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ARCHAEOLOGY AND POLITICS IN THE AGE OF DAMS: A SURVEY OF EVIDENCE FROM IRAQ

St John SIMPSON*

Resume

Since the 1950s large-scale dam projects have been carried out across the world. The archaeological component has varied greatly, even within some countries. In almost all cases the inauguration of these expensive infrastructure works has been celebrated nationally through media and visually on currency and postage stamps. The history of dams and archaeology is a rich but sometimes contentious mix of politics and opportunity. Ottoman authorities brought British engineers from India to advise on hydraulic measures in Egypt and it was at Aswan that the first rescue archaeology took place at the beginning of the twentieth century. The same engineers recommended other measures in Mesopotamia but, although the first steps were taken in Iraq then and under the British Mandate, it was only after nationalisation of the oil industry that they began to be seriously implemented. Egypt, Syria and Iraq looked to the Soviet Union and its leading dam design company, Institute Hydroproject. Turkey turned instead to European companies whereas Iran at first relied on America although both countries now use their own expertise. Despite the Cold War politics, international teams collaborated on the Nile, Euphrates and Tigris, and the results transformed understanding of Nubia, the neolithic and many other key periods, as well as the interconnection zones between regions previously regarded as heartlands of civilisation. After a brief review of the history of dam archaeology in the Middle East, this paper looks at the development of some of these projects in Iraq.

Introduction

Water is a scant resource. Although it covers two-thirds of the surface of the earth, only 3% is fresh and much is unequally distributed: control and competition over water has been a preoccupation of man for millennia and the world's oldest recorded dispute over water dates as early as 2400 BC and recorded on a stone border post from southern Iraq [Finkel, Rey and Schulz-Dornburg 2018]. More than 40,000 large dams now regulate many of the world's rivers, supplying hydropower and water for irrigation and drinking. They are expensive and increasingly controversial yet Iraq was one of the first countries to insist upon archaeological investigations being conducted prior to the impounding of the dams. The results have shed completely new light on parts of the country where the patterns of human settlement were previously poorly known.

The climate of much of the Middle East is characterised by hot arid summers and limited precipitation concentrated between September and April. Consequently, river flows vary greatly and, with the exception of the Nile which is fed by summer rains of the East African Plateau, the period of high water is in late winter or spring depending on the amount of catchment where snow melt is a major contributor to run-off. The extent of perennially irrigated lands has therefore been governed by the low-water flow of rivers: diminished flow during dry years can lead to crop failure and famine whereas flooding is a hazard during wet years. During the early 1950s advances in engineering finally offered a solution as the construction of large dams offered the potential to control rivers by stopping flooding, storing water for year-round use and generating hydro-electric power for growing populations and modern industries. The costs of construction are great but within countries these are considered offset by long-term economic advantages and the national prestige of

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such monumental infrastructure projects. Large dams are invariably constructed in areas which have had human activity for long periods of time. Their construction impacts not only on archaeology but also traditional lifestyles and living cultural resources as indigenous peoples are often displaced and the long-term effects on the local geology and hydrology not always fully understood. The tension between preservation of the past and the needs of modern society was recognised by Gamal Abdel-Nasser, then President of Egypt:

> "The preservation of the legacy of mankind is no less important than the construction of dams, the erection of factories and the [economic] greater prosperity of peoples" [quoted by Brandt and Hassan eds. 2000, 12].

Rescue archaeology in advance of flooding by dam reservoirs began in Egypt and was driven by successive constructions on the Nile at the First Cataract near Aswan. The first barrage or Low Aswan Dam was completed in 1902. It followed recommendations by British engineers brought from India and tasked with introducing ways of conserving flood waters in order that double cropping could be introduced to boost cotton production at a time when cotton supplies to the cloth mills in Lancashire were adversely affected by the American Civil War. Concern was soon raised that the temples of Hathor at Philae would be flooded, prompting engineer Sir William Willcocks to remark that the cost of the dam could be met by simply selling the Philae temples to an American buyer and rebuilding it in New York [Sandes 1937, 382]. In response to the outcry the temples were excavated so that their foundations could be strengthened and the level of the dam capped so that only the lower portion of the temples were partially flooded. However, economic needs prevailed and the barrage raised in 1907–1910 to allow the reservoir level to rise by 7 m. Knowing the sensitivities, the First Archaeological Survey of Nubia was initiated and the results proved fundamentally important for the study of the Middle Nile. A third heightening of the dam between 1929 and 1934 led to the reservoir level rising by another 7.4 m., triggering the Second Archaeological Survey of Nubia (the Philae temples were only rescued as part of the High Aswan Dam project in 1970).

Dam-building in the Middle East stopped during the Second World War but resumed in the early 1950s when there was bitter political and economic rivalry during the Cold War. Egypt, Syria and Iraq turned to the Soviet Union, Turkey drew on European financial aid and expertise and the Shah's Iran relied on America: all except Iran sought an archaeological response, the results were highly collaborative and revolutionised our appreciation of ancient settlement along the middle Nile [Säve-Söderberg 1987; Hassan 2007; Welsby 2008], middle Euphrates and southeast Turkey [Bahnassi *et al*. 1974; Margueron 1977; Whallon 1979; Lupton 1996; Tuna and Öztürk eds. 1999; Olmo Lete and Montero Fenollós eds. 1999]. Since then, dam building has increased in Turkey and Iran as both countries have developed their own expertise but sadly with little archaeology now being conducted [Őzdoğan 2000; Ghasemi 2014; Marchetti *et al*. 2019]. This paper now looks at the evidence from Iraq where consistently high attention has been paid to this aspect but which is still relatively little-known beyond a small number of Mesopotamian specialists[1].

1) This paper is part of a larger piece of research forthcoming in a monograph on results of archaeological excavations in the Eski Mosul dam of northern Iraq. The subject of this paper was delivered at a conference devoted to the memory of the leading St Petersburg archaeologist, A.D. Grach, and mainly on the subject of rescue archaeology within dams, organised by the Russian Academy of Sciences and held at the Institute for the History of Material Culture, St Petersburg. It was promptly accepted for publication, translated and published in Russian [Simpson 2020]. At the suggestion of my Russian colleagues, I have decided to re-publish this paper in English in order to reach a different audience.

Water management and rescue projects in Iraq

Control of its rivers has been a dominant factor in the life of Iraq since prehistory. Water management schemes date as early as the sixth millennium BC, and these developed in complexity over time. Disputes over water allocation and access have been an underlying source of tension throughout Mesopotamian history, and collective memory of the risk of flooding – both by rivers and rises in the level of the Persian Gulf – contributed to the flood story in the Sumerian Creation Epic and thence into the Old Testament.

At different periods, authorities strove to mitigate the risk of flooding and improve irrigation by maintaining canals, building regulators and barrages, and coping with salinity. During the Sasanian period water engineering reached a new height with the integration of the Euphrates, Tigris and many of the Tigris tributaries into a single carefully controlled system which ultimately connected the Kirkuk plains with the head of the Persian Gulf. The scale of this imperial scheme allowed water to be transported over longer distances, reduced the risk of flooding or local shortages and enabled perennial irrigation with the cultivation of water-hungry summer crops such as cotton as well as cereals. It also allowed new lands to be opened up for agriculture and archaeological surveys attest the level of rural and urban development across the Mesopotamian alluvium. In subsequent centuries, the pattern of agriculture reverted to a less ambitious scale and wetlands expanded in the southern delta.

During the late nineteenth century, the Ottoman authorities in Baghdad recognised the need for a new water management system. They began recording precipitation and brought in Willcocks to draw up plans based on his experience from India and Egypt [Willcocks 1911]. The First and Second World Wars interrupted the implementation of his recommendations but the first two barrages were built at Hindiyah and Kut. Other Mandate-period irrigation projects included the Abu Ghraib Canal and the Hawija Project, and in 1938 a detailed assessment of the Tigris-Euphrates hydrology was published drawing attention to ancient canals in the Kirkuk plain and inspiring engineers to consider reviving their use to increase water supply in the Diyala region. This was the beginning of archaeological rescue projects in Iraq: the construction of the Hawija, Musaiyib and Diyala irrigation schemes led to rescue excavations at Tell Mahuz, investigation of a fifth millennium BC site at Ras al-Amiya, and the first survey of the Diyala.

However, Baghdad continued to be struck by severe flooding and the newly established Development Board of Iraq soon declared plans for eight large water storage projects, with four already underway and the remainder scheduled for completion within the decade. The reason behind this timing was the huge increase in its budget following the nationalisation of the oil industry in 1951 and the Board's retention of 70% of oil revenues.

In 1948 and 1951 two barrages were built on the Euphrates at Ramadi. Solecki [1953, 104] observed that "we have every reason to believe that this [Habbaniyah] basin was used by the ancient Babylonians for flood relief and water storage" although it is not clear if any survey took place. As part of engineering works on the Tigris, the Tharthar Flood Escape included a dike designed to divert floodwater into the Tharthar saline depression south of Hatra and following the line of a Sasanian linear barrier known as el-Mutabbaq. Although Ottoman sources indicate this depression to have been an important resource for Bedouin pastoralists, a detailed archaeological survey was not conducted and the area suggested to be devoid of archaeological sites.

The remaining projects were dams intended to reduce flooding, provide irrigation water, diversify sources of energy and generate electricity through hydro-electric power. Since then, requirements for power across Iraq have increased massively and there has been a heavy reduction in water supply along the Tigris and Euphrates as a result of upstream dam construction, as well as reduced precipitation following global climate change: the role of these dams and the management of water resources have become even more critical and sensitive.

The Dokan Dam

This was situated on the Lesser Zab and flooded an area of between 230 and 270 sq. km. One of its functions was to facilitate water for rice flooding, but acute need for peak-load capacity saw the addition of a power station designed and built by Soviet and Yugoslav engineers. In 1955 an Iraqi team mapped some 40 mounds in the valley dating from the sixth millennium BC onwards, excavations following for four years at five of the larger sites (Qarashina, Tell Basmosian, Tell Shemshara, Kamarian, Tell ed-Deim), with soundings at several others [al-Soof 1970]. In 1957 a Danish team worked at Shemshara but the overthrow of the Hashemite monarchy during the 14 July Revolution in 1958 prevented them from returning. Archaeologists have recently returned to this area, resumed excavations at Shemshara [Eidem 2015], discovered a worn rock relief at the northern end and a previously unexplored late Assyrian fortress and early Parthian city located just above the floodzone commanding the same pass [MacGinnis *et al.* 2020].

The Bekhme Dam

This was situated on the upper Great Zab and its tributary Rowanduz river. This was intended as a two-stage project, initially with a 515 m. high flood pool, to be raised to 550 m. at a later stage. Several caves with early occupation were found here, of which the most famous is Shanidar [Solecki 1972]. The dam remains at the first stage of construction and the justification and cost of the project questioned if dams were to be built at Eski Mosul and Fatha, but it was recognised that the project was warranted if power needs were to increase, large reservoirs planned upstream in Turkey would impact on the effectiveness of the Eski Mosul dam, and if irrigation yields were to be increased.

The Hamrin Dam salvage project

The Hamrin basin lies in east central Iraq just above where the Diyala river breaks through mountains separating the uplands from the plains to the south. This is a border landscape and controls routes connecting the Kirkuk region of northern Iraq via the upper Diyala, the Kermanshah region of western Iran via Jalula, and central Iraq via the lower Diyala. The Hamrin basin therefore was susceptible to a range of external political and cultural influences and it is unsurprising to find a greater presence of northern Mesopotamian and western Iranian material culture than further south.

As early as 1923 construction of a dam was proposed at the point where the Diyala enters the Jabal Hamrin but it was not until 1980 that this was constructed. The salvage project was carried out between 1977 and 1984: expeditions from as many as 14 countries excavated 75 of the recorded 86 sites spanning the aceramic period onwards [Various 1981*a*; Gibson ed. 1981, 11–27]. These were situated along the Diyala and Narin rivers and varied considerably in size: despite the fact that the basin lies outside the zone of maximum alluviation, all of the early sites were found heavily blanketed with sediment. Some of the most significant results date from the fifth millennium BC: a complete village was excavated at Tell Abada, a burnt building at Tell Madhhur was preserved with the room contents *in situ* and several other settlements also excavated extensively. The fourth millennium was represented only by three sites but it was the following Early Dynastic I period which proved to be one of the most important: all settlements of this period were fortified and appear to have been part of a chain of complexes spreading northwards and connected by a common assemblage of “Scarlet Ware” pottery and distinctive burial customs. This period was followed by one of prosperity with a relatively large number of agricultural villages for much of the late third to late second millennia: substantial Isin-Larsa administrative buildings were excavated at Tell Suleimeh, Tell Yelkhi, Tell Khallaweh and as-Sib, a large residential quarter exposed at

Khallaweh and important Kassite remains explored at Yelkhi. In contrast, occupation in the Ur III, Old Babylonian, late Assyrian and Achaemenid/Seleucid periods was minimal. 19 sites produced Sasanian remains, mainly in the north-east and south-east portions of the basin and close to routes leading to the Iranian plateau or down to the Diyala; several were fortified and one may have been a local administrative centre as it contained over 800 sealed clay bullae in a burnt archive room, the largest such archaeological discovery from Iraq.

The Haditha (Qadisiyyah) Dam salvage project

The Euphrates upstream of Hit is hemmed by low limestone escarpments. There is a natural boundary almost exactly corresponding with the present Syrian/Iraqi frontier where the valley is completely desolate, but further downstream it widens slightly and is characterised by a series of mid-stream islands and a very narrow strip of fertile land on either bank which extends for almost 200 km. Owing to these physical constraints, historical settlement has generally been confined to the islands, burials situated on the barren ground above the flood-plain, either beneath tumuli, in rock-cut cists, or in rock-cut chambers, and the same position favoured by Assyrian and Roman military planners anxious to command and control the routes along the valley as well as access to and from the steppe beyond. It is important to always remember that rivers are boundaries but their valleys are corridors.

Following earlier recommendations, the Iraqi government decided to construct a dam upstream of Haditha. This was designed by the Soviet Ministry of Energy and constructed by Yugoslav engineers between 1977 and 1987. It was designed to generate hydro-electric power and provide water for irrigation but electricity generation has fallen considerably following the impoundment of the upstream dams in Syria and Turkey. A preliminary Iraqi survey was made and foreign archaeological teams then working in the Hamrin basin were invited to switch to this new project. A total of 36 sites covering the Old Babylonian to Ottoman periods were excavated between 1978 and 1984 by teams from eight countries [Various 1981*b*; Kepinski, Lecomte and Tenuk eds. 2006]. Among the results were the discovery of a series of Late Assyrian and late Roman forts, showing how in both periods this sector was carefully monitored, in the first case looking south at the Arabs and in the second looking east at Parthia.

The Eski Mosul Dam salvage project

The Eski Mosul Dam is a multi-purpose dam initially called the Suhlij, Eski Mosul or Saddam Dam, and now known as the Mosul Dam. The choice of its location and height followed different geological surveys and recommendations, many sharing concerns about the weak geology and favouring a rockfill dam with a compressed clay core. The dam was completed in 1986 and is a 113 m. high earthfill dam with a clay core and a blanket-grouted cement curtain around the foundations. At full capacity the reservoir extends over an area of 371 sq. km., of which 8.16 km^3 are used to generate power whereas the remainder is dead storage intended for irrigation projects in the North Jazira. This reservoir is known today as Lake Dohuk and is the largest in Iraq. Prior to construction, the authorities conducted an archaeological survey, issued a map marking 149 sites and a salvage project launched in 1981 (Fig. 1). Like the previous two dam projects, this project was carried out during a difficult period as Iraq was then engaged in a protracted war with Iran (Figs. 2–4). Some 15 organisations from 10 countries participated and as many as 209 sites were finally recorded (excluding Palaeolithic and later lithic sites), 66 of which were excavated, although only some are published in detail [Demirji 1987; Simpson 2007].

At the northern end of the basin, the valley is constricted as the Tigris cuts its way through low foothills and sites here were few. Further south, the flood plain opened into a wider valley overlooked by a high bluff at the northern end which also controlled access from the valley to the

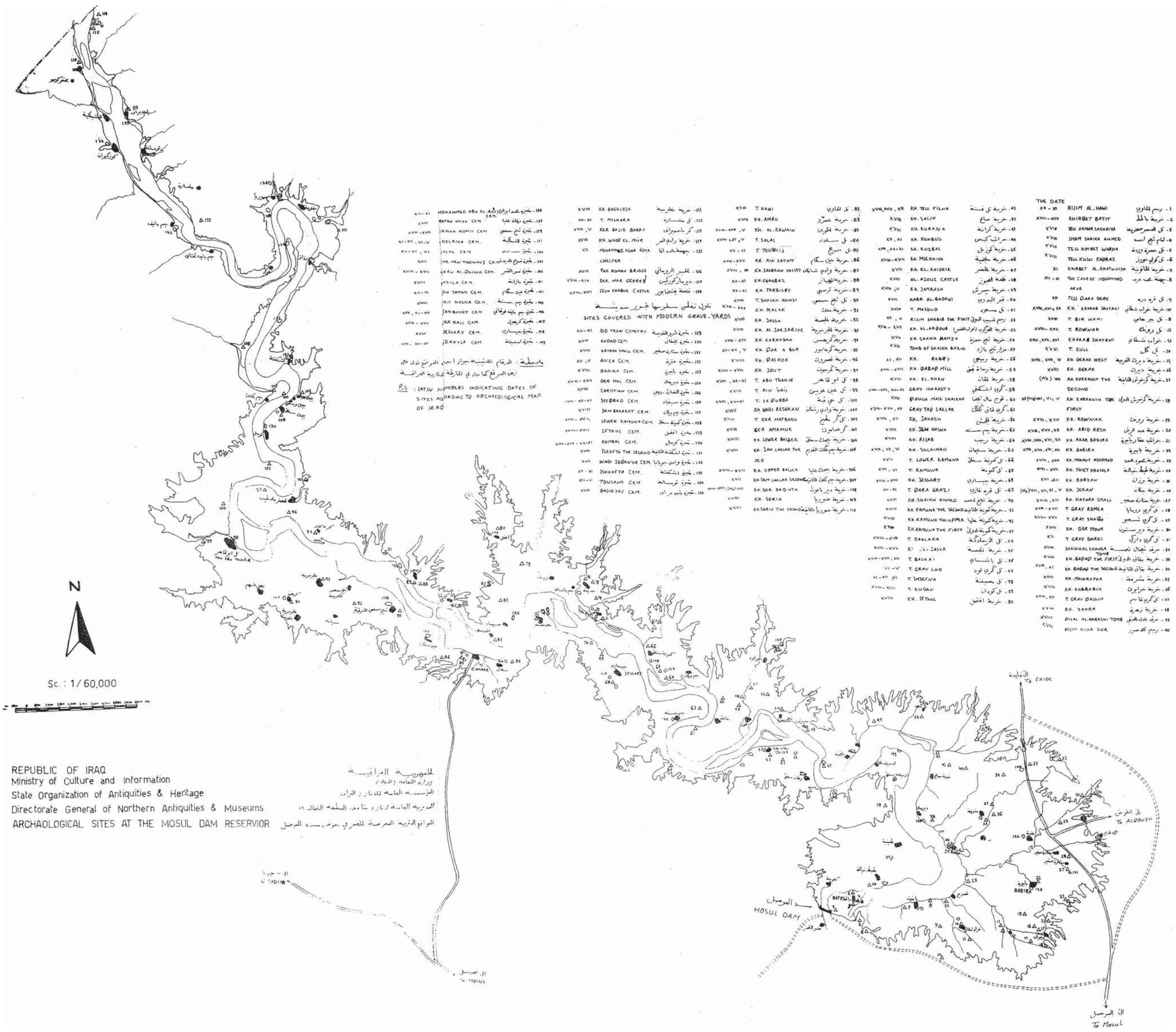

Fig. 1 Map of sites in the Mosul Dam prepared at the beginning of the salvage project.

Fig. 2 Excavations during the rainy season (photograph: author).

Fig. 3 One of the trenches excavated by the author at the multi-period site of Tell Abu Dhahir (photograph: author).

west and south, along the Wadi Suwaidiya and Wadi Bardiya respectively, and it was here that the Romans and then Sasanians maintained a fortress at Seh Qubba. At this point the valley was over five km. across and extended some 50 km. to the south-east before bending south-west and continuing through a more constricted course as it cut through more foothills at a spot known as the Butmah Anticline, the position of the modern dam (Fig. 5). Further south the valley opens out and allows much easier communication with the plains east and west, and this is the point where the medieval city of Eski Mosul was founded.

Fig. 4 Tell Abu Dhahir begins to be submerged in 1986 (photograph: author).

Fig. 5 Aerial view of the Mosul Dam in 2014 (Ali Haidar Khan/Wikimedia Commons).

The flood plain was fertile but mainly used for grazing because of the unreliability of the river. The rolling terrain above the lowest terrace was also good agricultural land. The valley was cultivated for cereals and vegetables and small orchards planted near some villages. Animal husbandry was widely practised, particularly on the adjacent terraces which consisted of a series of low rolling hills with denuded soil cover and gypsum or limestone emerging in many places, and the same area was seasonally occupied by pastoralists. Although passable on foot and offering good grazing, these hills provide a barrier to normal communication as there were relatively few natural passes onto the surrounding plains. The exceptions to this were along the Wadi Suwaidiya, Wadi Bardiya and near Tell Raffan and these were marked by sites of all periods.

Since the eighth millennium BC, this section of the valley has attracted settlement but, as in the Hamrin basin, densities fluctuated at different periods. Very few sites show occupation for more than a few hundred years before abandonment and occasional re-occupation at a much later date: periodic discontinuities were the normal pattern of settlement rather than the continuous occupation sequences promoted in the archaeological literature. There is evidence for violent destructions of many during what appears to be a single phase in the mid/late third millennium BC, but this was exceptional and most settlements appear to have been abandoned and left to collapse rather than being violently destroyed. Understanding the reasons for these now requires fresh examination.

Sites which were not re-occupied were usually heavily eroded and the present topography highly misleading in terms of assessing depth of archaeological deposit: preliminary assessment of Tell Deir Situn suggested a multi-period site with up to 3 m. of deposit but excavations proved it to consist of a single-period second century BC building with only a few courses of the stone footings surviving. The effect was even more marked at single-period sites of earlier periods: what appeared to be a 6 m. high multi-period mound at Bardiya 8 proved on excavation to be a single-phase Late Uruk occupation with only half a metre of deposit. Inspection of sections along the Wadi Suwaidiya showed relatively high densities of potsherds which might reflect evidence for manuring but equally could have derived from erosion of sites, and pottery and crude stone tools were found up to a depth of 7 m. in the Wadi Anzeh. Single-period mudbrick villages abandoned between 1971 and 1974 left no remains apart from a series of stone wall-footings and scatter of artifacts, or a few traces of wall lines, virtually no mounding and a thin sherd scatter; even small mounded sites could disappear, as was noted in 1987 when a single rise and fall of the dam reservoir obliterated the 3.2 m. high site of Siyana Ulya.

These factors have important implications for appreciating prehistoric site patterns, particularly where those settlements did not use mudbrick: an early sixth millennium occupation at Tell Abu Dhahir relied on wood and wattle and daub whereas relatively thin clay walls were typical of the later Ubaid architecture at the same site. The use of either of these building traditions, let alone perishable superstructures, would explain the absence of any recognisable architectural remains – other than a few stone footings – at other sites. Many, if not most, seasonal or short-lived settlements therefore were probably not detected during this project and this is another case of absence of evidence, rather than evidence for absence.

Immediately prior to the construction of the dam, villages were either situated in the flood plain, along the edge of the lowest (fourth) terrace or sheltered along the banks of tributaries. Although originally probably perennial, these were now mostly dry but narrow and deeply incised. The villages were generally spaced at intervals of up to 3 km. and there was considerable variation in their size, layout, architecture and ethnic composition. The villages in the flood plain itself were recent and constructed of mudbrick: they were vulnerable to flooding but were situated on the most fertile land, and the same must have existed in antiquity. A few other villages along the fourth terrace were less than two generations old but were already abandoned and ruined by the time of the rescue project. These included one said to have been founded in 1945 but already abandoned by 1982. This spot was also known as Kharab Shattani and other informants stated that it was the forerunner of the nearby village of Kharabeh which is why some of the surrounding fields were still tended by villagers from the latter village. However, other settlements were at least twice that old and employed greater use of stone in the construction. In the northern section of the river valley there was further evidence for villages having been transformed or abandoned completely in the recent past, and sometimes these left few remains: a few traces of wall lines, virtually no mounding and a thin sherd scatter was all that remained of a village at Gir Matbakh which had been deserted as late as 1974. These show how short-lived occupation from more ancient periods could leave few recognisable traces.

The Eski Mosul dam was a multi-purpose dam intended to reduce flooding, provide hydroelectric power for Mosul and offer water for a large-scale irrigation project planned for the North Jazira. The latter and Tigris valley downstream became the focus of three further rescue projects. The first was on the North Jazira itself where a landscape survey was carried out [Wilkinson and Tucker 1995]. A small number of sites were excavated but the project was curtailed in the political aftermath of the Iraqi invasion of Kuwait. The Iraqis planned three further dams, one on the lower Adheim and two more on the Tigris. The first of these was about 150 km. north of Baghdad, and again followed the 1950s recommendations by the Development Board of Iraq described above. Rescue excavations were carried out between 1989 and 1993 [Sulaiman 2011]. The dam itself was completed in 1999 but is a comparatively modest construction and has a gross storage capacity of 1.5 billion cu. m. The second project was along the Tigris valley upstream of Ashur and threatened to flood the first Assyrian capital at Ashur, leading to extensive but somewhat futile discussions over whether an expensive coffer dam could be built around the site or if the level of the reservoir dropped sufficiently. Dr Muayyad Damerji, then head of the State Board of Antiquities and Heritage in Iraq, summed up the dilemma quite simply: “we need water and we need Ashur”. This stretch of valley was surveyed as early as 1987 and several sites excavated but the proposed Makhul dam was not constructed [Mühl and Sulaiman 2011]. The third project was on the Tigris just below

Eski Mosul: originally called Badush and now known as Sennacherib, it was designed to be a flow control measure in case of catastrophic failure of the Eski Mosul dam immediately upstream although its storage capacity of 0.5 billion cu. m. is a fraction of the dam upstream. The Iraqis carried out extensive excavations of the medieval city of Balad but the dam is unfinished.

The Eski Mosul dam is the fourth largest dam in the Middle East and is unofficially reckoned to be "the most dangerous dam in the world" because of concerns that its foundations will break without constant maintenance and grouting of the foundations as the impounding of the dam led to huge pressure on the underlying geology and seepage through constantly dissolving rock below the reservoir. The Iraqi Ministry of Water commissioned a report which concluded that in case of a catastrophic breach the initial wave would measure 54 m. high and reach Baghdad in 48 hours, causing an estimated 500,000 deaths (later raised to 1,500,000 by the US Embassy) with massive loss of property and infrastructure, followed by unprecedented dislocation of population, disease and disorder. This information became public knowledge after 2003 and was widely publicised when Daesh briefly captured the dam complex on 7 August 2014: retaking the dam ten days later was the first objective of the Iraqi government counter-offensive. Grouting of the foundations has resumed and between 2008 and 2015 had already consumed over 95,657 tons of different mixtures of cement, bentonite and sand. Similar treatment has been carried out at other dams where similar problems have been identified but the risk is considered to be particularly high in this case. The only good news is that the siltation rate has slowed down, probably as a result of the impoundment of new dams upstream within Turkey, and on that basis the lifespan of the dam has been raised to 169 years.

Conclusions

The story of dams and rescue archaeology in Iraq is still at a relatively early stage. The results and impact of the first archaeological projects were limited by the resources available whereas later projects were organised on the understanding that previous foreign archaeological projects would be suspended for the duration and thus allow the maximum amount of resource to be allocated to areas hitherto unknown archaeologically. Iraq has one of the most successful track records in managing complex high-level projects and involving international responses to the threats and opportunities created in exploring previously little-known sections of river valley. In each case, a preliminary archaeological survey was carried out by Iraqi archaeologists and the final map published and circulated to interested parties. These were then granted concessions covering one or more sites within a designated area. The Iraqi teams worked continuously, excavated on a large scale regardless of period of occupation, usually clearing whole building complexes and digging deep trenches to obtain long sequences, and moved from site to site as the objectives for each were achieved. In contrast, most international teams worked for much shorter periods within the year depending on what their institutions allowed: the British and Japanese archaeological expeditions were exceptional as they operated almost all-year-round as they were less constrained by university terms or museum budgets. Most of the international teams focused on particular sites and were generally interested in a given period, although the British, Japanese and Italian expeditions attempted to cover as many periods as possible in order to obtain a long-term history of settlement. Excavation techniques varied, sometimes greatly, but although there was informal contact between many teams there was little formal co-ordination or sharing of specialists. There was little systematic environmental recovery, no use of geophysics and the project pre-dated the use of other techniques, such as drone imagery, which are now considered standard. In many cases, additional sites were discovered within the different projects but these were not always investigated in detail. Unfortunately, as with all archaeological work and especially in rescue projects, there remains a backlog of final publications from all the projects and some are unlikely ever to be published.

The prospects of these or other large dams are unclear. They are national symbols projected internationally through the media and illustration on currency and postage stamps, yet most are acknowledged as having an effective life of 50 years after which sedimentation reduces their ability to generate sufficient hydropower. They retain usefulness for flood control and irrigation supply but once they become dead reservoirs, they risk becoming contaminated and their ability to supply fresh drinking water reduced accordingly. Large dams require constant maintenance and even small failures can lead to major accidents. Catastrophic breach of a dam is the worst-case scenario and it is not clear whether large amounts of flood surge can be contained, even in the case of additional dams located downstream, and massive loss of life and infrastructure is likely in such a case.

In most instances, there is very little understanding as to what the long-term effects of the dams are on the submerged archaeological sites but it will probably vary. Those sites subject to fluctuation of the water-level along the Flood Risk Zones suffer heavily from undercutting of exposed sections and it is possible that archaeological sites close to the entrance of the reservoir or near the dam sluices are eroded quickly because of the strong currents at these points. However, as reservoirs retain the greater part of the suspended sediment carried by the rivers, many sites must be gradually disappearing beneath and becoming protected by the accumulating sediment, either the backwater deltas of coarse sediment, gravel and pebbles which form at the upstream end or below the fan of fine sediment and clay deposited immediately above the dam. Visibility will be poor for the same reason but remote UAV survey offers untested potential as a cultural heritage management tool. The recent discovery that one of the few sites on the left bank of the Mosul dam reservoir not to be inspected closely has produced a monumental second millennium BC building with wall-paintings indicates how important new discoveries can still emerge from intensively studied reservoir landscapes.

Bibliography

Al-Soof, B.

1970 Mounds in the Rania Plain, and Excavations at Tell Bazmusian, *Sumer* 26: 65–104.

Bahnassi, A., *et al*.

1974 *Antiquités de l'Euphrate. Exposition des découvertes de la campagne international de sauvegarde des antiquités de l'Euphrate*. Aleppo: Direction Générale des Antiquités et des Musées.

Brandt, S.A. and Hassan, F., eds.

2000 *Dams and Cultural Heritage Management. Final Report, August 2000*. Cape Town: World Commission on Dams Secretariat.

Demirji, M.S., ed.

1987 *Researches on the Antiquities of Saddam Dam Basin Salvage and Other Researches*. Baghdad: State Organisation of Antiquities and Heritage.

Eidem, J.

2015 Dams and Damage. Heritage loss and second phase salvage on the Rania Plain (Kurdish Region of Iraq), *Annual Report NINO and NIT, Netherlands Institute for the Near East / The Netherlands Institute in Turkey*: 2–13.

Finkel, I., Rey, S. and Schulz-Dornburg, U.

2018 *No man's land*. London: The British Museum.

Ghasemi, P.

2014 The Khersan 3 archaeological survey: New insights into settlement patterns in the Zagros folding zone from hydro-dam project archaeology, *Ancient Near Eastern Studies* 51: 167–211.

Gibson, McG., ed.
1981 *Uch Tepe I*. Chicago: The Oriental Institute.

Hassan, F.A.
2007 The Aswan High Dam and the International Rescue Nubia Campaign, *The African Archaeological Review* 24/3-4: 73–94.

Kepinski, C., Lecomte, O. and Tenu, A., eds.
2006 *Studia Euphratica. Le moyen Euphrate iraquien révélé par les fouilles preventives de Haditha*. Paris: De Boccard.

Lupton, A.
1996 *Stability and Change, Socio-political Development in North Mesopotamia and South-East Anatolia 4000–2700 B.C.* Oxford: Tempus Reparatum.

MacGinnis, J., *et al.*
2020 Excavations at the Darband-i Rania Pass, Kurdistan Region of Iraq: report on the 2016 and 2017 Seasons, *Iraq* 82: 139–178.

Marchetti, N., Curci, A., Gatto, M.C., Nicolini, S., Mühl, S. and Zaina, F.
2019 A multi-scalar approach for assessing the impact of dams on the cultural Heritage in the Middle East and North Africa, *Journal of Cultural Heritage* 37: 17–28.

Margueron, J.-C.
1977 *Le moyen Euphrate: zone de contacts et d'échanges*. Strasbourg / Leiden: Université de Strasbourg / Brill.

Mühl, S. and Sulaiman, B.S.
2011 The Makhūl Dam Project, *Between the Cultures. The Central Tigris Region from the 3rd to the 1st millennium BC. Proceedings of a Conference at Heidelberg*, 22–24 January 22 2009 (P. Miglus and S. Mühl eds.), 371–384, pls XXV–XXIX. Heidelberg: Ruprecht-Karls-Universität Heidelberg.

Olmo Lete, G. del and Montero Fenollós, J.-L., eds.
1999 *Archaeology of the Upper Syrian Euphrates: The Tishrin Dam Area. Proceedings of the International Symposium Held at Barcelona, January 28th–30th 1998*. Barcelona: Editorial Ausa / Institut del Pròxim Orient Antic, Universitat de Barcelona.

Őzdoğan, M.
2000 Cultural Heritage And Dam Projects In Turkey: An Overview, *Dams and Cultural Heritage Management. Final Report, August 2000* (S.A. Brandt and F. Hassan eds.), 58–61. Cape Town: World Commission on Dams Secretariat.

Sandes, E.W.C.
1937 *The Royal Engineers in Egypt and the Sudan*. Chatham: Institution of Royal Engineers.

Säve-Söderberg, T.
1987 *Temple and tombs of ancient Nubia*. London: Thames and Hudson.

Simpson, St J.
2007 *Ancient Settlement in the Zammar Region. Excavations by the British Archaeological Expedition to Iraq in the Eski Mosul Dam Salvage Project, 1985–86* (W. Ball ed.), *Volume Two. Excavations at Tell Abu Dhahir*. Oxford: Archaeopress.
2020 Arkheologiya i politika v vek plotin: obzor materialov po Iraku, *Arkheologicheskiye Vesti 26 (K 90-letiyu so dnya rozhdeniya Aleksandra Danilovicha Gracha)*: 260–271 (Russian with English abstract). St. Petersburg: Russian Academy of Sciences, Institute for the History of Material Culture.

Solecki, R.S.
1953 A Programme for Salvage Archaeology in the Projected Flood Basins in Iraq, *Sumer* 9/1: 101–103.
1972 *Shanidar. The Humanity of Neanderthal Man*. London: Allen Lane / Penguin.

Sulaiman, B.S.
2011 A Brief Report on the al-Adhaim Dam Salvage Project, *Between the Cultures. The Central Tigris Region from the 3rd to the 1st millennium BC. Proceedings of a Conference at Heidelberg*, 22–24 January 22 2009 (P.

Miglus and S. Mühl eds.), 385–394, pls XXX–XXXIII. Heidelberg: Ruprecht-Karls-Universität Heidelberg, 2011.

Tuna, N. and Öztürk, J., eds.
1999 *Salvage Project of the Archaeological Heritage of the Ilısu and Carchemish Dam Reservoirs Activities in 1998*. Ankara: Middle East Technical University.

Various
1981a *Sumer* 40. *Special Issue: Researches on Himrin in the two international symposiums, second and third held in 1979 and 1981*. Baghdad.
1981b *Sumer* 42. *Special Issue: Researches on the antiquities of al-Qadissiya Dam and Ashur in the two international symposiums, second and third held in 1979 and 1981*. Baghdad.

Welsby, D.
2008 Dams on the Nile: from Aswan to the Fourth Cataract, *Sudan Studies* 37: 5–18.

Whallon, R.
1979 *An Archaeological Survey of the Keban Reservoir Area of East-Central Turkey*. Ann Arbor: University of Michigan.

Wilkinson, T.J. and Tucker, D.J.
1995 *Settlement Development in the North Jazira, Iraq. A Study of the ArchaeologicalLandscape*. Warminster: Aris and Phillips for the British School of Archaeology in Iraq.

Willcocks, W.
1889 *Egyptian Irrigation*. London: E. and F.N. Spon.
1911 *The Irrigation of Mesopotamia*. London: E. and F.N. Spon.

GIS AND HISTORICAL GEOGRAPHICAL ANALYSES OF THE RECONSTRUCTED ANCIENT COURSE OF THE TIGRIS IN THE NORTHERN PART OF SOUTHERN MESOPOTAMIA[1)]

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Abstract

It is widely accepted that from the beginning of the 4th millennium BCE until the Neo-Babylonian period around the end of the 7th century BCE in the northern part of southern Mesopotamia, the ancient course of the Tigris may have flowed to the east of its present course. However, studies in the late 1990s and later have indicated alternative possibilities. This study investigates and analyzes the validity of past theories on the location of the ancient course of the Tigris in this area with the aid of 3D contour maps of southern Mesopotamia developed from Shuttle Radar Topographical Mission Digital Elevation Model (DEM) and Advanced Land Observing Satellite DEM data using Geographical Information System, satellite imagery from World Imagery, Corona satellite photographs, and other topographical information on the ancient course of the Tigris found in ancient written sources. Using these comparative validation analyses, the location of the ancient course of the Tigris in the northern part of southern Mesopotamia from the beginning of the 4th millennium BCE until the Neo-Babylonian period is ascertained.

I. Introduction: Previous Studies, Study Methods, and Goal of This Work

Four hypothetically reconstructed ancient courses have been proposed for the Tigris in and around Baghdad and to its south in the northern part of southern Mesopotamia for the period from the mid-Holocene until the Neo-Babylonian period, around the end of the 7th century BCE. Two of these, proposed by R. McC. Adams [1965] and C. Hritz [2010, 184–203], place the Tigris to the east of its present course. A third one, initially proposed by S. W. Cole and H. Gasche [1998, 1–64; 1999, 87–110; 2001, 197–210] and later together with M. Tanret, and K. Verhoeven [2002, 531–544, maps 1–2], places it in roughly the same course as the present course, extending to the south and the west of the present course. The final proposal, by J. Jotheri [2016, 151–156, figs. 4.29–4.35], places the earlier course to the west of the present one and a later course in roughly the same course as at the present, in two different periods.

More details for these four reconstructions are given below. This discussion begins with Adams's reconstruction, followed by those by Cole and others, Hritz, and Jotheri. The validity of each reconstruction is examined and verified, using the same method as a previous study by this article's author, which used GIS analyses and various pieces of topographical information on the ancient course of the Tigris contained in written sources to reconstruct the ancient course of the Tigris in the southern part of southern Mesopotamia in the Ur III period [Kawakami 2021, in press]. The same methodological discussion and mention of its limitations as given in that article are quoted below with a goal of this article.

The ArcGIS 10.8 software published by Esri Inc. was used for the topographic mappings and analyses presented in this study. The Shuttle Radar Topographical Mission (SRTM) Digital Elevation

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1) I express my gratitude to Emeritus Rankin Prof. A. R. Millard and Dr. E. Cripps of the University of Liverpool for their help and suggestions in the course of the preparation of this article. Needless to say, I alone am responsible for the views expressed in this article.

Model (DEM) and Advanced Land Observing Satellite (ALOS) DEM were used to display 3D contour maps to discern the fluvial levees of the ancient course of the Tigris[2]. Initial hydrological analyses were carried out with these DEMs through GIS[3]. However, modern topographical data make it impossible to infer the flow paths of the ancient courses of rivers and watercourses that existed from a few hundred to a few thousand years ago. The fluvial levees of the ancient courses of the watercourses were observed on the SRTM and ALOS DEM 3D contour maps using visual examination.

The SRTM DEM features 3-second (about 90-meter) interval mesh data of the southern Mesopotamian region measured by radar on board the Space Shuttle Endeavour in 2000—the data have been available for free since 2003. Due to their low resolution, of approximately 90 meters, structures such as modern maintained roads and irrigation canals are smoothed out and do not appear. For this reason, the geomorphological features of tens of kilometers of fluvial levees of the ancient courses of rivers and watercourses can be clearly seen.

The ALOS DEM dataset has a resolution of approximately 30 meters; it has been available for free since 2016. It was created by the Japan Aerospace Exploration Agency, using the Panchromatic Remote-sensing Instrument for Stereo Mapping on board the ALOS Daichi. As its data have a resolution that is higher than that of the SRTM DEM, it was used in combination with the SRTM DEM 3D contour maps to complement the more detailed geomorphological features of fluvial levees of the ancient courses of rivers and watercourses, which are not shown on the SRTM DEM 3D contour maps. This makes it possible to reconstruct them more accurately. The 3D contour maps shown in figures below were prepared from these SRTM DEM and ALOS DEM data.

In addition to these two DEMs, the satellite imagery from World Imagery, which can be displayed directly on GIS via the internet, was also used and prepared in the figures below[4]. Corona satellite photographs were used as well[5]. These made it possible to complement the geomorphological features of the fluvial levees of the ancient courses of rivers and watercourses, which do not appear on the 3D contour maps of the two DEMs.

The Tigris and Euphrates Rivers have substantially influenced the process of land formation in the alluvial plain of southern Mesopotamia. The present course of the Tigris begins on the southern slopes of the Taurus-Zagros Mountains of eastern Anatolia. In northern Iraq, the Tigris cuts deeply into the surrounding plain, forming a narrow alluvial zone bounded by cliffs and hills. South of Samarra, the river enters the extensive Mesopotamian alluvial plain, where at first, it forms a meandering single channel and then a braided one, shortly before joining the present Euphrates to form the Shatt al-Arab, finally emptying into the Persian Gulf [Hirschfeld 1997, 206].

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2) See https://www.mizuho-ir.co.jp/publication/report/2016/mhir12_eros_03.html for more information on the freely available SRTM and ALOS DEMs (in Japanese). Apart from the ALOS DEM, as described on the same site, there is also another freely available DEM. It is the Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) Global Digital Elevation Model (GDEM) with resolution of 30 meters that is the same as the freely available ALOS DEM. However, it is reported that it is older than the ALOS DEM and contains more errors, so the freely available ALSO DEM is used in this study.

DEMs with very high resolution are also available. The ALOS DEM is also available with about 5-meter resolution: https://www.eorc.jaxa.jp/ALOS/aw3d/index.htm (in Japanese). The ALOS World (AW) 3D Digital Surface Model (DSM) and the AW 3D Digital Terrain Model (DTM) with resolution of half a meter to 2 meters are also available: https://www.aw3d.jp/ (in Japanese). However, they are too expensive to make their use practical for this study.

3) Hydrological analysis is a tool used in GIS based on DEM raster data to establish a water system model, which is used to study the hydrological characteristics and simulate the hydrological process of the surface to develop forecasts of hydrological patterns.

4) For World Imagery, see https://www.arcgis.com/home/item.html?id=10df2279f9684e4a9f6a7f08febac2a9. It provides 1-meter imagery or better satellite and aerial imagery in many parts of the world and lower resolution satellite imagery worldwide.

5) For Corona satellite photographs, see https://corona.cast.uark.edu/. The Corona satellite project was launched during the Eisenhower administration in the late 1950's. The goal was to take photographs of sensitive strategic areas, at the time, mainly the Soviet Bloc and China, and the Middle East was added in the 1960s. These photographs, some 860,000 in total, were declassified in 1996 and are publicly available at minimal cost through the United States Geological Survey. The photographs, taken by numerous missions of the Corona program between 1959 and 1972, include Mesopotamia [Hritz 2005, 67–72].

The present course of the Euphrates can be divided into a number of distinct geographic units. First, the Upper Euphrates begins in eastern Anatolia, while the Middle Euphrates receives Syrian tributaries. Then, the river crosses into Iraq near the ancient site of Mari and enters the Mesopotamian floodplain. The Lower Euphrates consists of a series of sub-geomorphological units. In a typical alluvial plain, its braiding streams create natural levees or river embankments, characterized by seasonal inundation and alluvial flats, reaching its closest point to the present course of the Tigris near ancient Sippar and modern Baghdad. The river then enters the delta plain and divides into two branches, which rejoin after passing Samawah to create a marsh/lake environment. The river finally joins the present Tigris to form the Shatt al-Arab in the estuarine zone [Zarins 1997, 287].

Because the Tigris and Euphrates flowed in the same courses for hundreds of years at a time across the very flat alluvial plain of southern Mesopotamia, their fluvial levees remain across a surface of tens of kilometers. The network of the fluvial levees of their ancient courses can be discerned on the SRTM and ALOS DEM 3D contour maps. They can be clearly displayed by adjusting the GIS color ramp settings, causing color changes from white at lower elevations to black at higher ones or the reverse[6]. The network of the fluvial levees of the ancient courses of the rivers is discernible on 3D contour maps, and the fluvial levees of the ancient courses of the Tigris and Euphrates can be identified by comparing them with the four hypothetically reconstructed ancient courses proposed for the Tigris in the northern part of southern Mesopotamia by Adams, Cole and others, Hritz, and Jotheri.

However, there are limitations to discerning the fluvial levees of the ancient courses of the Tigris and Euphrates on the SRTM and ALOS DEM 3D contour maps. The fluvial levees from the mid-Holocene until the Neo-Babylonian period, around the end of the 7th century BCE, the period examined in this study, may have been varied and erased by later sediment deposits caused by the large-scale construction of irrigation canals and other water facilities for agriculture during the medieval Islamic period. The levees appertaining to this area are unfortunately not discernible. It is also difficult to determine which fluvial levees of the ancient courses of rivers and watercourses relate to the Euphrates and which to the Tigris, as well as whether they date from even more ancient times than our period or a later time, such as the medieval Islamic period.

Finally, the positional relationship of the four hypothetically reconstructed ancient courses is compared with the further lower reach of the ancient course of the Tigris, which was initially assumed by R. D. Biggs [1965, 95–102] from a letter of the Kassite period and presumed later by W. Heimpel [1990, 204–213] and P. Steinkeller [2001, 22–84] from documents of the Ur III period, and most recently reconfirmed for the Tigris in the northern and central part of Sumer in the southern part of southern Mesopotamia in the author's previous study [Kawakami 2021, in press]. Then, the whereabouts of the ancient course of the Tigris in the northern part of southern Mesopotamia are ascertained by the results of this comparative verification and related analyses.

II. Ancient Course of the Tigris in the Northern Part of Southern Mesopotamia

II.1. Reconstruction by R. McC. Adams

The first hypothesis put forward for the ancient course of the Tigris in and around Baghdad and to the south of the city in the northern part of southern Mesopotamia was proposed by Adams [1965]. His theory became widely accepted. Adams thought that, in general, ancient settlements would likely not be established far from fluvial courses. This implied that rivers, their channels, and artificial canals would naturally flow from sites upstream to nearby contemporary sites downstream.

6) This GIS tool presents elevation data according to one or another set color scheme to indicate various geological features.

Using this reasoning, he established settlement patterns for ancient sites using typological analyses of pottery shards collected from surface remnants. Then, following his studies and analyses of the patterns of inhabited sites lying in the Diyala region east of the present course of the Tigris in relation to their histories of settlement, he established an approximate network for fluvial courses in the region. He concluded that the ancient course of the Tigris was to the east of its present course, at least from the beginning of the 4th millennium BCE until the Neo-Babylonian period, around the end of the 7th century BCE, afterward changing its flow to the west to form its present course[7]. Thus, he established a possible ancient course of the Tigris to the east of its present course on the latitude between the north of Baghdad and the diversion point of the Gharrāf Canal. As he had already reported in his work with Jacobsen [1957, 96–97; 1960, 175–179; 1969, 103–109], Adams [1957a, 139–141; 1957b, 270–273; 1958, 101–103, figs. 1–6] continued to argue that the Tigris did not affect the subsistence of inhabitants in the lower Mesopotamian alluvium [Jacobsen and Adams 1958, 1252]. Instead, according to this view, the Euphrates supplied water to all major channels in the southern Mesopotamian alluvium. This argument has been accepted by other scholars[8].

Adams's reconstruction of the ancient course of the Tigris was scanned and geo-referenced with 3D contour maps developed from the SRTM DEM and ALOS DEM data in GIS, and it was then traced and reconstructed as a double grayish line on the SRTM DEM 3D contour map (Fig. 2)[9]. However, unlike the SRTM DEM 3D contour map (Fig. 1), the ALOS DEM 3D contour map (Fig. 3), the World Imagery Map (Fig. 4), and the Corona satellite photographs, no levee of a fluvial course can be discerned on Adams's reconstructed fluvial line. This suggests that either this course was buried under the heavy silt sedimentation of the Tigris itself or that the reconstruction is in fact incorrect.

II.2. Reconstruction by S. W. Cole, H. Gasche, H. Tanret, and K. Verhoeven

The second hypothesis for the reconstruction of the ancient course of the Tigris in and around Baghdad and to the south was initially proposed by Cole and Gasche [1998, 1–64; 1999, 87–110; 2001, 197–210]. They later slightly modified this proposal with the aid of Tanret and Verhoeven [2002, 531–544, maps 1–2; Hritz 2006, 420]. For this, topographical survey records, aerial photos, and satellite images were used to create a 3D contour map with a gradation of 1-meter intervals on a Universal Transverse Mercator map projection. On their 3D contour map, like those of the SRTM DEM and ALOS DEM 3D, the meandering levees of a fluvial network are discernible. On their map, they found three fluvial meander levees, branching off from or in the vicinity of the present course of the Euphrates, with two joining the present course of the Tigris. They also found a large and wide fluvial mender levee running to the southeast of the ancient site of Seleucia. They inferred that this was likely created by the joint flows of the ancient Tigris and the Euphrates. Cole and Gasche attempted to identify these fluvial levees with specific ancient fluvial names of the Tigris and the Euphrates and their possible active periods as referred to in various ancient written documents, supplemented with other written, archaeological, and geomorphological evidence, as follows.

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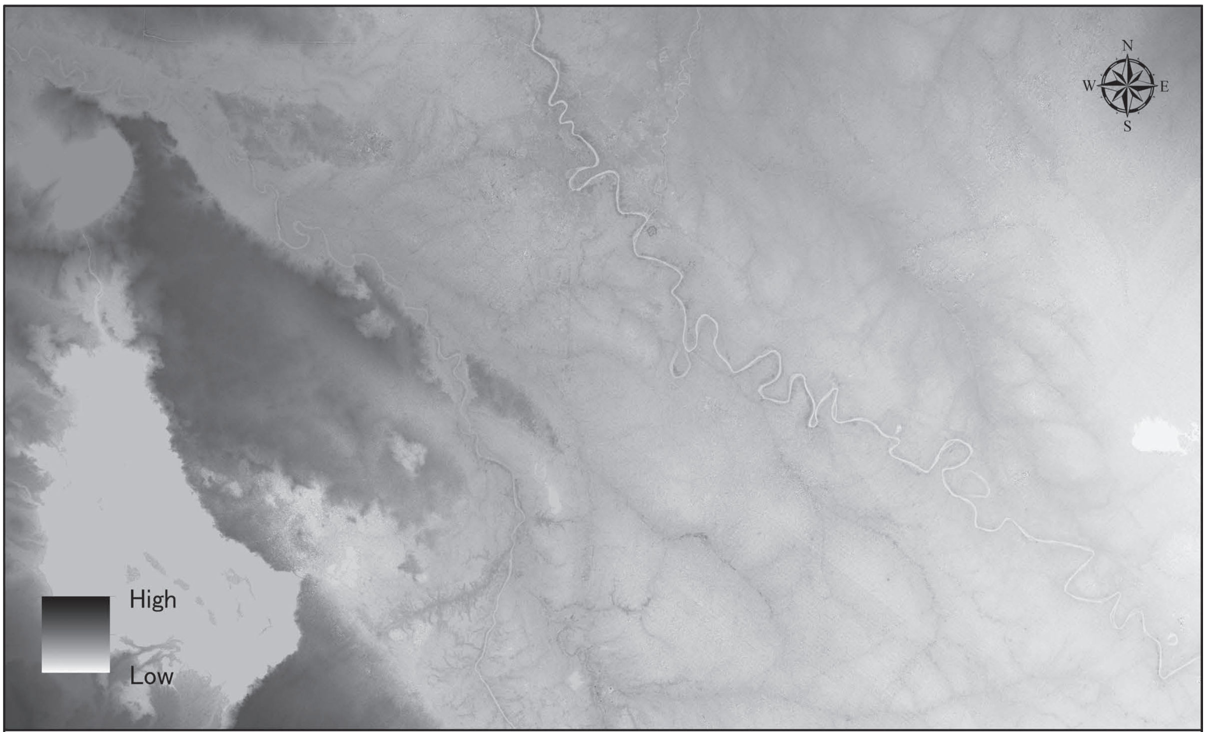
7) The dating of the ancient course of the Tigris from the beginning of the 4th millennium BCE to the end of 7th century BCE was determined using a typological classification of pottery shards collected from surfaces of ancient sites as an evaluation criterion [Adams 1965, 126–134].

8) Many scholars have followed Adams's hypothetical reconstruction of the ancient course of the Tigris [Gibson 1972a, 5–7, 13, fns. 56–63, fig. 69; 1972b, 119, map; Nissen 1972, 42; 1976, 20; 1988, 144; Postgate 1976, 77–100; del Monte and Tischlerin 1978, 530; Groneberg 1980, 287–288; Nashef 1983, B III 7; Röllig 1988, B II 7; 1991, B II 8; Roaf 1990; Wall-Romana 1990, 204–245; Finkbeiner and Groneberg 1991, B II 12; Frayne 1992, 41–48, map 4].

Zadok [1978, 304, 332, map; 1985, 361] also supported Adams's view in 1978. However, in 1985, he asserted that the course of the Tigris in the Neo-Babylonian period is uncertain.

9) Geo-referencing here refers to the process of capturing a scanned image of a paper map in GIS and assigning coordinates to it. This allows different maps to be overlaid on each other and given the same set of coordinates, enabling the reading and analysis of geographical features through GIS.



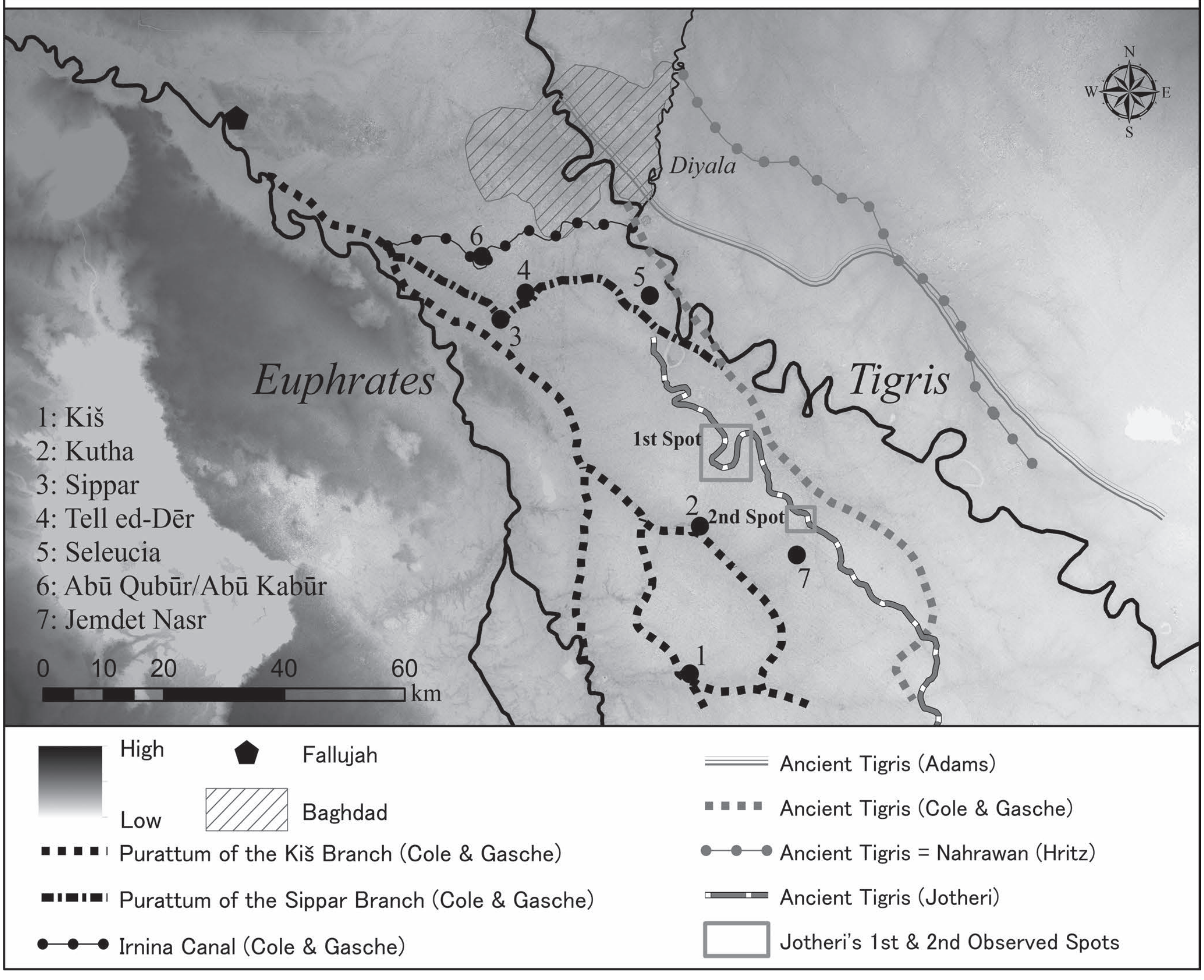
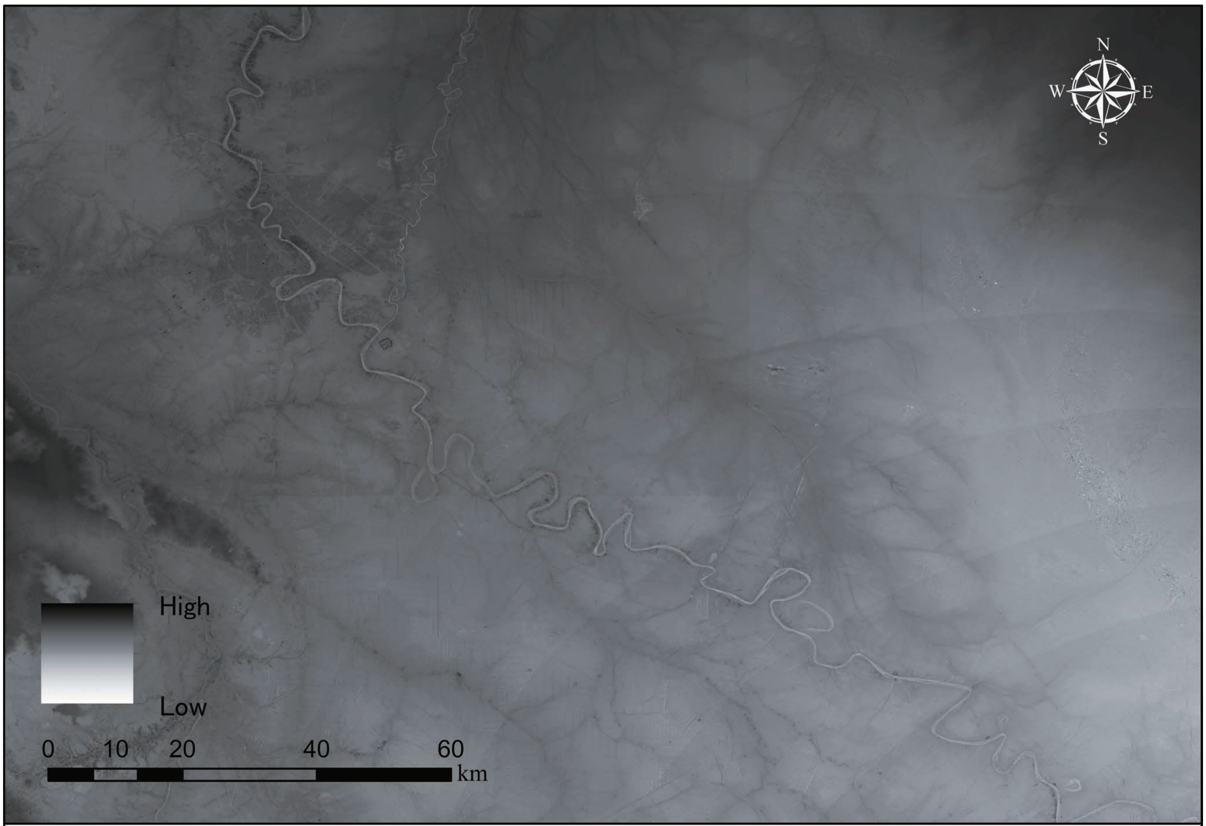


Fig. 1 SRTM DEM 3D Contour Map of the Northern Part of Southern Mesopotamia without Processing (upper).
Fig. 2 SRTM DEM 3D Contour Map of the Northern Part of Southern Mesopotamia with Processing (lower).



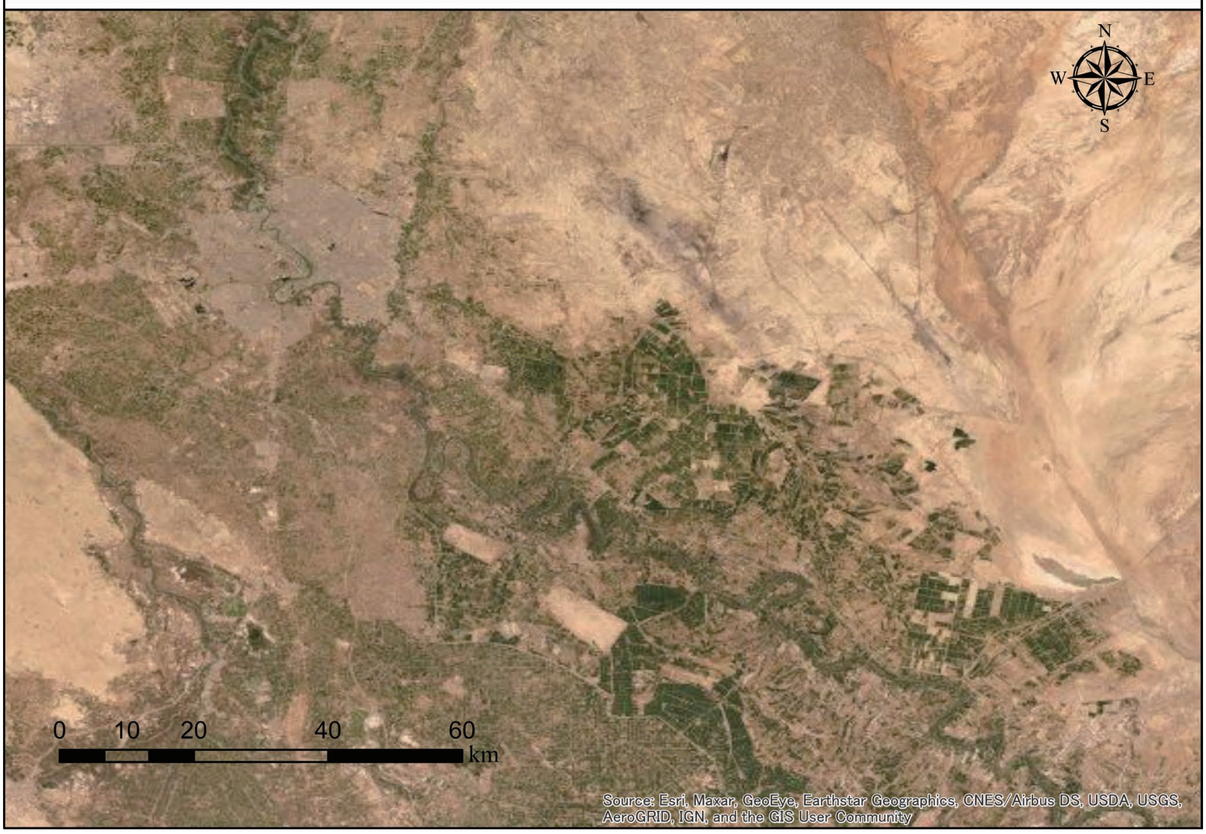


Fig. 3 ALOS DEM 3D Contour Map of the Northern Part of Southern Mesopotamia (upper).
Fig. 4 World Imagery Map of the Northern Mesopotamia (lower).

II.2.1. First Fluvial Levee: *Purattum* of the Kiš Branch

The first fluvial levee of the ancient course of the Euphrates runs from the southeast of Fallujah toward the west of Sippar. It further branches off toward Kiš and Kutha [Cole and Gasche 1998, 25–26]. Cole and Gasche identified this first levee with the ancient Akkadian name of the Euphrates, *Purattum*, because a royal inscription of Naram-Sin of the dynasty of Akkad and the 24th year name of Samsu-iluna of the first dynasty of Babylon refer to Kiš as being located on a bank of the *Purattum* [Edzard, Farber, and Sollberger 1977, 208–209; Groneberg 1980, 303–305; Cole and Gasche 1998, 25–26, fn. 119]. Accordingly, they argued that this first levee was active from the Old Akkadian to the Old Babylonian periods. This first fluvial levee of the ancient course of the Euphrates was reconstructed as black dotted lines on the SRTM DEM 3D contour map (Fig. 2) and is clearly discernible on the SRTM and ALOS DEM 3D contour maps (Figs. 1 and 3, respectively). This implies a possible identification.

II.2.2. Second Fluvial Levee: *Purattum* of the Sippar Branch and ÍD.UD.KIB.NUN.KI

The second fluvial levee branches off at a point 20 kilometers northwest of Sippar and runs southeast to Sippar and Tell ed-Dēr. From there, it curves gently to the southeast. It eventually joins the present course of the Tigris to the southeast of Seleucia. These researchers inferred that the ancient course of the Tigris must have generally been in the same course as the present course of the Tigris, from the north of Seleucia to its southeast, joining the second levee of the Euphrates to the southeast of Seleucia[10)]. On their 3D contour map, Cole and Gasche also found a large and wide fluvial levee running from the southeast of the confluence of the second levee with the present course of the Tigris further to the southeast, to the west of the present course of the Tigris. Thus, they inferred that this large and wide levee must have been created by joint flows of the ancient courses of the Tigris and the Euphrates from the second levee[11)].

Written sources from the first half of the 2nd millennium BCE discovered in Mari, further upstream, offer two distinct written ancient names for the Euphrates: the Akkadian name *Purattum* and the Sumerian logographic name ÍD.UD.KIB.NUN.KI (= literally, the Sippar River or Canal). Cole and Gasche [1998, 23–25, 41–52, maps; Groneberg 1980, 303] identified this second fluvial levee with *Purattum* of the Sippar branch and ÍD.UD.KIB.NUN.KI. They also demonstrated the historical existence of the confluence of the ancient courses of the Tigris and the Euphrates in the southeast of Seleucia based on an Old Babylonian document found in Sippar, YOS 12, 469: 4, which describes the field of a *nadītu* (= celibate priestess) in or near a fortress of Puš, bordered by both the Euphrates and the Tigris [Cole and Gasche 1998, 17, fn. 71; 1999, 96–97, fn. 25; 2001, 199–200, fn. 12].

McG. Gibson [1972a, 5–6, 13, fns. 56–58, fig. 69; 1972b, 119, map] presented an account of YOS 12, 469: 4 in the context of an investigation of the ancient course of the Zubi canal and read two registered fluvial names given as bordering the field as ÍD.UD.KIB.NUN.KI (= the

10) Drawing on geological evidence, R. Paepe [1971, 20–27] was the first to note the possibility that the ancient course of the Tigris could have been to the west of its present course. Paepe found a levee of the ancient course of the Tigris in an investigation of the geology of the region around Sippar and Tell ed-Dēr. However, he was only able to give a vague date for it, broadly, after the early Holocene.

Later, Adams [1981, 15–16, 158] conducted geological investigation in the same region and reached the same conclusion as Paepe. He argued that the ancient course of the Tigris appears to have been present until the 4th millennium BCE. However, he did not present concrete evidence to support this view.

11) J. Pournelle [2003, 146–154; Hritz 2010, 193–195] studied this large and wide fluvial levee using Corona satellite photographs, Aster Terra satellite imagery, derived DEMs, and Adams's survey data. Seeking to assign a date to this large and wide levee in relation to the dates of ancient sites situated on its banks, she found that the levee conflates two separate channel systems from two different periods, from the early to middle Uruk periods and from the 2nd to the 1st millennia BCE. Thus, it could have been created during these periods by both the Tigris and the Euphrates together or either the Tigris or the Euphrates separately.

Euphrates) and ÍD.ZUBI (= the Zubi canal). Steinkeller [1980, 26–27] in an investigation of the location of the ancient city of Urum also referred to in this document, read the latter logographic sign as ZUBI[12]. However, according to Cole and Gasche [1998, 17, fn. 71; 1999, 96–97, fn. 25; 2001, 199–200, fn. 12], U. Kasten, curator of the Yale Babylonian collection, collated the latter logographic sign with the original tablet of YOS 12, 469, YBC 6816 to find that the sign in question is not ZUBI but the Sumerian logographic name of the Tigris, IDIGNA.

Cole and Gasche argued that the description of YOS 12, 469: 4 fits with the geomorphological relief of the region southeast of Seleucia, and this supports the assertion of the historical confluence of the Tigris and the Euphrates in this region. They also noted that this supports the view that the ancient course of the Tigris was the same as its present course from the north of Seleucia to its southeast in the first half of the 2nd millennium BCE.

Cole, Gasche, Tanret, and Verhoeven [2002, 537, fns. 19–21, map 1] argued that the active period for *Purattum* of the Sippar branch can be dated further back, to as far as around 3000 to 2500 BCE. They stated that in written sources from the Early Dynastic and Old Akkadian periods, the earlier written form of *Purattum* for the Sippar branch, ÍD.UD.KIB.NUN.KI. (= the Sippar River or Canal) frequently occurs, which means that it was already in existence during these periods. Furthermore, the foundations of Sippar and Tell ed-Dēr can be dated as far back as 3000 BCE, and archaeological investigation confirmed that their foundations were built on the second fluvial levee of the Euphrates[13]. Thus, Cole and others concluded that, considering the margin of error, the historical presence of ÍD.UD.KIB.NUN.KI. can also be dated to at least as far back as 2500 BCE. They also argued that the ancient course of the Tigris could have also flowed generally on its present course and formed a confluence with ÍD.UD.KIB.NUN.KI. (= later *Purattum* of the Sippar branch) in around 2500 BCE[14].

The second fluvial levee of the ancient course of the Euphrates is reconstructed on the SRTM DEM 3D contour map (Fig. 2) as a long and short black dotted line, and it is clearly discernible on the SRTM and ALOS DEM 3D contour maps (Figs. 1 and 3, respectively). It certainly appears to join the present course of the Tigris. The presence of the large and wide fluvial levee running from the southeast of this confluence to further southeast on the west of the present course of the Tigris is also reconstructed on the SRTM DEM 3D contour maps (Figs. 2 and 6) as a grayish dotted line and is again clearly discernible on the SRTM DEM 3D contour maps (Figs. 1 and 5) and the ALOS DEM 3D contour map (Fig. 3). Therefore, the identification that Cole and others proposed also appears possible.

II.2.3. Third Fluvial Levee: Irnina Canal

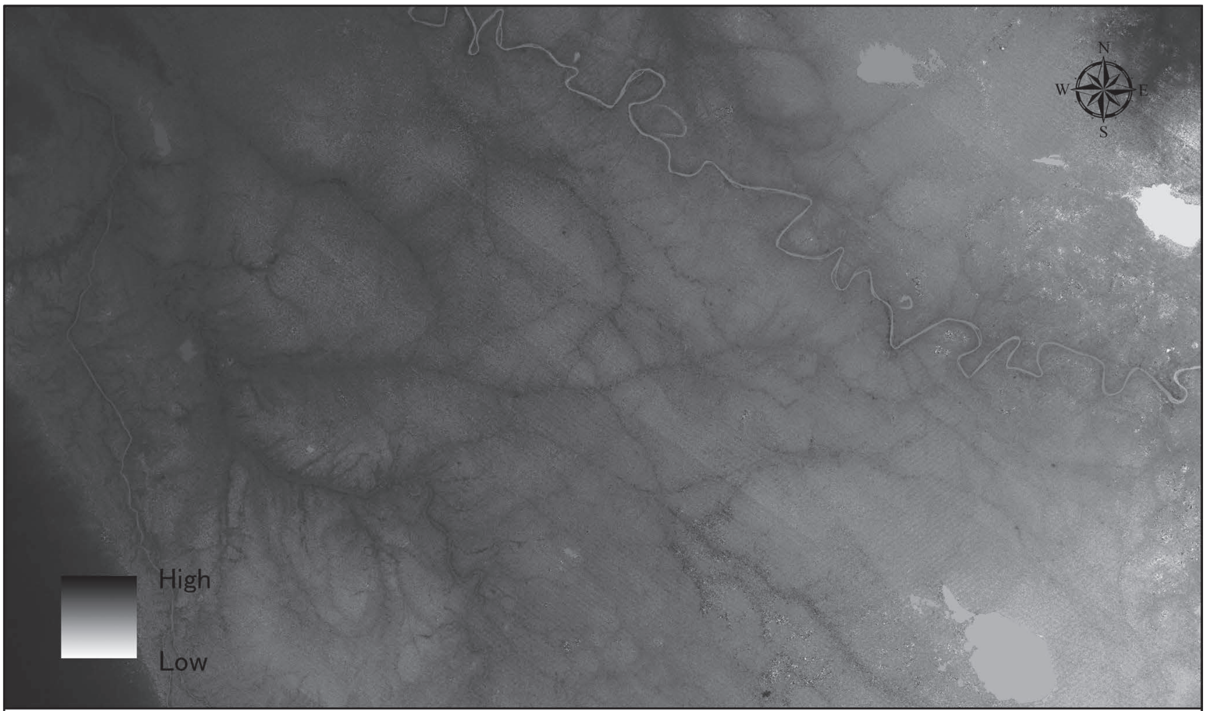
The third fluvial meander levee was discerned and reconstructed on their 3D contour map by Cole

12) It should be noted that Steinkeller [1980, 27] incorrectly cited YOS 12, 469 as 468.

13) The Sumerian name for Sippar, zimbir^{ki} is attested in two Sumerian lexical texts, P498157 and P499154, registered in Cuneiform Digital Library Initiative (CDLI). They are dated to the Early Dynastic I-II periods (2900–2600 BCE). Therefore, Sippar's historical presence must date to at least that time.

14) Steinkeller [2005, 32–33] provided support for Cole and others' view that the ancient course of the Tigris was located on its present course and to its west. He took into account an unpublished tablet from the Neo-Babylonian period discovered in Sippar. According to Steinkeller, the tablet records the location of a residential area in the vicinity of the former course of the Tigris, written as ÍD.IDIGINA *labiri*. Therefore, he argued that before the Neo-Babylonian period, the Tigris could have flowed in the vicinity of Sippar, to the west of its present course.

Jotheri [2016, 68] points out that V. M. A. Heyvaert and C. Baetman [2008, 2401–2410] confirmed Cole and others' argument based on the integration of geological, historical, and archaeological data. In tandem with the Belgian-Iraqi excavations of the 1970s, geological boreholes were carried out in the surroundings of Tell ed-Dēr and Sippar. However, these were only partly explored. They used a database of those 225 unpublished geological borehole descriptions with the coupling of archaeological and textual data and identified that the channel activity of ÍD.UD.KIB.NUN.KI. (= later *Purattum* of the Sippar branch) started at least 3100 BCE before the foundation of Sippar. This continued until 1400 to 1000 BCE in the area between Tell ed-Dēr and Sippar.



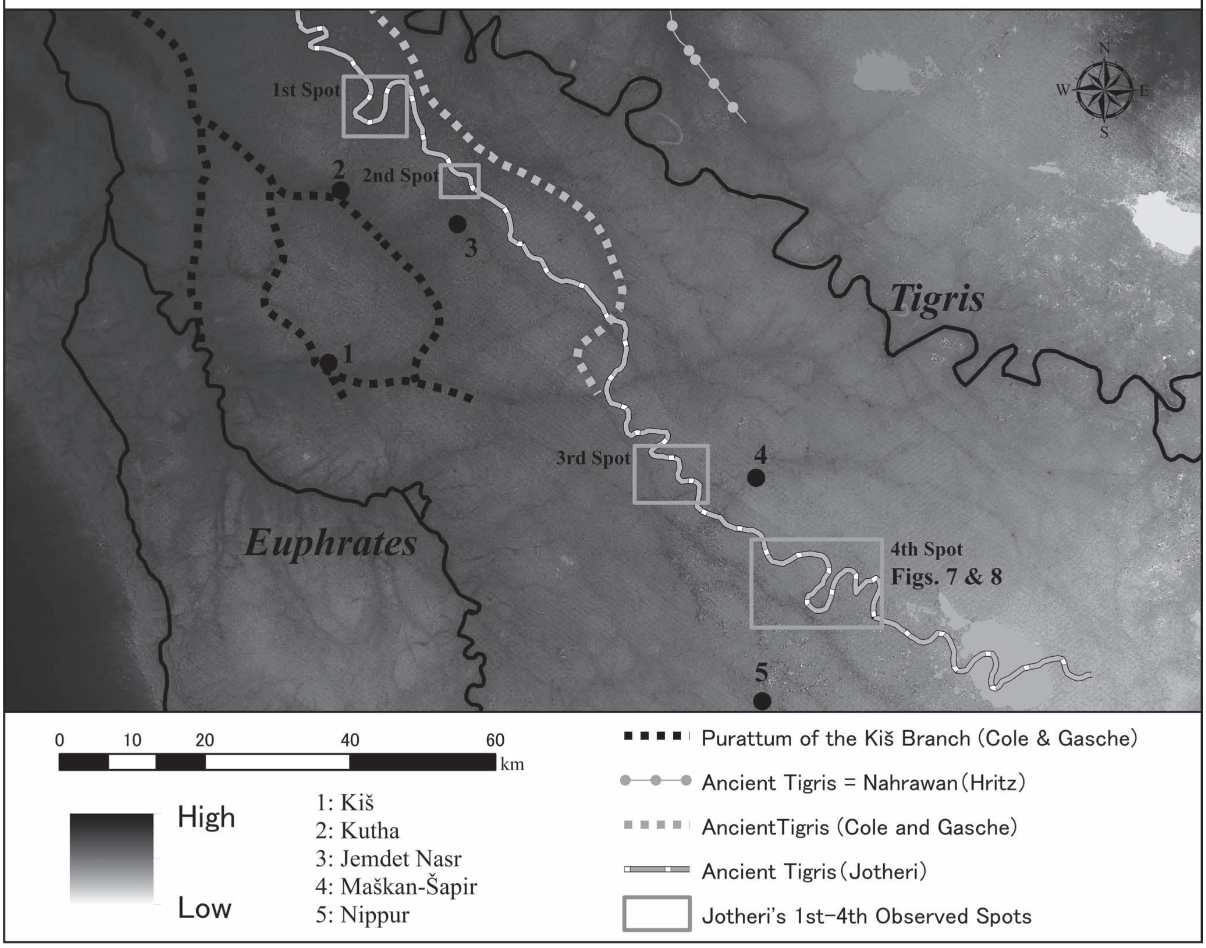


Fig. 5 SRTM DEM 3D Contour Map of the Central Part of Southern Mesopotamia without Processing (upper).
Fig. 6 SRTM DEM 3D Contour Map of the Central Part of Southern Mesopotamia with Processing (lower).

and Gasche [1998, 18, 41–52, maps] to branch off a few kilometers upstream, at a point where the second fluvial levee branches off, and then it curved east as far as the ancient site of Abū Qubūr/Abū Kabūr. They further indicated that from Abū Qubūr/Abū Kabūr, it continued to run east and eventually joined a fluvial levee of the ancient course of the Tigris near its present course at a point a few kilometers south of the confluence of the Diyala in an urban district of Baghdad.

Cole and others [1998, 16–23, 41–52; 2001, 200–201; 2002, 540–541, maps 1–2] identified the region around this confluence with the damaged and unreadable toponym of God Sin, referred to in two Old Babylonian tablet copies of the Cadastre of Ur-Nammu, founder of the Ur III dynasty, published by F. R. Kraus [1955, 46–47]. In this text, the damaged toponym is bordered by the Irnina and Zubi canals and is above Puš. According to Cole and others, an Old Babylonian document CT 52, 3: 11–12, found in Sippar refers to Puš, and an Ur III document TCL 5, 6041, states that Puš was located near Sippar[15]. Therefore, they argued that Puš was in the vicinity of Sippar.

Moreover, as shown above the Old Babylonian document found in Sippar, YOS 12, 469: 4, places the field of the *nadītu* (= celibate priestess) in or near the fortress of Puš, bordered by the Euphrates (= ÍD.UD.KIB.NUN.KI = later *Purattum* of the Sippar branch) and the Tigris (= IDIGNA). Cole and others thus identified this field with the region to the southeast of Seleucia. In the Cadastre of Ur-Nammu, the lost toponym was placed above Puš, so it can accordingly be placed above the region of the southeast of Seleucia.

Cole and Gasche [1998, 17–18, fn. 75] also indicated that the Zubi canal, which bordered the lost toponym of the Cadastre, is identifiable as a synonym for the Tigris on the basis of the following pieces of written evidence. The Cadastre places the toponym Ḫibarītum on a bank of the Zubi canal, whereas in a document of the Kassite period, PBS 1/2, 15: 14–5 (= UM 1/2, 15), Ḫibarītum is located on a bank of the Tigris[16]. In the Practical Vocabulary of Aššur, the Zubi canal (= ÍD.ZUBI) is equated with the restored Akkadian name of the Tigris, *di*-[*ig-lat*][17]. In the Neo-Assyrian lexical text Erimḫuš, CT 19, 02, K 04256, found in Nineveh, the Zubi canal is equated with another ancient designation of the Tigris, namely, ÍD.ḪAL.ḪAL.LA[18].

From these observations, Cole and others identified the third fluvial levee of the ancient course of the Euphrates with the Irnina canal. Then they identified the lost toponym of God Sin in the

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15) C. B. E. Walker [1976, no. 3] published the original Old Babylonian document, CT 52, 3, and Kraus [1977, 4–5] translated it.

Steinkeller [1980, 26–27] first pointed out the presence of the Ur III document TCL 5, 6041 in his search for the location of the ancient city of Urum. According to Steinkeller, this document indicates that 418 soldiers or workers of the fortress of Puš were under the supervision of a ruler of Sippar, which suggests that Puš must have also been under the control of Sippar, and the two must have been located near each other.

16) Kraus [1955, 46–47] had already pointed out this contradiction. He cited the lexical reference of A. Deimel [1928, 114–115, 60*], in which Deimel had observed that the cuneiform sign of the Zubi might have been either confused with or mistaken for the cuneiform sign for the Tigris. Thus, Kraus [1955, 63] suggested that the Zubi canal may have flowed for a great distance parallel to the Tigris or might have been one of several ancient names for the Tigris. However, Heimpel [2014–2016, 24–25] has recently denied the possibility that the similar sign ZUBI was a variant of the sign IDIGNA.

17) This equation in the Practical Vocabulary of Aššur was first noted by W. W. Hallo [1964, 68, fns. 19–25; Gelb, Landberger, and Oppenheim 1961, 13b–14a; Landsberger and Gurney 1957–1958, 333, 739].

Hallo's [1964, 57–88] views on the relationship between the Zubi canal of the Cadastre of Ur-Nammu and the Tigris and their ancient courses were based on his studies on geographical information of the Old Babylonian Itinerary, which lists the travel stations from Larsa in Babylonia to Emar in Syria; it appears that he considered the Zubi canal to have been a tributary of the Tigris that linearly connected Samarra and Baghdad, or it may have been the name of the main ancient course of the Tigris, initially curving eastward and then running toward Baghdad, like the present course of the Tigris.

18) Regarding the equation of the Zubi canal with ÍD.ḪAL.ḪAL.LA, see Cavigneaux, Güterbock, Roth, and Ferber [1985, 90 rev. iii 11'–13'], Heimpel [2014–2016: 25–28], Bagg [2014–2016, 28–30]. Its photo is registered with CDLI no. P385942, and its transliteration and translation are also registered and searchable under its museum registration no. K 04256 in The Open Richly Annotated Cuneiform Corpus (http://oracc.museum.upenn.edu/dcclt/corpus).

ÍD.ḪAL.ḪAL.LA is equated with the Tigris in the Neo-Assyrian lexical text found in Nineveh, CT 19, 25, K 14042 (= incorrectly published as K 14047). It is registered in CDLI with CDLI no. P385942.

Cadastre, bordered by the Irnina canal and the Zubi canal, with a region bordered by the confluence of the third fluvial levee of the ancient course of the Euphrates with the fluvial levee of the ancient course of the Tigris near its present course at a point a few kilometers south of the confluence of the Diyala, in an urban district of Baghdad[19]. They inferred that from the north of Baghdad to the southeast, the Tigris must have been on its present course as far southeast as Seleucia in the Ur III period[20].

The third fluvial levee of the ancient course of the Euphrates is reconstructed on the SRTM DEM 3D contour map (Fig. 2) as a black line of circular dots. However, the meander levee is undiscernible on the SRTM DEM 3D contour map (Fig. 1), the ALOS DEM 3D contour map (Fig. 3), the World Imagery Map (Fig. 4), and the Corona satellite photographs, as well as on their own 3D contour map. The argument given for the equation of the Zubi canal with the Tigris remains possible. However, the identification of the third fluvial levee of the ancient course of the Euphrates with the Irnina canal cannot be fully supported because no corresponding fluvial levee is discernible. Accordingly, the identification of the lost toponym of God Sin of the Cadastre with the region near the present course of the Tigris at a point a few kilometers south of the confluence of the Diyala with the present course of the Tigris in an urban district of Baghdad cannot be fully supported.

Thus, following the arguments of Cole and others, the ancient course of the Tigris can be reconstructed along its present course only from the north of Seleucia to the southeast, to the west of its present course after 2500 BCE, provided that their identification of the large and wide fluvial levee found southeast of Seleucia with the fluvial levee of the joint flows of the ancient Tigris and Euphrates is correct.

II.3. Reconstruction by C. Hritz

Hritz [2010, 184–202; 2014, 259–262] puts forward another hypothesis, which, like Adams's, placed the ancient course of the Tigris to the east of its present course. She was the first scholar to use SRTM DEM data with GIS to discern a levee of the ancient course of the Tigris in the northern part of southern Mesopotamia. She based her thinking on the belief that all of the ancient meander

19) As mentioned above, Jacobsen [1960, 175–176, fn. 4] followed Adams's [1957a, 139–141; 1957b, 270–273; 1958, 101–103, figs. 1–6] view that the ancient course of the Tigris must have flowed to the east of its present course. Thus, based on his studies of the meander levees of the fluvial network and geographical information on the Zubi canal and other ancient canals recorded in surviving written sources, he tentatively reconstructed the ancient course of the Zubi canal. He identified the Zubi canal with a fluvial meander levee left in the vicinity of Abū Qubūr/Abū Kabūr, north of Sippar, running toward the southeast of Tell ed-Dēr as an early-branching and most easterly flowing tributary of the ancient course of the Euphrates in southern Mesopotamia. He further inferred that it may have continued to run as far as the east of Jemdet Nasr and Abu Salabikh. Jacobsen was then followed by Gibson [1972a, 5–6, 13, fns. 56–58, 69; 1972b, 119, map] and Adams [1981, 159].

F. Carroué [1991, 130–132] found that the lost toponym of God Sin referred to in the Cadastre may be identified with the city of Urum, and Urum may be also identified with Tell Uqair, located northeast of Kutha and northwest of Jemdet Nasr. This was substantially the same view as Jacobsen's.

Frayne [1992, 12–17, map 4] also followed a series of earlier views. In the same year, G. Farber and W. Röllig [1992, B II 9] made distribution maps of ancient sites in the Old Akkadian and Ur III periods on which the ancient course of the Zubi canal was depicted. No specific explanation was given for the course depicted on the map, but it is consistent with these earlier conclusions as to the ancient course of the canal.

In comparing these views about the identification and the ancient course of the Zubi canal with the SRTM DEM 3D contour map (Fig. 1), the ALOS DEM 3D contour map (Fig. 3), the World Imagery Map (Fig. 4), and the Corona satellite photographs, no fluvial meander levee can be discerned running from Tell ed-Dēr to an area where Jemdet Nasr, Abu Salabikh, and Tell Uqair are located. Therefore, the views of Jacobsen and others are obviously questionable.

As a further supplement, J. Bauer [1972, 284–286, fn. III2] suggested that there was another canal named Zubi in the lower part of southern Mesopotamia that had no relation to the Zubi canal of the northern part of southern Mesopotamia.

20) In the Cadastre, the toponyms Namzium and Ḫirītum appear in close association with both the Irnina and Zubi canals. Cole and Gasche [1998, 18–23, 41–52, maps] argued that they are tentatively identifiable in the vicinity of a region near the present course of the Tigris at a point a few kilometers south of the confluence of the Diyala in an urban district of Baghdad. Thus, they suggested that their localizations strengthened their view of the historical location of the lost toponym of God Sin of the Cadastre as well as the ancient course of the Tigris in the given region.

levees of the fluvial network evident to the west of the present course of the Tigris in the south of Baghdad were left by ancient courses of the Euphrates. For this reason, she rejected the contention that the historical course of the Tigris was the same as its present course or that it was to the west of the present course, as asserted by Cole and others.

Instead, she argued that another levee of the ancient fluvial course to the east of the present course of the Tigris indicates the ancient course of the Tigris. As indicated with a grayish line of circular dots on the SRTM DEM 3D contour map (Fig. 2) and as is clearly discernible on the SRTM DEM 3D contour map (Fig. 1) and the ALOS DEM 3D contour map (Fig. 3), a levee of the ancient course of the Nahrawan canal of the Sassanid Persian period, with an approximately 1-kilometer width and 3-meter-high levees, branches off from the present course of the Diyala River to the east of Baghdad and runs as far as the diversion point of the Gharrāf Canal from the present course of the Tigris. Hritz [2010, 195–202] analyzed differences in the altitude of this course and identified the presence of another ancient fluvial levee with the 2-kilometer width and the 4-meter-high levees left under the levee of the ancient course of the Nahrawan canal with GIS. She pointed out that the levee of this ancient fluvial course runs for a longer distance than the Nahrawan canal and resembles the present course of the Tigris, meandering in a similar way.

To understand the possible active period of this meander levee, Hritz analyzed the positional relationship between it and ancient sites lying along its banks. She geo-referenced Adams's [1965] distribution maps of the ancient sites of the Land Behind Baghdad Survey located to the east of the present courses of the Tigris and the Diyala with a 3D contour map drawn from SRTM DEM data using GIS. She found that ancient sites from the 5th millennium BCE to the second half of the 3rd millennium BCE lie along banks of this levee. She concluded that this meander levee lying under the levee of the course of the Nahrawan canal must have been active during the same period, drying up until the levee was reutilized as the Nahrawan canal during the Sassanid Persian period. On the assumption that all meander levees of the fluvial network remaining to the west of the present course of the Tigris were ancient courses of the Euphrates, she concluded that the meander levee below that of the Nahrawan canal represents the ancient course of the Tigris and must have been active from the 5th millennium BCE to the second half of the 3rd millennium BCE to the east of the present course of the Tigris.

Boreholes were recently drilled in the Nahrawan region to obtain sedimentary samples for analyses by a team of 13 researchers, including Hritz, and their analyses indicated the possibility that the Nahrawan could have been a part of the ancient Tigris before it became a canal [Altaweel *et al*. 2019, 23–24, 32–33]. The sediment was analyzed for its structure, petrography, mineralogy, and microfossil remains, and absolute dates were obtained using accelerator mass spectrometry (AMS) where possible[21]. As a result, it became clear that the pattern of its channel and floodplain deposit indicates contributions from the Tigris and Diyala in about a 2:1 ratio between about 10500 and 5200 BCE. These dates are older than the 5th millennium BCE, so the possibility of the continuous existence of the ancient courses of the Tigris in the Nahrawan region after the 5th millennium BCE was not established.

Using GIS analyses, we observe that two factors make Hritz's reconstruction of the ancient course of the Tigris inconclusive. The first is that, using our SRTM DEM and ALOS DEM 3D contour maps to judge the reconstruction, it is not possible to find any fluvial meander levee

21) To perform radiocarbon dating, it is necessary to determine the amount of radiocarbon in a sample. This measurement can be performed either by measuring the radioactivity of the sample or by directly counting the radiocarbon atoms in AMS. Measuring the radioactivity of the sample works very well if the sample is large; however, less than 0.01% radiocarbon ions decay within 9 months. Thus, within a reasonable measurement time (typically a few weeks), only a very small proportion of radiocarbon atoms can be detected with this method. In principle, AMS can detect a much higher proportion (typically about 1% of the total), allowing sample sizes to be about 1000 times smaller (https://c14.arch.ox.ac.uk/ams.html).

connecting what Hritz assigns as the northern end of the fluvial levee of the ancient course of the Tigris with either the present course of the Tigris or any fluvial levee that can be identified with that of the ancient course of the Tigris in the upper reach region. The second factor relates to her dating of its ancient course. The possible active period for the fluvial levee of the ancient course of the Tigris was assessed by Hritz as falling from the 5th millennium BCE to the second half of the 3rd millennium BCE. However, she does not indicate where the ancient course of the Tigris flowed after this period. Without giving satisfactory explanations of these two factors, her reconstruction of the ancient course of the Tigris cannot be supported.

II.4. Reconstruction by J. Jotheri

Jotheri [2016, 151–156, figs. 4.29–4.35] argues that a string of four fragmentary fluvial meander levees of the ancient course of the Tigris can be identified to the south of Baghdad in four separately observed spots with the aid of QuickBird satellite images[22]. Therefore, he considers that this ancient course of the Tigris ran to the west of the present Tigris course from the south of Baghdad, passing several important sites by running to the east of Jemdet Nasr, to the west of Maškan-Šapir, east of Nippur, and to the east of Adab, subsequently disappearing under the sediments of the present Gharrāf Canal. He geo-referenced Adams's [1981] distribution maps of ancient sites of southern Mesopotamia and, in association with ancient sites aligned along a meander line connecting those four fragmentary fluvial meander levees, he dated this tentatively reconstructed ancient course of the Tigris from the mid-Holocene to the early 2nd millennium BCE.

He agrees with Cole and Gasche that this course of the Tigris was joined by the ancient course of the Euphrates (= *Purattum* of the Sippar branch = ÍD.UD.KIB.NUN.KI) south of Baghdad. However, he identifies this course as different from the large and wide fluvial levee of the ancient course that runs from southeast of Seleucia to the west of the present course of the Tigris, which Cole and Gasche identified as the levee of the joint flows of the Tigris and Euphrates's ancient courses. Like Hritz, he indicates that the levees of the fluvial network visible on the 3D contour map of SRTM DEM data in the region south of Baghdad are all those of the Euphrates (= *Purattum* of the Sippar branch = ÍD.UD.KIB.NUN.KI) from the period beginning from the late 1st millennium BCE. Jotheri, in fact, determined that the associated ancient sites geo-referenced from Adams's [1981] distribution maps of southern Mesopotamia along those levees of the fluvial network date to this period.

For the ancient course of the Tigris after the early 2nd millennium BCE, Jotheri [2016, 156–157, fig. 4.36] argues that the earlier course had changed its trajectory to become the present course of the Tigris. He considers that the present course of the Tigris would then have formed when the earlier course of the Tigris broke away south of Baghdad, presumably starting as a canal from the earlier main course and then becoming the main course itself.

His reconstruction of the ancient course of the Tigris is geo-referenced and recreated on the SRTM DEM 3D contour map (Fig. 2) with the first and second observed spots (his figs. 4.32–4.33) and on the SRTM DEM 3D contour map (Fig. 6) with first to fourth spots (his figs. 4.32–4.35), where Jotheri claims to have found fragmentary fluvial meander levees of the ancient course of the Tigris on QuickBird satellite images[23]. The four fragmentary fluvial meander levees identified by Jotheri are clearly discernible in the satellite image from World Imagery as well. Those levees certainly resemble the present course of the Tigris. Therefore, they appear to have belonged to the

22) For Quickbird, see https://www.arcgis.com/home/item.html?id=10df2279f9684e4a9f6a7f08febac2a9. It has very high resolution, with 61 centimeters for panchromatic data.

23) Jotheri's third observed spot is mistakenly designated in his fig. 4.31, where no fragmentary fluvial meander levee is discernible. He provides its accurate coordinates, 45°5'45".98"E and 32°24'28.69"N, which suggest that it is located at a point further south-southeast, see Fig. 6.

ancient course of the Tigris. However, no fluvial meander levees are discernible in the tentatively reconstructed ancient course connecting those four fragmentary fluvial meander levees on our SRTM DEM and ALOS DEM 3D contour maps, the satellite image from World Imagery, or the Corona satellite photographs.

Jotheri's dating method has a noticeable failing. He does not give a clear reason for his dating of the earlier course of the Tigris from the mid-Holocene to the early 2nd millennium BCE or of the later course from the early 2nd millennium BCE to the present. He notes that he geo-referenced Adams's [1981] distribution maps of ancient sites in southern Mesopotamia and used these to date the earlier and later courses of the Tigris. He classified and divided all of the ancient sites into only two groups, namely, sites dated from the 4th millennium BCE and sites dated from the late 1st millennium BCE. He only established that ancient sites dating back to the 4th millennium BC are aligned along the identified earlier course of the Tigris, and the ones dating back to the late 1st millennium BCE are aligned along the present course. We could not recreate how he determined the date for the change of the earlier course to the present course during the early 2nd millennium BCE. Using his method, we can only determine the date for the change of the earlier course to the present course in the late 1st millennium BCE, simply because he classified and divided ancient sites into only two groups[24)].

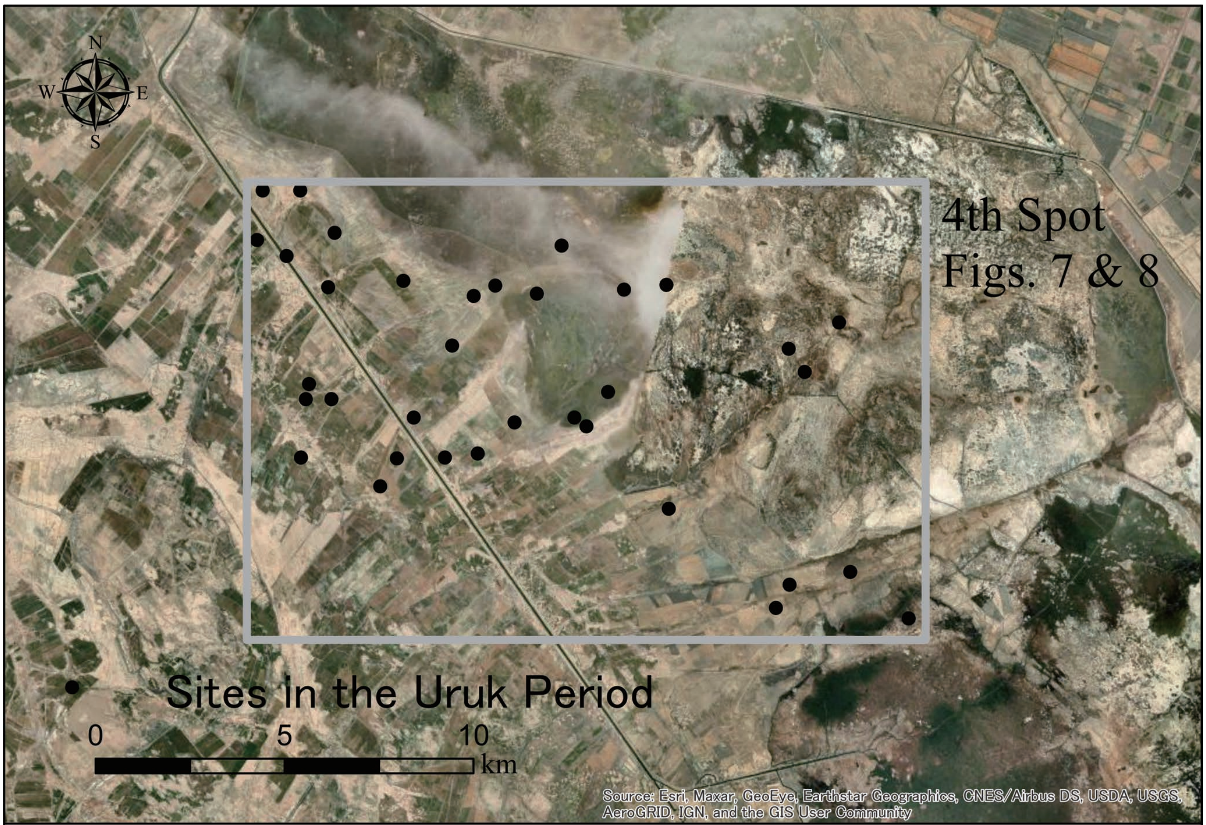
Boreholes were also drilled in the Dalmaj region just south of Baghdad to the west of the present course of the Tigris to obtain sedimentary samples for analyses by the same team of 13 researchers, which also included Jotheri as well as Hritz. The sediment of the Dalmaj region was analyzed in the same way as the sediment of the Nahrawan region, and absolute dates were obtained using AMS where possible [Altaweel *et al*. 2019, 23–24, 32–33]. Thus, it became clear that forward compositional modeling indicates equal contributions of the Euphrates and Tigris Rivers in the formation of Dalmaj sediment in the pre-Ubaid to Uruk period. Hence, the possibility of the continuous existence of the ancient course of the Tigris after the Uruk period was not established.

The fourth observed spot where Jotheri claimed to identify the fragmentary fluvial mender levee of the ancient course of the Tigris was reinvestigated by this article's author, and it was found that the fragmentary levee was likely from the Uruk period [Kawakami 2021, in press]. Comparative verification in GIS ascertains that the fragmentary levee discerned by Jotheri on the fourth observed spot is identical with a levee of an ancient watercourse earlier identified and reconstructed by Adams [1981, 56, 64–65, figs. 9, 12–14, map] from analyses of aerial photographs and field surveys. As discerned in the World Imagery Map (Fig. 7) and recreated on the SRTM DEM 3D contour map (Fig. 8), Adams identified a large number of ancient sites lying along the fragmentary fluvial meander levee left in the fourth observed spot, and he dated them to the Uruk period based on the typological analyses of pottery shards collected from their surface remnants; accordingly, he gave this fragmentary levee with the same date[25)].

24) Jotheri [2016, fig. 4.31] notes that Adams's [1981] distribution maps of ancient sites of southern Mesopotamia were used for the dating of the ancient and present courses of the Tigris and the levees of the fluvial network visible on the 3D contour map of SRTM DEM data in the region south of Baghdad. However, the distribution conditions of the ancient sites do not appear to be reflections of Adams's distribution maps of the ancient sites of southern Mesopotamia published in 1981. In the region to the north of Nippur, Adams and V. Crawford separately surveyed the distribution conditions and active periods of ancient sites in 1956–1957 and later published their distribution maps [Adams 1972, 182–28, map 1, maps 1A–1F].

Moreover, only 282 out of the 1567 ancient sites identified from aerial photographs and spotted on the distribution maps were actually visited and dated on the basis of typological analyses of pottery shards collected from their surface remnants. All 282 of these sites were overlaid on the SRTM and ALOS DEM 3D contour maps, and their distribution patterns were analyzed in relation to the fluvial levees of the ancient watercourses that are discernible in the north of Nippur. However, 282 was an insufficient number to obtain any useful results. Therefore, it is unclear where Jotheri takes the information for dates and distribution conditions of ancient sites given in his fig. 4.31. We suppose that he must have relied on the distribution maps of ancient sites and their information published in Arabic by Directorate General of Antiquities, Republic of Iraq [1970; 1976].

25) Figs. 7 and 8 are quoted from the author of this article's previous work [Kawakami 2021, in press, figs. 6.1–6.2].



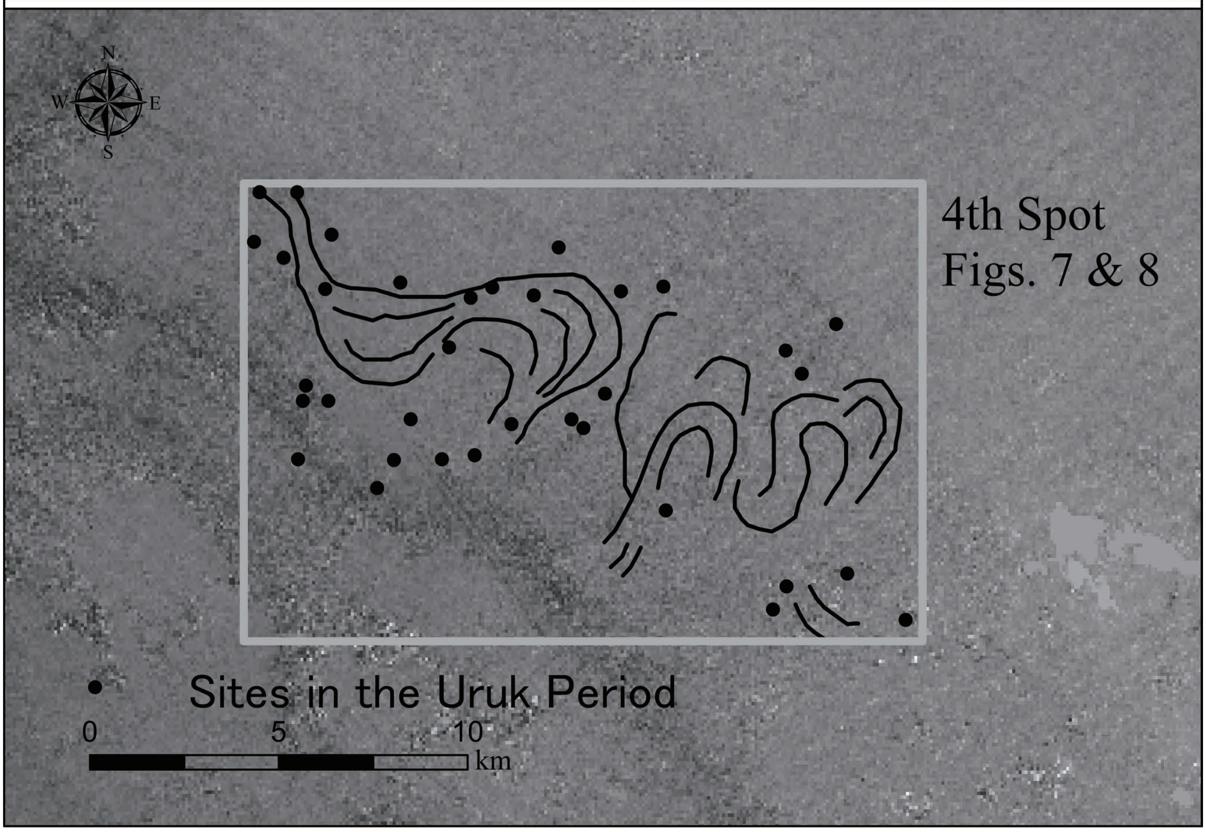


Fig. 7 World Imagery Map of Jotheri's Fourth Observed Spot with Processing (upper).
Fig. 8 SRTM DEM 3D Contour Map of Jotheri's Fourth Observed Spot with Processing (lower).

From Jotheri's reconstruction of the ancient course of the Tigris, his dating is certainly problematic. He identifies four fragmentary fluvial meander levees that appear to belong to the ancient course of the Tigris, but from borehole analyses, they appear to have belonged to the Uruk period, and the associated ancient sites on the fourth observed spot only accord with this date.

III. Positional Relationship with the Ancient Course of the Tigris Further to the Southeast

Further to the southeast in the southern part of southern Mesopotamia, historical geographical analyses were made by Biggs [1965, 95–102], Heimpel [1990, 204–213], and Steinkeller [2001, 22–84] to reconstruct the ancient course of the Tigris. Biggs's study of a letter from the Kassite period indicated that the Tigris may have flowed in the eastern vicinity of Nippur, west of its present course. In Heimpel's study on the documents of the Ur III period and later in Steinkeller's study of a large number of the documents of the same period found in Umma to reconstruct a route of riverine transportation of goods from Umma and/or its surrounding areas through KA-saḫar to Nippur and/or Esagdana, it has been presumed that the ancient course of the Tigris during this period extended from a point in the north-northwestern vicinity of Umma to Karkar and Adab in the further northwest, and then to a point 20–25 kilometers north-northwest of Nippur, west of its present course in the northern and central parts of Sumer in the southern part of southern Mesopotamia. Three documents given by Steinkeller are particularly important: *ASJ* 8: 68–69: i 3–4, MVN 15 94: iii 7–8, and Sigrist Yale 1452: 1–5[26]. In association with many other documents of the Ur III period found from Umma, the former two confirm the historical presence of the ancient course of the Tigris in the vicinity of Umma, Karkara, and probably Adab, and the latter confirms its historical presence in the vicinity of Nippur and Esagdana (= Puzriš-Dagan) [Steinkeller 2001, 33–34; Kawakami 2021, in press].

The majority of their views were reconfirmed by this article's author, who as mentioned above, employed the same GIS analyses as described in this article to discern the presence of an actual fluvial levee of the ancient course of the Tigris on the SRTM DEM and ALOS DEM 3D contour maps, satellite imagery from World Imagery, and Corona satellite photographs of the southern part of southern Mesopotamia, comparing it with the views of Biggs, Heimpel, and Steinkeller [Kawakami 2021, in press]. These previous research results are summarized here to indicate and verify which ancient course of the Tigris, as reconstructed by Adams, Cole and others, Hritz, and Jotheri in the northern part of southern Mesopotamia enables it to be joined to the ancient course of the Tigris in the region of its lower reaches in the southern part of southern Mesopotamia.

On the SRTM DEM 3D contour maps (Figs. 9 and 10), the region from Umma to Nippur and the further north are shown[27]. Fig. 9 presents the SRTM DEM 3D contour map without any processing. Fig. 10 is the processed SRTM DEM 3D contour map, on which both the present watercourses and the fluvial levees of ancient watercourses are traced and highlighted.

In Fig. 9, a fluvial levee of an ancient watercourse is clearly discernible at a location that is almost coincident with the ancient course of the Tigris, which Steinkeller, from the topographical information contained in the documents of the Ur III period, presumed that it extends from a point in the north-northwestern vicinity of Umma to Karkar and Adab in the further northwest and then to a point north-northwest of Nippur. The presence of the consistent fluvial levee is also discernible on the ALOS DEM 3D contour map. As indicated in Fig. 10 by a black and white line, the fluvial levee of this ancient watercourse extends for about 100 kilometers from a point 10 kilometers to the north-northwest of Umma through Karkar and Adab to a point 30 kilometers north-northwest of

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26) The abbreviations of these three texts are as per Steinkeller [2001, 22].

27) Fig. 9 is also quoted from fig. 2 of the author of this article's previous work, whereas Fig. 10 is a modified version of fig. 3 [Kawakami 2021, in press, figs. 2–3].

Nippur. The fluvial levee is particularly clear from a point 9 kilometers southeast of Adab to a point 30 kilometers north-northwest of Nippur. This fluvial levee is up to 2 kilometers wide, as measured by GIS. Therefore, the fluvial levee of this ancient watercourse can likely be identified with that of the ancient course of the Tigris, as Steinkeller concluded.

In addition, it is discernible on the SRTM DEM 3D contour map (Fig. 9) and on the ALOS DEM 3D contour map that the fluvial levee of this ancient watercourse, which extends from the north-northwestern vicinity of Umma to the north-northwest of Nippur, diverges in the direction of Nippur from a point 30 kilometers north-northwest of Nippur, as is also reconstructed in the form of a black dotted line on the SRTM DEM 3D contour map (Fig. 10). It then passes through the eastern vicinity of Nippur and rejoins the main stream near Adab.

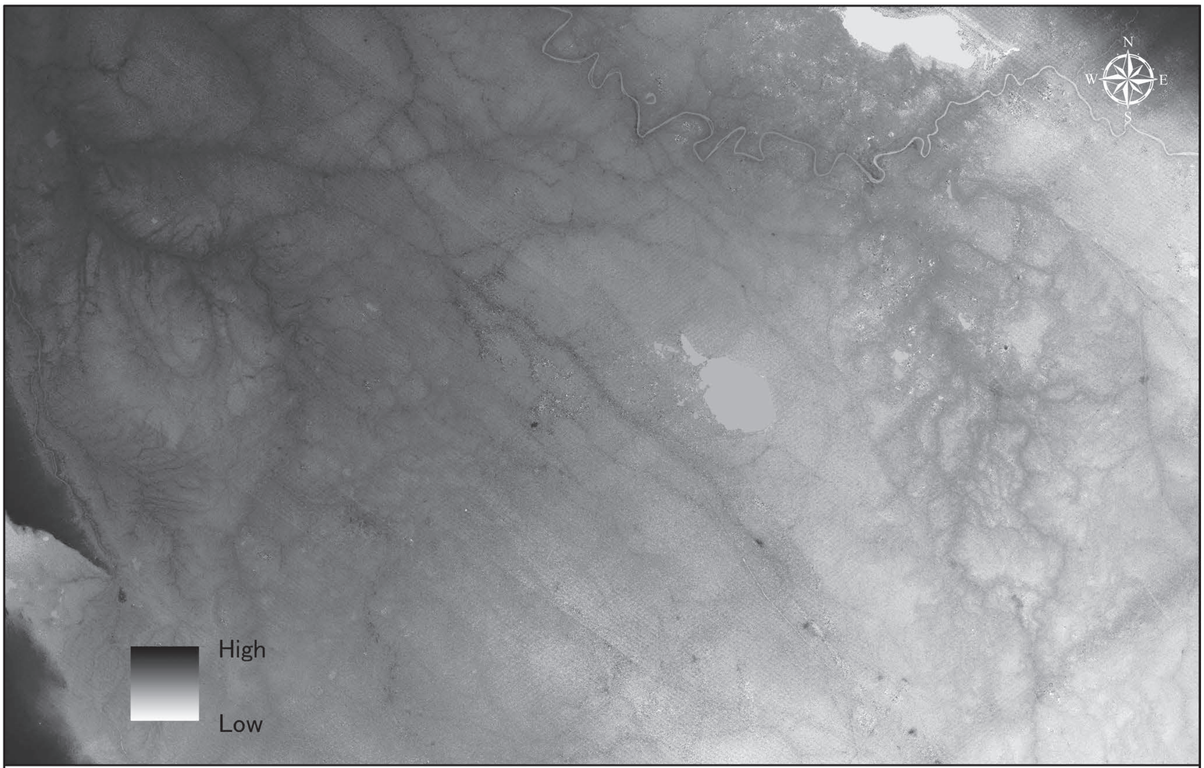
Comparative analyses were conducted to clarify the positional relationship between the fluvial levee of the ancient course of the Tigris, discerned on the SRTM DEM 3D contour map (Fig. 9) and the ALOS DEM 3D contour map with the distribution conditions of the ancient sites of the Ur III period [Kawakami 2021, in press]. Adams's [1981] distribution maps of ancient sites in the northern and central parts of Sumer were also used. These maps were geo-referenced using GIS, and only ancient sites dated to the Ur III period were overlaid on the SRTM and ALOS DEM 3D contour maps. Thus, it was found that the ancient sites of this period were distributed along the fluvial levee of the ancient course of the Tigris, as observed on the SRTM DEM 3D contour map (Fig. 11), on which ancient sites are overlaid that date back to the Ur III period[28]. This certainly demonstrates that the fluvial levee of the ancient course of the Tigris was the only major watercourse active in the northern and central parts of Sumer in the southern part of southern Mesopotamia during the Ur III period that could support habitation at that time in this region, and the surrounding land was irrigated with a number of canals from this watercourse.

In an area to the northeast of Nippur, a cross-section of the fluvial levee of the ancient course of the Tigris was investigated by Gibson and T. J. Wilkinson in 1990 [Wilkinson, Rayne, and Jotheri 2015, 406–409; Wilkinson and Jotheri in press]. Furthermore, at a point slightly to the southeast of the area northeast of Nippur that was investigated by Gibson and Wilkinson, a borehole survey was carried out by Jotheri [2016, 104–105]. It proved possible to discern that the course of the Tigris diverges toward Nippur from a point 30 kilometers to the north-northwest of Nippur. The bifurcated fluvial levee then passes through the eastern vicinity of Nippur and rejoins the fluvial levee of its main stream near Adab. A cross-section of this diverged fluvial levee at a point in the southwestern vicinity of Adab was investigated in 2013, and a borehole survey was also later carried out at the same point by Jotheri [2016, 104–105; Wilkinson and Jotheri in press].

Their investigations confirmed that the deposition process of the fluvial levees of the main stream and the tributary of the ancient course of the Tigris began in the later 5th millennium BCE and were continuously active until the first half of the 15th century CE. Therefore, the results of Gibson and Wilkinson's and Jotheri's investigations are additional confirmation that the fluvial levees of the main stream and tributary of the ancient course of the Tigris, discerned on the SRTM DEM 3D contour map (Fig. 9) and the ALOS DEM 3D contour map were definitively active in the northern and central parts of Sumer in the southern part of southern Mesopotamia during the Ur III period [Kawakami 2021, in press].

Looking further north than the location 30 kilometers to the north-northwest of Nippur, a number of fluvial levees of ancient watercourses are discernible on the SRTM DEM 3D contour maps (Figs. 9 and 12) and the ALOS DEM 3D contour map. Two of them join downstream to form the fluvial levee of the ancient course of the Tigris at a point 30 kilometers north-northwest of Nippur. One of them, which runs from the north-northwest, is connected in its upper reach with

28) Fig. 11 is also quoted from the author of this article's previous work [Kawakami 2021, in press, fig. 7].



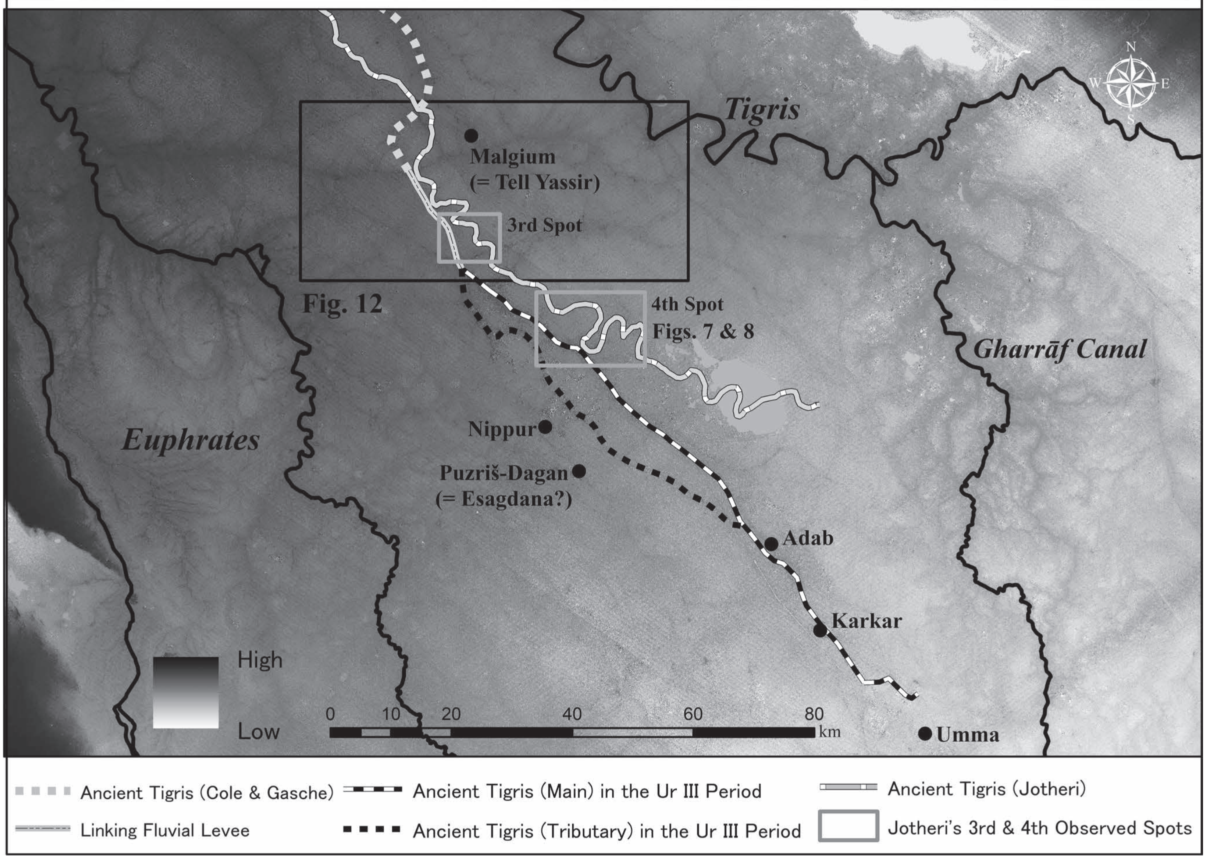


Fig. 9 SRTM DEM 3D Contour Map of the Southern Part of Southern Mesopotamia without Processing (upper).
Fig. 10 SRTM DEM 3D Contour Map of the Southern Part of Southern Mesopotamia with Processing (lower).

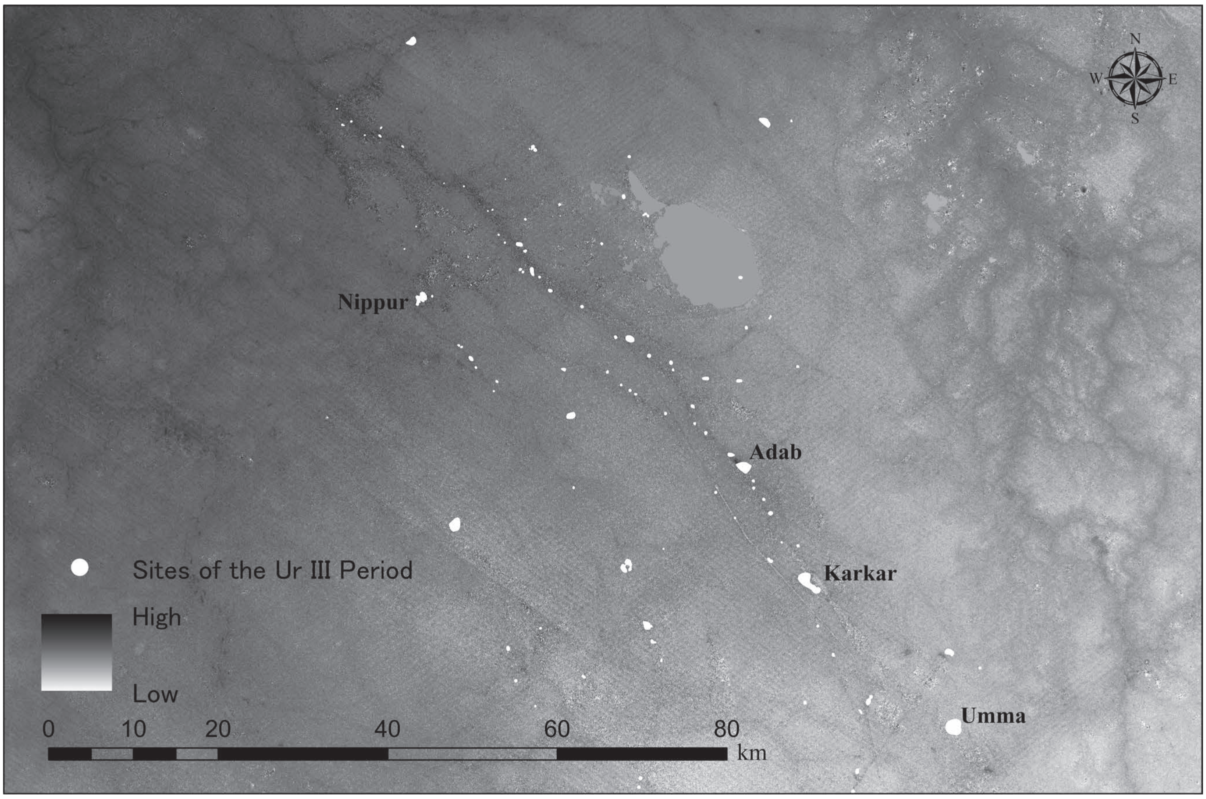


Fig. 11 SRTM DEM 3D Contour Map with Sites of the Ur III Period.

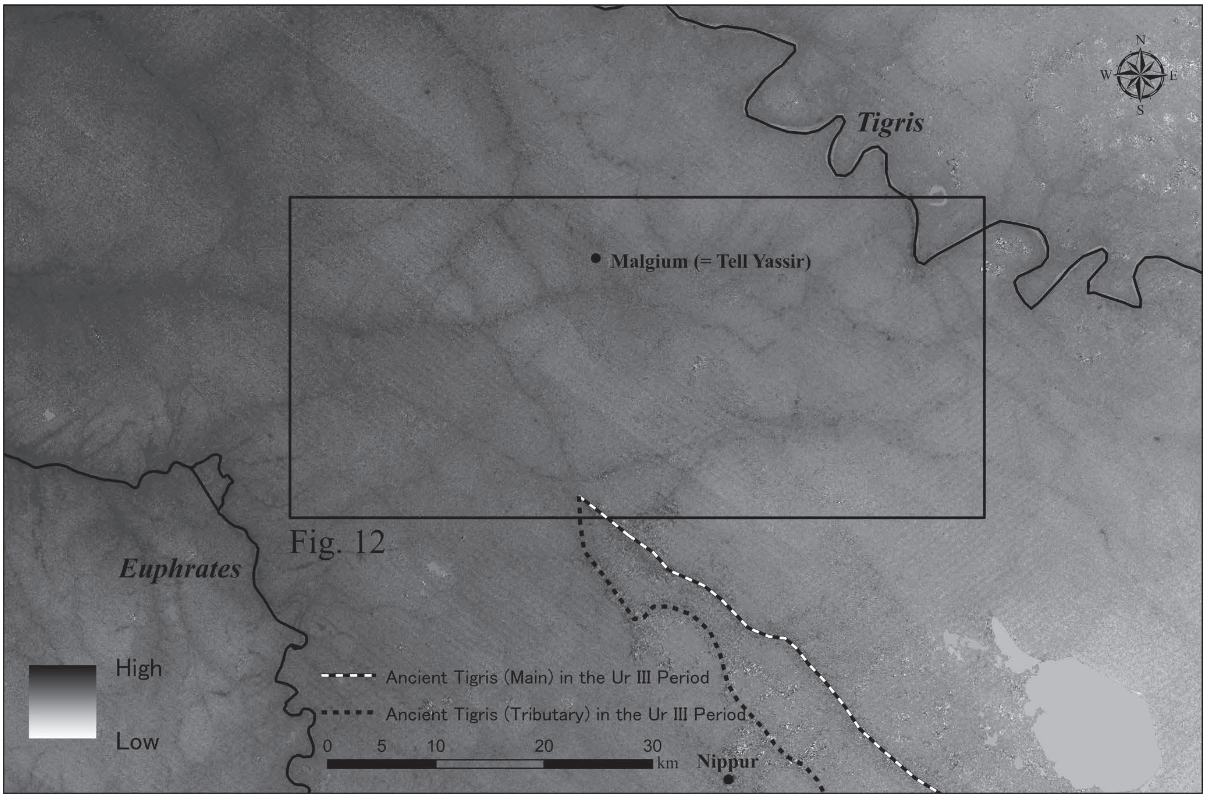


Fig. 12 SRTM DEM 3D Contour Map in the Vicinity of Malgium.

a large and wide fluvial levee, which Cole and Gasche identified with the joint flows of the Tigris and Euphrates's ancient courses. Cole and Gasche's large and wide fluvial levee is reconstructed as a grayish dotted line and the linking fluvial levee is reconstructed as a grayish line on the SRTM DEM 3D contour map (Fig. 10). This suggests that Cole and Gasche's reconstruction of the ancient course of the Tigris in the northern part of southern Mesopotamia is the most plausible.

However, it is not possible to determine the active periods of this linking fluvial levee and the large and wide fluvial levee of the joint flows of the Tigris and Euphrates's ancient courses identified by Cole and Gasche at a glance only on the SRTM DEM contour maps (Figs. 9 and 12) and the ALOS DEM 3D contour map. Hence, the need to clarify the histories of the depositional processes of these fluvial levees is a pressing concern. If the histories of these fluvial levees are dated back to the Ur III period, this enables us to confirm that they are the fluvial levees of the ancient course of the Tigris in the northern part of southern Mesopotamia. Accordingly, Cole, Gasche, Tanret, and Verhoeven's identification and reconstruction of the ancient course of the Tigris in the same region are certainly supported.

Furthermore, the historical presence of the ancient course of the Tigris at this linking point is confirmed. Malgium was recently identified with Tell Yassir with the discovery of royal inscriptions of early Old Babylonian kings of Malgium [Jawad *et al*. 2020, 65–86]. Royal inscriptions of the Ur III kings Šulgi and Šu-Suen were also discovered at the site, confirming that it was occupied before the end of the 3rd millennium BCE. Most importantly, its location in the vicinity of the ancient course of the Tigris was historically confirmed in a royal inscription clearly stating that the great wall of Malgium on the banks of the Tigris was destroyed. Its location is visible in the SRTM DEM 3D contour maps (Figs. 10 and 12) on the eastern bank of the ancient courses of the Tigris, as reconstructed by Cole and Gasche as well as Jotheri. Thus, in historical terms, Cole, Gasche, Tanret, and Verhoeven's and Jotheri's reconstructions of the ancient course of the Tigris are consistent, whereas Adams's and Hritz's reconstructions are not possible.

IV. Conclusion

The validity of four reconstructions of the ancient course of the Tigris proposed by Adams, Cole, Gasche, Tanret and Verhoeven, Hritz, and Jotheri in and around Baghdad and to its south in the northern part of southern Mesopotamia is verifiable using GIS analyses with the aid of SRTM DEM and ALOS DEM 3D contour maps, satellite imagery from World Imagery, and Corona satellite photographs. Adams established a possible ancient course of the Tigris to the east of its present course on the latitude between the north of Baghdad and the diversion point of the Gharrāf Canal from the present course of the Tigris from the beginning of the 4th millennium BCE until the Neo-Babylonian period, around the end of the 7th century BCE, afterward changing its flow in a westward direction to its present course. No fluvial levee that corresponds to Adams's reconstruction was found in the GIS analyses. Therefore, his reconstruction is inconclusive.

Cole, Gasche, Tanret, and Verhoeven proposed to reconstruct the ancient course of the Tigris from the north of Baghdad along its present course as far as the southeast of Seleucia and then to the further southeast, west of its present course from 2500 BCE until the first half of the 2nd millennium BCE. They demonstrated that the two tributaries of the Euphrates, the Irnina canal and ÍD.UD.KIB.NUN.KI. (= later *Purattum* of the Sippar branch) joined the ancient course of the Tigris. They proposed that the former joined at a point a few kilometers south of the confluence of the Diyala in an urban district of Baghdad, and the latter at a point southeast of Seleucia. Our GIS analyses did not identify the physical presence of any fluvial levee of the Irnina canal on their reconstructed line but could clearly establish the fluvial levee of ÍD.UD.KIB.NUN.KI. (= later *Purattum* of the Sippar branch) and its confluence with the present course of the Tigris southeast of Seleucia. Cole and Gasche also found a large and wide fluvial levee running southeast of the confluence of ÍD.UD.KIB.NUN.KI. (= later *Purattum* of the Sippar branch) with the present course of the Tigris, west of its present course. They inferred that this was likely created by joint flows of the ancient courses of the Tigris and Euphrates. This fluvial levee was also discerned in our analyses. Thus, their reconstruction of the ancient course of the Tigris appeared obviously plausible, apart from their reconstruction of the Irnina canal.

Hritz reconstructed the ancient course of the Tigris to the east of its present course under the levee of the course of the Nahrawan canal and dated it from the 5th millennium BCE to the second half of the 3rd millennium BCE. No fluvial meander levee connecting the northern end of the ancient course of the Tigris was reconstructed by Hritz in either its present course or any fluvial levee of the ancient course of the Tigris in its upper reach region. Moreover, she did not demonstrate the whereabouts of its course after the second half of the 3rd millennium BCE. Considering these factors, her reconstruction of the ancient course of the Tigris is not convincing.

Jotheri argued that the ancient course of the Tigris must have flowed from the south of Baghdad, west of the present course of the Tigris, to further south from the mid-Holocene to the early 2nd millennium BCE; subsequently, after the early 2nd millennium BCE, the earlier course changed trajectory and became the present course of the Tigris. Jotheri found four fragmentary fluvial meander levees resembling its present course in four separately observed spots south of Baghdad. Those fragmentary levees are clearly discerned on the satellite imagery from World Imagery by our GIS analyses. However, no fluvial meander levee was discernible under his tentatively lined ancient course connecting these four fragmentary fluvial meander levees. Additionally, no fluvial meander levee connecting the northern end of Jotheri's tentatively reconstructed ancient course of the Tigris with either its present course or any fluvial levee of the ancient course of the Tigris in its upper reach region were evident. Unfortunately, his dating of the reconstructed earlier and later ancient courses of the Tigris is problematic and cannot be supported. The four fragmentary fluvial meander levees identified resemble its present course. Thus, they appear to belong to the ancient course of the Tigris. However, the borehole analyses and the associated ancient sites on the fourth observed spot indicated that those four fragmentary fluvial meander levees belong to the much earlier Uruk period. These factors make his reconstruction of the ancient course of the Tigris inconclusive.

Thus, only Cole, Gasche, Tanret, and Verhoeven's reconstruction of the ancient course of the Tigris along its present course is ultimately the most plausible candidate. Moreover, their reconstruction can be directly connected to its present course upward in the region of its upper reach.

Finally, the locations of the four reconstructions of the ancient course of the Tigris proposed by Adams, Cole and others, Hritz, and Jotheri were compared with their southeastern counterpart in the southern part of southern Mesopotamia. From Steinkeller's study of a large number of the documents of the Ur III period found from Umma, it was presumed that the ancient course of the Tigris during this period extended from a point in the north-northwestern vicinity of Umma to Karkar and Adab in the further northwest and then to the north-northwest of Nippur, west of its present course. This author's previous study reconfirmed most of Steinkeller's view and identified the physical presence of the fluvial levee corresponding Steinkeller's presumed ancient course of the Tigris in the Ur III period. A linking fluvial levee that connects the northwestern end of the fluvial levee of the ancient course of the Tigris of the Ur III period in the south with the southeastern end of the large and wide fluvial levee of the joint flows of the ancient courses of the Tigris and Euphrates, as identified by Cole and Gasche, was discerned by our GIS analyses. Moreover, the historical presence of the ancient course of the Tigris in this linking point was confirmed with the recently identified location of Malgium with Tell Yassir with the discovery of the royal inscription of the early Old Babylonian king of Malgium, stating its location in the vicinity of the ancient course of the Tigris.

Ultimately, we made clear that Adams's and Hritz's reconstructions, which place the ancient course of the Tigris to the east of its present course, are not in accord with the location of the ancient course of the Tigris in the southern part of southern Mesopotamia and in the vicinity of Malgium. Thus, their views cannot be supported. Instead, the location of the ancient course of the Tigris in the south was found to be consistent with Cole and others' and Jotheri's reconstructions of the ancient course of the Tigris in the north.

In conclusion, having comprehensively considered each perspective, Cole, Gasche, Tanret, and Verhoeven's reconstruction of the ancient course of the Tigris in the northern part of southern Mesopotamia seems to be the most plausible. To further confirm the whereabouts of the location of the ancient course of the Tigris in this region, two things must be determined, namely, (1) the dates of the large and wide fluvial meander levee that runs to the southeast of the ancient site of Seleucia— identified by Cole and Gasche—with the joint flows of the Tigris and Euphrates's ancient courses and (2) the linking fluvial levee that connects the former with the ancient course of the Tigris in the Ur III period—presumed by Steinkeller—along with its physical presence in the southern part of southern Mesopotamia—reconfirmed by this article's author. If both fluvial levees can be dated back to the Ur III period, this would verify the correctness of Cole and others' reconstruction of the ancient course of the Tigris. If the dates cannot be established to the Ur III period, the majority of fluvial levees of the ancient course of the Tigris in the northern part of southern Mesopotamia must have varied and erased as suggested by Jotheri; accordingly, only four fragmentary fluvial meander levees could be identified in the four observed spots. Therefore, this indicates that its fluvial levees are no longer discernible in GIS analysis.

As noted above, Huritz, Jotheri, and others have conducted sediment investigations of the levees of the ancient courses of the Tigris in the Nahrawann and Dalmaj regions and analyzed sediment to identify active periods [Altaweel *et al*. 2019, 23–24, 32–33]. The same investigation was also carried out on the levees of the ancient course of the Euphrates [Jotheri *et al*. 2017, 1–13; Jotheri, Allen, and Wilkinson 2015, 1–19]. If this type of investigation were to be performed across the large and wide fluvial meander levee of the joint flows of the ancient course of the Tigris and Euphrates identified by Cole and Gasche and the linking fluvial levee that joins the former with the ancient course of the Tigris of the Ur III period in the region of the lower reach, a more accurate identification and reconstruction of the ancient course of the Tigris would be possible in this region.

Bibliography

Adams, R. McC.

1957a A Reconnaissance of Early Settlements and Watercourses in Central Iraq, in H. Franke (ed.), *Akten des vierundzwanzigsten Internationalen Orientalisten Kongresses*, 139–141. Wiesbaden: Deutsche Morgenländische Gesellschaft, in Kommission bei Franz Steiner Verlag.

1957b Settlements in Ancient Akkad, *Archaeology: A Magazine Dealing with the Antiquity of the World* 10, 270–273.

1958 Survey of Ancient Water Courses and Settlements in Central Iraq, *Sumer* 14, 101–103.

1965 *Land Behind Baghdad*. Chicago and London: The University of Chicago Press.

1972 APPENDIX V. Settlement and Irrigation Patterns in Ancient Akkad, in McG. Gibson, *The City and Area of Kish*, 182–208 and Maps 1A-1F. Miami: Coconut Grove.

1981 *Heartland of Cities*. Chicago and London: The University of Chicago Press.

Altaweel, M., Marsh, A., Jotheri, J., Hritz, C., Fleitmann, D., Rost, S., Lintner, S. F., Gibson, McG., Bosomworth, M., Jacobson, M., Garzanti, E., Limonta, M., and Radeff, G.

2019 New Insights on the Role of Environmental Dynamics Shaping Southern Mesopotamia: From the Pre-Ubaid to the Early Islamic Period, *Iraq* 81, 23–46.

Bagg, A. M.
2014–2016 Tigris B, in E. Ebeling and B. Meissner (Hrsg.), *Reallexikon Der Assyriologie und Vorderasiatischen Archäologie* 14, 28–30. Berlin and Boston: De Gruyter.

Bauer, J.
1972 *Altsumerische Wirtschaftsiexte aus Lagasch*. Rome: Biblical Institute Press.

Biggs, R. D.
1965 A Letter from Kassite Nippur, *Journal of Cuneiform Studies* 19, 95–102.

Carroué, F.
1991 Études de géographie et de topographie sumériennes II. À la recherche d'Euphrate au IIIe millénaire, *Acta Sumerologica* 13, 111–156.

Cavigneaux, A., Güterbock, H. G., Roth, M. T., and Ferber, G.
1985 *The Series Erim-ḫuš = anantu and An-ta-gál = šaqû*, Materialien zum sumerischen Lexikon XVII. Rom: Pontificium Institutum Biblicum.

Cole, S. W. and Gasche, H.
1998 Second- and First-Millennium BCE Rivers in Northern Babylonia, in H. Gasche and M. Tanret, (eds.), *Changing Watercourses in Babylonia: Towards a Reconstruction of the Ancient Environment in Lower Mesopotamia* vol. 1, 1–64. Ghent and Chicago: University of Ghent.
1999 Levees, Floods and the River Network of Northern Babylonia: 2000–1500 and 1000–500BCE. - A Preliminary Report, in J. Renger, (Hrsg.), Colloquien der deutschen Orient-Gesellschaft Band 2, *Babylon: Focus Mesoptamischer Geschichte, Wiege Früher Gelehrsamkeit, Mysos in der Moderne*, 87–110. Saarbrücken: SDV, Saarbrücker Dr. und Verl.
2001 Irnia, Zubi and Other Watercourses in the Area North of Sippar. A Summary, in C. Breniquet and Ch. Kepinski, (eds.), *Études Mésopotamiennes: Recueil de textes offert à Jean-Louis Huot*, 197–210. Paris: Recueil de textes offert à Jean-Louis Huot.

Cole, S. W., Gasche, H., Tanret, M., and Verhoeven, K.
2002 Fleuves du temps et de la vie. Permanence et instabilité du réseau fluviatile baylonien entre 2500 et avant notre ère, *Annales, Histore Sciences Sociales* 57, 531–544.

Deimel, A.
1928 *Šumerisches Lexikon II Teil*, Vollständige Ideogramm-Sammlung Bd. 1, Roma: Verlag des Päpstlichen Bibelinstituts

Directorate General of Antiquities, Ministry of Information, Republic of Iraq
1970 *Archaeological Sites in Iraq*. Baghdad: Al-Huria Printing House, Al-Jumhuriya Press.
1976 *Atlas of the Archaeological Sites in Iraq*. Baghdad: Al-Huria Printing House, Al-Jumhuriya Press.

Edzard, D. O., Farber, G., and Sollberger, E.
1977 *Die Orts- und Gewässernamen der präsargonischen und sargonischen Zeit*, Répertoire Géographique des Textes Cunéiformes 1. Wiesbaden: Dr. Ludwig Reichert Verlag.

Farber, G. and Röllig, W.
1992 Babylonien, Akkade- und Ur III-Zeit: Politische Organization des Reiches von Ur III, *Tübinger Atlas des Vorderen Orients*, B II 9. Wiesbaden: Reichert.

Finkbeiner, U. and Groneberg, B.
1991 Mesopotamien in altbabylonischer Zeit, *Tübinger Atlas des Vorderen Orients*, B II 12. Wiesbaden: Reichert.

Frayne, D. R.
1992 *The Early Dynastic List of Geographical Names*, American Oriental Series 74. New Heaven, Connecticut: American Oriental Society.

Gelb, I. J., Landsberger, A., and Oppenheim, A. L.
1961 *The Assyrian Dictionary of the Oriental Institute of the University of Chicago*, vol. 21. Chicago and Glückstadt: The Oriental Institute of the University of Chicago.

Gibson, McG.
1972a *City and Area of Kish*. Miami: Coconut Grove.
1972b The Archaeological Uses of Cuneiform Documents, *Iraq* 34, 113–123.

Groneberg, B.
1980 *Die Orts- und Gewässernamen der altbabylonischen Zeit*, Répertoire Géographique des Textes Cunéiformes 3. Wiesbaden: Dr. Ludwig Reichert Verlag.

Hallo, W. W.
1964 The road to Emer, *Journal of Cuneiform Studies* 18, 57–88.

Heimpel, W.
1990 Ein zweiter Schritt zur Rehabilitierung der Rolle des Tigris in Sumer, *Zeitschrift für Assyriologie und Vorderasiatische Archäologie* 80, 204–213.
2014–2016 Tigris A, in E. Ebeling and B. Meissner (Hrsg.), *Reallexikon Der Assyriologie und Vorderasiatischen Archäologie* 14, 24–28. Berlin and Boston: De Gruyter.

Heyvaert, V. M. A. and Baeteman, C.
2008 A Middle to Late Holocene Avulsion History of the Euphrates River: A Case Study from Tell ed-Dēr, Iraq, Lower Mesopotamia, *Quaternary Science Review* 27, 2401–2410.

Hirschfeld, Y.
1997 Tigris, in E. M. MEYERS (ed.), *The Oxford Encyclopedia of Archaeology in the Near East*, vol. 5, 206–209. New York and Oxford: Oxford University Press.

Hritz, C.
2005 *Landscape and Settlement in Southern Mesopotamia: A Geo-Archaeological Analysis* vols. 1 and 2 (Doctoral Thesis at The University of Chicago). Chicago.
2006 The Changing Mesopotamian Landscape as Seen from Spot and Corona Images, in M. Mehrer and C. Wolcott (eds.), *GIS and Archaeological Site Location Modeling*, 413–436. Boca Raton, London, and New York.
2010 Tracing Settlement Pattern and Channel Systems in Southern Mesopotamia Using Remote Sensing, *Journal of Field Archaeology* 35(2), 184–203.
2014 Contributions of GIS and Satellite-based Remote Sensing to Landscape Archaeology in the Middle East, *Journal of Archaeological Research* 22, 229-276.

Jacobsen, Th.
1957 Early Political Development in Mesopotamia, *Zeitschrift für Assyriologie und Vorderasiatische Archäologie* 52, 91–140.
1960 Water of Ur, *Iraq* 22, 174–185.
1969 A Survey of the Girsu (Telloh) Region, *Sumer* 25, 103–109.

Jacobsen, Th. and Adams, R. McC.
1958 Salt and Silt in Ancient Mesopotamian Agriculture, *Science, New Series* 128, 1251–1258.

Jawad, A. A., Al-Reza, B. A., Nasir, A. J., As'id, A. A., and de Bore, R.
2020 The Discovery of the Location of Malgium (Tell Yassir), *Journal of Cuneiform Studies* 72, 65–86.

Jotheri, J.
2016 *Holocene Avulsion History of the Euphrates and Tigris Rivers in the Mesopotamian Floodplain* (Doctoral Thesis at Durham University). Durham.

Jotheri, J., Allen, M. B., and Wilkinson, T. J.
2015 Holocene Avulsions of the Euphrates River in the Najaf Area of Western Mesopotamia: Impacts on Human Settlement Patterns, *Geoarchaeology - An International Journal* 31, 1–19.

Jotheri, J., Altaweel, M., Tuji, A., Anma, R., Pennington, B., Rost, S., and Watanabe, C.
2017 Holocene Fluvial and Anthropogenic Processes in the Region of Uruk in Southern Mesopotamia, *Quaternary International: the Journal of the International Union for Quaternary Research* 30, 1–13.

Kawakami, N.
2021 Reconstructing the Ancient Course of the Tigris in the Northern and Central Parts of Sumer in the UR III Period Using a GIS Analysis, *Mesopotamia* 56, in press.

Kraus, F. R.

1955 Provinzen des neusumerischen Reiches von Ur, *Zeitschrift für Assyriologie und Vorderasiatische Archäologie* 51, 45–75.

1977 *Briefe aus dem British Museum* (CT 52), Altbabylonische Briefe in Umschrift und Übersetzung Heft 7. Leiden: E. J. Brill.

Landsberger, B. and Gurney, O. R.

1957–1958 Practical Vocabulary of Assur, *Archiv für Orientforschung* 18, 328–341.

del Monte, G. F. and Tischler, J.

1978 *Die Orts- und Gewässernamen der hethitischen Texte*, Répertoire Géographique des Textes Cunéiformes 6. Wiesbaden: Dr. Ludwig Reichert Verlag.

Nashef, K.

1983 Babylonien und Assyrien in der zweiten Hälfte des zweiten Jahrtausends v. Chr., *Tübinger Atlas des Vorderen Orients*, B III 7. Wiesbaden: Reichert.

Nissen, H. J.

1972 Continuity and Change in Early Historic Settlements and Watercourses, in R. McC. Adams and H. J. Nissen, *The Uruk Countryside*, 35–54. Chicago and London: The University of Chicago Press.

1976 Geographie, in S. J. Lieberman (ed.), S*umerological Studies in Honor of Thorkild Jacobsen on his Seventieth Birthday, June 7, 1974*, Assyriological Studies 20, 9–40. Chicago: The University of Chicago Press.

1988 *The Early History of the Ancient Near East 9000–2000 B.C*. Chicago and London: The University of Chicago Press.

Paepe, R.

1971 Geological Approach of the Tell ed-Dēr Area, Mesopotamian Plain, Iraq, in H. Gasche, L. de Meyer, and R. Paepe, *Tell ed-Der I*, 9–27. Leuven: Peeters.

Pournelle, J.

2003 *Marshland of Cities: Deltaic Landscapes and the Evolution of Early Mesopotamian Civilization* (Doctoral Thesis at The University of California). California.

Postgate, J. N.

1976 Inscriptions from Tell Al-Wilayah, *Sumer* 32, 77–100.

Roaf, M.

1990 *Cultural Atlas of Mesopotamia and the Ancient Near East*. Oxford and New York: Facts on File.

Röllig, W.

1988 Mesopotamien, Frühdynastische Zeit, *Tübinger Atlas des Vorderen Orients* B II 7. Wiesbaden: Reichert.

1991 Mesopotamien, Akkade- und Ur III-Zeit, *Tübinger Atlas des Vorderen Orients*, B II 8. Wiesbaden: Reichert.

Steinkeller, P.

1980 On the Reading and Location of the Toponyms ÚRxÚ.KI and A.ḪA.KI, *Journal of Cuneiform Studies* 32, 23–33.

2001 New Light on the Hydrology and Topography of Southern Babylonia in the Third Millennium, *Zeitschrift für Assyriologie und Vorderasiatische Archäologie* 91, 22–84.

2005 Larak and the “Old Tigris”, *Nouvelles Assyriologiques Brèves et Utilitaires* 2005, 32–33.

Walker, C. B. E.

1976 *Old Babylonian Letters*, Cuneiform Texts from Babylonian Tablets in the British Museum Part 52. London: Trustees of the British Museum.

Wall-Romana, C.

1990 An Areal Location of Agade, *Journal of Near Eastern Studies* 49, 205–245.

Wilkinson, T. J. and Jotheri, J.

in press The Origins of Levee and levee-Based Irrigation in the Nippur Area-Southern Mesopotamia, in M. Altaweel and C. Hritz (eds.), *Cycles and Stages in Jeeps and Passats: Studies in the Ancient Near East in Honour of McGuire Gibson*. Chicago: The University of Chicago Press.

Wilkinson, T. J., Rayne, L., and Jotheri, J.
2015 Hydraulic Landscapes in Mesopotamia: The Role of Human Niche Construction, *Water History* 7, 397–418.

Zadok, R.
1978 The Nippur Region During the Late Assyrian, Chaldean and Achaemenian Periods Chiefly According to Written documents, *Israel Oriental Studies* 8, 266–332.
1985 *Geographical Names According to New- and Late-Babylonian Texts*, Répertoire Géographique des Textes Cunéiformes 8. Wiesbaden: Dr. Ludwig Reichert Verlag.

Zarins, J.
1997 Euphrates, in E. M. Meyers (ed.), *The Oxford Encyclopedia of Archaeology in the Near East*, vol. 2, 287–290. New York and Oxford: Oxford University Press.

STONE BALANCE WEIGHTS FROM AREA A OF ‘USHIYEH

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Introduction

Weights for balance scales were undoubtedly created as a result of economic activity and were used to weigh wool and metal. In Mesopotamia, “talent”, “mina”, and “shekel” have long been known as units of weight, and studies on their weights and measures have revealed their weight in studies such as Powell [1971]. On the other hand, they are not always the same in each region. There are still under discussion. Studies of balance weights themselves have been reported in various regions such as South Mesopotamia, Anatolia, and Syria. In fact, Hafford is studying the weights of Tepe Gawra [Hafford 2019] in Northern Mesopotamia, Nippur and Ur [Hafford 2005, 2012 and 2019][1)] in Southern Mesopotamia, as well as Ascalone and Peyronel for Ebla in Syria [Ascalone and Peyronel 2001; 2006a and 2006b], and Kulakoğlu for Kültepe-Kanesh in Anatolia [Dercksen 1996[2)]; Kulakoğlu 2017]. In addition, Baratash’s research studies who measured how and who measured it from the cuneiform texts of the third millennium B.C. [Bartash 2019]. Melein is also studying a wide range of areas, focusing on iron oxide rock, which is often used for balance weights [Melein 2018]. Therefore, the main aim of this paper is to publish data on 26 balance weights excavated from Area A of ‘Usiyeh, which only photographs have been published so far, and to add some consideration based on above the previous studies.

Outline of the site and the find spots

The site ‘Usiyeh was located on a right bank river-terrace of the Euphrates River between Haditha and Anah[3)] and excavated by the Japanese Archaeological Expedition of Kokushikan University, under the direction of late professor Hideo Fujii, between 1982 and 1983 [Fujii *et al.* 1984/85: p. 111; K. and H. Oguchi 2006: pp. 157–189]. The excavation was carried out a part of the Haditha Dam Salvage Project of Iraq. Therefore, the site now submerged beneath the waters of Lake Qadisiyah. The site had a vast area of about 1200 m north-south and about 1000 m east-west protruding due to the meandering of the Euphrates River, and the highest excavation area about 137 m above sea level was named Area A [Fujii *et al.* 1984/85: p. 112].

In the northeast side of Area A, mainly two superimposed structures were discovered[4)]. The lower structure that we have called an underground structure, and the upper is a circular structure consisting of a gypsum-plastered floor fringed with large stone slabs, together with medium and small stones, and a stone staircase and a drainage system [K. and H. Oguchi 2006: p. 161ff.]. The underground structure had been constructed in a rectangular shaft, 6.8 × 5.5 m, dug into natural soil to a depth of 2.5 m [ibid.: pp. 162–165]. The structure had been consisted by two parts built by

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1) His studies include the balance weights of the Uluburun shipwreck and the Cape Gelidonya shipwreck, the island of Keos and Cyprus.

2) Dercksen summarises the hematite balance weights excavated from the Kültepe-Kanesh area [1996: pp. 251–252]. It contains data on a total of 87 balance weights, including eight from Stratum Ia, two from the surface collection, as well as those from Stratum Ib and Stratum II in the Kültepe-Kanesh area. There were 31 balance weights from Stratum Ib, of which 30 were made of hematite, and 25 from Stratum II, of which 22 were made of hematite (two were duck-shaped). The location of the other finds is unknown.

3) It was located about 30 km northwest of Haditha and about 30 km southeast of Anah, that is, 34 degrees 20 minites north longitude and 42 degrees 7 minutes 30 seconds east longitude.

4) Please refer to K. and H. Oguchi [2006] and Agha [1987/88] for the excavation information of the other parts and Areas of ‘Usiyeh.

piling up large and flat limestones. One of the part was consists of a pair of chambers (Rooms W and S) with a front open space (Forecourt Doorway: F. D.) of the entrance of these, and the other was three connected chambers (Rooms N, E and M). The underground structure has been used several times and was destroyed each time. On the other hand, it is known that the times of these destructions are not so far apart, and it is believed that the time from the first construction to the last destruction is within the first quarter of the second millennium B.C. In other words, it is from the Isin-Larsa to the Old Babylonian periods [ibid.: pp. 168–171 and 174: Table 1]. Usage of the underground structure is considered to be a tomb. It is believed that the chambers Room W (RW) and Room S (RS) were used for the burial itself, and chambers Room N (RN), Room E (RE) and Room M (RM) contained the accompanying furniture and other burial goods. However, since it has been destroyed so much, the excavation of human bones has not been confirmed. On the other hand, although it was destroyed, many luxurious burial goods such as cylinder seals, beads and pottery were discovered, and it is thought that it was the tomb of the upper class.

Of the 26 balance weights reported this time, ten examples (Figs. 1 and 2: 4, 7, 9–12 and 16 and 20–22) were discovered from the F. D.; as well as one (Figs. 1 and 2: 19, and Fig. 4) from the chamber RW; four (Figs. 1 and 2: 2, 6, 17 and 3: 1) from the chamber RS, two (Figs. 1 and 2: 5, 8) from the chamber RM; one (Figs. 1 and 2: 14) from the Chamber RE, and one (Figs. 1 and 2: 13) from relative place of the underground structure. In other words, 19 of 26 balance weights discovered from Area A were excavated from relatively deep points or directly above the original floor, *in situ*, of the underground structure. It can be pointed out that one (Figs. 1 and 2: 13) example may have risen to the upper debris when the underground structure were destroyed. The other one example (Figs. 1 and 2: 18) was found in the buried soil of a pit (D3) of the drainage system associated with above-mentioned upper level, and one example (Figs. 1 and 2: 3) was found in the debris in the southeast of the underground structure. Unfortunately, the finding spots of the

Fig. 1 Hematite balance weights from Area of ‘Usiyeh.

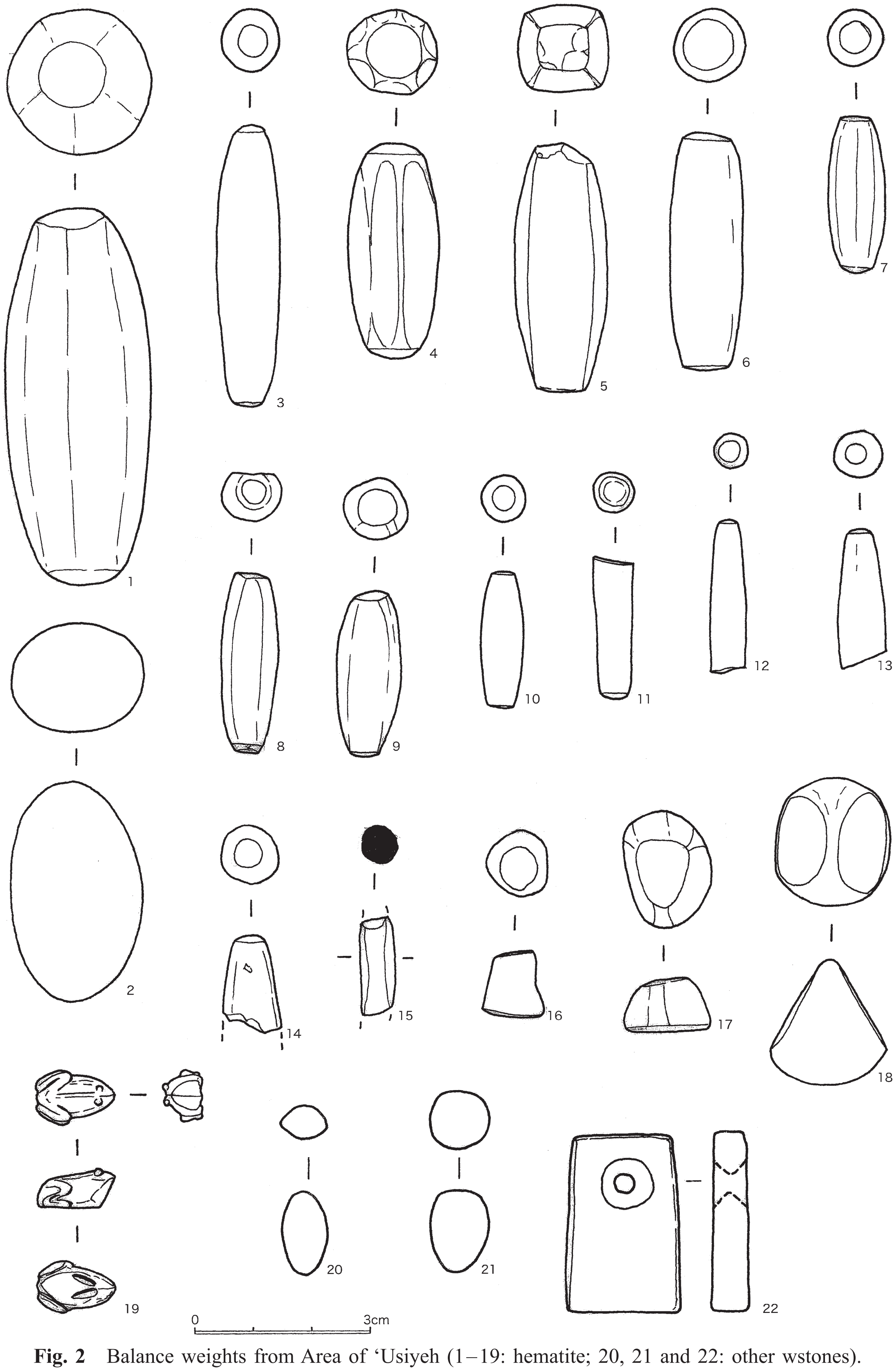

Fig. 2 Balance weights from Area of ‘Usiyeh (1–19: hematite; 20, 21 and 22: other wstones).

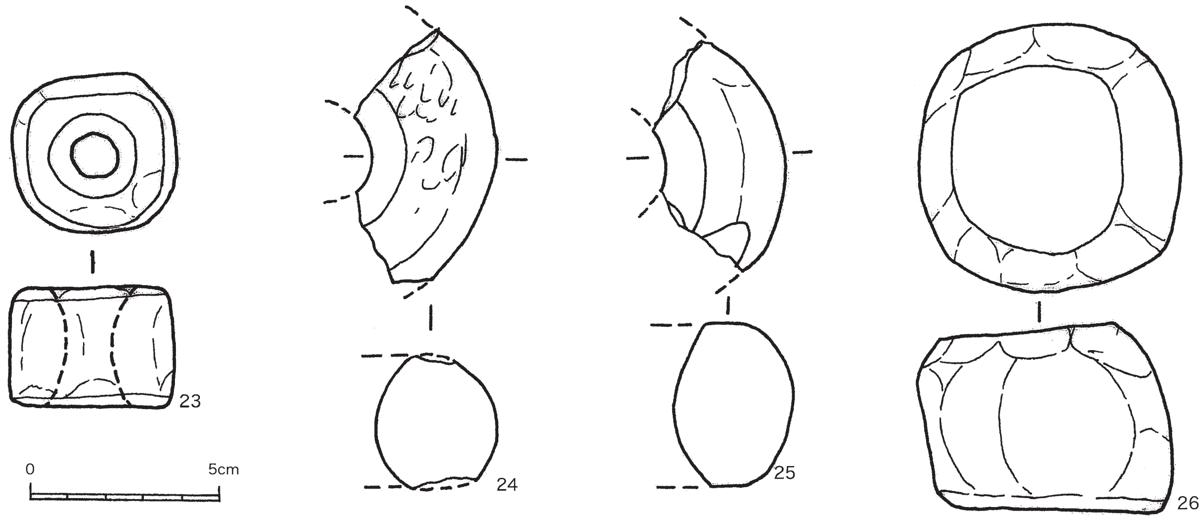

Fig. 3 Stone weights from Are A of 'Usiyeh.

other four examples are unknown. Among them, three (Fig. 3: 24, 25 and 26) are relatively heavy balance weights and may not be equated, but it is likely that they were related to the underground structure, including the other one (Figs. 1 and 2: 15). In other words, it is no exaggeration to say that everything except one (Figs. 1 and 2: 18) were probably related to the underground structure. If the underground structure was a tomb, then these balance weights were part of the tomb's burial goods.

Material for balance weights

Balance weights are generally made of stone or metal and not all shapes are the same [Melein 2018: p. 32], but here we will explain hematite[5], which is the most common material of the balance weights in the early second millennium B.C.[6]. Similar to these trends, 19 of 26 balance weights excavated at 'Usiyeh were made of hematite. Hematite was called Šadānu in Akkadian and $^{NA\ 4}$KA.GI.NA in Sumerian [ibid.: p. 109].

Iron oxide rocks are not present in Mesopotamia, but the powder have long been used as a pigment in painted pottery and for mainly medical-magical [ibid.: p. 124]. According to Melein, the use of iron oxide rock began in Syria in the 7th millennium B.C. [ibid.: p. 109[7]]. It seems that it was a long time later to process the hematite mass itself to make a product. The origin of iron oxide rocks brought to Mesopotamia is thought to be from the Zagros Mountains, Elburz Mountains, Taurus Mountains and the limestone plateau bordering the Euphrates valley near Tell Bazi, Syria [ibid.]. Although it is difficult to know the place of origin by analysis, it is highly possible that the place of origin is relatively close to the Taurus Mountains and the vicinity of Tell Bazi, considering the location of 'Usiyeh.

Hematite is believed to have begun to be used primarily as a material for cylinder seals, around the end of the third millennium B.C. This is because hematite is hard (Mohs hardness 5 to 6.5) and delicate processing is technically difficult, so it lags behind other soft stones. Hematite, with its

5) According to Melein, "hematite", "goethite", and "magnetite" cannot be visually distinguished. She also argues that for the term "iron oxide rock" should be used as a comprehensive term for these unanalysed archaeological finds. The stone weights excavated from 'Usiyeh have not been analysed, and we thought that the term "iron oxide rock" should be used, but in this article to the 'Usiyeh's examples, we use the term "hematite" commonly used in cylinder seals and weights excavated in Mesopotamia.

6) According to Karwiese, Most of the balance weights from the second millennium B.C. are made of hematite or limestone [Karwiese 1990: p. 58], while limestone has not been found in 'Usiyeh. Perhaps the limestone and hematite balance weights weigh differently.

7) Two stamp seals were discovered in Tell Sabi Abyad (7000–6000 B.C.) [Melein 2018: p. 109].

List of figs. 1, 2 and 3: Stone balance weights from Area A of ʻUsiyeh

No.	No.*	Field No.	Find spot	Material	Colour	Measurements (mm)	Shape	Weight (g)	Register No.**
1	S1	US-1	U.S. ③	hematite	black to dark brown	64 × 24.5 × 24.5	long barrel shape	82.5	I.M.13-1
2	S11	US-13	R.S.?	hematite	black	37 × 18 × 22.5	oval ball shape	41.6	I.M.76
3	S2	US-2	C-XII ①	hematite	dark brown to dark grey	48 × 10.5 × 10	long and thin barrel shape	16.7	I.M.17
4	S3	US-6	F.D. ②–③, west part	hematite	dark brown to dark grey	36.5 × 15 × 15	long barrel shape	16.95	I.M.14-1
5	S4	US-14	R.M. below Phase 3	hematite	blak to dark brown	42 × 15 × 15.5	long barrel shape with square-like horizontal section	25.6	I.M.77
6	S5	US-12	R.S.?	hematite	dark grey	40.5 × 12.5 × 12	cylindrical shape with slight bulge	16.3	I.M.76
7	S6	US-4	F.D. ④	hematite	black	27 × 9.5 × 9.5	long barrel shape	8.4	I.M.13-2
8	S7	US-15	R.M., below Phase 3	hematite	dark brown	31 × 8 × 10	long barrel shape	5.5	I.M.77
9	S8	US-16	F.D. ⑤	hematite	black	28 × 10.5 × 11	long barrel shape	6.0	I.M.78
10	S9	US-9	F.D. ④	hematite	black	23 × 8 × 8	long barrel shape	3.0	I.M.14-2
11	S10	US-17	F.D. ⑤	hematite	black to dark brown	23 × 7 × 7	cylindrical shape with slight bulge (incomplete)	3.0	I.M.78
12	S12	US-5	F.D. ④	hematite	black	26 × 6 × 6	long and thin barrel shape (incomplete)	2.8	I.M.13-3
13	S13	US-3	D-XII ②	hematite	black to dark brown	23 × 8 × 8	long and thin barrel shape (incomplete)	3.4	I.M.16
14	S14	US-7	R.E. −1.8 m, lowest phase	hematite	black to dark brown	16 × 10 × 10	long barrel shape (incomplete)	3.2	I.M.15
15	S15	US-8		hematite	black	16 × 6 × 6	cylindrical-like shape	1.5	
16	S17	US-10	F.D. ④, west part	hematite	black	11 × 11 × 10.5	circular truncated cone shape	1.6	I.M.18
17	S18	US-34	R.S. ④	hematite		9 × ×20 × 14.5	truncated cone shape		I.M.11-4(2)
18	S16		D3	hematite	dark brown	21 × 22 × 19	shape in which a sphere is cut on two sides and has a fan-shaped cross section		
19	S19	US-41	R.W. ④	hematite	black	7 × 9 × 13	frog shape		
20	S30	US-20	F.D. ④	whitish stone (polished)	whitish	14.5 × 5.5 × 8	oval ball shape		I.M. 8-2
21	S31	US-21	F.D. ③	light brownish stone (polished)	light brownish	13.5 × 10 × 10	oval ball shape		
22	S28	US-22	F.D. ③–④	dark brownish stone	dark brownish	30 × 20 × 65	thin rectangular parallelepiped with a hole		I.M.8-2
23	S20	US-18	R.S. below phase 4	greyish stone	greyish	32 × 44 × 42	square donut shape		
24	S21	US-21		stone		35 × 100 < × 100 <	donut shape		
25	S22	US-20		stone		42 × 90 < × 90 <	donat shap		
26	S23	US-19		basalt-like stone	dark greyish to brownish	50 × 50 × 70	truncated cone shape		

* List of plates 142 to 144 by K. Oguchi 1996.
** I.M.No.is the number when temporary registered in the Iraq Museum.

metallic luster, was highly regarded as a material for cylinder seals for 400 years at the beginning of the second millennium B.C[8]. Iron oxide rock started to be used in cylinder seals with introduction of copper drills, and it is said that the use in cylinder seals in decreasing with the introduction of cutting foil [ibid p. 41ff.].

In Area A of ‘Usiyeh, three of the 15 cylinder seals found are made of hematite [K. Oguchi 2002]. These belong to the first quarter of the second millennium B.C., and their styles are characterised by the Cappadocian style in Anatolia [ibid.: p. 39f., CS10], the North Syrian cylinder seal style [ibid.: p. 37f., CS8], and clay cylinder of Babylonia [ibid.: p. 37, CS7]. It can be seen that these were influenced by various surrounding regions. A hematite bead has been excavated from ‘Usiyeh, but only one out of 460 [K. Oguchi 2002]. These show that hematite was especially used for cylinder seals and balance weights. In particular, hematite has a higher specific gravity (5.3) than other stones such as cylinder seals, indicating that it is suitable for balance weights[9].

Hematite balance weights are found at many sites in an extensive region in the Near East, and are common between B.C. 2400 and B.C. 1200 [Melein 2018][10]. It can be seen that hematite was used as balance weights for a longer period than cylinder seals. As mentioned above, hematite cylinder seals seem to change to other materials due to technological evolution.

At Selenkahiye in Syria, a limestone cylinder seal, unworked hematite, and shaped and polished weights and cylinder seals blanks have been found together in a context of the late third millennium B.C. [Collon 1987: p. 39; Melein 2018: p. 21, Fig. 3-2]. These suggest that cylinder seal craftsmen and weight craftsmen, that is, craftsmen who process small stones, handled different stones and made different products. Especially in Mesopotamia, due to the shortage of stones for processing, it is believed that masons may carry semi-processed stones and inscribe them at the request of customers. Thankfully, stone products that haven’t corroded for thousands of years tell us a lot about what happened at the time.

Balance weights

The beginning of the balance weight in Mesopotamia seems to date back to the fourth millennium B.C. [Rashmstone 2014: p. 428f.]. The use of hematite at sites in southern Mesopotamia begins slightly later than at sites in the north, around 2000 B.C. [Melein 2018: p. 75]. Balance weights are generally made of stone or metal and not all shapes are the same [Melein 2018: p. 32]. Most of the balance weights from the second millennium B.C. are made of hematite or limestone [Karwiese 1990: p. 58]. Many hematite balance weights have been found in southern Mesopotamian sites such as Ur, Uruk and Nippur [Woolley and Mallowan 1927; Hafford 2005; Hafford 2012 and Melein: 2018]. At Ur, Hematite is effective for measuring small values, and it is said that more than 50% of those showing 80 g or less are made of hematite [Hafford 2012: p. 31].

In terms of how the balance weights were used, small weights seem to have been used to measure metals, precious stones and pigments [Rahmstorf 2010: p. 95]. ‘Usiyeh’s hematite balance weights fall into this category and are thought to weigh metals and precious stones. The larger balance weights were used to measure wool and cloth [Melein 2018: p. 30]. They were not used to measure food or to prepare medicines [ibid.]. And, as will be discussed below, not all weights were used accurately and rigorously, and there are several laws in the Code of Hammurabi that prohibit incorrect measurements [ibid.].

The shape of the weight was divided into 22 types by Woolley, but after that, they were divided into 11 categories by Haffore [Hafford 2012: pp. 25–32]. Most of the balance weights of ‘Usiyeh

8) Surprisingly, up to 70% of all cylinder seals during this period are made of iron oxide rock [Melein 2018: p. 112].

9) The other stones commonly used in cylinder seals have a specific gravity of 2.4 for lapis-lazuli, 2.7 for marble, and 2.6 for carnelian.

10) In fact, other areas seem to be found in later times [see Joseph D. Martin: online Fig. 2].

Fig. 4 Frog-shaped balance weight(?) from ‘Usiyeh.

(Fig. 2: 1 to 15) are sphendonoid type in the Hafford’s category [ibid.], but as Hafford points out, there are various names, so the list of figs of this article. Mentions them as long ballel shapes. Of the 19 hematite balance weights, 15 fall into this category. The lines drawn inside each figure in Fig. 2 are not clear. These are trace lines of polishing adjustment that are difficult to see in the photograph. The other two (Figs. 1 and 2: 16 and 17) are category of the loaf type of Hafford [ibid.], and the other one is frog shape (Fig. 1: 19, and Fig. 4).

Initially, the frog-shaped one was judged as an amulet, and unfortunately it was not weighed. However, It is doubtful that it was really a balance weight because it is so small and light, probably around 1 g. Frog and duck amulet [Wooley 1976: p. 217 U.1276 and U1277] believed to be made of frit and faience, have been excavated also in Ur[11]. It is unlikely that these are used for the balance weights, so it is not really known if the hematite frog of ‘Usiyeh was also an amulet or a weight. In particular, duck and frog balance weights have been attributed to Mesopotamia [Barjamovic 2021: p. 60]. The most common animal-shaped balance weights from Mesopotamia are duck-shaped, and rarely lion, frog and boar heads have been excavated [Melein 2018: p. 32]. Many sets of duck-shaped balance weights have been found, but it is unclear whether frogs were used for balance weights, as many frog-shaped ones seems to be single unit, not a set. However, as far as I know, ‘Usiyeh’s frog-shaped one is the smallest. An example of a frog-shaped balance weight from Kültepe [Kulakoğlu 2017: p. 400, Fig. 21.11–138] is known to be very large, so it may not be possible to equate them with ‘Usiyeh. A lapis-lazuli frog-shaped model has been found at Chagar Bazar since the Jamded Nasr period [Mallowan 1947: Pl. IX and p. 100]. In the case of a frog-shaped stone object, it is difficult to determine whether it was an amlet, a model, or a balance weight.

An unusually shaped hematite balance weight (Figs. 1 and 2: 18) has been found, but it is slightly later than the hematite weights shown above. A pendant-shaped stone balance weight has also been excavated (Fig. 2: 22). This is the Stele type in the Hafford’s category [Hafford 2012: pp. 25ff.].

Four large stone weights have also been excavated (Fig. 3: 23 to 26). Three of them have a hole in each (Fig. 3: 23–25), and one has no holes. These seems to have different used than the above balance weights. The three perforated examples may be loom weights, but they may be a little too heavy. Perhaps these four stone weights measure different things, such as wool.

Units of weight

The unit of weight is ‘talent (biltu)’, ‘mina (minu)’, ‘shekel (šiqul)’ from the heavier unit. The lightest unit was ‘she’ (še / uttatu). 1 talent = 60 mina, 1 mina = 60 shekel, 1 shekel = 180 she, using the sexagesimal system. 1 she represents a grain of barley and 1 shekel is equal to the weight of 180 grains of barley. In a study of units of balance weight, Powell carried out a metrological study of weights and proved that one shekel weighs about 8.33 g [Powell 1971]. The smallest unit, one she, was converted into one grain of barley, which weighed 1 she = 0.04627777777778 g [Monroe 2005: 175]. The next lightest unit, 1 shekel, weighed about 8.3 g (≒ 8.257368 g), followed by 1 mina = 499.8 g and 1 talent = 29,980 g [Dercksen 1996: p. 251; Kool 2012: p. 43]. One talent weights about 30 kg (29.980 kg at 8.33 g per shekel), which was considered to be

11) In ‘Usiyeh, a faience-made Humbaba-faced amulet and beads, and a frit-made lion-shaped amulet and beads have been excavated from the same period. The lion-shaped one is similar to the one excavated in Kültepe-Kanesh [Özgüç 1986: p. 37 and pl. 76-1; K. Oguchi 1998: p. 82 and Pls. 5 and 6-B180].

the amount that one person could carry [Monroe 2005: p. 175]. As mentioned above, according to Powell, 1 shekel = 8.33 g, but the actual gram weight of hematite balance weights varies, and few of them correspond exactly to the 8.33 figure. For Kültepe in Central Anatolia, Dercksen considers 19 items with a value between 7.8 g and 9 g as one shekel weights, based on the assumption that 1 shekel = 8.3 g [Dercksen 1996: p. 251ff.]. Of these, 10 were close to 8.3 g (8.1 g~8.5 g). Zaccagnini, who examined some contemporaneous example of Northern Mesopotamian, also pointed out that the minimum value of the actual grams of weight corresponding to one shekel was about 8.1 g, and the maximum value about 8.48 g [Zaccagnini 2000: pp. 1203–1209]. This variation in the actual grams of the balance weights means that it was not possible to produce accurate balance weights at that time.

It has also become clear that in areas outside Mesopotamia, such as Ebla, Alalakh, Ugarit in Sylia, and the Hittite Empire in Anatoria, a different system of weights and measures was used than in Mesopotamia [Bienkowski and Millard (eds.) 2000: p. 318]. Studies of ancient weights and measures show that in the Hittite Empire a shekel weighed 11.4 g [Ascalone and Peyronel 2006: pp. 50–56], and sometimes as much as 11.75 g [Zaccagnini 2000: pp. 1203–1209). The unit of measurement of the mina also changed, from 1 mina = 50 'shekels' in the Old Hittite to 1 mina = 40 shekels in the Hittite Empire [Monroe 2005: p. 175]. Weights and measures differed from region to region and from period to period in Western Asia.

The Balance weights from 'Usiyeh is similar to that used in South Mesopotamia and Central Anatolia, and one 'shekel' is thought to be related to 8.3 g Considering Figs. 1 and 2 (see also the List), 1 could have been 10 shekels; 2 was 5 shekels; 3 and 4 were 2 shekels, 5 was 3 shekels; 6 was 2 shekels; 7 was 1 shekel; 8 and 9 were 2/3 shekels; and 9 was 1/3 shekel. On the other hand, it is not very accurate.

After measuring the lengths of the weights excavated from 'Usiyeh and Kültepe-Kanesh, and investigating whether balance weights of the same size had the same weight, it was found that some weights were similar, while many others, even though of the same size, had very different weights. This means that weights could not be judged to be the same weight by appearance alone, which would have made unification of weights and measures difficult.

Balance scales

There are various ways to say it, such as weighing scale and mass scale, but here we call it balance scale as weighting tools. The balance scale of ancient Mesopotamia is considered to be a hanging type. The hanging type of balance scales (suspension balance) are well known in figures such as the *Book of the Dead* in Egypt.

The hanging type can be simply classified into three types. The first type in which a hanging rod is attached to the top of an upright support rod and a pair balance plates are hung on both ends of the hanging rod with ropes or strings; the second type the center of the hanging rod is hang with a rope or string by a hand instead of the support rod; the third type the weight is fixed on one side without fixing the hanging fulcrum of the hanging rod, the object is placed on the balance plate on the other side, the position of the fulcrum is moved, and the weight was measured by the ruler scale written on the balance rod.

The third type is said to have appeared in the Roman period. In other words, the first and second types are considered to be older. The first type seems to be suitable for large or fixed use, while the second type is considered to be used for small types or portability. The first type seems to be the most appropriate, on the other hand, the balance weights of 'Usiyeh is for measuring light things, and the first type is necessary to have a delicately horizontal place. Therefore, we think it may have been the second type in terms of portability which is also depicted on a cylinder seal in the Late Akkadian period [Boehmer 1965: Taf. 38-458; Ascalone and Peyronel 2001: Fig. 8 and

Melein 2018: p. 31, Fig. 3.10]. Two sealings from Kültepe-Kanesh in the early second millennium B.C. also depict the second type of balance scale [Tessier 1994: nos. 532 and 533; Ascalone and Peyronel 2001: Fig. 9].

In ‘Usiyeh, one bronze/copper balance scale plate (balance pan) has been excavated [K. Oguchi 2000: M26] (Fig. 5). Initially, it was reported as a bronze object for which the purpose of an ornament or stud [K. Oguchi 2000: p. 87], but it is definitely confirmed that it is a balance plate from the excavated examples of other archaeological sites, such as stratums II and Ib-a of Kültepe-Kanesh [Kulakoğlu 2017: p. 349ff.], Nippur McCown *et al*. 1979: pp. 33 and 52], Nuzi [Starr 1939: Pl. 142, F] and Ugarit [see Melein 2018: p. 30, Fig. 3.9].

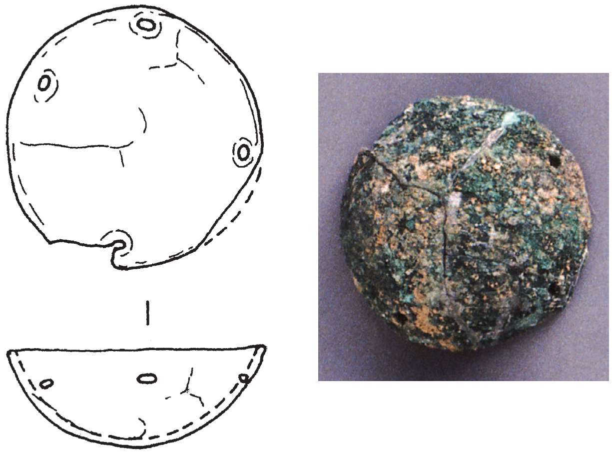

Fig. 5 Bronze/copper balance scale plate from Area A of ‘Usiyeh [Oguchi, K. 2000: Pls. 2 and 8-M26, Trench 1 in Grid E-XI].

‘Usiyeh’s blance plate is a dome-shaped with four small holes arranged diagonally near the edge (Fig. 5) [K. Oguchi 2000: Pls. 4 and 7d-M26.]. Normally, it seems appropriate that balance plates are hung with three strings, but in the case of ‘Usiyeh, it can be inferred that they were hung with four strings. Ugarit [Melein 2018: p. 30-Fig. 3-9], Nuzi [Starr 1939: pl, 142-F], and Kültepe [Kulakoğlu 2017: p. 349f.] examples also have four holes, so it is certain that they were hung with four strings. The initial balance plate was hung with four ropes or strings, but it is believed that it was later changed to an efficient three strings.

Some other bronze objects that can be imagined as parts of the balance scale have been excavated from ‘Usiyeh. It may be urgent to think of these as parts that are just balance scales, but we would like to show them here, including their possibilities (Fig. 6).

We think Fig. 6-1 and 2 may have been used for the hanging rod. We thought of these were the cores of the knife, but we decided that they might not have been because they were a little too thick. Only half of remains, but since there are holes on both sides and in the center, we think it may have been used by hanging it on both sides and hanging it through a string in the center. When these total lengths are restored, they are approximately 11 cm and 7 cm, respectively. These may look a little short, but the balance scale plate of ‘Usiyeh is as small as about 3 cm in diameter[12], so it may be possible. Also, Fig. 6-3 shows a metal hook that seems to be tin. It’s an incomplete shape, but

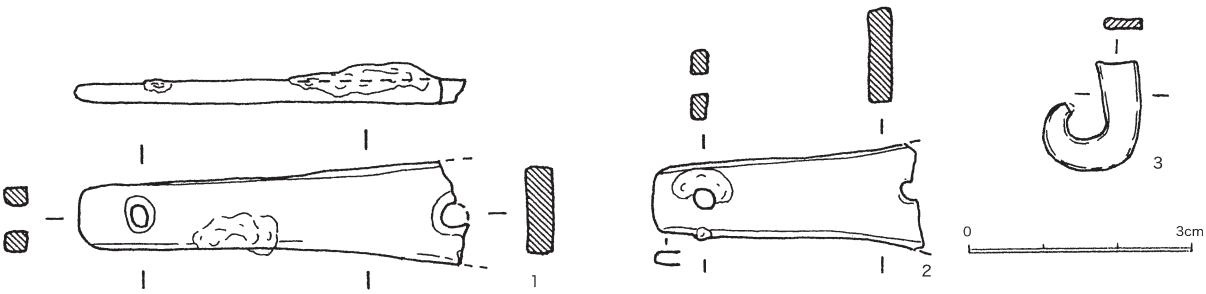

Fig. 6 Related objects? of the Balance scale [1: Oguchi, K. 2000, Pls. 4 and 7d-M54, UM-16, Grid E-XII③, bronze/copper; 2: ibid., Pls. 4 and 7d-M55, UM-51, Room M④, bronze/copper; 3: ibid. Pls. 2 and 8b-M33, UM-20, Room S④, tin?].

12) The diameter of the balance pan excavated from Kültepe is 5.7 cm to 8.3 cm [Peyronel 2000: pp. 181–183; Kulakoğlu 2017: p. 149]. It turns out that the balance scale plate of ‘Usiyeh is very small.

we think it may have been used for hanging part. However, these are just our imaginations.

Conclusions

From the weight of the balance weights from Area A of ‘Usiyeh, one shekel commonly used in Southern Mesopotamia and Central Anatolia seems to be related to the 8.3 g one, but it is not accurate.

According to Rahmstorf, balance weights were found in palaces temples and dwellings in the third millennium B.C., but rarely in graves and foundation deposits [Rahmastorf 2014: p. 433f.]. Perhaps it is only used as a practical tool and was found where it was actually used. In the second millennium B.C. the material change, hematite balance weights became common, and they were more commonly buried in graves in South Mesopotamia. In the case of Ur, nearly half of the weights during the period from the Early Dynastic to Neo Babylonian are related to burials [Hafford 2012: p. 47].

A characteristic feature of the burials excavated in northern Mesopotamia is the presence of weapons in male graves. This is thought to be due to the fact that men often fought as warriors due to tribal conflicts and other reasons, and as a symbol of this, they were buried with weapons [Wygnańska 2019: p. 410]. On the other hand, in southern Mesopotamia, objects related to commerce, such as weights, have been found as grave goods, pointing out that the graves in which these objects were found were those of merchants engaged in trading activities and were buried with their owners [ibid. pp. 397 and 410].

Weights In the case of ‘Usiyeh, the burial is likely to have been that of a merchant, as the example was found in a grave. According to Hafford, graves with weights are poor in grave goods [Hafford 2012: p. 48]. The marchant’s status may have been low. On the other hand, in the case of ‘Usiyeh, the underground structure are assumed to be a tomb, but many luxury objects were excavated there. For example, white-filled engraved pottery from Eshnunna and its eastern regions, shells and shell objects from the Gulf and even from the Indian Ocean, and cylinder seals reminiscent of Central Anatolian and western motifs. Considering these roots, it is certain that it was brought about by trade.

It is true that the location of ‘Usiyeh was not suitable for farming and livestock, and was also an area where nomads are wandering around. On the other hand, the middle Euphrates region is one of the meeting places between nomads and sedentary people [Kepinski 2010: p. 169]. It was also the region where it is appropriate for merchants to be stationed as a relay point for remote trade. In fact, it is known that Haradum which is located upstream, was a trading center, karum. In addition to the underground structure, a large artificial mound, Mound ‘Usiyeh, and dwellings adjacent to the Euphrates River were built in ‘Usiyeh. Area A also has a temple-like structure such as the discovery of many life-sized lion statues which accompanies the remains above the underground structure.

Considering these things comprehensively, it is not known which power belongs to, but it is possible that ‘Usiyeh was used as a trading center like karum. Also the underground structure is believed to have been the tomb of people like the chief of power or the chief of merchants.

Bibliography

Agha, A.A.

1987/88 Al-Usssiyeh, *Sumer* 45: pp. 110–141 (in Arabic).

Ascalone, E. and Peyronel, L.

2001 Two Weights from Temple N at Tell Mardikh-Ebla, Syria: A Link Between Metrology and Cultic Activities in the Second Millennium B.C.?, *Journal of Cuneiform Studies* Vol. 53 pp. 1–13.

2006a Balance Weights from Tell Mardikh-Ebla and the Weighing Systems in the Levant During the Middle Bronze Age, in ed. Alberti, M.E.; Ascalone, and Peyronel, L., *Weights in Context, Bronze Age Weighing Systems of Eastern Mediterranean, Chronology, Typology, Material and Archaeological Contexts,* Proceedings of the International Colloquium, Rome 22nd–24th November 2004, pp. 127–159, Instituto Italiano di Numismatica, Roma.

2006b Early Bronze IVA Weights at Tell Mardikh-Ebla, Archaeological Associations and Contexts, in Alberti, M.E.; Ascalone, E. and Peyronel, L. ed. *Weights in Contex: Bronze Age Weighing Systems of Eastern Mediterranean, Chronology, Typology, Material and Archaeological Contexts*, Proceedings of the International Colloquium, Rome 22nd–24th November 2004, pp.49–70, Instituto Italiano di Numismatica, Roma.

Barjamovic, G.

2021 Technologies of Trade in Western Asia in the Middle Bronze Age, In Rahmstorf, L., Barjamovic, G., Ialongo, N. (eds.), *Merchants, Measures and Money. Understanding Technologies of Early Trade in a Comparative Perspective 2*, pp. 55–68, Wachholtz Verlag, Kiel/Hamburg.

Bartash, V.

2019 *Establishing Value: Weight Measures in Early Mesopotamia*, Studies in Ancient Near Eastern Records, Vol. 23, De Gruyter, Berlin and Boston.

Bienkowski, P. and Millard, A. (eds.)

2000 *Dictionary of the ancient Near East*, Published for the Trustees of the British Museum by British Museum Press, London.

Boehmer, R.M.

1965 *Die Entwicklung der Glyptik während der Akkad-Zeit*, de Gruter, Berlin.

Collon, D.

1987 *First Impressions, Cylinder Seals in the Ancient Near East*, British Museum Publications, London.

Dercksen, J.G.

1996 *The Old Assyrian Copper Trade in Anatolia*, Nederlands Histoyisch-Archaeologisch Instituut, Istanbul.

Fujii, H., Okada, Y., Matsumoto, K., Oguchi, H., Yagi, K. and Numoto, H.

1984/85 Preliminary Report on the Excavations at Area A and Area B of ‘Usiyeh, *al-Rāfidān* Vols. 5/6, pp. 111–150 (in Japanese).

Hafford, W.B.

2005 Mesopotamian Mensuration Balance Pan Weights from Nippur, *Journal of Economic and Social History of the Orient* 48–3, pp. 345–387.

2012 Weighing in Mesopotamia: The Balance Pan Weights from Ur, *Akkadica* 133–1, pp. 21–65.

2019 Accounting for Civilization: Early Weights and Measures at Tepe Gawra, in Rashmstorf., L. and Stratford, E. (ed.) *Weights and Marketplaces from the Bronze Age to the Early Modern Period*, pp. 15–34, Murmann Publishers, Wachholtz Verlag Kiel/Hamburg.

Karwiese, S.

1990 Šiqlu, kite und stater: der der Weg zu einer neuen Metologie des Altertums. I. In R. Gyselen (ed.), *Prix, Salaires, Poids et Mesures*, Groupe pour l’Etude de la Civilisation du Moyen-Orient, Paris.

Kepinski, C.

2010 The Burial Mounds of the Middle Euphrates (2100–1800 B.C.) and Their Links with Arabia: the Subtle Dialectic between Tribal and State Practices, in Weeks, L. (ed.) *Death and Burial in Arabia and Beyond, Multidisciplinary Perspectives*, Society for Arabian Studies Monographs No. 10, BAR International Series 2107, pp. 165–171.

Kool, J.

2012 *The Old Assyrian Trade Network from an Archaeological Perspective*, MA Dissertation. University of Leiden.

Kulakoğlu, F.

2017 Balance Stone Weights and Scale-Pans from Kü̲ltepe Kanesh: On one of the Basic Elements of the Old Assyrian Trading System, *Culture and History of the Ancient Near East, Vol 90: Overturning Certaint in Near Eastern Archaeology, A Festschrift in Honor of K Aslthan Yener*, pp. 341–402. Brill, Leiden and Boston.

Malein, M.M.
2018 *Iron Oxide Rock Artefacts in Mesopotamia c.2600 –1200 BC, An interdisciplinary study of hematite, goethite and magnetite objects*, Archaeopress Archaeology, Archaeopress Publishing Ltd, Oxford.

Mallowan, M.E.L.
1947 Excavations at Brak and Chagar Bazar, *Iraq* Vol. 9, pp. 1–259.

Martin, Joseph D.
2020 Scales and Balances (online), https://www.jdmartin.org/scalesbalances (browsing date: 7/10/2021).

McCown, D.E., Hains, R.C., and Biggs, R.D.
1978 *Nippur II: The North Temple and Sounding E*, Excavations of the Joint Exppedition to Nippur of the American Schools of Oriental Research and the Oriental Institute of the University of Chicago, Oriental Institute Publications Vol. 97, Chicago, Illinois.

Monroe, C.M.
2005 Money and Trade, In Snell, D. C. (ed.), *A Companion to the Ancient Near East*, pp. 171–184, Blackwell Pub., Malden, MA.

Oguchi, K.
1996 *The Middle Euphrates Resion in the Early Second Millennium B.C.*, Ph,D Thesis submitted to the University of Manchester.
1998 Beads from Area A of 'Usiyeh, *al-Rāfidān* Vol. 19, pp. 75–117.
2000 Bone, Ivory, Gypsum and Metal Objects from Area A of 'Ushiyer, *al-Rāfidān* Vol. 21, pp. 85–102.
2002 Stamp Seals and Cylinder Seals from Area A of 'Usiyeh, *al-Rāfidān* Vol. 23, pp. 29–51.

Oguchi, K. and Oguchi, H.
2006 Japanese Excavations at 'Usiyeh, in K. Christine, L. Olivier and T. Aline (ed.), *Studia Euphratica: Le moyen Euphrate iraquien réaquen révélé par les fouilles preventives de Haditha*, pp. 157–189, De Boccard, Paris.

Özgüç, T.
1986 *Kültepe-Kanis II: New Researches at the Trading Center of the Ancient Near East*, Ankara.

Peyronel, Luca
2019 Weighing silver on the scales. An overview of silver hoards and balance weights during the Middle Bronze Age in the Near East, in ed. Rashmstorf, L. and Stratford, E., *Weights and Marketplaces from the Bronze Age to the Early Modern Period: Proceedings of Two Workshops*, Murmann Publishers, Hamburg.

Powell, M.A.
1971 *Sumerian Numeration and Metrology*, Dissertaion, University of Minnesota, Minnesota.

Rahmstorf, L.
2006 In search of the Earliest Balance Weights, Scales and Weighing systems from the East Mediterranean, the Near and Middle East, in ed. Alberti, M. E.; Ascalone, E. Peyronel, L., *Weights in Context, Bronze Age Weighing Systems of Eastern Mediterranean, Chronology, Typology, Material and Archaeological Contexts, Proceedings of the International Colloquium, Rome 22*nd-24th November 2004, pp. 9–46, Instituto Italiano di Numismatica, Roma.
2010 The concept of weighing during the Bronze Age in the Aegean, the Near East and Europe: in I. Morley and C. Renfrew (eds.), *The Archaeology of Measurement. Comprehending Heaven, Earth and Time in Ancient Societies*, pp. 88–105, Cambridge University Press, Cambridge.
2014 Early Balance Weights in Mesopotamia and Western Syria: Origin and Context, in P. Bieliński, M. Gawlikowski, R. Koliński, D. Ławecka, A. Sołtysiak and Z. Wygnańska (eds.), *Proceedings of the 8th International Congress on the Archaeology of the Ancient Near East, Warsaw, April 30th–May 4th 2012*, Volume 3 pp. 427–441, Wiesbaden: Harassowitz.

Starr, R.F.S
1939 *Nuzi: Report on the Excavations at Yorgan Tepa Near Kirkuk, Iraq*, Vol. 1: Text, Vol. II: Plates and Plans, Havard University Press, Cambridge.

Teissier, B.
1994 *Sealing and Seals on Texts from Kültepe karum Level 2*, Nederlands Hisstorisch-Archaeologisch Instituut,

Leiden.

Woolley, L. and Mallowan, M.
1927 *Ur Excavatios VII: The Old Babylonian Period*, Trustees of the two museums by the Oxford University Press.

Wygnańska, Z.
2019 Burial in the Time of the Amorites. The Middle Bronze Age Burial Customs from a Mesopotamian Perspective, *Ägypten Und Levante / Egypt and the Levant*, 29, pp. 381–422, Austrian Academy of Sciences Press, Wien.

Zaccagnini, C.
2000 A Note on Old Assyrian Weight Stones and Weight System, in Gaziani, S. (ed.), *Studi sul Vicino Oriente Antico*, *dedicati alla memoria di Luigi Cagni*, pp. 1203–1213, Instituto Universitario Orientale, Napoli.

OF BOXES IN THE BRONZE AGE: EXOTIC IMPORTS, SKEUOMORPHS AND LOCAL CRAFTS FROM CENTRAL ASIA TO SUMER

St John SIMPSON*

Introduction

A box is normally defined as a square, rectangular or circular container with a flat bottom and rigid sides. They are normally carved from wood, adzed by hand or turned on a lathe, and covered with a lid. The earliest surviving examples from the Near East come from 7th and 6th millennium BC contexts at Nehal Hemar, Kefar Samir and Çatalhöyük, preserved because of exceptional arid, waterlogged or carbonised burial environments respectively [Bar-Yosef 1985; Galili, and Schick 1990; Mellaart 1964, 86–92, pls. XIX–XXI]. Despite excavations at many other neolithic sites, there is little other surviving evidence for these types of containers which must have been rather commonplace, particularly before widespread use of pottery containers. The same applies to many other periods where there are occasional and exceptional finds, and their functional and social significance under-estimated as effort has instead been paid to the modern classification of vessels of pottery, metal, stone or glass. This paper now takes a look at some of the evidence, direct and indirect, from Bronze Age sites from Central Asia and eastern Iran to Mesopotamia[1].

Boxes in the Bronze Age

During 1989/90, the excavations at the ancient Mesopotamian city-site of Nippur revealed an extraordinary find in a late 3rd millennium BC grave in the Area WF sounding. This was one of the grave-goods interred inside a large burial chamber which had been dug into a courtyard from level XIIIB and dated by stratified pottery, seals and texts to the late Akkadian period [McMahon 2006, 45–51]. This tomb appears to have been originally entered by a ramp and ended in a shallow chamber measuring 3.5 × 3.5 metres across. This contained the skeletons of three individuals, with an equid, two sheep and a lamb piled up between two individuals interpreted as man and wife. Skeleton 1 was male and accompanied by weapons whereas Skeleton 2 was female and the more important of the two, wearing a gold fillet around her forehead, gold earrings, a pair of silver bracelets, a heavy beaded necklace, a lapis lazuli seal on a cloak pin at the right shoulder, and a set of copper and pottery vessels; other pots and offerings were placed nearby. Near her head was what was described as 'the extremely fragile and decayed remains of a small wooden box with a lid inlaid with bone mosaic decoration' (Fig. 1).

The photograph shows that the box was circular, measured 12 cm across and had a central knob handle measuring 2.5 cm across and 1 cm high. This was surrounded by a concentric arrangement of outward facing stepped pyramids, stepped crosses with the corners filled with smaller square inlays, hemispheres (originally presumably secured with wooden dowels as there were no rivets), alternating inward facing stepped pyramids and eight-petalled rosettes (each secured with a copper rivet through the centre) with paired plain discs between, and a border of interlocking triangles forming a running lozenge with a narrow plain outer edge. Two double rosettes were attached to B-shaped tab handles attached to opposite sides, the intervening area being decorated with a six-petalled rosette and plain roundel on each side. An additional cluster of teardrop and kidney-shaped inlays was also found but their original location or arrangement are unclear. All of

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1) This paper was first published in Russian in a volume partly dedicated to the leading specialist of Central Asia in the aneolithic and Bronze Age periods, Dr L.B. Kircho, and published to mark her anniversary [Simpson 2021].

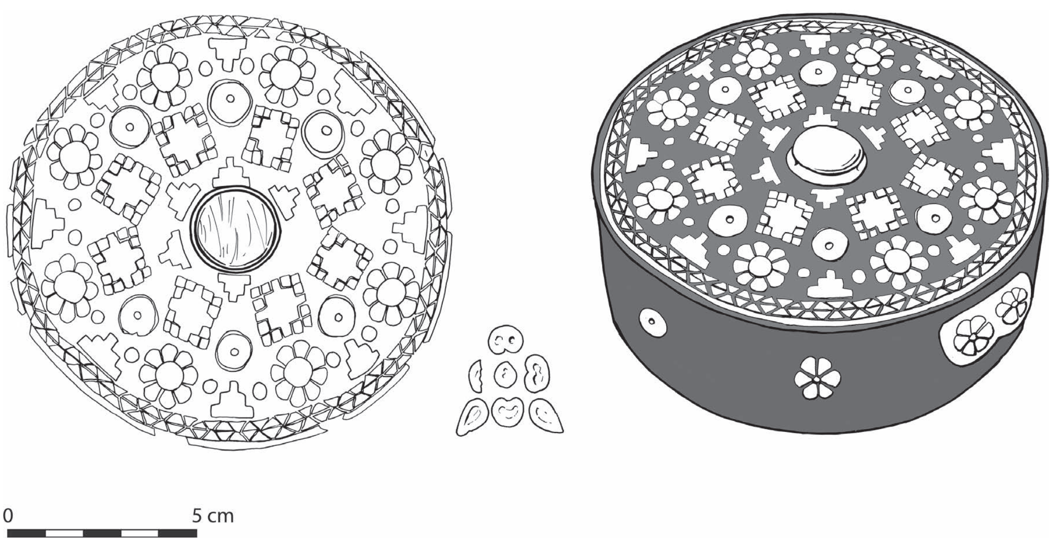

Fig. 1 Drawing of the lid and reconstruction of an imported Harappan wooden box with shell inlays found at Nippur (based on McMahon 2006, pl. 146.7; drawings by Kate Morton).

the inlays were described as bone and the wood must have been of a contrasting rich brown or dark colour, although all traces of this had disappeared. It was found empty. The depth of the box is unknown but the sparsity of decoration on the sides suggests it was shallow, and the pair of rosette-decorated tabs on the two sides were probably designed to secure a thin ribbon or sinew tied around the central knob and passed around them.

The Nippur box was not unique. A stepped cross shell inlay with bevelled edges and measuring 1.8 cm across was found on the surface of Tepe Gawra, in the Khorsabad plain of northern Mesopotamia [Speiser 1935, vol. I, 139, 197, pl. LIIIb.4]. It was recognised at the time as having Harappan parallels, very common at Mohenjo-daro and one of its excavators remarked on the similarity of the design to painted pottery from Baluchistan and Anau [Mackay 1931, vol. II, 566, vol. III, pl. CLV.31-33] (Figs. 2–3). An isolated stepped cross inlay measuring 2 cm across has also been published with finds from looted cemeteries in the Konar Sandal region of the Halil Rud [Madjidzadeh 2003, 148, 205, described as ‘marble’ but either shell or calcite], and the motif repeats in two registers of recesses around the top of a straight-sided chlorite bowl from the same group [Madjidzadeh 2003, 68, 185]. The finds from Nippur and Tepe Gawra were therefore exotic items, brought via the Persian Gulf and most likely originating from the Indus valley, and the Nippur inlays probably also shell.

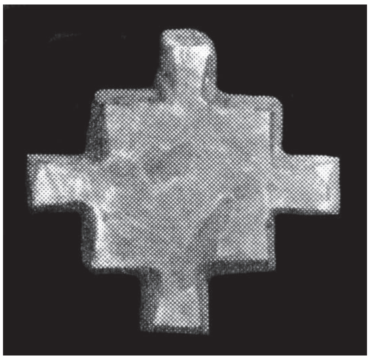

Fig. 2 Harappan shell inlay found at Tepe Gawra (after Speiser 1935, pl. LIIIb.4).

We turn now to the Royal Cemetery at Ur where the excavator repeatedly refers to finding wooden boxes, although mostly only recognisable when decorated with inlays. A double-compartmented box found in PG/1749 was decorated with ‘square plaques of plain mother-of-pearl framed in strips of inlay of shell and mother-of-pearl; the lid, of mother-of-pearl, turns on a swivel-pin’ [Woolley 1934, vol. I, 592, vol. II, pl. 103][2). A square box measuring 55 cm across and 23 cm high was found in PG/1156, and contained cosmetic shells [Woolley 1934, vol. I, 170][3); ‘remains of what was apparently a box inlaid with

2) The field notes add that a pottery vase lay behind the head end of the coffin and on top of an inlaid ostrich egg container and against ‘this small paint box in two square compartments containing green paint’.

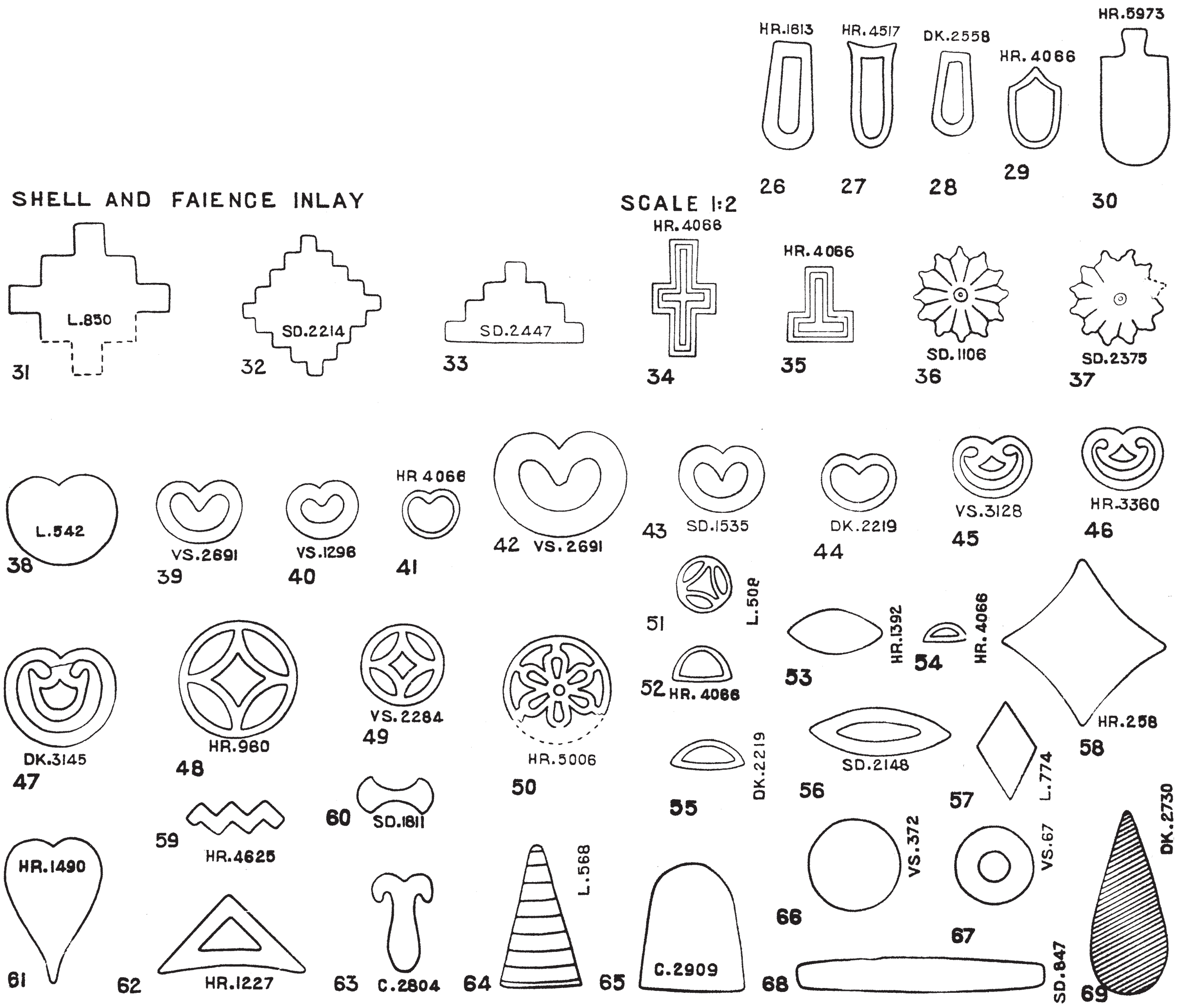

Fig. 3 Shell inlays found at Mohenjo-daro (after Mackay 1931, vol. III, pl. CLV.31-33).

mother-of-pearl and red and black stone' found in PG/1248[4]; an almost square wooden box measuring 65 × 60 cm across 'with sides of thin plank and shorter uprights' and containing two gold daggers found in PG/1054 [Woolley 1934, vol. I, 98][5]; and 'what may have been the lid of a circular box inlaid with red paste' found in PG/730, although in this case the design was lost as 'only the threads and spots of red powder formed a low relief on a smooth face of earth [and] to find which the earth mass had to be broken up, and that involved the breaking of the pattern' [Woolley 1934, vol. I, 385, vol. II, pl. 222] (Fig. 4). Two 'fragments of wood inlaid with wood of a lighter colour in a leaf pattern which reminds one of some of the engraved shell plaques; although there had been here a free naturalistic design' was found in PG/789; from PG/871 'comes a formal pattern of four-petalled rosettes regularly spaced; in this case the ground seems to have been light and the inlay is of a dark virtually black wood well preserved which resembled ebony; the same pattern in the same material occurred on the wooden sheath of a dagger in PG/709' (Fig. 5); in PG/645 there was found a patch of minute rectangles ... of reddish wood [measuring 4-5 mm across]

3) Simply described in the field notes as 'a wooden box ... containing large cockle shells [with] paint'.

4) Woolley 1934, vol. I, 579: 'inlay, triangles and squares of mother-of-pearl, red limestone, and black shale, probably from a wooden box which has decayed' (U.12176), described in the field notes as 'against side of coffin a quantity of inlay squares and triangles = white (mother of pearl) and red and black stone, apparently from a box'.

5) This description being from the field notes as the published account simply refers to it as 'now reduced to a whitish powder'.

which had been set in bitumen as inlay in a box of which the woodwork had vanished' [Woolley 1934, vol. I, 386, 546, 550 (with wooden sheath inlaid with a wooden rosette)]. 'Remains of a small wooden box (the wood all perished) inlaid with small strips and squares of bone' measuring 3 mm across were found in PG/543 [Woolley 1934, vol. I, 542]. Loose in the soil in the corner of a grave, in front of the face of the deceased and next to a copper vase and a calcite 'spill vase' were two 'shell plaques, 0.03 m. sq., engraved one with a figure of a goat and one with a leopard; originally mounted in bitumen. With them were 3 strips of bone inlay for border and 4 pieces of lapis-lazuli strip border' [Woolley 1934, vol. I, 544]. In PG/341, 14 gaming-pieces, '7 of black shale inlaid with 5 white shell spots, 7 of shell inlaid with 5 lapis spots ... were found lying in a row arranged in alternate colours; probably they had been in a wooden box which had perished' [Woolley 1934, vol. I, 536]. Finally, we should draw attention to the fact that the 'boards' for the 'Game of Twenty Squares' were also constructed as rather delicate hollow boxes (Fig. 6), rather than the chunky solid objects of modern reconstructions, thus the board was actually the top of a hollow box with the pieces and dice stored inside, as demonstrated by the discovery of a set inside a silver version from PG/789 [Woolley 1934, vol. I, 559; cf. Woolley 1934, vol. I, 540, 557, vol. II, pl. 221]. This game – like the related gaming boards found at Gonur depe[6] – probably originated in the Indus region but the boards found at Ur are decorated using exotic materials within a local design and colour combination. Many of the other inlaid boxes described above were probably also locally made but the petalled design on that from PG/871 is very reminiscent of Harappan designs, and the excavator's allusion to its dark wood resembling ebony reinforces the possibility that this was also an eastern import.

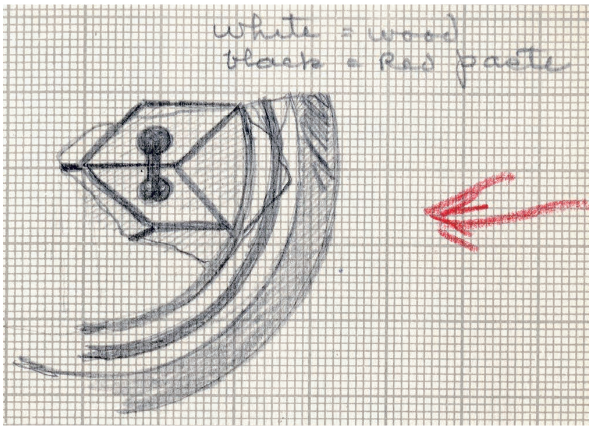

Fig. 4 Drawing of the red-painted design on the lid of a circular wooden box found in PG/730 at Ur (Ur excavation archive).

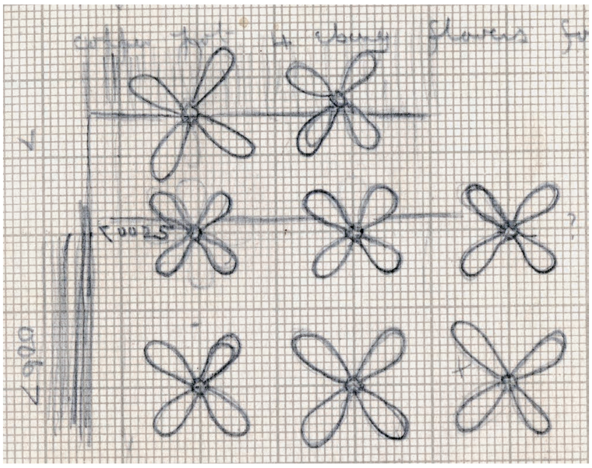

Fig. 5 Drawing of a repeating floral design on wooden panelling found in PG/871 at Ur (Ur excavation archive).

We now turn to a more spectacular find: the so-called 'Standard' of Ur, found in Royal Tomb PG/779 resting above the right shoulder of a man, as if carried there by him [Woolley 1934, vol. I, 61–62]. Decorated on each of the long sides with three registers showing scenes of war on one, and bringing livestock and culminating in a banquet on the other, it is decorated on each of the narrow ends with scenes of a mythological nature. Woolley's description cannot be bettered:

6) See Dubova 2021, 368–69; note that finds of dice in graves without remains of the boards probably simply reflects the fact that the boards were not inlaid, and therefore did not survive, rather than being interred by themselves, and supported by the fact that a wooden board which was not inlaid was found at Shahr-i Sokhta [Piperno and Salvatori 1983, 179–89, figs 5–7, pl. VI].

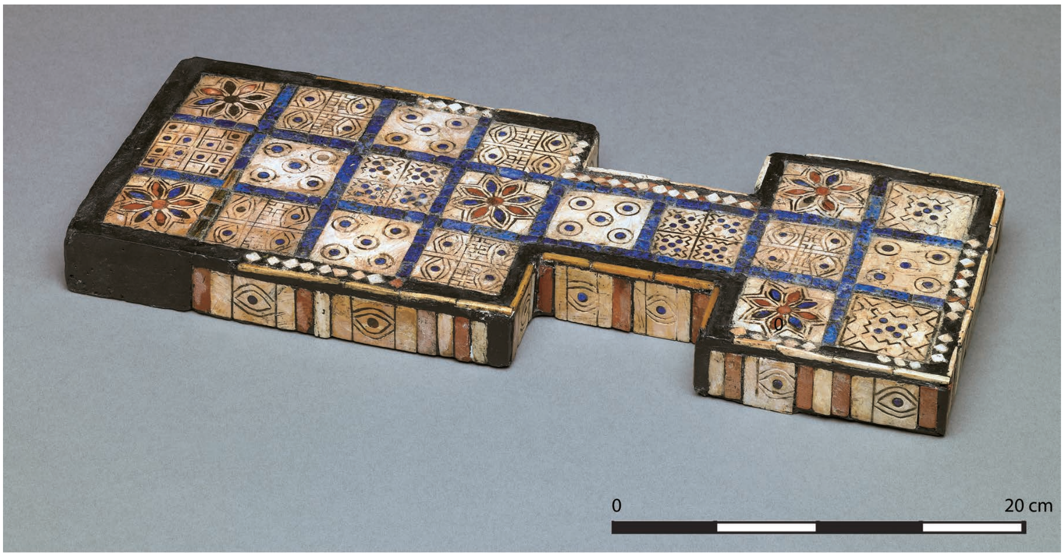

Fig. 6 ‘Game of Twenty Squares’ with mosaic inlays found at Ur.

> ‘The long flat sides sloped together, the ends taking the form of truncated triangles ... All four faces of the object were covered with mosaic, the top and the base were plain. Each face was divided horizontally into three registers framed by borders composed of shell strips with between them bands of lapis squares and shell triangles or red limestone squares and lapis triangles, the alternate borders being of different colours; similar borders with red squares and lapis triangles enclose the panel at either end. Each register is occupied with shell figures set against a field of lapis mosaic; the inner details of the figures are filled in with black except for the chariots, which have a bright red paste, and for the two cattle, the middle section of whose bodies is cut out of red limestone’ [Woolley 1934, vol. I, 266–67].

The iconography and visual narrative of this object is entirely Sumerian and belong to a genre known from wall plaques, yet the combination of these different types of scene into a single object is unparalleled. Its function baffled the excavator who initially described it as an ‘inlaid box’ but later concluded that it was some form of standard, and that is how it has been known until today. However, the significance of his remark that it was hollow seems to have been overlooked and, as my colleague Dr Finkel has observed, the arrangement of the inlays along the upper borders allows for the top to have been slid on and off in the manner of a carefully crafted pencil-case. In that case, it is one of the most spectacular examples of a mosaic-inlaid box known, made perhaps to house a tablet recording the events represented on the exterior, viz. a successful military campaign by a king of Ur against a non-Sumerian enemy judging by the iconography, and buried with him while the tablet itself presumably archived. In this hypothesis, the ‘box bearer’ must have been a man of high status and close to the interred king, and the box itself commissioned using exotic materials to complement its special significance.

In eastern Iran and southeast Arabia, small quadrangular boxes were carved from chlorite (and doubtless also wood): these were subdivided into up to five compartments, decorated with dotted circles or (in the case of Jiroft) figural and tufted designs in low relief, and closed with tight-fitting lids [e.g., Annen, and Hellwing 2017, 88, 269]. At Shahdad (Fig. 7), seven examples were found in six graves, two with clay boxes [Hakemi 1997, 190–91, 274–75, 280–81, 322–23, 326–27, 612–15]. Two others with white-filled incised zigzag designs on the exterior were found in room 76 in House XIII in Area VS at Mohenjo-daro, assumed to have been used as cosmetic boxes and recognised as imports [Marshall 1931, vol. II, 369, vol. III, pl. CXXXI.36–37]. Some were also traded up the Persian Gulf as they have been found on Bahrain [Ibrahim 1982, 78, fig. 45.3–4, pl. 53.3–4], and at Susa [De Miroschedji 1973, 30–31, figs. 9.2–3, 11.14–16. pls. VII.h, VIII.m–n]. They also trickled up into Central Asia as two are illustrated from Tomb 3245 at Gonur depe [Sarianidi 2006b, 243, 253, fig. 103]. As no contents have been noted in the literature, their intended function is unclear, although Sarianidi's [2008, 276] implication that they were 'cult articles' can be excluded. It should be noted that the capacities of these compartments are excessive for cosmetic, and it would have dried out before it could be fully used, so they must have been intended for another substance which has not left a visible trace.

During this period, larger decorated clay boxes are also known from graves in eastern Iran,

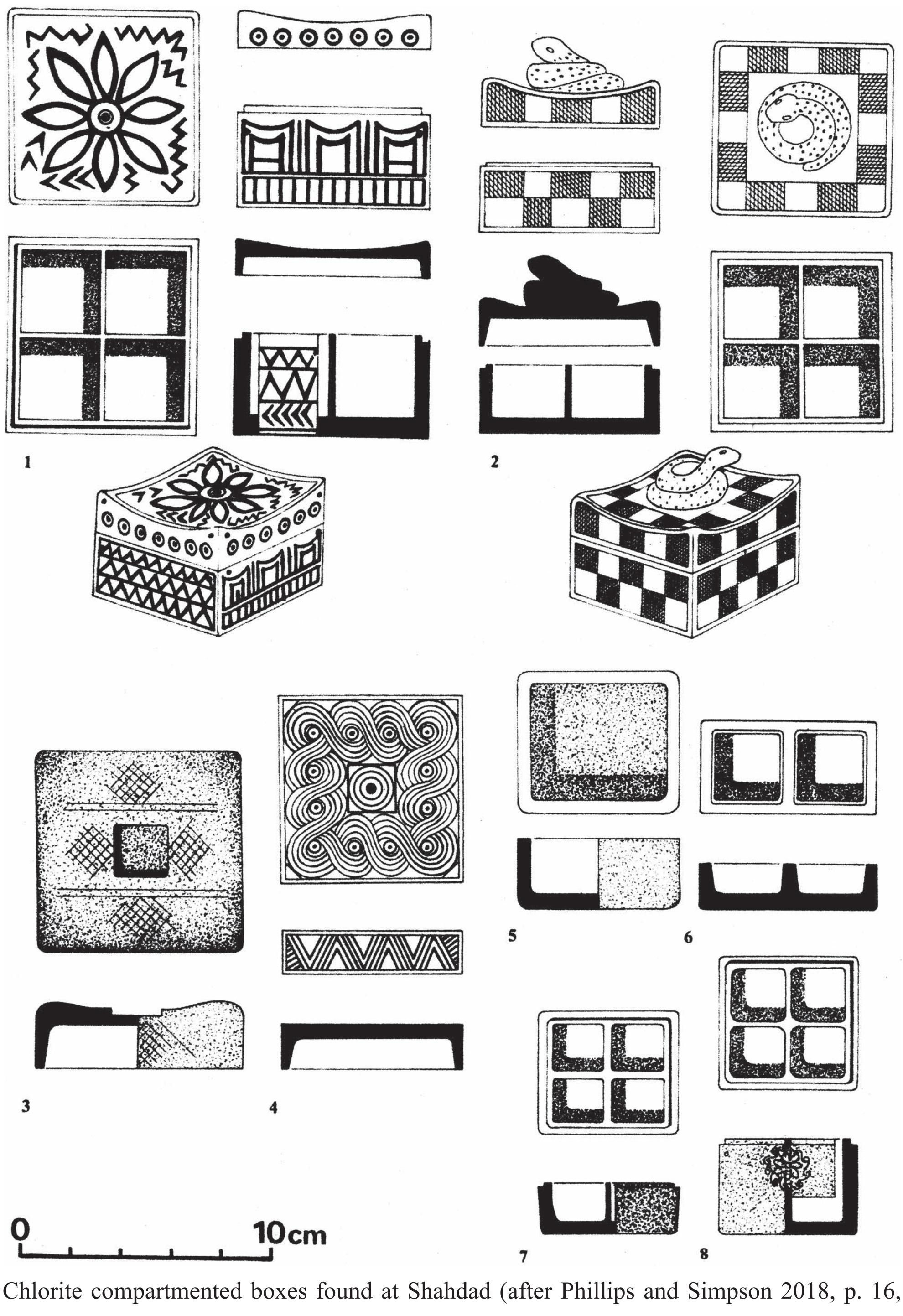

Fig. 7 Chlorite compartmented boxes found at Shahdad (after Phillips and Simpson 2018, p. 16, fig. 19).

the most spectacular example from grave 356 at Shahdad being described by the excavator as a 'clay room with mosaic decoration. Five sides of this small clay room are decorated with white, green and red flints and the design comprises two small and large rectangles. Inside the smaller rectangles there are two symmetrical lozenges with white sides. Inside the lozenges space is filled with green jasper and the outside one with red jasper. The wide space between the two rectangles is filled with two inclined designs similar to symmetrical jars' [Hakemi 1997, 662] (Fig. 8). This raises the possibility of other containers being made of wood but, unless they were inlaid, these would not be recognised archaeologically. However, these need not have been plain as a blue-painted wooden 'reliquary' was found at Shahr-i Sokhta [Tosi 1969, fig. 125], and it is reasonable to propose that decorated wooden versions were more commonly used than previously recognised.

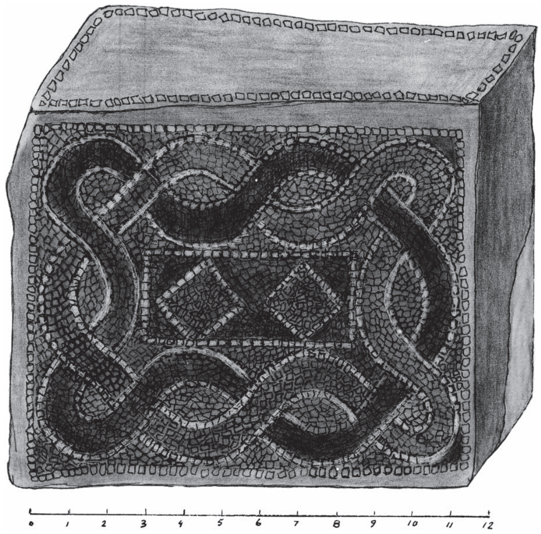

Fig. 8 Mosaic inlaid box found in grave 356 at Shahdad (after Hakemi 1997, p. 662).

L. Kircho has also drawn attention to the resemblance of this shape of object to the quadrangular square or rectangular fired clay 'reliquaries' found at Altyn-depe during the Chalcolithic and Bronze Age periods (ca 3300–2400/2300 BC). They are decorated with rows of carved 'stepped pyramid' or crenelation motifs, and the manner in which these are done suggests a chip-carving technique borrowed from the woodworking repertoire (Fig. 9). The motif itself may be inspired by woven textiles, was widely employed on painted pottery, compartmented seals, cosmetic applicator handles and beads, as well as small palettes and the 'cut out' decoration on some 'handbag weights', and was popular from the Kopet Dagh to Tajikistan and the Helmand basin during the late 4th and early 3rd millennia BC [Pottier 1984, figs. 23, 41, pl. XXXV; Bonora 2021, 755–56, fig. 26.2.16]. In other words, this motif was adopted as part of a distinctive regional design language applied to different media. L. Kircho proposed that their elaborate decoration, weight and fragility excluded an everyday function, suggesting that they served as symbolic homes for statuettes [Kircho 2010; cf. Kircho, Korobkova, and Masson 2008, 127–28, pls. 12.15, 23.22, 30.18–20, 46.5, 73.10-11, 96.14–17, 109.32, 120, 121.1–12, 147.25–17, 148; Kircho 2021, 124, 130, figs. 4.8.42–43, 4.9.37–38, 4.10.23].

We come finally to Gonur depe where the late V.I. Sarianidi found a range of evidence for mosaic inlay [Dubova 2021]. Two of the richer graves contained circular mirror boxes with decorated lids, one decorated with a bold cruciform design with small square black, red and white inlays arranged in the corners, the other with a composite cross in the centre, lozenges set into the arms of the cross and multiple square inlays in the corners again [Sarianidi 1998, 74, fig. 34; 2006b, 114, figs. 205–206; cf. also Rossi-Osmida 2002, 88–89, 121–31; Gass and Masanz 2018, 169–70]; two isolated inlays were also found in a robbed catacomb tomb in the Gonur depe North cemetery [Salvatori 1994, 17, fig. 5.8]. In other graves, the remains of large boxes or 'peculiar *ostensoriums*' and small earthen 'bins' were also found decorated on the exterior, and sometimes the interior, with geometric or figural mosaic patterns, including rows of heart or kidney-shaped inlays with coloured recesses, griffins, heads of panthers, boars and wolves and serpents devouring herbivores [Sarianidi 2006a, 97; cf. 2006b, 217, 248, figs. 71, 81, 83–87, 91; 2008, 194–95, 206, 221–25, figs. 83, 91–92, 114, 117–37; Gass, and Masanz 2018, 209] (Fig. 10). Moreover, another grave included a brick cist coffin covered with a wooden lid decorated with rows of multiple calcite discs with

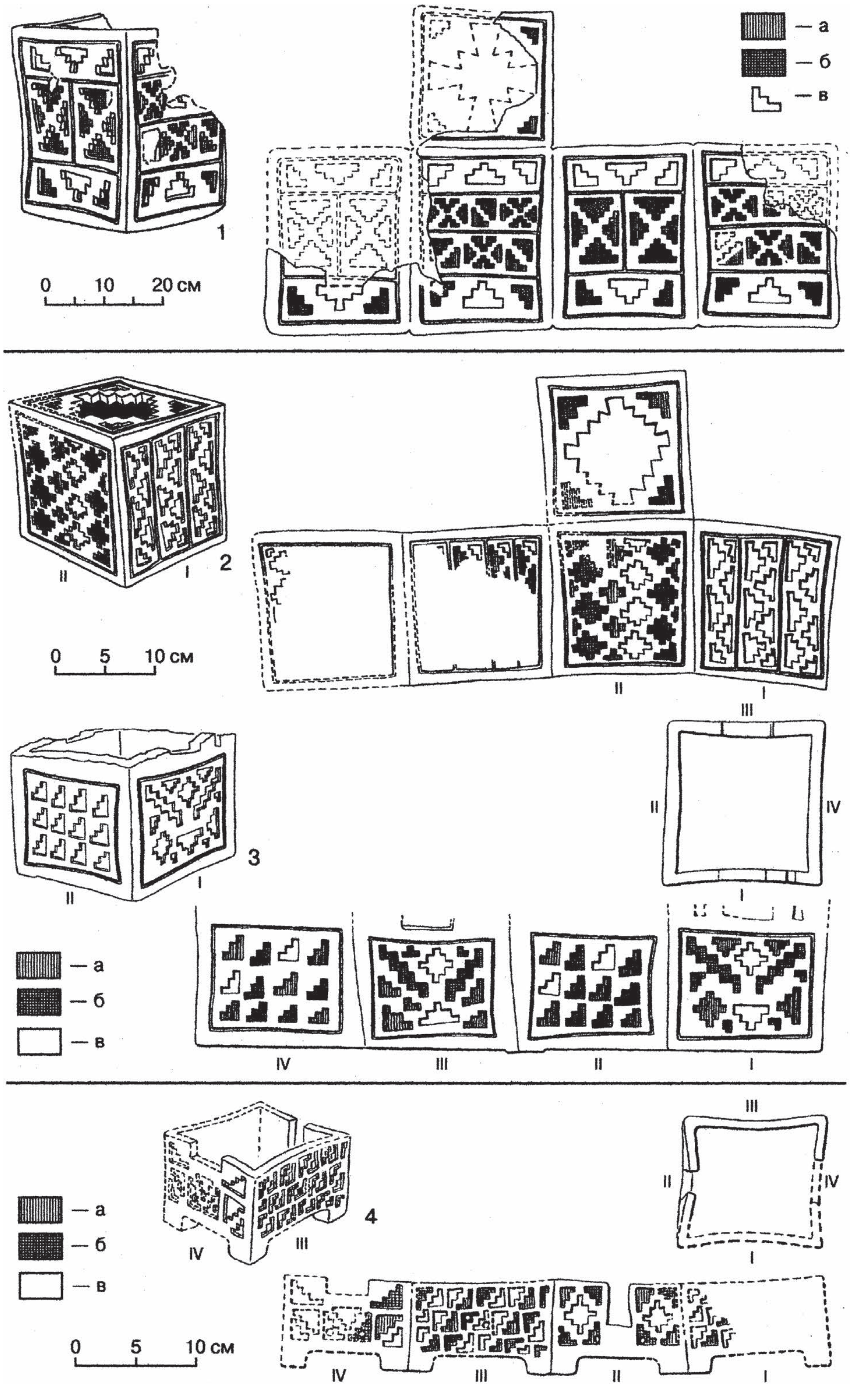

Fig. 9 Decorated fired clay 'reliquary' boxes found at Altyn-depe, Early (2–4) and Middle (1) Bronze Age periods: key: a, red paint; b, black paint; c, slit (1) or unpainted motifs (2–4) (after Kircho 2010, fig. 1).

coloured centres originally forming a geometric pattern [Rossi-Osmida 2002, 96–97]. These boxes were placed with the dead as a form of grave-good. Their size is consistent with a modern chest or trunk, and they may therefore have been used to hold clothing and other textiles which would not survive in these burial conditions. These excavated finds help provide a context for a number of other scattered or unprovenanced examples, including flat 'alabaster' pieces originally decorated with recessed trefoils and a humped bull found on a 'palace' floor at Dashly-3 [Sarianidi 1977, 47, fig. 19].

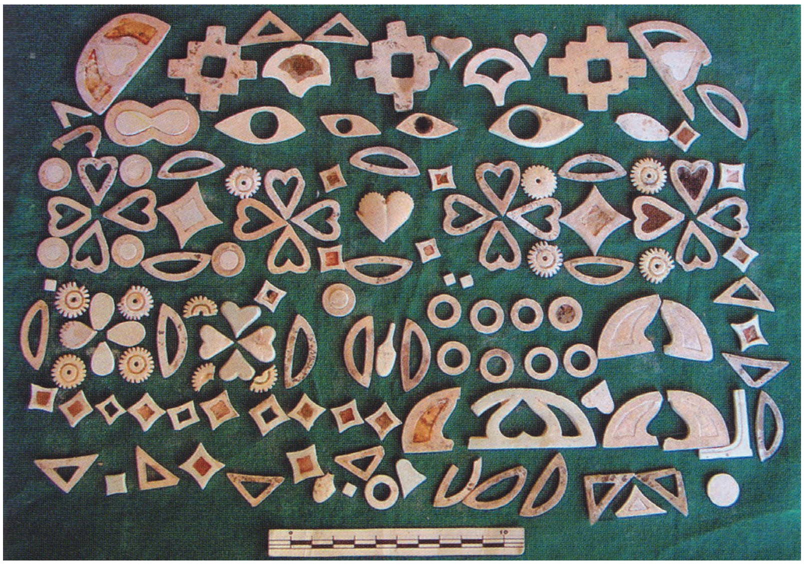

Fig. 10 Mosaic inlays found in tomb 3235 at Gonur depe (after Sarianidi 2006b, fig. 70).

Conclusions

The excavated evidence summarised here points to boxes of various sizes, shapes and decoration being part of the material culture and funerary repertoire during the late 3rd millennium BC from Mesopotamia to Central Asia. These Bronze Age communities were connected through trade, gift exchange and sometime military campaigns. Although the idea of a Meluhhan colony near Girsu has been contested [Laursen and Steinkeller 2017, 79–82], it is likely that trading family members lived for long periods abroad to secure good deals, just as Mesopotamian merchants are later attested on the Anatolian plateau to secure the tin for textile trade. We should not exclude the possible impact these well-placed individuals had on introducing new ideas, customs, games, vocabulary and exotic objects into their new surroundings, and that some objects were treasured keepsakes rather than trade goods. Zarins has drawn attention to the many comparisons the rich grave from Nippur described above has with other high-status burials of the late and post-Akkadian period from Ur, Aššur, Adab and Kish. He notes that inlaid wooden boxes are one of their diagnostic features, proposes that they belong to the mysterious foreign people described in Mesopotamian texts as Gutians, and goes so far as to suggest that they had a BMAC origin [Zarins 2020, 11–14]. Its function may now be explained as its comparable diameter to boxes and mirrors from Gonur suggests it was made to hold a circular mirror [e.g., Tishkin, Dubova and Seryogin 2019]. The possibility that this lady at Nippur may have been foreign raises another question: was this a traded import or was it a personal possession of the deceased if she entered Sumer from elsewhere? The ‘Amarna Letters’ refer to how royal princesses were married to secure treaties, and diplomatic correspondence between king Esarhaddon and the Scythian leader Bartatua refers to sending a princess in a diplomatic marriage [Simpson and Pankova 2017, 284]: such mechanisms therefore may explain the transmission of some items, such as hand-held mirrors and items of personal adornment, over very long distances [Pankova and Simpson 2020, 678].

As archaeologists, we have to follow the evidence in our interpretations and reconstructions of life in the past. However, we must always remember that much does not survive, either as a result of adverse burial conditions, ancient recycling, selective interment with the dead or removal from the record through systematic destruction in antiquity. In these cases, we subconsciously promote the importance of surviving categories of material culture at the expense of those which do not. In the case of the Bronze Age, much continues to be written about the trade in metals and semi-precious stones [e.g., Garner 2021; Pigott 2021; Tosi 1974], and the appearance of particularly diagnostic finds or classes of object as indicators of contact, including Mesopotamian and Harappan weights, Persian Gulf, Mesopotamian and Harappan seals, Harappan stick dice and gaming boards, denticulated glazed composition and bleached carnelian beads, steatite barrel beads with relief-cut trefoils, ivory combs, Iranian calcite and chlorite vessels, and willow-shaped bifacial arrowheads [e.g., Reade 1979; Phillips and Simpson 2018; Frenez 2018; Lombard 2021; Zarins 2020, 25–32]. To these we may now add another: lidded boxes with coloured geometric inlays. Some of these were of local design and limited circulation, but others moved great distances: even when all traces of the wood have vanished, the surviving inlays offer proof of these connections, raise tantalising questions over how they came to travel and oblige us to rethink how boxes of different shapes and sizes were used in antiquity.

Bibliography

Annen, S. and Hellwing, B., eds.

2017 *Iran. Frühe Kulturen zwischen Wasser und Wüste*. Bonn: Bundeskunsthalle / Hirmer.

Bar-Yosef, O.

1985 *A Cave in the Desert, Nahal Hemar, 900-Year-Old Finds*. Jerusalem: The Israel Museum.

David, H.

2018 Three examples of 3rd millennium BC softstone vessel imports found in Syria, *Softstone. Approaches to the study of chlorite and calcite vessels in the Middle East and Central Asia from prehistory to the present* (Phillips, C.S. and Simpson, St J., eds.), 79–84. Oxford: Archaeopress Archaeology.

Dubova, N.A.

2021 Polychrome inlayed and painted mosaics from Gonur Depe (Turkmenistan), *The World of the Oxus Civilization* (Lyonnet, B. and Dubova, N.A., eds.), 367–385. London and New York: Routledge.

Frenez, D.

2018 Manufacturing and trade of Asian elephant ivory in Bronze Age Middle Asia. Evidence from Gonur Depe (Margiana, Turkmenistan), *Archaeological Research in Asia* 15: 13–33.

Galili, E. and Schick, T.

1990 Basketry and a Wooden Bowl from the Pottery Neolithic Submerged site of Kefar Samir, *Mitekufat Haeven* 23: 142–151.

Garner, J.

2021 Metal sources (tin and copper) and the BMAC, *The World of the Oxus Civilization* (Lyonnet B. and Dubova N.A., eds.), 799–826. London and New York: Routledge.

Gass, A. and Masanz, R.

2018 Katalog der ausgestellten objekte, *Margiana. Ein köi greich der bronzezeit in Turkmenistan* (Parzinger, H. *et al*.), 148–233. Petersberg: Michael Imhof.

Hakemi, A.

1997 *Shahdad. Archaeological Excavations of a Bronze Age Center in Iran*. Rome: IsMEO.

Ibrahim, M.

1982 *Excavations of the Arab expedition at Sar el-Jisr, Bahrain*. Manama: Ministry of Information.

Kircho, L.B.

2010 'Relikvarii' Altyn-depe, *Transactions of the Institute for the History of Material Culture, St. Petersburg* 5: 117–122.

2021 The rise of the early urban civilization in southwestern Central Asia From the Middle Chalcolithic to the Middle Bronze Age in southern Turkmenistan, *The World of the Oxus Civilization* (Lyonnet, B. and Dubova, N.A., eds.), 110–142. London and New York: Routledge.

Kircho, L.B., Korobkova, G.F. and Masson, V.M.
2008 *Tekhniko-tekhnologicheskiĭ potent͡sial ėneoliticheskogo naseleni͡ia Altyn-Depe kak osnova stanovleni͡ia rannegorodskoĭ t͡sivilizat͡sii*. St. Petersburg: Evropejskij Dom.

Laursen, S. and Steinkeller, P.
2017 *Babylonia, the Gulf Region, and the Indus. Archaeological and Textual Evidence for Contact in the Third and Early Second Millennia B.C.* Winona Lake: Eisenbrauns.

Lombard, P.
2021 The Oxus Civilization / BMAC and its interaction with the Arabian Gulf. A review of the evidence, *The World of the Oxus Civilization* (Lyonnet, B. and Dubova, N.A., eds.), 607–634. London and New York: Routledge.

Mackay, E.
1931 Ivory, shell, faience, and other objects of technical interest, *Mohenjo-daro and the Indus Civilization. Being an official account of Archaeological Excavations at Mohenjo-daro carried out by the Government of India between the years 1922 and 1927* (Marshall, Sir John, ed.), vol. II, 562–588. London: Arthur Probsthain.

Madjidzadeh, Y.
2003 *Jiroft. The Earliest Oriental Civilization*. Tehran: Ministry of Culture and Islamic Guidance / Cultural Heritage Organization Research Centre.

Marshall, Sir John, ed.
1931 *Mohenjo-daro and the Indus Civilization. Being an official account of Archaeological Excavations at Mohenjo-daro carried out by the Government of India between the years 1922 and 1927*. London: Arthur Probsthain.

McMahon, A.
2006 *Nippur V. The Early Dynastic to Akkadian transition. The Area WF sounding at Nippur*. Chicago: Oriental Institute of the University of Chicago.

Mellaart, J.
1964 Excavations at Çatal Hüyük, 1963. Third Preliminary Report, *Anatolian Studies* 14: 39–119, pls. I–XXVI.

Miroschedji, P. de
1973 Vases et objets en steatite susiens du musée du Louvre, *Cahiers de la DAFI* 3: 9–79.

Pankova, S.V. and Simpson, St J., eds.
2020 *Masters of the Steppe: the Impact of the Scythians and Later Nomad Societies of Eurasia*. Oxford: Archaeopress Archaeology.

Phillips, C.S. and Simpson St J., eds.
2018 *Softstone. Approaches to the study of chlorite and calcite vessels in the Middle East and Central Asia from prehistory to the present*. Oxford: Archaeopress Archaeology.

Pigott, V.C.
2021 The acquisition of tin in Bronze Age Southwest Asia, *The World of the Oxus Civilization* (Lyonnet, B. and Dubova, N.A., eds.), 827–861. London and New York: Routledge.

Piperno, M. and Salvatori, S.
1983 Recent Results and New Perspectives from the Research at the Graveyard of Shahr-i Sokhta, Sistan, Iran, *Annali* 63: 172–191.

Pottier, M.-H.
1984 *Matériel funéraire de la Bactriane méridional de l'Age du Bronze*. Paris: Éditions Recherche sur les Civilisations.

Reade, J.
1979 *Early Etched Beads and the Indus-Mesopotamian Trade*. London: The British Museum.

Rossi-Osmida, G., ed.
2002 *Margiana Gonur-depe Necropolis. 10 years of excavations by Ligabue Study and Research Centre*. Venice: Ligabue Study and Research Centre.

Salvatori, S.

1994 Excavations at the Namazga V Late graveyard of Gonur 1 (Murghab Delta, Turkmenistan). Preliminary report on the 1993 field season, *Rivista di Archeologia* 18: 14–39.

Sarianidi, V.I.

1977 *Drevnyaya Zemledel'tsi Afghanistana. Materiali Sovetskoy–Afghaniskoy Ekspedisii 1969–1974.* Moscow: 'Nauka'.

1998 *Margiana and Protozoroastrism*. Athens: Kapon.

2006a A Tsar's Necropolis in the Kara Kum Desert, *Art and Archaeology of Afghanistan. Its Fall and Survival. A Multi-disciplinary Approach* (Krieken-Pieters, J., ed.), 95–101. Leiden / Boston: Brill.

2006b *Goňurdepe: City of Kings and Gods*. Ashgabat: Miras.

2008 *Necropolis of Gonur*. Athens: Kapon.

Simpson, St J.

2021 Шкатулки бронзового века: экзотические импорты, подражания-скевоморфы и локальное производство от Центральной Азии до Шумера, *Arkheologicheskiye vesti / Archaeological News* 32: 119–132 (with English abstract).

Simpson, St J. and Pankova, S., eds.

2017 *Scythians: warriors of ancient Siberia*. London: Thames and Hudson.

Tishkin, A.A., Dubova, N.A. and Seryogin, N.N.

2019 Rentgenofluorestsentnyy analiz metallicheskikh zerkal iz arkheologicheskiy kompleks Gonur-depe (Turkmenistan), *Drevnosti Vostochnoy Yevropy, Tsentral'noy Azii I Yuzhnoy Sibiri v kontekste svyazey i vzaimodeystviy v yevraziyskom kul'turnom prostranstve (novyye dannyye i kontseptsii)*: 83–86.

Tosi, M.

1969 Excavations at Shahr-i Sokhta. Preliminary Report on the Second Campaign, September-December 1968, *East and West* 19: 283–386.

1974 The lapis trade across the Iranian plateau in the 3rd millennium, *Gururājamaňjarikā. Studi in Onore di Giuseppe Tucci*: 3–22. Naples: Istituto Universitario Orientale.

Zarins, J.

2020 Ur, Lagash and the Gutians: a study of late 3rd millennium BC Mesopotamian archaeology, texts and politics, *In Context. The Reade Festschrift* (Finkel, I.L. and Simpson, St J., eds.), 11–42. Oxford: Archaeopress Archaeology.

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[Editorial postscript（編集後記）]

We are delighted that despite the COVID-19 pandemic, two articles have been contributed to this volume by one of our foreign friends, Dr. Simpson, who is a staff member of the British Museum. We are also pleased that a contribution has been made from Dr. Kawakami, who took the degree of Ph.D. at the University of Liverpool under the supervision of Professor A.R. Millard (who has now the title of Professor Emeritus), and that Dr. Tsuneki, who has recently received the degree of Ph.D. from Kokushikan University, has become one of the contributors to this volume. Additionally it is noted that Dr. Kawakami and Dr. Tsuneki are collaborative researchers of our Institute.

We would be very grateful to all the contributors to this volume of *al-Rāfidān*.

（H. Oguchi）

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