wire became charged with electricity, in the same manner as a Leyden jar, and he received a succession of forty small shocks from the wire, after it had been charged and the connexion with the battery broken. No such effect takes place when the coils of wire are suspended in the air, because in the latter case there is no external conducting substance. The storing-up of the electricity in the wire when immersed in water is exactly similar to the retention of electricity in a Leyden jar, and the phenomena exhibited correspond exactly with those of static electricity, proving in this manner, as had previously been proved by charging a Leyden jar with a volatic battery, that a dynamic and static electricity are only different conditions of the same force; one being great in quantity, but of low intensity, whilst the latter is small in quantity, but of great intensity. Some interesting facts connected with the conduction of electricity have also been disclosed by the working of the submarine telegraph, which Professor Faraday said confirmed the opinion he had expressed twenty years ago, that the conducting power of bodies varies under different circumstances. In the original experiments by Professor Wheatstone, to ascertain the rapidity with which electricity is transmitted along copper wire, it was found that an electric spark passed through a space of 280,000 miles in a second. Subsequent experiments with telegraph wires have given different results, not arising from inacuracy in the experiments, but from different conditions of the conducting wires. It has been determined that the velocity of the transmission through iron wire is 16,000 miles a second, whilst it does not exceed 2700 miles in the same space of time in the telegraph wire between London and Brussels, a great portion of which is submerged in the German Ocean. The retardation of the force in its passage through insulated wire immersed in water is calculated to have an important practical bearing in effecting a telegraph communication with America; for it was stated that, in a length of 2000 miles, three or more waves of electric force might be transmitting at the same time, and that if the current be reversed, a signal sent through the wire might be recalled before it arrived at America. Professor Faraday concluded by exhibiting a beautiful experiment illustrative of the identity of voltaic and frictional electricity. The terminal wires of a powerful secondary-coil apparatus were placed seven inches apart within the receiver of an air pump, and when the receiver was exhausted, a stream of purple colored light passed between the wires, resembling, though more continuous and brilliant, the imitation of the aurora borealis produced when an electric spark is passed through an exhausted glass tube. The volatic power employed to produce this effect of static electricity was only three cells of Grove's battery.

* From the London Mechanics' Magazine, January 7.

Deposition of Aluminium and Silicium by the Electrotype Process.

Mr. Gore, of Birmingham, has succeeded in depositing aluminium and silicium upon copper, by the electrotype process. To obtain the former, he boils an excess of dry hydrous alumina in hydrochloric acid for one hour, then, pouring off the clear liquid, adds one-sixth its volume of water. In this mixture was set an earthern porous vessel, containing sulphuric acid, diluted with 12 parts of water, with a piece of amalgamated zinc plate in it. In the chloride of aluminium solution was immersed a plate of copper, of the same amount of immersed metallic surface as that of the zinc, and connected with the zinc by a copper wire. The whole was then set aside for some hours, and, when examined, the copper was found coated with a lead-coloured deposit of aluminium, which, when burnished, possessd the same degree of whiteness as platinum, and did not readily tarnish, either by immersion in cold water, or by the action of the atmosphere, but was acted on by sulphuric and nitric acid, whether concentrated or dillute. If the apparatus is kept quite warm, and a copper plate much smaller than the zinc plate is employed, the deposit appears in a very short time—sometimes in half-a-minute; if the chloride solution is not diluted with water, the deposit is equally, if not more rapid.

The author has also succeeded in obtaining a quick desposit of aluminium, in a less pure state, by dissolving common pipe-clay in boiling hydrochloric acid, and using the clear liquid undiluted in place of the above-mentioned chloride. Similar deposits were obtained from a strong aqueous solution of acetate of alumina, and from common alum, but more slowly. With each of the solutions named, the deposit was hastened by putting from one to three small Smee's batteries in the circuit.

To obtain the deposit of silicium, monosilicate of potash (prepared by melting together 1 part silica with 2¼ parts carbonate of potash), was dissolved in water, in the proportion of 40 grains to one ounce measure, proceeding as with aluminium, the process being hastened by interposing a Smee's battery in the circuit. With a very slow and feeble action of the battery, the colour of the deposited metal closely resembled that of silver.—*Artizan.*

On Soap as a Means of Art. *

BY FERGUSON BRANSON, M.D., SHEFFIELD.

Several years ago, I was endeavoring to find an easy substitute for wood engraving, or rather to find out a substance more readily cut than wood, and yet sufficiently firm to allow of a cast being taken from the surface when the design was finished, to be re-produced in type metal, or by the electrotype process. After trying various substances, I at last hit upon one which at first promised success, viz., the very common substance called soap, but I found that much more skill than I possessed was required to cut the fine lines for surface printing. A very little experience with the material convinced me that, though it might not supply the place of wood for surface printing, it contained within itself the capability of being extensively applied to various useful and artistic processes in a manner hitherto unknown. Die-sinking is a tedious process, and no method of die-sinking that I am aware of admits of freedom of handling. A drawing may be executed with a hard point on a smooth piece of soap almost as readily, as freely, and in as short a time as an ordinary drawing with a lead pencil. Every touch thus produced is clear, sharp, and well defined. When the drawing is finished a cast may be taken from the surface in plaster, or, better still, by pressing the soap firmly into heated gutta percha. In gutta percha several impressions may be taken without injuring the soap, so as to admit of "proofs" being taken and corrections made—a very valuable and practical quality in soap. It will even bear being pressed into melted sealing-wax without injury. I have never tried a sulphur mould, but I imagine an impression from the soap could easily be taken by that method. The accompanying specimens will show that from the gutta percha or plaster cast thus obtained a cast in brass, with the impression either sunk or in relief, can at once be taken. If sunk, a die is obtained capable of embossing paper or leather; if in relief, an artistic *drawing* in metal. This suggests a valuable application. The manufacturer may thus employ the most skilful artist to make the drawing on the soap, and a fac-simile of the actual touches of the artist can be reproduced in metal, paper, leather, gutta percha, or any other material capable of receiving an impression. By this means even high art can be applied in various ways—not a translation of the artist's work by another hand, as in die-sinking, but the veritable production of the artist himself. One of the specimens sent is a copy of Sir E. Landseer's "Highland Piper," a rude one, I must confess, though its rudeness does not militate against the principal involved in its production. Suppose the drawing had been made by Sir E. Landseer himself; that accomplished artist's actual drawing might have been embossed on various materials in common use, and disseminated amongst thousands, thus familiarizing the eyes of the public with high art, and giving a value to the embossed transcript which no translation by the die-sinker, however skilful, could possibly give it. The raised gutta percha impression of this specimen is from soap itself; the sunk impression is cast in gutta percha from gutta percha. The works in metal during the 14th, 15th, and 16th centuries, owe their excellence in a great degree to the same individual of artist and artisan. The metal was finished by the artist himself, who left the stamp of his genius unmistakably upon it. By the plan just explained, something like a return to this combination might be effected, and the artist would at least have the satisfaction of finding his own work accurately rendered, and not enfeebled in the translation; for the art of casting in metal has of late been so much improved, that little difference can be detected between the impression on the cast and the mould which produced it. I wish to lay particular stress upon the fact that *drawing touches* can be thus rendered, and an effect *rapidly* produced, unattainable by modelling. The larger plaster casts were taken from drawings freely made—as the appearance of the touches will prove—in common brown soap. The finer kind of soap is of course better fitted for fine work; but should the process now described be adopted by the manufacturer—and I trust it may never become the subject of any patent—soap better suited to the purpose than any now made will doubtless be specially manufactured. In proof that fine lines can be drawn upon soap as well as broad vigorous touches, I can state that one of Rembrandt's etchings has been copied on soap, the soap pressed into gutta percha, and an electrotype taken from the gutta percha cast from which a print has been obtained very little inferior in delicacy to the original etching. Doubtless persons engaged in manufactures will see applications of the process which I have not contemplated, and I leave it to their ingenuity to discover them, and I would particularly call the attention of ornamental leather and paper manufacturers, book-binders, and, possibly, manufacturers of china, to the process, for it must be remembered that soap when made can be run into moulds of any form, so as to obtain curved as well as flat surfaces for the artist to draw upon. It has also occurred to me that it would prove a very ready and expeditious method of forming raised maps, pictures, and diagrams for the use of the blind. The manipulation is very simple. A lead pencil drawing if required, can readily be transferred to the smoothed surface of the soap, by placing the face of the drawing on the soap, and rubbing the back of the paper; every line of the drawing is then distinctly visible on the soap. The implements used are equally simple; all the specimens sent were drawn with ivory knitting-needles, and small ivory netting meshes for scooping out larger and deeper touches. The only caution necessary is to avoid under-cutting. Having felt the greatest interest in the establishment of schools of design, so well calculated to reconnect Fine Art with manufactures, it will afford me sincere gratification if the simple process now pointed out—and I trust its simplicity will be no bar to its being carefully tested—shall be in the smallest degree instrumental in accomplishing the re-union.

P.S.—The date 1850 is on some of the illustrative specimens.

* Dr. Branson has also employed Bees' wax, white wax, sealing wax, lacs, as well as other plastic bodies; and in some of these cases a heated steel knitting needle or point was substituted for the ivory knitting needle.—ED. *Jour. Soc. of Arts.*

RATE OF TRANSMISSION OF IMPRESSIONS MADE UPON THE NERVES, BY M. HELMHOLTZ OF KONIGSBERG.—The results of the author's experiments upon the human subject were as follows:—The intelligence of an impression made upon the ends of the nerves in communication with the skin is transmitted to the brain with a velocity which does not vary in different individuals, nor at different times, of about 60 metres, or 195 feet per second. Arrived at the brain an interval of about 1-10th of a second passes before the will, even when the attention is strung to the uttermost, is able to give the command to the nerves that certain muscles shall execute a certain motion. This interval varies in different persons, and depends chiefly upon the degree of attention. It varies also at different times in the case of the same person. When the attention is lax, it is very irregular, but when fixed very regular. The command travels probably with the same velocity toward the muscle. Finally about the 1-100th of a second passes after the receipt of the command before the muscle is in full activity. In all therefore from the excitation of the sensitive nerves till the moving of the muscle 1½ to two-tenths of a second are consumed.

NEW PLANET.—Mr. Marth, assistant at Mr. Bishop's observatory, Regent's Park, London, discovered on the 2nd March last a new planet close to the bright star Spica in Virgo. It appears as a star of the 10th magnitude. The same object was discovered by Mr. Norman Pogson, one of the assistants of the Radcliffe observatory, Oxford, on the evening of the 3rd March.

Royal Society of Literature.

At the last meeting of this society, Mr. Vaux read a paper, communicated to him by Captain Ormsby, of the Indian navy, "On the name given by Pharaoh to the Patriarch Joseph." The object of Captain Ormsby's paper was to show that the translation in the margin of our Bibles of the name "Zaphnath Paaneah" (the title conferred upon Joseph,) viz., "Revealer of secrets," was not confirmed by the analysis of the name itself; but that, on the other hand, a much more natural one was discoverable. Captain Ormsby remarked that there was nothing in the sacred narrative that would lead us to suppose that the patriarch either became himself a Pharoah, or was deified as Hermes, as some have supposed. It is quite clear that Pharoah did not lose sight of the fact that Joseph was a foreigner, and, as such, an abomination to the native population, while we know that after his death, though he was embalmed after the fashion of Egypt, he was not placed in any of the chambers of the Egyptian dead, but was eventually conveyed to the land from whence he came. His positon and rank were, however, secured to him by his investiture with the collar and raiment of fine linen, and by the reception of the royal signet ring, which was placed upon his finger; but still more so by his marriage with the daughter of the high priest of On the (Heliopolis of the Greeks, and one of the most sacred of the ancient cities of Egypt,) and by his subsequent naturalization, which was completed by a change of name—a custom then prevalent in Egypt, as it is still throughout the Oriental world. Captain Ormsby then proceeded to reduce the words "Zaphnath Paaneah" to their equivalents in hieroglyphical consonants, and showed, by a comparison of words in the "Book of the Dead," that they may be interpreted "The sustainer of life," or "The support of Pharaoh." The same result he proved to follow from an analysis of the title as spelt in the Septuagint.

Artificial Pearls.

The artificial production of pearls from the mussle fish is carried on to a great extent at Hoochow. The fish are collected in April or May, and are opened by children, who place a small bit of bamboo in the orifice to keep the shells apart. A piece of brass or bone, a small pebble, or a pellet of mud, is then introduced, a dose from 3 to 5 spoonfuls of fish-scales pounded and mixed with water is poured in, and the stick removed. The fish are then placed a few inches aparf in ponds, the water in which is from 3 to 5 feet deep, and which are well manured with night soil four or five times every year. In these ponds the fish are allowed to remain from ten months to three years. Upon taking them out, the shell is cut through with a fine saw, the pearl is separated from the shell, and the pellet, or other substance within it, extricated. It is then filled with white wax, and a piece of the shell carefully attached to conceal the aperture. Several millions of pearls are thus produced annually, which find a market at Hoochow, and are worth from about a penny to eight pence a pair. Whole villages are engaged in their production, and some 5,000 people are said to gain a livelihood by the trade. The process was discovered in the 13th century by a native of Hoochow, named Ye-jin, to whose memory a temple was erected, in which festivities are still observed in his honour. The Canton process of making pearls does not succeed at Hoochow, nor does the Hoochow method prosper with the Canton people, who are in general so sucessful. There would seem, therefore, to be some peculiarity in the fish or climate of Hoochow, for, so far as can be learned, Hoochow is the only place in China where the process is carried on.

ON THE AMMONIA CONTAINED IN RAIN-WATER.—M. Boussingault has continued at his country seat at Liebfrauenberg (Lower Rhine) his researches mentioned in the November number of this Journal. From his new investigations it appears that rain of the country contains less ammonia than that of the city, and that the ammonia is more abundant at the begining than at the end of a shower.

Boussingault has examined also the dew, and found it always to contain ammonia. The proportions, by several trials, were 6 milligrams to the litre; but the amount is reduced to 1·02 after a rainy day. On the 14th to the 16th of November a thick mist prevailed, so rich in ammonia, that the water had an alkaline reaction; a litre of the water contained about 2 pecigrams of carbonate of ammonia. Seventy-five rains (including the dew and mist) examined by Boussingault between the 26th of May and the 8th of November, contained, as a mean, half a milligram of ammonia. The great quantity of ammonia contained in the mist appears interesting in its bearing on vegetable pathology: in fact, although ammonia in small quantity is favorable to vegetation, a large proportion would be injurious, and would shew its effects especially on the leaves of flowers. Moreover, such a storm might have a deleterious influence on respiration, and especially on the lungs of persons with pulmonary affections.—*Sill. Jour.*

STATISTICAL SOCIETY.—LONDON *Dec.* 19.—The Rev. Wyatt Edgell, V. P., in the chair.—"On the Duration of Life among Medical Men,' by Dr. Guy.—The author stated that the sources whence he derived the facts which had been employed in obtaining the average results contained in this communication, were:—1. The ages at death of such English medical men, chiefly physicians and surgeons, as had by their writings and high professional reputation secured for themselves a place in the pages of Chalmers's Biographical Dictionary;—2. The ages at death of such English medical men (also chiefly physicians and surgeons) as have found a place in the less select obituaries of the Annual Register, from 1758 to 1818;—and 3. The ages at death of English Medical men (chiefly physicians and surgeons) recorded in the pages of the Biographical Dictionary up to the year 1815, added to the ages at death recorded in the obituaries of the Annual Register from that date up to the year 1852 inclusive. The object of combining the facts derived from these two sources was to bring the data down to the latest period as well as to increase the number of individual facts from which the average results were to be deduced; and he drew the following general conclusions from them:—1st. That the duration of life is greater among physicians and surgeons than among the general practitioners of medicine and surgery;—2nd. That this greater longevity of physicians and surgeons is only in part explained by a less amount of exposure to contagious diseases and other professional risks;—3rd. that the duration of life of members of the medical profession (being chiefly physicians and surgeons,) does not differ materially from the duration of life of the clergy, being somewhat less when the comparison is made between the less distinguised members of the medical profession and clergy whose deaths are recorded in the same obituaries; and somewhat greater when the comparison is limited to the now distinguished members of the two professions;—4th. That the duration of life of medical men has somewhat increased during the last three centuries.

RUTHVEN'S PROPELLER.—The Enterprise is 100 feet long and has a 16 feet beam; and her tonnage is about 100. Her engines consist of four horizontal cylinders, 12 inches diameter and 2 feet stroke, coupled to a vertical crank shaft. The propeller is composed of a fan wheel, 7 feet diameter, fixed on the lower end of the vertical shaft and revolving in a water-tight chamber; the water flows into this chamber along a covered passage, through a number of small openings in the bottom of the vessel, and is expelled in two continuous streams, by curved pipes, through the sides. The "nozzles," or extremities of these pipes, are only 10 inches diameter, and they are all that protrudes from the surface of the hull, yet the flow of the water through these nozzles furnishes the whole power required for the advance of the vessel. Their best action is obtained when they are entirely out of the water, and they are therefore situated about one foot above the water-line. They are pivotted to the sides of the hull, and are pointed astern when the vessel is to move ahead, or ahead when the vessel is to move astern, or vertically downwards when the vessel is desired to remain at rest. The changes of motion are thus effected with great rapidity, even while the engines continue at full speed, the reversing operation being confined to the rotation of the nozzles.

Now as to the performance. The motion of the vessel is as smooth as that of a canal boat, as the propulsion is continuous, not intermittent, like that of paddles. So remarkable is the smoothness of motion that persons on board the first trip, declared they could not be aware of the motion without looking over the ship's side. The highest speed that has yet been attained is about 12 miles an hour, and this was achieved on the second public trial of the vessel; and we feel confident that, after some obvious modifications of the machinery are completed, we shall reach a speed of 14 miles per hour. The means of quickly reversing enable us to stop the vessel within 50 feet when sailing at full speed: and, by placing the nozzles reversely, one ahead, and the other astern, the vessel may be turned on the spot, swinging on her beam, without the aid of the rudder.

Monthly Meteorological Register, at the Provincial Magnetical Observatory, Toronto, Canada West.—April, 1854.

Latitude, 43 *deg.* 39.4 *min. North. Longitude,* 79 *deg.* 21. *min. West. Elevation above Lake Ontario,* 108 *feet.*

Magnet.	Day.	Barom. at tem. of 32 deg. 6 A.M.	2 P.M.	10 P.M	Mean.	Tem. of the Air. 6 A.M.	2 P.M.	10 P.M.	M'N.	Tension of Vapour. 6 A.M.	2 P.M.	10 P.M.	M'N	Humidity of Air. 6 A.M.	2 P.M.	10 P.M.	M'N.	Wind. 6 A.M.	2 P.M.	10 P.M.	Mean Vel'y	Rain in Inch.	Snow in Inch.
						°	°	°	°														
b	1	29·157	29·418	29·682	29·447	36·6	36·0	26·0	32·56	0·194	0·152	0·123	0·155	·90	·73	·86	·83	W N W	W b N	N W b W	12·98	...	0·2
b	2	29·885	29·986	—	—	22·3	32·7	—	—	·106	·163	—	—	86	88	—	—	N N W	N W b W	—	6·26	...	...
b	3	30·157	30·066	·992	30·062	29·3	39·6	34·5	35·03	·140	·147	·174	·158	87	61	88	78	W S W	S b W	Calm	6·87	...	...
...	4	29·880	29·886	·870	29·877	34·1	50·3	34·8	40·27	·176	·239	·170	·204	91	66	88	82	S W b W	S S E	S E	3·08	...	...
b	5	·827	·698	·612	·704	36·3	53·3	42·4	44·65	·196	·348	·242	·259	92	87	90	88	Calm	S W	Calm	3·70	...	...
b	6	·456	·278	·483	·407	41·6	60·3	42·5	47·00	·236	·340	·208	·256	91	66	77	77	Calm	S W	N N W	11·23	0·010	...
d	7	·820	·908	·925	·893	27·3	40·2	33·4	33·53	·121	·192	·166	·162	80	78	87	83	N	S	E N E	5·59	...	...
a	8	·808	·641	·616	·674	35·2	42·7	46·0	41·83	·188	·204	·287	·233	92	74	93	87	E	E	W b S	6·58	0·185	...
a	9	·619	·472	—	—	37·7	40·2	—	—	·207	·208	—	—	91	84	—	—	N E	E b S	—	7·02	0·846	...
f	10	·239	·360	·548	·394	36·6	39·1	35·5	37·32	·204	·205	·184	·199	95	87	89	90	N E b E	N E b N	N N W	8·49	0·105	...
b	11	·742	·725	·708	·720	30·2	41·3	33·2	36·26	·147	·171	·167	·170	88	66	88	81	N b E	S S W	S S W	5·23	...	...
a	12	·744	·707	·719	·719	34·9	53·4	41·6	43·72	·184	·240	·209	·206	91	60	81	74	Calm	S	N	5·08	...	...
a	13	·866	·977	30·060	·977	34·8	37·3	27·5	33·37	·171	·176	·132	·160	85	80	87	84	N N E	E S E	E S E	5·57	...	...
...	14	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	12·24	...	...
a	15	·721	·654	29·674	·674	33·0	37·8	34·1	35·12	·155	·137	·172	·151	82	60	88	74	E	E	E N E	10·23	...	...
a	16	·702	·712	—	—	31·7	39·5	—	—	·148	·169		—	83	70	—	—	E N E	E S E	—	10·79	...	...
b	17	·668	·619	·621	·633	34·8	43·7	30·9	37·10	·176	·209	·137	·166	88	74	79	76	N E	S E b E	S b W	5·58	...	...
c	18	·616	·574	·567	·587	36 1	51·1	41·4	44·07	·147	·178	·170	·158	69	48	68	56	S W b S	S b W	S S W	4·38	0·060	...
c	19	·538	·442	·460	·476	36·0	45·7	39·1	42·30	·155	·248	·207	·223	74	82	87	83	S S W	E b N	Calm	2·59	0·070	...
d	20	·419	·448	·530	·469	40·6	50·4	39·8	43·60	·228	·246	·196	·223	91	68	81	80	N E b E	S b W	E b N	3·61	...	...
d	21	·603	·563	·490	·554	36·7	61·0	46·3	48·35	·204	·199	·275	·248	95	37	88	76	N E	E S E	E N E	5·28	0·020	...
c	22	·409	·311	·361	·359	43·4	46·0	48·8	46·12	·249	·276	·330	·283	90	88	97	92	E N E	E N E	N N E	6·64	0·185	...
f	23	·491	·607	—	—	47·5	61·9	—	—	·298	·195	—	—	92	36	—	—	N N E	N b W	—	8·13	...	...
c	24	·756	·649	·557	·640	41·4	57·1	51·7	50·98	·157	·245	·317	·247	61	54	84	67	N N E	S E b S	S b W	2·81	...	...
a	25	·509	·434	·352	·426	45·4	65·1	48·5	54·15	·249	·266	·307	·292	83	43	91	73	S S W	S E b E	N E b E	3·93	0·630	...
c	26	·257	·090	·196	·173	46·0	53·9	48·2	50·23	·287	·352	·308	·327	94	87	93	91	N E b E	S E b E	N	6·85	0·375	2·0
c	27	·388	·576	·732	·581	33·0	33·3	35·2	33·63	·175	·152	·180	·166	94	79	88	87	N E b N	N E b N	N E b N	11·25	...	0·5
b	28	·940	·996	30·023	·995	29·9	42·0	35·7	36·48	·141	·144	·158	·144	84	55	76	68	N N E	N E	N b E	10·30	...	...
b	29	·995	·881	29·786	·869	37·7	39·0	34·5	37·32	·197	·186	·188	·194	87	79	95	88	N E b N	N E	N N E	8·21	0·070	Inap.
b	30	·676	·606	—	—	37·1	44·5	—	—	·205	·240	—	—	94	83	—	—	N b E	S W b S	—	4·18	0·105	...
																		Miles.	Miles.	Miles.	Miles		
	M	29·646	29·621	29·648	29·6379	36·29	46·65	38·82	41·04	0·187	0·219	0·209	0·207	86	69	86	80	6·95	8·64	5·18	6·82	2.685	2·7

Highest Barometer.. 30·233, at 6.30 a.m. on 14th } Monthly range:
Lowest Barometer... 29·045, at 4 p.m. on 26th } 1·188 inches.
Highest temperature.. 65°·1, at 2 p.m. on 25th } Monthly range:
Lowest temperature... 20°·2, at a.m. on 2nd } 44°·9.
Mean Maximum Thermometer.............. 47°·82 } Mean daily range:
Mean Minimum Thermometer....... 30°·69 } 17°·13.
Greatest daily range............... 35°·4, from p.m. 6th to a.m. of 7th.
Warmest day....... 25th. Mean temperature...... 54°·15 } Difference,
Coldest day........ 1st. Mean temperature...... 32°·50 } 21°·65.

Sum of the Atmospheric Current, in miles, resolved into the four Cardinal directions.

North.	West.	South.	East.
2083·06	854·00	1050·89	2261.73

Mean direction of the Wind E 37° N.
Mean velocity of the Wind... 6·82 miles per hour.
Maximum velocity....... 20·2 miles per hour, from 3 to 4 p.m. on 1st.
Most windy day...... 1st; Mean velocity... 12·98 miles per hour.
Least windy day...... 19th; Mean velocity... 2·59 ditto.
Raining on 12 days. Raining 41·8 hours. Depth, 2·685 inches.
Snowing on 4 days. Snowing 8·9 hours. Depth, 2·7 inches.
Thunderstorms occurred on the 8th, 9th, 21st, 25th and 26th.
Aurora observed on 8 nights.
Possible to see Aurora on 15 nights.
Impossible to see Aurora on 15 nights.

5th. Frogs heard in the river Humber.
6th. Butterfly see in Observatory grounds.
8th. Toronto Ba; clear of ice.
9th. Flocks of wild geese passing over the Observatory from South towards North.
10th. Splendid Aurora from 9 p.m. of 10th to 3 a.m. of 11th, during which the magnetic disturbance much surpassed that which occurred during the great Aurora of the 27th ult.
14th. Swallows observed.
25th. Wild pigeons numerous, and passing northward.
26th. Thunderstorm from 3.55 to 7.45 p.m., during which very heavy rain and hailstones fully ¾ of an inch in diameter fell, and a very beautiful and perfect double rainbow with supernumary bands was formed.

Comparative Table for April.

Year.	Temperature. Mean.	Max. obs'vd.	Min. obs'vd	Range.	Rain. D's.	Inch.	Snow. D'ys	Inch.	Wind. Mean Vel'y.	
	°	°	°	°						
1840	42·7	65·9	25·3	40·6	14	3·420	2	Not Regist'd.	...	
1841	39·2	62·9	22·1	40·8	3	1·370	3		0·51	lb.
1842	43·1	89·5	21·6	67·9	8	3·740	2		0·57	lb.
1843	40·9	70·0	15·1	54·9	7	3·185	3	0·1	0·46	lb.
1844	47·5	74·5	17·2	57·3	10	1·515	1	Inap.	0·24	lb.
1845	42·1	66 0	14·8	51·2	11	3·290	4	1·5	1·00	lb.
1846	44·0	79·4	24·4	55·0	10	1·300	2	1·3	0·55	lb.
1847	39·2	65·6	8·4	57·2	8	2·870	2	4·0	0·59	lb.
1848	41·3	65·4	26·5	38·9	5	1·455	1	0·5	4·89	Miles.
1849	39·0	70·9	23·2	47·7	10	2·655	2	1·7	7·50	Miles.
1850	37·9	63·2	18·2	45·0	7	4·720	2	1·1	7·64	Miles.
1851	41·3	59·2	25·8	33·4	11	2·295	3	1·2	8·07	Miles.
1852	38·2	53·8	19·8	34·0	6	1·990	4	9·4	6·68	Miles.
1853	41·9	65·7	27·0	38·7	10	2·625	1	1·0	5·20	Miles.
1854	41·0	65·1	22·3	42·8	12	2·685	4	2 7	6 82	Miles.
									0·56	lb.
M'n.	41.29	67·81	20·78	47·03	8·8	2·608	2·4	2·04	6·69	Miles.

Monthly Meteorological Register, St. Martin, Isle Jesus, Canada East.—April, 1854.

NINE MILES WEST OF MONTREAL.

BY CHARLES SMALLWOOD, M.D.

Latitude—45 deg. 32 min. North. Longitude—73 deg. 36 min. West. Height above the Level of the Sea—118 Feet.

Day.	Barom. corrected and reduced to 32° Fahr.			Temp. of the Air.			Tension of Vapor.			Humidity of Air.			Direction of Wind.			Velocity in Miles per Hour.			Rain in Inch.	Snow in Inch.	Weather, &c. A cloudy sky is represented by 10; A cloudless sky by 0.		
	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10. P.M.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.			6 A.M.	2 P.M.	10 P.M.
1	28·948	29·000	29·216	39·0	41·4	33·0	·234	·235	·178	·91	·85	·86	N b E	W S W	W N W	14·60	9·43	11·69	0·410		Rain.	Rain.	Cum. Str. 8.
2	29·620	·602	·771	19·6	20·2	22·0	080	152	096	64	85	68	W b N	W S W	W b N	20·00	11·50	3·88			Clear.	Clear.	Clear. [Lights.
3	·902	·801	·741	27·2	12·1	28·3	112	208	153	67	73	88	S W b W	S W b W	S S W	0·15	2·25	11·33			Do.	Cir. Str. 8.	Do. Comet vis-
4	·661	·606	·518	33·4	50·1	29·0	187	326	161	90	87	89	S S W	S S W	E	0·21	Calm	Calm			Str. 10.	Str. 10.	Str. 2. [ible.
5	·662	·418	·370	35·4	55·0	40·0	186	372	246	83	84	92	S S W	S S W	S S W	1·51	1·07	2·14			Clear.	Cir. Str. 8.	Do. 10.
6	·216	·080	·040	43·2	54·0	43·5	252	373	280	85	87	94	W S W	W S W	S W	1·25	1·60	14·72	0·460		Cir. Str. 8.	Str. 10.	Rain at 5 p.m*
7	·421	·600	·691	31·4	39·0	26·6	171	214	137	89	81	82	N W	W b N	W b N	13·75	3·25	Calm	0·110		Clear.	Clear.	Clear. Comet
8	·614	·515	·461	26·0	31·6	28·8	123	178	170	76	92	91	N b E	N E b E	N E b E	0·85	6·75	6·50		1·40	Str. 10.	Snow.	Snow. [visible
9	·462	·314	·255	31·4	38·2	32·1	171	203	191	89	91	95	N E	N E b E	N E b E	8·75	6·22	16·66			Do. [8 a.m.	Cum. Str. 8.	Rain at 9.10
10	·126	·210	·246	33·8	44·0	36·0	204	261	210	95	85	91	N E b E	N E b E	N b E	11.57	10·21	3·00	1·570		Rain ceased at	Str. 10.	Cir. 4.† [p.m.
11	·431	·453	·420	26·7	47·6	32·8	137	291	187	83	86	90	N b E	S S W	S W b S	9.72	3·56	0·22			Clear.	Clear.	Clear.
12	·451	·614	·422	35·6	53·5	40·0	203	238	194	91	57	73	W S W	W b S	N E	2 67	0·68	0·62			Do.	Do.	Cir. Cum. 4.
13	·708	·680	·772	25·4	39·4	21·6	135	227	112	86	85	71	N N E	S E b S	E S E	2 75	5·78	Calm			Do.	Do.	Do.
14	·939	·770	·701	16·5	36·0	24·6	096	171	135	83	74	86	N E b N	S S E	N E b E	1·03	0·12	0·11			Cir. 4.	Cir. 2.	Clear. Aurora
15	·597	·520	·508	21·0	36·3	28·6	118	192	152	88	83	85	N E b E	N E	N b E	2·50	8·02	1·58			Cir. Str. 4.	Clear.	Do. [Borealis.
16	·597	·512	·526	22·2	41·2	30 2	123	217	160	88	79	86	N N E	N N E	N N E	6·21	Calm	4·99			Clear.	Do.	Do.
17	·554	·408	·343	27·0	41·9	34·7	116	230	178	87	83	83	N N E	N E b N	N E b N	3·06	6·93	4·80			Do:	Cum. Str. 8.	Str. 10.
18	·353	·240	·182	29·6	53·6	40·1	137	337	198	70	81	75	N E b N	S b W	S b W	4·92	1·01	0·08			Do.	Clear.	Do. 1.
19	·261	·166	·215	36·6	54·2	38·0	182	326	217	76	76	86	W b S	W S W	W b S	0·76	2·54	4·50			Hazy.	Do.	Do. 4.
20	·233	·203	·278	37·3	56·0	43·1	218	412	270	91	84	91	W b S	W	S W	1·12	Calm	0·55			Clear.	Cir. Cum. 4.	Do. 2.
21	·389	·318	·423	31·8	62·5	42·2	182	421	243	91	75	85	N b E	S b W	S S E	0·11	Calm	Calm			Do.	Clear.	Clear. Aurora
22	·350	·235	·240	38·7	50·5	40·0	214	326	227	84	87	85	N E b E	N E	N E	0·07	2·13	2·94			Cir. Cum. Str.	Cir. Str. 10.	Str. 8. [Bo.
23	·298	·414	·423	40·0	53·0	40·2	210	315	194	79	76	73	N E b N	N E	N	8·38	10·60	1·26			Clear. [8.	Clear.	Clear. Do.
24	·491	·366	·426	37·2	59·0	45·0	167	338	218	70	66	69	N b W	W b S	S W b W	0·66	1·26	1·26			Do.	Do.	Str. 2. Do.
25	·416	·410	·479	44·0	65·2	49·2	241	381	290	79	61	80	W S W	S W	N N E	4·55	0·75	5·79			Do. [at 6 40.	Cir. 2.	Do. 4.
26	·410	·309	·498	41·7	41·2	41·0	235	253	235	85	91	85	N E b N	N E b E	N N E	2·00	4·51	2·03	0·180		Str. 10. Rain	Rain.	Do. 10.‡
27	·500	·492	·490	32·0	31·2	32·1	160	186	160	80	87	80	N N E	N E b E	N N E	7·69	11·18	Calm		1·73	Do. Snow at	Snow.	Do. 9.§
28	·384	·376	·498	30·0	44·5	33·6	160	207	187	86	68	90	N N E	E b N	E b N	13·51	11·37	4·62		1·00	Snow. [8 a.m.	Str. 9. [a.m	Str. 4.
29	·478	·464	·456	31·7	34·2	33·5	182	201	205	91	·95	96	N E b E	N E b E	N E b E	Calm	3·25	21·47	1·390		Str. 10.	Rain at 11.40	Rain.
30	·478	·486	·512	40·0	47·2	43·0	251	291	282	95	86	94	N E b E	N E	E N E	15·78	0·21	Calm	3·826		Rain.	Str.c'd at noon	Str. 10.

Barometer ….
- Highest, the 14th day …… 29·939
- Lowest, the 1st day …… 28·918
- Monthly Mean …… 29·440
- " Range …… ·991

Thermometer.
- Highest, the 25th day …… 67°·6
- Lowest, the 14th day …… 15°·4
- Monthly Mean …… 37°·75
- " Range …… 52°·2
- Mean Humidity …… ·835

Greatest Intensity of the Sun's Rays …… 134°·0

Temperature of the month 3°·61 below that of last year.

Amount of exporation, 1·86 inches.

Rain fell on 7 days, amounting to 7·886 inches. Raining 49 hours 10 minutes, accompanied by lightning on 1 night.

Snow fell on 3 days, amounting to 4·03 inches.

Most prevalent Wind, N E b E. Least prevalent Wind, E.

Most Windy Day, the 2nd day; mean miles per hour, 11·79.

Least Windy Day, the 21st day; mean miles per hour, 0·03.

Aurora Borealis visible on 5 nights. Might have been seen on 8 nights.

Lunar halo visible on 1 night.; diameter, 60°.

Comet seen here for several nights; on the 7th at 8 p.m. R. on 3h. 35m. 31s. Declinature, S = 7°20·0.

Swallows first seen on the 12th day. First steamboat at Montreal on the 22nd day.

Electric apparatus out of order until the 20th day. Since that date the electrical state of the atmosphere has been marked by feeble intensity of positive electricity, and during the snow storm of the 27th day indicated high tension.

* Ceased at midnight. † Lunar halo; diameter, 60°. ‡ Rain ceased at 4 p.m. § Snow ceased at 3 p.m.

SUPPLEMENT
TO
The Canadian Journal
FOR JUNE, 1854.

Statistics of Upper Canada.

In the year 1840, a paper was published in the "British Colonist," headed "Lands and Population in the United States and Upper Canada." The author of that document now brings it again before the public in the *Canadian Journal*. He conceives that its republication *in extenso* will be interesting in the present history of this Province, if accompanied by a statement and remarks applicable to the period, and showing how far the expectations entertained fourteen years since have been realized. Those assumed results in 1840 were considered by many people as visionary, and based upon imperfect data. The period selected for the application of the principle set forth in the paper referred to, is from the year 1840 to 1852, and consequently freed from the beneficial influences of the railroads and other great improvements now in progress, and which must necessarily operate in an extraordinary manner in promoting an increase to our population, wealth, and importance.

It was desired to follow out the consequences of the increased population, as bearing upon the quantity of land placed under cultivation, and showing also its greatly enhanced value. And this would have been an extremely interesting subject, the reasoning under Section III. being so very applicable to the actual position of Canada in reference to Great Britain; but there is at present no sufficient reliable data upon which to proceed with safety. It is not apart, however, from the subject herein treated upon, to exhibit the advantages the Province has derived in a pecuniary point of view from the migratory emigration passing through this country.

It was only in the year 1831 that a systematic arrangement was made by the Canadian Government for receiving, arranging, and recording the numbers of emigrants which flocked to our shores, and it was not till after the devastation caused by cholera in 1832 and 1834 that the absolute necessity appeared of affording Government assistance (first by money and afterwards by superintendence) in the spreading of settlers, placing new comers amongst our population, and the rapidly pushing forward of those who made the passage by Quebec and our great Lakes their highway to the Western States. Since that time the most accurate registration of the numbers of emigrants has been kept, and the strenuous exertions of the Government have been directed to promote the rapid settlement or passage, as the case might be, of the newly arrived emigrants.

It was important, in every respect, to ensure a quick passage through our Lakes, rendering the route a favourite one to those bound for the far west, and who were thus benefited to a great extent by their transit. Speedy dispersion and settlement in Canada was still more important, not only in a sanitary point of view, but as it placed those who could ill spare the time in looking for employment at once amongst their employers, and enabled them to send aid to the British Isles, to assist their friends requiring aid to follow them.

4

The benefits as to increase in population which Upper Canada has derived from emigration have been overrated, and the amount of transient emigration which has used our canals and Lakes and river navigation has been very little understood—nor could it be, until, by the results of the census, we could form even a speculative opinion as to the numbers which had passed through the Province.

The entrance of the emigration through the water gate of Quebec gave us, to a fraction, the *arrivals;* but it required time and the official census to ascertain how many of those who arrived, remained as settlers, contributing to our prosperity, and how many merely benefited us by the expenditure of their cost of passage through our waters. As we said before, it was easy to number the arrivals at Quebec, and to follow them through the St. Lawrence; but once on the Lake, information upon their future routes became almost inaccessible, for the outlets were too numerous to be watched, and the course of the emigration could only be guessed at.

Not to go too far back and tire our readers—it will be sufficient for our purpose if we start from the year 1840. The number of emigrants arrived since then are as follows, viz.:—

In the year	1840	21,190
..	1841	28,937
..	1842	44,374
..	1843	20,142
..	1844	25,375
..	1845	29,253
..	1846	32,736
..	1847	90,150
..	1848	27,939
..	1849	38,494
..	1850	32,292
..	1851	41,076

The population of Upper Canada was in 1840, 460,000. Now, if we yearly add to this amount the number of emigrants arrived in the Province, and deal with them in conformity with the principle of the afore-mentioned table, the result will show us whether the opinions hitherto entertained, namely, that nearly, if not quite all, who arrived remained, or that, if some did pass on, their numbers were made up by emigrants from the States, was well grounded or not.

The result we arrive at is 1,229,214—showing that the before-named opinion would be incorrect, as had those numbers remained in the Province, the actual population should be 277,210 *more* than is given in the census.

We must therefore try again, and assume that one-half of the emigration settled in Canada, and the other half passed on, or died on their passage, and make the calculation accordingly.

The result, according to the principle of calculation laid down in 1840, shows that the population of Upper Canada should have been in the year 1852, 962,238, whereas the official census shows it to be 952,004.

Thus it appears that the anticipations entertained fourteen years since, fall short in amount to the extent of 10,234 only, thus establishing with extraordinary accuracy the correctness of the rule laid down in the year 1840, and more particularly so, if, as is believed, the census is imperfect, and that a precise return would have exhibited the number of our population to be considerably larger than is set down in that official statement.

The table also proves that one-half only of the emigrants who have arrived in Canada since 1840 to 1852, have made this

Province their permanent abode, a result which may astonish those who have not considered the subject under all the circumstances bearing upon it.

With respect to the one half of the emigrants who have passed on to the United States (excepting those who have perished from fever or cholera, being, it is hoped, only a small proportion of the number), the benefit of the cost of their passage through our waters is all they have left to us, but as this, on the average, has been £1. 6s. 3d. per head, exclusive of provisions, from Quebec to Buffalo, it amounts to £308,672 15s. 0d. add thereto 15s. per head for provisions, &c., and we have a sum total expended in this Province, during twelve years, by this transitory people, of £485,345 15s. 0d.

The emigration of 1852 was 39,176. In the last calculation, viz., of the advantages derived to the Province by the passage of that portion of emigrants who have passed through, we make use of one-half that number as they have actually benefited the Province by the cost of their transport; but in the former calculation, the emigration of 1852 is not included.

Since this document has been framed, the official returns of immigration of the *past* year (1853) have been issued in England, which show the arrivals in Canada to have been 36,699 souls, of which 11,504 passed through to the United States: 200 of the Norwegians destined for Wisconsin accepted employment at Hamilton. It is also assumed in the returns that 5000 immigrants arrived in the United States for Canada; and a number of railway labourers had passed on to Canada, attracted by the abundant employment at high wages in the Province, and the cessation of work in the Western States.

There is something (De Tocqueville observes) extremely grand and solemn in watching "this great wave of population," which annually takes its rise in the heart of Europe, rolls across the Atlantic Ocean, and, after breaking upon the shores of North America, swells the current of another and a mightier stream, which has flowed onward until it has partially peopled the almost boundless region of the "Far West," and reached the coasts of the Pacific. There are but few passages in English poetry more beautiful than that written by Wordsworth about forty years since, when the "Bees" that left the "thronged hives of Britain" were few in number, and the "new communities" they were forming were comparatively unimportant and feeble, nor do we think we can do better than close these few remarks by quoting the lines referred to:—

"As the element of air affords
An easy passage to the industrious bees,
Fraught with their burdens; and a way as smooth
For those ordained to take their sounding flight
From the thronged hive, and settle where they list—
In fresh abodes their labour to renew;
So the wide waters open to the power,
The will, the interests, and appointed needs
Of Britain, do invite her to cast off
Her swarms; and, in succession, send them forth,
Bound to establish new communities
On every shore whose aspect favours hope,
Or bold adventure; promising to skill
And perseverance their deserved reward.
Change, wide and deep, and silently performed,
This land shall witness; and, as days roll on,
Earth's universal frame shall feel the effect,
Even to the smallest habitable rock
Beaten by lonely billows, hear the songs
Of harmonized society, and bloom
With civil arts that send their fragrance forth,
A grateful tribute to all-ruling Heaven.

Book IX., Excursions.

Lyndhurst, Toronto, 1st June, 1854.

Lands and Population in the United States and Upper Canada.

[*Extract from a Tract written and published in the year 1798, by a gentleman who held an important official situation in the Government of the United States, entitled, "Facts and Calculations respecting the Population and Territory of the United States of America."*]

SECTION I.

OF THE POPULATION OF THE UNITED STATES.

It is well known that, about a century ago, the country which now composes the United States of America, contained but a few thousand civilized inhabitants, and that now the same country contains four or five millions.

But the causes of this vast increase in numbers seem not to be equally well understood. It is believed that many persons still suppose the population of America to be chiefly indebted for its growth to emigrations from other countries, and that it must become stationary when they cease to take place. Some facts and calculations will be here set down, to ascertain the ratio of the natural increase of the inhabitants of America, and to show that the great progress of wealth and population in that country is chiefly derived from internal causes, and of course less liable to interruption from without.

The highest estimate that is recollected of the number of inhabitants removing to America in any one year supposes the number to be 10,000.* If the same number had removed every year since the first settlement of the country, it would make the whole amount to 1,600,000. But it is to be remarked, that this estimate was made for a period when emigrations were unusually numerous—that during the many years of war which have taken place they have been very few; and that in former years, when the number of emigrants was complained of *as an evil*, it was not reckoned so high.† We may, therefore, suppose that 5000 persons per annum is a liberal allowance for the average number of persons removing to America since its first settlement. This, in the year 1790, would amount to 800,000 persons. At the end of 1790, and beginning of 1791, there were enumerated in the general Census the number of 3,993,412 inhabitants.‡ As some places were not enumerated at all, and from others no return was made, there can be little doubt but the actual number then was something more than 4,000,000. Supposing them to have increased so as to have doubled their numbers once in twenty years, then in the several preceding periods of twenty years since the year 1630 the numbers would stand thus:

At the end of	1790, 4,000,000	At the end of	1690, 125,000
" "	1770, 2,000,000	" "	1670, 62,500
" "	1750, 1,000,000	" "	1650, 31,250
" "	1730, 500,000	" "	1630, 15,625
" "	1710, 250,000		

But as this last date reaches back to the infancy of the first settlements in North America, it can hardly be supposed that they contained so many as 15,000 inhabitants. It follows, therefore, that they must have doubled their numbers oftener than once in twenty years; that is, that they must have increased faster than at the rate of 5 per cent., compounding the increase with the principal at the end of every twenty years.

To determine how far this rate of increase is justified by other

* "Cooper's Information," &c.
† "Douglas's Summary," Vol. II., p. 36.
‡ See the Census of 1791.

facts, some pains have been taken to ascertain and compare the number of inhabitants at different periods, viz., 1750, 1774, 1780, and 1791.

Here follows the estimate and the results, showing that in the year 1750, the total of inhabitants in the thirteen colonies was 1,179,259—1790, the whole number in the thirteen States, 4,000,000, being about 34-10 times the number of 1750. If this increase be computed in the manner of simple interest, it affords a ratio of 5-98, or very nearly 6 per cent., or in the manner of compound interest, of between 3 and 3½ per cent. Any number increased in the compound ratio of 3 per cent. per annum, is doubled in about 23½ years, and at 3½ per cent., in about 20 years; that is, it is equal to 5 per cent. simple increase for the same period.

In 1782 a return was made to Congress of the inhabitants in the several States, by which there appeared to be 2,389,300. This return was then believed to be accurate, for it was made the rule for the assessment of public burthens among the States; but, in 1784, the accuracy of it was attacked by Lord Sheffield, who affirmed it was too great. If it was, in fact, as much too great as he supposed, then the increase of numbers from that time to 1790 must have exceeded all credibility. But allowing it to have been accurate, the

Difference between the number, 1790		4,000,000
And the number, 1782		2,389,300
Is		1,610,700
From this deduct for emigrants, viz., 10,000 emigrants per annum for 9 years	90,000	
Increase of ditto at 5 per cent. 4½ years	20,250	
		110,250
Natural increase in 9 years		1,500,450

which, calculated upon the number of inhabitants returned in 1782, gives the astonishing natural increase of 6-97, or very nearly 7 per cent. per annum.

From these statements, compared with each other, it appears that in the year 1790 the actual increase of inhabitants in the United States, beyond the number ever imported,* must have been 3,200,000, or, after the most liberal allowances, at least 3,000,000; that the whole rate of increase upon the numbers at any given period has been more than 5 per cent., and, deducting for emigrations, that it has been equal to about 5 per cent. for any twenty years successively, or 3½ per cent. compound increase for any period that has yet elapsed.

But it may be said, no inference as to the future population of America can be derived from these facts, because, as the country becomes more thickly settled, the increase will be slower. We have an opportunity of examining what weight the objection possesses.

The Eastern States are the most thickly inhabited. The greater part of the emigrations from them have been either to other States in New England, or to the State of New York.

In 1750, New England and New York together contained 444,000—in 1790, 1,348,942, having more than trebled their numbers in 40 years, and increased during all that period at the rate of more than 5 per cent. upon their original number, and in the compound ratio of nearly 3 per cent.; and as many more persons have emigrated from these States than have come into them from abroad. All this, and *something more*, is their natural increase.

In 1750, Massachusetts contained 32 persons, and in 1790, about 60 persons to each square mile;

In 1750, Connecticut contained 20 persons, and in 1790, about 50 persons to each square mile;

In 1750, Rhode Island contained about 23 persons, and in 1790, about 52 persons to each square mile; so that, besides the numerous emigrants these States have sent forth, they have more than doubled their numbers in 40 years, and nearly trebled them since they contained 20 persons to each square mile.

Mr. Jefferson took some pains to prove that the inhabitants of Virginia double their numbers once in 27¼ years. He also proved, by an ingenious calculation, that in 1782, the numbers in Virginia were 567,614; in 1790, the same country (part of which made the State of Kentucky) contained 821,287, giving an increase of 496-100, or very nearly 5 per cent., and doubling their numbers, not in 27¼ years, as Mr. Jefferson sought to prove, but in less than 21 years. Virginia (exclusive of Kentucky) added about 180,000 to its numbers between 1782 and 1790, the period when the numerous emigrations to Kentucky caused so great a drain upon its population.

In 1780, the number of militia west of Blue Ridge in Virginia was 11,440, which, multiplied by four, gives for the number of inhabitants 45,760. In 1790, the same county contained 151,235, those counties having more than trebled their numbers in 10 years.

The writer then proceeds to say, it is to be observed that these facts (and many more of a similar tendency might be adduced) are drawn from the former and least prosperous state of America, and from periods which were either absolutely those of public calamity, or at best were not those of national prosperity; yet, it is apprehended they sufficiently prove that the inhabitants of the United States increase at least as fast as at the compound ratio of 3½ per cent.; that should foreigners cease to remove there, it would not prevent more than 1-15 or 1-20 of this increase, and that there are as yet no symptoms of this rate of increase being at all diminished by the crowded population of the country. The United States must contain 18,000,000 of people to equal the average of New England, and 55,000,000 to equal the rate of population in Massachusetts and Connecticut.

The causes of this great increase of population, so peculiar to America, might be readily and satisfactorily explained by a review of the state of manners, society, property, &c., in that country. This discussion is, however, unnecessary for the object entertained.

Here follow the calculations showing the increase of population since 1790 to 1797, at the ratio of 3½ per cent. per annum, compounding the increase with the principal every year. They result in exhibiting that the population of the United States in 1797 was 5,088,890.

SECTION II.

ON THE TERRITORY OF THE UNITED STATES.

From the statements in Section I., it appears that the increase of the inhabitants of the United States is in the compound ratio of about 3½ per cent, and that at the end of 1797 their numbers were 5,088,890. The territory of the United States has been usually reckoned, after Mr. Hutchins, as equal to a tract of

* Various authorities are quoted from which these data are taken.

1,000,000 square miles. This computation, though probably too large, will be followed.

It gives in acres, 640,000,000; from which deduct for water, 51,000,000, and there remains of land, 589,000,000. Of this quantity it is known that about 220,000,000 are contained in the territory north-west of the river Ohio, and is nearly all of it uninhabited. Of the 369,000,000 which remain, it is difficult to form any just estimate as to the proportion of the inhabited and appropriated parts to those which are not so. It is, however, thought reasonable to suppose that, in America, whenever any part of the country has acquired a population of about 20 persons to the square mile, or 150 to 200 acres to a family, that then the land must there have acquired nearly the average price of cultivated land, and the surplus population will incline to emigrate. Assuming this as a rule, the lands in the United States so occupied would, in 1796, be 157,337,664—remains, 211,662,336 a great part of which is inhabited in some degree. The remainder is owned by States and individuals, and much of it not for sale. Add for the North-west territory, 220,000,000 Land of all kinds yet to be settled, 431,662,336.

The increase of the population of the United States, calculated upon the principles established in Section I., will, if applied to the settlement of new lands, at the rate of 20 persons to each square mile, or 32 acres each person, occupy the lands of the United States in the proportion, and at the periods following, viz.:—

YEAR.	Number of inhabitants.	Acres of land occupied by the increase.	Acres of land remaining unoccupied.
1796	4,916,802	......	431,662,336
One year's increase.......	......	5,506,816	......
1797	5,088,890	....	426,155,520
Ten ditto.....................	......	66,863,712	......
1807	7,178,381		359,291,808
Ten ditto.....................	......	94,317,856	......
1817	10,125,814	......	264,973,952
Ten ditto.....................	......	133,044,704	.....
1827	14,223,461	......	131,929,248
Seven ditto...................	......	131,929,248	......
About 1834	18,406,150	......	000,000,000

SECTION III.

OF THE VALUE OF LANDS.

It has usually been supposed that the great rise which has taken place in the value of American lands, has been produced by caprice or accident, and not derived from any fixed and certain sources of profit; but it is allowed that this rise in their value has been constant, and very great ever since the first settlement of the colonies, and during periods which were far from being those of public prosperity. Without taking advantage, however, of the present favorable state of public affairs, it will be attempted to show, from facts and calculations drawn from the former and least prosperous state of the country, that the great increase in the value of lands is derived from fixed and necessary causes existing in the country, and is, in a great measure, subject to strict calculation. The following calculation is founded upon these principles:—

1st. It is supposed to be proved in Section I., that the inhabitants of the United States increase in the compound ratio of 3½ per cent.

2nd. It appears from the same Section that, at the end of the year 1796, the number of inhabitants in the United States is about 4,916,802.

3rd. It appears from the statements in Section II., that the quantity of vacant lands in the United States is about 431,662,336 acres.

4th. Of consequence there are in the United States 1,139 persons to each 100,000 acres of new lands.

5th. It is supposed that new lands on an average are worth one dollar per acre; and that lands inhabited at the rate of twenty persons to the square mile, are worth thirteen dollars or three guineas per acre.

The following statement, therefore, shows the increasing value of any 100,000 acres (taken equal to the average) upon the principle that the increase of 1,139 persons may be applied to the settlement of it; and that as much land as they settle at the rate of twenty persons to the square mile is worth thirteen dollars or three guineas per acre:—

YEAR.	No of Inhabitants.	Lands annually occupied by an increase of inhabitants.	Value of 100,000 acres each year.	Value per Acre.	The same in Sterling.		
		Acres.	Dollars	Dlls. Cts	£	s.	d.
End of 1796	1,139	....	100,000	1.00	0	4	6
Increase	40	1,280	16,640				
End of 1797	1,179	1,312	116,640	1.16	0	5	2½
Increase	41	....	17,056				
End of 1798	1,220	1,344	133,696	1.33	0	5	11¾
Increase	42	....	17,472				
End of 1799	1,262	1,408	151,168	1.51	0	6	9½
Increase	44	....	18,304				
End of 1800	1,306	1,472	169,472	1.69	0	7	4½
Increase	46	....	19,136				
End of 1801	1,352	1,504	188,608	1.88	0	8	5½
Increase	47	....	19,552				
End of 1802	1,399	1,568	208,160	2.02	0	9	4½
Increase	49	....	20,384				
End of 1803	1,448	1,631	228,544	2.28	0	10	3
Increase	51	....	21,216				
End of 1804	1,499	1,664	249,760	2.49	0	11	2½
Increase	52	....	21,632				
End of 1805	1,551	1,728	271,392	2.71	0	12	2¼
Increase	54	....	22,464				
End of 1806	1,605	1,792	293,856	2.93	0	13	2¼
Increase	56	....	23,296				
End of 1807	1,661	....	317,152	3.17	0	14	3
" 1808	1,719	1,856	341,280	3.41	0	15	4
" 1809	1,779	1,920	366,240	3.66	0	16	5¼
" 1810	1,841	1,984	392,030	3.92	0	17	7½
" 1815	2,186	11,040	535,550	5.35	1	4	0¼
" 1820	2,596	13,120	706,110	7.06	1	11	9
" 1825	3,083	15,584	908,702	9.08	2	0	8¼
" 1830	3,661	18,784	1,152,894	11.52	2	12	10
" 1834	4,255	19,008	1,400,000	13.00	3	3	0

It is not intended by this statement to convey the idea that the rise in the value of any particular tract of land will be in the exact proportion here mentioned. In many important instances in America it has been greater, in others, perhaps, less. But it is intended to show that the increase in the value of American lands is, in its nature, like that of compound interest; and that, assuming the very moderate ratio of 3½ per cent. for the increase of inhabitants, the general rise in the value of property resulting therefrom, is very far above the profit of capital in any of the ordinary ways of employing it. And it is to be remembered that these statements being matters of arithmetical calculation, are not to be disproved, except by disproving some of the premises on which they are founded.

It ought also to be remarked that the statement is burthened by the inclusion of all the lands in the United States, and, of course, of many millions which are not now for sale, and will not begin to be settled for many years. It is, therefore, much too moderate if considered with respect to the lands now in market.

The lowest price at which Congress sell the lands they offer for sale is two dollars per acre. The astonishing low prices of lands in America have hitherto been occasioned by the want of capital to invest in them. Only a few European capitalists have lately understood the subject; and nobody is ignorant of the immense advantages they have derived from it. The great increase of capital in America, together with the investments which Europeans are beginning to make in lands, will probably raise their value far above the rate at which it has increased at any former period.

Such a conclusion results not unnaturally from another consideration, which is this: The price of any commodity whatever may be raised in two ways; either by diminishing the quantity for sale, or by increasing the demand. But the extension of settlements and the increase of wealth and population operate at once in both these ways upon American lands; not only diminishing the quantity for sale, but increasing the means and the eligibility of making further purchases and settlements.

The Republic, as is well known, consisted of thirteen States in 1790, viz.: Massachusetts, Maryland, New Hampshire, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, Delaware, Virginia, New Carolina, South Carolina, and Georgia. The preceding statement has, of course, reference to these thirteen enumerated States only; subsequently the Republic has been extended to twenty-four States by the addition to the Union of the following eleven States, viz.: Maine, Vermont, Ohio, Tennessee, Mississippi, Indiana, Illinois, Missouri, Alabama, Louisiana, and Kentucky. To these might be added the territories of Michigan, Arkansas, Florida, and the District of Columbia.

In considering the accompanying statement and calculations founded thereon, although they may not at first view appear to have realised in 1834 the anticipations of the author, who penned them forty years since, many events and the consequences arising out of them have occurred, which have most materially affected the contemplated result; it may tend to illustrate the actual position of the case by bringing forward those events which bear in favour, and also those which bear against the statement. In favour of the statement:—

For some time, especially during the wars with England in 1812 to 1814, there was scarcely any immigration into the United States. On the contrary, there were considerable emigrations from thence to Canada, &c., nor would a state of war tend to promote any natural increase of the population.

The vast extension of the dominions of the Republic by the acquisition of Florida, the annexation of other States and territories since 1790, would necessarily postpone the settlement of all the lands in the manner anticipated, and also generally keep down their prices most materially. (1) But yet the average prices of settled land is supposed to far exceed thirteen dollars, or three guineas per acre. (2)

Against the statement:—

The population of the United States did not amount to 18,000,000 of inhabitants in 1834, being only 12,866,020 at the last census in 1830. (3)

The number of immigrants into the United States has been very considerable during the last 20 years—especially during the last 10 years.

To draw these observations to a point, the object had in view in extracting and condensing the annexed statement (although sufficiently interesting in itself, if proved to be tolerably correct—due allowances being made for the unforeseen circumstances) was to endeavour to draw a parallel statement of the prospective position of Upper Canada, in a given number of years, founded upon accessible data.

The population of Upper Canada, in 1838, was 400,000 inhabitants. (4)

Within the actual limits of Upper Canada, between the parallels 41°, 47°, and 49° of north latitude, there are 141,000 square statute miles. (5)

Assuming that only that portion of the territory embraced by, and on the south of French River, Lake Nepissing, and the Ottawa River, is available or suitable for agricultural purposes, and that the territory beyond those limits will only be settled when the population of the south shall become very dense, and making allowance for the superficies covered by water, it will not be underrating the quantity of land at present considered available, in estimating it at about one-third less than the whole territory, but say, for the purpose of this statement, at 100,000 square statute miles. (6)

Thus it appears there are now 160 acres to each inhabitant.

A recent intelligent Canadian writer (7) considers the territory suitable for settlement at 35,326,400 acres, after deducting 16,000,000 for water.

Thus it appears there are 88¼ acres to each inhabitant.

The annexed table will show that to settle the 100,000 square statute miles, or the 64,000,000 statute acres, in the proportion of 20 persons to a square mile, or 32 acres to each individual, will require 2,000,000 inhabitants. (8)

It will take 47 years, unassisted by immigration, compounding the natural increase with the principal, at three-and-a-half per cent. per annum, to settle 100,000 statute miles.

40	years assisted annually	by	5,000	immigrants.	
35	ditto	ditto	10,000	ditto.	
32	ditto	ditto	15,000	ditto.	
29	ditto	ditto	20,000	ditto.	
26	ditto	ditto	25,000	ditto.	

The table will also show the number of years it will take to settle in a like manner the 35,326,400 acres, and which will require 1,103,950 inhabitants.

It will take 30 years unassisted by immigration.
25 years assisted annually by 5,000 immigrants.
21 ditto ditto 10,000 ditto.
18 ditto ditto 15,000 ditto.
16 ditto ditto 20,000 ditto.
15 ditto ditto 25,000 ditto.

It is not considered necessary to extend this statement by entering upon the calculations as to the increased value given to lands, by being settled in the manner laid down, as there is no correct data within reach as to the average value of wild land, and that of land settled in the ratio established; but should these points be ascertained, the calculations would be very simple, although tedious from their number, were they pursued to each year mentioned in the table.

TABLE

Showing the annual increase of inhabitants in Upper Canada to the year 1847, and subsequent periods mentioned, until they shall reach 2,000,000 souls, at three and a half per cent. per annum, compounding the increase with the principal:—

Unassisted by Emigration.		Assisted annually by 5000 Emigrants.		Assisted annually by 10000 Emigrants.		Assisted annually by 15000 Emigrants.		Assisted annually by 20,000 Emigrants.		Assisted annually by 25,000 Emigarnts.	
Year.	Inhbts.	Year.	Inhbts.	Year.	Inhbts.	Year.	Inhbts.	Year.	Inhbts.	Year.	Inhbts.
1838...	400000 14000	1838...	400000 19000	1838...	400000 24000	1838...	400000 29000	1838...	400000 34000	1838...	400000 39000
1839...	414000 14490	1839...	419000 19665	1839...	424000 24840	1839...	429000 30017	1839...	434000 35190	1839...	439000 40365
1840...	428490 14997	1840...	438665 20353	1840...	448840 25709	1840...	459015 31065	1840...	469190 36421	1840...	479365 41777
1841...	443487 15522	1841...	459018 21065	1841...	474549 26609	1841...	490080 32152	1841...	505611 37696	1841...	521142 43239
1842...	459009 16065	1842...	480083 2180.	1842...	501158 27540	1842...	522232 33278	1842...	543307 39015	1842...	564381 44753
1843...	475074 16627	1843...	501885 22566	1843...	528698 28504	1843...	555510 34442	1843...	582322 40381	1843...	609134 46319
1844...	491701 17209	1844...	524451 23355	1844...	557202 2950.	1844...	589952 35648	1844...	622703 41794	1844...	655453 47940
1845...	508910 17811	1845...	547806 2417.	1845...	586704 30534	1845...	625600 36898	1845...	664497 43257	1845...	703393 49618
1846...	526721 18435	1846...	571978 2501	1846...	617238 31603	1846...	662498 38187	1846...	707754 44771	1846...	753011 51355
1847...	545156	1847...	596997	1847...	648841	1847...	700685	1847...	752525	1847...	804366
to 1856 10 ys	742957	to 1856 10 ys	86548.	to 1856 10 ys	987984	to 1856 10 ys	1110480	to 1856 10 ys	1222980	to 1856 10 ys	1335476
to 1865 10 ys	1012605	to 1865 10 ys	123140.	to 1865 10 ys	1450200	to 1865 10 ys	1668936	to 1865 10 ys	1887789	to 1864 9 ys.	2011191
to 1874 10 ys	1380078	to 1874 10 ys	173011.	to 1873 9 ys.	2000150	to 1870 6 ys.	2062977	to 1867 3 ys.	2062946		
to 1883 10 ys	1880901	to 1878 5 ys.	200641.								
to 1885 3 ys.	2014867										

If the number of inhabitants in any given year be multiplied by 32, it will show the number of acres settled: or, if it be divided by 20, it will give the number of statute miles settled.

The following table, given by Baron Ch. Dupin in his "Forces Productives et Commerciales de la France," showing the rate of increase in the population of the principal States of Europe, is highly curious, and may not be considered irrelevant to this statement:—

Annual increase upon each million of inhabitants, and period in which the population would double itself if the increase continued uniform:—

	Increase in 1,000,000 inhabitants.		Period of doubling.
Prussia,	27,027	....	26 years.
Britain,*	16,667	....	42 ,,
Netherlands,	12,372	....	56½ ,,
Two Sicilies,	11,111	....	63 ,,
Russia,	10,527	....	66 ,,
Austria,	10,114	....	69 ,,
France,	6,536	....	105 ,,

* This estimate is made upon the population of Europe in 1827, and as respects Great Britain is rather high; from 1811 to 1821 the increase was about 13,700 for Britain; for Ireland it might be about 20,090; and for both 15,800, and the period of doubling 45 years.

Von Malchus states the annual increase in all Europe to be two per cent., on about 215,000,000 inhabitants—the average issue of marriages four children.

NOTES.

(1) In 1832 the public domain in the new States and territories unsold, to which the Indian title had been extinguished, was estimated at . . . . 227,293,884 acres.
And the quantity in the same, to which the Indian title had not been extinguished, at 113,577,869
340,871,753
The quantity of land beyond the limits of those States and territories, has been estimated . 750,000,000
1,090,871,753
—*Pitkin's Statistics of the United States*, 1835.

(2) The average value of lands per acre (including buildings), according to the valuations in 1814 and in 1815, ranged for each State from four dollars, the value of lands in Kentucky, to 39 dollars, the value of land in Rhode Island. The average value in 1814 of lands throughout the United States was about ten dollars per acre.—*Pitkin's Statistics.*

(3) According to the rate of increase upon the previous census in 1820, which gave an increase of 3,227,839 souls, the population might probably have been in 1834, 15,000,000 inhabitants.

(4) The population of Upper Canada, according to the census for

1811	was	77,000	1827	was	176,059
1824	...	151,000	1828	...	185,526
1826	...	163,702	1830	...	215,000

(5) Vide Bouchette.

(6) The number of acres under agricultural improvement in 1828 did not exceed 570,000 acres.—(Vide Bouchette.)

(7) T. Neilson, "Prize Essay."

(8) The population in 1838 being 400,000 inhabitants, would thus settle 12,800,000 acres.

The Grand Trunk Railway—The Victoria Bridge.

We are indebted to the kind and ready acknowledgement of a request made in the name of the Council of the Canadian Institute to Alexander Mackenzie Ross, Esq., Engineer in Chief of the Grand Trunk Railway, for the original copy of the engraving of the Victoria Bridge, which appears in the present number of the *Canadian Journal.*

This remarkable structure will be without a rival upon the Continent of America, and may, perhaps, be the most stupendous and imposing work of its class in the world. Mr. Ross describes the Victoria Bridge in the following comprehensive paragraph:—

"No better description of the design can be given, than that it consists of a wrought-iron box, 20 feet deep, 16 feet wide, and about 7000 feet in length; supported at intervals of about 260 feet, by towers of stone, and open at both ends to admit of the trains passing through it, and made of sufficient strength to carry six times the heaviest load hitherto known to travel on railways in this or any other country."

In the accompanying plate of the Victoria Bridge, the centre arch is indicated by the steamer passing through it; the width between the towers is here 330 feet, or 110 yards, and the enormous tube which spans the gulf must be constructed so as "to sustain six times the heaviest load hitherto known to travel upon any railway in the world." Of course this is to be understood as applying to a train or part of a train 110 yards long—nevertheless involving a degree of strength and durability of which it is extremely difficult to form a just and accurate conception.

We hope to be able to furnish diagrams and descriptions of the details of this great Canadian work in future numbers of the *Journal*.

It will not be inappropriate, perhaps, to announce here the intention of the Council of the Institute to publish, from time to time, plans and views of the leading structures on the Grand Trunk, the Great Western, and other railways of Canada. Nor do we think that the time is far distant when—in continuing our illustrations of the great public works of this country—we may be enabled to delineate the details of the unrivalled Welland and St. Lawrence Canals, the Slides of the Ottawa, the Suspension Bridge and Rideau Locks at Bytown and other magnificent structures, which are scarcely known except by a misty reputation beyond the counties in which they are situated.

Subjoined is Mr. Stephenson's report on the Victoria Bridge to the Directors of the Grand Trunk Railway:—

24, Great George Street, Westminster,
2nd May, 1854.

Gentlemen,—Absence from England, and other unexpected circumstances, have prevented my sooner laying before you the results of my visit to Canada last autumn, for the purpose of conferring with your Engineer-in-Chief, Mr. Alexander Ross, respecting the Victoria Bridge across the River St. Lawrence, in the vicinity of Montreal.

The subject will naturally render itself into three parts, viz.:—

First,—The description of Bridge best adapted for the situation.

Second,—The selection of a proper site.

Third,—The necessity for such a structure.

Regarding the first point, I do not feel called upon to enter upon a discussion of the different opinions which have been expressed by engineers, both in England and America, as to the comparative merits of different classes of bridges, and more especially as between the suspension and tubular principles, when large spans become a matter of necessity. It is known to me that in one case in the United States a common suspension bridge has been applied to railway purposes, but from the information in my possession from a high engineering authority in that Country, the work alluded to can scarcely be looked upon as a permanent, substantial, and safe structure. Its flexibility, I was inform[illegible] was truly alarming, and although another structure of this kind is in pr[illegible]ess of construction near Niagara, in which great skill has been shewn in designing means for neutralising this tendency to flexibility, I am of opinion that no system of trussing applicable to a platform suspended from chains will prove either durable or efficient, unless it be carried to such an extent as to approach in dimensions a tube fit itself for the passage of railway trains through it. Such bridge may doubtless be successfully, and perhaps with propriety, adopted in some situations, but I am convinced that even in such situations, while they will in the first cost fall little short of wrought iron tubes, they will be more expensive to maintain, and far inferior in efficiency and safety.

I cannot hesitate, therefore, to recommend the adoption of a Tubular Bridge, similar in all essential particulars to that of the Britannia over the Menai Straits in this Country; and it must be observed, that, the essential features being the same, although the length much exceeds that of the work alluded to, none of the formidable difficulties which surrounds its erection will be involved in the present instance. In the Britannia, the two larger openings were each 460 feet, whereas in the proposed Victoria there is only one large opening of 330 feet, all the rest being 240 feet. In the construction of the latter, there is also every facility for the erection of scaffolding which will admit of the tubes being constructed in their permanent position, thus avoiding both the precarious and expensive process of floating, and afterwards lifting the tubes to the final level by hydraulic pressure.

In speaking of the facilities, it is a most agreeable and satisfactory duty to put on record that the Government Engineering Department has, throughout the consideration of this important question, exhibited the most friendly spirit, and done everything in its power to remove several onerous conditions which were at one time spoken of as necessary, before official sanction would be given for the construction of the Work.

On my arrival in Canada, I found that Mr. A. M. Ross had collected so much information bearing on the subject of the site of the Bridge, that my task was comparatively an easy one.

Amongst the inhabitants of Montreal, I found two opinions existing on this point—somewhat conflicting: the one side maintaining that the River should be crossed immediately on the lower side of the city, where the principal channel is much narrower than elsewhere, and where also the Island of St. Helens would shorten the length of the Bridge; the other seeming to be in favour of crossing a little below Nun's Island.

Sections of the bed of the River at both points had been prepared, and a careful study of these left no doubt on my mind that the latter was decidedly the one to be adopted.

In addition, however, to the simple question of the best site for the construction of a bridge across the St. Lawrence, my attention was specially called to the feasibility of erecting and maintaining such a structure during the breaking up of the ice in spring, when results take place which appear to every observer indicative of forces almost irresistible, and, therefore, such as would be likely to destroy any piers built for the support of a bridge. I have not myself had the advantage of witnessing these remarkable phenomena, but have endeavoured to realise them in my mind as far as practicable by conversation with those to whom they are familiar, and, in addition to this, I have read and studied with great pleasure an admirable and most graphic description by Mr. Logan of the whole of the varied conditions of the river, from the commencement of the formation of ice to its breaking up and clearing away in spring. To this memoir I am much indebted for a clear comprehension of the formidable tumult that takes place at different times amongst the huge masses of ice on the surface of the river, and which must strike the eye as it irresistible forces were in operation, or such as, at all events, would put all calculations at defiance.

This is no doubt the first impression on the mind of the observer; but more mature reflection on the subject soon points out the source from which all the forces displayed must originate.

The origin of these powers is simply the gravity of the mass occupying the surface of the water with a given declivity up to a point where the river is again clear of ice, which in this case, is at the Lachine Falls. This is unquestionably the maximum amount of force that can come into play; but its effect is evidently greatly reduced—partly by the ice attaching itself to the shores, and partly by its grounding upon the bed of the river. Such modifications of the forces are clearly beyond the reach of calculation, as no correct date can be obtained for their estimation; but if we proceed by omitting all consideration of those circumstances which tend to reduce the greatest force that can be exerted, a sufficiently safe result is arrived at.

In thus treating the subject of the forces that may be occasionally applied to the piers of the proposed bridge, I am fully alive to many other circumstances which may occasionally combine in such a manner as apparently to produce severe and extraordinary pressure at points on the mass of ice or upon the shore, and, consequently, upon the individual piers of a bridge. Many inquiries were made respecting this particular view, but no facts were elicited indicative of forces existing at all approaching to that which I have regarded as the source and the maximum of the pressure that can at any time come into operation affecting the bridge.

I do not think it necessary to go into detail respecting the precise form and construction of the piers, and shall merely state, that in forming the design, care has been taken to bear in mind the expedients which have hitherto been used and found successful in protecting bridges exposed to the severe tests of a Canadian winter, and the breaking of the ice of frozen rivers.

I now come to the last point, viz., the necessity of this large and costly bridge.

Before entering on the expenditure of £1,400,000 upon one work in any system of Railways, it is of course necessary to consider the bearing which it has upon the entire undertaking if carried out, and also the effect which its postponement is likely to produce.

These questions appear to me to be very simple, and free from any difficulty.

An extensive series of Railways in Canada, on the north side of the St. Lawrence, is developing itself rapidly; part of it is already in operation, a large portion fast progressing, and other lines in contemplation, the commencement of which must speedily take place.

The commerce of this extensive and productive country has scarcely any outlet at present, but through the St. Lawrence, which is sealed up during six months of the year, and therefore very imperfectly answers the purposes of a great commercial thoroughfare.

Experience, both in this and other countries where railways have come into rivalry with the best navigable rivers, has demonstrated, beyond the possibility of question, that this new description of locomotion is capable of superseding water carriage wherever *economy* and despatch are required; and even where the latter is of little importance, the capabilities of a railway, properly managed, may still be made available, simply for economy.

The great object, however, of the Canadian system of railways is not to compete with the River St. Lawrence which will continue to accommodate a certain portion of the traffic of the country, but to bring those rich provinces into direct and easy connection with all the ports on the East Coast of the Atlantic, from Halifax to Boston, and even New York,—and consequently *through these ports, nearer to Europe.*

If the line of Railway communication be permitted to remain severed by the St. Lawrence, it is obvious that the benefits which the system is calculated to confer upon Canada must remain in a great extent nugatory, and of a local character.

The Province will be comparatively insulated, and cut off from that coast to which her commerce naturally tends; the traffic from the West must either continue to adopt the water communication, or, what is more probable —nay, I should say, *certain*—it would cross into the United States, by those lines nearly completed to Buffalo, crossing the river near Niagara.

No one who has visited the country, and made himself acquainted only partially with the tendencies of the trade which is growing up on all sides in Upper Canada, can fail to perceive that if vigorous steps be taken to render railway communication with the Eastern Coast through Lower Canada uninterrupted, *the whole of the produce of Upper Canada will find* its way to the Coast through other channels; and the system of lines now comprised in your undertaking will be deprived of that traffic upon which you have very reasonably calculated.

In short, I cannot conceive anything so fatal to the satisfactory development of your Railway as the postponement of the bridge across the river at Montreal. The line cannot, in my opinion, fulfil its object of being the *high road for Canadian produce*, until this work is completed; and looking at the enormous extent of rich and prosperous country which your system intersects, and at the amount of capital which has been already, or is in the progress or prospect of being expended, there is in my mind no room for question as to the expediency—indeed, the absolute necessity of the completion of this bridge, upon which, I am persuaded, the successful issue of your great undertaking mainly depends.

I am, Gentlemen, yours faithfully,

ROBERT STEPHENSON.

To the Directors of the Grand Trunk Railway of Canada.

Canadian Institute.

At a general meeting of the Institute, held on the 6th of May, 1854, the following resolution was adopted:—

"That the amalgamation of the Toronto Athenæum with the Canadian Institute be agreed to, and be carried into effect according to the conditions set forth in the communication from the Council, which has just been read."

The Communication from the Council consisted of a recommendation to adopt and act upon the Report of the Special Committees of the Canadian Institute and Toronto Athenæum, appointed to confer on the subject of the union of those Institutions.

The Report alluded to, together with the resolution of the Council, are given in full on page 195 of this *Journal*, and need not, therefore, be repeated here.

At a meeting of the Council of the Canadian Institute, held on Saturday, June 3d, it was resolved—

"That the thanks of the Council be transmitted to Alexander Mackenzie Ross, Esq., Chief Engineer of the Grand Trunk Railway, for his kindness in furnishing the original copy of the plate of the Victoria Bridge, which appears in the June number of the *Canadian Journal*."

A member of the Canadian Institute, distinguished as much by an ardent love for natural science as for the remarkable liberality with which he encourages and promotes its study, has signified his intention of presenting the Institute with a very commodious piece of land in the city of Toronto for the construction of a building, subject to the condition that, either through the munificence of the Provincial Government or by means of private liberality, the necessary funds for the erection of a suitable building be ensured. We hope to enjoy the privilege of *being more explicit and definite in the July number.*

Coal in Canada.

We have observed with much regret that the question of the existence of coal in Canada West is again revived. The dark-coloured bituminous shales of the Utica slate have been once more mistaken for the "black diamond." The shales alluded to in a letter which has lately acquired a very wide circulation throughout this country by means of the provincial press, are many thousand feet below the true coal measures, and no wilder speculations could be indulged in than attempts at finding coal where those black shales appear. Sensible persons will soon be perfectly satisfied on this matter by the speedy publication in this *Journal*, of a paper "On the Physical Structure of Western Canada," by W. E. Logan, F.R.S., and G.S. Provincial Geologist. The delays which have arisen in the publication of that distinguished geologist's paper, have proceeded from the great difficulty which has been experienced in obtaining a correct copperplate engraving of a geological map of Western Canada. We hope, however, to be able to enrich the pages of the first number *of the third volume of the Canadian Journal, to be published in* August next, with an accurate plate of Mr. Logan's most valuable and instructive map.

The Quebec Meteorological Table for *April* was received at the office of the Canadian Journal, on Tuesday, the 13th *June*. This unusual delay will probably form an excuse for its non-appearance in the present number. As yet, we are quite unable to conjecture with whom the fault lies. We hope that it will be found side by side with its May brother in our next issue.