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Ohio Mining Journal

Title: Map Construction

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Issue Date: 1-Mar-1885

Citation: Ohio Mining Journal, vol. 3, no. 2 (March 1, 1885), 14-20.

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URI: <http://hdl.handle.net/1811/32457>

**Appears in
Collections:** [Ohio Mining Journal: Volume 3, no. 2 \(March 1, 1885\)](#)

MAP CONSTRUCTION.—R. S. WEITZELL, LOGAN, O.

In order to determine upon the quality of paper, proper scale and degree of accuracy, upon which to construct a map, it is necessary to know its object or purpose. This, of a mine map, is understood to be, to enable the operator to decide upon the most advantageous and economical manner of opening and operating the mine, to illustrate its workings as they progress, and to preserve a record of the mine operations.

To exhaust a coal property of any considerable size, requires a period of several years, during which time, the map will be much worn from handling, from putting on additional notes, and by its frequent use for reference. The paper, then, should be of the very best quality; one with heavy body that will stand considerable erasing and cleaning with knife and rubber; and having a good surface and muslin back.

Keuffel & Esser, in their "Paragon" brand, furnish a paper fulfilling these requirements splendidly; a paper that, perhaps, has no superior for mine maps.

A good water-proof India ink is desirable, and is pretty well provided in the "Water-proof" brand of Higgins' American Drawing Ink. It is jet black, liquid (put up in small bottles) and always ready for use. Perhaps not quite as fine lines can be drawn with it, with either drawing or steel pen, as with good stick ink

ground, and it will in the course of time, get too thick from evaporation, and accumulation of dust; but these objections are rather outweighed by the advantages cited above; *i. e.*, its color and readiness for use. Red and blue drawing inks that will stand washing are also a *desideratum*, and are pretty well supplied in Keuffel & Esser's Indelible Blue and Carmine Drawing Inks; the blue is all that could be desired, the carmine does not work quite so well, but is pretty fair.

In the number and kind of drawing instruments needed, draughtsmen will differ widely; some draughtsmen, possessing the happy faculty of making an instrument perform many offices, will need but few instruments; while others will require a separate instrument for each particular operation. As in the field, so it is in the office, better work can be done with first-class instruments, than with poor one, and therefore they are preferred.

The following outfit is, perhaps, the minimum that could well be got along with; this can be elaborated upon as much as taste, requirements and salary will permit:

A nickel-plated steel straight-edge, 36 to 48 inches long, with one edge beveled; *one edge of this length* answers pretty well, but two, one of 30 and one of 72 inches length, are better; two metal triangles, either German silver or steel nickel-plated; one with 30, 60 and 90 degrees, and the other of 45, 45 and 90 degrees; the former, with one side adjacent to the right angle, 12 to 15 inches long, will be found quite desirable, and both should have their 90 degree angles as nearly exact as they can be made; a 12-inch triangular scale, graduated 10, 20, 30, 40, 50 and 60 divisions to the inch; metal ones are best, as their graduations are more regular; a German silver semi-circular protector, with arm, and vernier reading to single minutes; a needle point (*i. e.*, a common sewing needle set into a wood handle) for pricking off distances; one or two good ruling pens, and a small bow pen: a pair of six-inch dividers, with pen, pencil and needle point; beam compass for any circles of large radii: some fine-pointed steel pens; Gillott's No. 170 and Gillott's mapping pens are both good: a stick of India ink, a few good water colors, color cups and camel-hair brushes; a dozen thumb tacks, or what is better, a dozen good paper weights, for holding the paper flat.

The scale must be decided upon, before anything can be done toward constructing the map; and upon this question, there would probably be a diversity of opinion as to what is proper. The mining law is not far wrong when it makes the minimum scale permissible, 200 feet per inch, as anything less than this would be too small to work to, with the desired accuracy, and would not show the work as satisfactorily. For maps of a less territory than a mile square, 100 feet per inch answers very well, but for larger areas it makes the maps too large and unwieldy.

The next thing claiming attention, is the position of the map upon the paper; in this, the general rule of making the top of a map north, is adhered to, unless this is impossible, or there are other good reasons for deviating from it.

With the field notes, which should be, and we assume are, copies, and accurately taken, we are now ready to construct the map. But before proceeding to do this, let us ascertain what the map should contain. Should a solution of this question be sought from the mine owners or operators, there would probably be as many different answers as persons answering, and differing all the way from no map at all to one of the most minute detail. We submit the following answer, believing it to cover the whole ground and nothing more—"All the information obtainable by survey that will be needed or desired in opening or operating the mine or that should be preserved when the mine is exhausted and abandoned."

This is a very general and unsatisfactory answer.

Let us itemize, and at the same time discuss briefly the best method of recording, at least some of the data to go upon the map.

One of the prime objects of a mine map is to show the boundary line of the premises and the position and direction of the lines subdividing the adjoining property, between the different owners. A mine map would certainly be very incomplete without these, even if they were not required by the mining law.

Small circles of the water-proof black ink, put on with the bowpen, mark the corners very neatly, and straight lines of the same ink, connecting adjacent corners, completes the boundary line. Subdivisions of the adjoining land are marked by short lines of the same ink, thrown off in the proper direction from the corners of such subdivisions. The boundary, and all subdividing lines of ad-

joining property, are rendered conspicuous by shading with water color, generally using carmine for the property being mapped, and some different color for all the others.

The position and extent of all railroad tracks, and all public roads, upon the property, is often very desirable, and these two objects are indicated upon the map, the first with carmine ink, by a single line for center of track, if the scale is 200 feet per inch, and by two parallel lines, indicating the gauge, if the scale is 100 feet per inch; public roads by parallel lines in black representing their margins.

The whereabouts of streams, or ravines of any size, and their elevations, is valuable knowledge to the mining boss, and therefore should be represented. The streams and ravines are represented in the indelible blue ink, and the summits of ridges by a dotted line of black ink and marking it, "summit of ridge." The stations and elevations are conveniently indicated by writing the former as numerators, and the latter as denominators, of a fraction. When the coal crops out on the premises it is very desirable to know the place or position of this outcrop, in order to arrange the underground workings suitably; a very appropriate conventional sign for this outcrop is a rather heavy line, of the stick ink ground, and laid on with a camel's hair brush; make the line very black next to the coal territory and blend it off next to the barren territory.

The position of the hoppers, houses, and all other buildings, are very often asked for, and are occasionally useful in determining a point on the surface corresponding to some one underground; therefore, these are located on the map in their proper position, size and shape.

The especial object for which mine maps are constructed, is to illustrate the underground workings, hence all the underground excavations—entries, air-courses, rooms and breakthroughs—are shown in their proper places, sizes and shapes. These various objects are outlined with steel pen and water-proof black ink, and the area excavated is tinted with water color, leaving the unexcavated portion white. A different tint is adopted for each year's work, and, where periodical measurements are made, the same can be shown by black lines across the entries, rooms, &c., indicating the extent of workings at the time of measurement; the dates of measurements can be placed along these cross lines.

As fast as pillars are drawn they, too, are colored up appropriately.

The first thing the Mine Inspector turns his attention to is the ventilation; the doors and air-shaft must then be added, that he may, by aid of these and the breakthrough, trace the air current through all its meanderings. The location of sumps, pumps and boilers, is frequently asked for, and the best way to answer such inquiries is to show their position upon the map. The rise or dip of the coal is one of the most valuable pieces of information to the mine boss; for this reason the levels throughout the mine are put upon the map in the same manner as the levels along the ravines and ridges. Faults of the mine, such as "clay veins," "horse-backs," etc., are matters of much interest, and considerable importance to the operator, at least one would be led so to believe, from the frequent inquiry, predictions and grave apprehensions about them. It would be an unpardonable oversight to omit such important matter from the record; hence we devise some conventional sign to indicate these characteristics. The draughtsman can not make reliable future additions of the underground workings, to the map without having indicated on the map the base lines and stations of the survey, throughout the mine. So it becomes necessary to put these on; and to insure this permanency and visibility they are neatly ruled on in indelible carmine ink, and the survey stations are indicated by small circles of same ink. As fast as permanent falls of the roof occur, they should be properly noted upon the map in some conventional manner. As a matter of course, the mine owner wants to know who his neighbors are (who don't?), and very naturally turns to his map to see, and if the map is thorough and complete and the mining law complied with, he will find their names neatly lettered on the various tracts of land adjoining him. The lengths of the boundary lines should be placed along them, to answer any questions as to the dimensions of the property. So far as a representation of the property on paper is concerned, the map is now complete. But when we go to use it we soon learn that it is still deficient in two or three particulars.

The first thing wanted to be known is the points of the compass. For the benefit of those who want these points exact, a meridian is put on at some convenient place, and for the benefit of those who only want the general direction of the points of the compass, the

word NORTH is conspicuously placed at the top, where it can scarcely escape the eye of all observers. The next thing wanted and not found is the scale,—that very essential appurtenance to all maps, and without which the uninitiated might be led astray in trying to ascertain some needed but unknown distance. Some prefer having the scale laid down on the map, others prefer just having the scale stipulated; as, so many feet per inch. We are inclined toward the latter method, and it should be placed upon the map where it can be easily found; following the title is a very appropriate one. Some explanation of the meaning of the various lines, tints, marks, figures, etc., is necessary for the understanding of those who are not so familiar with them as the draughtsmen, and this necessitates a copious list of notes and explanations, an appropriate place for which can always be found on some unoccupied spot of the paper.

The map is now complete, save a name, a title, and this title is quite indispensable to any map, and in mining maps contains a considerable amount of information very necessary or desirable to be known. The title, when properly constructed, tells that the drawing is a map, and of what; gives the section, township, county and State wherein the property is located, and when and by whom surveyed. There is no other part of a map that will add so much to its general appearance as a well proportioned and neatly constructed title, and on the other hand an ill proportional clumsy, slovenly title will detract materially from the appearance of a map, be it (the map) ever so artistically executed. For these reasons we are in favor of neat and appropriate titles.

The name of the delineator and date of execution (of the map, not the delineator) are very proper matters to be recorded on the map, that we may know whom to praise, if it is well done, and whom to censure and charge with mistakes, if the work is poorly done or mistakes made. If, in the author's opinion, it is a worthy piece of work, his name can probably be found in some corner or obscure part of the map, but if he does not deem it worthily executed you will look in vain for his card.

We have not mentioned the border, because it is not a necessary part of the map, but a neat border adds very materially to the appearance of a map, and we have no objection to urge against it.

Throughout the preparation of this article, we had in our mind's

eye the needs and requirements of the Hocking Valley and similar coal fields ; we are aware that such a map may not be applicable to all mining regions, or rather that some mining regions are of such character that all the data mentioned cannot be gotten, but we believe that in the more important data it can be followed very closely. Now, while there might be some additional notes that could be added to the map that would enhance its value a little, nothing we have provided for can be left off without somewhat impairing its usefulness. The original map should be kept at the Engineer's office, where proper care will be taken of it, and duplicates taken off on tracing cloth for the owner or operator and mine boss.