

# SCIENCE.—SUPPLEMENT.

FRIDAY, MAY 28, 1886.

## THE STATE AS AN ECONOMIC FACTOR.

### I.

THERE is no more significant difference between what, for lack of better terms, we may call the old and the new schools of political economy than their respective attitudes toward the state. The old school, in which I would include Adam Smith and his best-known English followers, culminating in the so-called orthodox economists, derived their ideas in regard to the nature and functions of the state from the views of the writers on jural and political science which prevailed in the latter half of the last century. They have almost universally accepted these conceptions of the state as fully satisfactory for the uses of the economist, without any real attempt at an analysis of the functions of the state from the economic side. It is hardly necessary to say that these ideas have long since been repudiated by the cultivators of the jural and politico-philosophical sciences as entirely unsatisfactory. But the orthodox economist has held to them as if they were law and gospel. We have, as a consequence, the rather absurd phenomenon of the cultivators of one science holding to the conceptions taken from another which the latter itself rejects as worthless for all scientific purposes.

The new school, on the contrary, has simply adapted itself to the changed conditions, and accepted the results of scientific progress in neighboring fields, and on this as a foundation has undertaken to carry the science another stage forward in its development. It has indeed contributed something to jural philosophy itself by its attempts to analyze the concept of the state from the economic side, in order to ascertain the function which it performs in the process of economic production and distribution.

Adam Smith, in common with the tendencies of his time in the field of political and jural speculation, looked upon the state as a purely negative factor in economic and social life, — a something which grew out of the defects of men, — a necessary evil which did most good when it did least harm. He considered its functions to be simply those of protecting society against aggression from without, and violence within. He saw in individual action the source of all progress, the

hope of all civilization, and held that the race would move forward in proportion as all government trammels were removed from individual activity. I do not mean to say, of course, that Smith was consistent in this view, because consistency in such a view is simply impossible, and has never been achieved by any great thinker. He was compelled to disregard his theory repeatedly when discussing practical questions of government and politics of his own time, and many passages may be quoted from his works to prove that he tacitly repudiated the whole doctrine. In this respect he resembles very much some of his distinguished followers, who, finding it impossible to be consistent and to bring their theories into harmony with the hard facts of the actual world about them, make all manner of practical concessions inconsistent with their fundamental principle, which may be quoted to prove that they did not hold such doctrines at all.

But no one can read Smith carefully without admitting that his theory of the state practically denies to the latter any economic function whatever, beyond the simple one of keeping order within its boundaries. All that is more than this cometh of and leadeth to evil. Certain it is that all those in this century who have been opposed to state action of any kind have appealed to the authority of Smith and certain of his followers as having established beyond a doubt that the state has no business to interfere with economic or social relations.

As a matter of fact, Smith made successful war upon certain forms of governmental interference, which in his time were undoubtedly doing great harm; but instead of being content with showing that those particular restrictions had outlived their usefulness, and that the time had come when they could be better dispensed with, he tried to show, or rather assumed, that such restrictions were *per se* injurious, and could be productive of evil only.

The investigation of historians in this century has proven conclusively that the state, so far from being the source of innumerable evils, has always been not only the absolutely essential condition of human progress, but also one of the most important, if not, indeed, the most important, factor in the economic evolution of society itself. It proved that no economic progress has ever taken place outside of the state, and very little indeed within it, except on the basis of the active sup-

port and co-operation of the latter. It established the fact that in state initiative, indeed, lay oftentimes the only hope of any economic development. It demonstrated that many of the very institutions which Adam Smith and his followers so vigorously and successfully assailed had in their own time done the most valuable service in initiating and furthering economic progress. In a word, it dealt a death-blow to that conception of the nature and origin of the state which played so large a rôle in the political speculations of English, French, and German philosophers of the last century by showing conclusively that nothing corresponding to their premises had ever actually existed in human history, and that state action, not merely of a restraining but also of a fostering and furthering kind, has always been the condition and concomitant of any considerable economic development.

The conclusions of history, sufficient of themselves to destroy the old theory, are amply sustained by a careful analysis of the process of production and distribution in our modern society. If we analyze any of the most ordinary acts of production, we shall find that the state is actually or potentially present at every stage of the process. Take, for example, the business of making cloth. The manufacturer could not hope to make any considerable amount of cloth if the state did not protect him in his work by the force of its courts and armies. He could make but a very small quantity, indeed, without the aid of inventions, the preservation and transmittance of which, nay, their very existence itself, is only possible within and through and by the state. Having produced his cloth, he would have no right worth the name to its ownership, if the state did not define and enforce his rights as against all other parties within the state. Having produced it, and being acknowledged as the owner of it, it would be of no earthly value to him, except so much as he might wish to make use of for his own personal purposes, if the state did not protect him in his right to exchange it for the product of other labor toward which the state stands in exactly the same relation as it bears toward that which he produced. The value of his product depends almost entirely upon the means which the state has provided, in the form of roads and means of transportation and communication, to enable him to get to a place where he can exchange it. The value, moreover, depends largely on the general state of civilization within the country, which is to a very great extent determined by state activity. The enjoyments which he can extract from the products he may receive in exchange for his cloth will depend to a great extent on the education which he may

have enjoyed, which, again, will be determined by the extent to which the state may have provided the necessary facilities. When we look, not merely at an individual act of production, but take in a wider view of the industry of the country as a whole, we shall see still more clearly the real character of the state as an economic factor. We see, for instance, in manufacturing, that the discovery and introduction of improvements, the provision of means of transportation, the general provision of educational facilities, both technical and general, — all necessary elements in any wide and long-continued successful system of industry, — have been nearly always chiefly furthered and promoted by state activity in some form or other. In other words, every great extension of the field of production has really been to a large degree dependent on state interference — not merely in a restraining, but also in a promoting and fostering way.

We may formulate our conclusion, then, somewhat as follows: the state is an economic factor of prime importance. To our modern system of production not only are natural agents, labor, and capital necessary, but also the particular kind of services which can be rendered only by the state. The nature of its service is just as fundamental to production as that of labor or capital, and it should be included among the requisites of production. It is a fundamental economic category, something which belongs to the very essence of production, and not something accidental and external, which may be lightly cast aside.

The particular function of the state in the sphere of economics is a varying one. It changes with time and place and circumstance. Perhaps the most general formulation of the essential characteristic of state action in this field is that it is pre-eminently a co-ordinating power. It is a special form of associative action. History shows that men as individuals do not live unto themselves. They must carry on the struggle for existence side by side within and through some kind of social organization, if they are to attain any higher level than the brutes. But no sooner do they appear within such an organization, than the absolute necessity of some type of co-ordinating power immediately appears. Individuals may and ordinarily do appropriate natural agents, and insist on utilizing them in such a way as to preclude any great economic advance; as, for instance, when men take possession of large tracts of land, and refuse to allow others to pass through them. In such a case, the necessity of a co-ordinating power immediately appears. The state, or what answers for that in the given condition of society, must open up roads, no matter what individuals may wish, if

economic development is even to begin. The lay of the land may be such that an extensive system of drainage may be indispensable in order to render it fit for cultivation. The whim or interest of individuals may, and where they are allowed free play usually do, prevent the inauguration and completion of any such work. Associative action may be, and ordinarily is, the only means of securing such an end. Voluntary associative action is generally precluded by the refusal of some individuals to take part whose co-operation is necessary to success. The only means left is compulsory associative action through and by the state. The time soon comes in a progressive society when, in order to secure a higher degree of efficiency, new crops, new kinds of live-stock, new inventions, are necessary; when a new organization of the labor of the country must be undertaken, as, for instance, the abolition of slavery or serfdom, or the development of a system of small farms, — all things which are just as necessary to an increased production as the application of more labor and capital, and all things which can be accomplished on a great scale only by the exercise of state power. Furthermore, a time comes when, in order to secure a larger production, the great mass of the people must be educated, and the skilled laborers necessary to the economic progress of a society must have facilities for acquiring a technical education. All recent history shows that the state must here interfere, and compel co-operative action on the part of its citizens, if the necessary facilities are to be obtained. To take another example, science and experience demonstrate, that in order to obtain the maximum of agricultural production, for instance, from a given country, it is necessary that a certain portion of the surface should be wooded. History shows us that there is no adequate economic motive for private individuals to preserve this proportion if it has once been established, or to establish it if it has never existed: hence the necessity for the state to interfere, and to secure by the application of compulsion the necessary conditions of progress. An excellent instance of this same thing is to be found in our modern railroad system. In order to secure the building and equipment of the railway, we have had to pay enormous sums, directly and indirectly, from the common treasury of society. The state, in all its various governmental forms, national and local, has contributed land, money, and legal powers and guaranties, without which our railways would have remained a comparatively insignificant element in our system of transportation. It has created fictitious persons for the ownership and management of the railways. It has given those

fictitious persons not only immense sums of capital, but peculiar and ample privileges; among others that far-reaching and most significant attribution of sovereignty, — the right to take the property of real persons against their will, and give them, not what the owners consider it worth, but what it seems worth to parties who look upon it in the character of disinterested appraisers.

To sum up this phase of the subject in a few words: a community, on emerging from barbarism, and as it passes from one stage of civilization to another, finds, that, in order to secure a healthy economic progress, large quantities of capital and labor must be expended along lines where a few individuals, by their ignorance or obstinacy, may prevent that collective action without which such investment cannot be made. It is necessary for the state to interfere in such cases; and its action is as truly economic action as that which removes by a tunnel the obstruction presented to trade by a hill, or which renders commerce across a river easy by the construction of a bridge. This same community finds, moreover, that large quantities of capital and labor must be expended along lines where private individuals cannot be persuaded to invest it, since they can see no immediate and sufficient return to them personally. The state is in such cases the only hope; and if, by its incompleteness or weakness, it is unable to respond to this demand, progress stops and retrogression begins.

It is easy to see the bearing of this general view of the economic functions of the state. It establishes the primary importance of state action in economic progress, and it claims for it a purely economic character. So far from allowing that the presumption is always in favor of non-interference on the part of the state in economic matters, it claims that in whole classes of economic processes the presumption is strongly in favor of government interference; so strongly, indeed, that the mere fact of government non-interference proves that the community is living in a lower economic stage than is within the grasp of its collective action by state agencies. It vindicates for the collective action of the community, within and through and by the state, an economic function no whit less fundamental, no whit less important, and in many respects more far-reaching, than that hitherto accorded to individual action. It is an idle attempt to decide which is the more important of two factors both of which are absolutely necessary to the result. It is like trying to prove, that, of the two lines which form an angle, one is more necessary than the other. And yet this is what the old school attempted to do in belittling the economic

functions of the state. The new school simply desires to claim for them their proper position. It is undoubtedly true that in certain countries individual activity and initiative are not vigorous enough to work out the highest possible economic results; but it is also equally true, that, in other countries, state activity and initiative are not vigorous enough to secure the economic results which can only flow from collective action within and through and by the state.

The relation of this theory to the subject of taxation, for example, is significant. From this point of view, taxes are not rewards paid by the individual to government for the protection accorded by the latter. They are simply a share of the product which the state may rightfully claim as being one of the factors in the process of production. The state, as the representative of society, is the great 'silent partner' in every business enterprise. As compared with any given individual, it contributes the larger share of the means of production. To test the relative productivity of the state and the individual, compare the fortune accumulated by Cornelius Vanderbilt in America with what he might have accumulated had he been adopted when an infant by a family of Hottentots.

One word more as to the bearing of this theory on the future of the state as an economic factor. According to the old theory, the functions of the state will become fewer and fewer as society progresses, until finally it will do nothing, or at least nothing but protect, in the narrowest sense, life and property. According to the newer theory, as men become more numerous, the conditions of society more complicated, the solidarity of interests more complete, we shall find that the economic sphere of collective action as opposed to individual action is all the time widening. Hand in hand with this advance, we shall find that government will be so improved that the state can safely undertake to a larger and larger extent the exercise of this collective action. So far, then, from the interference of government decreasing with the improvement of men, we shall find that this very improvement renders it safe and desirable to increase the sphere of state activity. All this can be done without in any degree impairing individual activity of a desirable kind, and, indeed, with the result that the sphere of the latter may be continually widened.

To put the case in a little different way, there are, according to this view, in any given state of civilized society, certain classes of economic actions which can be best performed by a general system of co-operation embracing all the members of said society. To the efficiency of certain of

these classes it is necessary to have complete co-operation, which, as all experience proves, is only possible through compulsion. The only form of desirable compulsion in such cases is state compulsion, which, of course, may be exercised in various ways—from compelling co-operation by courts and armies, to that of undertaking the business by government agencies. If such actions are left to private individuals, it just as surely results in economic injury to society, in circumscribing the field of employment, in discouraging and destroying individual enterprise in the widest and broadest view, as the assumption by the state of forms of economic activity, which should be left to private individuals, tends to destroy all spirit of enterprise in a body politic. When it appears, therefore, on analysis of a given case, that it is one which calls for compulsory collective action, it is not a satisfactory answer to say that the government is too defective in its organization to undertake such work, and therefore it must be left to individuals, since this simply means that it will not be done at all. For certain economic ends the only efficient agency is state agency; and, if that is not available, the only result can be failure to reach those ends. In case of defective government, then, our course is not to rest content with remanding government functions to private individuals, but to improve government until it is adequate to the legitimate demands; and one of the most effective means of improving government is to insist that it shall undertake its proper functions, since the consequent importance of its work will render imperative its re-organization on a proper basis.

E. J. JAMES.

## II.

1. Professor James says much of the old school and the new school of political economy. Yet the differences between the schools, so far as he mentions them, are not on strictly economic matters. He discusses the nature and function of the state, and raises very wide and difficult questions. These questions economic science does not answer and should not pretend to answer. It merely helps to answer them, by investigating one aspect of man's activity. Economists have often expressed themselves on the general subject of the sphere of government; but in so doing they have spoken, not as economists, but as speculators on the theory of the state and of society at large. Adam Smith no doubt said a good deal about the proper limits of government action. Yet his conclusions on that subject formed no essential part of his economic doctrines. So, in the first half of this century the followers of Ricardo frequently gave

expression to a certain conception of the state, which is indicated by the phrase *laissez faire*. They sometimes went so far as to treat *laissez faire* as a natural law, nay, as a natural law of political economy. It was a great mistake to treat it as a natural law; at most, the phrase indicates only a rough rule of thumb. It was a still greater mistake to treat it as a law of political economy. Political economy investigates and explains the phenomena of wealth; in doing so, it helps the 'jural and politico-philosophical' thinker (to use Professor James's comprehensive expression) in solving his general problem as to what the state should do. But economic science does not pretend to solve it, by laying down a rule of *laissez faire* or one of state interference. In laying down a rule as to state interference, the new school is not a new school of political economy, but a new school as to something else. Its adherents commit the same mistake, as it seems to me, that was committed in former days by the adherents of the *laissez faire* ideas, whom they attack so sharply. They fail to distinguish between the province of economic science, and that of sociology, or social science, or political science, or whatever the general science be called.

2. No economist has denied that the state is a most important factor in industrial matters. The economist says, given such and such a condition of the laws and of the government, what effect on the phenomena of wealth can be traced? Obviously the character of the government, and the extent to which it maintains peace and order, enforces contracts, and protects property, are of the utmost economic importance. Professor James's lucid exposition of the cloth-manufacturer's situation is hardly needed to prove this. But thereby he does not succeed in showing that the government should become a still more important factor, or a factor of an essentially different kind. Possibly it should; but to establish this, it is not a valid argument to adduce the unquestioned fact that the activity of the state is at present one important cause among a large number that bring about economic phenomena. In the eighteenth century, government interfered multifariously and vexatiously in industrial matters; yet surely that fact in itself did not go to prove that it should interfere still more.

3. It is a very sweeping statement that "every great extension of the field of production has been to a large degree dependent on state interference, not merely in a restraining but in a fostering and promoting way." That raises a question of fact, of economic history, on which I must beg to differ with Professor James. His statement seems to me exaggerated, and in essentials incorrect. The eco-

nomic history of the last hundred and fifty years does not support it. The enormous advance in the arts during the past century seems to me to have been singularly independent of state interference. Certainly it has not been the result of any extension of government activity over and above that degree of activity which was common in the preceding period. The state tried to foster and promote in the seventeenth and eighteenth centuries much more than it has done in our time; yet we have seen a striking enlargement of the field of production. If economists of the old school belittled the importance of the state, those of the new school are in danger of succumbing to a temptation to exaggerate it.

4. As to the main question, namely, the attitude we should take to the question of state interference in industry, Professor James states his belief that the presumption is strongly in favor of interference 'in whole classes of economic processes.' It is not clear to me how much he includes in this phrase. No doubt there is a tendency toward a degree of regulation in some branches of industry, of which railroads and telegraphs are prominent examples. Economic study gives certain data on such questions; for instance, by showing the advantages of single management, and the supplanting of competition by combination. The data given by economic study, together with those given by study from other points of view, lead us to believe that, as matters stand now, the community should regulate these industries more than it does cotton-spinning and bread-making. How far it should go in its interference is a practical question, to be settled for each case slowly, cautiously, tentatively. In comparatively simple cases, like water-supply, complete ownership by the public has come to be the general rule. The time has perhaps come to handle gas-supply in the same way. How far we will go or should go in a complicated problem like that of railroads, no man can tell. Certainly it is premature to lay down a general rule or presumption in favor of state ownership or management. That new theory which tries to lay down as some sort of a law, or at all events as a certainty for the future, a steady and continued enlargement of the sphere of state activity, rests as yet on a very slender basis of experience. In any case, it is not a new economic theory, but a wide speculation in sociology.

Very little seems to me to be gained by advancing, for problems of this kind, general speculations about collective action and the sphere of the state. Certainly there is no occasion in this country to stimulate the tendency in favor of state interference. There is already quite a sufficient general inclination to interfere. Not infre-

quently, to be sure, one hears expressions about natural freedom and non-interference with the natural laws of trade; expressions which are survivals of the exaggerated *laissez faire* tinge of a generation ago. But no feeling of this kind operates as an effectual barrier to state interference, or stands in the way of needed reforms. On the contrary, public men and voters alike are over-ready to jump at schemes for state regulation, and to engage in crude and harmful and impracticable legislation. Witness the passage in the house of representatives of a bill like the Reagan interstate-commerce bill, — fortunately replaced in the senate by the more moderate, though still far-reaching, bill just passed by that body. In face of the rash attempts of which the Reagan bill is a type, economists and students can most usefully approach the problems, not by general encouragement of state regulation, but by the careful and unbiassed study of specific questions.

F. W. TAUSSIG.

### III.

IN his criticism of my views, Professor Taussig takes the old ground that economic science has nothing to do with the functions of the state. This is exactly the point at issue, and could not, perhaps, be better put than it is by Professor Taussig. I hold that the science of political economy must consider the *economic* functions (notice the limitation) of the state in order to afford any satisfactory explanation of the phenomena of wealth in modern society. It would undoubtedly be possible to construct a science of an economy in which capital, for example, played only an insignificant part; but such a science would have no sort of relation to modern, social, or political life. A science of wealth which leaves out of its treatment the economic functions of that co-ordinating power which in its highest form we call the state, is almost as far removed from any vital connection with our present or future needs.

This is undoubtedly the real reason why all the great thinkers in the field of economics have as a matter of fact, in spite of their protestations that it had nothing to do with the subject, given such a large share of attention to the functions of the state. Adam Smith's views of state action are not an unessential feature of his economic theories. They form part and parcel of them, and cannot be extracted without shaking to its foundations the edifice into which they are built as constituent parts.

The scientific advantage of the view for which I am contending, over that represented by Professor Taussig, consists, as I conceive it, in this. If we recognize the fundamental economic char-

acter of state action, we have a simple, plain, scientific basis for examining the relations of state action to other forms of economic activity. It enables us to investigate within the limits of our economic system whole classes of economic facts connected with state action, which, however much we may wish to disregard them, will force themselves on our attention, and if not treated in an open and scientific manner, and assigned to their proper place, must be disposed of in a half surreptitious and unscientific way. This point of view enables us to bring state action, *so far as it is economic in its nature*, into organic relation with other economic forces in our scientific system, and by an analysis of the processes of production, distribution, and consumption of wealth, to assign to each factor that sphere of action which, with a due regard to existing economic conditions, shall work out the best economic result. This theory is, in my opinion, a progressive one. It contains the promise and potency of life.

The other, on the contrary, is the opposite of this in the respects just enumerated. And so far as any thinker maintains it, and is still doing progressive and active work in the field of economics, — and no better example of this class can be quoted than Professor Taussig himself, — he is continually, as it appears to me, violating his own fundamental principle, and working at a scientific disadvantage.

It will be noticed that this view in itself does not call for any extension or limitation of state action. It simply maintains that there is a sphere of economic activity in which state action is by far the best, if not the only, means of reaching satisfactory results. It holds that this state action is as truly economic as that of individuals, and that it should therefore be regarded as a fundamental economic category. The exact limits of this sphere — the exact things to be done by the state — vary with time and place and circumstance. It may therefore very well be, that two persons holding these different views might agree as to what state action, in an economic direction, is desirable, for instance, at this time in our own country. The difference, as it seems to me, would be simply that the views of the one in regard to state interference would form a consistent part of that one's general economic system, while those of the other would be more or less adventitious. It is the former class of views which promote the development of a science.

I desire, in closing, to express my dissent from Professor Taussig's opinion that the enormous advance in the arts during the past century has been singularly independent of state interference. To argue this point of difference would require a

long chapter of economic history. I think the statement on this point in the body of my article is essentially true. Nor can I agree with my critic that we do not need to stimulate the tendency in this country in favor of state interference. I think that we are prevented to-day from undertaking certain great reforms by the general feeling in the community at large that individual instead of state effort should be relied upon in all cases to secure economic advance. To present the conclusion of the matter in a word, it is perfectly possible, of course, for the state to interfere in such a way as to discourage and destroy industry. All of us agree to that. It is, on the other hand, we claim, perfectly possible for the state to interfere in such a way as to promote and create industry—nay, more: it must be continually interfering to do this, otherwise progress would stop and retrogression set in. Such action is economic in character, and the systematic investigation and discussion of it find their proper place in the science of economics.

E. J. JAMES.

#### CLIMATE AND COSMOLOGY.

No one should take up Mr. Croll's essays for light reading; not because his writing is not sufficiently clear and concise, but because the interaction of the many direct and indirect causes concerned in his physical theory of terrestrial climate requires so involved a conception that the reader must go slowly to possess himself of it fully. This is shown by Mr. Croll's frequent and just complaint that his critics fail to apprehend his points.

The essence of his argument is, that, during a time of great eccentricity of the earth's orbit, the hemisphere, having its winter in aphelion, will be subjected to glacial conditions as a result of the various physical processes then brought into play. Prominent among these is the diversion of the warm equatorial ocean-currents into the non-glaciated hemisphere by means of the increased velocity of the trade-winds in the glaciated hemisphere, and their extension well across the equator, on account of the then great difference between polar and equatorial temperatures on which they depend. For example: if our hemisphere be the cold one, it is supposed that the north-east trade would gain in strength, and extend south of the equator, so far as to carry all the equatorial currents into the southern hemisphere. "The warm water being thus wholly withdrawn from the northern hemisphere, its temperature sinks enormously, and snow begins to accumulate in temperate regions."

If this fundamental point be conceded, we may as well grant all that follows it; but it cannot be conceded for a moment. Our north-east trade will doubtless be strengthened, in winter at least; but so will the prevailing westerly winds of our temperate latitudes. Moreover, the heat equator, along which the trade-winds meet, will not migrate far south from the geographic equator, on a planet with as short a year, as moderately inclined an axis, and as large an equatorial water-surface, as ours—especially when the southern summer is moderated by coming in aphelion, and again, especially in the Atlantic, as long as the coast-line of Africa allows so much cool South Atlantic water to reach the central torrid zone, and as long as Cape San Roque stands in the way and turns so much of the equatorial current northward.

No sufficient reason, therefore, appears for granting the north-east trade strength and area enough at such a time to keep warm water out of the North Atlantic, summer and winter; and in this ocean, at least, the general eddy-circulation would be continued much in its present form, all the more because whatever aid is given by gravity to the wind-made currents is then intensified. The broad drift of waters that crosses the North Atlantic from our shores to Europe would then be accelerated by the stronger winter winds; it would then, as now, divide opposite Spain; and the northern branch on which the moderate temperature of north-western Europe so largely depends would then, as now, be supplied largely with water that had been warmed while crossing the equator. As long as this source of warmth prevails, a winter's snows in far aphelion cannot overreach the succeeding summer's melting in close perihelion, without the assistance of geographic or other changes which Mr. Croll deems unessential.

In view of such objections as this, it seems to me that Mr. Croll decidedly overstates the security of his position in saying that his theory contains 'no hypothetical elements.' The quantitative estimation of his causes is certainly often hypothetical. Until more is known, not only about winds and currents, but also about the behavior of the atmosphere towards radiant energy, and the part played by dust over the land (of which Mr. Croll takes practically no account) as well as by vapor over the ocean, there must naturally be much of hypothesis in the discussion of terrestrial temperatures.

Readers of Dr. Croll's work should examine also a *critique* by Woeikof in a recent number of the *American journal of science*.

W. M. DAVIS.