

upland separated it from the Tippecanoe Valley. Later, after Moot's Creek had swung to the west side of its valley, the Tippecanoe by its westward meander removed the dividing strip, thus forming the present gap.

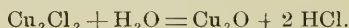
---

## THE ACTION OF HYDROGEN PEROXIDE ON CUPROUS CHLORIDE.

W. M. BLANCHARD.

This investigation was suggested by the results obtained in the study of the action of large volumes of water on cuprous chloride. Some time ago my attention was called to the fact that when a large volume of water is added to cuprous chloride the salt becomes orange colored. If this water is removed and a second quantity added the color of the salt deepens, and if this operation is carried on long enough, a few days being sufficient if the water is changed every few hours, the salt finally becomes a bright red and in all respects resembles cuprous oxide. Upon analysis the compound proved to be almost pure cuprous oxide.

A search through the literature at command was made but no such action as this was found recorded. A careful study of the reaction was then made. It was at first believed that the reaction took place according to this equation:



It seemed that the first water added resulted in the conversion of a part of the cuprous chloride into cuprous oxide and hydrochloric acid and that no further change took place until this acid was removed, and more water added. But further investigation showed that this was not correct. The water removed was found to contain cupric chloride; this salt could be produced in this case only by oxidation, and the oxidation could result in all probability only from oxygen dissolved in the water.

By properly constructed apparatus it was shown that water which had been previously boiled for an hour and cooled in a current of hydrogen produced no change on cuprous chloride.

About this time I had access to Dammer's Handbook of Inorganic Chemistry and there I found a reference to this very reaction. It was expressed by the following equation:

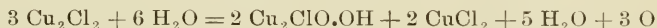


A further study of the reaction proved this to be correct. The reaction, however, is not complete, for only about 97 per cent. of the cuprous chloride is changed, even when the process is carried on for several months and the compound shaken repeatedly with water in a stoppered bottle.

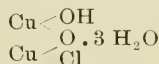
Since these results are produced by dissolved oxygen it seemed that the reaction might be hastened by running a current of oxygen into the water containing cuprous chloride in suspension, since in this case the oxygen could be replenished as fast as used up. The experiment was carried out, but instead of getting a red product, a blue one was obtained. This is probably the basic chloride described by Mallet<sup>1</sup> as formed when a current of moist air is passed over hot cuprous chloride.

This unexpected result led to a study of the action of hydrogen peroxide on cuprous chloride. The investigation is not complete; the results obtained up to date are as follows:

When hydrogen peroxide is added to cuprous chloride, the color of the salt immediately becomes a dirty green, and upon the addition of more peroxide, finally becomes a delicate blue. The compound appears very flocculent. If the reaction is carried out in a bottle or flask connected with a burette, a considerable amount of oxygen can be collected. The volume of oxygen evolved does not seem to bear any direct ratio to the amount of cuprous chloride used. If the reaction is carried out at 100° instead of at ordinary temperature, the reaction seems to be the same except that the evolution of the oxygen is much more rapid. The compound is evidently a basic chloride. It is insoluble in water, does not change in boiling with water, does not materially diminish in weight or change in color until heated to 250°, and is easily soluble in dilute acids and in ammonia. There is some evidence in favor of the following reaction:



The reaction probably taking place in two stages. The blue compound would seem to have the composition:



A curious fact was observed in connection with this study which seems to be true of other complex copper ions. If this blue compound is dissolved in ammonia and hydrogen peroxide added, a violent reaction takes

<sup>1</sup> Comp. rend. 62. 249.

place, accompanied by a rapid evolution of oxygen. The compound itself does not produce such a change, neither does ammonia, but only the solution of the one in the other. It was found that copper sulphate dissolved in ammonia will behave in the same manner.

---

## RIPPLE MARKS IN HUDSON LIMESTONE OF JEFFERSON COUNTY, INDIANA.

GLENN CULBERTSON.

In the proceedings of the Indiana Academy of Science for 1901, and in a paper entitled: Concerning Well Defined Ripple Marks in Hudson River Limestone, Richmond, Indiana. Prof. Joseph Moore and Allen D. Hole describe Hudson limestone ripple marks near Richmond, Indiana.

In this paper I desire to give briefly the location and some points of description of similar markings in the Hudson limestone of Jefferson County, Indiana. In this county, to my knowledge, Hudson limestone ripple marks occur in five widely separated localities and at six different horizons. In all essential points the accurate and full description of the ripple marks at Richmond may be applied to those mentioned in this paper.

The geographical positions of the Jefferson County markings will be given in the order of their geological horizons, the Clinton limestone being used as a basis for measurements. Following this a few of the principal points of interest touching the ripple marks will be included.

The Wolf Run ripple marks are found at the roadside and in the creek bottom within 200 yards of the end of the Ryker's Ridge pike on Wolf Run in Madison Township. In this place there are two quite distinct series of markings. The upper is in a stratum approximately seventy feet below the Clinton outcropping on the neighboring slope. The lower is in a stratum some six or eight inches below the first. The upper series of marks are exposed over a space some 35x8 feet, while the lower is exposed over a surface of some three or four square yards. The trend of the crests of the upper marks is N. 70° E., and of the lower N. 50° E., approximately. I say approximately since there are many small irregularities in the trend of the crests. These crests are, however, essentially