

An Analysis of Travel Costs Among Proposed Trading Partners in Northern Mexico

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Figure 1. The northern Mesoamerican frontier in relation to the site of La Quemada.

Abstract

La Quemada, Zacatecas, was part of a regional network of centers known to have interacted through ceramic exchange during the Epiclassic period (A.D. 600-900). This study utilizes a least-cost path analysis to evaluate the geographical accessibility of neighboring centers to La Quemada. Based on the current understanding of ceramic exchange in this region, it was expected that El Teul would be the trading partner with the least associated travel costs. This poster presents the methods and results of the analysis and suggests that more intensive exchange relations seem not to be with the nearest neighbors as measured by travel costs, which raises interesting questions about the web of social relations.

Table 1. Proposed production areas of decorated ceramics found at La Quemada.

Figure No.*	Type	Occurrence	Presumed Production Area**
1-4	Romos Red-on-buff	Frequent	Local
5	Colotlán Red-on-buff	Rare	Tlaltenango Valley
6	Santa Rosa Red-on-white	Rare	Unknown
7	Sierra Brown-on-white	Rare	Tlaltenango Valley
8	Tepetongo White-on-red	Rare	Tlaltenango and Juchipila Valleys
9	Tabasco White-on-red	Rare	Juchipila Valley
10	Morones Black-on-white	Rare	Sierra de Morones between Juchipila and Tlaltenango Valleys
11-13	San Luis Polychrome	Rare	San Luis Potosí
14	Ponce Resist Polychrome	Rare	Tlaltenango or Bolaños Valley
15-19	Malpaso Negative (Resist) Polychrome	Rare	Local
20	Angeles Resist Polychrome	Rare	Suchil Valley
21	Angeles Resist Black-on-white	Rare	Suchil Valley
22-23	Unclassified Resist	Rare	Unknown
24-26	Pseudo-cloisonné	Rare	Local?
27-38	Incised-engraved	Frequent	Local

* See Schiavitti et al. 1996 ** Per Peter Jimenez, personal communication to B. Nelson, 2007

Background

The northern frontier of Mesoamerica contained a network of regional centers that came to dominate the landscape during the Epiclassic period (A.D. 600-900). La Quemada, Zacatecas, Mexico, was one of these centers and reached the height of its occupation around A.D. 600/650-800 (Brown 1985; Jimenez Betts & Darling 2000; Kelley 1971; Nelson 1997; Trombold 1990). This research seeks to gain a better understanding of how La Quemada fits into this network of relationships by examining the exchange of rare decorated ceramics in the region (Schiavitti et al. 1996). Jimenez Betts (personal communication to Ben Nelson 2007) proposed production areas (typically

specified to a valley region, not a site) for most of the ceramic types found at La Quemada based on their form, style and decoration (Table 1). This table suggests that a large proportion of the decorated ceramics found at La Quemada were produced in the Tlaltenango Valley. Based on this pattern it was concluded that the Malpaso Valley may have had a greater amount of interaction with the Tlaltenango Valley than with other valleys in the region (Figure 2). To examine this relationship, I determined the length of time required to travel between La Quemada and other centers in the region. It was expected that traveling from La Quemada to the site of El Teul, located in the Tlaltenango Valley, should take less time than traveling to other centers.

Methods

A cost-surface model was used to evaluate the relative geographic accessibility of various regional centers to travelers making round trips from La Quemada. I used a 90-m resolution digital elevation model (DEM) of the region of northwestern Mexico acquired from the Global Land Cover Facility (GLCF). The original projection of this DEM was Latitude-Longitude, but all work was done in UTM. The centers of Alta Vista, Cerro Tepezuasco, El Teul, Las Ventanas and Nochistlan were chosen because each represents another major occupied area that was, for the most part, contemporaneous with La Quemada (Figure 2). A series of anisotropic cost surfaces, meaning the properties of the surface change depending on the direction over which it is traversed, were created using a module in GRASS GIS. This module takes into consideration the distance covered, changes in elevation based on specific slope intervals, as well as coefficients figured for energy expended while walking. These cost surfaces were then used to find a path across the landscape where the least amount of effort was needed to travel from one point to another (Figure 3). Each path provided the travel time from one center to another in seconds, which was then converted into the number of days it would take an individual to reach its destination (assuming an eight-hour day of continuous walking).

Table 2. Data concerning the least-cost path found from La Quemada to each center.

From La Quemada to:	Approx. Distance*	Time (h)	Walking Speed	Travel Time**
Alta Vista	161.72 km	35.07	4.61 km/h	4.38 days
Cerro Tepezuasco	86.64 km	17.85	4.85 km/h	2.23 days
El Teul	103.30 km	27.75	3.72 km/h	3.47 days
Las Ventanas	121.94 km	26.57	4.59 km/h	3.32 days
Nochistlan	112.92 km	25.76	4.38 km/h	3.21 days

Table 3. Data concerning the least-cost path found from each center to La Quemada.

To La Quemada from:	Approx. Distance*	Time (h)	Walking Speed	Travel Time**
Alta Vista	161.72 km	35.09	4.61 km/h	4.39 days
Cerro Tepezuasco	86.64 km	19.39	4.47 km/h	2.42 days
El Teul	103.30 km	28.15	3.67 km/h	3.52 days
Las Ventanas	121.94 km	26.65	4.58 km/h	3.33 days
Nochistlan	112.92 km	25.76	4.38 km/h	3.22 days

*Approximate distance was figured using a measurement tool in GRASS GIS. ** Travel time in days assumes an eight-hour day of continuous walking.

Analysis

This study produced rather interesting results concerning the relationship between La Quemada and El Teul. Table 4 clearly shows that, based simply on travel time, Cerro Tepezuasco was the most geographically accessible site for the residents of La Quemada, not El Teul. In fact, according to this analysis, El Teul actually takes the second longest amount of travel time, behind Alta Vista. Figure 3 shows that the paths to Cerro Tepezuasco, Las Ventanas and Nochistlan are exactly the same until a point approximately 15-20km north of Cerro Tepezuasco. The travel times to Las Ventanas and Nochistlan, however, are about two days longer than that to Cerro Tepezuasco. This is surprising because these three centers are all located within 30-40km of each other, therefore the difference in travel time can be attributed to the increase in elevation between Cerro Tepezuasco and Las Ventanas and Nochistlan. Regardless of this observation, all three of these centers were more geographically accessible from La Quemada than El Teul most likely because it is in a valley adjacent to the Malpaso.

Discussion

Since El Teul was not found to be the most geographically accessible site other factors must be explored to find an explanation for the overwhelming presence of ceramics produced in the Tlaltenango Valley at La Quemada. Several archaeologists have discussed evidence of extensive violence and conflict in the Malpaso Valley (Armillas 1964, 1969; Braniff and Hers 1998; Elliott 2005; Hers 1989; Nelson et al. 1992; Nelson 2000; Weigand 1978a,b). One might infer that the individuals inhabiting the Juchipila Valley (Cerro Tepezuasco and Las Ventanas) as well as the site of Nochistlan, located further east in the Sierra de Morones, were enemies of those inhabiting the Malpaso Valley and, therefore, no interactions other than conflict took place between them. This explanation can be questioned because there are decorated ceramics sourced to the Juchipila Valley (Tepetongo White-on-red and Tabasco White-on-red) and obsidian sourced to Nochistlan found in the Malpaso Valley (Darling 1998; Millhauser 1999), which suggests some level of exchange took place between these centers (Jimenez Betts, personal communication to Ben Nelson 2007). Archaeologists know from ethnographic studies that groups may have hostile relations and yet carry on exchanges with one another (Wiessner 2002). This may have been the case for centers in this region due to the evidence for both exchange between centers and violent interactions.

The present study uses ceramic evidence to interpret the exchange network of an entire region. Obviously ceramics were not the only items produced and exchanged in the northern frontier. Perhaps there was a pattern of regional specialization in which each valley specialized in different finished goods. The Chalchihuites area is famous for its mining activities (Weigand

1982); there is a known obsidian source near Nochistlan (Darling 1998; Millhauser 1999), and it is possible that the Tlaltenango Valley may have specialized in ceramic production. If this was the case then there may have been more Tlaltenango ceramics circulating in this exchange system than others, and Tlaltenango ceramics should dominate the assemblages of centers other than La Quemada. To evaluate this proposition, the relative frequencies of ceramic types at several regional centers need to be observed; this topic deserves closer attention in the future.

Finally, religion may have played a role in the exchange of ceramics in this region. It can be assumed that pilgrimages to sites like La Quemada may have been common in the past because the modern Cora and Huichol still move widely on the northern Mexican landscape, making offerings at sacred places (Grimes & Hinton 1969). Renfrew (2001) suggests the concept of a Location of High Devotional Expression (LHDE) to explain the deposition of valued goods in Chaco Canyon, New Mexico. In this context he describes a LHDE as an area where "The production and consumption of goods is to be understood in the context of the ideational/devotional significance of the great houses and great kivas of Chaco and of periodic visits made to them for devotional purposes (i.e., pilgrimages)" (Renfrew 2001: 14-15).

Table 4. Total travel time from La Quemada to each center.

From La Quemada to:	Total Travel Time*
Alta Vista	8.8 days
Cerro Tepezuasco	4.7 days
El Teul	7.0 days
Las Ventanas	6.7 days
Nochistlan	6.4 days

*Travel time in days assumes an eight-hour day of continuous walking.

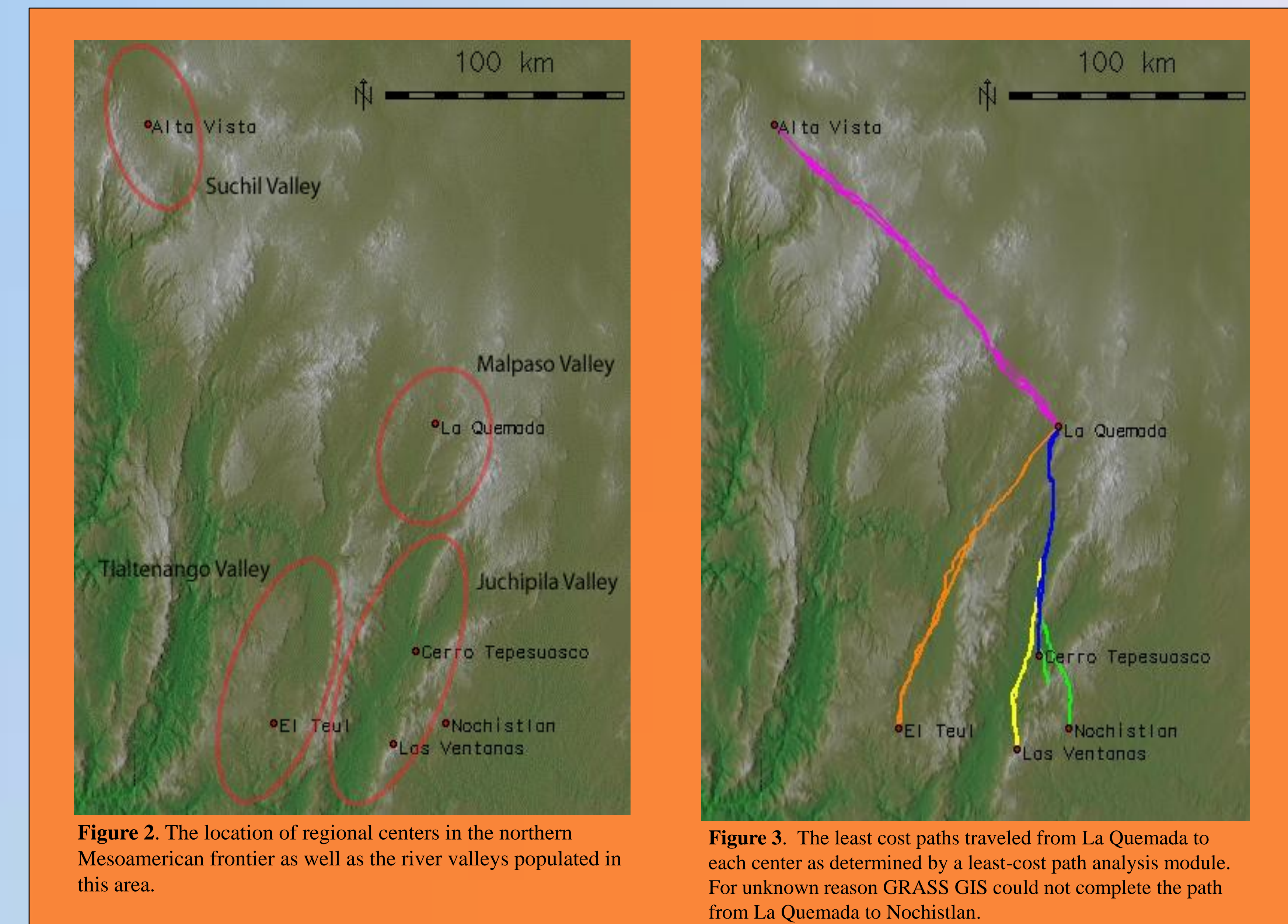


Figure 2. The location of regional centers in the northern Mesoamerican frontier as well as the river valleys populated in this area.

Figure 3. The least cost paths traveled from La Quemada to each center as determined by a least-cost path analysis module. For unknown reason GRASS GIS could not complete the path from La Quemada to Nochistlan.

Conclusion

Due to the evidence for ceramic exchange in northwestern Mexico it was proposed that the strongest trade relationship the residents of La Quemada maintained would have been with the nearest neighbor in terms of travel logistics. This expectation was evaluated through a least cost path analysis and found to be rejected based solely on data collected concerning travel time between centers in the region. It was concluded, therefore, that episodic warfare in the region may have influenced the pattern of ceramic exchange observed between La Quemada and El Teul. Future research will revolve around detailed ceramic provenance studies as well as the incorporation of other parts of the region (Bajío, Jalisco and more of the Bolaños) and exchange patterns of other product types (obsidian, greenstone, shell, sculpted figurines, etc).

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†See handout for references.

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