ARTICLES

COMPLEXITY, HIERARCHY, AND SCALE: A CONTROLLED COMPARISON BETWEEN CHACO CANYON, NEW MEXICO, AND LA QUEMADA, ZACATECAS

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Archaeologists have held a lengthy debate around the question of complex sociopolitical organization in the prehistoric American Southwest. Recent theory, though, urges scholars to "unpack" the properties of complexity. In this paper a southwestern regional center is compared with one on the northern Mesoamerican periphery in terms of properties generally associated with sociopolitical complexity: population size, labor investment in monumental construction, extent of road systems, mortuary practices, and symbolism of integrative facilities. Contrary to the conception of Mesoamerican societies as larger and more politically centralized, Chaco Canyon appears to have been organized at a larger scale than La Quemada. Yet it is argued that La Quemada was more hierarchically structured. Correctly evaluating complexity in both nature and degree is not only theoretically significant, but has implications for particular models of long-distance interaction between such large centers.

Hace tiempo que los arqueólogos disputan la complejidad de organización política en las sociedades del suroeste de los Estados Unidos, región que algunos estudiosos consideran como parte de Mesoamérica. Teorías recientemente planteadas indican la necesidad de deconstruir la complejidad, en este estudio un centro regional de dicha región es comparado con otro en la frontera septentrional de Mesoamérica, en cuanto a unas características que generalmente son vinculadas a la complejidad de la organización política: tamaño de población, mano de obra invertida en las construcciones monumentales, extensión de los sistemas de caminos, costumbres funerarias, y simbolismo arquitectónico. Contrario a lo que sería esperado, parece ser que Chaco Canyon fue organizado a una escala mayor, sin embargo, La Quemada manifiesta una estructura social más jerárquica. Esta contradicción indica que los arqueólogos, a pesar de ser acertados en identificar la escala y la jerarquía como dimensiones importantes de la complejidad, necesitan considerarlas como dimensiones independientes. La interpretación correcta tanto del grado como de la naturaleza de la complejidad es significativa teoricamente, y también tiene implicaciones para las inferencias sobre la interacción a larga distancia entre tales centros.

Considerable concern has arisen around the issue of "sociopolitical complexity" in the American Southwest, especially regarding the existence of decision-making hierarchies in regional centers such as Chaco Canyon. One approach to this problem is to consider southwestern populations comparatively instead of attempting to make inferences about absolute levels of scale and integration. Such comparison could be undertaken on a global or continental basis or restricted to groups of similar historical tradition. In this paper the political organization of southwestern populations is evaluated by comparison with their culturally related and presumably more powerful neighbors in northwest Mexico. The regional centers of Chaco Canyon, New Mexico, and La Quemada, Zacatecas (Figure 1), are taken as examples of political centers in the two regions.

One reason why these two polities are interesting to compare is that they have been linked together by archaeologists who postulate a trade route or "trade structure" that brought turquoise from the American Southwest to central Mexico

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Figure 1. Locations of Chaco Canyon in New Mexico and La Quemada in Zacatecas.

(Weigand and Harbottle 1993; Weigand et al. 1977). The cultural continuities between Mesoamerica and the American Southwest have long been noted (e.g., Haury 1944), and a colonizing relationship has even been proposed (Kelley and Kelley 1975). Although recent chronological findings, discussed below, call into question the particular connection between Chaco Canyon and La Quemada, it is still clear that long-distance interaction resulted in the transmission of goods and ideology across this vast expanse, and that regional centers periodically came to dominate the cultural landscape. This study is part of an attempt to understand the organizational principles underlying those occasional social and political transformations.

The term complexity, while easy enough to grasp intuitively, refers in archaeological practice to a web of properties whose interrelationships are poorly understood. Social systems are considered complex if they are comparatively large demographically and spatially, encompass multiple settlements in an integrated political structure, and exhibit horizontal and vertical social differentiation. Other properties associated with complexity are hereditary ranking, production of surplus and its appropriation by an elite, craft specialization, and long-distance exchange.

Recent theoretical discussions have called for abandonment of assumptions about the necessary coexistence of these properties, urging that archaeologists "break down" complexity (McGuire 1983),

"decouple" its constituent elements (Hastorf 1990), and consider the multiplicity of power bases from which actors construct social power (Yoffee 1993). There is also a sense that social power is historically contingent, i.e., constituted of the shreds and patches of unique traditions. These suggestions are productive in that they hint at the polythetic character of complexity and even begin to address it in specific terms.

In a discussion of the general notion of complexity, Gell-Mann (1992) suggests that complexity is the length of the shortest sentence that can be used to describe a system. With the term "sentence," he refers to a mathematical expression, and with "length," to the number of terms that the expression must contain in order to make up an adequate characterization. While such a definition might seem frivolous in the context of defining cultural complexity, in reality it is not because, much like designing a simulation, it forces specification of the dimensions in which modeling will occur. Thus an important arena in the investigation of sociopolitical complexity is the identification of dimensions of complexity along which independent variation may occur within and between societies.

In view of these considerations, an appropriate question to ask about the two polities at hand is not only "How complex were they?" but also "How were they complex?" Approaching the problem in this way leads to the finding that two of the major properties that archaeologists commonly associate with complexity, scale and hierarchy, are independent dimensions. Comparison of these two particular cases demonstrates that the Chacoan entity was organized at a larger scale, but La Quemada was more hierarchically structured. It is also apparent that the symbolism associated with the construction of power in the two societies was qualitatively different, rooted perhaps in the processing of information in the Chacoan case and in physical coercion at La Quemada.

Five manifestations or correlates of political power are compared: population size, labor invested in construction of central places, scale of road systems, mortuary programs, and symbolism associated with integrative facilities. Each of these variables is selected because it reveals something about scale or hierarchy.

Scale refers to the demographic and geographic size of a polity as well as to the size of its physical products such as monuments. Population size relates to scale since it indicates the number of people who constitute a polity and who might potentially act together in a coordinated fashion under a single leadership structure. The amount of labor invested in the construction of central places and road systems is another manifestation of scale, since it represents an investment in social products.

Hierarchy refers to the degree to which power is concentrated in the hands of a relatively few people within the political entity; one expression of a hierarchy's ability to capture social energy is the labor investment in the construction of central places standardized by the size of the population and time elapsed. This ratio of contributed labor to polity size indicates the degree to which the elite can control its subjects, compelling them to actions which at once symbolize and constitute their subjugation. Mortuary treatment is sometimes directly symbolic of the social order; at least in some contexts the statuses of the deceased, as well as relationships to those who remain alive, are marked by treatment upon death. Similarly, integrative facilities, be they political, military, or religious, may act as stages for the ritual enactment of power relations. The associated symbolic structures, although not necessarily decipherable when only observed archaeologically, can be translated with the aid of history and ethnography.

Cultural Settings

There seems to be general agreement that Chaco Canyon was at the core of an interconnected social system (Judge et al. 1981; Powers et al. 1983; Schelberg 1984; Sebastian 1991; Vivian 1992). Located in northwestern New Mexico, in a setting of unusual hydrological potential in the arid San Juan Basin, Chaco Canyon is a multi-site community dating from A.D. 900–1150 and probably extending later. The archaeology of the canyon has been extensively described, but many differences of interpretation remain among the investigators. Some of the debate centers around population size and its implications for self-sufficiency given limited arable land; other questions concern local sociopolitical organization and the role of the Chaco Canyon settlements in regional hegemony.

The attributes of the Chacoan settlement pattern that suggest political hierarchy are the monumentality of its largest structures (Lekson 1984), the extensiveness of its road system (Obenauf 1980), and its linkages to numerous "outlier" communities also displaying distinctive Chacoan architecture and ceramics (Marshall et al. 1979). Aspects of Chacoan mortuary patterning have also been interpreted as indicative of hierarchy (Akins 1986; Nelson et al. 1992; Turner 1993).

La Quemada is located in central Zacatecas, Mexico, forming part of the northern Mesoamerican frontier or periphery. Contrary to opinions held until fairly recently, La Quemada was not contemporary with Chaco Canyon. The occupation of La Quemada falls in the Middle Classic to Epiclassic interval A.D. 500–900, and the major portion probably occurred between 650–750 (Hers 1989; Jiménez 1989a; Nelson 1990, 1994a, 1994b; Trombold 1990). Earlier interpretations had placed the occupation during Postclassic times, ca. A.D. 1100–1300 (Diehl 1983; Kelley 1956, 1971a; Diehl 1981; Weigand 1977, 1982). The importance of this shift in dating is that La Quemada cannot have been founded as a Toltec outpost, as once thought, nor be contemporary with Chaco Canyon nor part of an inferred turquoise route that linked Chaco and the Toltec center of Tula, as it is too early to fit either of these postulated connections.

Despite these recent changes of chronological interpretation, it is still legitimate to compare Chaco Canyon and La Quemada as instances of political formations that occurred in northern Mesoamerica and the greater Southwest. Comparisons are profitably drawn between Chaco Canyon and the Hohokam even though they are not fully contemporary (Crown and Judge 1991). The attributes of La Quemada that suggest political centralization are similar to those of Chaco Canyon: monumental architecture, an extensive and well-integrated road system, and an obvious settlement hierarchy (Trombold 1976, 1978, 1991). Yet the cultural affiliation is clearly Mesoamerican, as attested by pyramids, altars, ball courts, colonnaded hall, sunken-patio residential complexes, abundant osteological evidence of human sacrifice, and Mesoamerican ceramic iconography.

Although these different attributes are vaguely suggestive of organizational contrasts, differences between southwestern and Mesoamerican societies have more often been assumed than systematically inferred. The cases of Chaco Canyon and La Quemada are useful as points of contrast because each represents an apical development or maximal florescence in its region, and each has the advantage of having a road system, possibly implying the boundaries of a political entity. In the following sections specific evidence is examined for differences in scale and mechanisms of integration between the two polities, and then the implications of these differences are discussed in terms of the construction of political power in the two regions.

Population Size

Population size is not a direct manifestation of political power, yet it may reflect the recruitment of subordinates by a powerful individual or group and also has implications for the ability of an elite to engage in warfare and conduct public-works projects. Even though there is no necessary relationship between political organization and population size, demographic scale limits the scale of political integration (Carneiro 1981; Earle 1987). Kosse (1992) finds that polities with fewer than 500 people generally are not regionally integrated, nor do they have ascribed ranking, while those having 2,500–3,000 people exhibit both regional integration and ascribed ranking. In the intermediate range, either regional or local integration may be found and ranking may or may not be ascribed; also, there is no clear relationship between the two. This research seems to suggest a "gray zone" in which certain selective pressures are present, and social groups may or may not opt to respond to them by becoming hierarchical and regionally integrated.

Although identifying the boundaries of prehistoric polities is typically difficult, in these two cases the evidence is better than usual. The road system radiating from each center is symbolic of multi-community integration, presumably political. The communities embraced by the roads share styles of architecture that mark their participation in a common system and distinguish them from surrounding populations. The boundaries

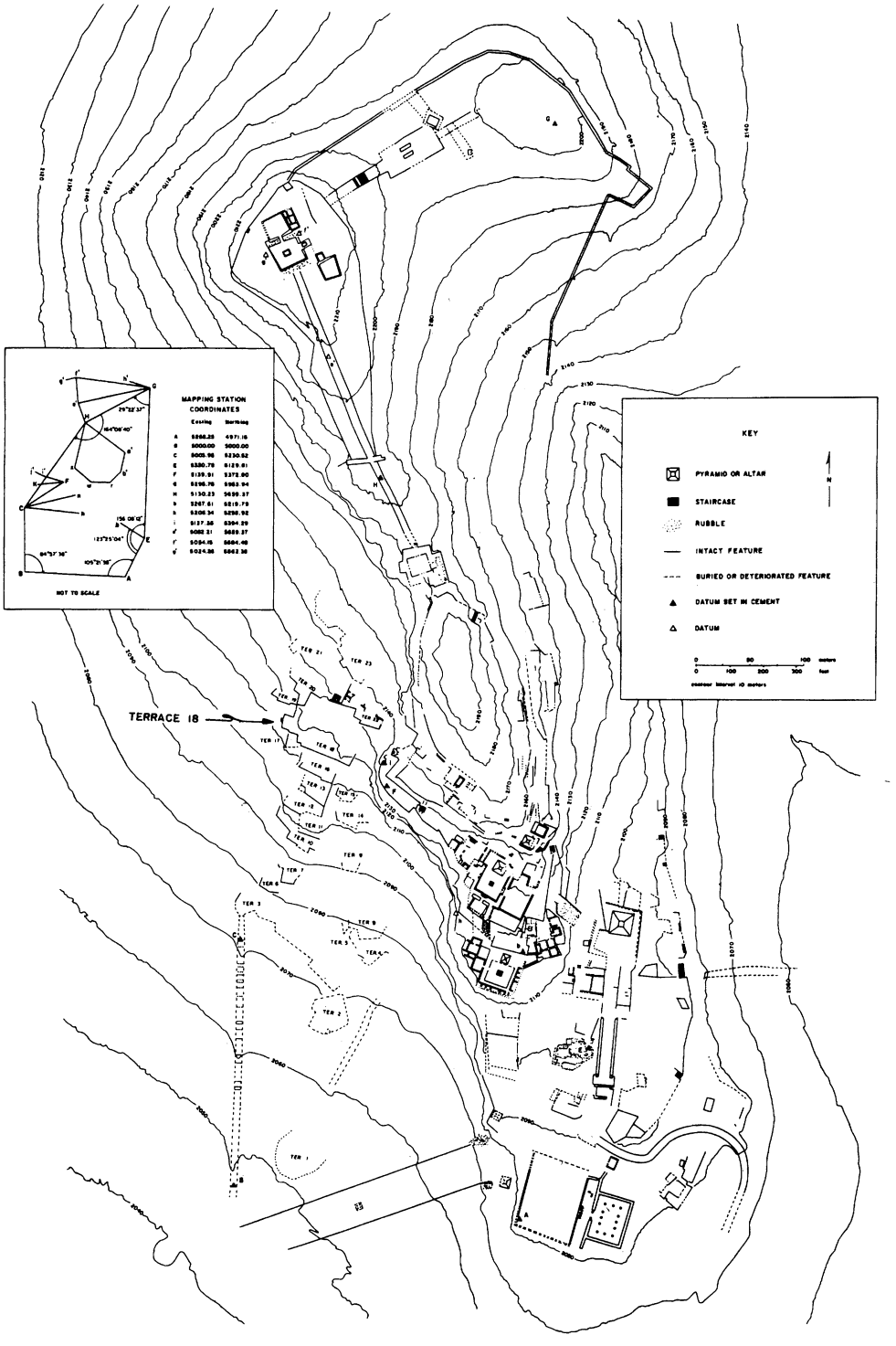

Figure 2. Plan view of La Quemada with a contour interval of 10 m. Topographic contours after *Plano Fotometrico de la Ciudadela La Quemada Verson Armillas-Weigand* (Weigand 1964).

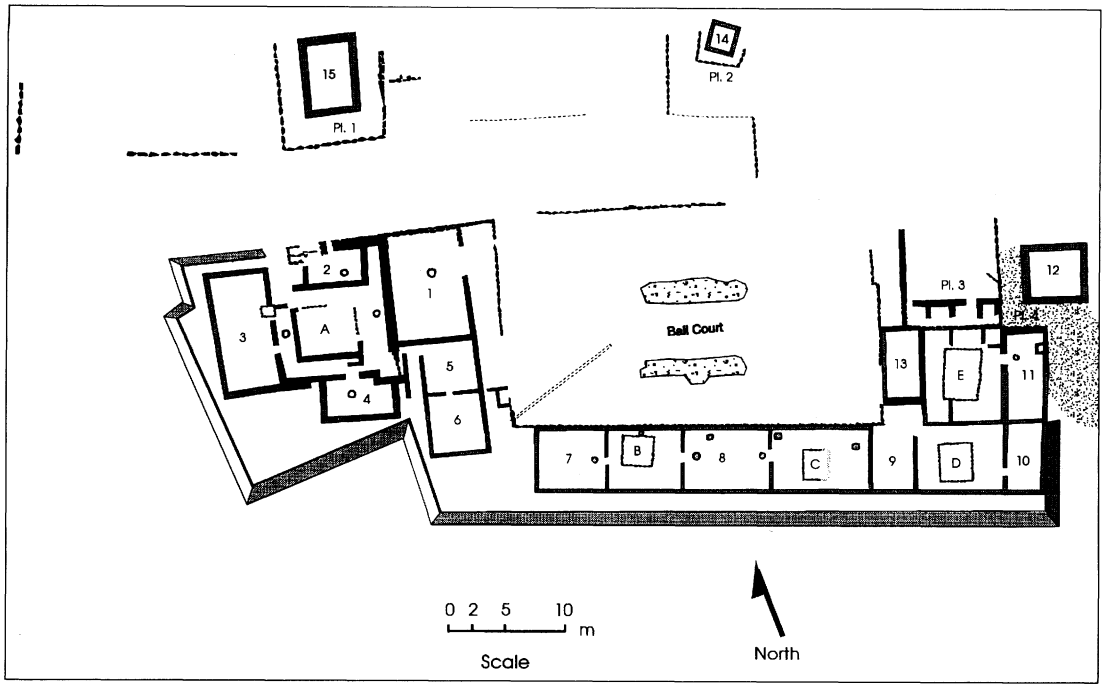

Figure 3. Distribution of rooms (designated by numerals) and sunken patios (designated by letters) on Terrace 18 of La Quemada. Wall locations for rooms 8, 10, 12, 14, and 15 are schematic projections based on limited evidence.

suggested by these indications are surely only approximate; communities probably participated in accordance with distances both geographic and social. Yet the roads are the clearest indications available to archaeologists as to the integrated territory. Survey coverage in both contexts is relatively complete for the core area of each system (Hayes et al. 1981; Trombold 1978) and declines sharply with increasing distance outward. In both instances coverage is biased in another way that is not a cause for concern here, away from artifact scatters and toward visible architecture.

Assuming the boundaries of the polity to be defined by the extent of the road system, it can be argued that both Chaco Canyon and La Quemada were at the upper end of Kosse's (1992) intermediate range, or in the case of Chaco Canyon, perhaps well above it. A number of scholars have attempted to estimate the population of the core, reaching values ranging from 2,000 to 10,000 (Judge 1989). The three most recent and systematic estimates are 2,100–2,700 (Lekson 1984), 3,700 (Schelberg 1982), and 5,000–5,500 (Vivian 1991). If 100 or so outlier communities are added to the estimate (Lekson 1991), the figure of 10,000 becomes considerably more plausible.

Population estimates for La Quemada may yet be premature, but the site is far better understood that it was even five years ago, owing to recent mapping and excavations (Jiménez 1989b; Nelson 1989; Nelson and Schiavitti 1992; Nelson et al. 1993). Combined with Trombold's (1978) survey, these data allow us at least to establish an order of magnitude. It must be acknowledged that differences in the character of the two settlement systems could distort this comparison, but every attempt is made in the analysis to control for such differences or to understand their impacts. The patio-banquette complex is a good unit of estimation for both the core settlement and the outlying areas of La Quemada. The complexes consist of a large sunken patio surrounded by rooms on an elevated banquette. The only systematically excavated patio-banquette complex is the one located on Terrace 18 (Figures 2 and 3). There, the rooms cover most of the south and west banquettes and about half of the east banquette, but the north banquette is nearly devoid of structures.

Terrace 18 may be used as a prototype for esti-

mating population; however, one must first ask how representative this particular terrace is of terraces in general and whether there might have been residences in places other than the terraces. The author personally mapped each of the terraces; the sizes of the terraces are estimated based on that detailed acquaintance as well as on the resulting map. In addition, he conducted testing in areas between the terraces to find out if there might have been people living there in relatively perishable structures; none was found. Evidence of only one off-terrace structure has been found, that case being located in a midden (Nelson et al. 1995). Four terraces other than Terrace 18, though not systematically excavated, have been cleared of overburden, revealing patterns of structures. The distribution of structures is also relatively clear from surface indications on many terraces. The amount of space devoted to residential as opposed to ceremonial facilities varies; in the monumental core some are completely dedicated to ball courts, pyramids, or other public structures. At the other extreme, some of the smallest probably have only a residential structure. The majority appear similar in surface configuration to Terrace 18, with a large central depression and mounding on two or three sides. In sum, Terrace 18 would appear to be a representative example of the terrace complexes.

Two different procedures might be used for estimating site population, one projecting from a roofed area and the other from small patios. The method based on roofed area, as shown below, results in unacceptable estimates; a range based on projection from the small patios is used instead.

All told, only 748 m^2 or 25 percent of Terrace 18's 3,000 m^2 was roofed. This constant could be applied to each of the 56 terraced areas on the site plan (Table 1) to predict population using an ethnographic constant; however, the Casselberry (1974) constant of 6 m^2 per person requires us to believe that 90 people lived in the 16 rooms on the terrace, or 5.6 persons per room on average, not an acceptable assumption.

Although such figures are believable for some residence patterns, the particulars of this setting seem to contradict it. It is clear that a substantial portion of the roofed space was devoted to ceremonial activities. Three of the rooms included in the estimate are situated on their own specially

Table 1. Terrace Dimensions Used in Estimating Population and Labor.

Terrace	Width	Depth	Height	Area
1	40	44	3	1,760
2	36	42	2	1,512
3	126	6	3	756
4	26	18	2	468
5	8	10	2	80
6	20	6	2	120
7	16	12	4	192
8	32	8	2	256
9	18	12	4	216
10	48	12	3	576
11	20	20	2	400
12	38	8	3	304
13	30	16	4	480
14	26	8	5	208
15	20	10	3	200
16	36	16	4	576
17	14	12	2	168
18	76	34	7	2,584
19	34	10	8	340
20	46	10	3	460
21	8	12	3	96
22	42	22	6	924
23	90	10	2	900
24	60	14	6	840
25	70	10	5	700
26	50	16	7	800
27	20	8	8	160
28	40	26	4	1,040
29	44	12	11	528
30	110	70	13	7,700
31	58	38	9	2,204
32	34	18	2	612
33	38	38	12	1,444
34	24	28	6	672
35	16	10	1	160
36	30	16	2	480
37	28	30	3	840
38	32	6	1	192
39	200	30	5	6,000
40	36	54	1	1,944
41	34	52	2	1,768
42	160	42	3	6,720
43	40	10	2	400
44	54	22	2	1,188
45	116	86	7	9,976
46	32	36	4	1,152
47	62	10	1	620
48	30	4	2	120
49	56	6	2	336
50	50	8	2	400
51	34	14	2	476
52	42	42	4	1,764
53	60	40	2	2,400
54	96	14	1	1,344
55	58	28	1	1,624
56	16	18	3	288
Total terraced area				70,468
Less nonresidential areas				−17,600
Net terraced area				52,868

Notes: Width measured across slope. Depth measured perpendicular to slope. Height measured from base of terrace to terrace surface on downslope side. Area in square meters.

elevated platforms, overlooking distinctive features such as the ball court and the causeway that passes through the terrace. Because an association between ball courts and temples is a well-established pattern in Mesoamerica, these rooms are strong candidates for temples. A fourth room, much larger than all others, has been interpreted as a temple associated with ancestor worship (Nelson et al. 1992). Four of the other rooms are closet-sized. If all of these rooms are considered non-habitational, then only eight rooms are left to house the estimated 90 people, a ratio that seems at least three times too high.

An alternative way of estimating site population is to consider the distribution of small interior patios. These features seem to be a fundamental architectural element, providing privacy, light, and drainage for contiguous rooms that would otherwise be dungeonlike. Although much evidence is lost to erosion, it appears that one or more rooms faced onto each of the small patios, and that rooms facing different patios were not connected. If each small patio represents the center of an inward-facing nuclear family household, Terrace 18 could have housed five such units in its last phase of construction. An average of five household members per small patio group, or 25 people for Terrace 18 as a whole, seems reasonable assuming that the families were in varying states of the developmental cycle. The numbers of small patios on the rest of the terraces are unknown but can be prorated based on terraced space. The presence of five patios on Terrace 18 suggests a ratio of one patio per 600 m^2 of terraced space; applying this ratio to the net figure 52,868 m^2 for the site suggests a total of 88 small interior patios. With five-member households, the site as a whole would have a total population of 440. Although this value could be adjusted downward for contemporaneity of terraces, it hardly seems conceivable that fewer than 400 people lived at the site.

A range built around this estimate of 440, allowing for the possibility of 50 percent overestimation to 50 percent underestimation, yields a reasonable if surprisingly small total population for La Quemada of 220 to 880 residents. To complete the estimate, it is necessary to consider the outliers. Trombold (1976, 1978) has recorded 220 outlying sites in his survey of the road system, in which he concentrated on sites with visible surface architecture. The information on the site is insufficient to judge population on a site-by-site basis, but Los Pilarillos, the second-largest site after La Quemada, has an area of five ha (Trombold 1985). The site consists of two large patio complexes that are clearly visible, plus two additional raised areas that may contain other patio complexes, possibly as many as five or six. Recent excavation at Los Pilarillos shows that major proportions of the architecture visible from the surface are devoted to ritual space, as at La Quemada (Nelson et al. 1995). The only other documented excavation of an outlying site is at MV 138, which has at least three patio complexes (Trombold 1991).

The subsurface findings at MV 138 have important implications for population estimates, since the site appeared from the surface to have only one small mounded area, but turned out to be much larger and more complex underground (P. Jiménez, personal communication 1990). This means that more research is needed about how to estimate number of rooms from surface evidence. However, if Los Pilarillos is by far the second largest site, it seems reasonable to propose that most sites had only one or two patio complexes. This gross evaluation is based on visits by the author to a limited number of outlying sites. The patio complexes on those sites are usually less than half the size of the one on Terrace 18, so that instead of holding 25 people per patio complex, they might have held only about 12.5. To make a very crude projection from these data, it could be suggested that with an average of 1.5 patio complexes per site, the 220 outlying sites could have held 2,750 people all told, 2,063 people if a correction for contemporaneity of .75 is applied. Converting this value to a range to allow for errors of estimation as above, the probable population of the satellite sites is between 1,032 and 4,126 people.

Combining the estimates for the center and its satellites, the total estimated range of polity size for La Quemada then comes to only 1,250–5,000 people (rounding to the nearest 10), a value that seems shockingly small in view of the monumentality of the site, the engrained perception of

Mesoamerican polities as states with large administrative centers, and the much higher estimate of 10,000 for the Chaco Canyon polity. This evidence, however, is in accord with that discussed below. One of the questions raised by this conclusion is under what social conditions it makes sense for so few people to build such an imposing monument.

Labor Investment in Construction of Central Places

The raw amount of labor invested in the construction of central places expresses scale, whereas labor standardized for polity size and elapsed time is a measure of hierarchy. These measures address the concentration of political power, which is the capacity of a relatively small segment of the population to direct the efforts of others in accordance with an ideology. The focus on monumental construction is not meant to suggest that such labor drafts were the only, or even the most important, means of mobilization. With typical archaeological inclination, the author is focusing on properties of the record that can be compared. It is possible that the two polities tapped heavily into household resources in other ways, such as in food production, and that they differentially emphasized these various mechanisms of extraction.

Erasmus (1967) provides a model for the evaluation of labor inputs to Maya monuments; subsequent studies by Muller (1986) at Kincaid, a Mississippian complex in the Ohio Valley, and by Lekson (1984) at Chaco Canyon further refine this approach. Lekson examines a series of exceptionally well-dated construction episodes in the "great houses" or "towns" of Chaco Canyon. Lekson's primary interest appears to lie in the question of how much labor could be requisitioned at a given time rather than in absolute monumentality. Based upon a series of calculations supported by tree-ring chronology, Lekson reckons that a crew of 30 skilled artisans could have been responsible for the procurement, transportation, shaping, and laying of the architectural elements, even during the busiest decades of building, and therefore concludes that the construction could have been managed without a high degree of social stratification. Such crew size could have been maintained without transgressing the theoretical 40-hour-per-year threshold. This assumes a slow, steady construction rate, although it is possible that the individual episodes occurred more rapidly (Sebastian 1991), implying a need for a larger labor force and greater coordination.

Such fine chronological resolution probably never will be achieved at La Quemada because of the absence of tree-ring dates, and the labor estimates cannot be as refined because excavation has been far less extensive. However, radiocarbon dates are available to bracket the principal phase of construction, and estimates of the amount of labor involved in construction can be based upon the site plan and intimate acquaintance with Terrace 18 (Nelson 1989; Nelson and Schiavitti 1992; Nelson et al. 1993). Lekson's methodology for estimating labor investment at Chaco Canyon is broadly applicable here, and this discussion centers on the contrasts between characteristics of the two places that have an impact on labor investment.

La Quemada is a small mountain converted into an artifact by the construction of numerous terraces to create level spaces for buildings and outdoor activity areas. The monumental core of the site is comprised of numerous contiguous terraces, so that almost all of the surfaces there are artificial; more widely dispersed terraced areas are found throughout the site. Both the rock terraces and the largely adobe structures atop them were coated with lime plaster. Other features that required substantial labor include causeways, staircases, pyramids, altars, ball courts, and a huge palisade-like wall encompassing the core of the site.

Following Erasmus (1967) and Lekson (1984), labor estimates are based on person-hours involved in the acquisition of raw materials as well as construction. Lekson's estimates are followed here with exceptions given below. As at Chaco Canyon, the stone did not have to be transported far, as the mountain on which La Quemada is situated is essentially a large outcrop of construction material. Raw materials for adobe and plaster probably had to be obtained from the valley bottom or at least part way down the knoll, as there is little soil development in the upper parts of the site. Assuming a deforested flood plain, most of the timber for building must have come from at least as far away as the escarpment that

Table 2. Labor Invested in Wall and Roof Construction, Terrace 18, La Quemada.

Feature No.	Wall Length (m)	Wall Material (m^3)	Wall Labor (PH)	Roofed Area (m^2)	Roof Labor (PH)
1	38.3	28.7	1,050.3	70.7	1,809.9
2	20.9	15.7	572.9	22.1	566.2
3	36.5	27.4	1,002.5	71.3	1,824.4
4	22.6	17.0	620.6	30.2	774.3
5	25.2	18.9	692.2	27.2	696.9
6	27.4	20.5	751.9	39.3	1,006.6
7	25.2	18.9	692.2	34.0	871.1
8	27.8	20.9	763.8	46.7	1,195.3
9	25.2	18.9	692.2	34.0	871.1
10	20.9	15.7	572.9	22.7	580.7
11	24.3	18.3	668.3	35.9	919.5
12	20.9	15.7	572.9	31.9	817.8
13	21.7	16.3	596.7	27.2	696.9
14	10.4	7.8	286.4	6.8	174.2
15	24.3	18.3	668.3	36.3	929.1
A	13.0	9.8	358.0	0.0	0.0
B	15.7	11.7	429.7	0.0	0.0
C	16.5	12.4	453.5	0.0	0.0
D	16.1	12.1	441.6	0.0	0.0
E	14.3	10.8	393.8	0.0	0.0
Platform 3	14.8	11.1	405.8		
Ball court	18.3	52.2	1,911.5		
Total			14,598.1	536.5	13,734.0

Note: PH = Person Hours

lines the east side of the Malpaso Valley, a minimum of 5 km but probably substantially farther in most cases. Today there are no trees suitable for roofing beams or posts in the study area, although Weintraub's (1992) macrobotanical study demonstrates that pine and oak were both present in the past. Bakewell (1971) documents the decimation of trees in early colonial times in the vicinity of Zacatecas, 50 km north of La Quemada, to support the nascent mining industry.

One major difference between Chaco Canyon and La Quemada is that most of La Quemada's buildings are built on top of terrace substructures. The terraces are constructed exclusively of rock; the small amounts of soil found within them appear to have accumulated as a result of the decomposition of floor plaster and adobe from above. To construct the terrace substructures, the builders had to mound crude stones, surround them with outer walls of shaped stone set in clay mortar, and raise the buildings, most of which were not made of masonry but adobe. The exteriors of the buildings were coated with lime plaster. Based on the partial dissection of Terrace 18, it appears that terraces were built by amassing unshaped cobbles and boulders into "cells," i.e., areas bounded by relatively simple, unmortared walls that ultimately were subsumed in further construction. The outermost walls were made of cut stone and mud mortar, taking the form of *taluds* or sloping buttresses that were finally covered with lime plaster. The builders made use of upward undulations in bedrock to minimize their work; often ledges and other irregularities were incorporated into the substructures.

As in the above demographic analysis, Terrace 18 is used as a prototype for developing labor estimates (Table 2) that are then applied to the site as a whole. The cost of quarrying, transporting, and mounding the stone for the core of the terrace substructure is estimated at 15 PH/m^3 (person-hours per cubic meter) based on Lekson's (1984:284) figure of 14 for acquiring and transporting stone plus one for the mounding of the stone. The volume of the terrace substructure is estimated at one-half of the product of the width, height, and depth, almost certainly an overestimate since, as discussed below, the builders often

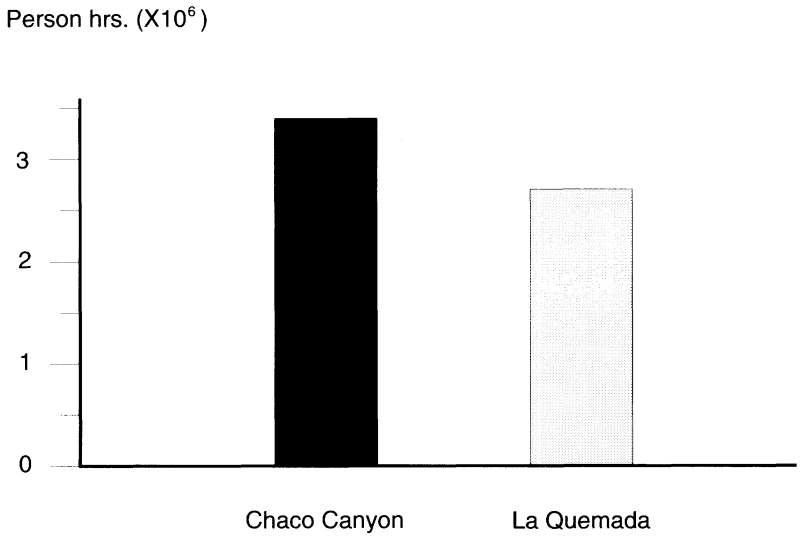

Figure 4. Monumentality of Chaco Canyon vs. La Quemada as measured by labor invested in construction of central places.

took advantage of outcropping ledges to reduce labor. The cost of exterior shaped masonry for the terrace substructure is calculated as one wall .25 m thick covering the entire exterior surface of the terrace, using Lekson's (1984:278) 36.6 PH/m^3.

A problem arises in comparing the masonry walls of Chaco Canyon with the mixed adobe and masonry walls of La Quemada. In La Quemada, masonry was used throughout the monumental core, but adobe predominated in the residential terraces. On Terrace 18, both materials were used. Because no literature seems to be available on the costs of constructing adobe buildings, the calculations are made as if all of the buildings were constructed of masonry. This procedure may overestimate the cost because stone, being plentiful, would have been less expensive and probably was used throughout most of the site. It is doubtful, however, that there was a great difference in the costs of the materials. Residents of the villages around La Quemada today use them almost interchangeably, and it is not uncommon to see a single wall built partly out of stone and partly out of adobe. Results from Terrace 18 are extended to the rest of the site, assuming constant ratios between volume of terrace fill and amount of roofed space. No adjustments are made for special features such as causeways, stairways, pyramids, and ball courts, since Terrace 18 probably contains more than its share of such features, and they are often integral parts of terraces.

Figure 4 compares the absolute monumentality of Chaco Canyon and La Quemada. It shows the total cost in person-hours of constructing the two central places, indicating that the cost of building La Quemada comes to less than 80 percent of that of the towns of Chaco Canyon, as estimated by Lekson (1984). A correction for the relative cost of adobe as opposed to masonry might lower this value somewhat, making the contrast greater. If this conclusion seems to contradict the visual grandeur of the site, it should be remembered that much of its apparent monumentality is in the vertical dimension, which is mostly natural rather than artificial. Not only did the builders capitalize on the overall slope, but they frequently positioned the terraces so as to incorporate major undulations of the bedrock. This pattern of incorporation, however, may also be true of Chacoan structures. An unknown is the amount of construction in both cases that has been subsumed by the latest, most visible stages. Although that earlier construction implies invisible labor investment in stone-cutting, the volumetric component of the construction is already incorporated in the La Quemada estimates, and this accretional process is also incorporated in Lekson's calculations for Chaco Canyon. Thus, even if many stages of construction

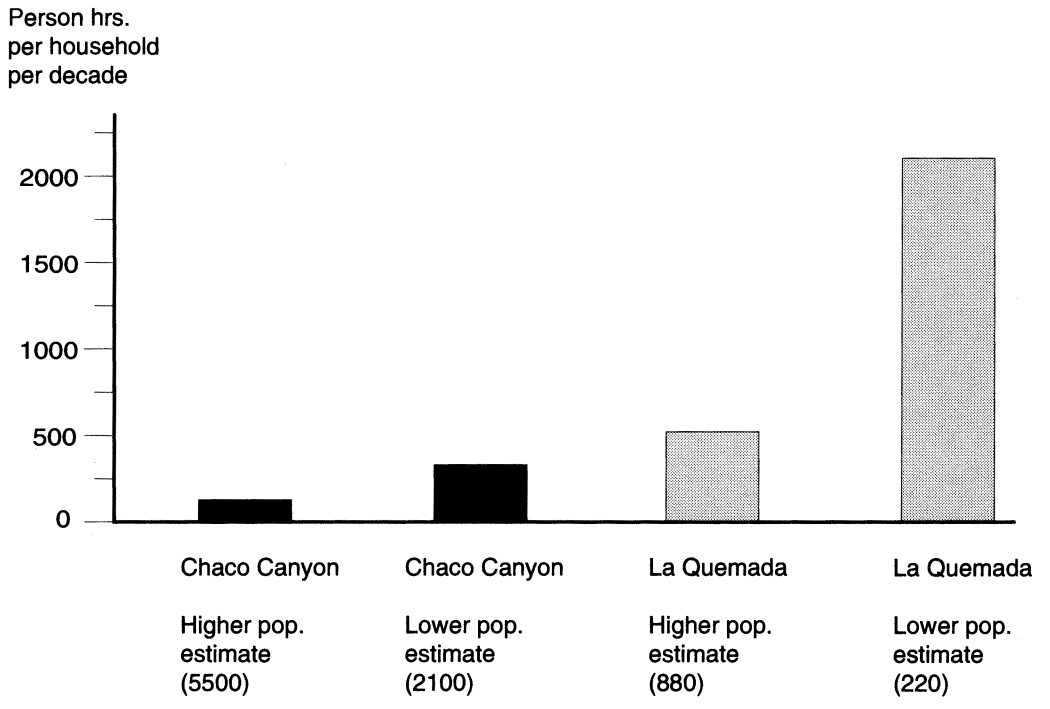

Figure 5. Construction labor per household of core population per decade at Chaco Canyon and La Quemada.

are embedded at La Quemada, the total cost of construction does not approach that of Chaco Canyon. The conclusion is inescapable, therefore, that in terms of absolute monumentality Chaco Canyon was a significantly larger, more expensive monument than La Quemada.

Another way of evaluating monumentality is in relation to the core population of the polity and the time that the core was inhabited. Such a measure should relate directly to the property of hierarchy since it expresses the degree of leverage that a core population exerts over its subordinates. Monumentality in relation to core population, standardized by time, may be calculated as the number of person-hours invested in construction per core household per unit time. Chaco Canyon's core was constructed over a period of 250 years (A.D. 900–1140), and housed between 2,100 and 5,500 people (Lekson's lowest and Vivian's highest estimates, cited above). Nelson (1994b) estimates that La Quemada's growth took place over about 300 years between A.D. 550–850; he suggests however, that all of the major construction probably occurred in about 150 years, from about A.D. 600–750. The estimate above suggests that La Quemada's core population may have been around 220–880 people. With time and population taken into account, Figure 5 indicates that whichever assumptions are used, the elites of Chaco Canyon were able to mobilize less labor per capita than their counterparts at La Quemada (125–327 person-hours per decade per household at Chaco Canyon as opposed to 520–2,080 at La Quemada—again assuming a mean household size of five people). If the shorter growth period of 150 years is used for La Quemada, the basic conclusion is further strengthened; elites at La Quemada appear to have mustered even greater amounts of labor in comparison to Chaco Canyon.

One might argue that this measure is biased because of differences in the nature of the core populations; the population estimates for Chaco Canyon include both "commoners" residing in "villages" and "elites" residing in "towns" or "great houses," whereas the La Quemada estimate includes only the elites residing at the central place. It is difficult to address this problem since the architectural elements that constitute the cores

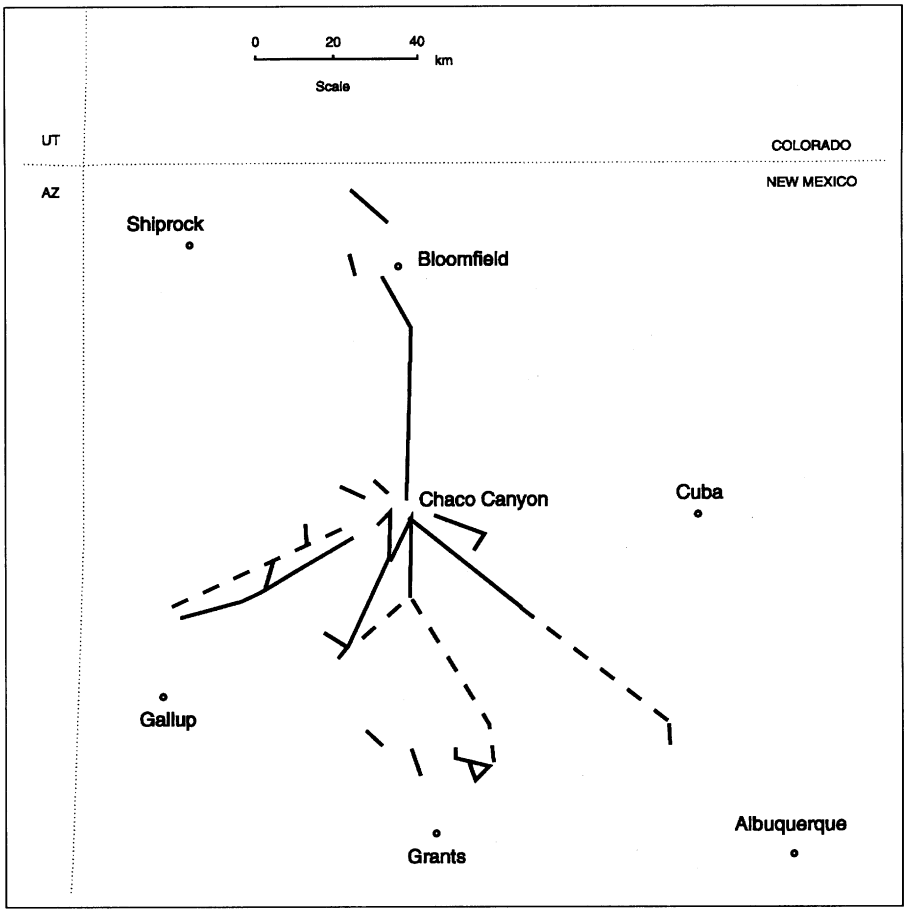

Figure 6. Chacoan road system (after Cordell 1984 and Obenauf 1980).

of the two systems are qualitatively different. One approach is to compare the monumentality of the central places relative to the populations of the whole polities; a problem here is that the total size of the Chacoan polity is unclear. If it is assumed to have contained approximately 10,000 people, as suggested above, then the central place of the Chacoan system might have been constructed with the contribution of about 69 person-hours per household per decade, while La Quemada, using the above figures and a polity-wide population of 1,250 to 5,000 people, would have required contributions on the order of 92 to 366 person-hours per decade. These measures are crude, but they confirm that La Quemada is a bigger monument relative to its constituent population than is Chaco Canyon.

The labor-based measures, then, argue that the scale of Chaco Canyon was greater than that of La Quemada, but that the elites of La Quemada may have been able to extract proportionally more labor from their subjects.

Scale of Road Systems

Other expressions of political power include properties of the road systems such as total length, physical structure, labor investment, numbers of communities integrated, and the size of the total area encompassed by the roads. Most of these properties of the road system are related to scale and not necessarily to hierarchy. Roads are public works projects in the same sense as pyramids and ball courts; they require coordinated labor and special expertise that may not have been volunteered. Roads have the further symbolic significance of physically linking communities that may

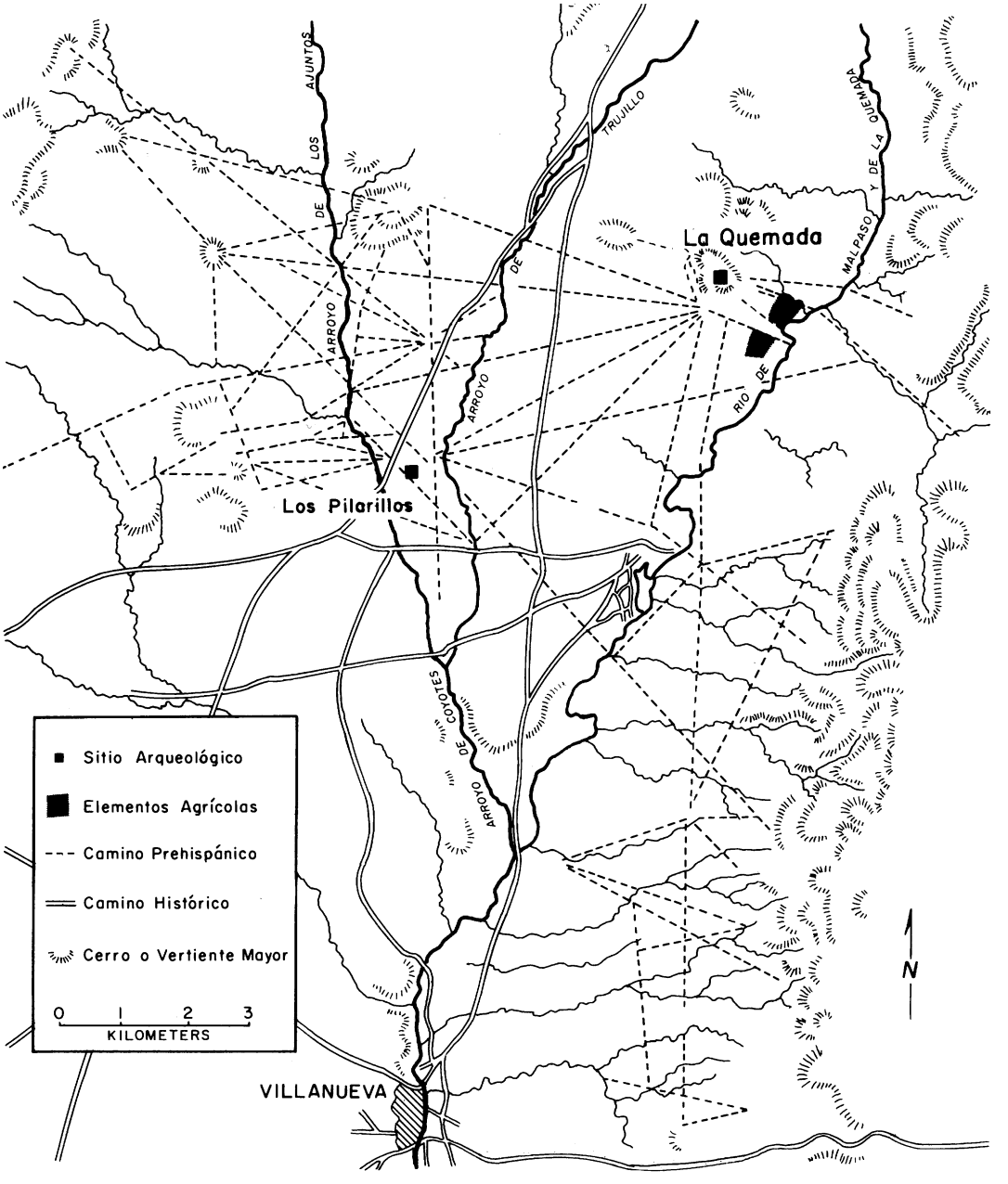

Figure 7. La Quemada road system (after Kelley 1971b and Nebel 1840).

have been politically integrated, and a linkage between a smaller community and a larger one strongly suggests subordination.

Interpretations differ for the functions of roads in the two systems, especially as regards the degree of political integration that they imply. At one extreme, Roney (1992) finds that some of the Chacoan "roads" were not even continuous segments, but only ritual entryways into isolated communities that happened to point toward other such features in other communities. At the other extreme, Trombold (1991) makes the case that the

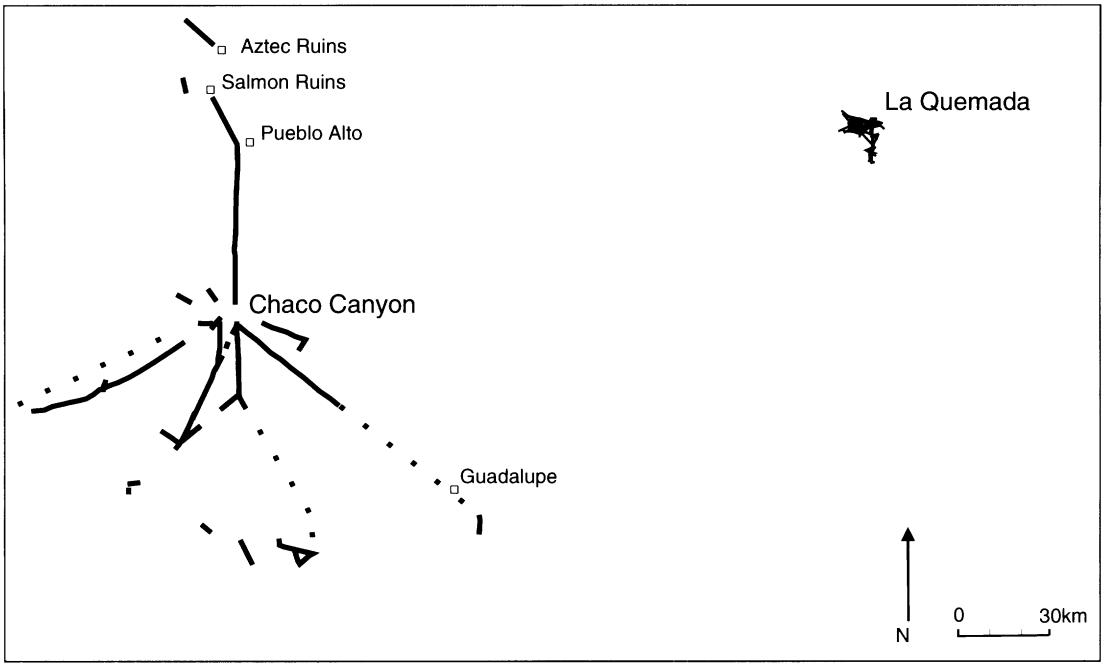

Figure 8. Chacoan and La Quemada road systems displayed at the same scale.

La Quemada roads represent a strong military organization that could be mobilized against external threats. Interpretations are difficult to support empirically because the ultimate function of roads—movement—tends to leave little in the way of physical manifestations.

Superficially the two road systems are quite similarly configured (Figures 6 and 7), and both have been fairly extensively documented and discussed (Judge et al. 1981; Kincaid 1983; Lekson et al. 1988; Marshall et al. 1979; Obenauf 1980; Powers et al. 1983; Roney 1992; Trombold 1978, 1985, 1991). The Chacoan system has "several hundred miles" of possible road segments (Obenauf 1980), while the total known length of the La Quemada system is approximately 175 km (Trombold 1985). Labor investment per unit of road length probably did not differ significantly in the two cases. In each case the roads were most substantial near the central place and narrowed to little more than trails at greater distances. The most elaborate segments of roads in both cases consisted of rubble-core beds marked off by upright or at least aligned cobbles. One structural difference between the two systems is in their termini; Chacoan roads always seem to lead to settlements, whereas Trombold (1991) points out that some of the La Quemada roads terminate at geographic prominences that he interprets as military overlooks.

The numbers of communities integrated by the roads also seem superficially similar, although important differences can be discerned upon close inspection. Well over 100 Chacoan outliers have now been reported, while Trombold (1978, 1985) has located more than 220 sites in the area encompassed by the La Quemada roads. A major difference, however, is that the Chacoan roads lead to "head communities," below which is another stratum in the settlement system comprised of villages or hamlets. Various authors have explored the suggestion that each Chacoan outlier served a network of small local settlements, and that each such complex made up a community (Doyel et al. 1984; Marshall et al. 1979, Powers et al. 1983). The La Quemada roads, on the other hand, lead directly to sites that represent the lowest order of the settlement hierarchy. The La Quemada settlement hierarchy is extremely "top-heavy"; after La Quemada at 18 ha, the next largest site is Los Pilarillos at 5

ha, and the rest of the settlements are much smaller (Trombold 1985). Thus the Chacoan road system integrated a network of far-flung communities, while La Quemada was the head of a single, highly aggregated, local community.

The most striking contrast is in the scope of the geographic area encompassed by the two road systems (Figure 8). The Chacoan roads extend over much of the San Juan Basin and beyond, reaching roughly 90 km east-west and 110 km north-south. The entire La Quemada road system, on the other hand, encompasses a comparatively tiny 10 x 12 km. One might think that this difference relates to the packing of larger numbers of people into a richer environment, but that is not the case. The Malpaso Valley is semiarid and has agricultural potential that is probably roughly equivalent to that of Chaco Canyon, if not considerably less. In any case this interpretation is contradicted by the population estimates discussed above. One can only conclude, therefore, that the Chacoan road system linked larger numbers of people and communities over a vastly larger area than did the La Quemada system, even though La Quemada seems to have a clearer relationship of dominance to its surrounding settlements.

Mortuary Programs

Treatment of the dead is often used by archaeologists as a basis for making inferences about sociopolitical organization (e.g., Braun 1984; Brown 1971; Ravesloot 1989; Saxe 1971). Many analyses proceed on the assumption that treatment at death is a straightforward expression of status in life, although some discussions show that the relationship is complex (Bloch 1981; Goldstein 1981). It may be safe to assume that clearly marked differences in mortuary treatment indicate status variation, but it is not advisable to infer egalitarian structure in the absence of such evidence nor to assume that all social categories are represented in the preserved patterning.

Neither population is represented by a cemetery or other easily interpretable context in which deceased individuals were deposited consistently through time. Chaco Canyon's skeletal record includes some "multiple burials" of people who may have been enemies rather than community members; La Quemada's burial population definitely includes such a component. There is also a remarkable paucity of grave goods in both contexts. Thus it is not possible to create a simple scale of comparison using burial wealth; the best comparisons that can be drawn relate to postmortem processing and display of human bone. Even so, the mortuary programs reveal important aspects of the construction of power in the two contexts.

Akins (1986) explores mortuary patterns in Chaco Canyon based on a sample of 135 individuals from 31 sites. If these individuals are taken as a random sample of Chacoan mortality over 250 years of occupation, significant status-related patterns emerge in health and physical characteristics. The large "towns" or "great houses" are represented by a group of burials from Pueblo Bonito, which Akins contrasts with another subsample from small sites. Town burials have significantly fewer pathologies representing nutritional stress, and are taller by 4 cm even when controlling for sex of the individuals. This difference is stark when seen from a global perspective (Nelson et al. 1994) and is a particularly strong suggestion of differences between the two subpopulations in access to nutritional resources.

In view of these skeletal indications, it might be expected that high-status burials would be present in Chaco Canyon, but evidence is limited and ambiguous. The famous burials beneath the wooden floor of Room 33 of Pueblo Bonito, associated with abundant turquoise and shell, are the best candidates for high-status individuals (Pepper 1976 [1909]). Above the floor of the same room are 12 other burials that are variously interpreted as disturbed by water movement (Pepper 1976), secondary interments (Akins 1986), or sacrificial victims accumulated over centuries (Wilcox 1993). In any event, while the singularity of this case implies that high-status treatment was rare in the Chacoan mortuary program, the existence of such a concentration of wealth leaves open the question of the degree of status differentiation. Based on the relative abundance of flutes and prayer sticks in the room, Pepper (1976) suggests that the buried individuals may have been members of the Hopi Flute Clan.

Turner (1993) discusses an apparent case of cannibalism represented by a skeletal deposit of eight adult and subadult individuals from the Small House Ruin in Chaco Canyon. The bones were

deposited in a subfloor pit in a manner that makes it impossible to regard them as "considerate burials," and exhibit a number of characteristics denoting cannibalism (Turner 1983). These include cut marks, crushing of the vertebrae and long bones apparently for the purpose of marrow extraction, mainly missing vertebra, differential burning of fitting fragments, and "pot polishing" or abrasion on the tips that may have come from their being stirred in pots while cooking. Turner (1993) considers the hypothesis that this skeletal deposit represents institutionalized violence used by Chacoan leaders as a mechanism of social control, finding support in that some of the crania exhibit evidence of "blown-out" teeth resulting from severe trauma. Turner (1993) suggests that the violence was associated with the early establishment of hegemonic relationships in Chacoan society.

Skeletal materials from the La Quemada area provide a comparative framework for evaluating these arguments for institutionalized violence. Burials at small satellite sites, the counterparts of Small House Ruin at Chaco Canyon, are found beneath room floors in flexed and extended positions, possibly representing ordinary residents. At La Quemada itself, in contrast, several excavated areas (the Cuartel, Hall of Columns, and Terrace 18) contain sets of extensively processed, multiple-individual bone deposits (Faulhaber 1960; Jiménez 1989b; Nelson et al. 1992; Pijoan and Mansilla 1990). As in the case described by Turner (1993), it would be inaccurate to call these deposits considerate burials. Many of the bones were mutilated, some were apparently displayed, and most ended up in huge discard piles that suggest little respect for the deceased. The contextual and physical attributes of the deposits suggest a range of mortuary programs. The identifiable individuals are overwhelmingly adult males, the elements predominantly skulls and long bones. Bones are found piled by the hundreds on the floor of the main ceremonial hall and in approximately equal numbers buried under a thin layer of soil at the foot of a small pyramid. Others, in smaller numbers, were suspended outdoors on walls and possibly on racks in large and small patios and suspended from the ceiling of the temple structure on Terrace 18 (Nelson et al. 1992). It appears that residents and visitors at La Quemada were confronted constantly with the sight of mortuary displays.

Thus if the Chacoan and La Quemada contexts suggest some parallels in violent behavior, they differ significantly in the degree to which reminders of that behavior were publicly displayed. The argument for institutionalized violence at Chaco Canyon would be more persuasive if the skeletal materials were placed in visible locations where the message of repression could be continuously communicated, as at La Quemada. At Chaco Canyon, the skeletal materials were deposited in subfloor pits and tiny interior chambers, whereas at La Quemada they were exhibited prominently in the ceremonial precinct and even in residential areas. This is not to suggest that institutionalized violence did not occur at Chaco Canyon, but rather to argue that the emphasis on it as a mechanism of social control was considerably greater at La Quemada.

Symbolism Associated with Integrative Facilities

When archaeologists look at the amount of labor invested in the architecture of central places, they are viewing political power from a systemic and energetic perspective, i.e., in terms of products of the social group as a whole. It is also useful to examine architecture in terms of human agency, symbolism, and intent, whereupon it becomes clear that architecture is actively used to create statements about social structure. The assumption that people manipulate architecture, among many other kinds of material culture, to legitimize and further their political power has long been used by archaeologists. There is widespread recognition that public architecture in particular is designed to perpetuate power relations. Donley-Reid (1990) extends the same reasoning into the domestic sphere, discussing the Swahili house as a facility for segregating status groups and structuring social mobility. Her analysis shows that architecture is a potent tool for structuring the activities that constitute social organization, expressing and constraining relations among individuals and groups. Following sociocultural anthropologists such as Bourdieu (1977), Douglas (1972), and the sociologist Giddens (1979), Donley-Reid suggests that architecture be considered a set of mnemonic devices constructed by those in power to represent their social superiority. By behaving appropriately in a built environment, people con-

tinuously reiterate the social order. Hegmon (1989) makes some of these same points with respect to Puebloan architecture, and Ferguson (1989:173) discusses "architectural theory that explains how buildings structure social interaction by controlling encounters."

The full extension of these premises into a comparison of southwestern and Mesoamerican integrative facilities is a large task, but it is possible to briefly suggest some of the major points of contrast, focusing on differences between southwestern kivas and Mesoamerican pyramid-altar complexes. These features are not the only integrative facilities used in either context, but seem to be among the most central to the respective ideologies. Kivas symbolize the place of origin at which ancestral people emerged from the underworld. One apparently enters a kiva to reestablish contact with ancient wisdom through ceremony. The behaviors appropriate to such a space are prayerful and consultative. The design of the kiva in Chaco Canyon is circular, the inward-facing benches implying a group structure that is consensual rather than confrontational. Zuni tradition holds that before the Spaniards arrived there was no tribal council, and most issues were handled by families; the few that could not be were resolved by ceremonial leaders (Ladd 1979).

The pyramid-altar complex, in contrast, is of a completely different design and has radically different symbolic associations. For the Aztecs, the pyramid symbolized a mountain where Huitzilopochtli established his warrior identity by confronting and defeating attackers (Townsend 1992). The dominance relationship created in battle was reenacted frequently at the altar with real human sacrificial victims (Duran 1964 [1581], 1971 [1581]), and was directly connected with activities of political conquest. Subject polities that failed to pay their required tribute or refused to swear allegiance to the Aztecs were visited in missions of reconquest, primarily for the purpose of capturing prisoners who were brought back to the capital to be sacrificed in the main plaza. The relevance of this behavior and ideology to integrative facilities at La Quemada is indicated by the disarticulated remains of several hundred individuals buried at the foot of a small pyramid in the monumental core of the site. Although we cannot know the meaning of the architectural statements made by residents of the places under consideration here, or how unique are the scraps of information about their historic analogs, structural contrasts are suggested by ethnographic images. In the case of Chaco Canyon, the image seems to be one of egalitarian consultation, whereas in La Quemada it is hierarchical confrontation.

Conclusion

Given current paradigms, our inclination when comparing two polities is to ask "How complex were they relative to one another?" The foregoing analysis suggests that instead we should be asking "How were they complex?" It also argues that scale and hierarchy are independent dimensions of sociopolitical complexity.

The view that prehistoric societies in the American Southwest were organized on a smaller scale than those of northern Mesoamerica is in need of revision. The above comparisons show that Chaco Canyon was a much larger system than La Quemada in terms of demographic and spatial scale. With relatively incomplete knowledge of what lies to the south, and spurred by scenarios of colonization and dependency (Kelley and Kelley 1975; Weigand et al. 1977), archaeologists have tended to assume more grandeur than is warranted. Such a tendency leads Mathien (1986) to suggest that the most likely Mesoamerican polity to have colonized Chaco Canyon, if any, must have been La Quemada. Aside from being contradicted by recent chronological evidence discussed above, this suggestion is not supported by the present information regarding the relative sizes of the two polities. A group such as that represented at La Quemada could not have fielded the human resources necessary to support distant enterprises on the order of founding Chaco Canyon, nor does it seem likely that a smaller polity would have dominated a larger one. This finding, of course, adds weight to Mathien's (1986) own conclusion that Chaco Canyon was an independent development. These comments on scale are not intended to suggest elevating Chaco Canyon to a state, but that the scalar conception of La Quemada, as well as other northern Mesoamerican settlements such as Alta Vista, needs to be downsized.

While Chaco Canyon was organized at a larger scale, La Quemada seems to have been more hierarchically structured. This inference rests primar-

ily on architectural symbolism and the apparently institutionalized use of force. Chaco Canyon includes a large number of roughly equally sized principal settlements (Sebastian 1991), whereas La Quemada, a visually imposing monument consisting of elite residences and ceremonial facilities, dwarfs the rest of the settlements in its own system (Trombold 1985). Chacoan roads connect more distant places; La Quemada's roads lead directly to numerous communities that are within sight of the central place, a seeming overstatement of dominance. The symbolism associated with Chacoan kivas, as known ethnographically, is linked to collaboration and consultation, whereas that of the La Quemada temple/ball court/pyramid complex is related to hierarchical structure and repression. The ubiquitous displays of human bone at La Quemada suggest a degree of institutionalized violence that far exceeds what is seen in Chaco Canyon.

This comparison shows that social power was constructed in significantly different ways in the two societies, and also demonstrates the inadequacy of the neoevolutionary concept of complexity for some purposes. Recent discussions of social relations (McGuire et al. 1994; Sebastian 1991) and of differential bases of social power (Yoffee 1993) point the way to these insights. Attempting to determine which of two societies was "more complex" seems irrelevant when they contrast so strongly on some of the very characteristics that theoretically constitute complexity. Rather, it would appear that in a study such as this one where individual societies are closely examined, the discussion of complexity needs to be treated so that such properties as inequality, differentiation, scale, and integration (Blanton et al. 1981; Laumann et al. 1970; Lipe 1992; McGuire 1983) are treated as irreducible. Irreducibility means that these dimensions may vary independently; drawing from the present example, scale and hierarchy do not necessarily co-vary even though both are dimensions of complexity. This is not to suggest abandonment of societal taxonomies for other purposes such as discussions of global variability; one can still profitably refer to Chaco Canyon and La Quemada as chiefdoms, and might distinguish them from one another as collaborative vs. coercive chiefdoms. Moreover, they are also both instances of another kind of broad process (i.e., experiments in sociopolitical organization on the periphery of Mesoamerica) and as such can be reasonably compared with other similar cases. If this particular pair is any guide, we can expect to find that the occasional "bright spots" of sociopolitical development in the Gran Chichimeca are characterized by extensive organizational diversity. The question then becomes why such different sets of social relations developed and what conditions structured the strategies of the local actors.

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