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ANTHROPOLOGICAL RESEARCH ON OSTEOLOGICAL COLLECTIONS OF THE NATURAL HISTORY MUSEUM IN FLORENCE

Abstract - In the second half of the nineteenth century, under the direction of Paolo Mantegazza, the National Museum of Anthropology and Ethnology of Florence (now Section of the Museum of Natural History) began to gather anthropological collections relating to people from all over the world. Thanks to collaborations with naturalists and travelers from all over in Europe, Mantegazza constituted a heritage of unique skeletal collections, which still today constitute an invaluable tool for studying the evolution and variability of the human species. The collection includes human remains of the Neolithic, Eneolithic, Bronze and Iron Ages, important examples of Italian paleoanthropology, a large number of Etruscan remains and a modern osteological collection of over 7,000 specimens, donated by public institutions and resulting from scientific missions carried out in the second half of the XIX century in several European countries and beyond. Among these ones, there are recognized populations now extinct, such as the Fuegians, or now hybridized with the invaders and assimilated to Western culture as, for example, the inhabitants of the Indonesian and Melanesian islands. The osteological collections of the Museum is still a destination for Italian and foreign researchers which carry out researches in diverse sectors as biometrics, auxology, dental anatomy, paleopathology, paleodemography, ecology, dating (with 14C), genetic similarity between populations (ancient DNA). The present paper will explain the latest research, conducted in collaboration with the Department of Biology, University of Florence and with other public and private institutions.

Key words - anthropology research, osteological collections, Fuegians, prehistory.

Riassunto - *La Ricerca Antropologica sulle Collezioni Osteologiche del Museo di Storia Naturale di Firenze* - Nella seconda metà del XIX secolo, sotto la direzione di Paolo Mantegazza, il Museo Nazionale di Antropologia e Etnologia di Firenze (oggi Sezione del Museo di Storia Naturale) cominciò a riunire collezioni antropologiche relative a popolazioni di varie parti del mondo. Grazie alle collaborazioni con naturalisti e viaggiatori di tutta Europa, Mantegazza costituì un patrimonio di collezioni scheletriche unico al mondo, che ancora oggi costituiscono un insostituibile strumento per lo studio dell'evoluzione della specie umana e della sua variabilità. La collezione comprende resti umani dell'età neolitica, eneolitica, del Bronzo e del Ferro, importanti testimonianze della paleoantropologia italiana, una serie numerosa di resti etruschi ed una collezione osteologica moderna di oltre 7.000 esemplari, provenienti da donazioni di istituzioni e enti pubblici e da missioni scientifiche effettuate nella seconda metà del 1800 in diversi Paesi europei ed extraeuropei. Fra queste vi sono documentate popolazioni ora estinte, quali i Fuegini, o ormai ibridate con gli invasori occidentali ed assimilate alla loro cultura come, ad esempio, gli abitanti delle isole indonesiane e melanesiane. Le collezioni osteologiche del Museo sono tutt'oggi meta di ricercatori italiani e stranieri che svolgono ricerche nei campi più disparati: biometria, auxologia, anatomia dentaria, paleopatologia, paleodemografia, ecologia, datazioni (carbonio 14), affinità genet-

ca tra popoli (DNA antico). Nel presente lavoro saranno illustrate le ricerche più recenti, effettuate in collaborazione con il Dipartimento di Biologia dell'Ateneo fiorentino e con altri enti e istituzioni pubbliche e private.

Parole chiave - ricerca antropologia, collezioni osteologiche, fuegini, preistoria.

INTRODUCTION

In 1869 Paolo Mantegazza, physician, traveler and politician at the time of the birth of the Italian nation, founded in Florence the National Museum of Anthropology and Ethnology, at present a Section of the Natural History Museum of Florence University.

With the institution of the Museum Paolo Mantegazza, who worked in a cultural climate strongly influenced by Positivism and Darwinism, intended not only to provide to the nineteenth-century Florence, capital of the newly formed Italian kingdom, a «panorama» of the cultures of non-European peoples through the exhibition of ethnographic artifacts from all over the world, but also to create a center for research on man. He intended to found a place where it was possible to explore every aspect of the human being both in his physical characteristics and in the sphere of cultural expressions, till to the ambition to investigate the human psyche with experimental methods as done in scientific research.

In this context Mantegazza created a «museum-microcosm» where heterogeneous materials were gathered and designed to contribute to anthropological research supported by a holistic, innovative and advanced approach, compared to a tradition that considered the study of the metric and morphology of the human body as a privileged course of anthropological investigation in the main European schools (Mantegazza, 1871, Chiarelli, 2002).

In Mantegazza's school, the research was conducted by means of the contributions of experts from different backgrounds, both in the field of natural sciences and in the humanities, which then brought useful instruments for a complementary and interdisciplinary approach to anthropological studies.

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The Museum collections themselves provided evidence of the quantity and quality of the research that was carried on. The ethnographic collections, formed by scholar explorers but also constituted by donations from private collectors and exchanges with other museums and institutions, came from all over the world and were the tool for the study of cultures, in order to document the domestic and social life, the subsistence economies and the spiritual life of the people. At present these collections characterize the permanent exhibition.

The experimental use of photography for the comparative study of body proportions, the physiognomy and mimicry, designed as an expression of the inner feelings and human emotions (Chiarelli, 1998; Chiozzi, 1987; Roselli, 1998; Mantegazza, 1876 (a) 1881; Piccardi (1998), originated a significant collection of images presently reunited in the historical photographic Archive.

The collection of human skeletal remains of Italian, European and extra-European origin, constitutes a large and important osteological collection, unique in the world, which was formed over a period of time ranging from 1870 to 1910 with various means of acquisition: acquired or received as donations from travelers and researchers, received as a gift or exchanged with other government agencies and museums. There are about 7,500 individuals, represented by skulls and post-cranial skeleton, not always in combination. The Museum holds the documentation of populations currently extinct, such as the Fuegians and the ancient Peruvians, and of populations already integrated with western ones such as, for example, some Indonesian and Melanesian groups (fig. 1).

RESEARCH ON OSTEОLOGICAL COLLECTIONS: TRADITION AND INNOVATION

The human remains gathered by Paolo Mantegazza in the Museum were the ideal breeding ground for



Fig. 1 - The museum's skulls collection.

studying the evolution of the human species and for the demonstration of the variability both within and among populations. The documentation of the considerable width of the individual variability and the craniological collection in its entirety allowed, in the second half of the nineteenth century, the demonstration that the concept of «race» in the human species has no scientific evidence (Mantegazza, 1876b; 1905).

To promote the study of these findings, the Museum was enriched by a collection of scientific instruments, which comprises a hundred objects supplied with accessories and containers (Boccone *et al.*, 2009).

There are mainly instruments for measuring the height, the length of the open arms, the weight, vital capacity but, above all, the collection includes instruments for detection of the skull characteristics, such as particular skull meters, compasses, occipital and mandibular protractors: by measuring specific skeletal landmarks, it was then possible to reconstruct morphology, proportions, ratios, cranial capacity, which made possible the identification of a more or less marked variability between populations (fig. 2).

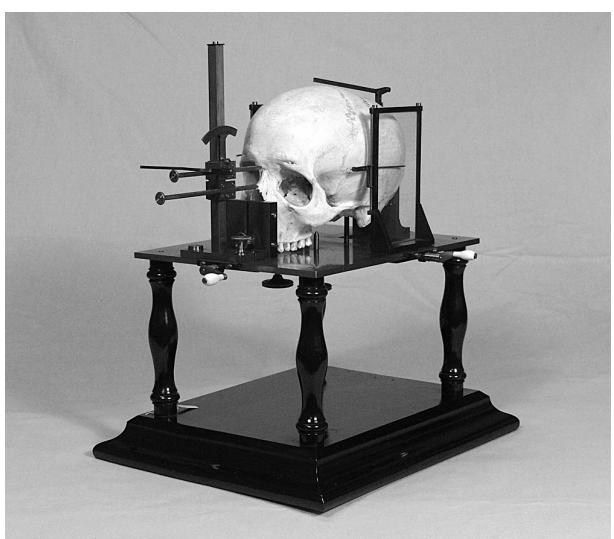


Fig. 2 - Ancient instrument for the skull measurement.

Following the adoption of photography as a method for the anthropological research, Mantegazza equipped his Laboratory with many cameras and accessories: stands, objectives, frames and canopies for plates and films. The person was photographed from the front and half-face, according to detailed methodological guidance, wishing to portray the individual in the same location used for anthropometric measurements. A «scientific» photograph was thus obtained, and its analysis could help the improvement of information obtained with measurements. The scientific instru-

ments collection of the Museum is a document of the past and of the tradition on which the research is developed in the Florence anthropological school.

Today, the osteological laboratory of the Museum is a regular destination of Italian and foreign researchers, who continue to investigate not only the evolution and variability among individuals and populations but also, through the observation of the skeletal remains, the living conditions of the disappeared populations. From the macroscopic, histological and radiographic study of skeletal lesions, it is possible to trace the diseases that affected the people of the past and understand their origin and spread through the identification of bacterial DNA. The lesions on the skeleton can lead to diagnose traumatic episodes, resulting from fights between individuals; the stress markers present on the skeleton and related to repeated movements, posture and mechanical loading endured in life, can inform us about the type of work and offer tools to formulate conjectures about the economy, the lifestyle, the labor division within the ancient society.

The markers of skeleton maturation allow the study of the growth of the individuals according to the quality of nutrition, which can be recognized by radiological signs of malnutrition and in the alteration of the tooth enamel. The analysis of the isotopic ratio of the stable isotopes of carbon ($\delta^{13}\text{C}$) and nitrogen ($\delta^{15}\text{N}$) on human skeletal remains of past populations permits to understand their diet.

In addition to the reconstruction of the life style of the people of the past, the study of the human skeleton is useful for the identification of the origin of populations and relationships between them. For example, the structure of dental tubercles, as well some non-metric characters of the skeleton, being genetically determined, can be used as markers for studies on affinity and migration, and the bone dating using the method of radioactive isotopes permits to attribute a date to findings.

The skeletal remains also help in the analysis of ancient DNA – used to identify the genetic characteristics of contemporary aboriginal populations – in order to determine their origin and migration routes.

The ability of the human skeleton to respond to internal and external stresses keeping the record, makes the osteological collections exceptional and irreplaceable anthropological archives.

Searches that have recently been developed on the osteological collections of the Museum, in collaboration with the Department of Biology of the University of Florence, focused on some nucleus of proto-historic interest and on the important collection of human remains carried out in 1881 by Giacomo Bove from Tierra del Fuego, including twenty skulls and some postcranial skeletal elements related to the Yámana ethnic group.

THE FACIES OF RINALDONE: NEW DATING

The collections of prehistoric and proto-historic interest are currently studied in the Laboratories of Anthropology of the Department of Biology, led by Prof. Jacopo Moggi Cecchi. Among the collections of proto-historic interest, the Museum houses the remains from the so-called «culture of Rinaldone», a cultural site from Eneolithic and early Bronze Age in central Tyrrhenian Italy, particularly widespread in Tuscany, Umbria and northern Lazio, which takes the name from the necropolis discovered at the beginning of the XX century in a village few miles from Viterbo. The necropolis is characterized by a specific funerary ritual in artificial cave tombs, with crouched up skeletons and by the presence of the same forms of ceramics, bone objects and stone tools.

The following table shows the origins and consistency of the remains preserved in the Museum from the «Rinaldone» Eneolithic horizon.

Region	Locality	Number of remains
Lazio	Necropoli Ponte S. Pietro	57
Lazio	Chiusa D'Ermini Bassa Val del Fiora	22
Tuscany	Garavicchi Bassa Val del Fiora	18
Tuscany	Pocareccia Bassa Val del Fiora	15

From the remains of Ponte S. Pietro and Garavicchi, samples were taken in order to date them with the ^{14}C method. The research, carried out by Andrea Dolfini (School of Historical Studies, Newcastle University, England), is part of the scientific debate about the extension of time of the Copper Age in Italy. The most widespread opinion is that in Italy the first metallurgy has developed only in the third millennium BC and continued until the beginning of the second millennium. The radiometric dating performed on samples of the collections from our Section, suggests that a local metallurgical tradition has emerged in central Italy around the middle of the fourth millennium BC, several centuries earlier than so far assumed (Dolfini, 2010). Currently, in collaboration with Prof. Nuccia Negroni (Study Centre of Prehistory and Archaeology of Milan), with the participation of several other organizations and institutions (the Superintendence for Archaeological Heritage of Southern Etruria, the Superintendence for Archaeological Heritage of Tuscany, University of Cambridge, University of Rome «La Sapienza», University of Verona), the radiometric analysis of the remains from the village of Chiusa d'Ermini and Pocareccia has been performed. The sampling was carried out in May 2012 and the expected results will probably confirm those already made by Dolfini (2010), contributing to a wider knowledge of the origins and development of the Copper Age in Italy.

PALEOGENETIC STUDY ON THE FUEGIANS YÀMANA SKULLS COLLECTION

The museum has a collection related to Yàmana ethnic group, once resident in the extreme south of Tierra del Fuego, collected by Giacomo Bove during his first expedition to South America (1881), consisted of twenty skulls and several elements of the post-cranial skeleton.

This is a very important collection from the historical, museological and anthropological point of view. Giacomo Bove was one of the most significant Italian explorers, and his first expedition to Patagonia and Tierra del Fuego was realized as a part of the great explorations promoted by the government of the newborn kingdom of Italy to improve the knowledge of unexplored territories.

Furthermore, Fuegians people are intertwined with one of the most important expeditions in the history of the natural sciences: that of the Beagle in 1831, which participated the young naturalist Charles Darwin. Skeletal collections belonging to the Fuegians are very rare. Few of them are presently preserved in Rome (Museum of Anthropology Giuseppe Sergi, La Sapienza University), in Paris (Musée de l'Homme), in Vienna (Naturhistorisches Museum) and in Punta Arenas in Chile (Museo antropológico Martín Gusinde, Puerto Williams).

This collection is a precious evidences of an extinct population, which represent an exceptional example of biological and cultural adaptation to extreme environments. They have disappeared following the decimation operated by the Western invaders, due to the diffusion of exogenous pathogens and the disruption of their bio-cultural equilibrium based on a subsistence economy that allowed them to survive for thousands of years (fig. 3).

Fuegians remains have been repeatedly studied over time, from anthropometric analysis made by Mantegazza and Regalia (1886), followed by those of Sergi (1888), recently taken over by De Stefano and Macchiarelli (1980), while Capasso and Milanesi (1981), Pinto-Cisternas, Moggi Cecchi and Pacciani (1986), investigated the dental morphology and diseases.

In 2012, the research of this collection was conducted at the Laboratory of Molecular Biology, Department of Biology, headed by Prof. David Caramelli, thanks to the work done by Dr. Erica Rovelli in her M. Sc. thesis.

The purpose of this research is to contribute to the knowledge of the Fuegians genetic characterization, which constitute an important hub in the reconstruction of the history of the peopling of the American continent due to the absence of mitochondrial A and B haplogroups, two of the four groups identified in American native populations.



Fig. 3 - Two Fuegian women into an image of the late nineteenth century.

Up to now, genetic analyses carried out on samples of these populations showed the presence of only C and D haplogroups in the mitochondrial DNA, probably due to geographical ancestral isolation associated with a strong founder effect and a genetic drift favored by the small number individuals colonizers of Tierra del Fuego.

For the analysis of mtDNA, as a less invasive sampling the researchers chose to drill the mastoid bone. A dental drill was used for the pulverization, as it produced a hole of bare minimum diameter (fig.4). After following the protocols for the contamination prevention, DNA extraction was carried out by means of absorption of silica particles and the amplification of the region HVRI of the mtDNA by PCR (Polymerase Chain Reaction).

The amplified mtDNA was then sequenced with both the method of direct sequencing, a technique which allows to obtain legible chromatograms for stretches of DNA that will be analyzed, both with the sequencing of cloned fragments, which exploits the ability of certain bacteria to incorporate in their DNA fragments to analyze and replicate them.



Fig. 4 - Extraction of the sample bone by a Fuegian skull.

All the tested samples gave readable sequences but not compatible with the characteristics previously observed in mitochondria of Amerindian populations: the molecules seem to be for the majority of European contaminants, with a dominant profile corresponding to the haplogroup T2.

The strong contamination of samples with exogenous DNA is most likely caused by their taphonomic history. In fact, since they were collected by Giacomo Bove, the Fuegians remains have suffered numerous transfers and subsequent manipulations.

For the future research, given the great interest that the Fuegians remains have in relation to biological adaptation that these populations had developed against the extreme environmental conditions of Tierra del Fuego, it is desirable to repeat the biomolecular analysis for portions of the post-cranial skeletons from the Museum collection. As the post-cranial bones have been of less morphological interest than skulls, they would allow to get a quantitatively more significant sample, being much less manipulated and therefore it is conceivable that they are less contaminated.

CONCLUSIONS

Within the Section of Anthropology and Ethnology of Natural History Museum of Florence there are noteworthy laboratory facilities dedicated to teaching and research in the field of Human Osteology. Furthermore, the Museum has a large collection of human skeletal including archaeological human remains from many locations and time periods, as well as a collec-

tion of primates and a series of modern human specimens casts and hominid fossils. Within our collection the specimens are frequently used by researchers from all over the world, with scholars and PhD students being the most frequent visitors. Research areas include paleoanthropology, primatology, paleodemography, auxiology, paleopathology, archaeology and ancient DNA.

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