Proc. Natl. Acad. Sci. USA
Vol. 96, pp. 6564–6570, May 1999
Anthropology

This contribution is part of the special series of Inaugural Articles by members of the National Academy of Sciences elected on April 29, 1997.

Fish and mammals in the economy of an ancient Peruvian kingdom

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Contributed by Joyce Marcus, April 8, 1999

ABSTRACT Fish and mammal bones from the coastal site of Cerro Azul, Peru shed light on economic specialization just before the Inca conquest of A.D. 1470. The site devoted itself to procuring anchovies and sardines in quantity for shipment to agricultural communities. These small fish were dried, stored, and eventually transported inland via caravans of pack llamas. Cerro Azul itself did not raise llamas but obtained *charqui* (or dried meat) as well as occasional whole adult animals from the caravans. Guinea pigs were locally raised. Some 20 species of larger fish were caught by using nets; the more prestigious varieties of these show up mainly in residential compounds occupied by elite families.

The coast of Peru is one of the world's most extreme deserts, yet, by the first century B.C., it had produced one of the earliest civilizations in the Americas (1, 2). The coast was later incorporated into the New World's largest empire, that of the Inca, which stretched for more than 4,000 km north to south (3). Two keys to the development of this desert coast were the maritime riches of the Peruvian Coastal Current and the irrigation water brought down from the Andes by coastal rivers.

The Coastal Current flows from Chile in the south to Chimbote in northern Peru, a distance of 2,000 km. The aridity of the coast is partly due to the presence of this cold current (10°C in places), with winds picking up little moisture as they pass over it. The current's low temperature results both from the inclusion of subantarctic water and an upwelling from the ocean's cold depths.

The impact of this upwelling is profound. Masses of nutrients rise to the sunny upper layers of the ocean to support phytoplankton and, in turn, the zooplankton that feed on it. The food chain progresses to anchovies and sardines, which once occurred in prodigious numbers along the desert coast. Anchovies in particular capture a high proportion of the energy available in this ecosystem; Idyll (4) estimates their total bulk at 15–20 million metric tons per year. Anchovies in turn support countless larger fish, the result being that, although Peruvian waters are but a tiny fraction of the world's oceans, they produce 22% of all marine fish caught today.

Two decades ago, Moseley (5) argued that this extremely rich near-shore fishery provided Peru's coastal populations with a head start, allowing them to grow and become sedentary before the development of agriculture. This model is strengthened by recent discoveries on the south coast (6, 7), which show that some of Peru's earliest inhabitants had a maritime focus. Agriculture was eventually added to the coastal economy, but its demand for irrigation water was such that it was feasible in no more than 10% of the areas that can be fished (8).

Yunga and *Chaupi Yunga*

In Quechua, the language of the Inca, the Peruvian coast was divided into *yunga* and *chaupi yunga*. The *yunga*, or coast proper, is an arid strip along the ocean, rarely extending inland more than 50 km. Beyond that point, it merges with the *chaupi yunga*, a piedmont zone at the base of the Andes. The *chaupi yunga* is cut by stream canyons supporting trees, shrubs, and grasses that are rare to absent in the *yunga*.

In ancient times, one could hunt deer and guanaco in these piedmont canyons. In certain localities, there was probably enough forage to support the llama (*Lama glama*), a domesticated camelid that is a relative of the guanaco (9). Much of the *yunga*, however, was so poor in forage that any llamas present would probably have to be fed domestic plants such as maize. Anyone attempting to breed and raise llamas on the coast probably had a greater chance of succeeding in the *chaupi yunga* than in the *yunga*. Occupants of the *yunga*, however, would have had access to camelid meat through two other sources: (*i*) *charqui*, or portions of dried meat, which was traded to the coast, and (*ii*) occasional animals obtained from llama caravans carrying products between the Andean highlands and the coast (10, 11).

The Question of Economic Specialization

It is generally believed that Peru's earliest coastal communities were widely dispersed and self-sufficient. However, by the Inca period (A.D. 1470–1530), there were thousands of communities, and many were economically specialized. On the coast, such specialization included farmers who did not fish and fishermen who did not farm (12). Such community specialization was probably facilitated by the rise of hierarchical societies whose leaders directed the movement of products; but, when did this specialization first arise? Were there already specialized fishing communities by the Late Intermediate period (A.D. 1000–1470), or was specialization imposed by the Inca after A.D. 1470?

From Spanish colonial documents, we know that sixteenth-century fishermen inhabited specialized communities. Some of the most interesting information we have comes from the Chincha Valley, 150 km south of Lima. According to a Spanish *Aviso* (13), the Chincha kingdom included 30,000 male tribute-payers; among them were 6,000 merchants, 12,000 farmers, and 10,000 fishermen. The fishermen are described as living together along one street, each entering the sea every day in a boat with his nets, and each proceeding to his own familiar area to fish without competing with others. The historian Lizárraga (14) states that the Chincha fishermen did not have to till the land; using their fish, they could acquire all of the agricultural produce they needed through exchange. In turn,

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local farmers did not have to go fishing; with their harvested crops, they could obtain all of the fish they wanted. When not fishing, the *Aviso* asserts that fishermen mainly danced and drank.

During Inca hegemony, fishermen, unlike farmers, did not have to comply with the empire's demands for *mita*, or obligatory labor service. Instead, fishermen provided the Inca with fish and crayfish, which were carried to storerooms in the highlands (15). There are also hints that the fishermen's alleged abstention from agriculture might not have extended to cotton (cultivated for fishing nets) and bulrush (cultivated for making boats). For example, a number of sources indicate that late prehistoric fishermen cultivated bulrush (*Scirpus*) in marshy areas on the coast. This was convenient because, in such swampy areas, fishermen also could catch mullet in nets (16, 17).

The Kingdom of Huarco

One of the coastal polities eventually incorporated into the Inca empire was the "kingdom" of Huarco in the lower Cañete Valley, some 130 km south of Lima. This polity covered ≈140 km^2 and was under the control of a *curaca*, or local hereditary lord. It was bordered by three other late prehistoric polities: (*i*) Lunahuaná in the piedmont sector of the same valley (18–21); (*ii*) Chincha on the coast to the south (22, 23); and (*iii*) Mala on the coast to the north. Although Huarco's relations with Chincha and Mala were frequently hostile, its relations with Lunahuaná were friendly. Because Lunahuaná lay in the *chaupi yunga* and Huarco in the *yunga*, the two polities had complementary environmental settings and exchanged products. By A.D. 1470, both had been taken over by the Inca.

In 1980, Marcus was drawn to Cañete by her colleague María Rostworowski, whose studies of sixteenth-century documents had revealed the history of Huarco and Lunahuaná (24). Previous scholars (18–21) had identified several major prehispanic communities belonging to the kingdom of Huarco. These were (*i*) Ungará, a fortified site guarding the takeoff point of a crucial irrigation canal from the Cañete River; (*ii*) Canchari, Los Huacones, and Cerro del Oro, three large sites in the midst of irrigable farmland; and (*iii*) Cerro Azul, a fishing community on the rocky promontory south of a bay (25).

Because Cerro Azul's location made it a promising place to investigate prehispanic fishing, Marcus carried out excavations and analyses there from 1982 to 1986 (26–28). As she had hoped, the site's aridity led to extraordinary preservation of architecture, fishing nets, fish bone, and the remains of camelids and guinea pigs. Sommer undertook the analysis of fish bone to address the nature of fish use by the occupants of Cerro Azul. Glew studied the mammal bone, hoping to determine whether Cerro Azul had raised its own llamas and guinea pigs or had obtained them from communities farther inland.

Cerro Azul

The prehispanic settlement of Cerro Azul covers 80,000 m^2, lying mainly in the protected saddle between an 86-m mountain (Cerro Camacho) and two sea cliffs (Cerro Centinela and Cerro del Fraile) (Fig. 1). The site's most prominent features are 10 buildings, 8 of which flank two sides of an irregular Central Plaza (25). These major structures are built of *tapia*, thick walls of poured mud that seem to have dried in place between wooden frames. This type of construction is typical of the Late Intermediate period. Surrounding the 10 large buildings are smaller structures of *tapia* and even more modest structures of *kincha* or wattle.

In 1984, Marcus excavated all of Structure D, a 1,640-m^2 *tapia* building on the southwest corner of the Central Plaza (Fig. 2). It appeared to be the residential compound of an elite family and its staff and servants. Divided into at least a dozen rooms and four major patios, Structure D included living quarters, a large kitchen, multiple storage rooms and cells, unroofed work areas, and a series of doors and corridors that controlled access to the interior of the building (ref. 26, pp. 41–56).

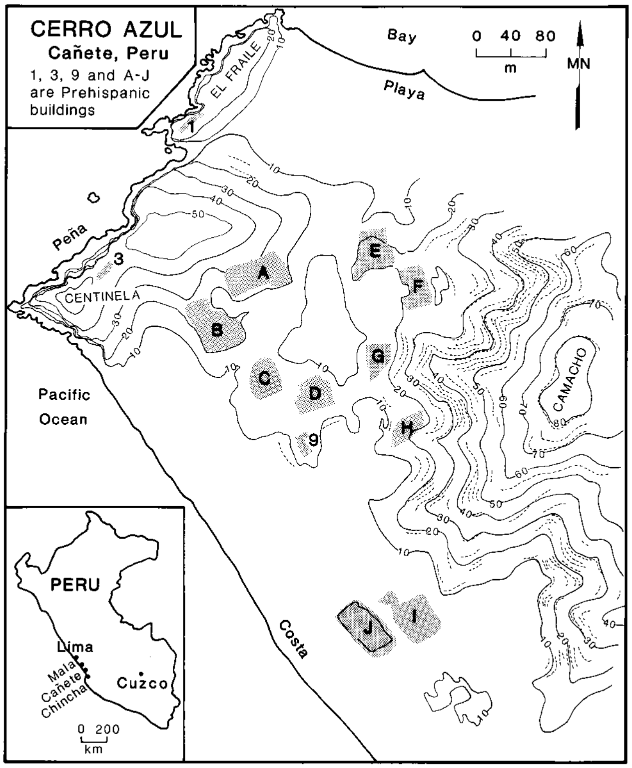

FIG. 1. The ruins of Cerro Azul, Peru occupy a depression between sea cliffs on the west and Cerro Camacho on the east. Structures A-J and 9 predate the Inca conquest of A.D. 1470; Structures 1 and 3 were built after the Inca arrived. The dashed lines on Cerro Camacho indicate artificial terraces, created by the dumping of refuse. *Peña*, *playa*, and *costa* are local names for the environmental zones. This figure has been published previously (26).

Also excavated in its entirety was Structure 9, a 290-m^2 building near Structure D. This *tapia* building was divided into 15 rooms, at least 7 of which had been used for dried fish storage at one time or another. It appeared that this storage facility was managed by a commoner-class overseer, who lived in a wattle house on a 5- × 2.5-m platform amid the storage rooms (Fig. 3).

A significant feature of both Structures D and 9 was the storage of small fish—mostly anchovies and sardines—in sand-filled rooms. Such small fish, if spread out on a pavement of beach cobbles, can dry in a single sunny day. They were stored in layers in clean sand, which prevented the fish from touching each other. The hygroscopic properties of the sand furthered the drying process by extracting the remaining moisture. Only where anchovies accidentally touched the *tapia* walls or floors of the storage rooms did the humidity in the clay pick up patches of skin, scales, heads, and tails (ref. 26, figure 33).

It appeared that Cerro Azul had specialized in fishing even before the Inca arrived. Evidently, 8–12 noble families, each with its retinue of commoners, lived in their own *tapia* compounds surrounded by smaller storage buildings. They oversaw hundreds of fishermen, who procured anchovies and sardines in excess of the community's needs. These surplus fish, temporarily stored in layers in sand-filled rooms, were later shipped to inland communities via llama caravans. The presence of llama dung on the floor of the Southwest Canchón of

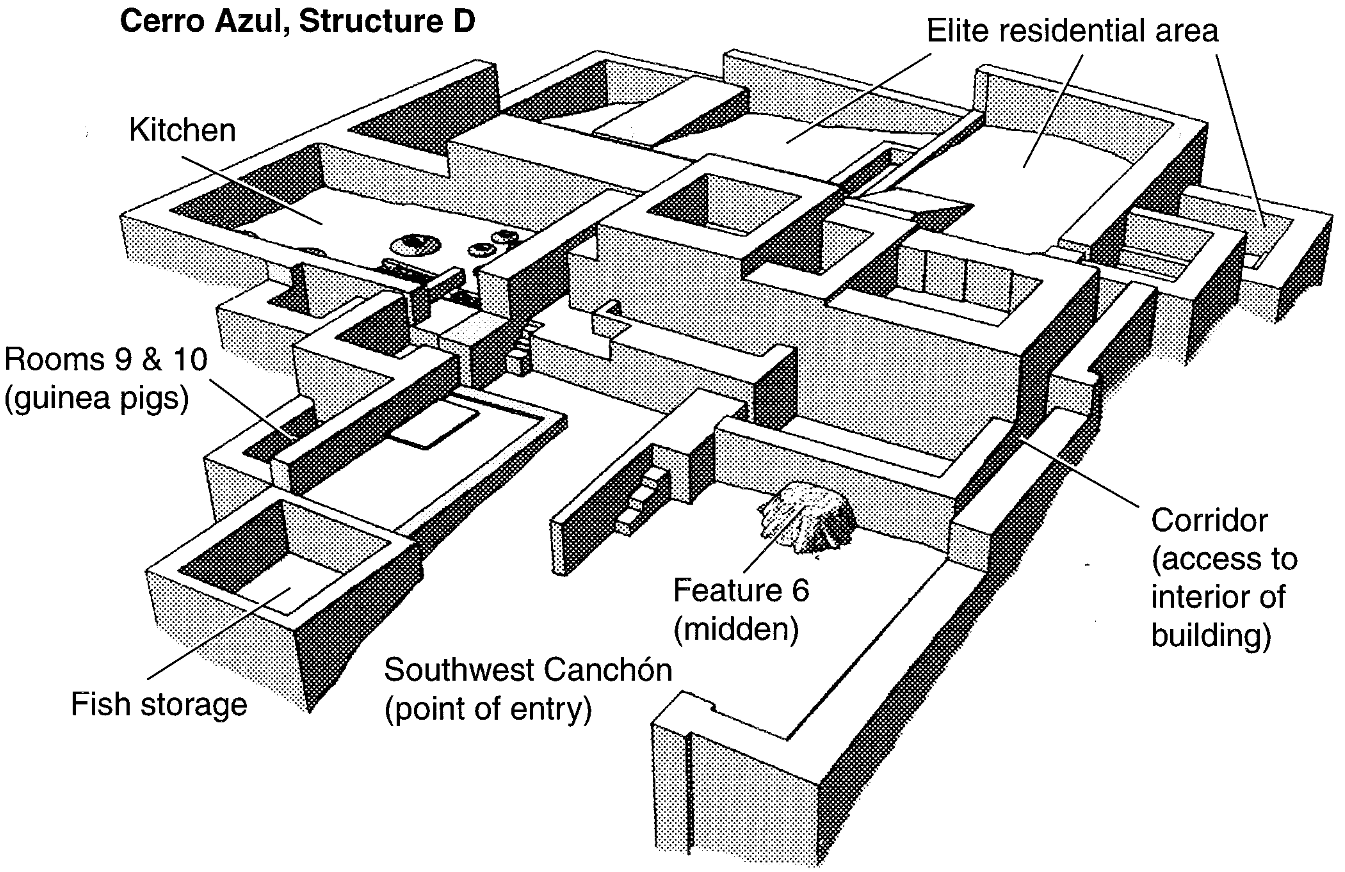

FIG. 2. Structure D of Cerro Azul, a large residential compound, seen from the southwest. This view shows the location of the Feature 6 midden. The building covers 1,640 m^2.

Structure D showed that such caravans had spent time there being loaded and unloaded but were never allowed into the interior of the building.

The fishermen of Cerro Azul also captured 20 larger species of fish, including grunts, drums, mullet, bonito, flounder, sea catfish, blennies, and even small sharks and rays. These larger fish, however, were present in smaller numbers, suggesting that they served mainly to meet the needs of the inhabitants of Cerro Azul. Larger fish also tended to show up in contexts other than sand-filled rooms.

Camelid bones occurred in modest numbers in Structures D and 9. This led us inevitably to questions of meat procurement. Were the residents of Cerro Azul actually raising llamas, as some archaeologists have argued for the north coast of Peru (29, 30)? Were they obtaining llamas from traders whose caravans came to carry away the dried fish (31, 32)? Or had

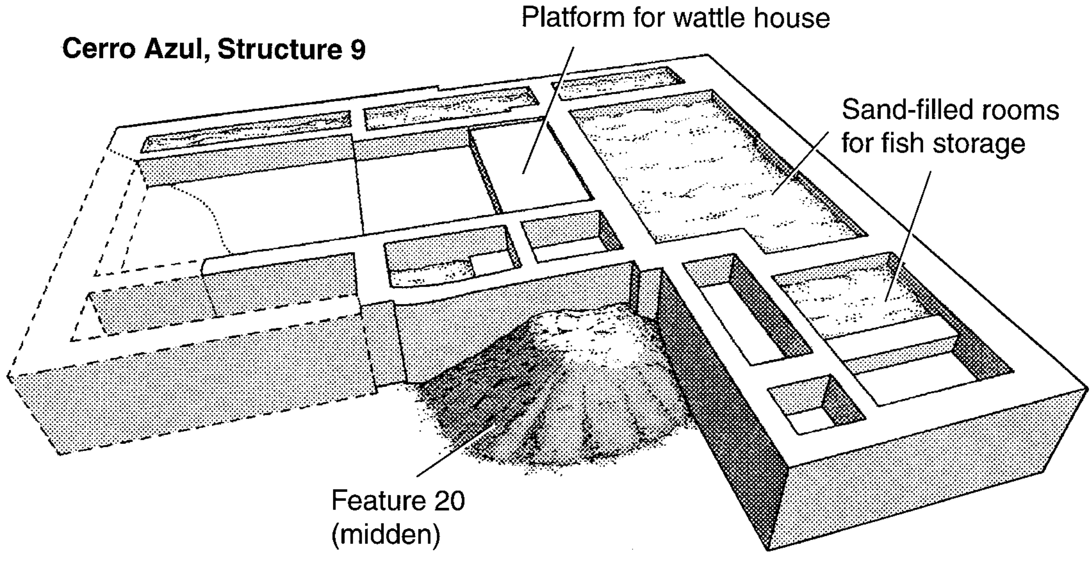

FIG. 3. Structure 9 of Cerro Azul, a dried fish storage facility, seen from the northeast. This view shows the location of the Feature 20 midden. The building covers 290 m^2.

their camelid bone simply been included in parcels of dried meat brought from inland sites?

The Fish Remains

Such is the aridity of the desert coast that fish bones, fish scales, and fishing nets were all well preserved at Cerro Azul (Fig. 4). Fish remains appeared in five main contexts. (*i*) Burials sometimes included whole fish as food for the afterlife. (*ii*) The sand-filled storage rooms yielded traces of anchovies, sardines, and occasional larger fish. (*iii*) The floors of residential areas, kitchens, and patios produced bones of larger fish such as drums and grunts. (*iv*) Periodically the *tapia* buildings had been swept, and the fish bones and other debris were dumped into gullies on Cerro Camacho, creating extensive midden terraces. (*v*) Shortly before Structures D and 9 were abandoned, their floor debris was swept up into midden piles that were never transported to the Cerro Camacho gullies.

Of all of these contexts, it was the midden piles in Structures D and 9 that yielded the richest fish remains. We screened such middens through mesh fine enough to recover elements as small as the lens from an anchovy's eye. Sommer has now identified all of the bony fish. Rare ossified vertebral centra of sharks or rays are present but still unidentified, and it is likely that, because of poor preservation of cartilaginous fish, our samples will always leave them underrepresented.

Two midden piles in particular allow a comparison of fish eaten by the occupants of Structures D and 9. Feature 6, a midden in the Southwest Canchón of Structure D, probably contained fish eaten by an elite family and the resident staff (Fig. 2). Feature 20, a midden banked against the east wall of Structure 9, probably contained fish eaten by the commoner-class administrator of the storage facility and his family (Fig. 3).

Table 1 compares the contents of these two middens. The fish include Pacific sardines (*Sardinops sagax*); another Clupeid, possibly *Brevoortia* sp.; Engraulids (mainly the Peruvian anchovy *Engraulis ringens*, although occasional specimens of *Anchoa nasus* cannot be ruled out); sea catfish (*Galeichthys peruvianus*); mullets (mainly *Mugil cephalus*, although other species cannot be ruled out); Peruvian rock bass (*Paralabrax humeralis*); Pacific jack mackerel (*Trachurus symmetricus*); grunts (mainly *Anisotremus scapularis*); drums or croakers of all sizes, including mismis (*Menticirrhus ophicephalus*), coco (*Paralonchurus peruanus*), ayanque (*Cynoscion analis*), burro (*Sciaena fasciata*), lorna (*Sciaena deliciosa*), corvina (*Sciaena gilberti*), robalo (*Sciaena starksi*), and mojarilla (*Stellifer minor*); pintadilla (*Cheilodactylus variegatus*); scaleless blennies (*Scartichthys gigas*); scaled blennies (*Labrisomus philippii*); Pacific bonitos (*Sarda sarda*); clingfish (*Sicyases sanguineus*); and left-eye flounders (mainly *Paralichthys adspersus*).

In both middens, 80% of the number of identified skeletal parts came from anchovies and sardines. In the midden from Structure D, however, sardines were almost three times as common as anchovies whereas in the midden from Structure 9, anchovies were more than twice as common as sardines.

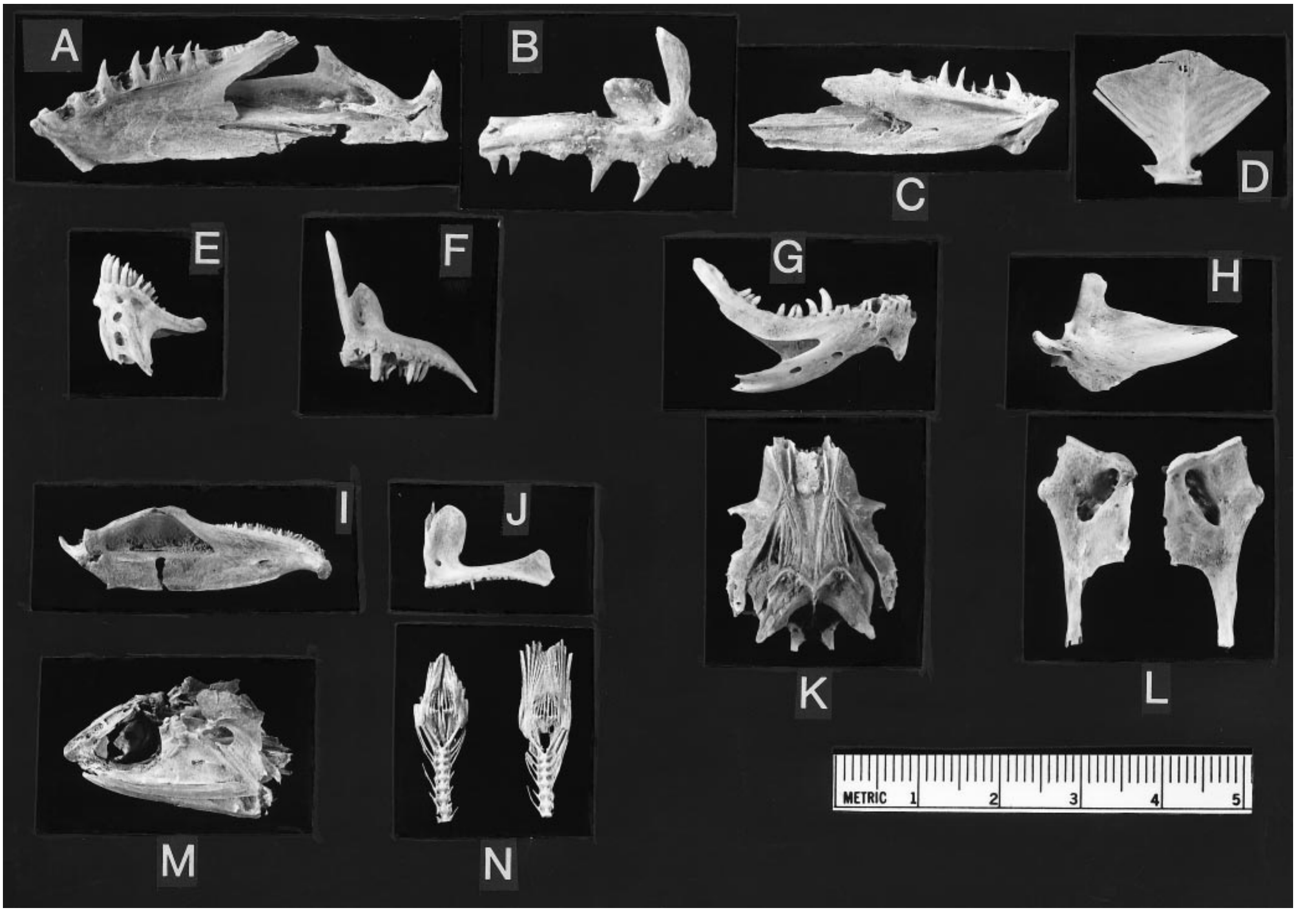

FIG. 4. Fish bone was well preserved at Cerro Azul. Shown here are the dentary and articular (*A*) and premaxilla (*B*) of left-eye flounder (*Paralichthys adspersus*); the dentary (*C*) and hypural plate (*D*) of Pacific bonito (*Sarda sarda*); the dentary (*E*) and premaxilla (*F*) of grunt (*Anisotremus scapularis*); the dentary (*G*) and articular (*H*) of scaled blenny (*Labrisomus philippii*); the dentary and articular (*I*) and premaxilla (*J*) of the lorna (*Sciaena deliciosa*), a medium-sized drum; the neurocranium (*K*) and hyomandibulars (*L*) of Pacific sardine (*Sardinops sagax*); and the dried head (*M*) and tails (*N*) of Peruvian anchovy (*Engraulis ringens*). Scale is in centimeters.

Table 1. Fish remains from Cerro Azul, Peru

Species	NISP		Percentage of NISP	
	SDF6	S9F20	SDF6	S9F20
cf. *Brevoortia maculatum*	4	0	0.03%	0.00%
Sardinops sagax	8,013	983	59.83%	25.55%
Engraulidae	2,857	2,260	21.33%	58.73%
Galeichthys peruvianus	0	113	0.00%	2.94%
Mugil sp.	7	0	0.05%	0.00%
Paralabrax humeralis	3	0	0.02%	0.00%
Trachurus symmetricus	13	0	0.10%	0.00%
cf. *Anisotremus scapularis*	261	46	1.95%	1.20%
Menticirrhus ophicephalus	57	11	0.43%	0.29%
Paralonchurus peruanus	2	4	0.01%	0.10%
Cynoscion analis	6	2	0.04%	0.05%
Sciaena fasciata	2	0	0.01%	0.00%
Sciaena deliciosa	1,007	119	7.52%	3.09%
Sciaena gilberti	23	3	0.17%	0.08%
Sciaena starksi	1	0	0.01%	0.00%
Stellifer minor	16	32	0.12%	0.83%
Small-medium Sciaenidae	150	95	1.12%	2.47%
Medium-large Sciaenidae	244	0	1.82%	0.00%
Cheilodactylus variegatus	30	0	0.22%	0.00%
Scartichthys gigas	431	129	3.22%	3.35%
Labrisomus philippii	84	12	0.63%	0.31%
Sarda sarda	88	26	0.66%	0.68%
Sicyases sanguineus	25	5	0.19%	0.13%
cf. *Paralichthys adspersus*	69	8	0.52%	0.21%
Totals	13,393	3,848	100.00%	100.00%

NISP, number of identified specimens; SDF6, Structure D, Feature 6; S9F20, Structure 9, Feature 20.

These figures suggest that, although both fish were widely available, elite families preferred sardines.

Further hints of dietary differences between elites and commoners come from the larger fish listed in Table 1. In both middens, lorna was the most common sciaenid. However, medium-to-large drums (including corvina and robalo) were roughly twice as common in the Structure D midden as in the Structure 9 midden. Evidence for greater elite access to these species should not come as a surprise; corvina and robalo are considered prestige foods today and often go directly from the docks of Cerro Azul to restaurants in Lima.

In contrast, the Structure 9 midden had higher percentages of the less prestigious small-to-medium drums, such as mismis and mojarilla. This commoner-class midden produced all 113 fragments of sea catfish. *Galeichthys* is considered a low-prestige food today and apparently was not sought after by the elite of Structure D.

The Technology of Fishing at Cerro Azul

Fishermen at Cerro Azul today recognize three coastal habitats: *peña*, *costa*, and *playa* (Fig. 1). *Peña* refers to the rocky sea cliffs of Centinela and El Fraile, whose submerged faces support millions of limpets, mussels, chitons, and sea snails. Grunts, pintadillas, scaled blennies, and small drums graze the cliffs with regularity.

Playa refers to the sandy beaches of Cerro Azul Bay and the coastline to its north. These sands support polychaete worms, euphausiids, coquina clams, mole crabs, and burrowing shrimp. Schools of anchovies and sardines once entered Cerro Azul Bay in such numbers that men standing waist deep in water could collect them in baskets (ref. 26, p. 23). This may be the way vast numbers of anchovies were procured for storage. Other important fish of the sandy beach include corvina, lorna, mismis, ayanque, flounder, and small sharks and rays.

Finally, *costa* refers to cobble or gravel beaches like those stretching south from Cerro Centinela. Prestigious drums like robalo can be caught in the surf there, and both mismis and lorna live on the small crustaceans of submerged cobble beaches.

Fish of the *peña* are caught today by fishermen standing on rocky ledges, using an *atarraya* (circular cast net). As can be seen in Fig. 5*A*, similar nets were used in ancient times. In the *playa* zone, however, the preferred artifact is a *red de cortina* (curtain net) like the prehistoric example shown in Fig. 5*B*. Shaped like a tennis net with floats on top and stone weights tied to the bottom, such devices were stretched either between two men standing in the bay or between two rafts or bulrush boats.

Although Cerro Azul was a community specialized in fishing, fishermen do not seem to have been divided into *playa* versus *peña* specialists. Burials suggest that each man was laid to rest with both a cast net and a curtain net, indicating that he was prepared to go wherever the fish were schooling. Either net could come in a variety of meshes for fish of different sizes; the spacing of the knots was set with a *mallero* or wooden template, ancient examples of which were preserved at Cerro Azul (ref. 26, figure 47*B*).

Finally, it should be noted that all of the fish found in Features 6 and 20 were species that can be caught within 100 m of the shore. Ancient watercraft in the region were relatively unseaworthy, leaving fishermen with little technology for taking fish from deep water offshore. As a result, the Pacific hake *Merluccius gayi*—one of Peru's most important commercial fish today—is absent from the middens. This is a demersal fish, caught today by motorized trawlers but virtually unobtainable by the technology available to ancient Cerro Azul fishermen (33).

The Procurement of Llamas at Cerro Azul

Also providing meat for Cerro Azul was the llama (*Lama glama*), a domestic camelid widely used in Peru as a beast of burden (9). In contrast to the abundant fish remains, however, camelid bones were not numerous; only 458 identifiable fragments were found in Structures D and 9. This scarcity of camelid bones from a site at the ocean's edge contrasts with their abundance in middens at Lunahuaná, a neighboring kingdom in the piedmont of the same Cañete Valley (K. V. Flannery, personal communication). It strengthens our suspicion that, if llamas were at times raised on the Peruvian coast, it was more likely in the *chaupi yunga* than in the *yunga*.

In a pioneering study of camelid domestication, Wheeler *et al.* (34–36) showed that high juvenile mortality in early domestic herds resulted in abundant archaeological remains of neonates, infants, and yearlings. Such juvenile age classes were absent at Cerro Azul. The overwhelming majority of camelid bones found in Structures D and 9 are from adults, the age group typical of transport caravans (11). We know that such llama caravans arrived at Structure D because their dung pellets were found on the floor of its Southwest Canchón. We presume that they came to Cerro Azul periodically to deliver inland products and carry away dried fish. At that time, the occupants of the site could have obtained an adult llama through barter. Another potential source of llama meat for coastal sites was *charqui*. One burial at Cerro Azul was provided with just such a ration of *charqui*—the complete desiccated lower hind leg of a white llama, from distal tibia to hoof.

Figs. 6 and 7 compare camelid remains from the Feature 6 midden (Structure D) and the Feature 20 midden (Structure 9). The occupants of Structure D, which included elite individuals, seem to have had periodic access to whole carcasses of

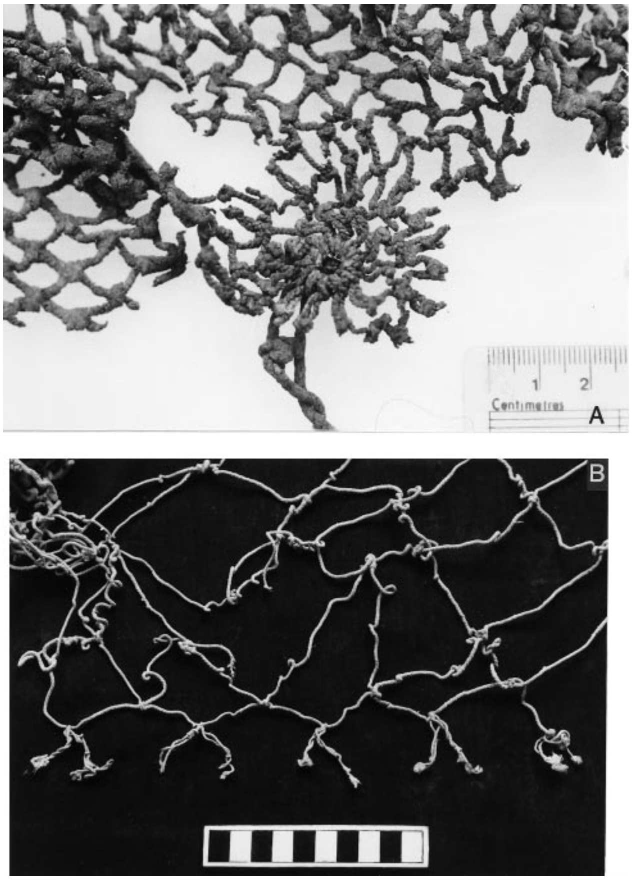

FIG. 5. Two varieties of fishing nets from Late Intermediate burials at Cerro Azul. (*A*) Photo of the center of an *atarraya* (circular cast net), consisting of 11 paired cords tied with cow-hitch knots to form a central ring. (*B*) The lower border of a *red de cortina* (curtain net), showing paired sets of dangling cords that once held weights (scales in centimeters). This figure has been published previously (26).

adult camelids. The commoners living in Structure 9, on the other hand, seem not to have had access to whole animals, relying on pieces of *charqui* that occasionally contained limb bones or vertebrae. Thus, Cerro Azul probably received both *charqui* and occasional complete llamas from visiting caravans, but it was the elite families who got most of the latter.

As Fig. 6 shows, the metapodial or cannon bone was underrepresented in the camelid remains from the Structure D

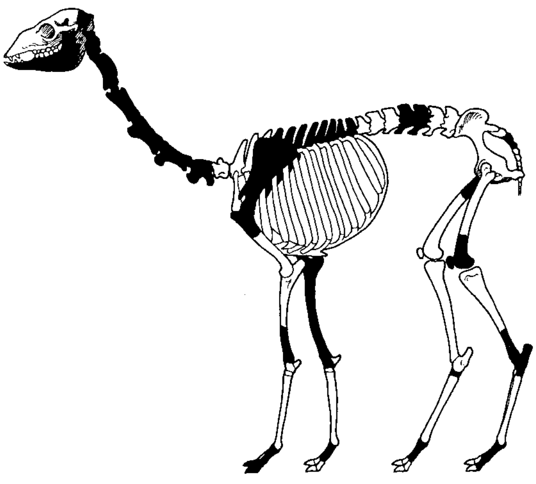

FIG. 6. Camelid bones present in the Feature 6 midden (Structure D) have been blackened on this drawing of a llama skeleton. (There were 119 camelid bones in the midden.)

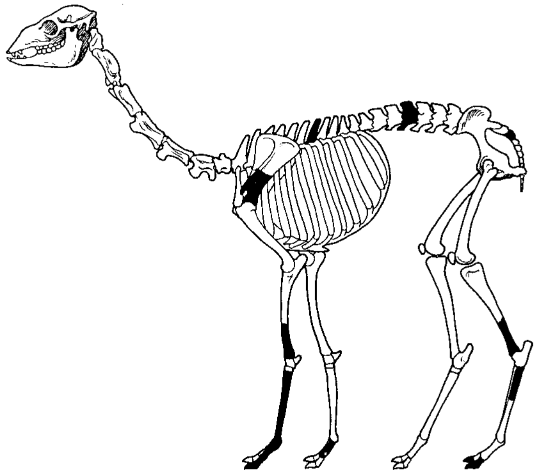

FIG. 7. Camelid bones present in the Feature 20 midden (Structure 9) have been blackened on this drawing of a llama skeleton. (There were 61 camelid bones in the midden.)

midden. This is perhaps explained by the saving of metapodials to make bone tools such as *chocchikuna*, or weaving swords, which the elite women of Cerro Azul used with small backstrap looms (ref. 26, figures 53 and 54). The occupants of Structure 9 seem not to have been involved in weaving and thus were less concerned with saving metapodials (Fig. 7).

The Raising of Guinea Pigs

One mammal definitely kept and cared for at Cerro Azul was the guinea pig, *Cavia porcellus*, some 377 fragments of which were found in Structures D and 9. Data from Rooms 9 and 10 of Structure D (Fig. 2) gave us insight into how this was done. Room 9 had a 10- to 15-cm layer of guinea pig droppings on its floor; Room 10 contained decomposing bedding (and perhaps also fodder) for these domestic rodents. The two rooms were separated by an informal wall, low enough for a human to step over but too high to be scaled by a guinea pig (ref. 26, figure 31).

Prehistoric Andean societies raised guinea pigs for both food and ritual; they were often used in curing and divination ceremonies. Several burials at Cerro Azul were supplied with whole guinea pigs, perhaps as food for the afterlife (ref. 26, figure 43*b*). Some of these were so well preserved that we can specify the coat color as brownish yellow.

Summary and Conclusions

Research at Cerro Azul indicates that economic specialization, at least at the level of fishing villages vs. farming villages, existed before the Inca conquest. It remains to be determined, however, whether this pattern can be traced back before the Late Intermediate. The Cerro Azul data do not suggest a finer division into "beach" or "sea cliff" specialists because fishermen seem to have been buried with nets for both environments.

Elite and commoner occupants had differential access to camelid meat and to different species of fish. Elite families occasionally obtained whole camelids or portions of *charqui* from visiting transport caravans whereas commoners seem only to have had access to *charqui.* Dried anchovies and sardines were the main fish products exported from Cerro Azul. Both also were consumed locally, with elite families showing a preference for sardines. Twenty species of larger fish were caught mainly for local consumption, with elite families getting most of the corvina and robalo and commoners getting most of the catfish. Under the aegis of a local hereditary lord, the occupants of Cerro Azul were part of a larger economic system in which agricultural and camelid products moved to the coast while fish moved inland.

We thank our project collaborators (María Rostworowski, Ramiro Matos, Charles Hastings, Kent Flannery, Dwight Wallace, C. Earle Smith, James Stoltman, and Sonia Guillén) and generous colleagues (Craig Morris, Duccio Bonavia, Michael Moseley, Jeremy Sabloff, Rogger Ravines, Jorge Silva, Christopher Donnan, Charles Stanish, Marc Bermann, Guillermo Cock, Rosa Stone, and Sandy Black) for their help. We gratefully acknowledge the support of the National Science Foundation (Grant BNS-8301542) and the advice of John Yellen and Charles Redman. We also thank Gerald Smith and Douglas Nelson of the Fish Division, Museum of Zoology, University of Michigan for their advice. Art work is by John Klausmeyer and David West Reynolds.

1. Donnan, C. (1978) *Moche Art of Peru* (Museum of Culture History, Los Angeles).
2. Donnan, C. & Cock, G., eds. (1997) *The Pacatnamu Papers: The Moche Occupation* (Fowler Museum, Los Angeles).
3. Morris, C. & von Hagen, A. (1993) *The Inka Empire and its Andean Origins* (Abbeville, New York), p. 11.
4. Idyll, C. P. (1973) *Sci. Amer.* **228** (6), 22.
5. Moseley, M. (1975) *The Maritime Foundations of Andean Civilization* (Cummings, Menlo Park, CA).
6. Sandweiss, D. H., McInnis, H., Burger, R., Cano, A., Ojeda, B., Paredes, R., Sandweiss, M. & Glascock, M. (1998) *Science* **281,** 1830–1832.
7. Keefer, D. K., deFrance, S., Moseley, M., Richardson, J., Satterlee, D. & Day-Lewis, A. (1998) *Science* **281,** 1833–1835.
8. Moseley, M. (1992) in *Andean Past*, ed. Sandweiss, D. H. (Cornell Univ. Latin Am. Studies Program, Ithaca, NY), Vol. 3, pp. 5–42.
9. Bonavia, D. (1996) *Los Camélidos Sudamericanos* (Instituto Francés de Estudios Andinos, Lima, Peru).
10. Murra, J. (1965) in *Man, Culture, and Animals*, eds. Leeds, A. & Vayda, A. P. (Am. Assoc. Adv. Sci., Washington, DC), p. 188.
11. Flannery, K. V., Marcus, J. & Reynolds, R. G. (1989) *The Flocks of the Wamani: A Study of Llama Herders on the Punas of Ayacucho, Peru* (Academic, New York).
12. Rostworowski, M. (1981) *Recursos Naturales Renovables y Pesca, Siglos xvi y xvii* (Instituto de Estudios Peruanos, Lima, Peru).
13. Rostworowski, M. (1970) *Revista Española de Antropol. Am.* **5,** 135–178.
14. Lizárraga, R. (1946) *Descripción de las Indias* (Loayza, Lima, Peru), Chapter 47, p. 90.
15. Rostworowski, M. (1977) in *The Sea in the Pre-Columbian World*, ed. Benson, E. P. (Dumbarton Oaks, Washington, DC), p. 173.
16. Thompson, D. E. (1967) *Am. Antiq.* **32,** 113–116.
17. Middendorf, E. W. (1973) *Perú* (Univ. Nacional de San Marcos, Lima, Peru), Vol. 2, pp. 92–93.
18. Williams, C. & Merino, M. (1974) *Inventario, Catastro y Delimitación del Patrimonio Arqueológico del Valle de Cañete* (Inst. Nacional de Cultura, Lima, Peru).
19. Hyslop, J. (1984) *The Inka Road System* (Academic, New York).
20. Hyslop, J. (1985) *Br. Archeol. Rep. Int. Ser.* **234**.
21. Stumer, L. (1971) *Arqueología y Sociedad* **5,** 23–35.
22. Morris, C. (1988) *Br. Archeol. Rep. Int. Ser.* **442,** 131–140.
23. Morris, C. (1998) in *Archaic States*, eds. Feinman, G. & Marcus, J. (School Am. Res., Santa Fe, NM), pp. 293–309.
24. Rostworowski, M. (1978) *Revista del Museo Nacional* **44,** 153–214.
25. Kroeber, A. (1937) *Field Museum Anthropol. Memoirs* **2,** 220–273.
26. Marcus, J. (1987) *Univ. Michigan Museum Anthropol. Tech. Rep.* **20**.
27. Marcus, J. (1987) *Am. Sci.* **75,** 393–401.
28. Marcus, J., Matos, R. & Rostworowski, M. (1985) *Revista del Museo Nacional* **47,** 125–138.
29. Shimada, M. & Shimada, I. (1985) *Am. Antiq.* **50,** 3–26.
30. Shimada, M. & Shimada, I. (1987) *Am. Antiq.* **52,** 836–839.
31. Topic, T. L., McGreevy, T. H. & Topic, J. R. (1987) *Am. Antiq.* **52,** 832–835.
32. Sandweiss, D. H. (1992) *Bull. Carnegie Museum Nat. History* **29**.
33. Samamé, M., Espino, M., Castillo, J., Mendieta, A. & Damm, U. (1983) *Boletín del Instituts del Mar del Perú* **7,** 114–191.
34. Wheeler, J. & Kaulicke, P. (1976) *Science* **194,** 483–490.
35. Wheeler, J. (1984) *Br. Archeol. Rep. Int. Ser.* **202,** 395–410.
36. Wheeler, J. (1984) *Boletín de Lima* **36,** 74–84.