CHAPTER 9

Conventional Map Projections

THE conventional map projections do not fall into the systems of cylindrical, conical and zen projections. They are drawn arbitrarily so that they are useful for specific purposes. They show whole world. We shall study the following conventional projections :

(i) The Sinusoidal Projection.

(ii) Mollweide's Projection.

I. THE SINUSOIDAL PROJECTION

This projection is called the **Sinusoidal Projection** because its meridians are the sine curves or sinusc It is also called **Sanson-Flamsteed Projection** after the names of its inventors—Nicholas Sanson, a Fr cartographer and Flamsteed an English astronomer. It has now been claimed by some authorities that projection had been used by Mercator earlier than Sanson and Flamsteed.

The Sinusoidal Projection is a special form of Bonne's Projection. In this projection the equat the standard parallel. The advantage of taking the equator as the standard parallel is that the whole g can be shown on this projection. The equator, the parallels and the central meridian of this projection drawn as we have drawn them in the Simple Cylindrical Projection and the parallels are divided for dra the meridians as we have done in Bonne's Projection.

Let us draw a network of the Sinusoidal Projection for the whole world on the scale of 1 : 410,000, spacing parallels and meridians at 30° interval.

Construction

Radius of the earth =250,000,000 inches.

∴ Radius (r) of the globe on the scale of 1 : 410,000,000

$$= \frac{1}{410,000,000} \times 250,000,000$$

$$= 0.609 \text{ inch}$$

Find out the length of the arc subtended by the interval at which the meridians are to be drawn. the meridians are to be drawn at an interval of 30°.

$$\therefore \text{The length of the arc subtended by } 30^\circ = 2\pi r \times \frac{30}{360}$$

$$= 2 \times \frac{22}{7} \times 0.609 \times \frac{30}{360}$$

$$= 0.319'' \text{ inch}$$

Draw a circle with radius equal to 0.609 inch (Fig. 71). Draw lines NS and WE cutting each other at right angles at the centre O of the circle. Let radii OP and OQ make 30° angle and 60° angle respectively

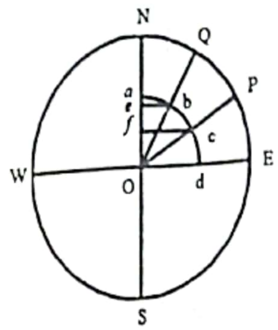

Fig. 71

with OE. With O as centre and radius equal to 0.319 inch draw arc a b c d. From points b and c drop perpendiculars on ON.

Now the equator $= 2\pi r$ (where r is the radius of the globe)

$$= 2 \times \frac{22}{7} \times 0.609 \text{ inches}$$

$$= 3.828 \text{ inches}$$

Draw line AB 3.828″ long to represent the equator (Fig. 72). Since the meridians are to be drawn at an interval of 30°, divide the line AB (the equator) into $\frac{360}{30}$, i.e., 12 equal parts. Let the point L bisect the equator into two equal parts. Take line CD equal to half the length of the equator, i.e., $\frac{3.828}{2}$ or 1.914 inches long. Erect CD perpendicular at point L keeping half (0.957″) of it on either side of the equator. Thus, CL = LD.

CD represents the central meridian. Since the parallels are 30° apart, divide each of LC and LD into 3 equal parts. Points C and D represents the poles. Through the points of divisions on the lines LC and LD, draw straight lines parallel to the equator. These lines will represent the parallels of latitude.

Now fc and eb represent the spacings between the meridians along the 30° parallels and 60° parallels respectively. Starting outwards from the central meridian, mark off distances along 30° parallels, each distance being equal to f c. Similarly mark off distance e b along 60° parallels. Join the points of divisions on the parallels and the equator by smooth curves. These curves represent the meridians. The meridians are sine curves.

Properties

1. The parallels are straight lines and they are parallel to the equator.

2. The central meridian is a straight line. All other meridians form curves and their lengths increase towards the margin of the projection.

3. The central meridian intersects the parallels and the equator at right angles. Away from the centre, the meridians intersect the parallels obliquely, the obliquity increasing towards the margin of the projection.

4. All the parallels and the equator are correctly divided with the result that the spacings betw... the meridians are correct. Thus the scale is correct along the equator and the parallels.

5. The scale is correct along the central meridian. The central meridian is also correctly divided. Th... the spacings between the parallels are correct. The scale along other meridians increases towards the mar... of the projection.

6. Shapes of the areas are well-preserved in the central part of the projection, along the equator a... the central meridian. The shapes are distorted away from the central meridian and the equator.

7. The equator and the parallels are true to scale. The spacings (i.e. perpendicular distances) betwe... the parallels are also correct to the scale. This projection is, therefore, an equal-area one.

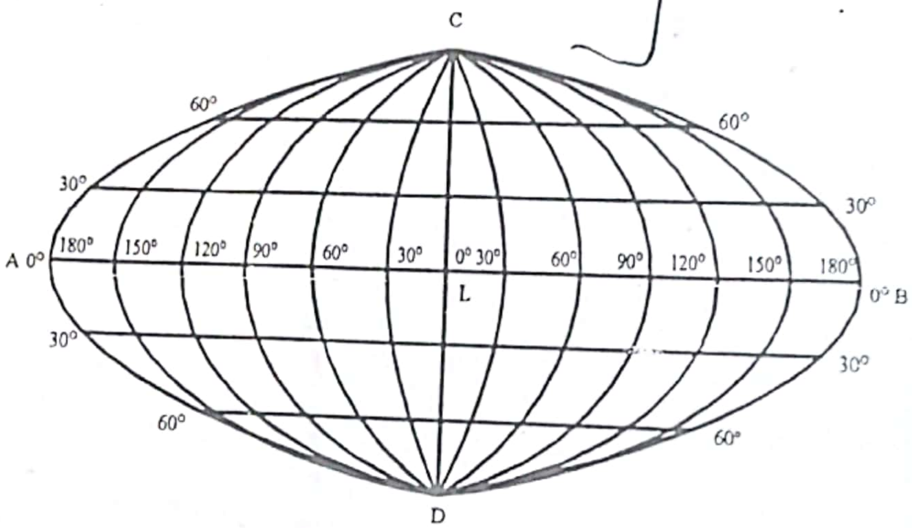

Fig. 72

Limitations

The shapes are distorted near and on the margin and in the polar areas. This projection is, therefo... not suitable for the world maps.

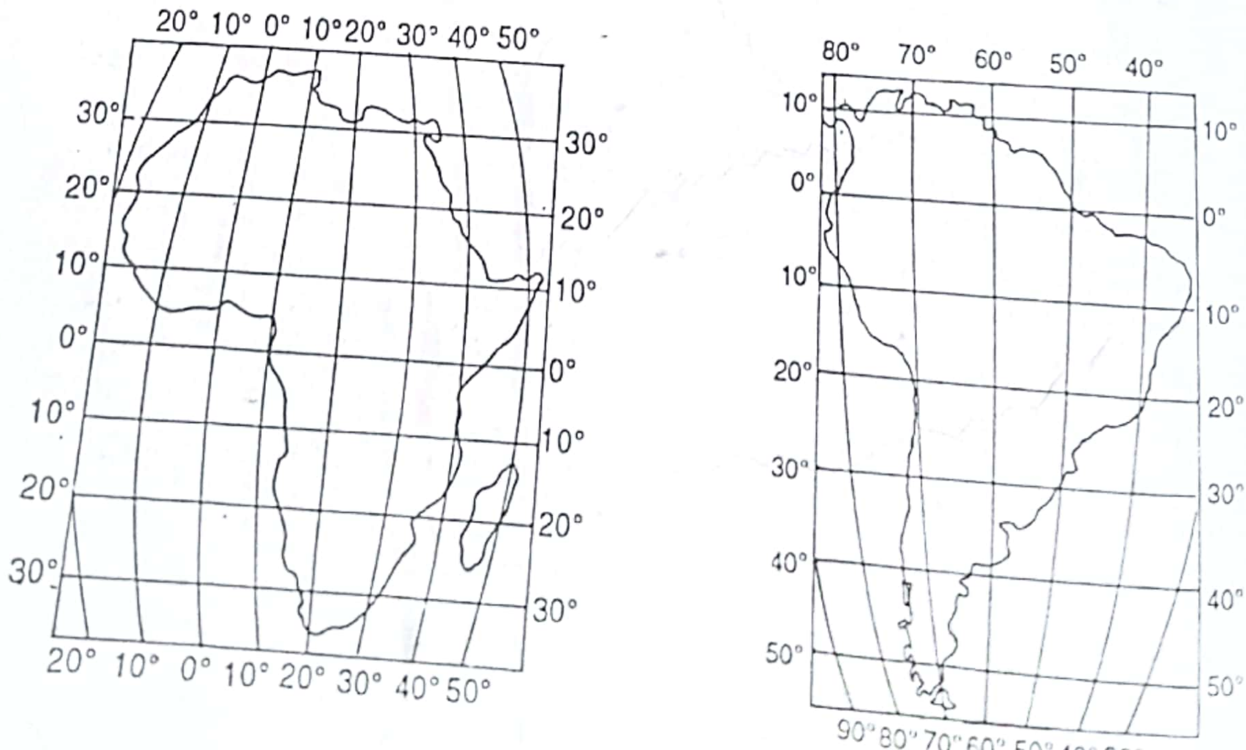

Fig. 73

Uses

It is suitable for showing small areas of the world. Africa (Fig. 73) and South America (Fig. 74) which have areas to the north as well as to the south of the equator are suitably shown on this projection. The meridians passing through the middle part of these continents are chosen as the central meridians (20°E for Africa and 60°W for South America). Longitudinal extent of these continents on either side of the central meridians being rather narrow, the scale along the other meridians is slightly exaggerated. The obliquity of the meridians is reduced and their intersections with the parallels are nearly perpendicular. Therefore, shapes are also well-preserved. Maps requiring equal-area properties can be usefully prepared on this projection (See also pp. 105 & 106).

II. MOLLWEIDE'S PROJECTION

This projection was invented by Karl B. Mollweide, a German, in 1805. This is an equal-area projection and its meridians except for the central meridian form ellipses. As a result of this it is also called the Elliptical Equal-Area Projection.

Let us draw a network of Mollweide's Projection for the whole world on the scale of 1 : 400,000,000 keeping the parallels and meridians 30° apart.

Construction

Radius of the earth =250,000,000 inches.

∴ Radius (r) of the globe on the scale of 1 : 400,000,000

$$= \frac{250,000,000}{400,000,000} = 0.625 \text{ inch}$$

Draw circle N W S E with centre O and with radius (R) equal to the radius (r) of the globe multiplied by $\sqrt{2}$ i.e. with a radius of $r \times \sqrt{2}$ or $0.625 \times \sqrt{2}$ or 0.625×1.4142 or 0.883″ (Fig. 75).

The area of this circle is equal to half the area of the globe. Area of a circle $=\pi R^2$ where R is the radius of the circle.

Area of the globe (sphere) = $4\pi r^2$ where r is the radius of the globe.

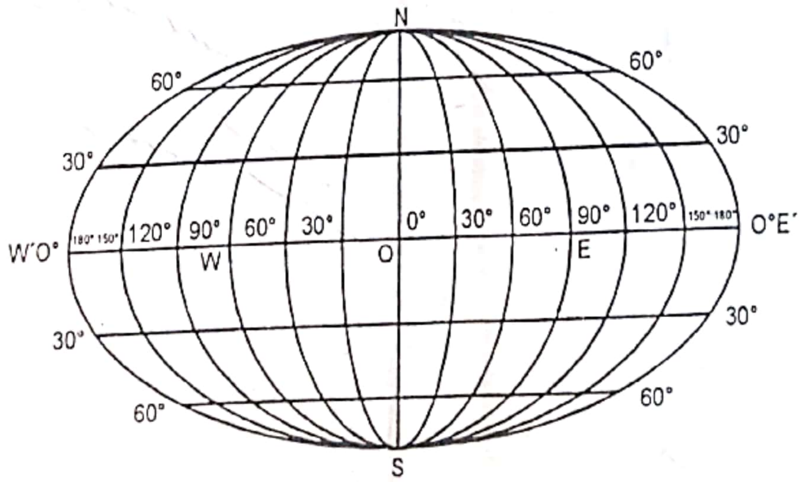

Fig. 75

Area of hemisphere $= 2\pi r^2$

We know the radius of the globe. To find out the radius (R) of the circle we equate the area... circle with half the area of the globe.

$$\pi R^2 = 2\pi r^2$$
$$\text{or} \quad R^2 = 2r^2$$
$$\text{or} \quad R = \sqrt{2} \times r$$

Let NS and WE intersect each other at right angles at O the centre of the circle. Produce OE and OW to W' so that OE=EE' and OW=WW'. Now W'E' representing the equator is equal to double... length of WE. Draw an ellipse[1] NW'SE' with W'E' as major axis and NS the minor axis. The ellipse b... all the parallels. Area of this ellipse will be double the area of the circle NWSE; in other words, it is... to the area of the globe. As such this is an equal-area projection.

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1. *Method of drawing an ellipse.* Draw two straight lines AB and CD intersecting each other at right... at the point O (Fig. 76). Let AB and CD be the major axis and the minor axis respectively. With A as centre... radius equal to the minor axis CD, mark point G on AB. Divide line GB into 3 equal parts. With a distance... to two parts of the line GB and O as centre mark points M and L. Now with ML as radius and M and L as c... draw curves cutting each other at points E and F. Taking ED as radius and E as centre draw a curve. This curve... through the point D. Similarly taking FC as radius and F as centre draw another curve. This curve will pass th... the point C. With L as centre and radius equal to LB draw a curve passing through the point B and with M as c... and MA as radius draw a curve passing through the point A. Suitable French curves are used to join these... with the curves passing through the points C and D, thus completing the figure of the ellipse.

Note : *Please note that point G in Fig. 76, coincides with point O in Fig. 75.*

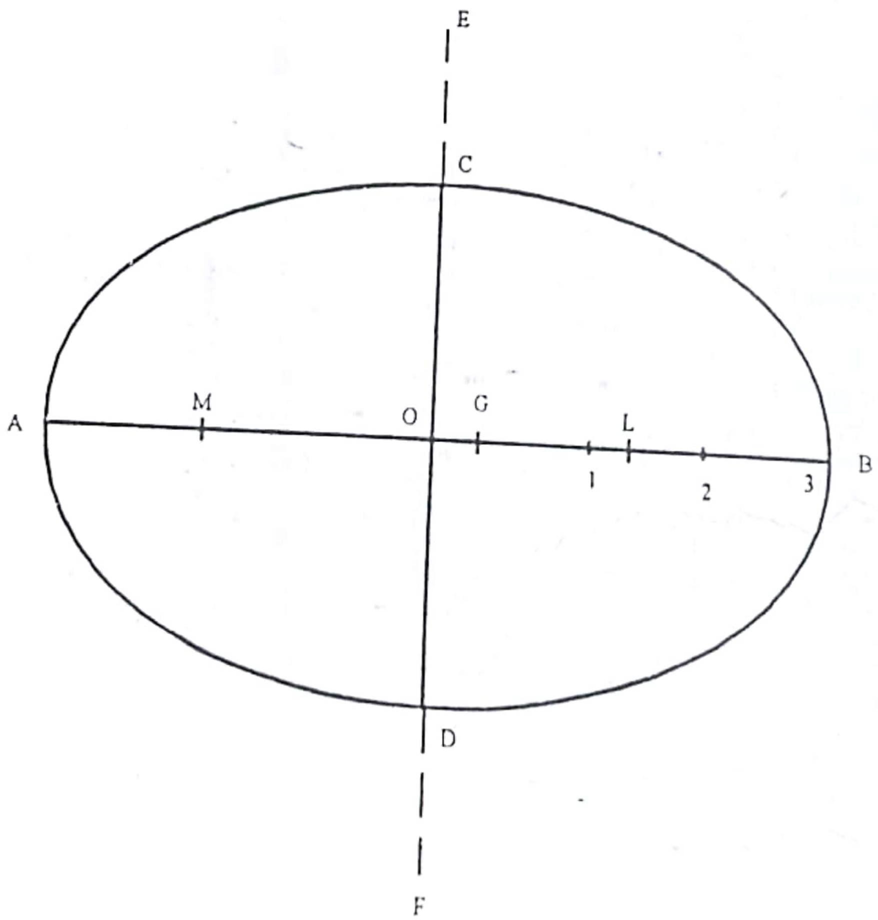

Fig. 76

The half circle NWS represents 90°W meridian...

Since the meridians are 30° apart, divide each of OE, EE', OW and WW' into three equal parts. Thus, we divide the equator W'E' into 12 equal parts.

To find out the distances of the parallels from the equator we use the following table :

Parallel of Latitude	Distance from the equator (r = radius of the globe)
10°	0.194 × r
20°	0.385 × r
30°	0.571 × r
40°	0.751 × r
50°	0.921 × r
60°	1.078 × r
70°	1.219 × r
80°	1.336 × r
90°	1.414 × r

Draw 30° parallels 0.571 × r or 0.571 × 0.625 or 0.356″ away from the equator, and 60° parallels 1.078 × r or 1.078 × 0.625 or 0.673″ away from the equator, taking care that these parallels are parallel to the equator (W'E'). Divide every parallel into 12 equal parts as we have divided the equator and draw curves passing through the points of divisions on the parallels and the equator. These curves represent the meridians.

Properties

1. This projection is elliptical in shape.

2. The parallels are straight lines and they are parallel to the equator.

3. The central meridian is a straight line. The 90°E and 90°W meridians together form a circle. All other meridians are curves forming parts of ellipses.

4. The central meridian intersects all the parallels and the equator at right angles. 90°W and 90°E meridians intersect the equator at right angles. All other meridians form curves and they intersect the parallels and the equator obliquely, the obliquity increasing towards the margin of the projection.

5. The parallels are not true to scale. The scale along them is exaggerated in the middle latitudes and the polar areas. Each parallel has its own scale. The equator on this projection is shorter in length than the equator on the globe. Thus, the scale along the equator and the parallels near it, is reduced.

6. The spacings between the parallels are unequal. They decrease towards the poles. The distance of a parallel from the equator is found with the help of tables. This distance is so adjusted as to make the area of the strip lying between the parallel and the equator equal to the area of the corresponding strip on the globe. This projection is, therefore, an equal-area one.

7. The central meridian being of half the length of the equator, is not true to scale. The scale is slightly reduced along the central meridian in the higher latitudes. The shapes are, thus, distorted in the polar areas. The scale along the other meridians increases away from the central meridian. The shapes of areas are, therefore, distorted away from the centre of the projection. Distortion of shapes on the margin of a world map on this projection is, however, less than that on the Sinusoidal Projection. The shape of the world is better represented on this projection than on the Sinusoidal Projection. It is because the scale along the parallels near the equator is slightly reduced and the scale along the parallels in the polar areas is slightly increased with the result that the shapes of the areas near the margin of Mollweide's Projection are less distorted than those near the margin of the Sinusoidal Projection. But the shapes of the polar and equatorial

areas are more distorted in this projection than in the Sinusoidal Projection. Therefore, this better than the Sinusoidal Projection for showing the distribution of commodities in the temp

Limitations

The scale being different along the parallels and the meridians, there is distortion in the areas. Africa and South America are, therefore, shown on the Sinusoidal Projection in which meridian, the parallels and the equator are correct to scale.

Uses

Being an equal-area projection it is used to prepare distribution maps for the whole world. It to the Sinusoidal Projection when it is required to show the distribution of commodities in the areas of the world.

QUESTIONS

1. (a) What do you understand by the term conventional map projections?

   (b) Comment on the following :

   (i) Although both Mollweide's and Sinusoidal are equal-area projections for the whole world is better for showing distributions in temperate areas and the latter for those in tropical

   (ii) Cylindricals and conventionals are the only projections which can show the whole world

2. Construct a graticule for Sinusoidal Projection on the scale of 1 : 225,000,000 spacing parallels and an interval of 15° to show the entire world. How is this projection related to the Simple Cylindrical and Bonne's Projection?

3. Compare and contrast the properties and uses of Sinusoidal Projection with those of Mollweide's

4. Draw a network of parallels and meridians for Mollweide's Projection on the scale of 1 : 225,000,000 parallels at an interval of 15° and the meridians at an interval of 30° to show the entire world.

   Is the equator correct to scale on this projection? Why is it an equal-area projection?