Quaternary Evolution of the Human Habitats in the Ili-Balkhash Region from Paleolithic to Modern Times

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CONTENTS

1. Formation of modern arid zones and human colonization of Kazakhstan

The formation of the arid zones of Kazakhstan is characterized by 4 stages: Pliocene, Eopleistocene, Pleistocene, Holocene. [1]

During the end of the Late Pliocene period occurred the last transgressions of the Caspian sea (Akchagylian 3,3-1,85 Ma BP and Apsheronian 1,7-1 Ma BP) covering most the huge area of the Turgai depression. The climate of that period was warm and wet, the Tienshan was still a low mountain range reaching 2,000 m and not impeding the monsoons moisture to fall in Kazakhstan.

With the Eopleistocene (1,8-0,8 Ma BP), the basin of the Caspian sea started to regress and the mountain ranges in the orogenic zones reaching the snowline got covered with ice caps. The climate started to be more arid because of the partial obstruction of the monsoons by the Tienshan and the landscape zones got divided in 3 vegetation belts: forest-steppe, steppe and desert.

The first trace of human colonization by Homo habilis (2.5-1.5 Ma BP) occurred at that time, Lower Paleolithic campsites are found at the level of the Apsheronian terraces in the Caspian shore of Mangyshlak (Sarytash bay, Shagbagata) and under the Quaternary conglomerates in the low hills of the future Karatau range (Arystandy).

The Pleistocene period (0,75-0,12 Ma BP) is characterized by a succession of pluvial and arid climatic phases determined by the global climatic tendencies. Paleolithic campsites of Homo erectus (1.6-0.25 Ma BP) appeared during the main interglacial periods (Gunz-Mindel, Mindel-Riss) in the four corners of Kazakhstan (Mangyshlag, Karatau, Saryarka, Pre-Irtysh). During the Middle Pleistocene, an accelerated rise of the Tienshan range and a total blocking of the monsoonal precipitations increased the aridization of the landscape with more desert zones (south and central deserts), the formation of new inland lakes (Aral, Balkhash) and the formation of relic forests of the Balkhash-Irtysh watershed (Karkaralinsk) and Pre-Irstysh (Bayanaul).

During the Riss-Wurm interglacial a new Mousterian industry connected with a third wave of human colonization (Homo Neanderthalensis, 130-30 ka BP) spread all over Kazakhstan. The Last Glaciation saw an extreme cooling of the climate causing cryolithic zones to develop in arid areas and in the mountains [2]. Even if numerous Late Paleolithic campsites developed all over Kazakhstan during the Wurm interglacial periods, the cold and dry conditions of the Late Glacial (12-9 ka BP) is

marked by a hiatus in the development of the Stone Age culture in Central Kazakhstan.

The Holocene stage is characterized by a long cold and dry period in the piedmonts that persisted till the end of the Boreal period (8,000 BP). With the Atlantic period (6,000 BP), the territory of Kazakhstan received its modern vegetation belts (forest-steppe, steppe and 3 types of desert) and start to be densely populated by Neolithic cultures found almost everywhere in the proximity of watered areas. The Bronze Age climatic aridization will favor a retraction of the habitats in the stably watered piedmonts and the successive historical phases will continue the pulsation between watered arid and piedmonts zones according to the climatic fluctuations.

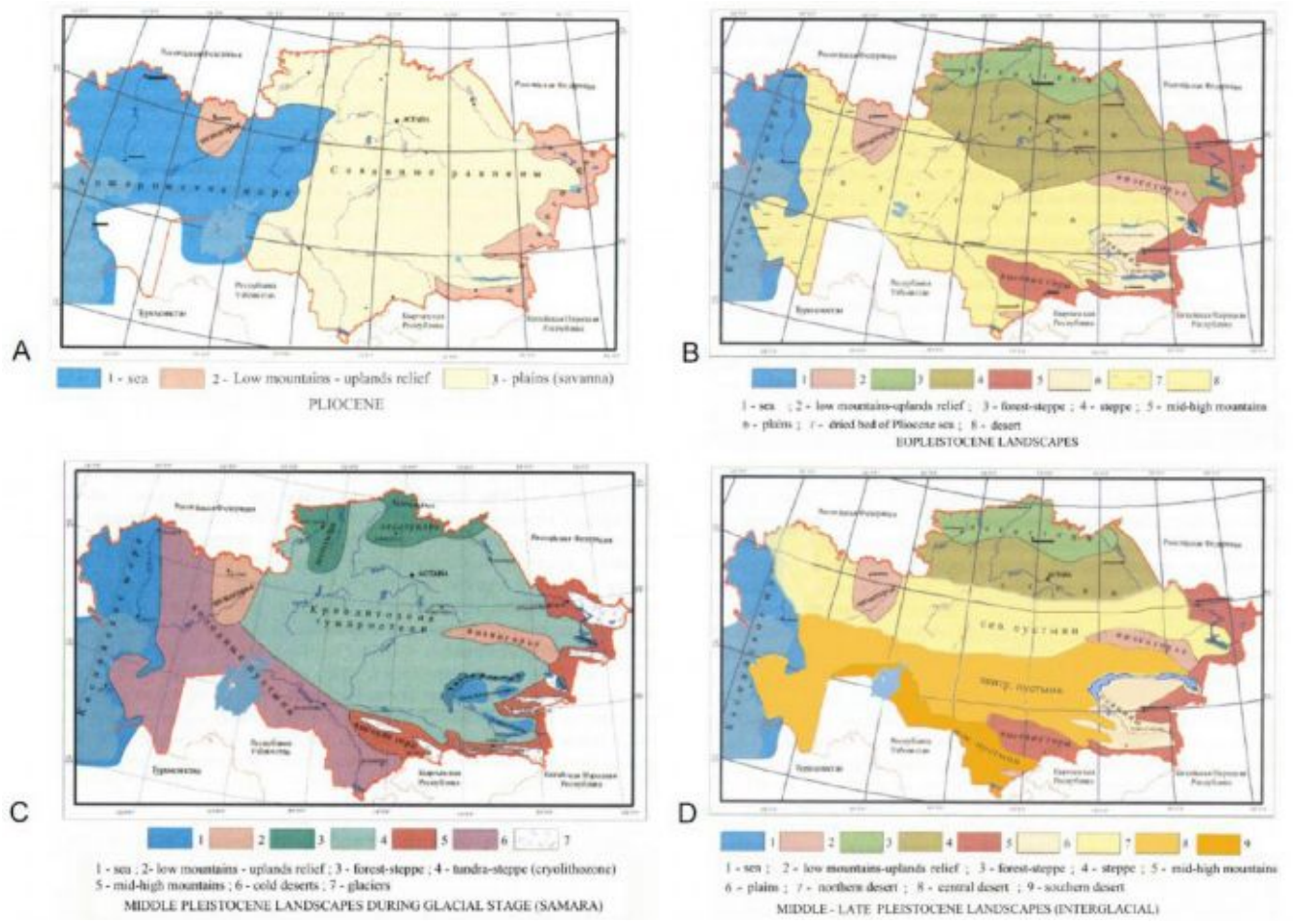

Fig. 1 Evolution of the Quaternary landscapes of Kazakhstan: A-Late Pliocene (Apsheron transgression of the Caspian sea, ± 1,7 Ma BP), B- Eopleistocene (1,6-0,75 Ma BP), C- Middle Pleistocene (0,35-0,12 Ma BP) during Samara glaciation (0,28-0,25 Ma BP), D- Middle and Late Pleistocene during Interglacial period (0,130-0,11 ka BP).

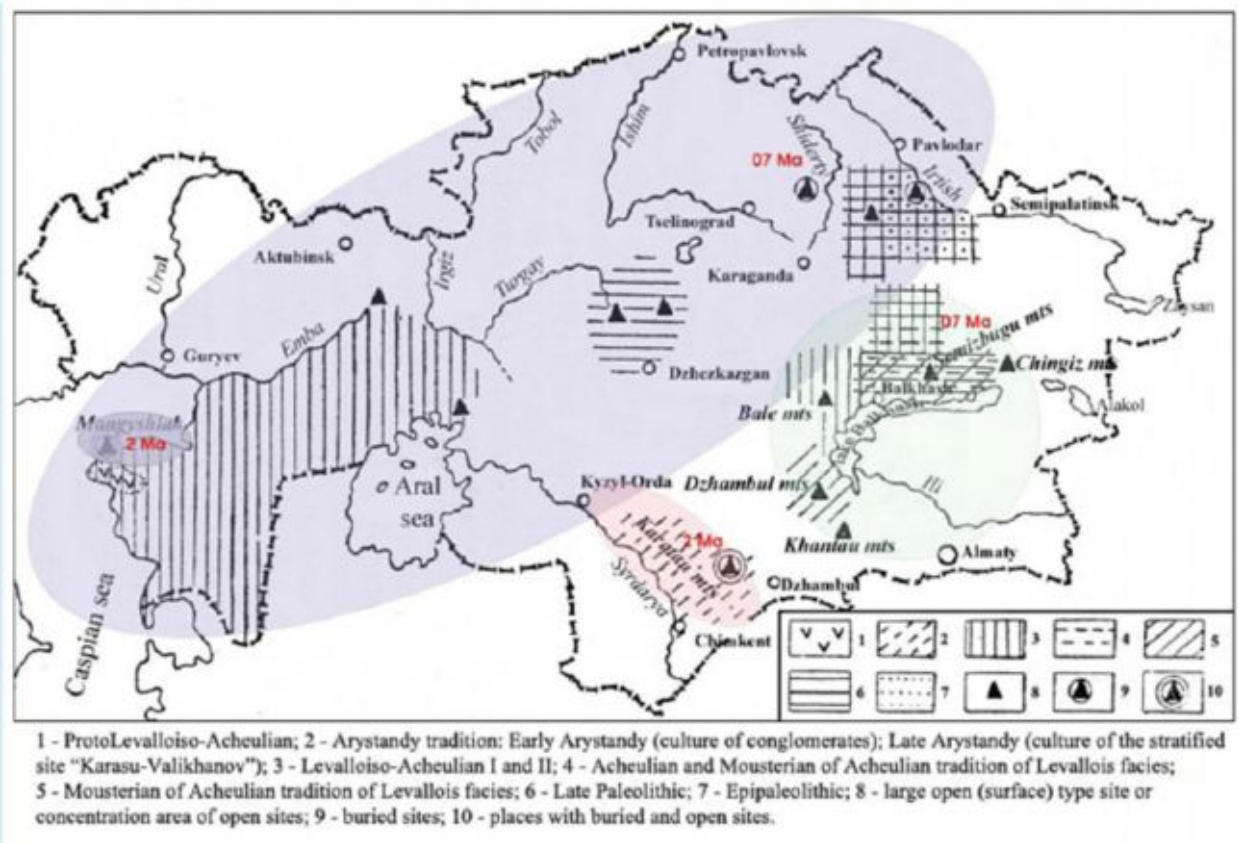

Fig. 2 Paleolithic cultures of Kazakhstan (3 main traditions related to 3 different rock materials highlighted in 2 colors: flint on the Caspian, chalcedony in the Karatau range, quartzite in the Pre-Balkhash). (After A.Medoev [3])

2. Quaternary landscape development and history of human habitats in the Ili-Balkhash basin

The formation of the modern landscape of the Ili-Balkhash basin can be divided in 5 stages: Early Pleistocene, Middle Pleistocene, Eopleistocene, Boreal, Atlantic [4].

At the end of the Early Pleistocene period, the Balkhash basin was already an arid zone with the Tienshan reaching the 4,000 partially impeding the Indian monsoons. The climate oscillated between cold-dry during the Gunz and Mindel glaciations and warm-wet during the Gunz-Mindel interglacial. At that time, the Balkhash depression was constituted by a band of small lakes mainly fed by streams flowing down the North. There was a lake in the Bakanas depression but the largest water body was the Ili lake located closer to the piedmonts zone in the Ili river basin and covering a vast area stretching from the Kurty river at the West till Yining (PRC) in the East. The first Paleolithic campsites are dated to this period and include chopping tools and Acheulian industries in Bale and Semizbugu in the North Balkhash region. Early stone industry is also found in the Charyn valley when the canyon was still shallow and closer to the Ili lake reaching the Zhalanash plain.

During the second half of the Middle Pleistocene (around 200 ka BP), the Ili lake opened northward through the Kapchagai canyon, filling the Bakanas lake and running into the Balkhash depression forming the Balkhash lake. At this early stage the lake covered a huge area including the modern Sassyk-kol and Alakol lakes. The climate oscillated between cold-dry during the Riss glaciations and warm-wet during the Riss-Wurm interglacial. Most probably to this favorable climatic phase is connected the diffusion of Mousterian cultures in the basin. Mousterian campsites are found in the Chu-Ili mountains, in the North of the Balkhash lake and in the Charyn valley.

During the Late Pleistocene Glaciation (70-11 ka BP), the further rise of the Tienshan and Tarbagatai ranges caused the uplift of the Arganaty mountain and the division of the Balkhash in 2 lakes (Balkhash, Alakol). These new borders are defined by the Old Balkhash lake shorelines. To the Wurm II glaciations (30-15 ka BP) is associated cryolithic layers found everywhere in the basin and the desiccation of the river networks at the north of the Balkhash lake. The Late Paleolithic campsites of homo sapiens are found in different places of the basin; in the Northern Pre-Balkhahsh (Sayak), on

the loess terraces in the piedmonts (Maibulak) and in the river terraces of the Ili river (Aktau).

The Last Glacial phase (15-10 ka BP) has been very severe and might have caused a hiatus in human occupation in the basin till the Atlantic period. During the post-glacial early Holocene period, the lake received its modern borders as New Balkhash and started a phase of regressions and transgressions that will characterize its Holocene behavior. If the cool and dry Pre-Boreal (8,3-7,7 ka BP) had a phase of regression, the favorable climate of the Atlantic period saw the transgression of the lake. Numerous Neolithic campsites are found around the debris cones around the lake. While the previous campsites were located on alluvial fans at the source of raw materials and in hunting zones, the Neolithic campsites are located on terraces of small rivers, near springs and wells.

The successive Holocene periods saw successive waves of immigration of populations (Indo-Iranian, Turkic, Mongol) and the progressive establishment of pastoralist communities practicing seasonal vertical migrations between deserts and alpine meadows proceeding till modern times.

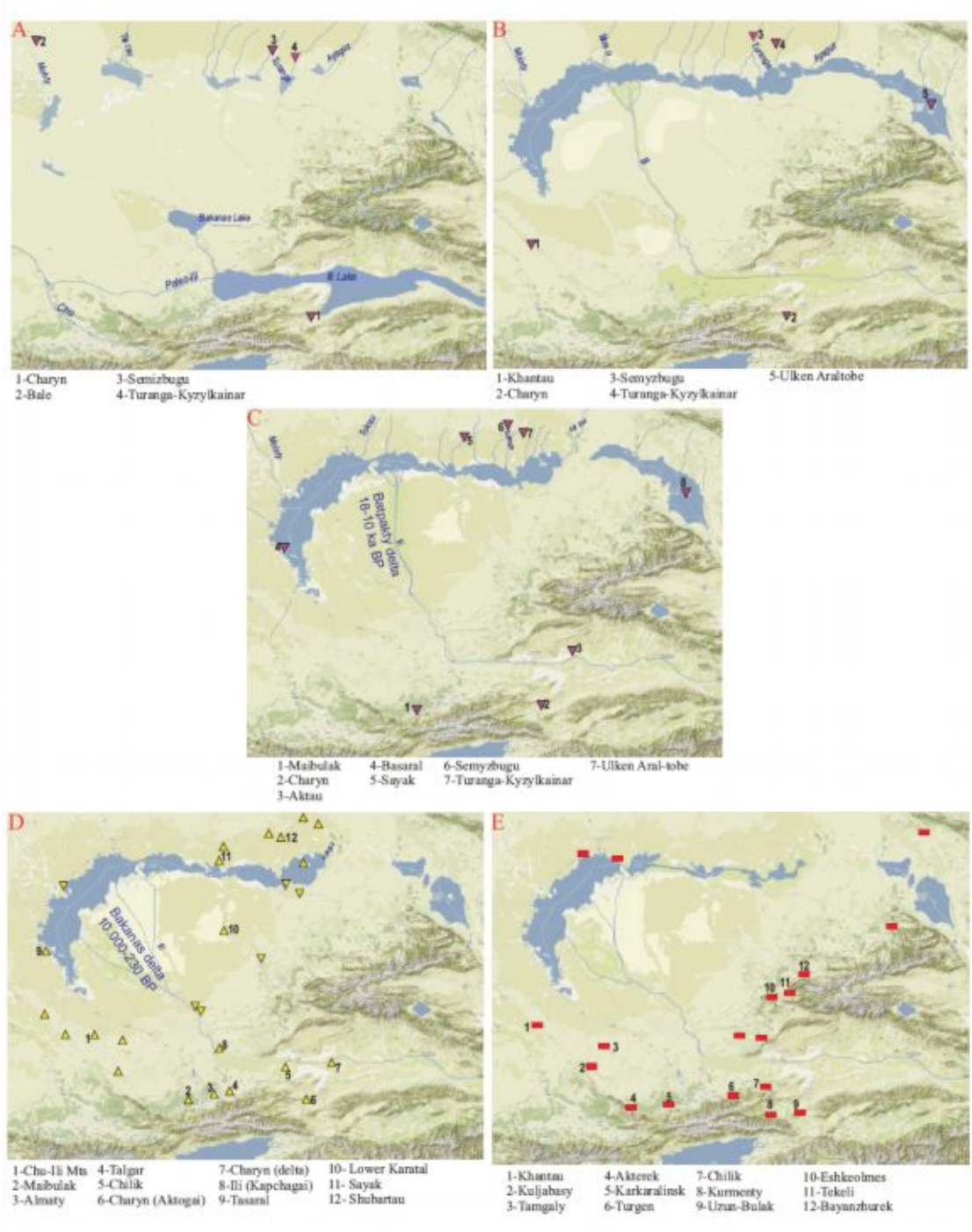

Fig. 3 Five stages of Quaternary landscapes and human habitats in the Ili-Balkhash basin.
A- Early Pleistocene/ Acheulian/ Homo erectus; B-Middle Pleistocene/ Mousterian/ Neanderthal; C-Late Pleistocene/ Aurignacian; D-Neolithic/ Microliths (humid phase); E-Early Bronze Age (dry phase).

3. Geoarchaeological proxy records correlated with the geomorphological studies in the Ili-Balkhash basin

In the context of the geological study of the lake level change and environmental evolution of the basin during the Holocene period through the research of shorelines, affluent river and delta terraces and aeolian deposits, systematic geoarchaeological surveys were conducted in the area selected for geomorphological studies.

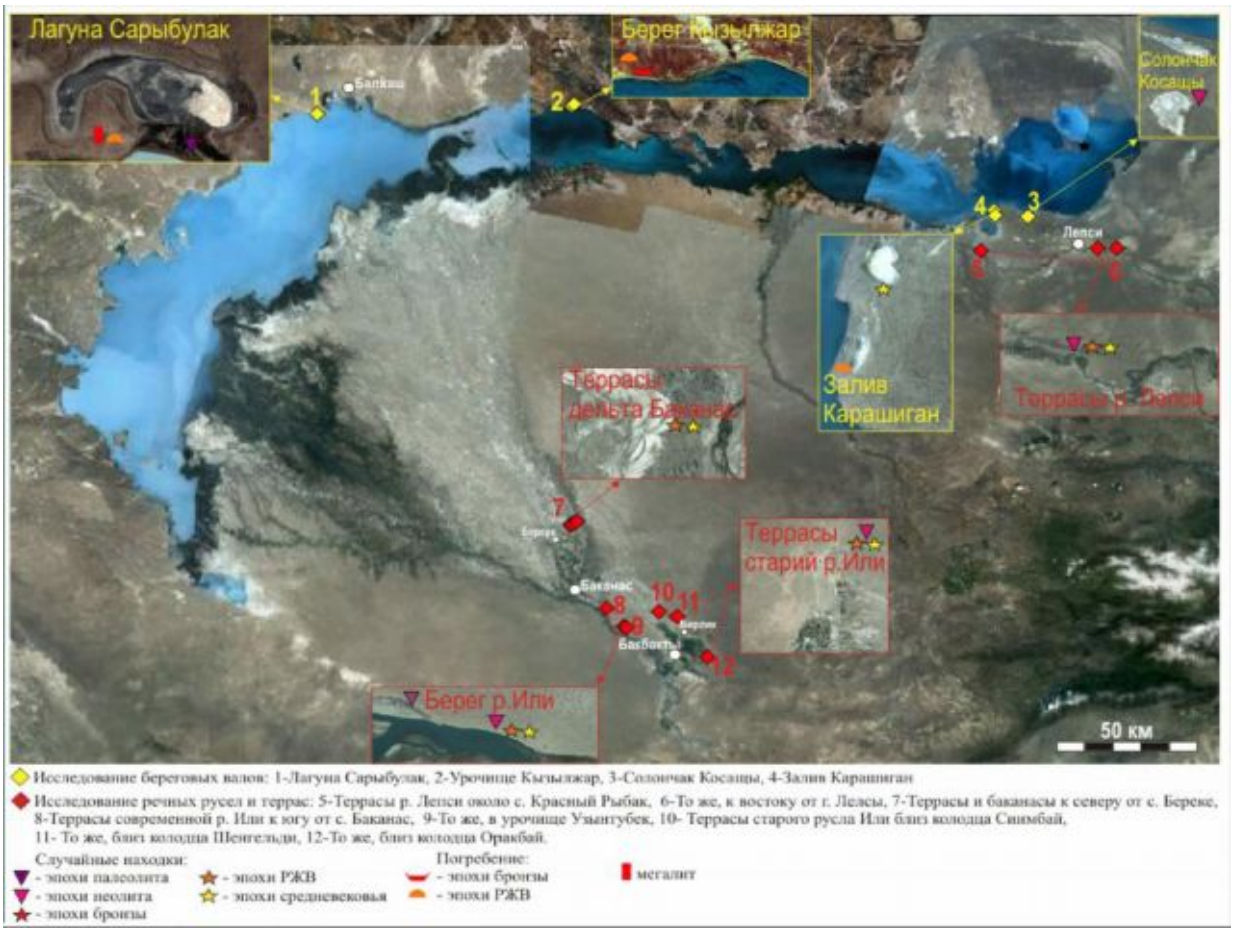

Fig. 4 Satellite image of the researched sites

3.1. Shoreline surveys

Sand bars and ancient lagoons were studied through remote sensing analyses and DEM (Digital Elevation Model) reconstruction, through shorelines topographic profile measurement with Total Station and dating through C14 and OSL (Optically Stimulated Luminescence). Four loci were selected for survey: the Sarybulak laguna in the northern shore at the west of the town Balkhash, the area close to the Balaitubek peninsula in the northern shore at the east of the town Balkhash, the salted lake Kosaschi and the Karashigan bay in the southeastern shore at the west of town of Lepsy.

Archaeological surficial findings were found in all the 4 areas providing new information on the human occupation in these loci.

1. In the **Sarybulak laguna**, archaeological findings were discovered at different altitudes around the laguna and on the lake shore.

The presence of a Late Paleolithic stone tool on the lake beach embankment at 346 m let suppose that it was brought here from the erosion of higher terraces of the Ancient Balkhash during a phase of transgression. The Bronze Age megaliths and cist tombs and the Iron Age kurgans didn't show any trace of water erosion which let us suppose that the XIII-XV AD transgression (348.5m as centuries long maximum) referred by R.Kurdin is or exaggerated or very ephemeral. Most

probably, this transgression phase didn't remain a long time over the 346 m. The presence of very pulverized medieval ceramics and shlags dated to the late medieval period and located around the laguna at 2 m under the transgression of the first half of the XVIII AD [7,8] lead to the hypothesis that it was brought down from a nearby stream channel from the upper part of the slope. The ethnographic winter house is located at the level of the 1910 transgression and the abandonment of the houses could be related to this very humid period.

2. In the lake shore at the **east of the Balaitubek** peninsula, two Bronze Age cist tombs have been fixed at an altitude of 346-346,3 m. If the lowest tomb clearly shows the trace of water erosion caused by a long transgression of the lake, the second tomb is intact. It confirms our hypothesis that that no post-Bronze Age transgressions (I, XIII-XV, XVIII AD) remained during a long time above 346 m.

3. At the northern border of the **salted lake Kosaschy**, in a gravel line among tamarisks around 10 microlithic tools and spalls have been collected on the surface at 346 m. The salt marsh and the lake are separated by high sand dunes terraces (356 m) with no traces of channel erosion. It invalidates the preliminary hypothesis of the Japanese geomorphologists that the salt marsh was an ancient lagoon divided from the lake by late Holocene deposits.

4. The medieval ceramics and kurgans found in the periphery of the **Karachigan bay** are located above the level of highest sand bars of the New Balkhash and confirm the scenario that there was no late Holocene transgression of the lake till the level of the Ancient Balkhash shorelines.

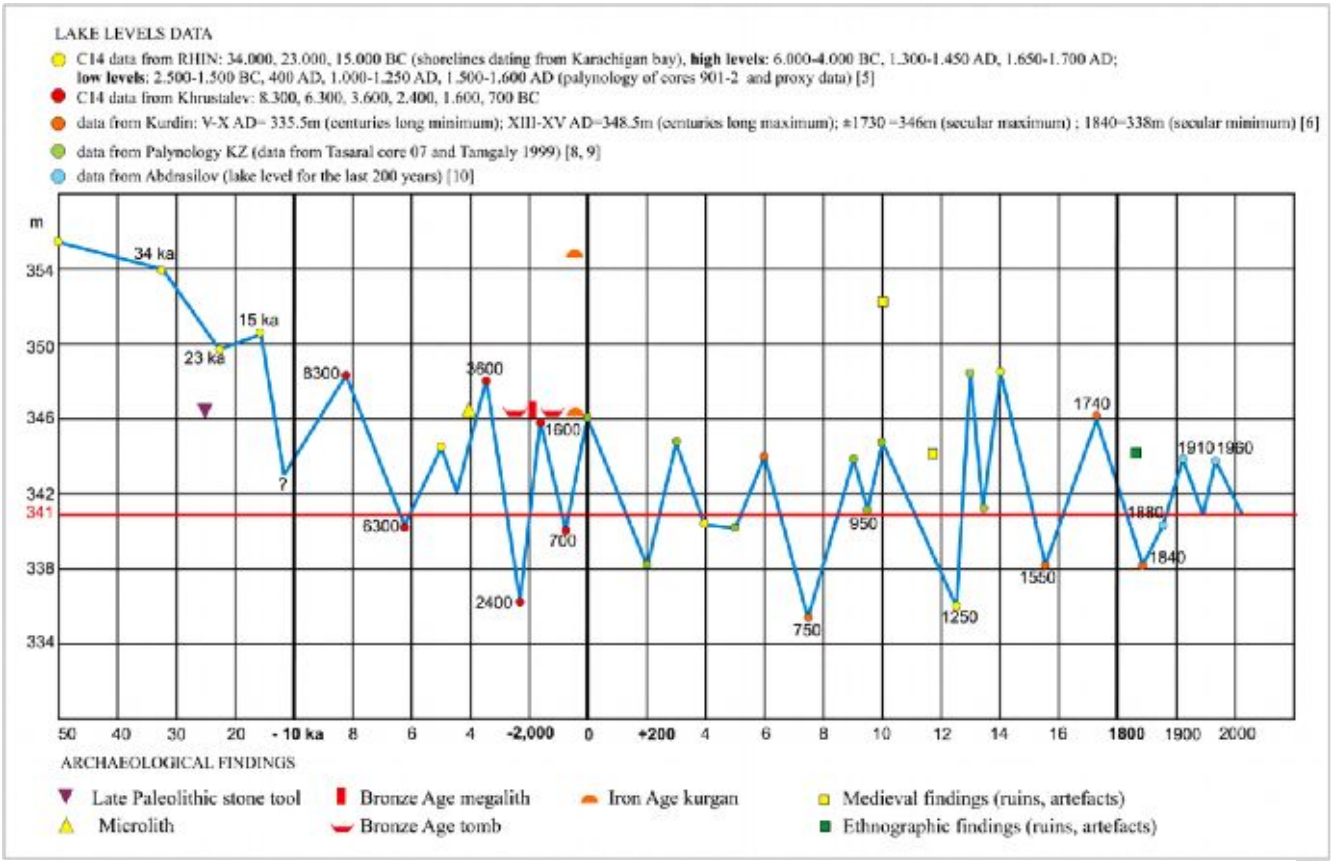

Fig. 5 Table of the Balkhash lake level with the location of the archaeological findings

SITE	GPS		FINDINGS	EXACT LOCATION	ALTITUDE (m) asl	DATING	SHORELINES (m) asl
1-LAGUNA SARYBULAK	74.7770-46.7772	1.1	stone tool (scraper)	Lake beach embankment	346	Late Paleolthic	Lake: 348 (AB), 343 (NB), 341.6 (AL) Laguna: 346 (AB)*; 343- 342 (NB); 338;337 (AL)
		1.2	Cist tombs & megaliths	SW terrace of laguna	346-346,5	Bronze Age	
		1.3	kurgans		346-346,5	Iron Age	
		1.4	ceramics, slag	NE of laguna upper shoreline	344	Middle Ages	
		1.5	ruins	SE terrace of laguna	345	Ethnographic	
2-EAST BALAITUBEK	76.1553-46.806	1.6	Cist tombs (2)	Lake terrace	346, 346,3	Bronze Age	Lake: 348 (AB), 341.6 (AL)
3-SALT MARSH KOSISCHI	78.6183-46.3521	1.7	microliths	On the salt lake shore at the level of the gravel line with tamarsisk	346	Neolithic	Lake: 342 (AL) Salt marsh: 338 (AL); 340 (1T), Sand dunes 356 (TL)**
4-LAGUNA KARACHIGAN BAY	78.4289-46.3669	1.8	ceramics	North sand dunes at level of higher sand bar	352	Middle Ages	Lake: 341.7 (AL) Laguna: 8 to 11, from 342 to 350
		1.9	kurgans	Rock promontory above lake	355	Iron Age	
* AB= Ancient Balkhash shoreline ; NB= New Balkash; AL= Actual water level ** 1T= 1st terrace;TL= Top level							

Fig. 6 Table of the location of the archaeological findings in the shorelines surveys

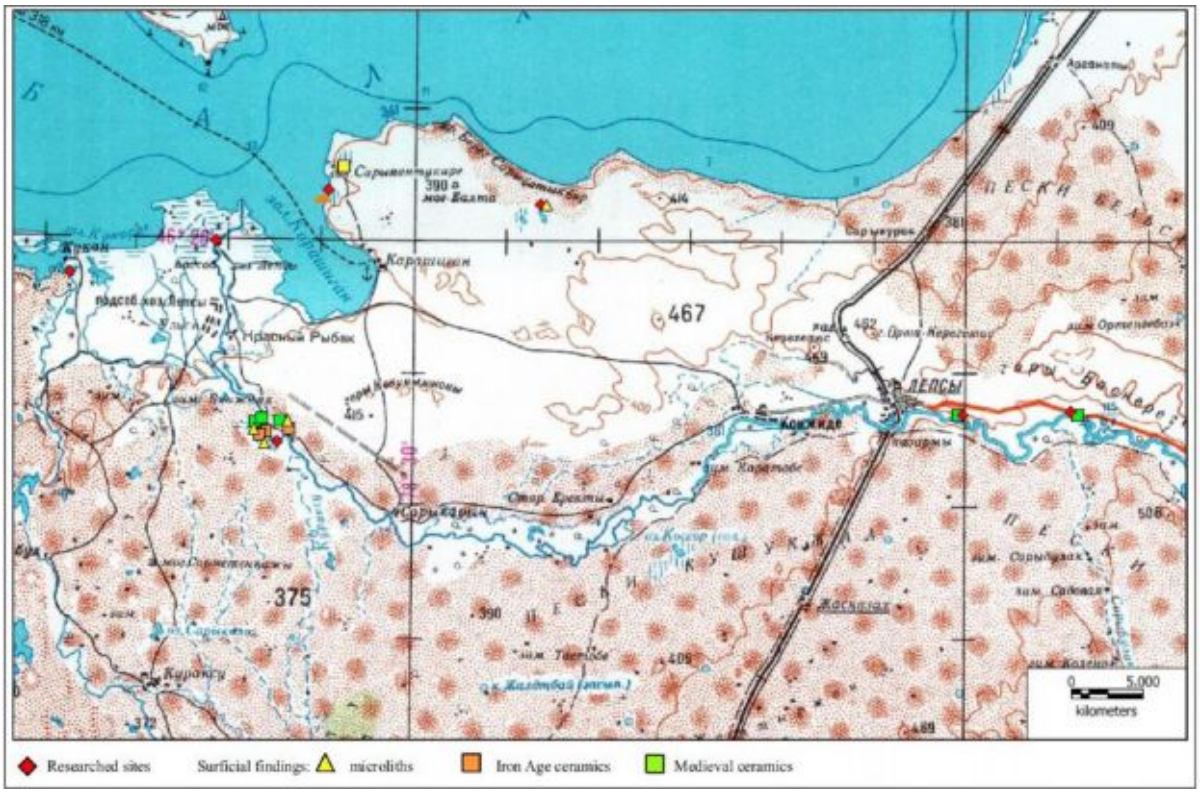

Fig. 7 Map of the location of the archaeological findings in the Lepsy river terraces

3.2. Terraces surveys

River terraces were studied through topographic profile measurement with Total Station and OSL dating of transect points, and collect of samples in the profile stratigraphy for C14 dating. Two lower courses and delta branches were investigated: Lepsy and Ili delta.

1. The terraces of the **Lepsy river** were studied in four loci: in the western branches of the Lepsy delta were it melts with the delta of the river Aksu, along the main active course 4 km before its confluence with the lake, upstream in the low course south of Krasnyi Rybak where the river crosses a rock outcrop forming a waterfall, further upstream at the east of the town Lepsy in a segment located near the head of the Lepsy canal.

The geomorphological analyses have revealed a high discharge rate connected with a cool and wet

phase of the Lepsy river till the 4.000 BC followed by a warm and dry phase till the 1.500 BC.
If the two first places didn't reveal any surficial findings, the terraces at the water fall provided a rich quantity of material (microliths and ceramics) from the Neolithic to the late medieval time revealing that the river terraces were densely inhabited during a long period (6.000 years). The last place upstream disclosed only medieval ceramics.

2. The terraces of the **Ili delta** were studied in five loci: in the Bakanas delta at the north of Bereke, along the active course of the Ili river between Bakbakty and Bakanas, in the old main course of the Ili river at the North and West of Birlik.

- The terraces of a dried course of the head of the Bakanas delta located between the Orta and Shett Bakanas was studied by topographic profile measurement along a transect NE-SW of 2 km with collect of samples for OSL dating in 4 places. The surficial findings revealed ceramic shards from the Iron Age (minority) to the late medieval period (majority) presuming that it was a good place for winter camps, especially during Little Glacial Age.

- The high sand dune terraces along the active main course of the Ili at Uzuntubek and in its surrounding was studied by topographic profile measurement along a transect of 100 m corresponding to the river terrace and included the collect of samples for OSL in the steep slope above the river. The study revealed the continuous activity of this main riverbed for at least 10.000 years. In the terrace above the river, the surficial findings revealed abundant Neolithic pottery shards and microliths, Iron Age and medieval ceramics. The river is eroding these ancient campsites that are now falling in the slope over the river, in depressions other mostly medieval ceramics were collected. A Late Paleolithic stone tool was also found in this area which let us suppose that the main course was already active before the Last Glaciation and remained continuously active during the whole Holocene.

- The sand dune terraces along the old dried course of the Ili river North of Birlik were selected for studying the period of activity of this main secondary course. It was expected that this segment might have represented the main riverbed of the Ili river during several historical periods.
  The terraces of the dried course and its riverbed were studied by topographic profile measurement and OSL dating in two places: at the North of Birlik on the 10 m high sand terraces above the riverbed along a transect N-S of 200 m and further downstream near the well Siimbai terraces. The study revealed the continuous activity of this riverbed till the beginning of the XX AD. Like in the terraces of the main active course, the surficial findings reveal similar material from Neolithic microliths to late medieval potteries allowing the inference that this course had always been active and inhabited until recently.

Most of the geomorphological data collected in the terraces surveys are still under analyses and, by lack of results, forbid a close correlation of the archaeological surficial material with the dating of the alluvial and aeolian deposits. But, both the dating of the Karachigan shorelines (Ancient Balkash sand bars dated to 36 ka BP at 354 m) and the long time span covered by the archaeological findings confirm the Quaternary historical reconstruction of the lake basin [4].

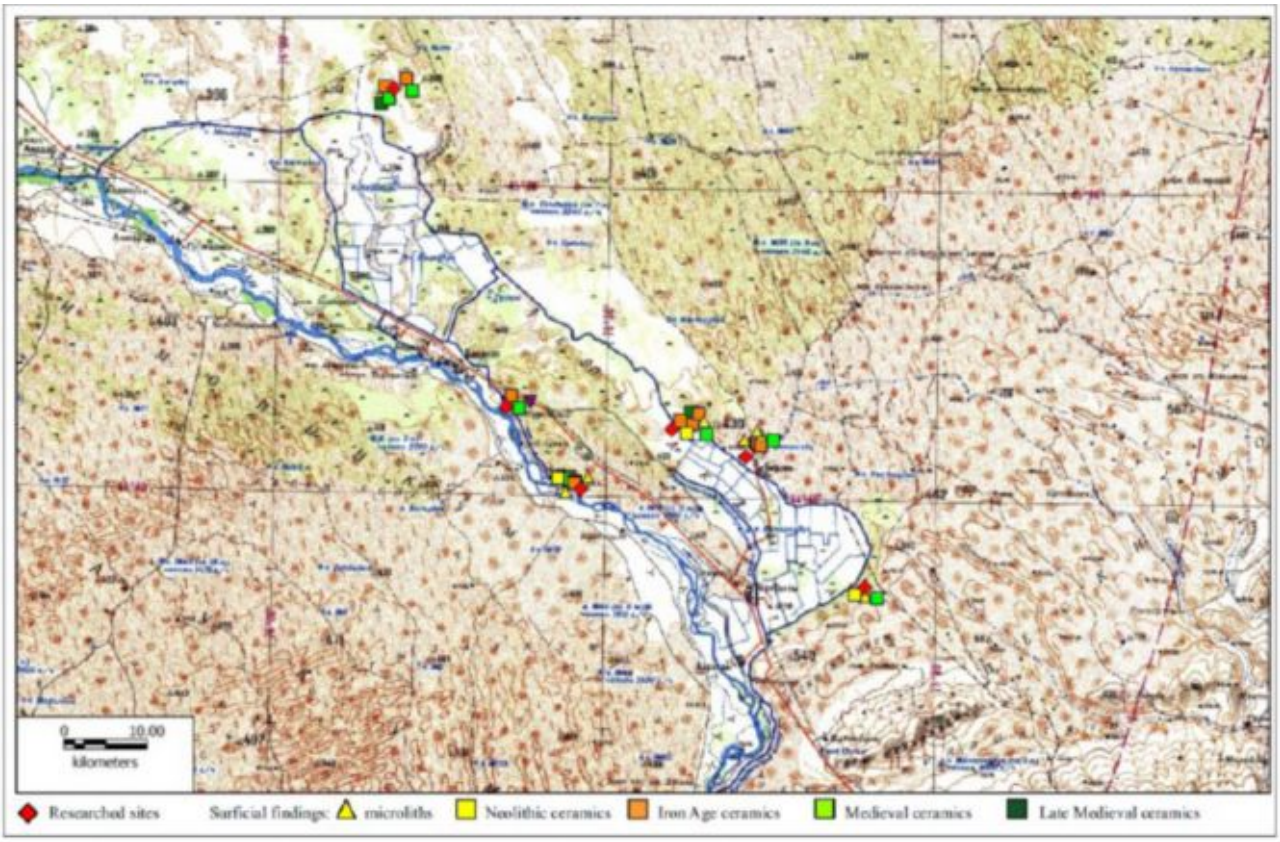

Fig. 8 Map of the location of the archaeological findings in the Ili river terraces

4. Conclusions

The historical stages of the formation of the modern landscape of Kazakhstan from a savanna plain to the modern arid region corresponds to the timeline of human occupation from its appearance on the shore of the Caspian sea two million years ago till its modern high demography relatively untied from natural factors.

In the Ili-Balkhash basin, man arrived along rivers feeding the Balkhash depression from the north when it was still made of several small lakes. He saw the main stages of its late quaternary formation: the creation of the lake under an accelerated rise of the Tienshan, the division of the Ancient Balkhash still joined with the Alakol under tectonic uplift, the cryogenic stage of the Wurm II glaciation with the desiccation of the North Balkhash river network followed by the disappearance of human culture during the Late Glacial and its return during the warm wet Atlantic period.

Even with a very reduced number of sample sites, the amount and long period cover of the surficial material have increased our knowledge of the human occupation of the Ili-Balkhash basin during the Holocene, confirming the wide distribution of Neolithic campsites in the vicinity of lakes (Kosaschy) and river courses (low course Lepsy, secondary dried and main active course of the Hi), the Iron Age antiquity of seasonal pastoral winter camps in the same areas with a large territorial occupation (Lepsy, Ili river terraces), its continuity and increase during the medieval period (mostly 1X-XII AD, found everywhere) and reduction during the Late Medieval period (XVI-XVIII AD, mostly in the head of the Bakanas delta).

The location, altitude and distribution of the surficial findings confirm the historical reconstruction of the lake basin [4] and provided more details about the late Holocene transgression of the lake Balkhash that hardly ever remained 4 m above its modern level during a long time, about the long period of human occupation along the low course of the Lepsy river and the even more antique occupation (Late Paleolithic to Late Medieval) of the terraces of the secondary and active course of the 111 river. As proxy data, these archaeological findings correlated with the geomorphological dating of the shorelines confirm the Late Pleistocene antiquity of its modern landscape and infirm alternate reconstruction circumscribing it to the Holocene [13]

The history of the emergence and long persistence of the phenomenon of continental water bodies on the periphery of arid zones and their importance as habitats and source of life was formerly weakly researched and the Kazakh-Japanese project brought a decisive contribution to this problem.

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