Economic Directness in the Western Andes: A New Model of Socioeconomic Organization for the Paracas Culture in the First Millennium BC

Christian Mader, Markus Reindel, and Johny Isla

Economic directness is a new model of socioeconomic organization for the Paracas culture (800–200 BC) in southern Peru, with wider implications for economic theory of the prehispanic Andean past. Using an archaeoeconomic approach to analyze settlement patterns, obsidian artifacts, malacological material, and camelid skeletal remains, this study reconstructs the Paracas economy by using primary archaeological data from the northern Nasca Drainage. Its results force reconsideration of existing socioeconomic models for the ancient Andes such as verticality, circuit mobility, llama caravan mobility, transhumance, and market concepts. Whereas components typical of these models are often absent in the case of the Paracas economy, our new proposal of economic directness integrates their relevant aspects. Economic directness is defined essentially by direct access to important resources from diverse ecological tiers, direct and down-the-line exchanges, reduced transaction costs, llama caravan transport, unbalanced commodity flows across the western Andes, and forces of supply and demand with major consumption on the coast. These features formed under conditions of population growth, generating a continuous and dense settlement pattern from the Pacific coast to the highland puna zone.

Keywords: Paracas culture, Formative period, Andes, Peru, economic archaeology, settlement archaeology, exchange, mobility, obsidian, South American camelids

*La economía directa (*economic directness*) es un nuevo modelo para describir la organización socioeconómica de la cultura Paracas (800-200 aC) en el sur del Perú, con implicaciones en la teoría y el razonamiento económico sobre el pasado andino precolombino. Siguiendo un enfoque arqueoeconómico para analizar los patrones de asentamiento, los artefactos de obsidiana, el material malacológico y los restos óseos de camélidos, este estudio reconstruye la economía Paracas utilizando datos arqueológicos primarios de la parte norte de la cuenca de Nasca. Estos resultados nos obligan a reconsiderar los modelos socioeconómicos existentes para los Andes, como la verticalidad, la movilidad giratoria, la movilidad de las caravanas de llamas, la trashumancia y los conceptos de mercado. Aunque a menudo faltan los componentes típicos de estos modelos en la economía Paracas, nuestra nueva propuesta de economía directa integra aspectos relevantes de ellos. Economía directa se define esencialmente por el acceso directo a recursos importantes de diversos pisos ecológicos, el intercambio directo y en línea, la reducción de los costos de transacción, el transporte por caravanas de llamas, el desequilibrio en los flujos de bienes a lo largo de la vertiente occidental de los Andes, así como por fuerzas de oferta y demanda con un consumo mayor en la costa. Estos atributos se formaron en condiciones de incremento de la población, dando lugar a un patrón de asentamiento continuo y denso desde la costa del Pacífico a la zona de la puna en las tierras altas y asentamientos estratégicos.*

Palabras claves: cultura Paracas, Formativo, Andes, Perú, arqueología económica, arqueología de asentamientos, intercambio, movilidad, obsidiana, camélidos sudamericanos

The extreme topography and tremendous diversity of landscapes in the Andes always implied both economic opportunities and limitations for prehispanic societies. A great variety of raw materials and options for agricultural production were available across the diverse

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Latin American Antiquity 34(2), 2023, pp. 385–403

doi:10.1017/laq.2022.40

ecological zones between the Pacific coast in the west and the tropical lowlands in the east; yet the procurement of resources from distant regions created stark dependencies, particularly in extreme environments such as the arid coastal desert and the Andean highland plateaus. Securing a supply of raw materials and exchanges of goods required certain degrees of mobility, cooperation, and the division of labor with social stratification.

In the course of Andean research, a number of models have been formulated to explain the types, mechanisms, and characteristics of Andean socioeconomic interactions in specific time periods and regions (Browman 1975; Burger 2013; Earle and Jennings 2012; Lane and Grant 2016; Lynch 1971; Moseley 1975; Murra 1972; Nielsen 2013; Núñez and Dillehay 1995; Stanish and Coben 2013; Trimborn 1928). Most of these studies focus either on theoretical considerations or on data-driven observations, such that the two approaches rarely complement each other in a balanced way. We propose "economic directness" as a new concept to define the socioeconomic organization of the Paracas culture (800–200 BC), founded on testing how existing models correlate with archaeological evidence from the northern Nasca Drainage in southern Peru. The northern Nasca Drainage comprises the valleys of the Santa Cruz, Grande, Palpa (Llauta in the highlands), and Viscas (Laramate and Ocaña in the highlands) Rivers (Figure 1).

Based on comprehensive research in this study area by the long-term Nasca-Palpa Archaeological Project (Isla 2010; Isla and Reindel 2018; Reindel 2009; Reindel and Isla 2006, 2013a, 2017, 2018), we refine here the economic directness model, first formulated in detail in Mader (2019a). The main features of this model are direct access to a diverse range of commodities from various ecological levels, direct and down-the-line exchanges, reduced transaction costs, transport organized through llama caravans, unbalanced flows of goods across the western Andes, and forces of supply and demand

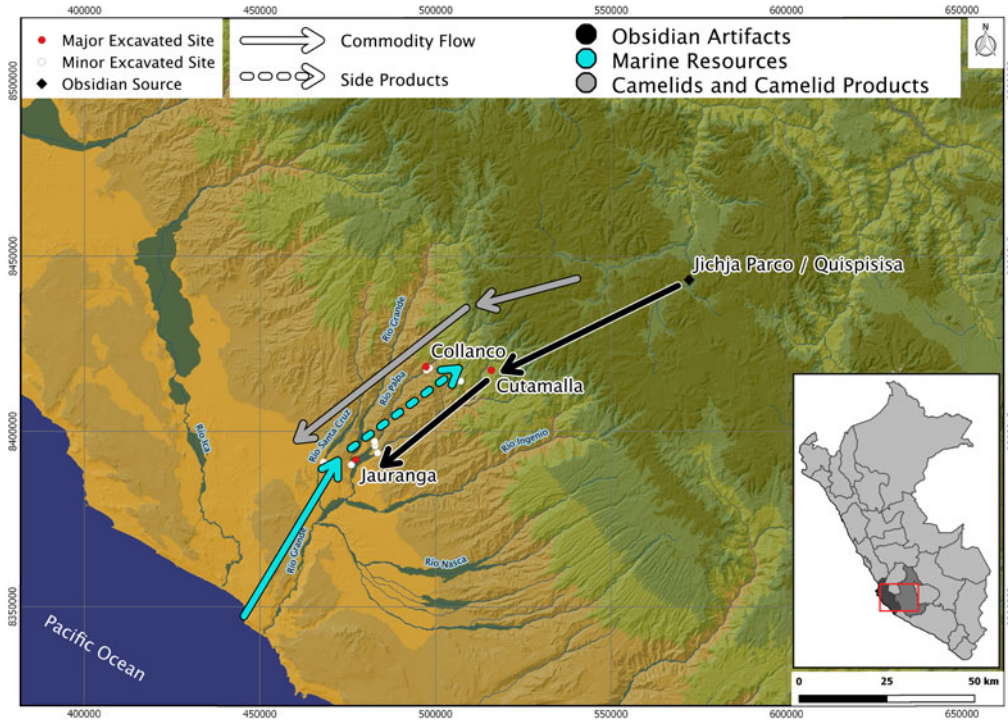

Figure 1. Map of the study area in the western Andes of southern Peru with a schematic reconstruction of commodity flows during the Paracas period (map courtesy of Christian Mader). (Color online)

https://doi.org/10.1017/laq.2022.40 Published online by Cambridge University Press

with significant consumption on the coast (Mader 2019b). These features formed under conditions of population growth, leading to a continuous settlement pattern from the Pacific coast to the puna zone above 4,000 m above sea level (asl) and strategic settlements (Soßna 2015). Thus, the term "economic directness" derives from direct access to resources, direct exchange, and indeed, direct archaeological evidence. It was the pattern of continuous and dense Paracas settlement along the western Andean slopes that enabled this direct access to diverse resources, including marine commodities, camelids, lithic materials, and agricultural goods. From an economic point of view, this scheme decreased actual trade processes over long distances and thereby transaction costs because most goods for daily use did not have to be exchanged with different cultural groups.

Furthermore, asymmetrical commodity flows across the western Andes, indicated by the available archaeological evidence, characterize the Paracas economy (Mader 2019a, 2019c). Whereas resources from the highlands—such as obsidian and camelid products—arrived on the Pacific coastal desert in large quantities, those from the coast—such as mollusks—reached the highlands only in very small quantities. Highland regions were not, however, merely places to procure important raw materials, for strategic centers were established there to coordinate the production, manufacture, and distribution of commodities. The availability and consumption of all kinds of products in coastal settlements seem to have been the major driving forces behind this economic organization, resonating throughout the Paracas social structure. Various lines of evidence, such as the much higher percentages of fine ware ceramics and more elaborated mortuary contexts on the coast compared to the highlands, strongly suggest that more privileged members of the Paracas society largely resided in coastal areas.

The features of economic directness evolved in southern Peru during the Formative period in the first millennium BC and became apparent especially in the Late Paracas phase (370–200 BC). These developments occurred not only alongside substantial growth in population and settlements, unprecedented in the study area of the northern Nasca Drainage, but also amidst a milieu of changing climate and increasing conflict (Fehren-Schmitz et al. 2014; Mächtle and Eitel 2013; Mader 2019a; Schittek et al. 2015; Soßna 2015). The new model of economic directness is the outcome of an archaeoeconomic approach applied to materials excavated in significant quantities, representing the sphere of everyday life of the Paracas people. This archaeoeconomic methodology entails the analysis of production, exchange, consumption, and social stratification patterns and their interconnections through the archaeological record (Feinman 2008). Complementing previous research designs, this approach also provides a fresh perspective on the constitution of the Paracas culture in the northern Nasca Drainage.

Although many types of archaeological data are consulted in this study, detailed analyses of settlement patterns, obsidian artifacts, malacological materials, and camelid remains offer particular evidence for the socioeconomic behavior of Paracas people and economic directness. The pool of analytical methods used includes the quantification, standardization, and artifact classification of archaeological finds; archaeometric techniques such as strontium isotope analysis of camelid teeth; and taxonomic identifications, primarily of mollusks. The finds come from 11 Paracas sites excavated by the Nasca-Palpa Archaeological Project in the northern Nasca Drainage (Figure 2)—particularly from large-scale excavations at Jauranga (285 m asl), Collanco (1,630 m asl), and Cutamalla (3,300 m asl)—thereby encompassing the entire research area also defined as the Andean Transect (for detailed discussions of excavation findings, see Mader 2019a; Reindel and Isla 2013b, 2017, 2018; Reindel et al. 2015).

We pay special attention to the economic concepts of verticality, circuit mobility, llama caravan mobility, Andean transhumance, and market exchange in our analysis of the Paracas case. None of those previous theoretical models for the ancient Andes, in and of themselves, sufficiently explain the varied aspects of the Paracas economy, evidence for typical elements such as vertical colonies and reciprocity being absent. Nonetheless, certain prevailing elements of those models such as zonal complementarity

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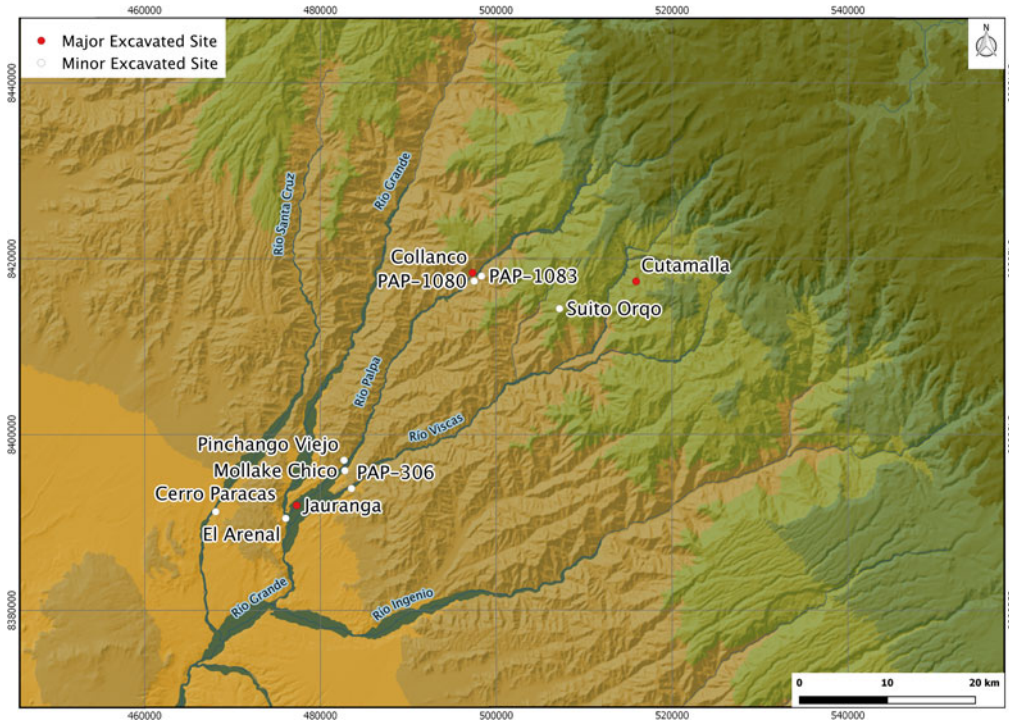

Figure 2. Map of the core study area showing the location of archaeological sites where the material analyzed in this article was excavated (map courtesy of Christian Mader). (Color online)

and direct access to resources are incorporated into the formulation of economic directness to describe the Paracas socioeconomic condition (Supplemental Table 1). The economic directness model we propose thereby integrates, equally, theory with primary archaeological data by this twofold research approach.

Andean Ideals: Established Models of Socioeconomic Interaction

Verticality and Ecological Complementarity

Verticality after Murra (1972, 1985a, 1985b) has certainly been one of the most influential socioeconomic models in Andean anthropology. In principle, the model depicts a population with a core area in a certain region of the Andes that gains direct access to raw materials or agricultural products from distinct altitudinal zones through the installation of permanent colonies in those territories, usually dominated by other cultural entities. The notion of these "vertical archipelagos" derives from analyses of ethnohistorical accounts, in particular documents of colonial *visitas* in the Peruvian highlands during the 1560s, edited in part by Murra (Espinoza 1964; Murra 1967; Murra, ed. 1972). The verticality model has since been used and discussed extensively in archaeological, ethnohistorical, cultural anthropological, and geographical studies (Aldenderfer 1989; Brush 1976; Dillehay 2013; Flores Ochoa 1972; Goldstein 2000; Hornborg 2014; Mayer 2002; Mujica 1985; Stanish 1989, 1992; Van Buren 1996).

Murra's (1972) five original cases convey an impression of the variable and hypothetical character of the verticality idea: (1) a small population in highland regions with permanent colonies below and above its core area, (2) a large population on the high plateau with permanent colonies on lower western and eastern Andean slopes, (3) a small coastal population with colonies in upper regions, (4) a large coastal population with permanent colonies in the highlands and access to goods from the eastern Andes, and (5) a small population in intermediate

https://doi.org/10.1017/laq.2022.40 Published online by Cambridge University Press

zones without vertical control. Various facets of verticality are accompanied by different terms such as vertical archipelago, vertical colony, vertical control, ecological complementarity, zonal complementarity, and reciprocity, each often used synonymously in the literature.

However, at least two forms of verticality should be distinguished (Stanish 1992): the specific model of land use with the establishment of economic colonies in other ecological tiers and cultural territories (vertical archipelago, vertical colony, and vertical control) contrasted with the broader framework simply for the economic use of several ecological zones and their resources (ecological and zonal complementarity). Although the flexibility of the verticality principle is doubtless part of its success as a model, its variability and, at times, vagueness also make it difficult to test verticality in archaeological contexts, not least because Andean geography almost always entails some degree of vertical and complementary economic practice.

From Circuit Mobility to Internodal Archaeology

Inspired by Murra's verticality, the concept of circuit mobility involves a revolving economic movement between strategic sites or axis settlements, thereby connecting different ecological floors (Dillehay and Núñez 1988; Núñez and Dillehay 1995). Llama caravans are fundamental to circuit mobility because these pack animals carried commodities for long-distance trade. The concept was designed as a comprehensive model over the *longue durée* of the south-central Andes, including Bolivia, northern Chile, and northwestern Argentina. Modes of mobility, so-called amplifications, define respective periods of time: exploratory or initial Archaic mobility (8000–1800 BC), transitional or initial mobility (1800–900 BC), pre-Tiwanaku productive mobility (900 BC–AD 400), complementary mobility convergent at Tiwanaku (AD 400–1000), post-Tiwanaku regional mobility (AD 1000–1450), mobility controlled by the Inka (AD 1450–1525), and Andean mobility versus mercantilism in the colonial era.

In addition to the application of circuit mobility in other studies (Berenguer 2004; Sepúlveda et al. 2005), the model served as an important basis for further conceptual developments for the movement of people, camelids, and things in the prehispanic south-central Andes. One of these is the notion of internodal archaeology exploring interregional interaction through an emphasis of archaeological remains from areas between settlements or nodes (Berenguer and Pimentel 2017; Nielsen 2013, 2017; Nielsen et al. 2019). Internodal archaeology thus shifts the focus of interest to features such as roads and paths, caravanserais and camps, seasonal sites, and landmarks. Ultimately, circuit mobility and internodal archaeology represent variants of network thinking in archaeological analysis, which has become an effective tool for understanding past social and economic relationships (Collar et al. 2015; Kerig et al. 2019).

Llama Caravan Mobility

In contrast to other parts of the Americas, Andean societies could make use of the only domesticated cargo animal in the New World, the llama (*Lama glama*), and there is a broad consensus in Andean studies that most long-distance exchange in prehispanic times was managed through the operation of camelid caravans (Berenguer 2004; Briones et al. 2005; Browman 1975; Clarkson and Briones 2001; Núñez 1976; Sepúlveda et al. 2005; Siveroni 2017; Tripcevich 2007; Yacobaccio 2012). Approaches explaining the circulation of commodities using camelids as beasts of burden were summarized in Nielsen's (2013) "caravan mobility model."

Using llama caravans for transport dates to at least the beginning of the Formative period, around 1700 BC (Núñez and Dillehay 1995). Although remains of a complete caravan have never been found (so far as we are aware) and are unlikely ever to be excavated in situ, there is copious indirect evidence for llama caravans, such as caravan sites and landscapes, including seasonal camps, strategic junction sites, petroglyphs with depictions of camelids and caravans, geoglyphs, shrines and landmarks, trails, corrals, and extensive highland pastures; high densities of excavated camelid bones indicating intensive husbandry and mobility of camelids; and the raw materials and products of interregional trade in archaeological contexts.

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Llama caravan mobility has also been investigated through ethnoarchaeological and experimental research as scholars have accompanied and studied some of the few llama caravans that still operate today (Lecoq 1987; Nielsen 1998, 2013; Tripcevich 2016). Although the extent and nature of caravan transport has changed dramatically, data obtained from still extant examples provide useful insights into their prehispanic operation: a single llama can usually carry between 23 and 40 kg (depending on the distance traveled), and a caravan can cover distances of between 15 and 30 km per day with 6–10 hours of traveling (Browman 1974; Clarkson and Briones 2001; Tripcevich 2007).

Andean Transhumance and Pastoralism

The term "transhumance" in Andean archaeology is associated with the works by Lynch (1971, 1975, 1983) that emphasize its distinct character compared to other economic models such as the vertical archipelago and modes of systematic exchange, especially in early forms of mobility. Transhumance is a variant of pastoralism involving the seasonal migration of livestock for access to different pasturelands. In the Andes, as a montane ecosystem par excellence, it entails the movement of herds and herders between different ecological spheres according to altitude. Certainly, South American camelids were of importance to prehispanic societies in many ways beyond their critical role in Andean economies that was already discussed. In addition to the exploitation of llamas as pack-bearers in caravans, camelids were treasured principally for their meat and wool, in the latter case predominantly from the other domesticated species, the alpaca (*Vicugna pacos*).

Almost every part of the animal provided resources, including its skin, tendons, bones, bone marrow, tallow, blood, and dung. Moreover, camelids were important in ritual and wider social purposes and as a source of surplus and reserve (Browman 1974, 1975). Integral to extensive camelid utilization were intensive pastoral activities. Pastoralism, the management of mobile herds, is an embedded economic strategy affecting sociopolitical, ideological, religious, and ecological aspects of life (Tripcevich and Capriles 2016). Transhumance and pastoralism also frequently occur simultaneously with other economic activities, such as arable farming and trade.

Markets

Andean anthropology and archaeology have long been dominated by an "anti-market mentality" (Cook 1966), not least because of the huge influence of substantivism on prominent scholars such as Murra (1995). With few exceptions (Hartmann 1971), this negation of the possible significance of markets in the prehistoric Andes has only recently abated (Hirth and Pillsbury 2013). According to Stanish and Coben, for instance, "There were markets in the prehistoric Andes. Andean markets were based on barter exchange without the use of currencies, price swings, and an independent class of traders" (2013:423). But what actually is a market, and how can they be identified in the archaeological record? There is indeed no accepted universal definition of a market, and market concepts can differ substantially, depending on the academic discipline, application, and perspective. Here, we introduce and clarify notions of marketplaces, markets in terms of economics, market exchange, and barter markets, because these distinctions are relevant to the debate about their putative roles in Andean prehistory.

A marketplace is a physical location where the exchange of commodities and services takes place. Often, these public settings imply additional socioeconomic purposes and activities such as pilgrimage. As straightforward as this definition is, it is still extremely problematic to distinguish direct archaeological evidence for marketplaces from that found in other places where economic transactions occurred. Among the reasons for this difficulty is the multifunctional and transitory nature of marketplace activities, which usually leave behind few remains. Archaeological indicators for a marketplace could include a public site alongside finds of the means of exchange, such as types of money, (standardized) weights and measurements, and garbage. Yet it remains to be established how developed were forms of money and weight and measurement systems in the prehispanic central Andes. Because of these problems, a common approach to detecting

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marketplace exchanges archaeologically is to take households and their provision as a starting point (Burger 2013; Hirth 1998).

In contradistinction to marketplaces, a market in terms of economics does not need to be a physical place but is rather a form of organization in which comparable goods, as well as services, labor, land, and any kinds of capital, may be exchanged. Supply and demand create the conditions for such a market, but it does not necessarily require a monetary system. Market exchange is therefore more abstract than marketplace exchange and means only that commodity flows in one direction are balanced, though not necessarily synchronously, with commodity flows in the other (Garraty 2010; Pryor 1977).

Price-making markets, the development toward corresponding prices for corresponding products, seems not to have played a role in the economies of the ancient Andes, thereby bringing to the fore their apparent counterpart: barter markets. These entail direct exchange of commodities and services without the use of money. In addition to its economic interaction, barter exchange is a significant social act involve the institutional, political, ideological, and religious background of its trading partners (Stanish and Coben 2013). In sum, whether Andean markets existed or not is, as so often the case, ultimately a question of definition and available archaeological data.

The Paracas Economy: Archaeological Evidence from the Northern Nasca Drainage

Settlement Pattern

Since its earliest definition in the 1920s by Tello (2005; Tello and Mejía Xesspe 1979), the Paracas archaeological culture has been conceived of as a coastal phenomenon unfolding in the first millennium BC between the Cañete and Acarí Valleys of southern Peru, although its interaction sphere was wider (Balbuena 2013; Canziani 2013; Cook 1999; DeLeonardis 2005; Dulanto 2013; Dulanto et al. 2019; Kriss et al. 2018; Peters 1988; Tantaleán et al. 2013, 2017; Young 2017). Yet our recent findings in the northern Nasca Drainage demonstrate that Paracas settlement extended continuously across the entire western flank of the Andes up to the puna highlands (Reindel and Isla 2017, 2018; Reindel et al. 2015). This Paracas settlement pattern across the western Andes facilitated access to important resources between the Pacific Ocean shore and the Quispisisa/Jichja Parco obsidian source further inland at 4,100 m asl.

Following Pulgar Vidal's (1981) ecozonation, this Andean Transect research area comprises the *chala*/coast (0–500 m asl), the yunga *marítima* (500–2,300 m asl), the *quechua* (2,300–3,500 m asl), the *suni* (3,500–4,000 m asl), and the puna (4,000–4,800 m asl). Each ecological level conveys different raw materials and economic possibilities. Over merely 120 km west to east, the study area of the Nasca-Palpa Archaeological Project rises from the Pacific shore to the summit of Cerro Llamocca at 4,487 m asl. Our surveys, excavations, and analyses have documented the evolution through time of a dense Paracas occupation, with a dramatic increase in population toward the end of the Formative period, around 200 BC (Isla 2010; Isla and Reindel 2018; Reindel 2009; Reindel and Isla 2006, 2013a, 2017, 2018; Soßna 2015; Unkel et al. 2012).

The increase of the Paracas presence in the study area is shown by 20 settlements with components of the Early Paracas phase (800–550 BC), 64 settlements with components of the Middle Paracas phase (550–370 BC), 165 settlements with components of the Late Paracas phase (370–200 BC), and 149 settlements with components of the transitional Initial Nasca phase (120 BC–AD 90). In this article we examine archaeological materials excavated at 11 Paracas sites: Jauranga (PAP-150; 285 m asl), El Arenal (PAP-78; 350 m asl), Cerro Paracas (PAP-1142; 450 m asl), Mollake Chico (PAP-435; 458 m asl), PAP-306 (459 m asl), Pinchango Viejo (PAP-11; 480 m asl), Collanco (PAP-1077; 1,630 m asl), PAP-1083 (1,853 m asl), PAP-1080 (1,935 m asl), Suito Orqo (PAP-873; 2,925 m asl), and Cutamalla (PAP-767; 3,300 m asl). Most of the data discussed derive from Jauranga, Collanco, and Cutamalla, in which large-scale excavations were performed. Each of these three settlements is situated at distinct elevations, so each reflects distinct ecological environments.

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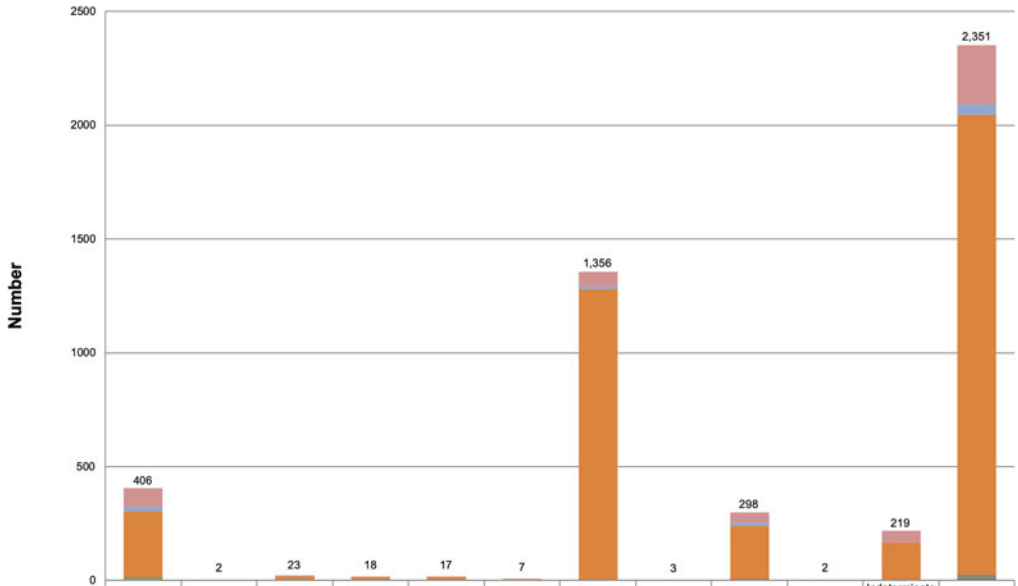
Jauranga was a domestic settlement and burial ground on a fertile alluvial plain of the Palpa Valley, today comprising agricultural fields. The site is located in the coastal *chala* zone, around 55 km from the Pacific Ocean (Isla et al. 2003; Reindel and Isla 2013b). Collanco is also in the Palpa Valley but farther upstream in the western yunga zone, the intermediate area between the coast and the highlands. Its domestic settlement is associated with a system of agricultural terraces and irrigation canals, together forming a large archaeological complex over approximately 2.5 km^2 (Reindel et al. 2015). Cutamalla lies in the highland *quechua* zone above the Laramate River. The settlement is situated along a mountain ridge: it consists of a domestic Sector A in its southern part, a more public Sector B in its northern part, and agricultural terraces that cover the slopes around the central area. Cutamalla, especially its Sector B, can be considered as the type site for the so-called flower structures: an architectural pattern we have recently identified that comprises an inner circular patio with a diameter of approximately 20 m surrounded by D-shaped units and that likely served for multipurpose economic activities (Mader 2013; Reindel and Isla 2017, 2018).

Obsidian Artifacts

Obsidian was a valued lithic material by the Paracas culture (Burger 2007; DeLeonardis and Glascock 2013; Van Gijseghem 2006), and—compared to other lithics—it was their key preferred material for the production of formal stone tools and weapons in the northern Nasca Drainage (Mader 2019a). The obsidian assemblage analyzed here is composed of 2,351 artifacts, classified into formal tools, which were modified by retouch; and debitage, which were lithic waste products of formal tool fabrication without evidence of intended surface alteration (Figure 3). Artifacts were classified and then subject to a combination of analyses: geochemical characterization, quantification, standardization, and cortex analysis. Using the methodological framework of the lithic reduction sequence



	Points	Drills	Scrapers	Invasively retouched pieces	Retouched flakes	Other retouched tools	Flakes	Cores	Shatter	Raw material pieces	Indeterminate tools and debitage products	Total
Jauranga	84	0	5	2	2	1	63	3	45	0	53	258
Collanco	18	0	0	0	0	0	13	0	14	0	0	45
Cutamalla	292	2	17	15	15	6	1,279	0	234	2	162	2,024
Pinchango Viejo	1	0	0	0	0	0	0	0	0	0	0	1
Mollake Chico	1	0	0	0	0	0	0	0	1	0	4	6
Suito Orqo	6	0	0	0	0	0	0	0	0	0	0	6
PAP-1080	0	0	1	1	0	0	0	0	2	0	0	4
Cerro Paracas	4	0	0	0	0	0	1	0	2	0	0	7

Figure 3. Overview of obsidian artifacts analyzed in this article. (Color online)

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(Andrefsky 2005, 2009; Kooyman 2000; Odell 2004; Shott 2003) together with a continuum approach (Shott 2017), we study the whole chain of the obsidian economy across the Paracas spatial context: from raw material procurement and distribution to tool manufacture, utilization, maintenance, repair, and discard.

Geochemical characterization by neutron activation analysis (NAA) and X-ray fluorescence (XRF) analysis of obsidian artifacts and geological reference samples demonstrated that the obsidian raw material used by Paracas people in the northern Nasca Drainage was obtained almost exclusively (93%) from the Quispisisa source, and more precisely its Jichja Parco outcrop, in the high-altitude puna of the Ayacucho Region (Gräfingholt 2016; Reindel et al. 2013; Stöllner et al. 2013). Quispisisa/Jichja Parco was one of the most significant mines in the prehispanic central Andes, as evidenced by the extensive distribution of its obsidian over distances up to 1,000 km (Burger and Glascock 2000; Matsumoto et al. 2018; Tripcevich and Contreras 2011, 2013).

The first stages of lithic reduction were already carried out at Quispisisa/Jichja Parco, where nodules were selected, tested for their quality, and reduced in size for transport (Figure 4). Obsidian lithics were then brought to regional centers in the highlands such as Cutamalla, located at a straight-line distance of 63 km from the Quispisisa/Jichja Parco obsidian quarry. The high concentrations of obsidian artifacts excavated at Cutamalla (4.8 g/m^3), in particular debitage primarily consisting of cortical and noncortical flakes, as well as shatter, reveal the economic importance of such centers, above all for tool production and the distribution of the material into other regions (Figure 5). Another settlement likely to have played a similar role in the Paracas obsidian economy is Huayuncalla (3,100 m asl), also sited on a mountain ridge opposite Cutamalla, and which maintained this function even into the Wari Middle Horizon (AD 600–1000; Isla and Reindel 2014; Reindel and Isla 2017, 2018). Notwithstanding the significance of these strategic centers, further reduction stages may have occurred anywhere throughout the journey from the Quispisisa/Jichja Parco source to the temporary and ultimate destinations of obsidian artifacts; therefore, this should be understood as a continuous process through space and time.

An overall exchange pattern directed west from the highlands to the lowlands was driven largely by the widespread demand for obsidian tools at coastal sites such as Jauranga and Cerro Paracas, and yet not all finished products were transported. Debitage excavated at Jauranga shows that formal tools were also fabricated on the coast, albeit on limited scales and including maintenance such as resharpening. Across the entire Andean Transect, obsidian modification was clearly directed toward the manufacture of points: a broad lithic category by which we mean any hafted tool with the morphology of a point, including projectile points, arrowheads, spearheads, and knives. Other knapped stone tools used to a lesser degree by Paracas people included scrapers, drills, and retouched flakes. Flakes without retouch could, of course, have served as expedient or informal tools, requiring relatively little effort to make.

Malacological Material

Seashells from archaeological contexts across the northern Nasca Drainage reveal a movement of commodities from the Pacific coast to the highlands during the Paracas period, although in a very different mode compared to the flow of obsidian artifacts. The large quantities and the variety of marine and terrestrial mollusk remains found at coastal Paracas sites testify to their significant economic value across the whole *chala* region (Beresford-Jones et al. 2009; Mader 2019a). This picture is affirmed by malacological finds excavated at Jauranga (7.9 g/m^3) and Cerro Paracas (17.8 g/m^3), where mollusks were consumed most notably as food and expedient tools, but also as offerings, and to make containers, jewelry, and other ornaments. The marine bivalves *Aulacomya atra*, *Choromytilus chorus*, *Mesodesma donacium*, *Mulinia edulis*, and *Perumytilus purpuratus* and the terrestrial gastropod *Bostryx* sp. dominate these archaeomalacological assemblages from coastal settlements (Supplemental Table 2).

Malacological material was also excavated at Collanco (0.3 g/m^3) and Cutamalla (0.1 g/m^3) at far higher elevations, albeit in smaller quantities, suggesting that its economic and nutritional

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Figure 4. Elongated open pit quarry at the Quispisisa/Jichja Parco obsidian source (photo courtesy of Christian Mader). (Color online)

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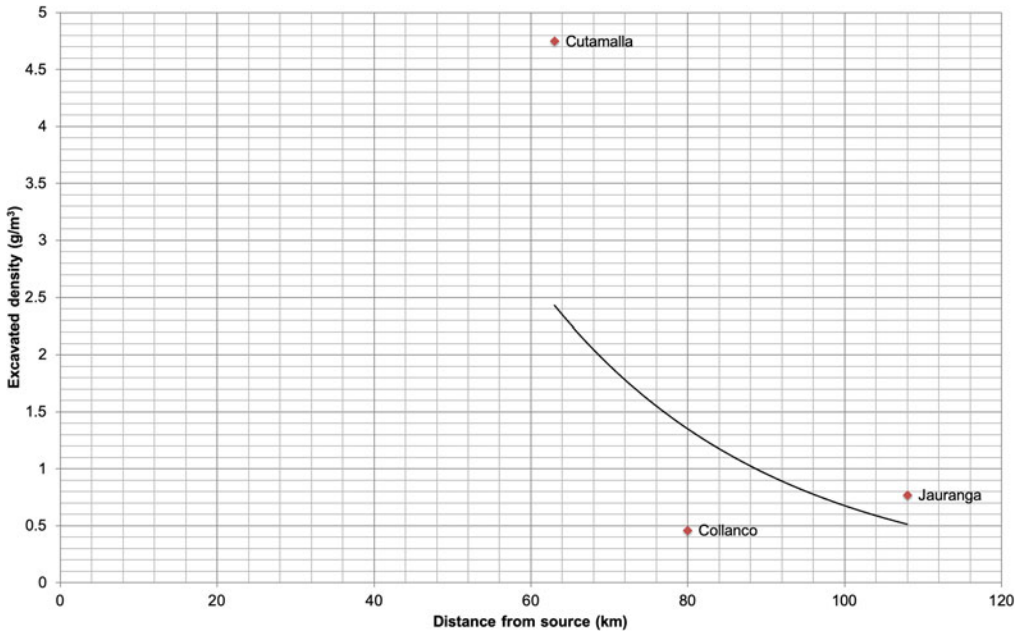

Figure 5. Fall-off curve showing the exponential distance decay of obsidian artifacts in the Andean transect study area. The excavated densities of obsidian from Jauranga, Collanco, and Cutamalla are plotted against the direct distances from the Quispisisa/Jichja Parco obsidian source, where the largest portion of the raw material was procured (for further explanations about fall-off analysis in archaeology, see Renfrew 1975, 1977).

importance decreased drastically with increasing altitude and that it reached the highlands principally as byproducts (Figure 6). *Choromytilus chorus* fragments are conspicuous in the Collanco and Cutamalla assemblages, several with use wear on their exteriors; the movement of this material so far into the mountains is evidence of their value as expedient tools with a specific purpose, perhaps in the production of ceramics and leather.

Comparisons with modern distributions on the south coast of Peru suggest that Paracas people harvested marine mollusks locally, likely at shortest distances, in both sandy beach and rocky headland habitats lying, in this case, at the estuary of the Río Grande. Other marine resources forming part of Paracas subsistence may have included fish, crustaceans, seaweeds, and seabirds; they may have undergone processes of preservation such as drying, salting, or smoking, although there is little evidence for this at Paracas sites in the research area.

Camelid Skeletal Remains

High densities of camelid bones excavated at Paracas settlements in the Andean Transect, particularly at Cutamalla (46.4 g/m^3), are evidence of intensive llama and alpaca husbandry and the varied exploitation and significance of the animals. All skeletal elements, including skulls and foot bones, are part of the archaeological record. Excavations at Jauranga even revealed a complete camelid skeleton (Figure 7). From this evidence we infer significant llama caravan transport, alongside the production of wool and meat as main products of camelid management. Skeletal remains were quantified, standardized, and examined zooarchaeologically, and we conducted strontium (Sr) isotope analyses on tooth enamel samples from 30 individuals from Jauranga, Collanco, and Cutamalla (Mader 2019a).

The application of strontium isotope analysis on teeth is an appropriate method to explore the whereabouts of mammals during their birth and juvenile years and, thus in our case, the breeding areas of llamas and alpacas (Hölzl et al. 2007; Slovak and Paytan 2011). Results from all three settlements show similar $^{87}Sr/^{86}Sr$ ratios, despite the fact that each site is located in very different altitudinal vegetation zones along the western

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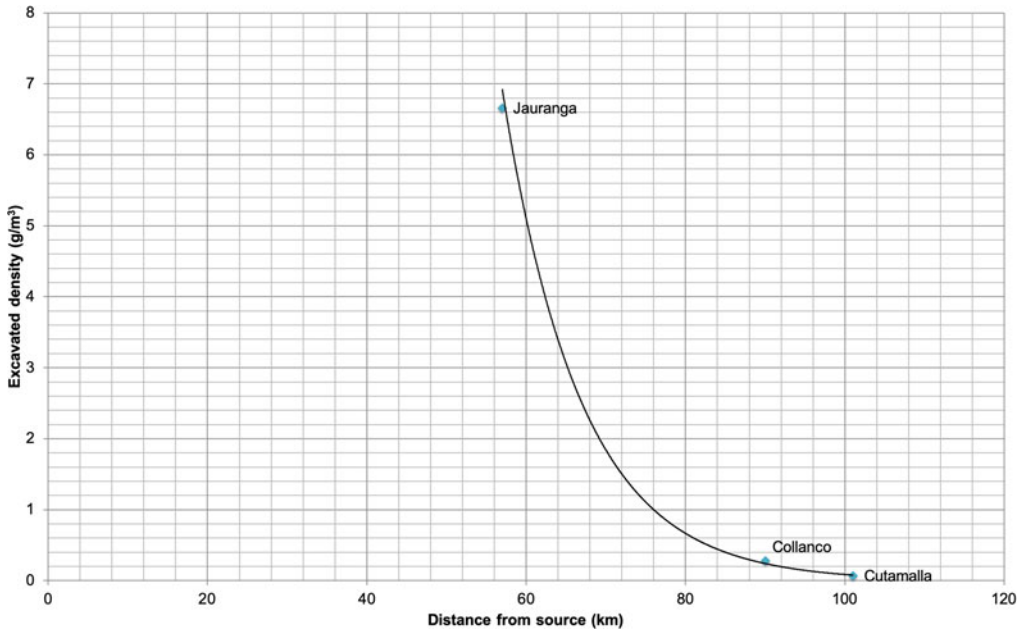

Figure 6. Fall-off curve showing the exponential distance decay of marine mollusk remains in the Andean Transect study area. The excavated densities of marine mollusks from Jauranga, Collanco, and Cutamalla are plotted against the direct distances from a point where the Río Grande flows into the Pacific, considered here as the "source" of mollusks for ease of calculation.

Figure 7. Excavating a complete camelid skeleton at Jauranga (photo courtesy of Johny Isla). (Color online)

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Andean gradient (Mader et al. 2018). Reference data from 277 environmental and archaeological samples indicate that the isotopic signatures of the camelid teeth correspond with the $^{87}Sr/^{86}Sr$ range of the Ayacucho Region of the study area (Horn et al. 2009). We deduce, therefore, that the domesticated camelids used by Paracas people mostly originated and were raised in the highlands. Because higher $^{87}Sr/^{86}Sr$ values of a few analyzed camelids overlap with $^{87}Sr/^{86}Sr$ ratios typical of both the highlands and the coast, the possibility remains that some animals may have been reared in ecological zones at lower altitudes.

General highland origins of Paracas camelids are also supported by the standardized quantities of excavated bones, particularly by their fall-off pattern toward the coast (Figure 8). For the manufacture of the famous Paracas textiles, Reindel and colleagues (2015) propose a sequence in which camelids were herded for fiber in the highland *suni* and puna zones where there is an abundance of ancient corrals; wool was processed mostly at sites such as Cutamalla in the *quechua* zone, before semi-finished materials such as spun and dyed yarns were distributed to the coastal *chala* zone for the final textile weaving steps.

Paracas fabrics, which can be very well preserved in the dry climate of the *chala*, are generally woven of both camelid wool and cotton (*Gossypium barbadense*) that grows in coastal ecosystems, suggesting that final textiles were largely manufactured on the coast. Cotton could have been moved into the highlands too, but there is no evidence for such a commodity flow in the archaeological record. The production and distribution of camelid meat, especially preserved as air- and freeze-dried *ch'arki* that would require highland conditions, likely followed in similar fashion from the highlands to the lowlands (Miller and Burger 1995, 2000). In sum, our findings strongly suggest not only a high degree of mobility of camelids and camelid products in the Paracas period but also that—alongside obsidian artifacts—they formed another flow of goods from the highlands to the coast.

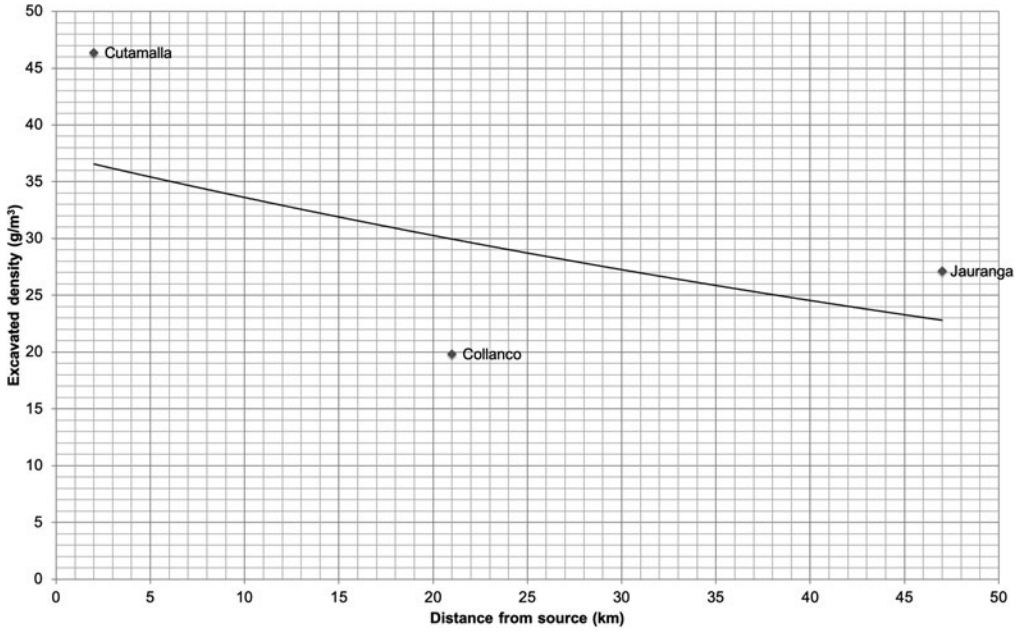

Figure 8. Fall-off curve showing the exponential distance decay of camelid skeletal remains in the Andean Transect study area. The excavated densities of camelid bones from Jauranga, Collanco, and Cutamalla are plotted against the direct distances from a point in the highlands near Cutamalla, considered here as the "source" of camelids for ease of calculation.

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Discussion and Conclusions

None of the established models of the prehispanic Andean economy adequately satisfy the detailed patterns of archaeological evidence from across the northern Nasca Drainage that we set out in detail here. The absence of their characteristic elements and the fact that single prevailing attributes are insufficient to describe the Paracas case compel a reassessment, which led to our formulation of the new model of economic directness. This model synthesizes relevant aspects of those previous models to conform better with that archaeological evidence, thereby offering a new perspective on Paracas socioeconomic organization. Those elements of existing socioeconomic models relevant to economic directness include, inter alia, direct access to resources and zonal complementarity following the verticality principle; strategic settlements and long-distance exchange articulated by llama caravans in circuit mobility; the intensive use of llamas and alpacas evidenced by the large quantities of camelid skeletal remains, campsites, corrals, and extensive highland pastures in caravan transport and transhumant mobility; and direct exchanges and forces of supply and demand according to economic market concepts. Typical elements and straightforward evidence of previous socioeconomic models missing from our archaeological case study include vertical archipelagos or colonies, reciprocity, revolving movements of commodities, marketplaces, marketplace exchange, market economies, and price-making markets.

Among the new insights offered by the economic directness model are aspects of settlement and demography and how they affected raw material access and socioeconomic transactions: in particular the continuous coast-highland settlement pattern of the Paracas culture; considerations of market principles, long neglected in Andean archaeology; and exchange processes—especially the unbalanced commodity flows—that it seems were not based on reciprocity, traditionally regarded as fundamental to order and life in the prehispanic Andes, but rather on forces of supply and demand, albeit without the use of money. At the current state of research, we can only speculate whether and how these flows of goods may have been compensated for through other commodities, services, or ideological values and performances, which may be difficult to see in the archaeological record.

The Paracas period was apparently extremely dynamic, showing significant increases in settlements and population, new influences, and sociopolitical and economic innovations, which culminated eventually in the transformation into a distinct archaeological culture, the Nasca (200 BC–AD 600). There are also signs of increased violence and conflict, notably during the Late Paracas phase, which are evidenced by defensive architecture in the form of stone walls and ditches and a variety of weapons such as projectile points, spearheads, clubs, axes, and sling stones (Mader 2019c; Soßna 2015). Although the precise causes of this conflict may still be debated, they seem likely to be correlated with a growing population and possible immigration to the area, alongside climatic changes, with consequent competition for control over resources such as farmland, water, obsidian, and other raw materials. These armed conflicts had important economic repercussions as situations of combat typically increase demand for certain resources such as those needed to cover basic needs and produce weapons.

The socioeconomic developments of the Paracas period are ultimately also an important example of the adaptability and variability of Andean economies. The model of economic directness reflects these adaptations for this period in southern Peru with time-specific and persistent parameters. Similar in-depth archaeological examinations are largely lacking for other time periods and regions of the prehispanic Andes. Such comparable studies are needed for a more comprehensive understanding of socioeconomic strategies and adaptations over the long-term perspective: one of our research objectives is to conduct such studies. The new model we propose is a good starting point.

Indeed, a critical principle underlying the model of economic directness and serving as a broader analytical framework for future research is what we call "resource dependency." Resource dependencies entail two significant forms of structural dependency within their particular sociopolitical and ecological setting: human

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dependencies on resources of every kind and the accessibility and control of those resources are crucial to dependencies between people, reflected, for instance, in cooperation and exploitation. These two forms of dependency profoundly affect each other, because the way humans interact will shape their dependency on resources. Thus, reconstructing the Paracas economy by combining theoretical and data-driven investigations through the new model of economic directness offers an integrated and symmetrical methodology by which to approach other socioeconomic systems of the past and will be pathbreaking for future research.

Acknowledgments. This study, representing one of the latest stages of the long-term Nasca-Palpa Archaeological Project, would not have been possible without the help of numerous institutions and collaborators over the last few years. Although there is no space to list them here, we greatly appreciate all this support. We wish to specifically thank Mareike Röhl, Shabnam Moshfegh Nia, and Danitza L. Márquez for their invaluable efforts and patience in creating the online catalog and database of Paracas archaeological materials used in this article (Mader 2019c). We also want to acknowledge and thank Manuel Gorriti for his taxonomic identifications of archaeomalacological remains. Lastly, we are grateful to David Beresford-Jones and four anonymous reviewers for their helpful comments and suggestions on the manuscript.

Data Availability Statement. Access to the data considered in this article is provided by the Arachne digital archive of the German Archaeological Institute at https://arachne.dainst.org/project/faak16 (Mader 2019c). A list of relevant archaeological contexts with their corresponding sites is available in Mader (2019a:184–211). Physical collections of the archaeological finds by the Nasca-Palpa Archaeological Project are curated at the Regional Museum of Ica, Peru. Remains of the camelid teeth examined for strontium isotope analysis are stored at the RiesKraterMuseum Nördlingen, Germany.

Competing Interests. The authors declare none.

Supplemental Material. For supplemental material accompanying this article, visit https://doi.org/10.1017/laq.2022.40.

Supplemental Table 1. Overview of Economic Directness with Prevailing and Nonprevailing Aspects of Existing Economic Models for the Prehispanic Andes.

Supplemental Table 2. Archaeomalacological Assemblage Excavated at Jauranga.

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Submitted January 15, 2021; Revised July 9, 2021; Accepted March 10, 2022