

**PROCEEDINGS AND
COLLECTIONS OF THE
LACKAWANNA
INSTITUTE OF HISTORY
AND SCIENCE. VOLUME ONE**

Published @ 2017 Trieste Publishing Pty Ltd

ISBN 9780649680856

Proceedings and Collections of the Lackawanna Institute of History and Science. Volume One
by Lackawanna Institute of History and Science

Except for use in any review, the reproduction or utilisation of this work in whole or in part in any form by any electronic, mechanical or other means, now known or hereafter invented, including xerography, photocopying and recording, or in any information storage or retrieval system, is forbidden without the permission of the publisher, Trieste Publishing Pty Ltd, PO Box 1576 Collingwood, Victoria 3066 Australia.

All rights reserved.

Edited by Trieste Publishing Pty Ltd.
Cover @ 2017

This book is sold subject to the condition that it shall not, by way of trade or otherwise, be lent, re-sold, hired out, or otherwise circulated without the publisher's prior consent in any form or binding or cover other than that in which it is published and without a similar condition including this condition being imposed on the subsequent purchaser.

www.triestepublishing.com

LACKAWANNA INSTITUTE OF HISTORY AND SCIENCE

**PROCEEDINGS AND
COLLECTIONS OF THE
LACKAWANNA
INSTITUTE OF HISTORY
AND SCIENCE. VOLUME ONE**

PROCEEDINGS AND COLLECTIONS

OF THE

LACKAWANNA INSTITUTE

OF

HISTORY AND SCIENCE.

VOLUME ONE.

THE REPUBLICAN PRESS, SCRANTON, PA.
1887.

OFFICERS FOR 1887.

J. A. PRICE, - - - - - PRESIDENT.
ALEX. W. DICKSON, - - - FIRST VICE PRESIDENT.
J. C. PLATT, - - - - - SECOND VICE PRESIDENT.
ROBERT D. SCHIMPF, - - - RECORDING SECRETARY.
WM. A. WILCOX, - - - - - CORRESPONDING SECRETARY.
FRANK L. PHILLIPS, - - - - - TREASURER.

TRUSTEES.

J. A. PRICE,	J. C. PLATT,	L. M. GATES,
R. D. SCHIMPF,	WM. A. WILCOX,	H. M. HANNAH,
D. N. GREEN,	ALEX. W. DICKSON,	J. H. FISHER,
HERMAN OSTHAUS,	GEO. W. PHILLIPS,	J. E. O'BRIEN.

R. D. SCHIMPF, A. L. BAKER, D. N. GREEN,
Committee on Library and Scientific Record.

WM. A. WILCOX, J. C. PLATT, HERMAN OSTHAUS,
Committee on Historical and Biographical Record.

11

GLACIATION:
ITS RELATIONS TO THE LACKAWANNA-
WYOMING REGION.

A LECTURE DELIVERED BEFORE THE LACKAWANNA INSTITUTE
OF HISTORY AND SCIENCE, JULY 3, 1886, WITH
NOTES UPON THE GLACIAL STRIÆ.

BY JOHN C. BRANNER, PH.D.

STATE GEOLOGIST OF ARKANSAS, PROFESSOR OF GEOLOGY
IN THE UNIVERSITY OF INDIANA.

PREFATORY NOTE.

The present paper was prepared for the purpose of laying before the members of the Lackawanna Institute the question of glaciation in its relations to the Lackawanna-Wyoming region, with the hope that they might be induced to pursue its study both for its own sake and for the purpose of adding to our knowledge of the subject.

Among the problems presented some are mentioned which are not now regarded as problems among geologists, but they are given for the purpose of stimulating research and encouraging young geologists to seek answers to the questions which must arise in their own minds. The bibliography of the subject will be found in "*Glaciers*," by Shaler and Davis. Maps of the glaciated and non-glaciated areas, by Dr. T. C. Chamberlin, are in the Sixth Annual Report of the U. S. Geological Survey.

GLACIATION :

ITS RELATIONS TO THE LACKAWANNA-WYOMING REGION.

It is now forty-six years since AGASSIZ, young and enthusiastic as he always was, read and interpreted aright the signs of the ancient glaciers. He had spent years studying the Alpine glaciers. He found and announced that the existing are but the remnants of the original ones; that they had once spread out across the whole width of the valleys, filling them with ice, and carrying boulders from the mountain tops to the opposite sides of the valleys.

Such announcements were received with much caution by some of the leading scientists at that time. HUMBOLDT himself, who then stood at the head of the scientific world, was unwilling to give credence to this new geological theory, and though he was a warm personal friend of young AGASSIZ, tried to dissuade him from his glacial studies and theories. But the proofs of the former extension of the glaciers were so convincing that opposition to such a theory could not last long. At the time, though, to use AGASSIZ's own words, while yet "deeply depressed by the skepticism of men whose scientific position gave the right to condemn the views of younger and less experienced students," he went to Great Britain for the purpose of looking for traces of glaciers in those islands. Fresh as he was from the study of the ancient glaciers of the Alps, he had no difficulty in finding the evidences of glaciation through the British Isles, a country whence every vestige of perpetual snow has disappeared.

If the original theory of the glaciation of Switzerland was startling, and put to the test the credulity of those scientific men

who had no opportunity of examining the evidences for themselves, what can be said of the announcement that a large part of northern Europe, part of England and Ireland, and all of Scotland had once been buried beneath glaciers continental in their dimensions? Yet the evidences of glaciation are just as clear in some parts of northern Europe and in Scotland as in Switzerland itself.

THE QUESTION IN NORTH AMERICA.

By the time the agitation of this question reached North America the study of glaciers had gone so far, and their movements and work were so well understood, that the whole question was very much simplified for us. In his address before the American Association of Geologists, delivered in Philadelphia, April 5, 1841, Professor EDWARD HITCHCOCK, State Geologist of Massachusetts, expressed the feeling of many of our geologists in regard to this subject. He said, referring to what were then known as the diluvial phenomena: "But the recent work of AGASSIZ, entitled '*Etudes sur les Glaciers*,' gives a new aspect to the subject. It is the result of observations made during five summers in the Alps, especially upon the glaciers, about which so much has been said, but concerning which so little of geological importance has been known. Henceforth, however, glacial action must form an important chapter in geology. While reading this work and the abstracts of some papers by AGASSIZ, BUCKLAND, and LYELL, on the evidence of ancient glaciers in Scotland and England, I seemed to be acquiring *a new geological sense*; and I looked upon our smoothed and striated rocks, our accumulations of gravel, and the *tout ensemble* of diluvial phenomena with new eyes." In a foot note he adds: "A flood of light having been thus unexpectedly thrown in upon my mind, I am free to acknowledge that many of my difficulties in respect to this theory have been removed."

The magnitude of the glaciated area in this country, however, was simply appalling, and especially so in view of the fact that not only the glaciers, but every trace of their remnants, as such, had disappeared as completely as they had from England,

Scotland and Ireland (with the exception of the existing glaciers of the Sierra Nevada).¹ Here we had a glacier covering a great continent—a continental glacier. At present no such bodies of ice are known on the face of the earth, except under the poles. Greenland presents the largest expanse of ice moving as a glacier or glaciers of which we have any knowledge, and one can, perhaps, get no better idea of how our own country appeared during the glacial epoch than by reading the description given by NORDENSKIÖLD of the interior of ice-covered Greenland. And yet, in point of size, Greenland is very insignificant when compared with the glaciated area of North America.

Doubtless the greatest difficulty in the way of those who objected and who may still object to the glacial theory, comes from the fact that existing conditions are so very different from those which must have obtained during the glacial epoch.

THE QUESTION IN NORTHEAST PENNSYLVANIA.

It is with great difficulty that we can realize the conditions of those times. At Scranton we must picture to ourselves the Lackawanna-Wyoming valley filled with one solid, slowly creeping mass of ice, rising high above the mountain tops to the east and west of us, while stretching away to the north this great ice-field was unbroken. To the southwest it came to an end a few miles below Shickahinny, while from it flowed away innumerable muddy streams, swollen by the water from the melting ice. During summer time the heat of the sun melting the surface of this great ice-field, and especially along its southern margin, must have covered it with water, which, draining away toward the south, flooded the valleys of the Susquehanna and Delaware and of the other streams heading in northern Pennsylvania and southern New York, and carried down the sands, clays and gravels that are now found over the flood plains of those streams. In the course of time, and gradually, the climate over this ice-covered region modified in a very marked degree. The

¹ For an account of these glaciers see "Existing Glaciers of the United States," by J. C. RUSSELL, in the fifth annual report of the U. S. Geological Survey, 1883-4, pp. 309-355.