RUSKIN JOHN

THE STORM-CLOUD OF THE NINETEENTH CENTURY

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Содержание

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PREFACE

The following lectures, drawn up under the pressure of more imperative and quite otherwise directed work, contain many passages which stand in need of support, and some, I do not doubt, more or less of correction, which I always prefer to receive openly from the better knowledge of friends, after setting down my own impressions of the matter in clearness as far as they reach, than to guard myself against by submitting my manuscript, before publication, to annotators whose stricture or suggestion I might often feel pain in refusing, yet hesitation in admitting.

But though thus hastily, and to some extent incautiously, thrown into form, the statements in the text are founded on

patient and, in all essential particulars, accurately recorded observations of the sky, during fifty years of a life of solitude and leisure; and in all they contain of what may seem to the reader questionable, or astonishing, are guardedly and absolutely true.

In many of the reports given by the daily press, my assertion of radical change, during recent years, in weather aspect was scouted as imaginary, or insane. I am indeed, every day of my yet spared life, more and more grateful that my mind is capable of imaginative vision, and liable to the noble dangers of delusion which separate the speculative intellect of humanity from the dreamless instinct of brutes: but I have been able, during all active work, to use or refuse my power of contemplative imagination, with as easy command of it as a physicist's of his telescope: the times of morbid are just as easily distinguished by me from those of healthy vision, as by men of ordinary faculty, dream from waking; nor is there a single fact stated in the following pages which I have not verified with a chemist's analysis, and a geometer's precision.

The first lecture is printed, with only addition here and there of an elucidatory word or phrase, precisely as it was given on the 4th February. In repeating it on the 11th, I amplified several passages, and substituted for the concluding one, which had been printed with accuracy in most of the leading journals, some observations which I thought calculated to be of more general interest. To these, with the additions in the first text, I have now prefixed a few explanatory notes, to which numeral

references are given in the pages they explain, and have arranged the fragments in connection clear enough to allow of their being read with ease as a second Lecture.

Herne Hill, *12th March, 1884*.

THE STORM-CLOUD OF THE NINETEENTH CENTURY

Let me first assure my audience that I have no *arrière pensée* in the title chosen for this lecture. I might, indeed, have meant, and it would have been only too like me to mean, any number of things by such a title;—but, to-night, I mean simply what I have said, and propose to bring to your notice a series of cloud phenomena, which, so far as I can weigh existing evidence, are peculiar to our own times; yet which have not hitherto received any special notice or description from meteorologists.

So far as the existing evidence, I say, of former literature can be interpreted, the storm-cloud—or more accurately plague-cloud, for it is not always stormy—which I am about to describe to you, never was seen but by now living, or *lately* living eyes. It is not yet twenty years that this—I may well call it, wonderful, cloud has been, in its essence, recognizable. There is no description of it, so far as I have read, by any ancient observer. Neither Homer nor Virgil, neither Aristophanes nor Horace, acknowledge any such clouds among those compelled by Jove. Chaucer has no word of them, nor Dante;[1] Milton none, nor Thomson. In modern

[1] The vapor over the pool of Anger in the 'Inferno,' the clogging stench which rises from Caina, and the fog of the circle of Anger in the 'Purgatorio' resemble, indeed,

times, Scott, Wordsworth and Byron are alike unconscious of them; and the most observant and descriptive of scientific men, De Saussure, is utterly silent concerning them. Taking up the traditions of air from the year before Scott's death, I am able,

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the cloud of the Plague-wind very closely,—but are conceived only as supernatural. The reader will no doubt observe, throughout the following lecture, my own habit of speaking of beautiful things as 'natural,' and of ugly ones as 'unnatural.' In the conception of recent philosophy, the world is one Kosmos in which diphtheria is held to be as natural as song, and cholera as digestion. To my own mind, and the more distinctly the more I see, know, and feel, the Earth, as prepared for the abode of man, appears distinctly ruled by agencies of health and disease, of which the first may be aided by his industry, prudence, and piety; while the destroying laws are allowed to prevail against him, in the degree in which he allows himself in idleness, folly, and vice. Had the point been distinctly indicated where the degrees of adversity necessary for his discipline pass into those intended for his punishment, the world would have been put under a manifest theocracy; but the declaration of the principle is at least distinct enough to have convinced all sensitive and earnest persons, from the beginning of speculation in the eyes and mind of Man: and it has been put in my power by one of the singular chances which have always helped me in my work when it was in the right direction, to present to the University of Oxford the most distinct expression of this first principle of mediæval Theology which, so far as I know, exists in fifteenth-century art. It is one of the drawings of the Florentine book which I bought for a thousand pounds, against the British Museum, some ten or twelve years since; being a compendium of classic and mediæval religious symbolism. In the two pages of it, forming one picture, given to Oxford, the delivery of the Law on Sinai is represented on the left hand, (*contrary to the Scriptural narrative*, but in deeper expression of the benediction of the Sacred Law to all nations,) as in the midst of bright and calm light, the figure of the Deity being supported by luminous and level clouds, and attended by happy angels: while opposite, on the right hand, the worship of the Golden Calf is symbolized by a single decorated pillar, with the calf on its summit, surrounded by the clouds and darkness of a furious storm, issuing from the mouths of fiends;—uprooting the trees, and throwing down the rocks, above the broken tables of the Law, of which the fragments lie in the foreground.

by my own constant and close observation, to certify you that in the forty following years (1831 to 1871 approximately—for the phenomena in question came on gradually)—no such clouds as these are, and are now often for months without intermission, were ever seen in the skies of England, France, or Italy.

In those old days, when weather was fine, it was luxuriously fine; when it was bad—it was often abominably bad, but it had its fit of temper and was done with it—it didn't sulk for three months without letting you see the sun,—nor send you one cyclone inside out, every Saturday afternoon, and another outside in, every Monday morning.

In fine weather the sky was either blue or clear in its light; the clouds, either white or golden, adding to, not abating, the luster of the sky. In wet weather, there were two different species of clouds,—those of beneficent rain, which for distinction's sake I will call the non-electric rain-cloud, and those of storm, usually charged highly with electricity. The beneficent rain-cloud was indeed often extremely dull and gray for days together, but gracious nevertheless, felt to be doing good, and often to be delightful after drought; capable also of the most exquisite coloring, under certain conditions;[2] and continually traversed in

[2] These conditions are mainly in the arrangement of the lower rain-clouds in flakes thin and detached enough to be illuminated by early or late sunbeams: their textures are then more softly blended than those of the upper cirri, and have the qualities of painted, instead of burnished or inflamed, color.They were thus described in the 4th chapter of the 7th part of 'Modern Painters':—"Often in our English mornings, the rain-clouds in the dawn form soft level fields, which melt imperceptibly into the blue;

clearing by the rainbow:—and, secondly, the storm-cloud, always majestic, often dazzlingly beautiful, and felt also to be beneficent in its own way, affecting the mass of the air with vital agitation, and purging it from the impurity of all morbific elements.

In the entire system of the Firmament, thus seen and understood, there appeared to be, to all the thinkers of those ages, the incontrovertible and unmistakable evidence of a Divine Power in creation, which had fitted, as the air for human breath, so the clouds for human sight and nourishment;—the Father who was in heaven feeding day by day the souls of His children with marvels, and satisfying them with bread, and so filling their hearts with food and gladness.

Their *hearts*, you will observe, it is said, not merely their bellies,—or indeed not at all, in this sense, their bellies—but the heart itself, with its blood for this life, and its faith for the next. The opposition between this idea and the notions of our own time may be more accurately expressed by modification of the Greek than of the English sentence. The old Greek is—

> ἐμπιπλῶν τροφῆς καὶ ἐυφροσύνης
> τὰς καρδίας ἡμῶν.

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or when of less extent, gather into apparent bars, crossing the sheets of broader cloud above; and all these bathed throughout in an unspeakable light of pure rose-color, and purple, and amber, and blue, not shining, but misty-soft, the barred masses, when seen nearer, found to be woven in tresses of cloud, like floss silk, looking as if each knot were a little swathe or sheaf of lighted rain."No clouds form such skies, none are so tender, various, inimitable; Turner himself never caught them. Correggio, putting out his whole strength, could have painted them,—no other man."

filling with meat, and cheerfulness, our hearts. The modern Greek should be—

> ἐμπιπλῶν ἀνέμου καὶ ἀφροσύνης
> τὰς γαστέρας ἡμῶν.

filling with wind, and foolishness, our stomachs.

You will not think I waste your time in giving you two cardinal examples of the sort of evidence which the higher forms of literature furnish respecting the cloud-phenomena of former times.

When, in the close of my lecture on landscape last year at Oxford, I spoke of stationary clouds as distinguished from passing ones, some blockheads wrote to the papers to say that clouds never were stationary. Those foolish letters were so far useful in causing a friend to write me the pretty one I am about to read to you, quoting a passage about clouds in Homer which I had myself never noticed, though perhaps the most beautiful of its kind in the Iliad. In the fifth book, after the truce is broken, and the aggressor Trojans are rushing to the onset in a tumult of clamor and charge, Homer says that the Greeks, abiding them "stood like clouds." My correspondent, giving the passage, writes as follows:—

> "Sir,—Last winter when I was at Ajaccio, I was one day reading Homer by the open window, and came upon the

lines—

Ἀλλ᾽ ἔμενον, νεφέλῃσιν ἐοικότες ἅς τε Κρονίων
Νηνεμίης ἔστησεν ἐπ᾽ ἀκροπόλοισιν ὄρεσσιν,
Ἀτρέμας, ὅφρ᾽ εὔδῃσι μένος Βορέαο καὶ ἄλλων
Ζαχρειῶν ἀνέμων, οἵ τε νέφεα σκιόεντα
Πνοιῇσιν λυγυρῇσι διασκιδνᾶσιν ἀέντες·
Ὣσ Δαναοὶ Τρῶας μένον ἔμπεδον, οὐδ᾽ ἐφέβοντο.

'But they stood, like the clouds which the Son of Kronos stablishes in calm upon the mountains, motionless, when the rage of the North and of all the fiery winds is asleep.' As I finished these lines, I raised my eyes, and looking across the gulf, saw a long line of clouds resting on the top of its hills. The day was windless, and there they stayed, hour after hour, without any stir or motion. I remember how I was delighted at the time, and have often since that day thought on the beauty and the truthfulness of Homer's simile.

"Perhaps this little fact may interest you, at a time when you are attacked for your description of clouds.

"I am, sir, yours faithfully,
G. B. Hill."

With this bit of noonday from Homer, I will read you a sunset and a sunrise from Byron. That will enough express to you the scope and sweep of all glorious literature, from the orient of Greece herself to the death of the last Englishman who loved

her.[3] I will read you from 'Sardanapalus' the address of the Chaldean priest Beleses to the sunset, and of the Greek slave, Myrrha, to the morning.

> "The sun goes down: methinks he sets more slowly,
> Taking his last look of Assyria's empire.
> How red he glares amongst those deepening clouds,[4]
> Like the blood he predicts.[5] If not in vain,

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[3] I did not, in writing this sentence, forget Mr. Gladstone's finely scholastic enthusiasm for Homer; nor Mr. Newton's for Athenian—(I wish it had not been also for Halicarnassian) sculpture. But Byron loved Greece herself—through her death—and *to* his own; while the subsequent refusal of England to give Greece one of our own princes for a king, has always been held by me the most ignoble, cowardly, and lamentable, of all our base commercial *im*policies.

[4] 'Deepening' clouds.—Byron never uses an epithet vainly,—he is the most accurate, and therefore the most powerful, of all modern describers. The deepening of the cloud is essentially necessary to the redness of the orb. Ordinary observers are continually unaware of this fact, and imagine that a red sun can be darker than the sky round it! Thus Mr. Gould, though a professed naturalist, and passing most of his life in the open air, over and over again, in his 'British Birds,' draws the setting sun dark on the sky!

[5] 'Like the blood he predicts.'—The astrological power of the planet Mars was of course ascribed to it in the same connection with its red color. The reader may be interested to see the notice, in 'Modern Painters,' of Turner's constant use of the same symbol; partly an expression of his own personal feeling, partly, the employment of a symbolic language known to all careful readers of solar and stellar tradition."He was very definitely in the habit of indicating the association of any subject with circumstances of death, especially the death of multitudes, by placing it under one of his most deeply *crimsoned* sunset skies."The color of blood is thus plainly taken for the leading tone in the storm-clouds above the 'Slave-ship.' It occurs with similar distinctness in the much earlier picture of 'Ulysses and Polypheme,' in that of 'Napoleon at St. Helena,' and, subdued by softer hues, in the 'Old Téméraire.'"The sky of this Goldau is, in its scarlet and crimson, the deepest in tone of all that I know

Thou sun that sinkest, and ye stars which rise,
I have outwatch'd ye, reading ray by ray
The edicts of your orbs, which make Time tremble
For what he brings the nations, 't is the furthest
Hour of Assyria's years. And yet how calm!
An earthquake should announce so great a fall—
A summer's sun discloses it. Yon disk
To the star-read Chaldean, bears upon
Its everlasting page the end of what
Seem'd everlasting; but oh! thou true sun!
The burning oracle of all that live,
As fountain of all life, and *symbol of*
Him who bestows it, wherefore dost thou limit
Thy lore unto calamity?[6] Why not

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in Turner's drawings."Another feeling, traceable in several of his former works, is an acute sense of the contrast between the careless interests and idle pleasures of daily life, and the state of those whose time for labor, or knowledge, or delight, is passed forever. There is evidence of this feeling in the introduction of the boys at play in the churchyard of Kirkby Lonsdale, and the boy climbing for his kite among the thickets above the little mountain churchyard of Brignal-bank; it is in the same tone of thought that he has placed here the two figures fishing, leaning against these shattered flanks of rock,—the sepulchral stones of the great mountain Field of Death."

[6] 'Thy lore unto calamity.'—It is, I believe, recognized by all who have in any degree become interested in the traditions of Chaldean astrology, that its warnings were distinct,—its promises deceitful. Horace thus warns Leuconoe against reading the Babylonian numbers to learn the time of her death,—he does not imply their promise of previous happiness; and the continually deceptive character of the Delphic oracle itself, tempted always rather to fatal than to fortunate conduct, unless the inquirer were more than wise in his reading. Byron gathers into the bitter question all the sorrow of former superstition, while in the lines italicized, just above, he sums in the briefest and plainest English, all that we yet know, or may wisely think, about the Sun. It is

Unfold the rise of days more worthy thine
All-glorious burst from ocean? why not dart
A beam of hope athwart the future years,
As of wrath to its days? Hear me! oh, hear me!
I am thy worshiper, thy priest, thy servant—
I have gazed on thee at thy rise and fall,
And bow'd my head beneath thy mid-day beams,
When my eye dared not meet thee. I have watch'd
For thee, and after thee, and pray'd to thee,
And sacrificed to thee, and read, and fear'd thee,
And ask'd of thee, and thou hast answer'd—but
Only to thus much. While I speak, he sinks—
Is gone—and leaves his beauty, not his knowledge,
To the delighted west, which revels in
Its hues of dying glory. Yet what is
Death, so it be but glorious? 'T is a sunset;
And mortals may be happy to resemble
The gods but in decay."

Thus the Chaldean priest, to the brightness of the setting sun. Hear now the Greek girl, Myrrha, of his rising.

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the '*Burning* oracle' (other oracles there are by sound, or feeling, but this by fire) of all that lives; the only means of our accurate knowledge of the things round us, and that affect our lives: it is the *fountain* of all life,—Byron does not say the *origin*;—the origin of life would be the origin of the sun itself; but it is the visible *source* of vital energy, as the spring is of a stream, though the origin is the sea. "And symbol of Him who bestows it."—This the sun has always been, to every one who believes there is a bestower; and a symbol so perfect and beautiful that it may also be thought of as partly an apocalypse.

"The day at last has broken. What a night
Hath usher'd it! How beautiful in heaven!
Though varied with a transitory storm,
More beautiful in that variety:[7]
How hideous upon earth! where peace, and hope,
And love, and revel, in an hour were trampled
By human passions to a human chaos,
Not yet resolved to separate elements:—
'T is warring still! And can the sun so rise,
So bright, so rolling back the clouds into
Vapors more lovely than the unclouded sky,
With golden pinnacles, and snowy mountains,
And billows purpler than the ocean's, making
In heaven a glorious mockery of the earth,
So like,—we almost deem it permanent;
So fleeting,—we can scarcely call it aught
Beyond a vision, 't is so transiently
Scatter'd along the eternal vault: and yet
It dwells upon the soul, and soothes the soul,
And blends itself into the soul, until
Sunrise and sunset form the haunted epoch
Of sorrow and of love."

How often *now*—young maids of London,—do you make

[7] 'More beautiful in that variety.'—This line, with the one italicized beneath, expresses in Myrrha's mind, the feeling which I said, in the outset, every thoughtful watcher of heaven necessarily had in those old days; whereas now, the variety is for the most part, only in modes of disagreeableness; and the vapor, instead of adding light to the unclouded sky, takes away the aspect and destroys the functions of sky altogether.

sunrise the 'haunted epoch' of either?

Thus much, then, of the skies that used to be, and clouds "more lovely than the unclouded sky," and of the temper of their observers. I pass to the account of clouds that *are*, and—I say it with sorrow—of the *dis*temper of *their* observers.

But the general division which I have instituted between bad-weather and fair-weather clouds must be more carefully carried out in the sub-species, before we can reason of it farther: and before we begin talk either of the sub-genera and sub-species, or super-genera and super-species of cloud, perhaps we had better define what *every* cloud is, and must be, to begin with.

Every cloud that can be, is thus primarily definable: "Visible vapor of water floating at a certain height in the air." The second clause of this definition, you see, at once implies that there is such a thing as visible vapor of water which does *not* float at a certain height in the air. You are all familiar with one extremely cognizable variety of that sort of vapor—London Particular; but that especial blessing of metropolitan society is only a strongly-developed and highly-seasoned condition of a form of watery vapor which exists just as generally and widely at the bottom of the air, as the clouds do—on what, for convenience' sake, we may call the top of it;—only as yet, thanks to the sagacity of scientific men, we have got no general name for the bottom cloud, though the whole question of cloud nature begins in this broad fact, that you have one kind of vapor that lies to a certain depth on the ground, and another that floats at a certain height in the sky.

Perfectly definite, in both cases, the surface level of the earthly vapor, and the roof level of the heavenly vapor, are each of them drawn within the depth of a fathom. Under *their* line, drawn for the day and for the hour, the clouds will not stoop, and above *theirs,* the mists will not rise. Each in their own region, high or deep, may expatiate at their pleasure; within that, they climb, or decline,—within that they congeal or melt away; but below their assigned horizon the surges of the cloud sea may not sink, and the floods of the mist lagoon may not be swollen.

That is the first idea you have to get well into your minds concerning the abodes of this visible vapor; next, you have to consider the manner of its visibility. Is it, you have to ask, with cloud vapor, as with most other things, that they are seen when they are there, and not seen when they are not there? or has cloud vapor so much of the ghost in it, that it can be visible or invisible as it likes, and may perhaps be all unpleasantly and malignantly there, just as much when we don't see it, as when we do? To which I answer, comfortably and generally, that, on the whole, a cloud is where you see it, and isn't where you don't; that, when there's an evident and honest thundercloud in the northeast, you needn't suppose there's a surreptitious and slinking one in the northwest;—when there's a visible fog at Bermondsey, it doesn't follow there's a spiritual one, more than usual, at the West End: and when you get up to the clouds, and can walk into them or out of them, as you like, you find when you're in them they wet your whiskers, or take out your curls, and when you're out of them,

they don't; and therefore you may with probability assume—not with certainty, observe, but with probability—that there's more water in the air where it damps your curls than where it doesn't. If it gets much denser than that, it will begin to rain; and then you may assert, certainly with safety, that there is a shower in one place, and not in another; and not allow the scientific people to tell you that the rain is everywhere, but palpable in Tooley Street, and impalpable in Grosvenor Square.

That, I say, is broadly and comfortably so on the whole,—and yet with this kind of qualification and farther condition in the matter. If you watch the steam coming strongly out of an engine-funnel,[8]—at the top of the funnel it is transparent,—you can't see

[8] 'Steam out of an engine funnel.'—Compare the sixth paragraph of Professor Tyndall's 'Forms of Water,' and the following seventh one, in which the phenomenon of transparent steam becoming opaque is thus explained. "Every bit of steam shrinks, when chilled, to a much more minute particle of water. The liquid particles thus produced form a kind of water dust of exceeding fineness, which floats in the air, and is called a cloud."But the author does not tell us, in the first place, what is the shape or nature of a 'bit of steam,' nor, in the second place, how the contraction of the individual bits of steam is effected without any diminution of the whole mass of them, but on the contrary, during its steady *expansion*; in the third place he assumes that the particles of water dust are solid, not vesicular, which is not yet ascertained; in the fourth place, he does not tell us how their number and size are related to the quantity of invisible moisture in the air; in the fifth place, he does not tell us how cool invisible moisture differs from hot invisible moisture; and in the sixth, he does not tell us why the cool visible moisture stays while the hot visible moisture melts away. So much for the present state of 'scientific' information, or at least communicativeness, on the first and simplest conditions of the problem before us!In its wider range that problem embraces the total mystery of volatile power in substance; and of the visible states consequent on sudden—and presumably, therefore, imperfect—vaporization; as

it, though it is more densely and intensely there than anywhere else. Six inches out of the funnel it becomes snow-white,—you see it, and you see it, observe, exactly where it is,—it is then a real and proper cloud. Twenty yards off the funnel it scatters and melts away; a little of it sprinkles you with rain if you are underneath it, but the rest disappears; yet it is still there;—the surrounding air does not absorb it all into space in a moment; there is a gradually diffusing current of invisible moisture at the end of the visible stream—an invisible, yet quite substantial, vapor; but not, according to our definition, a cloud, for a cloud is vapor *visible*.

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the smoke of frankincense, or the sacred fume of modern devotion which now fills the inhabited world, as that of the rose and violet its deserts. What,—it would be useful to know, is the actual bulk of an atom of orange perfume?—what of one of vaporized tobacco, or gunpowder?—and where do *these* artificial vapors fall back in beneficent rain? or through what areas of atmosphere exist, as invisible, though perhaps not innocuous, cloud?All these questions were put, closely and precisely, four-and-twenty years ago, in the 1st chapter of the 7th part of 'Modern Painters,' paragraphs 4 to 9, of which I can here allow space only for the last, which expresses the final difficulties of the matter better than anything said in this lecture:—"But farther: these questions of volatility, and visibility, and hue, are all complicated with those of shape. How is a cloud outlined? Granted whatever you choose to ask, concerning its material, or its aspect, its loftiness and luminousness,—how of its limitation? What hews it into a heap, or spins it into a web? Cold is usually shapeless, I suppose, extending over large spaces equally, or with gradual diminution. You cannot have in the open air, angles, and wedges, and coils, and cliffs, of cold. Yet the vapor stops suddenly, sharp and steep as a rock, or thrusts itself across the gates of heaven in likeness of a brazen bar; or braids itself in and out, and across and across, like a tissue of tapestry; or falls into ripples, like sand; or into waving shreds and tongues, as fire. On what anvils and wheels is the vapor pointed, twisted, hammered, whirled, as the potter's clay? By what hands is the incense of the sea built up into domes of marble?"

Then the next bit of the question, of course, is, What makes the vapor visible, when it is so? Why is the compressed steam transparent, the loose steam white, the dissolved steam transparent again?

The scientific people tell you that the vapor becomes visible, and chilled, as it expands. Many thanks to them; but can they show us any reason why particles of water should be more opaque when they are separated than when they are close together, or give us any idea of the difference of the state of a particle of water, which won't *sink* in the air, from that of one that won't *rise* in it?[9]

And here I must parenthetically give you a little word of, I will venture to say, extremely useful, advice about scientific people in general. Their first business is, of course, to tell you things that are so, and do happen,—as that, if you warm water, it will boil; if you cool it, it will freeze; and if you put a candle to a cask of gunpowder, it will blow you up. Their second, and

[9] The opposed conditions of the higher and lower orders of cloud, with the balanced intermediate one, are beautifully seen on mountain summits of rock or earth. On snowy ones they are far more complex: but on rock summits there are three distinct forms of attached cloud in serene weather; the first that of cloud veil laid over them, and *falling* in folds through their ravines, (the obliquely descending clouds of the entering chorus in Aristophanes); secondly, the ascending cloud, which develops itself loosely and independently as it rises, and does not attach itself to the hill-side, while the falling veil cloud clings to it close all the way down;—and lastly the throned cloud, which rests indeed on the mountain summit, with its base, but rises high above into the sky, continually changing its outlines, but holding its seat perhaps all day long.These three forms of cloud belong exclusively to calm weather; attached drift cloud, (see Note 11) can only be formed in the wind.

far more important business, is to tell you what you had best do under the circumstances,—put the kettle on in time for tea; powder your ice and salt, if you have a mind for ices; and obviate the chance of explosion by not making the gunpowder. But if, beyond this safe and beneficial business, they ever try to *explain* anything to you, you may be confident of one of two things,—either that they know nothing (to speak of) about it, or that they have only seen one side of it—and not only haven't seen, but usually have no mind to see, the other. When, for instance, Professor Tyndall explains the twisted beds of the Jungfrau to you by intimating that the Matterhorn is growing flat;[10] or the clouds on the lee side of the Matterhorn by the wind's rubbing against the windward side of it,[11]—you may be pretty sure the

[10] 'Glaciers of the Alps,' page 10.—"Let a pound weight be placed upon a cube of granite" (size of supposed cube not mentioned), "the cube is flattened, though in an infinitesimal degree. Let the weight be removed, the cube remains a little flattened. Let us call the cube thus flattened No. 1. Starting with No. 1 as a new mass, let the pound weight be laid upon it. We have a more flattened mass, No. 2.... Apply this to squeezed rocks, to those, for example, which form the base of an obelisk like the Matterhorn,—the conclusion seems inevitable *that the mountain is sinking by its own weight*," etc., etc. Similarly the Nelson statue must be gradually flattening the Nelson column, and in time Cleopatra's needle will be as flat as her pincushion?

[11] 'Glaciers of the Alps,' page 146.—"The sun was near the western horizon, and I remained alone upon the Grat to see his last beams illuminate the mountains, which, with one exception, were without a trace of cloud."This exception was the Matterhorn, the appearance of which was extremely instructive. The obelisk appeared to be divided in two halves by a vertical line, drawn from its summit half-way down, to the windward of which we had the bare cliffs of the mountain; and to the left of it a cloud which appeared to cling tenaciously to the rocks."In reality, however, there was no clinging; the condensed vapor incessantly got away, but it was ever renewed, and thus a river

scientific people don't know much (to speak of) yet, either about

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of cloud had been sent from the mountain over the valley of Aosta. The wind, in fact, blew lightly up the valley of St. Nicholas, charged with moisture, and when the air that held it *rubbed against the cold cone* of the Matterhorn, the vapor was chilled and precipitated in his lee."It is not explained, why the wind was not chilled by rubbing against any of the neighboring mountains, nor why the cone of the Matterhorn, mostly of rock, should be colder than cones of snow. The phenomenon was first described by De Saussure, who gives the same explanation as Tyndall; and from whom, in the first volume of 'Modern Painters,' I adopted it without sufficient examination. Afterwards I re-examined it, and showed its fallacy, with respect to the cap or helmet cloud, in the fifth volume of 'Modern Painters,' page 124, in the terms given in the subjoined note, ["But both Saussure and I ought to have known,—we did know, but did not think of it,—that the covering or cap-cloud forms on hot summits as well as cold ones;—that the red and bare rocks of Mont Pilate, hotter, certainly, after a day's sunshine than the cold storm-wind which sweeps to them from the Alps, nevertheless have been renowned for their helmet of cloud, ever since the Romans watched the cloven summit, gray against the south, from the ramparts of Vindonissa, giving it the name from which the good Catholics of Lucerne have warped out their favorite piece of terrific sacred biography. And both my master and I should also have reflected that if our theory about its formation had been generally true, the helmet cloud ought to form on every cold summit, at the approach of rain, in approximating proportions to the bulk of the glaciers; which is so far from being the case that not only (A) the cap-cloud may often be seen on lower summits of grass or rock, while the higher ones are splendidly clear (which may be accounted for by supposing the wind containing the moisture not to have risen so high); but (B) the cap-cloud always shows a preference for hills of a conical form, such as the Mole or Niesen, which can have very little power in chilling the air, even supposing they were cold themselves; while it will entirely refuse to form huge masses of mountain, which, supposing them of chilly temperament, must have discomforted the atmosphere in their neighborhood for leagues"] but I still retained the explanation of Saussure for the lee-side cloud, engraving in plate 69 the modes of its occurrence on the Aiguille Dru, of which the most ordinary one was afterwards represented by Tyndall in his 'Glaciers of the Alps,' under the title of 'Banner-cloud.' Its less imaginative title, in 'Modern Painters,' of 'Lee-side cloud,' is more comprehensive, for this cloud forms often under the brows of far-terraced

rock-beds, or cloud-beds. And even if the explanation, so to call it, be sound on one side, windward or lee, you may, as I said, be nearly certain it won't do on the other. Take the very top and center of scientific interpretation by the greatest of its masters: Newton explained to you—or at least was once supposed to have explained—why an apple fell; but he never thought of explaining the exactly correlative, but infinitely more difficult question, how the apple got up there!

You will not, therefore, so please you, expect me to explain anything to you,—I have come solely and simply to put before you a few facts, which you can't see by candlelight, or in railroad tunnels, but which are making themselves now so very distinctly felt as well as seen, that you may perhaps have to roof, if not

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precipices, where it has no resemblance to a banner. No true explanation of it has ever yet been given; for the first condition of the problem has hitherto been unobserved,—namely, that such cloud is constant in certain states of weather, under precipitous rocks;—but never developed with distinctness by domes of snow.But my former expansion of Saussure's theory is at least closer to the facts than Professor Tyndall's "rubbing against the rocks," and I therefore allow room for it here, with its illustrative wood-cut."When a moist wind blows in clear weather over a cold summit, it has not time to get chilled as it approaches the rock, and therefore the air remains clear, and the sky bright on the windward side; but under the lee of the peak, there is partly a back eddy, and partly still air; and in that lull and eddy the wind gets time to be chilled by the rock, and the cloud appears, as a boiling mass of white vapor, rising continually with the return current to the upper edge of the mountain, where it is caught by the straight wind and partly torn, partly melted away in broken fragments."In the accompanying figure, the dark mass represents the mountain peak, the arrow the main direction of the wind, the curved lines show the directions of such current and its concentration, and the dotted line encloses the space in which cloud forms densely, floating away beyond and above in irregular tongues and flakes."

wall, half London afresh before we are many years older.

I go back to my point—the way in which clouds, as a matter of fact, become visible. I have defined the floating or sky cloud, and defined the falling, or earth cloud. But there's a sort of thing between the two, which needs a third definition: namely, Mist. In the 22d page of his 'Glaciers of the Alps,' Professor Tyndall says that "the marvelous blueness of the sky in the earlier part of the day indicated that the air was charged, almost to saturation, with transparent aqueous vapor." Well, in certain weather that is true. You all know the peculiar clearness which precedes rain,—when the distant hills are looking nigh. I take it on trust from the scientific people that there is then a quantity —almost to saturation—of aqueous vapor in the air, but it is aqueous vapor in a state which makes the air more transparent than it would be without it. What state of aqueous molecule is that, absolutely unreflective[12] of light—perfectly transmissive of light, and showing at once the color of blue water and blue air

[12] See below, on the different uses of the word 'reflection,' note 14, and note that throughout this lecture I use the words 'aqueous molecules,' alike of water liquid or vaporized, not knowing under what conditions or at what temperatures water-dust becomes water-gas; and still less, supposing pure water-gas blue, and pure air blue, what are the changes in either which make them what sailors call "dirty "; but it is one of the worst omissions of the previous lecture, that I have not stated among the characters of the plague-cloud that it is *always* dirty,[In my final collation of the lectures given at Oxford last year on the Art of England, I shall have occasion to take notice of the effect of this character of plague-cloud on our younger painters, who have perhaps never in their lives seen a *clean* sky!] and *never blue under any conditions*, neither when deep in the distance, nor when in the electric states which produce sulphurous blues in natural cloud. But see the next note.

on the distant hills?

I put the question—and pass round to the other side. Such a clearness, though a certain forerunner of rain, is not always its forerunner. Far the contrary. Thick air is a much more frequent forerunner of rain than clear air. In cool weather, you will often get the transparent prophecy: but in hot weather, or in certain not hitherto defined states of atmosphere, the forerunner of rain is mist. In a general way, after you have had two or three days of rain, the air and sky are healthily clear, and the sun bright. If it is hot also, the next day is a little mistier—the next misty and sultry,—and the next and the next, getting thicker and thicker—end in another storm, or period of rain.

I suppose the thick air, as well as the transparent, is in both cases saturated with aqueous vapor;—but also in both, observe, vapor that floats everywhere, as if you mixed mud with the sea; and it takes no shape anywhere: you may have it with calm, or with wind, it makes no difference to it. You have a nasty haze with a bitter east wind, or a nasty haze with not a leaf stirring, and you may have the clear blue vapor with a fresh rainy breeze, or the clear blue vapor as still as the sky above. What difference is there between *these* aqueous molecules that are clear, and those that are muddy, *these* that must sink or rise, and those that must stay where they are, *these* that have form and stature, that are bellied like whales and backed like weasels, and those that have neither backs nor fronts, nor feet nor faces, but are a mist—and no more—over two or three thousand square miles?

I again leave the questions with you, and pass on.

Hitherto I have spoken of all aqueous vapor as if it were either transparent or white—visible by becoming opaque like snow, but not by any accession of color. But even those of us who are least observant of skies, know that, irrespective of all supervening colors from the sun, there are white clouds, brown clouds, gray clouds, and black clouds. Are these indeed—what they appear to be—entirely distinct monastic disciplines of cloud: Black Friars, and White Friars, and Friars of Orders Gray? Or is it only their various nearness to us, their denseness, and the failing of the light upon them, that makes some clouds look black[13] and others

[13] Black clouds.—For the sudden and extreme local blackness of thundercloud, see Turner's drawing of Winchelsea, (England series), and compare Homer, of the Ajaces, in the 4th book of the Iliad,—(I came on the passage in verifying Mr. Hill's quotation from the 5th.)"ἅμα δὲ νέφος εἵπετο πεζῶν.Ὡς δ' ὅτ' ἀπὸ σκοπιῆς εἶδεν νέφος ἀιπόλος ἀνὴρ'Ερχόμενον κατὰ πόντον ὑπὸ Ζεφύροιο ἰωῆς,Τῶ δέ τ', ἄνευθεν ἔοντι, μελάντερον, ἠύτε πίσσαΦαίνετ', ἰὸν κατὰ πόντον, ἄγει δέ τε λάιλαπα πολλήν·Ῥιγησέν τε ἰδὼν, ὑπό τε σπέος ἤλασε μῆλα·Τοῖαι ἅμ Αἰάντεσσιν ἀρηϊθόων αἰζηῶνΔήϊον ἐσ πόλεμον πυκιναὶ κίνυντο φάλαγγεςΚυάνεαι,"I give Chapman's version—noting only that his *breath* of Zephyrus, ought to have been 'cry' or 'roar' of Zephyrus, the blackness of the cloud being as much connected with the wildness of the wind as, in the formerly quoted passage, its brightness with calm of air."Behind them hid the groundA cloud of foot, that seemed to smoke. And as a Goatherd spiesOn some hill top, out of the sea a rainy vapor rise,Driven by the breath of Zephyrus, which though far off he rests,Comes on as black as pitch, and brings a tempest in his breastWhereat he, frighted, drives his herds apace into a den;So, darkening earth, with swords and shields, showed these with all their men."I add here Chapman's version of the other passage, which is extremely beautiful and close to the text, while Pope's is hopelessly erroneous."Their ground they still made good,And in their silence and set powers, like fair still clouds they stood,With which Jove crowns the tops of hills in any quiet dayWhen Boreas, and the ruder winds that use to drive

snowy?

I can only give you qualified and cautious answer. There are, by differences in their own character, Dominican clouds, and there are Franciscan;—there are the Black Hussars of the Bandiera della Morte, and there are the Scots Grays whose horses can run upon the rock. But if you ask me, as I would have you ask me, why argent and why sable, how baptized in white like a bride or a novice, and how hooded with blackness like a Judge of the Vehmgericht Tribunal,—I leave these questions with you, and pass on.

Admitting degrees of darkness, we have next to ask what color, from sunshine can the white cloud receive, and what the black?

You won't expect me to tell you all that, or even the little that is accurately known about that, in a quarter of an hour; yet note these main facts on the matter.

On any pure white, and practically opaque, cloud, or thing like a cloud, as an Alp, or Milan Cathedral, you can have cast by rising or setting sunlight, any tints of amber, orange, or moderately deep rose—you can't have lemon yellows, or any kind of green except in negative hue by opposition; and though by stormlight you may sometimes get the reds cast very deep, beyond a certain limit you cannot go,—the Alps are never vermilion color, nor flamingo color, nor canary color; nor did you ever see a full

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awayAir's dusky vapors, being loose, in many a whistling gale,Are pleasingly bound up and calm, and not a breath exhale."

scarlet cumulus of thundercloud.

On opaque white vapor, then, remember, you can get a glow or a blush of color, never a flame of it.

But when the cloud is transparent as well as pure, and can be filled with light through all the body of it, you then can have by the light reflected[14] from its atoms any force conceivable

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[14] 'Reflected.'—The reader must be warned in this place of the difference implied by my use of the word 'cast' in page 11, and 'reflected' here: that is to say, between light or color which an object possesses, whatever the angle it is seen at, and the light which it reverberates at one angle only. The Alps, under the rose[In speaking, at p. 11 of the first lecture, of the limits of depth in the rose-color cast on snow, I ought to have noted the greater strength of the tint possible under the light of the tropics. The following passage, in Mr. Cunningham's 'Natural History of the Strait of Magellan,' is to me of the greatest interest, because of the beautiful effect described as seen on the occasion of his visit to "the small town of Santa Rosa," (near Valparaiso.) "The day, though clear, had not been sunny, so that, although the snowy heights of the Andes had been distinctly visible throughout the greater part of our journey, they had not been illuminated by the rays of the sun. But now, as we turned the corner of a street, the chain of the Cordillera suddenly burst on our gaze in such a blaze of splendor that it almost seemed as if the windows of heaven had been opened for a moment, permitting a flood of *crimson* light to stream forth upon the snow. The sight was so unexpected, and so transcendently magnificent, that a breathless silence fell upon us for a few moments, while even the driver stopped his horses. This deep red glow lasted for three or four minutes, and then rapidly faded into that lovely rosy hue so characteristic of snow at sunset among the Alps"] of sunset, are exactly of the same color whether you see them from Berne or Schaffhausen. But the gilding to our eyes of a burnished cloud depends, I believe, at least for a measure of its luster, upon the angle at which the rays incident upon it are reflected to the eye, just as much as the glittering of the sea beneath it—or the sparkling of the windows of the houses on the shore.Previously, at page 10, in calling the molecules of transparent atmospheric 'absolutely' unreflective of light, I mean, in like manner, unreflective from their *surfaces*. Their blue color seen against a dark ground is indeed a kind of reflection, but one of which I do not understand the

by human mind of the entire group of the golden and ruby colors, from intensely burnished gold color, through a scarlet for whose brightness there are no words, into any depth and any hue of Tyrian crimson and Byzantine purple. These with full blue breathed between them at the zenith, and green blue nearer the horizon, form the scales and chords of color possible to the morning and evening sky in pure and fine weather; the keynote of the opposition being vermilion against green blue, both of equal tone, and at such a height and acme of brilliancy that you cannot see the line where their edges pass into each other.

No colors that can be fixed in earth can ever represent to you the luster of these cloudy ones. But the actual tints may be shown you in a lower key, and to a certain extent their power and relation to each other.

I have painted the diagram here shown you with colors prepared for me lately by Messrs. Newman, which I find brilliant to the height that pigments can be; and the ready kindness of Mr. Wilson Barrett enables me to show you their effect by a white light as pure as that of the day. The diagram is enlarged from my careful sketch of the sunset of 1st October, 1868, at Abbeville, which was a beautiful example of what, in fine weather about

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nature. It is seen most simply in wood smoke, blue against trees, brown against clear light; but in both cases the color is communicated to (or left in) the *transmitted* rays.So also the green of the sky (p. 13) is said to be given by transmitted light, yellow rays passing through blue air: much yet remains to be known respecting translucent colors of this kind; only let them always be clearly distinguished in our minds from the firmly possessed color of opaque substances, like grass or malachite.

to pass into storm, a sunset could then be, in the districts of Kent and Picardy unaffected by smoke. In reality, the ruby and vermilion clouds were, by myriads, more numerous than I have had time to paint: but the general character of their grouping is well enough expressed. All the illumined clouds are high in the air, and nearly motionless; beneath them, electric storm-cloud rises in a threatening cumulus on the right, and drifts in dark flakes across the horizon, casting from its broken masses radiating shadows on the upper clouds. These shadows are traced, in the first place by making the misty blue of the open sky more transparent, and therefore darker; and secondly, by entirely intercepting the sunbeams on the bars of cloud, which, within the shadowed spaces, show dark on the blue instead of light.

But, mind, all that is done by reflected light—and in that light you never get a *green* ray from the reflecting cloud; there is no such thing in nature as a green lighted cloud relieved from a red sky,—the cloud is always red, and the sky green, and green, observe, by transmitted, not reflected light.

But now note, there is another kind of cloud, pure white, and exquisitely delicate; which acts not by reflecting, nor by refracting, but, as it is now called, *dif*fracting, the sun's rays. The particles of this cloud are said—with what truth I know not[15]—to send the sunbeams round them instead of through

[15] Diffraction.—Since these passages were written, I have been led, in conversation with a scientific friend, to doubt my statement that the colored portions of the lighted clouds were brighter than the white ones. He was convinced that the resolution of the rays would diminish their power, and in *thinking* over the matter, I am disposed to agree

them; somehow or other, at any rate, they resolve them into their prismatic elements; and then you have literally a kaleidoscope in the sky, with every color of the prism in absolute purity; but above all in force, now, the ruby red and the *green*,—with purple, and violet-blue, in a virtual equality, more definite than that of

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with him, although my impression at the time has been always that the diffracted colors rose out of the white, as a rainbow does out of the gray. But whatever the facts may be, in this respect the statement in the text of the impossibility of representing diffracted color in painting is equally true. It may be that the resolved hues are darker than the white, as colored panes in a window are darker than the colorless glass, but all are alike in a key which no artifice of painting can approach.For the rest, the phenomena of diffraction are not yet arranged systematically enough to be usefully discussed; some of them involving the resolution of the light, and others merely its intensification. My attention was first drawn to them near St. Laurent, on the Jura mountains, by the vivid reflection, (so it seemed), of the image of the sun from a particular point of a cloud in the west, after the sun itself was beneath the horizon: but in this image there were no prismatic colors, neither is the constantly seen metamorphosis of pine forests into silver filigree on ridges behind which the sun is rising or setting, accompanied with any prismatic hue; the trees become luminous, but not iridescent: on the other hand, in his great account of his ascent of Mont Blanc with Mr. Huxley, Professor Tyndall thus describes the sun's remarkable behavior on that occasion:—"As we attained the brow which forms the entrance to the Grand Plateau, he *hung his disk upon a spike of rock* to our left, and, surrounded by a glory of interference spectra of the most gorgeous colors, blazed down upon us." ('Glaciers of the Alps,' p. 76.)Nothing irritates me more, myself, than having the color of my own descriptions of phenomena in anywise attributed by the reader to accidental states either of my mind or body;—but I cannot, for once, forbear at least the innocent question to Professor Tyndall, whether the extreme beauty of these 'interference spectra' may not have been partly owing to the extreme *sobriety* of the observer? no refreshment, it appears, having been attainable the night before at the Grands Mulets, except the beverage diluted with dirty snow, of which I have elsewhere quoted the Professor's pensive report,—"my memory of that tea is not pleasant."

the rainbow. The red in the rainbow is mostly brick red, the violet, though beautiful, often lost at the edge; but in the prismatic cloud the violet, the green, and the ruby are all more lovely than in any precious stones, and they are varied as in a bird's breast, changing their places, depths, and extent at every instant.

The main cause of this change being, that the prismatic cloud itself is always in rapid, and generally in fluctuating motion. "A light veil of clouds had drawn itself," says Professor Tyndall, in describing his solitary ascent of Monte Rosa, "between me and the sun, and this was flooded with the most brilliant dyes. Orange, red, green, blue—all the hues produced by diffraction —were exhibited in the utmost splendor.

"Three times during my ascent (the short ascent of the last peak) similar veils drew themselves across the sun, and at each passage the splendid phenomena were renewed. There seemed a tendency to form circular zones of color round the sun; but the clouds were not sufficiently uniform to permit of this, and they were consequently broken into spaces, each steeped with the color due to the condition of the cloud at the place."

Three times, you observe, the veil passed, and three times another came, or the first faded and another formed; and so it is always, as far as I have registered prismatic cloud: and the most beautiful colors I ever saw were on those that flew fastest.

This second diagram is enlarged admirably by Mr. Arthur Severn from my sketch of the sky in the afternoon of the 6th of August, 1880, at Brantwood, two hours before sunset.

You are looking west by north, straight towards the sun, and nearly straight towards the wind. From the west the wind blows fiercely towards you out of the blue sky. Under the blue space is a flattened dome of earth-cloud clinging to, and altogether masking the form of, the mountain, known as the Old Man of Coniston.

The top of that dome of cloud is two thousand eight hundred feet above the sea, the mountain two thousand six hundred, the cloud lying two hundred feet deep on it. Behind it, westward and seaward, all's clear; but when the wind out of that blue clearness comes over the ridge of the earth-cloud, at that moment and that line, its own moisture congeals into these white—I believe, *ice*-clouds; threads, and meshes, and tresses, and tapestries, flying, failing, melting, reappearing; spinning and unspinning themselves, coiling and uncoiling, winding and unwinding, faster than eye or thought can follow: and through all their dazzling maze of frosty filaments shines a painted window in palpitation; its pulses of color interwoven in motion, intermittent in fire,—emerald and ruby and pale purple and violet melting into a blue that is not of the sky, but of the sunbeam;—purer than the crystal, softer than the rainbow, and brighter than the snow.

But you must please here observe that while my first diagram did with some adequateness represent to you the color facts there spoken of, the present diagram can only *explain*, not reproduce them. The bright reflected colors of clouds *can* be represented in painting, because they are relieved against darker colors, or, in

many cases, *are* dark colors, the vermilion and ruby clouds being often much darker than the green or blue sky beyond them. But in the case of the phenomena now under your attention, the colors are all *brighter than pure white*,—the entire body of the cloud in which they show themselves being white by transmitted light, so that I can only show you what the colors are, and where they are,—but leaving them dark on the white ground. Only artificial, and very high illumination would give the real effect of them,—painting cannot.

Enough, however, is here done to fix in your minds the distinction between those two species of cloud,—one, either stationary,[16] or slow in motion, *reflecting unresolved* light; the

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[16] 'Either stationary or slow in motion, reflecting unresolved light.'The rate of motion is of course not essentially connected with the method of illumination; their connection, in this instance, needs explanation of some points which could not be dealt with in the time of a single lecture.It is before said, with reserve only, that "a cloud is where it is seen, and is not where it is not seen." But thirty years ago, in 'Modern Painters,' I pointed out (see the paragraph quoted in note 8th), the extreme difficulty of arriving at the cause of cloud outline, or explaining how, if we admitted at any given moment the atmospheric moisture to be generally diffused, it could be chilled by formal *chills* into formal clouds. How, for instance, in the upper cirri, a thousand little chills, alternating with a thousand little warmths, could stand still as a thousand little feathers.But the first step to any elucidation of the matter is in the firmly fixing in our minds the difference between windless clouds, unaffected by any conceivable local accident, and windy clouds, affected by some change in their circumstances as they move.In the sunset at Abbeville, represented in my first diagram, the air is absolutely calm at the ground surface, and the motion of its upper currents extremely slow. There is no local reason assignable for the presence of the cirri above, or of the thundercloud below. There is no conceivable cause either in the geology, or the moral character, of the two sides of the town of Abbeville, to explain why there should be decorative fresco

other, fast-flying, and *transmitting resolved* light. What difference is there in the nature of the atoms, between those two kinds of clouds? I leave the question with you for to-day, merely hinting to you my suspicion that the prismatic cloud is of finely-comminuted water, or ice,[17] instead of aqueous vapor; but the

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on the sky over the southern suburb, and a muttering heap of gloom and danger over the northern. The electric cloud is as calm in motion as the harmless one; it changes its forms, indeed; but imperceptibly; and, so far as can be discerned, only at its own will is exalted, and with its own consent abased.But in my second diagram are shown forms of vapor sustaining at every instant all kinds of varying local influences; beneath, fastened down by mountain attraction, above, flung afar by distracting winds; here, spread abroad into blanched sheets beneath the sunshine, and presently gathered into strands of coiled cordage in the shade. Their total existence is in metamorphosis, and their every aspect a surprise, or a deceit.

[17] 'Finely comminuted water or *ice*.'My impression that these clouds were glacial was at once confirmed by a member of my audience, Dr. John Rae, in conversation after the lecture, in which he communicated to me the perfectly definite observations which he has had the kindness to set down with their dates for me, in the following letter:—"4, Addison Gardens, Kensington, *4th Feb., 1884.* Dear Sir,—I have looked up my old journal of thirty years ago, written in pencil because it was impossible to keep ink unfrozen in the snow-hut in which I passed the winter of 1853-4, at Repulse Bay, on the Arctic Circle. [I trust that Dr. Rae will forgive my making the reader better aware of the real value of this communication by allowing him to see also the following passage from the kind private letter by which it was supplemented:— "Many years in the Hudson's Bay Company's service, I and my men became educated for Arctic work, in which I was five different times employed, in two of which expeditions we lived wholly by our own hunting and fishing for twelve months, once in a stone house (very disagreeable), and another winter in a snow hut (better), *without fire of any kind to warm us.* On the first of these expeditions, 1846-7, my little party, there being no officer but myself, surveyed seven hundred miles of coast of Arctic America by a sledge journey, which Parry, Ross, Bach, and Lyon had failed to accomplish, costing the country about £70,000 or £80,000 at the lowest computation. The total expense of my little party, including my own pay, was under fourteen hundred pounds sterling.

only clue I have to this idea is in the purity of the rainbow formed

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"My Arctic work has been recognized by the award of the founder's gold medal of the Royal Geographical Society (before the completion of the whole of it)"] On the 1st of February, 1854, I find the following:— 'A beautiful appearance of some cirrus clouds near the sun, the central part of the cloud being of a fine pink or red, then green, and pink fringe. This continued for about a quarter of an hour. The same was observed on the 27th of the month, but not so bright. Distance of clouds from sun, from 3° to 6°.' On the 1st February the temperature was 38° below zero, and on the 27th February 26° below. 'On the 23d and 30th (of March) the same splendid appearance of clouds as mentioned in last month's journal was observed. On the first of these days, about 10.30 a.m., it was extremely beautiful. The clouds were about 8° or 10° from the sun, below him and slightly to the eastward,—having a green fringe all round, then pink; the center part at first green, and then pink or red.' The temperature was 21° below zero, Fahrenheit. There may have been other colors—blue, perhaps—but I merely noted the most prominent; and what I call green may have been bluish, although I do not mention this last color in my notes. From the lowness of the temperature at the time, the clouds *must* have been frozen moisture. The phenomenon is by no means common, even in the Arctic zone. The second beautiful cloud-picture shown this afternoon brought so visibly to my memory the appearance seen by me as above described, that I could not avoid remarking upon it. Believe me very truly yours, John Rae." (M.D., F.R.S.)Now this letter enables me to leave the elements of your problem for you in very clear terms.Your sky—altogether—may be composed of one or more of four things:— Molecules of water in warm weather. Molecules of ice in cold weather. Molecules of water-vapor in warm weather. Molecules of ice-vapor in cold weather. But of the size, distances, or modes of attraction between these different kinds of particles, I find no definite information anywhere, except the somewhat vague statement by Sir William Thomson, that "if a drop of water could be magnified so as to be as large as the earth, and have a diameter of eight thousand miles, then a molecule of this water in it would appear *somewhat larger than a shot*." (What kind of shot?) "*and somewhat smaller than a cricket-ball*"!And as I finally review the common accounts given of cloud formation, I find it quite hopeless for the general reader to deal with the quantity of points which have to be kept in mind and severally valued, before he can account for any given phenomena. I have myself, in many of the passages of 'Modern Painters' before referred to, conceived of cloud too narrowly as always produced by

in frost mist, lying close to water surfaces. Such mist, however, only becomes prismatic as common rain does, when the sun is behind the spectator, while prismatic clouds are, on the contrary, always between the spectator and the sun.

The main reason, however, why I can tell you nothing yet about these colors of diffraction or interference, is that, whenever I try to find anything firm for you to depend on, I am stopped by the quite frightful inaccuracy of the scientific people's terms, which is the consequence of their always trying to write mixed Latin and English, so losing the grace of the one and the sense of the other. And, in this point of the diffraction of light I am stopped dead by their confusion of idea also, in using the words undulation and vibration as synonyms. "When," says Professor Tyndall, "you are told that the atoms of the sun *vibrate* at

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cold, whereas the temperature of a cloud must continually, like that of our visible breath in frosty weather, or of the visible current of steam, or the smoking of a warm lake surface under sudden frost, be above that of the surrounding atmosphere; and yet I never remember entering a cloud without being chilled by it, and the darkness of the plague-wind, unless in electric states of the air, is always accompanied by deadly chill.Nor, so far as I can read, has any proper account yet been given of the balance, in serene air, of the warm air under the cold, in which the warm air is at once compressed by weight, and expanded by heat, and the cold air is thinned by its elevation, yet contracted by its cold. There is indeed no possibility of embracing the conditions in a single sentence, any more than in a single thought. But the practical balance is effected in calm air, so that its lower strata have no tendency to rise, like the air in a fire balloon, nor its higher strata to fall, unless they congeal into rain or snow.I believe it will be an extreme benefit to my younger readers if I write for them a little 'Grammar of Ice and Air,' collecting the known facts on all these matters, and I am much minded to put by my ecclesiastical history for a while, in order to relate what is legible of the history of the visible Heaven.

different rates, and produce *waves* of different sizes,—your experience of water-waves will enable you to form a tolerably clear notion of what is meant."

'Tolerably clear'!—your toleration must be considerable, then. Do you suppose a water-wave is like a harp-string? Vibration is the movement of a body in a state of tension,—undulation, that of a body absolutely lax. In vibration, not an atom of the body changes its place in relation to another,—in undulation, not an atom of the body remains in the same place with regard to another. In vibration, every particle of the body ignores gravitation, or defies it,—in undulation, every particle of the body is slavishly submitted to it. In undulation, not one wave is like another; in vibration, every pulse is alike. And of undulation itself, there are all manner of visible conditions, which are not true conditions. A flag ripples in the wind, but it does not undulate as the sea does,—for in the sea, the water is taken from the trough to put on to the ridge, but in the flag, though the motion is progressive, the bits of bunting keep their place. You see a field of corn undulating as if it was water,—it is different from the flag, for the ears of corn bow out of their places and return to them,—and yet, it is no more like the undulation of the sea, than the shaking of an aspen leaf in a storm, or the lowering of the lances in a battle.

And the best of the jest is, that after mixing up these two notions in their heads inextricably, the scientific people apply both when neither will fit; and when all undulation known to

us presumes weight, and all vibration, impact,—the undulating theory of light is proposed to you concerning a medium which you can neither weigh nor touch!

All *communicable*

Конец ознакомительного фрагмента.