Conventional Symbols for Mine Maps

By LESTER C. UREN

There has been a strong tendency in recent years to standardize everything from mine accounts to the phraseology used in technical writing, but there seems to be a singular lack of interest in every effort to standardize the symbols used on mine maps. On several occasions the topic has been discussed in the technical press and elsewhere, but we have, as yet, no conventional symbols for use on mine maps that might be fairly regarded as having received the stamp of general approval. Only a few of the many symbols that are in use have approached standardization through common usage; and yet there seems to be a real need for agreement on at least the more frequently used symbols. Just as one must be familiar with the phraseology of a technical article in order to gain a full understanding of it, so he must be familiar with the symbols used on a mine map if he is to interpret it properly.

It makes little difference, perhaps, whether we use a full or a half-shaded rectangle, or one with crossed diagonals, to indicate a passage extending upward from a level in order to distinguish it from one extending downward, but if engineers use such symbols indiscriminately and without mutual understanding, much confusion may result. Such symbols are seldom explained in the legend that accompanies the map, and it is generally necessary for the reader to decipher for himself the code that the draftsman makes use of, often at the expense of considerable time and study.

Map draftsmen accustomed to the usage of a group of symbols at some particular property, or among a certain coterie of engineers, have the idea that such symbols have become standard, only to find when transferred to a new organization or locality that their use of these symbols is questioned or misunderstood. An inspection of mine maps, representing the best practice in many widely scattered Western metal-mining districts, shows conclusively that there are no accepted conventions and that no real standards can be said to have been developed.

Much more has been accomplished in other fields of drafting practice than in mine-mapping, in the development of standard conventions. Mechanical draftsmen have a commonly accepted code of symbols that has come into such general use that it is truly a 'sign language'. Architectural and structural draftsmen, too, have developed a fairly well recognized set of conventional symbols.

The accompanying four plates present a series of conventional symbols that are used by engineering students in mine-mapping at the University of California. They have been gathered from various sources. and they represent, as nearly as I am able to determine, the nearest approach to a group of standards afforded by a close study of current mine-mapping practice. There are a few repetitions of symbols, since each plate is intended to apply to particular classes of work and be complete in itself. Thus, Plates 1 and 2 contain symbols for use on surface or topographic maps, while those on Plate 3 are useful particularly on maps of underground workings. The symbols suggested on Plate 4 may be used on topographic maps to show areal geology, or they may be applied to geologic maps and sections.

Since these pages are printed in black, it is not possible to reproduce the symbols in the variety of colors in which they would be applied to the map. However, it will be noted that the descriptive lettering on the plates specifies the colors to be used, either for each symbol or for each group of symbols. When no color is mentioned, it is intended that black will be the color used.

Some instructions other than those it has been found possible to give on the plates will assist in the application of these symbols to the best advantage. These will be suggested briefly under the following headings, which coincide with the plate numbers on which the particular symbols discussed are to be found.

PLATE 1. In drawing contours, the heavy contours should come at 100-ft. intervals. If the contour interval is small, however, the accented 100-ft. contours may be too far apart for ready reference, in which case any convenient multiple of five may be used as the interval between heavy contours. The numbers indicating elevations of contours should be lettered in the contour—not above or below it—in a space left for the purpose, and they should always read up-hill. While brown is the color suggested for contours, if tracing cloth and India ink are the media used, it is preferable to use a mixture of equal parts of yellow and brown ink.

Canadian Copper Co. (now International Nickel Co. of Canada), drawing-office standards.
### Conventions Used on Topographic Maps

#### Hypsography (Color: Brown)
- Contours (Every fifth contour accented)
- Dumps and steep slopes
- Dumps and car tracks
- Fill
- Open Cuts
- Cut (shown by contours)
- Stripping
- Open Pits and Depression Contours
- Sand and sand dunes

#### Hydrography (Color: Blue)
- Large Size Streams
- Medium Size Streams
- Small Size Streams
- Intermittent
- Lakes and Ponds
- Intermittent Lakes
- Reservoir and Dam
- Pipe line
- Ditch
- Water Tank
- Marsh along shore-line of stream or lake

#### Geological Symbols (Color: Yellow)
- Contacts (tree band) Accurately determined
- Strike and Dip
- Fault
- Shear Zone
- Vein or Dike

#### Boundaries, Corners and Points
- Property Lines and Corners (Color: Black. A narrow band of color accents the inner side of the perimeter of each property)
- U.S. Mineral Monuments
- Trangulation Stations and Primary Traverse Monuments
- Bench Marks (Color: Brown)
- Temporary Transit Stations
- Permanent Transit Stations
- Section and Township Lines and Corner
- Boundary Lines and Monuments
- Lode Lines and Pasts

### Conventions Used on Topographic Maps

#### Artificial Features and Structures (Color: Black except as otherwise noted)
- Wagon Road
- Little used or Abandoned Road
- Trail or Path
- Large scale, Std Gauge
- Narrow Gauge
- Medium scale, Std. Gauge
- Double-track, medium scale
- Narrow Gauge, Electric
- Std. Gauge E, Medium Scale
- Std. Gauge E, Large Scale
- Power Line
- Fence
- Telephone Line
- Abial Tranway
- Bridge
- Railroad Bridge
- Ferry
- Ford

#### Reference Points and Lines
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#### Mine Openings
- Rectangular
- Circular
- Tunnels (Dotted lines show direction and length)
- Diamond Drill Hole (Color: Black circle and arrow. Red center) (Arrow appears only on inclined holes and points in direction of dip)
- Churn Drill Prospect Holes (Color: Black circle, orange center)
- Water well
- Oil well
- Gas well
- Sulfur well
- Barron well: Solid Black
- Mines and Quarries (Marked by tag)
- Prospects

Note: If conventional symbols or colors are applied to areas covered by different rocks, black ink may be used. Names of roads or contacts may then be omitted.

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**PLATE 1**

**PLATE 2**

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Conventions Used on Mine Maps

<table>
<thead>
<tr>
<th>SHAFTS, RAISES AND WINZES</th>
<th>ROOMS AND PILLARS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collar of three compartment timbered shaft.</td>
<td>Shrinkage stop with two chutes above drift.</td>
</tr>
<tr>
<td>Collar of untimbered shaft.</td>
<td>Stopes hatched in both plans and projections.</td>
</tr>
<tr>
<td>Abandoned Shaft.</td>
<td>Room and haulage level in badged deposit.</td>
</tr>
<tr>
<td>Opening Downward</td>
<td>First-Aid Station.</td>
</tr>
<tr>
<td>Opening Upward</td>
<td>Explosives Room.</td>
</tr>
<tr>
<td>Opening both up- and downward</td>
<td>Natural Pillar left to support &quot;roof.&quot;</td>
</tr>
<tr>
<td>Circular shafts or test-pits.</td>
<td>Ore-chute</td>
</tr>
<tr>
<td>Ore-chute</td>
<td></td>
</tr>
</tbody>
</table>

LEVELS, ADITS, DRIFTS, TUNNELS AND CROSSCUTS

<table>
<thead>
<tr>
<th>Levels, drifts or aditi in ore-body (various colors)</th>
<th>Cross-cuts, levels or adits in &quot;country rock.&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tunnel and portal. Intersecting drift or cross-cut extending away from plane of projection</td>
<td>Ditch, toward plane of projection</td>
</tr>
</tbody>
</table>

SHAFT STATIONS

| Shaft and shaft station in transverse section with ore-packet | Shaft and shaft station at intersection with drift, shown in plan. |

| Two-compartment inclined shaft and shaft-station, at intersection with drift, shown in plan. | Two-compartment inclined shaft and shaft-station, at intersection with drift, shown in plan. |

Geological Conventions

<table>
<thead>
<tr>
<th>Earth or Soil.</th>
<th>Earth or Rock.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shale</td>
<td>Slate</td>
</tr>
<tr>
<td>Limestone</td>
<td>Sand</td>
</tr>
<tr>
<td>Sandstone</td>
<td>Gravel</td>
</tr>
<tr>
<td>Conglomerate</td>
<td>Drift</td>
</tr>
<tr>
<td>Coal</td>
<td>Clay</td>
</tr>
<tr>
<td>Metamorphic Rocks</td>
<td>Gneiss</td>
</tr>
<tr>
<td>Vains or Dikes</td>
<td>Eruptive Rocks.</td>
</tr>
</tbody>
</table>

These conventions are frequently used to indicate various types of rocks and formations on mine maps and geologic sections. Those named on upper half of page are commonly accepted conventions; those below are used occasionally to designate any type of rock.
Colors used to accent property lines are preferably applied as a wash, and the tints used should be delicate in tone. The width of this band of color, to give the best appearance, will vary with the scale of the map and the size of the area to be enclosed. For a group of full-sized mining claims plotted on a scale of 500 ft. to the inch, a 1/10-inch band of color looks well. If the same map is plotted on a scale of 100 ft. to the inch, however, a wider band—say, 1/2-inch—will be preferable.

Small triangles, circles, and squares used to indicate triangulation stations, survey stations, monuments, reference points, etc., should be small, ranging between 1/20 and 1/10 inch in their largest dimensions. The best size to use will again depend upon the scale of the map, the latter dimension suggested being appropriate only for maps constructed on a scale of 50 ft. per inch or larger.

Blue stream lines used to characterize watercourses and submerged areas, should be purposely waved, as smooth lines used for this purpose seldom appear well. They should be very fine lines to give the best appearance. The shore-lines should be quite heavy and the smooth lines placed as closely as possible to it, leaving only a narrow white space between. In the case of a watercourse, a small arrow may be added to indicate the direction of flow. This arrow may be placed in the centre of the stream if space between banks permits; if not, it may be placed near either bank.

Plate 2. Parallel lines representing railroads are spaced at gauge-width, according to scale, on large-scale maps. On small-scale maps, one of the single-line symbols should be used. For temporary tracks, dotted symbols similar in form to those suggested for permanent installations, may be employed.

The symbols used to represent buildings on large-scale maps are improved somewhat in appearance by shading the lower and right-hand edges, as though the source of light were in the direction of the upper left-hand corner of the map and the buildings cast shadows represented by heavier lines. On more elaborate maps, the areas enclosed to represent buildings may be tinted, and a color scheme adopted to indicate the material of which the building is made. Thus, red may indicate a brick building; sepia, one made of wood; gray, iron or steel; blue, concrete; green, stone.

Co-ordinate lines should be made as fine as possible. To facilitate reference, numbers marking their distance from the origin of co-ordinate lines should be placed at each end of every co-ordinate line, just within the border-line. On tracings, the co-ordinate lines are sometimes placed on the back of the sheet so that they will appear in their proper relation as a convenient convention for reference purposes, rather than as an integral part of the map. This is also done so that erasures may be made on the map without marring the co-ordinate lines. The co-ordinate lines should not be spaced at less than 2-in. intervals; that is, 100 ft. apart on a scale of 50 ft. to the inch, or 200 ft. apart on a 100-ft. scale, etc. On maps plotted to a larger scale than 50 ft. to the inch, the co-

ordinate lines should not be spaced at smaller intervals than 100 feet.

The purpose of a scale-line is to provide a means of scaling distances on the map with the dividers. It also preserves the original scale for reference purposes in case the paper on which the map is made should expand or shrink. A scale-line is particularly necessary if the map is to be later reduced or enlarged by photographic methods.

The meridian arrow, used to indicate the North point on the map, should coincide with one of the co-ordinate lines. The length of the arrow should be proportioned to conform with the size of the map; thus, for a map 27 in. by 40 in., an arrow 6 in. long is suitable, while for an 8¼ by 11-in. page, a 2¼- or 3-in. arrow is long enough. The magnetic declination for the particular locality and for the time at which the survey was made, may be lettered along the stem of the arrow, or, perhaps, indicated graphically by means of a second arrow, marked 'magnetic meridian', through the centre of the arrow pointing the true North.

Plate 3. Where one level crosses over another, in a composite plan showing several levels of a mine, the lower level will always be dotted. The tints to be applied to the various levels, on both plans and vertical projections, will be carefully selected to give as much contrast as possible between adjacent levels. Thus, blue will never be placed next to purple, nor orange next to red. Should two levels cross each other several times at acute angles in the plan view, there will then be no confusion in following either level beyond the intersections. For convenience in reference, a definite color-scheme may be adopted for coloring the levels, using five or ten colors that are repeated at regular intervals. Thus, if five colors are used, level No. 1 may be tinted red; level No. 2, blue; level No. 3, yellow; level No. 4, purple; level No. 5, green; level No. 6, red; and so on, repeating the same colors in the same sequence for levels 7, 8, 9, and lower levels. Then, as frequently happens, if levels are spaced apart, in elevation, at regular intervals, the space between levels of the same color will always be a constant quantity; a convention useful for many purposes.

Cross-cuts, levels, or adits not in vein-material, or within the orebody proper, are divided into uniform rectangular areas by means of lines cutting across the level at regular intervals. Alternate rectangles, thus formed, are tinted with the same colors as are used on the main drifts with which they connect.

Cross-hatching shown on stope areas, either in plan or vertical projection, should be of the same color as the tint used on the level below. Another plan frequently practised is to cross-hatch stope areas in black and also apply water-color or crayon to the entire stope area to match that used on the level below.

In some cases, on mine maps, it is necessary to indicate progress of operations. In plans and vertical projections of mine openings, the boundaries of excavations are indicated either by solid or dotted lines, and the dates of such boundaries may be printed along them at
During the year 1918, mines in Colorado produced $12,705,000 in gold, 6,900,000 oz. of silver, 66,000,000 lb. of lead, 6,190,000 lb. of copper, and 86,550,000 lb. of zinc, according to statistics compiled by the U. S. Geological Survey. The statistics for 1919 will show a considerable decrease in the output of all metals in the State. The production of gold alone will decrease at least $2,000,000. If production is continued at the rate maintained for the first five months of 1919 the mines of Cripple Creek, which produced $8,125,000 in 1918, will produce $1,500,000 less in 1919. The Telluride district, which for several years has been the most persistent producing district in Colorado, will probably not equal its output of 1918, for the prevalence of influenza and lack of electric power reduced the output considerably during the winter and spring. The recent resumption of work at the Humboldt mines will help to maintain the output of silver. The closing of the Smuggler mine and the idleness of the Wasatch mill, at Silver Plume, will mean a greatly reduced output of silver, lead, and zinc from Clear Creek county. Though development work and production in Gilpin county have been resumed, the closing of the Argo mill, at Idaho Springs, and of the associated Fremont mine will cause a decrease in the production of gold which can be offset only by increased production at several mines. The closing of the Iron Silver Mining Co.'s mines and the Greenback mine and the abandonment of the Western Mining Co.'s operations, all at Leadville, means a greatly reduced output of silver and zinc from the Leadville district. The cancellation of contracts for manganese to be supplied from this district has resulted in the suspension of the shipments of lead-silver ores from mines at which manganese was a product. The low price and the lack of market for lead and zinc resulted in the closing of the Wellington mine, at Breckenridge, and the Eagle mines, at Red Cliff. The snowslides and fire at the Sunnyside mine, at Silverton, have handicapped the operation of that mine. The removal of the pumps from the lower levels at Aspen naturally indicates a heavy decrease in the production of silver-lead ores in that district. The shipments of silver ore from Creede have not equaled those of 1918. The silver output of Boulder county may show a small increase and the Camp Bird mine, at Ouray, may resume milling during the year. Development is going ahead in several districts and mines that have stopped shipping, preparing for the time when metal conditions will justify the resumption of production. The closing of the Globe smelter, at Denver, will put an additional burden of freight charges on shippers from Boulder, Clear Creek, and Gilpin counties, who will now ship to Pueblo. Only four lead smelters are now operating in Colorado, none of them at full capacity, and some at less than half capacity. The recent rise in the prices of metals may, however, bring relief sooner than was anticipated, although gold mines continue to be hampered by the prevailing high costs and fixed price for their product.