Missouri. No. 341 1900

Van Hise, Charles Richard, 1857-1918
[s.l.]: [s.n.], 1900

U. S. GEOLOGICAL SURVEY

FIELD SECTION BOOK

9-891

LAKE SUPERIOR DIVISION.

INSTRUCTIONS.

1. Ordinarily at least two pages of this book will be devoted to one section. On the left-hand page, place a map of as much of the section as has *actually been seen.* Denote rivers, lakes, marshes, etc., by the usual topographical signs. Denote the ledges of rock, when no structure is made out, by cross-hatching, making the cross-hatching cover as nearly as possible the areas occupied by the exposures. If the rock is a massive one, but still more or less plainly bedded, use the same sign with a dip arrow and number attached, showing the direction and amount of the dip. Denote a shaly or other very plainly bedded ledge by right parallel lines, and a ledge having a secondary structure by wavy parallel lines running in the direction of the strike, with dip arrow and number attached as before. The greatest care must be taken to avoid confusing slaty or schistose structure with bedding, and in all cases where there is the least doubt about the true bedding direction, indicate it by a query. To each exposure on the face of the map attach the number of the specimen representing it. In mapping the section count each of the spaces between the blue lines as 100 paces, and twenty of these spaces to one mile, or 2,000 paces. Usually the southeast corner will be placed at the bottom of the page, or at the first black line above the bottom of the page, and at the right-hand side. If, however, for any reason, it is desirable to show portions of an adjoining section, the southeast corner may be shifted up, or the map may be turned around and the north placed at the left-hand side of the page. The ruling of the left-hand pages is also arranged so that, if desirable, a larger or a smaller scale can be used, eight inches, two inches, one inch, or one-half inch to the mile. With the two-inch scale, the squares outlined in black represent sections, and those in red, quarter sections and "forties," while the space between the blue lines is 200 paces.

2. On the right-hand page place the notes descriptive of the exposures. Begin in each case with the number of the specimen, placing the number on the left-hand side of the red line, after which give in order on the right of the same red line the position of the ledges as reckoned in paces from the southeast corner of the section and the dip and strike when observable, the latter always being expressed from the north; for instance 4025, 250 *N.*, 300 *W.*, *Strike*, *N.* 78° *E.*, *Dip* 50° *S.* Then follow with a full description of the ledge. When topographical maps are used for locations this paragraph applies only in part.

3. Collect a specimen from every ledge, or wherever there is a change of rock on any one ledge, taking care to get fresh material, unless for a special purpose the weathered surface is desired. In case of trips made on foot or in canoes, for long distances, neighboring ledges, unquestionably of one kind of rock, need not be specimened. The position and extent of the ledges not specimened should be marked on the map, with notes that each is of a rock identical with specimen so-and-so. Under the same conditions small-sized specimens, trimmed to a uniform size of 2 x 2½ x ¾ inches will be allowed, but in all other cases *large-sized specimens*, trimmed to a size of 3 x 4 x 1 inches, must be selected, in accordance with section 3, chapter IV, p. 44, Regulations of the U. S. Geological Survey. Specimens should not be placed together without protection in the collecting bag, as the fresh surfaces, important in determining the character of rocks, are thus destroyed. They should be damaged by no temporary mark, but the numbers should be at once marked in at least two places upon the inclosing paper or cloth bags. Specimens may be permanently marked in camp by painting the numbers upon them in white upon a black background, using Silver White and Ivory Black oil tubes for color, with turpentine as a diluent.

4. On the last twenty-five pages of the book give, as may seem desirable, a general account of the examination of the region mapped in the previous pages, correlation of observations, sketches, cross sections, etc.

5. Forward this note book as soon as filled as registered mail matter to C. R. Van Hise, U. S. Geologist, Madison, Wis.

6—747

Webb City and Carterville.

Ore generally below shale; this much broken in places. The ore, galena and blende; the galena above the blende. In the deeper workings, those of 200 ft., galena and blende found together.

The open pits of Carterville show beautifully the broken shale and limestone. The original rock sheeted limestone and chert. The ore product is the brecciated chert with blende matrix. Ore plainly replaces the limestone. The brecciation partly due to solution and sagging; but the fine sharp character of the flint particles leads me to believe that they are generally in areas of mechanical brecciation.

That ore replaces the sheeted chert and limestone is perfectly clear.

The limestone associated with the ore and partly replaced by the ore is dark colored and apparently carbonaceous.

Joplin.

The ore here said always to be below some layer that keeps out the water. In the mines visited shaly layers, carrying much carbon, found in all the pits. In some places with these occurs asphaltum or pitch which burns readily,, lighted with a candle. Perfectly clear that near where pitch and organic-bearing chale is present in layers, ore is plentiful.

On driving from Webb City saw samething on dump. The ore a brecciated flint bearing fragments of shale.

At one dump found the ore in characteristic crystals in limestone. In places these crystals leached out. No carbonate or silicate. ZnS probably oxidized to sulphate and carried down in that form to be again reduced.

Galena again on top.

At Carterville, Webb City, and Joplin chert of the ore must be brecciated. If this were from the limestone by solution, the nodules would be rounded.

Aurora.

Here is a so-called sand ridge. Below the sand is shale. Below the shale, chert and limestone are locally brecciated. Perfect sharp breccia very rich in ore found at one shaft.

Capping shale is very thin bedded; 18 or 20 feet thick. In other places the shale is said to be only 2 or 3 feet thick.

In one place saw shale; but solid chert and limestone, sheeted, and below this the usual brecciated chert and ore (mainly jack, but containing in places some silicate). The silicate present is amorphous after the jack.

In the deeper workings, from 70 to 200 feet, are many water channels. Above these channels usually rich pockets or zones of ore, 2 or 3 or more feet in thickness.

In some places the jack and calcite make the inside of the channel.

In one place inside of this was the typical brecciated jack and chert; on this was the pyrite and marcasite, and on this the calcite.

Sometimes between the jack and dolomite is galena.

If this is general for the Aurora district, the ore was deposited comparatively early, and the later products are the final work of the waters.

This seems to suggest that the circulation wa s rather deep.

In the first developed part of the camp near Aurora the ore is silicate. This is shallow. With this was also galena. The lead was the product upon which the camp opened up. Deeper down they came to the silicate, or the silicate came in directly below the surface, as we saw at one cave. Here it is perfectly plain that the brecciated jack andflint horizon, with associated limestone, were acted upon by the surface waters. The flint was soft, so that it could be cut with a knife,- called tallow rock by the miners. This is a beautiful example of the product of the oxidizing waters. There are limestone boulders, etc., all mixed up, and yet upon the whole the silicate takes the place of the jack. Specimens show the silicate along the sides of the chert nodules, and in veins across them. Where the silicate is at the surface there is no shale capping. This has been removed.

General.

The ores were deposited along the shales as sulphides, being reduced by carbonaceous matter.

The water circulation is deep-seated. This is evidenced by the fact that all miners assert that rains, even if violent and long-continued, make no difference in the amount of water. Generally impervious roof or one approximately so above.

Takes much effort to remove the water,- vast quantities are taken out. Caves fall in in some cases. But when the water is "once beaten" it is easy to keep down. Often there is not enough to do the work of milling.

No impervious strata found and none needed so far as the workings have extended to the present depth.

There is little sulphide of iron. The iron probably has gone to carbonate. Explanation is probably the small amount of sulphur. This the galena and jack would get, and not the iron.

Silicate formed instead of carbonate by law of mass action and relative solubility. The silica is soluble form abundant, it is the most insoluble.
The absence of silicate in Wisconsin due to the absence of soluble silica. The silicate a weathering process contrary to the general rule.

East of Springfield the ore occurs in well defined crevices. Here this is followed for considerable distance. The blende in crystals in the shale below,- the lower shale of the Carboniferous. This is the lower confing stratum. Record of observed deposits.

At Aurora the shafts are in lines. There appears to be several "runs" of lines, as in Wisconsin.

At Webb City and Joplin and Carterville similar runs, but not always definite. No doubt however of fractured zones and belts of circulation, although upon account of solution these are somewhat variable.

Joplin, Mo., Dec. 27, 28,
29, 30, 1900.

With Willis and Bain went along some of the low areas adjacent to Joplin. There is no doubt that the development does to a considerable extent follow the drainage lines. It is no less certain that the veins of shafts follow belts along these low lying areas.

It is believed that the explanation lies in the presence of a zone of fracture. If one tried to locate a definite line, he would fail; but if he looks at things more closely, he will see the belts or zones along which the workings extend. In many cases these depressions also show the coal measure shales.

The explanation of the shales in some casesis faulting in. Bain in some cases regards same as due to pre-Carboniferous erosion; i.e., explained by unconformity. In many cases these belts are now zones of fracturing, and the drainage lines have been located by the shales, although it is possible that the drainage was located in pre-Carboniferous time by lines of fracturing, and that the post-Carboniferous fracturing has followed old lines.

With Willis and Bain went underground at Prosperity in the Boston-Get-There.

Here at a depth of about 20 feet saw a belt of sheeted flint which has been worked over an extensivearea for zinc; many acres have been worked out, the limestone above being held up by pillars. This is the broadest, largest continuous area of paying ground that I have seen.

Also examined other mines underground, most of them being in the deep sheet ground. In most places the chert is broken and recemented, and the ore usually associated with the secondary chert. Calcite and dolomite are also present.

At one place we saw the shale faulted in two or three blocks at the end of the drift, just as in a picture. At various other places saw signs of faulting; but to me the significant things are the broad belts of shattered ground coming against limestone bars, or, in other words the continuous belts of limestone. In many cases the chert is probably faulted against the limestone.

The faulting is probably normal, but in places locally having the appearance of overthrust; but this is believed to be due to drag.

At one mine the shale hanging over the blende seemed to be in plunging anticlines, the broken flint with slickensides below, and same bearing the ore.

At many places saw zinc sulphide abundantly, showing how fast oxidation goes on when the groundwater is lowered. Also at some places the ground was hot. The Foreman told me tha the ground was commonly hot at places where the ground is rich; in other words where sulphides abundant and oxidation going on rapidly.

In one place saw water channel where the zinc was oxidized and removed, the ground around being hard. In this channel the water is flowing into the mine. I suspect oxidation to have taken place since the groundwater lowered.

In reference to channels, one miner said they all followed the old channels in exploration, paying no attention even if the ore played out for some distance. At one mine visited was only 90 feet below. This is the upper run; the lower run is in sheet ground some tens of feet below. Here they were following water channel. The ground may not be sheet ground like the others above described. The ore is associated with broken flint, calcite, and dolomite. Where limestone appeared, there was little ore. In this mine at the top runs there was considerable galena; but in the lower part of the top run, mainly jack.

In deeper runs in the same area, it was all jack. In places the broken flint dull, the seam of calcite and dolomite partly dissolved. This ground the Foreman called "dead." Believe same to be ground wholly depleted in ore. The places where the ore is minerals of same material, but the minerals bright, not oxidized and depleted. This is the place where many of the lead crystals are oxidized to show curved surfaces. Thus even the lead is now being dissolved and carried lower, but is quickly precipitated by the other sulphides; and thus the lead is concentrated in and confined to the top, below the blende. Second concentration thus the explanation of this distribution.

At Joplin, the evidence of ascending water seems everywhere conclusive. Although Joplin is on a ridge, before prospecting began the water level nearly approached the ground. As result of pumping, the water level lowered. At several places this lowering has developed caves. These caves are lined with gigantic crystals of calcite,- dog-tooth form. Some of these are 18 or 20 inches long; those 10 to 15 inches are the average size. No stalactites, no stalagmites, or any other of the phenomena of ordinary caves. Originally almost no clay or dirt, but the clean, fine, perfect crystals. Notwithstanding the great size of the crystals, the faces are almost perfect planes. Often included in the calcite are many parallel hair-like inclusions of pyrite or other sulphide. The question arises as to the way in which these caves formed. Now it is certainly a place of deposition and cementation. If cave dissolved out, it is 200 or more feet long, 50 to 70 feet wide, and from 10 to 30 feet high. If dissolved out, conditions must have changed. Is it not possible that in the brecciation and faulting openings as large as the cave could be formed. The shapes of the water channels seemed in general to correspond with those of the caves; i.e., are usually several times as broad as high, as if partings had formed along bedding planes or other planes, and these on account of rottenness had left openings. Thus they explain the remarkable widening and narrowing, their subdivision, their variation from small and insignificant openings to larg ones; while if dissolved one would expect somewhat greater uniformity

If dissolved, it is probably due to the influence of mingled descending and ascending water.

Since the groundwater has lowered, the solutions have come down from above, and indurated the calcite with clay and iron oxide. In places the iron oxide is oxidized in situ. The calcite streaked with salts. In short, all the evidences of the inauguration of the conditions of the belt of weathering.

Willis told of case in Mexico where induration of Cretaceous through surface evaporation had cemented talus slopes, and had hardened the surface of the limestone to material like marble for depths of several to 20 feet.

Aurora, Dec. 31st.

Here walked around and saw the evidence of faulting in one of the open pits.

With Bain saw the way the runs went, as mapped.

Went underground at the Sand Ridge Mining Co.'s property. Here under the shale is limestone; under this is the rich jack ground, with no lead,- no silicate. The gangue, aside from the chert, is mainly calcite instead of largely dolomite, as at the Joplin camp.

The bottom of the ore area which is very rich and about 20 feet high, is 180 feet from the surface.

But a little way to the S. W., where shale is not found, have silicate ground at a depth of less than 100 to somewhat more than 100 feet. In this silicate is lead. The man in charge said that jack came in below. But in this case the clay is a transition. Mr. Taylor of the Baldwin, which is but a short distance from the other, says that he has silicate ground on top; that a little selvage comes in, and then lead alone is found, and this again is sharply separated from the blende below. I suspect however that close examination would show overlapping. At any rate, here have vertical distribution, precisely same as in Wisconsin; and here it is absolutely certainly due to downward concentration.

Mr. Boyer said that at the bottom of his shaft he found some lead mixed with jack. This is an interesting confirmation of the general theory, as showing that at the first concentration enough lead out of which a rich narrow belt could be concentrated by downward moving water.

At one place saw some jack and marcasite banded exactly the same as in Wisconsin. Bain says this occurs at several of the mines

Thus, while upon the whole the ores are rather different, they are so connected as to show essentially the same minerals in essentially similar relations.

This iron-bearing ore is treated by partial calcination and then jigged; or else the ore is calcined just enough to make the iron magnetic, and then separated magnetically.

While ascending waters are dominant for the district, yet descending waters produce their marked effects, as at Aurora. I am however impressed with the idea that the complex phenomena of many of the deposits is explained by the mingling and the resultant reactions of the ascending and descending waters by methods given in my paper.

Bain says the ore tends to be rich near the basis on impervious strata without reference to whether lime, shale, or what-not. This is primarily explained by slower motion, eddies, and by the side precipitating solutions. I would think the latter the main cause, if the ore did not occur about boulders of limestone; but even in this case the limestone or some of its compounds by going into solution may precipitate the ore.