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# The Uruk expansion as dynamic process: A reconstruction of Middle to Late Uruk exchange patterns from bulk stable isotope analyses of bitumen artifacts

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## ABSTRACT

This research examines broad regional patterns of inter-regional trade for the world's first colonial trading system, the economic expansion of southern Mesopotamia into southwest Iran and southeast Anatolia. Stable carbon and deuterium isotope analyses of bitumen artifacts from several Uruk enclaves and colonies show diachronic changes in trade routes as well as changes in the nature of the Uruk expansion from the Middle to Late Uruk periods. Hacinebi Tepe, a Chalcolithic Anatolian site located on the upper Euphrates River had material primarily from northern Mesopotamia in the period before the Uruk expansion. These findings highlight the importance of sites such as Tell Brak and Hamoukar which reached a high level of complexity in the early fourth millennium BC and influenced societies prior to trade with southern Mesopotamia. In the late Middle Uruk Period, during the Uruk expansion, bitumen found in trade colonies in the northern Euphrates regions derived mainly from central and southern Mesopotamia and an unidentified source area, while later colonies from the Late Uruk period acquired most of their material from the northern Mesopotamian sources. The significantly large quantity of bitumen from the sources near Hit and Khuzistan at the site of Hacinebi during Uruk contact suggests a high volume of trade in this area. The changes over the course of the Uruk expansion demonstrate shifting emphases in the upper Euphrates from riverine trade routes oriented north–south back to overland trade routes running east–west. These changes are consistent with the idea that Late Uruk colonies were focused on settlement and colonization rather than exchange. The preliminary results of these analyses demonstrate the utility of bulk isotopic analyses as a first step in the identification of broad regional patterns, which then can be bolstered with detailed isotopic and molecular work on asphaltene extractions of bitumen (Connan and Nishiaki, 2003).

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## 1. Introduction

This collaborative project focuses on scientific analyses of bitumen (natural petroleum) artifacts from southeast Anatolia, northern Syria, and Mesopotamia to reconstruct the exchange patterns of the Uruk expansion, the world's first colonial trading system. During the Uruk period (3600–3100 BC), the world's first states and urban centers appeared in the southern alluvium of Iraq and southwestern Iran, (Nissen, 1988; Pollock, 1992) and saw appearance of early administrative/writing systems, social stratification, kingship, warfare, and other key elements of early states (Algaze, 2001; Nissen, 1988; Pollock, 1992; Stein, 1999). While arable land, livestock and bitumen were plentiful, vital resources such as metals, stone, and timber were scarce (Algaze, 1989, 2008), necessitating intensive trade with neighboring regions (Algaze, 1989, 2005, 2008). The presence of Uruk style artifacts and architecture in distant areas of southeast Turkey, Syria and Iran

during the late Middle and Late Uruk Periods, has been interpreted to be evidence of trading colonies (Algaze, 1989, 2005, 2008). Spanning an area of approximately 5500 km<sup>2</sup>, this trading system, known as the Uruk expansion is regarded by many as the world's first colonial trading network (Algaze, 1989, 2008; Stein, 1999). Based on the ecology of the southern alluvium, many have hypothesized that Mesopotamian exports were grain, textiles and even bitumen (Algaze, 1989, 2008; Stein, 1999).

The evidence for Mesopotamian trading colonies in the areas of Anatolia, Syria and Iran usually include architectural remains, Uruk ceramics, iconography and administrative artifacts of southern origin (Algaze, 2001:38). Some sites contain what appear to be Mesopotamian enclaves or residential quarters established inside a local Late Chalcolithic settlement (Weiss and Young, 1975; Young, 1986; Algaze, 1989; Stein, 1999, 2002). Indigenous settlements in Anatolia and northern Mesopotamia (Algaze, 1986; Algaze et al., 1990; Palmieri and Frangipane, 1986; Gibson and Maktash, 2000), show varying degrees of contact with Mesopotamia (Stein, 1999, 2012).

Many colonies, except for Godin Tepe in the highlands of Iran, and Tell Brak and Nineveh in northern Mesopotamia, were located on the Upper Euphrates River clustered in north Syria and southeast Turkey (Algaze, 1986, 1989, 2005, 2008). The first group was located at a

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bend in the Euphrates River in the Tabqa Dam salvage area and includes Habuba Kabira South/Tell Qannas, Tell el-Hajj, Jebel Aruda, and Hadidi on the west bank, and Mureybit, Sheikh Hassan and Tannira on the east bank (Schwartz, 2001; Boese, 1995:171). The second cluster lies to the north in the Tishrin region with the site of Carchemish as the center, in addition to Jerablus Tahtani (Peltenburg et al., 1995, 1996, 1997) and Tell 'Abr (Hammade et al., 2006).

Algaze believes that the strong competition between polities in Mesopotamia led to individual Uruk city-states founding their own specific enclaves or outposts to command the critical lines of communication (Algaze, 1989, 2008). These colonies were uniformly positioned in a dendritic spatial pattern to effectively control exchange routes but were not designed to control large territories or exploit local agricultural resources. These Mesopotamian colonists and traders naturally gravitated towards preexisting local sites because they were already important indigenous regional centers (Algaze, 1989, 2008; Pollock, 1992).

The apparent lack of trade goods in archeological contexts is seen to be problematic (Pollock, 1992, 1994), suggesting that Mesopotamian style artifacts in Anatolia, Syria and highland Iran could have been local imitations and not the result of trade (Kohl, 1989; Wattenmaker, 1990). Others have seen the presence of Mesopotamian material culture in Anatolia not as evidence for trading colonies, but of displaced people from the southern centers in the Late Uruk Period (Johnson, 1988–89) establishing large agricultural and pastoral settlements (Schwartz, 2001). Originally, it was believed that the Uruk expansion was a product of the Late Uruk Period and a “rapid and short-term phenomenon” (Rothman, 2001: 5); a view that has changed when archeological evidence was amassed to the contrary. Revised radiocarbon dates show that the Uruk phenomenon lasted longer than previously thought (Wright and Rupley, 2001). The School of American Research Advanced Seminar Series successfully integrated this information into the chronology of sites of the fourth millennium and created a new chronology of 5 periods of the Late Chalcolithic (Rothman, 2001: 5–9), which this research will refer to. Through examination of bitumen artifacts from Uruk colonies and enclaves from the Middle Uruk Period/LC4 (Sheikh Hassan and Hacinebi) and the Late Uruk Period/LC5 (Jerablus-Tahtani, Habuba Kabira, and Tell Brak), this research can determine how the nature of the Uruk expansion changed over time.

Many of the trade goods that were hypothesized to have been so important in this trading network—textiles from southern Mesopotamia and copper, stone, and timber from Anatolia—are rare in archeological deposits. Studies of bitumen, a naturally occurring petroleum tar, have great utility because this natural petroleum tar was abundant in the ancient Near East, was used for a wide range of purposes, was traded between different cultural groups, was present in large quantities at many archeological sites, and is chemically sourceable using molecular and isotopic analyses.

## 2. Bitumen as a marker for ancient exchange patterns

Scientific analyses have made progress in the investigation of trade patterns of utilitarian and prestige goods in the Uruk expansion (Badler et al., 1996; Blackman, 1984). Analyses of local Uruk period exchange patterns in southeast Turkey using Neutron Activation Analysis (INAA) of pottery and clay administrative sealings proved successful in documenting Anatolian trade with Mesopotamia (Blackman, 1999; Evins, 1998), but sealings are not typically found in large quantities in archeological sites.

Bitumen, a term used by archeologists for the natural petroleum tar available from a variety of seepages in the Near East (Fig. 1), was utilized primarily for its waterproofing and adhesive properties. There is widespread evidence of bitumen's use as mortar in the construction of important buildings throughout the southern alluvium whose effectiveness is evident from ancient walls in Iraq that remain iron hard even today (Forbes, 1936). This substance was collected at ground seepages, in lakes, or from rock outcrops. Bitumen source areas are ubiquitous in Mesopotamia proper and the region of Hit, Ramadi and Abu Jir in central Mesopotamia is believed to have been one of the main sources of

bitumen for Uruk city-states (Forbes, 1964). Other significant sources exist in the Deh Luran and Susiana Plains of southwest Iran at the juncture of the Zagros Mountains and the Tigris–Euphrates alluvium. There were also major seepages near Kirkuk and Mosul, in northern Mesopotamia (Marschner et al., 1978; Connan and Van de Velde, 2010), a source on the Mediterranean coast of Syria near the modern city of Latakia, significant seepages in the area of the Dead Sea and sources in the very southern part of Mesopotamia used by the people of Ur (Connan et al., 1999). The presence of material from Bichri in northwest Syria has been documented with molecular analyses for a number of nearby archeological sites (Hauck et al., 2013; Boëda et al., 2008). In addition, the Burgan source in Kuwait was identified among Ubaid period artifacts at the nearby site of H3/as-Sabiyah (Connan et al., 2005; Connan and Carter, 2007). The primary sources for the Near East (Fig. 2) in general however, were the seepages in central Mesopotamia (Hit), northern Mesopotamia (Magda) and southwestern Iran (Khuzistan) (Van de Velde, 2015). There are some indications that bitumen from Hit was purer and of higher quality than the bitumen from northern Mesopotamia (Connan and Van de Velde, 2010).

The existence of different bitumen sources and seepages is known through textual records, archeological evidence, and modern geologic survey. Ancient texts often mention a bitumen source that has not been identified by modern survey and occasionally geologic surveys identify seepages that do not seem to have been used in antiquity. A bitumen well between Kufa and Basra (Forbes, 1936) and a pool of bitumen near Samarra (Peters, 1897) have yet to be discovered. The abundance of bitumen at Ur would seem to suggest that there was a nearby source and a Sumerian scribe from the Ur III period mentions a source at the nearby site of Eridu (Ferrara, 1973).

Archeological evidence for bitumen processing in Near Eastern sites includes pottery with bitumen dribbles on the inside and/or the outside, and pieces that appear to have been the result of cooled, solidified spills (Fig. 3). Ethnographic research provides a wealth of data on bitumen processing and demonstrates that, besides using containers to heat bitumen, people in southern Iraq would also use a trough dug into the mud at the side of a canal. Igniting a fire in a hole beneath the trough would supply the necessary heat to liquify the bitumen (Ochsenschlager, 1992). Written evidence from the Ur III period reveals that the price of mastic (processed bitumen mixed with mineral and organic inclusions) was considerably higher than raw bitumen because of the fuel consumed in the production process. Rock asphalt from outcrops has a much higher melting temperature than liquid bitumen from seepages, which may have been another reason why the people of southern Mesopotamia mainly used the latter kind for their projects (Forbes, 1936).

Bitumen artifacts are numerous at many southern Mesopotamian sites in addition to Uruk colonies and enclaves. During the Uruk period bitumen was used primarily in Mesopotamia as: (1) a waterproofing material for pottery, reed matting, baskets and boats (Gregg et al., 2007; Carter, 2002); (2) a mastic used in the production of art objects; (3) a mortar for bricks; (4) a pigment for colored wall cones in public buildings; (5) and a hafting for flint blades onto sickle handles (Forbes, 1964: 56–109; Harper et al., 1992; Ochsenschlager, 1992). In addition, it may have been an exchange item itself (Algaze, 2008) as well as packaging material for other commodities (Figs. 3 and 4). It is hypothesized that Mesopotamians used bitumen on jars, pots, baskets and reed mats to help transport other items (Stein et al., 1996). Furthermore, because different bitumen seepages and deposits have different geologic histories, one can estimate the possible source of individual bitumen artifacts using advanced geochemical techniques (Connan et al., 1999, Connan and Deschesne, 1995, 1996, 1998). In this respect, bitumen waterproofing can serve as a proxy for archeologically absent exchange items in sites associated with the Uruk expansion. However caution and a suitably large data set must be employed due to several examples of bitumen samples at archeological sites not deriving from the closest source but rather from sources further away (Gregg et al., 2007; Van de Velde et al., 2015).

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