

calcite* in my "Contributions to the Mineralogy of N. S.," in the "L. E. D. Phil. Magazine," and only name it here in connection with economic minerals because it contains almost exactly the same amount of boracic acid as natroborocalcite, and like it would no doubt give a good pottery glaze. I think it would also be found specially adapted for glazing iron vessels, as I find a borosilicate of soda is now preferred to silicate of lead for this purpose, as not affording lead in culinary operations to the contents of vessels so glazed. I found on analysis of the mineral:—

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|-----------------|---------|
| Water, | 11.62 |
| Lime, | 28.04 |
| Sulphuric acid, | 80 |
| Magnesia, | trace |
| Silica, | 15.44 |
| Boracic acid, | [44.10] |
| | <hr/> |
| | 100.00 |

Salt from Brine Springs. Although no deposit of rock salt of any importance has yet been found with gypsum, the brines of the gypsiferous districts, of which some account will be found in a former paper of mine, (Trans. N. S. Inst., 1865,) have furnished excellent salt at R. Philip, at Springhill, and Pictou, and a company is now making salt at Antigonish.

ART. IV. MAGNETISM AND ITS CONNECTION WITH THE TELEGRAPH. BY THOS. R. FRASER, M. D.

(Read January 6, 1868.)

THE object of this paper will be to give the philosophy and practical working of the *Magnetic* Telegraph. The term magnetic is chosen in preference to electric, as commonly used, Magnetism being the *primary* power or force which causes the magnetic action. Electricity being *merely an effect* of that

*Since this paper was written, Prof. Dana, to whom I sent specimens of the borates mentioned, has, in the new edition of his 'Mineralogy,' given the name of ulesite to natroborocalcite, retained the name of cryptomorphite, and given the name howlite to the new species here called silicoborocalcite.

power, when under certain conditions. True there is connected with the telegraph a mechanical power and action as well, but this is only from a secondary agency employed in its operations. The combination of these two powers, magnetic and mechanical, in the telegraph, may remind one of the action of the two powers we notice in the animal organization, distinguished as involuntary and voluntary. So close is the resemblance that we may without impropriety term the magnetic telegraph an artificial animal.

It will be necessary for the sake of clearness to distinguish between the two agencies, the magnetic and mechanical, for although they work in harmony they are nevertheless totally different in their modes of action, being *governed by different laws*. The mechanical or voluntary agency is well known, and is apparent only in visible matter and through *mathematical* rules. It controls all voluntary and *secondary* forces and motions. But these forces and motions are induced *primarily* by the involuntary power inherent in *all* matter, which power is under the control of *natural law only*. And this law may be observed in the action of all atoms visible and invisible, in *all chemical* and natural phenomena. It is only influenced by mechanical law through mechanical arrangement of matter, or in other words when matter is placed in a position by which its atoms may be free to act through their magnetic forces and natural properties. The magnetic or primary being a subtle invisible agency and force, can only be known as to its nature by observing its action and law on matter in its various forms, circumstances and positions. To this agency belongs what may be termed the primary force and involuntary actions of the telegraph.

Magnetism, or that primary force noticed in metals, and its law, is the invisible controlling agent or power in all matter or atoms, in either their gaseous, liquid, or solid forms. Concerning this power, its law and action, there has been many conjectures, particularly in reference to the nature and operation of electricity and magnetism in the telegraph and in animals. We have as yet had no certain theory of either, and most persons consider such subjects too mysterious even for enquiry.

I will now give a few opinions from late writings of Professors who have made electricity their study, and then submit an opinion of my own. Dr. E. L. Youmans, in a work published in 1865—"The Co-relation and Conservation of Forces, a series of expositions, by Prof. Grove, Prof. Helmholtz, Dr. Mayer, Dr. Faraday, Prof. Liebeg and Dr. Carpenter," has an article on Electricity, and says, "From the manner in which the peculiar force called Electricity is *seemingly* transmitted through certain bodies such as metallic wires, the term *current* is commonly used to denote its *apparent* progress. *It is very difficult to present to the mind any theory* which will give it a definite conception of its *modus agendi*." On Magnetism he says, "*It is difficult to convey a definite notion of the force of Magnetism, and of the mode in which it affects other forces.*"

"*Good Words*" for January, 1867, has a paper from Professor Thompson "On the Atlantic Telegraph." He says, "It may be regarded as *probable*, that there is a real electric fluid, and that this fluid really flows through the wire, *but in the present state of Electric Science we cannot tell*, or even conjecture on any grounds of possibility, whether the true, positive Electricity is that which is commonly so called, or whether it may not be, on the contrary, that which is carried by the oxygen to the zinc."

An article in the Jan'y No. of Ecler. Med. Review (1867,) "On Electrotysis of Metals," says: "As the velocity of the battery is a source of mystery to some persons, the following may not be irrevelent, &c. " * * * Here it is supposed that electricity derives its origin, or, at least, its dynamic force, *from the decomposition of water.*"

From the first that was noticed of electricity and magnetism by our savans to the present time, there appears to have been nothing more than an accumulation of facts. *From that* I can find no definite opinion either of its origin, operation or nature, further than this, that magnetism is an invisible power, the effects of which are more particularly noticed in steel, under certain conditions, as magnets, and generally supposed to be confined to metals only. There is exhibited throughout all the constituent parts of our material world an invisible power or

force commonly called "electricity." The *effects* of that force are seen in the atmosphere and in connection with the dissolving and reforming of substances, in animals and in vegetables, and more particularly in connection with metals. From a close examination of the observations and experiments of others, together with those of my own, I propose to state what I believe to be the *nature and action* of that force, or of *magnetism*, and its application to, and operation on telegraph lines and submarine cables. I find in *all atoms* an inherent power (an atomic power), more "or" (and) less in *all matter*, which power is brought into action *only* when the atoms are under certain conditions, which power is similar to that noticed in steel, and *there called magnetism*. All atoms *can* be arranged into *two separate classes*—"mineral" and "vegetable." These classes of atoms have properties in common, and also *dissimilar* properties. When these two classes of atoms are in the form of gases or liquid, and come into contact, their atomic *power* is brought into action, by which power each class attracts *its like*, causing a *reciprocal* action, which, in combination with the *dissimilar* properties of these classes of produce what is commonly known as *chemical action*. This action cannot be produced without the agency of the *two* classes of atoms, and then only when they are presented under certain conditions. In solids the magnetic or atomic power of those atoms are brought into action through the agency of water, which holds both classes in solution. When the two classes of atoms are in an "insulated" position *in the atmosphere*, and then under certain conditions, their action *produces* and exhibits what is called "*Electricity*." Thus the force *producing* electricity as exhibited by a telegraph line, is *caused* by that atomic, natural, magnetic, reciprocal, *chemical action*, in the battery, decomposing the metals and the acid, *through the agency of water*, which force and action *converts the line into a magnet*, at the will of the operator, and only conditionally exhibits electricity. There is *no electric current except at the poles*, and there only when they are in juxta position, and where that action is insulated from the earth. I will now explain the *cause* of that involuntary atomic action by its natural law in the battery producing mag-

nets and electricity on a telegraph line, and how that magnetic involuntary action harmonises with the voluntary or mechanical agency of the operator, exhibiting life or motion in the line, and showing the necessity for the combination of the two powers (similar to those in an animal) for the effectual working of the telegraph.

The first action is in the solution of acid and water, while preparing them for the battery; that *action* is *caused* by the acid having an excess of mineral and the water an excess of vegetable atoms in solution; when they are placed in contact, each *attracts its like* material; and their reciprocal action continues until their particles are equally distributed. Place the ends of a piece of zinc and a piece of copper in this solution, a similar reciprocal action is produced between the metals and the solution. The solution having the excess of vegetable atoms acts upon each piece of metal *separately*. If the upper ends of those pieces of metal are brought into contact, the action is increased at the lower ends, as poles, by the two pieces now forming *one* magnet, and *its poles reciprocating* through the solution. There is no action or current exhibited at their junction or middle. Any number of cups of the solution with similar pieces of metal alternately connected to form a battery, will thus be acted upon separately while they are disconnected. If connected or brought into contact through any moist or metallic substance of *any* length as a telegraph line, the metals will all act together as one magnet; the force of their union may be noticed in the battery by its increased decomposing action, and in the line by the greater power of *its* magnets, when the line is in a position to exhibit its polarity, but not otherwise. All the requirements for telegraphing with this line are a "relay" and "key." The relay is a piece of soft iron in "horse shoe" form, covered with a small wire coated, the ends of which are connected in the line. The ends of the iron of the relay forming the poles of the magnet, exhibit the force of the line from the battery by attracting another piece of soft iron called an armature. The key is an instrument attached to the line for the purpose of *breaking the line*, by the will of the operator; when the line is thus broken the force is thrown off

it and into each piece of metal in the battery as described; when the line is connected *by the key*, the force is then in the line, and is shown in the relay magnets by their attracting the armature. Thus the *motion* of the armature made by the key of the operator, can be read at the same time by any number of operators on any length of line, at any number of stations having similar arrangements. If a person on the moist earth take the uncovered line in his hand, or place the wire of the line to his tongue, he will be able to read the action of the operators on the line by reason of his connection with the earth. If he form a close connection between the line and the earth, no force can pass him on the line, as the force is absorbed through him by the earth, which forms a solid connection. If he is insulated from the earth and in contact with the line, he will find *no effect* from the line unless it be broken and each end in his hand, his body then forming a part of the line as a “conductor.” *No current* passes through him or through the line, but he feels the sensation and action *from the poles* at the point of contact only, and the Force is received in his body as in a magnet. *That action on him is GALVANISM*, and is a *result* or consequence of the action in the battery from the poles of its magnet, or the *ends* of the line. If those wire ends or poles are brought into contact by a fine point or *fine* wire that will concentrate their force, *their* reciprocal action will exhibit a spark of *fire*. *That spark is ELECTRICITY*, and may be elicited under certain conditions in *all* cases of “decomposition.” We may thus see *electricity* to be merely an exhibition or an effect of that force or power in atoms, or where reciprocally acting when insulated from the earth; and *galvanism* to be the effect of an application of the atomic or “magnetic” power and action in metals to a living animal, *causing* an increased life motion, and when applied to a dead animal an artificial or induced life motion. There is, therefore, no *current* that passes through or over the telegraph line, nor yet can there be a “return current,” through the earth, (as is supposed.) The earth being a solid moist mineral body, a *battery* and magnet of itself, receives and absorbs the force from the line at its junction. Hence I find the involuntary natural agent causing the action of the telegraph line,

to be that atomic "magnetic" power in the battery which produces magnets at the will of the operator, by his voluntary mechanical agency; and that *magnetism* is the primary power and action through which the line operates. Electricity being merely a conditional effect of the polar reciprocal action of the magnets, both poles being positive, under different conditions, and not one positive and the other negative, as is generally supposed, all that is required of a telegraph line is that its wire be "solid" in length, and thoroughly insulated from the moist earth, as the present Atlantic cables appear to be. Yet a telegraph cable that will gradually lose the iron may thus be of less weight and dimensions where the water deepens, and can still have these two properties; it would thus avoid all the difficulties met with in the frequent attempts to lay the Atlantic cables, that were finally surmounted by strictly *mechanical force*, in preference to their being avoided by an examination of the *natural* law and force of the material, and applying that law to those lines before attempting to lay them. The operation of which *law* on such material, I am now prepared to illustrate and explain to you by experiment, for your observation.

ART. V. OYSTER CULTURE IN FRANCE. BY T. F. KNIGHT.

(Read February 3, 1868.)

IN the application of science to industry France has long afforded a distinguished example, partly through the scientific genius of the nation, and partly through the encouragement which is given to scientific progress by the French government; and in no branch of scientific industry has she more excelled than in the art of Pisciculture. In France, it is well known, the first successful experiments were made to revive the ancient practice of breeding fish from the ova taken from the living animal; so that by a process of cultivation, from small beginnings, so greatly did the art of artificial propagation succeed, that valuable fisheries that had declined, were restored to fertility; and new localities were stocked with young, that soon teemed with the fruits of natural increase.