

facts in regard to a great strike impartially, and publishing them within a few days, while the strike is still in progress. In very striking contrast with this are the ridiculous attempts of committees of Congress to investigate strikes. These inquiries, even if they begin when the strike is in progress, are never completed until long after it is over; and by the time reports are made, popular interest in the matter has entirely died out. Besides this, the testimony which a committee of Congress makes is jumbled together without any regard to order, and from this incongruous mass it is impossible for any one to get an intelligent idea of the facts.

Twenty-one of the States now have bureaus of labor statistics, and an effort is now making to bring about among them a uniformity of organization and methods of work, which shall also be in harmony with those of the national Department of Labor. When this is accomplished all of these bureaus will be able to co-operate with and supplement the work of each other, to the mutual benefit of all.

It is worthy of remark in closing that no European country, until recently, has had any system of gathering social statistics such as the Department of Labor is publishing from time to time. In most countries the authorities would hardly dare to institute such a system of inquiries, or, if they did, they would not dare to publish them. Belgium has lately established a bureau of statistics modelled after our Department of Labor, and a beginning has been made in England. That the scientific value of the work of the Department of Labor is also recognized in almost every foreign country is evidenced by the numerous letters that have been received from distinguished scientific men abroad, and by notices of its publications that have appeared in most of the scientific periodical publications of Europe.

THE BENDEGO METEORITE.

THE famous Bahia or Bendego meteorite described by Mornay and Wollaston in the *Philosophical Transactions* for 1816, and by Spix and Martius in their 'Travels in Brazil,' was landed in Rio de Janeiro on June 15, and is now in the collection of the Brazilian National Museum. The transportation of this great mass of iron, whose weight was variously estimated from six to nine tons, and which has been found to weigh 5,361 kilograms, was rendered possible by the recent completion of a line of railroad passing within one hundred and fifteen kilometres of the Bendego Creek, where it has lain since the unsuccessful attempt to remove it to Bahia in 1785.

As there was little prospect of a nearer approach by rail in the immediate future, the authorities of the National Museum attempted last year to stir up an interest in government and private circles for the removal of the meteorite to Rio de Janeiro. Almost immediately after the subject was broached, Chevalier José Carlos de Carvalho, an ex-naval officer who had some experience in the transportation of heavy masses of ordnance in the Paraguayan war, took up the idea with great enthusiasm, and proposed to the Sociedade de Geographia de Rio de Janeiro that the society should undertake the removal, offering at the same time to take charge gratuitously of the technical part of the operation. This proposition, which was heartily supported by the president of the society, Marquis Paranagua, was at once adopted, and a committee, with Mr. Carvalho at the head, was appointed to raise the necessary means by a popular subscription. This work proved unexpectedly easy, as a prominent and wealthy member of the society, Baron Guahy, offered, as soon as the matter was mentioned to him, to defray all the expenses. The project was also warmly espoused by the Princess Regent, and by the Minister of Agriculture, Counsellor Rodrigo Silva; and everything depending on the government, such as transportation, material from the arsenal and railroad shops at Bahia, etc., was placed at the disposition of Mr. Carvalho, and two government engineers, Drs. Vicente de Carvalho and Humberto Anuores, were detailed to aid in the undertaking.

After about three months spent in preparing material and in studying the route to be traversed, the march commenced on the 25th of November, 1887, and the meteorite was placed on the railroad on the 14th of May of the present year. A road had to be opened for this special purpose, as those existing in the region are

only mule paths: over one hundred streams, one with a width of eighty metres, had to be crossed by temporary bridges. The route lay over several chains of hills and one mountain range, in which an ascent of 265 metres had to be overcome with a grade of 32 per cent. In overcoming these many and serious obstacles Mr. Carvalho and his companions gave a brilliant and practical rebuttal to the somewhat widespread, but unjust, notion among foreigners that the Brazilian character is deficient in the qualities of ingenuity, energy, and perseverance; while on the other hand the generous donation of Baron Guahy, amounting to about ten thousand dollars, proves that wealthy and public-spirited Brazilians can be counted on for pecuniary aid for scientific purposes when once the matter is properly brought to their attention.

Important aid was also rendered to the enterprise by Drs. Luiz da Rocha Dias and José Ayrosa Galvao, chief engineer and first assistant of the government railroad line in Bahia; by Richard Tiplady, Esq., superintendent of the Bahia and San Francisco Railroad; and by the firm of Claudio de Vicenzi & Co., owners of the steamship Arlindo, on which the meteorite was given free transportation from Bahia to Rio de Janeiro.

THE HEMENWAY-CUSHING EXPEDITION.

MR. FRANK H. CUSHING, whose wonderful discoveries in regard to the customs and religion of the Zuñi Indians, made during his residence among this remarkable people, are recognized as the most valuable of recent additions to American ethnologic knowledge, has spent the past winter and spring, as may be known to many readers of *Science*, in Arizona, making explorations of extensive ancient ruins there. The expenses of this expedition, which is well equipped, are paid by Mrs. Hemenway of Boston, the lady who has lately shown such substantial interest in Mr. Cushing's work. That gentleman had reached a point in his studies of the Zuñis that, in order to pursue them further, it seemed necessary to attempt to trace their history back to the beginning by an examination of the ruined cities and temples in which their ancestors lived and worshipped. This is the object of Mr. Cushing's recent work. Attached to this expedition, during the past winter and spring, was Dr. James L. Wortman, of the Army Medical Museum, who has recently returned to Washington. His mission was chiefly that of an anatomist engaged in anthropological work. The Medical Museum has been engaged for several years in the collection of human skeletons for the purposes of comparison, and the net result of Dr. Wortman's labors during the past winter and spring has been the securing of about one hundred complete skeletons, the skulls of which are in a good state of preservation, although the rest of the bones are more or less imperfect.

In an interview since his return Dr. Wortman has given the first account of Mr. Cushing's latest work that has been published, and from a report of this interview the following brief description of the explorations of the expedition and their results has been made up.

The scene of Mr. Cushing's explorations is the wide valley or plain at the confluence of the Salt and Gila Rivers in south-western Arizona. To-day railroads cross this valley, and much of it has been reclaimed by irrigation from the desert condition into which it relapsed when the ancient inhabitants disappeared. Still a wide expanse of the plain, which is forty-five miles across, remains a desert covered with sage-brush, cactus, and mesquite. It slopes from the Salt to the Gila River, and advantage was taken of this feature of its topography by the ancient people in constructing canals to irrigate the whole plain. In some places these old canals have been re-opened by the modern farmers, and restored to their original use. On this wide plain are many groups of mounds, in excavating which Mr. Cushing has discovered many ancient cities, to some of which he has given the names of Los Muertos, Los Hornos, Los Guanacas, Los Pueblitas, Los Acequias, etc. Los Muertos, the city of the dead, has been traced for three or four miles, and forty or fifty huge structures or communal houses in it have been examined.

The surface indications of these cities are a series of truncated mounds twenty or twenty-five feet high, surrounded by a great number of fragments of ancient pottery. The cities consist of irregular groups of houses built along the banks of the canals.

In the ruins of these structures, Dr. Wortman says, the greater part of the specimens have been found. The houses are rather large, 300 or 400 feet long and 200 feet wide, possibly larger. They were generally built of adobe bricks, sun dried, without straw or admixture of cement of any kind. In some instances, Mr. Cushing thinks, they were four or five stories high, but this can only be conjectured from the size of the mounds, the thickness of the walls, and the quantity of the *débris*. All that now remain are the foundation walls, and around and within them the *débris*. These houses seem to have been constructed on the same plan as the pueblos of the Zuñis, the Moquis, and other existing pueblos. In Casa Grande a cement is found to have been used on the outside and inside of the structure. The builders were probably acquainted, as the Aztecs were, with some sort of cement, which they used to protect their structures from the weather. In some instances it was found that, instead of building with adobe bricks, upright posts had been set up. The space between was wattled with cane or willow, and then filled with adobe. The woodwork has entirely disappeared, there being nothing left of it except occasional bits of charred wood. The post holes are still there, and show the manner of construction.

The dead were buried in the houses. Below the floor of the house a vault was dug, and the body, first wrapped in cloths of some description, was deposited in this sepulchre. Then the grave was filled with adobe, which was packed around the body. Food-vessels and water-jars were also buried with the dead. With the body of a man of consequence, war-clubs, images of various kinds, arrows, and other articles were also interred, but, of course, only the most imperishable remain. Sometimes two or three bodies have been found in the same sepulchre, and it is believed that where two are found in one grave they were man and wife. The skeletons are not well preserved, and crumble after a few hours' exposure to the air. The bodies were wrapped in cotton cloths, as is shown by the impressions left in the adobe, or mud, which was soft when it was first packed around them. In some instances the fragments of cloth have been found. It is of rather fine texture, and the size of the cavities in which the skeletons are now found proves that the bodies must have been wrapped thickly, so that little or no moisture had access to them. Such being the case, the condition of the bones, especially when the dryness of the climate of Arizona is considered, indicates a great antiquity for these burial places.

The tombs already described appear to have been those of the priestly class. The bodies of the common people were cremated. In connection with each house supposed by Mr. Cushing to be the house of a clan or one of the sociological divisions, such as are found among the Pueblo Indians, was what the explorer calls a pyral mound. On this the bodies and effects of the dead were consigned to fire. This mound is eight or ten feet high, and is composed entirely of the accumulations or *débris* resulting from these cremations. The ashes and charred bones of each body were collected and placed in an urn, which was buried at the foot of the mound from six inches to a foot below the surface. In some instances as many as 400 or 500 of these urns were found buried about a mound.

Between forty and fifty of the large, or communal, houses were found in Los Muertos. In the centre was a structure larger than the others, which Mr. Cushing called a temple. In this building, which was enclosed by a strong adobe wall, and in no other, were bodies found deposited in an upper story. Here there were four or five adobe sarcophagi, two of which were placed nearer the centre of the building than the others, were more conspicuous, and contained what appeared from the skeletons to be the remains of men of advanced age. Mr. Cushing said that extra decorations were found on these two sarcophagi. It is supposed that this was the home of the chief ruler of the tribe, the chief priest, or some one of exceptional note. The object of the wall surrounding the structure was probably to make it a stronghold or citadel in time of war. The temple might also have served as a general storehouse for provisions.

Other structures of a peculiar character were discovered. They were circular, and in the centre of each was a fireplace. One of these was found in each city. Mr. Cushing thought that this

round structure was a temple of the sun, or something of that sort, as nothing was found in them but the fireplace and broken pottery. The one most carefully excavated was forty or fifty feet in diameter.

This ancient people built all their houses on the main line of the irrigating canal. This irrigating system was extensive. The many ditches and canals were constructed on a peculiar plan. A cross-section shows a series of terraces. At the bottom is a central ditch, and above this, widening to the top, are terraces. The large canals are about twenty-five feet wide at the top, the central ditch being four or five feet wide. Mr. Cushing believes the canals were used not only for irrigation, but for navigation as well. "We know," said Dr. Wortman, "that the inhabitants of these towns used timbers of considerable size in their building operations. The only available wood in the immediate vicinity was cottonwood or mesquite, which would not serve their purpose. They used pine, and the nearest point where they could get lumber of that description from was seventy-five or a hundred miles away. Timbers of a size required by them in the construction of their buildings could not be carried such a distance on the backs of men. The conclusion is that they floated them down the Gila or Salt River. Certain remains have been found indicating that they constructed of reeds rafts, or balsas, such as are found in Mexico and the South Sea Islands. Stones of considerable size, not found on the plains, were taken to the towns from the mountains. It would have been impracticable to have carried these stones such a distance unless they were floated on rafts.

"To conduct water from one level to another in these canals was a gigantic undertaking, especially when the character of the implements used is considered. They had no tools except stone ones in making their excavations. A few copper implements were found, but metal was scarce. Copper was used for ornaments, earrings, and bells. There was not enough, it is supposed, to use for agricultural implements. The irrigating system is sufficient in extent to render the whole extensive valley fertile. The beds of the canals were puddled. Soft mud was packed down well, and then burned or baked by filling the canal with brush and setting fire to it. When constructed this way the lining was almost as hard and impervious to water as terra-cotta pipes. They lost but little water, and the people were extremely economical of water. In some places large ditches terminated in great reservoirs. In these probably water was stored to be used in times of drought. The longest irrigating ditch was probably about twenty-five miles long. The river has perceptibly gone down in its bed since water was taken from it to fill these canals."

The theory that these towns were occupied successively is disproved, Dr. Wortman thinks, by the fact that some towns are twenty-five miles from the river, and all the intervening space is covered with ruins. Canals were constructed from the river to the furthest town. If the towns were successively occupied there would have been no necessity for constructing these irrigating canals. The enormous labor expended with stone picks for excavating and baskets for carrying away dirt in extending these irrigating ditches to these distant points indicates plainly that all the land between them and the river was occupied.

Mr. Cushing's party found on the rocks of neighboring mountains petroglyphs, or crude etchings. All illustrated matters of a realistic nature, and did not record the history of an individual or of a nation. They represented men offering prayers for rain, or herders or hunters offering sacrifices. These rock pictures are interesting, however, as bearing upon the question of the use of domestic animals by these people, and their probable acquaintance with the use of wool. In these petroglyphs appear representations of animals much like the llama of South America. They are represented in a position or attitude that the llama habitually assumes. They are so pictured as to lead to the conclusion that they were domestic animals. They are connected with a string or cord, a man having hold of the string and appearing to be driving them.

Mr. Cushing has also found in the ruins a number of terra cotta figures, representing various animals that were hunted, — the mountain sheep, the deer, the fox, the coyote. In one case a number of figures of animals corresponding in appearance with those pictured were found buried together. Mr. Cushing came to the conclusion

that these were a herder's sacrifice. Instead of sacrificing the animals themselves he substituted the images. The animal represented undoubtedly resembles the llama. It is quite different from the mountain sheep or any other animal corresponding in size, and has a long neck. If it is true that they possessed a domestic animal of this species, either the people were of very great antiquity or there was a species of llama in North America at a much more recent date than scientific men suppose. It is a matter, too, of extraordinary interest and significance, if these people had the same domestic animal as that found among the Peruvians when the Spaniards first came to this country. If they had such a domestic animal they undoubtedly took its fleece for clothing, and had woollen as well as cotton fabrics. Some of the earlier Spanish explorers speak of woollen cloth in the possession of the Pueblo Indians. If there is truth in that, then it is more than probable that these people possessed a domestic animal of the llama species probably as large as a good-size sheep.

These people had access to the Gulf of California. This is proved by the discovery of shells in the ruins which have been identified as belonging to the Pacific coast. Though at a considerable distance, they probably had communication with the sea-coast and obtained shells by bartering with other Indians. Of some of these shells skilfully carved ornaments are made. Mr. Cushing found a frog carved from a shell, the back being inlaid with turquoise. The inlaying had been done by cutting little square holes in the shell and fitting pieces of turquoise to them. A native species of lac was used in cementing the pieces. This lac was used also in basket-work. They made carved bracelets, earrings, and finger rings, and various ornaments inlaid in the manner described.

The petroglyphs did not throw much light on the manner of dress that prevailed, as they showed only the costume worn at certain ceremonials, — a long gown extending down almost to the feet. Near the skeleton of an old war-chief was found a fragment of a gown that must have been richly embroidered in various colors. It was badly decayed, but there was enough left to show that it was an embroidered garment.

"The antiquity of these ruins is not settled," said Dr. Wortman. "It has been maintained by respectable authorities that these ruins were occupied within the historic period. I don't think that can be possible. Historic evidence is decidedly against it. We have some records of the earliest Spanish explorers bearing on that point." Dr. Wortman stopped here briefly to summarize the history of the explorations of Cabeza de Vaca, prior to 1530, and of his immediate successors, Father Nisa and Coronado. Coronado's route, he said, to Casa Grande could be easily traced. There he found the ruin now standing, and gave a description of it by which it could be recognized to-day. "If it be true," said the doctor, "that Casa Grande, or Chichillecato, the Red House, a ruin still standing three stories high, twenty-five or thirty miles from Los Muertos, was in ruins when the Spaniards came there, as the records of Coronado's expedition in 1540 plainly indicate, assuredly these houses that Mr. Cushing is excavating, now practically levelled to the ground, had disappeared long prior to that period. In all the excavations Mr. Cushing has made, in the thousands of specimens collected, not a single specimen has been found that would give evidence of contact with whites. My own opinion is that the ruins are pre-Columbian, and if I were going to give a guess I would say they are not less than a thousand years old. The size of the mesquite trees growing from the mounds, indicates a great age."

"Considering all the evidence," said Dr. Wortman, "I have no doubt that when these ruined towns were inhabited, this valley, many miles in extent, was a fertile region, occupied by a thrifty people. They raised cotton, corn, and tobacco. Fragments of cotton have been dug up, tobacco has been found in their sacred cigarettes, and charred corn-cobs also remain to give evidence as to the agricultural products of the valley. As to the population, allowing even a greater number of acres to the man than is now cultivated by the Pima Indians, who, besides supplying their own wants, raise a large quantity of wheat to sell, allowing, say from five to eight acres to a man, the population of the valley must have been at least 200,000, if, as I believe, all their towns were simulta-

neously occupied. There are evidences that the Zuñis of to-day are a remnant of these people.

The osteology of the people has not yet been thoroughly studied. The skeletons collected will be compared here at the Medical Museum, and the careful study of them will undoubtedly throw much light on the relations of these people to historic people. The heads were short, or, in other words, the people were brachy-cephalic. They were small in stature. The general indications are that they are related to the Zuñis, and they are not unlike the Aztecs and Peruvians. Among the skulls I have found frequently the Inca bone or *Os Inca*, the extra bone in the back part of the skull, which received its name because it was a common thing among the Incas. These indications, with other evidences, suggest many interesting inquiries. It may have been that from this ancient civilization sprang that of Central America and of the Peruvians. A portion of the people may have migrated south, taking the llama with them, while others went north and founded the later Pueblo civilizations."

THE IMPARTIAL STUDY OF POLITICS.

SINCE Burke vindicated in such a memorable manner the party-system in politics, it has taken an extension which probably he never dreamed of. It is a curious speculation what estimate he would have formed of those larger developments of his principle which the nineteenth century has witnessed; for, indeed, there is a great distance between his cautious assertion that 'no men can act with effect who do not act in concert,' and some modern applications of the doctrine of concerted action. We cannot prevent or avoid parties. But let us, at least, be alive to the dangers that attend them. They act upon our habits of thought. They accustom us to consider public questions in a spirit as unfavorable as possible to the discovery of truth. They produce a kind of epidemic lunacy, such as history sometimes exhibits to us in nations that are on the eve of great disasters.

Some efforts have lately been made in England, similar to those now making in this country, to which we referred last week, to grapple with the specific evil of this mental disease produced by party spirit. These efforts have chiefly proceeded from the universities, and have been more or less connected with the movement of university extension. The Social and Political Educational League lately held a meeting, to which Prof. J. R. Seeley communicated an address he had delivered two years ago to a similar society, the Cardiff Association for the Impartial Study of Political Questions. This address we reproduce from the *Contemporary Review*. It was made to an English audience, but has much in it to make clear the problem to those of us in America who are interested in the scientific study of political questions.

The impartial study of political questions! If political questions — that is, questions of the public well-being — are all-important, if an interest in them is among Englishmen universal, it might seem scarcely necessary for you to found a society, or for me to deliver an address, in behalf of the impartial study of them. For surely all honest, serious study tries at least to be impartial. Surely there can be no more obvious cause of error than partiality. The judge, when he addresses the jury, warns them against yielding to bias or prejudice; the scientific man, in his researches, is especially on his guard against that tendency to a foregone conclusion which spoils all investigation and reduces it to a mockery. Surely there can be no exception to the rule that study should be impartial; surely there cannot be subjects in the study of which partiality is to be recommended or not to be condemned.

Yet somehow this undertaking of yours, that you will study political questions impartially, sounds strange and startling, and you seem to feel it so yourselves. Perhaps what is strange is that politics should be regarded and spoken of as a matter of study at all. Yes. Let us frankly admit that we may naturally be a little startled, a little alarmed, to hear politics classed off-hand, as we might class arithmetic or geography, among subjects of study. Politics concern our greatest interests, and therefore excite our warmest feelings; not among studies, not among sciences, we class them more naturally among higher things, by the side of religion, honor, morality. To be a politician is to be warm, eager,