Studia Quaternaria, vol. 39, no. 2 (2022): 95–111 DOI: 10.24425/sq.2022.140886

THE ARID REGIONS OF DARYALYK TAKYR AND TELIKOL: ETHNO-GEOARCHAEOLOGICAL STUDY OF A STRATEGIC TRANSHUMANCE RANGELAND ON THE RIGHT BANK OF THE SYR DARYA DELTA, KAZAKHSTAN

Jean-Marc Deom*, Renato Sala

Al-Farabi Kazakh National University (KazNU), Faculty of History, Archaeology and Ethnology, 71 al-Farabi Ave., 050040 Almaty, Republic of Kazakhstan;
e-mails: Jean-Marc Deom jeandeom@kaznu.kz, Renato Sala renato.sala@kaznu.kz

** corresponding author*

Abstract:
A previously unexplored 20,000 km^2 area comprising the Daryalyk Takyr desert and the lacustrine landscapes of Telikol and Aschykol at the confluence of the Chu, Sarysu and Syr Darya rivers is presented here as object of a threefold geological, archaeological and ethnographic analysis assessing its historical importance. According to paleohydrological reconstructions, synchronous fluvial activity of the three rivers occurred during the Late Pleistocene. In the Holocene, the right branches of the Syr Darya delta were separated from the Chu-Sarysu confluence by alluvial sediments, becoming active only intermittently during undated flood events apparently strong enough to establish an ephemeral lake in the region. Geoarchaeological surveys analyzing surface finds indicate the densest occupation during the Late Neolithic and Bronze Age. From medieval to modern times, historical sources attest to the seasonal use of the Telikol region as a pastoral transit between the Syr Darya banks and the steppes of Central Kazakhstan. They are confirmed by ethnographic data about Telikol during its last phase of occupation (1870–1910) illustrating that land use in this area (and, probably, in all semi-desert regions in Kazakhstan) was not governed by property rights but by tribal political compromises between residential and transitory herders, occasionally exposing it to overgrazing.

Key words: Syr Darya delta, northern desert, Holocene, geoarchaeology, mobile pastoralism.

Manuscript received 7 December 2021, accepted 5 February 2022

INTRODUCTION

The left side of the Syr Darya river delta in Kazakhstan has been substantially researched, first by the Khorezmian Archaeological-Ethnographic Expeditions (KAEE) led by S. Tolstov (1937–97) (Tolstov, 1962; Levina, 2000) and subsequently by Kazakh and international expeditions during more recent years (Kurmankulov and Utubayev, 2017; Arzhantseva and Tazhekeyev, 2014; Baipakov *et al.* 2012; Bonora, 2019). Conversely, the right side of the delta, constituting a huge area of 100x200 km adjoining the Daryalyk Takyr desert, remains largely unexplored.

Archaeological studies in the Syr Darya delta began at the end 19th century with the recording of several large historical towns (Lerkh, 1870; Kallaur, 1901), but it was not until the multidisciplinary research of the KAEE that extensive past human occupation was discovered in the ancient deltas of the South and East Aral region. These expeditions developed from their initial geographical focus in the core of 'Ancient Khorezm' on both banks of the lower Amu Darya (1937–41, 1945–91) and were expanded into the Syr Darya delta (1946–97) for reconstructing the prehistory and history of the agro-pastoral urban centers of the region. Hundreds of sites and monuments from the Neolithic to modern (1500–1945 AD) periods were documented and excavated (Arzhantseva, 2015).

The KAEE did not concern the right bank of the lower Syr Darya river (Vainberg, 1997: 31), where 5 ancient towns surrounding Signak (dated 6th–18th century AD) had been known since the early 20th century, and where over the last 30 years Kazakh archaeologists have documented 20 sites mostly located in the alluvial plain (Svod, 2007). While the Daryalyk Takyr desert itself lacks any published archaeological reports (AKK, 1960; Svod…, 2007), two leading researchers from the last phase of the KAEE (1976–97) devoted to the study of the Zhetyasar monu-

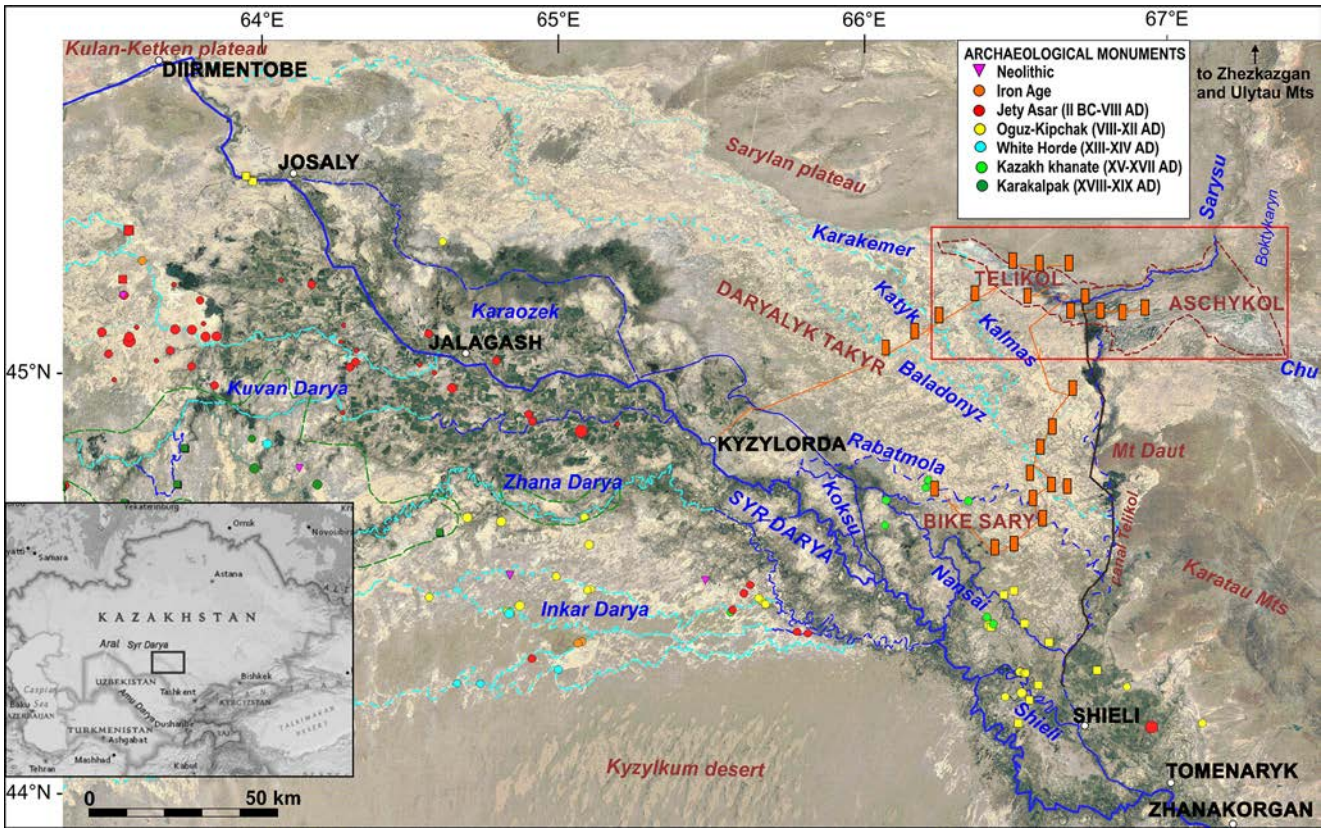

Fig. 1. Satellite map of the eastern part of the Syr Darya delta. Lines: Blue – Syr Darya delta and Sarysu active channels; Azure – dry paleo-distributaries. Colored dots: archaeological monuments of different chronological periods. Names: Blue – river courses; Brown – geological features; Black – towns and villages. Square frame: Telikol-Aschikol lacustrine landscape. Orange lines and rectangles: track and sites of the 2018 survey.

ments (3rd century BC–9th century AD) on the left bank of the Syr Darya delta, considered the Daryalyk Takyr to have played two major roles in supporting the left-bank Syr Darya urban centers (Levina, 1996; Vainberg, 1999). The first possible role was as water supply in the form of a huge lake, possibly larger than the Aral Sea that filled twice during historical times: in the Iron Age (~200–1 BC) feeding the Eski-Daryalyk and the Zhetyasar towns, and in the medieval period (~900–1100 AD) supporting the development of a regional urban complex (Vainberg, 1997; Levina and Galieva, 1995: 5). The second role was as vital transit point for the Syrdarya delta agro-pastoral population during their seasonal transhumance towards the summer rangelands of central and northern Kazakhstan (Vainberg, 1999).

Given the importance of these hypotheses and the current lack of empirical data, two goals motivated our research: a) to survey the Daryalyk Takyr in order to assess its potential water discharge during the late Holocene; b) to identify the existence and chronology of archaeological sites. The survey took place during 2018, comprising the geoarchaeological study of the area located between the Syr Darya in the south and the final courses of the Chu and Sarysu rivers in the north (Fig. 1). The research took place in three stages: 1) analysis and tentative reconstruction of geological, hydrological and environmental processes; 2) analysis of our geoarchaeological fieldwork; 3) synthesis of archaeological data, historical sources and ethnographic reports concerning land use in the region.

GEOGRAPHICAL-ENVIRONMENTAL FEATURES AND GEOLOGICAL HISTORY OF THE RIGHT BANK OF THE SYR DARYA DELTA

The northeastern part of the Syrdarya delta is a desertic plain covering a total area of 19,050 km^2 (around 25% of the entire area of the Syr Darya delta) and crossed by Syr Darya right-bank paleochannels. The paleochannel heads span from Tomenaryk village in the SE (where the first large relict branch departs northwards from the Syr Darya riverbed along the tract of the modern Telikol canal) to Diirmentobe in the NW (where the Sydarya river turns west after being joined by the last relict branches of the Chu-Sarysu river system) (Fig. 1). Their course slopes to the NW for 130 km in the east to 70 km in the west until the terminal Sarysu river reaching an elevation difference of -10 m.

This huge area can be divided into 3 regions:

1. The right-bank floodplain of the modern Syr Darya river (5,000 km^2), a 230 km long by 30 km wide moist band

Fig. 2. a – Daryalyk Takyr desert plain south of the Baladonyz paleochannel: view to W of a takyr from the top of sand ridges. b – Telikol lacustrine landscape: Sorkol lake, view to N.

between Tomenaryk and Josaly, crossed by intermittently active paleochannels and lacustrine systems, from E to W: Shieli, Nansai, Koksu, Karaozek, the latter representing the largest spill. This right floodplain played a significant hydrological role, with discharges antinomic to phases of desiccation in the left floodplain; and also a historical role as testified by the documentation of 25 medieval settlements within its boundary (Svod…, 2007).

2. The desiccated alluvial plain of Daryalyk Takyr (13,200 km^2), an almost totally flat relief with a slope of 0.3% from the limits of the Syr Darya floodplain (140–133 m asl) to the final Telikol river course (126 m asl). The plain is divided into two sub-regions: a) the Daryalyk Takyr proper (11,000 km^2), developing SE to NW as a large flat desert made of sand and clay and covered by scarce vegetation; b) the southeastern and eastern-northeastern peripheries of the plain, i.e. two areas with more abundant moisture and shrub vegetation due to its proximity and ephemeral floods from the Syr Darya, respectively: the Bike Sary steppe (2,200 km^2) crossed by higher dune formations, the Kalmas and Baladonyz paleochannels, and the Telikol canal (Figs. 1, 2a). Considering the proclivity of the lower Syr Darya course to spill through its right paleo-distributaries and the settlement patterns associated with their activation, Sala (2019) hypothesizes a flood from the right bank of the Syr Darya delta into the Daryalyk Takyr plain during the medieval period, which was responsible for the reduction of most of the residual Syr Darya river stock (21.1 km^3), the establishment here of a lacustrine landscape, and a significant regression of the Aral Sea.

3. The lacustrine landscape of Aschykol lake to the east (200 km^2, Chu river basin) and Telikol lake to the west (650 km^2, Sarysu river basin), created by the Chu and Sarysu deltas. The Aschykol lake is partially supplied by the Chu river system, but primarily by the Boktykaryn left distributary of the Sarysu river. The Telikol lake [*Telikol is a Turkic toponym made of two words, Teli, meaning 'young bull feeding on two cows' and kol, meaning 'lake', indicating that the lake is fed by the waters of two river systems, Sarysu and Chu* (Yerofeyeva, 2014: 388)] is separated from Aschykol by an 8 km wide strip of land devoid of modern surface flow between the two lakes and extends further west through the ephemeral Karakemer channel along the foot of the Cretaceous Sarylan plateau. The importance of the two lakes resides in the fact that they represent relatively vegetation-rich habitats that, from Late

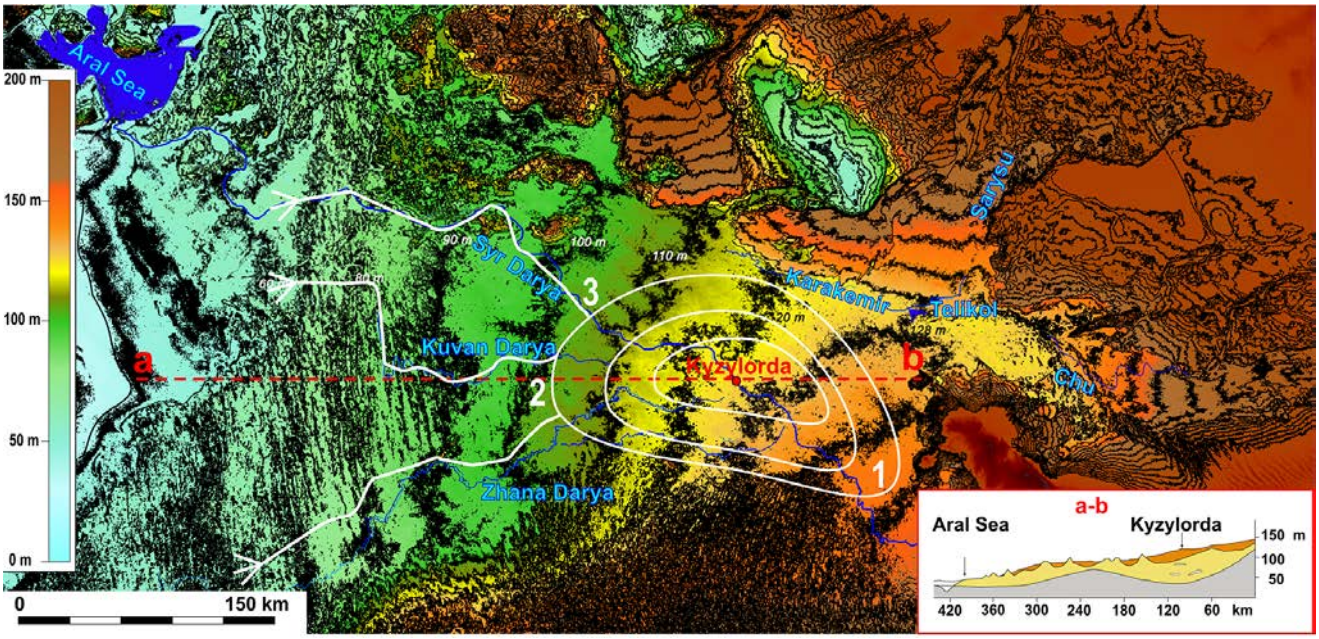

Fig. 3. Relief map of the Syr Darya delta showing the 3 Quaternary stages of delta formation (white lines): 1 – filling of the Kyzylorda depression (Middle Pleistocene); 2 – Ancient Syr Darya delta distributaries directed SW and W towards the Aral Sea basin (Post-glacial and Early–Mid Holocene); 3 – modern Lower Syr Darya course and Kazalinsk delta (Late Holocene). Framed scheme: cross-section of the Syr Darya delta on the latitudinal transect Kyzylorda-Aral Sea with 'Kelteminar' sediments (in yellow) and 'Yaxartes' sediments (orange), both above the Cretaceous layers of the Kyzylorda depression (gray) (modified from Borovskiy and Pogrebinskiy, 1958).

Neolithic to modern times, have been the object of transhumant pastoralist activities, as indicated by archaeological findings (Rogozhinskii, 2017) and ethnographic accounts (Mukanov, 1991; MKZ, 1912). Shallow and salty during most of the year, the lakes fill up from the beginning of April, reaching maximum water level in May, and retaining fresh water until August, after which they become quickly salinized. Throughout history only a few farmers with a small number of livestock could spend the summer season in Telikol, occasionally using the high water period for irrigation (MKZ, 1912) (Fig. 2b).

The modern **climate** of the region, according to the Köppen classification, is cold desert climate (BWk). In Telikol (Zlikha station), the average annual temperature is 8.54 °C (January -10.3, July 26.4), average precipitation 185 mm (max. April 31 mm, min. September 0.8 mm), continentality index 36.7, aridity index 4.0 (WBCS, 2020).

From SW to NE, the **vegetation** cover changes in three steps: from tugai forest and meadows along the banks of the Syr Darya to reeds, shrubs and halophytes near lacustrine depressions at the desert borders; saxaul shrubs further north and almost barren areas in the clayish and sandy desert of central Daryalyk Takyr; and again shrub and reed groves around the moister final Sarysu course and Telikol lake (Natsional'nyy atlas respubliki Kazakhstan, 2010).

The local **fauna** is typical of the northern deserts of Central Asia: agama lizard, snake (four-lined snake), gerbil and jerboa, tolai hare, saiga antelope, goitered gazelle (jairan), corsac fox and wolf; in the Telikol region, are found migratory birds (pelican, flamingo, cormorant, heron, stork, little and black-necked grebe, ducks) together with wild boar (Gubin and Levin, 2017); in the larger Telikol lakes fish like carp, pike, perch, crucian carp, catfish (Brockhaus-Efron, 1901).

The desert environment is only exploitable by humans through hunting or nomadic stockbreeding, but is very vulnerable to precipitation changes, inducing sharp variations in pastoralist opportunities and transhumance patterns at the millennial and decennial scale (Kerven *et al*., 2021).

Scientific research on the geological evolution of our study area began with N.A. Severtsov who crossed the Daryalyk Takyr in 1857 and recognized the alluvial origin of the plain (Severtsov, 1947). He was followed in 1888 by Y.A Schmidt who assumed that a mighty flow resulting from the confluence of the three rivers may have once been running "till the outskirts of the city of Perovsk [present-day Kyzylorda] into the Syr Darya river" (Shmidt, 1894: 37). S.S Neustruev undertook the first detailed research of the region, in particular on the formation of takyrs, in the context of its environmental characterization for the census of 1910 (Neustruev, 1911; MKZ, 1912). In 1927–33, the region was studied by D.I. Yakovlev who documented the resurgences of the Chu artesian basin across the Daryalyk Takyr towards the Aral Sea (Yakovlev, 1941).

Although lacking any absolute chronology, the study of the hydrological history of the Syr Darya delta has been attempted several times. I.P. Gerasimov, in the frame of the Cenozoic history of the Turan depression (Gerasimov, 1937), reconstructed the history of the Syr Darya delta in 3 phases: Early Pleistocene, when the Syr Darya merged with the Amu Darya, together discharging into the Caspian Sea; Middle Pleistocene when it crossed the newly formed sand

deserts of the Kyzylkum and Daryalyk Takyr; and Late Pleistocene, when the rivers Chu, Sarysu and Syr Darya converged as a large delta discharging in the Aral Sea.

This scenario was reassessed by B.A. Fedorovich who similarly dated the first phase to the turn of the Tertiary and Quaternary periods and the third phase to the Late Quaternary when the Syr Darya, after reaching the Kyzylorda region, twisted southwestward to the southeastern corner of the Aral Sea through the Zhana Darya channel (from which the name of the 'Zhana Darya' epoch). This third phase was followed by two further stages: a post-glacial stage when the Syr Darya course moved northward and reached the Aral Sea through the Kuvan Darya (Late Khvalynian, 20–10 ka BC, named the 'Kuvan Darya' epoch); and the Holocene stage when the Syr Darya moved further north, breaking the Cretaceous sediments of the Kulan-Ketken plateau and, turning west, formed the modern Kazalinsk delta (Fedorovich, 1952).

A more detailed hydrological reconstruction of the second and third phases was provided by B.M. Borovskiy and M.A. Pogrebinskiy, based on stratigraphic data resulting from a series of deep boreholes in the Syr Darya basin (Borovskiy and Pogrebinskiy, 1958). According to the authors, the Middle–Late Pleistocene history of the Syr Darya delta can be divided in two periods, called Kelteminar and Yaxartes, characterized by different geological formations The Kelteminar formation started during the Middle Pleistocene and developed in 2 stages. The first stage corresponds to the progressive filling of the Kyzylorda depression (depth of 60–80 m) with alluvial sediments from the Syr Darya, Chu and Sarysu rivers: the time required for filling the cavity might have taken around 56 ka. The second stage occurred when the Syr Darya, after filling the Kyzylorda depression, began forming a delta and reached the Aral Sea through a long phase of alluvial deposition. Based on the modern runoff of the Syr Darya, the time interval necessary to accumulate the sands of the Kelteminar delta has been estimated at around 200 ka (Borovskiy and Pogrebinskiy, 1958: 19).

The Yaxartes formation started around 20 ka BP with the simultaneous activation, in differing degrees, of several deltaic branches, among which a diagonal distributary to the northernmost paleo-Kazalinsk delta (Tolstov, 1962; Andrianov, 1969). The delta complex might have reached maximum discharge during the Atlantic period, after which Borovskiy and Pogrebinskiy, considering the relative stability of the climate and available runoff during the Late Holocene, attribute the successive south-to-north phases of aggradation and desiccation of the main deltaic distributaries (Inkar Darya, Zhana Darya, Kuvan Darya, Eski Daryalik, modern Syr Darya) to be the result of both drying natural trends and anthropogenic pressure from agro-urban activities upstream (Borovskiy and Pogrebinskiy, 1958: 26–27).

The cutting of the modern Syr Darya course across the Kulan-Ketken plateau (Fig. 1) and the formation of the modern Kazalinsk delta are events attributed by the authors to the last 2000 years.

MATERIALS AND METHODS

Our research involved three phases of work: 1 – desk-based survey of all available data concerning our study area: topography, environmental and paleoenvironmental contexts, archaeological background, and history of land and water use from historical and ethnographic materials; 2 – fieldwork; 3 – data analysis and synthesis of datasets, including remote sensing analysis of the elements of the cultural landscape and comparison between archaeological and ethnographic data.

Archival documentation

Environmental characteristics

We first incorporated modern topographic data in a GIS (MapInfo) (Soviet military maps, 1984–85), and georeferenced historical maps in order to reveal hydrogeomorphic and cultural changes during modern times. If 19th and early 20th century maps (Karta 1848; 1910; 1919) did not indicate significant changes in the environmental settings, we used 18th century maps (Truskot, 1772; Schraembl, 1792; Pansner, 1816). Although less accurate, these older maps revealed that the Telikol lake was once much larger, probably testifying to a more pluvial phase. Thematic layers were then added: Geological maps at two scales (Geological maps SSSR, 1966, 1979); maps of Quaternary deposits, geomorphology, soil, vegetation and landscape at larger scale (Natsional'nyy atlas respubliki Kazakhstan, 2010). Relief maps were produced with Global Mapper on the base of satellite land cover data and Aster GDEM at 1-arc-second resolutions for terrain analysis (Fig. 3).

All the cartographic material was then analyzed, synthesizing the available information on historical geography, relief, hydrology, climate, soil and vegetation for our study area. Our spatial data were supplemented by additional information on Quaternary sediments and stratigraphy (Borovskiy and Pogrebinskiy, 1958; Nikiforova, 1960), hydrogeology (Yakovlev, 1941), and the original fieldwork reports about the area compiled before the 1940s (Neustruev, 1911; Spiridonov, 1922; Pavlov, 1931). Detailed climatic data were obtained from the Bioclimatic Classification System of S. Rivas-Martinez (WBCS, 2020) and from archival data of the meteorological station Zlikha in Telikol (1951–2020, Pogodaiklimat, 2020). Paleoenvironmental proxies previously reconstructed for the Holocene climate of the Aral Sea basin were used as background of the present study (Sala, 2019; Sorrel *et al*., 2007; Krivonogov *et al*., 2014).

Archaeological context

To the same GIS platform, we imported all the available data on archaeological sites from national (AKK, 1960) and provincial (Svod…, 2007; GSPIKMZ-KO, 2020) in-

ventories. This information was previously systemized and analyzed during the study of the urbanization of the Syr Darya valley (Sala, 2012), and now supplemented with archaeological data more recent and from adjacent regions.

Historical context

We compiled historical sources for the pre-Mongol time (2nd century BC–13th century AD) (Barthold, 1963, 1965; Agazhanov, 1969), the Golden Horde and Timurid periods (Klyashtornyi and Sultanov, 1992; Abuseitova and Baranova, 2001) and the Uzbek and Kazakh Khanates (Sultanov, 1982; MKKh, 1969). Accounts relating to the Russian exploration of the region (IKRI, 2005, 2007), early scientific reports, and protocols of land use arbitration (Mukanov, 1991) were also used as historical documents.

Ethnographic and statistical data on land and water use (late 19th–early 20th century AD)

Significant to our present research are some statistical data concerning the pastoralist tribes of the Syr Darya delta, particularly details regarding their socio-economic structure and migratory strategies. These data suggest a model of environmental and social interactions that can be employed in the reconstruction of earlier phases (Vainberg, 1999). The data are provided through statistical accounts collected in 1910 and compiled in the 'Materialy po kirgizskomu zemlepol'zovaniyu' [Materials on Kyrgyz (*Kazakh*) land use] (hereafter abbreviated MKZ) (MKZ, 1912). Information included in MKZ is based on a demographic and economic census performed by a team of statisticians belonging to the 'Russian Tsarist Department of Population Resettlement' of the 'Directorate of Land Management and Agriculture'. Their goal was to quantify the amount of land required by the Kazakh population for its sustainable development, in order to calculate the land surplus that could be used by Russian colonists. The tables, organized by districts, communities and economic classes, contain information on the local population, including family composition, clan and hierarchical relations, environment and water supply, residency and mobility, occupation and economic dependence, ownership in terms of livestock, arable land and socioeconomic services.

This statistical compilation identified in the Perovsk county four residential districts:
– the right bank of the Syr Darya (from Tomenaryk to Josaly);
– the left bank of the Syr Darya including the upper course of the Kuvan Darya;
– southwestern Karatau (from Besaryk to Tomenaryk);
– the Telikol district consisting of the Telikol-Aschykol lacustrine landscape (Fig. 1).

In terms of economy, the first three districts were agro-pastoralist semi-nomadic, while the latter was pastoral nomadic. The rest of the Perovsk county, including Daryalyk Takyr, was land of common use.

Archaeological fieldwork

The fieldwork survey of Daryalyk Takyr and Telikol occurred in October 2018 with the goal of building a chronology of the human occupation of the region. The main strategy was to investigate sites attested by maps as previously populated areas, characterized by the remains of wells, houses and cemeteries.

The survey occurred along three transects intersecting the paleochannels and the lake system:
– diagonally, across the Daryalyk Takyr plain surrounding the Kyzylorda-Zhezkazgan road;
– meridionally, across the eastern part of the plain, from the Telikol lake in the north to the Nansai channel of the Syr Darya floodplain in the south;
– latitudinally, along the full length of the Telikol region (Fig. 1).

The survey was performed by a team of 5 people walking transects from a central feature (usually a well), recording environmental features, surface finds of artefacts (potsherds, lithics, metal), preserved structures (e.g. house, animal pen) and burials.

All finds were recorded by GPS and described in paper notebooks; and the results were then imported into a database and quantified (Excel). Extensive prospection was followed by a more detailed survey of loci with high concentration of finds and, in that case, by sampling and collection of diagnostic artefacts (those giving chronological information from ornamentation, fabric, shape etc.). In Telikol, given the abundance of ethnographic material, only older artefacts (~2%) were collected while modern finds were only recorded and photographed.

Remote sensing

Remote sensing material consisted of Landsat 7 (ETM+) images treated in false-color through ENVI for vegetation and moisture analyses as well as good resolution surface images (Bing, Google). Satellite images were used for analyzing the extent of wet areas during maximum flood periods (MODIS, 2002–2005) and early spring snowmelt accumulation (NASA EO, 2004) and, most significantly, for quantifying the cultural features (house, yurt, field, well etc.) in our study area. They also supported the planning of the survey itinerary by providing information on the present conditions of tracks, bridges and flooded areas. Satellite images were imported in MapInfo and all cultural landscape monuments were recorded and quantified.

RESULTS

Paleohydrology of the Daryalyk Takyr plain

With regard to the contribution of the Chu and Sarysu rivers to the hydrology and relief of the Daryalyk Takyr, it has been postulated that within this plain [*obviously in*

antiquity and probably again during the Middle Ages, was located a lake fed by the water of the rivers Syr Darya (part of its flow), Sarysu and Chu. It is not excluded that it could represent the lake noticed by ancient and medieval Chinese maps and mentioned by medieval Muslim travelers (...). If at a certain time existed such a lake and not, as now, just a chain of lakes formed by the Chu and Sarysu deltas, then it could maximally enclose the territory of the Quaternary sediments in the right bank (Vainberg 1997: 31)]. This assumption was based on the assessment that the Eski Daryalyk paleochannel supplying the western Zhetyasar towns (500 BC–800 AD) could have come from the east of the modern Syr Darya course but, in any case, in absence of right spills from the lower Syr Darya, no farther east than the Karaozek lake system.

In fact, for Borovskiy and Pogrebinskiy, [*the assumption of a former, much greater than now, high discharge of the river Chu cannot be considered solid (...); if it ever reached the Syr Darya during the formation of the Kelteminar delta, then it was probably a small river, many times smaller than the Syr Darya. The valley of the river Sarysu is very narrow and corresponds approximately to its modern scanty river flow: it is difficult to assume that in the past it could exist an arena for the activity of a much more powerful and deep river flow than its modern discharge* (Borovskiy and Pogrebinskiy 1958: 18]. Besides, after the filling of the Kyzylorda depression and the accumulation of alluvial deposits from the Syr Darya to the Daryalyk Takyr plain, the Sarysu and Chu rivers were gradually pushed back to their present position (Borovskiy and Pogrebinskiy, 1958: 23).

However, on the Daryalyk Takyr surface are detected traces of several parallel paleochannels departing from the right bank of the Syr Darya in the SE-NW direction, and large enough to erode and cut preexisting perpendicular elongated dune ridges 10 m high deposited by NE-SW winds. Besides the grayish color of paleo-courses and dark color of sand ridges, are detected 2 intermediate levels of relief: white flat areas of takyrs and, 0.5–1 m above them, brownish slightly inclined deposits from eroded sand ridges (Borovskiy and Pogrebinskiy, 1958: 64). Traces of the erosion of paleo-courses are sometimes covered again by subsequent sand deposits, which could be dated by OSL to fix an upper chronology of the flood event.

During the exceptional pluvial phase at the end of the 19th century (1886–1909), such triple confluence might have reached a maximum discharge (Panyuskina *et al*., 2018), being that at that time in Telikol are documented spring floods high enough to submerge most of the lake depressions and to feed the Karakemer ephemeral stream till its merging with the Syr Darya course at the level of Diirmentobe (Neustruev, 1911; Spiridonov, 1922).

Archaeological findings in the Daryalyk Takyr and Telikol regions

In the analysis of the archaeological findings of the Daryalyk Takyr (13,200 km^2) and Telikol (850 km^2) regions five periods have been identified: Late Neolithic, Bronze Age, Early Iron Age, Medieval and Modern (ethnographic Kazakh). The two regions are treated separately due to their great difference in size and moisture availability, Telikol being 15 times smaller and much wetter.

The survey of the ***Daryalyk Takyr*** covered 15 out of the total 50 sites estimated in the region and recorded around 310 diagnostic artefacts (Fig. 4). The densest clusters of surface finds (65% of the total) are located at takyr edges in the eastern part of the plain, in particular along the moister paleochannels of Kalmas and Baladonyz (Fig. 1). Most of the finds consist of potsherds and microliths. Among the stone tools (25%), some probably pre-date the Bronze Age; while among the ceramics the majority belong to the Bronze Age (42%, 1/4 of which with incised decoration typical of the Fedorovo-Alakul tradition) and lower percentages from the Iron Age (9%) and Middle Ages (24%). Finds from the modern period are very poorly represented by few artefacts. Only in the southern part of the desert, closer to wetter areas (Bike Sary steppe), do medieval and modern artefacts become more abundant.

The largely dominant ratio of lithic material and potsherds ascribed to a period from the Late Neolithic to the Bronze Age possibly indicates moister conditions in the region during these earliest phases. However, cultural factors such as a more localized use of pastures, a more settled way of life, and the importance of hunting among early herders could also explain denser occupation. Such a preponderance of Late Neolithic and Bronze Age artefacts is also observed in other arid rangelands of Kazakhstan, for example the Ili delta (Deom *et al*., 2019) and the Ryn sands of the Northern Caspian region (Ivanov and Vasilev, 1995).

The lower ratio of Iron Age and medieval finds in Daryalik Takyr indicates that later agro-pastoral communities became gradually engaged in long-distance transhumance with seasonal camps, using the desiccated plain as a transit point, as documented in the Late Modern period.

The survey of the ***Telikol*** region covered 10 out of its estimated total 30 sites and recorded 41 pre-ethnographic diagnostic artefacts (Fig. 5) mainly concentrated around the Telikol and Sorkol lakes and between the cemeteries of Bestam and Kargaly (Fig. 5, № 7–8). Among these are counted 10 lithic artefacts and 31 potsherds. Lithic artefacts are attributable to the Late Neolithic, and potsherds to the Bronze Age (17), Early Iron (4), and Middle Ages (10, of which 8 found around the well Kalmas have typical red engobe of the last Zhetyasar phase). Findings attributed to the Late Modern period (ceramics, metal, glass, etc.) are instead very abundant, numbering more than 3000 and pointing to very intensive use of the region during this period.

When compared to the Daryalyk Takyr region, Telikol contained a much greater density of archaeological finds, 2 times greater when referring to the pre-Late Modern period but 10 times greater when referring to the Late Modern. Besides different degrees of retrievability, this discrepancy could be tentatively attributed to different hydrological regimes and habitability of the two regions during those periods: better pre-ethnographic conditions in Daryalyk

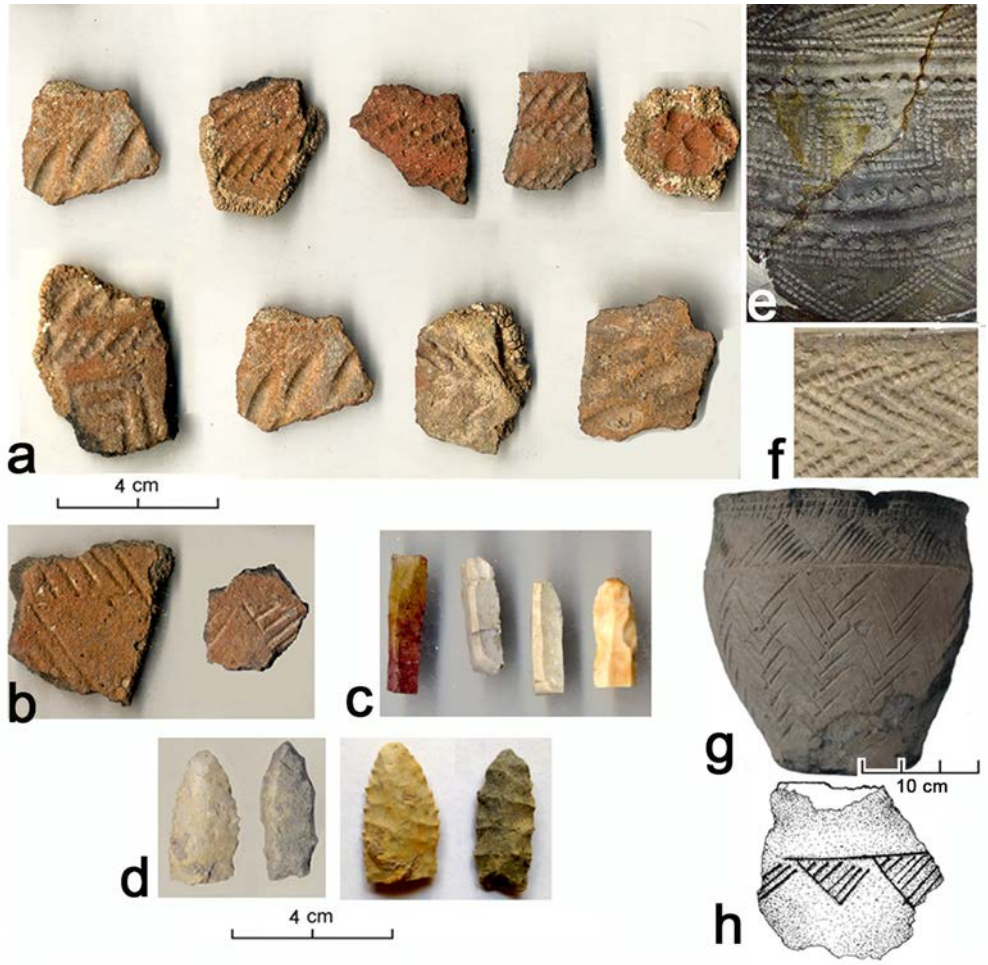

Fig. 4. Surface findings in the central eastern part of Daryalyk Takyr (transect 2) and their regional analogies. a–d – Bronze Age decorated potsherds and stone tools from the takyrs of Baladonyz (Laboratory of Geoarcheology, 2018); e–f – incised patterns of Bronze Age Federovo-Alakul potteries from the upper Sarysu (Atasu, collection of M.K. Kadyrbaev in the Al-Farabi Kazakh National University); g – Bronze Age pot from the Aral Karakum (Tapa, from Tazhekeyev *et al*. 2013), h – Bronze Age potsherd from Sauyiskandyk, Northwestern Karatau (Samashev *et al*., 2014).

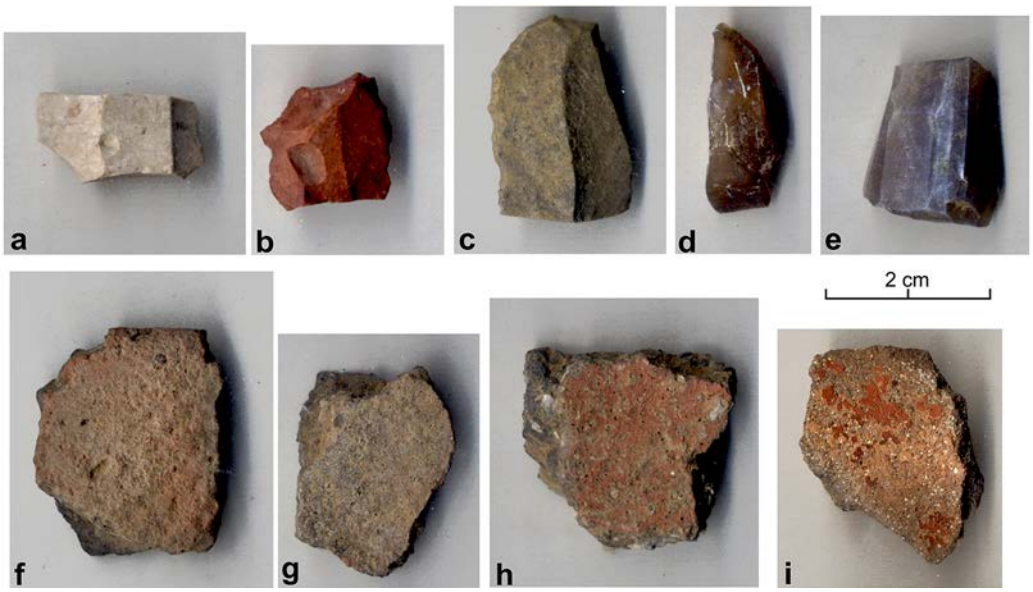

Fig. 5. Surface findings in the central part of Telikol region. a–e – lithic material (Pre-Bronze); f–h – ceramics (Bronze Age); i – Zhetyasar potsherd (Early Middle Ages) (Laboratory of Geoarcheology, 2018).

Takyr due to more frequent Syr Darya floods and year round pastoralist use of locales, and favorable conditions in the Telikol region after the Late Modern establishment in the Chu-Sarysu basin of a longstanding pluvial phase and long-distance transhumance.

Ethnographic monuments of the cultural landscape of the Telikol region

In the Telikol region the densest archaeological record is represented by ethnographic monuments ascribed to the last 200 years. Besides surface artefacts, we also recorded wells, agricultural fields, houses, cemeteries and mausoleums (Fig. 6).

Among the ***wells*** recorded on maps and surveyed during fieldwork, only the ones of the sites of Karaul Tobe and Beskol (Fig. 6) were still active with fresh (at present stagnant) water at a depth of 3 m. All the other wells were dry, with sedimented hollow or damaged Soviet-era cement structures. According to N.A. Maev's statistics (Maev, 1873) and the 1910 census (MKZ, 1912), the main source of drinking water was supplied by the 3 central lakes of Beskol.

Concerning ***agricultural fields***, the same census registered in the Telikol district just 39.4 ha of farmlands, mostly located in the western part of the region. In contrast, through remote sensing we identified 6 main areas including 19 sites totaling 103 ha with signs of irrigation and agriculture. The main three areas are located: W of the road Kyzylorda-Zhezkazgan, in the cavity of a paleochannel of the Syr Darya delta (22.6 ha); SW of the Kultan mausoleum (41 ha); and E of the Bestam cemetery (14.6 ha). All the sites are concentrated in depressions supplied by channels originating from a contiguous lake (at present ephemeral) and clearly show cultivation patterns of two types: vegetable and melon gardens (22.6 ha) and croplands (65.8 ha).

According to the 1st statistical committee of 1872 directed by N.A. Maev, there were no ***stable residencies*** in Telikol before the Russian colonization: [*Near Telekul* (Telikol) *there is no suitable land for agriculture, however for the nomadic Kirghiz (Kazakh) the place could be very convenient being that there is good fodder and fuel: but there are no nomadic Kirghiz here either* (Maev, 1873: 41)]. Houses must have been built between 1872 and 1920, being that the census of 1910 recorded that 63.9% of the Telikol population (446 households) had a house, which would correspond to 285 houses (if we include 33% of the non-registered households of Telikol district we would reach a max of 379 houses, a number very close to that individuated on maps and satellite images). The highest concentration of ruins of mudbrick houses is found 10 km east of the Telikol lake system at the administrative village known at the end of the 19th century as Telekul Tata, located around mausoleums 3 and 4 of Fig. 6 (see Ethnographic statistical data).

Burial monuments consisting of cemeteries and mausoleums (*mazar*) are very important elements of the cultural landscape because they are the main reference points for genealogical attribution and ritual meetings, distinc-

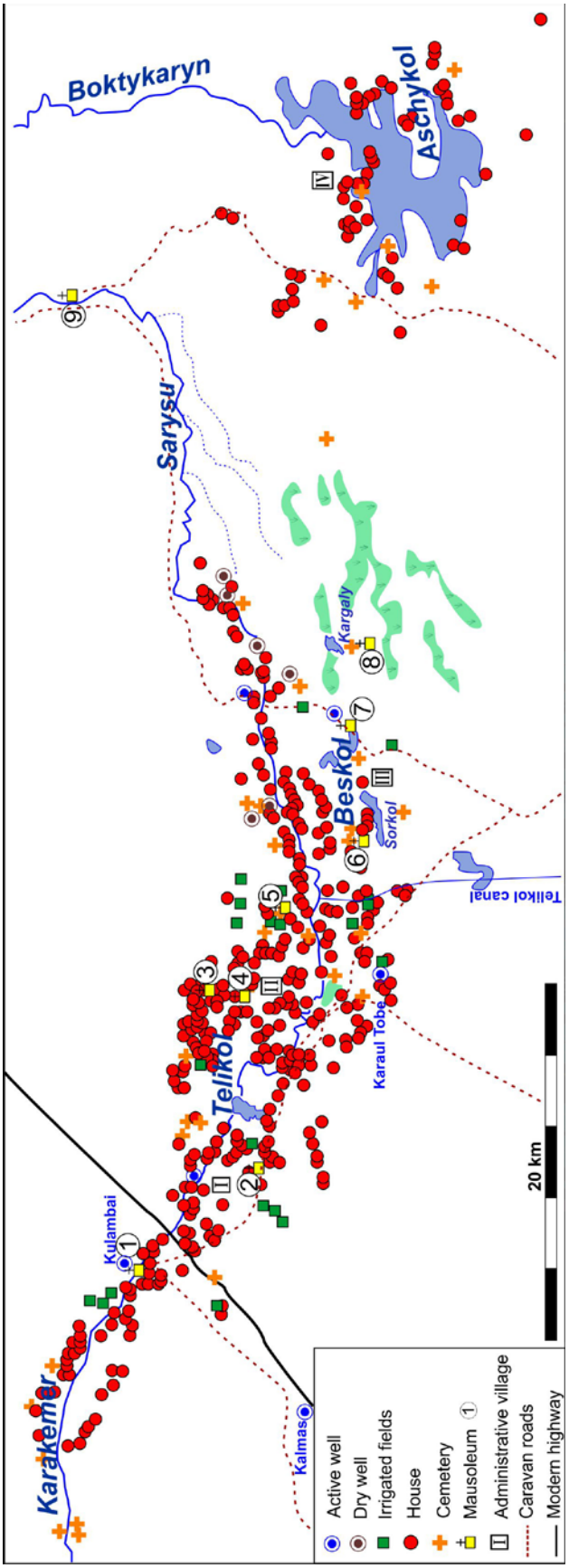

Fig. 6. Map of the Telikol cultural landscape. Marked are rivers and lakes (in blue), marshes (light green). Legend refers to sites of active and dry wells, irrigated fields, houses, cemeteries and 9 most important mausoleums, 4 administrative villages, caravan roads and modern highway.

tively located near settlements on the highest points of a largely flat relief.

The Telikol region includes 53 cemeteries and 9 mausoleums, mainly built in the more populated areas of the western lakes and at the Sarysu river mouth. The largest cemeteries usually contain tombs as well as one or several mausoleums standing as monuments of higher importance (marked in Fig. 6 as a west-to-east sequence of encircled numbers).

The best-preserved mausoleums, today protected by the Province as architectural monuments of the 19th century AD (Svod…, 2007), are Tazhibai and Baki (**1**), Kultan (**2**) and Makultam (**3**). The other vaulted tombs are still visited today by pilgrims: Shakhatai (**4**), Kolbaba (**5**), Aktai (**6**), Bestam (**7**) and Kargaly (**8**) (Fig. 6).

In the northeast corner of the Telikol region, a few km upstream from the piedmont exit of the Sarysu river, stands the important and still uninvestigated funerary complex of Belyan Ana (**9**), recorded in the *Zafarnama* (~1425) of Sharif al-Din Ali Yazdi as a halt during the pursuit of Tamerlane after Toktamysh (Tizengauzen, 1941: 158). According to the description of I. Rychkov, the site was an assemblage of ruins stretching on 6 km including 5 mausoleums dedicated to a holy woman (Rychkov, 1887). The complex was possibly built in honor of Bilan Khatun, who, according to Rashid al-Din's *Compendium of Chronicles* (~1310), was one of the four wives of Kuli, son of Orda-Ichen (1206–1251, eldest son of Jochi and founder of the 'Ulus of Orda') (Tizengauzen, 1941: 46).

Ethnographic statistical data

Ethnographic data concerning the Telikol region before the Russian colonization are provided by a few historical accounts confirming the general view of the social interactions of the Kazakh nomad shepherds within khanates: kin-based villages (*aul*) were headed by elder men (*aksakal*) entrusting a representative (*bii*) for negotiating land ownership and migratory routes, in particular long collective transhumances, under the supervision of a rich tribal genealogical aristocracy. Detailed statistical information was collected only by the administration of the Russian empire after 1870, when the bii started to be co-opted and enriched (*bai*) as indirect rulers (*kulak*) in order to break the former Kazakh social structure and accommodate the influx of Russian farmers and miners (Kerven *et al*., 2021: 2–6).

According to the data collected by statisticians in 1910 (MKZ, 1912), in Perovsk county 40% of the households and 67% of their livestock were transhuming from spring to autumn, moving to richer pastures located north of the lower Syr Darya. Of these mobile households, 2228 (25%) migrated across the Daryalyk Takyr plain (where only 100 households were wintering) to the NW and the much richer Telikol district as far as the Sarysu basin, and occasionally further north beyond the Ulytau region. Among the lasts, two groups are distinguished: a major group departing from the Syr Darya delta and a minor group departing from Telikol.

The major group made of herders migrating from the Syr Darya delta (83.4%) consisted of 1,859 households with a huge herd of 49,600 livestock units (around 160,0000 heads) [*by Livestock Unit, abbreviated hereafter LU, MKZ intends a coefficient where an adult horse older than 2 years corresponds to 1 unit. The other livestock types are calculated in the following terms: horse <2 years old: 0.5 unit; horse newborn: 0.167; camel adult >2.2 years old: 1; camel newborn: 0.5; cow adult: 0.833; cow <2 years old: 0.418; sheep or goat: 0.176*]. They passed through the Telikol district and stationed here for a period of 8 spring and 8 autumn days. In fact, the Telikol region, being a meadow environment located half-way between desert and steppe, acted as a strategic station in the pastoral transhumances of the Syr Darya delta as a whole.

The minor group (16.6%) was made of residents of the Telikol district. They wintered in situ and in spring 406 households (82.7% of the local residents) migrated far to the north, most often accompanying the movement of the major transhumant group.

The Telikol herders were occupying a total area of 75,007 dessiatin [*1 'dessiatin' corresponds to 1.09 hectares*] of pasturelands that by themselves could easily enable the winter feeding of 15,307 LU. But, due to the 8+8 days of mid-season transit of the major group, Telikol had the local winter fodder provision decreased by 13.2%, ending up with the actual livestock reduced to 13,280 LU and the wintering season shortened from 7 (217 days) to 5 months (147 days), forcing a part of the locals to move earlier and spend the last winter months closer to the Syr Darya (MKZ, 1912). In fact, the limiting factor of the herd dimension are the scarce resources for settled livestock during winter time, which, given the slow vegetation growth under the cold season, makes the overgrazing of autumn pastures particularly disruptive.

Evidently, the implementation during the warm season of a system of collective long transhumances was the determinant factor for enhancing the pastoralist productivity of all the groups, largely compensating the grazing costs along the route. In short, the overgrazing of the Telikol rangeland was tribally politically planned, and anyhow the district, thanks to its strategic location and much higher involvement in transhumant stockbreeding, ended up becoming the richest among the Perovsk county districts.

The ***Telikol district*** was divided in 4 administrative villages (*aul*) (Fig. 6) headed by an elder (*aksakal*) of Naiman ethnicity, from west to east:

– Telikol, around the Telikol lake;
– Telekul Tata, between Telikol and Beskol, main residential center;
– Beskol lake and Sarysu river;
– Aschykol lake.

All villages were inhabited by Naiman clans who only in Aschykol shared the land with Kipchak and Tore clans.

The district counted 446 registered households averaging 5.9 persons each, i.e. a total of 2624 persons (in reality,

due to absences during the census, 218 households were not recorded, making a total of 664 households and 3918 persons). The most populous residential areas, located around freshwater lakes and a better water supply, were the second and third administrative villages, comprising respectively 42% and 30% of the households, i.e. altogether 72% of the Telikol population. Much less populated were the other two administrative villages surrounded by salt lakes, in particular the Aschykol shores counting just the 8% of the population.

In terms of stockbreeding, the Telikol district counted a total 13,280 LU and 42,000 heads, i.e. a relatively high average of 20 LU and 63 heads per household; and had the largest percent of horses (5.2 horses/household against the average 3.3 of the Perovsk county), camels (8.0 against 5.1) and sheep (57.5 against 35.7). The 82.7% of the households were making seasonal migrations (against just the 40% of the other districts) and the 64% wintered in mudbrick houses rather than yurts.

In terms of agriculture, the production of hay was relatively well developed, with 60.8% of the households mowing a yearly average of 15.5 dry tons each, and so was the production of reeds that represented the main winter fodder. On the other hand, being that the water resources of the Telikol district were only available during the spring floods of the Sarysu river and then followed by poor runoff and strong decrease of the lake level, the region had very little potential for irrigated agriculture. Only 24% of the households were involved in the cultivation of an average area of 0.4 *dessiatin* per farming household, producing spring wheat (85%) and, in lesser measure, vegetables and melons.

Activities other than herding and farming (service jobs), including seasonal workers involved mainly in fishing and then in hired labor, craft and trade, concerned 49.6% of households and were more developed than in the other districts of the Perovsk county (45.7%) (Fig. 7 and Table 1).

Wide inequalities characterized the repartition of property, work and revenue, evidencing the presence of 4 economic classes (9 subclasses): on one side poor households owning zero or one horse and just 6.6–10 LU constituted 48% of the total; on the other side the extremely rich with more than 50 horses and 125.2 LU were just the 1.8% (Table 1).

DISCUSSION

Human occupation of the Daryalyk Takyr and Telikol regions from the Mongols to the Russian conquest (1221–1850)

Reconstruction of the human occupation of the Daryalyk Takyr and Telikol region during the Neolithic, Bronze and Early Iron Ages is hindered by the low number of archaeological finds and diagnostic artefacts, supporting a very low chronological resolution at millennial scale: microliths are attributed to the Kelteminar culture; Bronze Age potsherds to the Alakul-Fedorovo culture; Early Iron Age ceramics to generic Saka tribes.

More definite is its occupation during the Early Medieval period by the later stage of the Zhetyasar culture (6–8th century AD), followed by Oguz (8–11th century AD) and Kipchak (11–12th century AD) tribes. Besides ceramic findings, the use of the Telikol region by Oguz herders is indirectly attested by the presence of numerous Oguz tamgas (clan signs) engraved on sandstone blocks along the lower Sarysu gorge 70 km north of Telikol and ascribed to the 9–10th centuries AD (Rogozhinskii, 2017).

Table 1. Economic classes, household structure and activity in the Telikol district (1910). Highlights: dark gray = highest value by column; light gray = lowest value by column.

ECONOMIC CLASSES		HOUSEHOLD SOCIAL STRUCTURE								HOUSEHOLD ECONOMIC ACTIVITY						
		households (total 446)		horses by household n°	members n°	working members av. n°	service jobs %	labor offering %	labor hiring %	Mobility		L.U. %	Hay		Agriculture	
		n°	%							transhumant units %	with house %		makers %	tons by maker	farms %	dessiatinby farm
Poor	1	63	14.1	0	4.9	1.1	60.3	14.3	0	60	63	6.6	65	7.5	30.2	0.2
	2	149	33.3	1	5.2	1.4	61.1	6.7	3.4	71	64	10	66	10.3	30.2	0.3
Middle	3	112	25.1	2–3	6.1	1.7	48.2	6.3	11.6	92	62	17.6	78	12.1	17.9	0.4
Rich	4	36	8.1	4–5	6.7	1.7	33.3	2.8	25.0	97	61	26.2	64	14.7	11.1	0.3
	5	23	5.2	6–8	6.3	1.7	39.1	0	21.7	100	65	26.7	52	11.4	17.4	0.3
	6	24	5.4	9–13	6.1	1.5	12.5	0	33.3	100	54	31.1	37	12.0	16.7	0.3
Very rich	7	19	4.3	14–22	7.9	1.8	36.8	0	78.9	100	73	47.1	58	22.7	31.6	0.5
	8	12	2.6	23–50	8.8	1.9	41.7	0	75.0	100	75	68.7	50	14.3	25.0	0.2
	9	8	1.8	>50	10.0	1.8	25.0	0	100.0	100	75	125.2	63	35.2	25.0	1.3
average					*5.9*	*1.5*	*39.7*	*3.3*	*38.7*	*91.1*	*65.7*	*39.9*	*59.2*	*15.5*	*22.7*	*0.4*
ratio of involved households (100% = 446)							***49.6***	***6.1***	***16.1***	***82.7***	***64***	***20.0***	***61***	**–**	***24.0***	**–**

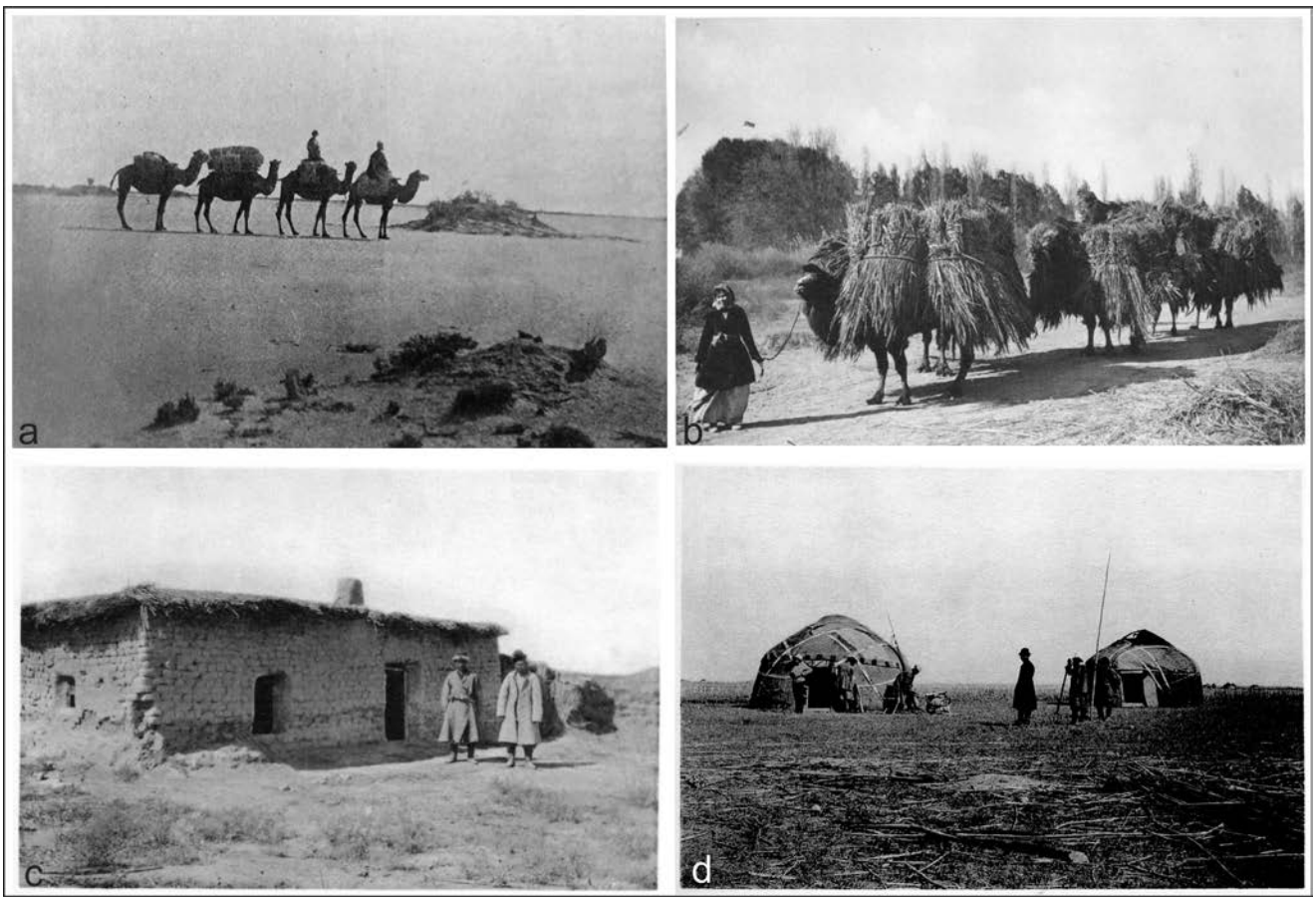

Fig. 7. Life scenes of agro-pastoralists of the Perovsk county. a – caravan crossing the Daryalyk Takyr plain (Neustruev, 1911); b – transport of reed forage; c – winter house of a middle-class Kazakh household near Tomenaryk; d – yurts prepared for the coming of censors (MKZ, 1912).

The first accounts of the Mongol period refer to the region as belonging to the Ulus of Orda (1204–1251, elder son of Jochi, 1182–1227) which had winter residence in Signak and summer quarters around the Ulytau mountains (Klyashtornyi and Sultanov, 1992). The inhabitants of the region were named the Kangly (*Cangle*) by William of Rubruck who crossed the area in 1253 (Rockhill, 1900). However, the territory was also shared with people of the Ulus of Shiban (1210?–1266, fifth son of Jochi) who received as appanage the lands south of the Ural mountains as summer camp and the lower Syr Darya, Chu and Sarysu as winter camp. In the 15th century AD the Uzbek Shaybanids became for a while the rulers of the region; and, after their southwestern migration and the split of the Kazakhs from them (1465), the region became the stable dwelling of the Kazakhs who established the capitals of their khanate in the towns of Suzak in 1465–1469 AD (NE Karatau) and Signak in 1469–1599 (head of the Syr Darya delta) (Pischulina, 2016).

At the beginning of the 17th century AD, after Signak under Esim khan (1598–1628) lost its preeminence as a capital to Turkestan, the Kazakh khans were soon confronted with the territorial expansion of the Dzungar khanate (1635–1755), which culminated with the Dzungar conquest of the towns of South Kazakhstan between 1684 and 1724, and of the Sarysu basin at the beginning of the 18th century AD. The Sarysu basin marked the border between Kazakh and Dzungar lands and along its course were located a series of Dzungar garrison posts. The toponym Karaul Tobe, located at the southern edge of the Telikol lake, would indicate the presence in that locality of a Dzungar fortification (Aubekerov and Yerofeyeva, 2015: 71). Despite a Kazakh victory in 1726 at Kalmakkyrgan (100 km SW of Ulytau), the military supremacy of the Dzungars held most of the entire territory of Kazakhstan until the death of Galdan Tseren in 1745 and the destruction of their power by the Chinese Qing army in 1758 (Klyashtornyi and Sultanov, 1992).

After the departure of the Dzungars, Telikol was used by a large transhumant group of 3500 yurts made of Kungrat and Sary-Wusun tribes led by the Kazakh khan Bolat (1771–1798), moving between the middle Syr Darya (Turkestan region) and the Turgai basin (Andreev, 1998).

In 1813, the Kokand khanate occupied the Syr Darya region and built a series of forts along the Syr Darya in Julek, Zhanakorgan, Dinkurgan and Ak-Mechet (Kyzylorda). Subsequent events are connected with the anti-Russian rebellion led by the last Kazakh khan Kenesary Kasymov (1802–1847) who captured several Kokand forts of the Syr Darya (Zhanakorgan, Julek) and north Karatau (Suzak) before moving towards Semirechie where he was betrayed and beheaded by Kyrgyz feudal chieftains (Bekmakhanov, 1992)

The first Russian historical testimony of the Telikol region is found in the Russian "Book of the Big Drawing" (1627) which stipulates that the river Sarysu ends in a lake at a distance of 80 versts (*85 km*) from the Syr Darya (IKRI, 2005). In a report made to the Tobolsk government in 1697 by a group of merchants led by Fedor Skibin (IKRI, 2005), the name of the Telikol lake appears as *Tinikul*; and finally as *Telegul* in the *Topography of the Orenburg governorate* written by I. Rychkov in 1762 (Rychkov, 1887).

Colonization of the Telikol region under the Russian empire (1850–1917)

In November 1851 the commercial clerk S. Klyucharev provided the following description of the Sarysu region: [*In spring the Sarysu river runs here so strongly that it floods the surrounding area. In summer, it dries up and only large lakes remain, abounding in fish. The banks of the river Sarysu are convenient in all respects: there are a lot of reeds, herbs and combustible plants. What is not good is that the water has a bitter taste; however, you can drink it* (IKRI, 2007)]. And in 1853 Telikol became known as an important station located on the caravan roads connecting Tashkent with the southwestern Siberian towns of Troitsk, Petropavlosk and Tobolsk.

Due to its relative abundance of water, Telikol surely played always an important role among the surrounding pastures and potential transhumant itineraries. But, apparently, until the second half of the 18th century, the use of its land was seasonal and winter houses (*zimovka*) were absent (Maev, 1873: 41). The situation changed during the second part of the century, following the Russian conquest, the relocation of several tribes and the establishment, between 1886–1910, of a very favorable pluvial phase.

According to a letter dated 1894 from the military governor of the Syr Darya province to the Turkestan governor-general, during the second half of the 19th century AD the territory made up of the lakes Telikol and Saumalkol (20 km south of Aschykol) were lands of the Kipchaks. But, at the end of the fifties, the expansion of Siberian Tsarist garrisons quelling the Kenesary Kasymov revolt provoked disorder, and large expanses were abandoned by several tribes. So, in accord with Tsarist authorities, the Naiman Baganaly clans (Baganalins), in order to reoccupy those territories, "not earlier than the sixties, began to move southward from their pastures near Ulytau to the summer pastures of the Kipchaks, Tamins, Zhappas, Bakhtyars, and other Kyrgyz (*Kazakhs*) peoples of the Chu and Syr Darya regions" (Mukanov, 1991).

The Baganalins descended the Sarysu, occupied Telikol and reached the lower Syr Darya basin, establishing winter camps in two regions: 1,000 yurts in the Perovsk county (*Kyzylorda province*) and 500 yurts in the lower Chu (Shymkent county). Intertribal disputes arose and were sentenced at the congress of Bes Kulan in 1883 decreeing that all the tribes of the Syr Darya and Chu had equal right to graze in the lacustrine Telikol region and further up along the Sarysu river; and at the end of the 19th century several Tsarist commissions were sent to the final Chu delta in order to arbiter a persistent conflict between Naiman Baganaly and Tamin tribes competing for seasonal pastures (Gern, 1889; Mukanov, 1991). The Baganalins continued to winter in southern areas: in Telikol, along the lower Syr Darya, some even in the Kyzylkum sands, along the lower Chu basin and in northeastern Karatau. The establishment of the 1886–1910 pluvial phase brought environmental amelioration, the number of their communities rose to 7,724 yurts (Mukanov, 1991), and winter houses started to be built.

These are the circumstances when the very significant MKZ census of 1910 was implemented. In the pastoralist use of the Telikol region the Tsarist period induced big changes of tribes and political rulers, but the basic structure of economic classes went unvaried until the Stalinist regime, i.e. until pastoralist households were forcibly switched to collective brigades, and long-distance seasonal transhumances were made to follow scientific plans of stockbreeding exploitation.

After 1920, with the end of the Tsarist regime and the establishment of a dry phase, the pastures and winter camps of Telikol were abandoned (Pavlov, 1931: 103) and so have largely been until today, after independence, when fewer than 20 wintering residents have been noted (fieldwork observation).

The Transhumance Model

In desert environments where water and vegetation are scarce and variable by season, pastoralist mobility across strategic itineraries is a main precondition of sustainable life. Collective long-distance seasonal transhumances can greatly enhance total stockbreeding productivity but require peaceful cooperation between mobile pastoralist clans, i.e. the existence of an ethno-political structure regulating the movements of groups among assigned rangelands (Masanov, 1995). The presence of such structure in the Kazakh culture is documented during the modern and Tsarist periods by historical records and detailed statistical reports respectively, but its formation is certainly rooted deep in the past (Khazanov, 1984).

The MKZ census of 1910 reports a brilliant case of collective pastoralist land use by different clans The collection of data refers to rangeland environmental potential, family structure, socio-economical stratification and synergic pastoralist strategies of the households involved; and, in the specific case of Telikol, testifies an involvement in seasonal transhumances twice higher than in the surrounding regions. As a whole, the data evidence the functioning of a transhumance model that could be tentatively applied to other regions and earlier epochs.

The hypothesis of interpreting the entire Daryalyk and Telikol archaeological record in the frame of such a model is very interesting and potentially fertile, but for this purpose the model requires a careful classification of migrations and transhumances, in particular a typology of their spatial range.

The spatial range of the mobility of pastoralist groups is very changeable, varying by climatic phase and historical period, depending on environmental, technological, demographic and ethno-political factors. We can theoretically suppose that the evolution of those factors has been more or less gradual and strictly related with an enlargement of the mobility range from short to medium to long distance transhumances. These three ranges would correspond respectively to the semi-settled life of Bronze Age pastoralist groups, the implementation of mid-range transhumance with multi-residential facilities of the tribes of the Early Iron Age (Ventresca Miller *et al*., 2020) and Medieval periods (Ibn Fadlan, 2012; Agadzhanov, 1969; Ananyevskaya *et al*., 2020), and, finally, to the high mobility and complex socio-political structure of the Modern period when transhumances, regulated by the traditional system of Kazakh territorial and ethnic divisions (*zhuz*), arrived to cover a third of the entire territory of Kazakhstan.

CONCLUSIONS

The Daryalyk Takyr has been hypothesized by a few researchers as a wide alluvial plain that during two historical periods (~200–1 BC and ~900–1100 AD) hosted a huge flooded area on account of the confluence of water from the Syr Darya, Chu and Sarysu river basins (Vainberg, 1997; Agadzhanov, 1969). However, the role of the Chu and Sarysu rivers has always been very secondary, even during the Late Pleistocene phase of filling of the Kyzylorda depression; and, unless undated flooding events reactivated some paleochannels of the Syr Darya right bank, the combined action of the three basins could hardly have provoked a longstanding inundation of the Daryalyk Takyr plain (Borovskiy and Pogrebinskiy, 1958).

If the role of the Daryalyk Takyr and Telikol territory in the distribution of runoff towards the Syr Darya delta branches can be downsized, its environmental importance as transit corridor towards summer pastures must instead be accentuated. The area, located half-way between desert and steppe, is dotted with small seasonal oases that throughout history played a strategic role in the economy and displacements of the ancient pastoralist tribes of the Syr Darya delta. Archaeological finds bear witness to human occupation from the Late Neolithic to the Late Modern periods. The MKZ demographic and economic statistical data collected in 1910 in the Telikol district, which witnesses here an involvement in seasonal transhumances two times higher than the regional average, allows the elaboration of a model explaining how the seasonal arrangement of a complex network of very productive long-distance transhumances could have supported the life of the stockbreeders of the Syr Darya delta during the Late Modern period and the pacification of potentially warring tribes migrating between the large expanses of the delta and the deserts and steppes of Central Kazakhstan. This transhumance model, when enriched with specific variants, could be regressively applied for the reconstruction of mobile stockbreeding activities during the past millennia.

Acknowledgements

Funding for this research was provided by a national grant from the Ministry of Education and Science of the Republic of Kazakhstan under the project: "AP05135126-OT-20: Traditional methods of water supply in arid zones of Kazakhstan: ethnological and geoarcheological approaches" (2017–2020).

REFERENCES

Abuseitova, M.Kh., Baranova, Y.G., 2001. Pis'mennyye istochniki po istorii i kul'ture Kazakhstana i Tsentral'noy Azii XIII–XVIII vv. (biobibliograficheskie obzory) [Written sources on the history and culture of Kazakhstan and Central Asia in the 13th–18th centuries (bio-bibliographical reviews)]. Almaty: Daik-press.

Agadzhanov, S.G., 1969. Ocherki istorii oguzov i turkmen Sredney Azii IX–XIII vv. [Essays on the History of the Oguzhs and Turkmens of Central Asia in the 9–13th c.] Ashkhabad: Ylym.

Ananyevskaya E., Akhatov, G., Loman, V., Dmitriev, E., Ermolayeva, A., Evdokimov, V., Garbaras, A., Goryachev, A., Kukushkin, A., Kukushkin, I., Kurmankulov, Z., Logvin, A., Lukpanova, Y., Onggar, A., Sakenov, S., Sapolaite, J., Shevnina, I., Usmanova, E., Utubayev, Z., Varfolomeev, V., Voyakink, D., Yarygin, S., Motuzaite Matuzeviciute, G., 2020. The effect of animal herding practices on the diversity of human stable isotope values in North Central Asia. Journal of Archaeological Science: Reports 34, Part A, 102615. doi.org/10.1016/j.jasrep.2020.102615.

Andreev, I.G., 1998. Opisaniye sredney ordy kirgiz–kaysakov [Description of the middle horde of Kirghiz-Kaisaks], Almaty.

Andrianov, B.V., 1969. Drevnie orositel'nye sistemy priaral'ya (svyasi s istoriei vozniknoveniya i razviya oroshaemogo zemledeliya) [Ancient Irrigation Systems of the Aral Sea Area (History, Origin, and Development of Irrigated Agriculture)], Moscow: Nauka.

AKK: Arkheologicheskaya karta Kazakhstana [Archaeological Map of Kazakhstan]. 1960, Alma-Ata, sheet 30 and 35.

Arzhantseva, I.A., Tazhekeyev, A.A., 2014. Kompleksnyye issledovaniya gorodishcha Dzhankent (raboty 2011–2014 gg.) [Complex study of the town Zhankent (work of 2011–2014)], Almaty: Arys.

Arzhantseva, I.A., 2015. The Khorezmian Expedition: Imperial Archaeology and Faustian Bargains in Soviet Central Asia. Public archaeology 14 (1), 5–26.

Aubekerov, B.Z., Yerofeyeva, I.V., 2015. Landshaftno-geomorfologicheskiye faktory formirovaniya nastupatel'noy strategii i taktiki kazakhov-kochevnikov v voyne s dzhungarami 1723–1730 gg. [Landscape-geomorphological factors in the formation of the offensive strategy and tactics of Kazakh nomads in the war against the Dzungars of 1723–1730]. In: Bulantinskaya bitva: Istoriya issledovaniy. Nauchno-informatsionnyy al'bom [The Battle of Bulanty: History of Research. Scientific Information Album]. Ulytau: Natsional'nyy istoriko-kul'turnyy i prirodnyy zapovednik-muzey «Ulytau», 68–83.

Baipakov, K.M., Voyakin, D.A., llin, R., 2012. The towns of Huwara and Yangikent, the old and the new capitals of the Oghuz state. Bulletin of IICAS 16, 22–44.

Barthold, V.V., 1963. Turkestan v epokhu mongol'skogo nashestviya [Turkestan Down to the Mongol Invasion]. In: Sochinenya (works). T.1. Moscow: izd. Vostochnoi literatury.

Barthold, V.V., 1965. Raboty po istoricheskoi geografii [Works on historical geography]. In: Sochinenya. (works). T.3. Moscow: izd. Vostochnoi literatury.

Bekmakhanov, E., 1992. Kazakhstan v 20–40-x godakh XIX veka

[Kazakhstan in the years 20–40s of the 19th century], Almaty: Kazakh universiteti.

Bonora, G.L., 2019. Inner Syr Darya Delta: Archaeological sites during the second half of the 1st millennium BCE: An analysis of the settlement pattern. In: Baumer, C. and Novak, M. (Eds.), Urban Cultures of Central Asia from the Bronze Age to the Karakhanids: Learnings and Conclusions from New Archaeological Investigations and Discoveries. Proceedings of the First International Congress on Central Asian Archaeology Held at the University of Bern, 4–6 February. Wiesbaden: Harrassowitz Verlag, 387–402, https://doi.org/10.2307/j.ctvrnfq57.

Borovskiy, B.M., Pogrebinskiy M.A., 1958. Drevnyaya del'ta Syr-Dar'i i severnyye Kyzyl-Kumy. Pochvenno-meliorativnyye usloviya i problema sel'skokhozyaystvennogo osvoyeniya. [Ancient Syr-Darya delta and northern Kyzyl-Kum. Soil-reclamation conditions and the problem of agricultural development] T.I Alma-Ata: izdat. Akad. Nauk SSR.

Brockhaus-Efron, 1901. Entsiklopedicheskiy slovar [Encyclopedic dictionary], https://dlib.rsl.ru/viewer/01003924196#?page=334 (Accessed January 10, 2021).

Deom, J.-M., Sala, R., Laudisoit, A., 2019. The Ili River Delta: Holocene Hydrogeological Evolution and Human Colonization. In: Yang, L.E., Bork, H.-R., Fang, X., Mischke, S. (Eds.), Socio-Environmental Dynamics along the Historical Silk Road. Cham: Springer Open, 67–122.

Fedorovich, B.A., 1952. Drevniye reki v pustynyakh Turana [Ancient rivers in the deserts of Turan]. In: Materialy po chetvertichnomu periodu SSSR, vyp. 3. [Materials on the Quaternary Period of the USSR, issue. 3] Moscow-Leningrad: Izd. AN SSSR.

Geological map SSSR, 1966. Scale 1: 200.000, L-41-XXX. series Kyzylkumskaya, Moscow.

Geological maps SSSR, 1979. Scale 1: 500 000, L-41-Г and L-42-B, Moscow.

Gerasimov, I.P., 1937. Osnovnyye cherty razvitiya sovremennoy poverkhnosti Turana [The main features of the development of the modern surface of Turan]. In: Trudy Instituta geografii AN SSSR. vyp. 25 [Proceedings of the Institute of Geography, USSR Academy of Sciences. issue 25], Moscow.

Gern von, V.K., 1889. Poyezdka na r.Chu, k yeye ust'yu cherez pustynyu Betpak-dala v sentyabre 1883 g. [Travel to the river Chu, to its mouth, through the desert of Bedpak-Dala in september 1883]. In: Zapiski Zapadno-sibirskogo otdela Imperatorskogo Russkogo geograficheskogo obshchestva. Knizhka X. Omsk, 1–22.

GSPIKMZ-KO, 2020. Gosudarstvennyy spisok pamyatnikov istorii i kul'tury mestnogo znacheniya Kyzylordinskoy oblasti [State list of historical and cultural monuments of local significance of the Kyzylorda oblast], postanavlenie от 4 мая 2020 года № 28 [Resolution of May 4, 2020 No. 28]: https://adilet.zan.kz/rus/docs/V20L0007411

Gubin, B.M., Levin, A.S., 2017. Ptitsy peskov Aryskum i nizov'yev reki Sarysu [Birds of Aryskum sands and the lower Sarysu River]. Russkiy ornitologicheskiy zhurnal, Tom 26, Ekspress-vypusk 1418, 1021–1055.

Ibn Fadlan: Lunde, P., Stone, C. (ed. and transl.), 2012. Ibn Fadlan and the Land of Darkness: Arab Travellers in the Far North. London: Penguin Books.

IKRI-2005: Istoriya Kazakhstana v russkikh istochnikakh XVI–XX vv. [History of Kazakhstan in the Russian sources] T.1 Almaty: Dayk-Press.

IKRI-2007: Istoriya Kazakhstana v russkikh istochnikakh XVI–XX vv. [History of Kazakhstan in the Russian sources] T.6. Putevye dnevniki i sluzhebnye zapiski o poezdkakh po yuzhnym stepyam XVIII–XIX veka [Travel diaries and memos on trips along the southern steppes of the XVIIII–XX c.] Almaty: Dayk-Press.

Ivanov, I.V., Vasilev, I.B., 1995. Chelovek, priroda i pochvy Rynpeskov Volgo-Ural'skogo mezhdurech'ya v golotsene [Nature and soils of the Ryn-sands of the Volga-Ural interfluve in the Holocene]. Moscow: Intellekt, 91–159.

Kallaur, V.A., 1901. Drevniye goroda, kreposti i kurgany na r. Syrdar'ye v vostochnoy chasti Perovskogo uyezda [Ancient cities, fortresses and mounds on the Syrdarya in the eastern part of the Perovsk district]. In: Protokoly Turkestanskogo kruzhka lyubiteley arkheologii (PTKLA), 6th year, Tashkent.

Karta, 1848. General'naya karta Zapadnoy Sibiri s Kirgizskoyu step'yu [General map of Western Siberia with the Kyrgyz steppe], 1848. Scale 1:2 100 000, https://maps.southklad.ru/forum/viewtopic.php?f=11&t=99.

Karta, 1910. Karta zemlepolzovaniya Perovskoko uezda [Land use map of the Perovsk county], 1910. Scale 1:420.000, included in MKZ, 1912.

Karta, 1919. Karta yuzhnoy pogranichnoy polosy Aziatskoy Rossii [Map of the southern border strip of Asian Russia], 1919. Scale 1:1680000, Sheet XI (Kazalinsk-Turkestan), https://geoportal.rgo.ru/record/244.

Kerven, C., Robinson, S., Behnke, R., 2021. Pastoralism at scale on the Kazakh rangelands: From clans to workers to ranchers. Frontiers in Sustainable Food Systems, 4: 4:590401
https://doi.org/10.3389/fsufs.2020.590401

Khazanov, A.M., 1984. Nomads and the Outside World. Cambridge: Cambridge University Press.

Klyashtornyi, S.G., Sultanov, T.I., 1992. Kazakhstan. Letopis' trekh tysyacheletiy [Kazakhstan. Chronicle of three millennia], Alma-Ata: Rauan.

Krivonogov, S.K., Burr, G.S., Kuzmin, Y.V., Gusskov, S.A., Kurmanbaev, R.K., Kenshinbay, T.I., 2014. The fluctuating Aral Sea: A multidisciplinary-based history of the last two thousand years. Gondwana Research, 26, 284–300.

Kurmankulov, Z., Utubayev, Z.R., 2017. Chirikrabatskaya kul'tura Vostochnogo Priaral'ya [Chirik Rabat culture in the East Aral region]. In: Beisenov, A.Z. (Ed.), Kazakhstan v sakskuyu epokhu. Kollektivnaya monografiya [Kazakhstan in the Saka epoch. Collective monography], Almaty: A.K. Margulan Inst. Arkheol., 191–210.

Lerkh, P.I., 1870. Arkheologicheskiye poezdka v Turkestanskom krai v 1867 g. [Archaeological travel in the Turkestan region in 1867], St-Peterburg, 21–40.

Levina L.M., Galieva, Z.S., 1995. Kul'turnyy landshaft vostochnoy chasti dzhetyasarskogo urochishcha [The cultural landscape of the eastern part of the Zhetyasar area]. In: Nizov'ya Sydar'i v drevnosti [Low Syr Darya in antiquity], vyp. V, Dzhetyasarskaya kul'tura, ch.5 [issue V, Zhetyasar culture, part 5], Moscow: Inst. Ethno and Anthrop, 5–30.

Levina, L.M., 1996. Etnokul'turnaya istoriya Vostochnogo Priaral'ya. I tysyachele-tiye do n. e. – I tysyacheletiye n. e. [Ethnocultural history of the Eastern Aral Sea region. 1st millennium BC–1st millennium AD], Moscow: izd.Vostochn. Literat.

Levina, L.M., 2000. Drevnosti nizovyev Syrdar'i [Antiquities of the Low Syr Darya]. In: Rapoport, Y.A. et al. (Eds.), V nizov'yakh Oksa i Yaksarta. Obrazy drevnego Priaral'ya [In the lower reaches of the Oxus and Yaksartes. Images of the ancient Aral Sea region]. Moscow: Indrik, 125–197.

Maev, N.A., (Ed.), 1873. Materialy dlya statistiki Turkestanskogo kraya. Ezhegodnik. Izdanie Turkestanskogo statisticheskogo komiteta. Vyp. 2. [Materials for statistics of the Turkestan territory. Yearbook. Published by the Turkestan Statistical Committee. Issue 2. St Peterburg, 39–42.

Masanov, N.E. 1995. Kochevaya tsivilizatsiya kazakhov: osnovy zhiznedeyatel'nosti nomadnogo obshchestva [Nomadic civilization of the Kazakhs: the life basics of the nomadic society], Almaty: Sotsinvest, Moscow: Gorizont.

MKKh: Materialy po istorii kazakhskikh khanstv XV–XVIII vekov izvlecheniya iz persidskikh i tyurkskikh sochineni [Materials on the history of the Kazakh khanates of the 15th–18th centuries, extracts from Persian and Turkic writings], 1969, Alma-ata: Nauka.

MKZ-1912: Materialy po kirgizskomu zemlepol'zovaniyu. Syr-Darinskaya oblast'. Perovskii uezd [Materials on Kyrgyz land use. Syr Darya province. Perovskii county]. 1912, Tashkent.

MODIS 2002–2005: MODIS flood inundation images. Kazakhstan and Uzbekistan: Syr Darya River – Rapid Response Inundation Map (28 February 2005), source: Dartmouth College, https://reliefweb.int/map/kazakhstan/kazakhstan-and-uzbekistan-syr-darya-river-rapid-response-inundation-map-28-february

Mukanov, M.C., 1991. Etnicheskaya territoriya Kazakhov v XVIII–XX vekov [Ethnic territory of the Kazakhs during the 18–20th c.]. Almaty.

NASA EO, 2004: NASA Earth Observatory images: Syr Darya flooded area as seen by the Terra satellite on February 10, 2004, https://earthobservatory.nasa.gov/images/12739/syr-darya-river-overflows

Natsional'nyy atlas respubliki Kazakhstan [National Atlas of the Republic of Kazakhstan], 2010, T.1 prirodnyye usloviya i resursy [natural conditions and resources], scale 1: 5 000 000 Almaty: Institute of Geography, 32–33 (Quaternary deposits); 52–52 (Geomorphology); 96–97 (Soils); 110–111 (vegetation), 120–121 (landscape).

Neustruev, S.S., 1911. O geologicheskikh i pochvennykh protsessakh na ravninakh nizov'yev r. Syr-Dar'ya [On geological and soil processes on the plains of the lower reaches of the river Syr-Darya]. Pochvovedeniye [Pedology], 2, 15–64.

Nikiforova, K.V., 1960. Kaynozoy Golodnoy Stepi Tsentral'nogo Kazakhstana [Cenozoic Hungry Steppe of Central Kazakhstan]. Moscow: Inst.Geology.

Pansner, L.I., 1816. Karta chasti Srednei Azii soderzhashaya zemli Kirgis Kaisakov, Karakalpakov, Truchmentsov i Buchartsov, socinena pri depo kart [Map of a part of Central Asia covering lands of Kirgis Kaisaks, Karakalpaks, Turkmens and Bukharians, compiled at the map depot], scale 1:2250000, St Petersburg, https://www.angelfire.com/nb/russianmaps/cyrillic/Pansner_1816_Karta_casti_srednej_azii_72.jpg.

Panyushkina, I.P., Meko, D.M., Macklin, M.G., Toonen, W.H.J., Mukhamadiev, N.S., Konovalov, V.G., Ashikbaev, N.Z., Sagitov, A.O., 2018. Runoff variations in Lake Balkhash Basin, Central Asia, 1779–2015, inferred from tree rings. Climate Dynamics, 51, 3161–3177. https://doi.org/10.1007/s00382-018-4072-z

Pavlov, N.V., 1931. Kompleksnyye stepi i pustyni Karsakpaya (opyt biogeograficheskoi monografii) [Complex steppes and deserts of Karsakpai (experience of a bio-geographical monograph)], Moscow.

Pischulina, K.A., 2016. Ocherki kazakhskogo khantsva. Sbornik statei [Essays on the Kazakh khanate. Collection of articles]. Almaty: Valkikhanov Inst. History and Ethno.

Pogodaiklimat: http://www.pogodaiklimat.ru/history/35969.htm (last assessed, 16/05/2020)

Rockhill, W.W., 1900. The Journey of William of Rubruck to the Eastern Parts of the World, 1253–55, as narrated by himself, with two accounts of the earlier journey of John of Pian de Carpine, London: Hakluyt Society, 131–135.

Rogozhinskii, A.E., 2017. Znaki i nadpisi «kamnya Tamgalytas» na okraine Betpakdaly [Signs and inscriptions of the «Tamgalytas stone» on the periphery of Betpakdala desert]. In: Arkheologicheskoye naslediye Tsentral'nogo Kazakhstana: izucheniye i sokhraneniye. Sbornik nauchnykh statey, posvyashchonnyy 70-letiyu organizatsii Tsentral'no-Kazakhstanskoy arkheologicheskoy ekspeditsii Akademii nauk Kazakhstana. T. 2. Almaty: «Begazy-Tasmola», 297–307.

Rychkov, P.I., 1887. Topografiya Orenburgskoy gubernii. Sochinenie 1762 goda [Topography of the Orenburg governorate. Opus of 1762]. Orenburg.

Sala, R., 2012. Medieval urbanization of Mid-Low Syr Darya and Northern Tienshan: Structure, development and environmental impact. In: Kubota, J., Watanabe, M. (Eds.), Toward a sustainable society in Central Asia: An historical perspective on the future, Kyoto: RIHN, 59–74.

Sala, R., 2019. Quantitative Evaluation of the Impact on Aral Sea Levels by Anthropogenic Water Withdrawal and Syr Darya. In: Yang, L.E., Bork, H.-R., Fang, X., Mischke, S. (Eds.), Socio-Environmental Dynamics along the Historical Silk Road. Cham: Springer Open, 95–121.

Samashev, Z., Murgabev, S., Eleuov, M., 2014. Sauyskandyk petroglifteri [Sauyskandyk petroglyphs]. Astana.

Severtsov, N.A., 1947. Puteshestviya po Turkestanskomu krayu [Travels in the Turkestan Territory]. 2d ed. Moscow: OGIZ.

Shmidt, Y.A., 1894. Ocherk Kirgizskoy stepi k yugu ot Aralo-Irtyshskogo vodorazdela v Akmolinskoy oblasti [Essay on the Kyrgyz steppe south of the Aral-Irtysh watershed in the Akmola region]. In: Zapisy Zapadno-Sibirsk. otdel. Russk.geogr.obshch. knig XVII, vyp. II [1–4], 1–149.

Schraembl, A., 1792. Allgemeiner Grosser Atlass Herausgegeben von F.A. Schraembl im Verlage bey Phil. Jos. Schalbacher. Wien, https://www.davidrumsey.com/luna/servlet/detail/ RUMSEY~8~1~303970~90074355:95{-}{-}Generalkarte-Russischen-Reichs-?sort=pub_list_no_initialsort%2Cpub_date%2Cpub_list_no%2Cseries_no&qvq=q:Schraembl%201792;sort:pub_list_no_initialsort%2Cpub_date%2Cpub_list_no%2Cseries_no;lc:RUMSEY~8~1&mi=0&trs=4

Soviet military maps, 1984–85. Scale 1:100.000: L-41-94-96; L-41-106-108; L-42-97-99; L-42-108-110.

Sorrel, P., Popescu, S. M., Klotz, S., Suc, J. P., Oberhänsli, H., 2007. Climate variability in the Aral Sea basin (Central Asia) during the late Holocene based on vegetation changes. Quaternary Research, 67, 357–370.

Spiridonov, M.D., 1922. Kirgizskiye pustynnyye stepi [Kyrgyz desert steppes]. Sibirskaya priroda, 1: 34–47.

Sultanov, T.I., 1982. Kochevyye plemena Priaral'ya v XV–XVII vv. (voprosy etnicheskoy i sotsial'noy istorii) [Nomadic tribes of the Aral Sea region in the XV–XVII centuries. (ethnic issues and social history)]. Moscow: Nauka.

Svod pamyatnikov istorii i kul'tury Respubliki Kazakhstan. Kyzylordinskaya oblast [Encyclopedia of the monuments of history and culture of the republic of Kazakhstan. Kyzylorda province], 2007. Almaty: Aruna.

Tazhekeyev, A.A., Ongar, A., Shorayev, B., 2013. Tapa – pamyatnik epokhi bronzy Severo-Vostochnogo Priaral'ya [Tapa – a monument of the Bronze Age of the North-Eastern Aral Sea region]. In: Trudy filiala Instituta arkheologii im. A.KH. Margulana v g. Astana. Tom II [Works of the filial of the IA.K. Margulan Institute of Archeology in Astana. Volume II]. Astana, 167–171.

Tizengauzen, V.G. (Ed.), 1941. Sbornik materialov otnosyashchikhsya k istorii Zolotoy Ordy. T.2. [collection of materials related to the history of the Golden Horde]. Moscow-Leningrad: izd.Akad Nauk.

Tolstov, S.P., 1962. Po drevnim deltam Oksa i Yaksarta [Following the ancient deltas of the Oxus and Yaxartes]. Moscow: izd.Vostochn. Literat.

Truscot, I.F., 1772. Karta Orenburgskoy gubernii [Map of the Orenburg Governorate], https://search.rsl.ru/ru/record/01008607613.

Vainberg, B.I., 1997. Ekologiya Priaralya v drevnosti i srednevekovye [Ecology of the Pre-Aral region during ancient and medieval times]. Etnograficheskoye obozreniye 1: 23–41.

Vainberg, B.I., 1999. Etnogeografiya Turana v drevnosti, VII do n.e.–VIII n.e. [Ethnogeography of Turan in antiquity. VII BC–VIII AD]. Moscow: izd.Vostochn. Literat.

Ventresca Miller, A.R., Haruda, A., Varfolomeev, V., Goryachev, A., Makarewicz, C.A., 2020. Close management of sheep in ancient Central Asia: evidence for foddering, transhumance, and extended lambing seasons during the bronze and iron ages. STAR: Science and Technology of Archaeological research, 6: 41–60. doi: 10.1080/20548923.2020.1759316

WBCS, 2020: Worldwide Bioclimatic Classification System. S.Rivas−Martinez and S.Rivas−Saenz, https://www.globalbioclimatics.org/pdf/ka-zliha.pdf (Adapted to Synoptical Table 14/02/2020).

Yakovlev, D.I., 1941. Golodnaya step' Kazakhstana. Chu-Balkhashskii vodorazdel', Bedpak-Dala i Muyun-Kum. Geograficheskoe, geologichskoe i gidrogeologicheskoe opisanie [The Hungry Step of Kazakhstan. Chu-Balkhash watershed, Betpak-Dala and Moyin-Kum. Geographical, geological and hydrogeological description]. Moscow-Leningrad: Ak. Nauk, 395–399.

Yerofeyeva, I.V. (Ed.), 2014. Kratkiy Entsiklopedicheskiy Slovar' Istoricheskikh Toponimov Kazakhstana [Brief encyclopedic dictionary of historical toponyms of Kazakhstan]. Almaty, 388–389.