USE OF CYLINDRICAL PROJECTIONS FOR GEOGRAPHICAL, ASTRONOMICAL, AND SCIENTIFIC PURPOSES.

By the Rev. James Gall, Edinburgh.

The value and importance of cylindrical projections have been somehow overlooked; and although Mercator's is only one of several, each of which has its own peculiarities and advantages, yet, until lately, it was the only one known.

There are three, but only three things, in which a cylindrical projection can be perfect; and these depend upon the way in which the latitudes are drawn.

1. We may obtain *perfect orientation* by rectifying the latitudes throughout, as Mercator has done; and this is especially valuable for navigation. But in order to obtain perfect orientation everything else must be sacrificed.

2. We may obtain *comparative area* with mathematical accuracy by projecting the latitudes orthographically. But in order to obtain comparative area we must sacrifice everything else.

3. We may obtain accurate *polar distance* by projecting the latitudes isographically, that is, at equal distances. But, in order to obtain this, everything else must be sacrificed.

My attention was first drawn to the subject in connection with astronomy. I had published *An Easy Guide to the Constellations*, in which each constellation had a page for itself; and it became necessary for me to publish an *Atlas of the Stars* [1] to show their connection. In planning the atlas, it occurred to me that a magnificent panorama of the stars, including three-fourths of the heavens, might be brought into one map by using a cylindrical projection, with the latitudes drawn stereographically and rectified at the 40th parallel. The result was, that the constellations on the 40th parallel were absolutely perfect in both hemispheres, and although those at the equator were a little contracted and those beyond the 40th degree a little expanded, the errors were so small as not to be observed.

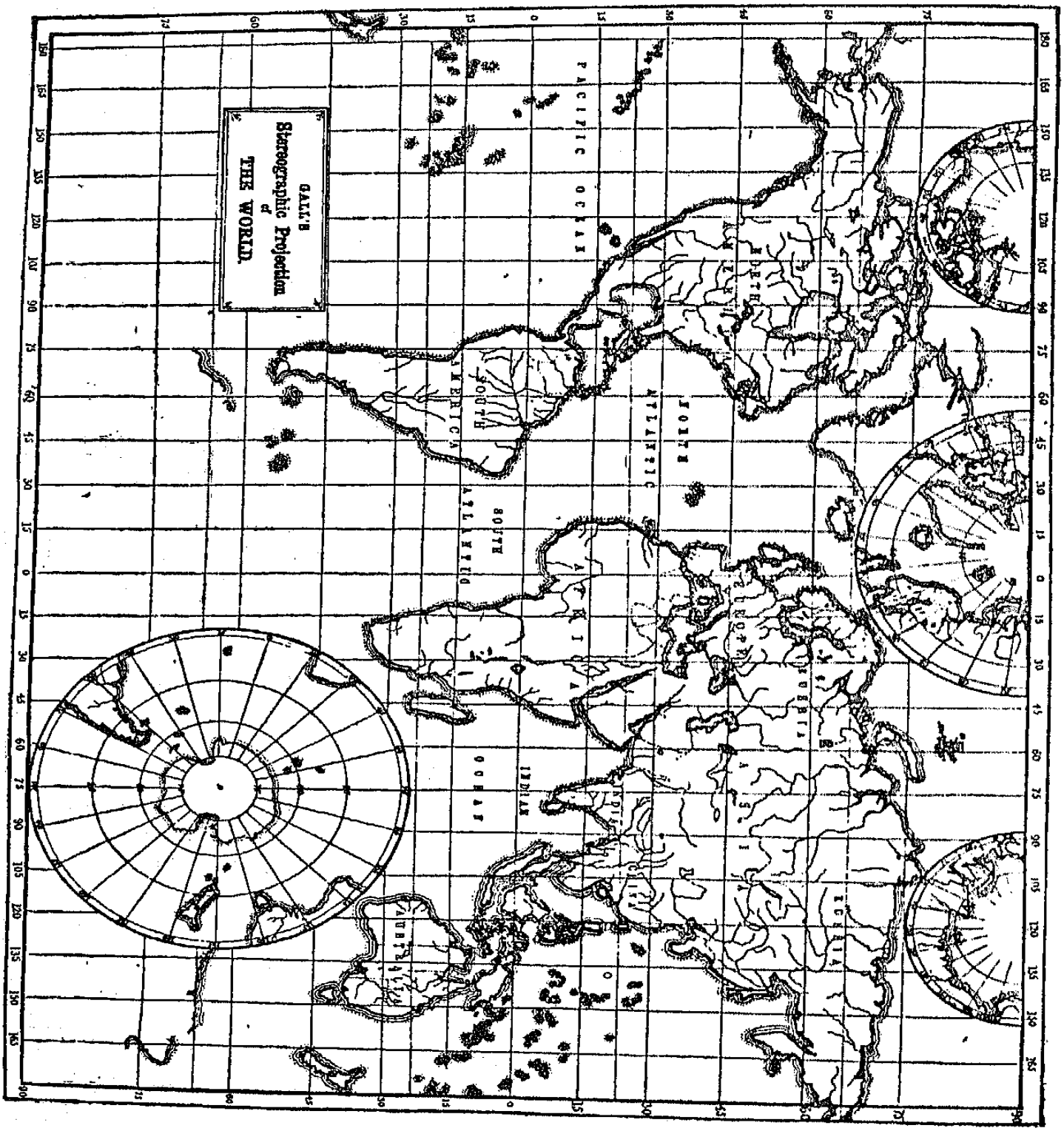
One great advantage which this projection has over every other is, that several astronomical problems can be solved upon it, the same as on a globe.

It then occurred to me that the same, or a similar projection, would give a complete map of the world, which had never been done before; and, on drawing a projection with the latitudes rectified at the 45th parallel, I found that the geographical features and comparative areas were conserved to a degree that was very satisfactory.

[1] In a series of Astronomical Charts which I drew for the Messrs. W. & A. K. Johnston, I adopted the Stereographic Cylindrical Projection for the Equatorial and Sub-Equatorial heavens.

Gall's Stereographic Projection of the World.

For General Purposes.



Having more closely studied the subject, I read a paper before the British Association in 1855, and exhibited the three new projections—the Stereographic, the Isographic, and the Orthographic; but I had not then thought of the supplemental diagrams, which add so much to the value of the Stereographic.

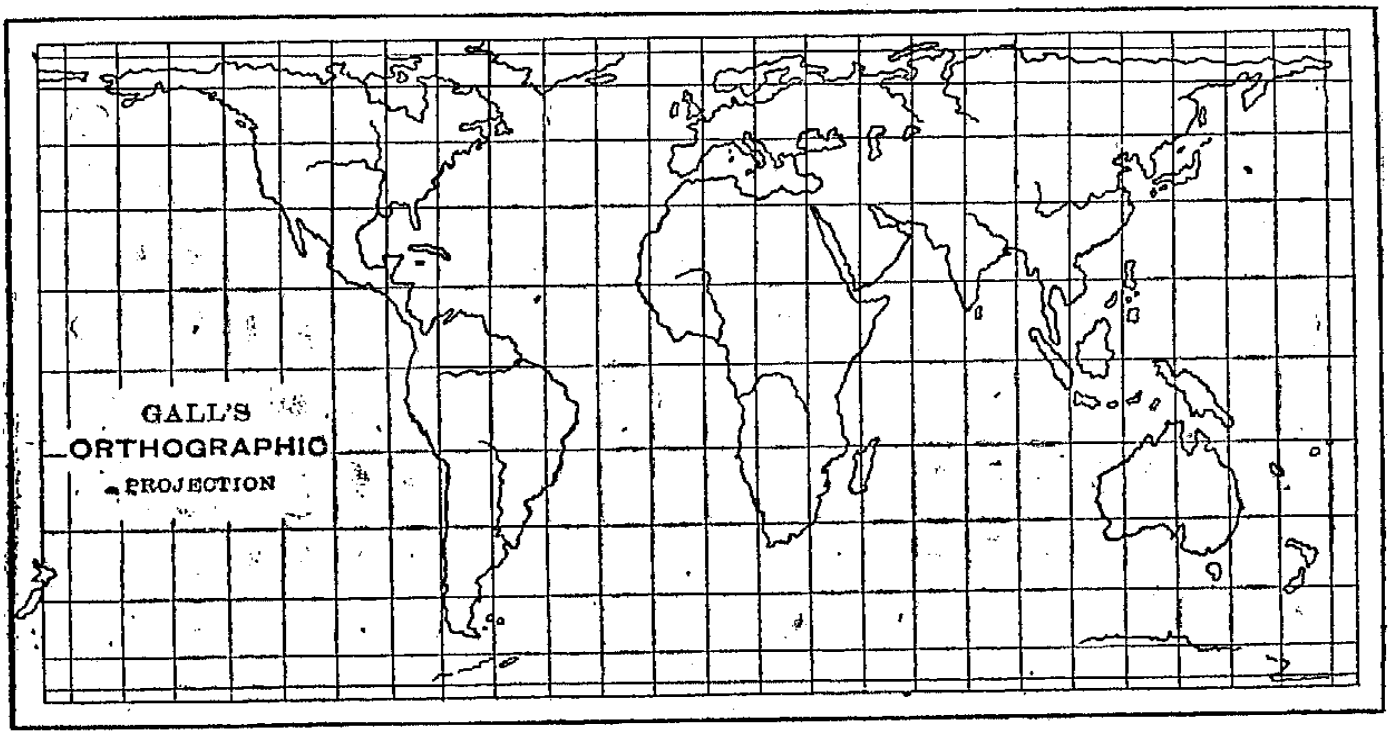
The Stereographic projection has this advantage over all the others, that it leaves room for supplemental diagrams at the top, on the same scale and on the same projection, which take up the extremities of the general map, and show their convergence towards the pole.

The Orthographic projection also is a valuable map for showing the comparative area occupied by different subjects, such as land and water, as well as many other scientific and statistical facts. It is true that the geographical features are more distorted on this than on any of the others, but they are not distorted so as to be unrecognisable; and so long as that is the case, its advantages are not too dearly bought.

GALL'S ORTHOGRAPHIC PROJECTION.

EQUAL AREA. PERFECT.

For Physical Maps, chiefly Statistical.



I have wondered why geographers never thought of using the Isographic projection with the latitudes rectified at the 45th parallel. Even for general purposes it is better than Mercator's, and still more for physical maps, where polar distance and comparative area are all-important. It is very simple, its geographical features are on the whole very good, although not so good as in the Stereographic; and for isothermal and other lines connected with climate, as well as for comparative area, it is greatly superior to Mercator's.

For general purposes, however, the Stereographic is best of all; for though it has none of the perfections of the others, it has fewer faults,

and combines all the advantages of the others in harmonious proportions. It does not give perfect orientation like Mercator, but it gives it better than the other two. It does not give exact polar distance like the Isographic, but it gives it better than the other two; and it does not give comparative area like the Orthographic, but it gives it better than Mercator, though not better than the Isographic. The consequence is, that even without the supplementary diagrams, the geographical features of the earth's surface are better conserved than in any of the others; while, with the supplementary diagrams the polar regions are as accurately and symmetrically represented as the equatorial.

The Stereographic projection, though inferior to Mercator's for navigation, is superior to it in the following particulars :—

1. On Mercator's projection the whole world cannot be represented, because as we approach the poles the difficulty increases; and after passing the 80th degree the map begins to run wild. For that reason, from ten to fifteen degrees of latitude are generally left out. On the Stereographic projection the whole world is represented from pole to pole.

2. In Mercator's projection there is a great waste of room. Nearly one half of the map is occupied with a vain attempt to represent the Arctic and Antarctic regions, while the habitable world is confined to a comparatively narrow stripe in the centre. In the Stereographic there is no waste of room.

3. In Mercator's projection, the comparative areas are grossly misrepresented. For example, Spitzbergen appears to be three or four times larger than Borneo, whereas in reality it is five or six times less. In the Stereographic they appear in their true proportions.

4. In Mercator's projection the polar distance is not only practically but theoretically ignored. The 90th degree is nowhere. This makes it peculiarly unsuitable for physical maps.

5. In Mercator's projection the polar regions have no resemblance to the reality. In the Stereographic they are as accurately represented as the equatorial.

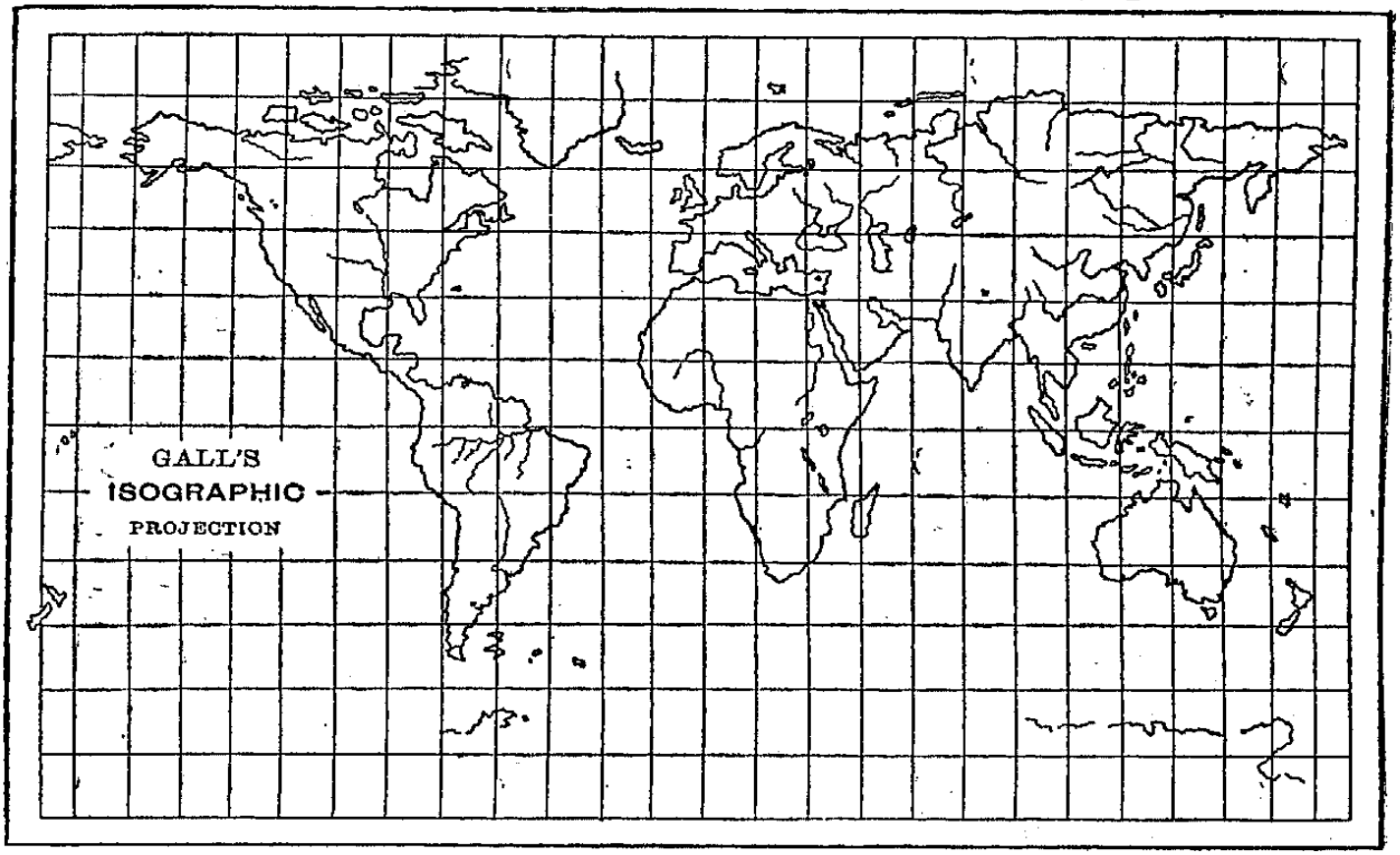
It is always difficult to introduce changes when long established custom has created a rut; and for more than twenty years after I had exhibited the three new projections before the British Association I was the only person that used them. But at that time I had not added the supplementary diagrams which add so much to the value of the Stereographic projection.

The first to adopt it was the late lamented Mr. Keith Johnston, who introduced it into his miniature Atlas, which was, I believe, the first of his publications. The next to adopt it were Messrs. Chambers and Mr. Bartholomew, who has done more than any other to make it known. After them it was adopted by Messrs. Nelson, Messrs. Gall and Inglis, and Mr. Heywood of Manchester. The late Dr. Keith Johnston when he saw it gave his hearty approval, and said that his only surprise was that it had never been thought of before.

GALL'S ISOGRAPHIC PROJECTION.

POLAR DISTANCE. PERFECT.

For Physical Maps, chiefly Meteorological and Hydrographic.



I do not know whether there is any copyright in new projections. I hope there is not. But if there is, I wish it to be known that I make no pretensions to it, and that every person is welcome to use them. All that I would ask is that, when they are used, my name may be associated with them, and that they may be severally distinguished as Gall's Stereographic, Isographic, and Orthographic Projections of the World.

THE SCOTTISH GEOGRAPHICAL SOCIETY.

Meeting of the Aberdeen Branch.

A meeting of the Aberdeen branch of the Scottish Geographical Society was held in the Square Room, Music Hall Buildings, Aberdeen, on March 18th, when Mr. Frederick L. Moir, of the African Lakes Trading Company, delivered a lecture on "The Eastern Route to Central Africa." Mr. David Stewart presided, and there was a large attendance. On the conclusion of the address, the Chairman read a circular that had been received from Mr. Ralph Richardson, the senior Honorary Secretary of the Scottish Geographical Society, with regard to Mr. H. O. Forbes's proposed expedition to New Guinea, in which an appeal for subscriptions was made to members of the Society; and, in urging the appeal, Mr. Stewart said that he had just heard that the Aberdeen Chamber of Commerce had voted £10 towards the cost, an announcement which was received with applause.

Professor Pirie subsequently proposed a vote of thanks to the Chairman, which having been very cordially awarded, the meeting terminated.