and below a mountain, or within any other extended region. The difficulty in the way of utilizing the masses of lead is the extreme minuteness of the attraction exerted by any manageable mass. On the whole, however, the latter method, in the hands of Bailey, Reich, and others, has been the more reliable of the two. A few years since, the late Professor Von Jolly of Munich undertook to measure the attraction of a globe of lead about one metre in diameter, upon a weight in the pan of a balance. The arm of the balance was at a height of twenty-one metres over the leaden globe, and the pan which held the weight was suspended by a wire of that length. It was balanced by a weight in the other pan immediately below the balance, so that the attraction was exerted only upon one weight.

A modification of Jolly's method was recently described in a paper read before the Berlin academy of sciences, by Arthur König and Franz Richarz. These gentlemen propose the following modification of the long suspension. They will cast a great block of lead in the shape of a parallelopiped. On the horizontal surface of this block will be placed an ordinary balance, the scales of which shall swing very near the surface. A vertical hole will be bored through the block, directly under the point of suspension of each scale of the balance; and a second pair of scale-pans will be suspended below the block by wires attached to the upper scale-pans, and passing through these openings. Thus the balance will consist of two pairs of scale-pans, — one pair below, the other above, — with the leaden mass between them. The masses whose attraction is to be measured will be placed, the one in the upper, and the other in the opposite, lower, pan of the scales. The attraction of the block will make the lower one lighter, and the upper one heavier. The positions will then be changed by removing the weight in the lower pan to the pan immediately above it, and *vice versa*. Then the attraction of the block will make heavier the weight which was before lighter, and *vice versa*, thus causing a difference in the weights amounting to four times the attraction of the block.

It is proper to add that this weighing method is subject to a good deal of criticism. So far as we are aware, its original inventor was Mr. C. S. Peirce, who proposed to utilize the Hoosac tunnel for the purpose, — to bore a hole from the surface of the earth vertically to the tunnel, and use it for the passage of a wire to hold a weight supported by a balance at the surface. It was found, however, that the air-currents, and other sources of disturbances, were such as to render the method inapplicable. It is difficult to see how Von Jolly's apparatus could have been free from the same difficulty. The attraction of his leaden sphere could only have been one five-millionth part of the weight, — a fraction which is about the extreme limit with which it is possible to effect a weighing under the most favorable conditions. With a block of any manageable size, the attraction by the method of König and Richarz will hardly reach a millionth part of the weight. Still the authors are making arrangements to execute their experiment, and physicists will look with interest for its result.

THE PREHISTORIC CONGRESS AT LISBON.

THE prehistoric studies in Portugal of the late lamented Carlos Ribeiro have already been brought to our readers' notice (*Science*, Dec. 14, 1883). He was the leading spirit at the Lisbon congress, as well as its general secretary; and his long illness dating from that time, and his death, which took place Nov. 13, 1882, account for the delay in the appearance of this long-expected official report. It has now been given to the world in the most satisfactory manner, with beautiful typography and ample illustrations, under the charge of Sig. Delgado, who has succeeded to the position of director of the Geological bureau of Portugal. The freshness of it, however, is somewhat impaired, owing to the full *résumé* of the proceedings, that was given by Cartailhac in the *Matériaux*, November and December, 1880, and by Professor Bellucci, at even greater length, in *L'archivio per l'antropologia, e l'etnologia*, vol. xi. fasc. 3.

It was understood that the chief interest of this congress would centre about the discussion of the first question proposed: "Are there any proofs of the existence of man in Portugal during the tertiary epoch?" Ribeiro and the Portuguese geologists desired that foreign geologists and prehistoric archeologists should visit and thoroughly study at least one of the localities from which the supposed tertiary flints had mainly come. All this was accomplished, and the results are already well known. An excursion (somewhat of the nature of a picnic) was made to 'the desert of Otta,' about thirty miles north of Lisbon, where Professor Bellucci of Perugia found *in place*, in a miocene deposit, a flint flake with a well-marked 'bulb of percussion.' This was seen by several witnesses before it was detached, and by many experts was pronounced to be of undoubted human origin. To the writer, however, the engraved figure of it does not appear entirely convincing. Upon their return, the series of flint objects discovered in this locality by Ribeiro, during the past twenty years, was submitted to the judgment of a commission of nine experts. Their report, and the discussion that ensued thereupon, developed a great difference of opinion. Upon the geological question all were in accord with the Portuguese geologists, that the locality was the shore of a miocene lake. In regard to the archeological

Congrès international d'anthropologie et d'archéologie préhistoriques. Compte rendu de la neuvième session à Lisbonne, 1880. Lisbonne, *Typographie de l'Académie royale des sciences*, 1884. 49 + 723 p., 44 pl. 8°.

problem, many refused to admit the human origin of the flints; among them John Evans, whose competency to pronounce an opinion cannot be questioned. Of those who believed them to be the work of men, some thought that they were of more recent origin than the beds in which they were found. In their judgment, the flints came from the surface, and had been washed by floods into crevices previously existing in the miocene clays. Thus the question was practically left in the same condition in which it stood before: the sanguine believed that the existence of the *tertiary man* had been demonstrated, while the cautious waited for further evidence. We do not find in the report any thing essential added to the abstracts of the various arguments that have been previously published; and the editor apologizes for not having given any figures of the particular objects that served as the basis for discussion, on the ground, that, as Ribeiro had not made the necessary selection, he feared to do it himself, lest he might by chance omit some capital piece of evidence.

Many important papers in various departments of archeology, read before the congress, are here given at length, of which we have only space to allude to a few, especially such as relate to the antiquities of Portugal.

The publication of the careful account of the researches of Sen. Vasconcellos in the valley of the Douro, with the accompanying plates, will have a tendency to add Portugal to the list of the countries of Europe in which the quaternary gravels have yielded human implements. The objects found consist of a number of very rude quartzites of the St. Acheul type, which, however, some of the members refused to admit to be artificial at all. Thus far, no organic remains have been found accompanying them in this locality; but in a cavern at Furninha, near Peniche, on Cape Carvoeiro, Sen. Delgado has discovered a deposit of quaternary gravel, which had been introduced by a natural opening in the roof, and in this he found a fragment of a lower human jaw, together with a fine specimen of a flint axe of the St. Acheul type. These are all the instances given of the discovery of vestiges of the *quaternary man* in Portugal, although Sen. Ribeiro, in his opening address, alludes to them as having been made in the valley of the Tagus, in the district of Alemtejo, and near Coimbra.

One of the most interesting papers is Sen. Delgado's methodical and lucid narrative of his exploration of the cavern of Furninha, and of the discoveries made in it pertaining to the neolithic period. Great quantities of human bonés were found, and many of them were broken, as if to extract the marrow, and calcined, precisely like those of animals used for food; so that the explanation of cannibalism at once suggests itself. But as pottery, polished stone axes, and other implements and ornaments were also found with them, Cartailhac stoutly maintained the theory that the cavern had been used as a place of sepulture. Although cannibalism has undoubtedly been practised by many modern savage races, its existence among the prehistoric peoples of western Europe is much disputed. An animated discussion upon this point, and a reference of the facts and arguments to a commission of experts, resulted in about an equal division of opinion.

Sen. Ribeiro gave an account of his exploration of kitchen-middens situated on the southern bank of the Tagus, about forty miles above Lisbon. The largest covered an area of some three hundred feet by a hundred and eighty, and was about twenty-one feet thick in its deepest part. The most remarkable circumstance connected with it was the discovery, in this restricted space, of no less than a hundred and twenty human skeletons, without any of the usual objects that accompany prehistoric interments. Not a trace of pottery was found, and such implements as were met with were of the rudest description, made of quartzite or flint and bone. Many bones of animals were scattered throughout the mass, but none of domestic animals except the dog. Like the kitchen-middens of Denmark, these seem to belong to the very beginning of the neolithic period. The study of the crania found in them, shows, according to Quatrefages, a type quite distinct from that of Cro-Magnon.

An entertaining paper by Sen. Pedroso gives an account of certain popular forms and customs in reference to marriage, still lingering in out-of-the-way villages in Portugal, which seem directly traceable to the ancient practices of polyandry and marriage by force.

The recent discoveries by Dr. Prunières in la Lozere, of several sepulchral caverns containing bones, in some of which stone arrow-heads are still embedded, are briefly noted. As the crania are all purely dolichocephalic, it is a fair inference that we have here proof of a struggle between the early race of Cro-Magnon and a brachycephalic, neolithic race of dolmen-builders who were acquainted with the use of the bow, since the arrow-heads precisely resemble those found in the dolmens.

We regret that we have no space to allude

to any more of the many valuable and important papers contained in this handsome volume.

The parliament of Roumania, upon the plea of poverty, has declined to extend an invitation to the congress to hold its next session the present year at Bucharest, which the leading members, under the initiative of the Baron de Baye, had selected as the place of meeting. We learn, however, that arrangements have been made for it to take place at Athens in 1886.

HARTLEBEN'S LIBRARY OF ELECTRICAL TECHNOLOGY (ELEKTROTECHNISCHE BIBLIOTHEK).

THE admirable collection of treatises published under this title was originally announced to contain ten volumes; but the number issued has already reached twenty-six, and others are stated to be in preparation. Almost every subject relating to electricity receives attention, including telegraphy, telephony, electric lighting, and electroplating; while certain topics are very minutely discussed, as, for example, electrical conductors, electrical clocks, the medical uses of electricity, and its applications to military purposes. The various volumes, while necessarily somewhat unequal both in merit and in importance, are yet all of them of substantial value; and it is much to be desired that they may, in part at least, be translated into English for the benefit of that large class of readers who are desirous of securing information at once elementary and accurate. This has, indeed, already been done in the case of the initial volume of the series,—that on dynamo-electrical machinery, by Glaser-De Cew, which has been translated by Dr. Paget Higgs, and which, notwithstanding some minor slips, is by far the best treatise of its size upon the specific matters which it discusses. The treatise on instruments for electrical measurements, by Wilke, contains some interesting descriptions of special forms of galvanometers and electrometers; as, for example, the admirable dead-beat galvanometers with bell-shaped magnets made by Hartmann and other German makers, the special form of Thomson galvanometer made by Siemens & Halske, Kohlrausch's torsion electrometer, and Zöllner's bifilar electrometer. Zech's 'Elektrisches formelbuch' is of very high grade, and contains much information that is not easily found elsewhere in a collected form. Its topics are arranged alphabetically; and it contains, in an appendix, a brief electro-technical dictionary giving the equivalent electrical terms in German, French, and English. Its scope will best be indicated by a brief reference to a few titles selected almost at random. Under 'Bussole' we find a general discussion of the effect of a circular current on a magnetic needle, including the tangent, sine, and Helmholtz-Gaugain galvanometers, together with the cosine galvanometer of Professor Trowbridge; the latter assigned, however, to Obach and Denzler instead of to its real inventor. The article 'Dämpfung' gives a demonstration of the formulae for the damping of a magnet; and under 'Schwingung' there is given the derivation of the various formulae for vibrations, including vibration with damping and aperiodic motion. Another valuable work is that of Tumlirz on potential. Volume xx. of the library contains a bibliography of electricity from 1860 to 1883, with special reference to technical electricity. Among the more timely of the works relating especially to the industrial applications of electricity are those by Japing on the electrical transmission of power, and Krämer on electrical railways. The volume relating to multiple telegraphy not only contains the duplex and quadruplex systems, but also the multiple systems of Meyer, Granfeld, and Baudot are described at length. The American systems of Gray and Delany are not noticed, certainly a most unfortunate omission. The last volume issued, that on cable telegraphy, is the most comprehensive treatise on the subject that we know, and is particularly valuable, as works relating to it are so few.

RECENT GOVERNMENT REPORTS.

WE regret that we are obliged to note a decided degeneration in the Bulletin of the fish-commission. What might and should properly be one of our most important government reports each year becomes less valuable. The present volume, although it contains several important scientific contributions, is in the main made up of unimportant letters, of value to very few people so far as we can judge. The first hundred and fifty pages are entirely occupied by lists and tables by the editor, not one of which is of importance to any class of people. What, for instance, can be the possible use of "A list of the blank forms and circulars of the U.S. fish-commission," which alone takes up twenty-one pages? Judging

Bulletin of the U.S. fish-commission, vol. iii. Washington, 1883.

Report of the U. S. fish-commission, part x. Washington, 1884.

Annual report of the Board of regents of the Smithsonian institution, for the year 1882. Washington, 1884.

Proceedings of the U. S. national museum, vol. vi. Washington, 1884.