as maps and charts showing the way in which the foreshores, &c., are leased by Government to individuals and companies interested in oyster culture. For further details concerning oyster culture in the Netherlands, we may refer the reader to the conference paper on this subject. On the whole oyster culture appears to be very successful in this country.

In the American department there is a large collection of the most various oyster-shells, as well as the model of a vessel occupied in dredging an oyster bed. "Culture" of oysters appears to be very little practised in that country up to the present day, the natural beds being as yet of a nearly inexhaustible richness, especially in the Southern States, where they are principally situated in the lagoons along the coast-line, and the oysters very often used as manure. Nor has the trade in these regions been developed to any extent. More northward Chesapeke Bay is the richest ground, and from thence oysters are transplanted along the coasts of the different Northern States, and at the same time brought into the market in enormous numbers. Together with the scientific investigations in the Netherlands, those in the United States, conducted by Brooks and Ryder, and those of Bouchon Beaudely in France, stand foremost as commendable efforts to bring pure science to bear upon fishery problems of great practical importance.

UNITED STATES COAST AND GEODETIC SURVEY[1]

THE author of this very important treatise states, in his preface, that he has attempted to give a sufficiently comprehensive account of the theory of projections to answer the requirements of the ordinary student of this subject. The literature of projections being extensive—the work of the most eminent mathematicians—the author has contented himself with making such extracts from the great mass of papers, memoirs, &c., which he deemed requisite for his purpose, giving, for further information, references to such original sources as are comparatively easy of access.

As the different conditions which projections for particular purposes have to satisfy are so wholly unlike, no general theory underlying the whole subject of projections can be given; it is therefore conveniently divided into several sections: and here the author mentions his obligations to M. Germain's most important "Traité des Projections" (Paris, 1865), which contains an account of almost every projection that has been invented. At the request of the Superintendent, Carlile P. Patterson, the treatise has been divided into two parts. The first part contains the mathematical theory of projections, while the second part contains merely such a sufficient account of the various projections as will enable the draughtsman to construct them.

The surface of the sphere being non-developable, the exact representation of even a portion of it upon a plane is impossible. Certain conditions can, however, be fulfilled which will render it sufficiently exact for any particular purpose. The areas may be proportionately preserved, in which case we have an equivalent projection; or the angles of small portions may be preserved, in which case we have an orthomorphic projection. The exigencies of any particular use for which a projection is designed give rise to a great number of other conditions corresponding to which projections have from time to time been invented: so that the history of projection has been peculiarly that of the solution of more or less independent problems: for a complete account of which the reader is referred to M. D'Avezac's "Coup d'Œil historique sur la Projection des Cartes de Géographie" (Paris, 1863).

[1] "United States Coast and Geodetic Survey" (Carlile P. Patterson, Superintendent). A Treatise on Projections. By Thomas Craig. (Washington: Government Printing Office, 1882.)

The author has treated his subject under the following heads:—

I. Orthomorphic Projection.
II. Equivalent Projection.
III. Zenithal Projection.
IV. Projection by Development.

The first part of the volume treats of the mathematical theory, and is subdivided into nine sections. The first section contains a brief introductory account of the principal properties of conic sections and perspective projection—the most natural and simple method of representation. Sections II. and III. treat of methods of orthomorphic projection. Section IV. treats of projections by development; Section V. gives an account of zenithal, and Section VI. of equivalent projections. Students of these sections are presumed to have a fair acquaintance with the methods of ordinary analytic geometry and the elements of the differential and integral calculus. The next three sections are extremely general, and will require rather more extensive mathematical knowledge. These sections were designed to connect the particular problem of the plane representation of a sphere with the much more comprehensive methods of representation of one surface upon another, and to induce in the student, having a real interest in the general theory, a desire to consult the original memoirs for fuller information.

The second part of the volume, which treats of the construction of projections, does not appear to require any detailed description; but as much of it is merely reprinted from the first part, the propriety of thus separating the "construction" from "theory" seems rather doubtful. The book ends with thirty-one tables, nearly all extracted from the original memoirs of the writers on different parts of the subject of projections. In some cases, however, improved tables by other authors are given. Where the ellipticity of the earth has been taken into account the tables are given unchanged, as the effect of small changes of ellipticity would be almost inappreciable; and, moreover, we have in p. xiii. of the introduction the important statement that "The United States Coast and Geodetic Survey will undoubtedly soon be able to produce a much better value of the ellipticity than has yet been given."

Such are the contents of this valuable book we have endeavoured to describe. It presents, however, some signs of hasty arrangement and want of strict attention to the correction of the press, which will doubtless be removed from the next edition. Indeed the copy under notice would scarcely seem intended for publication in its present form. For instance, "The accompanying plates . . ." mentioned in p. 230 are wanting; and we notice the following typographical errors, &c.:—

Preface, p. x. *Philosophical Magazine*, 1865, should be 1862.

Preface, p. x., and Introduction, p. xiv. There are obvious errors in the title of Gauss's Memoirs.

Introduction, p. xiv. *Phil. Trans.* vol. 1. should be vol. L.

P. 80, line 12 from bottom, for *platting* read *plotting*.

Pp. 80 and 210. The descriptions of Cassini's projection do not seem to be correct.

Pp. 81, 82, and 210. The woodcuts defective.

P. 83. Curious error in the numerator of the general expression for ρ.

Pp. 67 and 197. Woodcuts of Fig. 13 not good.

Pp. 71 and 201. Fig. 15, woodcuts require correction.

Pp. 76 and 206. Fig. 18, woodcuts not very good.

P. 149. In the denominator of the value of m the power 2 of $(1 \mp \epsilon \cos \omega)$ should be ϵ. In the first term of the denominator of the value of k, $\sin^2 \frac{\omega_1}{2}$ should be $\sin^2 \frac{\omega_2}{2}$, and in the second term ω_2 should be ω_1.

P. 150, line 2. For $1\ \epsilon^2 \cos^2 \omega$ in the denominator of the last term of the value of $\frac{d\,m}{n}$, read $1 - \epsilon^2 \cos^2 \omega$.

P. 214. Fig. 44, the letter P out of place; compare with Germain's Fig. 98; in the letterpress "angle $APC = \omega$" should be $= \pi$.

Also the numbering of the sections seems to require some revision. Section VII. referred to in p. xiii. of the introduction, as containing Mr. Schott's account of the polyconic projection, is not of course the Section VII. of the text, and though Part II. is not divided into sections, yet in p. 230 "The Tables" appear under § xii.

PROMISE AND PERFORMANCE IN CHINESE SCIENCE

UNDER the title of "Science à la Chinoise," a writer in a recent number of the excellent *North China Herald* dwells on what may be called the disparity between the promise and the performance of Chinese science. The ancient classics contain beautiful maxims on the necessity for research into nature. The "Great Learning" tells us that knowledge is perfected by the investigation of nature; Confucius urged his pupils to study the "Book of Poetry," because, among other things, they could become acquainted with the names of plants and animals; Mencius tells us that the careful study of phenomena is the road to knowledge, and in illustration says: "Though heaven is high and the stars distant, yet, having investigated their phenomena, we can sit down and calculate their revolutions for a thousand years." It has long been a proverb among the learned that to be ignorant of a single thing is a disgrace to the true scholar, and to be ignorant of nature is as if nature did not exist. When the revered ancient sages of China, whose words are in the mouths of all, thus encourage scientific research, we should be led to anticipate great results from the patience, intelligence, and ingenuity of the Chinese. But, as in so many other respects in that anomalous country, we have excellent maxims and little more. There is, says this writer, neither research nor knowledge; science has no existence. There is indeed a considerable natural literature. From ancient times the Chinese have taken note of natural phenomena. Their record of solar eclipses is perhaps the most ancient and accurate in the world. They have more or less elaborate works on astronomy, mathematics, botany, zoology, mineralogy, physiology, and many other sciences. Yet there is scarcely any true science in them. Classification, even in regard to plants and animals, there is none. Mineralogy is mainly a description of curious stones. Nor is there any progress, for the more ancient works are generally the best, and as a consequence the Chinese to-day are as their fathers were thousands of years ago. The superstitions respecting natural phenomena, which are as living active truths to-day for all classes in China, remind us rather of man in his state of barbarism than of the ancient culture and civilisation of the Middle Kingdom. The sun and moon are to the Chinese as they were to primitive man, living things, gods to be worshipped. The stars in their courses powerfully influence, if they do not absolutely determine all human events. In them the wise may read as in a book the destiny of man and the fate of empires. Their combinations make lucky and unlucky days, and we shall do well to note carefully their signs and silent warnings. Comets are the precursors of famine, pestilence, and war—prognosticators of the wreck of empires and the fall of kings. Eclipses are the periodic efforts of the dragon fiend to destroy the lights of heaven, and every notice of an approaching eclipse sent by the Imperial astronomer to the provinces is accompanied by a Government order to employ the usual methods of gong-beating and so forth in order to rescue the threatened luminary. Again, thunder is the roar of the anger of heaven, and to be smitten by a thunderbolt is to be marked as a thing accursed. Wind is born in the heart of great mountains, whence it issues at the command of the wind-god. Most districts have their wind-mountains. That at Lung-Shan in the northern province of Chihli is the most remarkable. It has a cave at each of its four sides. The spring wind issues from the cave on the eastern side, the summer wind from the southern, and so for the others. Wind eddies or whirlwinds are raised by the hedgehog in his rapid passage from one place to another, the dust serving to screen him from the vulgar gaze. Rain is produced by the dragon god, who carries up vast quantities of water from the lakes and rivers in his capacious jaws, and pours it down in showers over the earth. Every mountain has its spirit or genius, every valley its nymph, every spring its naiad. Hence mountains and rivers, old trees and curious rocks, become objects of worship.

These and the like superstitions which enter every domain of nature are not confined to the poor and illiterate; they are shared by the rich and learned, nay, they are repeated and acknowledged by the Imperial Government itself in its decrees in the *Peking Gazette*. The highest scholar in the empire knows no more of nature than the humblest peasant. The years have come and gone, repeating the same old story, but there has been no ear to hear it, no mind to understand it. Nature has found no interpreter among the Chinese; during their long national life they have contributed nothing to science. How are we to account for this? In other fields of national effort, and especially as inventors, they must be allowed a high place. It cannot be indifference, for they have written largely on the beauties, marvels, and mysteries of nature, and many have shown keen interest in the discoveries of science. It may partly, perhaps, be due to the fact that the intellect of the nation is employed in the struggle for place and power along grooves in which science has no part. The writer we quote thinks it is mainly owing to the narrow and perverted system of education; and while the present system continues the study of science will be impossible to the youth of China. The cleverest young men find it as much as they can do to take their first degree at twenty. The higher degrees, which are also the avenues to office, can scarcely be won for years later, and thus they cannot afford a thought for anything beyond the common curriculum.

ON THE PROPERTIES OF WATER AND ICE[1]

DR. PETTERSON'S memoir is a most valuable contribution to our knowledge of the natural history of the waters of the globe. Every reader of Arctic voyages must be familiar with the variety of names attached to the different kinds of ice met with in these regions, such as "pack-ice," "bay-ice," "brash-ice," and the like. To one who has never seen them, the names convey very little information either of their appearance or of their mode of formation. Dr. Petterson's paper explains in a satisfactory and very remarkable manner the nature of the difference between the different kinds of ice.

In the first part of the work the subject is treated physically, and in the second chemically. In both parts there is much that is new and valuable.

In the Arctic Ocean, and especially in that part of it visited by the *Vega*, the saltness of the water varies much from place to place. The large rivers of Siberia constantly pour forth fresh water which lies on the surface of the ocean and spreads round the coast like a fringe. This layer often extends a considerable distance out to sea, where it gradually thins out. Nearer the shore it is thicker, but wherever the depth exceeds 20 or 30 metres the dense ocean water is found below and the two layers

1 "On the Properties of Water and Ice." By Otto Petterson. Publication of the *Vega* Expedition. (Stockholm, 1883.)