experience in such matters. He was sitting in front of a house occupying a somewhat elevated position with reference to the rest of the town. Suddenly a meteorite appeared descending from the sky, and fell, he was sure, within a certain square on the lower level. He at once proceeded to the spot, only to find that he was mistaken but that it had fallen a "few blocks away." At this second point the same experience was repeated, and the stone finally located some twenty miles beyond the point where he was "certain" he had seen it strike.

An equally good illustration was offered in the flight of a meteorite over the city of Washington on Sunday, January 12, 1919. This was first called to my attention by a man some eighty miles south of Washington who saw it, as he assured me, strike the ground within one half a mile of where he was standing. Inasmuch as the meteorite had been observed passing over Washington in a northeasterly direction his statement was not accepted. Further reports of the fall in the immediate vicinity of the city and a few miles away were also received. Taking the direction along which the meteorite was traveling, I followed it up by correspondence for a distance of over 300 miles into northeast Pennsylvania where it became lost. The last reports received indicate that it was going in two directions at once (!) and it is very probable that it actually fell somewhere in that vicinity, nearly 400 miles from where first *seen* to fall.

Experiences similar to the above are common. In many other instances stones which were "seen to fall" have proved to be of strictly terrestrial origin. There comes a sudden flash and report, the observer goes quickly to the spot and there finding an object which had not previously attracted attention, assumes it to be a meteorite and in perfectly good faith writes some museum announcing his discovery and willingness to dispose of the same. There is probably not a museum of importance in the world that does not annually receive from one to many announcements of this kind. The receipt even of glacial boulders which were "warm when picked up" or "which set fire to the grass at the point where they fell" is not unusual.

This leads to the second point to which attention need be directed—that relating to the reported temperature of the fallen body, which is often to the effect that "it was too hot to touch," or has been the cause of fires. As in a great majority of cases it is impossible to investigate the actual temperature after the first report has been made it may be well for the moment to consider the probabilities.

While the original source from which meteorites are derived is problematical it yet seems certain that they have been wandering for an indefinite period in space and at a temperature of "absolute zero." At the time of entering our atmosphere it is fair to assume they are cold throughout to a degree of which we can have no conception. During the few seconds in which they are passing through our atmosphere, they become intensely heated on the immediate surface, but these portions are immediately stripped off, and, as we have absolute proof, the heat never extends to a distance of more than two or three millimeters. Before striking the ground the speed of the body is so far checked that it ceases to glow and the thin film of molten material quickly congeals. Cooling of the surface, owing to the intense cold of the interior, must follow rapidly and it is questionable in the writer's mind if a large majority of the reports of the heated condition of the meteorite when found are not based upon expectation rather than fact. He even goes so far as to suggest that when it shall become realized by the public at large that the chances are in favor of a meteoric stone being cold rather than hot when found, it will be so reported.

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## ORIGIN OF SOIL COLLOIDS

Dr. Whitney[1] has advanced an interesting theory as regards the origin of soil colloids. He says, in part:

> My present view is that particles of matter derived from silicate rocks and other soil-forming minerals when they approach a diameter of .0001 mm. contain relatively so few molecules that the

[1] Science, 54: 656, 1921.

bombardment of the water molecules in which the particle is immersed shatters the particle beyond the ability of the molecules in the solid to hold together as a solid mass. The atoms of calcium, magnesium, potassium and sodium in the molecule of the silicate would go for the most part into true solution, while the atoms of silicon, aluminum, and iron would go chiefly into colloidal solution forming the basis of the colloidal matter or the ultra clay of the soil. It should be possible for the mathematical physical chemist, from physical constants now known, to determine empirically the relative size of the particle of matter which could withstand such bombardment without complete disintegration. This is a problem which has not yet been worked out.

This is one way of looking at their origin, but the results of our experimental work on soil colloids force us to adopt quite a different view. One that is not based on bombardment of water molecules, but one based largely on chemical reactions.

Many soil particles are hydrated silicates which contain varying amounts of aluminium, iron, silcon, sodium, potassium, calcium, magnesium and other elements in smaller quantities. Soil chemists claim that these particles are surrounded with a water-film, and that this film is held tenaciously. In the light of this the salts in the outer layer of these soil particles are subjected to constant hydrolysis. The hydrolytic products of the soluble compounds of sodium, potassium, etc., are partly taken up by this water film by way of solution, and part of them are adsorbed by the hydrolytic insoluble products of the iron and alumina salts which form a gel casing for the soil particle, that is, there is an equilibrium of the soluble salt between the water film and the insoluble gel which now surrounds the soil particle.

When the soil becomes flooded as after a rain, and the water moves down through the soil, the soluble salt of the water film is partly removed by diffusing into the moving water. This destroys the salt equilibrium between the water film and the incasing gel, and, hence, some of the soluble adsorbed salt is released to the water film. This continues until most of the soluble material is leached from the outer layer of the soil particle. This leaching may be continued until the incasing hydrolytic gel products of alumina and silica, and ferric oxide may pass into colloidal solution. Not only will the freedom of electrolytes tend to bring the incasing gel into colloidal solution but some of the soluble salts themselves or some salts that are moving through the soil under the proper hydrogen ion concentration will very much hasten their pepitization.

The pepitization of the hydrolytic insoluble compounds removes the encasing gel and the soil particle is again exposed to hydrolytic action, and in this way the weathering of the silicate particles proceeds. The pepitized gel or hydrosol moves through the soil, provided the pepitization is great enough, until it encounters a coagulating electrolyte or different hydrogen ion concentration, when it comes back as the gel and may be deposited on a soil particle, or come down as a precipitate where it remains as an adsorbent and reservoir for plant food until the conditions are sufficiently changed for it to pass back into the hydrosol; that is, the process is reversible

$$\text{hydrogel} \rightleftarrows \text{hydrosol}$$

and whether it is a hydrosol or a hydrogel depends on the soil environment.

Certain soil salts in our work have brought about a very beautiful pepitization, while other salts have brought about an equally definite coagulation. Then there are salts that lie in between these extremes. Again the same salts and same concentration have brought about both coagulation and pepitization by changing the hydrogen ion concentration.

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## A CRAYFISH TRAP

IN ponds and streams where crayfish are abundant they can be readily taken by means of a trap constructed as follows: A rectangular box of any convenient size, sixteen by twenty-four inches for instance, is built of one-fourth inch mesh galvanized screen wire. Into one end of this box a removable funnel of like material is fitted. This funnel should project about eight inches into the box and have a flattened opening about four inches wide and an inch and a half deep. In setting the trap