LETTER

Pre-Columbian chickens, dates, isotopes, and mtDNA

Recently Gongora *et al*. (1) stated that their analyses of chicken mtDNA and potential offsets for dietary marine carbon cast doubt on "claims for pre-Columbian chickens" in the Americas. We present additional data supporting the interpretation of Storey *et al*. (2) showing that evidence for pre-Columbian chickens at the site of El Arenal, Chile, is secure.

Gongora *et al*. (1) analyzed mtDNA of modern chickens only. They gave no consideration to the fact that both European and prehistoric Pacific chickens are ultimately Asian-derived and thus may be expected to share lineages. European stocks were further influenced by the 19th-century import of Chinese chickens to develop commercial and show breeds (3). The authors also imply that the Indian/Asian/European mtDNA signature identified in our ancient Pacific and Chilean samples would not have been available for dispersal to the prehistoric Pacific. This is refuted by linguistic, archaeological, and ethnohistoric evidence (4).

Ultimately, the question rests on the antiquity of the El Arenal chickens. We have directly dated and sequenced two additional chicken bones from the site, which is not a shell midden as claimed (1). Stable isotope determinations ($\delta\ ^{13}C$, $\delta\ ^{15}N$, and $\delta\ ^{34}S$) further confirm a terrestrial dietary signature; thus, no marine calibration of the dates is required (Table 1). All dates obtained from the site are securely pre-Columbian (even at 2σ), consistent with the stratigraphic and artifactual evidence. Therefore, the most parsimonious explanation continues to be that chickens were first introduced to South America by Polynesian voyagers as part of a well-documented eastward expansion.

Table 1. Radiocarbon and isotope data for archaeological chicken bones and associated thermoluminescence dates obtained from pottery from the El Arenal-1 site in Chile

Sample no.	Lab no.	Material	Date	Calibrated age (2σ)	$\delta\ ^{13}C$, ‰	$\delta\ ^{15}N$, ‰	$\delta\ ^{34}S$, ‰	P, Gy	D, Gy/year
CHLARA001	NZA 26115	Chicken bone	622 ± 35 BP	AD 1304–1424	−20.9	ND	ND		
CHLARA003	NZA 28271	Chicken bone	510 ± 30 BP	AD 1427–1459	−19.85	2.6	2.16		
CHLARA004	NZA 28272	Chicken bone	506 ± 30 BP	AD 1426–1457	−19.45	3.5	ND		
EA1-001	UCTL 1617	Pottery	650 ± 65 BP	AD 1285–1415				1.14 ± 0.11	1.76×10^{-3}
EA1-002	UCTL 1618	Pottery	610 ± 55 BP	AD 1335–1445				0.96 ± 0.11	1.58×10^{-3}

All ^{14}C dates were calibrated with CALIB (5) by using the Southern Hemisphere atmospheric curve (6). P, Paleodose; D, dose rate.

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LETTER

Reply to Storey *et al*.: More DNA and dating studies needed for ancient El Arenal-1 chickens

In their letter, Storey *et al*. (1) concede that there is no direct genetic support for Polynesian–South American contact. However, they claim that linguistic, archaeological, and ethnohistoric evidence supports Polynesia as the most likely source of the El Arenal-1 chickens. We disagree on two grounds. First, such indirect evidence is conjectural, documents no eastward expansion to South America, and says nothing about the prehistoric availability of particular mtDNA haplotypes. Second, our central point was that analyses of all available ancient (2) and modern chicken mtDNA data reveal that the El Arenal-1 chicken carries a worldwide genetic signature potentially available to any of the possible introduction routes via Europe, Asia, and Polynesia (3). In contrast, none of the unusual genetic signatures from Easter Island chickens have been reported from South America (3).

The argument rests entirely on the radiocarbon dates. Current isotopic data indicate a fully terrestrial dietary signature (1). However, contrary to Storey *et al*. (1), El Arenal-1 is indeed a midden where chicken bones were found associated with marine organisms (4), and there are no local isotopic standards available to confirm the relationship between diet and isotopic signatures. Any marine input for the two new dates (1) would be consistent with a post-Columbian chronology. A region-specific set of isotopic standards and radiocarbon and stable isotope determinations for a large number of specimens of several species at the site are required as a matter of priority including dating additional chicken bones in independent laboratories to ensure reliable radiocarbon measurements (5).

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