MALARIA CONTROL WORK IN CHIMBOTE, PERU

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During the past two years an extensive and a very interesting program of malaria control has been in progress in the town of Chimbote, Peru. Chimbote lies on the coast of Peru about 250 miles north of Lima, and is, at the present time, a small fishing village of about 4,000 persons. Plans have been made to develop the Chimbote area into a large industrial center, and it is in connection with this industrial development that the malaria control work has been carried out.

Industrial development of the Chimbote area is feasible because of the existence of certain natural resources. One of the most important resources is the harbor, which has been termed the "finest natural harbor of the west coast of South America." The other principal resources in the region are an abundance of coal, and the availability of hydroelectric power which is being developed on the near by Santa River. In the southern part of Peru, about 400 miles from Chimbote, iron ore deposits are available. This ore, which will be shipped to Chimbote by boat, will make possible the development of a steel plant and will be a fundamental factor in the industrialization program.

Of vital importance to this program of industrial development is the improvement of sanitary conditions through the area and particularly in the town of Chimbote. Therefore, one of the initial undertakings has been a comprehensive program directed towards public health improvement and an elevation of sanitary standards in Chimbote. This public health program has included development of an adequate and safe water supply, construction of a sanitary sewer system, construction of a 42 bed hospital, and the malaria control work which is described in this report. The public health program has been carried out by the Servicio Cooperativo Interamericano de Salud Pública (Inter-American Cooperative Public Health Service). This Service is an agency of the Ministry of Public Health of Peru which has been established by agreement between the Governments of Peru and the United States.

THE PROBLEM

In beginning the malaria control work, the first consideration of course was the gathering of certain fundamental information. Medical and entomological surveys were required to determine malaria incidence, the vector or vectors, specific and potential breeding areas, and other pertinent data. Engineering surveys were required to determine elevations of lagoons, grades available for drainage, the amount of continuous runoff from each of the lagoons, and other data bearing on the design of a drainage system.

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In order to determine the malaria incidence, both parasite and spleen surveys were made. The month of May (1942) was selected as the time for these surveys because information from inhabitants of the area indicated that this was one of the months during which greatest intensity of the disease occurred. At this time some of the other phases of the program were already in progress. The engineering surveys had been almost finished and a considerable amount of designing had been done. However, no permanent control work was started until after the surveys had been completed. Examinations were confined to school children between the ages of 5 and 12. Results of the surveys showed that of a total of 472 children examined, 9.1% had parasites in their blood and 24.6% had enlarged spleens. These percentages, although not exceptionally high, indicated that a serious malaria problem existed in Chimbote. Even though the amount of clinical malaria actually present at the time may have been relatively low, the results of the surveys demonstrated that there was ample opportunity for the outbreak of severe epidemics under favorable conditions. In view of the fact that there was to be a large influx of population from non-malarious areas, the opportunity for malaria epidemics was a hazard of the first magnitude.

The malaria vector in Chimbote was found to be *Anopheles pseudopunctipennis*. One other Anopheline was found breeding within the area: *Anopheles punctimacula*. However, only a very small number of *A. Punctimacula* larvae were ever encountered, and all of these were found to breed in one small isolated spot. Furthermore, adults of *A. punctimacula* were captured only on one or two occasions throughout the entire program; this in spite of the fact that adult catches were made almost continually. Because of the evidence of such small numbers of *A. punctimacula*, it was concluded that the part this species played in the transmission of malaria was insignificant.

Extensive fresh water lagoons which existed on the north and east sides of the town of Chimbote served as breeding areas for huge numbers of *Anopheles pseudopunctipennis*. In Figure 1, which shows an aerial view of the town taken before control work was started, a part of these lagoons can be seen. The group of lagoons visible in the foreground of the picture is a part of the lagoons on the north side of town. The eastern lagoons, which were individual bodies of water rather than an interconnected group, are located on the far side of town immediately adjacent to the shoreline. The eastern lagoons were all of the same type, but were very distinct in nature from the group of northern lagoons. On the east side of town the lagoons consisted of waste water and underground water which emanated from nearby irrigated areas. This irrigation water had been dammed by the beach which had been built up as a result of wave action. The reason for the existence of the northern lagoons is not definitely known. However, they appear to be the result of ancient man-made excavations, and two theories for their formation have been advanced. One of the theories is that the Incas made these excavations for the purpose of extracting clay which they used for lining their irrigation ditches. The presence of an abundant amount of good quality clay throughout the lagoons may lend credence to this theory. The other theory is that the excavations were made for agricultural purposes and that later the area became submerged with
respect to the ground water table. There is a continuous flow from these lagoons of about 8.5 sec.-ft.; the water enters from underground along the eastern edge. Rainfall, which is practically zero in Chimbote, played no part in the problem.

The group of lagoons on the north side of town extended over an area approximately 0.3 mile wide by 1.5 miles long, and contained originally a water surface area of around 6,800,000 sq. ft. (156 acres). The distance from the center of town to the farthest point of these lagoons was very nearly 2 miles. Because there were constant prevailing winds to the north (i.e. in the direction away from town), it was felt that it would not be necessary to carry the control program to the extreme north end of this group of lagoons. Therefore, for the north lagoons, a radius of 1.5 miles was set as a practical limit to the extent of the control program.

On the east side of town there were a total of seven individual lagoons in which control work was done. These lagoons varied in size from 43,000 sq. ft. to 1,500,000 sq. ft. of surface area; the total surface area for all seven lagoons was 2,700,000 sq. ft. The distance from the center of town to the seventh lagoon was a fraction more than 2 miles. However, because there was heavy breeding in this lagoon, and because prevailing winds in this case were towards town, it was considered necessary to include the seventh lagoon in the control program. Although there were additional lagoons further east, at a distance of 3 miles and more from town, it was considered impractical to extend the control program beyond the seventh lagoon.

Larvae of Anopheles pseudopunctipennis were found breeding throughout practically all of the north and east lagoons. Most of the lagoons afforded breeding places which were highly typical for Anopheles pseudopunctipennis: areas of fresh water wholly exposed to the sun, and filled with algae or other aquatic vegetation. The density of breeding varied considerably throughout the lagoons; however, in some of the areas of heaviest breeding examinations showed concentrations of 20 to 25 larvae per dipper full.
In order to determine whether or not drainage could be employed as a method of permanent malaria control in Chimbote, detailed topographic surveys were required. Differences in elevation between the ocean and the lagoons were very small, and it was not known until after the surveys had been completed whether or not sufficient grades for a drainage system would be available. Topographic surveys were started during the month of January, 1942. A horizontal coordinate system was established by means of transit and tape surveys. This coordinate system was a continuation of the system which had been previously established by the Frederick Snare Corporation, the company engaged on the construction of port works. Elevations were determined by means of numerous level circuits; all elevations were referred to a low-low tide datum, which had been established by Snare Corporation. From the coordinate system all lagoon areas were mapped by means of planetables. In doing this mapping numerous shots were taken on the shorelines and on the bottoms of the lagoons; very little dry land topography was taken in order to conserve time and energy. After the surveys had been finished and detailed maps of each of the lagoons had been drawn, it was found that adequate grades for the drainage of all lagoons were available. However, grades available in the north lagoons were much less than those in the east lagoons, and therefore for the north lagoons lower design velocities had to be used. The personnel used for making these initial surveys consisted of six students from the National Engineering School who were hired to do the job during their summer vacation.

Temporary Control Program

In view of the fact that several construction programs (port works, hospital, water supply, and others) had already been started or were scheduled to be started immediately, it was desirable to put into operation an effective malaria control program as soon as possible. Therefore, a temporary mosquito control program, which consisted of a larvicidal campaign, was inaugurated at the time when the original survey work was being done. An effort was made to obtain Paris green from this larvicidal work; however, Paris green in the quantities required was not available at the time.

The most important larvicide used during the temporary program was tricalcium arsenite, which was manufactured in Perú by the Cerro de Pasco Mining Corporation. This larvicide was a white powder and consisted of 42.9% As₂O₃ and 41.6% CaO by weight, or 5.2% free CaO and 79.3% tricalcium arsenite. Experiments in Chimbote showed that this was an effective larvicide, although it was found that the concentration of tricalcium arsenite had to be approximately twice that used for Paris green in order to obtain comparable results with the two larvicides. In
addition to tricalcium arsenite, kerosene was used for general larvicidal work. Tricalcium arsenite was not available throughout the entire program, and when the supply became exhausted, kerosene, which could be obtained cheaply in Chimbote, was used.

The tricalcium arsenite was applied as a spray, which was composed of a mixture of tricalcium arsenite, kerosene, and water. The most commonly used proportions consisted of one volume of tricalcium arsenite mixed with two volumes of kerosene. One volume of this tricalcium arsenite-kerosene mixture was then diluted with water at the breeding places in proportions varying from 1:150 to 1:300; the amount of water used depended upon the amount of breeding and the amount of vegetation and debris present in the area to be treated. After dilution, the larvicide was applied by hand by means of liquid sprayers. This method of larvicidal application was the same as a method described by Barber for applying Paris green (Human Malaria, p. 338). The actual concentration of tricalcium arsenite per unit of surface area varied considerably; however, the range was from 6 to 17 cc. per 100 sq. meters. In a few instances the tricalcium arsenite was applied as a dust, the diluent being a fine road dust collected locally. Dusting operations were never employed as general practice, but were carried out solely for experimental purposes. Although results obtained with the dust were reasonably comparable to those obtained with the spray, it appeared that the spray was slightly more effective.

One of the features of the larvicidal program consisted of the continuous removal of vegetation and debris from the lagoons. In the north lagoons one of the most serious difficulties encountered was the widespread growth of reeds six to eight feet high. This vegetation of course prevented the distribution of larvicide, and also prevented the numerous fish from feeding on the larvae. The cleaning program, for which as many as 60 men were employed at one time, was started early in the project, several weeks before the larvicide and spraying equipment were available.

At the beginning of the larvicidal program, the personnel in addition to the cleaning crews consisted of 14 sprayers and two inspectors. All areas in which larvae were found breeding were sprayed once a week. The amount of larvicidal work was decreased gradually as construction of the permanent drainage channels proceeded. During the month of November, 1944, the permanent program had become far enough advanced so that all larvicidal work could be stopped.

The effectiveness of the larvicidal program was measured in two ways: by weekly inspection of all lagoon areas to determine anopheline larvae counts, and by regular collection of adult anophelines. As mentioned previously, larvae counts in some places before the temporary program was started were as high as 20 or more larvae per dip; however, the average count throughout most of the lagoons was around 8 to 10 larvae per dip. During the time in which the temporary program was in progress, average counts showed only a fraction, e.g. 0.2-0.3, of a larva per dip; and in many cases counts were zero for 20 dips. Two methods were used for collecting adult anophelines, the first of which was house catches. Three houses in town were designated as catching stations. On one day out of every week each house was visited early in the morning, and catches were made for a period of 30 minutes by means of a chloroform tube. Before starting control work, as many as 30 and as few as 5 anopheline mosquitoes were caught during one 30 minute period. After control work had been started, for many of the catching periods it was impossible to find any anophelines, and never did a catch show more than 6 anophelines. The second method employed for collecting adult anophelines
was the use of an animal trap. The animal most commonly used was a burro, although calves and sheep were used occasionally. Several catching stations were established in the vicinity of the lagoons, and the trap was placed at one of these stations every night. Every morning the trap was examined and the number of anophelines which had been caught during the previous night was recorded. Results of these catches showed reductions in adults varying from 60 to 100 per cent.

**Prophylactic Atabrine.**—One other measure taken for the temporary control of malaria was the use of prophylactic atabrine. A dispensary was established and the community advised of this service. Atabrine was made available free of charge to all persons living in Chimbote who cared to call at the dispensary twice a week. The prophylactic dose given was 0.40 gms. per person per week. This preventive measure proved very popular, and during the peak of the construction program atabrine was dispensed at the rate of around 50 gms. per week.

**Permanent Control Program**

Drainage is of course the most effective permanent method of reducing or controlling malaria. Therefore, when the engineering surveys showed that drainage of all lagoons within a radius of 1½ to 2 miles from the center of town was possible, this method was selected as the principal means of permanent control. Some filling was done in conjunction with the drainage operations; however, the filling was of secondary importance and was done only in those places where drainage could not be effected. As indicated previously, the problem of draining the east lagoons was very different from the problem encountered in the north lagoons. With the east lagoons, the principal difficulty lay in the construction of a satisfactory outlet through the beach. In the north lagoons the outlet did not present any great problem; however, the question of grades was very difficult because of the slight difference in elevation between the lagoons and the ocean.

**Outlet Structures.**—The outlet structures built in the east lagoons consisted of concrete pipe lines of 24 in. in diameter which extended from the shoreline back through the beach to the lagoons proper. Each of these outlets was made up of two structurally different sections. The first section, which was at the shoreline, was designed to resist heavy wave action and undermining. This section consisted of a very heavy reinforced concrete pipe, 33 ft. long, which was cast in place, and which was mounted on twelve piles. The piles used were of reinforced concrete and were 10 in. square by 20 ft. long. The second section of each outlet consisted of precast concrete pipe which ran from the structure on piles through the remainder of the beach. The total length of each outlet varied for the different lagoons; the shortest outlet was 130 ft. and the longest 210 ft.

The first step in construction of those sections of the outlets which were cast on piles was the placing of sheet piling. Complete sheeting was necessary because the inverts of the outlets were at or near mean tide level. The sheeting used consisted of 3 x 8 in. lumber in which a 1 x 2 in. tongue and groove had been set by hand. All sheeting was placed solely by loading with sand bags and jetting.
After the sheeting had been placed, the twelve reinforced piles were driven with the aid of a drop hammer pile-driving rig. By using jets it was necessary to do only a minimum amount of driving with the hammer. In most cases the weight of the pile and the weight of the hammer, which was rested on top of the pile, were sufficient with jetting to bring the pile near final grade. However, in all cases the pile was driven for the last few inches in order to consolidate the sand. After the piles had been brought to grade, the top 12 in. of concrete were broken away from each pile in order to expose hooks in the vertical reinforcing; later these hooks were tied into the reinforcing of the pipe barrel which was built on the piles. In casting the pipe barrel two pours were made; the first pour consisted of the lower half or invert section of the pipe and the second pour of the upper half. *Fig. 2* shows a picture taken during construction of one of the outlets; in the figure can be seen the sheeting and part of the form work and reinforcing steel for the pipe barrel.

![Construction of Lagoon Outlet](image)

After the outlet structures on piles had been finished, the pipe lines through the remainder of the beach were laid using precast sections 3 ft. in length. By laying the precast pipe sections during periods of low tide, it was not necessary to use sheeting.

*Fig. 3* shows a picture of one of the outlet structures in operation. It can be seen that the structure juts out into the ocean for only a few feet. Actually, the amount of clear pipe which extends beyond the beach varies from time to time for each of the structures. This variation is caused by constant changes in the beach as a result of wave action. In locating the structures it was of course necessary to have the mouth far enough away from the beach so that no clogging would be caused by the building up of sand on top of the pipe. At the same time it was desirable to have the mouth near the beach in order to provide as much protection as possible for the structure. Furthermore, it was desirable to limit all the structures which were cast on piles to a maximum length of 33 ft. if possible. This also limited the distance which the pipe could extend out into the water; it was essential that the upper end of the pipe on piles be well imbedded within the beach, for otherwise the precast pipe sections would be undermined and the outlet de-
stroyed. Before any locations were made, several profiles of the beach were run. Then on the basis of these profiles the structures were located as close in as possible with reasonable assurance that the beach would never build up beyond the mouth.

As mentioned above, invert elevations at the mouth of all structures were at or near mean tide level. The lowest invert was placed 0.7 ft. below mean tide, and the highest invert 1.3 ft. above mean tide. The factors controlling these elevations were of course the elevations of the bottoms of the lagoons and the grades necessary for the drainage channels and outlet structures. Grades for the outlet structures were chosen so as to give a minimum velocity of 4 ft. per sec. when flowing full. At the time of design it was believed that this velocity would be sufficient to keep the outlet open at all times regardless of any temporary deposition of sand in the mouth of the pipe during periods of high tide. Actually this has been the case. All outlet structures have now been in operation for more than a year, and there has never been the slightest tendency toward clogging.

Although there were seven lagoons on the east side of town included in the control program, only six outlet structures were required. The seventh lagoon (furthest from town) was located almost a mile from the beach. It was possible to drain this lagoon into the upper end of the sixth lagoon and therefore eliminate a separate outlet structure.

For the main north lagoons the construction of an outlet was not necessary. Here it was possible to use a concrete culvert over an existing channel at the beach for the outlet structure; the floor of this culvert was at an elevation of 1 ft. below high tide (1.3 ft. above mean tide). This outlet has also been in operation for more than a year, and has proved completely satisfactory.

**Drainage Channels.**—The permanent drainage system for the entire area consisted of 6.4 miles of concrete lined channels, of which half were constructed in the seven east lagoons and half in the north lagoons. The length of channels in each of the east lagoons varied considerably. In four of these lagoons only one channel per lagoon was required; whereas
for the other three lagoons it was necessary to build one main channel and one or more branches. The shortest channel in the east lagoons was 846 ft. in length, and the longest, including branches, was 4,700 ft. As has already been mentioned, runoff from the seventh lagoon was drained into the head end of the sixth lagoon. An 18 in. concrete pipe line 1050 ft. long was used to connect the channels in these two lagoons. A picture of the drainage channels in the sixth east lagoon is shown in Fig. 4. The picture was taken looking towards the pipe outlet through the beach, and shows the main channel on the left and a branch channel on the right.

The channels constructed in the north lagoons consisted of one main channel 9,850 ft. in length, and three branches. The lengths of the branches were 4,900 ft., 1,600 ft., and 660 ft. The first 5,000 ft. of the main channel were constructed through high ground from the ocean to the lagoons proper. The route of this channel was controlled by three culverts: the highway culvert at the beach which served as the outlet structure as described above, a railroad culvert which was not built at the time of design but which was to be located approximately half way between the ocean and the lagoons, and a culvert under the Franklin D. Roosevelt Highway, which was located only a few feet from one edge of the lagoons. Fortunately, the floor of the first highway culvert, which had been built before drainage plans had been made, was at a satisfactory elevation. Since the railroad culvert had not been built, the elevation of its floor was controlled by the profile of the drainage channel. However, the floor of the culvert at the Roosevelt Highway was too high, and it was necessary to remodel this culvert in order to lower the floor 4 ft. Excavation of the channel from the ocean to the lagoons proved to be a time-consuming task. This channel was over 50 ft. wide at the top and 6½ ft. wide at the bottom, with an average depth of 16 ft. All excavation had to be done by hand, and for about half the distance not even dump trucks were available.
All of the main channels and branches were lined with precast concrete blocks. Lining was necessary in order to prevent the channels from filling with sand, and to reduce the prolific growth of weeds. A tongue and groove type of lining block was used. The tongue and groove design gave stability to the channel, and at the same time by allowing water to enter through the joints, made it possible to have the water table in the surrounding soil near the level of water flowing in the channel.

The size of each lining block was 19.7 in. long by 13.8 in. wide by 3.1 in. thick. Two types of blocks, curved and flat, were employed. Fig. 6 shows a cross section of a lined channel; the section shown is that of the main channel in the north lagoons. Since the section shown contained seven lining blocks, it was designated as Type 7; this was the largest cross section used throughout the project. As can be seen in the diagram, the lining blocks were designed so that the two outside blocks, when placed in an inverted position, would meet a 1 on 3 slope of earth on each side of the channel. Two other sizes of cross sections were used for channels of lesser capacity: a five block section and a three block section. The five block section was constructed by leaving out the two flat blocks on either side of the center curved block of the seven block section. The three block section was the same as the five block section with the two top inverted blocks left off. In the north lagoons no three block sections were used; seven block sections were used for about 70% of the total length of channels, and five block sections for the remaining 30%. In the east lagoons it was not necessary to use any seven block sections; here 75% of the total length of channels consisted of five block sections and 25% of three block sections.

For lining the 6.4 miles of channels 110,000 blocks were required. Blocks were made in wooden forms at the rate of 400 per day during the peak of production. A 1:2:3 concrete mix was used, with a water cement ratio of 0.80. All blocks were cured under water for two weeks.

The minimum design velocity used for channels in the east lagoons was 4 ft. per sec. Higher velocities were used wherever sufficient grade was available. Channel slopes in the east lagoons varied from 0.0032 to 0.0089. In the north lagoons it was impossible to design for a minimum velocity of 4 ft. per sec. There were points on the bottom of these lagoons which were only 4.9 ft. above mean tide level, or only 2.6 ft. above high tide. In the final design for the north lagoon slopes of 0.00044 for seven block sections and 0.00080 for five block sections were used. These slopes gave a minimum velocity of 2 ft. per sec.

The alignment on all channels was kept as straight as possible. In many cases the alignment was strictly controlled by already existing culverts and bridges. Flat curves were used to connect all tangents, and to connect all branch channels with main channels. In a few cases a curve radius 80 ft. was necessary; however, on most of the curves radii of 350 to 500 ft. were used.

Construction of channels and installation of the lining proceeded upgrade from the outlets. For practically all of the channels it was necessary to use a gravel subgrade, as shown in Fig. 5. Muck was removed from the bottom of the lagoons, sometimes to a depth of 2 ft. or more, and replaced with broken stone, an abundance of which was found in the area. On the main outlet channel for the north lagoons an initial side slope of 1 on 3 was used (Fig. 5). However, beyond a distance of 3.28 ft. (one meter) horizontally from the edge of the concrete lining, the side slope was changed to 1 on 1 1/2 in order to reduce the amount of excavation. The 1 on 1 1/2 slope has proved satisfactory, as there has only been a very slight amount of caving. For channels in the east lagoons side slopes presented no problem, since the top of the concrete lining was at or near the bottom of the lagoons (see Fig. 4). In construction of most of the channels the excavated ma-
FIG. 5.—CROSS SECTION OF A LINED CHANNEL
terial was spread evenly on each side; wherever spreading was impractical, short lateral ditches were cut through the spoil banks at frequent intervals.

One of the features of construction of channels in the north lagoons was the discharge of stored water. During construction of the outlet channel it was necessary to dam the lagoons, with the result that a tremendous volume of water in addition to that normally contained in the lagoons was accumulated. Normal runoff from these lagoons was 8.5 sec. ft.; however, the outlet channel was designed for a capacity of 14.5 sec. ft. It was necessary to discharge the stored water gradually in order to prevent overflowing of the concrete lining and filling of the channel with sand. Gradual discharge was accomplished by means of a temporary adjustable weir and spillway which were built out of the concrete lining blocks. After the outlet channel had been finished, discharge of all stored water required a period of about two months.

Miscellaneous Earth Ditches and Filling.—An essential part of the drainage program included the construction of a secondary system of earth ditches and a small amount of filling. Small earth ditches were dug in all lagoons to connect isolated areas of water with the lined channels. The great majority of these ditches were only of temporary use, for once the standing water had been eliminated, flow from the ditches ceased. At the time of writing, sufficient time has not yet been allowed to realize the full benefit of the main channels. After stability of the ground water table has been reached, it will be possible to know which of the earth ditches will have a permanent flow. It may therefore prove advisable at a later date to line some of these earth ditches. Filling was resorted to wherever bodies of water were too deep to be drained. Also, small isolated holes were filled wherever this proved more economical than drainage.

Actually, filling operations and construction of temporary earth ditches have not yet been finished. These measures will be continued until existing and potential breeding areas have been eliminated to a practical degree.

Evaluation of Results.—The only real measure of effectiveness of the control program of course lies in the reduction of malaria incidence. Unfortunately, no medical survey has been made since completion of the main drainage channels. Such a survey is to be made within a short while. A survey made during construction of the drainage channels and after the temporary control program has been in operation several months, showed a reduction in blood parasites from the original 9.1% of those examined to 5.9%, and a reduction in enlarged spleens from 24.6% to 19.7%. These reductions are obviously attributable to the temporary program. Another important consideration in appreciating effects of the control programs is that there has been no epidemic outbreak of malaria in Chimbote since control work was started; this in spite of the fact that several thousands of new persons have moved into the area, a large percentage of whom have come from nonmalarious regions.

As a result of the drainage program there has been a reduction in breeding areas of the malaria vector of 90 to 95 per cent. As pointed out above, the elimination of residual breeding areas is still in progress and will be carried on so long as practical.

It is impossible to over-emphasize the necessity for adequate maintenance of all channels and other drainage structures. Maintenance
should be neither difficult nor expensive; it should be possible to do all maintenance work with a permanent crew of a very few men. Steps are being taken at the present time to set up a competent program of maintenance; this program will be carried out by the Anti-malarial Service of the Peruvian Ministry of Health. It is realized that if such a program is not followed, the efficiency to the drainage system will be gradually lessened until the effectiveness of all work which has been done will be lost completely.

ACKNOWLEDGEMENT

The work in Chimbote was carried out under the general direction of the Division of Health and Sanitation of the Institute of Inter-American Affairs. Major General George C. Dunham is President of the Institute, and Colonel Harold B. Gotaas is Director of the Division of Health and Sanitation. Lt. Col. Edward A. Westphal is Chief of the Health and Sanitation Field Party assigned to Peru.

At the beginning of the work in Chimbote Major Benjamin A. Whisler, Sn.C., was Project Director, with Major Robert K. Horton second in charge. Later Major Whisler served as Chief Engineer and Associate Chief of Party for the entire health and sanitation program in Peru. Major Whisler was responsible for most of the planning in Chimbote, and much of the information contained in this article has been taken from his reports. When Major Whisler was made Associate Chief of Party, Major Horton became Project Director in Chimbote.

After a year in Peru, Major Whisler left for reassignment. He was replaced by Major W. Allen Stone, who has remained in Peru as Associate Chief of Party during the remainder of the work in Chimbote.

Appreciation is expressed for the work of Captain Jo B. McLellan, Sn.C., and Mr. Harold E. Rankin. These men were in charge of construction during various phases of the program. Their contributions toward the success of the work have been invaluable.

Appreciation is also expressed to Lt. Colonel W. H. W. Komp of the United States Public Health Service, who spent some time in Chimbote as a consulting entomologist.

OBRAS ANTIMALÁRICAS EN CHIMBOTE (Sumario)

El puerto de Chimbote ha sido llamado el “Pitaburgo potencial del Perú” por poseer el mejor fondeadero natural de la costa del Pacífico y ofrecer salida al carbón de las ricas minas de la región. Por su importancia, el Ministerio de Fomento y Obras Públicas del Perú ha iniciado allí un vasto programa industrial con la construcción de obras portuarias. Al mismo tiempo abordóse el saneamiento de la zona, por el Servicio Cooperativo Interamericano de Salud Pública del Ministerio de Salud Pública y Asistencia Social del Perú, comprendiendo construcción de un sistema de cloacas, de un abastecimiento de agua y de un Hospital y Centro de Medicina Preventiva. Uno de los aspectos que recibió mayor atención de parte de dicho Servicio Cooperativo, fue el desagüe de los extensos pantanos que rodeaban a la población sirviendo de criaderos del Anopheles pseudopunctipennis. La zona comprendida en los pantanos conocidos como focos palúdicos cerca de la ciudad representaba 887,000 m², dividida en dos grupos de lagunas: uno al norte y otro al sur de la población. El grupo de lagunas situadas al norte...
y que era el mayor, se desaguó al mar por medio de un canal de 2 m de ancho y 53 cm de profundidad, y con una longitud de 5,200 m². Entre los problemas que hubo que resolver figuraron los derivados del estancamiento del agua que brotaba del subsuelo, el terreno fangoso y la continua afloración de dichas aguas. Bajo las baldosas de concreto que forman el revestimiento de los canales hubo que colocar, como refuerzo, una capa de cascajo, hasta un promedio de 30 cm de profundidad. Las siete lagunas situadas al sur de la población también se desaguaron al mar por medio de canales revestidos de baldosas y de tubos de concreto armado. La eliminación del 95% de los criaderos de zancudos reforzada por la utilización de pulverizaciones antimosquito, ya ha hecho disminuir apreciablemente los casos de paludismo, a pesar de haberse casi duplicado en los últimos años la población.

El lenguaje técnico.—El progreso de las ciencias exige constante renovación y, a veces, radicales cambios de palabras, supuesto que vocablos gastados por antiguos, ya pueden no corresponder en su connotación a hechos que vemos ahora bajo el brillo de aquel progreso. Más no conviene incurrir en torpe exageración novadora, siempre nociva a la claridad indispensable en la definición de objetos y fenómenos. “La creación de palabras nuevas —a lo que dice Alejandro Bain,— es inútil e inoportuna algunas veces; y cuando no hay sentido absolutamente nuevo de generalización, la invención de palabras no puede justificarse; porque además de que se recarga el peso ya considerable del lenguaje, se arrastra al vulgo a creer en significados distintos.” Por otra parte, el mismo afán renovador puede verse en el uso de neologismos, lo cual entraña serios inconvenientes, dado que el lenguaje se expone a caer en silos de corrupción. Pero no tan sólo en lo referente a la invención de palabras arraigadas en el latín o el griego, es aplicable el concepto, sino que, por infausta ironía, los galicismos, anglicismos y barbarismos, juegan indecorosamente en revistas más o menos afamadas de la América Latina. Veamos: “conducta o procedimiento a seguir”; “dosar” por dosificar; o lo peor: “dosaje”; “viciación” por enviciamiento; “obstétrica” en lugar de partera o comadrona.—EVERARDO LANDA: Revista Médica, 22, jun. 30, 1946.

El libro.—Cultivad el amor intenso al libro, que si la barbarie en épocas aún de actualidad ha querido desterrar y quemar el libro, no lo ha logrado, ni lo logrará, porque es él, no en balde, el modelador por excelencia de la personalidad y si es para nosotros en los días felices en que se goza de las bellezas de vivir un deleite suave, dulce y grande del espíritu humano, es también este libro en los días aciagos en que las tinieblas del infortunio entristecen nuestra alma, su bálsamo, su consuelo y siempre y en todo momento nuestro fiel y agradable compañero.—RAIMUNDO DE CASTRO y B.: Anales de la Academia de Ciencias de la Habana, 315, 1944-45.