DOCUMENTS

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THE LEGISLATURE,

OF THE

STATE OF MAINE,

DURING ITS SESSION

A. D. 1838.

SECOND REPORT

ON THE

GEOLOGY

OF THE

STATE OF MAINE.

BY

CHARLES T. JACKSON, M. D.,

Member of the Geological Soc. of France; of the Imperial Mineralogical Society, St. Petersburg; of the Boston Soc. Nat. Hist., and Cor. Memb. Acad. Nat. Sciences of Phila.; Lyceum Nat. Hist., N. Y.; Albany Inst; Nat. Hist. Soc., Montreal; Prov. Frank. Soc.; Prov. Nat. Hist. Society; Amer. Acad. Arts and Sciences; Hon. Memb. Maine Inst. Nat. Sciences;

GEOLOGIST TO THE STATE OF MAINE.

AUGUSTA:

LUTHER SEVERANCE, PRINTER.

1838.

STATE OF MAINE.

RESOLVES AUTHORIZING FURTHER APPROPRIATIONS FOR CONTINUING THE GEOLOGICAL SURVEY OF THE STATE.

RESOLVED, That the Governor. with the advice of Council, is hereby authorized to employ some suitable person or persons to continue the Geological Survey of the State, at a salary not exceeding One Thousand Dollars.

RESOLVED, That the sum of Three Thousand Dollars be appropriated from the Treasury of the State, subject to the direction of the Governor and Council, and to be expended in continuing said Geological Survey.

RESOLVED, That in addition to the suits of specimens ordered by a former Resolve, suits shall be collected for the following institutions, viz: one suit for the Maine Institute of Natural Sciences, one suit for the Maine Wesleyan Seminary, one suit for the Westbrook Seminary, one suit for the Parsonsfield Seminary, one suit for the Eastport Athenæum, one suit for the Bangor Mechanics Association, one suit to the Teachers' Seminary at Gorham, and one suit for the Maine Charitable Mechanic Association.

RESOLVED, That it shall be the duty of the Governor and Council to lay before the Legislature, at its annual sessions, a detailed account of the progress of the Survey, together with the expenditures in prosecuting the same.

STATE OF MAINE.

IN COUNCIL, March 30, 1837.

CHARLES T. JACKSON, M. D., of Boston, Mass., is, by the Governor, with the advice and consent of Council, appointed "to continue the Geological Survey of the State," agreeably to the provisions of Resolves of the Legislature, passed March 30, A. D. 1837, entitled "Resolves authorizing further appropriations for continuing the Geological Survey of the State."

Attest: A. R. NICHOLS, Secretary of State.

**To the Senate
and House of Representatives:**

I herewith lay before you the Second Annual Report on the Geology of the State of Maine, by CHARLES T. JACKSON, M. D., Geological Surveyor of the State, under the Resolve of March 30, 1837.

EDWARD KENT.

COUNCIL CHAMBER,
February 22, 1838.

INTRODUCTION.

Few subjects have, for many years, more strongly excited public attention, than the Science of Geology; and we may justly attribute this general interest to the improved condition of the science, and its numerous applications to useful purposes.

Formerly, rude conjectures, imaginary hypotheses, and vague theories, which naturally arose from an imperfect knowledge of the subject, owing to the imperfections of the collateral branches of Natural History, caused many intelligent persons to consider the whole science as uncertain aud chimerical. This state of things has, however, been succeeded by more sound and perfect knowledge, and no longer is Geology reproached with being merely visionary and speculative.

It has now assumed the rank of an accurate and certain science, adapted to the physical and intellectual wants of an enlightened community—revealing to us the situations in which are found our valuable metallic ores, quarries of building materials, beds of limestone, and a thousand other articles of daily use. It traces out the precise situation in which we may expect to find fossil coal, and gives us a knowledge of the means of making rational explorations for that valuable combustible.

Soils being mainly composed of the detritus of rocks, and those materials having been spread out on the surface of the globe, in conformity to regular geological laws, a just knowledge of their mineral components, and their order of distribution, serves to direct the farmer in the selection of his farm, and the cultivation of the earth. It would be easy to trace out many other good results, which are attainable by this science, but so general has now become a knowledge of the subject, that it will be unnecessary for me to enter into minute details.

To the quarryman, architect, engineer, metallurgist, manufacturer, merchant and agriculturalist, this science is of vast and almost incalculable utility, and serves not only to direct many of their operations, and to furnish them with the articles of their several professions and trades, while it prevents their being imposed upon by artful impostors or ignorant pretenders.

Enormous sums of money have been wasted, in every section of our country, in digging for treasures—mines of gold, silver or coal, in situations where a geologist would have in a moment decided such substances could not be found! Pyrites has been and now is frequently mistaken for silver or gold, black tourmaline for coal, or an *indication* of that combustible, while to the geologist it is a most certain proof that no coal will ever be found in its vicinity! Ores of brass and pewter are talked about as if any such ores really existed! Iron ores are warranted to contain from 80 to 90 per cent of that metal, while the geologist and chemist know, that no such ores can possibly exist. Yet companies are organized, and such pretensions are palmed off upon the community.

Some farmers run out the soil, instead of enriching it—cursing the earth with barrenness, instead of rendering it fertile—and then emigrate to some new district, to render that barren also! Are these things as they ought to be? Shall we not attempt to do something to relieve the present state of this most important of arts?

When we feel that we are in error, if we are wise we shall endeavor to correct ourselves, and eagerly embrace any plan that promises us sure relief. Science, embracing the great principles of all arts, combining the experience of all ages, indefatigable in its researches, strict and philosophical in its reasoning, tenders to us its aid, and furnishes us with the principles and the means for our improvement. With such knowledge, nature opens to us her illuminated page, and invites us to read her great and eternal laws, and by following her mandates, the elements become subservient to our will. Look back into the history of the arts and sciences but half a century, and contemplate their present state, and you will be astonished at the results already attained. The history of the past presages the future, and as much greater will be the improvements, as our means of knowledge are advanced. Problems, obscure and incapable of being solved by our ancestors, are now easily explained. Knowledge, which formerly gave to the person who possessed it, the proud rank of a philosopher, is now the common property of school-boys. Chemical experiments, that would a century since have been considered magic, and brought the operator to the stake for witchcraft, are now mere juvenile recreations, and boarding-scool girls are familiar with the laws of chemical affinity.

The course of science is onward, and who will now dare to limit the future? Knowledge is power, subduing all things to our will, provided we understand the laws of nature, and are obedient to their precepts. Collect facts, for they are the links of the chain of reason, by which we may mount to the causes of things. A single fact, taken by itself, appears to an unphilosophical mind extremely insignificant, and he who makes such a discovery, is instantly assailed with questions as to its uses. What is it good for? What can be done with it? &c. &c.

A philosopher, at Amalfi, in Italy, long before our nation had existence, was intent upon the examination of a curious property exhibited by a piece of iron ore. It attracted particles of the same kind of substance, and iron filings. In one of his experiments, he suspended the piece of iron ore by a thread, and found that it pointed towards the North star, and when turned in another direction, and set free, it instantly returned to its North and South position. This was a curious property, and I doubt not, if the experimenter had mentioned it, that he would have been asked, of what use is it? What can you do with it? and perhaps how much money can be made by it? To all these questions he would reply, I cannot tell to what uses it may be put, but I do believe that every law of nature is useful, and this, among others, will be applied to some useful purpose. Impressed with such an opinion, he wrote to the Academicians of Florence, and forthwith the curiosity of those philosophers was aroused, and they too tried experiments with the iron ore, and presently discovered, that its magnetic properties were transferable to hardened steel. Behold the results! The mariner's compass was invented, and served to guide Columbus across the pathless ocean. A new world was discovered, and soon became the abode of civilized men. Our great nation now extends its arms from the St. Croix to the Capes of Florida, and westward to the Rocky Mountains, and the Columbia river, and is destined to cover this whole Continent. All this is to be attributed to the discovery of one curious property of iron ore !

Let us then learn to attach due importance to all facts we discover recorded in the book of nature, for however obscure they may at first sight appear, be assured that they will most certainly serve to advance human civilization.

Geology is a science composed almost entirely of facts, and the theories serving to explain them, are but the *rationale* of those facts. Such, at least, is the modern aspect of the science, and the more rigid are we in our deductions, the more imperishable will be the results. Hypotheses may be exploded, theories are subject to continual modifications, according to the light that may be shed upon their subject, but FACTS are in their nature immortal.

Impressed with this belief, I have taken especial pains to record all my observations during the present survey, while on the spot where they were observed, and the Report presents a transcript of them from my field notes. Being willing that the work should suffer in a literary point of view, rather than distort a single fact, I have avoided every attempt at ornate diction, and have endeavored to let nature tell her own story, standing myself merely as the recorder and interpreter of her laws.

With the ardent desire of learning the truth myself, and transmitting it to you with fidelity, I have devoted my whole strength to the task, and have, by faithful observations, arrived at the discovery of many important facts, the bearing of which, upon general science, may be at once foreseen.

The arts and sciences are all so closely connected, that the advancement of one department always serves to carry forward the others, and hence we may confidently look forward to many useful results.

REMARKS ON SURVEYS.

A geological survey signifies an examination of the nature, situation and mineralogical contents of all the various rocks, minerals and soils.

It determines the order of super-position and relative ages of the different strata, their mode of disruption, and the nature of the unstratified rocks, that have been intruded from below, into the strata through which they cut, while, at the same time, the various beds and veins of valuable minerals form conspicuous objects for the surveyor's attention.

How is a geological survey to be conducted? This question may be answered as follows: The district in question is first to be examined, so as to ascertain the order of strata, and the relative age of each stratum, while, at the same time, the intersecting rocks are to be observed. The method pursued is first to form a plan of operations, so that all the observations may be recorded, in an orderly manner, that no confusion may arise in the completion of the work.

My plan for the geological survey of Maine, has been first, to obtain a longitudinal section of the State, and the sea-coast gave me an admirable opportunity of effecting that purpose. An outline map of the rocks along the whole coast of Maine, I have now completed, and this outline may be filled up hereafter, as may be found desirable. Then the North Eastern Boundary, according the treaty of 1783, was surveyed, and gave one transverse section of the strata of the State, from the sea-coast to the Madawaska river. This line has since been carried out to the Canada frontier, and to the St. Lawrence river. A sectional line was then surveyed from the mouth of the Penobscot, and up that river through the Allagash lakes, to the shores of the St. Lawrence, up the Sebois to the Aroostook, and down that river to the St. John. Two transverse sections, and one of a winding form, were thus obtained, which give the order of super-position of strata.

A line running through the State, longitudinally, N. E. and S. W. from Bangor to the New Hampshire line, gave the length of the great formations, in a longitudinal direction ; and the New Hampshire line served to complete a portion of the Western boundary.

It will be seen at a glance, that it has been my object to obtain the limits of the great rock formations of the State, and to make sectional lines. Besides which, I have also taken advantage of the great river courses, to divide the State into large natural squares, and the rivers are so disposed as to favor the operation. Thus the sea-coast forms the base line for all the squares. Between the St. Croix and the Penobscot and St. John rivers, we have the first great Eastern square ; and between the Penobscot and the Kennebec, we have another, which is bounded on the North by the St. John. This forms the Middle square. Between the Kennebec and the New Hampshire boundary, we have our third, or Western square. These divisions are to be again subdivided, according to the minuteness of the survey, and the facilities for accomplishing the work. The Androscoggin meanders from the N. W. corner of the State, and sweeping in an irregular manner through the country, gives an admirable zig-zag section through the Western square, in a diagonal direction.

I have adopted this plan for several reasons. First, because it is easy to form a distinct idea of these natural divisions, so that they are more easily remembered than arbitrary sections. Secondly, because along the sea-coast and river courses, we gain more ready access to the naked rocks. Thirdly, the rivers run in such directions, as to give transverse sectional views. Fourthly, it is frequently the case, that there is no other way to cross the country than by the rivers. This is especially the case in our long sections through the State to Canada, and through the Aroostook territory.

Several of these sections are already completed, while others are yet to be made. The great Kennebec section promises to furnish much valuable information, and that region will be explored during the next campaign.

In surveying these various sectional lines, where it was found practicable, I have measured the altitudes of every important point, by means of an excellent barometer, so that we shall be able, in a future report, to present you with profile views of the country, showing the relative elevations of the land, and the nature of the rocks, with their order and super-position.

A ground plan, or map of all the country we have travelled over, has been carefully kept, and will serve as a basis for a geological map of the State. It ought not, however, to be published until we have completed the work.

Embracing a wide territory, based upon so many rock formations, Maine possesses mineral wealth to an extent of which it is difficult to form an adequate idea, and respecting which, but little is yet known. The results of two seasons' labor have already given us ample satisfaction, and shew that Maine is not behind her sister States in natural resources.

During the infancy of any State, the inhabitants naturally avail themselves of those products most readily attained, and hence we find, that in Maine, the first industry was turned towards the forests, and timber became the principal article of export. As the forests began to be cleared of heavy pine trees, the people sought new occupations. Those on the sea-coast availed themselves of the fisheries and navigation.

Limestone quarries being discovered in some towns, changed the business of the community, and a new branch of trade sprang into existence.

Granite becoming an article of value for architecture, in the cities of the west, caused a portion of the community to turn their industry in that direction.

Farming became requisite to furnish supplies, and it was soon found that agriculture could be made a profitable employment.

In a more advanced stage of society, mines begin to be opened, manufacturing operations are carried on, and thousands of new sources of wealth begin to pour forth their various treasures. With increased resources, men soon begin to find time for literary and scientific pursuits, and a more exalted intellectual and moral culture extends itself over the country. Genius and taste soon burst the confines of mere mechanical and mercantile employments, and a portion of the community find time for literary and scientific pursuits; and the productions of the mind begin to appear in various works of science or of taste. Thus we trace forward the progress of society, and it will be found, that the natural resources of the country engender and support every department of human culture.

When we travel over a region where civilized men have not yet appeared, and where the woodman's axe has never resounded, by a geological knowledge of the country, we can predict, with a great degree of certainty, the occupations of those persons who will subsequently settle there, and trace the various stages of their improvement; for the natural resources of the country produce the various employments which are followed, and knowing those resources, we can predict the pursuits of the inhabitants.

Dr. Buckland, in his admiable Bridgewater treatise, makes the following remarks, showing the influence of the geological structure of Great Britain, over the employments and physical condition of the people in that country.

"If a stranger, landing at the extremity of England, were to traverse the whole of Cornwall and the North of Devonshire; and crossing to St. David's, should make the tour of all North Wales; and passing thence through Cumberland, by the Isle of Man, to the south-western shore of Scotland, should proceed either through the hilly region of the Border Counties, or, along the Grampians, to the German Ocean; he would conclude from such a journey of many hundred miles, that Britain was a thinly peopled sterile region, whose principal inhabitants were miners and mountaineers.

"Another foreigner, arriving on the coast of Devon, and crossing the Midland Counties, from the mouth of the Exe, to that of the Tyne, would find a continued succession of fertile hills and valleys, thickly overspread with towns and cities, and in many parts crowded with a manufacturing population, whose industry is maintained by the coal with which the strata of these districts are abundantly interspersed.*

* It may be seen, in any correct geological map of England, that

"A third foreigner might travel from the coast of Dorset to the coast of Yorkshire, over elevated plains of oolitic limestone, or of chalk; without a single mountain, or mine, or coal-pit, or any important manufactory, and occupied by a population almost exclusively agricultural.

"Let us suppose these three strangers to meet at the termination of their journeys, and to compare their respective observations; how different would be the results to which each would have arrived, respecting the actual condition of Great Britain. The first would represent it as a thinly peopled region of barren mountains; the second, as a land of rich pastures, crowded with a flourishing population of manufacturers; the third, as a great corn-field, occupied by persons almost exclusively engaged in the pursuits of husbandry.

"These dissimilar conditions of three great divisions of our country, result from differences in the geological structure of the districts through which our three travellers have been conducted. The first will have seen only those north-western portions of Britain, that are composed of rocks belonging to the primary and transition series: the second will have traversed those fertile portions of the new red sandstone formation which are made up of the detritus of more ancient rocks, and have beneath, and near them, inestimable treasures of mineral coal: the third will have confined his route to wolds of limestone and downs of chalk, which are best adapted for sheep-walks, and the production of corn.

"Hence it appears that the numerical amount of our popula-

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the following important and populous towns are placed upon strata belonging to the single geological formation of the new red sandstone: Exeter, Bristol, Worcester, Warwick, Birmingham, Litchfield, Coventry, Leicester, Nottingham, Derby, Stafford, Shrewsbury, Chester, Liverpool, Warrington, Manchester, Preston, York and Carlisle. The population of these nineteen towns, by the census of 1830, exceeded a million.

The most convenient small map to which I can refer my readers, in illustration of this and other parts of the present essay, is the single sheet, reduced by Gardner from Mr. Greenough's large map of England, published by the Geological Society of London.

tion, their varied occupations, and the fundamental sources of their industry and wealth, depend, in a great degree, upon the geological character of the strata on which they live. Their physical condition also, as indicated by the duration of life and health, depending on the more or less salubrious nature of their employments; and their moral condition, as far as it is connected with these employments, are directly affected by the geological causes in which their various occupations originate."

It would not require a wizard's ken, to anticipate the occupations that will be followed upon the Aroostook territory. Timber cutting, followed by the more sure and profitable business of farming, will be the chief occupations of the people. Upon the various tributary branches that pour their waters into that river, there are numerous waterfalls, and we should at once assign them to the service of sawing boards, grinding wheat, and when their iron mines are opened, we shall have furnaces, founderies, nail-factories and machine-shops. The wants of the community naturally calling for these various articles, will at length cause them to be brought forth. Agriculture will draw upon limestone ledges for lime, and the gypsum and sandstone of the Tobique will become articles of commerce, supplying the farms and furnaces upon the banks of the Aroostook.

This is as yet but a vision of the future, but it will ultimately be realized.

The present Report having proved more voluminous than I had anticipated, it was found impossible to print the barometrical tables, and our remarks on the public lands, before the recess of the Legislature. On that account, it has been thought expedient to bind up and deliver the first part of the work, treating of the inhabited portions of the State, while the second part, or the survey of the public lands belonging to Maine and Massachusetts, in common, is yet to be printed, and will be ready for delivery at the time when the public laws are sent to the various towns of the State. The remaining document will form a pamphlet of about 100 pages.

SECOND REPORT.

To His Excellency EDWARD KENT, *Governor of the State of Maine.*

SIR:—Having been commissioned by the Governor of Massachusetts, to complete a general reconnoissance of the geological structure of the public lands, belonging jointly to the States of Massachusetts and Maine, and being appointed by the Governor of Maine, to make a Geological Survey of the entire State, in conformity with a Resolve of the Legislature, passed on the 30th of March, 1837, I made due preparations for the performance of these responsible duties, and entered the field early in the month of June.

Mr. James T. Hodge was appointed as an assistant on the part of Massachusetts, and Mr. W. C. Larrabee for Maine.

I have great pleasure in stating, that both of these gentlemen performed, in the most faithful manner, the duties assigned them.

It was thought advisable to dispense with the services of a Draftsman, since it was feared that the appropriation made by Legislature would not suffice to cover all the expenses of the Survey, and having been advised by the Governor to that effect, we did not engage an artist for that service.

It is, however, much to be regretted, that we are not enabled to present many sketches of the magnificent scenery of the

State, and I earnestly desire that we may be allowed every facility for the most ample illustration of the subject.

We all know and feel how strongly our love of country is associated with the aspect of our native hills, and no present would be more acceptable to us, when absent from home, than graphic illustrations of the scenery of our native land. Strangers and travellers are generally attracted towards picturesque scenery, and if made aware of the beautiful contour of the mountainous districts of the State, varied by thousands of magnificent views of highlands, valleys, plains, lakes, rivers and waterfalls, surrounded by dense and varied foliage, forming many most delightful landscape views, many of which are peculiar to Maine, they would hasten to enjoy such magnificent scenery, and thus increase the amount of travel in the country, adding no small share to the wealth of the people, spreading abroad accounts of the interesting region over which they had travelled.—Many, also, having been induced to visit the State, would finally become settlers, and thus add to the population of Maine.

I need but remind your Excellency of the tide of travel, which is continually flowing through the mountain passes of Switzerland, and the Tyrol—countries visited wholly for the sake of viewing magnificent mountain scenery, to satisfy you, that such subjects are strong and powerful inducements for the traveller to visit the country, and Maine presents many scenes, which if not equal in sublimity to those amid the high Alps, are equally picturesque, and are different from any views that can be seen in other parts of the world.

I have premised the above remarks to show how useful it would be to the State should we be allowed the services of a good draftsman, skilled in landscape drawing.

Although I do not make any pretensions to graphic skill, I have nevertheless been obliged to draw many outline sketches, a few of which we have been able to present in the form of wood cuts, the cheapest kind of illustrations, which, however, will aid essentially in giving an idea of the country. Many of the diagrams are thus introduced, and they will answer the purpose, when the section is very limited. The long sectional views of the geological structure of the State, must be reserved for engravings or lithographic delineation, since they will form an atlas with the Geological Map, which will be presented when the work is complete.

There are many difficulties to be surmounted, in making a geological survey of a State, which has not been accurately surveyed and mapped. A very good general State Map of Maine has been published by Greenleaf, but its details are not sufficiently correct for laying down accurate Geological or Topographical observations.

There is, on that account, some difficulty in ascertaining the precise spot upon the map where any rock is to be put down. This difficulty we have endeavored to obviate, where it was possible to obtain town maps, made from actual surveys, but such plans are rarely to be met with, and even then, there may be but a single copy belonging to the town, and which cannot be spared. In such cases we require copies, and if we were allowed the services of a draftsman, much of my time might be saved and devoted to other more appropriate duties.

The mountains of Maine have never been measured, nor have the elevations of the various table lands ever been ascertained. It would therefore be utterly impossible for us to represent sectional views of the geological structure of the State, unless such measurement were made. On that account, I prepared myself with two excellent mountain barometers, and other instruments for measuring altitudes. The slender means in my hands did not allow me to purchase a Theodolite, (an instrument much needed in our operations) and on that account I obtained a simple and cheap instrument, which by some alterations which I had made in it, was found to be accurate for short distances. It has not, however, any telescope, and therefore will not answer for distant triangulations.

From my own stock of instruments I was able to supply deficiencies, and I have freely and cheerfully devoted them to the service of the State. A good pocket sextant, Sir Howard Douglas' reflecting semicircle, and a good compass, besides many other instruments of mensuration, were contributed by me in order to carry on the survey with accuracy.

In making barometrical measurements, it is essential that great care should be used in order to obtain correct results. The elevation of the mercurial column must be ascertained at the level of the sea, and at the point of observation, at the same time, while the temperature is to be carefully noted. In order to ensure accurate results, I made arrangements for a line of barometrical correspondence across the State, observers having been chosen in the intermediate places, wherever a good Barometer was to be found, and a gentleman able and willing to keep a correct register. Then I took my barometers, and carefully compared them with each of the station barometers, and noted the difference between them, so as to correct for it in the calculations required.

TOPOGRAPHICAL GEOLOGY.

HAVING prepared ourselves for the arduous duty in which we were about to engage, the Assistant Geologist from Massachusetts and myself, embarked on board the steamboat for Portland, on the 9th June. I directed Mr. Hodge to proceed directly to Bangor, and there to await my arrival, while I stopped a day at Portland to make arrangements with Mr. Adams for the establishment of a barometrical station at that place, which that gentleman kindly promised to attend to, and has since faithfully performed the task in the manner agreed upon. The difference in our instruments will be found noted in the Barometrical tables, which I shall have the honor to lay before you.

After arranging the above preliminaries, I took passage in the stage-coach for Bangor, by the routes of Brunswick and Augusta; it being my intention to stop awhile in Brunswick for the purpose of consulting Governor Dunlap respecting the survey, and to obtain from him orders for the pecuniary means required in the work. This being effected, I visited Professor Cleaveland, and engaged his services in keeping a barometrical Register for the survey.

At Gardiner we also engaged R. H. Gardiner, Esq. to furnish us with a copy of the register which he is in the habit of keeping. At each of these stations the instruments used were very carefully compared, and where any difference existed, it was noted, and will be found in our tables.

Although it is rarely possible to make many geological observations while travelling in a stage-coach, I was still anxious to turn this journey to some account, and at each station where we stopped, I noted very carefully the height of the mercury in the barometer and thermometers, so that by comparing observations with those made at the other stations, and calculating the results by means of barometrical tables, we can at once learn the exact height of each of the points in question above the sea level. The information derived from such operations is obviously valuable in a great variety of topographical operations, and in our work they were destined to serve as a basis for a sectional view of the Geology of that portion of the State.

At Augusta, I was promptly met by our excellent assistant, Mr. William C. Larrabee, who journied on with me to Bangor, from whence our excursions were to be made.

When Mr. Hodge had completed his preparations for the long and tedious voyage, which he was directed to make through the State wild-lands to the River St. Lawrence in Canada, instructions were given him as to the observations which were required. He then set out from Oldtown in a batteau and proceeded up the Penobscot, to Moosehead Lake. From thence through the long chain of lakes which supply the Allagash stream, and down that river to the St. John, from whence he ascended the Madawaska, crossed into Canada, and returned by the St. François, and down the St. John River, to Woodstock. The results of his survey are interesting and will be presented in our remarks upon the Public Lands.

It is now more particularly my object to describe those portions of the State, which we surveyed during the summer months, while Mr. Hodge was engaged upon the public lands. Three months were devoted exclusively to the settled portions of the State, and subsequently two months were spent by me upon the wild lands belonging to the two States in common. The first excursions made by Mr. Larrabee and myself, were devoted to the Geology of Bangor and its immediate vicinity. We have great pleasure in acknowledging the aid furnished us by Mr. Samuel Ramsdell, of that city, who has for a year past been an observer of the tertiary clay banks, from whence he has extracted a great number of curious fossil casts, specimens of which he has furnished for the State Cabinet.

The rocky strata on which rests the tertiary formation of Bangor and Brewer are argillaceous talcose, plumbaginous and pyritiferous slates. These various slates pass into each other by imperceptible shades, so that it is extremely difficult to define their boundaries. In some places the slate rocks are charged with numerous quartz and calcareous spar veins, and they frequently contain a sufficient quantity of carbonate of lime to cause them to effervesce with acids. When the rock contains a large proportion of silex, it passes insensibly into quartz rock of a blue color, and occasionally beds of it are found containing a sufficient quantity of fine scales of mica to convert it into mica slate of an imperfect kind.

On the summit of Thomas's Hill, in Bangor, the slates may be seen cropping out—their upturned edges appearing above the soil. On the Kenduskeag at a high ledge, overhanging the river may be seen several varieties presented by this rock. It is there observed to be charged with calcareous spar, and is sometimes of a green color owing to the presence of chlorite.

In the city the slate may be observed passing into quartz rock on the side of Exchange street, where the strata run E. N. E. and W. S. W. and dip to the N. N. W. 80°. On the S. W. side of river the strata dip to the North. Near Brewer Bridge they run E. by N. and dip N. by W. 70°. A little above the bridge on the south side of the Penobscot in Brewer, there is a cliff of argillaceous slate, which rises to the height of about 80 feet, and there the strata may be observed to run N. N. E. and S. S. W. and dip N. N. W. 65°. About half a mile south of Bangor, the slate strata run N. E. and S. W. dip N. W. 60°. There are many other places in the vicinity of Bangor, where these rocks may be seen, but it would be tedious to enumerate all the localities. A sufficient number have been noticed to show that the whole substrata of Bangor and Brewer, are composed of this class of rocks. In some cases the surface of the plumbaginous slate is glazed with plumbago or graphite, and owing to this circumstance such rocks have sometimes been mistaken for coal. The whole mass of strata which are above described, bear evident marks of having been exposed to the action of heat and pressure, while from the great variety of substances which enter into a sedimentary deposit, there would evidently result the various metamorphic varieties of stratified rock which I have described. It will be observed that all the strata now rest on their edges and are highly inclined to the horizon, and this position could not have resulted from their original deposition, for all strata which are deposited by water, are arranged horizontally. Now it is clear that these rocks were deposited from water in horizontal beds, and that since that time they have been thrown up by a violent subterranean cause into their present position. These slates belong to the oldest transition formation and are generally destitute of organic remains.

TERTIARY FORMATION OF BANGOR AND VICINITY.

The Tertiary formation in Maine consists of a series of layers of clay and sand, which have been deposited by water upon the various solid rocks beneath. This deposit is evidently a sediment of clayey and silicious matter, and is arranged in regular strata shewing the effect of tranquil subsidence from the waters by which it was deposited.

These beds of clay contain distinct remains of marine shell fish in the various strata, arranged in such a manner as to evince their having lived and died exactly in the spots where we find them. This shows a slow and gradual deposition of the clay, for the shell fish lived near the surface of the different strata and must have had time to live, grow and multiply in each stratum before the next was deposited.

The lower tertiary at Bangor, is composed of blue clay, very tenacious in its structure, tough and adhesive. It contains so much vegetable matter, derived from decomposed sea weeds as to give it in many places the odor of marsh mud. The shells characteristic of this deposit, are the Nucula, Saxicava and Mya dehiscens.

There are a majority of recent species of shell fish in this deposit, and hence we consider it as equivalent to the pliocene formation of Lyell. Above this deposit we come to another mass of clayey strata of a yellow color, and remarkable for the curious casts of various forms which it contains.

Nearly all these casts have a long cylindrical tube running through them from one extremity to the other.

In Bangor, the greatest elevation which the tertiary clays attain is not more than 100 feet above the level of the sea, or 75 feet above the level of the Penobscot river at that place. The hill upon which Mr. Pomeroy's church is built is tertiary, and is the highest point which that formation attains in Bangor. The lower portions of this clay-bed contain distinct remains of the marine shells Nucula portlandica, Mactra, and Venus. The upper beds contain a great abundance of those strange cylindrical and conical casts terminated sometimes by a large bulb or tuber, which fossils resemble in their general structure the siphoniae described and figured in Rozet's Geology. There are however in this deposit a number of different species, and their peculiar shapes have caused them to be mistaken for almost every variety of plant and fruit. There is, however, good reason to believe that they are of animal origin, and were probably once molluscous or soft animals, having but little consistency, so as not to leave any solid matter indicative of their composition.

There are beds of ferruginous and silicious sand, which here and there alternate with the upper clay-beds. In some places it is of good quality for moulding. Examples of this kind of sand may be seen on the side of Exchange street, where the strata of clay dip to the South 15°.

In Cumberland street the lower tertiary deposit may be seen with the upper beds resting directly upon it. The strata dip to the S. W. 10°. This deposit attains an elevation of 50 or 60 feet above the river's level.

Crossing the Penobscot we enter the town of Brewer, where the same tertiary clays may be seen. A little above the bridge on the river's banks, occurs a high cliff of sand attaining an elevation of 86 feet above the high water mark upon the Penobscot.

At the various brick-yards in this town we had an excellent opportunity of examining the nature of the clay, and the various shells which are contained in it. They are identical with those found in Bangor.

The clay, generally selected for making bricks, belongs to the upper tertiary, and is of a yellow color, and contains but very few marine shells. The blue clay answers very well for the same purpose, when there are not too many shells, but it is tough and hard to work.

The siliceous sand, found alternating with those clays, is used also in brick making.

These materials are so common in Maine, that little account is made of their value, but they are nevertheless sources of a very considerable income.

Thus, for instance, in the eight brick yards of Brewer during the last year, no less than three millions of bricks were made and sold. One million one hundred thousand machine-pressed bricks were made in three of these yards, during the same year.

So abundant is the brick-clay in Bangor, that in digging the cellars for most of the buildings, a sufficiency of it is dug out to make the bricks required for the edifice, and I understand that this is frequently done.

Brick makers are fully aware of the fact, that if clays contain any considerable proportion of lime, they will not answer for brick-making, since the lime is rendered caustic during the operation of burning, and when the bricks are moistened by water, the lime slakes, and they crack or burst to pieces. On that account they carefully avoid any admixture of shells, since they are composed chiefly of carbonate of lime, and produce the same effect.

These clays form extremely tough soils, and are liable to bake or harden by the action of solar heat, so that the roots of plants are often completely imprisoned by the hardened clay, and therefore the plant does not thrive.

In order to improve a clayey soil when it is found practicable, sand should be mixed with it, so as to break up its cohesive properties, and it often happens that hills of sand are found close at hand. After the texture of the soil is sufficiently broken up, air-slaked lime may then be used for a top-dressing, and it will be retained for a great length of time, since the clay is so impermeable to water.

It is certainly worth the labor required to bring into a high state of cultivation those tracts of land, which are in the immediate vicinity of the city, and their improved produce will amply repay the moderate expenditures, which would be requisite for the purpose.

Above the tertiary formation we have a confused mass of rounded stones and pebbles, which bear evident proofs of their diluvial deposition.

The current of diluvial waters, in rushing over this district, excavated deep vallies in the tertiary deposits, and transported the detritus far to the south. Near the Court House in Bangor may be seen beds of coarse pebbles at the base of the hill, and the sediment becomes finer as we ascend, until we meet with perfectly fine clay. This locality shows that the coarse pebbles were deposited by swiftly running water, while the fine sand and clay prove a gradual subsidence in the force of the current.

On examining these pebbles it will be remarked that they are mostly those composed of varieties of slate, which occur in places north of the spot where they are now found.

EXCURSION FROM BANGOR TO THE BARNARD SLATE-QUARRIES.

In the report, which I had the honor to lay before you the last year, I described some of the valuable slate regions of Williamsburg, and gave a particular account of several localities upon Pleasant river and Whetstonebrook. Public attention having been awakened to the importance and value of the roofing slates found in those regions, farther researches were made in the vicinity, and several very excellent quarries were consequently discovered in the town of Barnard. Not having visited that district, I was desirous of doing so, and set out from Bangor in company with Mr. Larrabee, and one of the owners of the quarries in question. The whole route from Bangor to Atkinson is composed of slate rocks, which run N. E. and S.

W. and dip to the S. E. from 70° to 80°. In Atkinson, two and a quarter miles from the south line of the town, the dip of the strata becomes suddenly reversed—that is, the strata dip to the N. W. and at about the same angle. From this point we observed that the slate became more regular in its stratification, and less intermixed with quartz-veins.

In the town of Charleston the direction of the slate is nearly E. N. E. and W. S. W. and the dip is to the N. W. There are to be seen on the road side, where the strata have been recently uncovered, some very fine examples of diluvial furrows on the rocks, in place. These scratches run from N. 15° W. to S. 15° E. and are very regular and parallel, while they cross the lines of stratification at an angle of 70°. In and upon the soil all around there are multitudes of large boulders and blocks of granite, compact talcose and mica-slate, and a few large masses of diallage rock. As we descend the hill, going towards Sebec pond, we discover an immense number of huge blocks of granite, piled up on the north side of the hill. We traced the diluvial grooves in a regular manner nearly to Sebec pond, where we stopped for the night. On comparing fragments of the granite boulders found so abundantly in Atkinson, we observed the rock was identical with that which occurs North of the pond in Sebec, and since that place lies precisely in the direction to which the diluvial markings point, there cannot remain a doubt that these scattered blocks were derived from that place, and were moved by a powerful current of water, which swept them over the surface of the slate ledges on which they made these deep grooves and scratches as they passed. Many of the larger blocks were unable to mount over this steep ledge, and remain heaped up in confusion upon its northern declivity. It will be remarked at once, that there is a striking coincidence between the direction of these marks and the diluvial grooves which I have before noticed. Those in Portland run from N. 15° or 20° W. to S. 15° or 20° E. and here, in a distant portion of the State, nearly the same direction is observed. We have, however, many more equally good illustrations of this subject.

SLATE QUARRIES OF BARNARD.

In the town of Barnard, four miles N. of Sebec, we examined a ledge of roofing slate, of good quality, which runs N. 85° E. and dips 68° W. This quarry has been opened to some extent and promises well.

We then visited another quarry, where the direction of the strata was N. 81° 30' E. and dip 81° N. At this quarry beautiful slates 5 feet by 6 feet square, and of proper thickness for roofing, may be easily obtained. On the Merrill-farm there are about 900 acres of land underlaid by this slate. From the direction of this place from the quarries described in my last annual report, there cannot remain a doubt that the slate is continuous from those quarries to this spot.

Proceeding to Bear-brook, we examined a quarry where the workmen were engaged in splitting out slate, and there had a good opportunity of judging of the workable quality of the rock.

At this place, which is near the site of an old saw mill, the strata run N. 88° E. and dip 80° N. The slates are naturally divided into 24 seams or layers, and the number of roof-slates obtained from a foot was 37. I took occasion to measure the size of some of the larger slates in the quarry, and found that some of them were 6 feet wide, 9 feet long, and perfectly free from defects.

The quarry has been opened to the extent of 9 feet in depth by 65 feet in length.

It was extremely difficult to work at that season of the year, on account of the dense clouds of black flies, which covered every portion of the body, to which they could gain access, and the laborers bore on their bloody faces ample proofs of the virulence of these tormenting insects. The width of this bed of slate is not less than 80 rods, or 1320 feet, while we know that it breaks out in a number of places to the eastward of these quarries for the distance of 3 miles, and it is highly probable that it runs westward to Foxcroft, where quarries of the same kind of slate are wrought. From these elements we may form some idea of the enormous quantity of roofing slate, which lies buried in this district, and we certainly shall feel very much ashamed of American enterprise, if we should still depend upon the quarries of Wales for our supplies of this valuable article.

I shall have occasion to speak more particularly of the value of roof-slate, when I come to treat of Economical Geology.

Returning to Bangor, I took pains to verify the observations made on our route to Barnard, and examined particularly some remarkable soils on our way. On the Wakefield-farm we observed that the soil was composed of a mellow loam, of a yellow color, crumbling readily when pressed with the fingers.

It contains fragments of calcareous slate and granite, and was doubtless derived from their disintegration. On examining the rocks in the vicinity, it was found that they contained a considerable proportion of lime, so that they answer well, when burned, for agricultural purposes.

The soil, above noticed, is said to produce in good seasons no less than 40 bushels of wheat to the acre. The field was covered with young, but luxuriant, wheat at the time we visited it, and probably ere this, the amount of the crop for this year has been recorded.

Specimens of this soil were taken for analysis. Beds of poor limestone, but fit for agriculture, are said to occur abundantly between Sebec and Brownville.

Having determined the extent and value of the above-mentioned quarries, we returned to Bangor, and noticed on our way a curious ridge between Charleston and Atkinson, which is called the Horseback. This ridge separates two tracts of low swampy land, now covered with cedars, and it is evident that formerly a fresh water lake existed on each side of this remarkable barrier. On examining the soil the gravel was found near the surface to bear evident marks of having been washed quite clean and smooth by the action of water.

I suppose, however, that the ridge itself is a diluvial accumulation, since its direction coincides with that of other "horsebacks" which I have examined, and also with the direction of the diluvial grooves before noticed. It is evident, however, that it served to separate two lakes which have modified its surface in some degree, as above noticed. A small branch of this ridge strikes off in a curve, just as if it had once formed the shores of a lake.

It was originally our intention to have followed the Piscataquis river and Wilson's stream in a boat, and to have crossed over to Moosehead lake, but owing to the tormenting swarms of black flies and mosquitoes, which annoyed us excessively, I determined to take another route and work elsewhere, until their virulence was over. On that account we effected a retreat from the woods,and bent our course towards the Penobscot below Bangor.

SECTION OF PENOBSCOT RIVER FROM BANGOR TO BELFAST.

Having made an examination of the vicinity of Bangor and Brewer, my next object was to take a sectional view of the banks of the Penobscot River from Bangor to Belfast.

For this purpose I hired a small boat, and accompanied by Mr. Samuel Ramsdell, who was engaged in the place of Mr. Larabee, the assistant geologist, who was necessarily absent, we proceeded slowly down the river, exploring carefully the various rocks on its western side. The first high cliff we examined was Dutton's Head, which is composed of sand and clay resting on argillaceous slate-rocks. In the town of Hampden, three miles below Bangor, near the steam saw-mills, we saw extensive ledges of argillaceous slate filled with an infinity of small veins of calcareous spar or carbonate of lime. These rocks are regularly stratified, and run N. E. by N. and S. W. by S. and dip 70° W. S. W. They are of a blueish-grey color, and contain so much carbonate of lime, that by disintegration they form a good calcareous soil.

Below Emery's steam mills the shores of the river are rocky, and the ledges of slate run parallel with the course of the river at that place.

One mile below Hampden, we observed that the slate strata were much contorted, and presently we discovered that they were highly charged with Iron-pyrites; from these circumstances it was thought probable we should soon discover a dyke of greenstone trap-rock—and having travelled a few rods farther along, we found such a dyke cutting through the slate, which has been broken into fragments, forming a kind of breccia, where the igneous rock has been thrown up. We found also, a number of narrow beds of very compact grey limestone near this place.

The shores below Hampden are composed of rough craggy slate-rocks, overhanging the river, alternating with rounded hills composed of sand and various pebbles, which have evidently been transported and deposited in their present localities by a diluvial current.

Approaching Frankfort, we came first to regular strata of gneiss, and then to that variety of stratified granite, called granite-gneiss.

The strata run N. E. and S. W. and dip 60° N. W. This rock has been wrought to some extent as a building stone. It contains black mica arranged in parallel laminæ. Here and there we observed small veins of coarse granite intruded into its mass. Proceeding down river, we next came to the coarse granite on which the granite-gneiss rests. At Marsh Bay, this rock forms hills 200 feet high above the river.

We stopped at Marsh river, 15 miles below Bangor, for the purpose of examining the granite mountains near that place. Mr. Pierce and Mr. Kelly joined our party on our excursion to Mt. Waldo, the height of which we proposed to determine by barometrical measurement. The next morning we made the necessary preparations for this purpose.

In our table of barometrical heights, the reader will observe that on the 27th June, 7 A. M. the barometer stood at Sawtell's tavern 25 feet above the river's level at 30.180 inches, the temperature of the instrument 62° F. Proceeding up the gradual slope of the rising land, we stopped at the house of Mr. Daniel Walden, near the base of the mountain. Here we observed, at $9\frac{1}{4}$ A. M. Bar. h=29.650 T.=68°. t air=66°.—Angle of elevation of the mountain, 8°. I reached the summit of the mountain at 10 A. M. and hung up the barometer on the shady side of a dead tree, 3 feet below the highest point of rock. It stood h=29.080 T.=64.

From the above observations it will appear by calculation, that the alttitude of Mt. Waldo, is 964 feet above the level of the river.

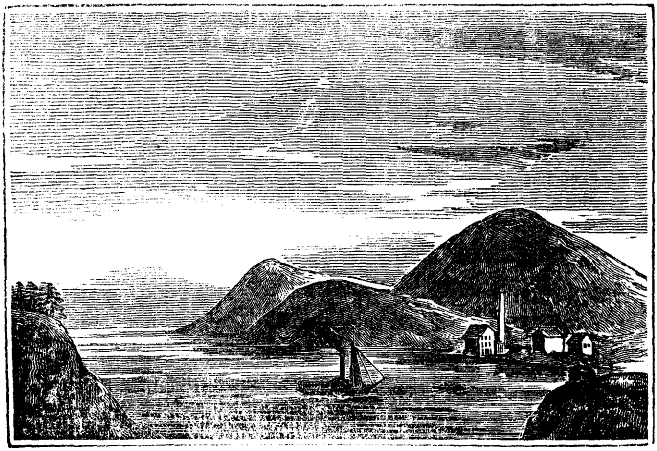
This mountain is a commanding eminence, seen distinctly from Bangor, and for the distance of 20 miles around. It is a huge dome shaped mass of naked rock, which was formerly covered with an abundant growth of small juniper and other forest trees, which have been destroyed by fire. Now a few low birch trees grow here and there on those spots where any soil remains, and on some places there are an abundance of blueberry bushes, which struggle for existence in the scanty soil. From the summit of this mountain, we enjoy a magnificent view of the surrounding country. On the North, the beautiful Penobscot river is seen winding its way from Bangor, and coursing by to the sea on the South East.

Hampden bears N. N. E.
Bucksport bears East.
Belfast " S. W. by S.
Brigadier's Island bears S. S. W.

The mountain is composed entirely of a peculiar porphyritic granite, consisting of large crystals of pure white felspar, black mica, and a little quartz. The average size of the crystals of felspar, is about ½ of an inch in width, and of variable length, and they are so disposed as to give the rock a porphyritic appearance. This granite is remarkably pure, free from foreign matters, and will resist well the action of the weather. Blocks of any size desired may be easily obtained, and I observed, that for 200 yards square, that there was not a single crack or fault in its mass. It splits into sheets, or huge blocks, when quarried, and will doubtless be wrought for architectural purposes. When hammered, it does not shew its porphyritic structure, but it is of very uniform color.

The Pharaohs of Egypt would have gloried in a mountain like this, for after removing sufficient granite to build a city, the nucleus, if left in a pyramidal form, would be more than twice the magnitude of the Great Pyramid of Egypt, and this mountain has the advantage of being founded upon an immoveable basis.

The following wood-cut will serve to give an idea of the appearance of Mt. Waldo, and its adjacent mountains.



View of Mt. Waldo, Mosquito Mountain, and Treat's Mountain, from Penobscot River.

After having examined Mt. Waldo, we ascended Mosquito mountain, and measured its height. At the level of the river, the barometer stood at 30.100 T.=66°. On the summit of the mountain it stood at 29.430 T.=59°. Calculating from these observations, we find the height of Mosquito mountain to be 527 feet above high water mark.

This mountain is composed entirely of porphyritic granite, which is extensively quarried for building stones, by the Frankfort granite company. The rock is certainly a very handsome building material, and withstands the action of the weather without changing its color. It is, like the Mt. Waldo stone, composed of felspar in large proportion, having a porphyritic structure. Its mica is black, and the quartz is in small quantity. I could not discover any pyrites, or other material that would cause it to decompose. On examining the weathered surface of the rocks, in place we observed that the mica was the first ingredient that underwent decomposition. When the felspar decomposes, it becomes of a dull or earthy white color, and loses its brilliancy, but does not become brown.

From the workmen at the quarry, I learned that the first operations upon this stone began in the month of May, 1836, since which time more than $50,000 worth of granite has been quarried and hammered for the New York market. The Albany exchange is being constructed of this stone. I measured several blocks, as they were hammered for this building, and found them to average from 10 to 15 feet in length, by 3 feet in width, and 1 foot in thickness, containing about 45 cubic feet to each stone. There were a large number of blocks, wrought in a beautiful manner, and ready for the market. On examining the loose blocks, on the side of the hill, it appeared that many could be obtained upwards of 40 feet in length, and free from seams.

This rock splits perfectly well, in the directions required, and is easily wrought. It has a light color when hammered, and will appear well in any kind of architecture.

I was informed, that no less than $20,000 had been expended by this company, in excavating a canal to the base of the mountain. This canal will enable the proprietors to ship the granite more readily.

Crossing the river, we stopped at Bucksport and examined some specimens of limestone which is found at that place, imbedded in slate rocks.

Having examined the rocks for some distance along the eastern shore of the river, we re-crossed to its western side. Nearly opposite Bucksport the mica slate is seen cropping out at the river's side. The strata run N. E. and S. W. and dip 75° S. E. This rock splits into regular sheets, and will answer for pavement, flagging stones, fences, &c. At Fort Point the argillaceous slate again shews itself, and is highly charged with pyrites, so that its surface is rendered brown by the abundance of per-oxide of iron deposited upon it.

The pyrites mixed with the slate causes it to decompose, and sulphate of alumina and sulphate of iron are formed. It is not yet certain whether this rock can be advantageously wrought for alum, but it will certainly work as well as that now undergoing trial, on Jewell's Island in Casco Bay.

Owing to a strong head wind, we were unable to proceed directly to Belfast, and therefore ran into Castine and examined the rocks near that town. The strata of argillaceous and talcose slates, are there seen in numerous places, and owing to the presence of iron pyrites, there are mineral springs of some repute, which deposit a large quantity of oxide of iron in the meadow through which the water runs. They are strongly charged with carbonate of iron, and are a good chalybeate or tonic water.

From Castine we crossed over to Belfast, and travelled from that place to Bangor, by land, examining the different rocks as we passed along. The rocks of Belfast, like those of Castine, consist of various slates, composed of argillaceous and talcose matter, with veins of quartz and laminae of plumbago or graphite interspersed. On our return to Bangor we passed through the town of Prospect, where we observed extensive beds of tertiary clay. The upper beds are yellow and contain remains of siphonae—while the lower are composed of blue clay, containing many marine shells. The clay is extensively used for the manufacture of bricks. Diluvial sand occurs near the brick yards, and is used in their manufacture.

Diluvial blocks of granite occur between Belfast and Frankfort, and were evidently derived from Mt. Waldo and its immediate vicinity. We visited several granite quarries on the eastern side of the mountain, where this stone has been wrought to some extent. At Kelley's quarry, good granite split into proper dimensions has been obtained and sold during the past year, at 17 cts. per cubic foot on the spot, or at 25 cents in Bangor. Several buildings in that city are constructed of this stone. Sargent's and Walker's buildings are mentioned as examples.

Bussey's quarry, situate three quarters of a mile North of Frankfort, has been wrought to a small extent. It is of that variety called granite gneiss, the layers or strata of which curve gently to the West. There are a few particles of iron pyrites scattered through the rock which, on decomposing, produces brown stains. There are also some veins of coarse granite which intersect the rock. This quarry was opened four years ago, and was wrought to some extent; but was finally abandoned, owing to the foreign matters in the rock. Mansfield's quarry, a quarter of a mile North from that last described, is likewise a granite gneiss, which was quarried a while, and then abandoned, since it did not split true.

At Hampden we again came to slate rocks which continue to be seen here and there on the road to Bangor.

It will be observed that the slates on the Penobscot below Bangor, are highly inclined, and rest, as it were, on their edges, the ends of which are frequently exposed along the river's course. Mt. Waldo, Mosquito Mountain and Mt. Heagan, are masses of granite which were probably elevated after the deposition of the slate through which the granite forced its way, producing such chemical changes in the strata that rested upon it, as to render them crystalline in their structure. Thus we suppose that the mica slate resting on both sides of Mt. Waldo, was formed from sedimentary matter, which was originally in a state resembling clay—but which, by the action of heat, has become crystalline.

COAST SECTION.—BLUE HILL.

Having determined, during midsummer, to devote our attention to those portions of the sea coast of the State, which we had not surveyed during the past year, I wrote to Capt. F. A. Jarvis, of the U. S. Revenue boat, at Castine, desiring the use of that vessel for our cruise. This request was most cheerfully complied with, both by Dr. Bridgham, the Collector of that port, and by Captain Jarvis. I have great pleasure in acknowledging the kindness and attentions of these gentlemen, who offered us every aid in their power. We also feel indebted to the pilot of the Revenue Boat, Captain Dyer, and to the whole crew for their strenuous exertions in our behalf, during our voyage along the complicated rock-bound coast, which we were called to explore.

Our first excursion was intended for the purpose of exploring the coast to Bluehill—a district, which we had slightly examined last year. We therefore ran down the Penobscot Bay, with a light westerly breeze, and had an admirable opportunity of landing on many of the islands in our way. Islesboro' is composed of various kinds of slate rocks, charged with either talc, plumbago or pyrites. There are also several beds of limestone, included between the strata. We ran down by Deer Isle, at which place we did not stop until our return from Bluehill, but we had a very fair opportunity of making an outline sketch of the island, as we passed gently along.

Bluehill Mountain, is a very commanding eminence, which forms a magnificent background to the beautiful scenery as we enter the harbor. The following wood cut will give some idea of the appearance of Bluehill Bay.

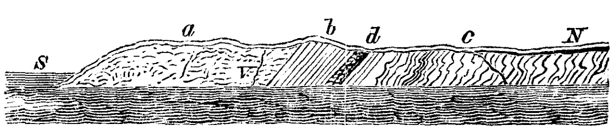
View of Bluehill Mountain from the Outer Harbor.

On arriving at Bluehill, I made known to several gentlemen our intention of exploring their vicinity, and was most cordially assisted by them in all our labors. No less than forty of the active and enterprising citizens of this place volunteered to go with us to the summit of the mountain, on the next day, when we proposed to measure the altitude of that eminence. We were not allowed to stop at the hotel, but were most kindly and freely entertained by the polite citizens of this town. It would not be proper, nor would it be desired by them that we should particularise those individuals who treated us with so much kindness, and therefore we beg leave here to tender our grateful acknowledgments to all.

Having prepared ourselves for an excursion to the mountain, we first took the level of the mercurial column in our barometer, at high water mark, and found it to be at 8¾ A. M. 30.012 inches, temperature of the instrument being 69°. On attaining the summit of the mountain, at 10 A. M., the barometer stood at 29.018 t=70°, These observations calculated with corrections for difference of temperature, and for curvature of the earth, give 914 feet for the height of the Mountain.

On exploring the geology of this mountain, we were surprised at its curious structure. It is composed of the most contorted variety of gneiss, that I ever beheld, presenting a perfectly curled mass of strata. This rock contains a considerable quantity of oxide of manganese disseminated in it, and on examining farther upon the S. E. side of the mountain, we discovered a huge bed of the gray silicate of manganese, which is fifteen feet wide, and runs E. N. E. and W. S. W. cutting through the mountain side. This mineral, I believe, has not yet been brought into use in the arts, but it will answer admirably for the coloring of glass, giving it a most rich and beautiful amethystine-purple tint. Other uses will probably ere long be devised in order to render it available in the arts. Before leaving the mountain our companions raised a pyramidal monument of stone, 12 feet high upon its highest peak.

Our next excursion was directed to Bluehill Neck, where we found the rocks to be gneiss and a curious variety of talcose and micaceous slate, containing veins of quartz and iron pyrites. The strata are remarkably contorted, but the general dip is to the S. E.

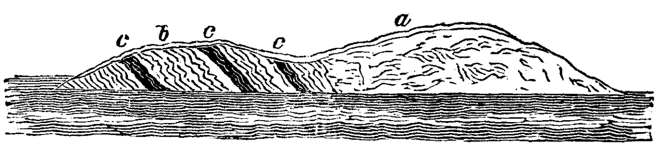


Section of Bluehill Neck.

a Granite.
b Gneiss.
c Talcose and mica slate.
d Dyke of trap.
v Vein of quartz and pyrites.

We found at this place, arsenical iron, chlorite, and numerous veins of spongy quartz, exactly like that variety from North Carolina and Virginia, which contains native gold. We could not, however, discover any visible particles of this metal. If gold mines are really desirable, this rock is the most probable matrix in which the metal may be found—still, however, I should consider its discovery a great evil to Maine, since it invariably produces extravagant expectations, which are rarely realized, as may be seen in examining into the history of the gold mines of the southern states.

Crossing over to Long Island, in Bluehill bay, we found the rocks to be gneiss and talcose-slate, resting upon granite, the latter rock forming about one half of the island. There are, also, three dykes of greenstone trap, which cut through the strata, and appear on each side of the island. In the granite, near its junction with the gneiss and trap, we found numerous veins of quartz, containing copper-pyrites, and arsenical iron. We also found several veins of fluor-spar, and while we were still remarking on the probability of the occurrence of lead ores with this mineral, with which it is frequently associated, one of the young gentlemen of our party handed me a specimen of galena, or the sulphuret of lead, which he found close by one of these veins.



Section of Long's Island, Bluehill bay.

a Granite.
b Gneiss and mica slate.
ccc Trap dykes.

The fluor-spar occurs in a vein 8 inches wide, and runs E. N. E. and W. S. W.; dipping to the S. S. E. It is of a light grass-green color, and is crystallized in octahedral forms. This mineral is now used only for chemical purposes. It is composed of fluorine and calcium, and by means of sulphuric acid, the fluoric acid is formed and disengaged. This gas has the property of dissolving silex, and will serve to engrave upon glass.

Large druses of crystals are found in these veins of quartz.

Phosphate of lime, of a light green color, is exceedingly abundant upon this island, there being veins of it 10 inches wide, traversing the granite.

Sulphuret of molybdena is also very abundant; occurring in large and brilliant tabular prisms, of 6 sides; also in large intersectings and radiating plates.

These minerals are among the usual indications of tin ores, and the granite is of the kind in which that metal is commonly found. We did not, however, succeed in finding any specimen of the ore on Long Island. The granite is of coarse texture, and contains reddish brown felspar. It is not worth quarrying, since so many better varieties occur close at hand.

It is probable that wider veins of lead ore will be found on the Island, for I have since learned that the fishermen have frequently found large masses of several pounds weight, and have reduced it to lead for their uses.

Our next object was to examine the various granite quarries, which have been opened at Bluehill. We therefore proceeded to Long's Cove, where there is a quarry, owned by Mr. J. Darling. The granite is of a light color, containing an abundance of felspar, with a little black mica and quartz. These minerals are well mixed, so as to produce an uniform color. Blocks of building stone, 5 feet thick, 20 feet wide and 10 feet long, may be readily split from the ledge. This quarry is situated on the south side of Long's Cove. On the opposite shore we examined a locality, where it was formerly supposed that a coal mine existed. The rocks there are granite, and the mineral mistaken for coal is the radiated black tourmaline, or schorl. It is, most assuredly, a certain indication that no coal will be found there, instead of being, as was supposed, an indication of that combustible.

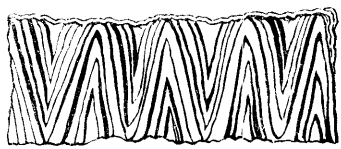
We next examined a quarry called the Mc-Herd ledge. It has been but little wrought, but the granite is a most beautiful variety, of fine texture, and working to an exceedingly sharp edge. It is composed of small particles of felspar, quartz and a little black mica in fine scales. This rock will work admirably for fine ornamental devices and for window caps. It cannot be learned whether it will quarry well as a building stone, until it is regularly cleared and opened. Blocks from 6 to 10 feet square may be now obtained. The Mc-Herd quarry is at the head of Long's Cove, 400 yards west from the bridge.

The quarry belonging to the Bluehill Granite Company was next examined. It is situate $1\frac{1}{2}$ miles E. S. E. from the village of Bluehill, on the North East side of the Narrows. It originally cost $5500, and is chiefly owned in New York. The granite is rather a coarse variety, composed chiefly of white felspar, containing little black mica and quartz. It, however, splits well, and works to a sharp edge. When smooth hammered, it is a handsome stone. Columns 4 feet square and 28 feet long, have been split out for the Reformed Dutch Church now building in New York. These columns will contain 488 cubic feet, and weigh 35 tons, and much larger masses may be obtained if desired. One block weighs 84 tons. This granite hill rises quite abruptly from the sea to the height of about 300 feet, and extends $\frac{1}{2}$ mile in an E. S. E. and W. N. W. direction, and $\frac{1}{2}$ mile to the N. E. The extent belonging to the Company is about 250 acres.

A rail road is being constructed to the top of the hill, at the cost of $10 per rod; the distance being 75 rods, the cost of the rail road will be $750. It is probable, however, that it will really cost more than this sum. I cannot perceive any advantage in making a rail road here, for the granite of excellent quality extends by a regular slope quite to the sea, and there would be but little expense in removing the stone, even if it was to be brought down the hill-side, from near its summit, the distance being so trifling. By means of the dimensions given for this locality, the amount of stone may be estimated.

On examining the weathered surface of the ledge, it was found that the granite withstood well the action of air and water, the first mineral giving way being the black mica; and the stone retains its color unimpaired.

Returning to Bluehill, after having ascertained the extent and value of the granite quarries, we next explored the various localities in the vicinity of the town. Two miles N. by W. from the village, we examined a bed of limestone, which is included in gneiss. There are several beds alternating with the rock, and the two substances are most curiously contorted, exhibiting a very remarkable kind of stratification. The following wood cut is a copy, taken from a piece of the rock.



The direction of the strata, taken upon the average, is about E. S. E. and W. N. W. We traced the width of these beds to the distance of 300 feet.

Owing to the ease with which lime of a better quality may be obtained from Camden and Thomaston, it will not be expedient to burn this rock for lime. It has, however, produced beneficial effects on the adjacent soil by its decomposition, and if wood was cheap enough on the spot, it might be burned for agricultural purposes.

On the estate of Mr. Jacob Osgood, we examined a bed of bog-iron ore of good quality, and black oxide of manganese.—The deposit of iron is, however, not sufficiently extensive to supply a blast furnace. Should, however, any such works be erected in the vicinity for the purpose of smelting the ores from Marshal's Island and Mt. Desert, then the Bluehill bog-iron would find a ready market, since it will work advantageously with those heavy ores.

Two and a half miles from Bluehill, we were shewn a remarkable chalybeate spring, which is highly charged with carbonate of iron, and may become valuable for medicinal purposes, as a tonic. It is surprising to see the enormous quantity of iron deposited by this spring. Where it flows out into the meadow, a deep and thick bed of beautiful brown carbonate of iron is deposited, which may be advantageously used for paint. Dried at a moderate heat, it is yellowish brown; heated to redness it assumes a deep red color, equal in richness to the Venetian red.

In the course of time, this mineral spring will become a place of resort for invalids and people of leisure, and there is no doubt that its use, combined with an occasional excursion to the mountain, would prove a sovereign remedy for dyspeptic complaints and many other diseases common to sedentary people. In order that the spring may come into notice, it will be advisable to clear it of sediment, and to place a slab of granite with holes in it, through which the water may rise into a well-tub. Then a small and tasteful building should be erected near or over it, to serve as a resting place for visitors, who may use the water. The moment such arrangements are made, the tide of travel will naturally carry many persons to the Bluehill Springs, and the place being one of the most picturesque districts on the coast, would soon become celebrated as a place of resort.

Near the tide-mills on the Camdage farm, we visited the locality from whence the specimen of wolfram was sent to me last year, and after a dilligent search, discovered the mineral in place. It occurs in the granite rocks, which rise through the gneiss, and forms a hill a quarter of a mile beyond the house. This rock contains numerous veins of quartz, filled with crystals and plates of sulphuret of molybdena. In the adjacent granite, we found the wolfram in flattened and wedge-shaped crystals. These minerals are both indications of tin, and it will certainly be worth while to examine very carefully the decomposed granite in this vicinity, in order to discover if there are not grains of tin ore imbeded. It occurs disseminated through granite, and is found also in veins. It has a reddish brown color, and is very heavy, so that it may be separated from the soil by washing and pouring off the water, when the oxide of tin would be left.

On this mountain, we found a large mass of arsenical iron, a mineral valuable for the purpose of granulating lead in shot making, and also as an ore of arsenic.

Leaving Bluehill, we set out for our western tour, stopping at the most interesting islands. We landed upon little Deer Island, and travelled from one extremity to the other, inspecting the rocks on our way. Near the southern extremity of this island, we noticed a remarkable mass of greenstrone trap, mixed with serpentine, which has burst through the strata of slate-rocks, and rises to the height of 150 or 200 feet above the sea-level. This mass resembles the appearance of a volcano, more nearly than any other spot I have seen in Maine. It here protrudes through the slate, which it has torn up all around, and melted, in many places, into a perfectly white hornstone or chert, while in other places, the chemical action which took place, has blown the whole mass into a sort of scoria or amygdaloid. The trap-rock is mostly columnar, and is broken into quadrilateral columns. A deep ravine separates the slate from the trap, so that it resembles a cone in the midst of a volcanic crater. Several dykes are sent off from this mass through the adjacent rocks.

On the North Western extremity of the island, occurs a beautiful variety of green novaculite, or hone-stone, which is suitable for oil-stones, and is equally valuable with that brought from the Levant. It is worth while to bring this article into the market, where it will meet with a ready sale. The hone-slate runs N. and S .and dips to the E. 25°. Masses may be obtained 3 feet square, and of any required thickness. The price paid for Turkey oil-stones, in Boston, is from 30 to 50 cts. a pound. This stone is equally as good as the foreign article, and if it will sell for one quarter as much as the Turkey stone, it will become a profitable article of trade.

We visited Buck's Harbor, in Brooksville, for the purpose of examining the extent and value of the granite, which is quarried at that place. This locality is directly opposite little Deer Isle, and has a small, but very commodious harbor, with deep water.

On ascending to the quarries, we had a good opportunity of seeing the stone in its rough and hammered state. It is rather a coarse variety of granite, but when split or hammered, has a very uniform appearance, and is a handsome stone. Its predominating ingredient is white felspar, and it has but little black mica and quartz; hence it is of a light color. The weathered surface of the ledge shows that the mica decomposes first, the felspar becomes white and earthy, as it usually does when pure, and the quartz remains unaltered. This is the order of decomposition, but the rock appears to withstand the action of the weather remarkably well. The extent of the quarry may be estimated at 80 rods in length, 300 feet in height, and 100 rods in width, which will give 634,000,000 cubic feet as the estimated mensuration of the mass.

The quarry belongs to a New York and New Jersey company, and they own about 30 acres of the hill: 10,000 tons of rough-split and hammered granite have been sent from hence to New York. The cost of quarrying and delivering on ship-board was only from $1,12 to $1,25 per ton, rough-split. It sells for 10 cents per foot when rough-hammered, and 30 cents per foot when fine-dressed. Cost of transportation to New York, from $2,50 to $3 per ton. At the time we visited this quarry, it was under attachment by the workmen for their wages, &c., the amount of the debt being stated at $3000. There was about $1000 worth of granite ready for the market. It is evident from the above statements, that the failure of the company was not owing to the expense of quarrying the stone, nor from its quality not being good, but it must have been caused by some other troubles unknown to me. It is probable that the debt will be paid, and the quarry redeemed, since it is really very valuable property, and is convenient for shipping.

Messrs. Redman and Tilden own the back part of this hill, and preparations were making by these gentlemen to open a quarry.

In Brooksville, opposite to Castine, occurs an abundance of pyritiferous slate, suitable for the manufacture of copperas and alum. This rock is cut through by numerous dykes of greenstone trap-rock, which doubtless were thrown up at the time, and by the same cause, that charged these slate strata with pyrites, for that mineral is most abundant in the immediate vicinity of the dykes.

There is also a remarkable dyke of compact felspar, which cuts through the strata in an E. N. E. and W. S. W. direction. The felspar is charged with large crystals of pyrites.

The slates run N. E. and S. W., and dip N. W. 70°. The pyrites is, in several places, laid with the most perfect regularity, in alternating layers with the slate, and owing to this admirable mixture of the two substances, it will form an excellent material for alum and copperas. It was, however, originally imagined by the English, during the late war, that a coal mine existed in this spot, for as coal frequently contains sulphur, they thought it probable that a rock containing sulphur must necessarily contain coal. Several other persons have since been deceived in a similar manner, and within a few years borings were made for coal. The auger penetrated to the depth of 100 feet, and brought up nothing but pyritiferous slate, as might have been anticipated. Borings were made in three or four different places with the same results. Now had this locality been a coal formation, as it certainly is not, there would have been no need of boring, for the strata stand upon their edges, or at an angle of 70° with the horizon, and no person, at all acquainted with the structure of the earth, would ever think of such an operation, for it would not give any information of the kind required. A geological observer can penetrate a thousand feet deep, when such is the position of the rocks, without digging into them at all. It is an open book that is laid before him, and he has only to observe attentively. Although coal is not found at this place, I doubt not that the rock contains so large a proportion of well-mixed pyrites, that it will work profitably for alum. I measured the extent of the kind of rock which appeared suitable for this purpose, and found that it occurs for 50 rods along the sea-shore, and runs back to an unknown distance inland. From its forming a cliff or ledge, rising immediately from the shore, it is evidently easy to work, since it can be broken up very readily, by means of gun-powder and the pick. Extravagant bonds have been sold for roofing-slate in this vicinity, but there is no probability of there being any rock suitable for this purpose. All the slate that we examined along the shores, was crooked in its stratification, and extremely rotten or fragile.

After visiting all the localities of any interest in this vicinity, we ran over to Belfast, and subsequently to Great Deer Isle, where we were desirous of examining the serpentine ledges, fragments from which had been sent to me. We first hove to by a little island near Cape Rosier, where there occurs a trap dyke, intersecting slates of various colors, such as blue, red, green and purple. We then ran over to Deer Isle, and called upon those gentlemen who were interested in the serpentine rock, and they politely accompanied us in our excursion, and gave us every aid. Near the landing, at the settlement, the rocks are gneiss, the strata of which run N. 55° E., and dip 80° S. E.

The serpentine occurs on the northern and north-eastern extremity of the island, of which it forms a considerable part. We traced this rock from Torry's Pond to the Reach, about $1\frac{1}{2}$ miles in width.

In some places, we found it most beautifully veined with indurated asbestus, which gives a silky lustre to the polished specimens, and augments their beauty.

In other localities, the rock was filled with foliated diallage, giving yellow spots of changeable hue to the mass, when polished. Other specimens are of a deep olive green, and when polished appear like black marble. This rock is naturally divided into large blocks, about 3 feet square. It has a columnar arrangement exactly like the trap rocks, and was evidently, like those rocks, thrown up from below in a molten state.

There is some difficulty in estimating the value of this serpentine, and in giving an opinion as to the best method of quarrying it. It is soft, and easily cut, so that blocks may be morticed out in the same manner that the ancient Greeks were in the habit of quarrying their building stones. Or it may be split out by means of gun-powder, provided that large and deep holes are bored for the purpose, so as to give large blocks. It is certainly worthy of exploration, for the stone is a very beautiful kind of serpentine or verd-antique marble. By making a trial, and sending some of it to market, the cost of working it, and its value may be readily ascertained. I am now unable to give an opinion of its statistical value. On Deer Isle we found a few veins of magnetic iron ore, included in serpentine, and saw numerous boulders and blocks of granite piled upon the serpentine, showing that they had been deposited there by diluvial action. We also found masses of grau-wacke slate, filled with impressions of terebratulae and other marine shells. These boulders were derived from the very centre of the State, and must have been brought hither by a diluvial current.

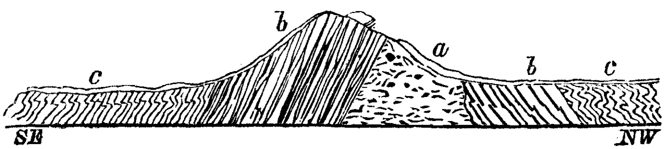
FOX ISLANDS. VINALHAVEN.

We crossed over to Vinalhaven, and passed into the strait called the Thoroughfare.

Landing on the north side, we observed a curious blending of broken masses of slate, by interfusion with greenstone trap-rock, a huge dyke of which occurs at this spot, and runs N. N. E.

We visited the land of Mr. Nathaniel Thomas, where we found two veins or narrow beds of anthracite, about an inch wide. They are found in a kind of conglomerated slate, which has been converted into hornstone by the action of the neighboring trap-rocks. These veins of coal are nearly vertical, and diverge from each other. It was extremely difficult to obtain a good specimen, since the coal crumbled when we struck such a blow, as was required to break the flinty rock. We obtained, however, enough to illustrate the fact that coal does occur in this rock. At Webster's Head, on the north end of the island, Capt. Dyer says that about a peck measure of the coal was got out and burned in a stove. These veins we do not consider of any statistical value ; but it is very remarkable that they should exist in so old a formation, and that they should have resisted the intense heat to which they have been evidently subjected. It is probable that they were formed from the remains of marine plants, since no land plants are found so low in the series. The reason why the coal was not burned by the action of heat, is evidently that the action took place at the bottom of the sea, where the oxygen of the atmosphere had no access. Thus, we see charcoal pass through an intense white heat, or even the temperature of melted iron, without change, where it is included in the slag.

After examining the various islands in Penobscot Bay, we ran in to Belfast, and made some measurements of the height of several hills in that vicinity. The hill in Belfast attains an elevation of 178 feet above the sea-level. Northport Mountain is 486 feet above the sea. This mountain is composed of gneiss, and on its side the granite appears protruding through the strata of that rock. The gneiss graduates away on either side, into plumbaginous and argillaceous slates, as represented in the diagram below.

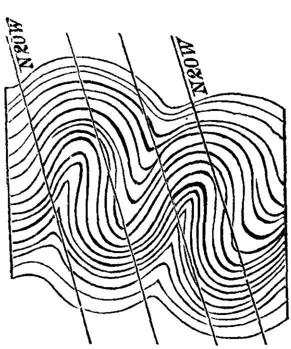


Northport Mountain, near Belfast.

a Granite.
bb Gneiss.
cc Argillaceous and Plumbaginous Slate.

From the summit of this mountain we have a charming view of Penobscot Bay, studded with beautiful islands, and skirted on the north and south by picturesque highlands.

On the western side of the hill are seen some very well characterized diluvial furrows, cut into the slate, which run directly across its curved strata, shewing that the grooves were produced by mechanical violence, and are not the results of disintegration of the rock. The following diagram represents this appearance.



Diluvial scratches, crossing contorted strata of slate rocks, Northport.

THOMASTON.

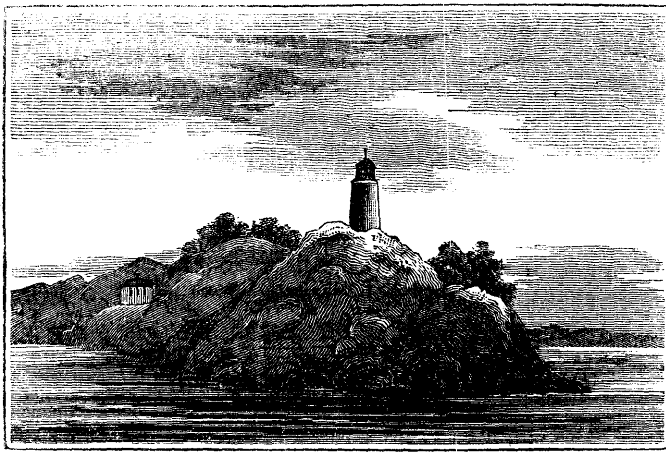
We revisited Thomaston, in order to learn the actual condition of the quarries, and the various improvements, which have been lately introduced in the art of lime-burning; besides which we made additional examinations as to the extent of the beds of limestone, there having been some progress made in developing the extent of the quarries, which could not be advantageously explored when we were last at Thomaston.

Since the last year, experiments have been made, for the purpose of ascertaining if more economical methods might not be devised in burning limestone, and the happiest results have been already attained. At the time we arrived, there were two good perpetual kilns in operation, the dust or skreenings of anthracite being used as fuel. By this improvement a complete revolution will be soon effected in the business at Thomaston, and in other districts, where wood has become scarce and dear. It has long been known, that it is profitable to carry Thomaston limestone to Boston, where it is burned in a similar manner to that now introduced in Maine; and when the demand for this substance begins to increase, as it soon will, for agricultural purposes, then the value of cheap methods of calcining the rock will be in great request. I shall endeavor to demonstrate in my Report on the Economical Geology of the State, the methods by which this may be done.

During the past year, there has been a great depression in the enterprise of our countrymen, owing to the difficulties in the mercantile world, and on this account building operations have been arrested, and consequently there has been a falling off in the demand for lime. Thomaston has, therefore, in common with other sections of the country, suffered some retardation in its prosperous career, but it has suffered less than almost any other portion of Maine. As the price of lime fell in the market, the price of the casks was also lowered, and the profit on the sales, that were made, remained about as usual. I am not able to state the exact returns for the sales made, at present, but shall be able to do so hereafter; partial returns I have at hand. We visited again the principal quarries, and took care ful measurements of the various beds of limestone, so that we are now enabled to make an estimate of the quantity of limestone, which is accessible to the quarrymen. Since our last visit, the dolomite of the Marsh quarry has been uncovered of soil to a considerable extent, and the road is now complete, so that the rock may be advantageously wrought for lime.

We made various excursions to the hills and farms around, for the purpose of collecting soils for examination, and also measured the heights of the hills. Dodge's Mountain is elevated 558 feet above the sea-level. The rocks are micaceous and talcose slates, passing into argillaceous slate, and are highly charged with manganese. The strata run N.E. and S.W. and dip 70° N. W. The soil on the top of the hill and down its western slope is very fertile, covered with groves of black oak trees, and its sides are clothed with good crops of clover, herdsgrass and grain. Specimens of the soil were taken for chemical analysis, and their composition will be seen in another section of this report. Black oxide of manganese forms from the decomposition of the manganesian slate, and this substance has been often mistaken for coal.

When we had collected all the information in our power, during our short visit to Thomaston, we ran down to Owl's Head, and examined the rocks near the Lighthouse. This remarkable headland is composed almost entirely of trap-rock, which has found its way from below sienite, through the strata of slates and limestones, to the surface, exhibiting many curious chemical changes, which are at once recognized as the effects of fire. The sketch below will give some idea of the appearance of Owl's Head, as seen from the Narrows.



View of Owl's Head Light.

I measured the height of this promontory above the sea-level, and found that the rock, upon which the lighthouse stands, is 81 feet 10 inches above high water mark. The Lighthouse is 14 feet high, making 95 feet 10 inches for the height of the lamps above the sea-level. The average rise of tide is 14 feet at this place.

Owl's Head is a favorite place of resort for people of leisure, and for invalids who require the refreshing sea-breeze for their health and comfort during the warm months of summer. At that season crowds of ladies and gentlemen take up their residence at the hotel, and scenes of gaiety and amusement serve to render the place quite inviting. It will, perhaps, be an additional and instructive amusement for visitors, to examine the curious rocks in the vicinity. It will be seen, that near the hotel, on the sea-shore, the trap-rocks are mixed with sienite, and evidently came from beneath that rock, for several dykes may be seen cutting through its mass. Visiting the cliffs on which Owl's Head Light stands, at low water, the spectator will have a fine opportunity of viewing the effects which were produced by the upheaving of a molten mass of rock into the strata around. The limestone included in the trap will be seen to have become white and crystalline, and the trap itself bears, in its cinder-like or scoria-form structure, evident proofs of its fiery origin. The scenery is here interesting, and there is even something of the sublime in our emotions, as we look up to the overhanging crags, which here project into the sea and bid defiance to the storm. The crags attain an elevation of from 45 to 60 feet perpendicular height, and overlook the sea on their northern side.

Running down to Seal Harbor, we examined Otter Island, White Island, and the Seal Harbor granite rocks. These localities were wrought to a small extent a few years since, but are now abandoned.

Rackliff's Island is also composed of granite, but is not wrought at present. The whole peninsula of St. George appears to be composed of this rock, and quarrying operations have been commenced in several places.

In one of the neglected quarries I measured a columnar mass, that had been split out, which was 27 feet long, 5 feet wide, and 8 feet thiek, and consequently contains 1080 cubic feet, or $77\frac{1}{7}$ tons. This granite is composed of white felspar, black and grey mica, and but little quartz. The only difficulty said to have been met with, in quarrying it, is, that it proved rather tough and difficult to split, but from the appearance of the work that had been done here, I should think that the drill-holes were made too far asunder. It is certainly more easily wrought than the Quincy sienite, and the quantity of stone is inexhaustible. There are, however, so many easier granites worked, upon the coast of Maine, that I doubt if this quarry will be wrought at present.

There are several granite quarries upon the peninsular of St. George, which belong to the State. We visited them, and found that, generally, the rock split well, but the people resident there, said, that it lost its beauty when exposed to the weather, becoming "foxy," owing to the presence of pyrites. It is evident, however, that many of these quarries may be advantageously wrought.

White Head Island is the site of a light-house, and is composed of granite, with an enormous trap-dyke intersecting it near the sea shore. This dyke is 50 feet wide, and runs in an

E. by N. direction for half a mile, when it disappears beneath the ocean. Many lateral dykes are thrown out from this, and some curious phenomena in the history of these rocks may here be seen. The granite has evidently been torn asunder by violence, and its fragments are frequently imbeded in the mass of the dyke. This locality is another proof of what I have repeatedly said, that the trap-rocks came from below the granite.

White Head Light is 35 feet high above the rock on which it stands, and that is 23 feet above the sea level, so that the lanthorn is exactly 58 feet above the level of the sea.

The Atlantic granite quarry is near Rackliff's Island, and is now extensively wrought. A granite wharf has been built for loading vessels with the stone.

One of the State quarries is at Long Cove, and from that quarry, the stone used for the State Prison was chiefly obtained. The Bethel meeting-house in Portland is said to have been constructed of this stone, so also was the jail at Belfast. It splits well, but is said to become "foxy."

Last year, it is said, this granite sold in New York for 40 cents per cubic foot, rough-split. It sells at the quarry for 20 cents. It can be put on board vessels for 12½ cents per cubic foot, rough-split.

The Chaise quarry has been wrought to some extent, and the stone was sent to Delaware breakwater.

Fort Munroe was built from Seal Harbor granite, and a vast quantity of this stone has been sent to New York for sale.

The town of Friendship is also remarkable for the extent of the granite rocks around, and the quarries have been, and still are wrought to advantage. This granite is generally of a light color, containing white or grey mica, and it includes small blood-red garnets scattered through its mass. On the Southern part of Long Island, quarries are now wrought.

The quarries belonging to the State, near Seal Harbor, are the following:

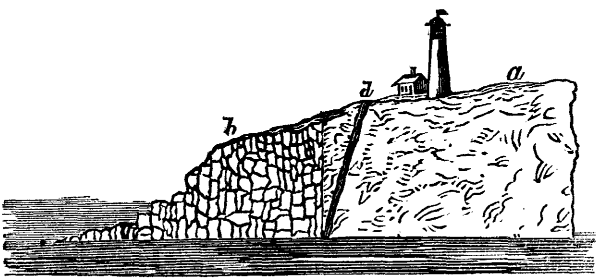
Long Cove quarry, North from White Head Island.

Two Brothers' Islands, near Mosquito Island.

School-house quarry and Biscay quarry, near Cutter's Cove.

We met with many obstacles on this complicated part of the coast; and there are so many sunken rocks dangerous to vessels, that it is extremely hazardous for a stranger to cruise among the islands and ledges. Indeed, we could not find pilots resident on the spot, who dared to run our vessel to any considerable distance; so numerous are the hidden rocks, that no man can remember their bearings, and the charts, even if correct, would be of little service, where there is so little room to work the vessel. Spindles and buoys ought to be put on the South breaker, ¾ mile S. E. from White Head Island, and on a sunken rock, 4 miles to the N.E. of this island. Two buoys are also needed at the mouth of Seal Harbor.

The following diagram shows the trap-dyke cutting through the granite at White Head Island.



White Head Island.

a Granite.
b Dyke of Trap.
d Small lateral Dyke.

Pursuing our course westward, we came next to Herring Cove Island, where we found the rocks somewhat interesting. Hornblende-rock here prevails, and is cut through, five or six veins of granite, and by numerous veins of rose and milk-quartz. The veins all run uniformly North and South, and many of them include portions of hornblende-rock, shewing by this fact and by their cutting through that rock, that they were thrown up since its consolidation.

Franklin Island is composed of gneiss, which runs N. E. and S. W. and dips 70° S. E. It is of the porphyritic variety, and is cut by veins of coarse granite, which run N. 10° E.

The island is the site of a light-house, and is a picturesque object as it presents itself in this little Archipelago.

The height of the light-house is 54 feet above the sea-level.

Pleasant Point, below Friendship, is composed of granite-rocks, as are nearly all the neighboring islands.

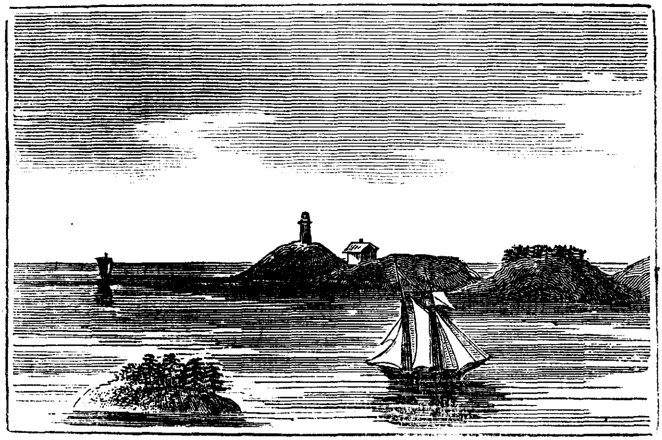
We ran down the coast of Bremen to Pemmaquid Point, but owing to the tremendous surf, we were unable to effect a landing upon that rock-bound coast. We were, however, able to discover, that the rocks are composed entirely of gneiss and granite, which form the whole extent of the promontory. Good granite quarries are said to exist near Broad Cove, but I have not yet been able to explore them.

Manhegan Island, which has a light-house erected on it, is also composed of granite.

The surf preventing us from exploring the islands around, we ran into Townsend Harbor at Boothbay. This place is one of the most frequented harbors on the eastern coast of the State, and is a favorite resort for invalids during the summer season, on account of the purity of the air, and the facilities for bathing in clear sea-water.

This harbor is well protected from the swell of the sea, and has an excellent light-house, placed at its entrance upon Burnt Island.

The following wood-cut will give a pretty correct idea of the entrance of this bay, as seen from the town.



View of Burnt Island Light, bearing S. 20° W. 1 1-2 miles distant from Boothbay village.

The rocks at Boothbay are not very interesting, being mostly coarse varieties of mica slate, gneiss and granite, the latter rock being found in veins traversing the gneiss.

We next ran to Cape Newagen, which we found to be composed of gneiss-rocks, the strata running N. E. and S. W. and dipping to the N. W. There are also veins of granite of a light color, intersecting the strata.

WISCASSET.

At this place, we examined a number of localities, where granite and gneiss are quarried. In the town, the gneiss may be observed near the court-house, where it crops out, and a vein of granite may be there seen, which runs N. 20° E. cutting through the strata.

On Squam Island occurs a kind of granite called granite-gneiss, the mica being arranged, so as to give it the appearance of stratification. This rock has been quarried for a building-stone, but not to sufficient extent to fairly test its quality. It is evident, however, from the appearance of the stone, where it had been opened, that it will be liable to turn rusty from the presence of oxide of iron, and pyrites.

Crossing over the island, we took a log canoe, and ran across the river to Edgecomb, where a quarry of beautiful blueish gneiss has been wrought to a very considerable extent.

The rock is stratified in its structure, and runs N. 30° E. to S. 30° W. and dips 85° N. W. Its mica is black, and in such abundance, as to give the stone a dark hue. The extent of the present opening at the quarry, is 194 feet long, 63 feet wide and 18 feet deep. The largest sheets measured 27 feet long, 20 feet wide, and 6 feet thick. The average thickness of the sheets is from 1 to 4 feet, most of them being about 2 feet in thickness.

The distance of the quarry from ship navigation is only 400 yards, and the slope is 5° to the ri er. A good road has been made for the transportation of the stone, and the facilities for ship navigation are admirable.

Near the river, at the point, this rock again crops out, and may be seen standing in nearly a vertical strata. We also observed there distinct diluvial marks or grooves, upon the edges of the strata, which had just been uncovered of soil. Some of them are $\frac{1}{8}$ inch deep, and they uniformly run North and South, while the gneiss runs N. 55° E. and S. 55° W.

From this point, we measured the extent of the granite up to the quarry, and found it to be 1500 feet in length. The hill is elevated about 200 feet above the level of the sea, so it is evident that there is an ample supply of building materials on this spot. The rise of tide in the river is said to be from 13 to 20 feet. Ten feet from the granite wharf, the water is from 10 to 12 feet deep.

A large quantity of the Edgecomb granite has been sent to Portland, where it has been used in building the Exchange. It has also been sent to New Orleans. It is certainly a beautiful article, and by suitable care, stones of an uniform color may be obtained in great abundance. Those blocks which contain veins of lighter colored granite, should be laid aside, since they will not answer for the fronts of buildings, but will meet with a ready sale for door steps and posts.

After making a cursory examination of the vicinity of Wiscasset, we proceeded to Bath, where we remained several days, occupied with the examination of the various localities of valuable building stones, and useful and curious minerals which abound in that vicinity.

There are several quarries of granite, which are extensively wrought.

Pitch-pine hill granite quarry, owned by Messrs. Winslow and Pratt, was opened in November, 1836, and has been in active operation ever since. The rock is granite-gneiss, and resembles that wrought at Hallowell. It works well, withstands the action of the weather, and meets with a ready sale. After making estimates of the value of this rock, which will be found in another part of the report, we visited Chandler's quarry, which is of a similar character with that just described.

NEW MEADOWS QUARRY IN BRUNSWICK.

This quarry is situate 3 miles West from Bath, in the South corner of Brunswick, at Howard's point. The rock is granite-gneiss, of good quality, and like the Hallowell stone, has a few minute red garnets scattered through its mass, which, however, do it no injury. I measured the extent of the rocks fit for quarrying, and found the hill to be about 85 feet high, and it extends North and South 90 rods, and to the same distance East and West. Nearly one half of this area may be successfully quarried.

The present openings are made at the height of 45 feet above the sea level, and the stone is dragged to the coast immedimediately below, where there is deep water, so that it is readily shipped and exported. The wharf is 600 feet from the quarry, and the slope is gentle. During the present year, 3000 tons of rough stone have been sent to the Portland break-water from this locality, and 6000 tons more are contracted for, to be used at the same place.

PHIPSBURG.

We visited another quarry, ½ a mile South from Capt. Moses Morrison's house. The rock is granite-gneiss, and extends between 2 and 3 miles North and South, and is ½ mile wide.

This rock has been quarried and sent to Portland. There are, however, some improvements to be made, before it can be wrought to advantage. It is three miles from the waters of the New Meadows river. There is also a considerable rise of land between the quarry and the river, so that a road must be prepared for the easy transportation of the stone. It is estimated that a road, which would answer the purpose, would not cost more than $300. The hill is about 150 feet high above the sea level, and may be drained to the depth of 50 feet into the low land around.

While I was employed in the examination of these quarries, I sent the assistant geologist to Parker's Island, for the purpose of obtaining some specimens of the magnificent beryls, which were discovered at that place, some years since, by Mr. Abraham Hammatt, of Bath.

We then went to Phipsburg Basin, and obtained some good specimens of the rare minerals, which there occur in the limestone. Beautiful yellow crystals of cinnamon-stone garnet, egeran, pargasite, axinite, &c., abound.

We measured the extent of the limestone, and visited several granite and mica-slate quarries, in the vicinity.

The Phipsburg limestone is abundant and valuable, but is not at present wrought to any considerable extent. There seems to be but one difficulty in burning it, and that is, that much of it crumbles in the fire. Wood is also rather dear, but the rock may be shipped, and burned where it is wanted, by means of coal dust. It is a valuable article for agriculture, since it is very pure, and lies convenient for transportation.

The limestone breaks out again in the woods half a mile N. E. from this place, where there are numerous caverns found in it, which were produced by decay of the rock and the action of water. One of these caverns is ten or fifteen feet deep, by four or five feet in height, and the interior is covered with calcareous tufa. Those who may visit the localities at the Basin, in order to obtain specimens of the beautiful minerals, which we have discovered there, will succeed more readily at the quarry in the woods, where it is easy to obtain specimens of egeran and garnet.

The Phipsburg limestone bed runs N. E. and S. W. It is 46 feet wide. When we had obtained a supply of specimens, and had collected all the information required, we went to the village of Phipsburg, where we were most hospitably entertained.

Our collections were put on board the Revenue Boat, which sailed down to Small Point Harbor, while I travelled there by land, for the purpose of examining the quarries lately opened for flagging stones. On Bartlett Lowell's estate, an opening has recently been made, so as to expose the strata of mica-slate, and slabs have have been split out, in order to test its quality. It was found to be too soft for a durable stone, and the strata were too much curved. Hence the quarry has been abandoned. The direction of the strata is N. 15° E. dip 80° Westerly. A little to the Eastward from this quarry, another opening has been made, where the stone is of good quality.—A number of platforms have been obtained, which are suitable for flagging stones.

A little to the Eastward of this locality, occurs another bed of mica slate of a more compact kind, and suitable for slabs for sidewalks. It is situate upon the farm of Messrs. Samuel and John Wildes, and has been operated upon, so as to show the quality of the stone. Slabs 15 feet long, 5 feet wide and from 2 to 6 inches in thickness, have been obtained. The rock is composed of grains of quartz and small plates of dark-green or black mica, with a few disseminated crystals of hornblende. Mica occurs in regular layers, so that the stone splits easily to the required thickness, and it is certainly as beautiful an article, though not quite so strong as that from Bolton, (Ct.)

It will be noticed that a long vein or bed of granite cuts through the mica-slate at this quarry, and runs N. 50° E. and dips 80° W. In some instances the strata of mica-slate are curved into semi-cylindrical forms, produced evidently by the upheaving of the granite. It will also be remarked, that the best flagging-stone is found near the bed of granite, and it is highly probable that the slate was rendered more compact and solid by the intrusion of that rock.

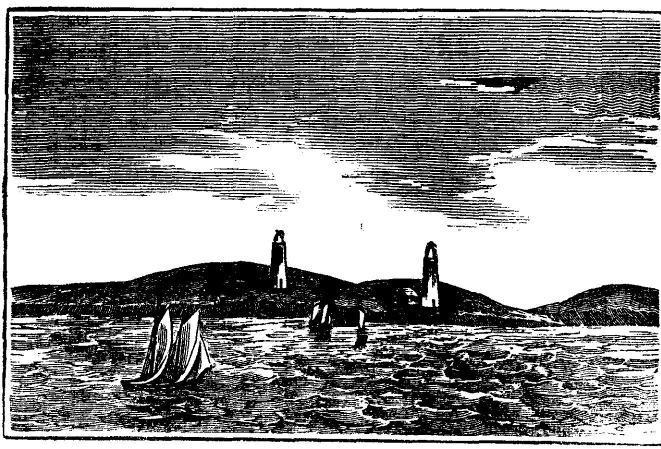
The extent of this ledge is 1 mile in length; the width of the strata is unknown. It is elevated about 150 feet above the sea, and can be drained into the low lands around. It is probable that this stone will be wrought advantageously, since it is a beautiful variety, and an article of value in our cities. The situation of the quarry is three quarters of a mile E. N. E. from Small Point Harbor, and two miles West from the fort on Hunnewell's Point. It is probable that by making openings elsewhere upon the peninsula, good mica-slate may be obtained.

At Portland we took leave of the Revenue Boat, and travelled along the remaining sea-coast by land, stopping long enough to determine the character of the different rocks. We first made an excursion to Jewel's Island, for the purpose of inspecting the copperas and alum works, which have been established there. These substances are manufactured from the pyritiferous slate. The sulphuret of iron or pyrites decomposing, forms sulphate of iron or copperas, and the remaining sulphuric acid uniting to the slate, or alumina, forms sulphate of alumina, to which salt a little sulphate of potash is added to form alum. There is a considerable difficulty to overcome in working this rock, for it contains talc, principally composed of magnesia, which is an article not wanted in the operation, and is difficult to separate from the alum.

Jewel's Island has long been a place of some celebrity, on account of the pyrites, which was formerly supposed by many to be gold, silver, or an indication of coal mines! It is not worth while to enter into the history of the various absurd operations, which have been carried on here by ignorant or artful imposters.

The pyritiferous slate on this island occurs disseminated in the rock and in narrow veins, and is found in abundance near the alum works. There are two dykes of greenstone-trap, which cut through the slate, and run E. N. E. and W. S. W. and dip to the S. S. W. 60° It is probable that these dykes have had some influence in charging the slate with pyrites, since we generally find the mineral near rocks of that character. These dykes no not appear continuous with those upon Cape Elizabeth, for that place bears S. W. by S. from Jewel's Island, and it is more likely that they run from the main land just below Portland Light.

The following wood cut gives the outlines of Cape Elizabeth as seen to the W. The rocks are entirely composed of stratified talcose slate, with two large dykes of trap cutting through its mass. The talcose slate is here remarkable for splitting into long masses which are used like rails for walls and fences.



View of Cape Elizabeth Lights, bearing West.

On Crotch Island are numerous clefts in the talcose slate, filled with veins and crystals of quartz. The strata run N. 52° E. and dip E. by S. 75°. A trap dyke here also intersects the strata, and runs S. W. by W.

We ran close under a number of islands which are generally composed of similar rocks to those above described.

Returning to Portland, we engaged a horse and wagon for our cruise Westward, and travelled along the margin of the sea to Kittery Point in York, stopping at those places where the rocks could be seen, and obtaining specimens. By this section I was also desirous of completing our outline survey of the sea-coast of Maine, so as to record the various rocks, upon a map prepared for that purpose.

The rocks extending entirely from Portland and Cape Elizabeth, to Saco, are composed of the various slates which I have formerly described as metamorphic, or such as have undergone changes in their structure, and chemical and mineralogical composition, from the agency of heat, which emanated from the igneous rocks below. Thus it will be seen that the argillaceous slate-rocks insensibly and gradually change into mica-slate, as they come in contact with granite, and where they contain magnesia, they become talcose slates, and so in accordance with their chemical composition, and the laws of igneous action. Since this subject will be more fully explained hereafter, I shall now refrain from theoretical inferences excepting when called upon to assign the rationale of the phenomena which I record.

In Scarboro' the strata of talcose slates run N. N. E. and S. S. W. and dip W. N. W. 70° Scattered crystals of iron pyrites occur in it here and there, and it is occasionally glazed with plumbago or graphite, hence it has been vainly imagined that coal would be found in this rock.

Near the brook crossed by the road to Saco, may be seen numerous diluvial scratches which appear upon the surface of slate, and run from N. 5° W. to S. 5° E. coinciding very nearly with the direction of the grooves before noticed. On the right hand side of the road to Saco, there are two trap-dykes, one of which is 2 and the other 4 feet wide. At Saco, we examined a locality where a little bog iron ore has been found on the land of Mr. Wm. Cutts, 1 mile N. W. from the village.

On reaching the town of Biddeford, a little West of the Saco river, the granite is seen to protrude from below the slate-rocks, which are altered in the manner to which I have formerly alluded. Here the argillaceous slate may be seen to pass directly into mica slate, where the two rocks come in contact. In one place the granite is seen protruding directly through the strata.

A beautiful dark colored granite occurs upon the estate of

Capt. Wm. Hill, about three quarters of a mile from the shores of the Saco, and one third of a mile from the road. The dark color of this rock is owing to the abundance of black mica which it contains. This stone exists in large tabular sheets, from 1 to 4 feet in thickness, which dip to the N. W. 55° and is easy to quarry, splitting well into the forms desired. There are a few white veins (called by quarry-men salt seams) which occasionally cut the granite. In some places there are spots or crystals of white felspar. Owing to its inequality of shades it may perhaps be difficult to furnish a large supply of uniformly colored stone from this locality. No quarries have yet been opened there, so that it is now impossible to decide this question, since much of the rock is still covered with soil. The area of Hill's granite-field is nearly 10 acres and the rock shews itself in 14 different places on the farm. Blocks of good stone from 4 to 6 feet long, by 4 feet in width, and 1 foot in thickness, have already been obtained. I am of opinion that this locality will furnish a beautiful building-material, but not in large quantities, since the land is not elevated sufficiently for the purpose. A very hard kind of slate passing into fine quartz rock is also found on this farm.

KENNEBUNK.

Proceeding westward, our next object was to examine the granite on the sea-coast, at the Ocean Quarry, Kennebunk. It is of the dark colored variety, with a hard white felspar and black mica well mixed, and it is of the same variety as that wrought at the Kennebunk U. S. Quarry. It forms a mass rising from 10 to 20 feet above high water, and runs back under the soil to an unknown distance. The only obstacle which quarrying operations here would meet with is, that there is no immediate harbor for vessels, so that it would be difficult to ship to market.

The Emmons ledge is of a similar kind of rock, situated one third of a mile from the sea, near a small cove, and opposite the

Goose Rocks of Cape Porpoise. The land is elevated about 30 or 40 feet, and slopes gradually to the sea. In order that this rock may be transported directly to the sea-shore, a road is required across the marsh, which should cost from 2 to $300. Since it would be difficult to drain cheaply below the depth of 20 feet, I doubt if this quarry can be wrought extensively.

The U. S. quarry in Kennebunk, belonging to a company, has been opened to a considerable extent. The granite is of a dark color, owing to an abundance of black mica which is well mixed with the other mineral components. Its felspar is remarkably hard, transparent and white, and breaks with a glassy fracture. The quartz is in comparatively small proportion. It is owing to the hardness of the felspar that the rock is so firm in its texture. There is a little sphene, an ore of titanium, scattered through it in minute wedge-shaped crystals. This mineral, however, does no harm, since it does not decompose. There are a few minute cystals of iron pyrites scattered through the rock, and generally in contact with the mica. Owing, however, to the dark color of the stone, the spots produced by its decomposition do not become apparent, as may be seen in many of the buildings where it has been used. The hardness of the felspar crystals also prevents the action of pyrites on the rock, since its cohesive force would retard chemical decomposition.

This quarry is elevated 75 feet above the sea-level, and is 3 miles from the wharf at Kennebunk-port, where the stone is shipped.

The following measurements were made of the present extent of the openings which are now wrought. First quarry, 50 feet wide, 15 ft deep. The second, at the canal, 75 ft wide, 10 ft deep. It is not found convenient at present to drain the quarries below the depth of 20 feet. A decomposing dyke of a peculiar kind of trap-rock, which is easily extracted, materially aids the drainage. This dyke is 6 feet wide, and runs N. 55° W. When it was discovered, it was found to have decomposed to the depth of 12 feet, and the ravine was filled with diluvial boulders and soil. This dyke forms a good "heading" for the quarry, and advantage is taken of it for that purpose. One of the blocks of stone which has been split off from this head by means of drill holes and wedges, measures 28 feet long, 6½ feet wide, 4½ feet thick and weighs 64 tons.

Enormous quantities of rough-split and hammered stone lie around the quarry and on the company's wharf, at the Port.

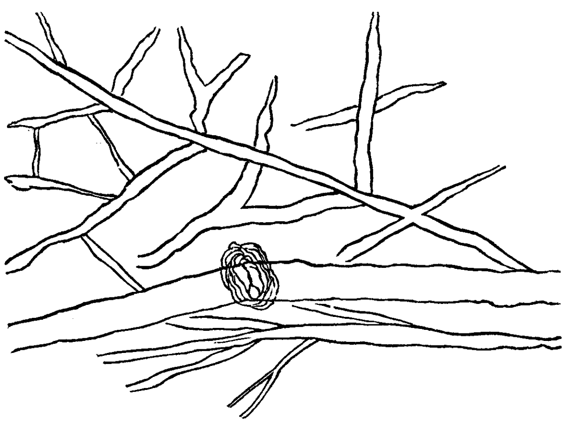
No less than 2000 cubic feet have been exported and sold at New York during the past summer.

It is well known that a thriving trade is carried on in Kennebunk from sales of granite, and that many hands are constantly employed in the work.

At the Port, near the Granite Company's wharf, may be seen a large trap-dyke, which cuts through mica-slate and runs N. E. by E.

On the road from the Port to Kennebunk village occur a great number of dykes, which cut through the strata of mica-slate in a N. E. by N., and S. W. by S. direction. One of them is 50 feet wide, and may be traced to a great distance through the fields on either hand.

Some very curious reticulated veins of blue quartz occur in the mica-slate on this road, and were probably formed at the time, when the neighboring dyke was thrown up. [See wood cut.]



Quartz Veins.

On the sea-shore at Kennebunk, we observed a great number of curious dykes which have been thrown up through the granite, and a peculiar kind of green and blue hardened slate. Some of them have evidently been dislocated or broken, since they were injected and hardened, and other dykes cut across them in such a manner as to shew two distinct eruptions. The general direction in which the main dykes run is E. N. E. and W. S. W., while the cross dykes run North and South. I shall presently be enabled to show three or four distinct epochs in the eruption of these igneous rocks.

It will be observed that the slate-rocks, where they are intersected by trap-dykes, are hardened into a kind of green flinty slate, while more remote from them, the slate is less hard, and has the appearance of novaculite, or hone-stone, presenting various stripes of blue, brown, and green colors, which run in the direction ofthe strata. It is here too hard for hones and oil-stones.

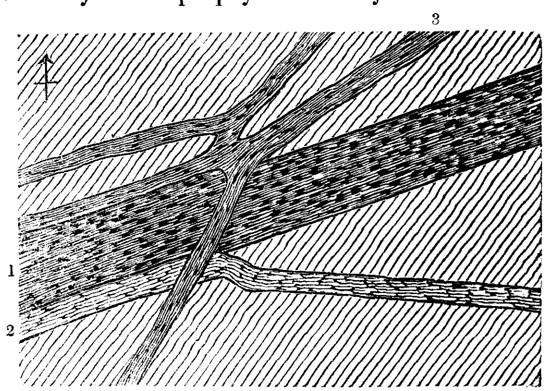
Several specimens of rose quartz were shown me which were obtained at Cape Porpoise.

Learning that Daniel Sewall, Esq., a gentleman of science and an accurate observer, was in the habit of keeping a register of his barometer and thermometer, for meteorological purposes, I took occasion to request his services in behalf of the State, when he most cheerfully complied with my request, and has since furnished me with a very neat and well arranged meteorological table, which is laid before you in the present report.

Leaving Kennebunk, we continued our route to Wells. The rocks which crop out here and there through the soil, are strata of indurated slate, cut by numerous trap-dykes, some of which are porphyritic with crystals of felspar. A little bog iron ore is found in Wells, and slate-rocks abounding in pyrites also occur. The soil is generally sandy, and was evidently derived from decomposed granite.

Half a mile West from Maxwell's hotel, we examined a hill of sienite, which extends N. E. and S. W. ½ mile, and ¼ mile in a N. W. and S. E. direction, and rises 70 feet above the sea-level. This sienite is composed of a deep bluish-green felspar, colored by the protoxide of iron, black crystals of hornblende, and a little quartz. It contains, in every place where we could examine it, so much iron-pyrites, as to cause its rapid decomposition, which destroys its value, as a building material. It is certainly worth while to explore it more extensively, but it cannot be done without considerable labor, since its surface is always decomposed, presenting a deep brown color, while its "sap," as the quarry-men call it, extends into the stone, to the depth of 8 or 10 inches from the surface. There is one place where a block may be split off for trial, to the extent of 81 feet in length, by 6 feet in thickness, and this may be done at little expense, and will show its quality, where it has not been affected by the weather. Should it prove to be of good quality, it can be advantageously quarried, since it is but ¾ mile from the seashore, and the slope of land is gradual.

On the road from Wells to York, we met with numerous trap-dykes of great dimensions, which generally traverse the slate-rocks in a N. E. by E. and S. W. by W. direction, and are mostly of the porphyritic variety.



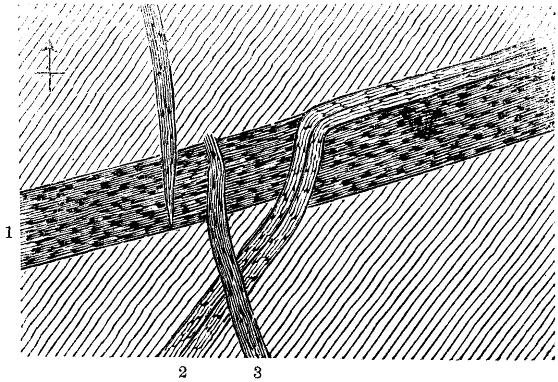
Trap-dykes of three eruptions.

YORK.

There are many singularly obscure rocks in this town, and every variety of metamorphosis which slate rocks can undergo, may be observed. Sienite veins and trap dykes, of various ages, occur in great numbers, cutting across the strata, and furnishing an index to their history. One of the sienite veins runs N. E. and S. W., and is seen intersecting the indurated slate. This vein is again cut off by a small trap dyke, running N. and S., which is a lateral dyke belonging to a larger one to the north, which is 3 feet wide, and runs N. E. by E. and S. W. by S., and dips 70° N. W. The slate is extremely hard, and non-fissile, and is striped with blue and brown colors.

The most remarkable phenomena may be seen at Bald Head, a singular promontory which runs out into the sea, presenting a huge overhanging mass of rocks, against which the ocean waves dash with tremendous fury. These rocks are composed of a most beautiful variety of striped novaculite, or hone-slate, the strata of which are cut through by an infinity of dykes. There are also a great number of veins of milk-white quartz, which traverse the strata. The hone-slate runs N. E. and S. W. and dips 80° N. W. It is a valuable material for fine hones and oil-stones, and remote from the intersecting dykes, it is soft enough for this purpose, while near them, it is so hard and flinty, that it will not answer, excepting for the hardest kind of whet-stones, used in sharpening lancets and other fine instruments.

Our excursion to Bald Head was exceedingly instructive, since we there discovered the relative ages of most of the trap-dykes, the directions of which we had before been accurately recording, knowing that if we put down exactly what we found in nature, some useful instruction would certainly result.—Here, then, to our surprise and gratification, we met with absolute proof of their different ages, a result which I had only hoped to have obtained after a long research. This locality solved at once, by absolute demonstration, this important problem; for here we saw the various dykes cutting across each other, in such a manner, as to prove their several different eruptions. It will be seen in the following diagrams, how three distinct intersections are presented.



Intersecting trap-dykes of three eruptions.

The first eruption was that of the porphyritic greenstone-trap, (1) which was thrown up in the form of large dykes, after the consolidation of the slate-rocks, and run N. 55° E.

The second series (2) cut the porphyritic dykes off in the above manner, and even dislocated them, and turned one portion of the older dyke out of place. They run N. E. and S. W., but are quite irregular.

The third cutting (3) is effected by another series of dykes of a brown scoriacious trap, which cuts off the second series; hence we have three distinct eruptions of these rocks, each taking place after the consolidation of the preceding series.

We have recorded, also, several other series of dykes, differing in direction from those, and hence we may now confidently affirm, that four or five distinct eruptions of molten trap-rocks have burst through the strata of Maine.

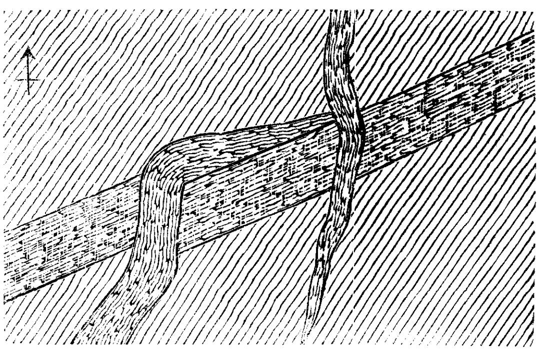
Persons unacquainted with the science of geology, will perhaps ask, what use it is to observe and record such observations as these, since the trap-rocks are seldom of any commercial value ? I reply, that all facts in nature are useful, to an extent we do not at first apprehend. These discoveries advance the science a step farther in its progress, and who will venture to calculate the importance of the results, which will follow ? Any fact which throws light on the history of the great rock formations of the earth, is of immense value, and may serve as the means of many very important discoveries of valuable minerals. Even the little information which the Cornish mines in England have given, respecting the intrusion of the dykes, serves there as a clew to the discovery of valuable veins of copper, tin and iron ores. Such will be the result in Maine, and to as much greater extent as the facts are well observed and recorded for future reference.

It will be remembered, that around the shores of Lubec bay, we generally found veins of lead, zinc and copper ores, directly beside the dykes ; and in Nova Scotia likewise, the most valuable beds of iron ore are found in the immediate vicinity of similar rocks, while at Cape Dor, in the same province, we find an abundance of rounded (evidently once molten) masses of copper, in the mixture of trap-rocks with the new red sandstone.

Let us, then, carefully record all facts which we discover, and look confidently forward for some useful result. Already we are enabled to account for the abundance of pyrites, or sulphuret of iron, in the slate-rocks of Maine, by the effects produced upon them during the protrusion of molten rocks from below.

One of the widest dykes at Bald Head, measured 55 feet in width, and they extend to a great distance in the directions N. 60° E. and S. 60° W. The smaller measure from 1 to 6, 8 and 10 feet in width.

2

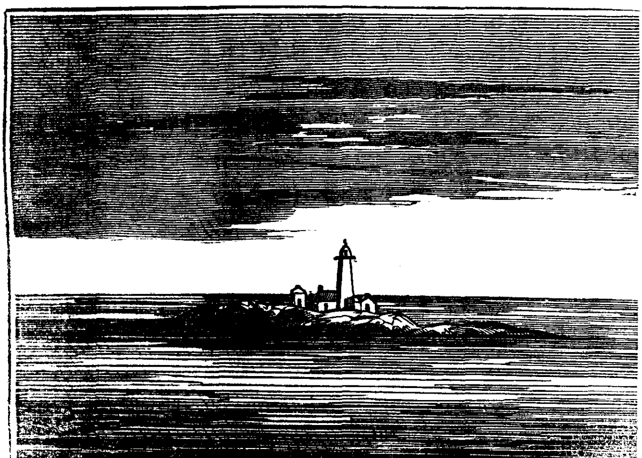


2

Trap-dykes of two eruptions, Bald Head, York.

After collecting a series of specimens, illustrative of the phenomena which we had observed, we set out for an excursion to the Agamenticus Mountains, in company with Col. Brooks and Mr. Emerson, who kindly tendered us their assistance. Agamenticus hills are three in number, and are distinguished by their numerals, 1, 2 and 3, the highest being No. 1. To this mountain we directed our course, after ascertaining the height of the barometer at the sea-level, one chief object being to determine the altitude of these mountains, which form conspicuous objects for the guidance of the navigator.

By inspecting our barometrical tables, it will be seen, that the sea-level barometer stood at 30.300 inches, temperature of the instrument being 62°. On the summit of the highest mountain, it stood at 29.567 inches, temperature 69°. Calculating from the elements, we have for the altitude of the mountain 672 feet above the sea-level. From its summit, we have a beautiful panoramic view of the sea, and of the surrounding country. Boon Island is seen to the S. 59° E. Cape Porpoise, N. 75° E. York meeting-house, S. 11° E.



View of Boon Island, seen through a telescope bearing S. E. by E. from Cape Neddock, distant 9 miles.

Agamenticus is composed entirely of sienite rocks, but since they have not been quarried, and it is extremely difficult to obtain a fair sample of the rock, without blasting, we were not able to form a correct estimate of its value, as a building material. It is also probable, that even were the stone found of excellent qualities, that it cannot be transported to the harbor, at a sufficiently low price to render quarrying profitable.

Leaving the first peak, we travelled to Agamenticus No. 2, where the barometer stood, at 4, P. M.=29.636 inches, temperature=62°. Height of the mountain is 525 feet.

Black oxide of manganese and bog iron ore, are found in small quantity at the mountain's base, and have been mistaken for indications of coal. It is hardly necessary to state, after giving an account of the geology of the country around, that it is utterly impossible for coal to occur there, since the whole mass of rocks are aggregates produced by fire.

KITTERY POINT.

This promontory forms the extreme Western boundary of Maine, and is directly opposite Fort Constitution upon New Castle Point in New Hampshire. The rocks are indurated varieties of argillaceous passing into micaceous slates, which run N. 70° E. and dip N. W. by W. 65° Several trap dykes cut through the strata, and nearly coincide with their direction. The only simple minerals found there are quartz and iron pyrites, which occur in veins or in scattered crystals. The slate is a solid material for rude architecture, and is suitable for wharves, breakwaters, stone walls, and perhaps for flagging-stones, but since it has never been quarried, I do not know whether it will split true enough for the latter purpose.

After examining this point we crossed over to Portsmouth, and the next day set out for our section along the western boundary of the state.

Travelling up beside the river to Berwick, along the State line to Newfield, we noted on our map the various rocks which were traversed. I had previously made several excursions to the White Mountains, and knowing the character of the rocks above Newfield, did not think it needful for our immediate purpose to proceed further up the New Hampshire boundary. I then took a line of observations from Newfield, eastward to Augusta.

At South Berwick occurs a bed of the upper tertiary clay, like that at Bangor, and contains similar fossils. This deposit is elevated 40 or 50 feet above the level of the river in Berwick, or about 100 feet above the level of the sea.

North from Berwick the soil becomes more sandy, and evidently resulted from the decomposition of granite rocks, since it is full of spangles of mica, and the other ingredients of granite.

On Salmon river, at the falls near the factory, may be seen slate-rocks, like those noticed at Kittery Point. The strata are contorted, but run generally N. E. by N. and S. W. by S. and dip E. S. E. 70° a 80°.

Salmon Falls are produced by the ledges of this rock, and the river rushes down over their out-cropping edges, with great force, and whirls its foaming waters over their rough and craggy surface. The first pitch of water is 14 feet, the second is 20 feet fall.

A new and elegant factory has just been erected on the N. Hampshire side, upon the ruins of one which formerly stood on the spot, and was destroyed by fire three years ago.

We were informed, that bog iron ore is found about a mile West from the factory, but we thought it would be unnecessary for us to explore it, since it is beyond the limits of Maine, and would not, if wrought, be carried through her territory.

Proceeding onward, we found mica slate, of good quality, for flagging-stone, on the road to Lebanon. Boulders of granite occur abundantly in the soil. Lebanon is an elevated table land, or extensive plain, attaining an altitude of 515 feet above the sea-level, and composed of a poor sandy soil devoid of any clay substratum. Here and there occurs a hard pan of gravel cemented by means of bog iron ore, which serves in some measure to compensate for the absence of clay, retaining the water and nutritive matters within reach of the plants.—This whole district is almost entirely devoid of forest trees, and the soil is very sterile. Indian corn here and there grows, but it is generally short and feeble. There are but very few spots in this district where any compensation is made by the soil, for the labor bestowed upon it, and the people, generally, have great difficulty in supporting themselves by farming. Wood is also scarce and dear, which shows improvidence in the first settlers, who destroyed the native forest trees, the only produce which can advantageously grow on such soil.

From the elevated lands of Lebanon, it is said that the sea may be discovered on a clear morning; but we were not so fortunate as to have a good view, on account of the fog which lay in the horizon, and appeared like a boundless ocean, while in the interior, the hills on Salmon river, the plain of Rochester, and the Bonny-big hills of Sanford appeared like islands seen in its midst.

The only rocks in place, at Lebanon, are alum and mica slate, the former being the result of decomposition of pyrites. The mica slate runs N. and S. and dips 60° W. This rock is a handsome material for side-walks, and sheets of proper dimension, will sell in Boston for 33 cents per superficial foot. The cost of transportation to Portsmouth is estimated at $4 per ton, the distance being 30 miles.

On the road to Acton, we observed granite rocks, of a coarse variety in place, farther on we came to mica slate charged with pyrites, and cut through by a dyke 15 inches wide, running N. E. and S. W. Near Shapleigh, we came to good mica slate, suitable for flagging-stones. The strata of this rock are cut by several coarse granite veins.

ACTON.

The soil in this vicinity appears to have been derived from the decomposition of granite-rocks. It produces about 15 bushels of rye to the acre, and about 25 bushels of indian corn.

On reaching Newfield, I called upon Dr. L. J. Ham, who kindly volunteered his assistance during our stay in that place. With him we visited the iron foundry at Shapleigh, on the corner of Newfield, and examined the extent of the ore which is found in that vicinity. The bog iron ore is found upon the little Ossipee river, in Newfield, and is of a very good quality, yielding from 40 to 45 per cent. of excellent cast iron. It occurs at the head of a pond South West from the furnace, in a peat swamp. Of this low land, about 15 acres belong to the iron company, and the ore has been traced about 100 yards back from the South bank of the river. Its longitudinal dimensions have not yet been ascertained, but it appears to be a very extensive deposit. The order of layers I found to be as follows.

A thin layer of peat occurs on the surface, below which there are of

Shot ore, 8 inches;
Pan " 14 "

The bottom is white siliceous sand.

Three men can dig 7 or 8 tons of the ore per diem, and deliver it at the works.

The furnace was erected last year, under the direction of Mr. Thomas Bates, of Bridgwater, Mass. It is of small size, and cost but $11,000. It was put in blast on the 9th of August, 1837, and has furnished about 1½ tons of iron per diem. The works appear to be profitable to those concerned, and will be prosecuted vigorously. Formerly, sea-shells were carried from the coast, to supply the furnace with lime for a flux, but since that time, limestone sufficiently good for the purpose has been discovered in abundance, in the immediate vicinity, and will save the expense of transporting shells. The furnace is 36 miles from Portland, 24 miles from Wells, and 25 from Kennebunk. The iron will be sent to Boston by the way of Wells or Kennebunk.

I shall give the statistics of this foundry in a subsequent chapter, and therefore dismiss the subject for the present with this remark, that it is highly probable, that many immense and valuable beds of bog iron ore lie concealed in the low lands and swamps of Maine, and that it will be of great importance to the State, to have them discovered and wrought. I beg leave, therefore, to call the attention of those interested in this busisiness, to the lands into which flow ferruginous waters from the pyritiferous slate-rocks, so abundant in the State, since bog iron ore is constantly and rapidly forming in such places, and many deposits may be found sufficiently extensive to warrant the erection of blast furnaces.

The manner in which these deposits form, may be seen at a glance, in looking upon the rusty sediment which is deposited by springs, which run out from the hill-side, and deposit iron ore in the meadows below. On looking at the ferruginous springs of Bluehill, or at Castine, it may be seen how rapid this deposition takes place.

It is evident, from the number of specimens brought to Augusta by members of the Legislature, that this ore is widely spread in the soil of Maine, while in many places it occurs in so large beds, as to prove valuable to the country. In exploring the extent of a bed of bog iron, you have to ascertain its length, width and depth, by which you may calculate its cubic measure. If two lines are run crossing at right angles, through the midst of the deposit, and the depth of ore is sounded by digging, and by the iron bar, there will be no difficulty in making a fair estimate.

Any locality which can keep a furnace supplied with from two to three tons of the ore per diem, may be deemed ample for the purpose, and allowing that other things are favorable, Iron may be made profitable. In general, charcoal should not cost more than 6 cents per bushel, at the furnace, and frequently it can be furnished for half that price. It is also important that water power should be at hand, to blow the furnace bellows—sometimes however, steam power may be used instead.

After examining the Newfield Iron Works, and obtaining all the statistical information in our power, we visited Thyng's mountain, on the summit of which occurs a large trap dyke, which has been mistaken for a vein of iron ore. This mountain is not less than 1700 feet above the sea-level, and is composed of sienite rocks. The dyke which cuts through the mountain, runs N. E. by E. and S. W. by S., and is 30 feet wide. It runs across another hill and continues its course towards the iron furnace, where it again makes it appearance. From the summit of this mountain we have a magnificent view of the Alpine country around—Ossipee, Davis, Bonds, and several other high mountains are seen nearly on a level with this peak.

Davis' mountain is composed of granite rocks, and on its sides occurs the gneiss which alternates with numerous narrow beds of granular carbonate of lime. This limestone by disintegration serves to enrich the neighboring soil, and if burned, would form a most valuable manure. Arsenical pyrites abounds in the granite, occurring in narrow veins.

Bond's mountain is also composed of granite, and there are found numerous veins of arsenical iron which has been frequently mistaken for silver ore. It is a mineral of some value, as it is a rich ore of arsenic, and may be used in the process for manufacturing shot. Columnar greenstone-trap occurs also on this mountain. Hydrate of silicia, a white mineral, frequently mistaken for, and sold as magnesia, is found abundantly in the low grounds of Newfield, and may be used for the manufacture of fire brick.

Fuller's earth occurs on Davis' farm in the South West part of Newfield, 2 miles from the S. W. corner of the town. This mineral was formerly dug for the supply required by factories and fuller's mills, but it is now abandoned, owing to a decline in the demand, new processes in the art having taken the place of this earth. It was formerly sold for $30 per ton, and was discovered twenty years ago, while digging for an imaginary silver mine.

Limestone suitable for agriculture abounds on this estate. It alternates with strata of gneiss, which run N. E. and S. W. and dip 30° S. E.

Near Limerick at Fogg's Mills the lime-stone is again observed and the dip is changed to the S. W. 20°. Several large trap-dykes here occur, five of which were measured, the widest of which is 30 feet broad, and the direction of the whole series is N. 55° E.

In Limerick we examined the peat bogs on the estate of Mr Ebenezer Adams, where a very remarkable substance is found resembling exactly the Cannel coal. It is found at the depth of 3 feet from the surface of the peat bog, amid the remains of rotten logs and beaver sticks, showing that it belongs to the recent epoch. The peat is 20 feet deep, and rests upon white silicious sand. This recent coal was found while digging a ditch to drain a portion of the bog, for the sake of obtaining peat as a manure ; about a peck of it was saved, and served to supply us with specimens. On examination, I found that it was formed from the bark of some tree allied to the American fir, the structure of which may be readily discovered by polishing sections of the coal, so that they may be examined by the microscope.

It contains in 100 grains.

Bitumen	72
Carbon	21
Ox. Iron	4
Silica	1
Ox. Manganese	2
	100

This substance is a true bituminous coal, containing more bitumen than is found in any other coal known. I suppose it to have been formed by the chemical changes supervening upon fir-balsam, during its long immersion in the humid peat.

The discovery of the recent formation of bituminous coal cuts the gordian knot which geologists and chemists are endeavoring to unravel, and shows that the process is still going on. The difference between bitumen and resin is not very great, and the absorption of a small quantity of oxigen is all that is required to effect the change. Other localities of this curious substance, may be found by searching the numerous peat bogs in other parts of the State. The fact is of immense importance in explaining the origin of coal, and the results of any advancement in our knowledge of this science cannot fail to have a most useful tendency. Peat is very valuable, but is too generally neglected. It may be made to serve as a substitute for wood or coal, and when properly prepared and burned it is a pleasant fuel. It burns well in an ordinary coal grate, and when the chimney has a good draught, does not give any unpleasant odour to the apartments. It may also be used, when it is abundant, for the burning of limestone intended for agricultural use, and its ashes, mixed with the lime, are valuable as a manure. Since the pressure of the charge might interrupt the burning of peat, some layers of wood ought to be interposed in preparing the kiln. Temporary kilns may be constructed of large size, of any rough stones at hand, and lime may be burnt well enough for agricultural purposes in three days. Throughout York and Oxford counties, there occur abundant beds of limestone, and peat also abounds.

Luxuriant artificial meadows are made, by carting sand and clay upon peat bogs, so as to cover the surface, and then by treating the soil with a few casks of lime to the acre, an evergreen meadow is formed.

Beneath the peat of Limerick occur valuable beds of hydrate of silica, a substance which has been there mistaken and sold for magnesia. It may be used for fire brick, and for a dressing to soils. It is full of vegetable juices, and possesses fertilizing properties to a degree not fully apprehended by farmers. It has the property of attracting and giving off the moisture of the atmosphere, and by this means, also, serves to vivify the vegetation growing upon it.

Bog iron ore occurs on the road from Limerick to Parsonsfield, on the estate of Mr. John Moore, and it is also found half a mile west from the Seminary, but to what extent, I am unable, at present, to decide.

In Parsonsfield we found an abundance of a rare variety of egeran, and beautiful crystals of yellow garnet, pargasite, adularia and scapolite. They occur in a granular variety of limestone, which is scattered in profusion, in the fields near Dr. Swett's house.

In a stone wall, north from Stackpole's Tavern, we obtained some beautiful specimens of these minerals which are found in angular boulders of granular limestone. Proceeding North 15° West, the number and size of the boulders is said to increase; and when I pointed in that direction, Mr. Swett remarked that he had found them along that line. Hence, it is probable that the parent bed of limestone lies in that direction.

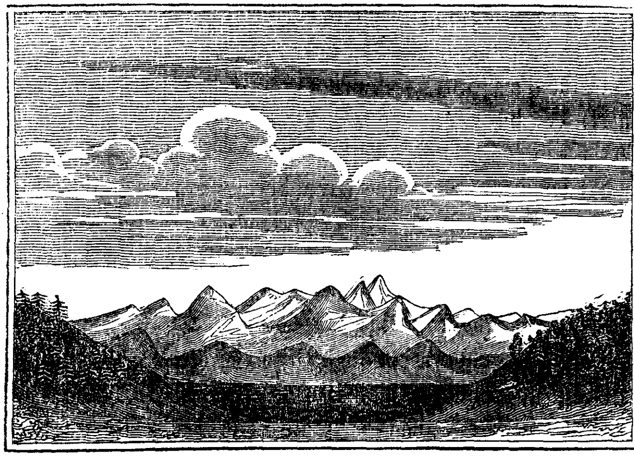
At Blazo's Corner, occurs a trap dyke 5½ feet wide, running in a N. W. by W. and S. E. by E. direction.

At Kezar's falls, near Gibbs' tavern, a vein of lead and zinc ore has been found. Pits have been sunk to the depth of 30 feet for the purpose of obtaining lead. The vein is included with quartz, in granite rocks. It runs N. 8 or 10 ° E. and is said to show itself near Denmark, 2 miles East from the corner of that town. This locality was originally discovered six years ago, and was wrought by Gen. Ripley and others. It was found unprofitable, and is now abandoned. The hardness of its matrix is one of the greatest obstacles to overcome in working it for lead, and the ore not being more than two inches wide, renders it extremely improbable that it will ever be wrought advantageously. It is not improbable that other and wider veins will be discovered. The minerals associated with the lead ore are sulphuret of zinc and pyrites. These minerals are of no value except in very large quantities.

Magnetic iron ore has been found in small quantity near Porter on Partridge's Mt. in Brownfield. Specimens were presented me but I had not time to visit the locality.

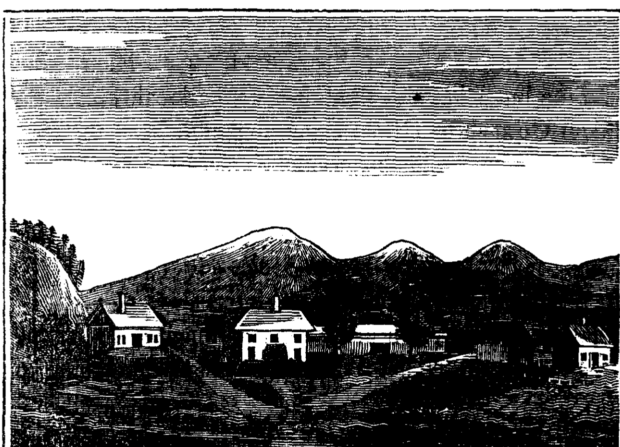
From Cornish to Hiram along the course of the Saco, we have very picturesque scenery, not unlike the mountainous districts along the Connecticut river. Abrupt crags of granite and gneiss rocks, in some places, almost overhang the road; high diluvial embankments are also seen, and the river meanders most beautifully amid the hills and intervales.

The following sketch presents an outline of the Alpine scenery viewed in the N. N. W. on the road from Hiram to Denmark.



View of the Mountains to the N. N. W. from the road between Hiram and Denmark.

In Denmark, there is a remarkable eminence, which shows itself in the rear of the village, called Pleasant Mt. Its highest point bears N. 37° W. from Mr. Ingalls' house, from which it is about 3 miles distant.



View of Pleasant Mountain in Denmark, bearing N. 37° W. 3 miles distant.

The route from Parsonsfield to Denmark, and from thence to Waterford, is very picturesque, and of an Alpine character, presenting groups of mountains rising abruptly, one behind the other, in the distance, while small, but beautiful lakes are seen here and there amid an amphitheatre of hills. An artist would find ample scope for his pencil in sketching this interesting panorama.

At Waterford, we called upon Mr. William Coolidge who shewed us great hospitality and guided me to a number of localities worthy of examination.

On Maj. Stone's farm, Mr E. L. Hamlin discovered many years ago a curious rock, composed of phosphate of lime and quartz. Also a fine crystal of richly colored amethyst. It was not attached to rock, and probably was out of place, since no more have since been discovered there. Mr Coolidge presented me with a mass of lepidulite like that of Paris which he found upon his farm.

Hawk Mountain is composed of granite, and presents a lofty mural escarpment, shewing the appearance of a slide from the cliff. This precipice is cut across by a huge but inaccessible dyke, that may be seen from the road below.

I obtained specimens of all the most remarkable soils on my route, and examined particularly those obtained in Waterford, where the farms are in thriving condition, and were clothed with heavy crops of wheat and other grain.

Norway is a pleasant village situated on a plain or intervale, and is remarkable for the neatness of its farms. The soil contains a little lime, which is evidently derived from the limestones which skirt the hill-sides around, alternating in strata with gneiss, and may be advantageously burned for lime, or for manure, since the soils will be improved by a more copious dressing.

In Paris I found the same kind of limestone exceedingly abundant and reposing upon the sides of the hills. It would be tedious to enumerate all the localities, since it is found in almost every part of the town.

We met, by appointment, Mr. E. L. Hamlin, who had kindly offered his services in showing us some of the most remarkable localities, discovered by him during his residence in Paris. By his aid we were enabled to make a more rapid examination of the beautiful simple minerals that abound upon Mount Mica, and have for many years been sought for by collectors and mineralogists.

These minerals are large plates or crystals of mica from 6 to 10 inches square, beryl of various shades of green, limpid and smoky quartz, black, green, blue and red tourmaline, rose quartz, felspar, garnets, &c. Specimens of all the minerals found at this place, were collected, and are now deposited in the State Cabinet.

We remained three days at Paris, collecting these rich and rare minerals, which operations having been placed under the superintendence of the Assistant Geologist, I was left at liberty to make further researches in the vicinity. Accompanied by Mr. Hamlin and a number of enterprising gentlemen of Paris, we made an excursion to Streaked mountain, for the purpose of examining its geology, and in order to measure the altitude of the mountain, by means of the barometer. On the 26th Aug. at Paris hill, on a level with the court-honse, the barometer stood 1 P. M. 29.418 T=69°. Ascending to the base of the mountain, we found, at Mr. Alonzo King's, $2\frac{1}{2}$ P. M., that the barometer stood at 29.150 T=69° On the summit of the mountain it stood 3 P. M. at 28.378 T=63°. Calculating the height of our second station from our first, we have 82.1 feet for its altitude above the first station. Then calculating from that point to the summit of Streaked mountain, we have 843.2 feet, which, added together, make 925.3 feet for the height of the mountain above Paris Hill. If now we calculate directly from the first station to the top of the mountain, we shall obtain 925.4 feet for its height, which differs from our former results but $\frac{1}{10}$ of a foot. By these operations we are enabled to prove the correctness of the measurements. Calculated from Portland harbor, and we find that Streaked mountain is 1756 feet above high-water mark, and Paris hill is 831 feet above the sea level. After making these measurements, I took the bearings of several points which may be seen from the mountain.

Pleasant Mountain in Denmark, North Peak bears S. 65° W. Southern Peak, S. 60°W. Central Peak, S. 64° W.

Kearsarge Mountain presents a sharp, well defined peak, which bears S. 82° W.

Speckled Mountain, a rough and barren mass of granite, near Peru, bears N. 60° W.

Paris church, N. 68° E.
Centre of Norway village, S. 77° W.
Hebron Peak, S. 30° E.
Singepole Hill, S. 54° W.

Norway Pond is 2°15 below the horizontal line from this mountain.

Streaked mountain is an important landmark for the country around, owing to its commanding situation. From its summit a most interesting panoramic view may be seen of the towns, lakes, and mountains around, and it has justly become a place of resort on account of its picturesque scenery. The mountain is composed of a coarse variety of granite, which has burst through the surrounding gneiss rocks that recline upon its sides, and form a large proportion of its mass. The granite appears in huge veins, which generally run E. N. E. and W. S. W. The gneiss alternates with granular limestone, suitable for agricultural purposes. The granite veins are rich in large and beautiful crystals of beryl, black tourmaline, and large plates of mica; common garnets also abound. Quartz crystals line cavities in the rock, but they are generally too small to be of interest to the mineralogist.

It will be observed by the geologist who may visit this mountain, that the strata of gneiss have evidently been forced up by a sudden and violent eruption of the granite; for not only are strata turned up and contorted, but fragments of gneiss have been torn off by the intruding rock, and are seen imbedded in its mass. The strata also recline upon the granite, through which passes the anticlinical axis of the strata. It is difficult where the rocks are so distorted to take the exact line of bearing, but we here estimate the direction of the gneiss to be S. 35° E. and N.35° W. When we had made our collections of specimens of the rocks and minerals we descended and returned to Paris, where we had left our assistantsat work, collecting the minerals of Mount Mica.

We visited the town of Greenwood, and near that town upon the estate of Dea. Porter, I obtained some specimens of bog iron ore. It does not occur there in sufficient quantity to supply a furnace.

There is a remarkable vein of plumbago, or graphite, near this place, included in a vein of granite, which intersects the gneiss, and runs E. N. E. and W. S. W. The plumbago is of fine quality, and suitable for drawing pencils, but it occurs in a very hard rock, and in comparatively small quantity. We obtained some specimens 3 inches long, by 2 inches thick, but they are difficult to procure. This mineral occurs in several other places around, and there may be some localities worth working, the mineral being of good quality.

It is a curious geological fact, that plumbago, generally believed to be of vegetable origin, should occur in such a situation as I have described. It may, however, have been derived from the stratified rocks of sedementary deposit, which may have been converted into gneiss. This question is not yet, however, fairly settled, and is open for discussion and more extended research.

The locality above referred to, is in the town of Greenwood. near its South Eastern corner, and occcurs on the hill almost overhanging the road.

Mica slate here rests upon gneiss, and is too much contorted for use as flagging-stones. It runs generally N. E. and S. W. and dips to the N. W. irregularly.

One mile South from Mr. Abiathar Tuell's house, we examined a locality, where black oxide of manganese is found in beds, just below the surface of the soil. It is about 16 inches deep, and is found in small heaps, separated from each other, and resting upon a fine white siliceous earth. The manganese is of good quality, and occurs in nodules, varying in size, from that of a pea, to an inch or more in diameter. These nodules are cemented together in solid masses, but are easily separated by pressure with the hand. It is evidently an alluvial deposit, and arises from the decomposition of the manganesian mica-slate forming the hills around. Black oxide of manganese is used for various chemical purposes, and supplies us with chlorine for the manufacture of bleaching powder, or chloride of lime. It is also used for the preparation of oxigen gas, and for the destruction of vegetable matters in melted glass.

It is also employed in giving a rich amethystine color to paste ornaments in imitations of that gem, and for staining glass of the same purple hue ; and in pottery it is used both as a coloring matter and enamel. It is probable that larger quantities may be found, for we obtained nearly a peck measure of it in a few minutes. It is occasionally used for paint, and resembles burnt umber in color.

On the road to Washburn's Mills, limestone is found on the road side, in beds alternating with gneiss. A mineral spring occurs in Paris, which is resorted to by invalids on account of its tonic properties. It contains a little carbonate of Iron, and carbonate of manganese, the latter substance being deposited in the state of a fine red sediment. The water evidently extracts its mineral ingredients from the rocks through which it percolates.

Having obtained a full supply of the interesting minerals of this vicinity, we set out for Buckfield. In this town occur numerous veins and beds of granite. We examined those upon the estates of Mr. Waterman and Mr. Lowe. On the former estate, there are numerous narrow veins varying in width from one to six inches, and a vast number of detached angular blocks of granite occur penetrated by them. Large crystals of dark reddish brown garnet are also abundantly scattered through the granite, but it is yet uncertain whether any workable veins of iron ore occur on this farm, although we are of opinion that a considerable supply may be furnished from this locality, should iron works be put up in that vicinity.

On the Lowe farm, we examined an important bed of this ore, which was formerly opened, and being mistaken for a vein, was cut through and was supposed to have run out. This however, is not the case—but it is evident from our examinations, that it is a bed or sheet, dipping to the North East 25°. I measured its extent, and found that where it is visible, it extends to the width of forty-eight feet by thirty-six feet in length. Its average thickness is one foot, but in some places it measures nineteen inches. Allowing the bed to be but one foot thick, we have already exposed $48 \times 36 =$

1728 cubic feet of ore, which will weigh almost 200 lbs to the cubic foot, and yielding 60 per cent of iron, will give 207,360 pounds of Iron within the limits measured. Since it may be easily wrought in a bloomery furnace, costing but a small amount, it is worthy of being manufactured. On opening this mine more extensively, should it be found to continue for a considerable distance, a blast furnace of a more extensive and costly kind might be erected. I would also remark that this ore is accompanied by an immense number of large garnets of a brown color exactly like those in the Sweden iron mines, which melted, with the ore, serve to render it more fusible. It may be easily mined, since it is naturally divided into irregular rhomboidal blocks, that can be turned up by the crow bar and pick. Charcoal, it is estimated, will cost $6 per 100 bushels, on the spot. Limestone suitable for a flux occurs abundantly in the vicinity. Should this mine be wrought, it will be advantageous, in case the blast furnace is employed, to add bog ore to the charge, since the ore is extremely heavy, and is liable to overload the furnace.

The little stream producing the cascade called basin falls, two miles west from the village, is a favorite place of resort for the inhabitants, on account of its picturesque beauty, and the grateful coolness of the air, under the shade of overhanging rocks and forest trees. This stream rushes over rough and craggy masses of gneiss and granite, and falls into a little clear basin of water, in a hollow of the rocks, and from this circumstance, the cascade receives its name. The gneiss is charged with pyrites, and by the action of the spray from the falls, its surface is kept moist, and a rapid decomposition takes place. The sulphur of the pyrites oxidizes, and becomes converted into sulphuric acid, and this acid attacks the felspar of the gneiss, appropriates to itself its alumina and potash, forming sulphate of alumina and potash or common alum. This substance encrusts the rocks in considerable quantities, above the falls, where they overlay the cascade. Sulphate of molybdena also occur in the gneiss in small scales. During our stay at Buckfield, we were kindly assisted in our labors by Mr. Parris of that town, who devoted his time to our labors, and engaged actively in the work. I beg leave here to tender him our thanks.

Leaving Buckfield, we travelled toward Turner, examining the rocks, minerals, soils, and the elevation of the country as we proceeded. Near the Androscggin river, one mile South from the bridge, occurs an extensive bed of excellent potters clay, extremely fine and tenacious. It belongs to the fresh water tertiary deposit, is regularly stratified, and dipping gently to the N. N. E. It breaks naturally, as it dries into prismatic masses of a rhomboidal form. This clay is valuable for the manufacture of brown pottery, and its extent is such as to furnish a never failing supply.

On the road to Readfield, we examined near the corner of Winthrop, the direction of the gneiss, which runs N. E. and S. W. and dip N. W. 45°. Diluvial grooves may there be seen on the surface of the rocks in place, running nearly North and South across the edges of the strata, forming with them an angle of 70°.

Limestone occurs upon the estate of Mr. Isaac Bolls in Winthrop, and is similar to that found in Norway, and may be made useful in agriculture, as a top dressing. The strata alternate with gneiss, and run N. E, and S. W. and dip 80° N. W.

Proceeding through Winthrop, I had occasion to examine the mica slate-rocks, which run N. 47° E. and dipping N. W. 85°. Their surface is marked by obscure diluvial furrows, which run N. 5° E.

One mile North from the town, near the pond, good mica-slate is found suitable for flagging stones. It contains a few crystals of brown staurotide, scattered through its mass. On the road side, there are several slabs of this rock, which have been split out quite true, so that they will answer for side-walks.

On arriving at Augusta, we deposited our load of specimens, and visited the granite quarries of Hallowell. Limestone of good quality for agriculture has been lately discovered in this town, on the estate of Mr. Levi Morgan, and on the road side. It runs across the country in a N. E. and S. W. direction, and is contained in strata of gniess. It may be advantageously burned for agricultural use.

HALLOWELL GRANITE QUARRIES.

Numerous quarries of granite-gneiss are wrought in this town, and large shipments of it are annually made to New York and other cities.

It is composed of white felspar, silvery-grey mica and a little quartz—the felspar being the predominating ingredient. Its color is greyish white, and when smooth-hammered, it appears at a distance like white marble. The mica is generally arranged in such a manner as to cause the stone to split easily into the forms desired, and it is very easily wrought by the quarrymen and sculptors.

Having made but a cursory examination of this stone, on a former occasion, I was desirous of making more extended enquiries, and was conducted to the quarries now wrought, by Mr. Otis of Hallowell, and Col. Redington of Augusta. The former gentleman is the director of the Hallowell Granite Company, and the latter owns extensive quarries which were in active operation when we visited them. Col. Redington's quarry occupies an area of about 6 acres, and the opening at present, is 154 feet square and presents an admirable view of the stone, which may be seen in regular sheets from 2 to 7 feet in thickness. Blocks of granite have been split off from the ledge, which contain 1200 cubic feet, and weighing more than 100 tons—and masses can be obtained of much larger dimensions. I measured one which can be detached or entire, that was 130 feet long by 4½ feet thick. The largest blocks that have been obtained for columns weighed from 16 to 18 tons, and were dressed and sent to New York.

A large contract has been made with Col. Redington for the supply of fine hammered stone, used in building the Hall of Justice in the city of New York, and some of the work executed on this granite is equal in beauty to any sculpture on marble. The architraves that were finishing at the quarry, are magnificent specimens of granite sculptured ornamental work in the Egyptian style. These stones are a little more than 15 feet long, 3 feet 11 inches wide, and 3 feet thick. On the front, are sculptured in relief, the symbols of the winged globe and serpents. This operation requires immense labor, since the face of the stone is cut away in order to present the figures in relief. The work is effected by Hallowell stone-cutters, men who have become adepts in the art. Each of the architraves cost no less than $317—$150 being expended in the sculpture. The window-caps of the same stone cost about $200 each when finished.

Ordinary ashler stones are furnished finely dressed for 25 or 28 cents, at Hallowell, and from 33 to 35 cents per superficial foot, in New York. The large blocks for columns sell for 90 cents per cubic foot on the wharf at Hallowell.

The expense of transporting the stone from the quarry, to the wharf, is 50 cents per ton, of 14 cubic feet, and shipment to New York costs $3 per ton.

This stone is certainly a very beautiful material for architecture, and admits of more ornamental work than the coarser kinds of granite and sienite, and the effects of light and shade are also seen to greater advantage. It is, however, more likely to become soiled when used in large cities for door-posts and basements.

The remarks which I have made respecting this locality, apply also to the quarries wrought by the Hallowell granite company, excepting that the dimensions of the stone obtained at their openings have not been so large.

It is, however, admirably wrought for ashler stones ; the opening, which is 500 by 400 feet in diameter, having been made in such a manner as to allow a great many different layers of the rock to be wrought at the same time, so that an immediate selection may be made of various dimensions required. There are no less than 26 different sheets of granite thus exposed, and the embankments, or steps of stone, are left in such a manner, that the quarry presents a perfect model of an ancient Roman amphitheatre. Indeed, so nearly does it resemble the ruins of one of those buildings at Verona, that a person standing in its arena would almost imagine himself amid the works of the ancient Romans.

The different sheets of stone measure from 8 inches to 4 feet in thickness, and the perpendicular depth of the quarry is about 20 feet. It is now ten years since quarrying was commenced here, and no less than $500,000 worth of granite has been sold. The capital stock of the company is $50,000, and is owned in Maine. No less than $13,400 clear profit was made at this quarry during the year 1836.

The land belonging to this company, at this place, is 175 acres, and about 20 acres of its area is composed of workable granite.

This statistical information was obtained from Mr. Otis, and is entitled to our fullest confidence. The immense value of these localities may be at once perceived on calculating the proceeds from the sales effected—the vast amount of labor employed, and the value of the carrying trade. It would require an essay upon political economy to trace the various beneficial results which flow from this species of industry, and it could be easily proved, that each and every citizen of the State possesses either a direct or an indirect interest in the wealth thus produced.

I examined also many other quarries in this vicinity, but since few of them are now wrought, it will be unnecessary for me to describe them here. Some of the stone contains a little iron pyrites, and since it shows a brown stain on its white surface, it should most sedulously be avoided. Indeed, every stone put into the front of an elegant building, ought to be most carefully inspected, in order to detect this troublesome mineral, and if it is found, the stone should be put aside, and used for some other part of the building, where it will not be seen. By such care, we shall avoid those discolored appearances, which mar the beauty of our public edifices.

It may be observed, that the surface of the granite, at the last mentioned quarry, presents, where it has been uncovered of its soil, a polished water-worn surface, and on examination, distinct diluvial scratches may be observed upon it, running uniformly N. 10° W. It is interesting to observe these markings upon the surface of such a hard kind of rock, and to find that their direction coincides nearly with those formerly described. It will also be noticed by the geologist, that boulders and masses of mica-slate containing staurotide crystals occur abundantly in the soil, while that rock is not found there in place but does occur to the North West, in the town of Readfield. The diluvial soil resting upon the granite, at the quarry, varies in depth from 3 to 10 feet, and is made up of granite and mica-slate boulders.

It will be noticed, also, that the granite at the Hallowell quarries shows many long fissures or cracks, and these cracks have an uniform direction from N. 70° E. to S. 70° W. They were probably effected by an earthquake, and elevation, which broke the rocks asunder in the line of its direction. At what time this took place, we are unable to ascertain, but it was evidently since the consolidation of the rock. It is not improbable that lines of fracture throughout the granite, and other rocks in the State, may be found to coincide with the above mentioned direction, and we may yet be enabled to fix the epoch when it took place, by learning what rocks were broken by it, since we can demonstrate their relative age.

In Gardiner, there is a deposit of tertiary clay, filled with remains of marine shells. This deposit occurs near the house of Mr. Allen, forming a steep cliff, elevated 50 feet above the level of the river. Mrs. Allen has made a collection of the various fossils which occur buried there.

During the last spring, while giving a short course of lectures in this town, I had occasion to examine this locality, and obtained a great number of perfect shells, such as the sanguinolaria, mya, venus, mactra, saxicava, astarte castanea, balani and nucula. All these shells are of marine origin, and were evidently the inhabitants of the clay when it was covered with the waters of the sea. The whole mass is now 60 or 70 feet above its level, and has doubtless been elevated by subterranean power to its present situation.

This deposit belongs to two distinct epochs, called the pliocene and the newer pliocene.

It is remarkable, that the substance of the shells decomposes more rapidly than the animal matter, forming their epidermis, or outer skin; hence we find this matter remaining with a most perfect impression of the shell, while the calcareous substance has disappeared or is reduced to fine powder. The clay itself has the odor of marsh mud, and traces of the decomposed sea-weeds are easily detected, while the clay is black from the quantity of decomposed marine vegetable matter which it contains.

This tertiary deposit is identical with that of Bangor, and with that in Portland and Westbrook, which I shall presently notice. It probably extends along the banks of the river, from Augusta to Gardiner, and from thence to the mouth of the river, with interruptions here and there. It never attains an elevation of more than 100 feet above the sea-level.

The rocks in this place are principally gneiss, charged with so large a proportion of sulphuret of iron, as to decompose with great rapidity. On Iron Mine Hill, the strata run N. E. and S. W. and dip N. W. 70 or 80°. The rocks there may be seen crumbling into powder with great rapidity, so that the surface of the earth is covered with their detritus. The soil is in consequence, generally barren around, since sulphate of iron is destructive to vegetation.

By treating this soil with lime, it may be improved so as to become extremely fertile, for not only will the sulphate of iron be decomposed and rendered inert, but the lime combining with its sulphuric acid, will form an abundance of gypsum or plaster of Paris, a valuable manure.

On the right hand side of the road, going to Portland, in the town of Richmond, we again observed diluvial marks running in a N. and S. direction.

In Bowdoinham, granite rocks abound, and they include an abundance of rich and beautiful crystals of beryl and garnet.—The fine transparent sea-green crystals are found in a vein of greasy quartz, but it is now difficult to obtain good specimens, since they have been mostly extracted by mineralogists and collectors. Being disappointed on a former visit to this place in 1827, I thought that when the rocks had decomposed, we might find the beryls in the soil, and by digging into the earth, Mr. Alger and myself, aided by a laborer, succeeded in obtaining in a few hours no less than two bushels of crystals. I have not yet had time to make any further explorations, but doubt not that there still are an abundance of beautiful specimens in this town:

Very large crystals of beryl have recently been found in the town of Albany, between Bethel and Waterford. I have not yet visited the place, but have seen a specimen of large size, which was sent to Professor Cleaveland, in Bowdoin College.

Brunswick and its vicinity have been most faithfully searched for minerals by Profr. Cleaveland and his pupils and a great variety of interesting specimens have been found. The rocks of that town are chiefly gneiss, cut through by an infinity of large veins of coarse granite containing large masses of felspar, admirably adapted for porcelain making. The general direction of these veins coincides with those formerly noted. The falls of the Androscoggin rush over rough, craggy masses, of these rocks. Specimens of this felspar have been wrought into beautiful mineral teeth by the Boston dentists, who prefer it to any other for their purposes, since it melts easily, and is free from oxide of iron. Fine poppy-red garnets abound in this rock near the falls, but they are seldom large and perfect enough for jewelry. Sulphuret and the oxide of molybdena occur below the bridge, close to the water's edge, and can be obtained only when the river is low.

A beautiful variety of green mica slate, filled with crystals of iron pyrites, was discovered in Brunswick, by Prof Cleaveland many years ago, and elegant specimens of it may be seen in almost every cabinet in the country. Large and valuable beds of pure crystalline white limestone, suitable either for marble or for lime, occur in the. S. E. part of Brunswick, near the coast on the estate of Mr. Jordan. The dimensions of these beds were given in my Report for the past year, to which I beg to refer for their description.

TERTIARY FORMATION OF PORTLAND.

While digging the space for a cistern in King street, in Portland, a great number of marine shells were thrown out, some of which were preserved by Mr. Gordon, and submitted to my examination. They belong to the tertiary deposit, and are similar to those which I have formerly noticed, and are found 50 feet above the level of high-water mark. The shells are the nucula, mya, saxicava, &c. which are found in regular beds of clay, and were evidently in their natural positions, just where they had lived and died—the whole mass having been since elevated 50 feet above the sea.

SLIDE OF THE PRESUMPSCOT, WESTBROOK.

This locality is one of interest, on account of the vast number of fossil shells which are exposed to view on the surface of the clay, they being washed out abundantly by every fall of rain.

This slide is said to have taken place during the night in the month of May, 1831. The season is said to have been uncommonly wet, and the clay probably loosened by the frosts of winter, was rendered slippery, so that when its hold was broken it glided forward into the river. The waters of this stream were stopped in their course, and so dammed up as to overflow their banks and alter the channel to the South Eastward. This place is worthy the attention of the curious.

On examination, we find no less than 12 different winrows or long masses of clay, which have been precipitated forward, and the stumps of trees remaining, all point toward the river. One of the trees on the border of the stream, stands inclined at an angle of 40° from the perpendicular, and towards the stream. The space left by this slide, is 120 yards in diameter, and the clay-banks exposed, are elevated 30 feet from the river. The lower bed of clay was of a dark blue, and very tenacious and plastic, while the upper beds are more sandy, and of a light grey color. Throughout the whole mass of the clay, we find an abundance of perfect marine shells frequently preserving the epidermis unaltered. Some of them are petrified, but more frequently they are unaltered. Among the shells obtained, are the following:—nucula portlandica, and new species of the same genus not yet described, two species of the mactra, mya dehiscens, saxicava, sanguinolaria, balani, and occasionally the remains of crabs and other crustacea. The various shells found at this slide are evidently of marine origin, and now we find them at an elevation of from 65 to 70 feet above the sea. It will be remarked that this elevation coincides nearly with the height of the tertiary deposits of Portland and Gardner, and with the lower tertiarv clay of Bangor.

At the brick-yard, near Pride's bridge, we found perfect casts of the natica and mytilus. This deposit is elevated about 60 feet above the sea, and belongs to the same formation as the clay at the Slide.

Before closing our remarks on the tertiary formation in Maine, let us observe, that the general height which these deposits attain, is about 70 or 80 feet, and since no such deposits occur at greater altitude than 100 feet, it is evident that the ancient tertiary sea covered the land only to that depth, and consequently a large portion of the State, now above its surface, must formerly have been submerged beneath the waters of the ocean, while the various prominences rising to a greater height than I have mentioned, must have stood like islands in the midst of the waves. A small portion of the land on which the cities of Portland and Bangor, are built, as well as a part of the land at Gardiner, Hallowell and Augusta, remained above the surface of the ancient ocean. These observations have not only a scientific interest, but a practical result, for the common brick-clays, being of this formation, generally lie below the altitude of 100 feet from the sea-level, and the higher land is destitute of such deposits. The plastic clay of Turner is of freshwater formation, and there occur also diluvial clays, but not abundantly. Hence in the elevated table lands of the State, we find that clay, suitable for brick, is comparatively rare.

The influence of the ancient sea, in the formation of soils, is not to be overlooked, for some of the richest calcareous marls are tertiary deposits. The water percolating through clay containing many marine shells, is always impregnated with carbonate of lime, and this occurs in such quantities in some wells of Portland and Bangor, as to become very sensible to the taste. It is deposited when the water is boiled, forming a crust within the tea-kettle.

In New Jersey there occur very extensive beds of marine shells belonging to the tertiary formation which are sought for as a manure for soils, and according to the report of the geological surveyor of that State, the quantity of this kind of marl varies according to the nature of the shells that it contains, some undergoing more rapid disintegration than others, so as to cause them to act more rapidly upon the soil. So far as our researches in Maine have extended, we find the shells too sparsely mingled with the clay to produce marl.

By calling public attention to this subject, I hope that many observing persons will engage in a search for deposits of sea-shells and marl, which if found, will add greatly to the agricultural interests of the State. Whoever remembers the formerly barren lands of New Jersey, now rendered fertile by this substance, discovered by her geologists, will appreciate the value of such a discovery. I would also beg leave to call the attention of citizens of Maine, to the recent marl formed by the decomposition of fresh water shells, on the shores of the lakes and rivers, for where many such shells are heaped up on the shores, they form marl.

In Pittsfield and Lenox, Massachusetts, marls evidently owe their origin to the decomposition of an infinity of fresh water shells, such as the planorbis, cyclas, and lymnea, and according to my analyses, they contain from 70 to 80 per cent. of carbonate of lime, besides a considerable quantity of vegetable matter.

Marls of a similar character occur on the shores of Millinocket lake, and may be seen at the carrying place between that and the Ambejegis lake, where the expansion of freezing water has turned up the muddy bottom.

ECONOMICAL GEOLOGY.

GRANITE.

This rock is essentially composed of the three minerals, quartz, felspar, and mica, crystalized or aggregated together, without any cement. Its good qualities as a building-stone, depend upon the regularity and admixture of these minerals, and upon the absence of those substances that deface or decompose the rock. It exhibits an infinite number of varieties of color and texture, while there are a few substances that have a chemical action upon it.

In some granites, the felspar is exceedingly hard, and breaks with an almost glassy fracture, presenting sharp and well defined edges, while it is translucent or transparent. This is the strongest kind of felspar, and it endures the action of the weather longer than the dull, earthy varieties. The mica contained in granite is of various colors, such as white, silvery-grey, green, red, or black; hence, from the intermixture of variable proportions of this mineral, we have the different shades of color. The quartz is an unalterable ingredient, and falls out when the other minerals have decomposed.

It will be generally observed, that black mica decomposes more rapidly than the lighter colors, while the bright white or silvery mica is slow in decomposition. The felspar, as it decomposes, first turns white, if pure, while if it contains prot-oxide of iron, it turns yellowish brown, and is gradually removed by rain and running water, and deposited on the lower lands in the state of clay. The quartz remains in sharp particles, or is worn by attrition into siliceous sand.

Sienite is composed of the same minerals as granite, excepting that it contains hornblende crystals instead of mica. The felspar of sienite is, however, more frequently impure, from the presence of prot-oxide of iron, and a little manganese;

these substances replacing an equivalent of one of its regular components.

When the quantity of oxide of iron is small, and in the state of per-oxide, the felspar is of a red color, and does not undergo any farther alteration from the action of the atmosphere.

When the oxide of iron exists in the state of prot-oxide, or at its lowest stage of oxidation, the felspar is of a green color, and will turn brown by the joint action of the air and water, owing to the per-oxidation of the iron, since we observe a deep brown crust upon the weathered surface of such rocks, known to quarrymen under the figurative name of the "sap," the term originating from an imagined analogy between this decomposed surface and the sap-wood of trees. This crust is apt to separate from the block of stone, and by the expansive action of freezing the water which infiltrates into the rock, the surface is gradually converted into gravel and soil. These remarks apply to the more highly ferruginous sienites. The stone from Quincy, Mass., contains a little prot-oxide of iron, and is observed to change color when kept constantly moist, but it preserves its freshness very well when exposed only to the atmosphere, being moistened but transiently. Thus we observe, that in but few instances, the buildings constructed of this stone become changed in color.

GRANITE QUARRIES.

Maine is pre-eminent for the abundance and excellent quality of her various and beautiful granite rocks, which offer facilities for quarrying and exportation, unequalled by those of any other part of the known world.

However public taste may vary in respect to the shades of color required for architecture, the quarries of Maine, furnishing every variety, will always be able to meet the demand.

Not among the least of the advantages over other states, are the facilities which exist for the ready transportation of the stone to market, since the numerous bays, deep inlets, and estuaries of large navigable rivers, afford ready access to most of the important quarries.

Owing to these uncommon advantages, the granite of Maine is destined to supply the whole Atlantic coast of our country, and the West Indies, for it can be quarried and shipped to any of our large cities at a lower price than any building-stone can be obtained in their vicinity.

It will be seen by the statistical observations in this report, that many of the Maine quarries can furnish regular dimension stones, of excellent granite, on board ship, for $1,12 per ton, and the expense of transportation to New York is rarely more than $2,50 per ton. Now there are but few cities where this article will not sell for at least $7 per ton, which will give a profit of $3,38 for each ton of granite.

Since this stone is so beautiful and substantial a material, it is certain that there will be a constantly increasing demand for it, as the population of the country increases, and new buildings are required.

I have not mentioned the high price which is paid for columns and other stones of large dimensions, but many such stones sell for 90 cents per cubic foot, and the increasing number of our public and monumental buildings, creates an extensive demand for such large masses.

I trust that we shall never again have occasion to see a public edifice, which ought to be a model of fine architecture, constructed of brick, and I doubt not, that the improving taste of our citizens will soon require more elegant materials for their dwellings than baked clay. Indeed, the effect of a blood-red brick city, is decidedly disagreeable to any person of taste, and is the first annoyance to which such persons are exposed on approaching our shores.

The rapidity with which a granite building may be constructed, is decidedly in favor of stone edifices, and I have no doubt that the materials may be furnished at nearly as low a price.

In this section I shall describe only those quarries which, from their situation, are available for commercial use. If I should undertake to describe minutely every locality in the State, where good granite is found, this report would be swelled into a large volume, for I have more than thirty different kinds before me, suitable for architecture, that were obtained in Maine, during the past summer, and there are many other localities, which not being available for commercial use, it was not thought worth while to represent.

The following quarries are all capable of being successfully wrought, and are situated near the sea-coast from whence they may be sent abroad.

On the Penobscot river there occur inexhaustible supplies of excellent granite rocks, admirably suited for architectural purposes, and so near navigable water as to render the stone valuable for exportation.

At the base of Mosquito mountain, beside a huge pile of rocks that have fallen from the mountain's side, and exposed a steep precipice of naked rock, the Frankfort Granite company have begun extensive operations for obtaining building stones. Thus far they have wrought only those detached blocks, that lie in confused heaps at the base of the mountain, by which much expense is saved in quarrying. Extensive buildings or sheds are erected to cover the workmen and their materials, and while engaged in dressing the stone.

This quarry was first wrought in the month of May, 1836; since that time more than $50,000 worth of granite has been sold. It has been mostly sent to New York, and is there used in constructing the Albany Exchange. That contract not yet being completed, the Frankfort Granite Company have not felt so severely as other quarrying associations the decline of business which has arrested so many other enterprises of the kind. There can be no doubt, if this quarry is properly managed, that it will become an immense and increasing source of revenue, both to the individuals immediately interested and to the State. A considerable sum, no less than $20,000, has been expended in digging a large sloop canal from the river to the base of the mountain, and that work must have consumed a considerable share of the proceeds from their sales, but when the work is complete, it will so favor the shipments as to make ample returns to the company. I am in hopes to obtain some statistical information respecting the operations at this quarry, and shall then be able to give a more accurate account of its value.

The whole mass of Mosquito mountain is composed entirely of granite, and its height is 527 feet above high water mark, while the diameter of the mountain is at least twice the measure of its height, and it must contain at least five hundred millions of cubic feet, equal to 30,000,000 tons.

Mount Heagan appears to be composed of similar rocks.

Mt. Waldo is composed of the same kind of granite and is elevated 968 feet above high water mark. This mountain contains more than one billion five hundred millions cubic feet of granite, or one hundred millions of tons.

This stone is of excellent quality, is free from stains of oxide of iron, and does not contain any pyrites. It is an admirable stone for architecture, and will preserve its color unchanged. Its effect, when seen at a little distance, is much like that of the light colored granite of Hallowell. When examined minutely, the crystals of felspar become apparent, since, like the Mosquito mountain granite, it contains squares of felspar or is porphyritic in its structure.

Preparations were making for opening an extensive quarry upon the side of Mt. Waldo, at the time when we visited it, and I doubt not that the work will prove advantageous to the parties concerned. A road has been made so as to transport the stone directly to the river, where it can be put on board ship and sent to the cities where it is wanted.

I have seen specimens of the Mosquito Mountain granite finely dressed and polished. It is like that above described, and is vastly more beautiful than any of the oriental granites used by the ancient Romans.

Many other quarries have been opened in Frankfort, but few of them are wrought for the purpose of shipping abroad. I have described them so minutely in our topographical section that it will be unnecessary to recapitulate.

BLUEHILL.

Bluehill bay is a very convenient harbor for vessels engaged in transportation of granite, and there are immense and inexhaustible quarries of this stone favorably situated for transportation. The New York Granite Company have opened extensive quarries about 1½ mile E. S. E. from the village, on the North East side of the narrows, and very near navigable water. The rock is coarse-grained, but when hammered, looks very handsome. Owing to the presence of black mica, it is a little darker than those before described. Columns weighing 35 tons have been split from this ledge, and others may be obtained which will weigh 84 tons. The mountain is elevated about 300 feet above the sea, and is about half a mile in extent E. S. E. and W. N. W. No less than six hundred millions of cubic feet of stone are contained in this hill within the limits of half a mile in length, by 1000 feet in width, and 300 feet in height.

The company own 250 acres of this mountain, and paid for it the sum of $5500. A railroad 70 rods in length costing $10 per rod has been made for the purpose of bringing the stone from the top of the hill, but it is entirely unnecessary, since it will be easier to quarry upon its side near the water, to which there is a regular and easy slope. Railroads so highly inclined as this, are very apt to get out of order, owing to the heavy loads carried upon them, and the wear and tear is so great that continual expenditures to a large amount are required to repair them.

This quarry, if well managed, must prove of great value, for the quantity of stone is inexhaustible, and transportation to market easy.

The Mc-Herd ledge at the head of Long's cove, has not been opened, but the stone seen there is a very fine kind of granite, splitting into any form desired and presenting a sharp and well defined edge. It is suitable for ornamental work and the most elegant devices may be carved upon it, which will present delicate sculpture to great advantage. I should recommend this stone for the capitals of columns and for window-caps upon which ornamental work should be carved. I do not know the extent of this granite, as much of it is evidently covered with soil, but there is amply sufficient for the purposes above designated.

There are many other localities where granite may be obtained on the shores of this bay, but few excepting those mentioned can be wrought profitably.

On the South Fox Island, Vinalhaven, good granite abounds, but has not been quarried. It is coarse-grained, but will answer well for large works. Granite also occurs upon Deer Isle, and may be used for the same purposes as that of the Fox Islands. For wharves, breakwaters, light-houses, monuments and other large or coarse structures, the large grained stone is as good as the finer and more costly varieties.

BUCKS HARBOR IN BROOKSVILLE, NEAR CASTINE.

The granite quarry opened at this place is one of great value, on account of the goodness of the stone, and the facilities for extracting and shipping it for sale. This locality is owned by a New York and New Jersey Company, and has been wrought by their agents to some extent, but owing to the pressure of the times, as I suppose, their operations were suspended at the time when I visited the quarry, and the place was under attachment by the quarrymen. About $1000 worth of rough and hammered stone lay neglected at the quarry. It is not probable, however, that property so valuable as this will be sacrificed for a small sum, and it will doubtless be again wrought.

This granite is rather coarse grained, but is handsome when dressed, and is free from any injurious admixture. Its felspar is of a pure white colour, and the mica is black. The latter mineral is generally the first that gives way to the action of the weather. The extent of the hill composed entirely of granite is 1320 feet in length, 1650 feet in width, and 300 feet in height. Its cubic contents will amount to more than 634,000,000 cubic feet, or nearly 40,000,000 tons. The cost of splitting and delivering the stone on board ship has not exceeded $1 12 per ton, and it may be furnished as low as $1 00 per ton. Cost of transportation to New York varies from $2 00 to $3 00 per ton.

Bucks Harbor is a deep and safe cove, protected by a little island at its mouth. Castine Harbor, close at hand, is one of the best on our coast, and open at all seasons of the year.

Nearly the whole coast of Lincoln County is composed of granite and gneiss, the former rock predominating. This coast is remarkably indented, or rather gashed or serrated by deep bays, which extend far back, so that the various promontories stand out like giant fingers into the sea.

In many places the stone is suitable for architecture, and may be wrought, especially for heavy works, since it is very abundant and easy of access. In some of the localities which are described at length in our topographical section, there are valuable quarries of fine building stone, that have been wrought to some extent. It would require a volume to enter into detailed descriptions of every quarry, and this cannot be expected in an annual report.

The coast on the main land, and the islands around St. George, Friendship and Bremen, abound in granite rocks, many of which are of good quality.

That on Rackliff's Island is a beautiful building stone, and is free from pyrites and other injurious minerals. Its color is light, owing to the circumstance of the mica being of a grey color, and the felspar white. It contains but little quartz. Near Friendship, good granite is also quarried and sent abroad.

EDGECOMB.

In this town, a little below Wiscasset, and opposite Squam Island, occurs an extensive hill of dark colored granite gneiss, consisting of black mica, quartz and felspar; the former mineral predominating, gives it a dark blue colour. It is generally free from pyrites, and withstands very well the action of the weather. An extensive quarry has been opened there and contracts have been made and completed for the supply of stone, to New Orleans and other ports.

It is evident, from the extent of the hill composed of this rock, that there is an inexhaustible supply of beautiful building materials, which will be again extensively wrought, when business shall have returned to its usual prosperous condition.

I would observe that the Edgecomb granite-gneiss is here and there cut by coarser granite veins, and these should be avoided when the stone is supplied for buildings. There is enough stone of an uniform color, which can be furnished, and those blocks containing veins should be laid aside, and will find a ready sale. It is admirably adapted for window caps, steps to houses, and for elegant buildings. I should estimate the quantity of granite at this place at 1,500,000,000 cubic feet, or more than 100,000,000 tons. Hence, it will appear that there is amply sufficient for all future time; and it is situated very favorably for transportion and shipment, the slope being gradual to the river, and the water deep enough for any class of ships, while a new granite wharf affords an excellent opportunity of putting the stone directly on ship board, as the vessel lies at its side, the depth of water within 10 feet of it being not less than 12 feet, so that any vessel used for the purpose may come directly along side of the wharf, and take its cargo.

Phipsburg has a number of good quarries of granite gneiss, similar to that wrought at Hallowell. Pitch Pine Hill, Hunnewell's Point and Small Point Harbor are the localities which we have visited. Stone from some of these quarries has been sent to Havana, in the Island of Cuba, where it has been used for the purpose of making tesselated pavement floors for their warehouses, it being split into regular squares of 10 inches in width and 4 inches in thickness. There will doubtless be a new and increasing demand for similar stones, and there are abundant quarries here which can furnish any amount required. I doubt not that when the inhabitants of the West Indies have once learned the superior comfort of granite floors and stone buildings, that such materials will become an article of exchange with them, for their tropical produce.

In Brunswick, three miles from Bath, the New Meadows quarry is in active operation; an abundant supply of granite-gneiss is obtained, there being more than one hundred millions of cubic feet of this stone in one hill, which is elevated 85 feet above the sea-level. This stone is like that wrought in Hallowell. For a more minute description of the locality, see our topographical section.

The Hallowell quarries are so well known that I need not enter into minute details of their value. I have already given a sufficiently full account of their extent and quality. The ridge composed of granite, in this town, is elevated about 400 feet above the level of the Kennebec, and it extends in a North East and South West direction. Since there are no well defined boundaries yet ascertained for this locality, it is improper to make an estimate of the quantity of stone that exists there; but we may say that, within the limits of 4000 feet in length and 1000 feet in width, that there are no less than 1,600,000,000 cubic feet, above the river's level, or more than 100,000,000 tons. This amount is, probably, not more than one half the actual quantity, but it must be remembered that, since the quarries are not on the immediate sea-coast, they will never be wrought to the lowest depths to which they can be drained. I merely give the above estimate, to show that the supply is amply sufficient for every demand that may occur.

There are also granite quarries in Augusta, which I have not yet explored, but which are said to be very extensive. The stone is exactly like the Hallowell granite gneiss, and is of good quality. It has the disadvantage, however, of not being so near navigable water, so that it cannot be shipped so easily as the Hallowell stone. It will, however, be used in the town, and I understand that quarrying operations are contemplated, for the purpose of sending it abroad.

Beautiful granite, of a light colour, splitting into any form desired, and perfectly free from impurities, occurs in the town of Waterford, but it is so remote from the sea, that it can only be used to supply the immediate vicinity.

KENNEBUNK.

Is also celebrated for its granite quarries, and large operations in this article are carried on at that place.

The principal opening is known by the name of the United

States quarry, and is extensively wrought by an enterprising company. The granite is of a dark color, owing to the predominance of black mica. Its felspar is of a pure white color, and is remarkable for its hardness, and almost glassy fracture. The quartz is in small proportion to the mass. It is the hardness of the felspar that gives this rock its peculiar tenacity, and prevents in a measure the action of the fine particles of pyrites, which it contains. Hence it does not show very perceptibly the brown marks which are apt to spot the granites containing this mineral. The dark color of the stone also serves to conceal such stains. There are numerous little crystals of sphene (an ore of titanium) scattered through the rock, but they do no harm, since they are more durable than its other ingredients, excepting the quartz.

I have given an account of the extent of the quarries opened, in another section of this report, and shall therefore only record here some statistical matter of interest, furnished through the kindness of John Neal, Esq. of Portland, one of the directors of the association.

"During the past season 12 men have been constantly employed at the quarry, and 10 are in Portland engaged in dressing the stone.

Rough split granite sells for $5 per ton of 14 cubic feet, on the Wharf at Kennebunkport. The price remains uniform up to the dimensions of 26 cubic feet, and above that measure, 2 cents per foot is charged for every additional foot.

Stones for store fronts hammered, sell for 75 cents per superficial foot.

Where two sides of a stone are fine dressed, and two rough hammered, three sides are charged, and nothing is demanded for the ends."

Where three sides are fine dressed, and one rough hammered, they charge for four sides and not for the ends.

Mr. Neal has promised to furnish me with a statistical return of the amount of their sales, for the present year, which I shall be happy to lay before you.

The granite obtained from the U. States quarry is mostly sold in New York.

There are many other ledges of similar granite in Kennebunk, some of which have been added to the property of the Kennebunk company, while others are owned by individuals, and by other corporations, but they have not yet begun to quarry the stone.

We may estimate the quantity of granite in this town to be 2 miles in length, by 1 in width, and 70 feet in depth, to the sea-level, which would give more than 3,500,000,000 cubic feet, or 250,000,000 tons. But it cannot be drained to more than half this depth, so that about half the above quantity is available.

The granite of the Ocean quarry, in Kennebunk, is exactly like that of the United States quarry.

That belonging to the New York and Kennebunk company differs by having light flesh colored felspar. It is colored by the per-oxide of iron, but will not undergo any change of color from the action of the atmosphere and water.

In Biddeford, there occurs a beautiful dark colored granite, of excellent quality, but not in sufficient quantity to supply large contracts.

Mr Libbey, Agent for the Sullivan Hopewell Granite Company has furnished me with the following statistical information respecting the quarry under his superintendence:

"The amount of stone quarried at the Sullivan Hopewell granite quarry, in the town of Sullivan, county of Hancock, on what is called Taunton bay, in 1837, 20 men being employed, was 17,783 feet, at 30c per foot, on the wharf. The facilities for getting the stone to the wharf are very good—the distance about 10 rods, a little descending. The expense of shipping to New York is from $2 to $3 per ton. There are about sixty acres, of which about one third is granite. Stone can be obtained of any dimensions required."

Sienite, a rock composed of felspar, hornblende and quartz, used also as a building-stone, under the common name of dark granite, occurs abundantly in Maine. Many high hills and mountains in York County are entirely composed of it, and if it should ever be required in the market, there is an abundant supply in the State.

The three mountains in York, called Agamenticus, are composed of sienite, the highest attaining an elevation of 672 feet above the level of the sea. The rock composing these hills is characterised by a brownish green felspar and hornblende. It is too remote from shipping to be profitably quarried for exportation.

An inferior kind of sienite occurs on the sea-coast, at Cape Neddock, but its felspar contains so much oxide of iron, that it has a dirty green color.

In Newfield there are huge mountains of this rock, of good quality, attaining an elevation of 1600 feet above the sea, but they are too remote from navigable waters to be available in commerce.

There are an infinite number of granite and sienite mountains in the interior of the State, that will furnish an abundance of building-stone, for use in their neighborhood, but which cannot be transported to the sea-coast, on account of the expense. I have, therefore, avoided taking up time in measuring their extent, or in describing them in this report.

Mica slate, valuable for flagging stones, and in great demand in our large cities for side-walks, is found abundantly in Maine. At Phipsburg, near Small Point Harbor, there are some beautiful and brilliantly spangled rocks of this kind, which would meet with a ready sale. They are not, however, so strong as the mica-slate brought from Bolton, Ct. owing to the predominance of granular quartz, but if made 6 inches thick, they will answer every purpose.

In Winthrop, Acton and Lebanon, good mica-slates are found, but they are so remote from the sea, that I do not know as they can be profitably quarried.

Slabs of good dimensions, and perfectly true, 4 inches in thickness, from the Bolton quarry, I am told, sell for 50 cents per superficial foot. If this price can be obtained for the mica slate rocks of Maine, it may be worth while to quarry them so as to supply the market.

Those which have been obtained at Phipsburg, measure 5 feet by 15, and are about 4 inches thick. I do not know whether any of them have been offered for sale. If such mica slate, as occurs in Acton, can be found near water communication, it will be of great value.

LIMESTONES AND MARBLES.

No other State can vie with Maine in the abundance of its limestones, and the amount of revenue derived from commerce in this article is immense, and probably far greater than is generally apprehended.

Thomaston is justly celebrated for her inexhaustible quarries, which serve to supply nearly all the cities on the Atlantic coast with the lime used in their buildings, and for agriculture.

Few, perhaps, realize the fact, that there are no less than 14 million dollars worth of limestone within 20 feet of the surface, in Thomaston; and that already, while but a trifling proportion of the stone is exported, nearly half a million of dollars are annually realized from the sales of lime; beside which, we have also to estimate the value of the carrying trade, the whole business being in the hands of the citizens of Maine.

Limestone abounds also in Camden, Hope, Lincolnville, Warren, Union, Whitefield, Machias, and Lubec, from several of which places it is exported in the state of lime.

The present season has added many new localities to our list, and they will be found fortunately situated, just where a new and important demand was springing up, owing to the discoveries made respecting the treatment of soils.

York, Cumberland, Oxford and Kennebec Counties contain as much lime as will be required for their agriculture.

I have, in several places in the interior, ascertained that the price paid for Thomaston lime, was as high as $4 per cask, which high cost precludes its use upon the soil.

On the Aroostook, the people pay $16 a tierce for St. John lime, while the very rocks under their feet are composed of excellent limestone, and wood costs only the labor of cutting. They are, however, unacquainted with the nature of the rock, from which this substance is made, and know nothing of the simple art of lime-burning. They will, however, soon learn, and will hereafter value the rocks around them, which were formerly unheeded, or considered useless.

There are many districts in Maine, where the comfort of a well plastered wall is unknown, yet limestone-rocks occur all around, and the untamed forest offers an abundance of fuel.

Although we have discovered many new and important deposits of limestone in the State, I am still of opinion, that every year the demand for the Thomaston lime will be on the increase, for the farmers in various parts of our country are now awakened to the value of this mineral, as a manure for the amendment of soils.

Many valuable beds of limestone occur in the interior of the State, where the expense of transportation forbids the use of Thomaston lime for agricultural purposes. By means of wood and peat, abundant in the vicinity, this limestone may soon be made to double the produce of the soil. For it may be readily burned in large quantities in temporary kilns erected for the purpose, and the lime ashes being mixed will form a most valuable article for fertilizing the soil.

The limestone found in York and Oxford Counties, is included in alternating strata of gneiss, or mica-slate, and the width of the beds varies from a few inches to several feet in thickness. These beds generally rest upon the flanks of granite mountains, and they occur also on the hills and table-lands.

In many of the towns through which we passed, the stone walls were principally built of this rock, and an abundance of it is scattered over the fields. This limestone is of the very best kind for agriculture, since it is destitute of magnesia, and may therefore be used more freely, and with less scientific knowledge on the part of the farmer.

When pure lime is wanted for mortar, the best stone may be selected for burning, or the rock with its foreign minerals can then be taken from the kiln after being burnt; slaked with a little water, the lime being riddled out very easily, while the refuse will prove valuable as a manure, for it will have much lime adhering to it. In this case, the sifted hydrate of lime is to be immediately mixed with the sand by means of more water, if it is required for mortar.

The limestones which we have collected were obtained in the following places.

Newfield, Norway, Paris, Buckfield, Winthrop, Hallowell, Whitefield, Brunswick, Phipsburg, Union, Bluehill.

The six first mentioned localities furnish granular limestone, imbedded in gneiss, suitable for agriculture.

The Whitefield locality I have not yet examined, but the specimens given me are the stratified blue and white compact carbonate of lime, of good quality.

The Phipsburg limestone is highly granular or crystaline, and is colored here and there by plumbago or graphite. This rock is very pure, and suitable for every usual purpose.

Union possesses a very inexhaustible supply of elegant white dolomite marble, suitable for lime and for monumental architecture.

ROOFING SLATE.

Bangor, in Wales, has hitherto enjoyed the exclusive privilege of supplying the world with roofing-slates, but it is certain that she will find a powerful rival in the Bangor of Maine, for that city is destined to be the place of exportation for all the good slates used on the Atlantic coast.

Inexhaustible quarries of this valuable material occur along the banks of the Piscataquis, from Williamsburg to Foxcroft, and it is highly probable that we do not yet know a tenth part of its extent. We do know, however, that there is a sufficiency there, to supply the cities of America, if not of the whole world.

In Williamsburg, Barnard and Foxcroft openings have been made, and the quality of the slates has been proved to be equal if not superior to any ever used in roofing. Every foot of rock gives from 30 to 40 handsome slates, and some have been obtained and made into writing slates, large enough to calculate upon the extent and value of the quarries, for they may be obtained 9 feet by 5 square. One which I have seen framed was $2\frac{1}{2}$ feet by 4 feet, and was very handsome and of good quality as might be desired.

There have been obtained during the present season about 100 boxes of roof-slate, which was quarried for the purpose of testing its value.

When a road is made, and the means of transportation are prepared, we shall see an abundance of this article in the market, and people will not care which Bangor it comes from, so long as it is of good quality, and is sold at a low price. Even in the present state of the country, I understand that the cost of furnishing the Barnard and Williamsburg slates to market is not more than $5 per ton, in Bangor, and $11 per ton in Boston. Thus:

Cost of quarrying and trimming, ...	$3
Transportation to Bangor, ...	5
Do. from Bangor to Boston, . . .	3
	$11

The Welsh slates, I am informed, sell for $27 per ton, so that even were the cost double the amount above estimated, there would still be a large profit to the owners of the quarry.

We observed that most of the houses in Bangor, and other cities of the State, are covered with Welsh slates, that were first imported into New York or Boston, and there purchased and transported to Maine.

A few years hence this will appear equally absurd with the fact, that our fathers used to send to Wales for grave-stones, and the good Dutchmen of New York to Holland for brick. Indeed, we need not go so far from home, for less than 20 years ago, I am told, that it was customary to send from Hallowell to Quincy for granite or sienite, to make underpinnings to the houses in that town, and to this day Quincy supplies Maine with tombstones!

So it has been and must be with every State, until their hills and mountains are explored, so as to develope their resources, which might otherwise pass unheeded for ages.

In Thomaston it has always been customary to burn limestone with a wood fire, and formerly an immense quantity of this fuel was used, since it then required no less than three weeks to burn a kiln of lime. It was afterwards found by trial, that the operation could be as well performed in the space of four days and nights. The stages are divided into four "turns," or watches, and the consumption of fuel for each turn of 24 hours is as follows:

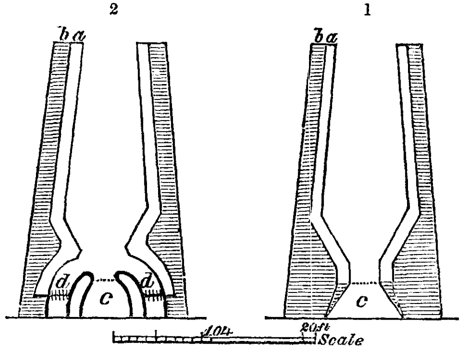
On the	first day, or turn,		2	cords	of wood	are burnt.
"	second	"	3	"	"	"
"	third	"	3	"	"	"
"	fourth	"	2	"	"	"
			10	"		

This amount of fuel is required for every 100 casks of lime, and an ordinary kiln contains 300 casks, so that about 30 cords of wood are consumed in burning each kiln. It is a curious fact, that although as much wood is crowded in as will burn, that the quantity consumed should vary in the manner above stated; but it is well known by the lime-burners, and I was assured of its truth by Dr. Cochran and other observing gentlemen in Thomaston. In order to expel the carbonic acid from limestone, it is only necessary to bring the rock to a uniform red heat, and if this is effected, the lime may as well be made in half an hour, as in four days, but it is difficult to heat the pieces of stone suddenly, without fusing their surface so as to destroy the lime. Hence the operation requires a slower and more regular application of heat than might at first be supposed.

On account of the present high cost of wood, it was proposed to make trials of other and cheaper methods of burning lime, and it has been found, that refuse skreenings, or dust of anthracite, will answer the purpose.

There have been two perpetual kilns erected in Thomaston during the past summer, and I was informed that the price paid for coal dust in New York is $1,75 per ton, and that it costs from 50 to 75 cents per ton to transport it to Thomaston. One ton of coal, it is estimated, will burn from 25 to 30 casks of lime, so that while that burned by means of wood costs 24 cents per cask, for burning, the coal kilns will furnish the same quantity for the cost of from 8 to 15 cents. Owing to this discovery, a complete revolution will be effected in this business, and when lime is furnished at a lower rate, there will be a proportionable augmentation in the demand. Every farmer who needs it, and who formerly could not afford to lime his soil, will now be enabled to obtain a supply at a low price.

It may be useful to present a sketch, showing the principles on which the perpetual kiln is constructed, and the wood-cut below represents a section of one of them. No. 1, is a perpendicular section of the coal kiln, used in Thomaston. The attached scale gives its proportions.



a Lining of fire stone, (talcose slate.)
b Common rock, (mica-slate, or argillaceous slate.)
c Drawing arch from which the lime is taken, as fast as it is burned, the bars of iron represented by the dotted line being removed, so that it falls upon the hearth, and is removed and packed when cool.

Lime may be burned also by means of peat and wood, in a large oblong square kiln, the stone being piled up in alternating layers, with this fuel which is to be fired from the arch below. This processs is particularly adapted to the burning of lime for agricultural purposes, and temporary kilns of large dimensions may be made for the purpose. In this case, it is intended, that the whole mass of lime and ashes mixed, should be used together, as the mixture will act favorably, especially in the treatment of sandy soils.

The dimensions of this kiln are 22 feet in height, 9 feet across the *boshes*, (the widest part internally,) 6½ ft at top, and the hearth is 2 ft wide. A shed is erected immediately before the drawing arch, so as to cover the workmen and protect the casks of lime from rain. Two kilns are kept in operation, and are covered by a common shed. The charge of limestone and coal is introduced from the cliff, against which the kilns are built, and they are kept always full, more charge being added as the lime is drawn.

Fig. 2, represents a section of a new kind of kiln, in which, either anthracite dust, bituminous coal or wood may be used, or both may be employed at the same time.

It differs from the other perpetual kiln only, by having arches in which the fuel used is to be wood or bituminous coal. The arches should be of larger dimensions in proportion than are represented in the plan.

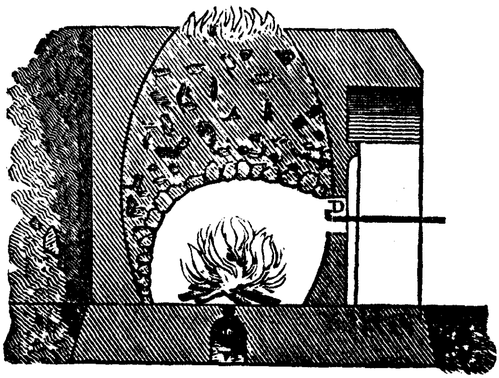
This kiln is easily constructed, and may be made to serve in various ways, as the price of each kind of fuel changes. In case coal dust is used, no fire is required in the lateral arches, but they should be stopped by means of a stone.

It is obvious that the fire is here under the absolute control of the person who tends the kiln, for the opening being closed below, the rapidity of the combustion can be checked at pleasure, and by opening the hearth door the draft may be renewed. Since the fire is never extinguished unless to make repairs, a vast amount of heat is saved, which in others is required to raise the heat of the kiln, and no time is lost in waiting for it to cool, so that it can be discharged. Since the heat is uniform, there is not so much injury sustained in the stone-work, by cracking from expansion and contraction.

In the country, where coal cannot be obtained, we recommend the new kiln, since it requires but very little wood, and the operation may be carried on steadily, while all the ashes is kept apart pure and suitable for the manufacture of potash. In this case, the limestone is not heated to full redness until it reaches the centre of the boshes, and it is there burned by the concentrated flames from the arches *d d*, from whence it descends to the hearth, converted into lime.

The following wood cut represents the form of the common lime kilns used in France, in which the lime is burned by means of fagots of wood in twelve hours.

FIG. 3.



A. Lime-stone laid in the form of an arch upon which the smaller fragments are piled.

D. Fire arch into which the fuel is thrown.

C. and V. Ash-pit and draft-arch through which the air passes to support combustion.

Figure 4 represents the new French lime-kiln in which Peat is used for fuel and it may be advantageously employed in Maine where that subs'ance is abundant.

Its proportions are 16 feet in height, 8 feet in diameter at its widest part internally.

The upper view represents a vertical section of the kiln set for burning, while the lower one is a ground plan of the hearth in the tranverse section at M. M.

L. L. F. F. represent the lining of fire-brick or fire-proof stone.

M. M. the outer layers of stone masonry.

G. shews the proportional lines of the curvature.

K. the Chimney.

E. E. C. the grate.

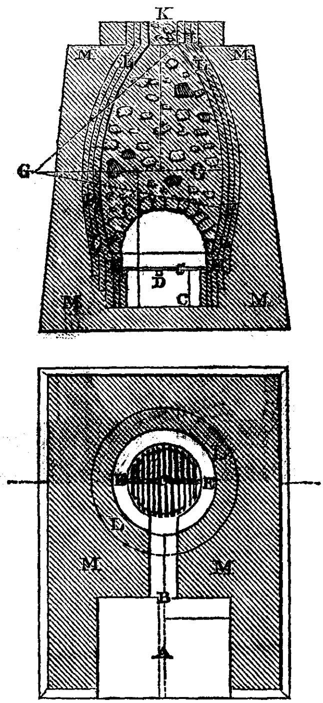
D. the ash-pit.

In the ground plan.

A. B. the arch where the fire is managed.

L. L. ground plan of the lining near the grate.

FIG. 4.



By means of their eliptical forms, the French kilns save a considerable proportion of the heat, since it is radiated by the walls into the midst of the limestone instead of being immediately lost by the mouth of the kiln.

I have considered it an essential requisite for granite quarries, that they should be situated near the sea-coast, but with regard to limestone intended for home consumption, it is decidedly advantageous to find it in the interior, where fuel is cheap and abundant.

Thomaston, Camden, Lincolnville, and Union will supply the market abroad, while it would prove too expensive for the farmer residing 50 or 100 miles from the sea-coast, to transport the lime from those regions, to his farm. Hence he will depend upon the localities discovered in his vicinity.

SERPENTINE.

On Deer Isle occurs an enormous mass of serpentine, which has been thrown up through the granite. This substance is composed of silex, magnesia, lime, oxide of iron and water. It is filled with delicate fibres of asbestus, which have become indurated, and will give an admirable effect to the polished stone. It also contains scattered lamellae of diallage, that gives it a variety of different shades.

This rock is identical with the highly prized marble, known under the name of verd-antique. It is of a deep olive green color, with many lines of asbestus and spots of yellow diallage.

In quarrying the serpentine, it will be necessary either to mortice it out, or to blast it in huge masses, by means of gunpowder, large and very deep holes being drilled for the purpose, so that the blocks may not be shivered by the discharge. Small ornamental articles have already been made from the quarry, but no extensive operations have yet been carried on. If it can be obtained in good sized slabs, it will become an important article of commerce. The locality has already been described in our topographical section.

If the price of epsom salts and magnesia would warrant the operation, these substances could readily be made from this serpentine, since 100 lbs of the rock, will, when combined with sulphuric acid and crystalized, produce 198 lbs of epsom salts, which decomposed by carbonate of potash or soda, will give carbonate of magnesia, and by the chemical operation a large quantity of Venitian red may also be produced. Works of this character are carried on near Baltimore, and they are for the present, able to supply the demands of the market.

Hone slate, or novaculite, useful for oilstones, is extremely abundant in Maine, and may be advantageously wrought upon Little Deer Island and the Western Island in Penobscot bay. It is equal in quality with that brought from the Mediterranean, known under the name of Turkey oilstone, which sells in Boston for fifty cents a pound. If this rock is extracted and shaped as required, for sale, it will meet with a ready demand, and the locality is amply sufficient in extent, to supply the world with oilstones.

Felspar, suitable for the manufacture of fine porcelain or china ware, is abundant in Maine, and is vastly more pure than the kind used at the porcelain works of Sevres in France. When citizens of Maine have become adepts in the art, we need not send abroad for China ware, for we have all the materials required and an abundance of soft wood necessary for baking the ware.

I have had the properties of the felspars of Maine amply tested by three years experience, and dentists to whom I have given specimens, pronounce that from Brunswick the best they have ever used in making mineral teeth, which are formed from this mineral.

Plastic clay, suitable for brown ware, is found abundantly in Maine, and that upon the Androscoggin in Turner, is the finest I have seen, and might be extensively used for this kind of pottery. From it milk pans, jars, and various other articles of domestic and dairy use may be manufactured. An extensive deposit of this fresh water clay occurs in the town of Madewaska, on the banks of the St. John.

Fuller's earth is found in Newfield and Parsonsfield, and in the former town was once an article of trade, but the demand has since declined, owing to improved processes in cleansing cloth, so that it is now but little used in factories. It will, however, be useful for domestic purposes in removing grease spots, for which purpose a small demand will always exist.

Jasper, a precious stone, is also found abundantly in the State, in beds always in contact with trap rocks. On Sugar Loaf Mountain, upon the Eastern bank of the Seboois river, there is a bed of this mineral, 10 feet wide, cutttng through the mountain, in contact with a huge trap-dyke to which it owes its origin. Immense quantities of boulders, or rounded masses of jasper, also occur scattered in diluvial soil, and are also found in the bed of the Aroostook and St. John Rivers.

Chalcedony and carnelian are also found in globes, or hollow sperical masses in the amygdaloidal trap rocks, and also as boulders, in the St. John river.

Horn-stone, which will answer for flints, occurs in various parts of the State, where trap-rocks have acted upon silicious slate. The largest mass of this stone known in the world is Mount Kineo, upon the Moosehead lake, which appears to be entirely composed of it, and rises 700 feet above the lake level. This variety of horn-stone I have seen in every part of New England in the form of Indian arrow-heads, hatchets, chisels, &c. which were probably obtained from this mountain by the aboriginal inhabitants of the country. It breaks with a sharp cutting edge, and appears well adapted to the uses for which it was employed.

Fluor-spar, a mineral composed of fluorine and calcium, is found in Maine at Long Island in Bluehill bay. It is of a green color and is crystalized in octaedra, a form composed by two four sided pyramids applied base to base. This mineral is used only by chemists, for the preparation of fluoric acid, and by the workers in glass for etching on that substance. When it is pulverised, and put into leaden or silver vessels and then treated with sulphuric acid, and warmed fluoric acid gas rises and will dissolve the silica in the glass, removing it in the state of fluo-silicic acid gas; and if the surface of the glass is covered with a layer of wax, and figures are drawn through the coating, with a pin or needle, and the glass is then exposed to the fluoric acid gas, designs may be engraved upon that substance in a few moments. Fluor-spar is sold in the apothecaries' shops for fifty cents a pound, but the demand at present, is very limited.

Phosphate of lime occurs in scattered crystals in granite-rocks in almost every part of the State, and may be known by its brilliant green color, and its phosphorence or light which it gives out, when thrown on heated iron. Some varieties of it, however, are clear and colorless, and others are straw yellow; hence its appearance being very deceptive, one of its names, *apatite*, is derived from the Greek word signifying to deceive. Another fine bluish green variety is called from its color, asparagus stone. Its colors arise from certain accidental coloring matters which it contains. This mineral is not an article of commerce.

Beryl, a sub-species of the emerald, occurs in Maine, in large and beautiful crystals, some of which are from 6 to 8 inches in diameter. It crystalizes in the form of a 6 sided prism, with plane terminations. Its color is of various shades of green, and the nearly transparent varieties of a sea-green color are used in jewelry, under the name of aqua-marine; the latter variety is found in Bowdoinham, imbedded in quartz veins, which traverse granite. The other dark grass-green varieties are also found there in the granite itself, and in the soil derived from its decomposition.

Large and beautiful beryls are also found in the granite of Parker's Island, at the mouth of the Kennebec river. [See specimen in the cabinet.] They are also found in Albany, near the Portland road.

This mineral is not used in commerce, excepting when of a rich and deep green color, and it is then known under the name of emerald—its color being produced by a trifling quantity of chromic acid.

Garnets suitable for ornament occur in various parts of the State, the finest yellow kind being found at Phipsburg, while the deep red occur at Brunswick.

The various colored tourmalines are found in Paris, Oxford County, and were first discovered by E. L. Hamlin, Esq. while a resident in that town. They are the following:

Green tourmaline, of a rich pistachio, olive, and emerald green color, frequently transparent, and equalling the emerald in beauty. Specimens of this stone have been cut and used for ornamental purposes.

IRON ORES.

There are an abundance of valuable ores of iron in Maine, which are of great statistical importance to the country. Iron is one of the essential requisites in all the arts of civilized society, and is the strong arm of national prosperity. It is a knowledge of the art of working this metal that distinguishes the more powerful civilized races of mankind, and gives them the means of withstanding the encroachments of barbarians.

It will be impossible for me to enter minutely into details re-respecting the usefulness of this substance, and I have only to refer to the various instruments used in the arts, to satisfy you of its paramount value. It will be seen that iron is the metal that gives us the power of subduing nature to our will. It forms the plough that tills our fields, and the sword, spear and gun which defend them. On the one hand it is employed as culinary utensils, in which our food is prepared, and on the other it is made to hurl cannon balls at our foes. From the plough to the penknife it is the most universal metal employed in the arts of life. Its magnetic properties directed Columbus across the ocean and discovered this continent; the same property serves now to direct our course through the midst of pathless seas and tangled forests, while it also serves to point out the boundaries of our landed estates. I need say no more of uses so apparent to every observing man, but I will remark that this metal, in a statistical point of view, is worth ten times as much as all the so called precious metals that are wrought in the world. That is the real amount of actual value received from iron mines is ten times as much as is obtained from those of gold and silver and is just half of the whole value of the metals known and wrought in the world. Several mines of this ore were described in my last report as occurring in Maine, and I have great satisfaction in stating that we have discovered several new and important veins and beds of this valuable mineral situated where they can be wrought advantageously.

On the Aroostook river, near the house of Mr. Currier, I found a bed of Red Haematite Iron, ore of the very best quality, 36 feet wide and of immense and unknown length.

This ore is included in Calciferous and Manganesian Slates and is admirably situated for mining and for transporting to market. Endless forests occur around, that will supply an abundance of charcoal, which requires only the labor of preparing. Stones suitable for building the furnace occur immediately above on the River, a few miles distant. Limestone abounds in the immediate vicinity and red sandstone that may be used for hearth stones, occurs upon the Tobique stream in New Brunswick.

This ore contains 53 per cent. of Iron and will give 60 per cent. of cast metal or 50 per cent. of bar Iron. The ore is wholly inexhaustible, since it runs with the strata of slate, probably through the wilderness towards Houlton. It is cut off in one place on the Presq Isle river by a dyke of trap, but will doubtless be found again beyond it, running on in the same line.

Since the last Report was presented, I have made a chemical analysis of the Woodstock, N. B. Haematite, which, like that above described, contains 53 per cent. of Iron. We have not yet been able to examine that bed so as to trace it across our boundary line, but there is no doubt of its existence within our jurisdiction.

At Linnaeus, Mr. Carey of Houlton, has discovered several valuable beds of Granular Magnetic Iron ore, accompanied by Manganesian slates. It has doubtless been acted upon by trap-rock which has reduced it from the Per. Oxide or Haematite to Magnetic Iron ore. In Buckfield there are found excellent ores of Iron, exactly like those of Sweden, from which their fine tough Iron is made, so universally admired for its strength, purity and adaptation to the making of cast steel.

Newfield and Shapleigh abound in Bog Iron ores, yielding from 30 to 40 per cent. of good cast Iron.

Argyle and Clinton have also extensive deposits of Bog Iron. Magnetic Iron ores have also been found in Patricktown and in Raymond, but I have not been able yet to explore their extent and value.

It is probable that many of these localities may be advantageously wrought by means of charcoal. Where a deposit is very extensive a blast furnace may be erected. If, however, there are doubts as to the extent of the ore, then Bloomery forges of trifling cost should be used and bar Iron may then be made.

A small blast furnace capable of smelting one ton and a half of iron per diem, will cost about 11,000 or $12,000.—Large establishments require a capital from 50 to $100,000.

Bloomery forges are like those used by blacksmiths, excepting that they have a deep fire-proof bed, and are of much larger dimensions. The cost of a bloomery, with its building (a mere wooden shed) would not amount to more than from 800 to 1000 dollars. Two trip hammers are required, and water power for moving them, and for blowing the furnace. No one should attempt to put up a blast furnace without the aid of a practical furnace-man, since there are many details in the art, which can only be learned by experience.

In the town of Buckfield in Oxford county, there are several beds of rich magnetic Iron ore, included in granite rocks. On Waterman's farm, it occurs in veins from one to eight inches wide, and they are so abundant that a considerable supply may be obtained. I should think, that even among the loose masses at present lying upon the soil, a man could collect nearly a ton of ore *per diem*. This locality is worthy of more extensive exploration, since it is probable that wider veins may be discovered and will prove a valuable addition to that which can be extracted from the mine on the Lowe estate, where there is a bed of excellent magnetic iron ore, capable of yielding an ample supply for bloomery forges, from which the very best kind of wrought iron and steel may be made. This locality is worthy the attention of iron founders, since the ore will yield about 70 per cent. of cast iron, and 60 per cent. of bar metal.

In the town of Shapleigh, there is an extensive bed of excellent iron ore, running along the borders of Newfield upon the Little Ossipee river; and there, a small but good blast furnace has been erected by a Portsmouth Company, and from 1 to 1½ tons of iron are manufactured daily, while the furnace is in blast. This ore yields about 40 per cent. of metal which is of good quality, and capable of being converted into bar iron and steel. I have had an opportunity of collecting some statistical information respecting these works, which is here presented.

The furnace belongs to a corporation called the Shapleigh Iron Company. It is situated upon the banks of the Little Ossipee river in Newfield, and was erected last year, under the superintendance of the experienced iron master, Thomas O. Bates, Esq. of Bridgewater, Mass. The cost of the furnace and buildings was $13,000 when completed. It is lined with English fire-brick, and the hearth is of Talcose slate from Smithfield, R. I. It was put in blast for the first time, on the 14th of January last, and by some accident the charge became chilled, so that the operations were arrested until the present year ; when on the 9th of August, it was again put in order and set at work, one thousand tons of the ore having, in the mean time, been collected. About 800 tons were on hand at the time when I visited the works. The charge for smelting is as follows:

4 boxes of bog ore,
10 bushels of charcoal, or 5 baskets.

Eight bushels of clam shells are used per diem as a flux. There are 20 charges as above. The quantity of iron obtained from it *per diem* is 2,400 lbs. and the castings are made twice a day, the metal being drawn into pig iron.

At the time when I visited the works, the furnace had not attained its full blast, and but 2,400 pounds of ore were smelted, which gave half a ton of pig iron daily. Charcoal made from hard wood costs 6 cents per bushel, but it is supposed that it may be obtained for a less price, when people in the vicinity have become accustomed to preparing it.

I have lately received from Messrs. Samuel Huse & Co. who are proprietors concerned in this furnace, the following statistical facts.

NEWBURYPORT, Dec. 20, 1837.

SIR — As we have now had more time to ascertain the qualities of the bed of ore, we have been engaged in working at Shapleigh, in the county of York, State of Maine, we will endeavor to give you as nearly a correct account of our results, as is practicable at this date. We will merely say that, in consequence of the ore working somewhat differently from the ores that have been found in Massachusetts, we have had some difficulties to encounter, which have prevented our complying with your request at an earlier period, and perhaps will not be sufficiently correct, in all the statements we shall make, for you to give as a correct data for others to build upon—but we give you the rate of the working of the furnace for the last thirty days, and you can draw your own conclusions.

The average amount of ore has been about one hundred and twenty boxes for 24 hours—weight per box 60 lbs.—7200 lbs. Coal 120 baskets, equal to 260 bushels. Nett amount of iron from the above ore, one and a half tons per day, or in thirty days 45 tons.

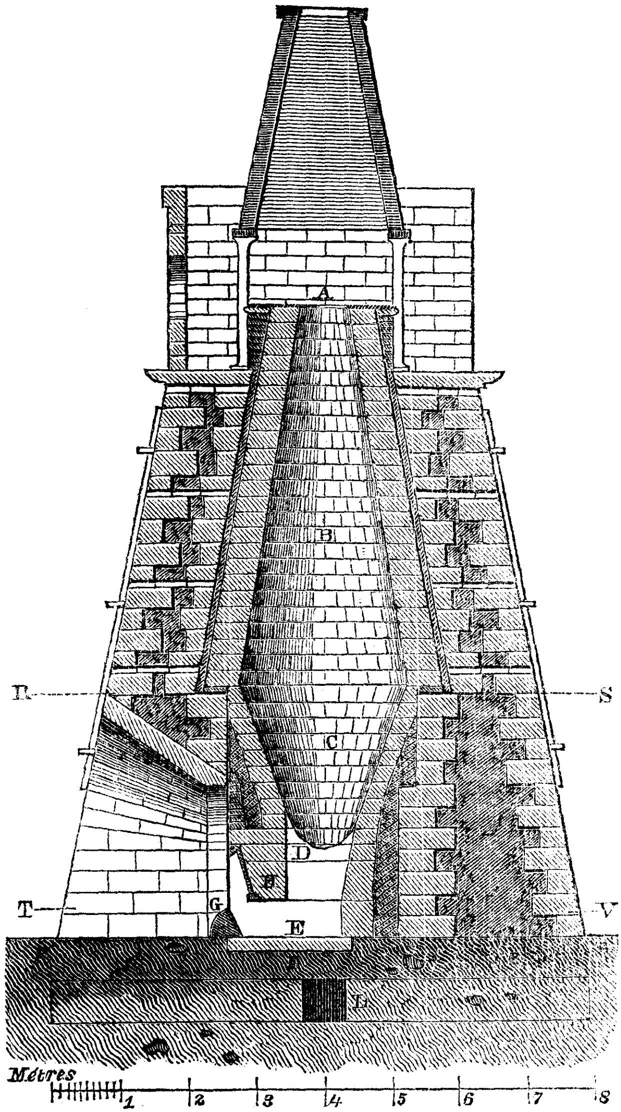
The quality of the ore is considered as good as any in the New England States, and much resembles that found in the State of New Jersey. This furnace is not of the largest class, as we did not think, at the time we erected this, the quantity of ore in our vicinity sufficiently large to justify one of that description. We have since discovered traces of more ore, which will increase the quantity sufficiently for this, and perhaps another furnace, for some years—but not so extensive a bed as may be found in some other parts of the United States. Any further information you may wish, we shall be pleased to communicate. The furnace is now out of blast, after making a blast of seventeen weeks, and will probably remain so for about sixty days, as the season is rather unfavorable for the commencement of new operations.

Respectfully yours,

SAMUEL HUSE & CO.

The following wood-cut shows a vertical section of an Iron Furnace, in which the ore is smelted by means of charcoal. It is 30 feet high from the hearth to the trunnel head, and 9 feet in diameter across the boshes. The lining is made of fire-brick, between which and the masonry of the stack, there is a layer of fine charcoal and sand, rammed into a space left for the purpose. Spaces are left also in the masonry of the stone work, which are filled with sand. Clamps made of iron bars bind the work together. The scale of French metres gives the proportions of the various parts of the furnace, a metre being 3 feet 3.37 inches.

FIG. 5.



A. Trunnel-head.
B. C. Interior of the furnace.
D. Entrance of the Tuyere for the blast pipe.
E. Hearth.
G. Vent for drawing off the iron.
H. Dam for casting.
R· S. Section across the boshes.
T. V. Line of section across the hearth.

A gentleman in Boston, well acquainted with iron works, has furnished me with the following statistical observations respecting the expenditures and profits of iron furnaces.

In Vermont near Troy, there has been lately established a large blast furnace, by which three tons of cast iron are obtained per diem from the granular magnetic ore of that town.

The charcoal used each day amounts to 600 bushels, and costs per bushel 4 cents,		$24 00
Cost of ore and flux for 3 tons of iron—$10 per diem,		10 00
Labour, $10,		10 00
Interest on capital of $100,000, $6 per diem,		6 00
Cost of three tons of cast iron		$50 00
Three tons of cast iron, at $45 per ton, sell for	135 00	
Deduct cost of manufacturing,	50 00	
Profit on three tons,	$85 00	
When two tons are made, the profit is	$43 33	

This gentleman also states that the following are the items of expenditure and profit, at the Franconia, N. H., iron works, where magnetic iron ore is also wrought, the average width of the veins being but two feet, from which one man can blast out two tons daily, at the cost of $6 per ton.

Six laborers are employed at the furnace, viz: two top men, who attend to the charge; three fire men, who have the care of the blast, and of the casting; and one gutter man.

Two tons of iron are made each day. Limestone, used for flux, is carted six miles to the furnace.

700 bushels of coal are used daily, costing 4 cents per bushel,		$28 00
Cost of the ore, $6 per ton, 4 tons,		24 00
Cost of flux, and roasting of the ore		2 00
Labour of six men		10 00
Interest on capital, and contingencies,		6 00
Cost of two tons of pig iron,		$70 00
Two tons of pig iron sell at the foundry for	100 00	
Deduct cost,	70 00	
Daily profit,	$30 00	

But, in the form of castings, made at the works, the iron sells frequently for $75 per ton, which would give $80 daily profit. Bar Iron sells for $100 per ton.

I trust that we may soon have a number of smelting furnaces in operation in Maine, and that no longer so large and valuable resources will be allowed to remain neglected, while the State is paying enormous sums of money to England, Sweden and Russia, for her supplies of this indispensable metal.

There are numerous deposits of iron ore in the State, a few of which have already been examined, while I have not yet been able to explore the extent of others. In Clinton, considerable deposits of bog ore are found, specimens of which have been sent to me. The ore is of good quality, but I am not yet aware of its extent. In the town of Williamsburg, 10 miles north from Mr. Greenleaf's house, there occurs a large and valuable bed of bog iron ore. It has also been discovered in large quantities in the town of Argyle. Mr. Curtis has sent me a package of specimens, which are of excellent quality, and exactly like the Shapleigh ore. He informs me that there is an ample supply for a blast furnace, and charcoal may be had for 3 cents per bushel. This locality, being near the Penobscot, and but a few miles from the Oldtown Railroad, can doubtless be wrought to advantage. Water power is found close at hand, and the locality is said to offer every facility required for successful operations. I hope to be able to ascertain the precise extent of the ore early the ensuing spring. Good bog ores are found also at Bluehill, and will, perhaps, be wrought, should the magnetic ores on the neighboring islands be mined and smelted, for the bog ore would mix with it to advantage, and occurs close at hand. There are small deposits of bog ore, also, at Castine; also at Paris, Saco, Jewel's Island and Thomaston. But they do not appear to be of sufficient extent to justify the erection of furnaces. In Lebanon there appears to be an extensive deposit of bog iron ore, which is found in numerous places where the diluvial gravel has been gullied by brooks; there being no forest trees around, it cannot be wrought to advantage. In the town of Union, there is an enormous bed of this ore, more than thirty feet thick, which occurs near a pond on the side of a hill. It is, however, contaminated by the presence of a little pyrites, and will only answer for common castings, since the presence of sulphur renders the iron brittle, and it cannot be entirely freed from it in the furnace. In a former report I had occasion to point out many other valuable localities, where iron ores occur abundantly, and I beg leave to refer you to that document for a particular description, it being my object now to present only what we have discovered during the present year.

The most valuable bed of iron ore which I have found in the State, occurs on the south side of the Aroostook River, above the house of Mr. Currier, in the township marked No. 13, 4th Range, on Coffin's map of the public lands. The bed is included in red and green argillaceous slate rocks, and runs in a N. W. and S. E. direction to an unknown extent. It is 36 feet wide, and was traced by us to the length of 1000 feet, while there is not a doubt that it runs across the country to an immense extent, and probably belonging to the same range as the great bed of Iron ore that I discovered last year in Woodstock. Its direction would cause its line to strike in the township belonging to Williams College and Groton Academy, situate near Houlton, and it will probably be found to cut through this town. It is of great extent and evidently inexhaustible. Situated upon a great and navigable river, where a large flat boat may run to the St. John, there being but one obstruction at the falls, near its mouth, where there is a carrying place for half a mile, it is evident that this iron may be advantageously wrought, not only for the supply of our territory, but also for the inhabitants upon the St. John, for at Woodstock no less than $120 is paid for a ton of bar iron, and we can afford to supply them for a less price, with better iron than England can produce. This ore yields 53 per cent. of pure metal, and will give 60 per cent. of pig iron. It is the very best kind of ore to smelt, being easily mined, and just heavy enough to make a good charge for the blast furnace. Wrought by means of charcoal, it will yield iron equal in quality to the best from Sweden, and capable of being wrought into the finest kinds of cast steel.

Although England exports her own iron, which is of an inferior quality, she is obliged to depend upon Sweden and Russia for all the metal used in cutlery, and no less than $70 per ton is paid by them for the Swedish iron manufactured by means of charcoal.

Iron furnaces will hereafter be put in operation upon the Aroostook, and all the various branches of manufacture, which are the invariable attendants upon such a furnace, will be erected, wherever water power and other suitable conveniences are found. All the implements of husbandry that are made of iron or steel, may be furnished from this mine, which is one of the most valuable in the Union, not only on account of its extent, but also for its situation on the borders of a large river, amid interminable forests, which will supply charcoal for the mere labor of cutting and burning the wood.

I trust, also, that American enterprise and capital will not allow the Woodstock mine to remain a buried treasure, for there is in that town an inexhaustible bed of iron ore, of the best quality, exactly like that upon the Aroostook which yields no less than 53 per cent. of pure iron.

Near our frontier, close to a United States military post, as I before observed, this bed is of national importance, and should it be found to cross our boundary, as I doubt not it does, then it would be one of the best localities in the Union for the establishment of a national foundry of cannon and small arms.

Let our enterprising citizens consider well the importance of this proposal, for not only will the locality become property of immense value to the State and the Union, but the various branches of wholesome industry, connected with the manufacture of iron, will invariably be found to enrich and improve the condition of all classes of persons concerned. If we are to have railroads and great agricultural improvements, let us at least make our own tools and iron bars for the purpose, and not depend upon foreign countries for most important instruments.

Should it come to pass hereafter, that difficulties may arise between Great Britain and this country, resulting in a declaration of war, would it not be of immense importance to us, to become disfranchised from our dependance upon their foundries, so as to be able to manufacture at least our own weapons of defence? Maine should learn to depend upon her own resources, and such resources she possesses in equal extent with any other country in the world.

Lead ores have been found in several parts of the State, but not in very large veins. The Lubec mines appear to be the most valuable, and may doubtless be wrought to advantage.—Some additional exploration has taken place during the past summer, and it was found, as I had indicated, that the veins widen as they descend. The prospects of the individuals concerned appeared very propitious, until the embarrassments of trade caused a stoppage of their operations, in common with almost every enterprise of the kind in the country.

Besides lead, zinc and copper ores, described as occurring at Lubec, an ore of bismuth has been found, which was analyzed by my friend A. A. Hayes. This ore may be wrought for making soft solder, used by the workers in tin-plate, and it may also be used as a component of type metal.

A small vein of lead and zinc ores has been discovered in the town of Parsonsfield, but not of sufficient magnitude to be profitably wrought. It is, however, an indication of the occurrence of those ores in the vicinity, which should not be overlooked.

Manganese occurs abundantly scattered in the soil of Maine, and in several places forms beds of considerable thickness. In Thomaston, upon Dodge's Mountain; Bluehill, on Osgood's farm; Paris, upon Tuel's estate, and in numerous other places, there are considerable masses of the black oxide of this metal. It is used for bleaching, and for the preparation of oxygen, also for the destruction of vegetable matter in the glass furnace, and for giving a violet color to ornamental glass. The silicate of manganese, composed of silex and the prot-oxide of manganese, with a little iron, all chemically combined, occurs in an enormous bed upon Bluehill Mountain, but although this mineral is so abundant, I have not yet found out any profitable method of using it in the arts; but as nothing is made in vain, I doubt not that uses will hereafter be found for it, if none exist in the present state of our arts. It forms a bed 36 feet wide, and of great but unknown extent.

Tungsten is found, in combination with iron and manganese, in the mineral called wolfram. It is considered, universally, an indication of tin. This mineral I found near the tide mills at Bluehill, in company with another mineral which also occurs in tin mines—the sulphuret of molybdena. Tungsten is used in porcelain painting and enameling, and this, with some chemical applications, are the only uses known for this substance.

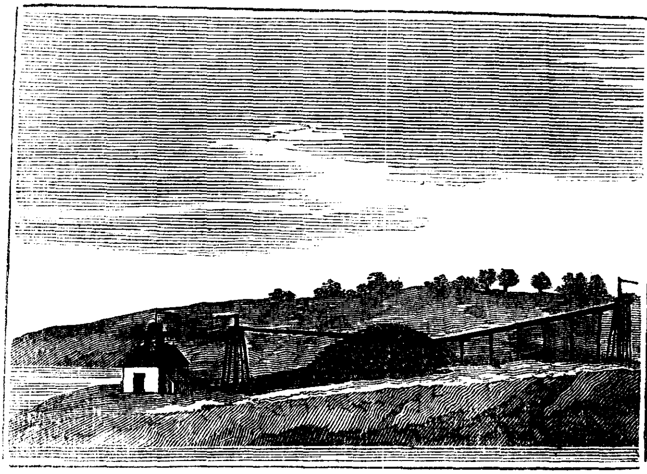
Arsenical iron occurs abundantly in Maine, forming veins in the granite, sienite, and greenstone trap-rocks. This mineral is composed of 46 per cent arsenic and 54 per cent iron, and may be used for the purpose of manufacturing the white oxide of arsenic, which is used in the making of shot. There are considerable veins of this ore at Bluehill, Thomaston and Newfield. It is frequently mistaken for silver, and sometimes for tin ore. When it is roasted in close vessels, metallic arsenic sublimes; and if atmospheric air is admitted, the metal oxidates as it rises, and forms the white oxide, or arsenious acid, a substance well known as a poison. Arsenical pyrites, or the sulphurets of iron and arsenic, also abound, and they occur in veins in granite rocks. On Davis farm, in Newfield, I observed that the rocks dug out in sinking a well, were filled with an infinity of veins of this mineral, and since it decomposes when exposed to the joint action of air and water, sulphuret of arsenic being formed, it may not be altogether safe to make use of water in contact with it, since this mineral is slightly soluble in water, and is poisonous. It can be easily imagined that a complicated case of medical jurisprudence might grow out of an occurrence of this kind, and I beg leave to call your attention to the subject, on that account. I should certainly feel very reluctant in making use of water constantly flowing from rocks charged with arsenic; and although I do not know of any case of poisoning, from such a cause, it is still possible that they may have occurred, unknown even to the sufferers.

Iron pyrites, or the bi-sulphuret of iron, is one of the most abundant minerals in Maine, and is frequently mistaken for gold or silver, according to the color it presents. It may be readily distinguished by its crystaline form, which is that of a right square prism, nearly approximating the cube, and by its chemical characters, which are readily tested. When it is struck with a hammer, it is easily crushed into powder, which serves to distinguish it from native gold or silver, which are malleable. When thrown on red hot iron, or upon burning coals, it gives off an odor of sulphurous acid, and the powder left behind is magnetic, so that it will be at once taken up by a magnetic bar or needle. This mineral is composed, in 100 parts, of

Sulphur	46
Iron	54

When it occurs in large quantities, it is valuable, and is used in the manufacture of copperas or sulphate of iron, which substance it forms by spontaneous decomposition, but more readiily if slightly roasted by fire and then treated with water.

The pyritiferous slates of Maine are exceedingly rich in this mineral, and may be made to form both copperas and alum. It should always be observed whether the slate contains magnesia or not. If it does, it will act as an almost insurmountable obstacle in the manufacture of alum, since a large quantity of sulphate of magnesia is formed, which renders it difficult to manage. On Jewell's Island there is an establishment for the manufacture of these articles, and there, the rock containing a considerable proportion of talc (a magnesian mineral) is found to decompose very slowly, and it is not yet ascertained whether the work can be profitably carried on.



Copperas and Alum Works on Jewel's Island.

In Brooksville, opposite Castine, there is a very rich deposit of pyritiferous slate, which may be profitably wrought for copperas and alum. The slate is of the argillaceous kind, and the pyrites is most beautifully and advantageously distributed, it being in layers alternating with the slate, which appears on its cross fracture like alternate leaves of silver and black paper, laid one upon the other. It contains sufficient pyrites to allow of a slight roasting so as to render it easily decomposable. I should think that this rock would give nearly its weight of crystalized salts, and hence the locality is evidently of great value.

When copperas can be made on the sea-coast, advantage may be taken of it to manufacture several other chemical products. Thus the sulphate of iron, (copperas) will decompose sea salt, and form sulphate of soda, which may be crystalized out, and then decomposed by the action of carbonate of lime, when it will give carbonate of soda, an article largely in demand for glass-making, and for the manufacture of soap.

Establishments of this kind have been set up in England, where, I understand a patent has been granted for the process.

In order to manufacture these salts from pyritiferous slate, we have first to break the ore into small pieces, three or four inches in diameter, or even of smaller dimensions. A large heap of it is then piled up on an inclined plane, made of hard clay, and a little fuel is put into the midst, and fired so as to heat a portion of the ore. The fire soon spreads through the mass, and if a little water is pumped upon it, it burns with increased activity, and the operation goes on rapidly. Then as the decomposition proceeds, more water is poured on, and it takes up the saline matters formed, and runs into a vat at the foot of the inclined plane, from which it is re-pumped upon the heap until the solution is saturated, when it is allowed to run into another vat where the sediment subsides, after which the liquor is boiled down and crystalized. The copperas is separated in crystals, and alum is formed from the remaining liquid, by adding some sulphate of potash. It is yet uncertain whether the Jewel's Island works will prove advantageous to the parties concerned, since the ore is rather poor, but there are many other localities where profitable operations may be carried on.

In case war should take place, we shall be able to extract all the sulphur required in the manufacture of gun-powder from pyrites, and should then be independent of the volcanoes of the Mediterranean. During times of peace, we can obtain sulphur at a lower rate from abroad, than we should have to expend in extracting it from this mineral, for when that substance is produced by natural operations, it is always much cheaper than it can be prepared by the hand of man.

AGRICULTURAL GEOLOGY.

GEOLOGICAL ORIGIN, DISTRIBUTION, CHEMICAL COMPOSITION AND CAPABILITIES OF SOILS.

Considering the vital importance of a correct knowledge of the science and art of Agriculture, upon which man depends for his daily bread, we shall willingly avail ourselves of any information that may throw light upon the principles, by which we are to be guided in practical operations.

It cannot be concealed that agriculture in this country is far below the standard attained in Europe, and that by their more scientific methods, the French, German and Italian farmers are enabled to raise larger crops, so as to supply us with many articles of agricultural produce, at a lower rate than we have been able to grow them upon our own soil, and this too has been effected by people whose soil costs vastly more than ours.

It is well known, that for several years past, large quantities of wheat, barley, indian corn and beans, have been imported into this country from France, Germany, Venitian Lombardy, Tuscany and Egypt, while at the same time, orders have been sent out from France for the purchase of our refuse bones; and the bone black of sugar refineries—substances used in that country for improving the soil. Thus, strange as it may seem, the French farmers send out to this country for manure, and supply us with bread, while many remain ignorant of the value of those very substances so eagerly sought for by our foreign brethren!

European science has been brought to bear upon the art of agriculture, and hence the improvements are rapidly progressing there; while we have as yet done but little towards the developement of this most important of arts.

I know that many intelligent farmers decry "book farming" as useless, and their remarks are certainly worthy of our attention, and we may perhaps remove their objections. Good books on this subject record the experience of many excellent practical farmers, and concentrate all the information that is scattered in various parts of the world; while at the same time they give general rules by which we are to be guided in practice. Where then is the objection that has been raised against such knowledge? It will be found that there are few such books in existence, although there are materials enough on record to furnish a good treatise, and those books that have appeared, are deficient in some of the most essential particulars, or they are so technical that those who are unacquainted with the elements of science cannot understand them. There are also imperfections in the certificates and rules, owing to no analysis having been made of the soils in question.

So also our own farmers are unacquainted with the composition of their own soils. Hence we account for the uncertainty of the results obtained by those who make trials of new methods in farming, and we ought not to be surprised at their frequent failures.

If, however, all the conditions of the problem were understood by both parties, farmers would readily join hands with their scientific co-laborers, and the art of agriculture would soon become as certain as any other art, while, by the application of scientific principles, the business would become of a more exalted character, and assume its true rank in the consideration of all men.

In order to make rational experiments in farming, it is essential that the composition of the soil should be known, and then we can act understandingly in our operations. In order to amend a soil, that knowledge is absolutely necessary, otherwise we might destroy its fertility, by the processes intended for its amelioration, and thus be subjected to disappointment and chagrin.

Mineralogy, geology and chemistry come to our aid, and serve to indicate the nature of various soils, while sure indications are readily discoverable for the amendment of those which are sterile.

Agriculture is of so great importance to the community, that we should not allow our knowledge of it to rest upon mere empyricism. It ought to be exalted to the rank of a true science, and then it will become one of the most honorable, as it is one of the most useful of arts, and even the most highly educated men will then be proud to rank as scientific farmers.

Let us now examine the subject more in detail, and ascertain how much light we may obtain from the science of geology, that may serve to guide us in our researches.

We have first to consider the geological origin of soils.

Every attentive person must have observed, that solid rocks, exposed to the combined action of air, water, and different degrees of temperature, undergo decomposition and disintegration, so that they crumble into powder, and that some rocks decay more rapidly than others, owing to their structure, or mineralogocal composition. If a rock is porous, or stratified in its structure, water infiltrates into it, and on freezing, expands with such power, as to tear the surface of the rock to pieces, so that it readily crumbles. When fire runs through the forests, it heats the surface of the rocks, and by the irregular expansion produced, they are shivered into fragments.

The action of running water and friction of stones, also serve to grind the rocks into powder, by attrition of their surfaces, and the detritus is borne along by the streams, and deposited in low lands, or along their borders.

When a rock contains iron pyrites, or sulphuret of iron, that mineral, by the action of air and water, decomposes, and forms copperas, or sulphate of iron, and the sulphuric acid of that substance acts powerfully on some of the ingredients of the rock, and causes its rapid decomposition. Any person, who has been on Iron Mine Hill, in Gardiner, will fully understand how rapid is this operation, and may there see its results. The oxidizing power of the atmosphere, also, acts powerfully upon the surface of those rocks, which have for one of their components, the prot-oxides of the metals, iron and manganese, and as those oxides take up another portion of oxigen, they increase in bulk, become brown or black, and the stone falls into fragments.

These are a few of the causes now in action, which modify the solid crust of the globe, and it appears that their effects are far more important, than we might at first imagine. Whoever looks upon the muddy waters of the Mississippi, Ganges, Po, the Rhine, and the Rhone, or reads the calculations respecting the enormous quantity of matter brought down from the mountains by those rivers, will at once appreciate the modifying influence of those causes which are continually wearing down the solid matter that forms the mass of our mountains.

Geology teaches us, that such causes were formerly in more powerful operation, and that the ancient world was, from its infancy, subject to violent catastrophes accompanied by powerful inroads of the sea; oceanic currents and tumultuous waves having for many successive periods rushed over the land, and beaten the loftiest crags of the highest mountains. We should then naturally expect, that the earth would present ample testimony of the action of these powerful causes of disintegration of the rocks, and we do observe that a large portion of the loose materials upon the surface, bear proofs of aqueous action and mechanical abrasion. By those ancient convulsions, the detritus of the solid rocks was prepared, and forming the various soils, which we observe, the earth was rendered capable of yielding its rich stores of vegetation, on which a large proportion of the animated creatures depend for their food. From the foundation of the everlasting hills, the CREATOR began to prepare the world for the habitation of his noblest creature, man, and converted a portion of the solid rocks into soils, which were given as the field of human labor, and to the progenitor of our race it was commanded that he should till the soil.

If we take up a handful of earth, and examine it attentively, we shall readily discover such mineral ingredients, as denote the rocks from which it originated. Thus we discover in a soil numerous spangles of mica, grains of quartz, and white or brown earthy looking particles, which are felspar; besides which, we remark a considerable portion of fine brown powder, which being examined with a microscope is found to be composed of the same minerals, more finely pulverised, and mixed with the brown oxide of iron. It will be at once understood, that such a soil arises from the disintegration and decomposition of granite rocks, and that the oxide of iron was derived from the pyrites, or the prot-oxide of iron, contained in that rock.

A soil arising from the decomposition of gneiss, possesses similar characters, only the mica is more abundant.

Soils from mica slate are made up of a large proportion of mica, mixed with grains of quartz.

Sienite, and hornblende rock, produce a dark brown soil, in which there is but little quartz, and a great deal of felspar, and decomposed hornblende.

Greenstone trap-rocks form by their decomposition a brown soil, which contains pieces of the undecomposed rock, but the component minerals in the soil itself, are rarely so distinct as to be discoverable. This soil is a warm kind of loam, soft and spongy, easily compressed into smaller dimensions by the pressure of the hand, but not adhesive like clay. It is peculiarly adapted to the growth of potatoes, and is a luxuriant soil for most of our ordinary produce.

Slate-rocks form a soil of a blue color, in which numerous undecomposed fragments of the rock may be discovered. When transported by water, it is deposited in the state of tough blue clay.

Limestone forms various colored soils, according to the nature of the impurities it contains. They are generally of a light yellowish brown color, from admixture of a certain proportion of oxide of iron. This is especially the case with those soils derived from the argillo-ferruginous limestone.

Calcareous soils, if they are rich in carbonate of lime, may be distinguished by their effervescence with acids, and the quantity of this substance may be estimated by the loss of weight which indicates the proportion of carbonic acid, that has been expelled, and since the carbonic acid always occurs in the ratio of nearly 44 per cent. to 56 per cent. of lime, it is easy, by a proportional calculation, to ascertain the quantity of that mineral in the soil.

It more frequently happens, that there is so minute a quantity of carbonate of lime in the soil, as to require a minute chemical analysis for its detection, and few farmers have either leisure or means for such an operation. Examples of such analyses will be presently laid before you.

Talcose slate-rocks, when decomposed, form a light brown soil, in which particles of the rock are discoverable, and on analysis, a considerable quantity of the silicate of magnesia is found, which is one of the chief components of talc.

Red sandstone, on disintegration, forms soil composed almost entirely of grains of quartz, with oxide of iron, and clay, with a few spangles of undecomposed mica.

Grau-wacke, or conglomerate, when disintegrated, produces a light grey soil, full of smooth rounded pebbles, which originate from the undecomposed components of the rock.

Red porphyry is very slow of decomposition, and forms a a bright red fine powder, filled with angular fragments of the rock.

I have thus distinguished and described the appearances which characterise those soils that arise immediately from the decay of solid rocks, and various characteristic specimens of each variety may be seen in the cabinet arranged for the use of the State.

Let us next consider how soils are distributed on the earth's surface, and see how their qualities depend upon their situation.

In various sections of this report may be seen recorded the proofs of diluvial transportation of rocks, far from their parent beds, and we have every reason to believe, that this removal was effected by a tremendous current of water, that swept over the State from the North 15° West, to the South 15° East, and we have adduced in testimony, that such was the direction of that current, numerous grooves, furrows or scratches upon the surface of the solid rocks, in place, and have shown conclusively, that the rocks which we find thus transported, proved to be portions of ledges situated to the North of the localities where their scattered fragments are found.

It is a matter of surprise, that such enormous masses of rock should have been moved so far by an aqueous current; but when it is remembered, that a rock does not weigh but half so much when immersed in water, as it does when weighed in air, owing to the support given it by the water around ; and when we reflect on the fact, that a rock is still more powerfully supported under the pressure of deep water, it may be conceived, that if a flood of water did once rush over the land, it might have removed large and weighty masses of rock, such as we find to have been the case.

From the observations made upon Mount Ktaadn, it is proved, that the current did rush over the summit of that lofty mountain, and consequently the diluvial waters rose to the height of more than 5000 feet. Hence we are enabled to prove, that the ancient ocean, which rushed over the surface of the State, was at least a mile in depth, and its transporting power must have been greatly increased by its enormous pressure.

It will be readily conceived, that if solid rocks were moved from their native beds, and carried forward several miles, that the finer particles of soil should have been transported to a still greater distance, so we find that the whole mass of loose materials on the surface has been removed southwardly, and the soil resting upon the surface of rocks, in place, is rarely, if ever, such as results from the decomposition of those rocks, but was evidently derived from those ledges which occur to the Northward.

If an attentive observer examines the soil in the city of Portland, he will discover, at once, that it is made up from the detritus of granite and gneiss rocks, while the ledges in that city are wholly composed of the argillaceous, talcose, and mica slate-rocks, and granite and gneiss occur in great abundance to the Northward.

All the markings on the surface of the rocks, and the scattered boulders of granite and gneiss, which abound in that soil, indicate its origin to have been in the North 15° or 20° West. I merely quote the above locality, on account of its being a spot were most persons will have occasion to examine the facts stated. The various sections of the State present ample illustration of the same fact, and every one who will take the trouble, may convince himself of its reality.

The tertiary deposits of clay, sand and marine shells, were evidently produced in tranquil water, since their strata indicate, by their situation, structure and beds of shells, that the clay was gradually and slowly deposited, allowing time for the propagation and growth of the various shell fish in its several layers. Not so was the diluvial matter deposited, for we find it to bear marks of sudden and violent transportation and deposition, the various pebbles, boulders and erratic blocks of stone being mixed in great confusion. I have formerly mentioned a locality, in Bangor, near the court-house, where, it would seem, there are proofs of a gradual subsidence of the diluvial current, the various particles becoming smaller, as we ascend the embankment, until we come to fine clay, which must have subsided from tranquil water.

We observe, then, that the tertiary deposits were cut through by the diluvial waters, which have excavated deep vallies, and heaped up long ridges called horse-backs, and the general direction of these vallies and ridges, coincides with the direction formerly indicated, as the course in which the current swept.

Although we are informed in the scriptures, that the Deluge was ordained for the punishment of wicked men, it is certain, that there was mercy mingled with this dispensation, for the soils were comminuted, transported, and mixed in such a manner, that their qualities were improved, and rendered more suitable for the growth of plants, so that the surface of the globe was not only purified, but new and more fertile soils were prepared for coming generations, who literally *reap* advantage from the Deluge.

Besides the ancient aqueous current, we see every day the action of water modifying the surface of the globe, transporting fine particles from the mountain-side, and depositing them in the valleys and along the margin of running streams. Especially during freshets, when the rivers burst their narrow confines, and spread out over the intervales, do we see rich deposits formed of *alluvial soil.*

Such currents, arising amid decomposing vegetable matters, transport an infinity of fine particles of such matter, and deposit it with the various earthy ingredients, which form our richest meadows, and luxuriant intervale soils. Thus are formed many of those bottom lands, which occur along the river courses of the Western States, and the banks of rivers in Maine, under similar circumstances, are found to be composed of like soils.

A river, coursing its way amid various rocks, carries down and deposits fine particles of every kind, which it meets with in its way.

If the rocks above are limestone, we shall have calcareous soil brought down and deposited by the river. So on the banks of the Aroostook, we find a rich alluvial soil, equalling in fertility the famed regions of the Western States, and capable, even under a less genial clime, of producing crops of wheat and other grain, fully equal in abundance with any soils of which we have any records.

That river, with its wide and fertile intervales, is destined to become the granary of the North, and whenever the policy of the State shall complete the roads, and offer facilities for settlement, we shall turn the tide of emigration, populate a fertile district, and I trust forever place that portion of Maine beyond the power of foreign aggression.

Soils are powerfully modified by the circumstances under which they are placed, and it will be useful to consider, how this may be affected by their order of super-position.

I have had occasion to examine two portions of a field, in the town of Saco, where the superficial soil was uniformly composed of a light brown sandy loam, and in one part of that field, the Indian corn growing upon it, was tall and luxuriant, while on the other, it was short and feeble. The several parts of this field were treated with the same kind of manure, and planted with the same grain, in the same manner, so that their circumstances were apparently alike. On searching into the cause of this difference of fertility, it was discovered, that in the luxuriant part of the field, there was a deposit of clay, from one to two feet from the surface, while in the other, it was four feet below. Hence it would appear, that in the first instance, the clay served as a retainer of moisture and of manure, while in the other, these indispensible requisites for healthy vegetation, sank beyond the reach of the corn. The remedy was at once apparent, for it was only necessary to mix clay with the barren soil, to make it retentive.

It frequently happens, also, that we observe a farmer toiling upon a tough clayey soil, which it is in vain for him to attempt to keep loose, for with the first rain, the clay is washed down into a slimy paste, which by the ardent sun-beams, is soon baked into an impermeable mass, which prevents the free germination and growth of the seed. Now, hard by, occurs a hill of sand, that nature seems kindly to have placed at his disposal, and he is only required, after ploughing his clay soil, to cart a quantity of sand into the furrows, and harrow it in, in order to produce a soil of good texture, which may then be manured as required, and will produce well. In such cases, the sand may be added every year, until there is a sufficiency. Such soils are highly retentive of manure, and are worth the labor of reclaiming, and I should denote the neighborhood of Bangor, as a suitable field for such improvements; and I doubt not, that the market of that city would, by its demand, amply repay the labor and money expended.

CHEMICAL COMPOSITION OF SOILS.

From the mineral ingredients we may form some idea of the chemical nature of the soils, but since there may be many matters mingled, in the state of fine powder, not capable of discrimination by the eye, and those very substances may be the cause of its peculiar properties, it becomes necessary to resort to the aid of chemical science, and analytical art for their detection.

It is a strange and almost unaccountable fact, that while we have the most minute and delicate analysis of rare and curious minerals, chemists have either neglected to ascertain the composition of soils, or have satisfied themselves with the most crude and careless examinations, that do not answer the purpose intended.

The late illustrious chemist, Sir Humphrey Davy, was called upon by the British Agricultural Board, to give a course of lectures upon the chemical composition of soils, and the modes of amending those which were sterile, and his lectures contain nearly all the information attainable by the farmer respecting the composition of soils. Although Davy's Agricultural Chemistry is as good an essay as we had a right to expect when the art of chemical analysis was in its infancy, and a vast deal of valuable information is contained in it, still the analyses are so imperfect, that they neither serve to distinguish one kind of soil from another, possessing altogether different properties, nor serve to indicate such ameliorations as are required. When Davy acknowledges that his errors in the analyses amount to 5 or 10 per cent, we must feel convinced that either sufficient care was not taken, or that the instruments of analysis which he used were not sufficiently exact. We shall see in the analyses that I shall present, that an error of even one or two per cent, would cause an utter failure in respect to the information desired, and shall at once perceive the importance of the most scrupulous exactness in the operation.

Chaptal has also given us some chemical essays upon agriculture, but the analyses of soils are generally borrowed from the work of Davy. It contains, however, much valuable information respecting several different departments of the art, and a special treatise upon the cultivation of beets and making of sugar. This essay has been translated into English, and is worthy of the farmer's attention.

The chemical analysis of soils is one of the most difficult and tedious operations the chemist is called upon to perform, and it seldom happens that the processes are completed within three weeks from the time they were commenced. Hence the necessity of my carrying on a number of analyses at a time, in order to be able to present them in season for this Report. By operating on three or four specimens at a time, the chemist is kept continually employed and an extensive supply of apparatus is put in requisition, since the processes multiply with astonishing rapidity, and soon every vessel in the laboratory finds occupation, and it is necessary to label each glass, funnel or filter as he proceeds. Attempts have been made to render the art of chemical analysis easy, so that farmers might be able to do them for themselves, but such attempts have been entirely abortive, for it would presuppose a knowledge of chemical science and manipulation rarely if ever in possession of any but professed chemists, and it would be idle to put instruments and reagents into the hands of those who do not know how to use them. It would certainly be very useful to the community, if our agricultural bretheren would establish a college or institute, devoted exclusively to those arts appertaining to agriculture, and such institutions will ere long be founded in each of of the States, for we begin to see and feel the importance of a good scientific education among the farmers throughout our country, and our young men ought to posses advantages so desirable and important for their welfare and prosperity. It is evident that small schools will do no good, since they would not be sufficiently well endowed to command the services of scientific teachers, and hence if the attempt is made, let there be one large and well endowed agricultural college in each State, connected, if found practicable, with the usual classical institutions, and forming a branch of each university. Many, who do not desire to spend years in the study of Latin and Greek authors, are still anxious to learn the elements of those sciences which appertain to their professions, and I have not the least doubt that a well ordered and scientific agricultural institute would prove one of the most popular and useful schools in the country. In such a college, mathematics, drawing, surveying, mechanics, architecture, chemistry, mineralogy, geology, zoology and the practical arts, each in their several departments, might be taught by study and lecture, while every practical operation should be learned by actual practice. I leave it to your good judgment to say if such an institution is not desirable, and if you desire its establishment you have but to say so and it will be done, and Maine will bear the palm of having founded one of the most useful institutions of the country.

MECHANICAL AND CHEMICAL ANALYSIS OF SOILS FROM MAINE.

Much information may be obtained by mechanical separation of the various particles of soil, and such I have made one of the preliminary steps in the operations of analysis.

Three different kinds of sieves were selected, the first of which has meshes $\frac{1}{12}$ of an inch, or one line in diameter, and is made of copper wire. The second is a sieve of nearly double the fineness of the above, having openings of the meshes $\frac{1}{20}$ of an inch. The third is a very fine gauze sieve, with openings not more than the $\frac{1}{50}$ of an inch.

By sifting the soil, we can then obtain four different divisions of the particles, which I divide into different grades, beginning with the coarse matter left on the sieve No. 1, and so on.

After these operations the next is to be effected by agitating the finest soil which passed the fourth sieve with a quantity of water, and then pouring off the suspended matter from that left at the bottom after $\frac{1}{2}$ minute's repose. This gives us two other degrees of fineness or the fifth and sixth divisions.

One thousand grains of each specimen was taken for each analysis, and each proportion of divided matter was weighed in the balance. For example, let us take a specimen of a soil from Maj. Stone's farm, in Waterford, taken from his luxuriant wheat field, six inches from the surface.

This soil is of a yellow loam of mellow texture and remarkably fertile, having on it a crop of wheat, which will probably measure more than 30 bushels to the acre. This soil had been limed four casks to the acre, and was also manured from the barn-yard to a small extent. One thousand grains divided as follows—

No. 1—does not pass the coarse sieve, and consists of gravel derived from granite rocks, sticks and roots. No. 1=175 grains.

Does not pass 2d sieve—fine sand and vegetable fibres. No. 2=240 grains.

Does not pass the third sieve—No. 3=20 grains.

Fine powder which came through the gauze sieve. No. 4 =565 grains.

No. 1=	175
2=	240
3=	20
4=	565
	1000

This fine powder, agitated with a pint of water, and turned off in 30 seconds, left fine sand. No. 5=249, matter not suspensible. Matter suspended, No. 6=316.

This will give an idea of a mechanical analysis of soils. These operations show the texture and relative fineness of the materials, which throws great light upon their peculiar properties.

Chemical Analysis of soil from Major Stone's farm, Waterford. One hundred grains of the finest powder, analyzed, gave the following results:

Water,	05.0
Vegetable matter,	14.0
Silica,	65.0
Alumina,	10.0
Oxide of Iron	2.0
Oxide of Manganese,	1.5
Phosphate of Lime,	1.0
Carb. Lime,	1.5
	100.0

This soil is remarkably productive, and is in a high state of cultivation.

Analysis of soil from the farm of Moses Emery, Esq., of Saco. This soil yields 40 bushels of corn to the acre. It is a yellow, sandy loam, and was evidently derived from granite rocks. One thousand grains, by mechanical analysis, give—The degrees of composition as per method above described—

1st, sticks and roots,	5
2d, coarse gravel,	13
3d, fine gravel,	40
4th, fine sand,	17
5th, fine powder, &c.	925
	1000

Of this fine powder there are—

Matter suspensible in water,	122
Matter not suspensible,	780
Vegetable matter which floats on the surface of water,	23
	925

Alluvial soil, Hooper's farm, Aroostook River. It is a fine yellow loam, very luxuriant and productive of wheat, potatoes, &c.

Mechanical analysis—

1st degree,	0
2d, vegetable fibres, and coarse sand,	4
3d, " " fine sand,	9
4th, very fine loam,	987
	1000

Chemical analysis gives the following results—

Water,	4.9
Vegetable matter,	4.0
Silica,	76.0
Alumina,	5.0
Per ox. iron and alumina,	10.9
	100.9

In 100 grains there are—

Insoluble matter,	77
Soluble "	23
	100

Soil of Phipsburg Basin, Dea. Hutchins' farm. Mechanical analysis on 1000 grains—

1st deg. of fineness, veg. fibres and pebbles,	50
2d " "	90
3d " "	40
4th " "	920
	1000

Chemical analysis of 100 grains—

Water,	6.5
Vegetable matter,	11.5

Silica,	60.0
Manganese,	4.0
Alumina,	11.0
Ox. Iron,	2.0
Lime,	1.0
Potash,	1.0
Magnesia,	3.0
	100.0

Analysis of soil from Dodge's Mountain, Thomaston. Dark red brown color; growth, black-oaks, grass, rye—luxuriant. Rocks around manganesian mica slate.

Mechanical analysis—

1st, particles of slate, pebbles and little pieces of manganesian slate,	206
2d silicious gravel,	175
3d, fine sand,	10
4th, very fine powder,	609
	1000

Chemical analysis on 100 grains of the fine powder—

Water,	6
Vegetable matter,	13
Silica,	51
Alumina and Magnesia,	15
Ox. Iron,	12
Manganese,	6
	101
Gain from moisture,	1
	100

Wiscasset. Soil remarkable for the excellence of its potatoes.

Mechanical analysis of 1000 grains—

1st degree of fineness, veg. fibres and sticks,	10
2d " "	10
3d " "	20
4th " " fine mould,	960
	1000

Chemical analysis on 100 grains of the fine powder—

Water,	4.0
Vegetable matter	10.0
Silica,	58.0
Alumina,	14.0
Magnesia,	12.0
Ox. Iron,	2.0
	100.0

Chemical analysis of fine alluvial soil, of an ash grey color, from the Oxbow, of the Aroostook river, not cultivated—

Water,	8
Vegetable matter,	5
Oxide Iron,	3
Alumina,	20
Silica,	61
Carb. Lime,	2
	99
Loss,	1
	100

Analysis of soil from Fairbanks's farm, Presq' Isle river, near the Aroostook; yellow loam, mellow, not adhesive; no stones in it; produces 35 bushels of wheat the acre.

Water,	4.0
Vegetable matter,	4.5
Ox. Iron,	4.5
Silica,	76.0
Alumina,	10.0
Carb. Lime,	1.0
	99.5
Loss,	5
	100.0

The black vegetable mould upon the surface of this soil contains 26 per cent of vegetable matter, and the remainder is yellow soil, like that above reported. This vegetable matter, when treated with boiling water gives 5 grains of vegetable extract which possesses the properties of *ulmine*.

Soil from Peter Bull's estate on the Aroostook river.

Mechanical analysis of 100 grains—

1st, pebbles,	525
2d, fine sand,	330
3d, " "	25
4th, fine powder,	130
	1000

CAPABILITIES OF SOILS—VEGETABLE PHYSIOLOGY.

It is evident that plants are not endowed with creative powers, and consequently are unable to produce any new elementary substances; hence the various substances which enter into their composition, must be derived from the air, water or earth. All the saline and earthy matters which they contain are readily traced to their origin in the soil; while the carbon, hydrogen, oxigen and nitrogen that exist in them, are elements which they draw from air, water, and the animal and vegetable substances used as manures.

The atmosphere is composed chiefly of the two gasses, nitrogen and oxigen, mixed together in aeriform solution, in the proportion of four-fifths nitrogen, and one-fifth oxigen, besides which gasses there is always a certain proportion of carbonic acid gas, amounting to $\frac{1}{10000}$ part, and variable proportions of aqueous vapor.

From the carbonic acid gas of the atmosphere, plants derive a large share of their carbon, which is the basis of all vegetable matter. Some of it is also furnished by the fermentation of vegetable and animal substances, which decompose in the soil, and this gas is either decomposed by the leaves of vegetables, or is carried into their roots by aqueous solution and absorption. All fresh growing plants decompose the carbonic acid of the air, take up its carbon, and exhale oxigen gas, and this operation goes on more rapidly while the sun shines upon them. In darkness, plants give out carbonic acid, but the quantity is relatively small, when compared with that which they absorb during the day. So that if a plant is grown under a bell glass, containing air mixed with this gas, the carbonic acid is soon removed, and replaced by pure oxigen.

Thus vegetation is continually removing a substance deleterious to man and all animals, and replacing it by pure vital air—a gas absolutely necessary for their respiration. This beautiful law of nature should never be lost sight of by the farmer, nor should he ever forget the relation which the green woods and fields bear to the healthfulness of the country.

Seed will not germinate, without the joint action of air, water, light and heat. Without these essential conditions, the germ remains, as it were, asleep for an unknown length of time. Seeds, taken from the tombs of ancient Thebes, in Egypt, where they had remained in a dry, dark and sequestered spot for more than three thousand years, were found still to possess their vital properties, and when planted in a botanical garden in London, sprang forth, to flourish in the present age. How long a seed, thus immured in darkness, shut out from all the causes which would produce germination or decay, would remain alive, is wholly unknown; but from the known facts respecting spontaneous rotation of crops and of forest trees, it would seem that the seed remain buried in the soil for enormous lengths of time, before the circumstances necessary for their putting forth, arrive. Dead leaves of the forest shut out light, and preclude, in some measure, the influence of the atmosphere, while the sombre foliage hangs over the soil, and serves, by its shade, as an additional cause preventing germination. Thus, I suppose, the seed, buried in the forests, remain dormant until the removal of the shade trees, or the burning of the leaves, gives free access to the causes requisite for germination and growth of the hidden plants; and we consequently perceive a new growth almost invariably follows the removal of the primeval forests. According to Decandole, plants exude from their rootlets certain substances, which have the property of eventually eradicating their own species, while they are not preventive of the growth of other plants; hence he accounts for natural rotation. It is probable, also, that one kind of vegetables may exhaust their proper nutriment, and thus render the soil incapable of supporting their kind, while there are other principles left, suitable for the support of different species. This subject is, however, the most obscure departments of vegetable physiology, and one which demands the labor of modern chemists and botanists. Thus much we know, that the conditions above stated are essential requisites to healthy vegetation, and that the soil must furnish certain substances not attainable alone from air and water. When we analyze a plant, we always find a certain quantity of silex, alumina, lime and potash, forming a large proportion of the ashes which is left on burning the plant. All these matters are contained in the soil, in greater or less proportions, and some of them are essential to the growth of the plants. The coating of wheat, rye and barley straw is silex, and gives the necessary strength and hardness to the stalk.

The analysis of the grain of wheat gives a large proportion of the carbonates and phosphate of lime, and we know that this grain only thrives upon a soil containing calcareous matter. It was long ago observed in Massachusetts, and is also seen in certain districts in Maine, that wheat straw grows very well, but the grain does not fill and present a plump and solid appearance, but looks wilted, and is not heavy. This was formerly supposed to be owing to the climate, but on more careful examination, it is found to arise from the want of lime in the soil. Many animal manures contain a little of this substance, and it accordingly appears, that where a farm is well manured, that wheat will grow well upon it, but a large annual expenditure is required for the purpose. It is observed, that all the grain regions of the country have soils more or less calcareous, and we find, that by adding lime to the soil, we may produce by art the material wanting; and it appears by the analyses here presented, and by the results of certain experiments, which have been made in France, and repeated here, that a very minute proportion of lime is amply sufficient for the purpose. Thus one or two per cent of carbonate of lime will answer the purpose, and this small quantity costs so little, that any farmer can well afford to apply it to the soil. Indeed, I do not see how he can afford to do otherwise, since he will be a loser, and his more skilful neighbors will be enabled to supply the market, while he will not be able to recover his seed.

It is a great mistake to suppose, that wheat will grow in any soil, for I know, that in many instances, the crop raised the past season, which has certainly been very propitious, did not equal in value the seed sown; and these instances all occurred where the soil was destitute of lime, and was not largely manured.

Unless you wish to waste your labor upon barren and unproductive fields, attend carefully to the nature of your soil, and supply those elements which are wanting, in order to render it fruitful.

When lime is moistened with water, it becomes hot, swells, and falls into a bulky white powder, called by chemists the hydrate of lime, it being composed of water combined with that substance in a solid state. This powder, if the lime is of good quality, will amount to nearly three times as much as before it was slaked, so that one cask of lime will fill three casks with the hydrate, or water-slaked lime. If, on the other hand, the lime is exposed to the action of the air, it will attract carbonic acid gas, and become air-slaked, which operation re-converts it into its original chemical state. The hydrate also attracts carbonic acid from the air, and is likewise converted into the carbonate, which will weigh nearly twice as much as the quick lime, from which it is made.

I mention these evident facts, in order to assure the farmer, that when he buys a cask of lime, it will make about three of the article which he uses as a manure, and consequently, that it is not so expensive as he might imagine, since it increases in bulk, and will cover a considerable surface. Moreover, by a skilful management, the farmer may, by the use of lime, form a vast number of valuable composts, and may destroy, or not, as he pleases, the seeds and insects in his compost or barn manure. It also has the power of decomposing animal and vegetable substances, the extent of which operations, a skilful hand can regulate at will, and a great variety of valuable saline compounds, the most active of manures, may be formed. There are are many cases, also, where the combining power of this substance can be taken advantage of, in the neutralization or removal of deleterious matters, and by judicious management, those very principles may be converted into valuable manures.

The following table shows the relative strength of several different kinds of limestone found in Maine during the past season; 100 grains being the weight of each stone analysed.

Locality.	*Kind of rock formation.*	*Insoluble matter, per cent.*	*Carb. Lime per ct.*	*Quantity pure Lime pr ct.*
Buckfield,	Beds in gneiss resting on gran. rocks,	49.	51.	28.71
Winthrop, Mr. Boll's farm,	" "	43.	57.	31.94
Hallowell,	" "	42.	58.	32.60
Newfield, impure kind,	" "	26.	74.	41.10
" purer, Davis' farm,	" "	19.	81.	45.41
Norway,	" "	38.	62.	34.80
Bluehill,	" "	31.	69.	38.70
Paris,	" "	18.	82.	46.12
Whitefield,	" "	5.	95.	53.50
Union,	" "			

It is a common practice among farmers to make use of peat, pond mud, or muck, as they call it, and I have observed instances in which it was evident that the soil was greatly injured by its application. In one instance, I observed in Waterford, that a portion of the field on which this substance was placed, presented a dwarfish and sickly yellow crop of Indian corn, while that part of the field, not treated by it, was covered with a most luxuriant and healthy growth of the same corn. The operation was tried experimentally, in order to ascertain the value of peat alone as a manure.

If it had first been made into a compost, with animal manure and lime, it would have presented very different results. Lime alone on peat merely renders its acid properties inert, and then it answers pretty well as a manure. But if laid down in layers with barn-yard manure, night soil, dead fish, or any other animal matter, and then each layer is strewed with lime, a most powerful fermentation will take place, and a vast quantity of ammonia will be disengaged, which combining with the ulmic acid of peat, will form ulmate of ammonia, a most powerful manure. Carbonate of ammonia, and many other salts, will also result, which convert the whole mass into the very richest kind of manure, forming what may be properly called a universal compost.

If the farmer is desirous of destroying the seeds and insects in barn-yard manure, let him heap it up in alternate layers, with fresh quick-lime, and the heat generated will effectually destroy them. This operation produces a number of soluble salts, and therefore it should only be done, where the manure is soon to be used, for the rain would remove them in solution.

If a soil is charged with sulphate of iron, it is best to use quick-lime in powder sprinkled on the surface of the soil, for its action is the more rapid and powerful. Generally, however, it is proper to slake the lime with water, and then to expose it freely to the air, in case it is to be sown broad-cast, so that it may become carbonated, which renders it more permanent, it being less soluble in water.

In general, it may be stated, that about four casks of lime are required for each acre of land, and according to the experience of M. Puvis, this quantity, in many cases, was found amply sufficient. If the soil is loose and sandy, without any clay bottom near the surface, it is evident that annual renewals will be required, until the desirable quantity is obtained.

The following tables shew the amelioration of soils in France where liming has been very successful; and where it has been found that 3 per cent of lime in the soil, was amply sufficient to render it extremely luxuriant. It will also be remarked that the beneficial effects of this treatment were even more strongly marked on the rye crops than on those of wheat. It is found also, that lime succeeds best when used in a compost of animal and vegetable matter, and where this method is pursued, the soil becomes annually richer, instead of being exhausted.

	Table of product of the domain of La Croisette.				*Table of product of the domain of La Barronne.*			
YEARS.	RYE.		WHEAT.		RYE.		WHEAT.	
	Seed.	Product.	Seed.	Product.	Seed.	Product.	Seed.	Product.
1822	110	600	24	146	110	505	22	180
1823	110	764	24	136	110	643	22	138
1824	110	744	24	156	110	662	24	149
1825	107	406	27	251	102	398	32	252
1826	106	576	28	210	110	612	32	187
1827	100	504	30	249	107	546	34	204
1828	90	634	36	391	98	696	38	243
1829	82	538	48	309	84	608	40	268
1830	60	307	60	459	91	389	59	374
1831	78	350	40	417	92	411	49	295
1832	55	478	68	816	70	512	80	649
1833	61	529	52	545	75	511	51	471

Marl may be used in the same manner as air slaked lime, and it is found to possess similar properties. Sea-shells may be used when broken to pieces by the action of fire, or by frost, and great benefit is gained by such a dressing. Shells owe their fertilising properties to the carbonate of lime, of which they are chiefly composed, but their compact texture requires to be broken down in the manner alluded to.

Burnt bones contain a small quantity of carbonate, mixed with a large proportion of the phosphate of lime, and may be advantageously used. Bones ground to powder have also a very powerful and desirable influence, forming one of the most valuable top-dressings with which we are acquainted. The refuse bone black, from sugar refineries, is also extremely powerful, and is one of the warmest and strongest manures known. It is highly prized in France, and I have formerly mentioned the fact, that orders were even sent to this country for this article. It may be made into a compost with other matters, since it is too strong to be used alone.

Gypsum is said to operate well as a stimulant to vegetation, and acts powerfully where the the soils are calcareous. In Pennsylvania, it is sown broad-cast upon their limestone soils, and operates powerfully, favoring the growth of grain and grasses. In Maine, it is the general opinion of farmers, that this mineral does not succeed upon the sea-coast, while it answers a good purpose in the interior of the State. I am not yet prepared, however, to report upon the subject, since I have not been able to gather the requisite number of facts.

I will venture to say, however, that gypsum will prove an advantageous dressing to the soils near Houlton, New Limerick, and along the whole course of the Aroostook, while, if it should be required, the Tobique river, opposite the mouth of the Aroostook, contains upon its banks an inexhaustible supply. It will, however, seldom be necessary for many years to apply any manures to the Aroostook soils, for the farmers there only complained that the soil was too rich at first, and when reduced by several years cultivation, was more easily managed. I have no doubt of the truth of this observation, for upon Mr. Fairbanks' farm, on that river, I observed gigantic wheat stubble, one straw of which measured $1\frac{1}{3}$ inch in circumference, and Mr. F. remarked that new crops were frequently *laid* by their weight, before they were ready to reap.

I have no doubt, that in the course of time, it will be found advantageous to burn the Aroostook limestone, for the treatment of the soils, where they are devoid of it, and every advantage is there presented for this purpose.

The limestone of Newfield, Norway, Paris and Buckfield, may be advantageously used for manure, and can be burned by means of peat or wood. On the sea-coast it will be more economical to purchase Thomaston and Camden lime, unless it should be found, that lime-burning can be carried on on a large scale by means of peat or hard coal.

There are so many localities of peat in Maine, that I hardly have thought it necessary to describe them, but I would, however, point out the localities.

1st. On the rail-road route in Bangor.

2d. At Bluehill.

3d. Near the Marsh quarry in Thomaston.

4th. In the town of Limerick, in York County.

5th. In the town of Waterford, in Oxford County, on the Coolidge farm.

These localities are among the most abundant, and may be most advantageously wrought for fuel, which may be used for the burning of lime and for domestic use, besides which it may be converted into a powerful manure, adapted admirably for loosening and enriching clayey soils.

Artificial meadows formed upon the surface of a peat bog, are always exempt from drought, and they are remarkably fertile. They may be made by carting soil upon them, and will amply repay the labor. Any person who is desirous of seeing a fine example of an artificial meadow of the kind I have mentioned, is referred to the rich farm of Benjamin Bussey, Esq. Jamaica Plain, Roxbury, Mass., where that enterprising agriculturalist has formed an almost evergreen meadow, of the kind alluded to above.

I may remark in general, that all the soils between Bangor and the mouth of the Kennebec, evidently need liming to greater or less extent ; and the vicinity of Richmond, Gardiner, Vassalborough, Unity and Dixmont, evidently would be highly improved by its judicious application.

When we have learned by chemical analysis, the composition of the most remarkable soils of the State, we may be enabled to give specific directions for their amelioration.

Much light may be gained respecting their relative fertility, by the agricultural returns made under the orders of the Legislature, and if due attention is paid to the filling of the blanks, sent out to the treasurers of the various towns, we shall have an admirable statistical view of the relative value of the various soils in different parts of the State.

It will be useful to send out printed blanks for other kinds of produce besides wheat, so that we may learn what are the present agricultural capabilities of the State, and in another year we can furnish more extended and accurate information on this very important subject.

Geology and chemistry are capable of furnishing powerful aid to the farmers, and if we are allowed sufficient means to accomplish the work in a satisfactory manner, immense benefits will necessarily accrue to the citizens of Maine.

Respectfully submitted,

By your obedient servant,

C. T. JACKSON.