The Geological Survey is making a geologic map of the United States, which necessitates the preparation of a topographic base map. The two are being issued together in the form of an atlas, the parts of which are called folios. Each folio consists of a topographic base map and a geologic map of a small area of country, together with explanatory and descriptive texts.

**THE TOPOGRAPHIC MAP.**

The features represented on the topographic map are of three distinct kinds: (1) modifications of surface, called relief; plateaus, valleys, hills, and mountains; (2) distribution of water, called drainage, as streams, lakes, and swamps; (3) the works of man, called cultures, as roads, railroad boundaries, villages, and cities.

Relief.—All elevations are represented from mean sea-level. The heights of many points are accurately determined, and those which are most important are given on the map in figures. It is desirable, however, to give the elevation of all parts of the area mapped, to delineate the horizontal outlines, or contours, of all slopes, and to indicate their grade or degree of steepness. This is done by lines connecting points of equal elevation above mean sea-level, the lines being drawn at regular vertical intervals. These lines are called contours, and the uniform vertical space between each two contours is called the contour interval. Contours and elevations are printed in brown.

The manner in which contours express elevation, form, and grade is shown in the following sketch and corresponding contour map:

![Sketch and corresponding contour map](image)

**Fig. 1. Ideal sketch and corresponding contour map.**

The sketch represents a valley between two parallel mountain ridges, with a lake which is partly closed by a hooked sand bar. On each side of the valley is a terrace, which probably consists of the part of the surface of the earth which has been smoothed over by the action of the waves; under water, whether in the sea, lake, or stream. They form a very large part of the dry land.

When the materials of which sedimentary rocks are composed are carried as solid particles by water and deposited as gravel, sand, or mud, the process is called accumulation. Such deposits may become hardened into conglomerates, sandstone, or shales. When the material is carried in solution by the water and is deposited without the aid of life, it is called a chemical sediment; if deposited with the aid of life, it is called an organic sediment. The more important rocks formed from chemical and organic deposits are limestone, chalk, oolite, sand, peat, lignite, and coal. Many of the above sedimentary deposits may be separately formed, or the different materials may be intermingled in many ways, producing a great variety of rocks.

Sedimentary rocks are usually made up of layers or beds which can be easily separated. These layers are called strata. Rocks deposited in successive layers are said to be stratified. The thickness or extent of a layer is called a bed, or a stratum, and may be measured.

The character of the original sediments may be changed by chemical and dynamic action so as to produce metamorphic rocks. In the metamorphism of a sedimentary rock, just as in the metamorphism of an igneous rock, the substances of which it is composed may enter into new combinations, or new substances may be added. When these processes are complete the sedimentary rock becomes crystalline. Such changes transform sandstone to quartzite, limestone to marble, and modify other rocks according to their composition. A system of parallel division planes is often produced, which may cross the original bed or strata at any angle. Rocks divided by such planes are called slates or schists.

Sedimentary rocks change as follows:

1. A contour indicates approximately a certain height above sea-level. In this illustration the contour interval is 20 feet, therefore the contours are drawn at 20, 60, 100, 120, 200 feet, and so on, above sea-level. Along the contour at 250 feet lie all points of the surface 250 feet above sea; and similarly with any other contour. In the space between any two contours are found all elevations above the lower and below the higher contour.

2. Contours define the forms of slopes. Since contours are continuous horizontal lines conformable to any surface of the earth, it is possible that the surface of a cliff may be mapped, or that of a sandy plain may be ascertained by counting up or down from a numbered contour.

3. The surface is divided into areas on a topographic map, each of which represents a certain altitude in feet above mean sea-level. In this illustration the altitude represented by each figure is 50 feet, and the relation that exists between the numbers and the altitudes is shown in the table that follows.

<table>
<thead>
<tr>
<th>Number</th>
<th>Altitude (in feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>50</td>
</tr>
<tr>
<td>3</td>
<td>100</td>
</tr>
<tr>
<td>4</td>
<td>150</td>
</tr>
<tr>
<td>5</td>
<td>200</td>
</tr>
</tbody>
</table>

**3. Contours and Grade.**

The vertical distance between two contours is called the contour interval. In this illustration the contour interval is 50 feet, and the distance between each two contours is 50 feet. Contour intervals are figured in the same way as the heights of points, and the contour interval is obtained by subtracting the smaller number from the larger number. In the illustration the contour interval is 50 feet, and therefore each contour represents an altitude of 50 feet above the preceding one.

**4. Contour Intervals.**

The contour interval of a topographic map is that distance between two consecutive contours. The contour interval on the map of the United States is 50 feet. The distance between each contour is represented on the map by a line of uniform width, and the altitude that each represents is shown in the table above.

**5. Contour Lines.**

Contour lines are drawn at intervals of 50 feet, or multiples of 50 feet, and are represented on the map by lines of uniform width, the altitude being indicated in the table above.

**6. Contour Maps.**

A contour map is a map that shows the surface of the earth by means of contour lines, which are lines connecting points of equal elevation. Contour maps are used to represent the surface of the earth, and are especially useful in illustrating the distribution of water, the location of minerals, and the general features of the landscape.
forming another graduation into sedimentary deposits. Some of this glacial drift was deposited underground: relations. The simplest of these, seen at the left of the section, is the developments in the column which represent the structure of the earth to a considerable depth, and construct a diagram exhibiting what would be seen in the side of a cutting many miles long and several thousand feet deep. This is illustrated in the following figure.

Each formation is further illustrated by a symbol of the period. In the case of a sedimentary formation of uncertain age, it is printed on white ground in the color of the period to which the formation is supposed to belong, the letter-symbol of the period being omitted.

The number and extent of surficial formations of the Pleistocene render them so important that, to distinguish them from those of other periods, the rock of the Pleistocene and the most recent periods is printed in a color that is not used for any other formation. The interval of time during which the Pleistocene rocks were laid down is not accurately known.

The Pleistocene and the Archean are distinguished from one another by different patterns, which may be traced out. These symbols exhibit of much variation, but the following are generally used in sections to represent the commoner kinds of rock.

**Figure 3. Symbols used to represent different kinds of rock.**

In cliffs, canyons, shafts, and other natural and artificial openings, the relation of different beds to one another may be seen. Any cutting which exhibits those relations is called a section, and the set of section drawings is called a geological profile. The arrangements of rocks in the earth is the earth's structure, and a section exhibiting the relations of the strata of the earth is the mass of the earth's structure. Knowing the manner of the formation of rocks and having traced out the relations among beds on the surface, he can infer their relative positions after they have been removed by erosion exhibited what would be seen in the side of a cutting many miles long and several thousand feet deep. This is illustrated in the following figure.

In the table in the next column, the names of important means for combining local histories for the formations of each period are printed in the time of the oldest fossiliferous rocks to the lived on in modified forms life became more intricate types, and they define the age of any bed of sedimentary origin the hachure patterns may be compared with those in the section. Any hachure pattern is a record of the action of the waves, and its direction shows the action of the waves at the time the hachure pattern was made. If the age of the formation is unknown the letter-symbol in the legend, where he will find the name of the rocks.

**Figure 4. Hachures.**

The fold. The fold is a movement of the earth's crust that causes the surface to wrinkle along certain zones. The broad belt of lower land is traversed by rilles and valleys, and the intermediate valleys follow the outcrops of limestone and calcareous shales. Where the edges of the strata appear at the surface their thickness can be measured and the angles at which they dip below the surface can be observed. This is important for the underground development of the strata.

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Information Concerning

Topographic and Geologic Maps and Folds

and Other Publications of the Geological Survey

can be had on application to

The Director, U. S. Geological Survey,

Washington, D. C.