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COTTON, WOOL, AND FLAX.

An analysis of Human labour in the aggregate shows many startling results. Few care to know how the masses earn their daily bread, or in what pursuits the majority of their fellow creatures in the old monarchies of Europe sustain existence from year to year, and often acquire a comfortable maintenance, sometimes affluence, and rarely rank and power. It is not a subject of general interest to know that in the United Kingdom, there is one person in every 72 of the population employed in a Cotton factory, while in Switzerland there is one in 100, in France one in 132, and in Austria one in 1,312, so spending their lives. Such knowledge however is of great value to the statistician, the politician, and the philanthropist. It shows the direction of labour, and from it the condition of a country in 10 or 12 years time, other things being equal, may be predicated with a considerable degree of certainty. The relative quantities of textile fabrics consumed per head by the people of the United Kingdom and Austria are in the proportion of £2 6s. 3d. sterling against 14s. 1d. In France the proportion of these fabrics consumed per head amounts to £1 4s. 7d. These items, insignificant as they appear, prove that the people of Great Britain and Ireland can afford twice and three times the amount of clothing indulged in by the Austrians and French; and that whilst the British people not only clothe themselves with comparative luxury, they are enabled to send to other nations, if they will admit them, as many of their moderately priced comforts and luxuries of clothing as they require, and thus help to raise the comfort of the masses among many foreign people to a degree of equality with their own.

A very able paper has recently been read before the Society of Arts "On the progress of textile manufactures in Great Britain," by Mr. Alex. Redgrave, one of Her Majesty's Inspectors of Factories. The facts elicited during the discussion on this important paper were of the greatest interest, and possess an attraction quite apart from their statistical or commercial value, on account of the insight given to the public respecting the manner in which a large part of the textile fabrics sent into the market are produced. We shall endeavour in this article to give a summary of Mr. Redgrave's paper and the discussion which followed.

There are four classes of raw products convertible into textile fabrics:—these are cotton—wool and worsted—flax, hemp, and its tribe—and silk. Wool and worsted, although the same material, are of a different nature, and require to be manufactured in a different manner; they are, therefore, treated of separately, and it is usual to divide the textile fabrics into five classes.

The cotton trade represents more than one-half of the whole of the textile fabrics.

The woollen manufacture, once the chief textile industry of the country ranks second in importance.

Worsted, which is obtained by separating the long fibre of the wool from the shorter staple, ranks as the third.

Flax is fourth; and silk is the fifth and last.

There are various methods of exhibiting the extent of these manufactures, in some of which, perhaps, the order in which they are enumerated might be varied, but taking the general importance and probable value of the several branches of manufacture, the order in which they have been named will be found the most correct.

Statistics have been procured, at intervals, by the Inspectors of Factories, with reference to the establishments under their supervision, viz., those in which either of the raw materials enumerated are spun or manufactured. No account has ever been taken of the print-works, bleaching and dyeing works, lace factories, &c., which are excluded from the operation of the Factory Acts, and the following figures refer, therefore, to those establishments only in which the first processes of manufacture, up to and including the weaving, are carried on by the aid of water or steam power.

	No. of Factories.	Horse-power.
Cotton	2,210	97,132
Wool	1,505	25,901
Worsted	525	14,904
Flax	417	18,322
Silk	460	5,176
	5,117	161,435

	No. of Spindles.	No. of Power Looms.
Cotton	28,010,217	298,847
Wool	1,786,972	14,453
Worsted	1,324,549	36,956
Flax	1,288,043	7,689
Silk	1,093,799	9,260
	33,503,580	367,205

	No. of Persons Employed.		
	Males.	Females.	Total.
Cotton	157,186	222,027	379,213
Wool	45,583	33,508	79,091
Worsted	30,023	57,771	87,794
Flax	23,446	56,816	80,262
Silk	16,899	39,238	56,137
	273,137	409,360	682,497

Mr. Redgrave estimates that there are 682,497 persons employed in establishments subject to the factory act, and 887,369 persons employed upon textile fabrics—in establishments not under the provisions of the factory act, which two classes of persons have dependent upon them at least 3,000,000 of unemployed persons, representing a total of 4,568,082 persons dependent upon the textile fabrics for their maintenance; being in the proportion of 16 per cent., or one-sixth of the population. But there are others, though not directly employed upon the fabrics themselves, equally dependent upon the prosperity of textile manufactures for their subsistance—for instance:—

Those engaged in the procuring of coal (at least 3,000,000 tons are consumed per annum in factories, print-works, &c.). Those engaged in the procuring of iron, engine and machine makers. Those engaged in the leather trade, in the manufacture of grease, in the procuring of oil, dry wares, paper, skips, or baskets, and of various minor articles used in manufacturing establishments. Those employed in warehouses, &c., &c.

At a moderate computation, the above persons and their families would raise the number of those dependent upon the textile fabrics to 20 per cent., or one-fifth of the population.

The following table shows the relative strength of the different countries in relation to cotton fabrics.

Countries	No. of Factories.	No. of Spindles.	No. of Persons employed.
Austria	202	1,500,000	30,020
Bavaria	18	558,700	12,000
Belgium	169	600,000	12,000
France	2,394	3,457,552	244,579
Prussia	132	194,290	5,201
Russia	70	1,400,000	50,000
Saxony	134	604,646	12,000
Switzerland	132	1,112,625	20,000
The smaller States of Germany	30	440,000	8,000
	3,281	9,867,813	393,800
Great Britain & Ireland	2,210	28,010,217	379,213

The above number of spindles, say in round numbers 10,000,000, are known to be in operation in certain countries in Europe, being those most engaged in industrial pursuits, and containing an aggregate population of 160,000,000. If to the remaining countries, containing a population of 55,000-000, we give 4,000,000 spindles, which is a very large estimate for Spain, Portugal, Italy, Turkey, Greece, Denmark, Holland, &c., it will be found that the continent of Europe gives employment to 14,000,000 spindles. To this number must be added the probable number in operation in America, which has been estimated not to exceed 7,000,000. There will then be a total of 21,000,000 out of England, tended by every variety of race, each with their different characteristics and habits, while in Great Britain alone there are 28,000,000, tended by industrious, intelligent, and steady operatives.

From a comparison of the Table just quoted with the first Table, the following results are obtained:—That in the United Kingdom there is one person employed in a cotton factory to every 72 of the population.

In Switzerland	One in every	100
France	"	132
Saxony	"	141
Prussia	"	300
Belgium	"	350
Bavaria	"	416
The smaller States of Germany	"	625
Austria	"	1,313

The following shows the value of the textile fabrics manufactured in the United Kingdom in 1856:—

	Estimated value of Goods manufactured	Quantity exported	Estimated quantity consumed in the country.
	£	£	£
Cotton	55,298,778	38,283,770	17,015,008
Wool	23,942,976	5,985,744	17,975,232
Worsted	12,715,569	6,415,569	6,300,000
Flax	15,100,000	6,262,588	8,837,412
Silk	18,900,000	2,966,938	15,933,062
Total	125,957,323	59,914,609	66,060,714

It is commonly believed that notwithstanding all the appliances of science, art, and marvellous skill, the hand looms of the East surpass in the beauty and delicacy of their productions the most elaborate efforts of the British manufacturer.

The beauty, softness, and delicacy of the fabrics of India have long been celebrated. We are accustomed to think of them with wonder, and to despise somewhat their coarser but cheaper rivals of Manchester and Glasgow. But these exquisite productions have been created in satisfaction of the law of supply and demand. The rajahs and princes of India, swathed in riches and steeped in luxurious pleasures, require in their enervating climate the softest and most delicate tissues for themselves as well as for their Zenana.

The use of the very finest muslins is restricted to members of a royal house. In a country which contains two prominent classes—princes and peasants—the former will naturally prevail, and we find throughout India that there has been a demand for the choicest and most beautiful specimens of manufacturing art, for the gratification of the powerful and the rich. The chief thought of the dependent has been to produce the most luxurious and most exquisite fabric for the prince and his favourites. The intelligence and dexterity of the spinner and weaver are taxed to the utmost strength to supply their wishes or anticipate their wants, and the reward is frequently as lavish as it is generous; and in proof of the estimation in which the art of weaving is held, Mr. Redgrave states that the Hindoo weaver ranks above all other mechanics, and next below the scribe. The delicacy and fineness of the Dacca muslins are not easy to describe. In the imaginative language of the East, they have been called "webs of woven wind;" and it has been stated that when laid upon the grass to be bleached, and the dew is upon it, it cannot be discerned. That this latter description is not overdrawn, we may gather from a circumstance which is related to have taken place at the court of Arungzebe. He is said to have chidden his daughter for appearing before him too thinly clad, when she replied to him that she was clothed in nine folds of raiment. She might have added that her garment contained a filament of cotton which, if produced, would measure upwards of forty miles. And a Persian ambassador, upon returning from India to his own country, is said to have presented his Sovereign with a cocoa-nut containing a piece of India muslin for a turban 30 yards in length, which when expanded in the air could hardly be felt.

"Reckoning the dress of the daughter of Arungzebe as containing 20 square yards, and that four miles of yarn could be spun by an expert spinner in India from 180 grains of cotton, her dress would weigh about four ounces, and contain forty miles of yarn; and then, calculating according to the English method of determining the fineness, or, as it is technically called, the counts, or numbers, of yarn, by reckoning so many hanks or skeins, of 840 yards each skein, to a ℔ weight, it would appear that her dress was made of about 320's, *i. e.*, 320 hanks of cotton yarn, each measuring 840 yards=160 miles of yarn, which would weigh 1℔. But to spin 300's is no marvel in Britain; 700's are constantly spun for the manufacture of lace, *i. e.*, a pound of yarn of that degree of fineness will measure upwards of 334 miles in length. The Messrs. Thos. Houldsworth & Co., of Manchester, who probably, spin the finest yarn in England, spun for the Great Exhibition of 1851 specimens in short lengths of 2,150's=1,026 miles to the pound weight, and the estimate is that the fibre of the raw cotton from which this yarn was spun would average 8,000's *i. e.*, it would require 8,000 hanks of a single fibre of the raw cotton, each hank measuring 850 yards, to weigh one pound. It may be true that the delicate fingers and sensitive organism of the Hindoo girl may enable her to manipulate the fibre of the cotton in spinning, with a certain degree of elasticity of which the spinning machine is incapable, but in the one quality of degree of fineness, we compete successfully with the Hindoo."

"It has been well said by Lord Palmerston, that dirt is only to be condemned when it is in the wrong place. Now, a factory is certainly not the place for the accumulation of dirt, nor is the stream which flows in its vicinity the proper place for its reception. All offensive and dirty matters used to be freely discharged into the nearest stream, but now the dirty and greasy washings of factories, and herein I allude chiefly to woollen and worsted factories, are conducted to a tank, and by a very simple process the watery particles are discharged, and the residuum is reconverted into a fatty substance, largely used for candles and the manufacture of soap. In one establishment alone I am assured that a profit of £800 a year, after paying a rent of £200 to some neighbouring factories for their refuse, is made by this conversion to useful purposes of the dirt which formerly polluted the stream and neighbourhood."

It has been found that old materials form very good substitutes for new. The bits of raw cotton which do not pass through the machines, the ends of rovings and yarn, the flaws, which are broken off, are all carefully preserved, and undergo several modes of preparation by which they become serviceable for various purposes. It is the same with wool, with flax, and with silk—but the chief utilisation of old materials is the manufacture of new coats out of old. A Polish Jew, or Italian beggar, is generally considered one of the dirtiest objects with which we can come in contact, yet it is not impossible that some of us may, at this moment, happily unconscious of our fate, be wearing some portion of the cast-off habiliments of a Polish Jew. Coats, trowsers, &c., after having been well worn in England, are shipped off for the German ports, and after having been distributed where most in request, and thoroughly used up as garments, they return to us as woollen rags. They are sorted into qualities, and they then go through a machine called a devil, which tears up the bits of cloth and delivers them out as wool, which undergoes again the various processes of carding, spinning, &c., and being mixed with new wool, again becomes cloth.

It is calculated that at least 45,000,000 ℔s. of woollen rags are annually consumed, which is about one-fifth of the whole of the material, new or old, now used in the manufacture of woollen cloth. Twenty-five years ago the price of the woollen rags averaged about £4 4s. per ton, but the present demand for them has raised that price to £44 per ton. When these rags were first introduced, and for some years afterwards, they were only of use if they contained nothing but wool originally. But the demand became so pressing, that the rags of fabrics made of cotton and wool, and of cotton and worsted, are no longer rejected. They undergo a process called "extraction," by which the cotton is destroyed, and the woollen fibre is preserved and utilised. Although rags are very generally used in woollen factories, they are principally manufactured at Dewsbury, Batley, and the neighbourhood near Leeds, in which it is estimated that from 7,000,000 to 8,000,000 of yards of cloth are annually manufactured, of the value of £1,500,000.

The amount of material produced by the looms of the United Kingdom is almost incredible. The cotton yarn annually spun in that country, reckoning it to be of an average size, would reach 600,000 times round the earth, and our looms produce annually 3,000,000 yards of calico.

The cotton factories contain one-half of the cotton spindles of the rest of the world, and can produce cotton better and cheaper than in any other country. They spin daily 50,000,000 of miles of yarn, from which our looms weave daily 10,000,000 yards of calico or other goods.

"Can it be wondered at that there is a party of politicans called the "Manchester School." It is common for us to condemn those who seek to maintain class interests, but do not all endeavour to support their own class? the army and navy—landowners—coal-owners—ironmasters, all keep their own interests before them. The manufacturers do the same. They have wealth, they have intelligence, and the 6,000 or 7,000 masters have the responsibility of being in the aggregate the mainstay of nearly one-fifth of the country."

There were consumed in 1860 not less than one thousand million lbs. of cotton, and the maximum extent of the manufactory of textile fabric reached £150,000,000 stg. At least 75 per cent. of the superior descriptions of paper are now made from the refuse of the Cotton Mills.

The statistics supplied by Mr. P. L. Simmonds who has had lately under his care the preparation of new editions of "Ure's History of the Cotton Manufacture" and other commercial works, go far beyond those given in the foregoing paragraphs, which were completed up to the year 1856. The position of the Textile Industry in 1850, Mr. Simmonds represents to us as follows:—

Textile Industry.	Estimated value of Goods Manufactured	Declared value of Quantity Exported.	Estimated Quantity consumed in the U. Kingdom. Value.
	£	£	£
Cotton	104,000,000	52,000,000	52,000,000
Wool and Worsted	32,000,000	16,000,000	16,000,000
Flax....................	18,600,000	6,600,000	12,000,000
Silk......................	18,400,000	2,400,000	16,000,000
	173,000,000	77,000,000	96,000,000

In explanation of this table it is stated in relation to cotton that the exports have nearly doubled in the last ten years. In 1850 we shipped £28,400,000; in 1855, £34,800,000; and in 1860, £52,000,000. The imports of raw cotton have also doubled in the same period. In 1850 we received 663½ million pounds; in 1855, 892 million pounds, and in 1860, 1,391 million pounds. Passing next to wool and worsted—Mr. Simmonds calculated it at 200,000,000lbs., but these opinions were conjectural. The nett imports of foreign and colonial wool (less the re-exports) were, in 1850, 64,000,000lbs.; in 1855, 70,000,000lbs.; and in 1860, 118,000,000lbs. The exports of woollen manufactures, including yarn, &c., had been to the value of £9,000,000 in 1850, £7,700,000 in 1855 (a year of war), and £16,000,000 in 1860. Pass next to the linen trade. There were more than 100,000 acres under culture with flax in Ireland, and at least £12,000,000 of capital employed in the trade. Our foreign supplies of flax are declining, for in 1850 we received 1,822,918 cwts., while in each of the past years we had received less than 1½ million cwts. But there is a fibrous material brought in and largely worked up now at Dundee with flax, which ought not to be lost sight of, namely jute, of which we imported upwards of 1,000,000 cwts. in 1859, a quadruple increase since 1853. Our exports of linen manufactures have not increased very rapidly; the value of the shipments in 1850 and 1855, was £5,000,000, and in 1860, £6,600,000, but the bulk of this manufacture was used at home, and was fully double the value of that exported. The last textile for notice is silk; and here, too, the principal quantity made is used at home. The value of the exports stood in the following order:—1850, £1,250 000; 1855, £1,523,000; 1860, £2,400,000. The total value, from the data and estimates submitted by Mr. Simmonds, showed an increase of fully 50 per cent. upon the returns submitted by Mr. Redgrave, and, even making all reasonable deductions for error, they would give, it was thought, a fairer estimate of the magnitude of the trade and of the present aggregate value of the textile industries of the kingdom. The utilisation of waste substances, the collection of the blowings and droppings, the recovered grease in the wool-factories, the re-conversion of old rags and mixed fabrics, &c.; these have risen into such importance that woollen rags, at one time worth only £4, now fetched £40 per ton. The use of these has been stigmatised as a fraud upon the consumers, and a disgrace to the manufacturers and to the country. But, in truth, the reconversion of old wool is a matter of necessity, arising from the dearth of raw material and the demand for cheap goods.

CATALOGUE OF THE ECONOMIC MINERALS OF CANADA.*

Metals and their Ores.

Magnetic Iron Ore.—Marmora, four localities; Madoc, four localities; South Sherbrooke, Bedford, Hull, three localities; Portage du Fort.

Specular Iron Ore.—Wallace Mine (Lake Huron,) MacNab, St. Arnaud, Sutton, three localities; Brome, three localities, Bolton.

Limonite (*Bog Ore.*)—Middletown, Charlotteville, Walsingham, Gwillimbury West, Fitzroy, Eardley, March, Hull, Templeton, Vaudreuil, St. Maurice, Champlain, Batiscan, Ste. Anne, Portneuf, Nicolet, Stanbridge, Simpson, Ireland, Lauzon, St. Vallier.

Titaniferous Iron.—St. Urbain (Baie St. Paul,) Vaudreuil (Beauce.)

Sulphuret of Zinc (*Blende.*)—Prince's Mine and Mamainse (Lake Superior).

Sulphuret of Lead (*Galena.*)—Fitzroy, Landsdowne, Ramsay, Bedford, Bastard, la Petite Nation, Anse des Sauvages, and Anse du Petit Gaspè, Maimanse.

Copper.—St. Ignace and Michipicoten Islands (Lake Superior,) St. Henri, *native copper*. Prince's Mine (Lake Superior,) *sulphuret of copper*. Mica Bay and Maimanse (Lake Superior) *sulphuret variegated copper and copper pyrites*. Bruce's Mine (Lake Huron,) Root River, Echo Lake and Wallace Mine (Lake Huron,) *copper pyrites*. Inverness and Leeds, *variegated copper*. Upton, *argentiferous copper pyrites*. Ascot, *copper pyrites containing gold and silver*.

Nickel.—Michipicoten (Lake Superior,) *arsenical nickel, with a hydrated silicate of nickel*. Wallace Mine (Lake Huron,) *sulpharseniuret of nickel*. Dailleboui Berthier, *nickeliferous pyrites*. Ham and Bolton, in small quantities, associated with chromic iron; the nickel in most of these different localities is associated with a little cobalt.

Silver. — St. Ignace and Michipicoten Islands (Lake Superior,) *native silver with native copper*. Prince's Mine (Lake Superior,) *native silver with sulphuret of silver*.

Gold.—Seigniory of Vaudreuil, Beauce, on the Rivers Guillaume, Lessard, Bras, Touffe des Pins, and du Lac. Seigniory of Aubert de Lisle. Rivers Famine and du Loup. Aubert-Gallion, Poses's Stream, and the River Metgermet. All these localities in the county of Beauce afford native gold in the alluvial sands. This auriferous region has an area of 10,000 square miles, and the precious metal has been found at Melbourne, Dudswell, Sherbrooke, and many other localities in the valleys of the St. Francis and the Chaudière. Native gold is also found in small quantities in Leeds, in a vein with specular iron, and at Vaudreuil, Beauce, with blende and pyrites. These sulphurets are both auriferous, and the copper pyrites of Ascot also contain a small proportion of gold. The native silver of Prince's Mine likewise contains traces of gold.

Non-Metallic Minerals.

Uranium.—The yellow oxyd of uranium is found in small quantities with the magnetic iron of Madoc.

Chromium.—Bolton and Ham are localities of chromic iron.

Cobalt.—At Prince's Mine, Lake Superior, *arseniate of cobalt* and associated with nickel in the localities mentioned above.

Manganese.—Bolton, Stanstead, Tring, Aubert-Gallion, Ste. Marie, Beauce, Ste. Anne, *earthy per-oxyd*.

Iron pyrites.—Clarendon, Terrebonne, Lanoraie, Garthsby.

Graphite.—Grenville, Fitzroy.

Dolomite.—Lake Mazinaw, North Sherbrooke Drummond, St. Armand, Dunham, Sutton, Brome Ely, Durham, Melbourne, Kingsey, Shipton, Chester' Halifax, Inverness, Leeds, St. Giles, Ste. Marie Saint Joseph.

Carbonate of Magnesia.—Sutton, Bolton.

Sulphate of Baryta.—Bathurst, Macnab, Landsdowne, and many localities on Lake Superior.

Iron Ochres.—St. Nicholas, Ste. Anne de Montmorency, Champlain, Waltham, Mansfield, Durham.

Steatite.—Sutton, Bolton, Melbourne, Ireland, Potton, Vaudreuil, Beauce, Broughton, Elzevir. The steatite of the last four localities is employed as a refractory stone, and that of Stanstead and of Leeds is ground and employed as a paint.

Lithographic Stone.—Marmora, Rama, late Couchiching.

Agates.—Isle St. Ignace, Michipicoten, and Thunder Bay (Lake Superior) Gaspé.

Jasper.—Great Rivière Ouelle, Gaspé.

Labrador felspar.—Mille Isles, Drummond and many other localities.

Aventurine.—Burgess.

Hyacinthe.—Grenville.

Corundum.—Burgess.

Amethyst.—Spar Island, and many other localities on Lake Superior.

Jet.—Montreal.

Quartzose Sandstone.—For the Manufacture of glass, Cayuga, Dunn, Vaudreuil, Isle Perrot, Beauharnois, and many localities on the north shore of Lake Huron.—The sandstone of St. Maurice is employed as a fire-stone for iron furnaces.

Retinite and Basalt.—For the fabrication of black glass: many localities on Lake Huron and Superior.

Gypsum.—Dumfries, Brantford, Oneida, Seneca, Cayuga, &c., the localities are very numerous.

Shell Marl.—Calumet, Clarendon, North-Gwillimbury, Bromley, MacNab, Nepean, Gloucester, Argenteuil, Hawkesbury, Vaudreuil, St. Benoit, Ste. Thérèse, St. Armand, Stanstead, St. Hyacinthe, Montreal, New Carlisle, (Gaspé.)

Phosphate of Lime.—Burgess, Hull, Calumet, Ottawa.

Millstones.—Several kinds of stone, more or less adapted to the purpose, are employed in Canada for the fabrication of millstones. The best is a corneous quartzite which accompanies the serpentine of the Eastern Townships, and has been wrought at Bolton.

A silicious conglomerate which serves to make millstones is found at Vaudreuil, at the Cascades, Ham and Port Daniel. We may mention also for this purpose the granites of Stanstead, Barnston, Barford, Hereford, Ditton, Marston, Stafford, Weedon and Vandreuil, Beauce, the granite millstones of Vaudreuil are much esteemed. The pseudo-granites and diorites of the mountains of Ste. Thérèse, Rouville, Rougemont, Shefford, Yamaska and Brome are also sometimes employed to make millstones.

* From the Report of the International Exhibition at Paris, 1855.

Grindstones.—A sandstone, known as the gray-band, and found at the base of the upper silurian of Western Canada in many localities is employed for the fabrication of grindstones. The Potsdam sandstone and a sandstone from Gaspé basin are also employed for the same purpose.

Whetstones.—Madoc, Marmora, Lake Mazinaw, Fitzroy, Potton, Stanstead, Hartley, Bolton, Shipton, Marston.

Tripoli.—Laval, Lanoraie.

Building Materials.

Granites.—Large masses of a very beautiful intrusive granite are found in many of the townships of the East. Among other localities we may cite Stanstead, Barnston, Hereford, Marston, Megantic mountains, Weedon, Winslow, Stafford, and Lambton. The diorites of the mountains of the Ste. Thérèse, Rouville, Rougemount, Yamaska, Shefford, and Brome, furnish also good building stones.

Sandstone.—A beautiful variety of yellowish-white sandstone occurs at Niagara, Queenstown, Barton, Hamilton, Flamboro' West, Nelson, Nassagaweya, Esquesing, Nottawassaga, and Cayuga. Other localities are Rigaud, Vaudreuil, Ile Perrot, St. Eustache, Terrebonne, Beauharnois, St. Maurice, Lac des Allumettes, and Fitzroy.

Calcareous Sandstone.—Brockville, Ottawa, and a great many places on the Ottawa River, St. Nicolas (Lauzon), Cape Rouge Malbaie.

Limestones.—Malden, Manitoulin and St. Joseph's Islands, Cape Hurd, Cabot's Head, Sydenham, Euphrasia, Nottawassaga, Mono, Esquesing, Nelson, Ancaster, Thorold, Matchedash Bay, Orillia, Rama, Mara, Marmora, Madoc, Belleville, Kingston, Macnab, Ottawa, Plantagenet, Hawkesbury, Cornwall, Isle Bizard, Isle de Beauharnois, Caughnawaga, Montreal, Isle Jésus, Terrebonne, Philipsburg, St. Dominique, Grondines. Deschambault, Beauport, Baie St. Paul, Malbaie, Upton, Acton, Wickham, Magoon's Point, Stanstead, Hartley, Dudswell, Temiscouata Gaspé, Port Daniel, Richmond, Anticosti.

Hydraulic Limestones.—Point Douglas, (Lake Huron,) Paris, Cayuga, Thorold, Kingston, Loughboro', Hull, Quebec.

Roofing Slates.—Kingsey, Halifax, Lambton, Melbourne, Westbury, Rivière du Loup.

Flagging Stones.—Toronto, Etobicoke, River Credit, York, Temiscaming, Bagot, Horton, Clarendon, Sutton, Potton, Stanstead, Inverness, Port Daniel.

Clays.—Clays suitable for the fabrication of red bricks, tiles and coarse pottery, are everywhere found through the valleys of the St. Lawrence, Richelieu and Ottawa. Clays, for the manufacture of white bricks are met with at London, Toronto, Cobourg, and Peterborough.

Moulding Sand.—Augusta near Prescott, Montreal, Acadie, Stanstead.

Fuller's Earth.—Nassagaweya.

Marbles.—*White.*—Lake Mazinaw and Philipsburg.

Black.—Cornwall, Philipsburg.

Red.—St. Lin.

Brown.—Pakenham.

Yellow and Black.—Several varieties at Dudswell.

Grey and variegated.—Macnab, Philipsburg, St. Dominique, Montreal.

Green.—Serpentines affording several beautiful varieties of marble occur at Grenville, and along a range of 150 miles in the Eastern Townships. Among other localities we may mention Stukely, Brompton, Oxford and Vaudreuil—Beauce.

COMBUSTIBLES, &c.,

Peat.—Humberstone, Wainsfleet, Westmeath, Beckwith, Goulbourn, Gloucester, Cumberland, Clarence, Plantagenet, Alfred, Caledonia, L'Orignal, Osnabruck, Finch, Winchester, Roxburg, Longueuil, St. Hyacinthe, Monnoir, the Seigniory of Rivière du Loup, Riviere Ouelle, Macnider.

Petroleum.—Mosa and many localities on the Thames, River St. Jean and Ruisseau-Argenté. (Gaspé.)

Asphaltum.—Enniskillen.

CONDITION OF INDUSTRY IN FOREIGN COUNTRIES.

Hungary.

Bounded on the west by Germany; on the south and east by the tributary Turkish Provinces of Bosnia, Servia, Wallachia, and Moldavia; and on the north by the Carpathian mountains—Hungary forms nearly a square of 400 miles in each direction, comprising, with all its appendant States, an area of 133,000 square miles.

The Carpathians sweep nearly in a semi-circle round the northern and eastern border of Hungary. Several connected chains penetrate into the heart of the country, of which the most elevated are those of Tatra and Matra. The Julian Alps, and the mountains of the Banat, on the southern border, render a great part of the country very hilly. On the other hand, there are plains of enormous extent, such as that to the east of the Danube, watered by the Theiss, which covers a space of upwards of 22,000 square miles; and another, to the west of that river, reaching to the borders of Styria.

The rivers of Hungary are very important. The Danube rolls through it, chiefly from north to south. The Drave and the Save, from the east, bring to it all the waters of the great Alpine border of Southern Germany. The Theiss, after collecting nearly all the streams which flow from the Carpathians, falls in from the east, near the southern frontier. The Maros is the greatest tributary of the Theiss; and the Gran and the Waag are considerable streams, which flow into the Danube itself.

Only two of the lakes of Hungary are large—the Platten, or Balaton which receives the waters of nine streams, and the Neusiedler, the water of which is salt.

The mineral wealth of Hungary is very abundant. Gold and silver are found in great abundance at Schemnitz, Kremnitz, Schmöllnitz, &c., in some parts of Transylvania, and also at Ruszberg and Orawicza in the Banat. Gold-dust is washed from the Rivers Danube, Koros, and Maros, the latter of which yielded a lump weighing above 22 ounces, which is preserved in the National Museum. The mines of Hungary yield also large quantities of copper, iron, lead, coal, and salt; and amongst its treasures may be enumerated quicksilver, arsenic, antimony, sulphur, soda, saltpetre, marbles, porcelain clay, millstone, porphyries; and stones for artistic purposes are also found in abundance.

Population.

According to the latest census, taken in 1857, the population of Hungary with the Banat amounts to 9,679,243 souls; that of Crotia and Slavonia to 865,403 souls; and that of Transylvania to 2,180,121 souls.

Means of Communication.

Several lines of railway are already completed and in use.

The ordinary roads for communication cannot be said to be in a satisfactory condition. The best are to be found in the County of Wiesselburg, and, generally, in Upper Hungary, while in Lower Hungary they are very bad, materials for their construction being deficient. Those leading to the great seats of trade on the Danube are generally well maintained. The ordinary cross-roads are all but impassable in bad weather.

The most important communication by water is on the Danube and the Theiss, both for steam and ordinary navigation, after which follow the Rivers Drave and Maros. The canals, especially the Bega, are of great importance in the corn-trade. The lesser rivers, in their present condition, can be considered as navigable only for rafts; but it is thought possible, by proper regulation, to render some of them such as the Waag, the Gran, and the Koros, of great importance to trade.

Markets.

Hungary, with the Banat, has 632 market-places, at all of which fairs are held three or four times in the year; and it is computed that on each day of the year no less than eight markets are held in the country.

The four annual fairs of Pesth are known to the whole commercial world, and may be said to possess European importance. Next, after them, rank the fairs of Debreczin.

Agricultural Production.

According to the statistics furnished by Hain, Hungary produces annually:—

	*Austrian measures.**
Wheat	11,186,000
Rye	13,150,000
Maize	11,530,000
Barley	14,425,000
Oats	21,912,000
Buckwheat, rice, &c	1,250,000
Vegetables	1,500,000

In the northern districts of Hungary, rye, oats, and potatoes are the chief objects of agricultural production, being also the staple articles of food; while in Lower Hungary, and especially in the Banat, and also in the Counties of Stuhlweissenburg and and Eisenburg, wheat is almost exclusively cultivated. In all the other parts of the country, the species of grain mainly cultivated is rye, which the peasants chiefly use to prepare their ordinary bread. In some of the northern districts bread is generally made from oats and potatoes, while the populations of Rouman race live almost entirely on maize.

Rape-seed is produced on the plains of Hungary; *flax* is chiefly grown in Upper Hungary; and *hemp* in the southern counties, generally for home consumption.

* An Austrian measure slightly exceeds two English bushels.

Turnips are cultivated as food for cattle, and *beet-root* for the use of sugar-factories. The cultivation of other kinds of fodder for cattle is greatly neglected.

Potatoes are produced throughout the country, partly for food, and partly for the use of distilleries. Of late, however, many of these have ceased to work, owing, in some measure, to the increased taxes levied upon spirits and brandy, but chiefly on account of deficient capital.

Hops are but little cultivated, Those generally used are imported from Bohemia.

Tobacco.—The production of this plant has greatly diminished since it became an object of State monopoly.

Timber.—The value of the "forest" productions of Hungary is estimated at 40,743,000 florins. The oak forests are reputed to consist of two kinds: the red, a quick-growing, soft wood, of little use, except for firing; and the white—a firm, lasting timber, said to be well adapted for ship-building.

Wines.—The annual production of wine in Hungary is popularly estimated at 20,000,000 eimers, but statistically it is computed at 17,740,680 eimers, the value of which, is 66,037,000 florins, while the value of the wine produced in the Banat and Transylvania is 17,541,000 florins.

Hungarian wines may be divided into: 1. Liqueur wines; 2. Good dry table wines; 3. Effervescent wines; and 4. Wines of consumption. The liqueur wines, of which that made in the neighbourhood of Tokay is the most celebrated, are not to be considered as the finest samples of what the country produces. It is amongst the good dry table-wines that delicacy of flavour and aroma is found in perfection. Both white and red wines of the three classes above mentioned are produced in different districts, and not unfrequently in the same. Effervescent wines, known as Hungarian "Champagne," are almost exclusively made in the Pressburg district. The sweet wines, commonly called "Ausbruch," which resemble those known as "straw" wines in France, are the result of a course of manipulation which is adopted, with little modification, in all the best districts of Hungary. The fruit is not, as in France, gathered and laid or hung out to shrivel, but the vintage is deferred until a greater part of the fruit has become dead ripe and partly shrivelled on the vines. The fruit that is in this state is carefully selected during the vintage from that which has only reached ordinary maturity; the berries are hand-picked from the stalks, all that are rotten or damaged being excluded, and are reduced to a smooth mash or jelly by treading, when a sufficient quantity of the best must of unwithered fruit is added to render the whole liquid; the liquor is then frequently stirred to set the pips free, which are skimmed off as they rise to the surface. As soon as fermentation begins, this mash is passed through the press, and the liquor is collected in seasoned casks to ferment. The fermentation is slow, the wine not clearing itself generally in less than six months, and, in some instances, owing to peculiarities of season, not fining itself sufficiently for use under three years. About 400lb. weight of shrivelled fruit, and nearly 15 gallons of fresh must, are required to produce a fass (about 33 gallons) of really good Ausbruch. Next to Tokay, which is white, the most celebrated Ausbruchs are those of Ménesh (Ménes) which are mostly red; those of Rust and Oedenburg, which are white and red; those of Erlau, which are red, and those of St. Georgen, near Pressburg, which are white.

Of the great majority of the red and white dry table wines, it may be said that they possess considerable body, and that they are endowed with fine flavour and very delicate aroma. It is the opinion of a highly intelligent English traveller, whose notes on the vineyards of Hungary have been printed anonymously, and are full of interesting details,—that these wines are, as a rule, drier than French wines, more mellow than those of the Rhine, and more piquant than the choicest of Spain.

Wool.—There are no certain data as to the production of sheep-wool in Hungary and the adjacent States, but it may be computed as averaging annually about 200,000 cwt.

Cattle and Swine.—The best specimens of cattle are found in the plains of Lower Hungary, those of Upper Hungary being of small size. Nine hundred thousand oxen are annually reared in Hungary, Croatia, and Salvonia, and they form, together with swine, an important article in the export trade with the neighbouring States. There is also an extensive trade in bristles, which are said to be superior to those of Russia.

Skins, Sheep and Lamb.—The annual exportation of these articles is computed at 2,500,000 pieces, of which a considerable quantity is taken by two trading houses at Frankfort. The English importation of undressed lamb-skins from Austria amounted in 1858 to 324,444 pieces.

Among minor articles of trade are gall-nuts, honey and wax, linen rags, feathers, leather, &c.

The prevailing system of farming throughout the country is of the very rudest description. Wooden ploughs are used to turn the soil, and the operation of threshing is accomplished by the tramp of horses' feet. Primitive precepts accompany primitive art, and it is held shameful in Hungary "to muzzle the beast that treadeth out the corn."

There are some industrial enterprizes in connection with agriculture, but they cannot be said to be in a flourishing condition. Amongst them may be mentioned, distilleries of spirit from grain, potatoes, beet-root, &c.; beer breweries; sugar refineries and factories; and flour mills. These enterprises suffer from severity of taxation, and languish generally from want of capital. Indeed, in every department of husbandry, the want of capital is most severely felt in Hungary. Capital applied to the land itself; capital employed in the manufacture of implements; capital expended on the improvement and extension of the means of communication, would render Hungary one of the most flourishing agricultural countries in Europe.

Manufactures,

in the sense understood in England, can scarcely be said to exist in Hungary. There are, however, coarse domestic fabrics of linen and woollen for home consumption. Of late years, too, some factories have been established in the country, of which the following are the principal:—

1. The cotton-printing and blue-dyeing factory of the Brothers Goldberger, in Buda (Alt-Ofen).
2. The factory of the same kind, of Spitzen, in the same city.
3. The wood cutting and sawing mills in Pesth.
4. The China factory of Fischer, in Herend, in the county of Veszprim.
5. The cloth factory in Zai-Ugrocz, belonging to Count Zay.
6. The cloth factory of Gáes, belonging to a Joint Stock Company.

There are also some paper and chemical factories, and there are steam mills in Sneged, Snolnok, Buda, Pesth, &c., in which latter city is a factory of agricultural implements.

ON THE CHEMICAL HISTORY OF A CANDLE.

BY M. FARADAY, D.C.L., F.R.S.

From the Chemical News, Jan. 19th 1861.

Lecture III.—Products: Water from the Combustion—Nature of Water—A Compound—Hydrogen.

I dare say you well remember that when we parted we had just mentioned the word "products" from the candle. For when a candle burns we found we were able, by nice adjustment, to get various products from it. There was one substance which was not obtained when the candle was burning properly, which was charcoal or smoke, and there was some other substance that went upwards from the flame which did not appear as smoke, but took some other form and made part of that general current which, ascending from the candle upwards, becomes invisible and escapes. There were also other products to mention. You remember that in that rising current having its origin at the candle, we found that a part was condensible against a cold spoon, or against a clean plate, or any other cold thing, and part was incondensible.

We will first take the condensible part and examine it, and, strange to say, we find that that part of the product is just water—nothing but water. I last time spoke of it incidentally, merely saying that water was produced among the condensible products of the candle; but, to-day, I wish to draw your attention to water that we may examine it carefully, especially in relation to this subject, and also with respect to its general existence on the surface of the globe.

Now, having previously arranged an experiment for the purpose of condensing water from the products of the candle, my next point will be to show you this water; and perhaps one of the best means that I can adopt for showing its presence to so many at once, is to exhibit a very visible action of water, and then to apply that test to what is collected as a drop at the bottom of that vessel. I have here a chemical substance discovered by Sir Humphrey Davy, which has a very energetic action upon water, which I shall use as a test of the presence of water. If I take a little piece of it—it is called potassium, as coming from potash—if I take a little piece of it, and throw it in that basin, you see how it shows the presence of water by lighting up and floating about, burning. I am now going to take away the candle which has been burning underneath the vessel containing ice and salt, and you see a drop of water—a condensed product of the candle—hanging from the under surface of the dish. I will show you that potassium has the same action upon it as upon the water in that basin in the experiment we have just tried. See! it takes fire and burns in just the same manner. I will take another drop upon this glass slab, and when I put the potassium on to it you see at once, from its taking fire, that there is water present. Now, that water was produced by the candle, In the same manner, if I put this spirit-lamp under that jar, you will soon see the latter become damp from the dew which is deposited upon it—that dew being the result of combustion; and I have no doubt you will shortly see, by the drops of water which fall upon the paper below, that there is a good deal of water produced from the combustion of the lamp. I will let it remain, and you can afterwards see how much water has been collected. So, if I take a gas-lamp, and put any cooling arrangement over it, I shall get water,—water being likewise produced from the combustion of gas. Here, in this bottle, is a quantity of water—perfectly pure, distilled water, produced from the combustion of a gas-lamp—in no point different from the water that you distil from the river, or ocean, or spring, but exactly the same thing. Water is one individual thing, it never changes. We can add to it by careful adjustment, for a little while, or we can take it apart and get other things from it, but water, as water, remains always the same, either in a solid, liquid, or fluid state. Here again [holding another bottle] is some water produced by the combustion of an oil-lamp. A pint of oil, when burnt fairly and properly, produces rather more than a pint of water. Here, again, is some water, produced by a rather long experiment, from a wax candle. And so we can go on with almost all combustible substances, and find that if they burn with a flame, as a candle, they produce water. You may make these experiments yourselves; the head of a poker is a very good thing to try with, and if it remains cold long enough over the candle, you may get water condensed in drops on it; or a spoon, or ladle, or anything else may be used, provided it be clean, and can carry off the heat, and so condense the water.

And now—to go into the history of this wonderful production of water from combustibles, and by combustion,—I must first of all tell you that this water may exist in different conditions, and although you may now be acquainted with all its forms, they still require us to give a little attention to them for the present; so that we may perceive how the water, whilst it goes through its Protean changes, is entirely and absolutely the same thing, whether it is produced from a candle by combustion, or from the rivers or ocean.

First of all, water when at the coldest is ice. Now we philosophers,—I hope that I may class you and myself together in this case,—speak of water as water, whether it be in its solid, or liquid, or gaseous state—we speak of it chemically as water. Water is a thing compounded of two substances, one of which we have derived from the candle; and the other, which we shall find elsewhere. Water may occur as ice; and you have had most excellent opportunities lately of seeing this. Ice changes back into water; and on our last Sabbath we had a strong instance of this change, by the sad catastrophe which occurred in our own house, as well as in the houses of many of you. Ice changes back into water when the temperature is raised: water also changes into steam when it is warmed enough. The water which we have here before us as ice, is in its densest state, and although it changes in weight, in condition, in form, and in many other qualities, it still is water; and whether we alter it into ice by cooling, or whether we change it into steam by heat, it increases in volume,—in the one case very strangely and powerfully, and in the other case very largely, and strangely, and wonderfully. For instance, I will now take this tin cylinder, and pour a little water into it, and seeing how much water I pour in, you may easily estimate for yourselves how high it will rise in the vessel: it will cover the bottom about two inches. I am now about to convert the water into steam, for the purpose of showing to you the different volumes which water occupies in its different states of water and steam.

Let us now take the case of water changing into ice; we can effect that by cooling it in a mixture of salt and pounded ice,—and I shall do so to show you the expansion of water into a thing of larger bulk when it is so changed. These bottles [holding one] are made of strong cast-iron, very strong and very thick—I suppose they are the third of an inch in thickness; they are very carefully filled with water, so as to exclude all air, and then they are screwed down tight. We shall see that when we freeze the water in these iron vessels, they will not be able to hold the ice, and the expansion within them will break them in pieces as these [pointing to some fragments] are broken which have been bottles of exactly the same kind. I am about to put these two bottles into that mixture of ice and salt, for the purpose of showing that when water becomes ice, it changes in volume in this extraordinary way.

In the meantime look at the change which has taken place in the water to which we have applied heat; it is loosing its fluid state. You may tell this by two or three circumstances. I have covered this glass flask—in which water is boiling—over with a watch-glass. Do you see what happens? It rattles away like a valve chattering, because the steam rising from the boiling water sends the valve up and down, and forces itself out, and so makes it clatter. You can very easily perceive that that flask is quite full of steam, or else it would not force its way out. You see also that the flask contains a substance very much larger than the water, for it fills the whole of the flask over and over again, and there it is blowing away into the air; and yet you cannot observe any great change in the bulk of the water, which shows you that its change of bulk is very great when it becomes steam.

I have put our iron bottles containing water into this freezing mixture that you may see what happens. No communication will take place, you observe, between the water in the bottles and the ice in the outer vessel. But there will be a conveyance of heat from the one to the other, and if we are successful—we are making our experiment in very great haste—I expect you will by-and-by, so soon as the cold has taken possession of the bottles and their contents, hear a pop on the occasion of the bursting of the one bottle or the other, and, when we come to examine the bottles, we shall find their contents masses of ice partly enclosed by the covering of iron which is too small for them, because the ice is larger in bulk than the water. You know very well that ice floats upon water; if a boy falls through a hole into the water, he tries to get on the ice again to float him up. Why does the ice float? Think of that, and philosophise. Because the ice is larger than the quantity of water which can produce it, and therefore the ice weighs the lightest and the water is the heaviest.

To return now to the action of heat on water. See what a stream of vapour is issuing from this tin vessel. You observe, we must have made it quite full of steam to have it sent out in that great quantity. And now, as we can convert the water into steam by heat, we convert it back into liquid water by the application of cold. And if we take a glass, or any other cold thing, and hold it over this steam, see how soon it gets damp with water; it will condense it until the glass is warm—it condenses the water which is now running down the sides of it. I have here another experiment to show the condensation of water from a vaporous state back into a liquid state, in the same way as the vapour, one of the products of the candle, was condensed against the bottom of the dish and obtained in the form of water; and to show you how truly and thoroughly these changes take place, I shall take this tin flask, which is now full of steam, and I shall close the top. We shall see what takes place when we cause this water or steam to return back to the fluid state by pouring some cold water on the outside. [The Lecturer poured the cold water over the vessel, when it immediately collapsed.] You see what has happened. If I had closed the stopper and still kept the heat applied to it, it would have burst the vessel: yet, when then the steam returns to water, the vessel collapses, there being a vacuum produced inside by the condensation of the steam. I show you these changes for the purpose of pointing out that in all these occurrences there is nothing that changes the water into another thing; it still remains water, and so the vessel is obliged to give way and is blown inwards, as in the other case, by the further application of heat, it would have been blown outwards.

And what do you think the bulk of that water is when it assumes the vaporous condition? You see that cube [pointing]; it is a cubic foot. There, by its side is a cubic inch: it is square, exactly the same shape as the cubic foot, and that bulk of water [the cubic inch] will make that bulk [the cubic foot] of steam, and the application of cold will contract that large quantity of steam into that small quantity of water. [One of the iron bottles, burst at that moment.] Ah! There is one of our bottles burst, and here you see is is a crack down one side an eight of an inch in width. [The other now exploded sending the freezing mixture in all directions.] This other bottle is now broken; although the iron was nearly half-an-inch thick, the ice has burst it asunder. These changes always take place in water; they do not require to be always produced by artificial means, we only use them here because we want to produce a small winter round that little bottle instead of a large one. But if you go to Canada, or to the North, you will find the temperature there out of doors will do the same thing as has been done here by the freezing mixture.

To return to our quiet philosophy. We shall not in future be deceived, therefore by any changes that are produced in water. Water is the same everywhere, whether produced from the ocean or from the flame of the candle. Where then, is this water which we get from a candle? I must anticipate a little, and tell you. It evidently comes, as to part of it, from the candle, but is it within the candle beforehand? No. It is not in the candle; and it is not in the air round about the candle which is necessary for its combustion. It is neither in one nor the other but it comes from their conjoint action, a part from the candle, a part from the air; and this we have now to trace so that we may understand thoroughly what is the chemical history of a candle when we have it burning on our table. How shall we get at this? I myself know plenty of ways, but I want *you* to get at it from the association in your own minds of what I have already told you.

I think you can see a little in this way. We had just now the case of a substance which acted upon the water in the way that Sir Humphrey Davy showed us, and which I am now going to recall to your minds again by making an experiment upon that dish. It is a thing which we have to handle very carefully, for you see if I bring a little splash of water near this mass it sets fire to part of it; and if it set fire to a part, and there was free access of air, it would set fire to the whole. Now this is a metal—a beautiful and bright metal—which rapidly changes in the air, and as you know, rapidly changes in water. I will put a piece on the water, and you see it burns beautifully making a floating lamp, using the water in the place of air. Again, if we take a few iron filings or turnings and put them in water we find that they likewise change. They do not change so much as this potassium does, but they change somewhat in the same way, they become rusty, and show an action upon the water, though in a different degree of intensity, to what this beautiful metal does; but they act upon the water in the same manner generally as this potassium. I want you to unite these different facts in your minds. I have another metal here, and when we examined it with regard to the solid substance produced from combustion, we had an opportunity of seeing that it burnt; and I suppose, if I take a little strip of this zinc and put it over the candle, you will see something half way, as it were, between the combustion of potassium on the water, and the action of iron,—you see there is a sort of combustion. It has burnt, leaving a white ash or residum, and here also we find that that metal has a certain amount of action upon water.

By degrees we have learned how to modify the action of these different substances, and to make them tell us what we want to know. And now, first of all, I take iron. It is a common thing in all chemical reactions, where we get any result of this kind, to find that it is increased by the action of heat; and if we want to examine minutely and carefully the action of bodies one upon another, we often have to refer to the action of heat. Now you know, I think, that iron filings burn beautifully in the air; and I am about to show you an experiment of this kind, because it will impress upon you what I am going to say about iron in its action on water. If I take a flame which I make hollow,—you know why, because I want to get air to it and in it, and therefore I make it hollow,—if I take a few iron filings, and drop them into the flame, you see how well they burn. That combustion proceeds from the chemical action which is going on when we ignite those particles. And so we proceed to consider these different effects, and ascertain what iron will do when it meets with water. It will tell us the story so beautifully, so gradually and regularly, that I think it will please you very much.

I have here a furnace with a pipe going through it like an iron gun-barrel, and I have stuffed that barrel full of bright iron turnings, and the part that is so stuffed is put into the fire and is made red-hot. We can either send air through the barrel to come in contact with the iron, or else we can send steam from this little boiler at the end of the barrel. Here is a stop-cock which shuts out the steam from the barrel until we wish to admit it. There is some water in these jars, which I have coloured blue so that you may see what happens. Now you know very well that any steam I might send through that barrel, if it went through into the water in the form of steam, would be condensed; for you have seen that steam cannot remain as steam if it be cooled down; you saw it here [pointing to the tin flask] crushing itself into a small bulk, and causing the flask containing it to collapse. So that if I were to send steam through that barrel it would be condensed — supposing the barrel were cold, — it is, therefore, heated to perform the experiment I am now about to show you. I am going to send the steam through the barrel in small quantities, and you shall judge for yourselves when you see it issue from the other end, whether it still remains steam. Steam is condensible into water, and when you lower the temperature of steam you convert it back into fluid water; but I have lowered the temperature of the gas which I have collected in this jar, by passing it through water after it has passed through the iron barrel, and still it does not change back into water. I will take another test and apply to this gas. (I hold the jar in an inverted position, or else I should lose my substance.) If I now apply a light to the mouth of the jar it ignites with a slight noise. That tells you that it is not steam, steam puts a fire out, it does not burn; but you saw that what I had in that jar burnt, We may obtain this substance equally from water produced from the candle flame as from any other source. When it is obtained by the action of the iron upon the aqueous vapour, it leaves the iron in a state very similar to that in which these filings were when they were burnt, It makes the iron heavier than it was before. So long as the iron remains in the tube and is heated, and is cooled again without the access of air or water, it does not change its in weight; but after having had this current of steam passed over it, it then comes out heavier than it was before, having taken something out of the steam, and having allowed something else to pass forth, which we see here. And now, as we have another jar full, I will show you something most interesting. It is a combustible gas; and I might at once take this jar and set fire to the contents, and show you that it is combustible; but I intend to show you more if I can. It is also a very light substance. Steam will condense; this body will rise in the air, and not condense. Suppose I take another glass jar, empty of all but air; if I examine it with a taper I shall find that it contains nothing but air. I will now take this jar full of the gas that I am speaking of, and deal with it as if it were a light body; I will hold both upside down, and turn the one up under the other; and that which contains, or did contain, the gas obtained from the steam, what does it contain now? You will find it now only contains air. But look! Here is the combustible substance [taking the other jar] which I have poured out of the one jar into the other. It still preserves its quality, and condition, and independence, and therefore is the more worthy of our consideration, as belonging to the products of a candle.

Now, this substance which we have just got by the action of iron on the steam or water, we can also get by means of those other things which you have already seen act so well upon the water. If I take a piece of potassium, and make the necessary arrangements, it will produce this gas; and if I take a piece of zinc, I find, when I come to examine it very carefully, that the main reason why this zinc cannot act upon the water continuously as the other metal does, is because the result of the action of the water envelopes the zinc in a kind of protecting coat. We have learned in consequence, that if we put into our vessel only the zinc and water, they, by themselves, do not give rise to much action; and we get no result. But suppose I proceed to dissolve off this varnish,—this encumbering substance,— which I can do by a little acid; the moment I do that I get the zinc acting upon the water, exactly as the iron did, but at the common temperature. The acid in no way is altered, except in its combination with the oxide of zinc which is produced. I have now poured the acid into the glass, and you would think I was applying heat to cause this boiling up. There is something coming off from the zinc very abundantly, which is not steam. There is a jar full of it; and you will find that I have exactly the same combustible substance remaining in the vessel, when I hold it upside down, that I produced from the experiment with the iron barrel. This is what we get from water, and this is the substance which is contained in the candle.

Let us connect these two points clearly and distinctly together. This is hydrogen—a body classed among those things which, in Chemistry, we call elements, because we can get nothing else out of them. A candle is not an elementary body, because we can get carbon out of it, we can get this hydrogen out of it, or at least out of the water which it supplies. And this gas has been so named hydrogen, because it is that element which, in association with another, generates water.[2] Mr. Anderson having now been able to get two or three jars of gas, we shall have a few experiments to make, and I want to show you the best way of making these experiments. I won't be afraid to show you, for I like you to make experments, if you will only make them with care and attention, and the assent of those around you. As we advance in Chemistry we are obliged to deal with substances which are rather injurious if in their wrong places; the acids, and heat, and combustible things we use, might do harm if used carelessly. If you want to make hydrogen, you can make it easily from bits of zinc, and sulphuric, or muriatic acid. Here is what in former times was called the "philosopher's candle." It is a little phial with a cork and a tube or pipe passing through it. And I am now putting a few little pieces of zinc into it. This little instrument I am going to apply to a useful purpose in our demonstrations, for I want to show you that you can prepare hydrogen, and make some experiments with it as you please, at your own homes. Let me here tell you why I am so careful to fill this phial nearly, and yet not quite, full. I do it because the evolved gas which, as you have seen, is very combustible, is explosive to a considerable extent, when mixed with air, and might lead to harm if you were to apply a light to the end of that pipe before all the air had been swept out of the space above the water. I am now about to put in the sulphuric acid. I have used very little zinc and more sulphuric acid and water because I want to keep it at work for some time. I, therefore, take care in this way to modify the proportions of the ingredients so that I may have a regular supply,—not too quick, and not too slow. Supposing I now take a glass and put it upside down over the end of the tube, because the hydrogen is light I expect that it will remain in that vessel a little

[2] ὑδωρ, "water," and γενναω, "I generate."

while. We will now test the contents of our glass to see if there be hydrogen in it,—I think I am safe in saying we have caught some [applying a light]. There it is you see. I will now apply a light to the top of the tube. There is the hydrogen burning. There is our philosophical candle. It is a foolish, feeble sort of a flame, you may say, but it is so hot that scarcely any common flame gives out so much heat. There is the flame and the heat of the flame, and you see it goes on burning regularly, and I am now about to put that flame to burn under a certain arrangement in order that we may examine its results and make use of the information which we may thereby acquire. Inasmuch as the candle produces water, and this gas comes out of the water, Let us see what this gives us by the same process of combustion that the candle went through when it burnt in the atmosphere, and for that purpose I am going to put the lamp under this apparatus, in order to condense whatever may arise from the combustion within it. In the course of a short time you will see moisture appearing here in the cylinder, and you will get the water running down the side, and the water from this hydrogen flame will have absolutely the same effect upon all our tests, being obtained by the same general process as in the former case. This hydrogen is a very beautiful substance. It is so light that it carries things up; it is far lighter than the atmosphere, and I daresay I can show you this by an experiment which, if you are very clever, some of you may even have skill enough to make. Here is our generator of hydrogen, and here are some soap-suds. I have an india-rubber tube connected with the hydrogen generator, and at the end of the tube is a tobacco pipe. I can thus put the pipe into the suds and blow bubbles by means of the hydrogen. You observe how the bubbles fall downwards when I blow them with my warm breath; but notice the difference when I blow them with hydrogen. [The Lecturer here blew bubbles with hydrogen, which rose to the roof of the theatre.] It shows you how light a thing this must be in order to carry with it not merely the ordinary soap-bubble, but the larger portion of a drop hanging to the bottom of it. I can show its lightness in a better way than this; larger bubbles than these may be so lifted up; indeed, in former times balloons used to be filled with this gas. Mr. Anderson will fasten this tube on to our generator, and we shall have a stream of hydrogen here with which we can charge this balloon made of collodion. I need not even be very careful to get all the air out, for I know the power of this gas to carry it up. [Two collodion balloons were inflated and sent up, one being held by a string.] Here is another larger one made of thin membrane, which we will fill and send up; you will see they will all remain floating about until the gas escapes.

What, then, are the comparative weights of these substances? I have a table here which will show you the proportion which their weights bear to each other. I have taken a pint and a cubic foot as the measures, and have placed opposite to them the respective figures. A pint measure of this hydrogen weighs three quarters of our smallest weight, a grain, and a cubic foot weighs one-twelfth of an ounce; whereas a pint of water weighs 8750 grains, and a cubic foot of water weighs almost 1000 ounces. You, therefore, see what a vast difference there is between the weight of a cubic foot of water and a cubic foot of hydrogen.

Hydrogen gives rise to no substance that can become solid, either during combustion or afterwards as a product of its combustion; but when it burns it produces water only, and if we take a cold glass and put it over the flame of it, it becomes damp, and you have water produced immediately in abundance; and nothing is produced by its combustion but the same water which which you have seen the flame of the candle produce. It is an important point for you to consider that this hydrogen is the only thing in the world that by combustion gives such a substance as this as its sole product

And now we must endeavour to find out some fresh proof of the general character and composition of this water, and for this purpose I will keep you a little longer, so that at our next meeting we may be better prepared for the subject. We have the power of arranging the zinc which you have seen acting upon the water by the assistance of an acid, in such a manner as to cause all the power to be evolved in the place where we require it. I have behind me a voltaic pile, and I am just about to show you at the end of this lecture, its character and power, that you may see what we shall have to deal with when we next meet. I hold here the extremities of the wires which transport the power from behind me, and which I shall use to act on the water.

We have previously seen what a power of combusis possessed by the potassium, or the zinc, or the iron filings; but none of them show such energy as this. [The Lecturer here made contact between the two terminal wires of the battery when a bright flash of light was produced.] This light is, in fact, produced by a forty-zinc power of burning, it is a power that I can carry about in my hands through these wires at pleasure, although if I applied it wrongly to myself it would destroy me in an instant, for it is a most intense thing, and the power you see here put forth while you count five [bringing the poles in contact and exhibiting the electric light] is equivalent to the power of several thunder-storms, so great is its force. And that you may see what intense energy it has I will take the ends of the wires which convey the power from the battery behind me, and with it I dare say I can burn this iron file. This is a chemical power, and when we next meet, I shall apply it to water, and show you what results we are able to get.

The Boards of Arts & Manufactures

FOR UPPER AND LOWER CANADA.

The subjoined Memorials have already appeared in the Supplement to the April number of this Journal. They may, however, be again appropriately introduced here, in case it should be thought advisable to omit binding the Supplement with the volume for the year. The notice of the meeting of Architects, Civil Engineers and Provincial Land Surveyors of Canada, is introduced elsewhere, with the same object.

Copy of the Memorial

Submitted by the Board of Arts and Manufactures for Upper Canada, to the Honorable the Legislative Assembly, on the subject of the International Exhibition, to be held in London in 1862.

"Your memorialists respectfully beg leave to address your Honourable House on the subject of the International Exhibition to be held in London in 1862.

"Your memorialists have the best grounds for the expectation that the proposed Exhibition will exceed in importance and grandeur those illustrations of progressive Industry and Art which elicited the astonishment and admiration of the civilized world, at London in 1851, and at Paris in 1855.

"Your memorialists consider that the honourable position acquired by Canada at those Exhibitions greatly contributed to diffuse information throughout Europe respecting the resources of the Province, to draw the attention of emigrants to it as a field for industry and settlement, as well as to induce numbers of commercial men and capitalists to make it their home or the scene of their enterprise.

"Your memorialists believe that the progress which has been made in our knowledge of the resources of Canada since the year 1855 might greatly enhance the value of any display that could be made in 1862. They believe that the advance in our civilization during the past six years will, if properly represented, exercise a proportionately greater effect upon those who may have the opportunity of comparing 'CANADA IN 1862' with 'CANADA IN 1855' or 'CANADA IN 1851.'

"But while your memorialists are firmly persuaded of the great benefits which might accrue to the country from a proper representation next year at London, of its resources and the civilization of its people, they also believe that without ample pecuniary assistance from Your Honourable House that great object can not be attained.

"With a view to enable our countrymen to exhibit the Progress of their Industry, the increased Extent and Value of the Resources at their command, their Growing Power as an Industrial People, your memorialists humbly pray that Your Honourable House will be pleased to grant that a sum not less than $60,000 of public money may be expended, under proper supervision and control, in assisting to secure a fit representation of the Resources and Civilization of Canada at the International Exhibition of 1862.

"And your memorialists will ever pray, &c."

Copy of the Memorial

Submitted by the Board of Arts and Manufactures for Lower Canada, to the Honorable the Legislative Assembly, on the subject of the International Exhibition, to be held in London in 1862.

"The Memorial of the Board of Arts and Manufactures of Lower Canada, respectfully sheweth:

That Her Most Gracious Majesty hath, by Her Royal Letters Patent, bearing date at Westminster, on the fourth day of February last past, appointed certain Commissioners, creating them a Corporation or body politic and corporate, for the purposes of conducting and managing an International Exhibition of the Products of Industry and Art of all Nations, such Exhibition to be held in or near the Metropolis in the year 1862:

That instructions have been issued (as this Board learns from a published letter of the Royal Commissioners), through His Grace the Secretary of State for the Colonies, to all the British Colonies, to compete at such Exhibition:

That it is exceedingly desirable, should the arrangements made prove to be of a satisfactory nature, that this Province, which won so much distinction in the Great International Exhibitions held in London and Paris in the years 1851 and 1855 respectively, should on this occasion make known to the world, through the coming Exhibition, the steady progress it is making in the opening up of its resources:

That it is therefore advisable that a Commission should be appointed to act in connection with this Board, and the Board of Arts and Manufactures of Upper Canada, and the two Provincial Boards of Agriculture, in obtaining in a similar manner as was done in the year 1854 for the Paris Exhibition, objects to be forwarded to the Great Exhibition to be held in London in the year 1862, and that a sum not exceeding 40,000 dollars should be placed at its disposal for that purpose:

That this Board has reason to believe that the sum named will be amply sufficient to defray all expenses to be incurred, and that after the sale of the articles purchased for Exhibition, ten thousand or fifteen thousand dollars will be returned to the Provincial Treasury:

Wherefore, your Memorialists humbly pray that your Honourable House will be pleased to sanction such grant for the purposes above set forth:

And your Memorialists, as in duty bound, will ever pray, &c."

INTERNATIONAL EXHIBITION OF 1862.

The following is the classification intended to be adopted by Her Majesty's Commissioners for the Great Exhibition of 1862:—

Section I.—Raw Materials.

Mining, Quarrying, Metallurgy, and Mineral products; Chemical Substances and Products, and Pharmaceutical Processes; Substances used for Food, including Wines; Animal and Vegetable Substances used in Manufactures.

Section II.—Machinery and Engineering

Railway Plant, including Locomotive Engines and Carriages; Carriages not connected with rail or tram roads, Manufacturing Machines and Tools; Machinery in general, as applied to industry; Agricultural and Horticultural Machines and implements, Civil Engineering, Architectural and Building Contrivances; Military Engineering, Armour and Accoutriments, Ordnance and small arms; Naval Architecture and Ships' Tackle; Philosophical Instruments, and Processes depending on their use; Photography, and Photographic Apparatus; Horological Instruments; Musical Instruments; Surgical Instruments and appliances.

Section III.—Manufactures.

Cotton; Flax and Hemp; Silk and Velvet; Woollen and Worsted, including Mixed Fabrics generally, Carpets; Woven Spun, Felted, and Lace Fabrics, when shown as specimens of Printing or Dyeing; Tapestry, Lace, and Embroidery; Skins, Furs, Feathers, and Hair; Leather, including Saddlery and Harness; Articles of Clothing; Paper, Stationery, Printing, and Bookbinding; Educational Works and Appliances; Furniture and Upholstery, including Paper-hangings and Paper Maché; Iron and General Hardware, Steel, and Cutlery; Works in Precious Metals and their imitations; Jewellery; Glass; Pottery; Manufactures not included in previous Classes.

Section IV.—Fine Arts (Modern).

Architecture; Paintings in Oil and Water Colours and Drawings; Sculpture, Models, Die-sinking, and Intaglios: Etchings and Engravings.

In the Exhibition of 1851 there were only 35 Classes. In the proposed one, therefore, there are five additional.

COMMITTEES.

Her Majesty's Commissioners have appointed the following Committees of Advice:—

FINANCE.

Rt. Hon. R. Lowe, M.P.	E. A. Bowring, Esq., Board of Trade.
Sir A. Spearman, National Debt Office.	H. Thring, Esq., 16 Duke st., Westminster, S.W.
T. F. Gibson, Esq.	

Lord Frederick Cavendish, *Honorary Secretary.*

BUILDING.

The Earl Shelburne.	William Fairbairn, Esq., L.L.D., F.R.S.
William Baker, Esq., C.E.	

FINE ARTS.

The Duke of Buccleuch, K.G.	The Lord Taunton.
The Marquis of Lansdowne, K.G.	The Lord Elcho, M.P.
	The Lord Chief Baron.
The Marquis of Hertford, K.G.	Sir Stafford Northcote, Bart., M.P.
The Earl Spencer.	Sir Francis Scott, Bart.
The Earl Stanhope.	Thomas Ashton, Esq.
The Earl of Malmesbury.	R. Henry Cheney, Esq.
The Earl Somers.	Rev. E. Coleridge.
The Earl of Dudley.	E. C. Field, Esq.
The Lord Ashburton.	R. S. Holford, Esq., M.P.
The Lord Overstone.	H. T. Hope, Esq.
The Lord Talbot de Malahide.	John Ruskin, Esq.
The Lord Llanover.	Wm. Stirling, Esq., M.P.
S. J. Stern, Esq.	The President of the Society of British Artists.
Tom Taylor, Esq.	The President of the New Society of Painters, in Water Colours.
John Walter, Esq., M.P.	The President of the Institute of Britsh Artists.
W. Wells, Esq.	The President of the Royal Institute of British Architects.
The President of the Royal Academy.	
The President of the Royal Scottish Academy.	
The President of the Royal Hibernian Academy.	
The President of the Old Society of Painters and Water Colours.	P. Le Neve Foster, Esq., *Secretary.*

ORGANIZATION OF COMMITTEES OF CLASSES.

The Marquis of Hartington, M.P.	W. Dargan, Esq.
The Lord Stanley, M.P.	The President of the Royal Agricultural Society.
The Lord Naas, M.P.	The Chairman of the Society of Arts.
The Lord Stanley of Alderley.	The Chairman of the Royal Dublin Society.
The Right Hon. the Lord Mayor of London.	The President of the Institution of Civil Engineers.
The President of the Board of Trade.	The President of the Institution of Mechanical Engineers.
The Vice-President of the Board of Trade.	Presidents of Chambers of Commerce.
Thomas Bazely, Esq., M.P.	Edgar A. Bowring, Esq., *Honorary Secretary.*
T. F. Gibson, Esq.	
Dr. Lyon Playfair, C.B.	
H. Cole, Esq., C.B.	

Every article produced or obtained by human industry, whether of

Raw materials,
Machinery
Manufactures, or
Fine Arts,

will be admitted to the Exhibition, with the excep-o nof

1. Living animals and plants.
2. Fresh vegetable and animal substances, liable to spoil by keeping.
3. Detonating or dangerous substances.

Spirits, or alcohols, oils, acids, corrosive salts, and substances of a highly inflamable nature, will not be admitted, unless sent in well secured glass vessels.

The articles exhibited will be divided into the following classes:—

SECTION 1.

CLASS 1. Mining, Quarrying, Metallurgy, and Mineral Products.
" 2. Chemical Substances and Products, and Pharmaceutical Processes.
" 3. Substances used for Food, including Wines.
" 4. Animal and Vegetable Substances used in Manufactures.

SECTION 2.

CLASS 5. Railway plant, including Locomotive Engines and Carriages.
" 6. Carriages not connected with Rail or Tram Roads.
" 7. Manufacturing Machines and Tools.
" 8. Machinery in general.
" 9. Agricultural and Horticultural Machines and Implements.

CLASS 10. Civil Engineering, Architectural, and Building Contrivances.
" 11. Military Engineering, Armour and Accoutrements, Ordnance, and Small Arms.
" 12. Naval Architecture, Ship's tackle.
" 13. Philosophical Instruments and Processes depending upon their use.
" 14. Photographic Apparatus and Photography.
" 15. Horological Instruments.
" 16. Musical Instruments.
" 17. Surgical Instruments and Appliances.

SECTION 3.

CLASS 18. Cotton.
" 19. Flax and Hemp.
" 20. Silk and Velvet.
" 21. Woollen and Worsted, including Mixed Fabrics generally.
" 22. Carpets.
" 23. Woven, Spun, Felted, and Laid Fabrics, when shown as specimens of Printing or Dyeing.
" 24. Tapestry, Lace, and Embroidery.
" 25. Skins, Fur, Feathers, and Hair.
" 26. Leather, including Saddlery and Harness.
" 27. Articles of Clothing.
" 28. Paper, Stationery, Printing, and Bookbinding.
" 29. Educational Works and Appliances.
" 30. Furniture and Upholstery, including Paper-hangings and Papier-machié.
" 31. Iron, and General Hardware.
" 32. Steel and Cutlery.
" 33. Works in Precious Metals, and their imitations, and Jewellery.
" 34. Glass.
" 35. Pottery.
" 36. Manufactures not included in previous classes.

SECTION 4.

CLASS 37. Architecture.
" 38. Paintings in Oil and Water Colours, and Drawings,
" 39. Sculpture, Models, Die-sinking, and Intaglios.
" 40. Etchings and Engravings.

Her Majesty's Commissioners will be prepared to receive all articles which may be sent to them, on or after Wednesday, the 12th of February, and will continue to receive goods until Monday, the 31st of March, 1862, inclusive.

Articles of great size or weight, the placing of which will require considerable labour, must be sent before Saturday, the 1st of March, 1862; and manufacturers wishing to exhibit machinery, or other objects, that will require foundations or special constructions, must make a declaration to that effect on their demands for space.

Any exhibitor whose goods can properly be placed together, will be at liberty to arrange such goods in his own way, provided his arrangement is compatible with the general scheme of the Exhibition, and the convenience of other exhibitors.

Where it is desired to exhibit processes of manufacture, a sufficient number of articles, however dissimilar, will be admitted for the purpose of illustrating the process; but they must not exceed the number actually required.

Exhibitors will be required to deliver their goods at the building, and to unpack and arrange them, at their own charge and risk; and all articles must be delivered with the freight, carriage, porterage, and all charges and dues upon them paid.

Packing cases must be removed at the cost of the exhibitor or his agent, as soon as the goods are examined and deposited in charge of the Commissioners.

Exhibitors will be permitted, subject only to the necessary general regulations, to erect, according to their own taste, all the counters, stands, glass frames, brackets, awnings, hangings, or similar contrivances which they may consider best calculated for the display of their goods.

Exhibitors must be at the charge of insuring their own goods, should they desire this security. Every precaution will be taken to prevent fire, theft, or other losses, and Her Majesty's Commissioners will give all the aid in their power for the legal prosecution of any person guilty of robbery or wilful injury in the Exhibition, but they will not be responsible for losses or damage of any kind which may be occasioned by fire or theft, or in any other manner.

Exhibitors may employ assistants to keep in order the articles they exhibit, or to explain them to visitors, after obtaining written permission from Her Majesty's Commissioners; but such assistants will be forbidden to invite visitors to purchase the goods of their employers.

Her Majesty's Commissioners will provide shafting, steam (not exceeding 30 lbs. per inch), and water, at high pressure, for machines in motion.

Intending exhibitors in the United Kingdom, are requested to apply to the Secretary to Her Majesty's Commissioners, at the offices 454, West Strand, London, W.C., for a *Form of Demand for Space*, stating at the same time in which of the four Sections they wish to exhibit.

Foreign and Colonial exhibitors should apply to the Commission, or other Central Authority appointed by the Foreign or Colonial Government, as soon as notice has been given of its appointment.

Her Majesty's Commissioners having consulted a Committee as to the organization of the Fine Art Department of the Exhibition, will publish the rules relating thereto at a future date.

By Order,

F. R. SANDFORD,
Secretary.

Office, of Her Majesty's Commissioners,
454 West Strand, London, W.C.

DECISIONS OF HER MAJESTY'S COMMISSIONERS ON POINTS RELATING TO THE EXHIBITION.
MARCH, 1861.

Her Majesty's Commissioners have fixed upon Thursday, the 1st day of May, 1862, for opening the Exhibition.

The Exhibition building will be erected on a site adjoining the gardens of the Royal Horticultural Society, and in the immediate neighbourhood of the ground occupied in 1851, on the occasion of the first International Exhibition.

The portion of building to be devoted to the exhibition of Pictures, will be erected in brick, and will occupy the entire front towards Cromwell-road; the portion in which Machinery will be exhibited will extend along Prince-Albert's-road, on the west side of the gardens.

All works of Industry to be exhibited should have been produced since 1850.

Subject to the necessary limitation of space, all persons whether designers, inventors, manufacturers, or producers of articles will be allowed to exhibit; but they must state the character in which they do so.

Her Majesty's Commissioners will communicate with Foreign and Colonial exhibitors only through the Commission which the Government of each Foreign Country or Colony may appoint for that purpose; and no article will be admitted from any Foreign Country or Colony without the sanction of such Commission.

No rent will be charged to exhibitors.

Prizes, or rewards for merit, in the form of medals, will be given in the Industrial Department of the Exhibition.

Prizes may be affixed to the articles exhibited.

THE PROPOSED NEW DYE FROM A COCCUS.

Having had our attention directed to the following paragraph, which has appeared in several newspapers, we desire to notice an objection to the proposed cultivation of this species of coccus. While it is our earnest wish to foster and advance, as much as in us lies, the production of anything—especially Canadian,—that is likely to be of service in the Arts and Manufactures, we cannot but consider the preservation of our forests, which would in all probability be greatly injured by such an insect as this, if encouraged to propagate freely, to be a subject of paramount importance.

"At a meeting of the Botanical Society of Kingston, Professor Lawson exhibited specimens of a new dye of great richness, prepared in the laboratory of Queen's College, from an insect, a species of Coccus, found for the first time last summer on a tree of the common black spruce (Abies nigra, Poir), in the neighbourhood of Kingston. This new dye closely resembles true cochineal, a most expensive coloring matter capable of being produced in warm countries only, and which is used to give a fine and permanent dye in red, crimson, and scarlets, to wool and silk. Unlike cochineal, the new dye discovered at Kingston, is a native Canadian product, and capable of being produced in temperate countries. Having been but recently observed, sufficient quantity has not yet been obtained for a complete series of experiments as to its nature and and uses; but the habits of the insect, as well as the properties of the dye, seem to indicate that it may become of practical importance. In color it closely resembles ordinary cochineal, having rather more the scarlet hue of the flowers of adonis autumnalis, and no doubt other shades will be obtained. The true cochineal is now being cultivated in Teneriffe and other vine-growing countries of Europe and Africa, with such success as to displace the grape vine; yet the Directors of the East India Company offered in vain £2,000 for its introduction into India."

We are ourselves unacquainted with the insect mentioned above, but have frequently observed others of kindred species. On the white spruce (*abies alba*, Michaux), for instance, may often be seen a species of coccus (*C. pinicortis*, Fitch,) in the form of a white cotton, or down-like substance, covering a vast number of minute insects of a black, or blackish-brown color, closely huddled together, and clinging to the bark. Dr. Fitch, in his report on the noxious, &c., insects of New York, remarks with respect to this insect, that "when a tree is much coated with this white substance, it becomes sickly, and presents a slender, dwindled appearance, its leaves are short and stinted in their growth, and of a dull green color, and the annual growth of the tree is much curtailed." The coccidæ belong to the order Homoptera, all the insects of which subsist upon vegetable jucies, which they obtain by means of a sort of proboscis. According to Westwood, in his Modern Classification of Insects, the coccidæ, "which are ordinarily of very small size, are amongst the most injurious insects to the interests of the horticulturist and arboriculturist: their powers of propagation are excessive: when they once gain possession of a plant or young tree, its death is almost certain, the minute size of the larva rendering it impossible to exterminate them. Sometimes they are so numerous, that I have seen instances in which the entire surface of a branch of an apple tree has been completely covered with them. They are well known to gardeners and others under the name of scale insects and mealy bugs; the former especially, affixing themselves to the twigs; and the females by degrees, assuming the appearance of galls." We learn from the same authority that the typical species of this family is the *coccus ilicis*, Linn, found in the south of Europe, and from which the Greeks derived their famous dye *kokkos*, the *coccus baphica* of the Romans, and *kermes* of the Arabs. The cochineal insect however, he distinguishes from the preceding, and calls by the generic name of *pseudo-coccus*. Kirby and Spence in their introduction to Entomology—when giving an account of the various indirect injuries inflicted upon man by insects, mention various species of coccus as committing great ravages upon the currant, the plum, apple, peach, olive, vine, &c. That on the apple-tree, they state, was thought to have been introduced from America, whence its common name of *American blight;* it was at first confined to the neighbourhood of London, where it destroyed thousands of trees; afterwards it found its way to the cider counties, where it committed an infinity of damage. But what need is there of adducing further authorities and examples respecting the pernicious effects produced by insects of this genus; enough have surely been cited to shew that we base our objections to the cultivation of this insect on something more than ideas derived from personal observations, and that our opinion is upheld by those who have investigated the matter most thoroughly. In fine, we have not a doubt but that, were the production of this insect to be encouraged, since it naturally increases with such excessive rapidity, it would soon prove a dreadful pest to our forests, which are daily increasing in value, though the preservation of them is, we regret to say, even yet but too little regarded by the majority among us.

THE BOTANICAL SOCIETY OF CANADA.

Annals of the Botanical Society of Canada. Vol. 1. part 1, 4to, pp. 60. Kingston: Creighton.

Here we have the first fruits of the labours of a society, the existence of which, supplies a necessity of our provincial life, and which has before it a bright prospect of distinction and usefulness.

Professor Lawson, of Queen's College Kingston, the Secretary to the society, brings to it the experience he hos gained from the discharge of similar duties in Edinburgh. He is a scientific botanist of established reputation, and a gentleman in whose hands the general interests of this association are secure. The president, Principal Leitch, fills the chair at the meetings of the society, and insures the success of these re-unions by his judgment, taste and skill, as their director.

The evenings appointed for the monthly meetings of the society have too commonly turned out severely cold, or wet, or stormy; and the unlighted streets of Kingston are not to be trodden on a winter night, without some danger of a fall; but the difficulty of going and returning has not deterred the citizens from seeking pleasure and instruction on every offered opportunity.

The place for assembling in, is the convocation-hall of the University, a plain apartment, in shape a parallelogram, and of moderate size. Though it is, in appearance, a room easily to be filled by any voice of ordinary power, it must be stated with regret, that the readers of the many valuable papers contributed, have too often failed to make themselves distinctly audible to the whole assembly.

The audience have shown themselves intelligent, interested, appreciative,—that considerable portion of them, the students of the college, have been hearty in their applause, and quick to recognise talent in the treatises read, especially when they have been the productions of any members of their own university.

On the conclusion of the business of the sittings, it has been customary to withdraw to another apartment, where tea and refreshments have been hospitably provided, and botanical specimens exhibited.

The botanical society of Canada has gained the warm support of many eminent botanists abroad. In an important letter received by the Secretary, from Sir W. J. Hooker, he calls upon Canadian botanists to review the whole flora of their respective neighbourhoods, and to forward to him dried specimens when needed, in order to his assigning their *Canadian habitats* to all plants found within the province, in future editions of his works on American botany. It may, however, be conjectured, that Sir Wm. Hooker wrote in ignorance of the intention of Professor Hincks to publish a flora of Canada; a purpose lately made known, much to the delight of our provincial botanists.

The business of the Canadian botanical society hitherto, has taken a very practical course, a fact which commends the institution to the favor of a journal like this. Usefulness being a main consideration, no "Chinese exactness" has been shown in confining their speculations to the vegetable world. Thus,—papers have been read on Maple trees and sugar making. Good news has been provided for the epicure and the housekeeper in reference to those many species of edible fungi, which are growing ready to their hands, waiting only to be gathered, cooked, and eaten. A cochineal insect, found on the black spruce near Kingston, has been described, and the probability of its furnishing a valuable dye has been considered. Vegetable fibres have received much attention. A paper on cotton has been presented,—important information has been given on the properties of fibres obtained from some of our indigenous plants, such, for example, as Asclepias incarnata. In connection with the subject of serviceable fibres, silk of course was not to be ignored; and the society has been favoured with some interesting papers, the productions of two lady silk worm breeders. One of the fair essayists adheres firmly to the opinion adopted by those engaged in the silk trade, that the caterpillar of Bombyx Mori, when fed only on lettuce leaves, cannot produce a thread fit for the loom. Her gentle antagonist is strong in the belief that the lettuce fed silk worm can and does spin a thread of highly serviceable kind. She produces specimens of such silk, as wound off from the cocoon, and calls on all sceptics to test its strength.

Two most important papers on the subject of bees have been communicated to the society by their president. In his remarks upon the subject, which were in part unwritten, Dr. Leitch was understood as inclining to the belief that *the male* egg of the bee, being placed in the cell prepared for the nidus of the queen-egg, being hatched therein, and treated by the working bees its nurses, as a royal larva, might come forth at last a queen *i. e., a fertile female!* The peculiar treatment of the immature occupant of a royal cell, seems to him to consist rather in the maintenance of a high * temperature around it, than in supplying it with any special kind of food.

Now this supposed change of sex must certainly be pronounced improbable in an extreme degree, and the testimony of experience can also be produced against it. An article upon the honey-bee appeared in the *London Quarterly Review* about ten years ago, which was republished in a little volume—"READING FOR THE RAIL." It is there affirmed, as from an eye witness, that a male egg *is* sometimes laid by accident in a cell intended for a queen, that the bees feed and tend the changeling through all the early stages of its life, as if it were a queen *in posse*,—that it comes forth at last a drone, "a nasty male critter,"—and that its nurses discover their mistake then, and not till then.

There will be no more evening meetings of the Botanical Society until next winter, but out-door excursions during the summer months are promised and expected. The writer of this notice need only express his hope that these anticipated field-days will be pleasant and instructive, like some which he recalls to mind as having been organised and conducted by Professor Henslow of Cambridge, some quarter of a century ago, and that, when they do come off, "he may be there to see."

* Not long ago a French Provincial newspaper stated as a fact, that a little girl had been struck by lightning and rendered insensible. She recovered yet did not *come* exactly to *herself*, for her sex was found to have been changed.

THE ONTARIO WOOLLEN MILLS.

The following excellent notice of the Ontario Woollen Mills, is from the Toronto *Leader*. In one unimportant feature the description requires a slight modification, which has been supplied to us from the proprietors of the mills; it relates to the process of fulling in different seasons of the year, and the effect it has upon the amount of work done.

During the summer the hands are engaged in carding the coarser kinds of wool for the winter fabrics, and thus the operations does not go on so speedily as when the fine varieties of wool are subjected to the same process for the production of light summer cloths, and this is owing to the smaller weight of wool being required for the finer materials. It is this difference in material rather than the heat of the weather, which occasions a diminution in the quantity of work obtained.

The largest woollen manufactory in the country is situated at Cobourg, on a stream which generally suffices to supply all the motive power required; and just above the Ontario Woollen Mills—for such is the name of the factory in question—the Hon. Sidney Smith owns another valuable hydraulic power, which has not yet been economized. In these mills, to make doubly sure, there is auxiliary steam power, which serves to prevent any freezing about the water-wheels, to heat the building in winter, and to assist in the propulsion of the machinery when the heavier fabrics are being made, for winter use, in the summer season. With green wood at $2.50, and dry at $3, it is used instead of coal, for heating, dyeing, drying, and whatever other purposes it is required for. A very small rise in the price would render the use of coal an economy to which it would be necessary to resort. The factory building, composed of brick, is 100 by 50, and five stories high, with large wings. The value of the machinery is about $60,000. The products are woollen tweeds, cloths and satinets. About 100 hands are employed, by Messrs. Frazer & Co., by whom the mills are carried on; thirty-five of whom are females, and fifteen boys; the remainder being men. The average produce is from 650 to 850 yards a day; the smaller amount being produced in summer, when the heavier kinds of goods are being manufactured for winter use. Owing to the heat of the weather, the fulling cannot be conducted so rapidly, at that season of the year; and the other processes have to wait upon this. Doubtless also, though it may be imperceptible, the summer heat tends, by relaxing the system of the operatives, to diminish the production. This is found to be the case in the cotton mills of New England. The same number of hands are at work: and there is no interruption in any department: everything seems to go on precisely as in winter; but the production is less. Doubtless, however, the main cause of the diminished production of woollen frabrics during the summer arises from the check given to the fulling process. The product of these mills is all readily bought up; and it is sold entirely to wholesale houses. The annual consumption of wool is about 200,000 lbs, chiefly of Canadian growth.

In the different stories of the Ontario Woollen Mills may be seen in full activity all the processes of sorting wool, cleansing, dyeing and carding it; spinning, weaving—and this presents the most animated scene, one entire floor being crowded with machinery in active operation—fulling, gigging, scouring, dyeing, finishing and hot-pressing. You might look into a Manchester factory and not be more instructed or impressed with the scene. We think we are justified in pointing to these mills for satisfactory proof that woollen manufactures may be made to pay in Canada. The mills when in other hands, were stopped once, but it by no means follows that there ought, with adequate capital, care and economy, to have been a failure even then. Our tariff was at that time somewhat lower; but we cannot accept even that temporary stoppage as proof that the manufacture of woollen goods in Canada, was an impossible operation. Of their kind, the fabrics produced at these mills are excellent, and quite able successfully to compete with any imported, whether from England, Scotland or the United States.

ASSOCIATION OF ARCHITECTS, CIVIL ENGINEERS AND PROVINCIAL LAND SURVEYORS OF CANADA.

At a meeting of this Association held in Toronto on the 6th of February last, George Brown, Esq., of Montreal, 1st Vice-President, in the chair, the question of an uniform system of measurement of Artificers work was brought up on a report from the Special Committee. The subject was very fully discussed, there being a very large number of members present, who took great interest in the matter. The report recommended the application of a decimal system similar to that in general use on the Continent of Europe, but the majority considered that such a mode, however convenient, would be next to impracticable in this Province. It was therefore resolved to refer back the report, with instructions to adapt, as far as possible, the system set forth in Laxton's *Price Book*, which contains the rules regulating the general measurement of work in England. A Paper was received from Mr. Hanvey of St. Thomas, "On the Allowance to be made for the Curvature of the Earth in surveying," which was appointed to be read at the next meeting. A resolution was passed sympathising with the family of the late lamented President of the Association, Wm. Thomas, Esq. The 1st Vice-President, Mr. Brown, having vacated the chair, a vote of thanks was accorded him for his zeal in making a journey from Montreal at so inclement a season of the year to attend the meeting, and for his able conduct in the chair. The meeting then adjourned.

The Association met again at Toronto for the nomination of officers, on the 6th March last, Wm. Hay, Esq., Architect, Toronto, in the chair. After the nomination, which was the chief business of the meeting, an interesting discussion ensued on Mr. Hanvey's paper, presented at the previous meeting, in which Mr, J. O. Browne, of Toronto, Mr. Peters, of London, and others took part. The question greatly affects the practice of surveying in this Province, where frequently the first line of a survey is run on a true meridian, and the others parallel or rectangular to it. It was generally admitted that the polar lines should be true local meridians, and that some alteration in the Statute directing the mode of surveying for the Province is required. Mr. Peters having been called to the chair, a vote of thanks was given to Mr. Hay for the able manner in which he presided at the meeting.

Correspondence.

To the Editor of the Journal of the Board of Arts and Manufactures.

SIR,—When the Prospectus of your Journal was issued in November last, I was much pleased to notice that you intended to publish abstracts of reports and proceedings of the several Mechanics' Institutes in Upper Canada, whenever furnished for that purpose; and that you also invited correspondence in relation thereto.

I have been anxiously looking for correspondence on this subject, as each issue of the Journal has appeared, but have so far had to look in vain.

I believe the general impression is that the Mechanics' Institutes in this Province are, with few exceptions, in anything but a prosperous condition; and that unless new life and energy are thrown into their management, a large number of them will soon cease to exist, or will exist only in name without fulfilling any of the important duties which properly devolves upon them.

Taking up the *St. Catharine's Semi-Weekly Post* of the 9th instant, I noticed some lengthy editorial remarks respecting the Mechanics' Institute in that town, from which it appears that, in 1859, its library contained nearly 1400 volumes of books, since which time no books have been added. That while the town has increased within a certain period from 4,500 to 6,500 of a population, the Institute has decreased at a greater ratio, and that the Institute has been so much involved in consequence, that during the past Winter no fire could be allowed the Librarian on the two evenings in each week that the library has been kept open.

The *Post* takes the professional men, the merchants, and the mechanics, sorely to task for allowing such a state of things to exist, and I have no doubt but they richly deserve it, for their culpable neglect of so valuable an institution as it would become if generously supported; but still I cannot help thinking, Mr. Editor, but that the management of that institution has been very remiss in the discharge of duty, or it would not be in such a deplorable condition as is pictured by the Journal referred to—a picture, I fear, that might be truthfully drawn of many other such institutions in the province.

Let the managers of the St. Catharines Mechanics' Institute, or of any others so favourably situated as to population, secure a comfortable room for a library, and also a reading room comfortably seated, well lighted and kept open every evening, and having, in addition to necessary papers containing the current news of the day, a moderate supply of such works as the London Illustrated News, and Times, Punch, and Harper's Weekly, and a few of the best Magazines of Literature and Science, and I confidently predict that such rooms will be well attended, and become an object of interest in their respective localities.

I remember when the Toronto Mechanics' Institute had less than one hundred members, and only two of those taking books from the Library, yet, from adopting the course I have indicated, its membership numbered in the year 1858 upwards of 800, of whom 650 were regularly taking out books.

Such a result is well worth the effort made, especially when we consider that in all cities and towns of any magnitude there is a large class of young men, merchants and mechanics, who have no home but a boarding house, or a residence with their employers, which in many cases is to them even more cheerless than ordinary boarding houses, comfortless as they are in too many instances. To this class, a judiciously selected library of books and a comfortable reading room, in which to spend their evenings when not otherwise engaged, is a positive boon, and I have no doubt is so esteemed by a large proportion of this class of individuals.

In addition to a library and reading room, a lecture room should be secured if possible, where, through the Winter season, weekly lectures might be delivered; and in anything approaching a populous community, I cannot imagine any great difficulty in obtaining gratuitous lectures from the various ministers and professional gentlemen of the neighbourhood.

I am aware that considerable prejudices have of late arisen in regard to such lectures, as being too unconnected in the subjects treated of to be of any practical value to those who attend them. In that opinion I do not at all agree; for although no large amount of information can be obtained by listening to one single lecture on any given subject, yet the attention may be awakened and an interest excited, that may lead to a course of consecutive reading on the subject treated upon by the lecturer.

Indeed I am of opinion that, unless of a very popular character, one lecture, or at the most two, on any one subject during the same session, will be the most beneficial to the Institute and to the Public.

I had intended to refer to the establishment of classes in the several institutions, both as a means of instruction and amusement, but will leave that subject for the present, hoping some abler hand will take it up in the next number of the Journal. I trust also that others will follow the example of Dundas and Hamilton, in furnishing abstracts of reports and proceedings of their annual meetings, thus supplying each association with information as to what other institutions are doing, and awakening a spirit of emulation amongst them which will undoubtedly tend to their general benefit.

Yours, &c. &c.

A MEMBER T. M. I.

Toronto, April 26th, 1861.

NOTICES OF BOOKS.

An Introduction to Entomology, or Elements of the Natural History of Insects: comprising an account of Noxious and Useful Insects, of their Metamorphoses, Food, Stratagems, Habitations, Societies, Motions, Noises, Hybernation, Instinct, &c. By REV. WILLIAM KIRBY, M.A., F.R.S., F.L.S.; and WILLIAM SPENCE, ESQ., F.R.S., F L.S. Seventh edition, with an appendix relative to the Origin and and Progress of the work—1 vol., crown 8vo. pp. 607. London: Longman & Co. Price $1 50.

To pass any comments upon a book that has been stamped with the approbation as well of the learned as of ordinary readers, for upwards of forty years, and which now appears in its *seventh* edition, would be presumption on our part. We merely desire, while paying our tribute of admiration and approval, to bring it under the notice of those of our readers who are not yet acquainted with it, and to inform them where they can gain access to this very mine of instruction and amusement. There is probably no other work in the English language that has done more than this to spread the taste for Natural History, and to direct it to the vast field for observation afforded by the transformations, habits, and instincts of the countless species of insects. Its popularity has not been confined to one country, or even to one tongue, but by means of translations, and through the effect it has undoubtedly exercised over many of the best elementary books in other languages, its influence has been extended far and wide. The present edition is published in one volume, and at less than one-sixth of the price of the former one, thus placing it within the reach of all; its value is further enhanced by an addition from the pen of Mr. Spence (who survived his associate by about ten years), detailing, in the shape of letters and recollections the origin and progress of the work, and giving an account of the life-long friendship of the learned authors, who, after having originated and carried out the undertaking, so long survived its completion, and shared in its success.

The title affords a very good index to the contents of the work; the book opens with an introductory letter, giving a general view of the science of Entomology, and showing that it possesses attractions sufficient to reward any one who diligently studies it. The authors next go on to answer (which they do most conclusively) all the objections that are usually urged against this pursuit. Any one who imagines that it leads to inhumanity and cruelty, and is on that account to be avoided, has but to read our author's masterly refutation of this charge to perceive its unreasonableness and inconsistency, and to feel that the converse of what our great poet says,

> "The poor beetle that we tread upon,
> In corporeal sufferance feels a pang as great
> As when a giant dies,"

is nearer the truth. The next chapter gives an account of the metamorphoses of insects, a matter interesting alike to the moralist and the naturalist. The authors then take up the subject of the injuries and benefits derived from insects, shewing how important these minute creatures are as instruments both of evil and good; how closely connected with them are our prosperity, comfort, and happiness, and consequently how extremely useful and necessary is the knowledge and study of them. They then pass on to the more interesting parts of their history, those namely, that relate to their affection for their young, their food and methods of obtaining it, their habitations, societies, &c. From the observation of all which "it is clear—to quote the words of the authors themselves—that by these creatures and their instincts, the power, wisdom, and goodness of the Great Father of the universe are loudly proclaimed; the atheist and infidel confuted; the believer confirmed in his faith and trust in Providence, which he thus beholds watching with incessant care, over the welfare of the meanest of his creatures; and from which he may conclude that he, the prince of the creation, will never be overlooked or forsaken; and from them what lessons may be learned of patriotism, and self-devotion to the public good; of loyalty, of prudence, temperance, diligence, and self-denial." The remainder of the work treats of the means of defence possessed by insects, their motions, noises, hybernations, and finally their instincts, all subjects alike interesting and instructive. In conclusion we have but to say to all, both old and young, parents and children, 'buy and read,' enjoy yourselves all the strange accounts of insect history and economy, which have been collected with so much study and diligence, combined with personal observation, and put forth with so much taste and judgment by these talented authors. We venture to affirm that time thus bestowed will never be regarded as lost, or spent in vain.

Selected Articles.

ON SOME POINTS IN AMERICAN GEOLOGY.*

BY T. STERRY HUNT, M.A., F.R.S., OF THE GEOLOGICAL SURVEY OF CANADA.

The recent publication of two important volumes on American geology seems to afford a fitting occasion for reviewing some questions connected with the progress of geological science, and with the history of the older rock formations of North America. The first of these works is the third volume of the Palæontology of New York by James Hall; we shall not attempt the task of noticing the continuation of this author's labors in the study of organic remains, labors which have by common consent placed him at the head of American palæontologists, but we have to call attention to the introduction to this 3rd volume, where in about a hundred pages Mr. Hall gives a clear and admirable summary of the principal facts in the geology of the United States and Canada, followed by some theoretical notions on the formation of mountain chains, metamorphism and volcanic phenomena, where these questions are discussed from a point of view which we conceive to be of the greatest importance for the future of geological science. A publication of this introduction in a separate form, with some additions, would we think be most acceptable to the scientific public.

The other work before us is Prof. H. D. Rogers' elaborate report on the geology of Pennyslvania, giving the results of the Survey of that State for many years carried on under his direction, and embracing a minute description of those grand exhibitions of structural geology, which have rendered that State classic ground for the student. The volumes are copiously illustrated with maps, sections and figures of organic remains, and the admirable studies on the coal fields of Pennsylvania and Great Britain add much to its value.

The oldest series of rocks known in America is that which has been investigated by the officers of the Geological Survey of Canada, and by them designated the Laurentian system. It is now several years since we suggested that these rocks are the equivalents of the oldest crystalline strata of western Scotland and Scandinavia.† This identity has since been established by Sir R. I. Murchison in his late remarkable researches in the north-western Highlands, and he has adopted the name of the Laurentian system for these ancient rocks of Ross, Sutherland, and the Western Islands, which he at first called fundamental gneiss.* These are undoubtedly the oldest known strata of the earth's crust, and therefore offer peculiar interest to the geologist. As displayed in the Laurentide and Adirondack mountains they exhibit a volume which has been estimated by Sir William Logan to be equal to the whole palæozoic series of North America in its greatest development. The Laurentian series consists of gneiss, generally granitoid, with great beds of quartzite, sometimes conglomerate, and three or more limestone formations, (one 1000 feet in thickness) associated with dolomites, serpentines, plumbago, and iron ores. In the upper portion of the series an extensive formation of rocks, consisting chiefly of basic feldspars without quartz and with more or less pyroxene, is met with. The peculiar characters of these latter strata, not less than the absence of argillites and talcose and chloritic schists, conjoined with various other mineralogical characteristics, seem to distinguish the Laurentian series throughout its whole extent, as far as yet studied, from any other system of crystalline strata. It appears not improbable that future researches will enable us to divide this series of rocks into two or more distinct systems.

Overlying the Laurentian series on Lakes Huron and Superior, we have the Huronian system, about 10,000 feet in thickness, and consisting to a great extent of quartzites, often conglomerate, with limestones, peculiar slaty rocks, and great beds of diorite, which we are disposed to regard as altered sediments. These constitute the lower copper-bearing rocks of the lake region, and the immense beds of iron ore at Marquette and other places on the south shore of Lake Superior have lately been found by Mr. Murray to belong to this series, which is entirely wanting along the farther eastern outcrop of the Laurentian system. This Huronian series appears to be the equivalent of the Cambrian sandstones and conglomerates described by Murchison, which form mountain masses along the western coast of Scotland, where they repose in detached portions upon the Laurentian series.

Besides these systems of crystalline rocks, the latter of which is local and restricted in its distribution, we have along the great Apalachian chain, from Georgia to the Gulf of St. Lawrence, a third series of crystalline strata, which form the gneissoid and mica slate series of most American geologists, the hypozoic group of Prof. Rogers, consisting of feldspathic gneiss, with quartzites, argillites, micaceous, epidotic, chloritic, talcose and specular schists, accompanied with steatite, diorites and chromiferous ophiolites. This group of strata has been recognized by Safford in Tennessee, by Rogers in Pennyslvania, and by most of the New England geologists as forming the base of Appalachian system, while Sir William Logan, Mr. Hall, and the present writer have for many years maintained that they are really altered palæozoic sediments, and superior to the lowest fossiliferous strata of the Silurian series. Sir William Logan has shown that the gneissoid ranges in Eastern Canada have the form of synclinals, and are underlaid by shales which exhibit fossils in their prolongation, while his sections leave no doubt that these ranges of gneiss, with micaceous, chloritic, talcose and specular schists, epidosites, quartzites, diorites and ophiolites, are really the altered sediments of the Quebec group, which is a lower member of the Silurian series, corresponding to the Calci-

*(From the *American Journal of Science* for May, 1861.)

† Esquisse Geologique du Canada, 1855, p. 17.

* Quar. Journal Geol. Society, vol. xv. 353: xv.; 215.

ferous and Chazy formations of New York, or to the Primal and Auroral series of Pennsylvania. Prof. Rogers indeed admits that these are in some parts of Pennsylvania metamorphosed into feldspathic, micaceous and talcose rocks, which it is extremly difficult to distinguish from the hypozoic gneiss, which latter, however, he conceives to present a want of conformity with the palæozoic strata.

To this notion of the existence of two groups of crystalline rocks similar in lithological character but different in age, we have to object that the hypozoic gneiss is identical with the Green Mountain gneiss, not only in lithological character, but in the presence of certain rare metals, such as chrome, titanium, and nickel which characterise its magnesian rocks; all of these we have shown to be present in the unaltered sediments of the Quebec group, with which Sir William Logan has identified the gneiss formation in question. Besides which the lithological and chemical characters of the Appalachian gneiss are so totally distinct from the crystalline strata of the Laurentian system, with which Professor Rogers seem to identify them, that no one who has studied the two can for a moment confound them. Prof. Rogers is therefore obliged to assume a new series of crystalline rocks, distinct from both the Laurentian and Huronian systems, but indistinguishable from the altered palæozoic series, or else to admit that the whole of his gneissic series in Pennyslvania is, like the corresponding rocks in Canada, of palæozoic age.* We believe that nature never repeats herself without a difference, and that certain variations in the chemical and mineralogical constitution of sediments mark successive epochs so clearly that it would be impossibie to suppose the formation in adjacent regions of a series of crystalline schists like those of the Alleghanies contemporaneous with the sediments which produced the Laurentian system. We have elsewhere indicated the general principles upon which is based this notion of a progressive change in the composition of sediments, and shown how the gradual removal of alkalies from aluminous rocks has led to the formation of argillites, chloritic and epidotic rocks, at the same time removing carbonic acid from the atmosphere, while the resulting carbonate of soda by decomposing the calcareous and magnesian salts of the ocean, furnished the carbonates for the formation of limestones and dolomites, at the same time generating sea salt.†

Closely connected with these chemical questions is that of the commencement of life on the earth. The recognition beneath the Silurian and Huronian rocks of 40,000 feet of sediments analogous to those of more recent times, carries far back into the past the evidence of the existence of physical and chemical conditions, similar to those of more recent periods. But these highly altered strata exclude, for the most part, organic forms, and it is only by applying to their study the same chemical principles which we now find in operation that we are led to suppose the existence of organic life during the Laurentian period. The great processes of deoxydation in nature are dependent upon organization; plants by solar force convert water and carbonic acid into hydrocarbonaceous substances, from whence bitumens, coal, anthracite and plumbago, and it is the action of organic matter which reduces sulphates, giving rise to metallic sulphurets and sulphur. In like manner it is by the action of dissolved organic matters that oxyd of iron is partially reduced and dissolved from great masses of sediments, to be subsequently accumulated in beds of iron ore. We see in the Laurentian series beds and veins of metallic sulphurets, precisely as in more recent formations, and the extensive beds of iron ore hundreds of feet thick, which abound in that ancient system, correspond not only to great volumes of strata deprived of that metal, but as we may suppose, to organic matters, which but for the then greater diffusion of iron oxyd in conditions favorable for their oxydation, might have formed deposits of mineral carbon far more extensive than those beds of plumbago which we actually meet with in the Laurentian strata.

All these conditions lead us then to conclude to the existence of an abundant vegetation during the Laurentian period, nor are there wanting evidences of animal life in these oldest strata. Sir William Logan has described forms occuring in the Laurentian limestone which cannot be distinguised from the silicified specimens of *Stromatopora rugosa* found in Lower Silurian rocks. They consist of concentric layers made up of crystalline grains of white pyroxene in one case and of serpentine in another, the first imbedded in limestone and the second in dolomite; we may well suppose that the result of metamorphism would be to convert silicified fossils into silicates of lime and magnesia. The nodules of phosphate of lime in some beds of the Laurentian limestones also recall the phosphatic coprolites which are frequently met with in Lower Silurian strata, and are in the latter case the exuviæ of animals which have fed upon *Lingula, Orbicula, Conularia* and *Serpulites*, the shells and tubes of which we have long since shown to be similar in composition to the bones of vertebrates.* So far therefore from looking upon the base of the Silurian as marking the dawn of life upon our planet, we see abundant reasons for supposing that organisms, probably as varied and abundant as those of the palæozoic age, may have existed during the long Laurentian period.

Along the northren rim of the great palæozoic basin of North America the potsdam sandstone of the New York geologists is unquestionably the lowest rock from below Quebec to the Island of Montreal, and thence passing up the valley of Lake Champlain and sweeping round the Adirondack mountains, until it reënters Canada and soon disappears to the north of Lake Ontario, where the Birdseye and Black River limestones repose directly upon the Laurentian rocks, and furthermore overlie the great Lake Superior group of slates and sandstones, which reposing on the unconformable Huronian system, constitutes the upper copper-bearing rocks of this region. This Lake Superior group, as Sir William Logan remarks,

* Dr. Bigsby in 1824 described an extensive tract of gnessoid rocks on Rainy Lake and Lake Lacroix, north of Lake Superior. The general course of the strata he states to be from N. W. to N. by W., with a corresponding easterly dip;" but he elsewhere speaks of the gneiss as running (dipping?) E. N. E. This gneiss often contains beds and disseminated grains of hornblende, and passes in some places into micaceous, chloritic and greenstone slates, and syenite. Staurotide is abundant in the mica schists, and octahedral iron occurs in the chloritic slates. A porphyritic granite containing beryl is also met with in this region. This gneiss is regarded by Dr. Bigsby as belonging "to transition rocks, from its constant proximity to red sandstone, the oldest organic limestone, and trap." (Am. Jour. Sci. (1) viii. 61). The lithological and mineral characters of these crystalline strata seem to be distinct from those of the Laurentian system, and to resemble those of the Appalachians. Too much praise cannot be ascribed to Dr. Bigsby for his early and extensive observations on the geognosy and mineralogy of British North America.

† Am. Journal of Science (2) xxv. 102, 445 xxx. 133; Quar. Journal Geo. Soc. xv. 488, and Can. Naturalist, December, 1859.

* Logan and Hunt, Am. Jour. Sci. (2) xvii. 235.

may then include the Potsdam, Calciferous and Chazy, and thus be equivalent in part to the Quebec group hereafter to be described.

Passing westward into the Mississippi valley we again find a sandstone formation, which forms the base of the palæozoic series, and is considered by Mr. Hall to be the equivalent of the Potsdam. Here it occasionally exhibits intercalated beds of silico-argillaceous limestone, in which occur abundant remains of trilobites of the genera *Dikellocephalus*, *Menocephalus*, *Arionellus*, and *Conocephalus*. Passing upwards this sandstone is succeeded by the Lower Magnesian limestone, which is the equivalent of the Calciferous sandrock of New York, and in Missouri, where it is the great metalliferous formation, alternates several times with a sandstone, constituting the Magnesian Limestone series, which in Missouri attains a thickness of 1300 feet. The same thing is observed to a less degree in Wisconsin and Iowa; throughout this region the higher beds of the Potsdam sandstone are often composed of rounded oolitic granules, and the beds of passage are frequently of such a character as to lead to the conclusion that they have been deposited from silica in solution, and are not mechanical sediments.* For a discussion of some facts with regard to the chemical origin of many silicious rocks, see *Am. Journal of Science*, (2) xviii. 381.

Evidences of disturbance during the period of its deposition are to be found in the brecciated beds, sometimes fifty feet in thickness, which occur in the calciferous sandrock of the north-west, and are made up of the ruins of an earlier sandstone. In Missouri, the Birdseye and Black River limestones repose directly upon the Lower Magnesian limetone, while further north a sandstone intervenes, occupying the place of the Chazy limestone.

The Potsdam sandstone of the St. Lawrence valley, has for the most part the character of a littoral formation, being made up in great part of pure quartzose sand, and offering upon successive beds, ripple and wind marks, and the tracks of animals. Occasionally it includes beds of conglomerate, or as at Hemingford, encloses large rounded fragments of green and black shale; it also exhibits calcareous beds apparently marking the passage to the succeeding formation, which although called a Calciferous sandrock, is for the most part here, as in the west, a magnesian limestone, often geodiferous, and including calcite, pearl spar, gypsum, barytes and quartz. Sir William Logan had already shown that the fauna of the Potsdam and Calciferous in Canada are apparently identical (*Canadian Naturalist*, June 1860, *American Journal of Science* [2] xxxi. 18), and Mr. Hall has arrived at the same conclusion with regard to the more extended fauna of these formations in the valley of the Mississippi, so that these two may be regarded as forming but one group. While in the west *Dikellocephalus* occurs both in the lower sandstones and the magnesian limestones, *Conocephalus minutus*, found in the Potsdam on Lake Champlain, and identified by Mr. Billings, has lately been detected by him in specimens from the sandstones of Wisconsin with *Dikellocephalus*, which genus has there been found to pass upwards into the magnesian limestones. On the other hand, the sandstones of Bastard in Canada, having the characters of the Potsdam, contain *Lingula acuminata* and *Ophileta compacta*, species regarded as characteristic of the Calciferous, together with two undescribed species of *Orthoceras*, and in another locality a *Pleurotomaria* resembling *P. Laurentina*. The researches of Mr. Billings have extended the fauna of the Calciferous in Canada to forty-one species, and the succeeding Chazy formation to 129 species. The thickness of this latter division in the St. Lawrence valley is about 250 feet, and it includes in its lower part about fifty feet of sandstones with green fucoidal shales and a bed of conglomerate. The Calciferous has a thickness ef about 300 feet, while the Potsdam may be estimated at not far from 600 feet.

* See Mr. Hall's Introduction, to which we are indebted for many of these facts regarding the formations of the west, and also the Reports of the Geological Survey of Missouri.

We have then seen that along the north-eastern outcrop of the great American basin in Canada and New York, the base of the palæozoic series is represented by less than 1000 feet of sandstones and dolomites, reposing directly upon the Laurentian system. A very different condition of things is, however, found in the more central parts of the basin. According to Prof. Rogers, the older Primal slates, which form the base of the palæozoic system, attain in Virginia a thickness of 1200 feet, and are succeeded by 300 feet of Primal sandstone marked by *Scolithus*, which he considers the Potsdam, followed by the upper Primal slates, consisting of 700 feet of greenish and brownish talco-argillaceous shales with fucoids. To these succeed his Auroral division, consisting of sixty feet or more of calcareous sandstone, the supposed equivalent of the Calciferous sandrock, followed by the Auroral limestone, which is magnesian, and often argillaceous and cherty in the upper beds. Its thickness is estimated at from 2500 to 5500 feet, and it is supposed by Rogers to include the Chazy and Black River limestones, while the succeeding Matinal division exhibits first, from 300 to 550 feet of limestone (Trenton), secondly, 300 to 400 feet black shale (Utica), and thirdly, 1200 feet of shales with red slates and conglomerates (Hudson River group), thus completing the Lower Silurian series.

In Eastern Tennessee, Mr. Safford describes (1st) on the confines of North Carolina, a great volume of gneissoid and micaceous rocks similar to those of Pennsylvania, succeeded to the west by (2nd) the Ococee conglomerates and sandstones, with argillites, chloritic, talcose and micaceous slates, and occasional bands of limestone, all dipping, like the rocks of the 1st division, to the S. E. In the 3rd place we have the Chilhowee sandstones and shales, several thousand feet in thickness, including near the summit, beds of sandstone with *Scolithus*, and considered by Mr. Safford the equivalent of the Potsdam. (4th.) The Magnesian limestone and shale group, also several thousand feet thick, and divided into three parts; first, a series of fucoidal sandstones approaching to slates and including bands of magnesian limestone; second, a group of many hundred feet of soft, brownish, greenish and buff shales, with beds of blue oolitic limestone, which as well as the shales, contain trilobites. Passing upward these limestones become interstratified with the third sub-division, consisting of heavy bedded magnesian limestone, more or less sparry and cherty near the summit. The limestones of Knoxville belong to this group, which with the 3rd or Chilhowee group is designated by Mr. Safford as Cambrian, corresponding to the Primal and Auroral of Rogers, or to the Potsdam and Calciferous sandrock, with the possible addition of the Chazy, being equivalent to the great Magnesian limestone series of Prof. Swallow in Missouri. To these strata succeed Safford's 5th formation, consisting of limestones, the equivalents of the Black River, Trenton, and higher portions of the Lower Silurian.

In Eastern Canada we find a group of strata similar to those described by Rogers and Safford, and distinguished by Sir William Logan as the Quebec group. It has for its base a series of black and blue shales, often yielding roofing slates, succeeded by grey sandstone and great beds of conglomerate, with dolomites and pure limestones, often concretionary and having the character of travertines. These are associated with beds of fossiliferous limestones, and with slates containing compound graptolites, and are followed by a great thickness of red and green shales, often magnesian, and overlaid by 2000 feet of green and red sandstone, known as the Sillery sandstone, the whole from the base of the conglomerate, having a thickness about 7000 feet. These red and green shales resemble closely those at the top of the Hudson River group, and the succeeding sandstones are so much like those of the Oneida and Medina formations, that the Quebec group was for a long time regarded as belonging to the summit of the Lower Silurian series, the more so as by a great break and upthrow to the S. E., the rocks of this group are made to overlap the Hudson River formation. "Sometimes it may overlie the overturned Utica formation, and in Vermont, points of the overturned Trenton appear occasionally to emerge from beneath the overlap."* This great dislocation is traceable in a gently curving line from near Lake Champlain to Quebec, passing just north of the fortress; thence it traverses the island of Orleans, leaving a band of higher strata on the northern part of the island, and after passing under the waters of the Gulf, again appears on the main land about eighty miles from the extremity of Gaspé, where on the north side of the break, we have as in the island of Orleans, a band of Utica or Hudson River strata. To the south and east of this line the rocks of the Quebec group are arranged in long, narrow, parallel, synclinal forms, with many overturn dips. These synclinals are separated by dark gray and black shales, with limestones, hitherto regarded as of Hudson River age, but which are perhaps the deep-sea equivalent of the Potsdam.

The presence of conglomerates and sandstones, alternating with great masses of fine shales, indicates a period of frequent disturbances, with elevations and depressions of the ocean's bottom, while the deposits of dolomite, magnesite, travertine and highly metalliferous strata show the existence of shallow water, lagoons and springs over a great area and for a long period between the formation of the upper and lower shales. We may suppose that while the Potsdam sandstone was being deposited along the shores of the great palæozoic ocean, the lower black shales were accumulating in the deeper waters, after which an elevation took place, and the magnesian strata were deposited, followed by a subsidence during the period of the upper shales and Sillery sandstones.

Associated with the magnesian strata at Point Levi and in several other localities in the same horizon of the Quebec group, an extensive fauna is found, of which 137 species are now known, embracing more than 40 new species of graptolites, which have been described by Mr. James Hall in the report of the Geological Survey of Canada for 1857, and 36 species of trilobites described by Mr. Billings in the *Canadian Naturalist* for August, 1860. These species are as yet distinct from any thing found in the Potsdam below or the Birdseye and Black River above; although the trilobites recall by their aspect those found by Owen in the Lower Sandstone of the Mississippi. Seven species alone out of this fauna have been identified with those known in other formations, and of these one is Chazy, while six belong to the Calciferous, to which latter horizon Mr. Billings considers the Quebec group to belong. The Chazy has not yet been identified in this region, unless indeed it be represented in some of the upper portions of the Quebec group. The Calciferous sand-rock is wanting along the north side of the St. Lawrence valley from near Lake St. Peter to the Mingan Islands, but at Lorette behind Quebec, at the foot of the Laurentides, the Birdseye limestone is found reposing conformably upon the Potsdam sandstone.

It is not easy to find the exact horizon of the Potsdam sandstone among the black shales which underlie the Quebec group. The *Scolithus* of Roger's Primal Sandstone, and of the summit of Safford's 3rd or Chilhowee formation is identical with that found in the quartz rock at the western base of the Green Mountains, and figured by Mr. Hall in the 1st volume of the Palæontology. It is distinct from what has been called *Scolithus* in the Potsdam of Canada. The value of this fossil as a means of identification is diminished by the fact that similar marks are found in sandstones of very different ages. Thus a *Scolithus* very like that of the St. Lawrence valley occurs in the sandstone of Lake Superior and in the Medina sandstone, while in Western Scotland, according to Mr. Salter, the two quartzite formations above and below the Lower Silurian limestones of Chazy age are alike characterized by these tubular markings, which are regarded by him as produced by annelids or sea worms. We find however in shales which underlie the Quebec Group at Georgia in Vermont, trilobites which were described by Mr. Hall in 1859 as belonging to the genus *Olenus*, a recognized primordial type; he has since erected them into a new genus. Again at Braintree in Eastern Massachusetts occur the well known *Paradoxides* in an argillaceous slate. These latter fossils Mr. Hall suggests probably belong to the same horizon as certain slaty beds in the Potsdam sandstone, or perhaps even at the base of this formation. (Introduction, page 9.) In this connection we must recall the similar shales of Newfoundland, in which Salter has recognized trilobites of the same genus. These shales containing *Paradoxides*, like those underlying the Quebec group, thus appear to belong to the so-called Primordial zone, and are to be regarded as the equivalents of the Potsdam sandstone, which both on Lake Champlain and in the Mississippi valley is characterized by primordial types. The intermingling of Potsdam and Calciferous forms to which we have already alluded, seems however to show that it will be difficult to draw any well defined zoological horizon between the different portions of these lower rocks, which at the same time offer as yet no evidences of any fauna lower than that of the Potsdam. So that we regard the whole Quebec group with its

* See Sir William Logan's letter to Mr. Barrande, *Canadian Naturalist* for Jan. 1861, and *American Journal of Science* (2) xxxi. 216.

underlying Primordial shales as the greatly developed representative of the Potsdam and Calciferous (with perhaps the Chazy), and the true base of the Silurian system.

The Quebec group with its underlying shales is no other than the Taconic system of Emmons. Distinct in their lithological characters from the Potsdam and Calciferous formations as developed on Lake Champlain, Mr. Emmons was led to regard these strata as belonging to a lower or sub-Silurian group. We have however shown that the palæontological evidence afforded by this formation gives no support to such a view. To Mr. Emmons however is undoubtedly due the merit of having for a long time maintained that the Taconic hills are composed of strata inferior to the Trenton limestones, brought up into their present position by a great dislocation, with an upthrow on the eastern side. We would not object to the term Taconic if used as indicating a subdivision of the Lower Silurian series, but as the name of a distinct and sub-Silurian system it can no longer be maintained. The Quebec group evidently increases in thickness as we proceed towards the south, and the calcareous parts of the formation are more developed. In 1859, I visited in company with Mr. A. D. Hager the marble quarries of Rutland and Dorset, in Vermont. The latter occur in a remarkable synclinal mountain of nearly horizontal strata of marble and dolomite, capped by shales, and attaining a height of 2700 above the railway station at its base. I then identified these marbles with the limestones of the Quebec group, considering them to be beds of chemically precipitated carbonate of lime or travertine, and not limestones of organic origin.

(*To be continued.*

MISCELLANEOUS.

Cotton Manufactures in Canada.

Projects are on foot for the establishment of Cotton Manufactories in various parts of Canada, both in the Upper and Lower Province. A proper conception of the magnitude of our importation of cotton manufactures may be gathered from the fact, that their declared value in 1849 amounted to $4,863,444, or one-eighth of the entire importations of that year.

Table of Importations and Exportations from 1851, *to* 1860, *inclusive.*

	Importations.	*Exportations.*
1851	$21,434,790	$13,810,604
1852	20,286,492	15,307,607
1853	31,981,436	23,801,303
1854	40,529,325	23,019,190
1855	36,086,169	28,188,460
1856	43,584,387	32,047,017
1857	39,428,584	27,006,624
1858	29,078,527	23,472,609
1859	33,555,161	24,766,981
1860	34,441,621	34,631,890

From the foregoing table it appears that the year 1860 is distinguished in Canadian History by being the first year during which the exports exceeded the imports.

Dr. Gesner F. G. S., on Artificial Guano.

Guano, so valuable a fertilizer, is chiefly composed of the excrements of sea fowls. Frequently it contains feathers, bones of fishes, humus, &c. It is very variable in composition, a circumstance that has been ascribed to the different kinds of food upon which the birds subsisted. Some Guanos contain upwards of 25 per cent of uric acid, in others that acid is almost entirely absent, and it is the same in regard to other acids, salts and alkalies. Ammonia usually enters largely into the best qualities of this fertilizer, and the presence of its carbonate is known by its odour. The oxalate, urate and phosphate of ammonia and magnesia are almost always present with the phosphates of soda and lime, the phosphates having been derived from the bones of the fish upon which the birds feed. In the supply of ammonia and of earthly and alkaline salts, guano is of the greatest value for plants cultivated for food. The food of the birds, from which the guano had been deposited has been a certain fish that fed upon other fish, the food of which was marine plants, or animalculæ. The origin of this fertilizer is therefore found in marine plants and animals.

The writer has obtained a product analogous to the true guano, and one nearly, if not quite, equal in its value for fertilizing purposes. Chemical and mechanical means have been applied to the marine *fuci* and fishes and fish offal until an artificial guano has been obtained. The sources of the alkaline carbonate, chloride of sodium and organic matter have been found in marine plants, the phosphate and carbonates of lime and ammonia in the bones and flesh of fishes, and after many experiments carefully performed, they have been combined so as to form a cheap and portable manure. At Long Island, in the State of New York, *menhaden* are manufactured into manure : the oil, which is very offensive, being extracted from the fish and employed for common purposes.

Having visited a great number of the fishing establishments of the Provinces of New Brunswick, Nova Scotia, Newfoundland and the Islands and coasts of the Gulf of St. Lawrence and Labrador, the writer obtained a knowledge of the vast quantity of fish and flesh offal annually thrown into the sea, or otherwise lost to every useful purpose. The garbage thrown-overboard yearly from vessels fishing on the banks of Newfoundland, if properly preserved and manufactured, with the annual growth of sea weeds upon the shore, would fertilize the entire cultivated surface of the Eastern States and British Provinces; still the amount of animal matter thus referred to is far less than that produced by the inshore fisheries.

To the forgoing may be added the enormous quantities of mytili and other shellfish growing upon the shore, and which are not less applicable for the manufacture of artificial guano, than the offal of the finny tribes. At many places on the shores, fish are met with in such abundance that they are employed by the fishermen to manure the small patches of ground some of them cultivate. At the principal fishing stations, the refuse garbage and bones alone would supply a manufactory, and with good management and the use of kelp, the offal may be transported from place to place without inconvenience. Like the bones of terrestial animals, the inorganic matter or ash of the bones of fishes consists in the greater part of the phosphates of lime, or bone phosphate, with carbonate of lime, the fertilizing properties of which are well understood. Few soils preserve their fertility for any length of time. Every crop removes from the earth certain elements, which it is the business of the farmer to restore, and for that purpose no manure is better adapted than guano, either natural or artificial.

Apple Skins.

M. Victor Chatel, who brings forward numerous citations from the most distinguished agriculturists, asserts that wherever apple skins have been employed, either for feeding cattle, or as manure for fields, corn, rape, or young apple trees, the results have been most satisfactory. The skins are preserved by being pressed down tightly in a hole, and covered with a well beaten layer of earth. When cooked and given to pigs, the latter are quickly fattened, and kept in perfect health.

Berthelot—The French Chemist.

The most remarkable scientific event of modern times is the publication of a treatise on chemistry, proceeding on the same plan in organic chemistry as has been adopted for a century past in mineral chemistry; that is, forming organic substances synthetically by combining their elements by the aid of chemical forces only. The author who has performed demonstrations by this method is Berthelot, who has been occupied with organic synthesis since he first devoted himself to chemistry. Berthelot is not a vitalist; he is convinced that "we may undertake to form, *de novo*, all the substances which have been developed from the origin of things, and to form them under the same conditions, by virtue of the same laws and by means of the same forces which nature employs for their formation." Let us hasten to add a distinction upon which Berthelot properly insists and which it is necessary to recognize between organs and the matter of which they are composed. "No chemist pretends to form in his laboratory a leaf, a flower, a fruit or a muscle; these questions relate to physiology;" and it was by not observing this distinction that it was possible to form that school of medicine of which mention was made in my last communication, and which referred everything to vital force. This distinction being admitted, and calling to mind the synthesis recently effected, such as the direct preparation of $C^4 H^4$ from carbon and hydrogen, and alcohol from the union of $C^4 H^4$ and water, we may understand the possibillity of performing for organic chemistry what has been done for mineral chemistry, and to give to it a basis independent of the phenomena of life.—*Silliman's Journal.*

The Color of Water.

Dr. Tyndall has shown, by a series of beautiful and conclusive experiments, that water has a decided color —that even in small thicknesses it is not the colorless substance it is usually imagined to be. When seen through a glass full of the liquid, of course it appears without color, but if looked at through a stratum of fifteen fest its color is very evident. The following is Dr. Tyndall's arrangement of the experiment for showing this to a large audience. A tin tube, fifteen feet long and about three inches in diameter, is placed horizontally on a stand, and half filled with water. The tube being about half filled with water, and the image upon the screen being inverted by the lens, the upper air space in the tube is seen in the lower part of the image, which is quite colorless; whilst the upper portion, illuminated by the rays which pass through the stratum of water, is of a greenish blue color. The color varies from a pure green up to a blue, according to the purity or otherwise of the water. Thus it is evident that the color of water is very appreciable; for, in a stratum of fifteen feet, a very considerable amount is exhibited, and thus there is no difficulty in comprehending the fact that, in looking through a deeper stratum, such as is seen in the Swiss lakes and in the water which we have around our own shores, this color of water makes itself very perceptible.—*Scientific American.*

Tanning Statistics.

In a communication to the *Shoe and Leather Reporter*, J. M. Kiersted, jun., states that, during the operation of tanning, conducted for six years at Mongaup, Pa., the average quantity of leather made with one cord of hemlock bark was 145 lbs., and the average cost for tanning 1 lb., was 5c. 92m. The cost of the bark per cord was $3.05. During these six years 92,522 hides were tanned from which 2,988,464 lbs. of leather were made. There were 20,547 cords of hemlock bark used. The leeches for extracting the tannic acid of the bark are heated with steam, and the spent bark is burned for fuel. The expense of tanning with hemlock is continually increasing, as the bark is becoming scarce and the price advancing.

Composition of the Human Body.

Not only does food supply the daily waste of the human body, but, as the body increases in size from birth to adult age, it is supplied with materials for this increase by the aid of food. In order, therefore, to understand the value of food from its composition, it is necessary to know the composition of the human body. Just as any other compound substance can be submitted to chemical analysis and the elements of which it consists ascertained, so can the composition of the human body be discovered. Such analyses of course become difficult in proportion to the complication of the body analysed, and only an approach to the true quantities in which the elements exist can be expected.

The following are the elements and their quantities entering into the composition of a human body weighing 11 stones or 154 pounds:

ULTIMATE ELEMENTS OF THE HUMAN BODY.

	lbs.	oz.	gr.
1. *Oxygen*, a gas. The quantity contained in the body would occupy a space equal to 750 cubic feet	111	0	0
2. *Hydrogen*, a gas. The lightest body in nature. The quantity present would occupy about 3,000 cubic feet	14	0	0
3. *Carbon*, a solid. When obtained from animals it is called animal charcoal	21	0	0
4. *Nitrogen*, a gas. It would occupy, when free, about 20 cubic feet	3	8	0
5. *Phosphorus*, a solid. This substance is so inflammable that it can only be kept in water	1	12	190
6. *Calcium*, a solid. The metallic base of lime, which has not yet been obtained in sufficient quantity to be employed in the arts. It is about the density of aluminium	2	0	0
7. *Sulphur*, a solid. A well known substance. It unites with hydrogen, forming sulphuretted hydrogen, which gives the unpleasant smell to decomposing animal and vegetable matter	0	2	219
8. *Fluorine*, a gas. This substance has not been separated in such a manner as to permit of an examination of its properties, and cannot be exhibited. It is found united with calcium in the bones	0	2	0
9. *Chlorine*, a gas. When combined with sodium it forms common salt	0	2	47
10. *Sodium*, a metal. It is so light that it floats on water, and is kept in naphtha to prevent its oxidation	0	2	116
11. *Iron*, a metal. In small quantities it is necessary to the health of the body	0	0	100
12. *Potassium*, a metal. Like sodium it floats on water, and burns with a flame when placed on it	0	0	290
13. *Magnesium*, a metal. Combined with oxygen it forms magnesia	0	0	12
14. *Silicon*, a metallic substance. With oxygen it forms silex or silica. It enters into the composition of the teeth and hair	0	0	2
	154	0	0

Other elements have been found in the body, as copper and manganese, but these are probably accidental.

These elements, when combined together, form a set of compound bodies called "proximate principles," out of which the tissues and fluids of the body are formed.

PROXIMATE PRINCIPLES OF THE HUMAN BODY.

	lbs.	oz.	gr.
1. *Water*, composed of oxygen and hydrogen gases	111	0	0
2. *Gelatin*, of which the walls of the cells and many tissues of the body, as the skin and bones, are principally composed	15	0	0
3. *Fat*, which constitutes the adipose tissue	12	0	0
4. *Phosphate of Lime*, forming the principal part of the earthy matter of the bones	5	13	0
5. *Carbonate of Lime*, also entering into the composition of bone	1	0	0
6. *Albumen*, found in the blood and nerves	4	3	0
7. *Fibrine*, forming the muscles and the clot and globules of the blood	4	4	0
8. *Fluoride of Calcium*, found in the bones	0	3	0
9. *Chloride of Sodium*, common salt	0	3	376
10. *Chloride of Potassium*	0	0	10
11. *Sulphate of Soda*	0	1	170
12. *Carbonate of Soda*	0	1	72
13. *Phosphate of Soda*	0	0	400
14. *Sulphate of Potash*	0	0	400
15. *Peroxide of Iron*	0	0	150
16. *Phosphate of Potash*	0	0	100
17. *Phosphate of Magnesia*	0	0	75
18. *Silica*	0	0	3
	154	0	0

These compounds, in passing away from the body, form many others, which may be here left out of consideration as not forming a necessary part of the fabric of the human body.

None of these constitutents of the body remain permanently in the system, and whilst the old particles are being removed new ones are supplied by the food. It is calculated that in this way a quantity of material, equal to the weight of the whole body, is carried away every forty days. So that we may be said to moult or cast away our old body and get a new one every forty days.

The materials for the food of man, and containing the above elements, are derived from the mineral, vegetable and animal kingdoms. The vegetable kingdom, however is the great source of food to man and animals, as it is in the cells of the plant that the elements undergo those chemical changes which fit them for food. The animal can only supply what it obtains from them, and the substances supplied by the animal kingdom as food are identical with those obtained from plants. To a certain extent the physiological action of food depends upon its chemical composition.—*Guide to the Food Collection of the South Kensington Museum.*

New Zealand Steel.

The occurrence of Titaniferous ores of iron in Canada is well known. Sir W. Logan has long since pointed out their distribution at St. Urbain (Baie St. Paul) and Vaudreuil (Beauce). The following notice of the Titaniferous ores of New Zealand will serve to direct renewed attention to the Canadian deposits of this important material:

Ever since the settlement of New Zealand by Europeans their attention has been daily called to the peculiarities of a kind of metallic sand along the shores of New Plymouth, in Taranaki. This sand has the appearance of fine steel filings, and if a magnet be dropped upon it, and taken up again, the instrument will be found thickly coated with the iron granules. The place where the sand abounds is along the base of Mount Egmont, an extinct volcano; and the deposit extends several miles along the coast, to the depth of many feet, and having a corresponding breadth. The geological supposition is that this granulated metal has been thrown out of the volcano along the base of which it rests into the sea, and there pulverized. It has been looked upon for a long time as a geological curiosity, even to the extent of trying to smelt some of it; but, although so many years have passed since its discovery, it is only recently that any attempt has been made to turn it to a practical account; in fact, the quantity is so large that people out there looked upon it as utterly valueless. It formed a standing complaint in the letters of all emigrants, that when the sea breeze was a little up they were obliged to wear veils to prevent being blinded by the fine sand which stretched for miles along the shore. Captain Morshead, resident in the West of England, was so much impressed with its value that he went to New Zealand to verify the reports made to him in this country, and was fortunate enough to find them all correct. He smelted the ore first in a crucible, and subsequently in a furnace; the results were so satisfactory that he immediately obtained the necessary grant of the sand from the Government, and returned to England with several tons for more conclusive experiments.

It has been carefully analysed in this country by several well-known metallurgists, and has been pronounced to be the purest ore at present known: it contains 88·45 of peroxide of iron. 11·43 of oxide of titanium, with silica, and only 12 of waste in 100 parts. Taking the sand as it lies on the beach and smelting it, the produce is 61 per cent. of iron of the very finest quality; and, again, if this sand be subjected to what is called the cementation process, the result is a tough, first-class steel, which, in its properties, seems to surpass any other description of that metal at present known. The investigations of metallurgical science have found that if titanium is mixed with iron the character of the steel is materially improved; but, titanium being a scarce ore, such a mixture is too expensive for ordinary purposes. Here, however, nature has stepped in, and made free gift of both metals on the largest scale. To give some idea of the fineness of this beautiful sand, it will be enough to say that it passes readily through a gauze sieve of 4900 holes or interstices to the square inch. As soon as it was turned into steel by Mr. Musket, of Coleford, Messrs. Moseley, the eminent cutlers and toolmakers, of New-street, Covent-garden, were requested to see what could be done with the Taranaki steel. They have tested it in every possible way, and have tried its temper to the utmost; and they say the manner in which the metal has passed through their trials goes far beyond anything that they ever worked in steel before. It has been formed into razors, scissors, saws, penknives, table cutlery, surgical instruments, &c.; and the closeness of the grain, the fineness of polish, and keenness of edge, place it in the very foremost rank—almost in the position of a new metal.

Some silk-cutting tools have been made, and so admirably have they turned out that one particular firm will in future use no others. In the surgical instruments the edges have been examined by the microscope, and have stood the test in keeping the superiority. This steel is stated to possess peculiar advantages for gun-barrels and boring-cutters for ordnance purposes. As far as is at present known of this extraordinary metal, it bids fair to claim all the finer classes of cutlery and edge-tool instruments to itself, so well has everything made from it turned out. Messrs. Moseley, in whose hands the sole manufacture of cutlery and edge-tools is vested for this country, have placed a case, filled with the metal in all its stages, in the Polytechnic Institution. There is the fine metallic sand, some beautiful specimens of the cutlery made from it, and the intermediate phases of the iron and steel.—*The Australian Mail.*

The Cotton Supply.*

There are, as far as my information extends, but two countries that are likely to furnish us with a fair supply of good cotton, and this not in substitution of the cotton of America, but as considerable auxiliaries to it. These are our recently acquired territories on the eastern side of the Bay of Bengal, including Arracan, Pegu and Martaban, but excluding those on the Tennerasim coast, and the lately formed colony of Queensland in Australia. I shall describe the little I know of them.

Our territories on the eastern coast of the Bay of Bengal embrace four degrees of latitude extending from the 16th to the 20th degree, and contain an area of 64,450 square miles, or are larger than England and Wales by at least 10.000 miles. Their scanty population ranges from 8 to 50 inhabitants to a square mile, or on an average about 26, not one twentieth part of the average density of the population of lower Bengal. The country is watered by one great river and three considerable ones, each with branches and affluents, forming an extensive network of internal boat navigation, so that the territory, on a minor scale, bears no inconsiderable resemblance to that of the Lower Mississippi. The coast has at least four safe harbours to which there is inland communication by water. The greater portion of the country is a rich alluvial plain, producing as before stated, by far the largest amount of the rice which is exported from British India under the name of "Bengal," a commodity of which we ourselves imported in 1859, about 64,000 tons of the value of £686,000, forming 88 parts in a 100 of all of that grain which we imported.

The wild or unoccupied land must, of course, from the sparseness of the population, be large, and there ought to be no more difficulty in obtaining the fee-simple of it by Englishmen, than there is in Canada or Australia. This would be a necessary preliminary to the production of good cotton. If the local population —a very docile one—were not found sufficient for the requisite labour, the exuberant population of India is close at hand to make up the defficiency. The periodical rains of great severity, extend from April to September, and during their continuance, the cultivation of cotton could not be carried on. Sown in March, however, the crop would have six months of dry weather to ripen, which, it may be presumed, would suffice. A rice crop, in this case, would occupy the land during the rains, so that there would be a cereal and a cotton crop within the year. I resided for some time in the country I am now giving an outline of, and the impression which my acquaintance with it has left is, that it seems better adapted to the culture of the cotton plant than any other part of India. Experience alone, however, must be the only test of its practical adaptation.

Of Queensland we know, as yet, far too little to enable us to speak confidently of its capacity to produce cotton. It is described, however, as having a fertile soil with sufficient moisture, and to possess some commodious harbours. It certainly lies within latitudes (that is from the 30th degree south to the tropic), corresponding with those parts of Brazil which produce cotton superior to the average of American. Should Queensland be found adapted to the cultivation of cotton, the heat of the climate will necessitate Asiatic labour, and this may be obtained from India, as in the case of Ceylon and the Mauritius, or from China, equally ready to yield it, and indeed, yielding it already largely to Australia in the case of the gold mines.

From the facts which I have adduced in the course of this paper, I must come to the conclusion that there exists no reasonable ground for apprehending any serious deficiency in our supply of cotton, although in cotton, as in every other product of the soil, fluctuations must be expected which no care can obviate. Our chief reliance, must long, in my opinion, be on Anglo-Saxon America, which at present furnishes us with four-fifths of the value of all that we consume. This mere name, however, does not imply that we receive the whole from a single country, for no fewer than seven sovereign states, each as large as an European kingdom, contribute to our supply,—all, too, competing with one another to make that supply as cheap, good, and abundant as possible.

The integrity of the cotton manufacture is indispensable to our prosperity, but the cultivation of the plant is, if possible, of still more vital importance to the Southern States of America. We derive our chief supply from them, and we are by far their best customers. There exists between us, consequently, a mutual and profitable dependence, which promises a long duration. If other countries can supply us with better cotton than America, our market, the best in the world, is free to them, and no doubt they will furnish it, but it does not appear to me that we are called upon to make extraordinary or eccentric efforts to insure it, any more than we are to insure a supply of corn or any other staple article of our consumption. In a struggle of seventy years, the Southern States of America have, in a great measure, succeeded in driving all other competitors out of the market, leaving to the rest of the producing countries but a small fraction of our consumption. To save themselves from their overpowering competitors, the tropical countries have betaken themselves to the culture of the sugar-cane and coffee, in the production of which they have the same advantage over the Southern States of America that these have over them in the culture of cotton.

* Extract from a paper read before the Society of Arts, by John Crawford, F.R.S., late governor of Singapore.

ERRATUM.

In the April number of the Journal, page 86, 2nd column, eighth line from the bottom, for "*imago* state," read "*pupa* state."

TO CORRESPONDENTS.

Correspondents sending communications for insertion are particularly requested to write on one side only of half sheets or slips of paper. All communications relating to Industry and Manufactures will receive careful attention and reply, and it is confidently hoped that this department will become one of the most valuable in the Journal.

TO MANUFACTURERS & MECHANICS IN CANADA.

Statistics, hints, facts, and even theories are respectfully solicited. Manufacturers and Mechanics can afford useful coöperation by transmitting descriptive accounts of Local Industry, and suggestions as to the introduction of new branches, or the improvement and extension of old, in the localities where they reside.

TO PUBLISHERS AND AUTHORS.

Short reviews and notices of books suitable to Mechanics' Institutes will always have a place in the Journal, and the attention of publishers and authors is called to the excellent advertising medium it presents for works suitable to Public Libraries. A copy of a work it is desired should be noticed can be sent to the Secretary of the Board.