SCIENCE:

PUBLISHED BY N. D. C. HODGES, 874 BROADWAY, NEW YORK.

SUBSCRIPTIONS TO ANY PART OF THE WORLD, $3.50 A YEAR.

To any contributor, on request in advance, one hundred copies of the issue containing his article will be sent without charge. More copies will be supplied at about cost, also if ordered in advance. Reprints are not supplied, as for obvious reasons we desire to circulate as many copies of *Science* as possible. Authors are, however, at perfect liberty to have their articles reprinted elsewhere. For illustrations, drawings in black and white suitable for photo-engraving should be supplied by the contributor. Rejected manuscripts will be returned to the authors only when the requisite amount of postage accompanies the manuscript. Whatever is intended for insertion must be authenticated by the name and address of the writer; not necessarily for publication' but as a guaranty of good faith. We do not hold ourselves responsible for any view or opinions expressed in the communications of our correspondents.

Attention is called to the "Wants" column. It is invaluable to those who use it in soliciting information or seeking new positions. The name and address of applicants should be given in full, so that answers will go direct to them. The "Exchange" column is likewise open.

HYDROGRAPHIC AREA OF THE RIO WANQUE OR COCO IN NICARAGUA.

BY J. CRAWFORD, CAPE GRACIAS AL DIOS. NICARAGUA.

ABOUT four miles west from the town Ocotal, capital of the Department of Nueve Segovia, in Nicaragua, at about Long. 86° 40′ west (from Greenwich) and Lat. 13° 30′ north, the waters in the large creeks Somote-grande and Maculiso, unite and form the commencement of a river, known to all persons living on its banks, for fully three-fourths of its length, from its mouth up as Rio Wanque,[1] for the remaining fourth as Rio Coco or Rio Segovia.

The general course of this river, for the first ninety miles from its commencement down to the mouth of a confluent, the Rio Phantasma, is eastwardly and from thence to its disembogue into the Caribbean Sea at Cape Gracias a Dios, is about 22° east from north, but it is very sinuous, changing its course every three-fourths of a mile to every two miles of its length as it flows rapidly near to or along the southern side of "The mountain system of New Segovia."[2]

The important creeks and rivers are herein named in the order they enter the Wanque River, commencing at the most westerly.[3]

Rio Somote-grande, rising on the south side of Dullsupo Mountain ridge,[4] and flowing southeasterly to where it unites with the Rio Maculiso, and forms the Wanque River.

Rio Maculiso, draining the southern side of the mountain range, Ococan (to the N. E. of the Dullsupo Mountains), composed in part of the mountain ridges, Maculiso, Santa Maria, and Ococan (about Long. 86° 50′ W., and Lat. 13° 20′ N.) and flowing southeastwardly until uniting with the Rio Somote-grande, and forming the Segovia or Wanque River.

Rio Depilto, receiving its waters principally from the southerly sides of the mountain ridges Ococan, Depilto, and Jalapa, and flowing southwardly, between moraine ridges for a part of its route until confluent with the Segovia or Wanque on the southeast side of Ocotal.

[1] Rio "Coco," "Segovia," "Wanx," or "Wanque." Coco, abbreviated from Cookra, the name of the aborigines once living on its banks, has precedence because of antiquity. Segovia, the next oldest name, was given to it by the Spaniards, and it is now known as Rio Segovia by the Latin and North Americans and Europeans living near it and near its headwaters in the department of Nueve Segovia, and is the official name used by the Government of Nicaragua for that part of this river. At its mouth, however, it is officially referred to as Rio Coco or Wanx. Wanque is the name invariably used by the Sambos (a mixed semi-civilized people) living along two-thirds of its length from Cape Gracias up the river. Also, the Sumo Indians, living along one of its largest tributaries, the Rio Bokay, always name it Rio Wanque.

[2] So named by Élie de Beaumont. For its direction, locality, etc., see Professor Joseph Prestwich's Geology, London, 1886.

[3] Recorded in this paper because convenient, at present, for reference to locate lodes and deposits of valuable minerals and metals, and groves of valuable trees discovered near to these rivers and creeks.

[4] The locality is known as "rin on del burro" (i.e., resembling dimly a mule) and is a landmark guide in that part of Nicaragua, where no roads have been made and the paths are often dim.

Rio Palacaquina, percolating from old volcanic ridges on the southwest, it flows northeastwardly until its waters enter the Wanque or Segovia at the Indian village of Telpanaca.

Rio Jicore has as its principal hydrographic area the southern sides of the mountain ridges of Jalapa, Jicore, Encino, and Murar, in the Encino Range of mountains, and also the Quilali and San Juan del Panaca Mountains in the Quilali Range, and flows southeastwardly until entering the Wanque River at Pueblo Quilali.

Rio Phantasma flows from the south, draining ridges that form the Phantasma Range in the mountain system of Matagalpa.[5]

Rio Quă, from the southwest, rising in the Quă Range in the Matagalpa System of mountains [5]

Wa-wa-lee Creek, from the northeast; it drains a part of the short ridge Ventura, in the mountain system of Nueve Segovia.

Kilambe Creek, from the south, rising from a long mountain ridge of that name.

Rio Opoteka enters the Wanque River from the northward and drains the southern side of the Opoteka Range in the mountain system of Nueve Segovia.

Rio Wanblau, from the southeast, joins the Wanque River near the head of the long series of cascades in the Wanque known as Ke-y-on; it drains the northeastern termination of the ridges Wan-blau, Keyon, and Pene Blanca (about 7,000 feet altitude above the Caribbean Sea, the highest mountain in Nicaragua) in the mountain system of Matagalpa.

Ya-male Creek flows from the west into the Wanque near the foot of the cascades Keyon.

Peas Creek, from the southeast, gathers its waters from a low ridge that is within four leagues of the Rio Bokay, to the south.

Bolemaca Creek, flowing from cerros of that name (that are composed of cryptocrystaline limestone intersected by numerous interusculating veins now filled with crystallized calcite), eastwardly into the Wanque River; the mountain Bolemaca is in the system of Matagalpa.

Oulawas Creek, flowing from the east from a cerro named Kay-ān that is composed of marble and compact limestones.

Rio Bokay, from the southeast and east, about one-half of the size of the Wanque River, drains the hydrographic area on the east side of the mountain ridges Pene Blanca and Barbar, and the north side of the Wanblau Mountains; its general course is northeastwardly, near to and parallel with the Wanque River in that part of the country.

Wylawas, Attawas, and Saccos Creeks come from the eastward, draining, through placer gold mines at their heads, a part of the western side of a long lateral moraine of glacial epoch, unstratified deposits of clays, gravels, boulders, and sands.

Six creeks, flowing eastwardly from the mountain system of Nueve Segovia, examined and names not recorded, but reported by the Sambos to have along near their banks numerous groves of large-sized mahogany, cedar, walnut, and rosewood trees.

Naga-was Creek, from the northwestern end of the long lateral moraine above mentioned, flowing northwardly through placer gold mines to the Wanque River.

Rio Wash-pook, draining the northeastern end of the lateral moraine above mentioned, and entering the Wanque from the southeast; several of its tributaries drain placer gold mines, also lodes containing gold.

From the mouth of the Rio Wash-pook, east of north and north to the Caribbean Sea, is the delta of the Wanque River, embracing several lagoons and lakes and intersected by several inter-connecting natural canals. There are three long series of cascades and low falls in the Wanque River. The most westwardly commences a few miles below (N. E. of) the mouth of the Rio Opoteka, at the locality named Ke-y-on, where the river has eroded about 3,000 feet in depth from the present altitude at the south end of the mountain ridge Opoteka, and about 2,700 feet depth from the altitude at the northern terminatoin of the Keyān Mountains. The other two long series of cascades are below the

[5] This mountain system was so named in 1889 by the author of this paper and examined by him on its southern ridges up to the water-dividing ridge in 1890.

mouth of the Saccos Creek and continue with short intervals between the two series, for about 75 miles. These series of cascades, the Ke-y-on, Saccos, and Naga-was, impede the navigation of the Wanque River; passing up or down over them being quite dangerous even on rafts or in the light oval-bottom canoes, the only kind of transportation at present on this river; consequently the area drained by about 250 miles of this Wanque River (including, also, the hydrographic area of the Rio Bokay, from the mouth of Rio Qua to the mouth of Rio Wash-pook) is a "terra-incognito," about which neither the citizens nor the Government of Nicaragua have any reliable information; however, rafts of logs of cedar, mahogany, walnut, nispero etc., can be safely floated over the cascades and down the Wanque River to Cape Gracias a Dios.

The soils in the area drained by the Wanque River and its tributaries, extending about one hundred miles from the Caribbean Sea coast are fertile, alluvial, delta lands, suitable for the production of plantains, bananas, bread-fruit, rice, ginger, sugar-cane, grasses (Teocinte, Guinea, and Para are indigenous), and along the sandy rim of the sea-coast cocoanuts grow to large size and are numerous on each tree. From thence up the hydrographic area of the river the lands are composed, usually, of a deep and fertile soil constituted generally of a large percentum of partly decomposed organic matter, mixed or inter-laminated, to depths of five to fifty feet, with deposits, in situ, of disintegrated and partly decomposed lime — alkali — or ferriferous rocks. These lands support dense forests of trees and jungles of vines and plants of semi-tropical and warm-temperate vegetation, and are suitable for the annual or semi-annual yield of full crops of rice, corn, ginger, bananas, plantains, also annual yield of căcă, mangoes, coffee (the Liberian species), vegetables, bread-fruit, oranges, lemons, limes, etc., and lands on the sides of mountains and their elevated planes, above 1,500 feet altitude above the Caribbean Sea or Gulf of Mexico, are suitable for tobacco, almonds, grapes, coffee (the Arabic species), corn, oranges, lemons, limes, vegetables, etc. (All the lands in Nicaragua are below the frost-line.) From the Rio Jicore, up westwardly on the area drained by the Segovia or Wanque River and its tributaries, the lands are generally sand, gravel, and clay; in this region the rocks have not disintegrated so rapidly nor to such depths by meteorological influences as they have down the Wanque River below the Rio Jicore, or the vegetable matter, alkalies, and alkaline earths have been removed by rain water. In some parts of the western headwater localities, especially just northeast of the town Ocotal, the surface lands are largely drift from moraines, and not desirable for agricultural purposes.

The climate has a wet and a dry season each year; the former continuing over the area from the sea-coast up the Wanque, to about the mouth of the Opoteka, for fully seven months. However, in a part of that time, the rain showers, although two or more times a day, are only of a few minutes' duration; for about five months in each year there are no, or but a few, showers of rain; enough, however, to counteract in part the effects of rapid evaporation.

The temperature is semi-tropical from Cape Gracias up the Wanque River to the mouth of Rio Opoteka, especially in the lower valley lands, but cooler on the mountains' sides and on the elevated planes, where the temperature varies in the year from 22° C. to 32° C. From Opoteka up to the western sources of the Wanque River, the temperature is — between low land and mountain planes — from 12° C. (sometimes) at night to 30° C. at noon, the average daily temperature being about 27° C.[1]

Several large mineral springs are found at the heads of the western tributaries to this river, some of them containing salts of the alkalies or alkaline earths, others salts of iron. No sulphur springs were discovered. Some of these are cool water, others tepid, others boiling waters. The principal localities observed, where springs of mineral waters were found, are:—

A large spring of tepid water containing sulphate of magnesia as its principal salt (and other sulphates) located one league west from the town of Ocotal, near to the margin of the Segovia or Wanque River. Several large springs of boiling water were found near the foot of an arenaceous limestone ridge, about four leagues northwest from Ocotal (rose quartz is found in the creek of hot waters, in pieces of various size, some containing a cubic foot). This creek has a temperature of about 50° C., two miles distant from the springs, where it enters Rio Maculiso.

Several large springs of boiling waters are found near the Pueblo Jalapa (on Jalapa Creek, a confluent to Rio Jicore) one of them containing lithia salts in quantities to be easily recognized.[2]

Among the most valuable and useful in the industrial arts, medicines, etc., of the flora observed in the area drained by this river and its tributaries, the principal ones, found in such large numbers and in such large size that the collecting and exporting of them could be made a profitable industry, were noted more particularly at the following named localities; these areas, however, represent only a few of the many similar groves and forests that were not entered and examined.

From the western sources of the Wanque or Segovia River, down its area to the Rio Phantasma are, in order as observed from the west, oak (quercus), pine (pinus silvestrus), sarsaparilla, ipecacuana, liquid amber, balsam (Peru and Copaiva), nispero, tamarind, mora, walnut (a variety of Ingulaus cathartica), copal-chi, and other species of cinchona, ironwood, ebony, mahogany, cedar (a variety of junipuris), guana (a cellular, endogenous tree of specific gravity near cork and compressible like cork), ginger, fibrous plants (in great variety and luxuriance), că-că (Theobroma, indigenous), grasses, bananas, plantains, oranges, lemons, also a great variety of beautiful orchids and flowering plants.

From the Rio Phantasma to Laccos Creek, including the area drained by the Rio Bokay and its tributaries are mahogany, cedar, walnut, ironwood, ebony, nispero, mora, guana caste, guana, cinchonas, rosewood, guttapercha, tamarind, also numerous large groves of India rubber trees (usually Syphonias) of small size (the larger ones having been felled by collectors of India rubber), grasses (Teocinte, Para, and Guinea are indigenous), că-că (Theobroma), bamboo (attaining fourteen inches in diameter), ginger, bananas, plantains, etc.

From Laccos Creek to the Caribbean Sea are principally tamarinds, palms ("pebepias"), bread-fruits, and cocoanuts.

The types of man living or existing in the hydrographic area of the Wanque River of about 15,000 square miles are,—

From the western headwaters of the Wanque to Rio Phantasma, Latin-Americans and partly-civilized Indians, interspersed by a few Europeans and North Americans. (Negroes in one Pueblo, Cindad Viejo.) Their ancestors came in the 18th century from Belize or the island of Jamaica to fell cedar and mahogany trees for some company of Englishmen; the chief occupation of a majority of the people in that region being agriculture or mining on small scale and by primitive processes (i.e., sharpened sticks and machetes; no plows, no hoes).

This area embraces about 4,000 square miles and contains about 16,000 population.

From the Rio Phantasma along the banks of the Wanque River — east of north — to the Caribbean Sea are Sambos.[3] They live

[1] My reliable thermometers were broken early in each expedition to northeastern Nicaragua, i.e., in 1890, when exploring the mountain system of Matagalpa, and this year, 1892, when examining and exploring the hydrographic area of the Rio Wanque, Segovia, or Coco.

[2] Analyses of some of these springs are reported to have been made, but the name of the chemist is not given. The author of this paper has not yet had opportunity to analyze or have analyzed any of these waters.

[3] The Sambos are a mixture of Caribs, Negroes, and Europeans, the Negro predominating, although they have straight hair and nose, and exhibiting distinctly the rapid retrogressive influence towards Primates, caused by this mixture of the types above named; a small profile or sideview of the faces of a majority of this people would be mistaken easily at first glance for that of an anthropodia monkey. A part of this people, however—a mixture of Negro, Sumo, Indian, and European (usually Spanish)—are less rapid in their degenerating tendency. The Sambos have a language largely of modifications from the Sumo Indians, the English, and the Spanish. They claim allegiance to the King of the Moskoes (Mosquitoes) Indians, but have no laws, no government, no officials, no schools, no agriculture, no churches, no religious faith, no conception of a future existence after death on earth (although sometimes they bury food, clothing, and cooking utensils with their dead); without an idea of moral responsibility, they have become experts in deceptive practices; they are excellent canoe-men, navigating the river up and down through the cascades without injury to themselves or their canoes (made oval bottom in one piece from a cedar or mahogany log). They live on roots, fruits, fish, and wild animals (one variety of monkeys included). The women invariably do the greater part of the work, such as collecting wood, fruits, and roots, cooking, carrying water, etc., and "dress" in a short-sleeve jacket extending to their waists; then down to their ankles is covered by a wrapper of one piece of cloth tied by withes of bark or by pieces of vines around their waist. All are lazy, idle, and brutish.

in small communities and number about 2,000, also about forty Latin-Americans live on the banks of this part of the river and on the banks of the Rio Bokay.

On the Rio Bokay and its tributary, the Rio Amaca, there live about 300 Sumo Indians, descendants from the Cookras. Their houses are better constructed than those occupied by the Sambos; the houses of both Sumos and Sambos being only roofs of palm-leaves, tied onto upright posts of—generally—bamboo; no walls; only dirt floors.

The Sumos are a superior people — intellectually, physically, and morally — to the Sambos. They have a language modified from that of their progenitors, the Cookras (aborigines), and including some English words. They have numerals to twenty, but like the Sambos are very dull in numbers. They have no laws, no religious faith, no schools, no agriculture, no feast days. They bury cooking utensils, clothing, and food owned by their dead with the cadaver. They have small-area, community patches of bananas, which they never cultivate.

Nicaragua has no officials in the territory claimed by her from the mouth of the Rio Phantasma, northeastwardly, to near Cape Gracias a Dios. It is a lawless part of her territory.

The mountain system of Nueve Segovia, composed largely of Eozoic and early Palæozoic systems of rocks, is delineated at the earth's surface, on its northwestern side, by the Rios Patuca (emptying into the Gulf of Mexico) and Choluteca (flowing southwestwardly into the Gulf of Fonseca), from the Mesozoic, Kainozoic, and recent formations in Honduras, which have all been elevated into mountains whose meridional trend is at nearly right angles to the about 22° E. of N. and W. of S. alignment of the ranges in the mountain system of Nueve Segovia. On the south side of this Nueve Segovia system flows the Wanque River for about three-fourths of the entire length of the mountains, and at its southwesterly side is the Rio Negro (a confluent of the Choluteca, flowing around the western termination of the mountain system). It is, so far as known, a monogenetic system, and its anticlines expose Eozoic and Palæozoic formations in systems of sinuously outcropping rocks. The largest exposed areas of Eozoic and Palæozoic rocks are on the Ococan Range at the mountain ridges Maculiso, Santa Maria, and Ococan, and consist largely of granite, slates, gneiss, and extensive deposits of both iron ores (Titanite, Magnetite, and Hematite) and limestones, interstratified at two localities, and of graphite. The mountain ridges Dullsupo (southwestwardly from the Ococan Range) and of Depilto, Jalapa, Jicore, Quilali, Ventuo, and Opoteka (to the northeast from Ococan) have *cine del cerros* of Eozoic and early Palæozoic rocks, and exposed on their sides are upper Silurian, Devonian or carboniferous — including the Dios — system of rocks.

The mountain system of Matagalpa has the Wanque River at its northern, and the Matagalpa River at its southern surface boundary. Its present southwestern termination is about Long. 86° 45′ W. and Lat. 12° 36′ N. (a few leagues southwestardly from the Pueblo San Dionesia); to the southwest of this termination, on to the Gulf of Fonseca, the mountain ridges have been levelled to a low plane, on which are numerous subsequently elevated intumescent hills and knolls. In this plane the localities once occupied by the mountain ridges are now marked by the continuation,— southwestwardly,— from the present termination of the ridges to the Gulf of Fonseca, of lodes that in several places are rich in gold; and along near to the lodes are many small knolls or low ridges of pinkish and purplish colored argillaceous gangue of an aluminate of gold (containing Au Al_2) in a percentum that could be made profitable to miners. The present southeastern terminations (it has two) of this mountain system are: the most northerly, the low limestone ridge and hills terminating at the Rio Princapulka, a few miles west from the Pueblo Quequena (lower carboniferous limestone there), the other eastern termination is more southerly and is known as the Barbar Mountains, where it breaks off abruptly with jagged edges (not partly smoothed or slickened side surfaces as usual with faults). The general course of this mountain system is parallel with that of the Nueve Segovia system to the north; from its western termination, along three-fourths of its length, to the Wanblau Mountains; from thence to its eastern terminations the entire system of ranges and ridges have been bent into a crescent (the concavity facing northeastwardly), or this system of mountains deflects in a curve southeastwardly from the Wanblau Mountains and then northeastwardly to its present termination at the Barbar Mountains, excepting the limestone ridges on the north side of the system; these continue parallel with the Nueve Segovia system until they terminate near Quequena in lower carboniferous limestone.

This bend or deflection in the Matagalpa system of mountains forms the hydrographic area of the Rio Bokay, which has eroded a channel through the ridges of limestone. The central range, Pene Blanca, has an exposed longitudinal axis of Eozoic granites and gneiss, flanked usually by formations in the Palæozoic system of rocks, and those by Mesozoic or later deposits, limestones occupying a larger area in this than in the mountain system of Nueve Segovia. The Matagalpa system of mountains is probably polygenetic; the long, low, much-eroded ridges of limestone at the north side of the system were evidently elevated subsequent to the curving of the other ranges composing this system.

The minerals and metals in most common use and of the greatest value discovered in the hydrographic area of the Wanque River are, and their localities are as follows:—

In Dullsupo Mountains are lodes of ores of silver and copper.

In the Maculeso Mountains are lodes of ores of silver, tin, arsenic, antimony, also gold in the gangue in one lode examined, between two different geological formations, and it appears to be a very valuable gold-containing lode.

In the Santa Maria Ridges are lodes containing gold, and gold and ores of silver, also ores of silver and copper, and a deposit of galena and silver in a fissure 21 feet wide and traceable for more than three miles, also deposits of iron ores and limestones.

In the Ococan Mountains is a large deposit of lower Silurian or earlier iron ores (Hematite and Titanite) and limestone, the latter between two thick deposits of iron ores.

In the Depilto Mountains the lodes are rich in galena and silver, also lodes containing gold and ores of silver.

In the Leuje Hills (east about thirty miles from Dullsupo Mountains) are lodes and deposits rich in gold that is generally about 925 fine.

In the mountains of Pericon and San Juan del Panaca the lodes contain silver ores and gold, often in particles of size to be seen by the unaided eye; and further to the eastward, in the mountains (and creeks) Quilali (the Quilali is a tributary of the Rio Jicore) grains and small masses of platinum have been found associated with gold.

Crossing the Wanque River, about one mile west from the Rio Phantasma is a large strata of early Palæozoic, argillaceous slate in which are numerous veins, 1 Mm. to 2 Cm. wide, having a gangue of quartz and ores of silver, and also deposits of silver ores have been interlaminated with the slate.

From the mouth of the Rio Phantasma, northwardly to the mouth of the Rio Washpook, the difficulties and delays at present associated with the transportation of necessary instruments, provisions, etc., from place to place, are so great (even to a naturalist accustomed to excursions along and over mountains, and through forest jungle, and up and down through the cascades and "rapids" in rivers and creeks) that examinations of sufficient accuracy to record were made only at a comparatively few places, sufficient, however, to ascertain that the numerous lodes in this large area usually contain, as the principal metals, gold and ores of silver; also there are large deposits of marble and of crypta-crystaline limestone; also placer mines rich in gold have been discovered, especially in the area drained by the southern and eastern tributaries to the Rio Bokay and at the heads of Wylawas, Attawas, Laccos, and Nagawas Creeks and the southern and southeastern tributaries to the Rio Washpook.

The gold in these placer mines are in interlamina crevices in slate rocks and in superimposed stratified and partly stratified deposits of drift (sands, gravels, small boulders, and clays) that was eroded and transported by rain floods during the Champlain Epoch from terminal and lateral moraine deposits of the Glacial Epoch. The placer mines containing gold in the eastern

and northeastern part of the hydrographic area of the Rio Bokay, also the placer mines of gold along tributaries of the Wylawas, Attawas, Laccos, and Nagawas Creeks and the Rio Washpook have all been eroded and transported by currents of water from the lateral moraine (about 60 miles long and 300 to 1000 feet altitude above the level of the valleys) that extends northeastwardly from the Barbar Mountains (the easterly termination of the Matagalpa system of mountains) to the Rio Washpook; and on the southeastern side of this series of terminal and lateral moraines are the placer mines, also quite rich in gold, discovered in 1889 at Principulka.

P.S.—Since writing the above an opportunity occurred to pass through and hurriedly examine a part of "the placer" mines containing gold along one of the headwater confluents of Nagawas Creek (tributary to Rio Wanque) and they gave such results from panning as to indicate much gold in the deposits, although no satisfactory estimate of the quantity of gold in the cubic yard of the gold-containing gravels was made because the examination was hurriedly made and the "bed rock" on which the gravel deposits rested was either not reached or not examined at any place in that locality. These are drifts eroded and deposited by floods from the Glacial Epoch lateral and terminal moraines in that region.

NATURAL AND ARTIFICIAL CEMENTS IN CANADA.

BY H. PEARETH BRUMELL, GEOLOGICAL SURVEY DEPT., OTTAWA, CANADA.

IN the last report of the U. S. Geological Survey on the mineral resources of the United States, and under the heading of Cement, particular stress is laid upon the fact that there has recently been discovered in California an extensive deposit of natural cement rock, and the fact of its importance to the State is spoken of at length. The knowledge that a good, yet cheap, cement is of importance to any district has led the writer to prepare the following brief statement regarding cements in Canada.

We have in this country a practically illimitable store of materials applicable to the manufacture of natural and artificial hydraulic cements, of both of which we are now producing a considerable quantity, the production for 1891 being about 93,473 barrels of all kinds. Of this, however, the greater part was of natural cement, and the total production altogether that of the provinces of Ontario and Quebec.

Over a considerable portion of the Dominion are to be found the following materials, which are or may be used in the manufacture of cement: Argillaceous and pure limestones, magnesian limestone, marl, and clay. Of the limestones, probably the best known in Ontario is that constituting a band about eight feet thick and of Niagara age. This band is quarried along its exposure on the Niagara escarpment between Thorold and St. David in Lincoln County, and consists of a bluish-gray argillaceous limestone overlying black bituminous shales. Again, at Limehouse, in Holton County, the Niagara affords a good cement rock. The band here is nine feet thick and rests upon eight feet of bluish shales. As may be supposed, the shales underlying the cement rock in both the foregoing instances form a very distinct quarry floor, thus minimizing the danger of mixture with inferior rock. At Rynal station, Wentworth County, a similar cement rock is quarried. Many other bands of limestone and magnesian limestone in the Niagara formation in Ontario are known to possess hydraulic properties, though at present no others than those noted are being utilized.

Throughout the Onondaga formation, which is developed in Canada only in Ontario, are many beds of hydraulic cement rock, the best known being those of the Saugeen valley and vicinity and those in the neighborhood of Paris. The lower beds of the Lower Helderberg (Waterlime group) also afford impure magnesian limestones eminently suitable for the manufacture of cement.

In Eastern Ontario, cement is made from an impure limestone found at Napanee Mills, in Addington County, and in the township of Nepean, Carleton County, there is developed a bed of argillaceous magnesian limestone of Chazy age, from which the so-called "Huce cement" is made. An analysis of the crude Nepean rock gave Delesse: —

Carbonate lime	45 30
Carbonate magnesia	12.77
Alumina and iron oxide	12.52
Insoluble argillaceous residue	19.77
Water and loss	9.64
	100.00

In the Province of Quebec natural cement is made in Quebec City from a bluish-black dolomite, and at the Mountain Portage, on the Magdalen River, Gaspe County, is found a black dolomite, which is said to possess strong hydraulic properties. A similar band has also been noticed on the Grande Conde, six miles below Great Pond River, in the same county.

An analysis of the Magdalen River rock gave Delesse: —

Carbonate lime	43.17
Carbonate magnesia	32.12
Alumina with iron oxide	4.10
Insoluble (fine clay)	20.30
	99.69

Many other bands of rock suitable for the manufacture of natural cement are known in Canada, but the foregoing is thought sufficient to illustrate their geographical and geological distribution.

For the making of Portland cement, suitable clays and marls or limestones are found at many places in that juxtaposition necessary for economical and profitable working, mention will therefore be made only of those points whereat works are situated. These are, Hull and Pt. Claire, in Quebec; Napanee Mills, Marlbank, and Ocorn Sound, in Ontario. At Hull, Pointe Claire, and Napanee Mills clay and limestone are used, while at Marlbank and Ocorn Sound the cement is produced from clay and marl, which occur in quantity and of singular purity. Of the materials wherefrom the Ocorn Sound cement is produced the following analyses are available.

Marl.— Analyst, Ed. Chapman, Ph.D., Toronto.

Carbonate lime	96.41
Carbonate magnesia	1.64
Carbonate iron	0.42
Intermixed sand, clay, and organic material	1.16
Moisture	0.37
	100.00

Clay, underlying marl.— Analyst, R. R. Hedley.

Moisture	1.42
Silica	62.26
Alumina	14.70
Ferric oxide	3.22
Lime	5.28
Magnesia	0.63
Carbon dioxide	10.09
Potassium oxide, Sodium oxide	2.64
	100.24

Of the various manufactured natural cements, the following analyses only are at hand: —

	I.	II.	III.	IV.
Lime	53.55	43.05	39.70	52.49
Magnesia	2.20	18.02	9.58	Traces.
Silica	29.88	28.43	—	27.40
Alumina and iron oxide	12.70	10.50	19.74	12.16
Insoluble argillaceous residue			30.98	
Sulphate lime	1.58	—	—	7.95
	99.91	100.00	100.00	100.00