**Supplementary Information**

**Supplement A**

Here are some details on sources of obsidian artefacts from Wadi Rabah sites in Israel: Twelve obsidian artefacts found at Wadi Rabah layers of the site of Ein Zippori originated in the central Anatolian source area of Göllü Dağ, and 32 originated at Eastern Anatolian sources (15 from Bingöl A, and 17 from Bingöl B) (Schechter et al. 2016). At the site of Nahal Zehora II (strata I-II) one obsidian item originated at a central Anatolian source, located on the eastern flank of the Göllü Dağ volcano. Four others were shown to have originated from Eastern Anatolia, one from the vicinity of Bingöl and three others from this area or from the easternmost Nemrut Dağ. The origin of two others could not be determined (Delerue et al. 2012). At Hagoshrim Wadi Rabah layer IV out of the 28 items analysed the majority of the obsidian items originated from Eastern Anatolian sources (seven items from the ’Bingöl A/Nemrut Dağ’ type; six from the ‘Bingöl B’ type; four from ‘Sarikamiş’ and three from ‘Meydan Dağ’), while only 18 per cent (5 out of 28) originated in central Anatolia (‘Göllü Dağ East’) (Delerue 2007, Schechter et al. 2013). The analysis indicates that certainly during the later parts of the PN period the Obsidian sources for Hagoshrim IV are mainly in eastern Anatolia although Schechter et al. (2013) note that based on visual type characterization (geochemical analyses being expensive and time consuming) (e.g. see Healey 2001; Carter 2006; Kayacan and Ozbaşaran 2007) it is possible that a larger quantity of the obsidian from Hagoshrim originated from Central Anatolian sources. Hopefully, in the future, further analyzes of the obsidian thought to be Central Anatolian in origin will shed light on their actual origin and clarify the picture at Hagoshrim IV. At Ein el Jarba 22 items originated from Bingöl B, 12 items (25 per cent) from the ’Bingöl A/Nemrut Dağ’ type, and one from Gürgürbaba Tepe (in total 36 or 75 per cent from Eastern Anatolian sources). Eight items originated in Göllü Dağ, and Nenezi Dağ in Central Anatolia. One of the Ein el-Jarba artifacts was made of obsidian from Pasinler-Eksisu (also in Eastern Antolia) and one from Syunik–Satanakar in the Caucuses (but geographically close to the Eastern Anatolian sources. A source for two further pieces was unidentified however Carter et al. (2020) propose that they originate in Eastern Anatolia as well. Thus, as per the summary table below, approximately 75% of all sourced obsidian originates in Eastern Anatolian sources.



**Supplement B**

The use of the seals and sealings is not entirely clear, however, Carter (2010) analysing 44 Halaf stamp-seals and 4 seal impressions from Domuztepe in South Eastern Turkey noted that the seals were used over long periods of time, curated and recycled. Other evidence such as rounded corners, string wear in the suspension loops, worn seal faces and redrilling when the suspension loop broke indicate that they were probably worn on the neck or the wrist. Carter (2010) goes on to propose that the similarity of the seal shapes (square, circle, rectangle, triangle, lozenge) with those of the clay tokens, which were used (in her view) to represent counted units, might suggest that the late Halaf geometric seals had a comparable mnemonic function related to reckoning. Carter (2010) suggests that the sealing institution or person wore a set of seals of different shapes and sizes, which used singly or in combination, carried additional information about quantity or commodity and that the sealings (such as those from Arpachiyah) represent the remnants of a “complex system of accountability and/or exchange in which multiple parties or commodities were involved” (Carter 2010:165). This position is not accepted by all researchers, Duistermaat (2012) for example argues[[1]](#endnote-1) that seals and sealings during the Halafian period were not purely for administrative functions but had other, non-administrative functions as well and that the primary function of some seals might have been decorative, amuletic, ritualistic or magical. Likewise, Denham (2018) proposes that the stamp seals had two uses, identifying people as group members to other people or themselves and as amulets and talisman.

**Supplement C**

When testing this model on the archaeological data available to him at the time, Renfrew (1975:46) distinguished between a “supply zone” radius of 200 or 300 km and a contact zone. The supply zone was that closest to the obsidian sources and within the supply zone, the proportion of obsidian in the total chipped stone industry fell only gradually to a figure above 80 per cent. Renfrew interpreted this as meaning that within this zone, communities were directly supplied from the obsidian sources. Outside of the supply zone Renfrew identified a large contact zone, where the proportion of obsidian fell off rapidly to around 0.1 per cent at a radius of 600 km.

**Supplement D**

The flaws in Renfrew’s "down the line" model (based on Ortega et al. 2014):

(a). Higher quantities of obsidian than predicted by the down-the-line model, have been observed at a number of PPNB sites such as Tell ‘Arqa (Thalmann 2006) in Northern Lebanon, or Nahal Lavan 109 in the Negev in southern Israel (Burian and Friedman 1988). This is, of course, also the case at Hagoshrim IV of the PN Wadi Rabah culture with conspicuously high quantities of obsidian.

(b). Renfrew assumed only terrestrial transport of obsidian, excluding transportation by sea or through rivers. However, maritime transport was used during the earliest stages of the Neolithic, as the presence of obsidian from Anatolian sources in Cyprus demonstrates (Vigne et al. 2019).

(c). In structuring his model, Renfrew assumed that population density was homogeneous.

(d). Finally, Renfrew’s model assumed that all villages were prepared to exchange.

Ortega et al. (2014) further shows that following the "down the line" model, only an unreasonably low consumption/exchange ratio (10 per cent consumption and 90 per cent exchange) would have allowed obsidian to arrive to the southern Levant in the quantities observed in the archaeological record (representing around 0.5 per cent obsidian in the lithic assemblages).

**Supplement E**

Possibly due to its relatedness with anthropology, the focus in archaeology when considering exchange systems is predominantly on “non-Western, preindustrial, nonmonetized, translocal exchange systems” (Appadurai 1986:18). For example Ibáñez et al. (2016) support the existence of distant exchange links, which are at the base of their proposed complex network model with ethnographic examples such as the Irian Jaya of New Guinea, the Tlingit from the North-West coast of North America, Australian aborigines, and the Kalahari !Kung.

Likewise, Appaduri (1986) in her book “The Social Life of Things” brings examples such as Raffia cloth by the Kuba people in the Democratic Republic of Congo, wampum among the Iroquois Indians of the eastern United States, shell money among the Yurok of Northwestern California and the shell currency of Rossell Island.

It must be recognised, however, that, while exceptions exist (such as the kula ring system of the Western Pacific (Weiner 1992; and see Appaduri (1986)), much of the anthropological work carried out to date on such exchange systems has been on communities belonging to specific cultural groups with limited geographic reach. These communities may provide some insight into possible exchange networks amongst the Wadi Rabah settlement system of the southern Levant, however, as shown above the amount of obsidian found in stratum IV of Hagoshrim does not fit Renfrew’s "down the line" model nor the more complex network model proposed by Ibáñez (Ibáñez et al. 2014) and Ortega (Ortega et al. 2014, 2016).

**Supplement F**

Obsidian mirrors were probably produced by specialist craftsmen and are exceedingly rare in the obsidian assemblage. The largest number of mirrors were found at Çatalhöyük, some from burial contexts, (Connolly 1999, Vedder 2005). Additional mirrors are still being unearthed, during the 2012 excavations at Çatalhöyük an additional two obsidian mirrors were discovered associated with Neolithic burials F.3630 and F.3684 from the North Area (Carter 2012) while during the 2017 excavations an additional obsidian mirror was found in burial fill 30039 of building B.131 (Doyle 2017).

Other than these, obsidian mirrors have also been found at Güvercinkayası (Balci and Altinbilek Algul 2019), Domuztepe (Healey and Campbell 2014), Sırçalıtepe (Balci et al. 2021) and a few other sites.

The only obsidian mirror found to date outside of Anatolia is the one from Kabri in northern coastal Israel. Based on similarities between the handles, it is closest in form to the mirrors from Halafian Dumuztepe and from Güvercinkayası (7200 – 6750 Cal B.P.) which are equivalent in time to the Wadi Rabah culture in the southern Levant. Mirror making is quite a unique (and rare) trajectory of production in obsidian and may possibly be viewed as a prestige good.

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1. Considering the sealing practices at Tell Sabi Abyad where 300 clay sealings were found in level 6 houses dating to the very early Halafian (7950 Cal. BP) (see further Duistermaat, 1996; Duistermaat and Schneider 1998) [↑](#endnote-ref-1)