REPORT OF THE REGENTS OF THE ON THE NEW YORK STATE CABINET OF NATURAL HISTORY FOR 1867. APPENDIX E. ON THE LAURENTIAN LIMESTONES OF NORTH AMERICA, PP. 47-95

Published @ 2017 Trieste Publishing Pty Ltd

ISBN 9781760579098

Report of the regents of the on the New York State Cabinet of Natural History for 1867.
Appendix E. On the Laurentian Limestones of North America, pp. 47-95 by T. Sterry Hunt

Edited by Trieste Publishing Pty Ltd.
Cover @ 2017

www.triestepublishing.com

T. STERRY HUNT

REPORT OF THE REGENTS OF THE ON THE NEW YORK STATE CABINET OF NATURAL HISTORY FOR 1867. APPENDIX E. ON THE LAURENTIAN LIMESTONES OF NORTH AMERICA, PP. 47-95

Trieste

REPORT OF THE REGENTS OF THE UNIVERSITY

ON THE

New York State Cabinet of Natural History for 1867.

APPENDIX E.

ON THE

LAURENTIAN LIMESTONES

OF

NORTH AMERICA

BY

T. STERRY HUNT, LL.D., F.R.S.

REPRINTED WITH ADDITIONS FROM THE REPORT OF THE GEOLOGICAL SURVEY OF CANADA FOR 1863-66.

ALBANY:
VAN BENTHUYSEN PRINTING HOUSE.
1871.

(E.)

ON THE MINERALOGY OF THE LAURENTIAN LIMESTONES OF NORTH AMERICA.

By T. Sterry Hunt, LL. D., F. R. S., of the Geological Survey of Canada.

Introduction.

In a general report of the Geological Survey published in 1863, under the title of the *Geology of Canada*, the ancient gneissic system of the Laurentides of Canada and the Adirondacks of New York, is described under the name of the Laurentian system. Farther researches have shown that under this title were included two distinct and unconformable groups of rocks, which have since been distinguished as the Lower Laurentian and the Upper Laurentian, or Labrador series. The first and most ancient of these, to which it will be well for the future to restrict the name of Laurentian, corresponds to the primitive gneiss of Scandinavia and of the west of Scotland. This opinion was put forward by the author in 1855, and has since been confirmed by Sir R. I. Murchison, for Scotland. More recently, Messrs Gümbel and Hochstetter, after a lengthened study of the older gneiss of Bavaria and Bohemia, have declared it to be identical with the Laurentian of North America, a conclusion sustained by the discovery by Gümbel of the fossil remains of the rhizopod *Eozoon Canadense*, in the limestone of the Bavarian gneiss.

The lower or true Laurentian consists in great part of orthoclase gneiss, sometimes granitoid, with quartzites, occasionally becoming conglomerates; hornblendic and micaceous schists, pyroxenites, serpentines and limestones, sometimes magnesian. These limestones, generally very crystalline, are seen on the Ottawa, in

the counties of Argenteuil and Grenville, to form three distinct formations, having each a thickness of from 1,000 to 1,500 feet, separated, underlaid and overlaid by still greater masses of gneiss and quartzite. The measured thickness of this series on the Ottawa is more than 20,000 feet, which is probably far from representing its total volume, while in Bohemia it is supposed to equal not less than 90,000 feet. In the county of Hastings, in the province of Ontario, not less than 21,000 feet of strata, consisting of crystalline schists, limestones and diorites, are found resting conformably upon Laurentian gneiss.* It appears certain, however, that this series, which differs both in the succession and the lithological character of its strata from the sections in the Ottawa valley, belongs to the Lower Laurentian, of which it would appear to constitute a member higher in the system than any observed in New York or in the province of Quebec, so that the whole known thickness of the Lower Laurentian in Canada would surpass 40,000 feet. The *Eozoon Canadense* is met with in several localities, both in the lower and higher members of the Lower Laurentian.

The Labrador (or Upper Laurentian) occurs in detached areas, resting unconformably upon the true Laurentian system. Some of these areas are many miles in breadth, and they occur at intervals in Canada from the shores of Lake Huron to the coast of Labrador. The Labrador series contains strata of orthoclase gneiss, quartzites, and crystalline limestones; but its predominant element is an anortholite—a rock composed essentially of a feldspar of the anorthic or triclinic system, generally with a small admixture of pyroxene or hypersthene. This anortholite is sometimes gneissoid, and even fine-grained; but is more often granitoid, and occasionally presents large cleavable masses of opalescent feldspar, generally labradorite or andesine. The thickness of this Labrador series cannot be less than 10,000 feet, and is perhaps much more. The true Laurentian offers nothing similar to these anortholites, which seem to be identical, both lithologically and geognostically, with the norites of Norway. They are the hypersthenites of the Hebrides, described by McCulloch, and subsequently recognized by Emmons under the name of hypersthene rock in the Adirondacks, of which, according to him, they form some of the highest summits.

To these two great series of ancient rocks must be added a third—the Huronian, which attains on Lake Huron a thickness of

not less than 18,000 feet, where it lies between the Laurentian and Silurian systems, conformable with neither. It is believed to be newer than the Labrador series, though the two have never yet been seen in contact. The recent observations of Prof. Hall, have shown that the Huronian system is found interposed between the Silurian and the Laurentian to the west of the Mississippi, while it appears to have been very recently identified both in Newfoundland and in New Brunswick. Of these three great series, Sir William Logan remarks that their united thickness "may possibly far surpass that of all the succeeding rocks from the base of the Potsdam series to the present time. We are thus carried back to a period so far remote, that the appearance of the so-called primordial fauna may by some be considered a comparatively modern event. We find, however, that even during the Laurentian period, the same chemical and mechanical processes which have ever since been at work disintegrating and reconstructing the earth's crust, were in operation, as now. In the conglomerates of the Huronian series, there are enclosed boulders derived from the Laurentian, that seem to show that the parent rock was altered to its present crystalline condition before the deposit of the newer formation, while interstratified with the Laurentian limestones, there are beds of conglomerate, the pebbles of which are themselves rolled fragments of a still older laminated sand-rock; and the formation of these beds leads us still further into the past." (*Quar. Jour. Geol. Soc.*, February, 1865.)

The area occupied by the Laurentian rocks in Canada, is about 200,000 square miles, of which about 1,500 square miles have been accurately studied and mapped in the valley of the Ottawa, in the province of Quebec, and a still smaller area in the county of Hastings, Ontario. The Laurentian area of the Adirondacks, in northern New York, comprises about 10,000 square miles, but has never yet been stratigraphically studied, although much attention has been paid to the mineralogy of the limestones of the series, which present many characters both of scientific and of economic interest. The following pages are extracted from the Report of the Geological Survey of Canada for 1863–66 (pages 182–223), published at Ottawa, and here reprinted with some few additions, which are distinguished by being enclosed in brackets:

The evidence afforded by the careful stratigraphical study of these Laurentian limestones, and their associated rocks in the val-

ley of the Ottawa, left, as we have seen, no doubt of their sedimentary nature and origin. Similar limestones in the Highlands of New York and New Jersey were long since recognized by Rogers, by Mather, and by other American geologists, as in like manner altered stratified rocks, which were by some regarded as of Silurian age, and by others of greater antiquity. The observations made by Sir William Logan and Prof. James Hall, in 1864 (*Amer. Jour. Science* [2], xxxix, 97), in the Highlands of the Hudson, however, leave no doubt that these limestones, and their accompanying gneissoid strata, belong to the Laurentian system.

The study by the late Dr. Emmons of the similar series of rocks, constituting the mountain region of the Adirondacks in northern New York, and continuous with the great Laurentian area of Canada, led him, however, to regard the limestones of the series as of igneous origin, and in fact as intrusive rocks. (See his Report on the Geology of the First District of New York, published in 1842, pages 37–59.) This view, although in contradiction with the conclusions of other geologists who have examined these Laurentian limestones in Canada and the United States, was not so singular as might at first sight appear. Mather, in his Report on Second District of New York (page 485), while maintaining the sedimentary and metamorphic nature of the crystalline limestones of the Highlands, asserted that there were examples in Washington county fully sustaining Emmons' view that such limestones sometimes occur as eruptive rocks.

Many of the first geologists of other countries have also maintained the igneous origin of certain crystalline limestones. Thus, in 1863, we find Von Leonhard asserting that limestones have sometimes come from the interior of the earth in a liquid state, like other igneous rocks. A similar view was at that time maintained by Guidini with regard to the dolomites of Spezzia in northern Italy, and by Rozet for similar rocks at Oran in Algeria, and for the crystalline limestones of the Vosges, which, like those of the Laurentian series, occur in gneiss, and are often mingled with serpentine. (*Bull. Soc. Geol. de France*, iii, pages 215 and 235.) These observers, like Dr. Emmons, urged in support of their view, among other reasons more or less fallacious, the undoubted fact that such limestones, in some cases, apparently form dykes or veins, which, like those of granite and greenstone, traverse gneissic or quartzose strata.

It has been pointed out in the Geology of Canada (pages 28 and 643), that, in the case of the Laurentian limestones, there is abundant evidence that they were at one time in such a plastic condition that external forces were able, not only to contort great masses of limestone, and to break and fold in a remarkable manner certain interstratified quartzose layers, but to force the softened limestone into fissures in the adjacent silicious strata. Examples of the latter phenomenon are, however, comparatively rare, and the limestone veins upon which Mr. Emmons, and probably other observers, have founded their view of the igneous origin of crystalline limestone, remain to be described, after a brief account of the limestones and their immediately associated strata. It should here be mentioned that Bischof considers the great dykes of granular limestone, which, near Auerbach in the Bergstrasse, are met with traversing gneiss, to be deposits from water, filling up fissures; in fact, veritable veinstones. (*Chem. Geol., English Ed.*, iii, pp. 148–150.) See also the note on page 47 for a description of a similar calcareous vein.

The Laurentian limestones of North America, and other crystalline limestones in different regions, some of which belong to other geological periods, often abound, as is well known, in foreign minerals. These occur disseminated through the mass of the rock, of which they serve, in many cases, to mark the lines of stratification. While some beds consist of nearly pure carbonate of lime, others will be found to be characterized by an admixture of grains or crystals of chondrodite, pyroxene, serpentine, mica, feldspar, quartz, graphite, or other minerals, either alone or variously associated, and sometimes in such quantities as to make up a large proportion of the rock.

Recent investigations have shown that in some cases the dissemination of certain of these minerals through the crystalline limestones is connected with organic forms. The observations of Dr. Dawson and myself on the *Eozoon Canadense* showed that certain silicates, namely, serpentine, pyroxene and loganite, had been deposited in the cells and chambers left vacant by the disappearance of the animal matter from the calcareous skeleton of that foraminiferous organism, so that when this calcareous portion is removed by an acid there remains a coherent mass, which is a cast of the soft parts of the animal, in which not only the chambers and connecting canals, but the minute tubuli and pores are represented by solid mineral silicates. It was shown that this