Mercy." The polarity of the magnetic needle would become known to the Chinese of that city and its neighbourhood first. The first who noticed the polarity would be some intelligent person who communicated the fact as an unaccountable peculiarity in an age when omens and portents were diligently sought for in every natural object and phenomenon.

The earliest author who mentions the "south-pointing needle" lived in the fourth century B.C. There can be no reasonable doubt that the polarity of the needle was known at that time. The discovery of the fact must have preceded the invention of any myth embracing it. As to the discovery, there is no reason to suppose it was in any way foreign, because the Chinese use an enormous number of needles, and have an inexhaustible supply of ironstone. But though the polarity was known, it was not turned to a practical use till the Tsin dynasty, when landscapes began to be studied by the professors of *fengshui*, or geomancy. There was at that time a general belief in the magical powers of natural objects. This was a Buddhist doctrine, and it took firm hold on the Chinese mind of that age. The Chinese philosophers of those times taught that indications of good and ill luck are to be seen all through Nature. The polarity of the needle would take its place in this category of thought. Though it is not distinctly mentioned by writers of the fourth century, yet to their disciples it became an essential part of the landscape compass which the professors of *fengshui* all use. Kwo Pu, the founder of this system, died A.D. 324, and it was not till four centuries later that the *fengshui* compass began to assume its present form. The compass used by the professors of geomancy for marking landscape indications was first made about the eighth century. It was of hard wood about a foot wide, and it had in the centre a small well in which a magnetized needle floated on water. On the compass were inscribed several concentric circles, as on the wooden horizon of our globes. They embrace the twelve double hours, the ten denary symbols, eight diagrams, and other marks. This compass was used in preparing a geomantic report of any spot where a house or tomb was to be constructed, so that the construction might not be upon an unlucky site or planned in an unlucky manner. At the same time there was living a Chinese who had studied Hindoo astronomy, and was the Imperial astronomer, and also a Buddhist priest. He noticed that the needle did not point exactly north, and that there was a variation of 2° 95′. This variation went on increasing till a century later—that is, till the ninth century. A professor of geomancy then added a new circle to the compass. On this improved compass the first of the twelve hours begins on the new circle at $7\frac{1}{2}°$ east of north.

The compass, it will be observed, grew out of the old astrological report or nativity paper, calculated from the position of the stars, and prepared in the Han dynasty by astrologers as a regular part of social life, especially when marriages were about to be solemnized. Some of the old astronomical circles are preserved in the new geomantic chart. This was the compass used when Shen-kwa wrote on the south-pointing needle in the eleventh century. This author mentions that any iron needle acquires polarity by rubbing it on a piece of loadstone. He alludes to the variation as a fact which he himself had observed, and speaks of the south-pointing needle as an implement used by the professors of geomancy. By them it was employed in the form of a float upon water. After this, in 1122, an ambassador to Corea describes the use of the floating needle on board ship while he made the voyage. This is the first instance, the earliest by more than a century, of the use of the mariner's compass on board ship, found as yet in any book, native or foreign. The existence of the book in which this is recorded settles the question of the first use of the mariner's compass at sea in favour of the Chinese. At that time the needle floated on water supported on a piece of wood, but in the Ming dynasty some Japanese junks engaged in piracy were captured by the Chinese, and the compass in use on board was found to have the needle dry and raised on a pivot, while still pointing southward. The Japanese had learned from the Portuguese navigators to make a compass of this kind, and probably the needles they used were brought from Europe. From this time, the Chinese adopted the principle of a pivot, and made their compasses without a well of water in the middle to float the needle in. Charts were probably used of a very rough kind, but how far is not known. What is known is that the junk-master was aware of the direction in which the needle must point to reach the port to which he was going. In the Sung dynasty, embracing part of the tenth, as well as the eleventh, twelfth, and part of the thirteenth centuries, Chinese junks went to Persia and India. The Arabs trading to China directly would learn at that time the use of the compass, and would apply it on board their dhows. From them the Europeans learned this useful invention.

The credit of the discovery, both of the polarity of a magnetized needle and its suitability for use by mariners at sea must therefore, according to this writer, be given to the Chinese. It was China also that has the credit of having first noticed that any iron needle may be polarized by rubbing it with a magnet. In the thirteenth century the Arabs used a floating compass on their dhows. The needle was made to float on the water by attaching it crosswise to a cornstick or splinter of wood. A magnet applied to it drew it into a north and south direction. They would use Western notation to mark the quarters and intermediate points on the horizon. When therefore the mariner's compass was adopted from them, the Chinese 24 points were not communicated. In the European compass the notation of 32 points is Western, and rests on the winds and the sun. In the Chinese primitive mariner's compass the notation is that of the professors of geomancy, and rests on the old astrological division of the horizon into twelve double hours. From the Arab account we learn, what the Chinese accounts do not tell us, that the Chinese floated the needle by inserting it in a splinter of wood.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

ROYAL COLLEGE OF SCIENCE.—The following scholarships, prizes, and Associateships have been awarded for the session 1890–91 :—First year's scholarships to William Allan, Thomas T. Bedford, Edwin Edser, and Herbert A. Clark ; second year's scholarships to John W. Pickles and Sydney Whalley ; the Edward Forbes Medal and prize of books for biology to Arthur G. Butler ; the Murchison Medal and prize of books for geology to Charles G. Cullis ; a Tyndall prize of books for physics, Course I., to William Allan ; the De la Beche Medal for mining to James G. Lawn ; the Bessemer Medal and prize of books for metallurgy to Joseph Jefferson ; the Frank Hatton prizes of books for chemistry to Herbert Grime and Lionel M. Jones. Prizes of books have been given by the Department of Science and Art in the following subjects :—Mechanics—Charles H. Kilby, Charles P. Butler, Herbert A. Clark. Astronomical Physics—Lawrence Parry and Samuel S. Richardson. Practical Chemistry—William A. C. Rogers. Mining—James G. Lawn. Principles of Agriculture and Agricultural Chemistry—Henry Wilkinson. Associateships of the Royal College of Science have been awarded as follows :—Mechanics—1st class, Harold Busbridge and Ernest W. Rees ; 2nd class, Angus Leitch. Physics—1st class, Sidney Wood ; 2nd class, William Shackleton and Alfred B. Lishman. Chemistry—1st class, Herbert Grime, Lionel M. Jones, Alfred Greeves, William A. C. Rogers, and Morton Ware ; 2nd class, John G. Saltmarsh. Biology (Zoology)—1st class, Arthur G. Butler and James Harrison. Geology—1st class, William J. Smeeth. The following Associateships, Royal School of Mines, have also been awarded :—Metallurgy—1st class, Joseph Jefferson, Alfred Stansfield, John Eustice, and William F. P. Tindall ; 2nd class, John D. Crabtree, Thomas S. Fraser, Henry T. Bolton, Benjamin Young, Hugh F. Kirkpatrick-Picard, George J. Snelus, James R. Crum, and Stanley H. Ford. Mining—1st class, James G. Lawn, John Yates, Robert Pill, Theodore G. Chambers, Algernon P. Del Mar, Nono Kitto, and George R. Thompson ; 2nd class, Reginald Pawle, Charles C. Scott, Henry Cavendish, Gustave Busch, George H. Gough, and Ben Howe.

SCIENTIFIC SERIALS.

THE *American Meteorological Journal* for June contains :—An account of the meeting of the New England Meteorological Society on April 18 last. The subject of discussion was weather predicting. The general methods of predicting in the United States and Europe were first described, and afterwards local and long-range predictions were considered. Papers were read by J. Warren Smith, on the Signal Service weather forecasts ; W. M. Davis, on European weather predictions ; A. L. Rotch, on

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