TRADITIONAL ARDS OF JORDAN

by
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Introduction

During fieldwork conducted independently by the authors into rural agricultural practices in northern and southern Jordan, the opportunity arose to document the traditional tillage implements which are still employed in these regions. Later comparisons of field notes revealed several striking similarities and differences. The present article documents and analyzes the attributes of the two predominant types of traditional tillage implements in northern and southern Jordan, drawing primarily upon examples from the region of el-Mazar in the northwest, and Petra in the southwest (Fig. 1). Possible reasons for the observed differences from north to south are sought in variations in local ecological conditions.

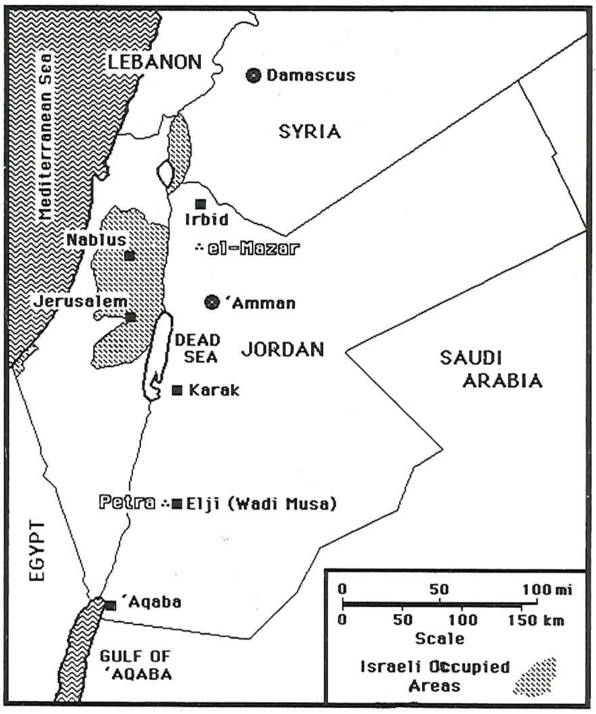

Fig. 1. Map of Jordan showing the locations of el-Mazar and Petra.

The traditional tillage implements of Jordan have not been the focus of research since the seminal work of Gustav Dalman (1932) earlier in this century. While traditional tillage implements in neighboring areas have been more recently studied (Avitsur 1965), those of Jordan have been relatively neglected. Currently, modern mechanized equipment is rapidly replacing traditional tillage implements in Jordan, increasing the need to better document these tools and their applications in local environments before they are lost for ever. In the absence of a better understanding of these implements and their traditional behavioral correlates, the interpretation of animal traction tillage as reflected in the archaeological record remains problematic.

The Nature of Ards

By at least the fourth millennium B.C., animal traction tillage implements known as ards with symmetrical shares were being used for cultivation in the Near East and Europe (Aberg 1956; Bishop 1936; Curwen 1938: 143-147; Ellison 1982: 180; Glob 1945; Gow 1914; Harrison 1915-16; Huntingford 1932: 237-233; Manning 1964; Payne 1947; 1957; Sherratt 1981: 266-272; 1983: 91-92; Steensberg 1936; Zagreb 1952). Built of wood and capable of scratching a relatively shallow groove according to their shape, these implements deposited loosened soil equally on both sides of the furrow created, generally working at depths of approximately 10-30 cm (Avitsur 1965: v-vi; Steensberg 1976: 271; Varisco 1982: 166-167). Colloquially termed "scratch ploughs" or "nail ploughs," these symmetrical implements and their subsequent asymmetrical counterparts prior to the development in the seventeenth century A.D. of modern ploughs with curved mouldboards are formally known as "ards" or "ard ploughs," a derivation of the Latin *aratrum*.

It is widely recognized that the wooden ards ethnographically employed in the Near East and throughout the arid and semiarid regions of the world have changed little from their prehistoric counterparts (Avitsur 1965; Hopfen 1969: 47-55; Russell 1988a: 38-40; Simpson 1930: 66; Varisco 1982; Watson 1979: 74-75). In areas, however, where drainage was a problem and seedbed ridges desirable, small flat, bent or tilted slide-boards were sometimes attached to both sides of an ard's share at the final ploughing to widen the furrow and create "rafters" or ridges, a practice attested by at least the first century B.C. (e.g., Varro I.29.2; Virgil *Georg*. I.172; see Aitken 1956: 101-102; Manning 1964: 56, 118-124; Steensberg 1976).

Further, as the denser, moisture-retaining clay soils of Europe came under cultivation, larger slide-boards were often attached to only one side of the ard, producing an asymmetrical ard capable of cutting and partially pulverizing furrow-slices (but not fully inverting them), a development initially attested in the first century A.D. in the foothills of the Italian Alps and eastern Switzerland (Pliny XVIII.48). While flat, tilted, and bent slide-boards were frequently attached to ards in Europe prior to the seventeenth century in order to clear the cut furrow from the untilled soil, the model for the modern curved mouldboard came from China in the seventeenth or early eighteenth century.

These Chinese prototypes initially became known in western Europe in the region of Brabant, a former duchy now divided between the Netherlands and Belgium (Hopfen 1969: 59). Dutch and Flemish ploughwrights apparently made the first attempts at attaching curved mouldboards to ards at that time (Allen 1847: 229; *Edinburgh Encyclopaedia* 1832: 238; Loudon 1883: 389; Payne 1957: 83), leading to the development of the modern asymmetrical plough. Fig. 2 diagrams these three basic stages in the historic evolution of ards to ploughs.

Ards from Northern Jordan

During field research in the hill country of northern Jordan, the first author was introduced to an elderly man (c. 70 years old) in the village of el-Mazar who has been making wooden ards for the past thirty

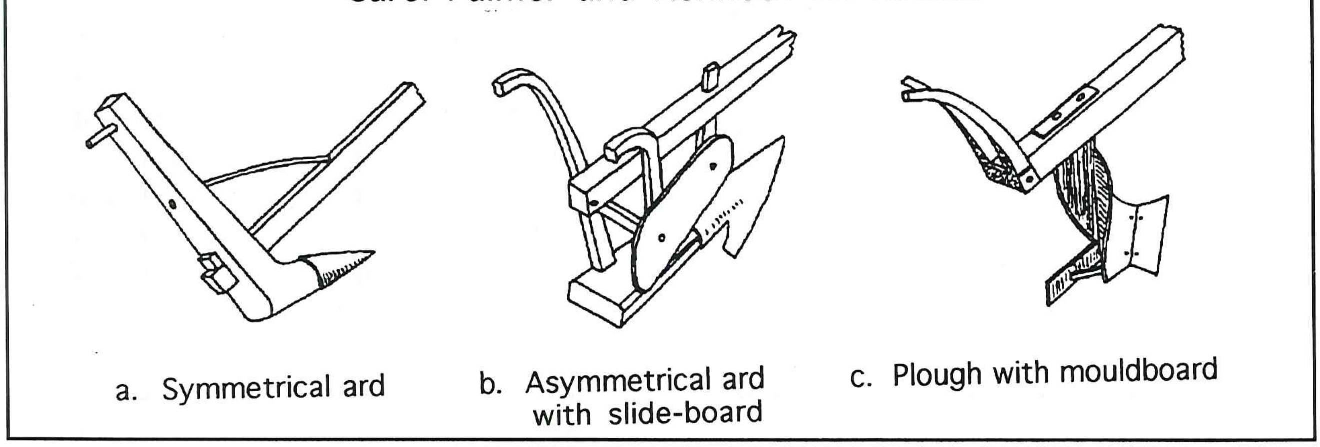

Fig. 2. Simplified historic evolution of the mouldboard plough (after Hopfen 1969). Symmetrical ards (a) were being used in the Near East and Europe by at least the fourth millennium B.C. Asymmetrical ards with large slide-boards (b) are initially attested in Europe in the first century A.D. Ploughs with mouldboards (c) were subsequently developed in Europe in the late seventeenth or early eighteenth century A.D. from Chinese prototypes.

years (Pl. I, 1). The type of ards which he constructs are broadly representative of the ards used in northern Jordan. Once suitable pieces of oak have been chosen, one ard can be assembled in approximately one day. Indeed, a large part of the skill employed in this task is selecting branches of the correct shape, strength and length so that they can be trimmed and fitted together. Once appropriate branches have been selected, only five basic tools are used in ard manufacture (Table 1).

Table 1: Ard manufacturing tools.

Tool	*Arabic name*	*Transliteration*
Ax	طبر، بلطه	Ṭibar, Balṭah
Saw	منشار	Munshār
Rasp/File	مبرد	Mabrad
Adze	قدوم	Qaddūm
Chisel	منقار، إزميل	Menqār, Izmīl

The main body of the ard consists of two basic pieces: a beam and a combined piece for the stilt and sole (Fig. 3, Pl. I, 2). The ratio between the beam and the stilt/sole is set at 5:6 of his hand-spans (c. 22 cm per hand-span), with each hand-span referred to as a *shibir* (شبر). Approximately 10 cm before the base of the beam, a hole is carved so that the sole/stilt piece can be slotted into position. The upper end of the stilt/sole is adzed down to a flat piece (c. 7-8 cm wide and c. 3 cm thick) whilst the lower portion is left with the branch's full circumference. The adzed stilt section is inserted through the beam, with the unadzed sole section resting against the bottom of the beam. The sole itself is slightly pointed to receive the share. A third piece of wood, a dog-leg strut, is mortised at both ends into the beam and the stilt/sole, and is subsequently secured using a metal tie or band. The handle, which is slotted onto the top of the stilt, is carefully adzed and rasped down to a symmetrical shape bulging in the center around its mounting hole.

This basic structure broadly conforms to a Type III ard ("with the passing through stilt") as defined by Éach (1968: 12) and is equivalent to the *nord- und ostpalästinische Pfluggestell* described by Dalman (1932: 83-84). The north Palestinian *Arabische Pflug* was also described by Schumacher in 1889. This ard type appears to be the predominant form traditionally used in northern Jordan. It is commonly called a *maḥrāth* (محراث), a noun derived from the verb "to plough", but is also known as an *'Ūd ḥarrāth* (عود حراث), referring to the ard beam, and as a *sikkah* (سكه), referring to the share. For comparative purposes, Table 2 summarizes the indigenous names applied to the various parts of this northern ard.

The share itself (Fig. 3) is manufactured by a blacksmith, or *ḥaddād* (حداد). Formerly, every village would have had its own blacksmith. However, blacksmiths are now only found in the larger villages and towns. The body of the share consists of a convex triangular iron plate (for similar forms, note Dalman 1932: 71-73, and plates 19, 22). On the broad end of the plate, two narrow wings (c. 5 cm width, 17 cm in length) are set at mirrored angles, with a long tapering tongue at the narrow end (c. 15 cm long). The share is held in position on the sole (the ard head) by the convex shape of the share and an iron strap across the share's lower side. This strap extends through slots in the base of the wings and wraps around the upper surface of the share's body. Historically, all pieces of the share were hand wrought iron, although modern examples are of welded steel (as depicted in Pl. I, 2). In these modern examples, tongues appear to be longer (c. 20-25 cm), while the holding strap is simply welded to either side of the share's bottom. Historically, a worn or broken tongue would be replaced by forging a replacement. Currently, replacements are welded on.

On the ard depicted in Fig. 3, the share

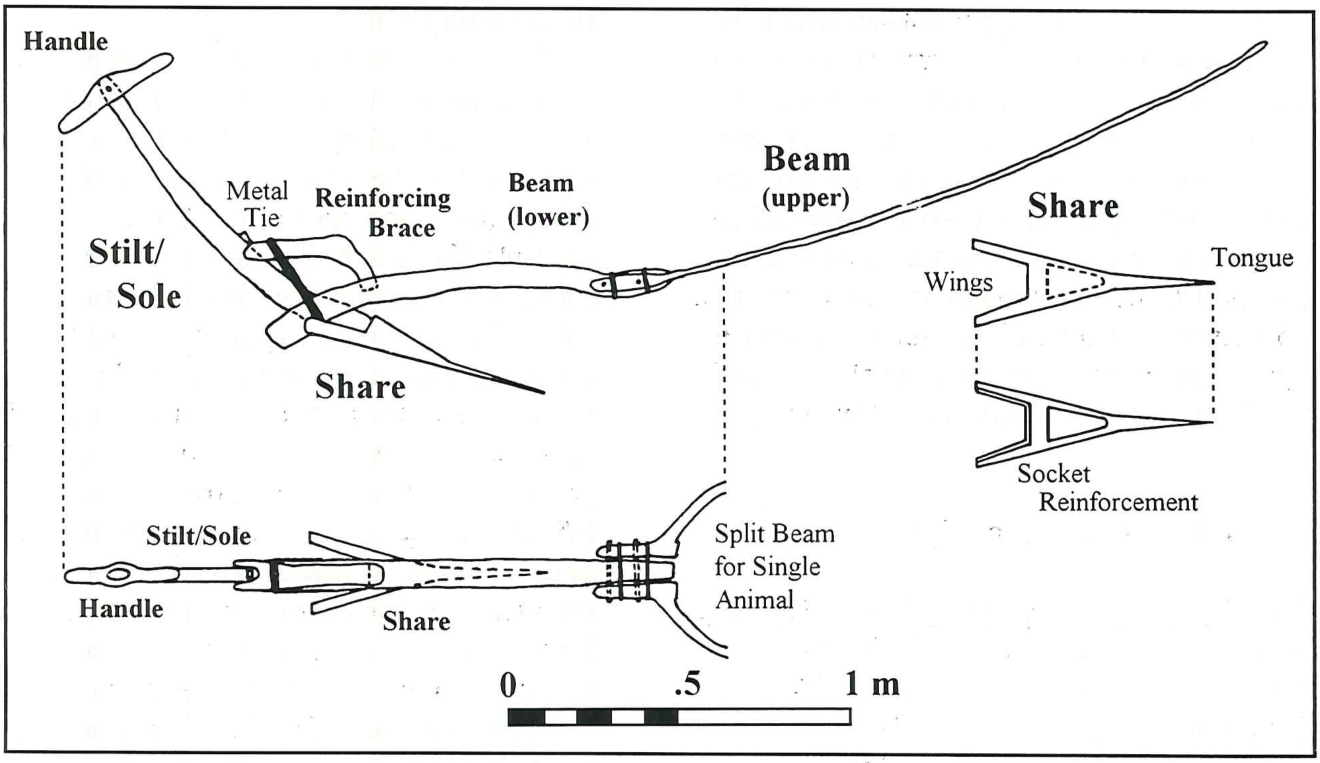

Fig. 3. Ard (*maḥrāth* محراث, or *ʻŪd ḥarrāth* عود حراث) for single horse traction from el-Mazar.

Table 2: Northern classification of ard (*maḥrāth* محراث).

Part	*Arabic name*	*Transliteration*
Beam (entire)	عود	ʻŪd ("long stick")
Lower part	برك	Burk
Upper part	وصله	Waṣlah ("connection")
Stilt/sole	ذكر	Dhakar ("male")
Tip end of sole	فجله	Fijlah ("raddish")
Handle	كابوسه	Kābūsah
Reinforcing brace	ناطع	Nāṭeʻ ("butting heads")
Metal band	طوق	Ṭūq
Wedge	بلعه	Bilʻah
Share	سكه	Sikkah
Body	حلق، بطن	Ḥalaq ("ring"), Baṭn ("belly")
Wings	إذن	Idhn ("ear")
Socket reinforcement	إيد	Eīd ("hand")
Tongue	حسمه، راس	Ḥismah, Rās ("head")
Yoke	نير	Nīr
Yoke struts	سلاحات	Salāḥāt
Yoke center pegs	شريفات	Sharīfāt
Twisted hide rope	شرعه	Sharʻah
Toggle of hide rope	جازل	Jāzal
Padded collar	حواه	Ḥuwāah
Strut Collar	كدانه	Kidānah

rests on the sole at an angle of approximately 40° to the line of the composite beam, and operates at an approximate angle of 23° to the soil surface. However, this may be adjusted as needed by manipulation of the handle, or by shifting the location of the ard's attachment to the traction animal or animals, as discussed below.

To set the main body of the ard for tillage, it is attached to an animal or animals through a forward extension of the beam. In the example depicted in Fig. 3, this forward extension consists of two bent branches, a design intended for single animal traction. These are attached to either side of a triangular L-shaped wooden collar, known as a *kidānah* (كدانه), which is set in front of the animal's padded collar, or *ḥuwāah* (حواه), as depicted in Fig. 4b. By shifting the point of attachment of the bent branches to the *kidānah* forwards or backwards, the angle of the share can be altered.

For dual animal traction, the mechanics are somewhat different (Fig. 4a). In such cases, the forward section of the beam will consist of a single tongue with notches at its uppermost end so that it can be tied to the central pegs of a yoke, or *nīr* (نير). The tongue is fixed to the yoke using two looped lengths of twisted hide, allowing for flexibility between the yoke and the ard. By shifting notches on the tongue forwards or backwards, the angle of the share can be altered. When used with oxen, the yoke simply rests on the shoulders of the animals without any padding, and is held in place by the yoke struts and their attachment cords. However, when mules or donkeys are employed, the padded collar, or *ḥuwāah*, is used in conjunction with the

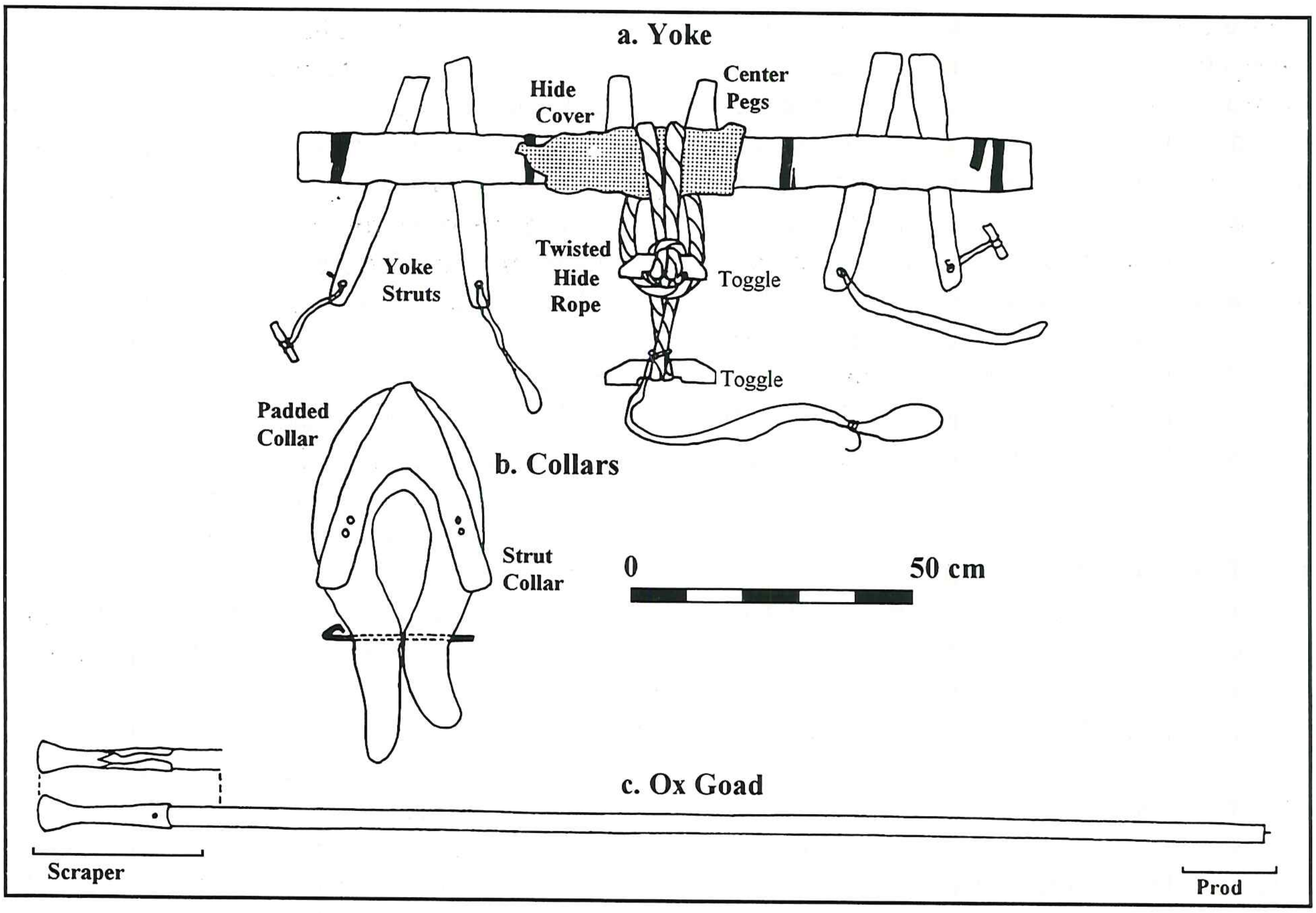

Fig. 4. Items associated with ard tillage in northern Jordan. a. Yoke (*nīr* نير) for two donkey traction, b. Padded (*ḥuwāah* حواه) and strut (*kidānah* كدانه) collars for a donkey, c. Ox goad (*mizān el-faddān* ميزان الفدان).

struts.

While tilling, horses, mules and donkeys are controlled by pulling appropriately on a rope which extends from their halter to the handle of the ard. Oxen, on the other hand, are controlled using an ox goad (Fig. 4c), known as a *mīzān el-faddān* (ميزان الفدان). This is made from a long thin branch of wood over 2 m in length. It has a sharp pin on one end for prodding the ox, known as a *minsās* (منساس), and a spatula-shaped iron fixture on the opposite end, known as a *'abwah* (عبوه), which is used to scrape mud off the share during tillage.

In addition to the traditional wooden ard, modern ards constructed completely from iron are also employed in tillage in northern Jordan. These appear to be a comparatively recent phenomenon, with farmers reporting their first appearance some 20 to 30 years ago, and possibly earlier. This ard form is illustrated by Elezari-Volcani (1930: 65). They are principally used in conjunction with a single donkey, and have been observed in use for tillage between summer crops, and in tillage for winter crops sown on very small plots of land. In comparison to the wooden version, these metal ards are comparatively inexpensive, at approximately one third to one half the cost of the former. The basic structure of these modern iron ards broadly conforms to a Type VIII ard ("sole type") as defined by Éach (1968: 14).

Ards from Southern Jordan

During several seasons of ethnoarchaeological fieldwork among the Bedul bedouin of Petra (Russell 1988b; Russell and Simms 1986), observations were made on the traditional ards used in southwestern Jordan. As with the ards of northern Jordan, these are generally made from branches initially selected for their shape, strength and length so as to minimize manufacturing labor. Unlike northern ards, however, which are exclusively made from oak, southern ards frequently possess elements made from juniper and willow. Similarly, several structural variations also distinguish southern ards from their northern counterparts.

Initially, the wooden part of the southern ard consists of three (rather than two) basic pieces. In addition to the beam, the sole and stilt of southern ards exist as separate entities (Fig. 5; Pl. I, 3). Like northern ards, the beam itself is in two parts. Most frequently, the forward section of the beam consists of a single notched tongue attached to a yoke for dual animal traction (often, as in this example, a pair of donkeys), although it may alternatively consist of two bent branches for single animal traction (often by camel).

Approximately 10-15 cm above the base of the lower beam, a hole is carved so that the sole piece can be slotted into position. The sole piece extends through the beam approximately 30 cm, at which point the stilt is attached. This rear extension of the sole is adzed to a relatively flat piece (c. 7 cm wide and 2.5 cm thick) whilst the forward portion is adzed flat on its upper surface (its lower side generally retaining the branch's circumference) to facilitate the attachment of a flat share. The rear extension of the sole is inserted through the beam, with the partially adzed forward section resting against the bottom of the beam.

The stilt and handle are a single unit, consisting of a straight limb (c. 4.5-5 cm diameter, 72-75 cm long) with a small forking branch (c. 2-3 cm diameter and 9-10 cm long) near its top. It is usually attached to the right side of the sole's extension with a metal band or strap, and is sometimes adzed flat near its base to facilitate this. A small, downward-curved strut runs between the beam and the sole, and is secured at both ends using metal bands or straps.

This basic structure broadly conforms to a Type V ard ("with beam sole") as defined by Éach (1968: 12-13), and is equivalent to the *mabische Pfluggestell* described by Dalman (1932: 84-85). Unlike the northern ard,

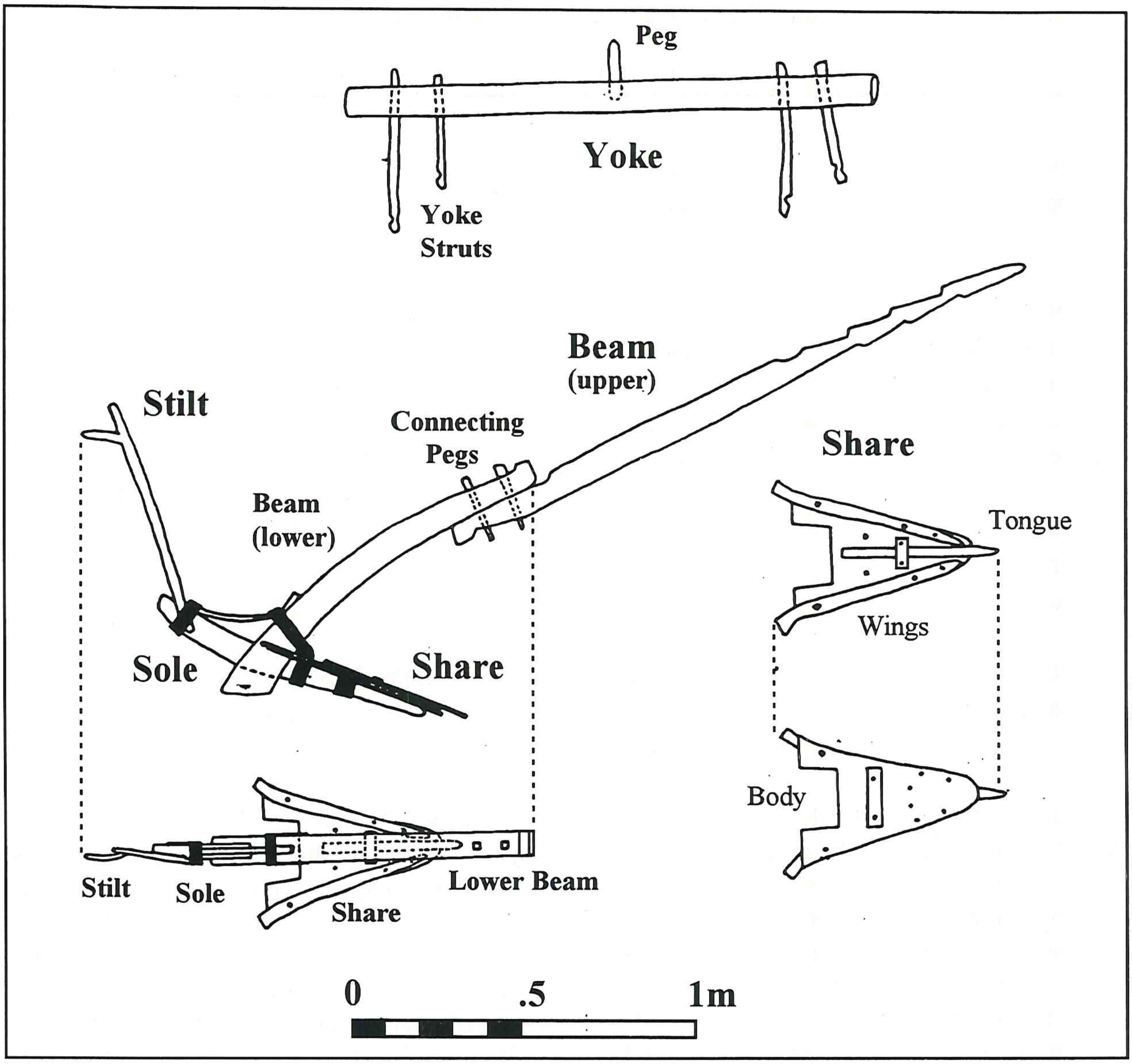

Fig. 5. Ard (*Sukkah* سكه) for two donkey traction from Petra.

it is generally known simply as a *sukkah* (سكه), again referring to the share and the tracks or furrows it makes. The variation in transliteration is a function of common pronunciation (*sikkah* in the North, but *sukkah* in the South). This ard type appears to be the predominant form traditionally used in much of southern Jordan, although a less common wooden type was observed below Petra in Wadi 'Arabah, the basic structure of which conforms to a Type VIII ard ("sole type") as defined by Éach (1968: 14). For comparative purposes, Table 3 summarizes the indigenous names applied to the various parts of the predominant type of southern ard.

Unlike the convex triangular shares with fixed tongues and slanted wings associated with northern ards, southern shares (Fig. 5) are broad, flat triangular iron plates with flat wings and separate, adjustable tongues (for similar forms, note Dalman 1932: 73-74, and plates 18, 19, 20). The flat share and wings are reinforced along their outer edges with riveted strips of iron. The share rests upon the flattened upper side of the

Table 3: Southern (Bedul البدول) classification of ard (*Sukkah* سكه) parts.

Part	*Arabic name*	*Transliteration*
Beam		
Lower part	صرعه	Ṣur'ah
Upper part	وصال	Wṣāl
Stilt	إيد	Eīd ("hand")
Sole	ذكر	Dhakar ("male")
Sole brace	ظهر	Ẓahr ("backbone")
Metal tie (sole to beam)	لجام	Ljām
Metal tie (stilt to sole)	سوار الإيد	Swār el-Eīd
Connecting pegs (ard to beam)	سلاسيل	Salāsīl ("pegs")
Wedge	بلعه	Bil'ah
Share	سكه	Sukkah ("furrow" or "track")
Body	طاسه	Ṭāseh ("plate")
Wings	جناح	Jināḥ ("wing")
Tongue	لسان	Lisān ("tongue")
Yoke	نير	Nīr
Yoke struts	سلاسيل النير	Salāsīl el-Nīr ("yoke pegs")
Yoke center peg	عين السكه	'Aīn es-Sukkah ("eye of the ard")
Collar	حويّه	Ḥuwīyah

sole, and is held in place by a metal strap riveted to the bottom of the share.

The movable tongue is similarly held in place by a metal strap riveted to the top of the share, and may be lengthened or shortened as deemed necessary. It is always adjusted, however, to operate at a much shorter length (e.g., c. 10 cm) than that observed for the set tongues of northern shares. In the example depicted in Fig. 5, the share rests on the sole at an angle of approximately 35° to the line of the composite beam, and operates at an approximate angle of 23° to the soil surface (although this may be adjusted as needed by shifting to alternate notches on the front end of the beam, or by manipulation of the handle).

Comparisons and Analysis

Several structural variations have been noted between the traditional ards of northern and southern Jordan, as summarized in Table 4. Similar variations were previously noted by Dalman (1932: 64-89), who suggested that regional environmental factors may have played a causative role. Unfortunately, this observation was limited to an apparent correlation between available raw materials (i.e., greater stands of wood in mountainous Palestine, Lebanon and Jordan) which seemingly accounted for regional variations in whether ards were constructed of single (large) as opposed to multiple (small) sections (Dalman 1932: 83). While agreeing that regional environmental factors do underlie observed variations between northern and southern ards in Jordan, we suggest that the relationship is far more complex than he suggested.

Initially, the structural strength of the northern ard relative to that of the south is particularly striking. The combination of sole and stilt as a single element, coupled with a heavy dog-leg shaped mortised brace between stilt and beam, provides an exceptionally strong frame. By comparison, the

Table 4: Comparison of major northern and southern ard components.

Component	Description	Construction: Petra Šach's Type V	Construction: El-Mazar Šach's Type III
Beam (body)	links ard head to draught power	sole passes through arched base of beam, with composite beam	sole/stilt passes through arched base of beam, with composite beam
Stilt	directs ploughing action from handle	small straight limb attached to end of sole	adzed continuation of sole
Handle	controls ploughing action to stilt	small forking branch off top of stilt	separate shaped and mortised piece
Sole	holds the share	elongated to pass through beam and hold stilt	continues into adzed stilt
Reinforcing brace	strut fixing and strengthening sole and beam angle	small downward-curved strut held by metal bands on both ends	substantial dog-leg strut mortised at both ends and reinforced with a metal band or heavy wire
Share	breaks the soil	broad flat triangular plate with flat wings reinforced with riveted strips along its edges. and a separate adjustable tongue. Attached to sole by riveted strap on share bottom	narrow convex triangular plate with angled wings and welded/forged elongated tongue. Attached to sole through socket formed by curvature of share and held by a welded/forged strap
Set share angles	Share to line of composite beam	35°	40°
	Share to soil surface (angle of penetration)	c. 23°	c. 23°

southern ard, with its composite sole with small limb stilt braced by an almost ephemeral strut, represents a relatively weaker implement of tillage. Similarly, the northern share, with its single piece construction and convex form represents a comparatively stronger and sharper working element than the southern share, with its composite construction and broad flat surface (attributes which reduce the durability of the share).

These distinctive attributes would seemingly reflect a need for greater strength and less resistance in northern tillage relative to that of southern regions. It is therefore suggested that these differences reflect readily observable basic variations between the comparatively dense, compact and stoney clay soils of northern Jordan and the loose, friable and relatively stone free sandy soils of the south. It is extremely doubtful whether the structurally weaker southern ard with its broad flat share, the latter referred to as "duck's feet" by northern locals, could long withstand the stresses attending tillage in the north. Conversely, the more heavily constructed northern ard would be both cumbersome and less efficient than its lighter and broad-shared counterpart if employed in the south.

It is suggested that several of the other observed differences attending northern and southern tillage relate to similar (and interrelated) environmental differences between these regions. Hence, it is reasonable that ards (excluding the yoke) in the north would be constructed exclusively from the readily obtainable and durable oak, while southern ards would additionally employ both willow and juniper given the appropriateness and presence of these alternative wood sources. That these alternative woods are light, durable and occur naturally in suitable shapes for ard parts provide additional causative reasons for their use in the south.

The same may be said for the animals traditionally employed for traction in these regions. Environmental conditions in the south are not generally conducive to cattle due to limitations of water resources and pasturage, nor are the stoney, wooded and clay-soiled mountains of northern Jordan generally favorable for camel husbandry (Russell 1986: 57-60). Variations in the heights of alternative traction animals may in turn underlie such differences as the angles at which shares are attached relative to the line of the beam. Hence, while shares appear to operate at similar angles of soil penetration, greater share to beam attachment angles are required for taller animals (i.e., horses, camels and cattle) than for donkeys.

Variations in Preferred Animal Traction

During fieldwork, various preferences were expressed concerning the relative desirability of different draught animals. For example, in northern Jordan, single animals (either a horse, mule or a donkey) are normally used for ploughing between trees and summer crops. In dual traction for arable crops, a pair of donkeys, two oxen or two cows are employed. In the past, a pair of oxen was specifically referred to as a *faddān* (فدان), although today it is often used as a general term to describe all dual animal traction. Like the origin of the English acre as a unit of areal measure, a *faddān* was also equivalent to the area of land which could be tilled in a working day (see Bergheim 1894: 192; Cuinet 1896: 373), and seemingly varied from region to region. The word *faddān* was also formerly used to denote a share in village lands on plains areas of former Greater Syria (Latron 1936: 14-18; Firestone 1981: 816).

The general preference for oxen in dual animal traction was often expressed in the north by stating that "they produce more even and regular furrows." Even so, donkeys currently are employed more frequently than oxen or cows. A similar preference for oxen over donkeys in tillage was occa-

Table 5: Normal draught and work potential of various animals.

ANIMAL	Average Weight (kg)	Approximate Draught (kg)	Average Speed of Work (km/hr)	Horsepower Developed	Daily Work (hrs)
Light horse	400-700	60-80	3.6	1.00	8+
Ox	500-900	60-80	2.2-3.1	0.75	6-8
Buffalo	400-900	50-80	2.9-3.2	0.75	---
Cow	400-600	50-60	2.5	0.45	2-3
Mule	350-500	50-60	3.2-3.6	0.70	8+
Donkey	200-300	30-40	2.5	0.35	---

adapted from Hopfen (1969:10-11, Table 2), after Russell (1988a:120, Table 24)

sionally expressed in southern Jordan, although, as noted above, donkeys are the more commonly used animals due to environmental constraints. Horses seem rarely (if ever) used in southern Jordan. While the mechanics of draught may vary between specific animals (e.g., oxen and cows do not require the use of a collar with the yoke), and while the relative costs of animals may explain the more frequent use of one over another (e.g., horses are generally more expensive to acquire and maintain than oxen, cows or donkeys), it would seem that stated preferences also reflect more significant functional variations in actual draught capabilities.

Initially, several factors may be expected to affect the efficiency of all forms of ancient and modern animal traction tillage (Russell 1988a: 120). For example, the heaviness of various soils, the depth of tillage, and the size of the implement employed may all be expected to affect the draught required for tillage. Once the required draught is achieved, however, the speed at which tillage proceeds would be primarily determined by the working pace of the animal or animals employed. Unless extra animals were available, the amount of land which could be tilled in a day would depend upon the number of hours for which an animal could be worked in draught. Table 5 summarizes the normal draught and work potential of animals commonly used in various locations worldwide. When employed in teams, total draught capacity would increase, although the average speed of work would not. Further, the use of teams with a cumulative draught greater than that required for tillage would diminish the energy expended by each animal, thereby increasing the length of time during which they could be worked.

In light of these data, it is not surprising that a general preference for oxen over donkeys is often expressed, since the cumulative draught of a pair of oxen would amount to approximately 120-160 kg with 1.5 horsepower, while a pair of donkeys would only generate approximately 60-80 kg draught with 0.7 horsepower. While these variations would be less critical given the loose, friable sandy soils of southern Jordan, they would be significant within the heavy clay soils of northern Jordan. Yet such variations in draught and horsepower capabilities under specific soil conditions do not explain why a general preference for oxen over horses should also exist.

It seems probable that the more steady and easily controlled pace of oxen relative to horses results in greater consistency of tillage, a significant factor in regulating the distribution of a crop. Regular furrows allow for consistent light and nutrient distribution within a crop, while also facilitating

Table 6: Reported tillage efficiencies and draughts of symmetrical ards.

LOCATION	DRAUGHT	HRS/UNIT AREA	HRS/DU	SOURCE
Palestine	2 oxen	10/3-3.75 du	2.7-3.3	Mishna Ohalot 17A
Palestine	2 oxen	10/1-4 du	2.5-10	Avitsur 1965:iv
Palestine	2 oxen	10/2.5-3 du	3.3-4.0	"
Yemen	1 donkey	0.5/100 m^2	5.0	Varisco 1982:167
Iran	2 oxen	10/3,700 m^2	2.7	Alberts 1963:350

after Russell (1988a:123, Table 27)

weeding and harvesting activities. Related to this may be a frequently stated preference for animal traction tillage over tractor ploughing, since the latter generally results in uneven tillage. As with the stated preference of oxen over donkeys while donkeys are more frequently used, the economics of tractor tillage in terms of greater speed and lower costs per unit of land apparently override such sentiments.

Variations in Tillage Efficiency

Actual variations in the efficiency of animal traction tillage observed in southern Jordan are comparable to similar data from other sources (Table 6). It was commonly stated that individuals could till three dunums (a dunum = 1,000 m^2) of land in a working day of 8-10 hours with a team of donkeys. This would be equivalent to 2.7 to 3.3 hours per dunum. For comparison, it was also stated that an individual could till 3.5-4 dunums per working day with a single camel, equivalent to 2-3 hours per dunum.

In northern Jordan, variations in tillage efficiency have been noted between areas with open plains and the western hill country. On the plains around Irbid, it was stated that a team of oxen could till between 3-4 dunums in a working day, equivalent to 2.0 to 4.4 hours per dunum, assuming an 8-10 hour day. A single horse was reported to be able to till between 4-5 dunums per day, and a team of donkeys between 2-3 dunums per day. This is equivalent to 1.6-2.5 hours per dunum for a horse, and 2.7-5 hours per dunum for a team of donkeys, again assuming an 8-10 hour day.

By contrast, in the hill country around el-Mazar, it was commonly stated that individuals could till 1.5 dunums of land with a team of oxen in a current working day (approximately 7 am to 1 pm). This would be equivalent to 4 hours per dunum. This figure falls within the lower range of previously recorded tillage efficiencies, and is suspected to primarily reflect the effects on tillage efficiency of dealing with the heavier clay and stone filled soils of the mountainous zone. It also seems probable that the comparatively more narrow share required in the denser soils of northern Jordan results in the need for a greater number of furrows to be tilled per unit of land. Variability in the actual size of a traditional *faddān*, relating to the unit of land ploughed by a team of oxen in one day, would presumably reflect this same principle, with a smaller *faddān* expected in the north than in the south.

In the northern plains, a large part of the agricultural year was traditionally consumed in tillage. As a result, extra labor was frequently required. For example, east of Irbid in the village of Saum, men were traditionally employed full time for tillage labor in return for a share of the crop, food and lodging. These individuals were known as *Ḥarrāthīn* (حـــراثين) and were formerly widely employed across the whole of northern Jordan.

Conclusions

It has been suggested in this article that variations between the predominant ard forms of northern and southern Jordan may be understood largely in reference to regional differences in environmental conditions. Draught animal tillage is achieved in both regions through broadly similar implements and actions, but varies in specific detail according to local conditions. Variations in the draught animals used in tillage and their associated relative efficiencies appear to be influenced by regional ecology, even though stated cultural preferences often remain common. In such cases, the material correlates of these differences would not reflect either cultural or ethnic diversity, but rather spatial variations in a broadly common cultural tradition as a result of regional environmental constraints. Although the traditional subsistence activities of northern Jordan were predominantly agricultural, while those of southern Jordan were predominantly pastoral, and although distinct ard forms are observed in both areas, these are not necessarily covariant attributes. Ard forms, therefore, vary primarily according to environmental constraints but can also reflect differing cultural considerations. Additionally, other factors, such as field size and the crop under cultivation, appear to affect ard forms as well as the choice of draught animals.

The dramatic cultural changes sweeping Jordan as a developing country are rapidly altering traditional subsistence activities. Household and community self-sufficiency has virtually disappeared in the past thirty years, for ever altering patterns of subsistence behavior relevant to a better understanding and interpretation of the archaeological record. The present article represents a first step towards documenting the traditional subsistence activities of Jordan and their material and environmental correlates before the ability to do so is lost for ever.

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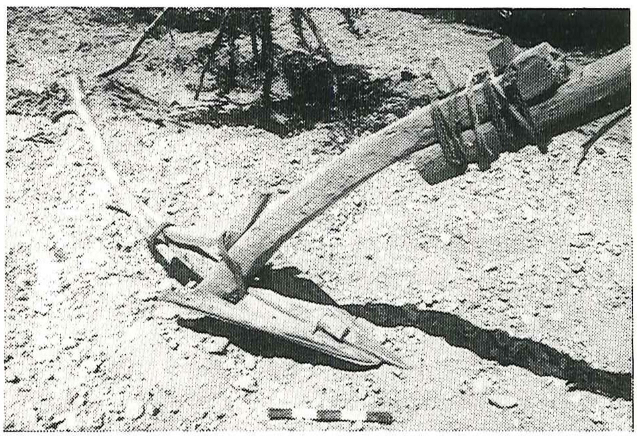
1. Ard manufacturer at work in house courtyard in el-Mazar.

2. Detail view of the main body of an ard (*maḥrāth* محراث, or *'Ūd ḥarrāth* عود حراث) for single horse traction from el-Mazar.



3. Detail view of the main body of an ard (*sukkah* سكه) for two donkey traction from Petra.