

Tracking the first Americans

Tom D. Dillehay

A study of 33 ancient skulls excavated from Mexico invites us to reconsider our view of the ancestry of the early Americans. Unlike most other early American remains, the skulls resemble those from south Asian populations.

Questions of which human populations first arrived in the Americas, and when, where and how this happened, have been debated by scientists for decades¹. It has long been presumed that the first people entering the New World were the direct ancestors of present-day Native Americans and that they arrived in America from northeast Asia about 12,000 years ago². But this theory has been challenged by new archaeological discoveries and by findings of early human remains bearing anatomical similarities to the people of south Asia and the southern Pacific Rim^{3,4} (Fig. 1). Writing on page 62 of this issue, González-José *et al.*⁵ add more fuel to this heated debate. They present a comparative study of early historic human skulls from Baja California, Mexico, and their findings lend weight to the view that not all early American populations were directly related to present-day Native Americans.

Human skeletal remains have long been used by palaeoanthropologists to model early human migration. The conventional view is that different skeletal populations with similar craniofacial features (skull form) shared a common ancestry and were genetically related, whereas different features reflect

different ancestry. Migration histories and evolutionary forces explain the similarities or differences.

Piecing together the ancestry of the Americas has been difficult, as early human remains dating from about 10,000 years ago (the end of the last ice age) are fragmentary and scarce. Scientists have typically reconstructed the missing pieces of the most ancient skulls by extrapolating backwards from later, more complete skeletons. Ancient American skulls reconstructed in this way were anatomically indistinguishable from early northeast Asians and also from present-day Native Americans². So a theory arose, supported by dental and other archaeological data⁶, that the first humans entering the Americas were northeast Asians who arrived in three successive migrations beginning around 12,000 years ago. These founding colonizers were thought to be big-game hunters, equipped with so-called Clovis spears⁷, who rapidly populated the Western Hemisphere and gave rise to present-day Native Americans (Fig. 2a).

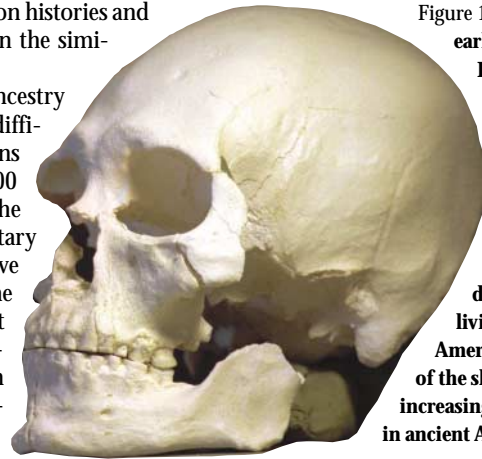


Figure 1 The skull of an early American. The Kennewick Man, excavated from Washington state, lived about 9,300 years ago. His craniofacial features, which do not resemble living Native Americans, are typical of the skulls that are increasingly being found in ancient American sites.

But more recent archaeological discoveries suggest that there were several different founding populations, arriving from different places, each with different lifestyles and technologies⁸. Some populations not only hunted big game but also exploited a wide range of plant and animal life. To complicate matters further, it is no longer certain that the first colonizers arrived about 12,000 years ago — some archaeological sites in South America date from 12,500 years ago, which suggests that the first humans arrived at least 15,000 years ago.

A similar pattern of diversity is emerging from statistical analyses of cranial and facial measurements of some of the oldest skeletons found in the Americas. The archaeological and skeletal data have led to a new model, in which the Palaeoamericans — the proposed first arrivals in the New World — were not northeast Asians. They came instead from south Asia and the southern Pacific Rim, and they probably shared ancestry with ancient Australians and other southern populations^{3,9}. A second group of humans then arrived from northeast Asia or Mongolia, and it was this second population that adapted to the warming climate after the Ice Age and gave rise to the modern Amerindians (an ancient population of Americans whose skeletal remains make up most of the human material found in the New World) and the present-day Native Americans (Fig. 2b). So according to this theory, the Palaeoamericans are unrelated to most modern Amerindians and to the Native Americans.

González-José *et al.*⁵ now propose a more complex view of American ancestry.

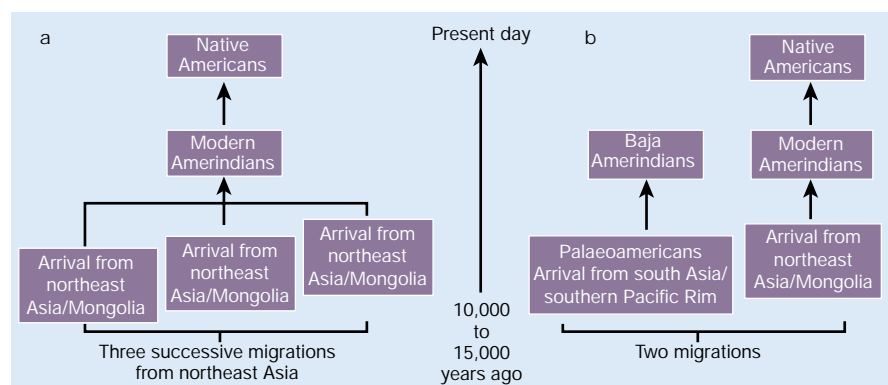


Figure 2 Tracing American ancestry. Analysis of skeletal remains has led to at least two models to explain the origin of early human populations in the Americas. a, It was originally thought that the first colonizers were the direct ancestors of present-day Native Americans, who arrived from northeast Asia and possibly central Asia in three successive migrations about 12,000 years ago. b, More recent analyses of the craniofacial features of skulls dating from the end of the Ice Age suggest that the first arrivals were from south Asia or the Pacific Rim. These 'Palaeoamericans' were thought to be unrelated to the majority of modern Amerindian remains — a later group of colonizers from northeast Asia were thought to have given rise to these late-prehistoric populations. Now, González-José *et al.*⁵ have found that a group of early historic Amerindian skulls from the Baja peninsula in Mexico bear a strong resemblance to the early Palaeoamericans, suggesting that the colonization of the Americas was more complex than had previously been suspected.

These authors analysed the skeletal remains of 33 modern Amerindians from early historic times, excavated from the tip of the Baja peninsula in Mexico. Surprisingly, the craniofacial features of these Baja Amerindians show closer affinity to the Palaeoamerican skulls than to other modern Amerindian remains. The Baja Amerindian and Palaeoamerican skulls have similar long and narrow braincases and relatively short, narrow faces, implying a common ancestry with the ancient inhabitants of south Asia and the Pacific Rim. González-José *et al.* confirm that modern Amerindian skulls from other areas are similar to ancient northeast Asian remains. Their new data add to accumulating evidence of morphological differences between early humans from different areas of the Americas^{8,9}.

The authors consider several potential explanations to account for the presence of Palaeoamerican traits in the Baja Amerindian skulls, but they suggest that the best explanation is that the Palaeoamericans were the direct ancestors of the Baja Amerindians. After the Ice Age, the increased aridity could have geographically isolated the founding Palaeoamerican population in the Baja area, and limited its gene flow with other modern Amerindian groups.

Do the new findings tell us anything more about when the first humans arrived in the Americas? The authors do not fully discuss the chronological implications of their work, but their interpretation of shared ancestry between the Palaeoamericans and the Baja Amerindians might best fit a model of Palaeoamerican arrival about 11,000–12,000 years ago. There is no direct evidence to support this view, but if the Palaeoamericans had arrived 15,000 years ago or earlier, the Baja population would have remained isolated for much longer. This seems unlikely, given the rate of population growth and movement that probably occurred after initial colonization and then after the Ice Age when the climate warmed.

But could the similarities between the ancient Palaeoamericans and the later Baja Amerindians instead reflect the influence of other evolutionary forces, such as gene flow or natural selection and convergent adaptation of different populations to similar local environments? Answering this question will depend upon finding more isolated prehistoric populations showing ancient Palaeoamerican traits, and then establishing whether parallel evolutionary forces were acting on them and whether they were derived from a single ancestry. But this will be a difficult task. Human remains from the end of the Ice Age are scarce and often fragmentary, so we have only a vague notion of the skeletal characteristics of the ancient Palaeoamericans. And we have a poor

understanding of the migration history of different American populations and what kind of evolutionary forces might have influenced them¹⁰.

Given these limitations, the findings of González-José *et al.* do not allow us to draw firm conclusions about the relationship between the ancient Palaeoamericans and the later Baja Amerindians. But the importance of this and other studies^{7,11} is that they suggest a different view of the origins and interactions of early human populations in the Americas. What we really want to know is what took place within and between these populations, how they changed over time, and how quickly they changed. These issues can be resolved only by obtaining more skeletal data¹¹ and by combining them with regional archaeological records, which should provide information on the social and cultural histories of the different

populations. Slowly, we are realizing that the ancestry of the Americas is as complex and as difficult to trace as that of other human lineages around the world. ■

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Earth science

Just add water

Albrecht W. Hofmann

A new model could explain why Earth's upper mantle is depleted of many trace elements. At a certain depth, minerals might release water, creating a molten filter that traps trace elements in the mantle beneath.

Sandwiched between Earth's thin crust and its metallic core lies a layer of pressurized rock at high temperature — the mantle. Convection in this layer drives plate tectonics and sea-floor spreading, but we know little about the pattern of circulation. Indeed, current thinking about mantle dynamics is in a state of turmoil. As we cannot observe convection directly, we must piece together indirect evidence from seismology, geochemistry, mineral physics, fluid dynamics and numerical simulations of convection. But the evidence is contradictory and has led to at least two conflicting views about mantle movement. On page 39 of this issue, Bercovici and Karato¹ propose a new model that might resolve this conflict. They suggest that water dissolved in the mantle might create a thin layer of melt at a depth of 400 km, causing an unexpected pattern of circulation in the mantle.

The two conflicting models for mantle convection (Fig. 1a, b, overleaf) are usually described as 'layered' convection (supported by geochemists) and 'whole-mantle' convection (supported by seismologists). Geochemists have long insisted on the two-layered model, in which the mantle consists of a relatively primitive layer below a depth of 660 km — containing primordial noble gases, trapped 4.5 billion years ago when the Earth formed — and an upper layer that is highly depleted of heat-producing elements (uranium, thorium and potassium), noble

gases and other 'incompatible' elements. The primitive layer serves as a reservoir for these elements (which were depleted from the upper mantle when Earth's crust was formed) and it is occasionally sampled by deep-mantle plumes (Fig. 1a).

Over the past several years, however, seismic tomography has given us increasingly detailed images of apparently cold 'slabs' (characterized by fast seismic velocities) descending into the deep mantle right through the 660-km boundary, effectively cutting to shreds the simple picture of the mantle convecting in two nearly isolated layers. If cold 'slabs' descend into the deep mantle, there must be a corresponding upward flow of deep-mantle material to shallow levels (Fig. 1b). No matter what specific form the exchange across the 660-km boundary takes, in this 'whole-mantle' model of mantle convection, it would within a few hundred million years destroy any compositional layering that had possibly been inherited from early in Earth's history.

Meanwhile, the geochemical arguments for a separate deep reservoir have not disappeared. Primordial noble gases are still preferentially associated with 'hot spots'², at least some of which seem to come from deep-mantle plumes³. And much of the upper mantle remains highly depleted of incompatible trace elements, including the heat-producing thorium, uranium and potassium — also suggesting the presence of a less