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Contents.

(Illustrated articles are marked with an asterisk.)

SCHOOLS OF OBSERVATION.

With all their changes for the better which the work of our primary schools has undergone of late years, it is still ingeniously perverse in its methods and barbarous in its aims; almost hopelessly so, for so great is the conversatism, the inertia rather, of these schools that they not only withstand any radical improvement from within, but make such improvement all but impossible in the higher schools also.

Every college professor—still more every teacher in scientific institutions—complains that the youth who come up to him for instruction have been, as a rule, so blunted in sense and intellect by a vicious preparation, so fixed in bad habits of thought, that more time has to be spent undoing and redoing the work of the lower schools than is left for genuine college work. Thus the whole weight of the elementary school system, and it is great, bears dead against the improvement of the upper schools, wherein unfortunately all educational reforms have to begin.

Hence we see the colleges tardily adapting their work to the needs of the times, the high schools tardily following the example of the colleges, and the primary schools bringing up the rear a century or so behind: behind the colleges that is; they are twenty centuries behind the discovery and announcement of their proper work by thinkers independent enough to break with the tradition of their day. There is not a common school or an elementary private school in the land that approaches in its mode of operation the ideal of youthful culture set down by Plato: not one that does not violate, more or less atrociously, the primary requirements of young humanity in its entire scheme of operation. And yet we flatter ourselves that our schools exemplify the finest fruits of modern civilization!

We marvel at the logical blindness of our forefathers, who sought for personal freedom, yet could not see the absurdity of trying to erect a free government on a foundation which had slavery for a cornerstone. To those who shall celebrate the second centennial of our country's existence, we of to-day will probably appear quite as illogical in educational as they were in political matters. We know what should be done, yet submit to the habitual performance of the opposite. We brag about the school of marine observation which Agassiz set up at Penikese, and say: "That is the way a school should be conducted." We cry "well done" and "God speed" to Professor Shaler for the projected school of inland observation to be camped next summer at Cumberland Gap, looking upon such enterprises as the proper outcome of the best system of public education in the world. And we are blind to their biting satire upon our entire work of instruction!

Just think of it. We take our children at the age when observation is instinctive, when every sense is keen and hungry, the whole world fresh and new, and every object and phenomenon a challenge to their curiosity: when "what is it?" "what for?" and "why?" are the burden of their speech, and "what are you?" "what can I do to you?" "what can you do to me?" the language with which they approach all things: we take them at this stage and—aid and encourage their attempts to master their environment? Not a bit! On the contrary we shut them up, literally as well as figuratively, at home and in school. "Don't bother me with so many questions!" is the mother's response to incessant queries. "It isn't polite to ask questions" is the reproof a child gets when it turns to strangers for the gratification of a curiosity, sure to be impertinent if unwisely repressed where it should be wisely guided. "That has nothing to with your lesson: attend to your book" is the teacher's reply when the eager child wants to know about something not set down in the day's exercises.

The fruitless quest is not long persisted in. The mind, even of adults, soon wearies of rebuffs; and the naturally bright and observant child, under such treatment, soon settles down to a listless indifference to all but a narrow round of facts and phenomena, or wisely keeps his observations and doubts to himself. If studiously inclined, he studies books, gradually learning to rely on other people's experience and to seek for knowledge of the world through the distorting medium of words. Language becomes the only instrument of intelligence or culture; and his powers of original perception, at first undeveloped, end by being stultified by years of unobservant going to and fro. And then we set before him the happy chance of becoming one of the twenty-five or fifty lucky fellows who are permitted to supplement their college life with a six months' training in a school of observation!

Give to Agassiz and Shaler all credit. The Penikese and Cumberland Gap schools are germs of a new life, destined, it is to be hoped, to develop downward till, by the time our great-grand-children are ready to go to school, the whole school system will be leavened. But to ourselves we must reserve unlimited discredit for permitting such a "reform" to be possible. Schools of that sort are properly not the crown but the basis of a sensible educational system. What they propose to do should be made unnecessary by the work of every primary school, for childhood is the time for cultivating the art of observation, when everything in Nature and Art is new and open to discovery: not after a quarter of a lifetime has been spent in habitual inattention to all save books, when a shadowy familiarity has bred such contempt of common things that the would-be observer has to resort to the wilderness or to the bed of the sea for objects to excite his dormant curiosity.

THE ANTIQUITY OF LIFE.

When Lyell and the rest of the uniformitarian school of geology began to attribute all geological changes to the protracted operation of the influences now remodeling the earth's surface—sunshine and showers, rivers and seas, arctic frosts and tropic heats, slow risings and sinkings of the earth's crust, with their attendant quakings and volcanic outbursts, the growth of vegetation and the slowly accumulating deposits of coral polyps and other forms of animal life—it was objected that time was too short for such proceedings. Men had scarcely begun to question Usher's six thousand years of Biblical chronology, and their imaginations were incapable of spanning monotonous milleniums marked by no catastrophes. The Niagara could not have carved its six mile gorge at its present rate, for that would leave no time for antecedent operations!

By Darwin's day, such objections were worn out. Men had become accustomed to granting hundreds of milleniums for the periods of the geologist; yet they stood aghast at the demand for more. Geology had been modest in its requirements compared with the rising science of biology. Allowance was asked, not merely for the geologist's rock-recorded ages, but for gaps in the record for pages destroyed, and for measureless periods during which no records were kept in parts accessible to man. Darwin's theory called for an extension of time compared with which that of the geological record was small; and his opponents refused. A theory, they said, which requires such boundless concessions of time cannot possibly be true.

Now we learn that, whatever objections may be urged against the evolution theory, lack of time for the slow development of creation is not one of them. The soundings of the Challenger expedition give a clue to ages of life whose duration dwarfs to insignificance that of the periods between the Lower Silurian and the present, the limits formerly set for the duration of life upon the earth. The addition of the vast periods covered by the deposition of the many thousand feet of Cambrian and Laurentian rocks, with their shadowy traces of life, does not bring us sensibly nearer the beginning; nor is the light they hint of any guide to a comprehension of the swarms of living things which sported in the waters of those primeval oceans, or inhabited their shores.

We have given elsewhere a *resumé* of the grounds on which Professor Wyville Thompson and his colleagues base their belief that the red clay, which covers such vast areas of the deeper ocean beds, is a residuum representing less than two per cent of the mineral matter of the microscopic animal and vegetable life which inhabits those waters; and that it is identical with the basic clays of the extensive azoic formations known as slates, schists, and even gneiss and granite. If this position is sustained, as there is reason to expect it will be, by further observation, the antiquity of life surpasses the most extravagant demands of biologists; even the oldest known rocks, the fundamental granites as they have been considered, cannot be taken as sufficiently ancient to mark the time when life first made its appearance on earth. We must say of the organic as Hutton did of the inorganic world: "We find no vestiges of a beginning": for the farther back we go, the vaster are the measures of life's duration, and their number is countless.

The slow development of a thousand feet of coraline limestone covers a period not incomputable, however vast. Something like an approximate estimate can be made for the time required to deposit a thousand feet of sand in a lake bed or along a sea coast. But what arithmetic can number the ages required for the deposition of thousands of thousands of feet of the basic material of rock which at most can represent in its mass not much more than the hundredth part of the mineral constituents of animal and vegetable life, so minute and so distributed that it barely tinges the deep sea water with a shade of green?

If the great deposit of red clay, now forming in the eastern valley of the Atlantic, were metamorphosed into slate and then upheaved, says Professor Huxley, it would constitute an azoic rock of enormous extent; and yet that rock is now forming in the midst of a sea which swarms with living beings, the great majority of which are provided with calcareous or silicious shells and skeletons, and therefore are such as, up to this time, we should have termed eminently preservable. He might have added that the sea whose bed is so barren in organic remains lies between continents abounding with highly organized animal and vegetable life, with ancient cities, imperishable pyramids, and countless other traces of a higher than animal existence. Yet were the present continents submerged with the supposed elevation of the azoic sea bed, the geologist of that period might say—as our geologists have been used to say, under similar circumstances—"the earth was void of life when these slates were laid down!"

Who shall say that higher forms of life could not have inhabited the shallow seas and the dry lands surrounding the deep seas wherein our "primary" rocks were deposited? Who shall say that the vestiges of higher life discovered in the comparatively recent "fossiliferous" strata afford anything like a complete history of life on earth, or deny to the student of biology unlimited time for bringing about the results he observes?

DANGEROUS HOUSES.

Four deaths from diphtheria, recently occurring in Brooklyn have attracted the attention of the health authorities of that city to the condition of the house in which they took place. The report which a sanitary committee made upon the dwellings sounds a note of warning which is certainly timely at this especial period when moving is everywhere in progress. The house in question was new, and damp in every room from cellar to attic, for there appears to have been no effort made to dry the walls. This is precisely the condition of scores of dwellings into which families have entered on the first of this month; and unless proper precautions be taken, further cases of illness and death will be the cost of neglect.

If any reader of this journal, therefore, finds himself located in a dwelling on the walls of which the moisture condenses in beads, as on the outside of an ice pitcher, or the rooms of which cause a chilly, damp, sensation, with a strong odor of plaster, or any portion of which does not, on wall, ceiling, or floor, feel perfectly dry to the hand, let him, as he values his own life and that of his family (or hopes to escape from rheumatism, lung and kidney diseases, and the like) start fires at once. Better waste a few tuns of coal than pay five times the amount in doctors' bills or a still greater value of the money in suffering. Build a big fire in the furnace and in every grate, and keep all up night and day; and if the weather admits, throw open the windows and doors, but keep out of the drafts. The object of the fires is to dry out the walls, not so much to warm the rooms for comfort. Then as the weather becomes warm, let all go out but the furnace, retaining that until its use becomes a discomfort.

We offer these suggestions to persons who have already moved into new houses, but of course it is much wiser not to enter a dwelling that is not thoroughly seasoned. In all cities, blocks of houses are constructed, of the flimsiest materials, in incredibly short spaces of time, for spring occupancy. Many of these have been frozen from top to bottom during the recent severe winter; and instead of the water drying out, it has remained in the walls in the condition of ice. In an ordinary three-story house, 30,000 gallons of water are absorbed by the brick and mortar used in the construction; and this immense quantity must all or nearly all be got rid of before they are safe as dwellings.

THE COMING ARCTIC EXPEDITIONS.

The arctic exploring expedition which has been projected by the English government, and which for some time past has been fitting out, will, it is stated, sail from England on or about the first of June. Two vessels, the Alert and the Discovery, commanded respectively by Captain Nares and Commander Markham, have been rebuilt so as to be immensely strong and fully capable of withstanding the severest ice nip. The sides are composed of three thick skins of solid oak, each five inches through, and iron girded tiers of beams run all around the interior, which is finally lined with a sheathing of plank covered with thick felt. Nothing which the most experienced arctic voyagers could suggest has been omitted in preparing the vessels for their arduous service, so that the failure, of the Polaris and of the other expeditions which were despatched in a condition far from that required by the exigences of the undertaking, is not likely to be repeated.

The route to be followed is directly to Cape Farewell, the most southerly point of Greenland, thence to Cape Shackleton, in 74 degrees north latitude, and through the ice in Melville Bay to the open sea at Smith Sound. The Alert will push northward as far as possible, and then go into winter quarters, preparatory to sending out parties polewards in the spring. The Discovery, on the other hand, will not proceed beyond Newman's Bay, in 83 degrees north. Here she will winter, carry on such scientific observations as are possible, and be prepared to open up communications in the spring with the Alert, and also with a third ship, which will be sent out from England with fresh supplies and to bring back the news.

The total sum appropriated by Parliament for the expedition for the first year is $493,100. The anticipated subsequent expenditure per annum is placed at $65,000. From these figures it will be seen that the difficulties are to be grappled with in earnest, and with every aid which Science can suggest and ample appropriations procure. The *personnel* of the expedition is composed of officers and men who have already tasted the discomforts and privations of arctic life, and who, besides, will maintain that rigid military discipline, the absence of which contributed so greatly to the ill success of the unfortunate Hall.

This makes the thirty-third expedition sent in quest of the North Pole since 1848. The first ten were made by British sailing men of war; and the balance included merchant vessels and steamers, specially chartered from both the United States and England.

A Swedish expedition is also now being fitted out by a well known merchant named Dickson, of Gottenburgh. Professor Nordenskjold will accompany it, and the start will be made from Tromsoe early in June. The course proposed is by the western coast of Nova Zembla, and thence (from the most northerly point) north easterly, to explore this unknown portion of the polar basin.

PATENT LITIGATION IN ENGLAND AND THE UNITED STATES.

Under the present law of Great Britain, patents are granted to every applicant who chooses to pay the fees, without any official examination as to novelty. All the patents are printed, and the applicant, or his agent, makes his own examination, or none as he prefers.

Some people hold the theory that this plan of granting patents, without official examinations, must be bad, necessarily leading to many litigations, which would be avoided if the government were to examine, before granting the patent. But this theory is in practice, fallacious. Mr. W. Lloyd Wise, of London, in a recent paper on the subject, shows that the total number of common law and chancery cases litigated per annum in Great Britain is, in round numbers, 30,000, out of which *only eight are patent cases.*

In this country, by reason of our system of official examinations, we have a species of patent litigation totally unknown in England. As nearly as we can estimate, there are between ten and fifteen thousand cases annually, that are litigated, to a greater or less extent, before our Patent Office authorities. To search up answers to litigants, to cut down their claims, attend to hearings, write out and record decisions, and maintain the legal paraphernalia, necessary for the adjudication of our twenty thousand applications for patents yearly, gives employment to an army of five hundred officials, fed and supplied at a cost of about six hundred thousand dollars per annum. This represents only the government side of the litigations. On the opposite side the applicant must either appear in person, or employ a solicitor, and the aggregate amount of time, labor, and money thus spent, is quite large.

Having passed the ordeal of Patent Office litigation, the American patentee is then in the same situation as the English patentee, who went through no such operation: namely, both patentees have the privilege of litigating in the courts, where alone the validity of their patents can be finally settled.

DEADLY BALLOONING.

The names of Croce-Spinelli and Sivel, two of the most daring and successful of French aeronauts, are now to be added to the long list of those who have laid down their lives in the cause of Science. In company with M. Gaston Tissandier, they attempted to ascend to a higher altitude than had ever before been reached. At 29,000 feet elevation, all three men became unconscious. The balloon soared higher and higher and then descended. Tissandier regained his senses on reaching respirable air, to find his companions dead from suffocation.

This voyage which has resulted so disastrously was the second of two recently projected by the French Society of Aerial Navigation. During the first, which was safely accomplished, the balloon was kept afloat for twenty-three hours, and a number of interesting observations of natural phenomena of the atmosphere were obtained. The aeronauts, during the second ascension, were to test the atmosphere at the highest possible altitude, make experiments for carbonic acid, conduct spectroscopic observations, and in general to obtain scientific data relative to the upper aerial regions with greater accuracy than heretofore attained. Thus it was believed possible, through the respiration of oxygen, to enable the investigators to exist in a highly attenuated atmosphere, a fact already apparently practically demonstrated by the previous ascension of Croce-Spinelli and Sivel to a hight of 25,000 feet, described in these columns a year ago.

The balloon Zenith started on its voyage from Paris at 1 P. M., on April 15. It shot directly upward, reaching the hight of 21,000 feet in a very few minutes. At this elevation Tissandier says: "My companions were pale; I felt weak, but inhaled a little of the gas, which somewhat revived me. We still ascended." In response to Sivel's request, he acquiesces in throwing out ballast, and three of the nine eighty-pound bags of sand were emptied. "All at once," he continues, "I found myself so feeble that I could not even turn my head. I wanted to exclaim 'we are at 8,000 yards,' but my tongue seemed paralyzed." Tissandier then faints—but revives and finds the balloon falling rapidly. Greatly alarmed, he arouses Sivel, who has fallen into a stupor, and the latter, seizing the respirator, inhales large quantities of oxygen. "Shall we go up?" exclaims Tissandier; "yes," replies Sivel, gaily, "and happy the one of us that returns." Sivel becomes intoxicated with repeated doses of oxygen, and in his exhilaration throws over the respirator, besides the ballast and a number of the instruments. Again the Zenith soars aloft, and Tissandier, as he lapses once more into stupor, reads from the barometer an altitude of 29,000 feet. Spinelli and Sivel, he states, were still conscious, though apparently incapable of any exertion. How high the air ship ascended will be known when the test barometers are examined by the French Society. When Tissandier awoke, two hours later, the balloon was falling at a fearful rate. He hurriedly cut away the grapnel and other articles which had escaped Sivel, checking the speed; and then, on attempting to rouse his companions, he found both stone dead, their blackened faces and blood-suffused mouths denoting their struggles against the suffocating atmosphere.

There is no definite period stated by the survivor at which he surmises the death of his comrades took place. Tissandier was the weakest, physically, of the three, and his loss of consciousness at an early period undoubtedly saved his life. Glaisher and Coxwell, at Wolverhampton, Eng., in 1862, ascended, according to the calculations of the former, to an altitude of 37,000 feet; but this record cannot be regarded as accurate, inasmuch as it was only by superhuman exertion that Coxwell was enabled to open the valve by pulling the line in his teeth, and both aeronauts had so far succumbed to the cold and rarefied air as to make their observations under such conditions not very reliable.

It is sad to chronicle that two such men as the deceased lost their lives fruitlessly, but we see no other conclusion. Their death does not fix the limit of human existence in the hights of the atmosphere, and the most that can be gained will be the indications of the test barometers, and the knowledge that the aeronauts died before the marking shown was made. The fact of a semi-delirious state being produced by the oxygen materially reduces the practical value of that gas as a life supporter in rarefied air, in cases where a person requires his wits about him. It certainly was of little use in the present instance, as its effects caused Sivel to throw overboard the apparatus—probably while deprived of self-control—and thus to abandon the only means of safety in the higher regions which, by lightening the balloon, it was his object to reach.

Les Mondes, in commenting on this unfortunate casualty, points out that the way of avoiding similar disasters in future is to render the means of respiration completely automatic. Either the aeronauts should have been provided with dresses similar to those of divers, or, as suggested by M. Toselli, the car of the balloon should be a metallic cylinder, perfectly airtight, into which, or into the dresses, a small pump, easily worked by hand, should force air until a constant pressure is obtained, sufficient to maintain life.

THE LAWS OF STORMS.

When the United States Signal Service was organized and first began to attract attention, it was claimed that any law respecting the motion and direction of wind and storms was clearly beyond the grasp of the human mind. But now, in all large cities and in many country towns, the "probabilities" and weather maps are eagerly scanned every morning, greatly to the advantage of all classes; and seamen closely watch the cautionary flags displayed—as occasion requires—from the frequent signal stations along our whole coast. They have learned the lesson of giving careful heed to these monitions. Though the whole work of the Signal Service is interesting as a fairy tale, we propose at present to call attention only to some of the deductions of Professor Loomis respecting storm laws. This savant commenced his investigations in 1872, and has reported his results at three several meetings of the National Academy of Sciences. The last was at the session of this learned body at Washington, which has just adjourned, and a report of whose proceedings will be found on another page.

It is now fully accepted that all storms are circular, and most of those reported by "Old Probabilities" extend over a space hundreds of miles in extent, and often a thousand or more. The storms are not only circular but rotary, and advance across the country at a rate varying from two or three hundred to much more than a thousand miles per day. Their average direction is a little north of east, and they seem to originate either in the northwestern part of the United States, if not in the Pacific Ocean, or in the vicinity of Texas and the Gulf of Mexico. Storms are not necessarily accompanied with rain; they may be only of wind, like the small whirlwinds we often see carrying around sand and leaves, yet, at the same time, they progress slowly forward. But they are usually accompanied with rain, and the rain extends hundreds of miles (500 is the average) to the east of the storm center, but a much shorter distance to the west. The barometer, whose normal hight is about 30 inches, is usually low at the center of these vast, advancing whirlwinds. We now proceed to notice the means by which these facts, and others to be mentioned, were deduced, and some of their suggested causes.

On the weather map, which the signal service of the United States army daily distributes, Professor Loomis divided the field covered by a storm into four quadrants, and noted the observed directions of the wind in each. He did the the same on all the weather maps showing a position of the storm center suitable for his purpose. By taking a mean of all these observations, he found that winds blow in a circular direction; not, however, in the line of the tangent to a circle having its center at the eye of the storm, but directed inwards more than 45° from the tangent. Hence the wind's direction is more nearly central than tangential. Of course the currents, blowing in from all directions towards one central point, can escape only when moving upwards at the center. This makes a kind of suction at this point, which diminishes the weight of atmosphere and consequently lowers the barometer. When swift, rotating, upward currents of this kind occur on the ocean, they sometimes produce the waterspouts of which we read. The causes which produce this inward motion of the air currents must be looked for in those distant quarters where the storm originated. They may be due to the collision of moist air with some cold mountain peak. This would condense the moisture; the condensation would produce heat, which would expand and lighten the air; and then the heavier air on all sides would move towards this central point of diminished pressure. The air, heated by contact with the warm earth, takes up a large quantity of moisture; and then, on being carried up into colder regions, becomes condensed, and precipitates the moisture, thus showing us the cause of rain. The real center of a storm is probably one or two miles high at least; and from the average of a month's observations on the velocity of wind at the top of Mount Washington, compared with its velocity in neighboring places near the level of the sea, the Professor calculates that the velocity of wind at 6,000 feet high is five and a half times greater than at the sea level. The high currents, moving so much more rapidly than the base of the storm resting on the earth, would of course carry the ascending water-charged air forward. This gives a reason for the fact that the rain area is in advance of the storm center.

Professor Loomis also learned, by deductions from his tabulated data, that the more rapid the storm, the greater was the extent of rain area to the east of it; that the velocity of the storm increased more rapidly than the extension of the rain area; and that the direction of the storm for 24 hours was in general the same as the direction of the major axis of the rain oval for the preceding eight hours. The second of these facts seems to be a little anomalous, but the first and last are as we should expect them to be, because the velocity and direction of the most freely moving part of the storm should harmonize with the velocity and direction of the eastward upper air current, to which all parts of the storm, in the main, owe their motion. If the comparison had been made with the direction of the storm paths for the succeeding eight hours instead of twenty-four, the conclusions on the last point would probably have been still more satisfactory.

But the upper current is not the only cause of the eastward motion of the storm. The condensation which causes rain expands, by its heat, the air which rises and comes down outside of the rain area. Hence we have low barometer in front of the storm center, and the descending air behind makes it high there. So the center is not only drifted forward by the upper air currents from the west, but is pressed forward by the fact of a high barometer behind it and a low pressure before it. He also determined that the state of the barometer at the center, or its rate of fall in front, had little or nothing to do with the velocity of the storm's progress, but that the rate of rise behind it was directly proportioned to the velocity of the storm.

Again, he finds, by taking the mean of the velocities of wind in the four quadrants and comparing it with the storm's velocity, that, when the wind in the east quadrant has a greater average velocity than in the west, the storm moves faster than its mean rate, but slower when the wind's velocity in the west quadrant is the greatest. He explains this by supposing the upward movement would be greatest in the quadrant which had the greatest velocity of wind: then here would be the lowest barometer, and diminished pressure would tend to make the center move in this direction. Now if the excess of the wind's velocity in the west quadrant were sufficient, it might cause a westward instead of an eastward movement to the storm center. This movement has occurred several times, and caused the storm's path to make a loop upon itself. In one case the storm was made to change its direction more than 360° in a little over 24 hours. This explanation seems a little defective, for it apparently assumes a separate upward movement in each quadrant, whereas it is presumable that the rotary centripetal motion of the wind on all sides contributes to one grand upward movement in the center. Again it would seem that the greater velocity of a west wind would tend, by its superior momentum, to veer the central cylinder of ascending air to the east rather than to the west.

For making architectural ornaments in relief, a molding composition is formed of chalk, glue, and paper paste. Even statues have been made of this material.