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В научном издании, сборнике трудов, связанных с историей и археологией страны «батыров и акынов» представлены последние достижения ведущих исследователей этой земли как из Казахстана, так и ученых из России, Бельгии и Италии. В приложении дается сводка по нескольким десяткам археологических памятников района. Публикация будет осуществлена заповедником-музеем «Танбалы» - ведущим государственным учреждением региона, связанным с охраной, изучением и популяризацией культурного наследия.

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Spatial analysis of the kuljabasy archaeological complex

Contents

Introduction

The petroglyph and archaeological complex of Kuljabasy, located at the southern borders of the Chu-Ili mountains, has been discovered in 2000 by Renato Sala and Jean Marc Deom during a campaign of research of the potential locational factors of a main petroglyph site [1]. The hypothesis was that 3 natural factors, i.e. good rock material, water availability supporting a human habitat, and the geographical alignment of such locales, favor the development of an important site by providing respectively the medium for the message, the presence of potential authors, and the presence of a road with potential users-spectators. This ”locational formula” has been successfully verified in several locales, among which the 14 western valleys of the Kuljabasy range showed to be most significant by number, wide distribution and quality of engravings.

The discovery has been immediately followed by archaeological works and publications. The first scientific report about the Kuljabasy archaeological and petroglyph complex [2] still represents the basic reference for the study of the site. The history of the study has been brilliantly reconstructed by A. Rogozhinskyi[3].

[1] *In the research team were also present 2 geologists, Yuri Nikolaich Koslov and Pasha Vinakurov, by now both deceased.*

[2] *This article has been summarized in a following publication Sala R. and Deom J.M. Petroglyphs of South Kazakhstan. Almaty, Laboratory of Geoarchaeology (in English and Russian) 2005.*

[3] *Rogozhinskiy A.E. 2012. The Kuljabasy complex: results of 10 years of study (2001-2011) [Komplex Kuljabasy: Itoghi desiatilietiya isledovanniy (2001-2011 gg)]. Isvestiya NAN RK 2012-3, 35-53. (in Russian)*

In 'Antiquities of Kuljabasy'[4] is discussed the chronology of the oldest 'Archaic' layer of the engravings, and is advanced the hypothesis of the background presence of bull and wolf 'cults' [5]. A couple of amateurish publications have the merit of providing to the public some additional color illustrations[6] [7] [8]. Images and scenes from the Kuljabasy repertory had become mandatory materials for any publication about the rock art of Kazakhstan and W-Central Asia.

The aim of the present article is to provide an enhanced spatial analysis of the site: detailed and extended maps, coding, and analysis of the distribution of rock material, springs and habitats, archeological monuments and petroglyph concentrations, chronological periods, and few relevant subjects. Table-I and Maps 02-03-04 constitute the data base of the present analysis.

The new maps are extended beyond the already known 14 parallel valleys of the Kuljabasy-West range to the other valleys adjacent on the west and on the east. They include: the 6 valleys of the Kostobe range on the west (which develop along 6 km); the already published Valleys 1-14 of Kujabasy-West (10 km); the valleys following to the east until Valley-26, i.e. the train of valleys 15-26 that we call Kuljabasy-Central (13 km). Further east, valleys 27-39 of Kuljabasy-East (16 km) are still unexplored because included in a military polygon: they surely hid some rock art executions and most probably represent the area where few petroglyph groups have been discovered and documented in the 50ies (Marikovskiy1961). (Fig 1)

The former valley codes have been maintained. The 6 valleys of the Kostobe range on the west are defined by the prefix Kt: Kt1, Kt2, etc. The valleys of the Kuljabasy range are named by the prefix "V" followed by an integer number proceeding from W to E (V2, V3, etc) or, in case of very short valleys better considered as part of the precedent one, by a decimal number (V2.1).

The coding of petroglyph groups, which has never been published, is fixed valley by valley: here groups, when more than one, are ordered by valley's segment proceeding from the mouth to the top (S to N) and from W to E.

The spatial analysis is also applied valley by valley to specific entries like: quality of the lithic material, valley length and incline; number of springs, settlements and tombs; petroglyph groups, surfaces, images and chronological periods. The spatial distribution of some significant subjects is also provided.

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[4] Maryashev A.N. and Jelesnyakov B.A. 2013. Antiquities of Kuljabasy [Drevnosti Kuljabasy]. Almaty, Inst. of Arch. Margulan. (in Russian)

[5] Actually the image of humans with wolf head, which occurs in few petroglyphs of Kuljabasy, doesn't allow suspecting the presence of a wolf's cult but rather of the consciousness of the human imitation of wolf's hunting tactics and appropriation of part of its game (Fig. 9).

[6] Baipakov K.M. and Maryashev A.N. Petroglyphs of the Kuljabasy mountains [Petroglify v gorax Kuljabasy]. Almaty, 2004. Inst. of Arch. Margulan. (in Russian and English)

[7] Hermann L. and Zhelesnyakov B. The petroglyphs of Kulzhabasy in Kazakhstan. Paris, 2012. Books on Demand.

[8] Hermann L., Beisenov A. and Zheleznyakov B. The rock art of Kulzhabasy, Kazakhstan (Kazakhstan, Zhamboul oblys). INORA, №74, 2016, p.6-11.

Altogether these data are summarized in Table-I and analyzed by graphics and commentaries in par. 2.

A more exhaustive database of all the petroglyph surfaces and related entries (locational, semiotic, chronological, etc) will be soon completed and, as a kind of GIS, would provide a platform for data elaboration. In fact the specific structure of a very large site like Kuljabasy, made of a train of numerous parallel valleys, would support the elaboration of statistical evaluations, correlations and quantitative indexes endowed of semantic and paleo-ethnographic significance. In that sense the present article proposes procedures and methods for the study of rich petroglyph and archaeological sites diffused on a very large territory.

1 - Geographic, geological and environmental context

1.1 - Geography

The Chu-Ili mountains constitute an hilly system between the Trans-Ili Alatau in the south and the Western Balkhash in the north. They are oriented NW-SE, covering an area of 250x50 km, made of peaks with max height of 1242 m asl above plateaus at 1000 m asl and valleys, both sloping northward between the Kopa valley in the south (900 m asl) and the Jusandala steppe in the north (700 m asl). (Fig 1)

Of the Chu-Ili mountains, the Kuljabasy range represents the southeastern part and the rocky border between the Kopa depression and the plateaus, aligned with the Kostobe range in the west (6 valleys developing along an aerial length of 6 km) and the dismembered Jartas mts on the east (16 km). The Kuljabasy range develops with 39 valleys for 46 km, with higher peaks (max 1183 m) and shorter valleys (max ground/aerial length 2.5/1.9 km) in the west, and lower peaks (less than 1100 m) and two times longer valleys (5/4 km) in the east.

As consequence, the 6+39 parallel valleys cutting meridionally the Kostobe and Kuljabasy ranges are steeper (average incline 4.5%) and rockier in the west, and flatter (average incline of 2.5%) and smoother in the east, so that the Kuljabasy range itself can be divided in a western (valleys 1-14), central (valleys 15-26) and eastern part (valleys 27-39). (Fig 2-3-4)

The flattest valleys providing the easiest access road from the plain to the plateau are V12, V17-18 and V29.

1.2 - Geology

The Chu-Ili mountain system we see today has been uplifted during the Pliocene epoch (5.3-2.5 Ma) between 2 diverging first-order tectonic faults, the Zhalair-Naiman in the south and the Sarytuma in the north, from which comes

its sub-triangular shape with two external sides represented by fault-block mountains uplifted along the faults spoken above.

The Kuljabasy range, like the whole Chu-Ili mountains, are located on the southern borders of the Kazakhstania platform and share its geological history, which can be reconstructed through the analysis of the exposed materials.

During the Cambrian (540-488 Ma) the area constituted a deep oceanic siliceous-terrigenous floor in a phase of post-rift subsidence, accreted by a prism of sediments deprived of fossil remains.

In the subsequent layer of Ordovician sediments (488-444 Ma) the presence of fossils point to a context of shallow waters.

In the Devonian, Carboniferous and Jurassic periods happened three pulses of tectonic and volcanic activity that led to the uplift of the ancient Chu-Ili mountains. The last, during the Mesozoic (240-66 Ma), had been subjected to destruction and leveling of the surface (denudation), with fragments surviving to the present in the form of inclined plains[9]. In particular, the sediments of the Cretaceous (145-66 Ma) and Paleogene (66-23 Ma) periods, being characterized by lacustrine deposits, point to an already flattened relief.

The modern relief got formed during the tectonically active Pliocene and Quaternary epochs. Tectonic movements exposed igneous rocks only in the central and northern parts of the Chu-Ili mountain system; in the south they faulted and uplifted Cambrian and Ordovician sedimentary metamorphosed rocks, forming the 'upthrown blocks' of the Kostobe and Kuljabasy ranges and the 'graben' of the Kopa valley. Additionally, the Kostobe and Kuljabasy ranges have been transversally crossed by a couple of secondary neo-tectonic faults that, at their intersection with valleys, expose rocky outcrops with the best rock surfaces and in that way define 2 parallel latitudinal bands of petroglyph groups. These two lithic-petroglyphic bands, and particularly the upper northern one, are most evident in V1-14 (see Maps 02-04).

The different exposition within the Kuljabasy range of Cambrian and Ordovician rocks is relevant for understanding the distribution of different lithic materials by valley. Upper Cambrian very fine grained shale and slate and, in lesser measure, sandstone and schist are exposed at the mouth of Kt4-5 and in valleys V1-14 and V20-22; in all the other valleys are exposed less metamorphosed Middle Ordovician sandstone and meta-sandstone. Quite interesting are the contrasting lithic features and cultural effects of the exposed Cambrian rocks: the entrance of Kt4 and the valleys V1-14 show the concentration of the best rock surfaces and constitute by far the center of the petroglyph complex; at the contrary, valleys V20-22 present only few and poor surfaces and constitute the only area totally deprived of petroglyph executions!

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[9] Babkin Alexander 2011. Geography, geology, paleontology, Stone Age culture and rock art of Kazakhstan. http://paleokazakhstan.info/chu_ili.php (in Russian).

1.3 - Climate

The prominent features of the climate of the Chu-Ili mountains are dryness and continentality, both depending from the geographical location of the region at the center of the Eurasian continent, very far from oceanic air masses and characterized by clear weather and high solar radiation Yearly precipitation values (P) are low, between 350 and 250 mm, and evaporation potential (EP) high, making all together 4-5 months of aridity (EP>P). Daily and seasonal continentality are pronounced due to the distance from the mitigating effects of maritime air masses and to the shortness of spring and autumn seasons: here unstable and rather cold winters quickly switch to rainy short springs that are quickly replaced by hot and long summers.

The mountain zone, less windy, is warmer, wetter and less continental than the surrounding open plains: it provides much better winter habitats, with milder climate, wind-sheltered slopes and more abundant springs and pastures.

As a whole the climate of the territory of Kuljabasy, as the one of the entire Chu-Ili mountains, is ranged by the Koppen classification as BSk, i.e. as mid-latitude continental steppe-semidesert-desert climate.

The nearer meteorological station is Chokpar, located 40 km far on the west. The average values of the most important climatic factors are the following.

- *Insulation:* 2700-2900 hours per year
- *Winds:* main directions: from N and NE (30%) // local patterns largely determined by the spatial arrangement of basic orographic elements // average speed: 3-4 km/hour // duration: 1-19 hours // stronger in the northern-northeastern part of the Chu-Ili range and by winter.
- *Temperature:* average T: yearly +8°, January -6.5, July +24.5° // absolute min T: -27° (at Kurty on the eastern piedmonts of the Chu-Ili range: -34°); absolute max T: +40° // annual continentality index: 31-33 // date of crossing above 0°: 30-IV (earliest 3-IV, latest 29-V); below 0°: 30-IX (earliest 15-IX, latest 3-XI) // date of crossing above 5°: 31-III (±15 days); below 5°: 20-X (±10 days) // date of crossing above 10°: 20-IV (±10 days); below 10°: 10-X (±10 days).
- *Precipitation:* average yearly precipitation: 350-280 mm (April 35-40, August 8-10) decreasing from SW to NE of the Chu-Ili range // yearly evaporation potential: 720 mm // annual aridity index 2.0-2.5 (August 8-10) // yearly days of atmospheric drought: 60-80.
- *Snow cover:* average height: 15 cm (min-max 5-50 cm) // water equivalent: 30 mm (min-max 10-100) // first snow cover: 30-XI (earliest 1-XI, latest 10-I) // last snow cover: 5-III (earliest 14-II, latest 11-IV) // yearly days of snow cover: 100 // yearly days of snow storm: 5.

Concerning the paleo-climate fluctuations of the last 5000 years, in south and central Kazakhstan we generally see the succession of cool pluvial and hot arid phases.

At the end of the hot-wet Atlantic thermal optimum, around 5200 BP, the climate of the N-Hemisphere entered a cool dry period (Subboreal) that endured for almost 2500 years, covering the entire span of the Eneolithic and Bronze age epochs of Kazakhstan. Particularly arid continental peaks are documented around 5200-4900 (preceded by the first sharp cold peak of the Holocene), 3700-3500 (particularly arid) and 3100-2900 BP (preceded by an even sharper cold peak).

A cold pluvial phase is established at the start of the Subatlantic climatic period, between 2600-2200 BP (Early Iron Saka period), followed by a long cool continental phase (Wusun period) and finally, between 1200-800 BP, by the Medieval Warm Period with hot-dry climate similar to modern. The Little Ice Age is established between 600 and 250 BP (Ethnographic period) and its end corresponds with the start of the modern hot-dry climate[10].

1.4 - Environment

The Kuljabasy landscape is pre-mountain desert and semidesert, with common serozem soil of low carbonate content, and a vegetative cover typical of the mountainous external borders and peripheral piedmonts of the entire Chu-Ili mts.

Herbs and shrubs are low-growing, thorny, small-leaved or leafless, grayish to light green in color, with extensive and, in most cases, deep roots: ephemeral-lightsoil wormwood (artemisia terrae albae), bluegrass (poa bulbosa) and sedges (carex pachystilis), the last 2 edible by herbivores.

From the agro-climatic point of view the area is classified as dry-premountain or very-dry-ephemeral-desert of lowhill and plain, producing respectively an average yearly biomass of 2.5-9.0 (values that, in case of southern slopes, would decrease by 25%) and 1.5-6.5 tons x ha.

The fauna, well adapted to the desert landscape, pertains to the Mediterranean sub-region, Uralo-Turanian province, Turanian area, Chu-Ili district. It includes several species of desert insects, reptiles, field and migratory and predatory birds, rodents and big mammals. The lasts consist of big ungulates [wild sheep (argali), wild goat (siberian ibex) and Siberian roe-deer (capreolus, that when alarmed barks as a dog) in the mountain zone; the saiga antelope and the jairan (gazella subgutturosa, persian or goitered gazelle, of which females are hornless)] in plains; mammal predators (fox, wolf, coyote, korsak, wild cat) everywhere.

The modern mammal inventory, when compared to the one of 3-4 millennia ago, is quite poor by population number and species diversity. In fact in the past the South Urals, Kazakhstan and S-Siberia, unaffected by deep vegetation postglacial changes and human hunting pressure, constituted Holocene refuges for the eastward retreat of the Last Glacial Palearctic fauna[11]: these regions

[10] *Sala R. La tradizione petroglifica dell'Asia Centrale Occidentale. In Popoli della yurta, ed. F Facchini, 111-165. Milano: Jaca Book. 2008. (in Italian)*

[11] *The 'mammoth steppe' was dominated by bison, horse and wholly mammoth, and included rhino, lion, saiga, wild goat (ibex), reindeer, and muskox.*

delayed and minimized faunal extinctions (12%) and still now present species compositions relatively similar to their Pleistocene counterparts.[12]

Kazakhstan, and in particular the Chu-Ili mountains, hosted steppe species like bison, bulls (aurochs), wild Bactrian camels, wild asses, wild sheep and goats, deer, wolves, cheetah, tigers, lions, hyenas, etc. The steppe bison became probably extinct at the start of the Holocene (8000 BP) but some paleontologists suspect its extinction in Siberia just 1000 years ago. In Kazakhstan the aurochs disappeared around 3000 BP and the wild Bactrian camel was probably still roaming the deserts few centuries ago. Until less than 80 years ago wild donkeys (kulan, equus hemionus) were still living in the desert plain, and so did tigers in the tugai of the Ili delta. Petroglyph representations from Kuljabasy make suspect the local presence of bison, aurochs, hyenas, lions, cheetah and tigers until around 3500-3000 BP, and of wild camels until 1000 AD.

2 - Spatial analysis by valley

1.1 - Database Table

The spatial analysis of the Kuljabasy archaeological and petroglyph complex is based on a compilation of data summarized in Table-I and 3 Maps ((Fig 2-3-4). Table-1 is included as color image in order to show data as well as highlights.

The list of the 6 Kostobe and 26 Kuljabasy valleys is provided with entries of geological, archaeological and petroglyphic character. The entries are the following: valley length, lithic quality, water sources; settlements (4 identified epochs) [13] and cemeteries (4 identified epochs); petroglyphs' groups, surfaces and images, petroglyph chronology (number of engraved surfaces x 7 identified epochs) and some petroglyph subjects (bull, camel, horse, deer, predators, human hunters and other anthropomorphic scenes).

Highlights are distributed in the table cells for underlining the specific level of quantity or quality of the related entry: blue=high, green=medium, yellow=low, no-highlight=very low.

Referring to the 'Valley' column, highlights are applied to valleys characterized by the coincidence of good lithic material (index 3 or 2), springs, rich archaeological complex and high number ($\geqslant$100 and $\geq$60) of engraved surfaces. These valleys all together hold the 86% of the engraved surfaces of the

[12] *Řičánková V.P., Robovský J., Riegert J. and Zrzavý J. 2015. Regional patterns of postglacial changes in the Palearctic mammalian diversity indicate retreat to Siberian steppes rather than extinction. https://www.ebscohost.com/academic/subjects/category/free-databases*

[13] *In general, in the case of the Kuljabasy archaeological complex, the earliest settlements, because located in the best locales, are also inhabited during the subsequent Saka and Medieval periods. So, for example, the 'total' number of settlements of every epoch would be not 15+23+15+76=128, but 15 +(15+23) +(15+23+15)+ 76=182.*

entire complex, representing by far the most significant part of the petroglyph site: we call them "*main valleys*". Colors are distributed following the criteria exposed in the table here below.

entries	blue	green	yellow
valley	lithic-3; ≥100 engraved surfaces	lithic-2; ≥50 engr. surf.	
lithic quality	3=very good	2=medium	1=low
water	>1 spring		
settlements	>10 'total' settlements		
tombs	B≥20, K≥20, Ka≥2, M≥2	B≥10, K≥10	B≥5, K≥5
surfaces	≥100	≥60	≥30
images	≥1000	≥500	≥150
chronology	≥50 surfaces (B, LB)	≥20 (same + A, S, W)	≥10 (same + M, E)
subjects	≥20 (bull, camel, horse, human)	≥10 (same + predator, hunter)	≥5 (same + deer)

The elaboration of Table-I allows the graphic representation and visual correlation of the distribution by valley of: lithic material, water sources, archaeological monuments (settlements and tombs), petroglyph surfaces by chronological period, and of some relevant petroglyph subjects. (Graphic 1-5)

Table-1 can be further developed in several ways, most important being the statistical analysis of the petroglyphs archive by groups, the widening of the number of petroglyph subjects under consideration, their classification not only by location but also by chronological period, and the elaboration of correlation indexes between entries.

2.2 - Geoarchaeological context

As spoken in par.1, in the geo-archeological complex of Kuljabasy, the form of relief and its geological history explain the location of the best rock material (Kt4, V1-14, V18-19), which is well correlated with the presence of the most abundant *water sources* (Kt1, Kt5, V1-7, V12-14, V18-19) and with the highest number and quality of *petroglyph surfaces* (Kt4-5, V1-14, V18-19). (Graphic 1)

Settlements are located at different heights inside the valleys, higher during the Bronze and Early Iron periods and lower during the Medieval and Ethnographic. Referring to settlements of all epochs, they average a number of 5.6 per valley and reach peaks above 10 in V2-3, V5, V7, V12, V14 and V19. So, relief, lithology, hydrology, petroglyph executions and settlement patterns show a good spatial correlation. (Graphic 2)

Tombs instead follow quite different location patterns than the elements spoken above. They are all located on the alluvial fan at the mouth of the valley in average number of 16, but unevenly distributed by valley as well as by period.

Bronze tombs are counted in number of 123, with big concentrations of ⩾20 at the entrance of V3, V6 and V23; Saka kurgans in number of 379, with ⩾20 at V7 and V17-20; Kazakh mausoleums are in number of 17, with more than 1 at V5,16,18,19,24. Almost deprived of tombs are V8, V15 and V22. (Graphic 2)

2.3 - Petroglyph record

Petroglyphs are counted by number of images, number of rock surfaces hosting one image or the juxtaposition of several images, and number of groups, i.e. concentrations consisting of more than 10 surfaces. When less than 10, sets of engraved surfaces are considered isolated executions. It is more significant to refer to groups than to isolated executions, and to engraved surfaces than to petroglyph images, being that the absolute majority of the executions is found in groups and on surfaces hosting compositions of 5-20 images.

Referring to *images*, their number in the entire complex has been approximately estimated as 14851, of which the main valleys spoken above host the 88% of the total. The average number of images per surface is 6.3 in the main valleys and up to 10 in V1 [14].

The total number of engraved *surfaces* is of 2461, distributed among valleys as shown by the red line in Graphic-1 and 2. Concentrations of ≥60 surfaces are found in Kt4 (125 surfaces), in V1-14 (an average of 130 surfaces per valley, with 230 surfaces in V3 and V14, and a decrease to 60 in the intermediate valleys V8-9 and V11) and V18-19 (60 and 115 surfaces). These so-called "main valleys" count all together 2205 surfaces representing the 86% of the total. Each of the other valleys of the complex count less than 30 surfaces.

Referring to the number of *engraved surfaces by chronological period* [15], the periods more represented are Saka (739 surfaces, mainly in V12-14 and V7), Late Bronze (597, mainly in V1-3 and V5), Bronze (427, mainly in V3, V14 and V5) and Wusun (384, in V7-10, V13-14 and V18). The other periods are much less represented: the Medieval (177 surfaces) privileges V10-14; the Ethnographic (74 surfaces) V12 and V19. The archaic period, with only 55 surfaces, mainly consisting of single images of aurochs, is exclusively present in Kt4-5 and V1-6, with 34 surfaces concentrated in V3.

So, the earliest periods (Archaic, Bronze and Late Bronze) engraved the 44% of the total surfaces of the complex, privileging Kt4-5, V1-5 and V14. The following periods, responsible for the 66% of the total surfaces, favored the valleys further east: Saka and Wusun are most abundant in V12-14 and V7; and

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[14] *In reality, images very faint and ambiguous or poorly done and insignificant have been omitted: their consideration, together with the one of still undiscovered engravings, could probably double the estimated number of executions.*

[15] *The absolute date of the periods is the following: Archaic (before Bronze), Bronze (2000-1200 BC), Late Bronze (1200-800 BC), Early Iron Saka (800-200 BC), Early Iron Wusun (200 BC - 500 AD), Medieval (500-1500 AD), Ethnographic (1500-1900 AD).*

the most recent Medieval and Ethnographic periods become relatively abundant even further east in V19. (Graphic 3)

Graphic-4 gives the percentage of chronological executions by valley and in that way it allows the reconstruction of the spatial evolution of the site during more than 4 millennia. The distribution of colors shows quite clearly that the entire petroglyph complex had been progressively built starting from the best rocks and habitats of V1-6 (mainly V3) and then diffusing to the poorer ones, first to the west (Kostobe) and then to the east.

V12, in spite of the presence of good rock material, is one of the valleys less concerned by Bronze and Late Bronze executions. It had been practically engraved starting with the Saka, of which preserves the most numerous archive (together with its neighbor V13, it hosts the 19% of all Saka executions). Being that this valley represents the easiest road between the plateau and the plain (it is named 'Kulukbaisai', 'valley of the quick gallop'), we can suspect that its petroglyph record is strictly connected with the development of seasonal transhumances and trade routes.

2.4 - Petroglyph subjects

The analysis of the spatial distribution by surfaces of some petroglyph subjects (aurochs, camel, horse, deer, predator, hunters, other human scenes) brought to quite interesting and unsuspected conclusions (Graphic-5).

The almost totality of the subjects quoted above are engraved in V1-14 and Kt4-5. In particular, valleys V2-3, V14, Kt5 and V12 host all together and in order of importance almost half of these representations and represent the richest valleys by semantic diversity.

Images of *humans* are found on 269 surfaces, highly concentrated in V2-3 and V13-14. Of them, 94 represent hunting actions (on foot or on horse, with bow or other weapons), half of which located in V2-3, V5 and V14. The other 175 consist of other scenes, and are more evenly distributed among the main valleys [16].

Referring to animal images, besides the ones of goats that, starting with the Saka, became the animal subject by far most represented, most numerous are the representations of the Bactrian camel, the aurochs (wild bull) and the horse. The *Bactrian camel* is found on 196 surfaces (mainly in V7-14). The *aurochs* on 178 surfaces (mainly in V1-6 and V14). The image of the *horse* is found on 162 surfaces, mainly concentrated in V2-6 and V13-14 and so distributed with the same locational patterns of the bull [17]. *Predators* (wolves, dogs and felines) are found on 144 surfaces, *deer* on 53 (Fig 8).

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[16] Most recurrent human scenes are: riders and caravaneers (52 surfaces), man with outstretched arms (50), archers (48), standing man (32), couple of men with or without weapons (16), man with metaphoric head (radiant, mirror, labyrinth) (11), woman birth giving (8), sexual scene (6), wolf man (6), etc.

[17] In 37% of the cases horses are represented together with a human holding or riding it, in the same proportion. This isotopy human-horse concerns mainly men, but few exceptions are detected: 2 cases of

The analysis of the spatial distribution of subjects brings to evidence 2 main significant and opposite patterns: the spatial correlation between aurochs and horse, and the spatial exclusion of aurochs and camel.

The affinity between the aurochs and the horse found in the similarity of their locational valleys is also supported at the semantic level. In fact, these two animals form a recurrent '*isotopy*' by being frequently juxtaposed on the same surface. And their images are not just compatible but like their mutual proximity, and even miss each other! During the Late Bronze and the extinction of the aurochs, the horns of the last are sometimes 'metaphorically' engraved on the horse's head (in the Kuljabasy complex are found 5 cases of 'horned horse')[18] .

Instead, somehow antithetic and more mysterious is the distribution in space and time of the images of the aurochs and of the Bactrian camel. Referring to space, the aurochs is present on 112 surfaces of V1-6 (76% of the occurrences), 22 of V14, but only 13 surfaces of V7-13; the camel instead on just 33 surfaces of V1-6, 16 of V14, but 107 surfaces of V7-13 (54% of the occurrences). Referring to time, all the images of aurochs have been engraved during the Archaic, Bronze and Late Bronze periods; the ones of the Bactrian camel start to be engraved during the Late Bronze and become prevalent during the Saka.

This exclusive discrepancy spatial and temporal discrepancy between aurochs and camel representations is very significant at the semantic level. From the spatial point of view, it suggests a semantic partition of V1-14 in a western and an eastern block: the first consisting of V1-6, the "valleys of the bull"; the second of V7-13, the "valleys of the camel". And, from the chronological point of view, it suggests the individuation of a specific semantic period: the "camel period".

A preliminary explanation of this dichotomy can be attempted on the basis of paleo-ecological and chronological considerations.

The "valleys of the bull" have been the first to be colonized during the Archaic and Bronze period. The wild aurochs was at the time still roaming in the Kuljabasy plains and, as the biggest and more majestic concurrent and prey, became the main object of the petroglyphs representations. It lied at the center of the 'semantic cosmos' of a long epoch, making of the Archaic period the "auroch period"; and making of the Bronze the period of a typical isotopy "bull-horse", wild or domesticated, hunted or enslaved. (Fig 5-6). The total disappearance of aurochs images during the Late Bronze must be correlated with its extinction in Central Asia; but must be underlined the fact that together with them disappear also the images of harnessed domesticated bulls and of charts and chariots as a whole.

The second largest wild animal having its habitat in the deserts of Central and South Kazakhstan was the wild Bactrian camel that, on the basis of literary sources, was here present and hunted until the Medieval period. In the petroglyph record, scenes of camel hunting are absent, but well documented are images of

woman playing with running horses, 2 cases of woman rider, and 1 case of a couple on horse.

[18] Sala R. Semiological methods in rock art studies. In: Rock Art in modern society, vol 2. Occasional SAPAR publications, vol VIII. Kemerovo: State University. 2011. (in Russian and English)

wild Bactrian camels (with small pointed humps) as well as scenes of its use as pack and draft domesticated animal (with high round humps), and even to be ridden, starting from the second part of the II millennium BC (Fig 6-7). Its earliest Bronze period images are relatively few and located in V1-6. It is at the end of the Bronze age that, with the disappearance of the aurochs, the central semantic position of the last was inherited by the wild and domesticated camel, which spread abundantly with the Saka colonization of the eastern valleys.

This process made of V7-13 the "valleys of the camel"; and, at the chronological level, it established the "camel period', which endured all along the I millennium BC.

Actually, a camel (dromedary) period, starting during the I millennium BC and enduring for more than 1000 years, is documented on petroglyph sites distributed in a very large area: in all the arid zones of the Sahara, NE Africa, the Arabian peninsula and the Middle East[19]. All authors find an explanation to the phenomenon in the growing importance of the camel as pack animal in the context of a developing network of commercial routes. Supported by the introduction around 500 BC of the N-Arabian saddle[20], the loaded camel successfully competed with the wheel transport (of which the images disappeared from the petroglyph record), conferring to the nomad breeders of the southern and northern deserts an absolute monopoly of distant trade, and eventually founding a new geopolitical assessment at continental scale. The rise in power of the caliphate itself is largely based on that background[21].

Conclusions

The implementation of statistically based spatial and chronological analyses is a main tool for the detection of the space-time hidden structure of a large petroglyph site.

The establishment of a "camel period" is well proved for the dromedaries in petroglyph sites of the southern deserts. Its detection in the rich and significant petroglyph archive of Kuljabasy is evidence of an early spread of the same global phenomenon to Central Asia, in the context of the Bactrian camels.

The large geographical diffusion of the "camel period" in the petroglyph sites of the desert zones of Afro-Eurasia is an additional proof of the high importance held in petroglyph representations by the theme of global transports: of the carriages and of the animals involved[22]. That approach by itself provides an explanation of the relatively high number of petroglyph representations of large transport animals (bulls, horses and camels); and, more important, it also explains

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[19] *UNESCO 2014. Rock Art in the Hail Region of Saudi Arabia. UNESCO World Heritage List as a Serial Nomination. http://whc.unesco.org/uploads/nominations/1472.pdf*

[20] *Baum D. 2015. The camel saddle: a study. https://www.soas.ac.uk/camelconference2013/file88887.pdf*

[21] *Bulliet, Richard (20 May 1990) [1975]. The Camel and the Wheel. Morningside Book Series. Columbia University Press. p. 183.*

[22] *Novozhenov V. 2012. Communications and the earliest wheeled transport of Eurasia. Moscow*

the coherence of the chronological succession of their semantic centrality with historical developments in transport technology.

Резюме

Петроглифы и сам археологический комплекс Кульжабасы, расположенный на южных границах гор Чу-Или, были обнаружены в 2000 г. Ренато Сала и Жаном Марком Деомом во время проведения исследований потенциальных географических факторов, влияющих на распространение основных памятников наскального искусства. Гипотеза заключалась в том, что на это могут влиять 3 естественных фактора, то есть хорошие поверхности скал, наличие водных источников, наличие потенциальных авторов и потенциальных пользователей и зрителей. Эта ”географическая формула” была успешно проверена в нескольких местах, одним из которых стали 14 западных долин Кулжабасы - наиболее значащие по числу и качеству гравюр.

Цель данной статьи состоит в том, чтобы дать расширенный пространственный анализ комплекса Кулжабасы: подробные и расширенные карты, кодирование данных и анализ распространения памятников наскального искусства, родники и среды обитания, археологические памятники и группы петроглифов, разнесены по хронологическим периодам. Карты и таблицы составляют базу данных для проведенного анализа.

Публикуемая здесь новая карта расширена в обе стороны от уже ранее известного и опубликованного участка, включавшего 14 долин Кулжабасы (западного) другими долинами, смежными с первым участком с запада и с востока. Увеличенная территория теперь включает: 6 долин Костобе, которые располагаются западнее (6 км); уже опубликованные (здесь обновленные) долины 1-14 (Кулжабасы, западная часть) (10 км); долины к востоку, достигающие числа 26, то есть последовательность долин 15-26, что мы называем Кулжабасы - центральная часть (13 км). Дальше на восток, долины 27-39 из Кулжабасы – восточная часть (16 км). Эта часть комплекса остается, все еще неразведанной, потому что была занята военным полигоном. Безусловно, на этом участке имеются памятники наскального искусства, и, наиболее вероятно, именно здесь, относительно немногочисленные группы петроглифов были обнаружены в 50-е гг. П.И. Мариковским.

Наиболее полная база данных, содержащая данные обо всех плоскостях с петроглифами и связанных информацией (географической, семиотической, хронологической, и т.д.) будет скоро закончена и, как своего рода база ГИС, обеспечила бы платформу для разработки общих данных. На самом деле определенная структура столь значительного комплекса как Кулжабасы, состоящая из последовательности многочисленных параллельных долин, поддержит разработке статистических оценок, корреляций и количественных индексов, сопровожденных семантическим и палеоэтнографическим значением. В этом смысле данная статья предлагает процедуры и методы, примененных при исследовании очень большого количества петроглифов и мест археологических раскопок.

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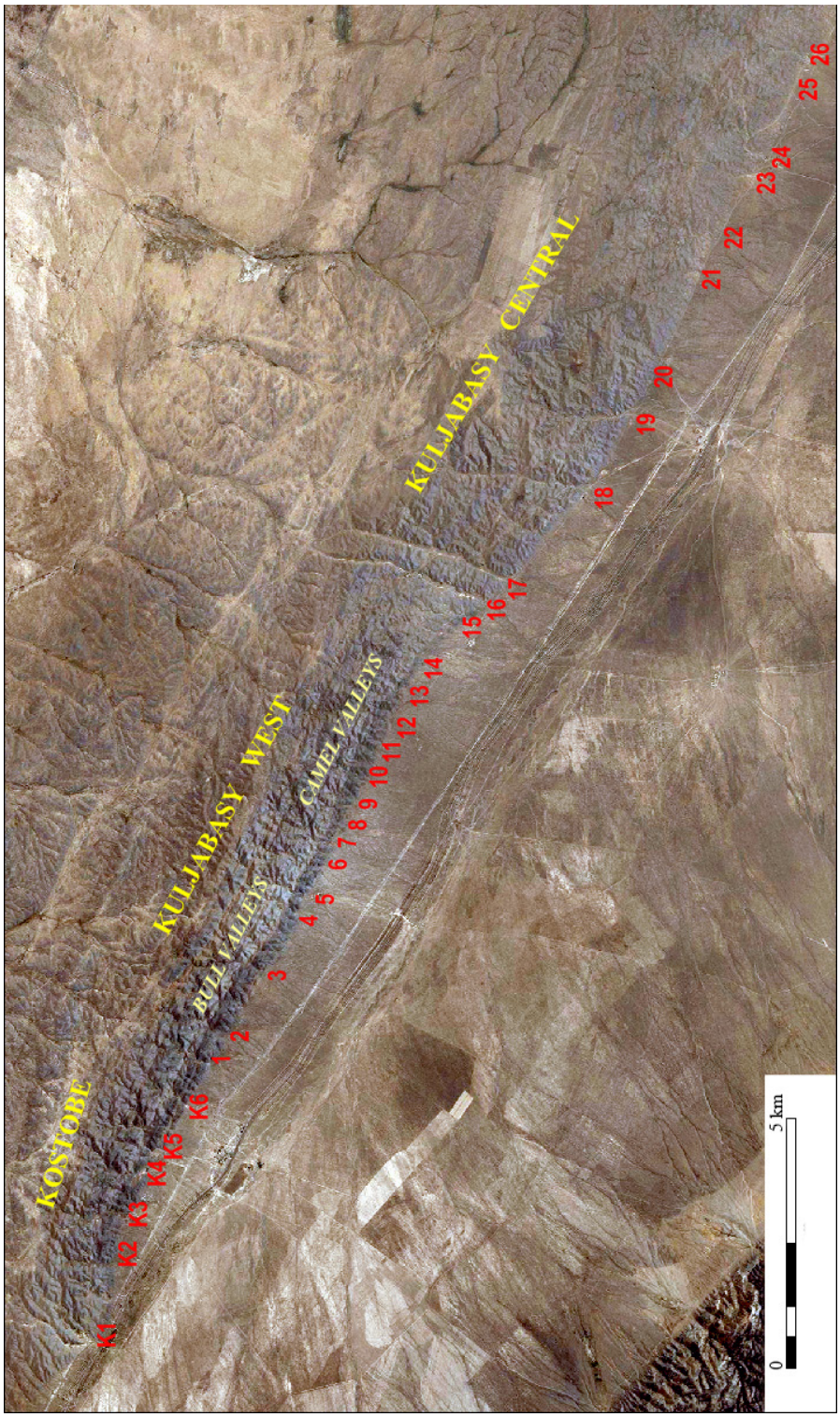
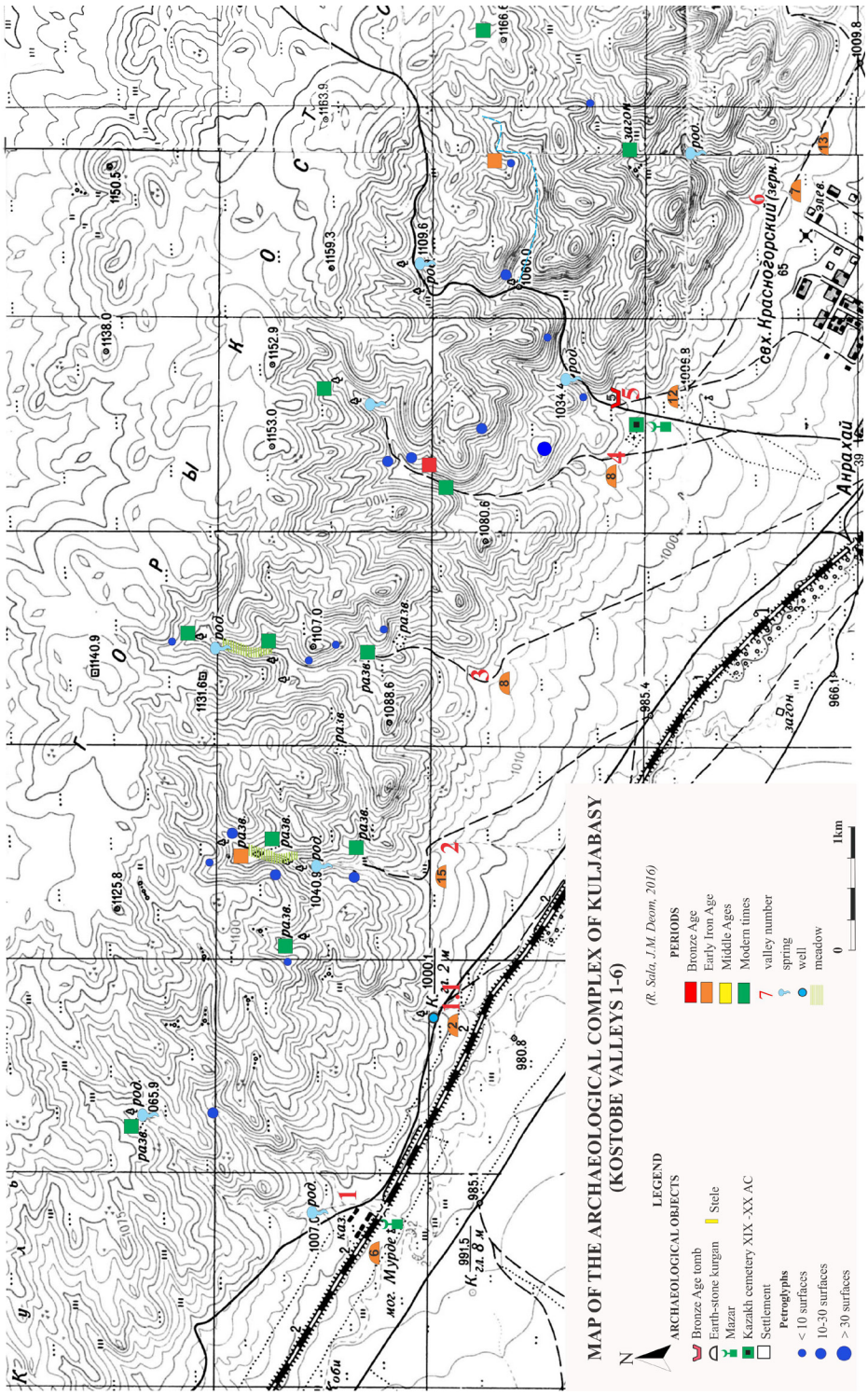


01- Geographical map of the Kostobe and the Kuljabasy ranges



02 - Map of the geo-archeological complex of Kostobe (Kt1-6)

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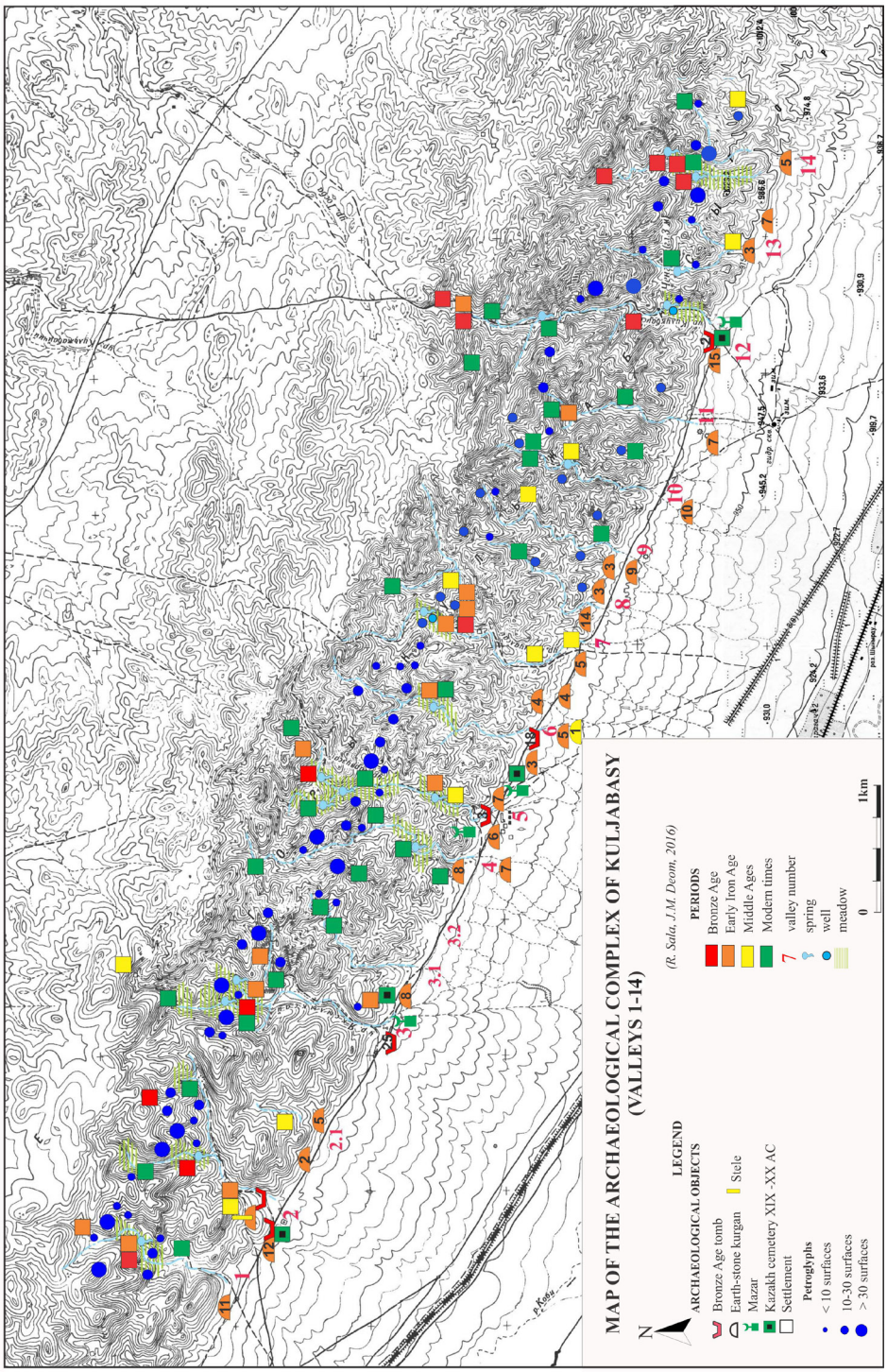

03 - Map of the geo-archeological complex of Kuljabasy-West (V1-14)

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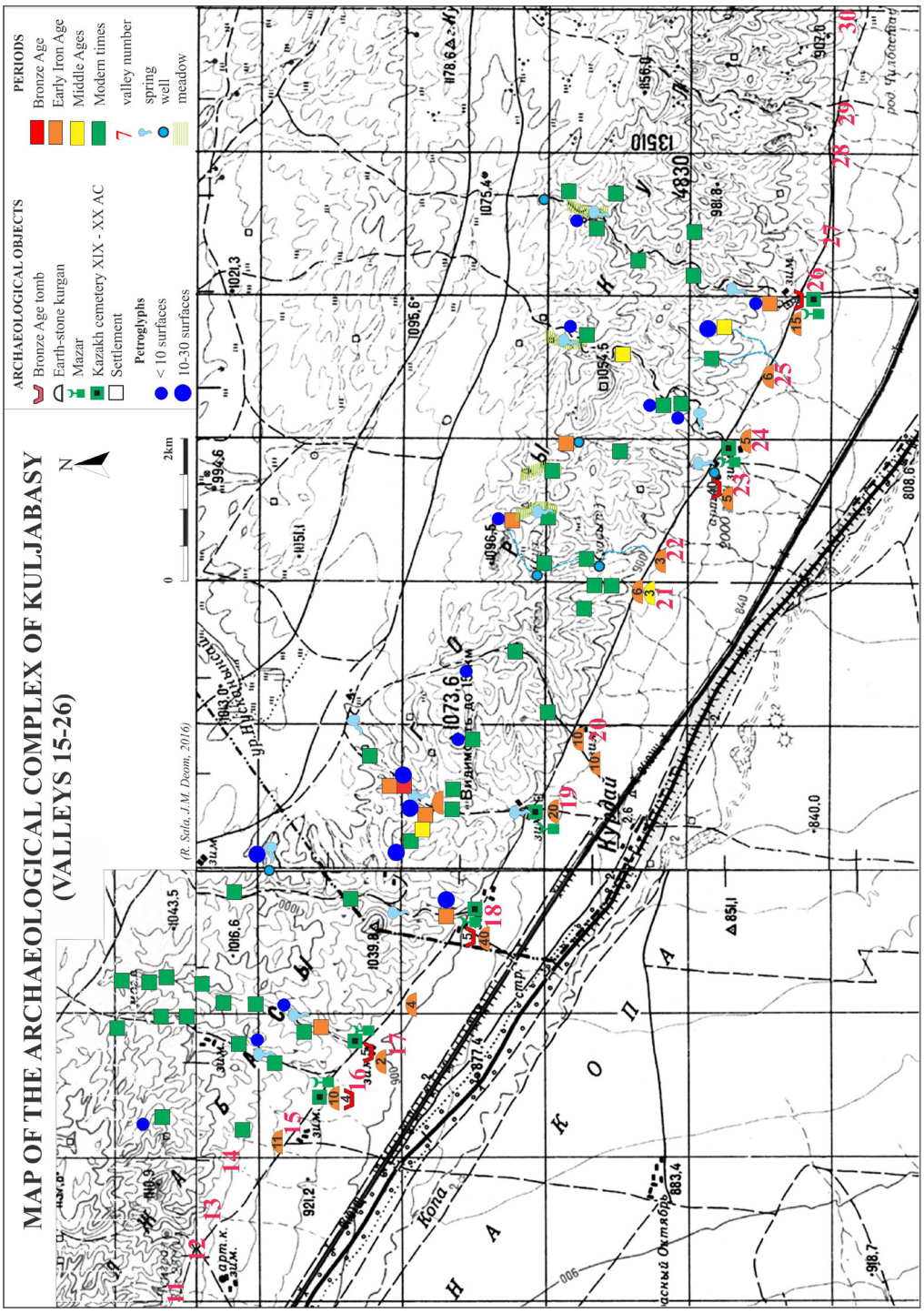
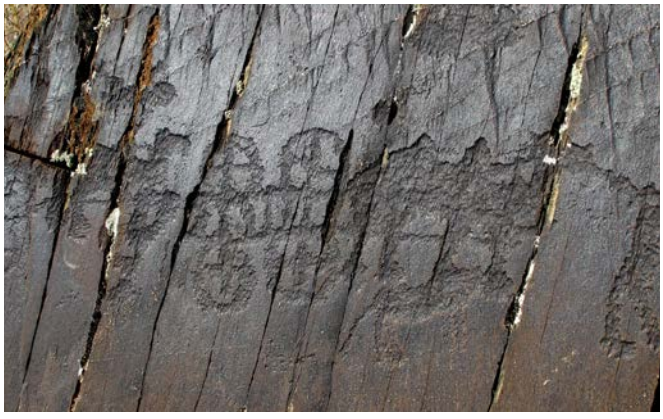


04 - Map of the geo-archeological complex of Kuljabasy-Central (V15-26)

05 - Petroglyph representation of auroch. Kuljabasy V5-G4, Archaic period. The 1.8 m long massive body covers the entire horizontal surface, with the small black head and horns barely visible on the right low corner of the body.

06 - Petroglyph representation of aurochs. Kuljabasy V3-G2, Bronze period. 52 cm long on horizontal surface.



07 - Petroglyph representation of caravan of a 4-wheel chart and a 2-wheel chariot harnessed with 2 Bactrian camels and lead by men. Kuljabasy V4-G2, Late Bronze period. Man on the right: height 17cm.

08 - Petroglyph representation of ridden Bactrian camel. Kuljabasy V11-G2, Saka period. 11cm between feet.

09 - Petroglyph representation of deer and predator. Kuljabasy, V3-G4, Saka. Central deer: 20 cm between feet.

10 - Petroglyph representation of man with wolf's head, claws and tail. Kuljabasy, V9-G3, Bronze period. 26 cm high.

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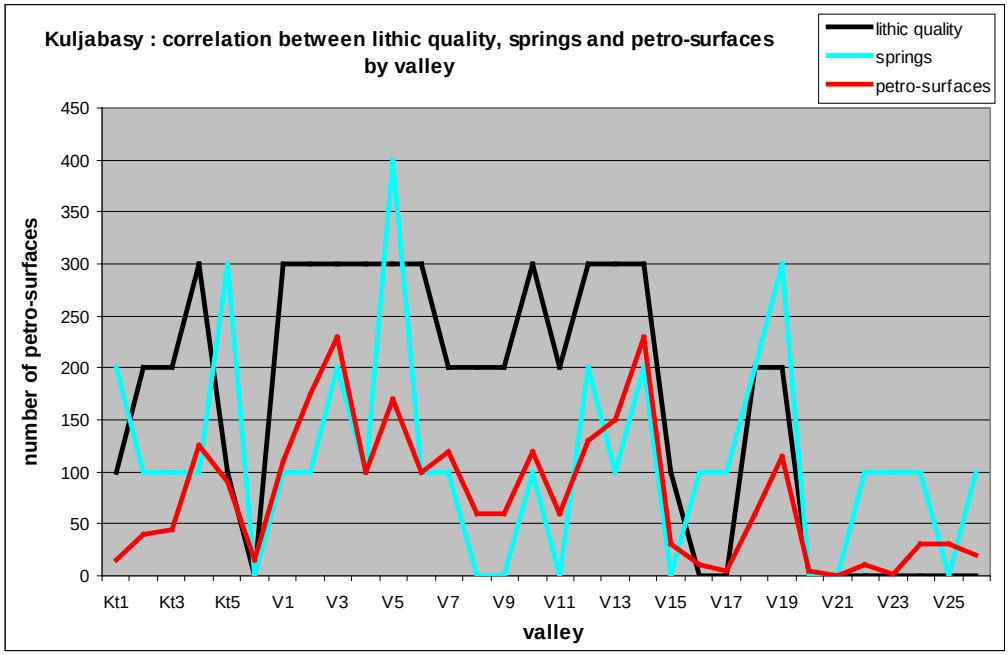
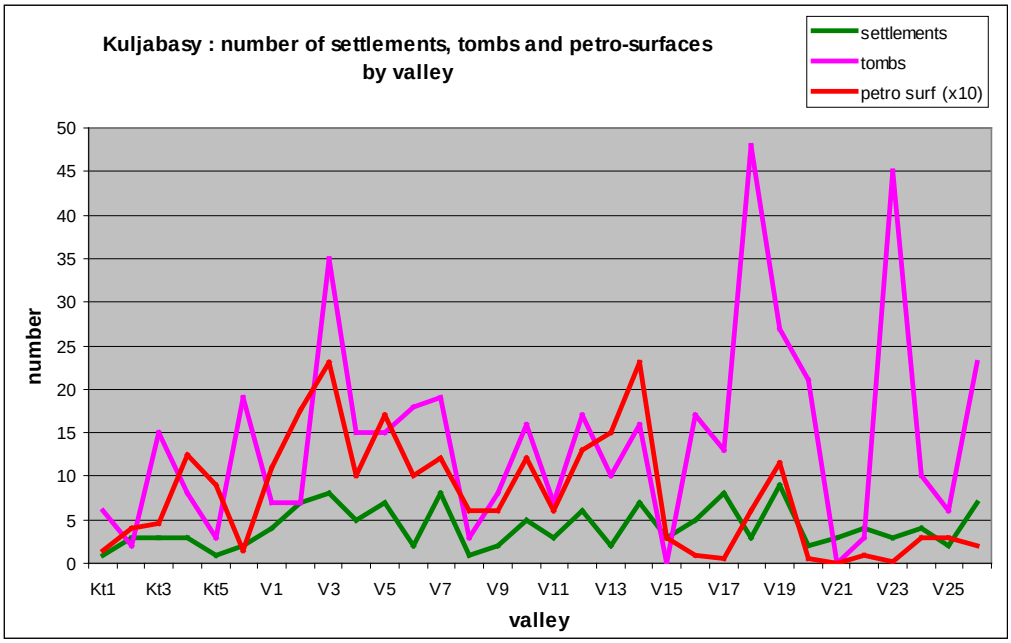
TABLE-I _Spatial analysis of the geoarchaeological and petroglyph complex of Kuljabasy (1)

Valley	Geology			Archeology									Petroglyphs																
	valley length ground/ aerial (km)	lithic quality (2)	water sources n°	settlements n° (3)				tombs n° (4)				groups, n°	surfaces, n°	images, n°	chronology (surfaces n°) (5)							subjects (surfaces n°)						
				B	S	M	E	B	K	Ka	M				A	B	LB	S	W	M	E	bull	camel	horse	deer	predator	human	
																											hunter	other
Kt1 Kt1.1	1.9/1.7	1	spring 2	0	0	0	1	0	6	0	0	1	15	100	0	1	5	3	1	1	4	1	2	2	1	1	0	3
Kt2	1.2/1	2	spring 1	0	1	0	2	0	15	0	0	3	40	280	0	36	0	4	0	0	0	1	1	1	0	2	5	2
Kt3	1.7/1.4	2	spring 1	0	0	0	3	0	8	0	0	0	45	200	0	5	20	6	7	4	3	2	4	3	3	6	3	5
Kt4	2.4/1.8	3	spring 1	1	0	0	2	0	8	0	0	3	125	520	1	18	49	16	19	14	8	8	3	7	5	7	4	13
Kt5	2.2/1.7	1	spring 3	0	1	0	0	5	12	1	1	1	90	300	1	9	37	16	11	12	4	11	9	4	7	14	6	14
Kt6	2/1.5	-	-	0	0	0	2	0	20	0	0	1	15	100	0	6	6	2	1	0	0	2	0	0	0	0	0	0
V1	1.8/1.3	3	spring 1	1	2	0	1	0	11	0	0	2	110	1100	3	21	66	17	3	0	0	6	4	5	4	10	7	6
V2 V2.1	2/1.5	3	spring 1	2	1	2	2	5	18*	1	1	8	175	1200	9	33	88	35	3	7	0	16	6	7	2	5	12	19
V3	2/1.8	3	spring 2	1	3	1	3	25	8	1	1	4	230	1800	34	71	74	35	7	7	2	47	6	32	6	7	10	20
V4	2.5/1.9	3	spring 1	0	0	0	5	0	15	0	0	3	100	800	2	13	16	46	19	3	1	14	3	11	3	4	2	10
V5 V5.1	2.6/2.1	3	spring 4	1	2	1	3	3	16	1	2	4	170	1200	3	53	55	46	7	3	3	12	4	20	1	5	11	5
V6 V6.1	2/1.6	3	spring 1	0	1	0	1	18	13*	0	0	3	100	600	2	13	16	46	19	3	1	17	10	13	2	10	3	2
V7 V7.1	2.5/1.7	2	spring 1 well 1 basin 1	1	3	3	1	0	20	0	0	3	120	750	0	7	19	53	36	5	0	2	13	5	1	4	4	14
V8 V8.1	1.6/1.3	2	-	0	0	0	1	0	3	0	0	3	60	400	0	2	5	23	21	5	4	2	5	3	3	5	1	4
V9	1.6/1.2	2	-	0	0	1	1	0	12	0	0	4	60	350	0	1	6	21	22	6	4	1	6	2	0	4	1	4
V10 V10.1	1.8/1.4	3	spring 1	0	0	2	3	0	10	0	0	5	120	600	0	10	23	34	34	14	5	3	18	6	1	10	2	6
V11 V11.1-2	1.1/1	2	-	0	1	0	2	0	7	0	0	1	60	250	0	1	10	28	15	4	2	0	22	4	2	6	1	10
V12	2.6/2.3	3	spring 2 well 1	3	1	0	2	2	15	0	0	3	130	600	0	12	11	61	11	24	11	3	27	6	3	12	4	4
V13 V13.1	1.7/1.5	3	spring 1	0	0	1	1	0	10	0	0	3	150	1000	0	15	14	78	26	15	2	2	16	11	2	2	3	13
V14 V14.1	2.3/1.9	3	spring 2	4	0	1	2	0	16	0	0	4	230	1200	0	62	41	69	37	21	0	22	16	10	4	12	9	9
V15	4/2.6	-	-	0	0	0	3	0	0	0	0	1	30	100	0	2	2	12	8	3	3	2	7	2	2	5	1	3
V16	3.7/3.2	-	spring 1	0	0	0	5	4	10	1	2	0	10	60	0	0	0	4	4	0	0	0	0	0	0	0	0	0
V17 V17.1-3	4/3.9	-	spring 1	0	1	0	7	5	6	1	1	1	5	20	0	0	0	2	2	0	1	0	0	0	0	0	0	0
V18	4.3/3.8	2	spring 2 well 1	0	1	0	2	5	40	1	2	2	60	200	0	6	7	20	23	4	0	1	2	1	1	2	0	1
V19	3.5/2.6	2	spring 3	1	2	1	5	1	20	3	3	4	115	500	0	29	17	32	11	10	11	1	4	3	0	6	1	4
V20	3/2.2	-	-	0	0	0	2	1	20	0	0	1	5	20	0	0	0	1	3	1	0	0	0	0	0	0	0	0
V21 V21.1	1.5/1.2	-	-	0	0	0	3	0	6***	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V22	2.9/2.3	-	spring 1 well 2	0	1	0	3	0	3	0	0	1	10	150	0	1	1	2	4	1	1	0	3	0	0	0	2	1
V23	2.8/2.4	-	spring 1 well 2	0	1	0	2	40	5	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
V24	4.5/3.3	-	spring 1	0	0	1	3	1	5	0	4	3	30	150	0	0	4	12	10	0	4	0	5	1	0	1	0	0
V25	1.6/1.3	-	-	0	0	1	1	0	6	0	0	1	30	150	0	0	2	15	9	4	0	1	0	3	0	3	1	2
V26	5.2/4.1	-	spring 1 well 1	0	1	0	6	8	15	0	0	2	20	150	0	0	3	0	11	6	0	1	2	0	0	1	1	0
TOT	-	-	-	15	23	15	76	23	379	10	17	75	2461	14851	55	427	597	739	384	177	74	178	198	162	53	144	94	175
	valley length	lithic quality	water sources	B	S	M	E	B	K	C	M	groups	surfaces	images	A	B	LB	S	W	M	E	bull	camel	horse	deer	predator	human	
																											hunter	other

(1) Highlights are distributed in cells for underlining the specific levels of quantity or quality of the case: blue=high, green=medium, yellow=low, no-highlight=very low. Referring to 'Valley', highlights are applied to the most important, i.e. the ones characterized by the coincidence of good or medium quality of lithic material, springs, rich archaeological inventory and high quantity (≥100 and ≥50) of engraved surfaces. Referring to 'chronology', highlighted have been cells pointing to ≥50, ≥20, ≥10 surfaces. Referring to 'subjects', highlighted have been cells pointing to ⩾20, ⩾10, ⩾5 surfaces.
(2) 3=high quality; 2=medium; 1=low, –=very low.
(3) B=Bronze, S=Saka-Wusun, M=Medieval, E=Ethnographic.
4) B= cist tomb Bronze; K= kurgan Early Iron or Turkic; Ka: Kazakh fence with several tombs; M: mausoleum Kazakh. The asterisk * points to a Turkic kurgan with fence.
(5) A=Archaic; B=Bronze Age; LB= Late Bronze; S= Iron Age Saka; W= Late Iron Age Wusun; M= Medieval; E= Ethnographic.



Graphic 1



Graphic 2

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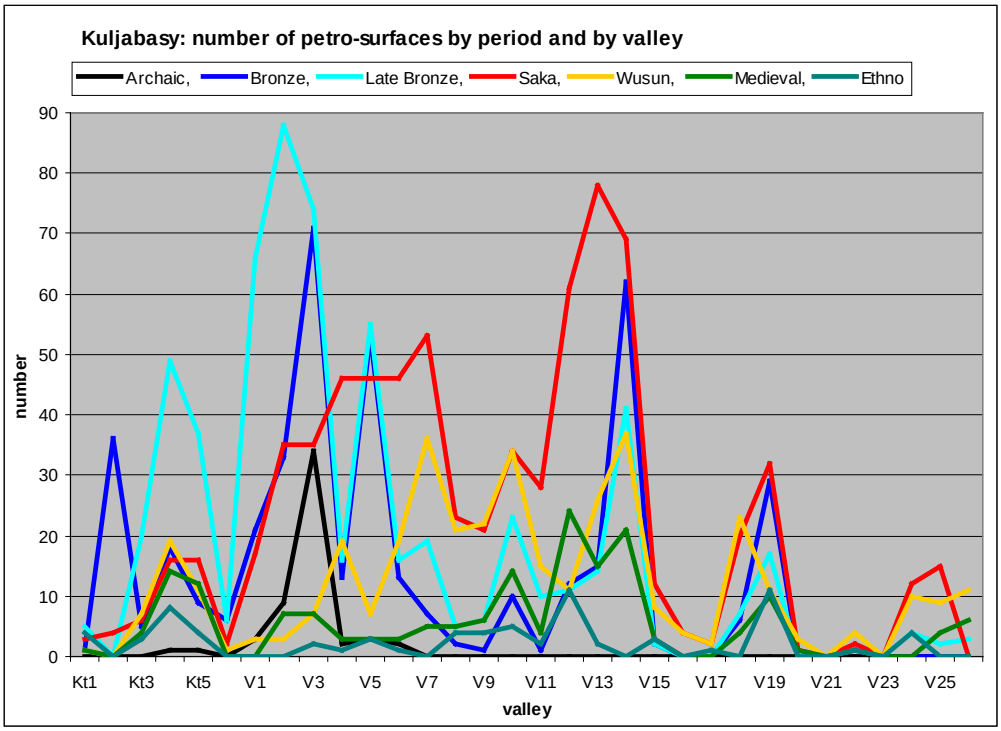
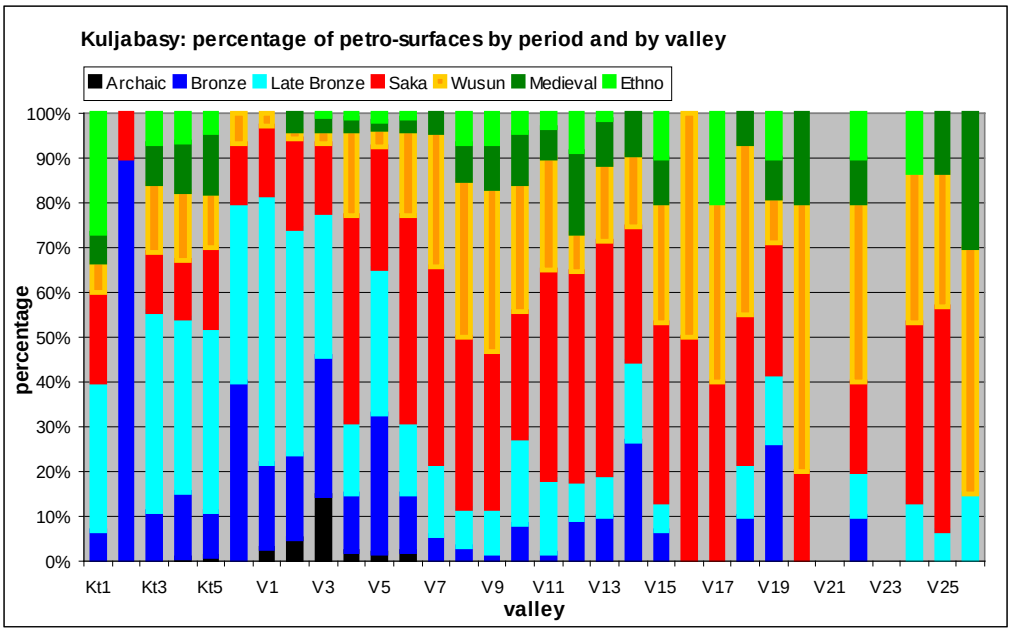


Graphic 3



Graphic 4

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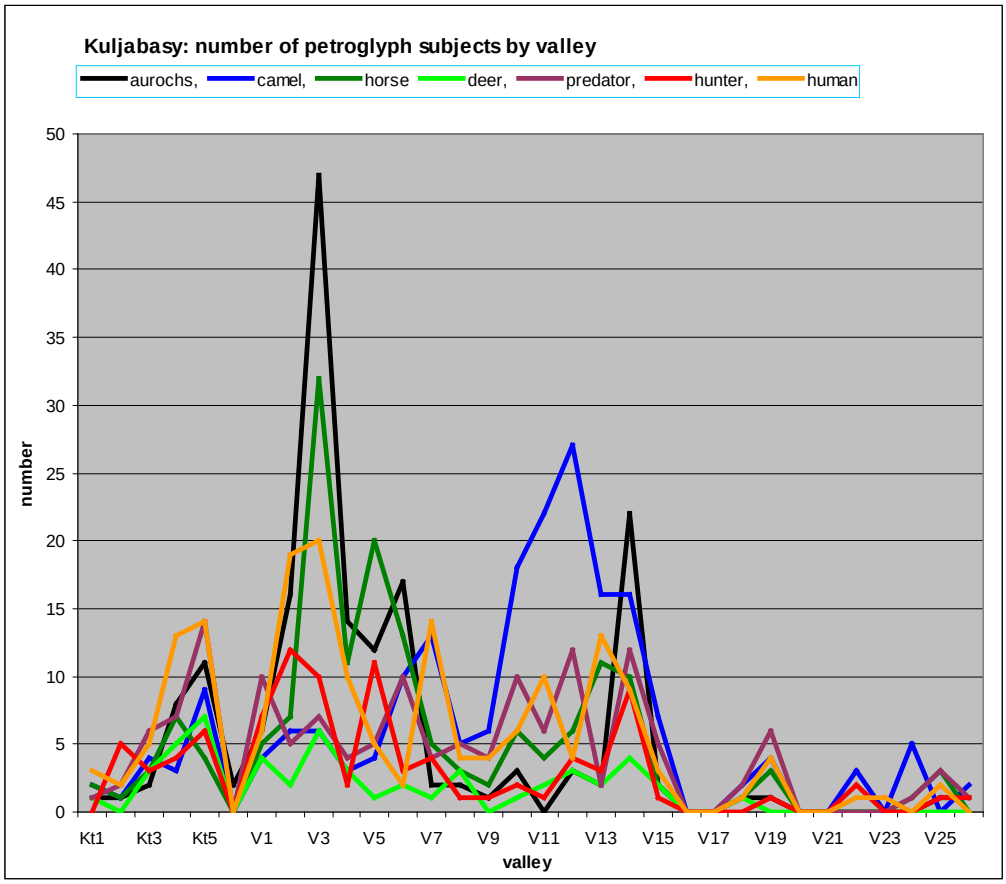

Graphic 5