Iranica Antiqua, vol. LI, 2016
doi: 10.2143/IA.51.0.3117836

PARTHIAN AND SASANIAN SETTLEMENT PATTERNS ON THE DEH LURAN PLAIN, KHUZISTAN PROVINCE, SOUTHWESTERN IRAN

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Abstract: A stratified pedestrian survey provides the data for this interim report on the Partho-Sasanian occupations of the Deh Luran Plain. Settlement and site patterning observed in relation to water and soil management systems are described and compared with other regions, primarily the Diyala and Upper Khuzistan (Susiana) Plains. The roles of marginality, autonomy, and cooperating corporate groups are considered in relation to the findings of the survey.

Keywords: Southwestern Iran, Parthian, Sasanian, Settlement Patterns, Agricultural Strategies, Water Management, Corporate Groups

Introduction

The purpose of this paper is threefold: (1) to present an interim report on the Partho-Sasanian occupations of the Deh Luran Plain, (2) to compare the settlement patterns of the Deh Luran Plain for the Parthian and Sasanian periods with those of a few other key regions of the Middle East, and (3) to discuss the possible role(s) of the Deh Luran Plain in relation to the larger economic and socio-political centers in the greater Mesopotamian sphere during these periods.

The settlement pattern data presented in this paper were derived as part of a long-term comprehensive archaeological program conducted on the Deh Luran Plain of southwestern Iran, but curtailed since the Iranian Revolution of 1979. Sponsored by Rice University and funded by the National Science Foundation, this program was under the general direction of Dr. Frank Hole. The majority of the data were collected during a 1968-69 reconnaissance of the plain (Neely 1969, 1970, 1974; Neely & Wright 1994; Wright & Neely 2010), although some information comes from the 1963-64 fieldwork as well (Hole, Flannery & Neely 1969).

This paper is preliminary to a third monograph on the settlement history of the Deh Luran Plain. The first two volumes described settlements from the Neolithic through the Achaemenid periods and the final volume will deal with the Seleucid through the Medieval Islamic periods. While the data we present on sites and canals are well established, we anticipate some further refinement of the ceramic chronology that will allow more precise dating of the sites within the 900 years span considered here.

Environmental setting

Since the fieldwork was completed the Deh Luran Plain has been transformed through intensive irrigation so some of the following remarks are out of date, but are pertinent to the pre-modern conditions. The details concerning the microenvironments (Coe & Flannery 1964) and general environment of the Deh Luran Plain have been published in several venues (Hole 1987; Hole, Flannery & Neely 1969; Kirkby 1977; Kirkby & Kirkby 1969; Neely 1974; Neely & Wright 1994; Wright & Neely 2010). Only the most salient characteristics pertaining to the economy and this settlement pattern study will be reviewed.

The Deh Luran Plain (Pl. 1) is located in southwestern Iran near the border with Iraq, some 300 kilometers north of the Persian Gulf and 550 kilometers southwest of Tehran. Note that this is about 200 kilometers southeast of the Diyala region of Iraq and 125 kilometers northwest of the Upper Khuzistan (Susiana) Plain of Iran, areas to be referred to in this paper in relation to the findings of the intensive archaeological surveys conducted by Adams (1962, 1965) and Wenke (1975, 1987).

The Deh Luran Plain lies within the semi-arid Assyrian Steppe (Hatt 1959) biotic province at an elevation of about 150 to 300 meters above sea level. The summer months are dry and hot, with high mean temperatures of over 50° Celsius quite common. Winter temperatures seldom fall below freezing. The annual precipitation of 250 to 350 millimeters is highly variable and not equally distributed throughout the year. In the winter, when the vast majority of the precipitation occurs, the alluvial plain is transformed in places into meadows of various grasses and wild flowers.

There are four major microenvironmental/environmental zones on the plain, which were exploited in different ways. These zones (Pl. 2), the rocky piedmont, the riverine, the alluvial plain, and the shallow, salty marsh are based on the situation in 1969 (Hole, Flannery & Neely 1969; Krikby 1977; Kirkby & Kirkby 1969).

1) The *rocky piedmont* (Pl. 3) forms the northern portion of the survey area, north of the improved road passing southeast-to-northwest through the Deh Luran Plain from the city of Dezful. The piedmont rises in a fairly steep slope to the foothills of the Kuh-i-Siah Range of the Zagros Mountains. This microenvironment is rocky and highly dissected by erosional channels. A number of small springs, as well as tar and naphtha seeps, effloresce at and near the juncture of the piedmont with the foothills of the Kuh-i-Siah. Compared with the alluvial plain, the piedmont is characterized by a substantial increase of perennial grasses as well as small trees and shrubs.
2) The *riverine microenvironment* (Pl. 4) consists of the channels of the Mehmeh and Dawairij Rivers and their flood plains. The rivers, especially the Mehmeh, carry brackish waters charged with gypsum and other salts from geological strata cut by their channels in the foothills and mountains north of Deh Luran. Upstream, beyond the plain, the river channels are deep and narrow and are characterized by nearly vertical banks with heavy rock content. As they enter the plain from the north, the channels are over ten meters below the alluvium, but become shallower to the south. The terraced flood plains, lying between the main river channel and the alluvial plain, are most extensive to the south. There, the terraces are vegetated densely with grasses and low forests of Tamarisk *(Tamarix),* wild Licorice *(Glycyrrhiza),* and Poplar *(Populus).*
3) The *alluvial plain* (Pls. 5-7) forms the largest of the four microenvironments. It is essentially a flat alluvial surface with small amounts of scattered, low vegetation. Natural topographic features consist of depressions or "sink holes", the erosional cuts of the two main perennial river systems, a few smaller spring-fed watercourses, and numerous small intermittent drainages. Manmade features consist of canals and qanat systems, and nearly all forms rising above the level of the plain's surface.
4) The *shallow, salty marsh* (Pl. 8) extends as an arc-shaped zone divided into two segments. Lying predominantly in the west-central portion of the plain, the marsh area extends southeast until it takes a more easterly trend. The second, smaller segment, which forms the easternmost extreme of the arc-shaped zone, lies east of the Dawairij River and spans at least 15 kilometers. The zone ranges from about one to three kilometers in width and is over 35 kilometers in total length. Characterized by saline soils and sparse low vegetation of highly salt-resistant

shrubs, the zone is dissected by numerous small erosional cuts. While marshy during the winter rainy season, this microenvironment is essentially dry and salt-encrusted during the summer. In pre-Islamic times this area apparently served, as it does today to a limited extent, as a drainage area for excess irrigation waters.

In summary, it is important to emphasize three environmental characteristics that affected the economy and settlement patterns: (1) the extreme aridity of the area, (2) the microenvironmental zones of the plain, and (3) the presence of springs and the two rivers available to supply waters for domestic and irrigation purposes.

Survey results

A total of 330 sites were recorded during the archaeological survey of the Deh Luran Plain (fig. 9). While the entire area of the nearly 1000 square kilometer plain was not surveyed, the use of a "zone" and "band" stratified sampling technique resulted in survey coverage of approximately 70 percent of the plain and the discovery of an estimated 80 percent of the visible sites and features in each of the microenvironmental zones defined (Neely 1969: 9-11; Neely & Wright 1994: 9).

Fortunately, the smaller sites and features of the Parthian, Sasanian, and Islamic periods were conspicuous on the ground surface. Not only could they be located with relative ease, but also with a minimum of troweling it was often possible to determine and accurately map the various components of the sites and even the internal features of many of the houses (Pls. 10-15). The information pertaining to the smaller occupations, which are often not visible or overlooked, may be considered a major contribution of this survey. This ease of location and mapping was probably the result of a number of factors: the relatively recent date of these features, the nature and location of their construction, and the fact that the plain has undergone a relatively long period in which little alluviation has taken place (Kirkby 1977; Kirkby & Kirkby 1969: 2-3).

Overview Data

Of the 330 sites recorded for all periods, 263 were habitation sites of which 123 (47%) were found to have ceramics dating to late occupational

components representing periods from the Parthian into Medieval Islamic times (ca. 210 B.C.E. to Post-10th Century C.E. – see Table 1). Of the 123 sites, 31 (25%) sites had Parthian ceramics, 112 sites (91%) had ceramics dating to the Sasanian and 7th Century Islamic periods, 68 sites (55%) contained ceramics belonging to the 8th and 9th Century Islamic period, 27 sites (22%) were characterized by 10th Century Islamic ceramics, and only 8 sites (0.07%) were found to have Post-10th Century Islamic ceramics.

In addition, of the 123 sites, 77 sites (63%) had two or more periods of occupation, and 113 (92%) had pottery dating to the Parthian and/or Sasanian periods. Of the 113 sites, only one site (0.009%) had only Parthian pottery, 30 sites had both Parthian and Sasanian ceramics, 42 sites (37%) had only Sasanian pottery, and 60 sites (53%) had Sasanian and later pottery. Of the 113 sites, 7 (0.06%) were Parthian reoccupations of immediately preceding occupations while only one (0.009%) represented a Parthian reoccupation of a long abandoned site. Of the 31 sites with a Parthian occupation, 30 (97%) had a Sasanian occupation. Of the 112 sites with a Sasanian occupation and 7th Century Islamic occupation, 60 (54%) have an immediately following 8th and 9th Century Islamic occupation.

Of the 113 Parthian and Sasanian sites, only three (0.03%) were found with only glazed pottery, 35 sites (31%) had both glazed and unglazed (i.e., plain and surface manipulated) pottery, and 71 sites (63%) were found to have only unglazed (i.e., plain and surface manipulated) pottery. There was a great variance in the number and density of pottery found on these late sites, ranging from none to many hundreds of sherds. In general, as one would suspect, the number and density of pottery fragments increased as the site size increased. It was also noted that the numbers and density of sherds tended to be greater on the later sites.

Table 1 presents a listing of the dated late sites on the Deh Luran Plain. Those sites listed with diagnostic glazed pottery have at present the more precisely dated components (Hill 2006). As will be noted in Table 1, the Optically Stimulated Luminescence dating of a small number of ceramic samples (Hill 2006) and the discovery of a limited number of coins have augmented and made more precise the dating of a few sites.

Unfortunately, the glazed ceramics from only 51 (50%) of the 101 sites with glazed ceramics could be classified precisely enough to determine the period or periods of occupation. This low level of success was due primarily to the presence of only blue/green-glazed pottery at 50 sites that could not be assigned to a time period more specific than "Parthian/Sasanian/

Islamic." The fact that we could identify diagnostic ceramics from 51 sites was, in fact, somewhat of a surprise considering the rural nature of the Deh Luran Plain and the small size of most of the sites. Our inability to date the 50 sites was also affected by the lack of sherds present at some sites and the small size of some sherds. Of the 51 sites having diagnostic glazed ceramics, 19 (37%) were multi-component sites containing glazed ceramics diagnostic of from two to all five of the late periods (i.e., Parthian and later) identified in Hill's (2006) ceramic analysis.

The Parthian Period (ca. 210 B.C.E. to 225 C.E.)

The Parthian period is represented by at least 31 sites. Seven (23%) of these sites, one in the northwest quadrant of the plain, one in the southwest, and five in the southeast, were continually occupied or reoccupied sites that had been founded in earlier periods. Ten of the Parthian sites had only glazed ceramics, eight had only unglazed ceramics, while 13 had both glazed and unglazed sherds on their surfaces.

Settlement and Site Patterns. The settlement pattern appears to reflect the changes noted by Wenke (1981: 313, 1987: 255) for the same period on the Susiana Plain and by Adams (1965: 73) for the Diyala region of Iraq. This change was from large mounded sites (*tells* or *tepes*) that were frequently walled, to growing numbers of unwalled sites composed of many small buildings, often occurring as single structures, and often laid out apparently without regard to any overall plan. This type of site increased in number during the Sasanian period.

During this period there are two main clusters of sites as well as a few scattered sites on the plain (Pl. 16). The main clusters, in the northwestern and southeastern portions of the plain, are linear in nature due to the sites being located along canals coming from the Mehmeh and Dawairij Rivers. This pattern had been established in these areas long before the Parthian Period. Neely & Wright (1994) documented these linear arrangements of sites, and contemporary associated canals, on the Deh Luran Plain dating as early as the Chogha Mami Transitional phase (ca. 5,400 to 5,200 B.C.E.).

The six sites not falling into the two main clusters are loosely aligned from north to south down the center of the plain. Sites DL-2 and DL-172, at the northern extreme of the piedmont, were located on natural drainages, and probably drew water from mountain runoff and springs. Three other

sites were located along a drainage/canal carrying waters from the Ab-i Garm spring (Neely & Wright 1994). The sixth site, DL-32 (Cohen 1981; Wright 1981), is a reoccupied site that probably received water from the Mehmeh River. Site DL-2, was evidently founded during this period and apparently becomes the largest late occupation on the plain, although it may not have attained that status until the Sasanian period.

During the Parthian period, there is a striking paucity of sites in the piedmont zone and central portions of the alluvial plain, suggesting a heavy dependence on canal irrigation from the rivers and a lack of focus on dry-farming. The few Parthian sites recorded on the piedmont may have been camps of pastoralists. The likelihood of transhumant pastoralists occupying the piedmont zone during this and subsequent periods is discussed below.

Measurable site areas for occupations of only one period were usually determinable. However, the site area for each period of occupation on multicomponent sites was difficult and resulted in only rough estimates. Therefore, the following data for all periods should be seen as approximations. During the Parthian period the site areas ranged from 0.02 hectares to about 50 hectares, with a mean of ca. 7.0 hectares. Dwelling areas ranged from 0.008 hectares to 18 hectares, with a mean of ca. 2.1 hectares. Small sites were in the majority, and often were comprised of one well-defined structure (e.g., Pl. 12). However, several of the larger sites were also found with well-defined component structures (e.g., Pl. 13).

In the Parthian period, the number of sites increases from the previous periods, and the majority of the sites are smaller than in previous periods. This is the first period in which we find evidence of small alluvial plain irrigation farming homesteads (described below) with a well-defined structure and courtyard/compound arrangement (Pl. 12). This is also the first period in which evidence of piedmont dry-farming complexes (described below), also with a well-defined structure and courtyard/compound arrangement (Pl. 17), are found.

Water Management and Irrigation Systems. The dating of Parthian and Sasanian canals has only been tentatively accomplished through association with adjacent sites. Most of the canals assigned to these periods were either in continuous use or were refurbishments of canals evidently dating to earlier times. Thus, the dimensions (i.e., length, width, depth) of the canals at any specific point in time were extremely difficult, if not impossible, to determine. As a result, the dimensions we present herein are

well-considered estimates that must await excavations for verification. As in earlier times, sites were in close proximity to canals, presumably to obtain water for domestic needs. In association with the late period sites, the 1969 survey found each of the three canal systems (the Mehmeh, the Ab-i Garm, and the Dawairij) to be over 25 kilometers in length. The primary canals were large, ranging from approximately five meters to twenty meters in width, with an average width of about ten meters.

The several qanat systems present and evidently associated with Parthian sites may have been introduced to the plain to augment already existing canals supplying domestic and irrigation waters perhaps as early as 2,350 B.C.E. This possible early use of qanat technology is based on the apparent association of a qanat/canal system with a large Early Dynastic I-III phase site (DL-34; Pl. 9) and surrounding fields that would have lacked a water supply if the qanat/canal system had not been present (Neely & Wright 1994: 190).

An interesting water management technique was noted at site DL-2 (Pl. 9). There, the community was designed to enhance domestic water resources by harvesting rainfall runoff from architectural features into below ground cisterns (cf. Neely 2015; Scarborough 2009).

The Sasanian and 7th Century Islamic Periods (225 to ca. 700 C.E.)

Because of the difficulty in distinguishing Sasanian ceramics from the 7th Century Islamic ceramics, I have, for the time being, combined these two periods. The largest number (112) of sites recorded by this survey has occupations dating to this period. Two (0.02%) sites from this period are represented by only glazed ceramics, 92 (82%) sites had only unglazed ceramics, and 18 (16%) sites had both glazed and unglazed ceramics. Seventeen (15%) of the 112 sites were reoccupations of earlier sites that had not been occupied during the Parthian period, while 30 (27%) of the sites were reoccupations of Parthian sites. The west and east clusters each had five reoccupied sites, while the center cluster had seven (Pl. 18).

Settlement and Site Patterns. On the alluvium, the Sasanian and 7th Century Islamic settlement pattern was not radically different from that of the preceding period (compare Pls. 16 and 18). However, the number of sites had increased, with the northwest portion having the densest grouping. At the same time, the settlement pattern and site density on the

piedmont changed dramatically. A comparison of Pl. 16 with Pl. 18 illustrates the increase of dated sites, but an examination of Pls. 9 and 19 gives a better idea of the true site density as most of the piedmont sites lack diagnostic pottery and remain attributable only to Parthian/Sasanian/Islamic times. The majority of the piedmont sites were dry-farming complexes.

The sites were more numerous and more dispersed across the landscape than in previous periods. Sites also varied greatly in size from small one-family farmhouses (e.g., DL-10 – Pls. 10 & 11), some of which were less than 100 square meters in floor area, to a center (DL-2) of about 112 hectares. For this period, site areas range from 0.005 hectares to about 112 hectares, with a mean of 8.8 hectares. Dwelling areas range from 0.003 hectares to 5.0 hectares, with a mean of 0.69 hectares. The mean site area of about 8.8 hectares is 1.8 hectares larger than the mean area of the Parthian period sites, and that, in addition to the increase in the total number of sites (from 31 to 112), a nearly fourfold increase, suggests an increase in population. However, this figure may be deceiving, as we do not know if all of the structures were occupied contemporaneously.

When compared with other studies of sites dating to the Parthian and Sasanian periods (e.g., Adams 1965; Wenke 1975, 1987), the majority of the Deh Luran Parthian and Sasanian sites were small. Wenke (1987: 261) reports that there are few settlements in any period on the Susiana Plain that are less than one-half hectare in area, but the Deh Luran Plain has many sites with areas smaller that one-half hectare. It has not been determined if the presence of these small sites is unusual, or if their discovery was due to the near absence of alluviation on the plain for the last several hundred years, the relatively undisturbed condition of the plain at the time of the 1969 survey, or the use of a different survey strategy. It may well be a result of all three.

Most of the sites on the Deh Luran alluvial plain conform to the description provided by Adams (1965: 73) for sites in the Diyala region: "…low and sprawling, with irregular shapes and indefinite contours. …occupational remains extend in thin bands for considerable distances along old canal levees or crop up sparsely at intervals separated by apparently uninhabited areas." Because of indefinite site boundaries and the close proximity of sites one to another, it is entirely possible that some features recorded in 1969 as multiple sites were originally part of a single larger site. Large structures consisted of platforms and low mounds of earth constructed of

unfired and fired brick. Small structures are usually represented by foundations of cobbles, boulders, and occasionally stone slabs, that today lie partially buried in the alluvium of the plain and the clay eroded from the upper walls. Based on a few preserved upper wall fragments, and ethnographic building techniques seen in Deh Luran, the upper walls of most structures and compounds were evidently constructed of bricks of straw-tempered, unfired clay. The upper walls of some less well made structures and compounds may also have been constructed with straw-tempered, unfired "turtlebacks" (i.e., irregular large globs of clay with nearly parallel longitudinal sides shaped by scraping, a convex upper surface, and a concave lower surface).

It is during this period that small irrigation agriculture farming complexes, such as those illustrated at DL-274 and DL-275 (Pl. 20) near the southwestern margins of the plain, may be distinguished. The fields and canals illustrated in fig. 20 are believed to be associated with the sites due to the presence of contemporaneous diagnostic ceramics on their surfaces.

With the exception of courtyard/compound sites (see below), the only walled communities recorded by our Deh Luran survey appear to have been constructed before or after the Partho-Sasanian occupations. DL-2, evidently the largest site (ca. 112 ha) on the Deh Luran Plain during the Sasanian period, has no evidence of being a walled community, and was sited in a broad canyon not suitable for defense. While this Deh Luran pattern evidently parallels both Adams' (1965: 73) Diayla findings and Wenke's (1981: 313, 1987: 255) Susiana observations, this situation contrasts with other areas of Sasanian occupation. For example, on the Mughan Steppe in northwestern Iran and southern Azerbaijan (Alizadeh & Ur 2007; Ur & Alizadeh 2014) and the Gurgan Plain (Kiani 1982), many of the sites, both large and small, have been found with fortification walls.

An important contribution of the Deh Luran survey was the recording of the small Partho-Sasanian courtyard/compound homesteads (figs. 12, 17) especially characterizing the western and central portions of the piedmont and the western alluvial plain areas. The majority of these courtyard/compound units were located in previously occupied portions of the Deh Luran Plain, but most were constructed on previously unoccupied land. These compounds may represent the single or extended family versions of the larger earlier and later multi-family walled sites that have been found on the plain. A question that arises is whether these compounds were unique to Deh Luran, or if they were present elsewhere and have not been

recognized or recorded? St John Simpson called my attention to the work of Elisabetta Valtz (1985) at Tell Mahmud, in the Hamrin Dam Project area of east-central Iraq and about 275 kilometers northwest of Deh Luran. Valtz briefly reports the excavation of a complete structure at Tell Mahamud that is quite similar to some of the Deh Luran structures with compound walls. Although the Tell Mahmud example is about twice the size of its Deh Luran counterparts, the date of the structure, the location and nature of the exposed complex of rooms within the compound, and the geographic orientation of the structure and compound are quite similar. The economic and socio-political relationships between the occupants of these widely separated areas with similar structures deserve further study. Ethnographic studies of both sedentary agriculturalists and transhumant pastoralists (e.g., Digard 1981: fig. 132; Mortensen 1993: figs. 6.50, 6.51; Watson 1979: figs. 5.6, 5.9) attest to the temporal persistence of this courtyard/ compound format of construction.

It has been noted (Hole 1978, 1979, 1987; Hole, Flannery & Neely 1969: 349-350) that the transhumant round practiced today by the Luri pastoralists between the Khorrambad Valley and Deh Luran Plain extends back in time perhaps as early as 4,800 B.C.E. It seems possible that pre-Partho-Sasanian pastoral encampments on the Deh Luran piedmont and alluvium may have been tent sites like Hole (1974, 1987: 83) found at Tepe Tula'i. Considering the long history of transhumance in this region, we should consider that a transhumant pastoral group or groups, living on the Deh Luran Plain primarily during the winter, occupied at least some of the piedmont and alluvium homesteads. Hole (1987: 36) has noted that the mapped Mehmeh phase (4800-4600 B.C.E.) alluvial plain houses at Tepe Ashrafabad (Neely and Wright 1994: 88-94) have a general plan layout that: "... resembles that of a tent rather than a mud-walled house …", and perhaps indicates, as is found today, that some of the transhumant pastoralists spent seasonal residence in settled villages. Mortensen (1993) illustrates structures attributed to the Lurs in the Hulailan Valley, about 100 kilometers north of Deh Luran, quite similar in plan view to those illustrated in figs. 12 & 17. The compounds representing the majority of the structures forming the village of Deh Luran during our fieldwork bore a close resemblance to those illustrated in Pls. 12 & 17, but were larger in size and area. Mortensen (1993: figs. 6.50, 6.51) illustrates similar closely situated compounds forming the village of Kahreh in the Hulailan Valley. The distinct possibility that pastoralist inhabited piedmont and alluvial

sites, immediately brings to mind the related, and very important, question of how much the subsistence and economy of the plain's inhabitants depended on domestic animals?

Water Management and Irrigation Systems. Modifications in the water management technology were evidently correlated with variations in the settlement pattern and the apparent population increase. These modifications consisted of the expansion of old canal and qanat systems and the addition of new canals/qanats in nearly all portions of the plain. The farming complexes, such as those illustrated at DL-274 and DL-275 (Pl. 20) near the southwestern margins of the plain, are excellent examples of the latter. Other new modifications included the construction of terraces and check dams in the western part of the plain, and the introduction of dry-farming water and soil management technology to the piedmont zone.

These modifications permitted the inhabitants of the Deh Luran Plain to occupy and utilize an additional surface area of some four hundred square kilometers, or approximately 40 percent of the total area of the plain. Thus, Sasanian and 7th Century Islamic times appear to have been the apex in terms of the total amount and intensity of land use as well as the maximum population density on the plain. In spite of the different nature of the survey data available from the Diyala, Upper Khuzistan (Susiana), and the Mughan Steppe, the patterns of intensity of land use and technological maximization appear to be generally similar.

Canals and qanats, appear to have increased in number during this period. New systems of canals and qanats, tapping springs and the subterranean aquifers, appear on the piedmont (see Pls. 9 & 19). The water harvesting of piedmont runoff into canals excavated nearly perpendicular to the slope (see canal DL-330 on Pl. 9) may also have been introduced during this period. In addition, if not introduced earlier (Neely & Wright 1994: 200), it seems probable that it was during this period that some of the late Deh Luran qanat systems were constructed to incorporate an ingenious modification of the qanat technology which obtained seepage water from the Mehmeh and Dawairij Rivers rather than to tap underground aquifers as traditional qanat technology does. The modified qanats did not take water directly from the rivers, but ran parallel to them at distances from ten to fifty meters for stretches of two hundred meters to nearly two kilometers, and then turned in toward the center of the alluvial plain. Water was obtained from the rivers as it percolated through the soil and rock of

the river channel banks into the qanat. This modification of an already existing technology may well have been contrived to serve four purposes, three obvious to the users and one probably not. First, it greatly reduced the amount of silt carried into the systems — a problem that must have been enormous in canal systems that took water directly from the Mehmeh and Dawairij Rivers by means of diversion dams or weirs. Second, the percolation of the water through the riverbanks filtered out vegetal matter and minerals in suspension. Third, it is believed that this filtering process resulted in the deposition of dissolved minerals in solution through evaporation as hardened calcium carbonate (*caliche*) layers at the top of the aqueous zone, thus eliminating their presence in the waters used for domestic and irrigation purposes. Fourth, although the inhabitants of Deh Luran were undoubtedly unaware of it, the filtration of water through riverbanks has been documented as serving to remove microbes and other pollutants (e.g., heavy metals) from water supplies (Hubbs 2004; Ray et al. 2003). Three of these processes reduced the frequent need to clean the systems and slowed soil salinization that probably was gradually affecting crop production. The fourth benefitted the health of the inhabitants of the now larger and more densely populated plain.

Dry-Farming Water Management Systems. In the western portion of the plain, especially in the western and central parts of the piedmont, a second, less impressive water management technology was also apparently introduced, although there is some evidence that this process may have begun in the late Parthian period. The piedmont microenvironment was converted from a sparsely inhabited zone to one of rather dense occupation with the introduction of this new water management technology. To augment Table 1 and Pl. 18, which do not record the presence of undated sites, see Pls. 9 & 19 to note the density of these sites.

Terraces and check-dams were introduced to conserve and renew soils as well as more efficiently distribute and retain rainfall and runoff waters on sections of the alluvial plain and piedmont. Low terrace walls of unmodified dry-laid cobbles and boulders were built at intervals varying with the slope of the terrain and following the contours of the land (Pls. 17, 21). An integral part of this system were small check-dams, or cross-channel terraces, of dry-laid, unmodified cobbles and boulders, constructed at right angles to the flow across intermittent drainages dissecting the plain and piedmont (Pls. 17, 22). Water and soil washing from the

piedmont slopes would flow into the drainages where the check-dams functioned to retain soils and retard runoff so that water would thoroughly soak the soils. Because the small plots behind the check-dams had relatively deep soil deposits, and the fact that the plots received greater amounts of rejuvenating soils and water than the slope terraces, these small areas probably had greater crop productivity and reliability. Such features were likely also constructed to retard headword erosion and the deterioration of the piedmont slope fields. In addition, considering some of the locations of these features *vis-à-vis* canals, it is likely that they also functioned in combination with more usual irrigation techniques. Rainfall could easily have been augmented with water diverted from nearby canals, and it is conceivable that the labor-intensive practice of hand watering (Castetter & Bell 1942; Doolittle 2000; Kirkby 1973; Neely 2005a, b, 2014, 2015; Neely & Caran 2011; Neely et al. 1990) may have been used on the terraces upslope from the canals.

The piedmont agricultural terraces and check-dam systems clustered in distinct units associated with one or more habitation structures (usually having a walled courtyard/compound), one or more small "storage" structures, and frequently one or more rectangular structures reminiscent of cattle pens or "corrals." Plate 17 is a plane-table map of site DL-194 and illustrates a classic example of one of these units. These distinct socio-economic units may be referred to as: "dry-farming homestead complexes." Each unit comprised of houses, corrals, farming terraces, and check-dams is usually clearly separated by some twenty-five to one hundred meters from the next. In many cases this separation is further defined by an intermittent drainage, or by a low wall of unmodified dry-laid cobbles and boulders. Sites likely associated with the piedmont homesteads were situated on nearby hilltops (Pl. 17). These hilltop sites comprise several structures, and were found distributed one for every four to six piedmont homesteads. Their locations would have made them good defensible refuges, but there is no other evidence to foster that interpretation.

From these dry-farming homestead complexes we may derive information beyond the apparent technological and architectural data. For example, from the ratio of habitation area to the area of cultivation we may obtain an idea of the area needed to sustain population through the use of dry-farming techniques. Using site DL-194 (Pl. 17) as an example of a piedmont homestead, we find the total living area (including the walled

courtyards/compounds) of the two structures to be 1,088 square meters, or 289 square meters if we only consider the area of the definable rooms. The ratio of total living area (including compounds) to the area under dry-farming cultivation (totaling 16.88 hectares) at DL-194 is 1:155 square meters, or 1:584 square meters if only the area of the definable rooms is used. Unfortunately, there is no comparable exposed architecture on contemporary alluvium sites so that the settlements in the two areas cannot be directly compared.

Sites and structures of this type and size are not usual in most of the population size calculations conducted for Middle Eastern sites (e.g. Adams 1965: 23-25; Pasciuti & Chase-Dunn 2002). Until we complete our study of the late periods of Deh Luran Plain occupation, we are unable to more accurately work out the settlement dynamics for this period. However, until we can achieve that goal, I have chosen a reasonable method from an ethnographic study conducted in 1960-1961 by F. G. L. Gremliza (1962). That study collected data from 55 small communities scattered over an area of about 223 square kilometers just south of the city of Dezful, and about 100 kilometers east of the Deh Luran Plain. Although collected from modern contexts, the small rural communities represented in this study were similar to those being considered in this article. Gremliza (1962: Table 15) reports a population range of from 2.4 to 5.7 persons per room, with a mean of 3.9 (with a standard deviation of 0.6) persons occupying each of the 2,975 rooms in the 2,274 houses his study recorded. Thus, using the site of DL-194 as an example, Gremliza's mean of 3.9 persons per room, and would indicate that the two compounds with a total of seven rooms (Pl. 17) at that site had an estimated population of about 27 persons.

Spring-Fed Canals with Drop-Tower Gristmills. As with the Mehmeh and Dawairij Rivers, the waters of the Ab-i Garm springs (DL-170; see Pl. 9) were managed at an early time (Neely & Wright 1994: 187-188). These sulfurous springs are located high in the piedmont near its juncture with the foothills of the Kuh-i-Siah Range of the Zagros Mountains. While there is a number of other springs similarly located along this break in the topography, evidently only the Ab-i Garm sources, north-northeast of the present town of Deh Luran, were managed.

Perhaps beginning during the Chogha Mami Transitional phase (ca. 5400 - 5200 B.C.E.), but quite likely by the Khazineh phase (ca. 5000

- 4800 B.C.E.), the management of Ab-i Garm waters appears to have been focused on slight modifications of its natural drainage channel (see DL-276A and 276B on Pl. 9). The earliest canals (DL-5; see Pl. 19) to carry Ab-i Garm waters appear to have been dug during either the Sargarab phase (ca. 4000 – 3750 B.C.E.) or more likely the Early Uruk period (ca. 3750 - 3500 B.C.E.) to convey waters to the site of Sargarab (DL-169 – Neely & Wright 1994: 130-138; Wright et al. 1975).

This small canal system was apparently modified and expanded during the Sasanian period. North of DL-169, where secondary natural drainages joining the Ab-i Garm channel were particularly broad or deep and would thereby require the excavation and maintenance of many meters of additional canal to follow the contours properly, an aqueduct of mortared masonry was constructed to span the secondary drainage (Neely 2011). The small canal at first paralleled the Ab-i Garm natural drainage and then continued to course southward while the natural drainage of the Ab-i Garm took a more southwesterly course (Pl. 19).

The spring waters were diverted into the canal system either at the springheads or just downstream. There was no evidence as to exactly how this was accomplished, but a diversion dam or weir seems most likely. The canal system was small, averaging about 1.5 meters wide by 0.6 meters deep, and had been excavated into both faces of the banks of the natural drainage that carried Ab-i Garm waters down slope to the alluvial plain. On the east bank in the northern portion of the system, test trenches were excavated through the canal at right angles to the flow (Pl. 23) to permit an accurate measurement of the gradient. The canals carefully followed the contours of the banks to retain a very gentle, but efficient, grade of about 0.1 percent.

Well-made, tower-like structures of mortared masonry were built against, and partially into, the steep face of the drainage banks (Pls. 19, 24 – Neely 2011). These tower-like structures were constructed at irregular intervals ranging from approximately 50 to 600 meters apart, with an average distance of about 275 meters separating these features. The system was traceable for a straight-line distance of about 6.5 kilometers, within which the remnants of 22 drop-towers were found. The towers received the canalized water and dropped it some 6.5 meters into a continuation of the canal system.

The excavation of one of the drop-towers (Pls. 19, 24) in the northern portion of the system revealed that the towers concentrated the flow of the

water to provide power to drive a millwheel (Neely 2011). This drop-tower gristmill construction is technically termed the *"Arubah* penstock" (Avitsur 1960). The technology of the Deh Luran gristmills was extremely well adapted to the topography and the limited, variable water supply of the region.

Water management features and systems are notoriously difficult to date, however, a direct method of dating was possible with the excavated drop-tower. A ceramic fragment recovered from the masonry (a blue glazed sherd - sample OxL-1349) was assayed at the Research Laboratory for Archaeology and the History of Art at Oxford University by means of Optically Stimulated Luminescence, and has provided an absolute date of 680±150 C.E. The extended use of this canal and gristmill system is suggested by an under-glaze painted sherd (sample OxL-1348), recovered from the spoil bank of the DL-5 canal at site DL-3 (Pl. 19), that was dated by OSL to 1750±100 C.E. An ethnographic study (Neely 2011) indicated that parts of the then defunct gristmill system were refurbished in the 18th century, but were again abandoned in 1958.

In the 4.25 kilometers of the canal system south of the excavated gristmill tower the canal first paralleled the Ab-i Garm, then was continued more southward as the natural Ab-i Garm drainage changed course toward the southwest (Pl. 19). From a point just south of the 800-meter contour line the construction of the towers involved a more laborious method. There, trenches were excavated into the piedmont slope so as to duplicate the gently graded canals present in the upper segment of the system. As this canal grade was gentler than that of the piedmont, the trenches excavated were necessarily deeper at their upper ends and became proportionately shallower as they coursed southward. The towers were set into the trenches at their deep, northern extremes. Costa and Wilkinson (1987: 56-76) found similar "buried" towers in the Sohar region of Oman. This portion of the canal system probably was built in response to the need for additional gristmills, the domestic water needs of the adjacent Sasanian and later communities (DL-3, DL-4, DL-168, DL-312/313, 135, and 123 - see Pl. 19), as well as the irrigation needs of fields located on the alluvium immediately south of the central piedmont zone (Neely 2011). Prior to the completion of this canal system, the part of the alluvial plain for which it eventually supplied water would have been useful only for seasonal dry-farming and grazing. Rainfall runoff from the piedmont zone undoubtedly augmenting the Ab-i Garm waters flowing through canal

DL-330, a probable further extension of the DL-5 canal (Pl. 9) that coursed along the toe of the piedmont towards the southeast for about another 15 km. Several other canals (e.g., DL-6) and Qanats (e.g., DL-161) also apparently fed into that piedmont-toe canal (Pl. 19). That canal, in turn, appears to have drained into and augmented canal DL-121 about 2.5 kilometers northeast of Tepe Guran (DL-34), to supply additional water for domestic uses and the irrigation of the fields paralleling the canal further to the southwest (see Pl. 9).

Only one other example of a drop-tower gristmill was recorded during the 1969 survey. That was a gristmill situated in a deep trench cut into the alluvial plain, located just east of qanat/canal system DL-121, and apparently driven by the waters of that system. This drop-tower gristmill is situated just east of the large site of DL-34 (Pl. 9).

This interesting gristmill technology has been found elsewhere in the Middle East (e.g., Avitsur 1960; Beasley 1967, 1977; Costa & Wilkinson 1987; Gardiner & McQuitty 1995; Harverson 1978; Roaf 1999-2000; Wulff 1966: 280-282), as well as in Europe (e.g., Beasley 1963; Goudie 1886), and in the New World (e.g., Gritzner 1974; Neely 1999), and examples are still being reported (e.g., Anonymous 2006; Kirchner 2011).

Observations

Information and interpretation of land use in earlier periods on the Deh Luran Plain may be found in two monographs (Neely & Wright 1994; Wright & Neely 2010). The present study has benefitted from subsequent analyses and the help of colleagues who have provided excellent comparative data to place Deh Luran into perspective within the Partho-Sasanian spheres.

Settlement and Site Patterns

During Partho-Sasanian times, the Deh Luran Plain displays a pattern of settlement and site change that generally parallels events documented for the Diyala region of east-central Iraq (Adams 1965: 69-83), the Upper Khuzistan (Susiana) Plain of west-central Iran (Adams 1962: 116-117; Wenke 1975, 1987), the Mughan Steppe of northwestern Iran and southern Azerbaijan (Alizadeh & Ur 2007; Ur & Alizadeh 2014), and elsewhere. However, there are differences.

Site locations along canals on the Diyala Plain (Adams 1965: Figure 5), the Susiana Plain (Wenke 1975), and the Mughan Steppe (Alizadeh & Ur 2007; Ur & Alizadeh 2014) seem to be more strategically situated (e.g., at the branchings of major canals) than those of the Deh Luran Plain.

The Deh Luran survey recorded extremely well preserved Partho-Sasanian house and settlement remains (Pls. 10-15). Augmenting these were well-preserved evidences of evidently contemporaneous fields and smaller canal systems (Pls. 17, 20). Obtaining such detailed, but seldom recovered, data has augmented our knowledge of both the site/settlement and subsistence/economic systems for these periods.

Simpson (1996: 99) notes cyclical settlement patterns in the area of the Saddam Dam on the upper Tigris: "The results suggest clear peaks and troughs in settlement densities at different periods: whereas Seleucid, Late Sasanian and Middle-Late Islamic settlements were relatively frequent, those of Parthian/Roman-Early Sasanian and Early Islamic date were rare." As of this stage of study, I have not been able to discern similar cyclical perturbations in settlement densities on the Deh Luran Plain, but this may be the result of a less refined ceramic chronology.

Both Adams (1965: 73) and Wenke (1975, 1987) observe that while population densities apparently reached their peaks during the Parthian Period in their respective study areas, it was during the Sasanian period that the landscape as well as the settlement and subsistence systems were most affected and modified. The findings of the Deh Luran survey concur with these assessments of the Sasanian period; however, the data suggest that it was during the Sasanian period when the population densities of the Deh Luran Plain peaked. Wenke (1987: 256) supports this finding in his discussion of the Deh Luran Plain. Wenke (1981: 310) also observed that, in spite of apparently rapid population growth, that fertile, irrigable areas were not exploited and there is little to suggest that population pressure was a problem on the Susiana Plain. However, this does not appear to have been the situation on the Deh Luran Plain.

Agriculture vis-a-vis Pastoralism

In order to better understand the Partho-Sasanian imperial dynamics we need to know the processes by, and extent to, which farmers and herdsmen from the highlands were assimilated into the lowland economies and socio-political systems (Hole 1980; Wenke 1987: 253).

The presence of two distinctive types of sites and agriculture/water management technologies (i.e., the irrigation-based agricultural communities on the alluvium and the dry-farming/pastoral communities on the piedmont) suggest the existence of two distinct, but probably interrelated, subsistence/settlement systems on the Deh Luran Plain. The former of these was a sedentary occupation while the latter was likely of a transhumant nature that developed into a combination of sedentism and transhumance between sedentary settlements that has been documented both archaeologically (Hole 1974, 1978) and ethnographically for the Lurs of Deh Luran and Khuzistan (Lambton 1969; Layard 1846: Whyte 1977).

Following a transhumant pattern between Deh Luran and upland valleys, as documented by Hole (e.g., 1974, 1978, 1979), the pastoralists would have occupied the plain during the winter and sustained themselves through pastoralism and dry-farming. Survey site morphology suggests that at lease some of the pastoralists also occupied sedentary/permanent sites on the alluvium, and participated in irrigated agriculture as they do today (Whyte 1977). This may have been an economically directed scenario initiated by the pastoralists themselves that the Parthians and Sasanians encouraged to incorporate transhumant groups as contributing members into their respective Empires. It would have been an approach to maximize the use and productivity of the Deh Luran Plain with minimal disturbances to either the agricultural infrastructure or disruption of the long established pattern of transhumance. Such a scenario presents an alternative to the more traditional cyclical either/or picture of Middle Eastern subsistence systems (e.g., Abdi 2003; Alizadeh & Ur 2007; Salzman 2004; Wilkinson 2003). However, this tentative explanation begs questions regarding the processes involved in such a co-residence: for example, the amelioration of traditional antagonistic relationships (Alizadeh & Ur 2007; Bucellati 1966). These are questions that are difficult to answer through archaeology alone.

The apparently contemporaneous three-part agro-pastoral system, with irrigation agriculture, dry-farming, and pastoralism as integral parts of the subsistence system and the economy, marks the Deh Luran Plain and analogous areas as locations where questions regarding the processes of change, development, and maintenance of such a mixed economy and its sociopolitical milieu can be effectively studied.

Water Management and Irrigation Systems

On a pan-Middle Eastern scale, it is interesting to note that areas located between rivers (e.g., Mesopotamia, Susiana, Mughan Steppe, and Deh Luran) were frequently chosen by groups for agricultural expansion and intensification. However, this choice was most logical considering the access to water and the alluvial soils available.

The majority of the Partho-Sasanian water management and irrigation technology and systems found on the Deh Luran Plain are not unique. Most have earlier origins on the Deh Luran Plain and elsewhere in the Middle East, and those recorded in other regions of the Parthian and Sasanian Empires often appear at a much greater scale of size and complexity. However, two aspects of the Deh Luran Plain water management technology that appear to be unusual are: (1) the modification of some of the qanat systems to offtake waters by a seepage process from flowing rivers, and (2) the design of at least one community (DL-2; fig. 9) to enhance domestic water resources by harvesting rainfall runoff from architectural features into below ground surface cisterns (cf. Neely 2015; Scarborough 2009).

A more complete picture of the nature and density of the canal and qanat systems of the Deh Luran Plain may be seen in the map (Pl. 9) generated by the 1969 survey. Although these systems are extensive, compared to the larger canal networks of Mesopotamia (e.g., Adams 1965: Figures 4, 5; Simpson 2000: Figure 12) and the Susiana Plain (Wenke 1975: Maps 24-28) they are of relatively limited scale. However, the detailed recording of sites of all sizes in relation to canals and qanats has provided a better understanding of the relationships of these two types of features at both a macro- and micro-scale. On a micro-scale, Pl. 20 provides a detailed example of the relationships of secondary and tertiary canals with two evidently associated small Sasanian irrigation agriculture sites.

It is probable that the shallow, salty marsh microenvironmental zone (Pls. 2, 8) is a result of the natural desertification of the plain (Whyte 1977) as well as the human modification of the landscape. Data from excavations (Hole, Flannery & Neely 1969) indicate the presence of a marsh on the plain that provided comestible flora and fauna. The species of flora and fauna found evidence that "sweet" waters characterized the marsh, and settlements in this area declare the marsh area was viable for occupation. However, the settlement patterns of the 8th through 10th Century Islamic periods imply a slow abandonment, and by post-10th Century Islamic

times the plain appears to have been nearly unoccupied. This trend could very well have resulted from, or been exacerbated by, the heavy use of mineral-laden water from the Mehmeh and Dawairij Rivers, which slowly salinated the soils and made cultivation of the lands less and less productive. Thus, the shallow, salt marsh found during our survey is, in fact, very probably a relatively recent phenomenon most likely intensified by the large influx of population in Partho-Sasanian times and perhaps not fully formed until the 10th Century Islamic occupation. A generally similar human-induced body of salinated water resulting from irrigation outfalls has been documented for the Amuq Plain of southeastern Turkey (Wilkinson 2000: 176-177). Thus, apart from socio-political reasons, salinization may have been a reason why the Deh Luran Plain was slowly depopulated.

The many canals of the Deh Luran Plain very likely generated a riparian micro-environment along their courses (Wright & Neely 2010: Pl. 6). Such riparian zones would have provided a ready supply of edible and useful plants, and would have been a haven for animals that would have found the zone a source of both water and food prior to their kill or capture for human use. Such animals and plants were a part of the prehistoric diet (Hole, Flannery & Neely 1969; Watson 1979: 68), and were locally gleaned in Deh Luran in 1969 (Neely, personal observations). The availability of these riparian microenvironment subsistence resources along canals has been noted for the American Southwest (Neely 2014; Neely & Murphy 2008) and in the Tehuacán Valley of southern Mexico (Neely 2005b, 2015).

Reorganization and Change on the Deh Luran Plain

Notwithstanding the presence of the Achaemenid Royal Road passing through the plain, probably closely following the path of the present road from Dezful to Deh Luran (Pl. 16), and the presence of some very large sites (e.g., DL-20, DL-32, DL-34), the marginal position occupied by Deh Luran relative to economic and socio-political systems in the greater Middle East during the Early Empires (ca. 2,600 – 210 B.C.E.) has been noted (Hole 1987; Wright & Neely 2010). The role played by Deh Luran in the larger picture remains largely unknown, however, we have been able to document that the settlement patterns for the plain during the early empires were generally similar to those in the more central economic and socio-political regions of the Middle East. Based on the late glazed ceramics

found during the 1969 survey, David Hill (2006) sees the Deh Luran Plain as being well integrated into the Mesopotamian economic system. He observes that the presence of glazed ceramics that were produced in both Northern and Southern Mesopotamia during the Parthian, Sasanian, and Islamic periods indicates a wide range of trade-contacts and communication between the peoples of Deh Luran with the larger communities in the Tigris-Euphrates Basin. Nevertheless, the settlement pattern changes recorded for Deh Luran suggest that in some respects its marginal role continued and that it followed the reorganization that was taking place earlier in the other regions closer to the centers where policies relating to the Parthian and Sasanian Empires were developed. The results of these apparently conflicting findings indicate that neither pottery (most especially glazed pottery) nor settlement patterns may be used alone to evaluate the status of regional integration. From the data at hand, it appears that the Susiana Plain was the earliest of the large regions to see this reorganization (Wenke 1987), with central Mesopotamia following (Adams 1981: 183). Deh Luran evidently more closely follows the dating of central Mesopotamia, but it is not clear which of these two areas was primal. Adams (1981: 183) observes that lags in reorganization and development are: "… in line with the Sasanian pattern of shifting economic investments from one zone to another."

While the Parthians were evidently successful in conducting their political systems, Greek, Latin, and Hebrew documents suggest the Parthian "Empire" was mostly an unstable coalition of vassal states brought periodically under Parthian control (Wenke 1981: 306). It was not until the second half of the fourth century C.E. in the Sasanian period that there was a transformation of political control and administration throughout much of the Middle East that strengthened the economic and socio-political systems (Simpson 1996: 88). Be that as it may, the historical record indicates that the Parthians, and to a much greater extent the Sasanians, were quite successful at integrating member ethnic groups, inaugurating taxation and conscription, expanding and intensifying agriculture and water management, and competing in trade. Archaeological evidence and documents indicate that the Sasanians, perhaps emulating and expanding upon a policy apparently enforced by the kings of the Neo-Assyrian Empire (Ur 2005; Wilkinson et al. 2005), moved tens of thousands of people, sent engineering missions into the most underdeveloped parts of their empire, and literally reshaped the land surface of large areas of the Middle East.

As noted, there are easily recognized changes in the settlement patterns of the Deh Luran Plain beginning in the Parthian Period that evidently accelerated in the Sasanian Period. These changes (i.e., an increasing number of sites, smaller sites, a wider distribution of sites, and the appearance of new architectural forms [e.g., unwalled sites and compounds] in previously little used areas of the plain [e.g., the piedmont zone]) all suggest rather drastic modifications of the economy and/or the socio-political systems.

Considering the foregoing, and perhaps stating the obvious, it is proposed that population growth, the expansion of existing and introduction of new methods of water management and irrigation, and the socio-political developments reflected in the changing settlement and site (community) patterns from ca. 210 B.C.E. to 640 C.E. on the Deh Luran Plain are a result of processes of planned expansion, a program of directed (Spicer 1961, 1962) socio-political and economic change, promoted initially by Parthian leaders but drastically expanded by the Sasanian government. Supporting this hypothesis is documentation indicating that the Sasanians undertook an intensive, well-planned expansion program to build the economy and population, and thereby the power and importance of their empire. The Sasanian kings, primarily Shapur II (C.E. 309-379), Kavadh I (C.E. 488-531), and Chosroes I Anosharwan (C.E. 531-579), fostered the rebuilding and resettlement of entire communities, the incorporation of large numbers of war prisoners within the empire, the encouragement of population growth by providing incentives for marriage and childbearing, and the planning and construction of large-scale public works including irrigation systems and other local and empire-supporting infrastructure (Adams 1965: 69-71; Morony 2004; Nöldeke 1973; Rawlinson 1885: 484-485, 488). This program could have been carried out on the Deh Luran Plain for political reasons to provide a location for the settlement of a newly conquered population, or to relocate part of the rapidly expanding population from densely occupied areas within the empire such as Upper Khuzistan (Susiana) and the Diyala (Adams 1965: 69-71; Neely 1974). Simpson (1996: 88) also observes that: "Population transfers appear to have been effected in order to bolster community loyalty in newly acquired frontier zones …". I might add that the transfer of certain groups could also serve to remove rebellious factions from potentially hostile areas and resettle them in locations where they lacked the numbers and local prestige to do harm. Reinforcing this hypothesis, Wenke (1987: 257) agrees that:

"… it is not at all unlikely that Deh Luran was chosen for imperially directed development schemes."

A correlated alternative hypothesis is that this proposed program of development may well have been economic; to use Deh Luran as a "bread-basket" area to provide additional land for the production of badly needed foodstuffs for the rapidly expanding local population as well as that of the greater empire (Howard-Johnston 2008: 124; Neely 1974; Rawlinson 1885: 488), and/or to produce foodstuffs in large quantities for trade and taxes. Wenke (1987: 259) notes that subsistence agricultural systems in many areas gave way, under imperial direction and funding, to the cultivation of foodstuffs the major value of which could be realized only with a centralized system of management, transport, distribution, and, especially, taxation. It was the great agricultural productivity (and the tax potential of this activity) of the regions chosen by the Sasanians for development that was a major force in their political history (Wenke 1987: 253).

The site density findings of the survey lean toward the acceptance of the first hypothesis, while the estimated land productivity (Neely 2011) for the Deh Luran Plain appears to support the second hypothesis. The data lead me to slightly favor of the use of the plain to supply foodstuffs to the rapidly expanding empire, although a sizeable population was probably introduced to the plain to grow and process the crops. Estimates of Deh Luran land productivity vis-à-vis Deh Luran gristmill capability suggest that a grain surplus was produced, and that grain probably had to be shipped to the large gristmills at Shushtar and/or Dezful for processing and distribution (Neely 2011).

No documentation pertaining to the Deh Luran Plain during the rule of the Parthian or Sasanian Empires has been found, and details regarding the lower classes, peasantry, and the relationship of the major centers to the provinces are also lacking (Howard-Johnston 2008: 126). However, from available documentation (e.g., Howard-Johnston 2008: 126; Morony 1976, 1981, 1984) and considering the apparent provincial/ rural nature of the Deh Luran Plain during Sasanian times, it seems reasonable to assume that Deh Luran was a sub-district that may have been overseen by a member of one of the lower of the proposed five grades of dehij or dehik (dahlquin), termed dihqan in Arabic; a person holding a low rank just above the peasant class (Howard-Johnston 2008: 126, 128; Lambton 1981: 286; Morony 1976: 45–46, 1984: 129; Tafazzoli 2000: 38–59). Brosius (2006: 156, 184) states that the dehkanan (i.e., dahlquin) were an intermediate class

between the landed aristocracy and the peasants, created by Khosrow I to ameliorate the imbalance between rich and poor farmers. From the little that is known of the dahlquin, it appears that their roles relative to the peasantry and the upper classes were not well defined and rather flexible (Morony 1984). Our knowledge of the Sasanian socio-political organization and operations is provided by all too skeletal hierarchical bureaucratic ranking lists, which are inconsistent in their content and debated (Karimian 2008; Rubin 1995). While it has generally been accepted that an organization of four classes characterized the Sasanian Empire, there apparently was flexibility (Howard-Johnston 2008: 127; Lambton 1981: 285–287) and a crossing of class boundaries (Morony 1984: 184). This fluidity boded well for the existence of some degree of autonomy in remote rural regions. Considering the foregoing, as well as the tolerance of local socio-political mores by the preceding Achaemenids (Brosius 2006: 1–2), the prevailing tradition of conquerors to allow a measure of social and political continuity and freedom to the conquered (Tao 2007; Wiesehöfer 2007a, b), the egalitarian doctrine of the Mazdak religion (Brosius 2006: 195–196; Daryaee 2008: 68–70), and the autonomy permitted in Peroz's (A.D. 459–484) reign due to a great drought and famine (Brosius 2006: 185), it is proposed that the occupants of the Deh Luran Plain, and the inhabitants of similar provincial and rural areas within the Empire, were not under an oppressive totalitarian rule, but had a degree of autonomy that has been little recognized. This autonomy was probably most like that of the "smallholder" or "householder" as described by Netting (1993). A hypothesis may be proposed that Deh Luran existed as a marginal or provincial rural segment of the Sasanian Empire, and that the inhabitants of this relatively remote region, while still having all of the attendant responsibilities (e.g., sharecropping and taxation), probably operated economically and socio-politically on a much simpler level as a relatively autonomous peasant population that had only minimal ties with the empire and its officials. Unfortunately, however, only circumstantial evidence is currently available to support this hypothesis. In contrast to Simpson's (2003, 2008) insightful papers, presenting a reconstruction of the diet and daily life conditions in a Sasanian urban context (i.e., the city-site of Merv), little is known of the daily life, economic, and socio-political conditions of the lower classes from both urban and rural settings of the Empire. On the other hand, this hypothesis is supported by widespread evidence that has great time-depth. Archaeological, ethnohistorical, and ethnological data from the Middle

East (Fernea 1970; Lambton 1969; Rost 2011), Mexico (Enge & Whiteford 1989; Evans 1990; Hunt 1972; Hunt & Hunt 1974; Pérez Rodríguez 2006; Ramírez Sorensen 1998, 2008; Smith & Price 1994), the American Southwest (Hunt et al. 2005), and other locations throughout the world (Lansing 2005, 2006; Netting 1993; Scarborough et al. 2000), point to households and villages in the past and present, existing at various levels of socio-political organization from the tribe to the state, as the primary decision-making entities in a large number of matters, including agricultural pursuits and the construction of water management systems, based on the environment and long-term cultural mores. These cases document the agriculturalist as having cooperative reciprocal obligations with his neighbors, so that there are both temporary and permanent corporate groups that seldom include persons from more remote locations than the household, village, and multi-village levels. This certainly was true for the occupants of the Deh Luran Plain in the early part of the 20th century (Abdullah Javadi, personal communication 1969), and as I observed in 1969.

Conclusions

Deh Luran has a long history of internally developed water management (Neely & Wright 1994; Wright & Neely 2010). However, because of the history of water management in other parts of the Middle East, it is appropriate to consider that some of the technology, features, and systems may have been brought into the Deh Luran region and modified to the situations at hand. These modifications were probably the result of adapting tried-and-true techniques to the Deh Luran Plain to permit increases in crop production through the utilization of previously little-occupied and cultivated portions of the plain, as well as improvements in grain processing through the use of drop-tower gristmills to accommodate at least a portion of the increased productivity. Such modifications would have facilitated the introduction of foreign peoples for various socio-political reasons as well as the growth of the local population. Additional work on the plain may provide evidence of those techniques and technologies introduced and those internally developed on the plain.

Currently the amount of land cultivated and the productivity of the land in Deh Luran are far less than estimates based on archaeological data and ethnohistorical documentation, due, at least in part, to desertification and the present highly salinated nature of the plain's soils. Estimates of the

productivity of the gristmills and ethnographic consumption data lend themselves to an estimated Deh Luran population that is essentially the same population size as that of 1969, contradicting archaeological evidence for a larger population during the Sasanian period (Neely 2011). While this disparity is recognized, unfortunately, it cannot be explained at this time. The answers to some of the questions that arise regarding this problem may provide explanations for this disparity: were the drop-tower gristmills dedicated to a small segment of Deh Luran's Sasanian population? Will querns be found in many of the small, unexcavated Sasanian sites present? Did flour form a minor part of the diet on the plain in Sasanian times?

A comparison of continually occupied and/or reoccupied sites provides some further reinforcement of the proposition made concerning the directed changes taking place on the Deh Luran Plain in Partho-Sasanian times. It also suggests a continuity of Partho-Sasanian economic and socio-political policy into the 8th and 9th Century Islamic occupations. Only seven (23%) of the 31 sites that have been identified as having Parthian occupations on the Deh Luran plain were continually occupied sites founded in the preceding period. However, 30 (97%) of theses 31 Parthian sites showed continuity of occupation during the subsequent Sasanian Period. Continuing this line of inquiry, I found that 60 (88%) of the 68 sites occupied during the 8th and 9th Century Islamic occupations had been occupied during the preceding Sasanian Period. Using these data, which will probably be modified somewhat with our ongoing attempts to refine the temporal placement of the Deh Luran sites, we may tentatively compare the relative impact of economic and socio-political change from pre-Parthian to Parthian, Parthian to Sasanian, and Sasanian to Early Islamic times. This comparison is based on a slight revision of Adams' (1965: 81) proposition that the pattern of founding Early Islamic sites near abandoned Sasanian sites, but on previously unoccupied land: "… suggests that the Sasanian abandonment was associated with a social upheaval sufficient to break off the tradition of residence at most of the Sasanian sites; …". The above comparative data on continuity of occupation and/or reoccupation suggest that on the Deh Luran Plain there was a significant difference between pre-Parthian and Parthian economic and socio-political mores and that there was a high positive correlation and continuity between Parthian and Sasanian practices. However, unlike Adams' findings on the Diyala Plain, these same data suggest that there evidently was also a high positive correlation and continuity between the Sasanian and Early Islamic economic and

socio-political systems on the Deh Luran Plain! This latter positive correlation may well substantiate the more conservative rural nature of the plain and may be reflected by our difficulty in separating the Late Sasanian from the Early Islamic pottery.

Several scholars, including Adams (1965: 73, 82-83), have stated that a continuous process of sociopolitical integration or "centralization" of power has resulted in, or played a major role in, changes toward urbanization and increased population density. Attempts to define the nature of this centralization have placed the emphasis of research on the ancient centers of economic and socio-political power in the Middle East. I submit that it would be enlightening to approach this problem from the opposite direction. By studying the more marginal regions we may obtain new and quite likely different perspectives as to the role and status of the various parts within and comprising the larger sphere of the centralization process. For example, to what degree did the centralized authority control relatively marginal regions such as the Deh Luran Plain and the Mughan Steppe? I suspect there was a degree of economic and socio-political autonomy enjoyed by the inhabitants of these regions that has not yet been fully recognized or appreciated. The question that immediately arises is: what was the degree of autonomy enjoyed and how was it expressed?

Notwithstanding the forces involved in the population growth, technological development, and socio-political changes, the settlement and site patterning suggest a condition in Deh Luran that does not correlate with the traditional thoughts on Parthian and Sasanian socio-political relationships. In spite of the presence of the Royal Road and large sites (e.g. DL-2, DL-12), the dispersed population and the presence of numerous small and unwalled sites appears to be a reflection of the rural nature of the area, and suggests a detachment from direct control of the socio-political powers of the empire to which it belonged. Furthermore, the settlement and site patterns found point to a changing economy (Wenke 1981: 313) as well as number of related factors such as the residence by a population primarily organized and operating as a small cooperating corporate groups that were largely autonomous. It is evident that the Sasanian state ruled the Deh Luran Plain from afar, but the question remains as to its actual affects on the Deh Luran population.

The picture of Deh Luran during the Parthian and Sasanian periods is muddied not only by the lack of documentation on the plain, but also by the little we know of the smaller, more rural enclaves of those empires and

the daily lifeways of the people that occupied those communities. As noted above, recent ethnographic studies have shown that, in spite of the presence or indications of state-like political control, that rural peoples frequently act in an independent, autonomous fashion, and are able to successfully complete monumental construction tasks as cooperating small corporate groups. Archaeological, ethno-historical, and ethnological evidence point to Deh Luran playing such a rural/provincial role in the Sasanian Empire, implying probability that the population operated economically and socio-politically on a relatively simple and autonomous agrarian level with minimal ties with the empire.

Because Deh Luran is now, and for most of its long history of occupation probably was, an out of-the-way, marginal, or provincial region, characterized by a somewhat less-than-ideal environmental setting, it also bodes well for providing well- preserved interesting and valuable information on the processes of acculturation involved in directed technological, economic, and socio-political change that led to the economic and social expansion of large and developed political units — the Parthian and Sasanian Empires. Further detailed investigations in this and analogous regions should also provide data on certain aspects of the operational systems of the Parthian and Sasanian periods not readily accessible through the study of large nuclear population and political centers.

Acknowledgements

The following individuals have graciously provided their time, labor, and information to the betterment of this study: Elizabeth Carter, Nathalie Desse-Berset, John V. Cotter, William E. Doolittle, Lynn Berry Fredlund, McGuire Gibson, John Hansman, David V. Hill, Frank Hole, Vance T. Holliday, Anne Kirkby Whyte, Michael Kirkby, Pierre de Miroschedji, St John Simpson, Jason A. Ur, Tony J. Wilkinson, and Henry T. Wright. It is with profound gratitude that I acknowledge their contributions. I especially wish to thank Frank Hole for his comments on drafts of this paper.

Table 1. Chronological Placement of Datable Late Site Occupations on the Deh Luran Plain.
The key identifying the ceramic types will be found at the end of the table.

Site Number	Parthian or Earlier	Sasanian and 7th Century Islamic	Eighth/Ninth Century Islamic	Tenth Century Islamic	Post - Tenth Century Islamic	Notes and Independent Dating Method (s)
DL-1				Ω	Ω	Cave – no visible architecture.
DL-2	B, W, X, Ω	P, X, Ω	A, ES, C, L, W, PM, SG, Ω	LP, Ω	UG-B, Ω	Probably the largest site on the Deh Luran Plain during the Sasanian period. Total area: 113 ha.
DL-3		Ω	SG, Ω			Habitation site associated with DL-5.
DL-4		Ω				Habitation site associated with DL-5.
DL-5		X, Ω	Ω		UG-B	Canal - Gristmill System. Drop-Tower Mill = 680+150 AD (OxL-1349). Isolated Artifact = 1750+100 AD (OxL-1348).
DL-6		Ω	SG, Ω			NW to SE trending Canal Segment.
DL-7		Ω	Ω			Reoccupied early site (Neely and Wright 1994: 31-33). Dating uncertain. Highly disturbed by modern constructions.
DL-8	Ω	Ω	Ω			Reoccupied early site (Wright and Neely 2010: 24).
DL-9		Ω	Ω			Six small mounds or platforms.
DL-10		Ω	Ω	LS, Ω		One mound with a single, multi-roomed foundation atop.
DL-12	W, Ω	P, Ω	ES, SG, Ω	LS, Ω		Large site with many structures visible.
DL-13		Ω				Qanat and Canal. Dated by technology used and apparently associated sites.
DL-15		Ω				Reoccupied early site (Neely and Wright 1994: 44-47).

Site Number	Parthian or Earlier	Sasanian and 7th Century Islamic	Eighth/Ninth Century Islamic	Tenth Century Islamic	Post - Tenth Century Islamic	Notes and Independent Dating Method (s)
DL-16		Ω	ES, Ω			Three small mounds bordering a small old canal.
DL-17		P, Ω	A, Ω	Ω		L-shaped platform, house foundations, and canals.
DL-18		P				Reoccupied early site (Neely and Wright 1994: 48-53).
DL-20	B, Ω	P, Ω	ES, C, WM, PM, Ω	LP, LS, Ω		Reoccupied early site (Neely and Wright 1994: 57-67; Wright and Neely 2010: 25-45).
DL-24		Ω	Ω			Reoccupied early site (Neely and Wright 1994: 78-81; Wright and Neely 2010: 46-51).
DL-27	X, Ω	Ω	ES, Ω			Reoccupied early site (Neely and Wright 1994: 83-84: Wright and Neely 2010: 84 & 86).
DL-28			Ω	Ω		Reoccupied early site (Neely and Wright 1994: 85-88).
DL-32	Ω	P, X, Ω				Reoccupied early site (Cohen 1981; Neely and Wright 1994: 97-99; Wright and Neely 2010: 51-57).
DL-33		X, Ω				Reoccupied early site (Neely and Wright 1994: 99-101).
DL-34	B, X, Ω	X, Ω	A, Ω	Ω		Reoccupied early site (Neely and Wright 1994: 102-103; Wright and Neely 2010: 58-67). 490+180 AD (OxL-1350).
DL-35	B, W, X, Ω	X, Ω	A, ES, Ω	Ω		Reoccupied early site (Wright and Neely 2010: 68-75). Coins - Parthian Period.
DL-36	W, Ω	P, X, Ω	L, SG, Ω	LP, LS, Ω	UG-B, Ω	Large site with many mounds. 830+250 AD (OxL-1352). 1290+150 AD (OxL-1351).

DL-38	W, Ω	P, X, Ω	A, ES, WM, SG, Ω	LP, LS, Ω	Ω	Large site, two platforms, 8 mounds, and canals.
DL-39		Ω	Ω			Large site, similar to DL-38.
DL-40		Ω	Ω			A walled town, many mounds, and associated canals.
DL-41		Ω	Ω			Large site, similar to DL-38 (Wright and Neely 2010: 76-81).
DL-43		Ω	Ω			Reoccupied early site (Neely and Wright 1994: 104).
DL-44	B	P, Ω				Three small mounds overlaid by a modern black-tent camp.
DL-45		Ω	Ω			One large and one small mound overlaid by a modern black-tent camp.
DL-48		Ω	Ω			Small platform with a surrounding canal, similar to DL-43.
DL-49		Ω	Ω			Five small mounds along a canal.
DL-51		Ω				A 25 by 50 m platform with 3 mounds atop.
DL-52		Ω	ES, Ω	LP, LS, Ω		Three platforms, two with mounds and plazas. Area of site: 3.2 ha.
DL-53		Ω				Small mound, probably part of DL-52 or 54.
DL-54	Ω	Ω				Reoccupied early site (Neely and Wright 1994: 105-109; Wright and Neely 2010: 84-85).
DL-55		Ω				Mound (22 by 30 m), little pottery, much flaked stone.
DL-56	B, W, Ω	P, X, Ω	SG, Ω	Ω		Large site, many mounds (one 5 m high), walls, columns, canals.
DL-57		Ω	Ω			Six small mounds in two clusters, several house foundations visible.

Site Number	Parthian or Earlier	Sasanian and 7th Century Islamic	Eighth/Ninth Century Islamic	Tenth Century Islamic	Post - Tenth Century Islamic	Notes and Independent Dating Method (s)
DL-58	B, W	P, Ω				One 90 by 160 m mound bordered by canals.
DL-59		X, Ω	ES, SG, Ω			Large platform with 14 mounds atop.
DL-62	B, W	P, Ω	C, ES, Ω	LP, Ω		Reoccupied early site (Neely and Wright 1994: 112-115).
DL-63	Ω	Ω	SG, Ω	Ω		Large site, 78 small and 7 medium-size mounds.
DL-68		P				Twelve by 30 m mound next to canals.
DL-71			ES, Ω	Ω		Reoccupied early site (Neely and Wright 1994: 116-117).
DL-72			SG, Ω	Ω		Fifty-seven by 62 m platform, 7 mounds, foundations, walls.
DL-73			SG, Ω	Ω		Two mounds (24 by 32 and 10 by 33 m). Site area: 1.1 ha.
DL-74	B, W, Ω	P, Ω	A, ES, WM, SG, Ω	LP, LS, Ω	UG-B, Ω	Large site, large platform, many mounds. Sites DL-72, 73, 74 all one site? 1230+330 AD (OxL-1353).
DL-75		Ω				Platform (215 m in circumference) with two mounds atop.
DL-85		Ω	Ω			Reoccupied early site (Neely and Wright 1994: 119-123).
DL-88		Ω	Ω			Small site next to a canal.
DL-89		Ω	Ω			Reoccupied early site (Neely and Wright 1994: 123).
DL-90		P, Ω				Reoccupied early site (Neely and Wright 1994: 123).
DL-100		P, Ω	Ω			Small site between two secondary canals.

DL-104		Ω	Ω			Reoccupied early site (Neely and Wright 1994: 124-130; Wright and Neely 2010: 84-85).
DL-105		Ω	Ω			Reoccupied early site (Neely and Wright 1994: 124-130).
DL-108		Ω	Ω			Small site between two old canals.
DL-111	W, X, Ω	Ω	Ω			Platform (75 by 90 m) supporting 3 mounds. Site area: 2.9 ha.
DL-112		Ω				One mound (45 by 60 m). May be part of the DL-104, 105, 108, 111 complex.
DL-113				Ω	Ω	Small site located between a primary and a secondary canal.
DL-132	W, Ω	Ω				Small farming site near edge of alluvium.
DL-138		Ω	Ω			Piedmont dry-farming and herding site.
DL-150		Ω				Piedmont site, with small qanat –irrigated (?) fields.
DL-171		Ω				Structure (15 by 18m), north of many dry-farming terraces. Probably a part of DL-172.
DL-172	Ω	Ω	Ω			Three houses, each with a compound, situated in the mouth of a canyon.
DL-194		Ω	Ω			Two houses, each with a compound, many terraces and check dams.
DL-195		Ω				Small dry-farming complex with terraces and check dams.
DL-219	Ω	Ω	ES, WM, PM, Ω			Site (area: 1.2 ha) with small mounds and foundations that lies between canals.
DL-220		Ω				Site with one mound (9 by 25 m) and several foundations.

Site Number	Parthian or Earlier	Sasanian and 7th Century Islamic	Eighth/Ninth Century Islamic	Tenth Century Islamic	Post - Tenth Century Islamic	Notes and Independent Dating Method (s)
DL-222		X, Ω	SG, Ω			Reoccupied early site (Neely and Wright 1994: 138-139).
DL-223		Ω				Mound (25 by 32 m) with 7-room house with a compound (19 by 25 m) atop.
DL-224		Ω				Circular (Diam: 9.5 m) and rectangular (3 by 5.5 m) stone foundations among many terraces.
DL-225	B	Ω				Three mounds, one with a 4-room house with a compound atop.
DL-226		Ω			GLAZED TILE	Mound (40 by 50 m) with a foundation atop.
DL-227		Ω				Three+ room house (5 by 14 m) with a compound.
DL-228		Ω				Mound (25 by 25m) of boulders in mortar, on a high terrace above the Mehmeh River.
DL-230		Ω	ES, Ω			Many dry-farming terraces and check dams (Area: 5 ha).
DL-231		Ω	Ω			Small platform with a 3-room foundation with a compound atop.
DL-232		Ω				Three small mounds, one foundation (Total circumference: 400 m).
DL-233		Ω				Small mound, 2 foundations, with terraces and check dams.
DL-235			ES, Ω			Two small (4 by 7 m) mounds near drainage with checkdams.
DL-236		Ω	ES, Ω	LS, Ω		Platform (70 by 70 m) bordered to N and S by alignments of one-meter square rock-piles.

DL-238	B	Ω	Ω	Ω		Mound (7 by 9 m) with terraces and rock-piles.
DL-239		Ω				Platform (9 by 12 m) and foundation (5 by 10 m) with terraces and check dams.
DL-240		Ω				Reoccupied early site (Neely and Wright 1994: 139).
DL-241		Ω				Reoccupied early site (Neely and Wright 1994: 140-141).
DL-242	Ω	P, Ω	ES, Ω	LS		Platform (22 by 30 m) and house foundations. Site circumference: 300 m.
DL-243		Ω				Platform (5 by 10 m) with a house foundation atop.
DL-244	B	Ω	PM, Ω	Ω		Complex of 12 small mounds. Site circumference: 585 m.
DL-247			ES, Ω			Reoccupied early site (Neely and Wright 1994: 142-145).
DL-248		Ω				Reoccupied early site (Neely and Wright 1994: 146-147).
DL-250	B, Ω	Ω		LS		Platform with a 2-room house with a compound (18 by 25 m) atop.
DL-251	B	Ω				Eight small house mounds along an old canal.
DL-252	W	Ω	C, Ω			Seven small platforms (2 are L-shaped). Site area: 1.44 ha.
DL-253		Ω	ES, Ω	LP, LS, Ω		Three small structures, each with a compound, and field terraces.
DL-254		Ω	ES, L, Ω			Platform (40 by 85 m) with a L-shaped and an oval mound atop.
DL-255		Ω				Mound (15 by 24 m), between a qanat shaft branching.

Site Number	Parthian or Earlier	Sasanian and 7th Century Islamic	Eighth/Ninth Century Islamic	Tenth Century Islamic	Post - Tenth Century Islamic	Notes and Independent Dating Method (s)
DL-256	B	Ω				Small mound (8 by 20 m), near a canal that overlies a qanat.
DL-257		Ω				Two small mounds with one foundation eroding out.
DL-262		P, Ω				Reoccupied early site (Neely and Wright 1994: 147-148).
DL-263		Ω				Mound (8 by 23 m) with much flaked stone.
DL-264		Ω				Two small mounds. Site circumference: 350 m.
DL-271		Ω				Small farming site next to an old canal.
DL-272		P, Ω				Small farming site next to an old canal. South of DL-271.
DL-274		Ω	Ω			Small farming site. Old canals and fields nearby.
DL-275		Ω	Ω			Small farming site. Old canals and fields nearby.
DL-278		Ω				Small farming site between two large canals.
DL-281	P					Small farming site between two large canals.
DL-282		P, Ω	Ω			Small farming site between two small canals.
DL-286		Ω				Reoccupied early site (Neely and Wright 1994: 149-155).
DL-290			A, Ω			Reoccupied early site (Neely and Wright 1994: 155).
DL-291	Ω	Ω	Ω			Platform (28 by 35 m) with mound (15 by 35 m) atop.

DL-294		Ω				One platform (30 by 70 m), near a canal branching.
DL-298		P, Ω	Ω			Four-room house with a compound. Total size: 10 by 13 m.
DL-303			ES, Ω	Ω		At least 9 stone semi-circular structures. Site circumference: 350 m.
DL-304		Ω				House with a compound (25 by 40 m). Site circumference: 500 m.
DL-305		Ω	A, Ω			Three-room house foundation. Total size: 4 by 8 m.
DL-307		Ω				Two house foundations (3 by 7 m & 4 by 5 m) with 2 field walls (55m & 1,350 m).
DL-310		Ω				Two multi-room house foundations, both with a compound. Total site area: 0.72 ha.
DL-311		Ω				A 6-room structure (4 by 14 m), much flaked stone.
DL-312		Ω				Reoccupied early site (Neely and Wright 1994: 160-161).

SYMBOLS KEY:

A: APPLIQUE DECORATION.
B: BLACK GLAZE.
W: WHITE GLAZE.
P: PEA-GREEN / OLIVE GLAZE.
B/B: BLUE GLAZE ONE SURFACE / BLACK OBVERSE.
LP: LATE PAINTED.
ES: EARLY SPLASH (WHITE OR YELLOW - BASE GLAZE).
LS: LATE SPLASH (OLIVE / PEA-GREEN - BASE GLAZE).
C: COBALT.
LP: PAINTED DESIGNS / LINES / PSEUDO-KUFIC ON GLAZED BACKGROUND.
L: LUSTER.
WM: WHITE MAJOLICA.
PM: PRESS MOLDED.
SG: SGRAFFIATO.
UG-B: UNDERGLAZE BLUE.
X: DIAGNOSTIC RIM (APPLIED TO SASANIAN AND EARLIER CERAMICS).
Ω: UNGLAZED PLAIN AND/OR SURFACE TEXTURED CERAMICS

NOTE: Rows showing no symbols, "blank rows", represent sites with one or more undiagnostic turquoise-colored glazed sherds, and as such could represent any time between the Late Parthian and the tenth century Islamic periods. This table is modified from Hill (2006:Table B.10).

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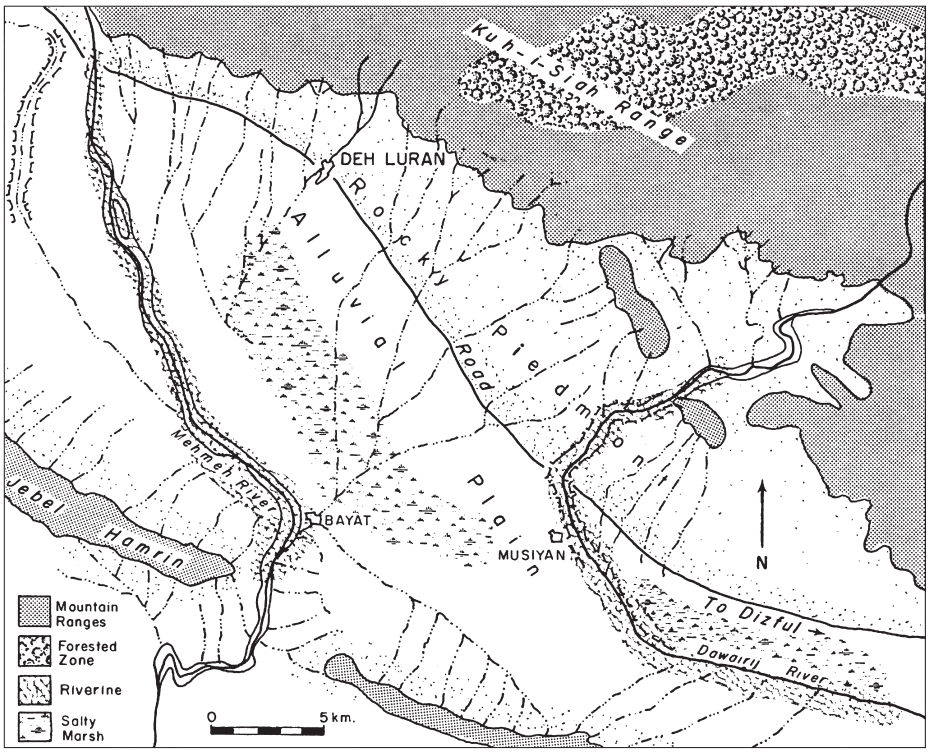
Pl. 1. The location of the Deh Luran Plain in relation to the Diyala Plain and the Upper Khuzistan (Susiana) Plain.



Pl. 2. Plan view of the Deh Luran Plain, showing the approximate boundaries of the four microenvironmental zones defined in the text.

Pl. 3. Photographic overview of the rocky piedmont zone. Looking northeast from DL-2 toward the Kuh-i-Siah Range of the Zagros Mountains.

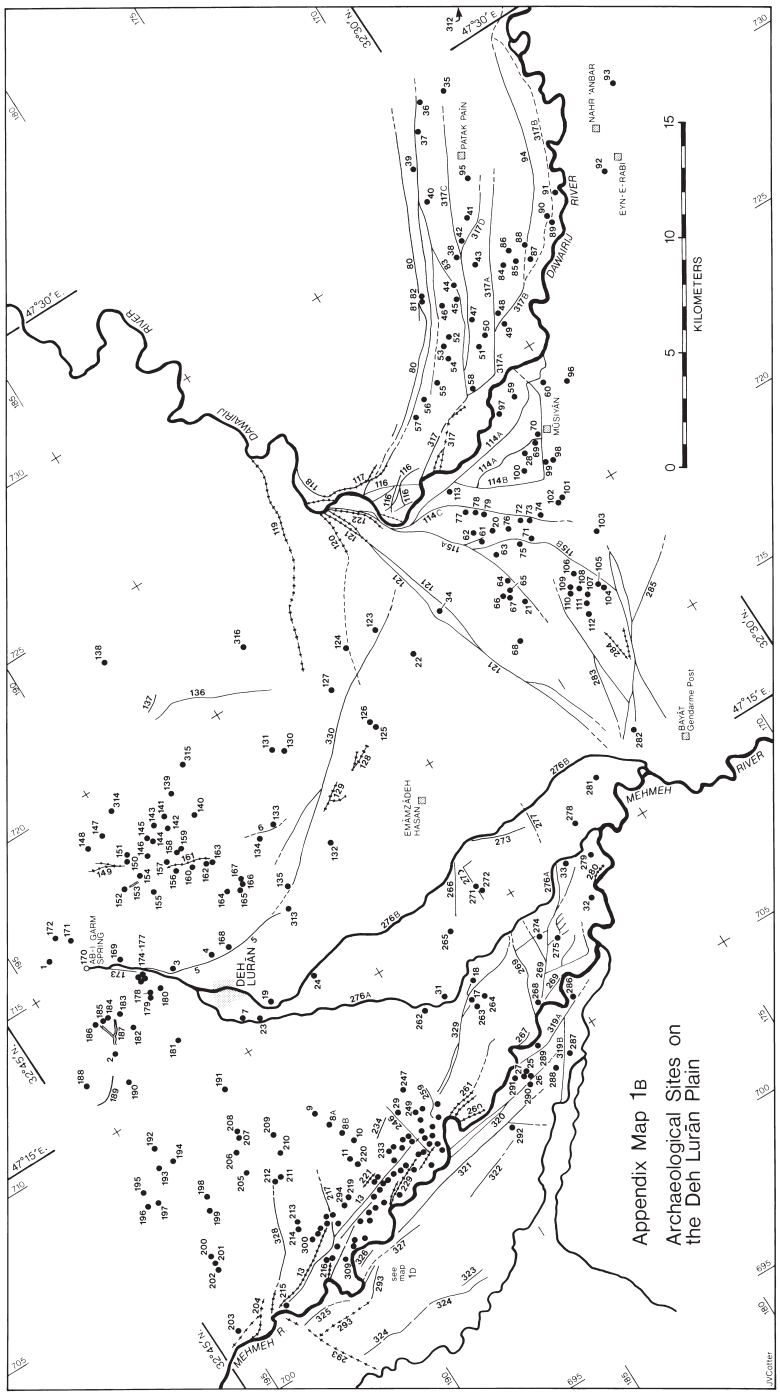
Pl. 4. Photograph of the Mehmeh River, illustrating the riverine zone. Note the depth of the river below the alluvial plain. Looking north, with Tepe Farukhabad (DL-32) in the center background.

Pl. 5. The alluvial plain, looking southeast from DL-2. The southern edge of the rocky piedmont zone (fore- and middle-ground) may be seen to blend into the alluvial plain (middle- and background). The two arrows point to tepe/tell sites situated near the northern edge of the plain.

Pl. 6. A view looking northwest across the alluvial plain, with the Kuh-i-Siah Range of the Zagros Mountains in the background. The late afternoon October lighting clearly delineates large and small tepe/tell sites.

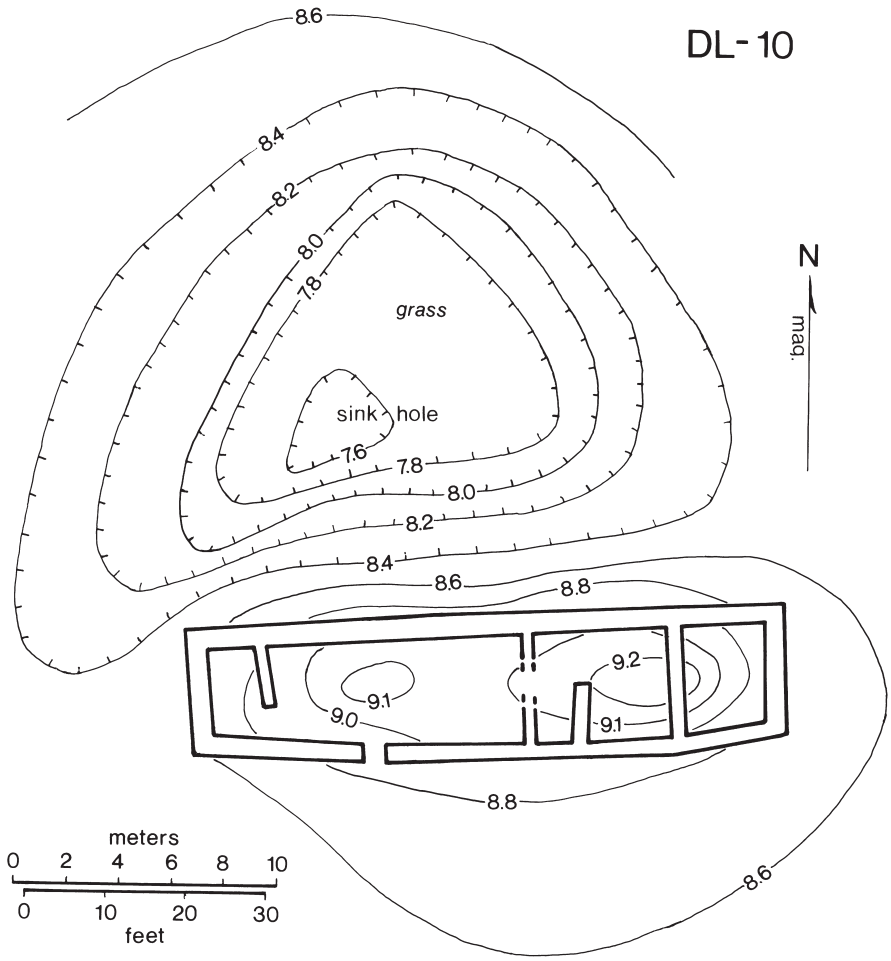
Pl. 7. A view looking southwest across the alluvial plain. Tepe Musiyan (DL-20), the largest site on the alluvial plain, is in the background. Note the several generations of canals clearly visible in the fore- and middle-ground.

Pl. 8. The shallow, salty marsh, looking north. This photograph was taken during the month of October just after a light rain. Traces of mineral salts appear as a thin white crust in the upper-middle-ground.

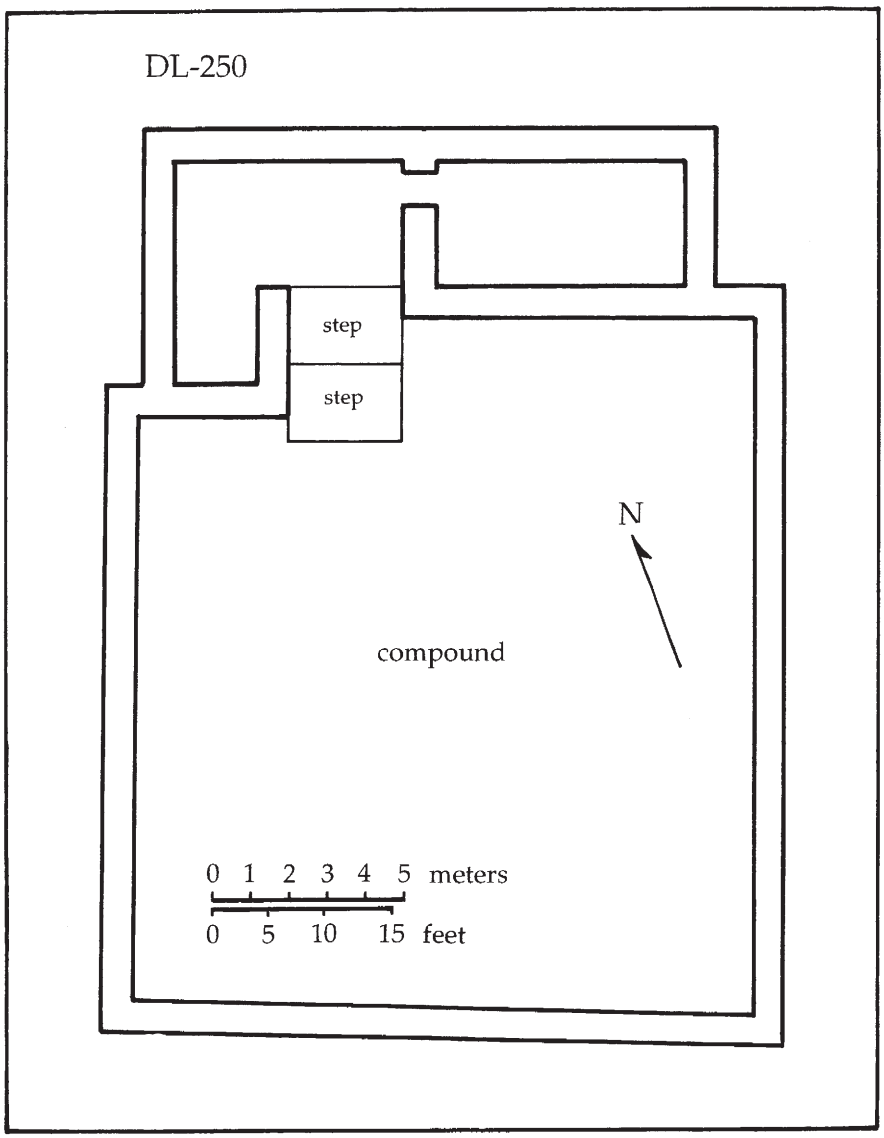


Pl. 9. A map of the Deh Luran Plain showing the locations of archaeological sites and water management features. Thin solid lines indicate canals, thin broken lines denote probable canals, and small dots connected by a line represent qanat systems. (After Neely and Wright 1994: Appendix Map 1B).

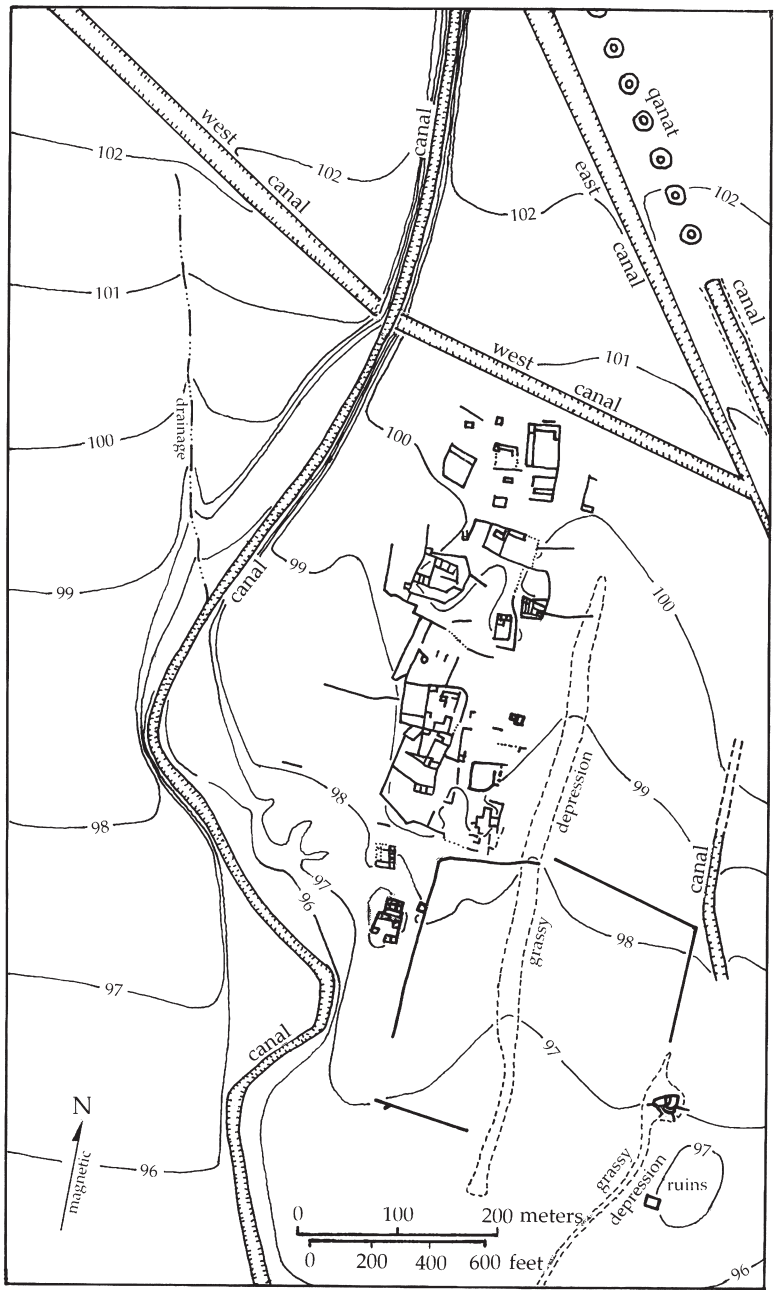
Pl. 10. Site DL-10. Photograph of the remains of a small irrigation agriculture homestead on the northwestern portion of the alluvial plain that was constructed during the Sasanian Period (see Pl. 11).



Pl. 11. Plan view of site DL-10, a small irrigation agriculture homestead on the northwestern portion of the alluvial plain constructed during the Sasanian Period. The depression to the north of the structure may have resulted from the excavation of clay as building material, and may have subsequently been used as a small reservoir for domestic water storage. The contours represent metric distances below a hypothetical datum of 10 meters.

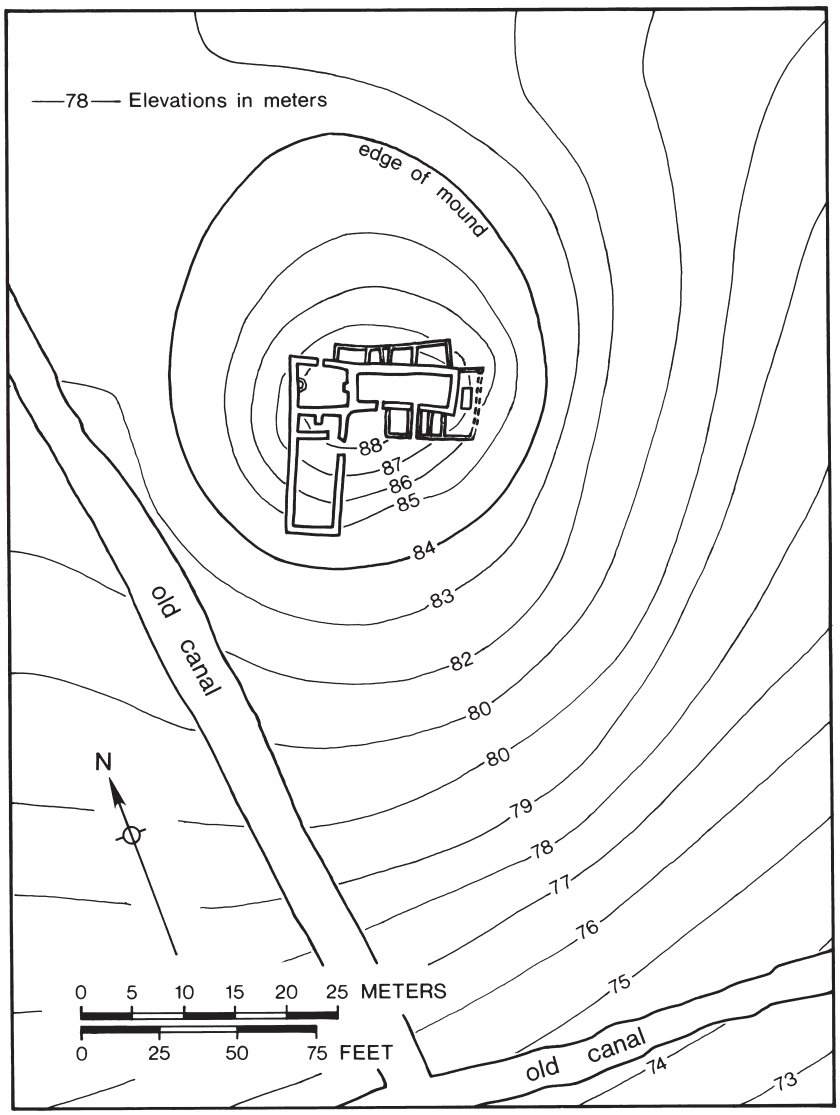


Pl. 12. Plan view of site DL-250, an irrigation agriculture courtyard/compound homestead on the northwestern portion of the alluvial plain constructed during the Parthian Period.

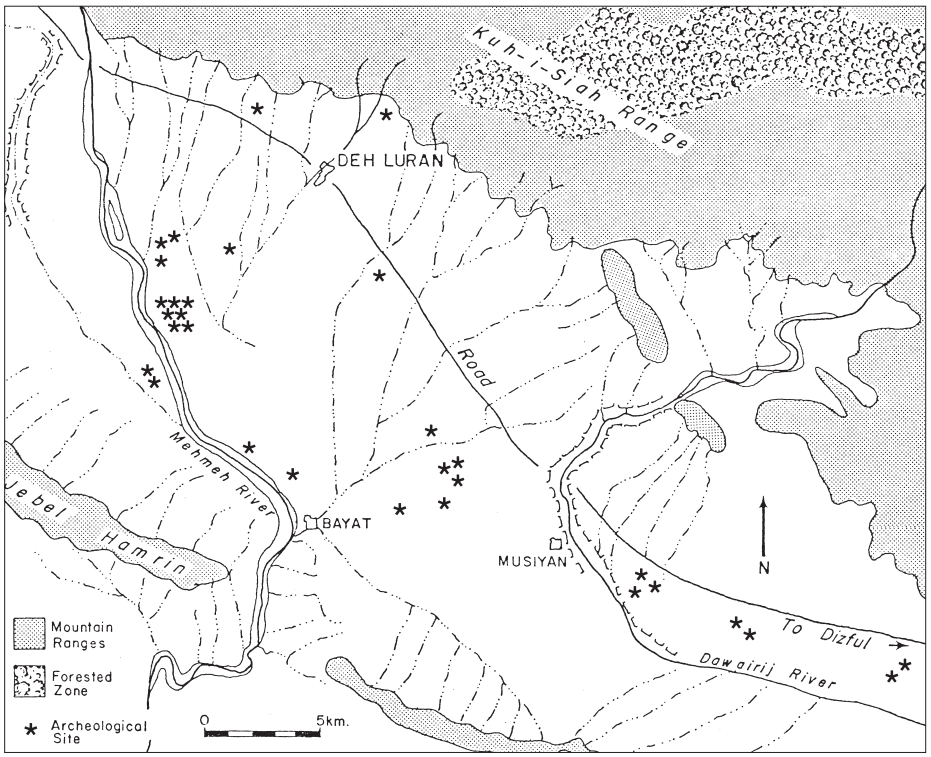


Pl. 13. Plan view of site DL-12. Founded during the Parthian Period with occupation into the 10th century, this large site is situated on the northwestern part of the alluvial plain.

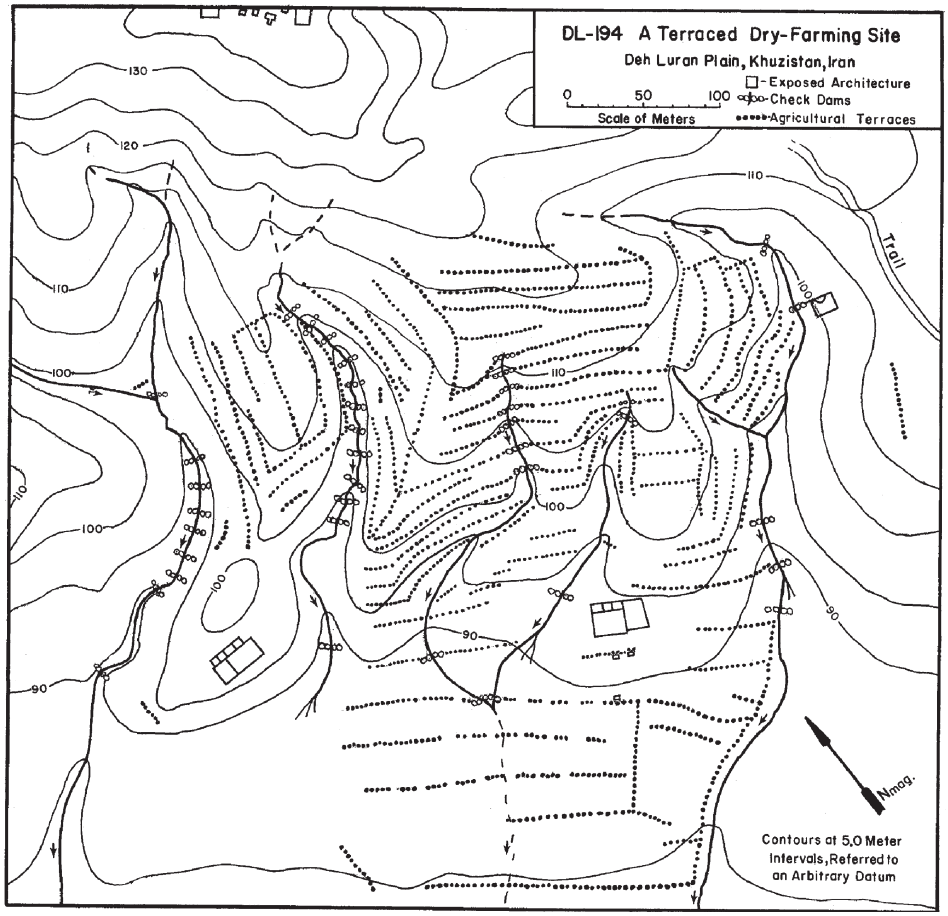
Pl. 14. Photograph of the remains of the Sasanian Period structure at site DL-241. This is an example of an irrigation agriculture homestead on the northwestern portion of the alluvial plain. Looking south-southeast (see Pl. 15).



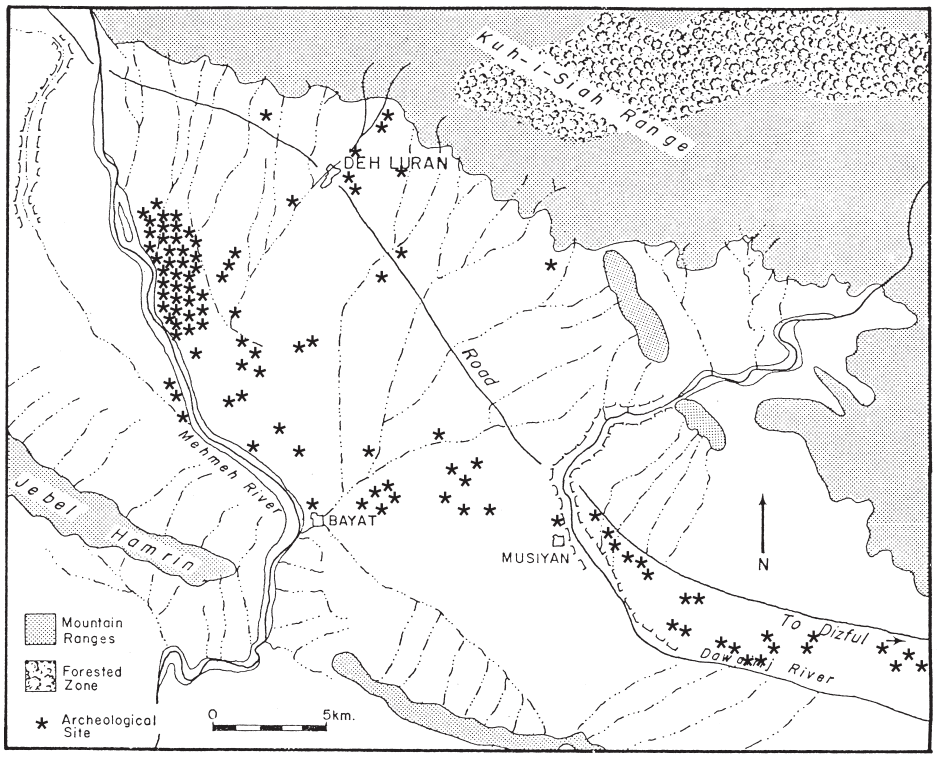
Pl. 15. Plan view of site DL-241, an irrigation agriculture homestead on the northwestern portion of the alluvial plain constructed during the Sasanian Period. The semi-circular feature abutting the wall of one of the larger rooms may be a hearth. The rectangular feature in the floor of the easternmost room may be a ceramic coffin. This site was situated atop a mound site dating to the Khazineh and Mehmeh Phases (5,000-4600 B.C.E.; Neely and Wright 1994: 140-141).



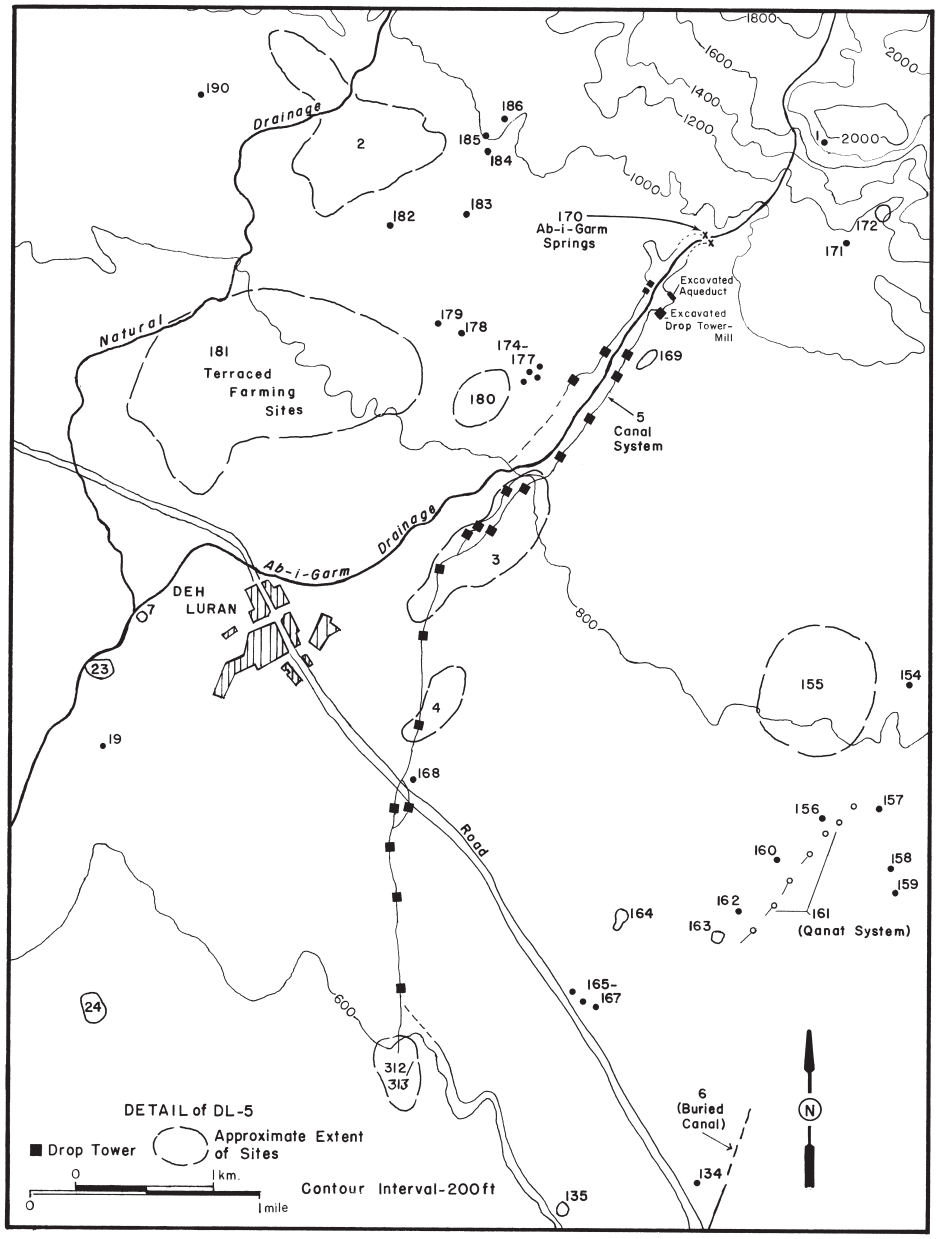
Pl. 16. Plan view of the Deh Luran Plain, with the distribution of dated sites for the Parthian Period (ca. 210 B.C.E. to 225 C.E.). Because of the small scale of this map, the site numbers have not been indicated.



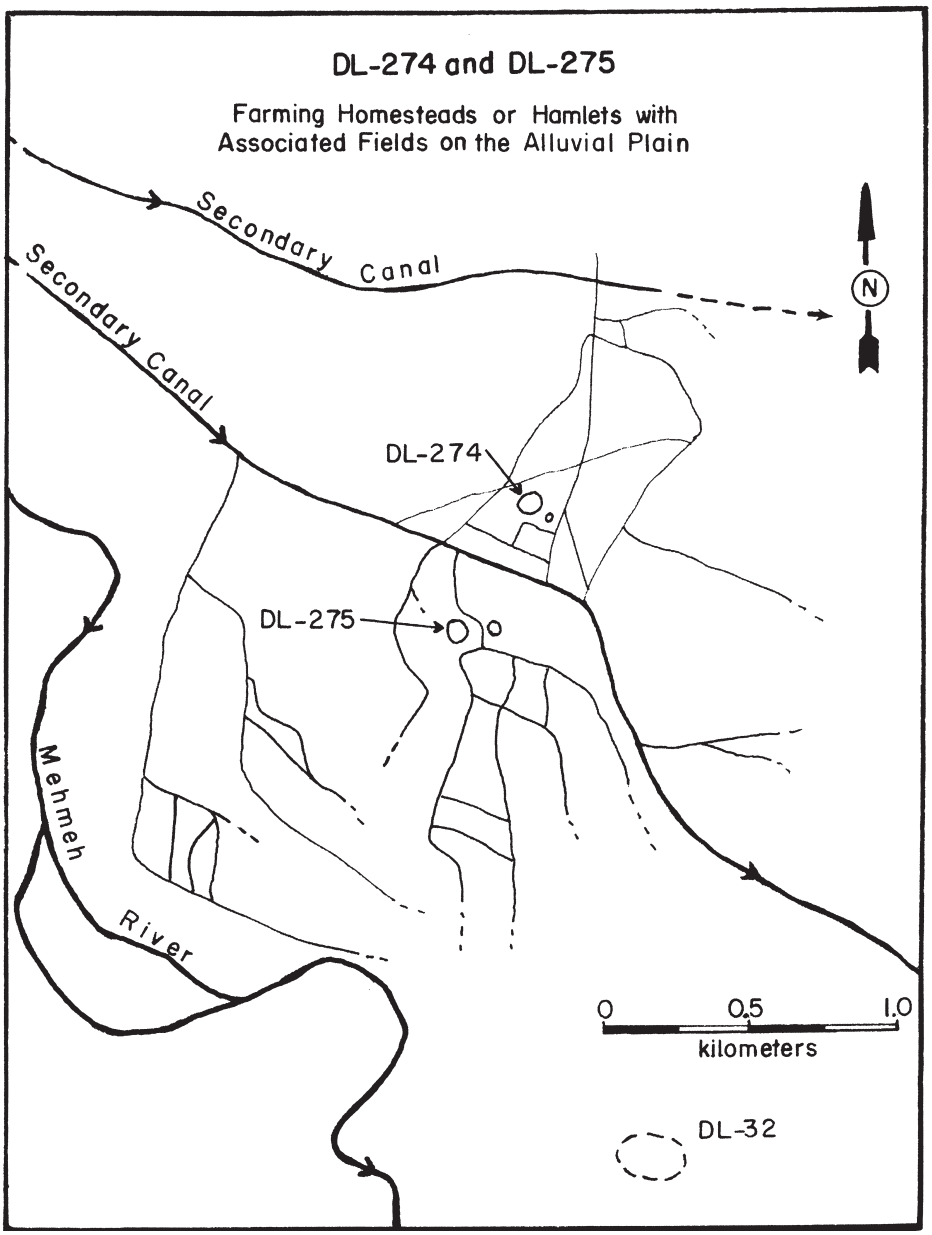
Pl. 17. Plan view of site DL-194, a dry-farming homestead on the northwest portion of the piedmont zone constructed during the Sasanian Period. Note the courtyard/ compound homestead architecture. The structures shown at the northern extreme of this map form part of a likely associated hilltop site mentioned in the text.



Pl. 18. Plan view of the Deh Luran Plain, with the distribution of dated sites for the Sasanian and the 7th Century Islamic periods (225 to ca. 700 C.E.). Because of the small scale of this map, the site numbers have not been indicated.



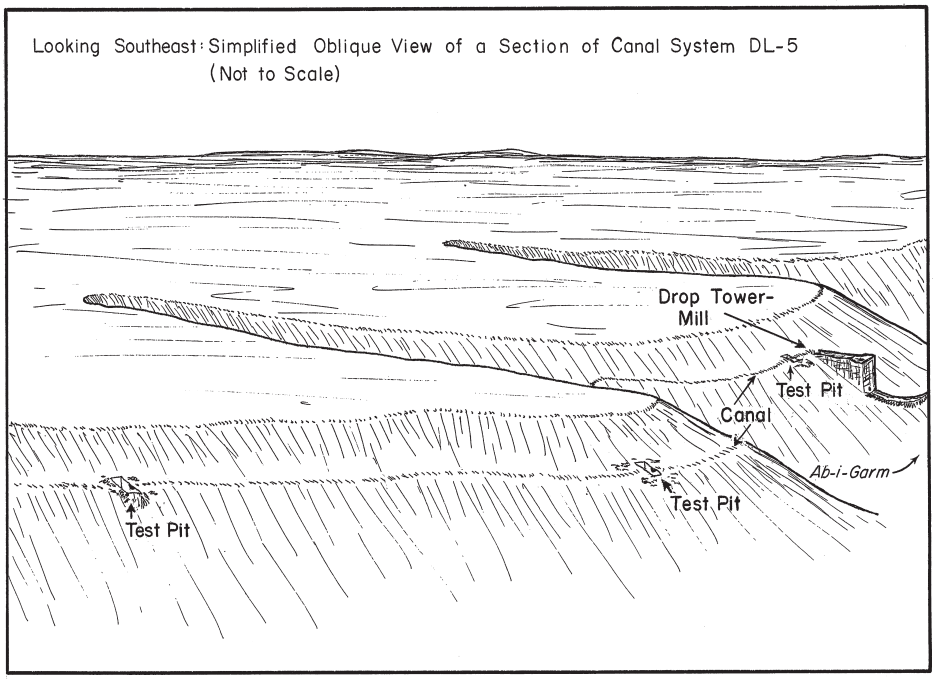
Pl. 19. Plan view detail map of the north-central portion of the Deh Luran Plain. Note the canal system (DL-5) with its drop-tower gristmills. See Pl. 24 for a rendering of an excavated drop-tower gristmill.



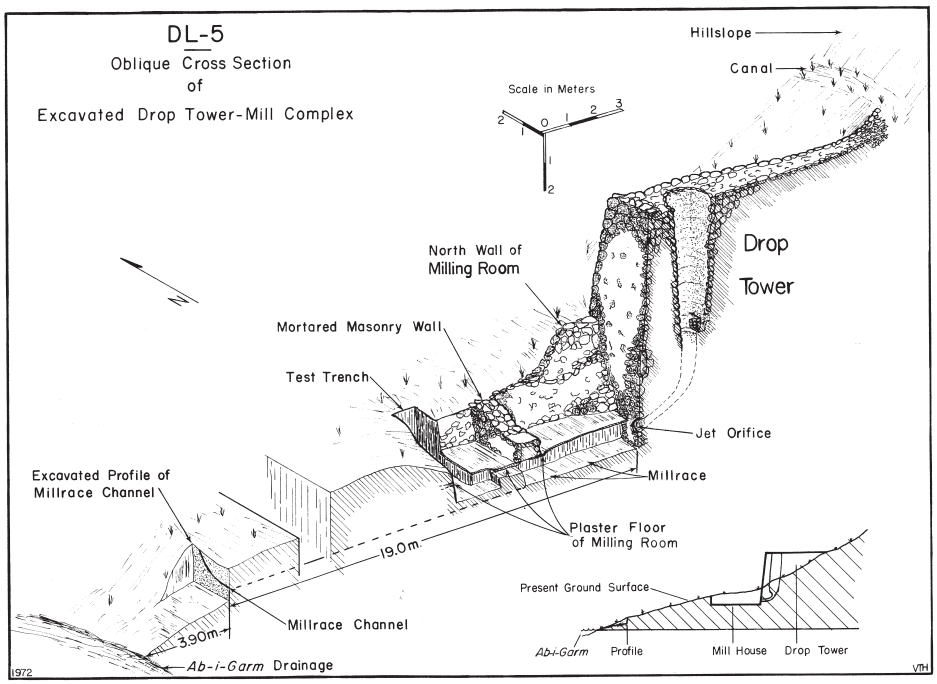
Pl. 20. Plan view of sites DL-274 and DL-275, irrigation agriculture homesteads on the southwestern margin of the alluvial plain constructed during the Sasanian Period. The fields and canals illustrated in are believed to be associated with the sites due to the presence of contemporaneous diagnostic ceramics.

Pl. 21. Low dry-farming terraces located at the northwest corner of site DL-194 and bordering the drainage forming the site's western boundary (see Pl. 17). Looking northeast.

Pl. 22. Check-dams, or cross-channel terraces, located in the drainage forming the western boundary of site DL-194 (see Pl. 17). Looking northwest.



Pl. 23. A perspective drawing of a segment of canal system DL-5 near its point of origin. Lush grasses within a very shallow linear depression indicate the presence of the canal. The bed of the Ab-i Garm drainage lies in front and to the right of the drop-tower gristmill. Looking southeast.



Pl. 24. An oblique perspective cross-section drawing of an excavated drop-tower gristmill. This is one of several such gristmills forming an integral part of canal system DL-5 near its point of origin at the Ab-i Garm springs. See Pl. 19 for the location of this gristmill. Looking northeast.