The Amerindian Microcosm

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Anthropology, Comparative History, Ecology, Genetics and Evolution

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PREFACE

On September 27, 2018, science lost one of its most devoted followers, Francisco Mauro Salzano. His life extended for 90 incredibly productive years and his last work was this book, which he completed writing whilst in hospital. Unfortunately, he passed away soon after finishing the book. As his closest collaborators, we decided to proceed with this publication, because we believe this account of the fascinating history of Native Americans and the significant evolution of a key portion of our species needs to be read by other scholars and students around the world. This book aims to be as comprehensive as possible, examining all information that could influence the fate of Amerindians. Therefore, this work contains information of interest to archeologists, physical and cultural anthropologists, physiologists, physicians, geneticists and all those interested in evolution in general.

A general review of anthropological, historical, demographic, ecological, health, morphology, genetics and evolutionary studies in South Amerindians was published by Francisco Salzano and S. M. Callegari-Jacques. 1988), called *South American Indians. A Case Study in Evolution*. The aim of that book was the broad coverage and in-depth analysis of the genetic variability of South American Indians using the tools available at that time. The field of human molecular population evolution has recently been revolutionized by the development of sophisticated laboratory and bioinformatics approaches that can now interrogate both whole genomes and specific genetic regions in order to understand classical questions of the past, present and future of humankind. Therefore, a new synthesis was warranted to update existing resources and to offer, in a single source, a wealth of information on these topics. The present book currently has no parallels as far as scholarly works on Amerindians are concerned, despite the fact that this major (and diverse) continental group is an integral portion of our species. Any analysis which does not include them would be incomplete.

The book is divided into eleven chapters with many subdivisions. Chapter 1 discusses the origins, archeology and paleoanthropology of Amerindians. This important subject is returned to in more detail in Chapter 6, where mitochondrial DNA and maternal lineages are described. Chapters 2 and 3 address the clash of cultures that resulted from European conquest and the

indigenous population's recovery after this first contact. Chapters 4 and 5 describe the ecology, physiological adaptations and disease patterns observed among Amerindians. Genetic information is given in Chapters 7 to 9. Studies on sex chromosomes are summarized in Chapter 7 whereas Chapters 8 and 9 describe the main findings with autosomes at the DNA level. The objective of Chapter 10 is to ascertain ways in which some infectious agents could furnish relevant information on Amerindian patterns of migration. These studies provide an additional contribution to unraveling the complex factors that influenced Amerindian history. In the last chapter (Chapter 11), Salzano shows his preference for a synthetic approach to science instead of the reductionist approach preferred by most scholars. The book ends with Salzano's optimistic view that Amerindians will preserve at least part of their biological and cultural identity, assuring a more interesting and varied picture of the world of tomorrow.

Noteworthy, that present book is primarily a survey of the huge and varied literature on this topic, all units and dates are presented in the same way as the sources being cited. It therefore uses a mix of date formats (YBP – years before present as well as BC/AD) and units.

We would like offer thanks to Professor Salzano's family, who gave us permission to continue his work; to Laci Krupahtz, Professor Salzano's former secretary, for her work during the writing of the book; and to Rebecca Gladders, Senior Commissioning Editor of Cambridge Scholars Publishing, for accepting this book for publication. Our research, as well as Professor Salzano's, was supported by Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq, Brazil) and Fundação de Amparo a pesquisa do Estado do Rio Grande do Sul.

Porto Alegre, 2019
Maria Cátira Bortolini
Mara Helena Hutz

CHAPTER 1

ORIGINS, ARCHEOLOGY AND PALEOANTHROPOLOGY

It was the final act in the prehistoric settlement of the earth… A band of hardy Stone Age hunter-gatherers headed east… without realizing they were leaving one hemisphere for another.
—David J. Meltzer

1.1. The long journey

1.1.1. Starting point and the prehistoric environment

Presently there is consensus that the prehistoric colonization of the Americas started from southern Siberia and continued through Beringia, a vast, flat, ice-free region that existed 27-11,000 years ago where the Bering Strait now separates Asia and America.

The colonization started during the Last Glacial Age, also known as the Wisconsin glaciation, which can be further subdivided into (a) Early – a cooler, major glacial episode which occurred 80-65,000 years ago; (b) Middle – a warmer stage, 65-35,000 years before present (YBP); and (c) Late – also called the Last Glacial Maximum (LGM), from 35-10,000 YBP. The present interglacial period is termed the Holocene. During the LGM, Beringia was more than 1,000 kilometers wide from north to south (Dixon, 1999; Meltzer, 2009).

What kind of environment existed in Beringia at the time? Fossil estimates suggest that temperatures ranged from 5.5ºC colder than today's 20,000 YBP to 0.9ºC warmer than today's 28,000 YBP, with maximum temperatures of 12-13ºC in northeastern Siberia. These numbers point to relatively mild climatic conditions, allowing the development of a closed, dry, herb-rich tundra with a continuous moss-layer type vegetation (Elias, 2002). The region also provided a major refuge for large mammals,

including four species of mammoth, a mastodon, four genera of giant ground sloths and the glyptodont. Preying on these herbivores were carnivores such as the giant short-faced bear. All these megafauna ultimately vanished, although it is not clear if their extinction was due to over-hunting by humans who had arrived at the region or to climate change (Meltzer, 2009).

1.1.2. Heading south

The colonists stayed for an extended period of time in Beringia (Hoffecker et al., 2016), but ultimately started migrating south. The problem they had to face at the beginning was a massive barrier formed by the merging of two huge ice sheets, the Laurentide and Cordilleran glaciers, stretching all the way from the Atlantic to the Pacific Ocean, extending 800 km. There is evidence that a habitable corridor between the two glaciers would have been open 13,000 YBP (Waters et al., 2015; Heintzman et al., 2016; Pedersen et al., 2016), but any midcontinental migration by this route could only have occurred after that date.

The alternative is the use of watercrafts, possibly skin boats, following the Pacific coast, enabling the migrants to enter the southern areas before the melting of the continental glaciers. As new early dates have been obtained using archeological and genetic data, this route is increasingly suggested (Dixon, 1999; Waguespack, 2007; Meltzer, 2009). Hall et al. (2004) stress the importance of the living conditions of the migrants. The warming period that occurred from 14,000 to 12,800 YBP would have offered extensive food resources, and provided more daylight hours in mid-winter along the coastal route than the interior route (Braje et al., 2017).

1.1.3. Archeological sites and past migrations

By the end of the 19th and beginning of the 20th century, controversy was emerging in the USA over the antiquity of humans in America. The first clear, indisputable evidence for the presence of bison hunters was provided by the Folsom site in New Mexico in 1927/1928, with the association of fluted points made from the bones of these animals. Subsequently, in 1933, similar observations were made at another site in the same region, Clovis. The fluted points were longer, broader and less finely made than the Clovis artifacts, and proved to have a widespread distribution across the continent. The radiocarbon dates approximately coincided with the opening of the Laurentide-Cordilleran corridor, providing a nice scenario for the early

colonization of North America. But the question remained, were there pre-Clovis people in the continent? If not, how could one explain "the apparently sudden appearance" of these artifacts over much of North America 11,500 years ago? (Meltzer, 2009).

This question was considered by Hamilton and Buchanan in 2007 using statistical models. Based on the dates of 23 Early Paleoindian sites spread throughout the USA (Table 1.1), they used a time-delayed wave-of-advance model to measure the lifetime dispersal of the migrants. Spatial gradients were observed, but only the northern origin model furnished a statistically significant value. The Clovis colonists would have arrived at the mouth of the ice-free corridor 11,342 ^{14}C YBP and would have traveled at a rate of 5 to 8 km per year. But Surovell (2003), also using a migration model, concludes that the coastal route cannot explain the age discrepancy between the Clovis complex and the Monte Verde site (see below). Note, also, that three more recent studies (listed in Table 1.1) furnish earlier dates than those considered by Hamilton and Buchanan (2007).

The question of the pre-Clovis colonists was considered by Waters et al. (2011). They described the tip of a projectile point made of mastodon bone embedded in a rib of another mastodon found at the Manis site in the state of Washington, USA. Radiocarbon dating and DNA analysis indicated that this material dates to 13,800 YBP. They referred to other evidence suggesting that people were hunting proboscideans at least two millennia before the Clovis.

Against the absence of pre-Clovis colonists is a vast array of finds from early sites in South America (Table 1.2). The dates obtained for 30 of them show values of about the same order of magnitude as those found in North America, without a clear north-south cline. Differential site preservation (less in the north) could explain this curious result, although hesitation to accept or tendency to reject earlier dates in the north is also a tenable hypothesis.

Another puzzle relates to the introduction of hookworms in America. The earliest record of their presence dates from 7,200 YBP, in human coprolites from northeast Brazil. Taking into consideration the parasites' biology, it would be impossible for them to have been introduced by land migration about 13,000 YBP (Montenegro et al., 2006).

A more recent migration took place involving the Aleutian Archipelago colonization. This region represents Beringia's southern margin, and has

been the subject of not less than 140 years of archeological research (Veltre and Smith, 2010). The earliest settlement date is thought to be 9,000 YBP, and the evidence points to an overall cultural continuity, the sequence being divided into five phases: (a) Early Anangula (9,000-7,000 YBP); (b) Late Anangula (7,000-4,000 YBP); (c) Margaret Bay (4,000-3,000 YBP); (d) Amakmak (3,000-1,000 YBP); and (e) Late Aleutian (1,000-200 YBP) (Davis and Knecht, 2010).

1.2. Siberian and early North American archeologies

Arctic Siberian archeology was reviewed by Pitulko et al. (2017). According to them, humans began colonizing the area around 45,000 years ago, and these populations were likely supported by mammoths, which were a source of both food and weapons, via the processing of their tusks for long points and full-sized spears.

Hoffecker (2005) provided an overall evaluation of the Upper Paleolithic record of *Homo sapiens* in northern Eurasia, comparing southern Siberia with western, central and eastern Europe. He remarked that the rapid pace of innovation and the complexity of artifact design were unprecedented, characterizing what he called behavioral modernity. Dixon et al. (2005) described new methods for discovering sites emerging from under melting and retreating glaciers and ice patches, which represent important sources of knowledge about the Siberian prehistoric past, while Hall et al. (2002) reviewed how 323 North American sites from the Pleistocene-Holocene transition (dating from at least 7,500 YBP) were discovered.

Beringia's early archeology has been described by Dixon (2001), Hoffecker and Elias (2003) and Hoffecker et al. (2016). Dixon identified three archeological traditions and two complexes in eastern Beringia and the Pacific Northwest. The three traditions are: the American Paleoarctic (10,500-8,000 YBP), the Northern Paleoindian (10,500-8,500 YBP) and the Northwest Coast Microblade (10,500 to <7,000 YBP); the complexes are Nenana (>11,600-10,500 YBP) and Denali (10,500-8,000 YBP). The Yana RHS site described by Pitulko et al. (2004) lies well above the Arctic circle and dates to 27,000 YBP, at least twice the age of other sites (for instance, Berelekh: 13,000 YBP; Zhokov: 8,000 YBP).

The spatiotemporal distribution of Holocene populations in North America was assessed by Chaput et al. (2015) through aggregated radiocarbon (^{14}C) dates, used as a proxy of population size. Demographic changes were mapped for the past 13,000 years. On the other hand, Halffman et al. (2015)

found evidence of human use of salmon in North America at 11,500 years ago; and O'Shea et al. (2014) discovered a 9,000-year-old caribou hunting structure beneath the waters of Lake Huron.

The archeology of the northwest coast of North America was considered by Ames (2003). The area studied extends 1,800 km from Cape Mendocino, California, to Yakutat Bay, Alaska, and seems to have been occupied 13,000 YBP or earlier. The settlers of the region formed what could be classified as complex hunter-gatherer societies which displayed social hierarchy. Additional characteristics include: (a) large corporate households; (b) sedentary communities; (c) logistical mobility patterns; (d) complex division of labor; (e) mass food harvesting, processing and storage; (f) regional interaction; and (g) key technological acquisitions including boats, waterproof boxes and plank houses.

The cultural context of plant domestication in eastern North America was examined by Smith (2011). At least four indigenous seed-bearing plants were domesticated there between 5,000 and 3,000 YBP: squash (*Cucurbita pepo*), sunflower (*Helianthus annus*), marsh elder (*Iva annua*) and pitseed goosefoot (*Chenopodium berlandieri*). Seven archeological sites dating to this period (the Late Archaic) were considered. None of them had pottery vessels, and artifact assemblages were dominated by chipped-stone tools and debitage, with chert and quartzite used to manufacture bifacially flaked knives, drills, spear points, unifacial end scrapers and side scrapers. Floral and faunal assemblages suggested continued reliance on many wild species, with no evidence of resource depletion or high site density. Therefore, models of domestication and agricultural origins based on population pressure and/or depletion of natural resources do not apply here.

On the other hand, the presence of maize in the southwestern United States by 2,100 calibrated calendrical years before the Christian era had previously been explained through the migration of Proto-Uto-Aztecan farmers who had left their homeland in Mesoamerica. But Merrill et al. (2009) suggest that the dispersal of maize agriculture in this region would have been by cultural diffusion across a southern Uto-Aztecan linguistic continuum, without a specific demic migration.

The phenomena that have been called the North American Neolithic transitions were examined by Bingham et al. (2013) plus 17 other contributors in a special issue of Evolutionary Anthropology. A question was raised as to whether the use of bows preceded increased social complexity (the warfare theory) or followed other correlates of increasing

complexity (the social coercion theory). The contributors to this debate concluded that the weight of the evidence favored the second over the first alternative.

1.3. Latin America

1.3.1. Plant cultivation and domestication

A similar set of questions about the development of agriculture in Central and South America were tackled by Piperno (2011). She collected a large amount of molecular, botanical and archeobotanical data, which revealed some points of difference between this process in America, the Near East and China. In the American continent, food production did not originate and develop in association with larger permanent nucleated villages situated in major river valleys. Rather, the first events related to the process, for which there is evidence from between 11,000 and 7,000 YBP, took place in rock shelters and/or limited clusters of small open-air places beside secondary watercourses and seasonal streams, whose small stretches of alluvium were likely used for cultivation.

Crop origins, also, were spatially diffuse, with multiple areas of domestication. The wild ancestors of these first cultivated plants were native to the seasonal tropical forest, where for 4-7 months of the year little or no rain falls. The soils in these places were less weathered, and the dry season enabled the efficient clearing of vegetation and the preparation of plots for planting with the simple use of fire. Table 1.3 lists 7 and 15 species of plants which were domesticated in Mexico and South America respectively. Information from 16 archeological sites dates the first appearance of crops in those sites to between 10,100 and 4,000 YBP. More specific details about the work of Dolores R. Piperno and her colleagues can be found in Piperno and Stothert (2003), Perry et al. (2006), Pohl et al. (2007), Ranere et al. (2009) and Piperno et al. (2009).

A species not considered by Piperno (2011) was cacao (*Theobroma cacao*), which has been cultivated in Mexico and Central America for over 2,000 years. Since no truly wild populations were present in this region, its origin must be looked for elsewhere. Motamayor et al. (2002), based on DNA restriction fragment length polymorphisms and microsatellites, suggest that cacao was probably established there having originated from a few plants from South America, and was subsequently spread by humans through this region.

Maize derived from teosinte, a plant in which the grain is enclosed in a hard fruit case; the earliest maize cobs were very small and the grain was very low in proteins. Why, then, would our ancestors raise it? Tykot and Staller (2002) and Smalley and Blake (2003) suggest that during the initial period of maize domestication, this plant was grown because its stalk provided a key sugar source with many uses, including the production of alcoholic beverages. The social importance of alcohol production thus helped maize's early and rapid spread. Only afterwards, with the increase in size of pods and grains, was its food importance increased. Grobman et al. (2012) studied two sites on the north coast of Peru dating from 6,700 to 3,000 YBP and found that maize cultivation in this area could be traced from at least 6,000 YBP, with the early development of distinct maize racial groupings. These were roughly contemporary in age, with the earliest maize macrofossil remains from Mexico. The early Peruvian maize was of a popcorn type.

The Late Archaic period (3000-1800 BC) was a time of major cultural development in the Pacific Coast of Peru. Large permanent communities were established, monumental architecture built, and distinct religious practices were established. Archeological studies in the North Chico region provided broad information on the production, processing and consumption of maize. The data were obtained from coprolites, pollen records and stone tools residues, indicating that maize was a primary component of the diet there during this period (Haas et al., 2013).

The dynamics of genome variation during maize domestication and improvement was considered by Hufford et al. (2012). They performed genome-wide resequencing of 75 wild, landrace and improved maize lines and found recovery of diversity after domestication, introgression from wild relatives, and evidence for stronger selection in the earlier domestication events than in the later improvement lines.

Mesoamerica and the Andes have been alternatively considered as the origin of the common bean, *Phaseolus vulgaris*, but Bitocchi et al. (2012), based on the nucleotide diversity in five gene regions of the bean's wild forms, gave what they considered to be clear evidence of the Mesoamerican origin of *P. vulgaris*, most likely Mexico.

The bottle gourd, *Lagenaria siceraria*, indigenous to Africa, had long been an enigma to archeologists, due to its almost simultaneous presence in East Asia and the Americas 8,000 YBP. Erickson et al. (2005) through the use of ancient DNA, arrived at the conclusion that the plant has had a long

history of domestication, and that it arrived in the Americas via Paleoindian populations as they colonized the continent.

Combining archeology, archeobotany, paleoecology, soil science, ecology and aerial imagery, McKey et al. (2010) determined that pre-Columbian farmers of the Guianan coast constructed large raised-field complexes on which they grew crops such as maize, manioc and squash. They created physical and biogeochemical heterogeneity in flat, marshy environments by constructing raised fields. When they were abandoned, ants, termites, earthworms and woody plants would occupy them, giving rise to a distinct type of landscape.

1.3.2. Megafaunal extinction

The widespread occurrence of megafauna in the Americas and its extinction in the late Quaternary (current geological period; from ~12 kya to present) has been a puzzle to researchers, who tend to fall into two camps: those who attribute this extinction to human action through hunting, habitat modification, or the introduction of new predators; and those who maintain that humans had a minor role in this extinction, suggesting that it occurred due to climatic changes.

Steadman et al. (2005) related the last appearance date of these organisms to the first arrival of humans in North and South America and the West Indies (respectively 11,000, 10,500 and 4,400 YBP), thus favoring the human predation hypothesis. Hubbe et al. (2007), however, after providing new radiocarbon dates for South America, argued that the general lack of megafaunal killing sites and megafaunal remains in archeological sites is against the overkill hypothesis. They favor climatic fluctuations as the main cause of the extinction, relating it in Central Brazil to a dry period which happened 9,500-8,200 YBP. The debate is ongoing.

1.3.3. Ecological-social relationships in Mesoamerica

The association between Clovis artifacts and Proboscidean gomphothere (*Cuvieronius* sp.) in the Mexican Sonoran desert at a site dated 11,550 YBP (El Fin del Mundo – The End of the World!) is of significance because it broadens the age and geographic range of the Clovis culture, and expands our knowledge of continental megafauna (Sanchez et al., 2014).

Killion (2013) examined Olmec subsistence practices that occurred many thousands of years later (1200-400 BC), emphasizing the importance of