then more recent globes of Bonne and Lelande were sold in the one foot size at 100 livres the pair; 10 inch at 18 livres; 8 inch at 10 livres; 6 inch at 7 livres. The prices are more than double those quoted by Stevenson (II, 136) from Moxon, a century earlier.

Lalande cites among the enormous globes one at Cambridge and one at Lyon by Picpus de la Guillotiere. Lalande further states that the finest of the large terrestrial globes is that made in 1787 by D. Bergerin. The Cambridge celestial globe was made, according to the *Encyclopedia Britannica* (IX edition, Vol. X, Globes, p. 683) about 1764 by Dr. Roger Long, professor of astronomy and master of Pembroke College. This globe was 18 feet in diameter, lined with tin. No one of these three men is mentioned by Stevenson.

Nowhere does the author touch upon early appearances of globes in America, North or South. One would expect to find the earliest references in Mexico or Peru; certainly in North America globes must have been imported in the eighteenth century and possibly even constructed here. In the geography by John Payne, revised by James Hardie, that appeared in New York in 1798, there is a figure of an artificial sphere and pages xxxi-xxxviii are devoted to the use of the globe; other references could doubtless be found.

These additions have been made to indicate the wide appeal which globes have made in the past as instruments of instruction. Stevenson's work may well stimulate a revival of interest in globes for instruction purposes.

The two volumes constitute an enduring monument of American scholarship. The press work and the plates are up to the highest standards of the finest presses of Europe. It is to be hoped that students of astronomy and geography in American colleges will make the appearance of a second edition of more than 1,000 copies necessary. The author is to be congratulated upon having added new laurels to his crown in a field closely related to cartography wherein the name of Edward Luther Stevenson has so long stood first in America and almost alone.

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SPECIAL ARTICLES

THE EFFECT OF ABSORBED HYDROGEN ON THE THERMOELECTRIC PROPERTIES OF PALLADIUM

IT is well known that palladium will absorb relatively large quantities of hydrogen under the proper conditions. Palladium black absorbs the gas more readily and in larger quantities than the solid metal but the latter will contain several hundred times its own volume. The purpose of the work here described was to determine the effect of the absorbed gas on the thermoelectric properties of the metal.

The palladium used was in the form of a strip $0.01 \times 0.125 \times 10$ cm. It was first annealed in a vacuum at a temperature of 1,000° C., and then used in a thermo couple with a strip of platinum as the other metal. The cold junction was kept at 0° C. and the hot junction could be heated to various temperatures up to 300° C. This strip of platinum was used as a reference metal throughout all of the determinations.

After the thermoelectric power was obtained, the palladium strip was heated to a temperature of about 700° C., in vacuo, and then allowed to cool slowly in an atmosphere of hydrogen. It is well known that palladium will absorb hydrogen under these circumstances. The thermoelectric power obtained with the gas filled metal against platinum was less than with gas free metal, amounting in one case, at 0° C., for instance, to 73 per cent. of the gas free value. The palladium was then heated in vacuo to a temperature of about 700° C., to remove the hydrogen, and another determination showed the thermoelectric power to have returned to its gas free value. This process was repeated several times, the gas filled palladium having its thermoelectric power against platinum lowered each time hydrogen was absorbed, and restored again to its original value after the hydrogen had been removed.

A much greater decrease in the thermoelectric power of palladium against platinum as a reference metal was obtained when the palladium was filled with hydrogen by the electrolytic method. The palladium strip was used as the cathode in the electrolysis of water from a very dilute solution of sulphuric acid. The nascent hydrogen obtained in this way is very active in penetrating the palladium. At 0° C., the thermoelectric power of the palladium, after being exposed to nascent hydrogen, was in one case only 28 per cent. of the value for the gas free metal. The process of filling with hydrogen by the electrolytic method and then removing the gas by heating in vacuo to about 700° C. was repeated several times and each time the thermoelectric power was lowered by about the same amount as a result of the absorption of the gas and restored to the original gas free value upon removal of the hydrogen.

To obtain the largest effects it was necessary to use the palladium soon after it had been exposed to the hydrogen as the gas slowly diffused away from the metal over a period of several days. Also if the region containing the temperature gradient of the gas filled strip were heated during a determination of thermo e m f, the result was a removal of the hydrogen and a restoration to the original gas free value of thermoelectric power. During a determination of thermo e m f the conduction of heat from the hot junction along the palladium strip caused the evolution of some of the gas and for the higher temperatures of the hot junction the thermoelectric power approached that for the gas free metal.

These results show that a monometallic circuit consisting of gas free and gas filled palladium will give rise to a thermo e m f when the junctions are at different temperatures. Since palladium is negative at the cold junction of a palladium-platinum couple, and since the absorption of hydrogen causes a reduction in thermoelectric power, it follows that gas filled palladium is positive to the gas free metal at the cold junction. Data obtained for one case in which the palladium was electrolytically filled give the value of the thermo e m f in such a monometallic circuit as: $E = 0.12\theta - 0.00023\theta^2$, where θ is the temperature of the hot junction, the cold junction being to 0°C. The constants will depend upon how completely the palladium is filled with hydrogen.

According to the electron theory of thermoelectricity the thermoelectric power (e) of a couple is given by the expression: $e = K \log\frac{n_a}{n_b}$, where K is a constant, n_a and n_b are the effective electron densities in the two materials forming the circuit. When n_a is larger than n_b the current flows from material a to material b at the cold junction. The effect of absorbed hydrogen, then, is to increase the effective electron density in palladium.

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THE EFFECT OF SPERM BOILED IN OXALATED SEA-WATER IN INITIATING DEVELOPMENT

IN connection with certain experiments (the results of which have not yet been published) that were made in an attempt to analyze the rôle of calcium in the fertilization of the egg of *Nereis*, the following results were obtained: (1) *Nereis* sperm that have been treated with oxalated sea-water are capable of fertilizing normal *Nereis* eggs; (2) *Nereis* eggs treated with oxalated sea-water are capable of fertilization with normal *Nereis* sperm; (3) Eggs of *Nereis* are capable of fertilization in oxalated sea-water. Such eggs form jelly, maturate, cleave and give rise to swimming larvæ in the oxalated sea-water. These larvæ show a varying per cent. of abnormalities; (4) Uninseminated *Nereis* eggs treated with oxalated sea-water (0.5 per cent. and above of sodium or potassium oxalate in sea-water) form swimming larvæ which show differentiation without cleavage; (5) Sperm of *Nereis* boiled in 0.1 per cent. to 0.25 per cent. sodium or potassium oxalate in sea-water are capable of initiating development in the egg of *Nereis*. This last result may be briefly considered.

Uninseminated eggs of *Nereis* obtained by cutting a dry female are exposed to each of three boiled sperm suspensions. These boiled sperm suspensions are made up as follows: one drop of dry sperm in 5 cc of sea-water; one drop of dry sperm in 5 cc of 0.53 M NaCl; and one drop of dry sperm in 5 cc of 0.1 to 0.25 per cent. sodium or potassium oxalate in sea-water. In each case the drop of sperm is carefully placed in the bottom of a test tube and the solution added. The test tube is then quickly brought to the boiling point over a flame and the suspension is kept at the boiling