



MAP PROJECTION

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Introduction

- A map is a representation of all or part of the Earth drawn on a flat surface at a specific scale.
- It is a visual representation of an area – a symbolic depiction highlighting relationships between elements of that space such as objects, regions, and themes.
- It is a diagrammatic representation of the earth's surface or part of it, showing the geographical distributions, positions, etc, of natural or artificial features such as roads, towns, relief, etc.
- Cartography is the study and practice of making maps and one who make maps is called a cartographer.



MAP SCALE

- Map scale refers to the relationship (or ratio) between distance on a map and the corresponding distance on the ground. For example, on a 1:100 000 scale map, 1cm on the map equals 1km on the ground.
- The map scale may be expressed in three ways and the pictorial representation of these three types is shown in the figure.

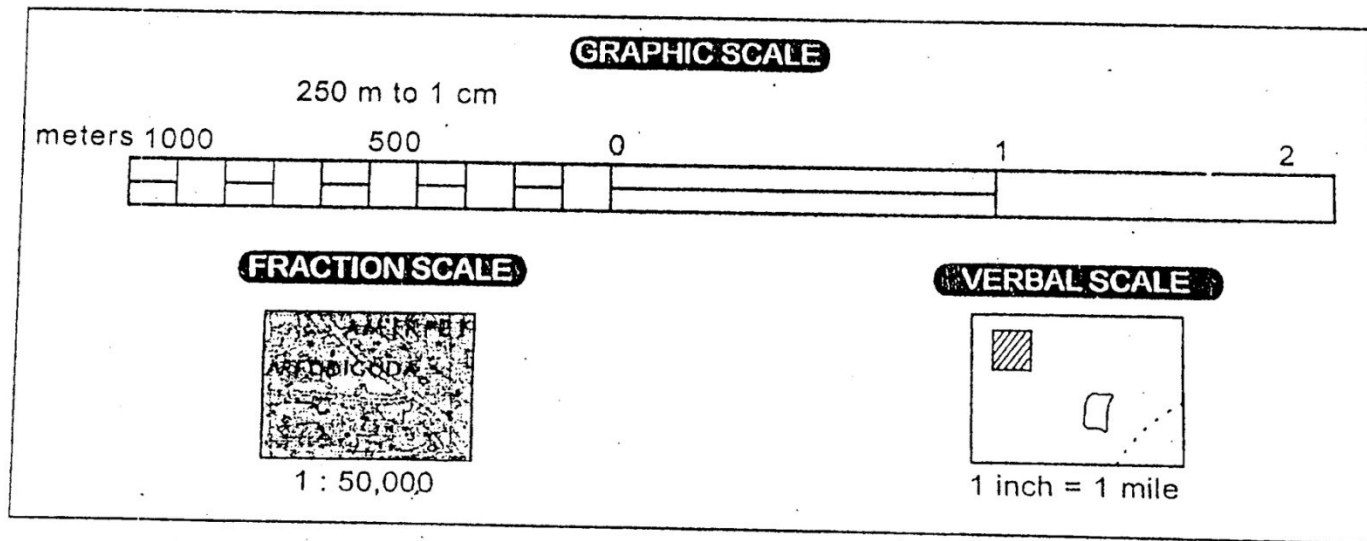


Fig. Three different types of scale representation.

MAP PROJECTION

- A map projection is a systematic transformation of the latitudes and longitudes of locations on the surface of a sphere or an ellipsoid into locations on a plane.
- It is the representation of the objects and information on a curved surface in a plane using mathematical and geometric relations.
- Transformation from the earth surface to a flat surface always involves distortion either in size, shape or in relative location and therefore no map projection is perfect.

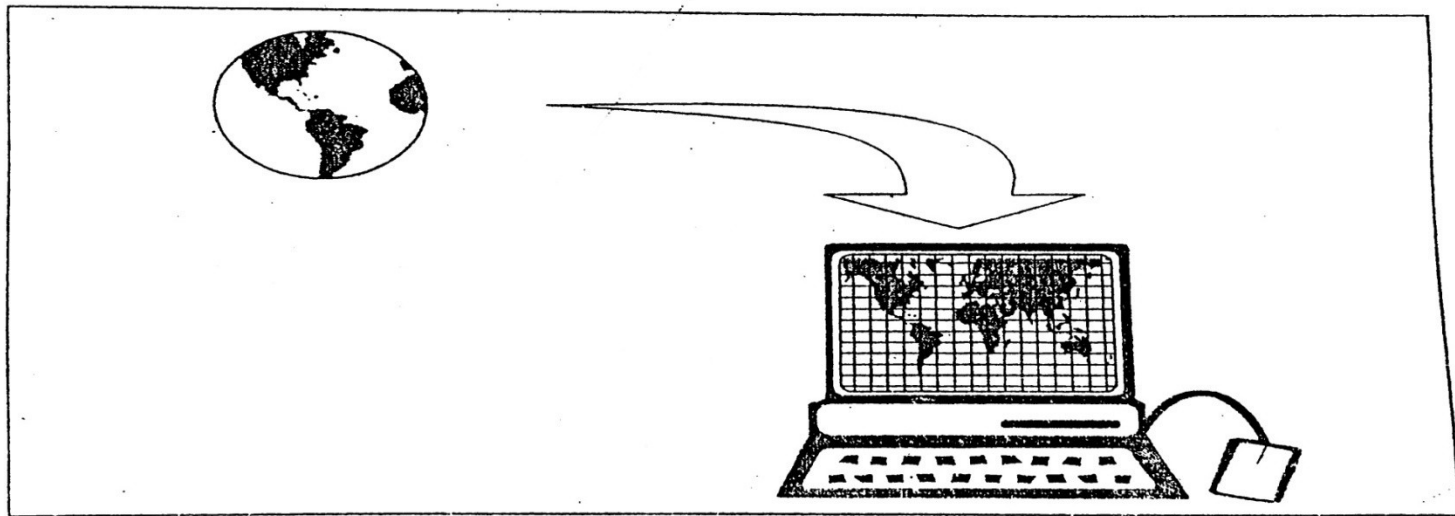


Fig. Concept of Map Projections.

- The term 'projection' comes from the notion of placing a light source inside transparent globe and projecting shadows of the meridians, parallels and other geographic features onto a sheet of paper placed tangent to the globe.
- Position of light source can be-
 - Gnomonic i.e light source is at the centre
 - Stereographic- light source is at the antipode of the point of tangency
 - Orthographic- light source is at an infinite distance from the point of tangency.

- When transferring the image of the earth and its irregularities on the plane surface of the map, three factors involved, they are
 - Geoid:** Rendition of irregular spheroidal shape of the earth.
 - An ellipsoid:** Geoids are then transferred to a regular geometric reference surface
 - Projection:** Geographical relationship of the ellipsoid, still three dimensional form, are transformed into two dimensional plane of a map.

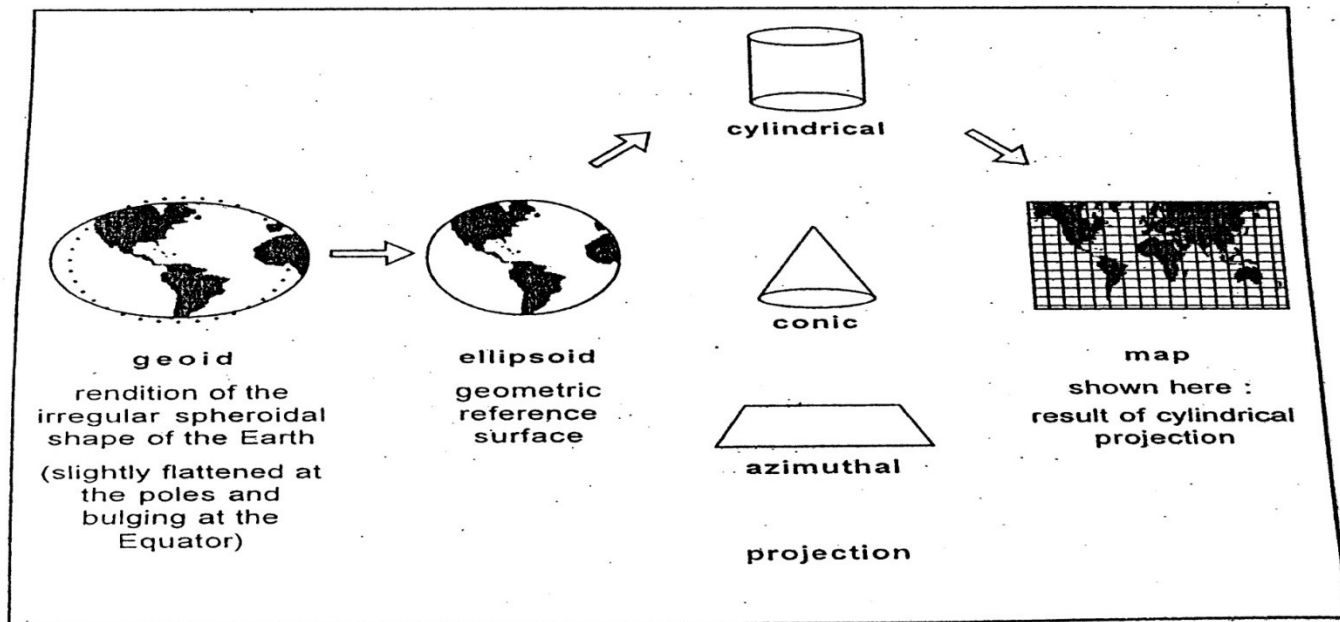
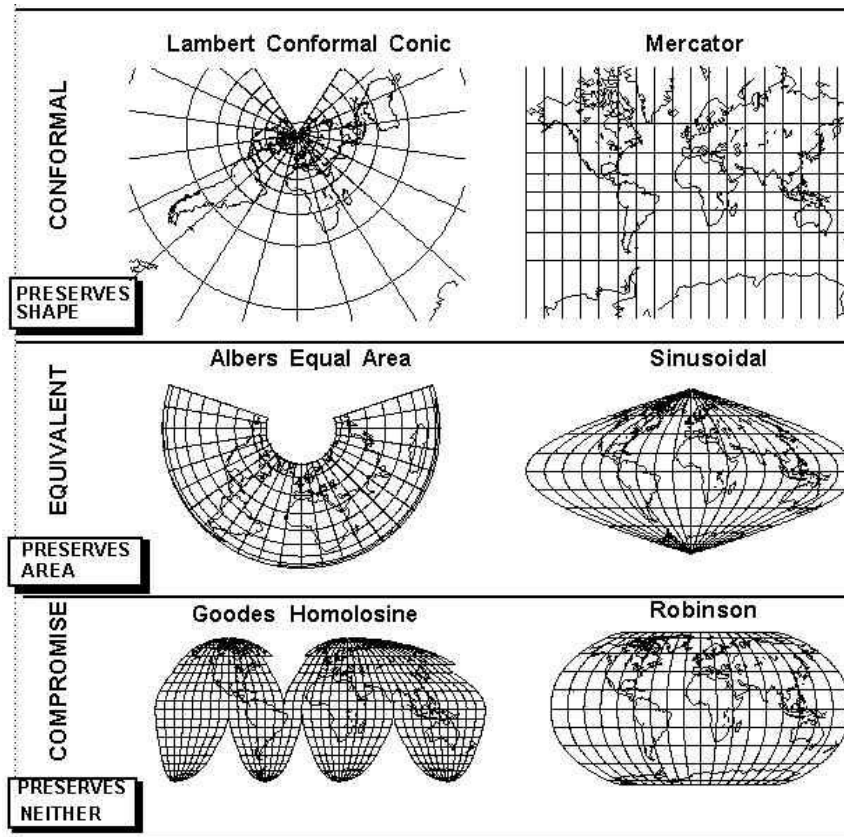


Fig Geoid Ellipsoid - Projection : Relationship.

PROPERTIES OF MAP PROJECTION

Three principal cartographic criteria;

1. *Conformality* : correct representation of *shapes*.
2. *Equidistance* : correct representation of *distances*.
3. *Equivalency* : correct representation of *areas*.



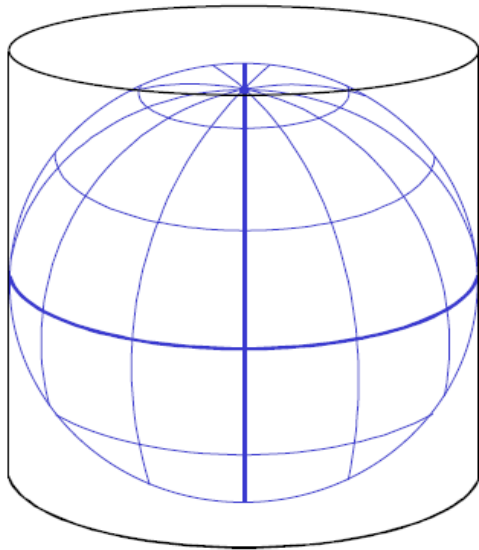
CLASSIFICATIONS OF MAP PROJECTIONS

The map projection are classified according to five criteria :

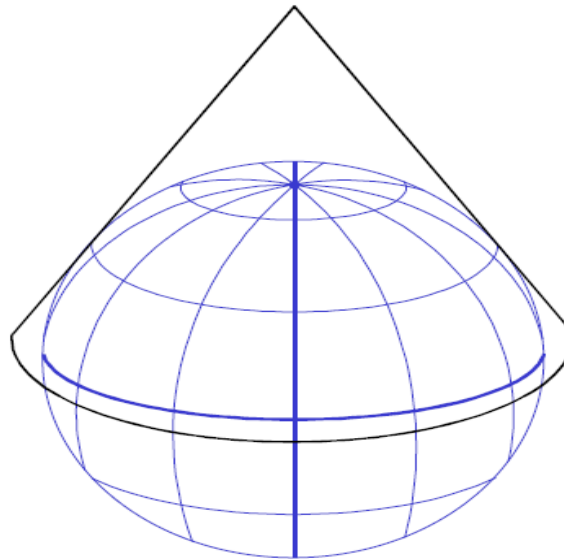
1. Nature of the projection surface as defined by geometry
2. Coincidence or contact of the projection surface with the datum surface
3. Position or alignment of the projection surface with relation to the datum surface
4. Properties of cartographic requirements, and
5. Mode of generation of datum surface and coordinate systems.

Three main types of map projection are:

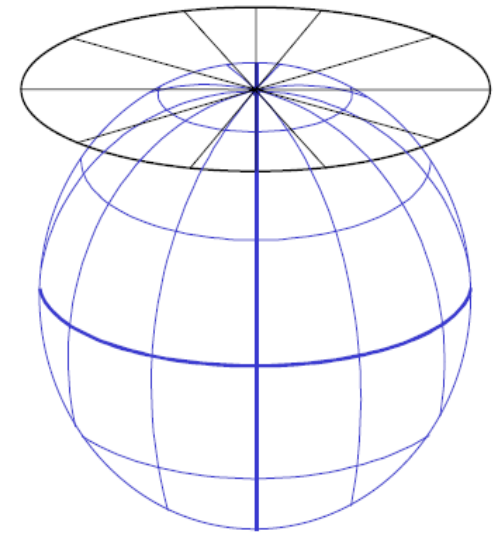
1. Cylindrical projection
2. Conic projection
3. Azimuthal or planar projection



**Cylindrical
Projection**

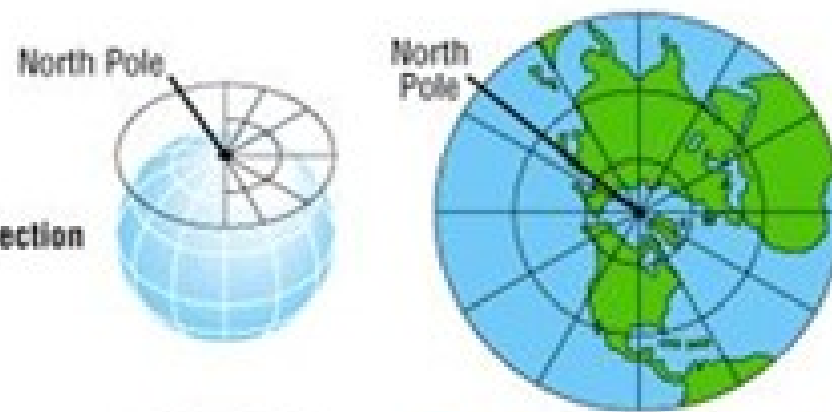


**Conic
Projection**

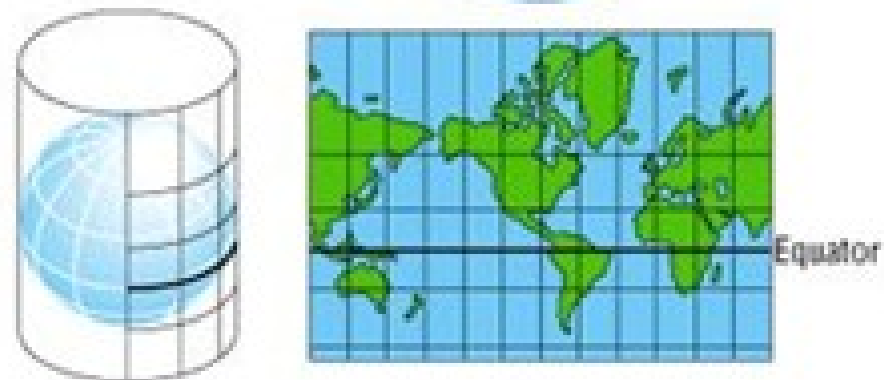


**Azimuthal
Projection**

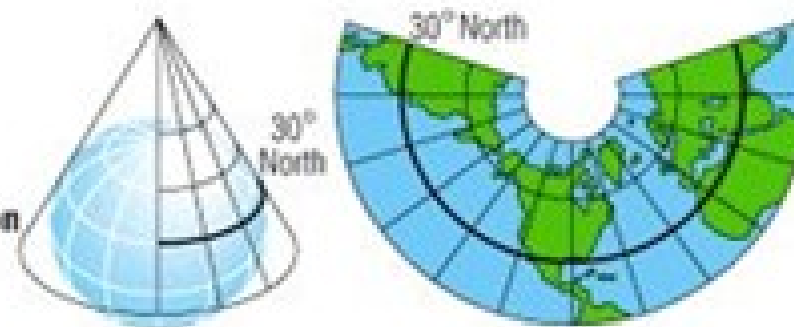
azimuthal projection



cylindrical projection

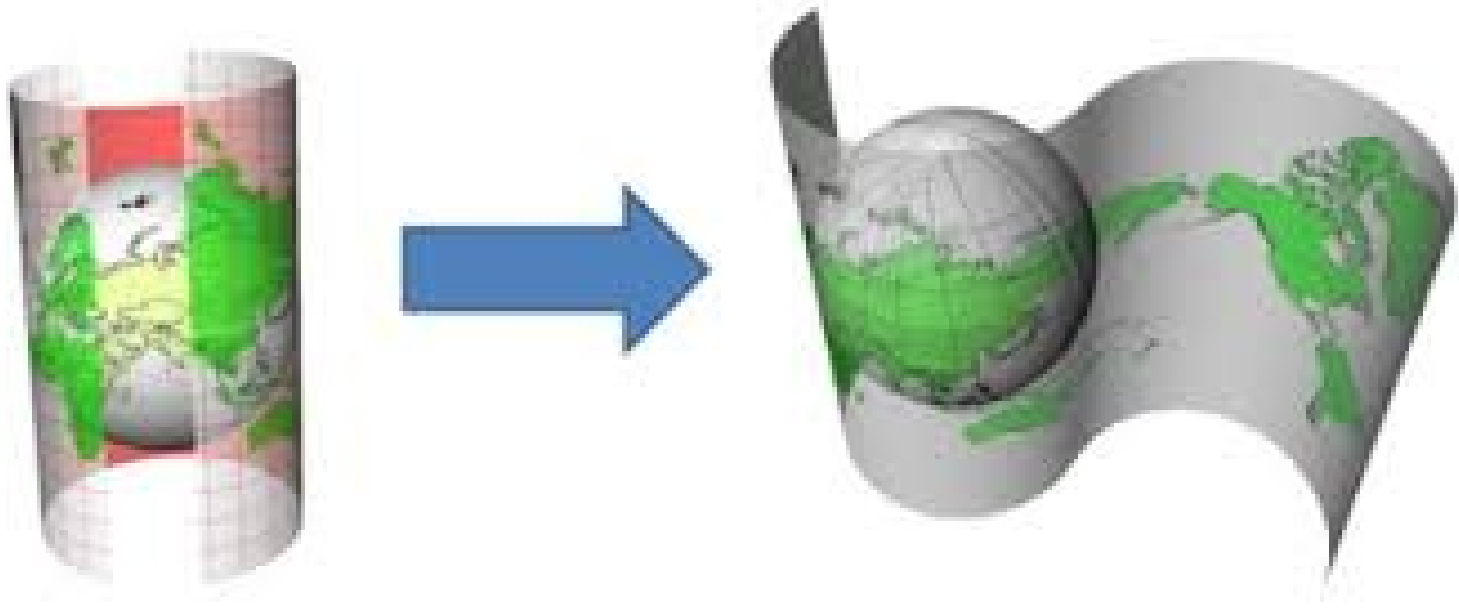


conic projection



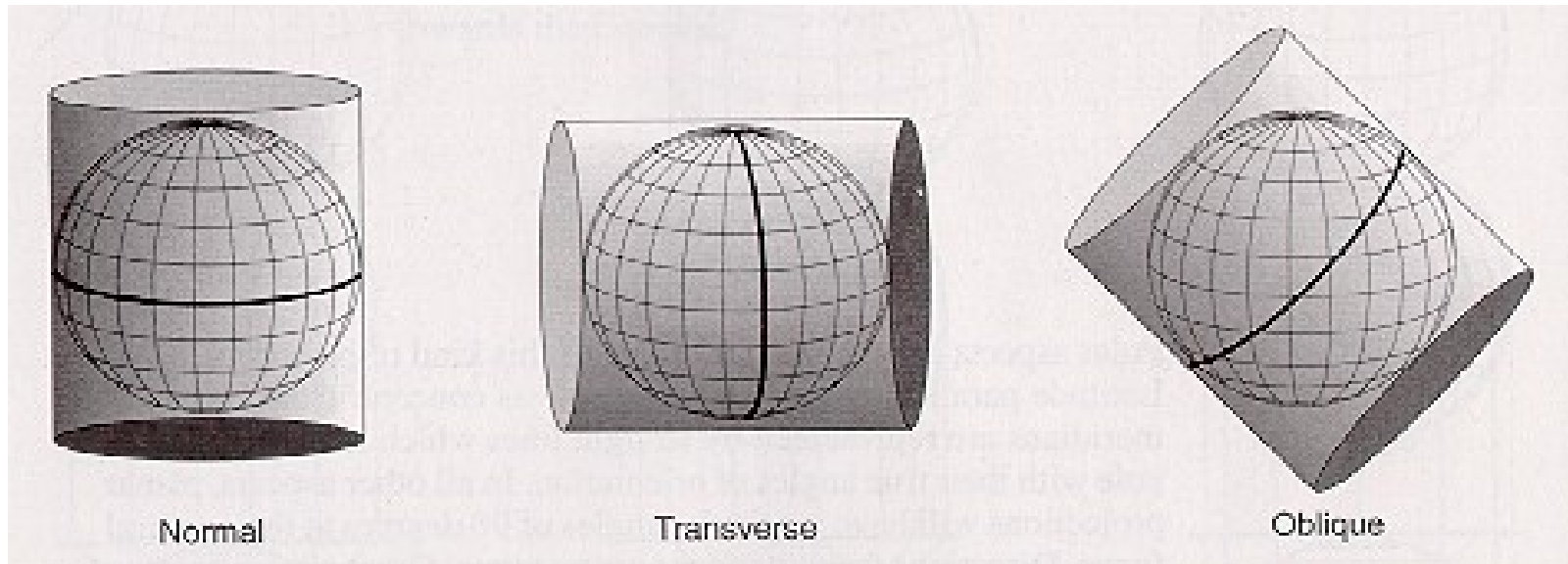
1.Cylindrical projection

- Wrap a sheet of paper around the globe in the form of a cylinder, transfer the geographic features of the globe on to it. Then unroll the sheet and lay it.
- To achieve projection, the graticule would be rectangular, the cylinder tangent to one line on the globe or intersects two line of the globe.



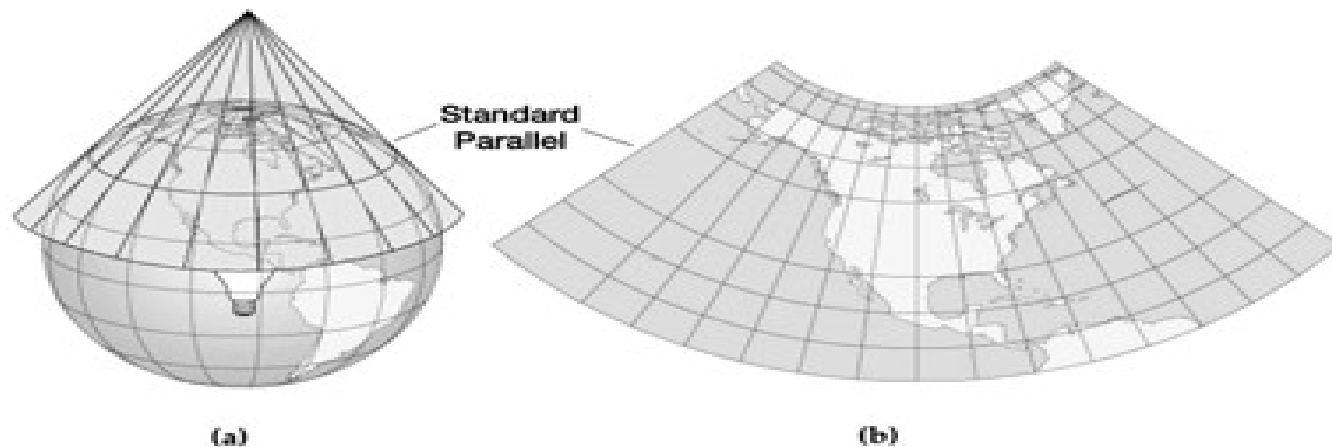
The three different cylindrical projection are;

1. Normal (using the lines of latitude as lines of contact - e.g. Mercator)
2. Transverse (using meridians – e.g. Transverse mercator)
3. Oblique (using any other great circle lines)

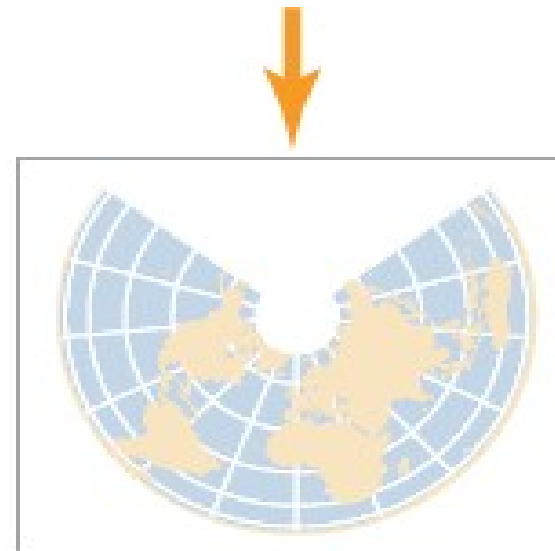


2. CONIC PROJECTION

- A method of projecting maps of parts of the earth's spherical surface on a surrounding cone, which is then flattened to a plane surface having concentric circles as parallels of latitude and radiating lines from the apex as meridians
- A cone is placed over the earth, normally tangent to one or more lines of latitude. A conic projection works best over mid latitudes for this reason.



- Wrap a piece of paper around the globe to form a cone. Shine a light from the center of the earth, trace the image that is projected onto the paper, and then take the paper off for a conic projection.

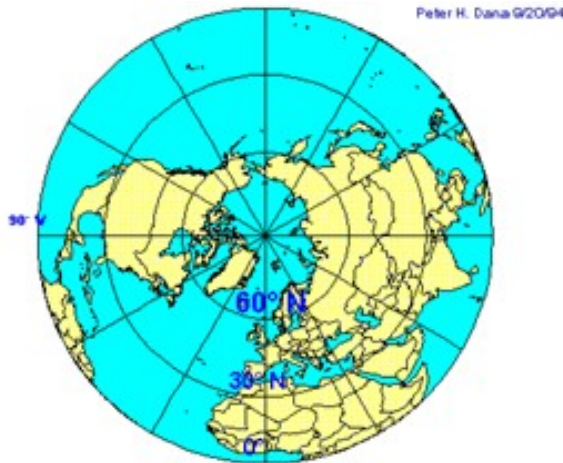


3. Azimuthal or planar projection.

- A map projection in which a globe, as of the Earth, is assumed to rest on a flat surface onto which its features are projected.
- It is a one of the important projection result from projecting a spherical surface in to plane.
- In this projection a flat paper is suppose to touch the globe at one point and project the lines of latitude and longitude on a plane. This type of projection usually tangent to the globe at one point, but may be secant.
- The point of contact may be north pole, south pole, a point on the equatorial or any point in between.

Azimuthal or planar projection are of three different types;

1. Polar (using either north or south pole)
2. Equatorial (using a point somewhere on the Equator)
3. Oblique (using any other point)



Lambert Azimuthal Equal Area

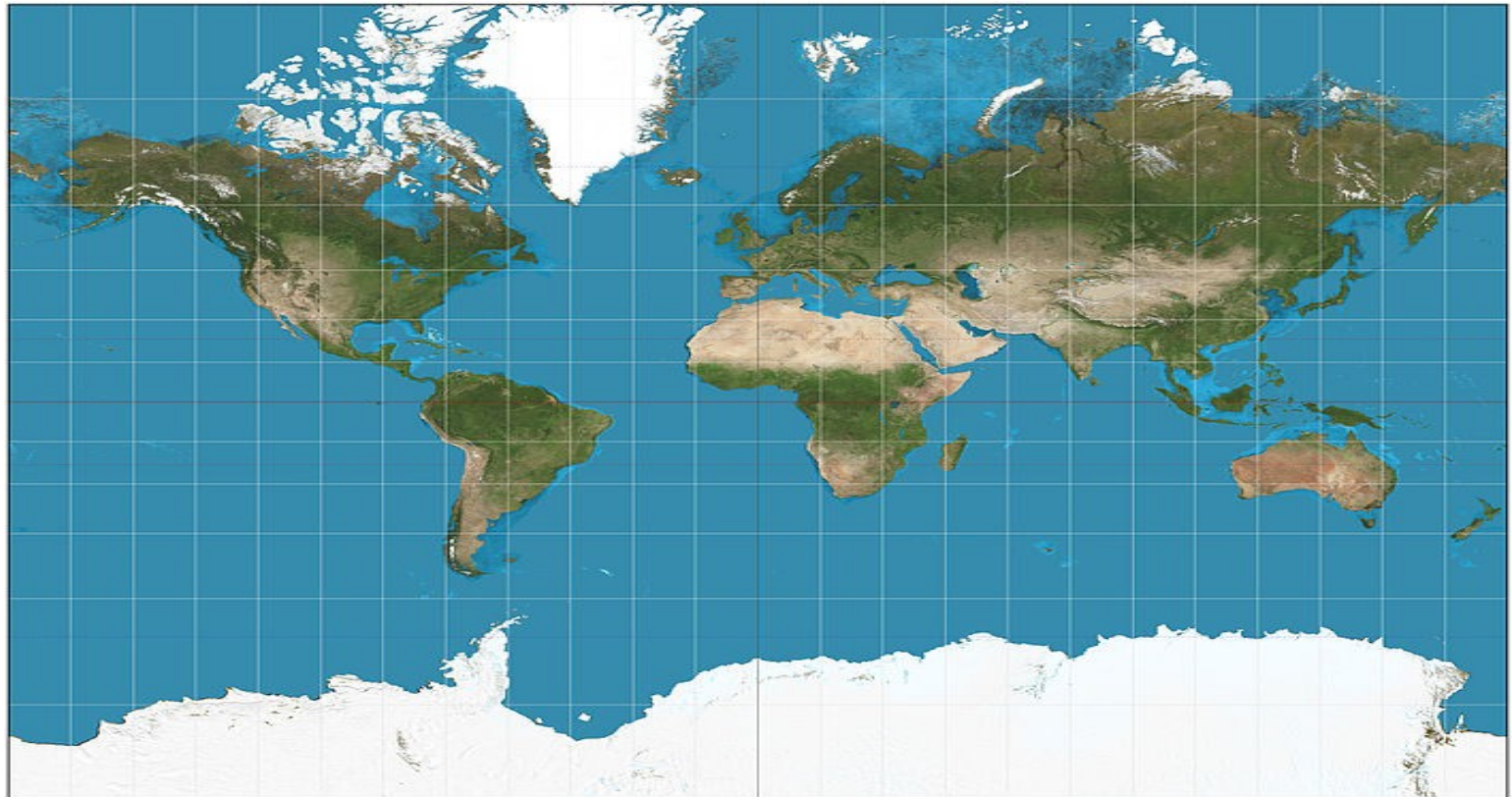
AZIMUTHAL



OTHER COMMONLY USED MAP PROJECTIONS

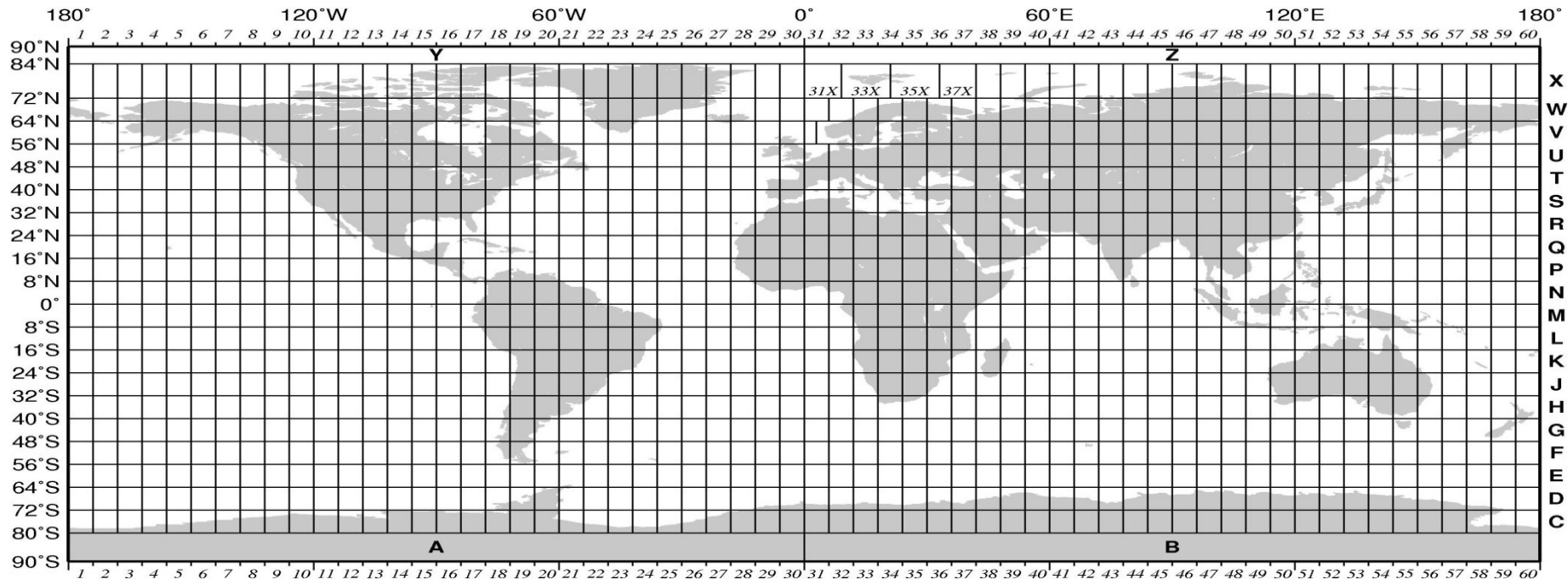
1. MERCATOR PROJECTION

- The Mercator projection has straight meridians and parallels that intersect at right angles.
- Scales can be used to measure distances and are true only along equator or at two standard parallels equidistant at the equator.
- This projection is often used for navigation for maps of equatorial regions.



2. UNIVERSAL TRANSVERSE MERCATOR (UTM) GRID

- The Universal Transverse Mercator (UTM) geographic coordinate system uses a 2-dimensional Cartesian coordinate system to give locations on the surface of the Earth. It is a horizontal position representation, i.e. it is used to identify locations on the Earth independently of vertical position.
- Divides the Earth into sixty zones, each a six-degree band of longitude, and uses a secant transverse Mercator projection in each zone.



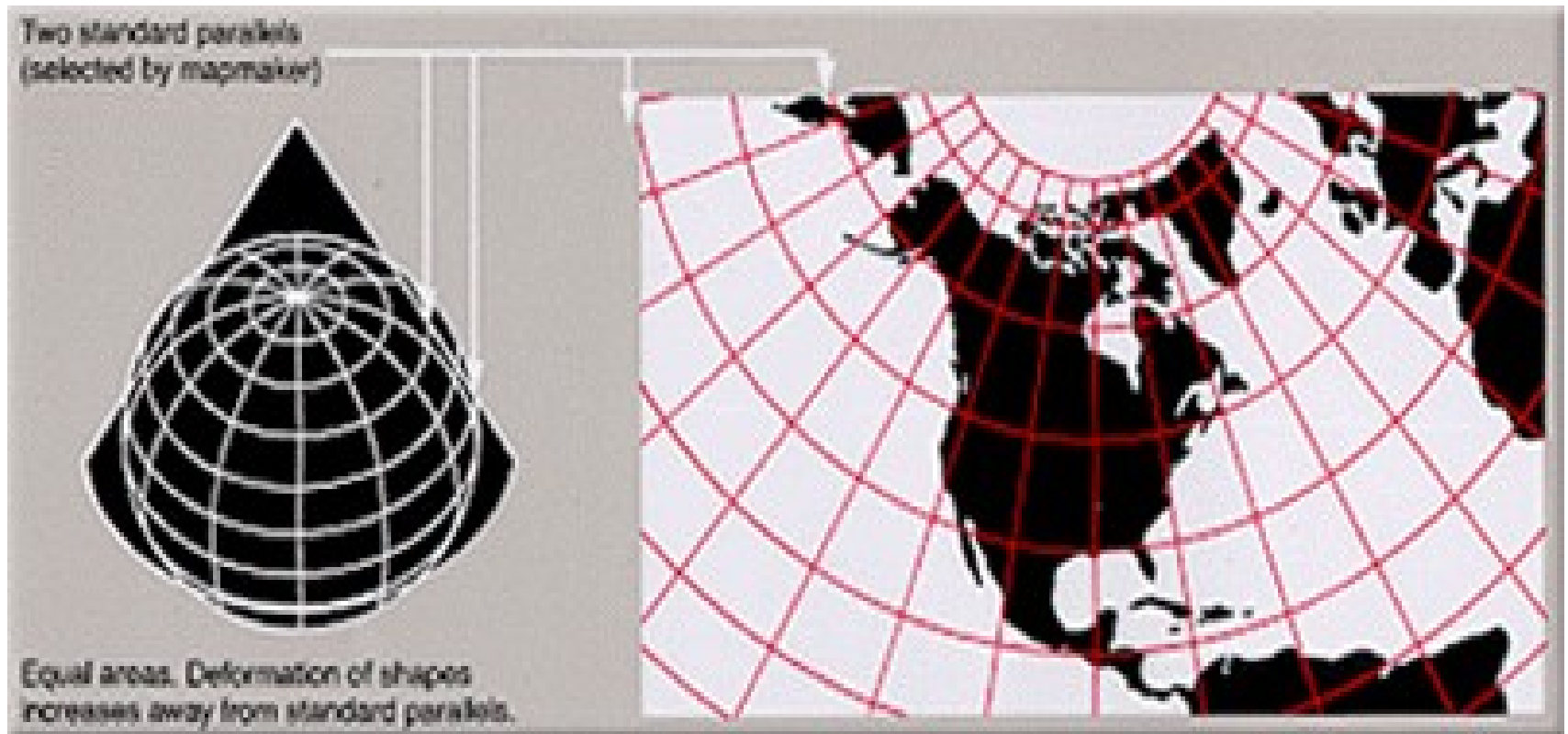
3. LAMBERT CONFORMAL CONIC

- The projection seats a cone over the sphere of the Earth and projects conformally onto the cone. The cone is unrolled, and the parallel touching the sphere is assigned unitary scale in the simple case.
- It is based on infinite number of cones tangent to an infinite number of parallels. The central meridian is straight whereas others are complex curves.



4. ALBER EQUAL-AREA CONIC

- The Albers equal-area conic projection, or Albers projection (named after Heinrich C. Albers), is a conic, equal area map projection that uses two standard parallels. Although scale and shape are not preserved, distortion is minimal between the standard parallels.



CONCLUSION

- Map is a visual representation or diagrammatic representation of the earth's surface or part of it, showing the geographical distributions, positions, etc, of natural or artificial features.
- It has different scale and base on the range scale of the map it can be either large, medium or small map.
- A map projection is a systematic transformation of the latitudes and longitudes of locations on the surface of a sphere or an ellipsoid into locations on a plane.
- There are mainly three main categories or classification of map projection i.e cylindrical, conic and planar/Azimuthal projection.
- Map projection is thus the basic principle of map making.

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