affinities of the American races with those of the Eastern hemisphere, which are relied on to establish the unity of mankind, are evidently of a much earlier period, and can be predicated with greater certainty, than those which are adduced to show a derivation of the former from the ancient civilizations with which history makes us acquainted.

We must await with patience the complete solution of the problem. Through the researches of learned men the early history of mankind is becoming better known than heretofore. The obscurities of mythology and tradition are being permeated by the light of science and the evidence of facts. In our own day, we know more perhaps of primitive and prehistoric man, and can speculate with more probability upon the operations of his mind, than the ancients themselves. To use the language of one of the followers of the celebrated African traveller, Dr. Livingstone, who had just got a glimpse of the wonders of civilization—"We are the ancients, and all that has gone before us is but as of yesterday."

Art. X. — On the Progress of Weather Knowledge.

By Frederick Allison, Esq.

(*Read May* 12, 1873.)

In 1848—now a quarter of a century ago—I began taking some observations of Temperature in this Province in a very rude manner, with an ordinary thermometer fastened to the side of a large building. I thus detail my own beginning, as it happens to coincide with that of many others; and the experience of a large number of present regular observers is similar.

In Nova Scotia, and even in all parts of the Continent of America, observations of climatic phenomena were then in their infancy. The Smithsonian had initiated a good work at Washington, but the best position of instruments, their construction, and hours of observing, were known to comparatively few. The British Government had established the Toronto Magnetic Observatory, where meteorological phenomena were also observed, and

thus laid a foundation for the system now developing through Canada; but the most simple laws of weather were yet disregarded by the public. I do not intend to allude to Great Britain and Europe just now, beyond saying that the difference between the knowledge of then and now, is fully as marked in those countries.

In 1873 how different is the condition we find ourselves in. Not looking, at the moment, at the other Provinces, I have in this Nova Scotia alone, regularly reporting to me monthly, these stations of weather observers, viz: Yarmouth, Digby, Wolfville, Windsor, King's College, Beaver Bank, Truro, Pictou, Cape North, Sydney, Glace Bay, Cow Bay, Guysboro', Seaforth, and Halifax; besides St. John's, Harbour Grace, Fogo and George's Bay in Newfoundland; and Charlottetown in Prince Edward Island —while four other Nova Scotian stations are, I hope, only temporarily discontinued—making twenty-four in all. But the multiplication of observers is but one evidence—and a slight one—of the progress of weather knowledge. The knowledge gained of the instruments of our equipment has been immense; of course this information has been mostly obtained from abroad, chiefly from the experience of the scientific workers of Great Britain.

The placing these instruments in the best positions to obtain equitable readings has occupied a large share of the attention of many meteorologists. Our own Chief Director, G. T. Kingston, at Toronto, has made some valuable improvements and suggestions in this respect. In the Barometer, one of the earliest instruments in connection with our science, comparatively little improvement has been necessary. The addition to it of a recording apparatus—in fact making a Barometer also a Baragraph—is to it, what it may be called to all instruments, a mechanical adjunct rather than a scientific improvement. Apart from self-registration, the Fortin Barometer with metallic scale, tube not less than 0.4 inch internal diameter, and zero of scale adjustable by reflection of inverted cone in cistern, when mounted plainly and in a room of equable temperature, and read by a Vernier, seems to leave little to be desired in the primary and useful instrument.

Perhaps no greater injury is done to the establishment of climatic truths than by the use of erroneous Thermometers. It is so

easy to throw a portion of mercury into an ordinary glass tube and attach the latter to a scale graduated carelessly, thereby manufacturing an interesting but pernicious toy—while it is comparatively difficult to expend the necessary time, skill, and money upon a true Thermometer, that we can scarcely wonder at the very wonderful pieces of mechanism which are popularly received as measures of Heat. I have several times found so-called Thermometers differing from the standard full seven degrees, while scarcely two Thermometers taken haphazard from a large stock will agree exactly. Our climate is quite liable enough to extraordinary changes of Temperature without our calling in art to assist nature in that respect. At our first class stations we use no Thermometers whose readings have not been compared with a verified standard. A large bulb in free air, narrow tube, porcelain scale, without backing, and the graduations carried across the tube itself, are essential to correct marking and reading. Makers of whom I can by experience speak as very good, are Casella, Negretti and Zambra, of London; Acrè, of Edinburgh; and Green, of New York. The wet and dry bulbs, and maximum and minimum registering Thermometers should be placed about five feet above ground, sheltered on all sides from direct, reflected, or refracted sun's rays; under a screen constructed with slats, or louvre boards on three sides, and to the south of two layers of boards or fences, at intervals of several inches.

Having merely glanced at the principal instruments now in use by meteorologists, I pass on to discuss for a short time the effects so far obtained in this country from the systematic observations now established. It is evident that the primary objects of continued series of meteorological observations is a settlement of the normal climate of the country—especially in its chief elements of Temperature, Pressure, Wind and Precipitation. Having learned the mean condition of the place and the extremes to which it is liable, the organic life, the animal and the vegetable customary to the climate, and possible under such conditions, may be more readily ascertained. But it has been proved that very frequent observations of Pressure and Temperature—say hourly, or even tri-hourly, are not absolutely required at more than one station within a large extent

of country. Stations at which these frequent readings are taken are called in the Dominion Organization "Chief Stations," and embrace at present seven cities, to which number but few more need ever be added, except in Manitoba and British Columbia. From these chief stations the variations for the ordinary posts may be calculated with sufficient exactitude.

Besides the determination of the regular and extreme climate at any given point, another very important object is the connection of the differences between two such points; in other words, their relative bearing upon each other. This consideration is very useful in summing up the probabilities of ensuing weather. Before this audience I need not dwell upon the importance of weather forecasts, beyond the mere gratification of the restless curiosity, natural to the human kind. To encourage the advancement towards certainty in this direction, should be the effort of every one who tills the ground and who feeds upon the produce of that tillage; of every one who lives by the traffic of the sea, and earns his meat by toiling over the boisterous waters—a life peculiar to so many of the inhabitants of our wave-washed Province. Such knowledge should in brief be striven after by all mankind. This comparison of different climates and its result, the determination of atmospheric changes, and storm paths, make necessary the telegraphic branch of meteorology now just emerging into existence in this Dominion. That such information can be obtained, and climatic laws therefrom deduced, as will ultimately bring the forecasting of coming weather very near perfection, no one who has carefully observed the directions of atmospheric fluctuations can for a moment doubt. For instance, at noon on Friday last the 9th inst., what weather could be more fair than that enjoyed then in Halifax. A sky perfectly clear, a barometer standing high at 30.255 inches, temperature 66.5—the mildness of a well advanced spring—a gentle northerly breeze, and to a superficial gaze every promise of a continuance of fair weather. True, a certain haziness of atmosphere giving unnatural distinctness to some substances, and bringing apparently nearer remote objects, might have warned the man versed in local signs of a coming change; though apart from scientific grounds he could give you no

satisfactory reason for his suspicion. Also the Barometer had fallen somewhat from the greater height of the preceding day; but was still much above the normal, so that those trusting only to its bare and uncompared reading could not reasonably expect bad weather. But the telegraph told us of heavy rain and high N. E. wind at New York, and of threatening clouds farther east and north that morning; of eastwardly rain and heavy clouds again down the St. Lawrence Valley—all Barometers to our immediate west falling fast. The limits of this paper would not suffice to set forth the details of reasoning from proved scientific truths leading to the belief of a N. E. progression of this rain and wind, but recognizing the almost sure consequences of the above facts, and convinced by them of the usual cyclonic nature of the disturbance, I anticipated the S. E. wind, and rain present in Halifax on Sunday, and doubtless fresh in the recollection of my hearers.

Farther, regarding Telegraphic Meteorology, I am in hopes that, taught by experience gained from European and American systems, Canada may be able to improve on both of these. I must consider the practical working of the British Meteorological office superior to that of Washington; but, happily for us, we are so situated politically, geographically, and meteorologically, that we may introduce much of their cautious system into our Country with greater facilities for its successful use. Especially does it seem prudent for us in the infancy of our organization to provide that the drum (the best method of warning of probable storm) be hoisted for a period of forty-eight hours as in Great Britain, rather than follow the constantly changing bulletin of the United States. The greatest difficulties that we have to contend with here, are the want of more numerous ordinary and reporting stations—the want of longer series of observations even at the best of our posts, and the imperfect arrangements of the Telegraph Companies. The first want I trust may be soon remedied, that more volunteers may be encouraged to assist in advancing the public knowledge of all branches of meteorology. With their assistance Barometrical gradients can be established, and all the varying elements continually studied, until a much more thorough knowledge of the compa-

rative pressures, temperatures, &c. may be obtained, and a two-fold benefit is derived from these, viz: first, the determination of general comparisons between all stations—neighbouring and remote—and second, in telegraphing opinions and warnings, the progressive rate of changes going on at any particular time may be accurately marked and their arrival at the various points predicted within very narrow limits. The second need is very important—longer series of observations—the use of those in general is at once evident; if seven years readings are good in calculating normals, eleven years are better. But a specific use of prolonged series is to fix more accurately the occurrence and effect of abnormal phenomena, and thus, in studying the probable appearance of any change at a given station, to be able not only to form an opinion from established laws affecting a whole Province, or even a larger portion of the Continent; but to eliminate from those wider deductions, errors which may arise from individual position, and to give their full value to local circumstances whose influence may not be felt for more than a few miles, but within that small area may be quite sufficient to induce purely local phenomena, or even to divert from its course the whirling storm at one time, while at another they cease to exist and leave the district entirely controlled by the relative conditions normal within itself and adjacent areas.

The last obstacle I mention is one readily susceptible of great improvement, being a purely mechanical defect; and I believe that when once the whole importance of these labours is publicly appreciated, and Government is seriously extending a thorough scheme, the owners of Electric Telegraph Lines will also give to these bulletins and warnings the necessary facilities of transmission, causing the telegrams between Toronto and Halifax to occupy much less than the four or five hours, which I regret to say is at present consumed over that distance.

Without elaborating the very fruitful subject of prospective meteorology, I close this hurried paper by summarizing the progress of weather knowledge in Nova Scotia as an advance from the efforts of a couple of observers in 1869, to the establishment of 24 stations in 1873, placed now in connection with the Canadian Government System, included in the department of one of the most intelligent

and hard-working ministers—Hon. P. Mitchell of the Marine and Fisheries—who successfully carried through Parliament at its present Session a grant of $37,000 for meteorology; and under the chief directorship of G. T. Kingston, M. A.,—head of Toronto Observatory—whose guidance and extensive scientific attainments are sufficient guarantees for our future successful progress.

Art. XI. The History of a Boulder. By the Rev. D. Honeyman, D. C. L., F. G. S., &c.

(*Read May* 12, 1873.)

Our Boulder lies partially interred on the side of the road, between New Glasgow and Antigonish, about a mile and a half east from Sutherland's River Bridge. It is nearly thirteen years since this boulder first attracted my attention. Its hard weather-beaten face was traversed by a dark brown line which led me to suspect that it had a history to relate, which had yet been untold. In shorter time than I have taken to pen these sentences, my hammer and chisel had verified my conjecture. A familiar hieroglyphic appeared which at once informed me that the boulder was not a thing of yesterday,—that it had been clay deposited at the bottom of the ocean,—that it had been deposited there in an age long gone.

The hieroglyphic was the pygidium of a trilobite—*Dalmania Logani*—which lived, died, and was buried at nearly the close of the Upper Silurian Period,—which is known by English Geologists as the Upper Ludlow, by American Geologists as the Lower Helderberg, and by ourselves as the upper part or D, of the Upper Arisaig Series. I observed that this boulder was not solitary; many smaller ones were scattered on the sides of the road and in the fields: all were alike weather-beaten. Many enclosed beautiful forms—beautiful, but brittle. Trilobites, *Phacops* and *Prœtus* and *Homalonotus*, of a new and undescribed species. There were heads of *Phacops* having eyes in a beautiful state of preservation.

All told the same story as the tail of the *Dalmania Logani*—