

The Introduction of Domestic Camels to the Southern Levant: Evidence from the Aravah Valley

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It was recently suggested that the introduction of the camel to the southern Levant occurred in the early Iron Age (late 2nd–early 1st millennia BCE). Our study of faunal remains from Iron Age sites at Timna, together with previous studies of Late Bronze and Iron Age sites at Timna and Wadi Faynan, enable us to pinpoint this event more precisely. The new evidence indicates that the first significant appearance of camels in the Aravah Valley was not earlier than the last third of the 10th century BCE. This date accords with data from the Negev and the settled lands further to the north when the low chronology is applied to the early Iron IIA.

KEYWORDS Aravah Valley, Timna, Domestic camels, Copper production, Iron Age, Arabian trade

The introduction of the dromedary camel (*Camelus dromedarius*) as a pack animal to the southern Levant signifies a crucial juncture in the history of the region; it substantially facilitated trade across the vast deserts of Arabia, promoting both economic and social change (e.g., Köhler 1984; Borowski 1998: 112–116; Jasmin 2005). This, together with the depiction of camels in the Patriarchal narrative, has generated extensive discussion regarding the date of the earliest domestic camel in the southern Levant (and beyond) (e.g., Albright 1949: 207; Epstein 1971: 558–584; Bulliet 1975; Zarins 1989; Köhler-Rollefson 1993; Uerpmann and Uerpmann 2002; Jasmin 2005; 2006; Heide 2010; Rosen and Saidel 2010; Grigson 2012). Most scholars today agree that the dromedary was exploited as a pack animal sometime in the early Iron Age (not before the 12th century BCE) (Uerpmann and Uerpmann 2002; Horwitz and Rosen 2005; Heide 2010). A recent study of Timna Site 30, coupled with a new set of radiocarbon dates, supports this broad conclusion (Ben-Yosef

et al. 2012; Grigson 2012).¹ However, observations thus far have not allowed for a dating resolution more precise than century level at best.

In this paper we further constrain the exact timing of this event based on new data from the well-researched copper production and trade centres of the Aravah Valley. Situated between the deserts of Arabia and the settled land of the Mediterranean region, and requiring transportation of large quantities of copper, these sites constitute an excellent proxy for timing the introduction of domestic camels as pack animals to the entire southern Levant.

Identifying domestic camels

The dating of camel exploitation as a pack animal is commonly based on zooarchaeological studies as well as artistic depictions and textual evidence. In artistic depictions camel riders appeared during the 8th century BCE (Epstein 1971: 566; Heide 2010: 341) or the late 10th–9th centuries at the earliest (the Tell Halaf [Guzana] relief, Pritchard 1969a: Fig. 188), and in textual evidence as early as the 9th century BCE (Shalmaneser III's Kurkh Stela relating King Gindibu of Arabia sending 1000 camelry to the Battle of Qarqar, Pritchard 1969b: 279). The identification and dating of earlier camel figurines and drawings is debatable (Epstein 1971: 559–561; Heide 2010: 340–342), and at most represent the acquaintance of ancient people with wild camels. Thus, it cannot be concluded, based on early artefacts and drawings, that camels were exploited as pack animals prior to the Iron Age.²

This observation is supported by zooarchaeological studies, in which the identification of the camel's status (domestic or wild) is based on the animal's relative frequency (e.g., Horwitz and Rosen 2005) and diachronic size changes (e.g., Uerpmann and Uerpmann 2002; von den Driesch and Obermaier 2007). Identifying the means of its exploitation (hunting, milking or riding/loading) is based on mortality profiles, sexing of the herd (e.g., Wapnish 1984; Horwitz and Rosen 2005) and bone lesions (Grigson 2012). Based on the above criteria, previous studies have shown that the domestic dromedary probably appeared in southeast Arabia sometime in the first third of the 1st millennium BCE, and earlier camel remains from Arabia are all identified as wild (Uerpmann and Uerpmann 2002; von den Driesch and Obermaier 2007; Heide 2010). In the southern Levant, the earliest evidence of domestic camels was considered to be from Timna Site 30 (Grigson 2012), now dated to an early phase in the Iron Age (11th–9th centuries BCE, and see suggestion for more precise dating of these camel bones below).

¹ Contrary to previous, incorrect dating of Site 30 that gave rise to the notion that domestic camels were introduced to the region as early as the 13th century BCE (Late Bronze Age); see discussion in Grigson 2012.

² This includes a depiction of a camel (unridden) on a 'Midianite' sherd (Qurayya Painted Ware) from Qurayya in northwestern Arabia (Ingraham *et al.* 1981: Pl.79, No.14); however, not only this might represent a wild camel—it is now suggested that the use of this pottery type continued into the 9th century BCE (see discussion in Smith and Levy in press).

The driving factor for camel domestication is speculated to be either its milk (e.g., Bulliet 1975; Zarins 1989) or its advantages as a pack animal (Clutton-Brock 1987; Uerpmann and Uerpmann 2002). However, studies of mortality profiles and bone lesions have demonstrated that the earliest documented domestic camels (to date) were exploited as pack animals (Uerpmann and Uerpmann 2002; Grigson 2012); other considerations also render early phase of exploitation exclusively for milk rather unlikely (Uerpmann and Uerpmann 2002: 250).

New evidence from the Aravah Valley

Recent research at the copper production sites of the Aravah Valley (e.g., Ben-Yosef 2010; Levy *et al.* in press a) has yielded a substantial amount of radiocarbon dates for stratified contexts of the Late Bronze and Iron Ages (Levy *et al.* 2008; Ben-Yosef *et al.* 2010; Ben-Yosef *et al.* 2012). This enables high resolution studies of the chronological background of the faunal remains, while using absolute dates rather than the relative and debated terminology of culture-ceramic periods for the Iron Age southern Levant (e.g., Levy and Higham 2005). The dates from these sites show that copper production in the Aravah Valley started as early as the late 14th–13th centuries BCE and ceased towards the end of the 9th century BCE (e.g., Ben-Yosef *et al.* 2010), covering the period in which domestic camels were introduced to the region. Hence, diachronic comparisons of faunal assemblages (on inter- and intra-site levels) from these sites are a key for precise timing of this event. Moreover, since all of these sites were of the same nature, concerned with copper smelting and transportation, appearance of camel remains in the stratigraphic sequence would most probably reflect its introduction as a pack animal rather than a change in subsistence patterns (i.e., introduction of camel into the diet of the metalworkers).

Examination of our recent faunal studies from Timna (Sites 30 and 34, Sapir-Hen and Ben-Yosef forthcoming), together with previous studies from Timna and Faynan (Table 1) (Lernau 1988; Grigson 2012; Muniz and Levy in press; Bar-Oz and Erickson-Gini unpublished), reveals a distinct pattern: camel bones in substantial quantities appear only in contexts dated to the last third of the 10th and the 9th centuries BCE. This is most evident in the extensive smelting site of Khirbet en-Nahas (KEN) in the Wadi Faynan area, Jordan, which represents continuous production from the 13th to the late 9th centuries BCE. Camel bones were found almost exclusively in Strata II–III that are dated to the late 10th–9th centuries BCE (Layers M1, S1, S2 and A2, Muniz and Levy in press; A. Muniz, personal communication 2013;³ for stratigraphy and radiocarbon dating see Levy *et al.* 2008; Levy *et al.* in press b: Table 2.1). They demonstrate a sudden appearance of camels at the site, following a major change in the organization of production in the entire region (below). So far, the only other camel bones from the early phases of the Iron Age Aravah Valley were recorded at the only site in Timna that also has an occupation phase of the late 10th–9th centuries BCE—Site 30 (Table 1, Grigson

³ A single bone fragment was found in an 11th century BCE context (Layer M4, Stratum VI), and none were reported from the extensively excavated early mid-10th century BCE (Strata V–IV, Table 1, A. Muniz, personal communication 2013).

2012, including osteological indications of exploitation for transport). Although the site represents continuous smelting from as early as the late 12th century BCE (Ben-Yosef *et al.* 2012) and despite the fact that Grigson (2012) assigns the bones to the earlier layers, we argue that the original stratigraphy reported by Rothenberg (1980) is confused, and that the bones all originate from the last occupation phase at the site, namely from the late 10th–9th centuries BCE (Layer I). The complicated nature of archaeological accumulation at smelting camps renders lateral stratigraphic correlations extremely difficult (Rothenberg 1980: 189–192), and independent, absolute dating is needed for each excavated area in order to establish accurate chronologies. Our investigation of the faunal assemblage from the 2009 excavations at Site 30 (Sapir-Hen and Ben-Yosef forthcoming) which are fixed in absolute chronology based on radiocarbon dating (Ben-Yosef *et al.* 2012), shows no camel in the earlier phases. Moreover, the direct radiocarbon measurement of camel bone published recently by Grigson (2012: 84) also suggests a late date (OxA-2165: 2650±90 BP, 969–600 BCE [1σ], calibrated using OxCal 4.2, Ramsey 1995).

This observation is supported by the absence of camels from earlier sites in Timna (Table 1), including the Late Bronze Age Egyptian Temple (Site 200, Lerna 1988), the Late Bronze smelting camp of Site 2 (Bar-Oz and Erickson-Gini unpublished; the one camel bone reported by Hakker-Orion [1984] could not be assigned to a specific period) and the newly excavated Site 34. The latter was investigated with emphasis on the zooarchaeological aspect (Sapir-Hen and Ben-Yosef forthcoming), and new radiocarbon dates demonstrate that it was abandoned towards the end of the 10th century BCE (Ben-Yosef forthcoming).

The synchronic appearance of camels at Faynan and Timna in the last third of the 10th century BCE coincides with a major change in the organization of production in the Arava Valley, including the abandonment of most smelting sites, centralization of labour and a significant improvement in smelting technologies (Ben-Yosef 2010). The improvement in means of transportation should now be considered as another factor in this substantial transformation of the industry, which is attributed to the campaign of Pharaoh Shoshenq I to the region (or/and its repercussions) (Levy *et al.* 2008; Ben-Yosef *et al.* 2010; Levy *et al.* 2012).

Camel remains from other sites in the southern Levant

Previous studies also support an Iron II date for the introduction of domestic camels to the southern Levant. While Neolithic to Iron Age I camel remains have been reported from several sites (reviewed in Horwitz and Rosen 2005; Grigson 2012), the assemblages are meagre (and in several cases their dating is questionable), and most probably represent wild camels (*ibid.*).⁴

⁴ Tell Jemmeh (Wapnish 1984) is often cited as evidence for the presence of domestic camel in this region in the Late Bronze Age. However, the site was never fully published and the context of camel bones is insecure, described as “unlikely [to] pre-date 1100 BC” (*ibid.*: 171). Furthermore, the domestic status of the camels is based on the assessment of the entire camel assemblage at the site, treating Iron Age to Hellenistic remains as one population.

The compilation of Horwitz and Rosen (2005: Table 2) shows that camel remains become common only in contexts from the Iron II (Horwitz and Rosen 2005: 126).⁵

TABLE 1
Camel remains from Late Bronze and Iron Age sites in
the Aravah Valley

Site	Context	Camel	Period [†]	Reference
Site 200	Cultic Site	-	Late Bronze	Lernau 1988
Site 2 (2005)	Copper smelting	-	Late Bronze	Bar-Oz and Erickson-Gini unpublished
Site 2 (1964)	Copper smelting	*	Unclear context and dating	Rothenberg 1972: 105; Hakker-Orion 1984
KEN (Stratum VI)	Copper smelting	*	Late 12th–11th, one bone	Muniz and Levy in press/pers. comm.
Site 34	Copper smelting	-	11th–mid-10th	Sapir-Hen and Ben-Yosef forthcoming
Site 30 (2009)	Copper smelting	-	11th–mid-10th	Sapir-Hen and Ben-Yosef forthcoming
KEN (Strata V-IV)	Copper smelting	-	10th	Muniz and Levy in press/pers. comm.
Site 30 (1974, 1976)	Copper smelting	+	Late 10th–9th (see text)	Grigson 2012
KEN (Strata III-II)	Copper smelting	+	Late 10th–9th	Muniz and Levy in press/pers. comm.

[†] Abundance of radiocarbon dates from the Aravah copper smelting sites enable us to provide absolute dates for contexts with camel remains, refraining from relative terminology. The radiocarbon boundary between contexts of “mid-10th century BCE” and “late-10th century BCE” in the table (the latter represents the first appearance of camels in the Aravah) occurred in the beginning of the last third of this century; for precise dates and statistics, see references.

* Unclear context/one fragment.

When focusing on the Negev sites (Table 2), this pattern becomes clearer: Camels are absent from Iron I contexts at Beer-sheba (Strata IX–VIII, Hellwing 1984) and Tell Masos (Stratum III, Tchernov and Drori 1983), which are located directly on the principal trade route from the Aravah Valley to the Mediterranean coast. Camels first appear in the Negev during the Iron II, and there is a gradual increase in their exploitation. They become common in the early Iron Age IIA “Negev Fortresses” (Cohen and Cohen-Amin 2004; for the ceramic phase see Herzog and Singer-Avitz 2004: 225–226) that were recently connected with the copper production industry of the Aravah (Martin *et al.* 2013; Martin and Finkelstein 2013). In the Iron IIB camels appear in almost all of the studied contexts (except the cultic site of Qitmit, Table 2).

⁵ These include the camel remains from Izbet Sartah (Hellwing and Adjeman 1986) that are now dated to the early Iron IIA (Finkelstein and Piasezky 2006: 55).

TABLE 2
Camel remains from Iron Age sites in the Negev

Site	Context	Camel	Period	Reference
Tel Masos III	Town	-	Early/middle Iron I	Tchernov and Drori 1993
Beer-sheba IX, VIII	Settlement	-	Late Iron I	Hellwing 1984
Tel Masos II, I	Town	-	Early Iron IIA	Tchernov and Drori 1993
Beer-sheba VII	Settlement	-	Early Iron IIA	Hellwing 1984
Horvat Rahba	“Fort”	+	Early Iron IIA	Hakker-Orion 2004
Horvat Masora	“Fort”	-	Early Iron IIA	Hakker-Orion 2004
Horvat Ramat Boker	“Fort”	+	Early Iron IIA	Hakker-Orion 2004
Har Raviv	“Fort”	-	Early Iron IIA	Hakker-Orion 2004
Beerotaim	“Fort”	-	Early Iron IIA	Hakker-Orion 2004
Ramat Matred	“Fort”	-	Early Iron IIA	Hakker-Orion 2004
Beer Hafir	“Fort”	+	Early Iron IIA	Hakker-Orion 2004
Metsudat Laʿana	“Fort”	-	Early Iron IIA	Hakker-Orion 2004
Metsudat Har Saad	“Fort”	+	Early Iron IIA	Hakker-Orion 2004
Metsudat Nahal Yeter	“Fort”	-	Early Iron IIA	Hakker-Orion 2004
Metsudat Nahal Sirpad	“Fort”	-	Early Iron IIA	Hakker-Orion 2004
Metsudat ʿEin Kadis	“Fort”	+	Early Iron IIA	Hakker-Orion 2004
Kadesh Barneʿa (Strata 4-1)	Settlement/ “Fort”	+	Iron IIA-C	Hakker-Orion 2004
Beer-sheba VI	Settlement	-	Late Iron IIA	Hellwing 1984
Beer-sheba II	Town	+	Iron IIB	Sasson 2004
ʿAroer III	Town	+	Iron IIB	Motro 2011
Tel ʿIra	Town	+	9th-8th centuries	Horwitz 1999
ʿAroer IIb	Town	+	Iron IIC	Motro 2011
Tawilan	Town	+	Late Iron II	Köhler-Rollefson 1995
Qitmit	Cultic site	-	Iron IIC	Horwitz and Raphael 1995

Conclusions: The introduction of domestic camels to the southern Levant

Current data from copper smelting sites of the Aravah Valley enable us to pinpoint the introduction of domestic camels to the southern Levant more precisely based on stratigraphic contexts associated with an extensive suite of radiocarbon dates. The data indicate that this event occurred not earlier than the last third of the 10th century BCE and most probably during this time. The coincidence of this event with a major reorganization of the copper industry of the region—attributed to the results of the campaign of Pharaoh Shoshenq I—raises the possibility that the two were connected, and that camels were introduced as part of the efforts to improve efficiency by facilitating trade.

The observations from the Aravah Valley are in accordance with reports from the Negev and the settled land, which demonstrate high frequency of camel remains only from the Iron IIA onward. Moreover, as camels at Negev sites appear in association with the ceramic phase of the *early* Iron IIA (Herzog and Singer-Avitz 2004), the evidence from the Aravah supports low chronology dates for this period (Finkelstein 1996; Finkelstein and Piasezky 2010) (for the debate see Levy and Higham 2005).

In addition to new insights regarding animal economy during the early phases of the Iron Age, our results have direct implications on dating the beginning of the Arabian trade and the many related economic and social phenomena (e.g., Groom 1981; Finkelstein 1988; Artzy 1994; Singer-Avitz 1999; Jasmin 2005; 2006; Rosen and Saidel 2010). As most probably significant trade between southern Arabia and the Levant was not feasible before the use of camels as pack animals (see, e.g., Jasmin 2006), it could not have commenced before the last third of the 10th century BCE.

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