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An El Jobo Mastodon Kill at Taima-taima, Venezuela

Abstract. *Excavation at Taima-taima in 1976 recovered artifacts of the El Jobo complex in direct association with the butchered remains of a juvenile mastodon. Radiocarbon dates on associated wood twigs indicate a minimum age of 13,000 years before the present for the mastodon kill, a dating significantly older than that of the Clovis complex in North America. The El Jobo complex must have evolved independently in northern South America.*

The El Jobo lithic complex was first defined by one of us (J.M.C.) from a surface collection consisting of distinctive long lanceolate projectile points with thick cylindrical cross section, large bifaces, choppers, and flake tools found on a high flat in the valley of the Rio Pedregal in the state of Falcón approximately 70 km southwest of the town of Coro, Venezuela (*1*). Subsequently, several fragments of El Jobo projectile points were found in excavations at the water hole of Muaco, approximately 10 km east of Coro, together with bones of mastodon, glyptodon, and other extinct taxa (*2*). Burned bone from Muaco was radiocarbon dated between 16,000 and 14,000 years before the present (B.P.) (*3*). Since modern artifacts such as glass fragments were also found in the spring deposits, many archeologists doubted the association of man with the early-dated extinct faunal assemblage at Muaco despite published illustration of modified mastodon bone from the site (*4*).

In 1962 another water-hole site yielding bones of extinct Pleistocene fauna was found by J.M.C. and Alex Krieger at Taima-taima, about 3 km north of Muaco. J.M.C. subsequently excavated an extensive area at this site during four field seasons (*5*). In a basal gray sand unit, among bones of mastodon and glyptodon, he found three fragments of El Jobo points and one uniface knife or scraper, together with rough stones probably used as choppers or pounders and scarred long bones of mastodon probably used as anvils. A series of 14 radiocarbon dates ranging between 14,000 and 12,000 years B.P. from the water-saturated gray sand unit in which the bones and artifacts occurred were announced by 1971 (*6*).

Archeologists continued to express doubt about the antiquity of El Jobo points (*7*). Taima-taima was perhaps like Muaco: the deposits disturbed by spring action, the evidence of association of man with the extinct fauna perhaps fortuitous, the series of radiocarbon dates questionable. In view of the doubts, J.M.C. agreed with A.L.B. and R.G. to conduct further excavations jointly at the site of Taima-taima in the summer of 1976 in order to confirm the association of man with extinct animals and to clarify the stratigraphy and dating. C.O. contributed to paleoenvironmental studies at the site, and the faunal remains recovered were analyzed after the excavation by R.M.C. The results of these researches are conclusive. El Jobo artifacts were found in direct association with the skeleton of a young mastodon killed and butchered in situ approximately 13,000 years ago.


Fig. 1. The remains of the slain juvenile mastodon as exposed in the lower part of a saturated gray clayey sand stratum (unit I). The posterior portion of the skeleton is in the foreground.

The mastodon, a juvenile *Haplomastodon* to judge from the mandibular molars and the unfused epiphyses, had collapsed on its left side (Fig. 1). The mandible was lying about 3 m to the left of the skeleton. The cranium, all of the cervical vertebrae, and a number of the upper thoracic vertebrae had been removed; the entire right forelimb had also evidently been carried away. The left forelimb was dismembered, with six sharp cut marks at a tendon attachment point on the left humerus. Ribs remained in articulation with the lower thoracic vertebrae, and two ribs bore the marks of sharp knife cuts. Most of the remaining thoracic vertebrae were in line, but the lower part of the spinal column had been forcibly turned to the left. The pelvic bones were in anatomical relationship although splayed by collapse. The bones of the right hind limb were in anatomical relationship but the left hind limb had been dismembered. Most of the foot bones were missing, as well as all of the caudal vertebrae. No bones showed intentional breaking for marrow. Most importantly, there was no evidence of subsequent geological disturbance of the partially dismembered skeleton after it was buried by gray clayey sand.

Two flaked stone artifacts were exposed in situ in direct association with the skeleton of the young mastodon. The midsection of a quartzite El Jobo projectile point was situated within the cavity of the right pubis (Fig. 2). A utilized jasper flake was situated within 3 cm of the midshaft of the left ulna. In addition, a rough pointed stone cobble had been jammed in the right acetabulum between the head of the right femur and the acetabulum. Other rough stones found in the vicinity of the skeleton and likely used in the butchering process are being studied.

The mastodon skeleton was embedded in a water-saturated fine clayey gray sand zone (unit I) just above a pavement of cobbles and pebbles formed from a Miocene limestone. The area of the Taima-taima water hole is a much faulted and uplifted region of marine sand and consolidated fossiliferous limestone beds determined to be of Miocene age. Below the cobble pavement is a compact ma-

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rine sand unit which is dipping at an oblique angle to the overlying deposits. The pebbles and cobbles forming the pavement had apparently been let down vertically from a solid bed of fossiliferous limestone by removal of the underlying sand by headward erosion of the stream draining the small valley in which the site is located. Erosion of the Miocene marine sand has been hastened by active artesian springwater flowing through the sand and emerging horizontally near the center of the valley. There is no single large springhead, but rather an extensive area of seepage where the aquiferous sand is exposed. The source of the aquifer is about 10 km south near the base of the Sierra de San Luis. The area where the water emerges was evidently a major water hole frequented by macrofauna in late Pleistocene times.

Fig. 2. The midsection of a quartzite El Jobo projectile point in situ within the cavity of the right pubis of the juvenile mastodon.

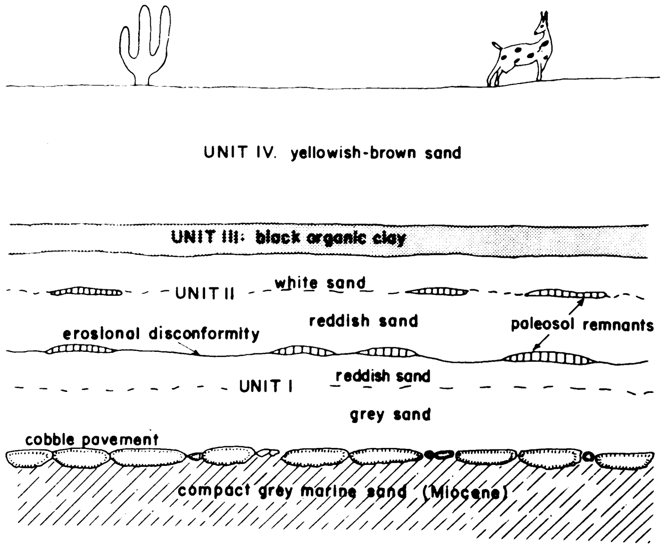

Fig. 3. Schematic profile of stratigraphy at Taima-taima. The mastodon skeleton with associated El Jobo artifacts was buried in the lower part of unit I just above the cobble pavement.

Fig. 4. Sheared wood twig fragments found abundantly in close association with the slain mastodon and hypothesized to be stomach contents preserved in saturated gray clayey sand. A sample of this material has been radiocarbon dated at between 12,980 ± 85 and 14,200 ± 300 years B.P. The scale is in centimeters. [Photograph from British Museum (Natural History), courtesy of A. Sutcliffe]

The late Pleistocene and Holocene sediments at Taima-taima can readily be divided into four major stratigraphic units clearly separated by erosion or new deposition (Fig. 3). Remnants of three paleosols, badly disturbed by erosion or reduction, are situated in the major stratigraphic units. Color ranges, caused by repeated oxidation and reduction events, are variable within each major stratigraphic unit. The details within each unit are complicated, but the overall stratigraphy is clear and there is no mixture between the major units.

Three of the major units (I, II, and IV) are composed principally of sand which was deposited as colluvium. The ultimate source of the sand is the old Miocene foreshore beds, which outcrop on the valley slopes. In addition to colluvial deposition by slope wash, some of the gray sand in unit I, which is 30 to 80 cm in total thickness, has evidently moved upward from the underlying Miocene sand bed with water rising through the interstices between the cobbles in the pavement. After the pavement was exposed by excavation, tiny "volcanoes" of upwelling water and sand were noted and photographed during their intermittent activity. The profiles of unit I exhibit narrow necks of relatively clean sand extending upward from openings between the cobbles of the underlying pavement. These funnel-shaped necks are only 1 to 3 cm wide, and they never penetrate the higher sand units in the area excavated. Although the original fine horizontal beds in unit I have been locally distorted and convoluted by the upwelling water (which also sorted out the clay fraction), evidently the hydrostatic pressures were not sufficient to move bones enclosed in unit I by any significant amount. The upper 20 cm of unit I have been locally oxidized to a reddish color.

In addition to the skeleton of the young mastodon, bones of other mastodons of varying age (and also glyptodon remains as well as rare horse, sloth, felid, and bear) were found scattered in the water-saturated lower part of unit I. Numerous water-worn mastodon bone fragments are embedded in the underlying cobble pavement. Molars and mandibles are especially frequent, and they indicate individuals of all ages. Two of these bones embedded in the pavement are adult mastodon femora exhibiting cuts and striations that were produced by use of the bones as chopping blocks. Possible stone artifacts embedded in the pavement are under study.

Water-worn bone fragments were also found on an erosional disconformity capping unit I, and these belong to a different faunal assemblage than that of unit I. Mastodon remains were absent. Bones and teeth of horse, glyptodon bones and scutes including an inverted carapace, and tortoise scutes were excavated from this erosional disconformity, as well as a few bones tentatively identified as *Macrauchenia*. No indisputable cultural evidence was found on this horizon. No macrofaunal remains were recovered above the base of unit II.

The lower part of unit II, a reddish sand deposit approximately 50 cm thick, was cemented to a hardness requiring a heavy pick or hammer and chisel for excavation. Paleosol remnants were found with the horse and glyptodon bones at the base of unit II and again near the top of unit II where they are exposed in an undisturbed position beneath a white reduced sand. The upper part of the unit II deposit was apparently drowned and almost all of the A horizon of the soil which had formed on the unit II colluvial sand was completely reduced to a white color to a depth of 10 to 15 cm.

A black organic clay (unit III), about 30 cm in maximum thickness, overlies the white sand. The organic carbon content of the clay yielded six stratigraphically consistent radiocarbon dates between 10,290 ± 90 years B.P. and 9650 ± 80 years B.P. (*6*). The origins of the black clay, which contains unidentified woody plant remains, are uncertain, although ponding must be involved.

Colluvial yellowish-brown sand (unit IV) overlies the black clay to a thickness of 100 to 300 cm. The colluvium contains rolled fragments of cemented red sand, indicating that another paleosol had developed on the slope above the site and had been incorporated into a landslide or mudflow that covered much of the site, thus sealing and preserving the earlier stratigraphic section.

Four radiocarbon dates have been obtained on a wood sample collected in association with the butchered mastodon in unit I. The sample consisted of a concentrated mass of small wood twig fragments which were notably sheared at both ends as if masticated (Fig. 4). The twig fragments were found abundantly and in fresh condition in the saturated sand of unit I in close association with the skeleton of the young mastodon. We hypothesize that the material is derived from the contents of the slain beast's stomach or intestines. The radiocarbon dates obtained on this material are (in years before present): 12,980 ± 85 (SI-3316), 13,000 ± 200 (Birm-802), 13,880 ± 120 (USGS-247), and 14,200 ± 300 (UCLA-2133).

The minimum radiocarbon age of the El Jobo mastodon kill is thus 13,000 years. The field data from Taima-taima demonstrate that a big-game hunting complex of a completely different technological tradition existed in northern Venezuela at least a millennium and a half earlier than the well-known Clovis complex of North America. In the southwestern United States, the radiocarbon age of the Clovis complex has been established at between 11,500 and 11,000 years B.P. (*8*). At present it is widely believed that big game hunters using fluted projectile points of Clovis type were the earliest inhabitants of the Americas. On this premise, a statistical model of wavefront expansion of Clovis big-game hunters from north to south throughout the New World has been presented by Martin (*9*). The minimum dating of 13,000 years B.P. for the El Jobo complex at Taima-taima demonstrates a significant temporal priority over the Clovis complex. The Martin model of the earliest peopling of the New World is thereby refuted by field evidence.

Technologies for the procurement of Pleistocene megafauna must have evolved independently in northern South America and on the North American plains. The Clovis complex and the El Jobo complex must have developed mutually distinctive flaking traditions from simpler technological bases, which had probably entered the New World much earlier. We believe that evidence of the technological traditions ancestral to the various early projectile point technologies of the Americas is to be found by concerted investigation of promising Pleistocene deposits in the New World (*10*).

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Soybean Lines Lacking the 120,000-Dalton Seed Lectin

Abstract. *Seeds of 102 lines of* Glycine max *(L.) Merr., the soybean, were screened quantitatively for the presence of the 120,000-dalton soybean lectin. Wide variation in the content of this lectin was noted, and five lines of soybean whose seed totally lacked the lectin were identified. Roots of all five lines were effectively nodulated by several strains of* Rhizobium japonicum, *thus indicating that the 120,000-dalton soybean seed lectin is probably not required for the initiation of soybean-*Rhizobium *symbiosis.*

Approximately 175 million metric tons of atmospheric nitrogen are biologically fixed each year by microorganisms. The fixation of almost half of this amount is the result of symbiosis between legumes and bacteria of the genus *Rhizobium* (*1*). Legume-*Rhizobium* symbioses are markedly species-specific in that a given legume is usually nodulated by only a small group of rhizobial strains. The molecular mechanism whereby leguminous plants differentiate their symbiotic rhi-

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