the specific identification of the organisms recovered remains problematic under even the most favorable conditions. A thorough knowledge of each parasite's morphology and life history, and of the epidemiology of the diseases they may have caused is required for meaningful interpretation of findings. Archeologists, medical parasitologists, palynologists, and other specialists must collaborate and exchange materials and information, in order to extract maximum value from the finds, and still avoid the myriad pitfalls that result from the invasion of free-living saprophagous organisms, and the presence of pseudoparasites (derived from viscera of food items ingested) and parasite-like artifacts. The activities of coprophagic animals in concentrating and disseminating fecal artifacts from a variety of sources may confound results based on only a few specimens. Additional evidence of the 'humanness' of fecal samples, their seasonality, and dietary information could be obtained through pollen spectra. In the near future, specific molecular markers (e.g. hemoglobin, enzymes, bacterial or viral DNA sequences) may permit the accurate identification of the fecal source of parasite materials. At the present time, cautious identification of organisms recovered (or absent) and parsimonious interpretation of their impact is required.

PALEOPARASITOLOGICAL RESEARCH IN BRAZIL: PRESENT STATUS AND PERSPECTIVES

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Research was started in Brazil in 1978 to identify parasitic infections present in pre-Columbian South America. 566 samples have been examined, including human and animal coprolites and six naturally mummified human bodies. The material came from 10 Brazilian sites, three Argentinian sites, and two sites in Chile. Eggs and/or larvae of Trichuris trichiura, ancylostomids, Enterobius vermicularis, Diphyllobothrium pacificum, and Trichostrongylidae were found in human material. Trichuris sp., Capillaria sp. and Parapharyngodon sp. were found in animal coprolites. The differentiation of human from animal coprolites and new lines of investigation such as experimental paleoparasitology and biometrics are discussed.

HELMINTHIASIS AND MUMMIFIED HUMAN REMAINS

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Coprolite analysis has provided us with most of the direct information we have for helminthiasis in prehistoric times. The other important source of such information comes from the study of mummified human remains. An important advantage of these studies is that there can be no doubt as to the human origin of the host. These studies have given us helminth information not

PALEOPARASITOLOGICAL RESEARCH IN BRAZIL: PRESENT STATUS AND PERSPECTIVES

First of all I would like to thank the organizing committee of the 13th annual meeting for the invitation and the facilities offered to be here speaking to such a selected audience about our research done in Brazil.

I apologize for my English. I was in this country as a student ten years ago and since then I have not practised the language very much.

Our research in paleoparasitology started in 1978 when we became interested in a question raised by former authors about the origin of Schistosomiasis in the New World.

There were some historical and possibly some biological facts suggesting an autochtonous origin of this infection and the long held opinion of the introducion of the parasite along with the African slaves was being questioned. But there were no sound data on which to base these arguments and we decided to search for direct evidence of the infection in pre-Columbian remains of human beings. We have not yet been lucky enough to find a Schistosoma mansoni egg in archeological sediments but some other interesting findings that will be shown later stimulated us to continue the work.

A decisive event in the establishment of paleoparasitology in Brazil was the presence of Aidan Cockburn in the Brazilian Congress of Parasitology in 1981. His conference was a success and it certainly contributed not only to the rapid acceptance of this emerging area of research by our Institutions but also impressed the committee that awarded the medal of the best paper presented to one of our findings reporting helminth eggs taken from 9000 year old animal coprolites.

Our research group has presently six members (FIRST SLIDE) and financial support comes in part from the Brazilian National Research Council. Although we belong to different Institutions our laboratory work is performed at the National School of Public Health.

The material we have studied was kindly sent by archaeologists from Brazil and from abroad and consisted basically of the following types of archaeological findings (SECOND SLIDE).

We have examined the soil found around the abdominal and pelvic region of skeletons using the technique of CALDWELL and CALDWELL

South American Countries.

Our most interesting finding have almost all been published, mainly in the NEWSLETTER, but will be briefly reviewed now:

1) (SLIDE) Ancylostomid and Trichuris trichiura eggs at Unaí.

These were our first findings. The material could not be more accurately dated and they were found between layers dated from 3.490 ± 110 years BP to 430 ± 70 BP. But even with this last possibilit we can assure these indians had no contact with Europeans or Africans since historical records do not show evidence of migratory movements of these latter toward the region at that early time.

(SLIDES)

2) T. trichiura from Itacambira (SLIDE)

This is the only evidence of parasitic infections we haye obtained from the past human population of the historical period. (SLIDES)

This shows a day in the life of brazilian paleoparasitologi We took the corpses from the village to the capital city of the state using a car of the local University but we had not permission travel further. We had then to wrap the mummies and take them with us in the luggage place of a bus.

We are here at the road making the packages and praying for the road police not to come otherwise we would have had hard times to explain the origin of those corpses.

3) D. pacificum in Chile (SLIDE)

This was a rather interesting finding. When JEAN BAER, a famous Swiss helminthologist found this sea lion parasite in comtemporaneous human hosts at the Peruvian coast in 1969 he remarked: "It is also more than likely that D. pacificum was already a parasite of pre-Columbian man".

Jean Baer's intuition was right. (SLIDES) This is also a good example of how with paleoparasitological findings we can make interesting cultural correlations. When we examined the coprolites we had only the information about the location of the camp site of the paleoindians: in the desert, about 40 kilometers away from the coast. But the parasite indicated that those people made trips to the coast to catch fish since the only way of acquiring the infection is by eating the intermediate hosts which are marine fish.

Later the Chilean archeologist told us that bones of marine fish were indeed found during the excavations.
(SLIDES)

4) Enterobius vermicularis (SLIDE)

This parasite was found in prehistoric sites in North America by several authors and in South America by ZIMMERMAN in Argentina and PATRUCCO in Peru. This finding in Chile extends the known range of the infected pre-Columbian human population in South America.

5) Ancylostomid eggs from S. Raimundo Nonato
(SLIDES)

This is our most recent and perhaps the most exciting finding. The datings of the archeological layers are currently being done in France but the coprolites are certainly more than 7000 years old. This has important implications concerning the theories that explain the peopling of the New World. It is currently accepted that ancylostomids could not have been introduced with the terrestrial migrations through the Behring strait since the larvae could not have resisted the low temperatures of the soil. Only the transoceanic contacts could have brought it but these are known to have started only about 5000 years ago.

This is a puzzle that remains to be solved.

6) Parapharyngodon sp

We have done a kind of detective work to identify these eggs. In an attempt to identify the host animal that produced these feces we classifiyed the insect remains of the coprolites and surveyed the small vertebrate fauna of the region of the site by capturing some potential hosts. Their intestinal parasites were studied and their feces artificially desiccated for morphological comparisons before an accurate identification could be done.
(SLIDES)

7) Trichuris sp. from animal coprolites

These observations have not been published yet. In our experience eggs of this nematode genus are the most common parasitic forms encountered in archeological sediments. The identification of the different species rests upon the size of the eggs which ranges frequently overlap. This task has so far been almost impossible due to the lack

We are looking forward to finding qualitative characters for the separation of the different species using the scanning eletron microscope in a research that has just started with recent material.

(SLIDES)

We have also some other finds of helminth eggs from animal coprolites whose identification was possible only to the family or generic level such as Capillaria sp.

During our work we recognized some methodological difficulties concerning the main goal of paleoparasitology: the accurate identificati od the specimens.

We know that animal coprolites are common finds in archeological sediments and sometimes they can be mistaken as humans or vice-versa. This question had been discussed by several authors but the classical aspects of gross morphology and microscopic analysis of the coprolites as well as the color and aspect of the rehydrating solution are helpful but not always decisive.

As an example the original shape of the coprolites disappear: in exceedly fragmented specimens and we have observed dark brown and opaque solutions after the rehydration of small animal coprolites.

We think a good indicator of the origin of the coprolite is the type of parasite found in it, for instance, species of the genus Trichuris are parasites only of some orders of mammals.

A potential area of study for the creation of additional criteria for identification is the recognition of specific chemical components such as bile acids in feces of the different animals.

It is also obvious that a sound knowledge of the past and present vertebrate fauna of these sites and their intestinal helminths is fundamental.

Another concern is the possible effects of the natural desiccation process on the parasitic forms within the coprolites. We still do not know if dehydration destroys a significant number of eggs, which could result in a false negative analysis and an erroneous assessment of the health status of the past populations. There is also the possibility of changes in the dimensions of eggs after dessiccation and rehydration which is crucial for the identification of eggs of those species differentiated by biometrical but not qualitative characters.

We are undertaking the experimental verification of these phenomena using the approach devised by Adamson; Zimmerman and Fry throug the artificial desiccation of recent feces containing helminth eggs and

technique of Callen and Cameron.

Besides these research activities we offer a course each year on the "Paleoepidemiology of Parasitic Infections" to graduate students in biomedical sciences.

The aim of the course is to introduce the student into the study of the biological as well as the geographical origin and prehistoric dispersion of some infections caused by protists and helminths, with emphasis on New World infections. This is followed by an analysis of the epidemiological changes which occurred in these infections as a consequence of the environmental and cultural modificatio observed in the evolution of mankind.

Here is a summarized schedule of the topics discussed (SLIDE).

These are the topics of the lectures and seminars and ther is also laboratory work on the techniques for the analysis of coprolite

Finally I would like to suggest to our colleagues working with paleoparasitology en effort to intensify an exchange of ideas, information and even material. To facilitate this enterprise we propose the organization of an international study group and we can offer our Department at the Brazilian School of Public Health as the seat for the group involved in this fascinating area of research.

Thank you for your attention.