Topographic maps represent features on the earth's surface by means of symbols and labels; separate colors distinguish the main classes of map features. The amount of information shown on a topographic map depends on the map scale, the purpose of the map, and the cost of obtaining the information. A map is a graphical representation, at an established scale, of a part of the earth's surface, showing important natural and manmade features in their correct positions relative to a coordinate reference system and to each other.

a. Topographic map. --A topographic map, as distinguished from other kinds, portrays by some means the shape and elevation of the terrain. Geological survey topographic maps usually represent elevations and landforms --the shapes into which the earth's surface is sculptured by natural forces--by contour lines. Other features are shown by a variety of conventional signs, symbols, lines, and patterns, which are printed in appropriate colors and identified by names, labels, and numbers. A topographic map is a detailed and accurate illustration of man-made and natural features on the ground such as roads, railways, power transmission lines, contours, elevations, rivers, lakes and geographical names.

The topographic map is a two-dimensional representation of the Earth's three-dimensional landscape. The most frequently used topographic map is at the scale of 1:50 000. Topographic maps identify numerous ground features, which can be grouped into the following categories:

- *Relief: mountains, valleys, slopes, depressions as defined by contours*
- *Hydrography: lakes, rivers, streams, swamps, rapids, falls*
- *Vegetation: wooded areas*
- *Transportation: roads, trails, railways, bridges, airports/airfield, seaplane anchorages*
- *Culture: buildings, urban development, power transmission line, pipelines, towers*
- *Boundaries: international, provincial/territorial, administrative, recreational, geographical*
- *Toponymy: place names, water feature names, landform names, boundary names*

b. Planimetric map. --A planimetric map is similar to a topographic map, except that it does not portray relief in a measurable form.

2. Elements of map construction

A topographic map is the product of both engineering and the graphic arts. surveys made on the ground and from photographs are organized in a coherent form and reproduced graphically according to a plan. To be useful the map must present information legibly. The graphic accuracy must be consistent with the accuracy of the source surveys and with the publication scale. The map must include the information essential to its purpose and must exclude nonessentials. The main elements of quadrangle map construction have been formulated to attain these objectives.

a. Colors and classes of features. --The information shown on the quadrangle map is divided into three general classes, each printed in a different color. Information about the shape of the

land surface--hypsographic or topographic information--is printed in brown. Water features--hydrographic information--are shown in blue. Cultural features--manmade objects‘--are shown in black. The system of division is not precise. Some manmade features--for example, levees and earth dams --are also topographic features and are printed in brown, not black. Besides the colors used for the three main classes of features, green is used to show wood- land--timber, brush, vineyards, and orchards-- and red is used to show public-land subdivisions (cultural features) and the classification of the more important roads.

b. Lines and symbols. --Linear features are represented by lines of various weights and styles (solid, dashed, dotted, or some combinations). Structures, or individual features, are portrayed by a system of pictographs or symbols. The symbols originated as plan views of the objects they represent, and they retain something of this character although they are now formal-ized. The building symbol, for example, is a solid or open square. The railroad symbol is a line with evenly spaced crossties. The dam and levee symbols look approximately like dams or levees as seen from the air.

c. Letters and numbers. --Because lines and symbols cannot represent map information completely, they must be supplemented by the names of places and objects. Notes must be added to explain some features that cannot be depicted clearly by symbols alone. In mapping topographic features the information portrayed by contour lines must be supplemented by elevation figures. Letters and numbers are essential to map interpretation, but they tend to ob-scure other map information. Therefore, they must be selected and positioned carefully on the map so that interference with other detail is kept to a minimum.

d. Map scale. --Map scale is the relationship of the size of the map to the size of the ground area it represents. The relationship may be expressed as a linear equivalent, such as l inch equals 1 mile--meaning that 1 inch measured on the map represents 1 mile on the ground--or it may be expressed in many other ways. The scale of Survey maps is given in the form of a ratio or fraction, without dimensions; the numerator is the distance on the reap, and the denominator is the corresponding distance on tone ground. For example, 1:24, 000 means that one unit of length on the map represents 24, 000 similar units on the ground.

Purpose

Topographic maps are often made for a particular purpose. For example, a map made for the purpose of designing a new highway would show the type or woodland cover and the classifi-cation of soil and rock along the route. Information about drainage, property lines, and buildings would be shown in detail as required. The map would be in the shape of a strip and would cover a relatively small ground area.. This type of map is called a special-purpose map because it has limited value for other uses.

Scales, contour intervals, accuracy specifications, and features that are shown on the maps have been developed gradually over a period of years to satisfy the requirements of government- al

agencies, industry, and the general public. Because these maps serve a wide variety of uses -- scientific, engineering, military, and administrative--they are called general-purpose maps.

Factors in selecting map features

a. Legibility. --The requirement that map information be legible and easily read means that small map features must be represented by symbols larger than 'the true scale size of the features. Roads, for example, are shown 90 feet wide on 1: 62, 500-scale maps despite the fact that most roads are not actually this wide. Buildings and other structures also are shown by minimum-size symbols that may be larger than the actual scale size of the buildings. On aerial photographs at the same scale as the map, which show all features at true scale size, small. features sometimes are not visible without magnification. Symbols larger than scale size take up extra map space; therefore, where small features are close together, all of them cannot be shown. Generally, the less important features are omitted in contested areas.

b. Cost of production. --The extent to which some kinds of map features are shown is determined partly by the cost of compiling the information. Aerial photographs are the source of most map information, but features that cannot be identified on mapping photographs must be obtained by field methods, a procedure that is relatively more expensive. As an example, not all section corners are mapped; they are too small to be seen on aerial photographs, and the cost of map- ping all of them by field surveys would be excessive.

c. Obsolescence. --Not only the original cost but also the cost of keeping the map up to date is considered in deciding what features to map. Generally, the more features depicted, the more quickly the map becomes out of date. Cultural features are especially subject to change. If the maps are to have a reasonably long useful life, the features portrayed must be restricted, to some extent, to relatively permanent. objects.

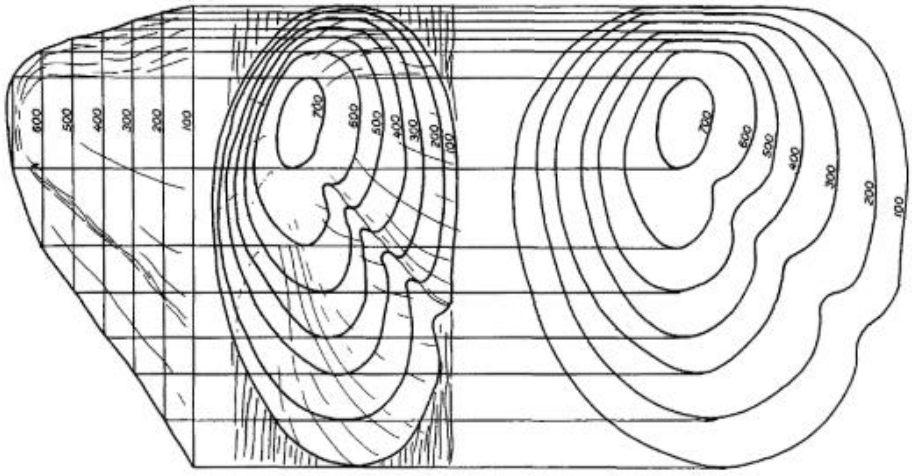
d. Concept of a landmark. --Many kinds of features are shown on some maps, although omitted from others, because of the landmark character of the features. In this sense, a landmark is an object of sufficient interest in relation to its surroundings to make it outstanding. For example, buildings may be considered landmarks when they are used as schools or churches or when they have some other public function. They may be landmarks also because of their outstanding size, height, or design; or they may be land- marks because of their history, such as old forts or the birthplaces of famous men.

RELIEF

Contour lines are the principal means used to show the shape and elevation of the land surface. Other means are spot elevations and hachures and pattern symbols for special kinds of relief features that are not suited to contour- inq. Relief information is printed in brown on topographic maps. Contours are lines connecting points of equal elevation. They always are continuous lines, and, if the map is large enough, they re- turn to the points of beginning to

form closed loops. A contour may be variously defined as -- An imaginary line on the ground, every point of which is at the same elevation above a specified datum surface (mean sea level for topographic. the contour interval is the difference in elevation between adjacent contours.

The contour interval, together with the spacing of the contour lines on the map, indicates the slope of the ground. On steep slopes the lines are more closely spaced than on gentle slopes. To make maps more readable, contours are classified and the classes distinguished by different weights and styles of lines. Index contours--every fourth or fifth contour, depending on the basic interval--are accentuated by making the line wider than the other contours. Supplementary contours, used on the flatter areas of some maps, are shown as dashed or dotted lines. Elevation figures are shown on the contour lines at frequent intervals to facilitate their identification, as well as to assist in determining the values of adjacent contours.



The two main reasons for showing relief information on maps are to furnish coordinated data for engineering calculations or other scientific mensuration and to present a graphic picture of the ground surface.

a. Measurement. --For engineers or scientists who are interested in exact measurement, topographic maps furnish dimensional information about elevations, areas, grades, and volumes. The approximate elevation of any point can be read directly or interpolated from contours. A series of elevations on a line determines the grade or profile of the line, and areas and volumes can be computed by combining line profiles in various ways. The relief information shown by contours is sufficient for calculating the storage capacity of a reservoir, the area of a watershed, or the volume of earth to be moved in a large road cut or fill.

b. Interpretation. --On the other hand, many persons who use maps are not concerned with exact ground elevations but are more interested in the general appearance and shape of the land. For them, contours are the graphic means of visualizing the terrain and an aid in locating positions on the map.

The amount of relief information that can be shown on a map depends larqely upon the scale of the map and the contour interval used to portray the relief. If a qreat amount of relief detail is re- quired, the scale must be enlarqed and the contour interval made smaller; but reqardless of the scale and contour interval all information concerning the ground surface cannot be shown on maps.

The mapmaker must always make a judicious selection of the features that it is desirable to portray. Choosing a contour interval. --A satisfactory contour interval is one that shows the im- portant topographic features adequately, yet does not result in closely spaced contour lines that are difficult to read. For a given scale and contour interval, the slope of the ground determines the spacing of contours on the map. Therefore, the most appropriate contour interval is selected according to the scale and the average ground slope in the quadrangle. Where slopes vary considerably within a quadrangle, the interval chosen may not give enough information in flatter areas because the contours are too far apart. Where this occurs, supplementary contours --at one- half or one- fourth of the basic interval--are added in the flat areas. The the interval based on average slope causes too much congestion of contours in the steeper areas, intermediate contours may be dropped for short distances to avoid coalescence in printing. This treatment in drafting or scribing is called ”Feathering.”

Relief features

a. Erosional features. --These features are formed by the erosive action of wind, waves, glaciers, and streams. Features formed by stream courses are the most common and include valleys, gullies, washes, and gorges.

The typical contour characteristic of stream courses is the shape of the contour reentrant, the part of the contour that curves or bends toward and away from the drainage channel. In a series of contours outlining a hill, reentrants show the copses of streams too s mall to be shown on the map with blue lines. The spacing between the reentrants along a stream shows the grade or slope of the watercourse. The shape of the reentrants sometimes suggests the steepness of the banks of the drain, or the kind of soil or rock formation through which the water flows. In flat areas the width of a stream channel often must be exaggerated to avoid running the contour lines together,

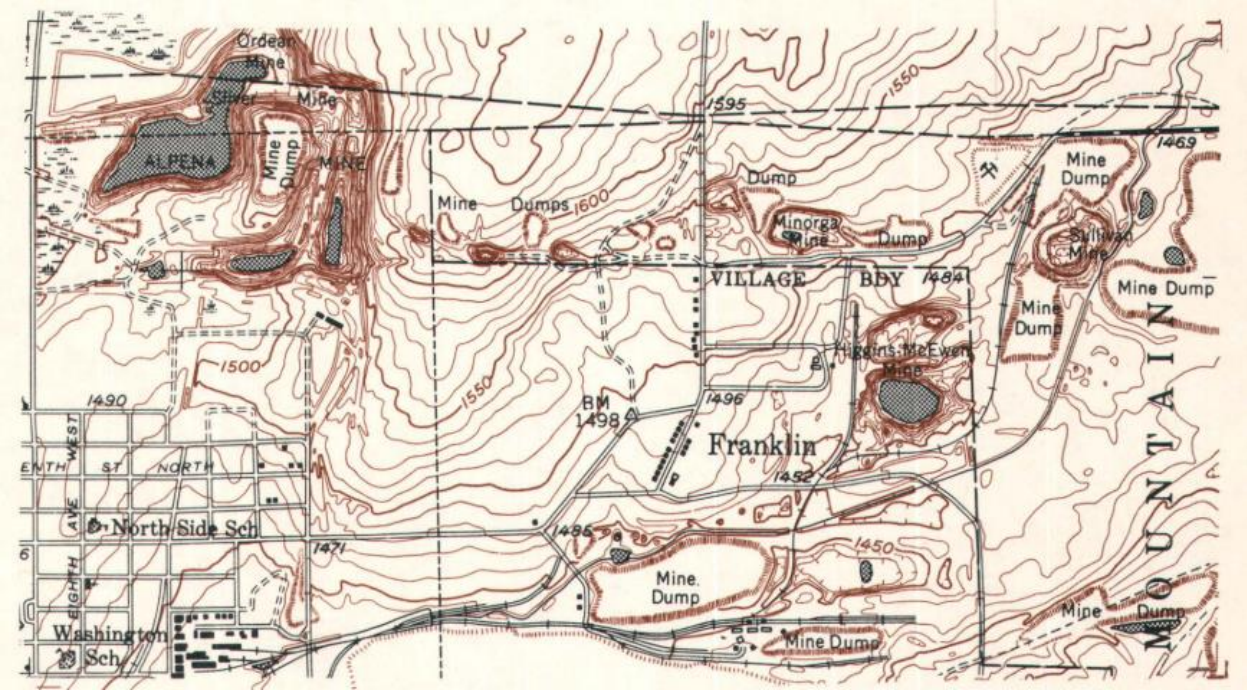
b. Residual features. --Features of this kind are the parts of the earth’s' crust that have resisted erosion effectively and have remained somewhat in their original state. Plateaus, benches, mesas, escarpments, cliffs, and terraces are typical residual features. Important

characteristics of this class of features shown by contours are the slope and the breaks or changes in the slope.

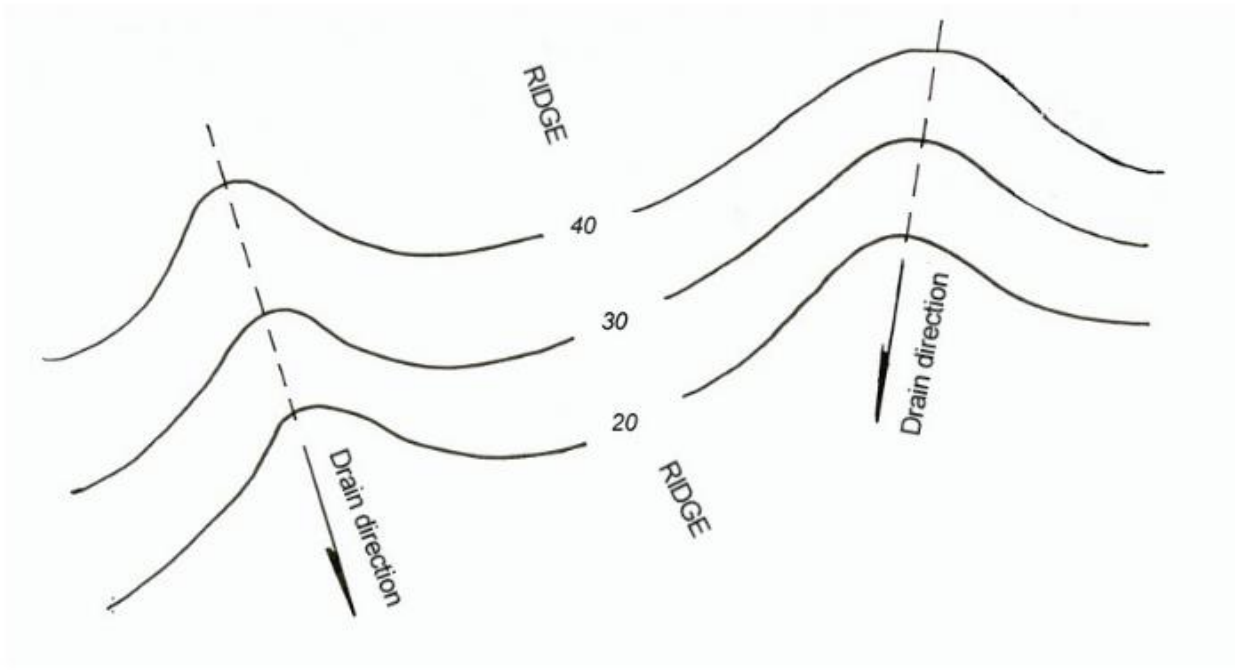
c. Depositional features. --As the class name indicates, these features are deposits of soil, rock, and other material built up by such carrying agents as glaciers, streams, winds, and volcanoes Alluvial fans develop in valleys at the base of block mountains, beinq formed from rock and gravel washed out of canyon mouths. They may be almost any size from a few feet to several miles in diameter. Usually, they slope evenly from the center to the outer edge, and their contoured appearance is that of a fan—hence the name.

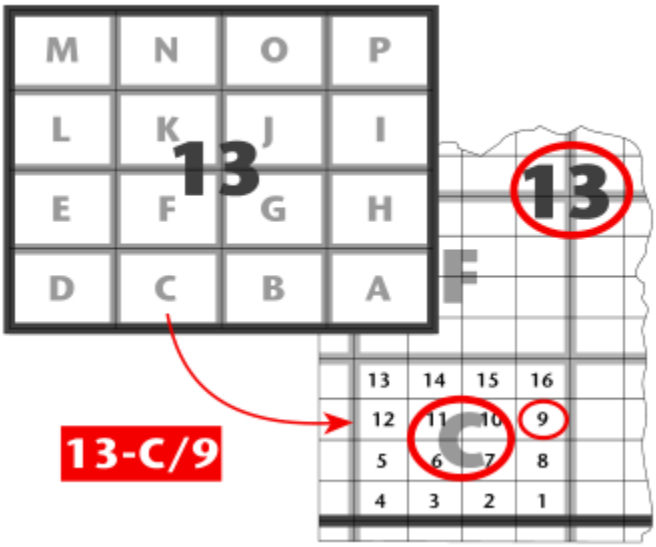
Symbols and patterns used to show relief

Hachures relief shading spot elevations,,,,,



Example of Depression contours and hachures. Hachures show the piles of ore and waste material. Depression contours, with short right-angle ticks, show the open-pit mines.





Example of Sheet index. scales: 1:50 000 and 1:250 000 for the Kenya index maps visit the link shared in the class

TOPOGRAPHIC MAP SYMBOLS

VARIATIONS WILL BE FOUND ON OLDER MAPS

Hard surface, heavy duty road, four or more lanes

Hard surface, heavy duty road, two or three lanes

Hard surface, medium duty road, four or more lanes

Hard surface, medium duty road, two or three lanes

Improved light duty road

Unimproved dirt road—Trail

Dual highway, dividing strip 25 feet or less

Dual highway, dividing strip exceeding 25 feet

Road under construction

Railroad: single track—multiple track

Railroads in juxtaposition

Narrow gage: single track—multiple track

Railroad in street—Carline

Bridge: road—railroad

Drawbridge: road—railroad

Footbridge

Tunnel: road—railroad

Overpass—Underpass

Important small masonry or earth dam

Dam with lock

Dam with road

Canal with lock

Buildings (dwelling, place of employment, etc.)

School—Church—Cemeteries — Cem

Buildings (barn, warehouse, etc.)

Power transmission line

Telephone line, pipeline, etc. (labeled as to type)

Wells other than water (labeled as to type) — Oil — Gas

Tanks; oil, water, etc. (labeled as to type) — Water

Located or landmark object—Windmill

Open pit, mine, or quarry—Prospect

Shaft—Tunnel entrance

Horizontal and vertical control station:

tablet, spirit level elevation — BM△3899

other recoverable mark, spirit level elevation — △3938

Horizontal control station: tablet, vertical angle elevation — VABM△2914

any recoverable mark, vertical angle or checked elevation — △5675

Vertical control station: tablet, spirit level elevation — BM×945

other recoverable mark, spirit level elevation — ×890

Checked spot elevation — ×5923

Unchecked spot elevation—Water elevation — ×5657 — 870

Boundary: national

state

county, parish, municipio

civil township, precinct, town, barrio

incorporated city, village, town, hamlet

reservation, national or state

small park, cemetery, airport, etc.

land grant

Township or range line, U.S. land survey

Township or range line, approximate location

Section line, U.S. land survey

Section line, approximate location

Township line, not U.S. land survey

Section line, not U.S. land survey

Section corner: found—indicated

Boundary monument: land grant—other

U.S. mineral or location monument

Index contour

Intermediate contour

Supplementary contour

Depression contours

Fill

Cut

Levee

Levee with road

Mine dump

Wash

Tailings

Tailings pond

Strip mine

Distorted or broken surface

Sand area

Gravel beach

Perennial streams

Intermittent streams

Elevated aqueduct

Aqueduct tunnel

Water well—Spring

Disappearing stream

Small rapids

Small falls

Large rapids

Large falls

Intermittent lake

Dry lake bed

Foreshore flat

Rock or coral reef

Sounding—Depth curve — 10

Piling or dolphin

Exposed wreck

Sunken wreck

Rock, bare or awash—dangerous to navigation

Marsh (swamp)

Submerged marsh

Wooded marsh

Mangrove

Woods or brushwood

Orchard

Vineyard

Scrub

Inundation area

House omission area