with protons could occur through the Higgs force, which is associated with the famous Higgs boson. Because up and down quarks have minuscule masses, these interactions are likely to be governed by strange quarks and other hidden flavours in the proton. With strange quarks aptly named for the behaviour revealed in subatomic particles 70 years ago, it would make for a fascinating tale if they were again to be instrumental in unveiling new strange behaviour in nature.

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ARCHEOLOGY

Unexpectedly early signs of Americans

Humans are thought to have reached the Americas less than 15,000 years ago. But evidence of stone tool use on an animal carcass excavated in California points to a much earlier arrival of human relatives from the genus Homo. See Letter p.479.
hammerstones strike a bone placed on a stone anvil. Holen et al. note the similarities between the modification marks on the cobbles and bones that occurred after particular actions in their experiments and those uncovered in Bed E. The authors did not find evidence that the stones were modified by other actions, such as tool manufacture by purposeful flaking. They therefore interpret the large cobbles (10–30 centimetres in diameter) in Bed E as hammerstones and anvils used to process a mastodon carcass.

Similar ‘single carcass sites’ are known from the earliest archaeological periods until late in the prehistoric record. The mastodon bones might have been broken to extract bone marrow for food or to create bone tools. A number of primate species, including our own lineage, have used percussion to extract food from plant or animal tissue.

The big surprise is the site’s age. Rigorous uranium-series dating of the bones yielded an estimated burial age of 130,700 ± 9,700 years ago, coinciding with the beginning of the wet and warm last interglacial period. The finds from Bed E could place hominins in the New World more than 100,000 years earlier than previously thought.

An ongoing debate about the human colonization of the Americas is whether it involved a coastal or inland route. In the Supplementary Information accompanying the paper, the authors propose coastal entry, given claims that hominins reached Asian and Mediterranean islands more than 100,000 years ago. They argue that, despite sea-level rise during the last interglacial, the distances to the Americas by water were within the capabilities of human populations at that time; the warm interglacial conditions would have facilitated adaptation to the newly discovered environment.

Several hominin species roamed Eurasia 130,000 years ago, although different species had not necessarily developed similar technological behaviours. Possible hominin candidates for the ‘authors’ of the Cerutti Mastodon site are late populations of Homo erectus, Neanderthals and the elusive Denisovans (known through genetic analysis of only a bone and some teeth). Genetic analysis of present-day Amazonian Native Americans links them to indigenous Asian and Australian populations, which are linked in turn to the Denisovans. Such traits are weak or absent in modern indigenous North and Central American populations, and in North Americans from the late Pleistocene, which might indicate a diverse set of founding populations of the Americas. This could support at least one early (before 14,500 years ago) entry to the Americas, but the exact timing remains an open question. Holen and colleagues do not report skeletal or plant or animal tissue from the site.

Holen et al. do not consider the insular Homo floresiensis as a probable early colonizer of America. And most evidence indicates that modern H. sapiens had not yet dispersed out of Africa 130,000 years ago. Early forms of modern humans — bearing anatomical similarities to modern humans — such as the Qafzeh–Skhul people of the Near East, might have been dispersing from Africa to Eurasia at that time. The authors speculate that archaic H. sapiens could be responsible for the Cerutti Mastodon site.

What happened after these hominins reached the Americas? The archaeological record is silent until much more recent times. The best-known and controversial archaeological claims for early human entry into the Americas are from the Calico Hills in California (originally thought to be 80,000–50,000 years old or even older) and Pedra Furada in Brazil (40,000–20,000 years old) and Old Crow in the Yukon Territory of Canada. However, the interpretations of site context, the nature of the stone items, and the human ‘signature’ on fossil faunas offered in support of these claims have been criticized. In these cases, the findings could be explained as the outcome of geological or biological processes that superficially mimic human-made items, or the associations of the dated sediments with the artefacts are questionable.

The evidence from the Cerutti Mastodon site has been rigorously researched and presented, and might be more difficult to refute, even though the proposed hominin narrative derived from these data has some gaping holes that need filling. Time will tell whether this evidence will bring a paradigm change in our understanding of processes of hominin dispersal and colonization throughout the world, including in what now seems to be a not-so-new New World.

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Figure 1 | Broken mastodon bones and possible stone tools at a 130,000-year-old archaeological site in California. Holen et al.2 report analysis of the findings made from excavation of the Cerutti Mastodon site. Some stones found there, such as a possible anvil (the stone shown here weighs 8.3 kilograms), might have been used to break the femur bone of a mastodon, an extinct animal distantly related to elephants. Possible signs of tool-mediated bone breakage, including a fractured femoral bone and separated, fractured ends of the femur known as femoral heads, could indicate activity by ancient humans. Scale bar, 10 centimetres.