MASCA Research Papers
in Science and Archaeology

Supplement to Volume 7, 1990

ECONOMY AND SETTLEMENT IN THE NEAR EAST:
Analyses of Ancient Sites and Materials

---

edited by

Naomi F. Miller

MASCA, The University Museum of Archaeology and Anthropology
University of Pennsylvania, Philadelphia
1990

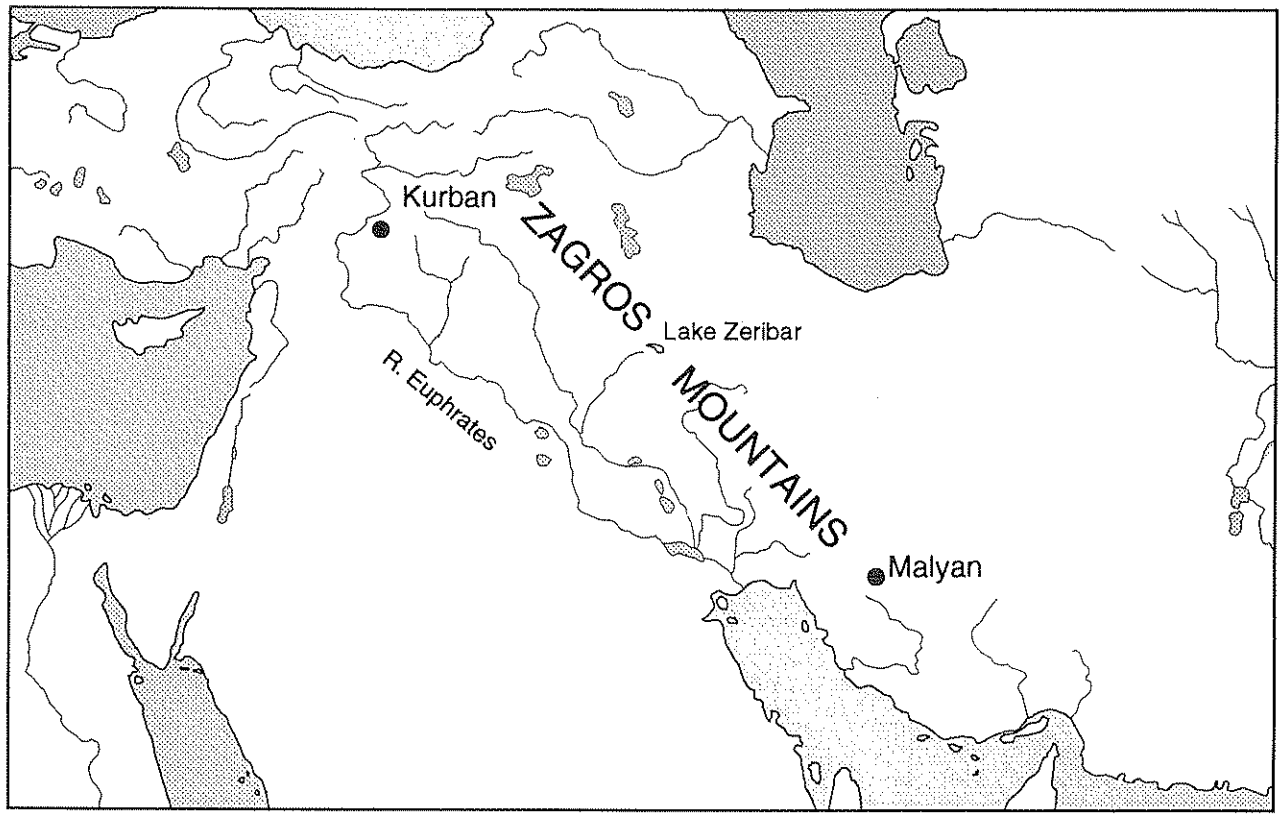

Fig. 1:
Map of Near East showing sites mentioned in text.

ARCHAEOBOTANICAL PERSPECTIVES ON THE RURAL-URBAN CONNECTION

Naomi F. Miller

MASCA, The University Museum of Archaeology and Anthropology, University of Pennsylvania, Philadelphia, PA 19104

The previous paper discussed major landscape changes brought on by population growth and technical development in parts of the ancient Near East. Contemporaneous increases in economic and social differentiation are signalled archaeologically by changes in the settlement system, namely, the development of distinct urban and rural sectors. Archaeobotanical studies can yield important insights into the relationship between town and countryside.

In the ancient Near East, craft and administrative activities are generally presumed to have been based in cities. Farmers, too, could have lived in urban settings while working the surrounding fields. In many regions, increasingly complex settlement patterns show that the rural agricultural sector developed along with urbanization. After all, someone had to provide surplus food for urban nonproducers. As population densities increased, surplus production became even more important as a buffer against poor harvests. Archaeologically, the interdependence of the rural and urban components of the social system is reflected in settlement hierarchies and in the differential distribution of features and artifacts on different types of sites.

Much archaeobotanical research in the Near East focuses on the origins of food production, but scholars are increasingly directing their attention to the environmental conditions and agricultural practices of the early civilizations. The importance of archaeobotanical studies is evident when one considers that it was the rural agricultural economy that sustained the urban civilizations of the ancient Near East. Most work on the early civilizations concentrates on urban sites. The reconstruction of regional environment and land use in complex societies based on excavations at a single site is inherently subject to distortion for at least two reasons, however. First, no single site can be considered typical in a complex settlement system, and second, any subsistence practices which took advantage of very localized resources and habitats will be hard to verify. In the absence of excavations in the rural component of complex settlement systems, one should at least be aware of how urban remains reflect regional phenomena.

Archaeology of the Kur river basin

Late third/early second millennium developments in the Kur river basin of southern Iran exemplify the processes of urban growth and rural development. This area was the heartland of the Achaemenid empire, but people have lived there since Paleolithic times. Archaeological data come from various surveys of the valley and from the excavation by The University Museum of the University of Pennsylvania at Malyan, the largest site in the valley (summarized by Sumner 1986, 1988, 1989). Ethnographic and census data collected in modern times provide a basis for interpreting the material evidence for ancient land use patterns (Census 1970; Kortum 1976; Miller 1982).

Malyan achieved urban status in the second half of the fourth millennium B.C., locally known as the Banesh period. After a probable discontinuity in settlement, the city was reestablished by 2200 B.C. (Kaftari period; Sumner 1988). The site has been identified as Anshan, a capital of the Elamite polity (Stolper 1984), and was contemporary with the Akkadian and later civilizations of Mesopotamia. Malyan-based studies of the pastoral and agricultural sectors of the ancient economy have been completed. Zeder (1984, 1985) has discussed the distribution of pastoral products in the urban economy, and archaeobotanical work has provided information about the agricultural economy and the envi-

ronmental setting (Miller 1982, 1984, 1985). Ideally we would test these reconstructions against new data from other sites in the valley, but political events since the late 1970s have prevented us from excavating rural settlements contemporary with Malyan.

A glance at the map (Fig. 1) shows that population in the valley was unevenly distributed. (The following discussion is based on Sumner [1989]). At the beginning of the second millennium, Malyan had clearly become the major settlement of the Kur river basin. Evidence of craft and administrative specialization and long-range trade further indicates its urban status. Although supported by a multi-tiered settlement hierarchy of towns and villages throughout the valley, Malyan was not centrally located with regard to the rural population. At 130 ha, it housed nearly half the settled population of the valley. These data suggest that the Kur river basin settlements were not economically and politically independent of one another.

Malyan's preeminence in the settlement system insured that it was a major locus of agricultural production, consumption, and distribution in the valley. First, Malyan is very large, and only a few small sites lie within a 10-km radius; it is therefore likely that many agricultural workers actually lived in the city, and farmed in the immediate vicinity. Second, if Malyan housed about half of the valley's population, about half of the consumption of agricultural products (namely, food) would have taken place there as well. Third, some of the agricultural products produced elsewhere in the valley would have been brought to the city, to feed non-producers (scribes and other administrative personnel, craft workers, and the like).

The available data are heavily biased in favor of the urban settlement, yet Malyan was not independent of its rural hinterland. Because Malyan was involved in a regional system, it is possible to make some generalizations about the environment and land use in the valley as a whole. Yet until we have excavated evidence from other parts of the valley, we will not be able to determine how the rural population participated in and was integrated into the regional economy.

Ethnobotanical considerations

Fortunately, plant remains do not simply reflect environmental conditions. At Malyan they provide evidence for basic resource management, such as fuel procurement and agricultural and pastoral practices. Plant remains recovered from urban settings represent the final deposition of fuel, agricultural products, and other resources that originated in the countryside. Most plant remains are preserved by charring, so fire, usually under human control, is the primary factor of archaeobotanical preservation. Patterns of fuel use must be understood before one can infer the environment, irrigation, crop choice, and pasture practices from plant remains (Miller 1984, 1985).

Wood may be brought to a site for a variety of reasons, but when burned (and thus archaeologically visible) it is generally used as fuel. In non-industrialized situations, transport cost determined by distance is typically the overriding factor in species choice. Although archaeological charcoal cannot be used to determine the relative proportions of tree types in the forest, it is usually the only direct evidence that we have for species availability. The third millennium saw a great increase in settled population in the Kur basin (cf. Sumner 1989). Land use patterns had to change in order to satisfy the increased demand for both fuel and food.

The following interpretation of the Malyan plant remains rests on several assumptions about fuel use that are strongly supported by ethnographic analogy (Miller 1984, 1985). First, given a choice, wood and charcoal were preferred to dung. Second, as the more desired fuels, wood and charcoal could be transported profitably from as far away as the mountainsides, a distance of only about 10 km. And finally, most of the archaeological seeds reflect animal fodder.

The view from Malyan

The charcoal analysis identified some of the environmental disturbance that resulted from fuel cutting during the third millennium. For example, trees growing within 5 or 10 km of the site were most probably utilized at the beginning of the third millennium; by the end of the third millennium, the more distant stands of oak were tapped (Miller 1985, this volume). Wood is not the only fuel, however, that provides information about the environment.

The other commonly used fuel at Malyan was dung. When burned, dung leaves a residue of ash and identifiable seeds. The seeds represent plants of pasture, field stubble, and fodder, and they are incidentally useful indicators of environment and land use. Thus, the documented increase in the use of dung fuel relative to wood corroborates this picture of an expanding circle of tree clearance around Malyan (Miller 1985).

Aspects of agricultural and pastoral production may also be addressed with the archaeobotanical data. The presence of weed species of irrigated fields in the archaeobotanical assemblage (e.g., *Chenopodium, Avena, Lolium, Fumaria,* and *Hyoscyamus* [Miller 1982:161 ff.]) suggests that at least some crops were irrigated in both Banesh and Kaftari times. The high proportions of seeds of nearby meadow and field plants found in flotation samples suggests that animals were pastured relatively near Malyan; there are only a few seeds of *Prosopis,* a plant that grows as much as 30 km away.

Food plants grown or collected by ancient Malyanis in both Banesh and Kaftari times include cultigens (wheat, barley, lentil, and grape), and nuts (pistachio and almond). Wheat and barley are the most important crop plants represented. A mineralized Kaftari latrine deposit yielded twice as much wheat as barley, whereas barley predomi-

nates at better than ten to one in the charred material from both Banesh and Kaftari deposits. Presumably, wheat was more important as human food, and barley was grown primarily as fodder (that is, most of the charred seeds were incidentally incorporated in dung fuel [Miller 1984]).

There was an increase in 2-row barley at the expense of the 6-row type. The major economically important difference between the two is that 6-row barley has a higher protein content relative to starch than does the 2-row form, a trait which makes 6-row more suitable for food and fodder. In contrast, the high starch content of 2-row barley makes it well suited to malting and beer-making (Hutcheson et al. 1936). Textual evidence from Mesopotamia suggests that there was a shift from food to drink in the use of barley between the Sargonid period (mid-third millennium) and the Third Dynasty of Ur (late third to early second millennium) (Oppenheim 1950). One might suggest that a similar shift, reflected in a changing pattern of barley use, occurred in the Kur basin, but archaeological evidence of brewing, such as large ceramic vats containing masses of wheat and barley residue (cf. Geller 1989), has yet to be found at Malyan.

Alternatively, crop choice at Malyan could reflect agricultural practices in the Kur river basin. Harvests of both wheat and barley are more secure if irrigated, but barley is more drought resistant than wheat (Nuttonson 1957:7). Two-row barley tends to be more drought-resistant than the 6-row type, and in those parts of the Near East where both are grown, 6-row barley is irrigated and 2-row is not (Harlan 1968).

One might expect the grain yield of 6-row barley, with three times as many grains per spikelet, to be greater than that of 2-row barley, but this does not appear to be the case. In one experiment, yields of two varieties each of 2- and 6-row barley types were not correlated with type (Thayer and Rather 1937). In another test, the 2-row barley was found to yield slightly less in general. However, at lower rates of seeding, it outyielded both of the 6-row varieties tested (Bonnett and Woodworth 1931). Considering that in the Kur basin today, unirrigated grain fields are seeded less densely than irrigated ones, this might confer a yield advantage on 2-row barley under dry farming.

In the third millennium barley production for hay and fodder could therefore have been expanded by clearing

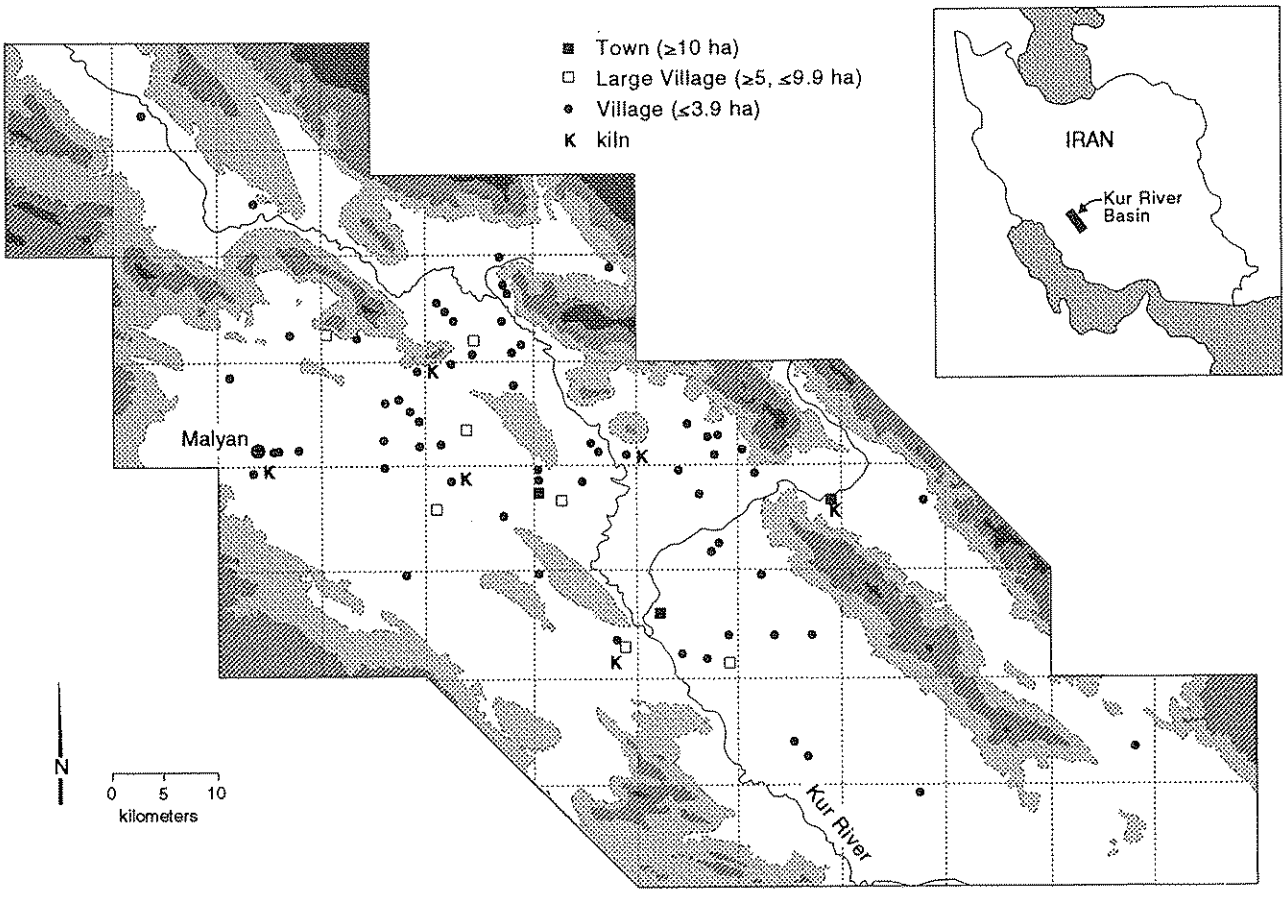

Fig. 1:
Map of the Kur river basin during the Kaftari period.

trees from unirrigated land around Malyan, and 2-row barley could have been grown with relatively little risk of drought. Turning irrigated lands over to wheat production would have minimized additional labor costs, while at the same time reducing the risk of crop failure and maximizing *food* yield. The irrigated fields would have been used to secure a plentiful and reliable wheat harvest for the human population, and barley for the animals would have been relegated to the recently cleared dry-farmed fields.

The view from the countryside

Remnants of the natural vegetation, physiography, and modern land use enable one to identify ecologically distinctive zones. Pistachio and almond dominate the southeastern end of the valley, whereas oak grows on the hillsides to the northwest. Traditionally, the north edge of the valley had extensive pasture, as did the central moist meadow area (cf. Census 1970; Miller 1982). The southeast part has a long history of river irrigation (Kortum 1976). Any economic differentiation of the communities in the valley which takes advantage of this variability will allow for more efficient use of the landscape.

Rainfall agriculture is possible in the Kur basin, but irrigation greatly enhances crop security and productivity. Based on the distribution of water sources and archaeological sites in the valley, William Sumner (1989) suggests that irrigation was an important factor in agricultural production of the late third millennium. But the archaeobotanical evidence, based on excavated materials from one site, does not support the inference of expanding irrigation. This apparent discrepancy can be resolved by considering rural-urban relations.

Irrigation near Malyan is limited only by the availability of water; it may have reached its limit in both Banesh and Kaftari times (Sumner, pers. comm. 1989). Furthermore, dry-farming would have been more suitable for distant fields, as it is less labor-intensive than irrigation agriculture. If Malyan were an independent, self-sufficient settlement, one could reasonably infer from the archaeobotanical evidence that people expanded food and fodder production by increasing the area cultivated rather than by improving yields with more labor intensive practices. First, forest clearance would have opened more land for fields. Second, the wheat-to-barley ratio is fairly constant. And third, cultivation of 6-row barley declined relative to the 2-row type.

But Malyan was not independent, even though it dominated the valley. As suggested above, the most efficient system of agricultural production would take advantage of the variety of natural conditions in the valley. This could only occur if valley-wide systems of distribution developed. Although distribution may have been uneven, with political centers drawing in more resources from the countryside than they returned, intra-valley specialization could have increased production. Near Malyan, the only available water sources for irrigation are a few springs along the valley edge, and rainfall is higher there, so barley may have become the preferred crop. Malyan could well have obtained fodder locally, and imported irrigated wheat through trade or taxation. Since the archaeological remains reflect fodder, not food, we are seeing only one part of the agricultural system. Distinguishing local from regional production requires archaeobotanical assemblages from more than one site, however important that site may be.

Archaeobotanical test implications

One way to test the degree of economic integration in the valley is to focus on different supply systems. For a given product, if availability is the primary determinant of its distribution, one might expect a gradual falloff in quantity as one leaves the source area. If, on the other hand, distribution is influenced by a central authority or central marketing point, one might expect "central places" to have relatively large amounts of that product. I think fuel and fodder distribution was governed by availability, but food distribution is more likely to have followed a central place model (cf. Johnson 1973). The identification of distribution channels for particular items would increase our understanding of the relation between Malyan and its hinterland, and excavation in the southeastern irrigation district should clarify the degree of Malyan's dominance.

Charcoal analysis could prove to be a useful tool here. Trees are likely to have lasted on the mountainsides longer than in the valley because the hilly land is unsuited to alternative agricultural uses and population densities were lower. One would therefore expect villages on the valley edge to have greater access to wood fuel. Similarly, villages in the central meadow areas might have particularly high percentages of meadow plants. If each family collected its own fuel, one would expect those sites on the valley edge to have a relatively high proportion of charcoal of forest woods, oak in the northwest, and pistachio and almond in the southeast. Dung use as determined by the amount of charcoal relative to weed seeds would be low compared to a populous site like Malyan. In contrast, if city dwellers had direct access to forest woods either as individuals or perhaps through some kind of specialized marketing channel (like charcoal cutters), one would expect wood use at Malyan to be comparable to or even higher than that of the valley edge.

If animal pastures and fuel sources are local, weed seed assemblages from sites in the irrigation district should yield seeds from irrigated weeds and plants of the region, like *Capparis* and *Prosopis*, neither of whose range extends to Malyan. Inter- and intra-settlement differences in pastoral production might also lead to occupational or status-based differences in fuel residues. Patterns of meat distribution at Malyan itself suggest higher status people living in Malyan were further removed from production

than some of the other residents who were pastoral specialists (Zeder 1984). These specialists would have had ready access to the daily output of locally produced dung. Unfortunately, there is insufficient evidence to determine whether people had differential access to the various fuels, wood, charcoal, and dung.

Finally, the nature of relations with groups outside the valley can be assessed through excavation in rural sites. The Kur basin lies on a major route to Mesopotamia from the Iranian plateau. If Malyan was indeed the urban center it appears to have been, one would expect exotic goods destined for or passing through the valley to be concentrated in that city; rural settlements would have less access to such items. Source analyses of minerals are widely used to trace trade networks, but even humble plant remains can provide evidence for long-range trade. Two imported date pits from late third millennium Malyan show the potential of this kind of analysis.

Conclusions

The contribution of the agricultural sector to urban development is an important aspect of the study of ancient civilization. The nature of the rural-urban connection can be illuminated by a research strategy that combines regional archaeological survey and excavation at both major centers and smaller sites. Archaeobotanical evidence is critical for identifying regional patterns of land use, and the analysis of plant remains can provide insight into the relations between rural and urban communities.

Acknowledgments

The Malyan excavation (1974-1978) was sponsored by The University Museum of The University of Pennsylvania. William M. Sumner, Paul Minnis, and an anonymous reviewer provided many useful comments on an earlier draft of this paper.

References

Bonnett, O.T., and C.M. Woodworth. 1931. A Yield Analysis of Three Varieties of Barley. *Journal of the American Society of Agronomy* 23:311-327.

Census. 1970. *National Census of 1966. Village Gazetteer, Fars Ostan.* Plan Organization, National Statistical Centre of Iran, Tehran.

Geller, J. 1989. Recent Excavations at Hierakonpolis and Their Relevance to Pre-Dynastic Production and Settlement. *Cahiers de Recherche de l'Institute de Papyrologie et d'Égyptologie de Lille.* (forthcoming)

Harlan, J.R. 1968. On the Origin of Barley. In *Barley: Origin, Botany, Culture, Winter Hardiness, Genetics, Utilization, Pests*, pp. 8-31. Agriculture Handbook No. 338. Agricultural Research Service, Washington DC.

Hutcheson, T.B., T.K. Wolfe, and M.S. Kipps. 1936. *The Production of Field Crops.* McGraw-Hill, New York.

Johnson, G.A. 1973. *Local Exchange and Early State Development in Southwestern Iran.* Anthropological Papers No. 51. Museum of Anthropology, University of Michigan, Ann Arbor.

Kortum, G. 1976. *Die Marv-Dasht Ebene in Fars.* Kieler Geographische Schriften 44. Geographisch Institut der Universität Kiel, Kiel.

Miller, N.F. 1982. *Economy and Environment of Malyan, a Third Millennium B.C. Urban Center in Southern Iran.* Ph.D. dissertation, University of Michigan, Ann Arbor.

_____ 1984. The Use of Dung as Fuel: An Ethnographic Example and an Archaeological Application. *Paléorient* 10(2):71-79.

_____ 1985. Paleoethnobotanical Evidence for Deforestation in Ancient Iran. *Journal of Ethnobiology* 5:1-19.

Nuttonson, M. 1957. *Barley-Climate Relationships.* American Institute of Crop Ecology, Washington DC.

Oppenheim, A.L. 1950. On Beer and Brewing Techniques in Ancient Mesopotamia. *Journal of the American Oriental Society* Supplement 10.

Stolper, M.W. 1984. Political History. In *Elam, Surveys of Political History and Archaeology,* by E. Carter and M.W. Stolper, pp. 3-100. Near Eastern Studies 25. University of California, Berkeley.

Sumner, W.M. 1986. Proto-Elamite Civilization in Fars. In *Gamdat Nasr Period or Regional Style?*, ed. U. Finkbeiner and W. Röllig, pp. 199-211. Dr. Ludwig Reichert Verlag, Wiesbaden.

_____ 1988. Maljan, Tall-e (Ansan). In *Reallexikon der Assyriologie und Vorderasiatischen Archäologie,* pp. 306-320. Walter de Gruyter, Berlin.

_____ 1989. Anshan in the Kaftari Phase: Patterns of Settlement and Land Use. In *Archaeologia Iranica et Orientalis: Miscellanea in Honorem Louis Vanden Berghe,* ed. L. de Meyer and E. Haerinck. Peeters Press, Ghent.

Thayer, J.W., Jr., and H.C. Rather. 1937. The Influence of Rate of Seeding Upon Certain Plant Characters in Barley. *Journal of the Society of Agronomy* 29:754-760.

Zeder, M.A. 1984. Meat Distribution at the Highland Iranian Center of Tal-e Malyan. In *Animals and Archaeology. 3: Early Herders and Their Flocks,* ed. J. Clutton-Brock and C. Grigson, pp. 279-307. BAR International Series 202, Oxford.

_____ 1985. *Urbanism and Animal Exploitation in Southwest Highland Iran 3400-1500 B.C.* Ph.D. dissertation, University of Michigan, Ann Arbor.