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**ЭКОСИСТЕМЫ ПЛЕЙСТОЦЕНА И КУЛЬТУРНЫЕ СВИДЕТЕЛЬСТВА
ИЗ ДОЛИНЫ РЕКИ БЫТАТАЙ, ЦЕНТРАЛЬНАЯ ЧАСТЬ БАСЕЙНА ЯНЫ,
СЕВЕРО-ВОСТОЧНАЯ ЯКУТИЯ**

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**PLEISTOCENE ECOSYSTEMS AND CULTURAL EVIDENCE
FROM THE BYTANTAY RIVER VALLEY, THE CENTRAL YANA BASIN,
NORTH-EAST YAKUTIA**

ABSTRACT: Studies of the past landscape development and ecosystems linked to early human peopling of the sub-Arctic and Arctic regions of Siberia has become a topical and international theme of the current geoarchaeological and palaeontological research largely geographically centered in the Yana, Indigirka and Kolyma Basins. Recent pilot Quaternary geology, palaeoecology and the Palaeolithic geoarchaeology investigations in the Bytantay Valley in the central Yana Basin, northern Yakutia (66-67°N), have delivered initial multi-proxy evidence on the late Quaternary palaeo-relief, the regional climate evolution as well as the cultural manifestations in the sealing geo-contexts related to early prehistoric occupations of this territory (Chlachula et al., 2014; Chlachula and Czerniawska, 2015). Stratified fine-grained alluvial layers inter-bedded with fossil organic (moss/wood) horizons exposed by the intensified fluvial dynamics of stream channels due to the currently accelerated permafrost thaw document cyclic environmental shifts within meandering valley settings. The activated de-freezing cryolithic

formations expose the formerly buried and well-preserved biotic records providing testimony on high-resolution palaeo-climatic variations during the Late Pleistocene–Holocene time span. Diagnostic expedient core-and-flake tools made of selected fluvial cobbles (quartz-quartzite-carbonate rocks) from the last glacial alluvia of the Bytantay River as well as humanly articulated large fossil fauna bones and mammoth tusk fragments ¹⁴C-dated in the nearby Yana Basin to ca. 41–38 ka BP provide the first indices of the pre-Holocene peopling of this still marginally explored area as well as proof of human natural adaptation to the local Last Ice-Age ecosystems. Study Area: Geographical and Environmental Research Context

The close study area is located in the central part of the Yana Basis, the Vekhoyansk District, NE Yakutia. Continuous permafrost stretches over the entire territory with current average MAT of -14.5°C (The Verkhoyansk Meteorology Station Records). Extreme seasonal air temperature deviations with an annual range of >100°C reflect an unparalleled climate continentality of the NW Yakutia with deep winter ground freezing due to the arid Siberian High over NE Asia. Yet, the regional annual temperature has increased by ca. 2.5°C over the past three decades with intensified top surface insolation (Romanovsky et al., 2010). The principal vegetation cover is tundra-forest with dominant trees/thickets of *Larix sibirica*, *Salix* and *Betula nana* accompanied by undemanding grassy communities.

A mosaic physiography characterizes the prospected area in the middle and lower reaches of the Yana River and its tributaries. The local topography along the foothills of the Verkhoyansk Range (max. 2.389 m asl) is formed by igneous and metamorphic rocks (granites, schists) with mountain slopes covered by fragmented debris from weathered bedrock exposures. Coarse gravity slope and colluviated clastic materials constitute most of the surface cover in the transitional hilly relief zone (1500–500 m asl). This is transected by narrow draining riverine valleys filled by fluvial sandy-gravelly alluvial deposits. Fine overbank sediments are aligned along the principal and tributary meandering rivers channels with massive (pebble-/cobble-size) river-bed accumulations. Lacustrine sediments interstratified by boggy layers (turfs) fill small closed ponds and lakes on elevated topographic platforms above the active river channels. Other phenomena linked to degrading permafrost such as gravity flows and thermokarst formation are present as well.

Seasonal river-level fluctuations with markedly increased (late spring/early summer) water volumes triggered by progressing thaw of the top ground surface promotes lateral bank erosion generating exposure of the Pleistocene-age alluvia sealing well-preserved fossil remains that are subject of the current investigations.

Methods and Approaches. The pilot field investigations on the early human occupation of the Bytantay Valley and the adjoining part of the Yana Basin conducted in summer 2014 implemented Quaternary geology (stratigraphy, sedimentology), geomorphology, (palaeo)ecology, palaeo-climatology, paleontology and geoarchaeology studies integrated in the regional GIS framework and supplemented by recent satellite databases monitoring permafrost degradation rate and erosional activity within the catchment Adycha-Yana River basin. As a result, new information has been assembled, completing the existing proxy database on the past climatic evolution and palaeoenvironmental change, as well as the geological contexts sealing well-preserved palaeoecology records (fossil flora and fauna) released from permafrost grounds. Datable organic remains in conjunction with the stratified sequences of archaeological and paleontological sites best contribute to mapping of the late Quaternary (the mid-Last Glacial through Holocene) natural history of the region.

The integrated multidisciplinary research focused on: 1) documentation of the local geo-settings in terms of the fluvial system dynamics and sedimentary facies analyses (the Yana valley S-N geographic transect); 2) the regional thermo-karst development in the most active (seasonally-melting) frozen ground zones; 3) identification of the key stratigraphic sites delivering most complete proxy archives of past climatic shifts and corresponding environmental transformations; 4) cryolithic (permafrost-sealed) formations with occurrences of the Last Glacial palaeontological and early cultural materials; and 5) taphonomic and chronological documentation and assessment of the key archaeological sites delivering novel knowledge on the initial peopling of this opening sub-polar area of East Siberia.

From a field-prospecting viewpoint, the most active erosional sections along the bending river flows of meandering channels, about 5–10 m high, as well as the laterally sliding banks of the melting

Pleistocene-age fossiliferous formations have proven to be most productive for collecting palaeoecology and archaeology data.

Palaeoecology and Cultural Evidence. The northern Yakutia is known for mass concentrations of well-preserved fossil organic remains-flora and fauna-sealed in permafrost, and often contextually associated with the earliest (pre-Holocene) cultural finds (Boeskorov et al., 2011; Pitulko, 2013; Pitulko et al., 2004, 2014, 2016; Ченпачов et al., 2015). Due to the ongoing continental warming, numbers of parallel Pleistocene-age faunal records in conjunctions with active fieldwork will undoubtedly increase in the coming years. These unique findings document: 1) human colonization of the sub-Arctic and Arctic areas of Siberia; 2) physical ability and a successful cultural adaptation to harsh late Pleistocene environments, and 3) potential of early people to migrate along the Arctic coast of the Western Beringia to reach the American Continent prior to the Last Glacial Maximum (Chlachula 2011; Chlachula 2015).

Geology, paleontology and geoarchaeology survey focused on locating potential Late Pleistocene-age human occupation sites. The corresponding cultural indices were encountered as flaked stone artifacts, showing signs of corrosion and re-deposition, and by clearly humanly worked and modified fragments of the large Last Ice Age megafauna. At several river-side loci, some undisputable, although rudimentarily worked stone tools were found, mostly in eroded physical forms and secondary geological positions. The corresponding primary geo-contexts of the detected lithics displaying eloquent anthropogenic modification (defined by regular flaking scars and percussion marks, both diagnostic of a controlled hard-hammer human cobble flaking) indicate fluvial transports after having been eroded from the original places by the present river activity due seasonal water level fluctuations. Exact geology positions of these cultural assemblages remains unclear. It is assumed that these are associated with top surfaces of low-elevation terraces (5-15 m above the present river level at the mid-summer stands) that are being currently undercut by lateral channel erosion (Fig. 1). Subsequently, the implements after release from the original contexts are dragged along the river banks with other pebble- and cobble- size clasts before being eventually exposed (together with isolated fauna bone and tusk fragments) largely on lee-sides of the Bytantay River banks at the lowest seasonal (late summer and early fall) river stands (Fig. 2).



Fig. 1. Eroded fossiliferous sections of the Bytantay River banks exposing fossil wood and fauna from the permafrost-sealed Late Pleistocene beds. A progressing lateral channel migration in conjunction with frozen ground thaw delivers new evidence of past climatic and associated environmental change



Fig. 2. A well-preserved mammoth tusk released from the destabilized Bytantay River bank sections as a result of the seasonal river-level fluctuations and active river-bank undercutting

The assembled lithic artifacts and tools display the characteristic Palaeolithic (though time-transgressive) attributes of hard-hammer (direct-percussion) stone flaking. These are represented by laterally retouched flakes, massive polyhedral and bidirectional cores as well as chopping tools formally reminding the earliest Palaeolithic implements. Employment of a bipolar technique and/or an anvil-percussion cobble-fracturing is exemplified on massive flakes, secondarily worked along the naturally sharp edges in a form of lateral or distal scrapers. Burin-like tips appear on some isolated specimens. The small lithic industry components are surely under-represented due to the high-energy riverine environments and preservation limitations. In view to the presumed Last Glacial age of the sealing stone and bone industry finds as well as an overall nature of the collections, these likely represent a specific facies of the Siberian Upper/Final Palaeolithic providing supporting evidence of a pre-Holocene occupation of the north-central Yana basin (67°N), in accordance with the Upper Palaeolithic records known in the lower reaches of the Yana valley, ca. 500 km north (Pitulko et al., 2004, 2014, 2016).

The lithic records are backed-up by the finds of articulated and humanly modified pieces of fossil fauna (mammoth, bison, woolly rhinoceros, deer, horse). Rich palaeoenvironmental records from the degrading river-side cryolithic sections complete well-preserved remains of (sub-)fossil forest-tundra vegetation (moss, turf and wood fragments (presumably of *Larix sibirica*) from the same geological contexts. Similarly as the cultural lithics, most of the fossil fauna shows some short-distance fluvial transport and/or surficial corrosion and surface-weathering. The large mammals of the Last Glacial sub-polar parkland-steppe attests to most productive ecosystems established in this part of East Siberia during the mid-Late Pleistocene (MIS 3-2), ¹⁴C-dated to 41,000-38,000 cal. yr BP (unpublished data).

Summary and Conclusion. Multi-proxy palaeoecology and geoarchaeology records from the lower Bytantay valley, a major left tributary of the Yana River, confirm conditions for sustainment of the Pleistocene megafauna as well as early peopling of the area. The well-preserved and taxonomically diverse large fossil fauna skeletal remains sealed in the Pleistocene colluvial and alluvial-plain formations in intact geological positions 10-20 m above the present river and scattered on gravelly river banks after their erosion point to a very high biotic potential of the Late Pleistocene (MIS 3-2) sub-Arctic forest-tundra. The pollen records

from the ancient sediments show dominance of the Siberian larch, dwarf birch and willow accompanied by grassy communities during the mid-Last Glacial stage not dissimilar from the present conditions. Humanly worked and used fauna bones (mammoth, rhinoceros, horse, bison and reindeer among others) found in large numbers in the Yana Basin attest to the co-existence of the large animals with humans within the mosaic Ice-Age open riverine valley ecosystems. The time-transgressive macro-lithic stone industry produced from the preselected gravel cobbles document some specific ways of environmental adjustment of the early humans. The empiric field observations of increasing annual temperatures in the Yana-Adycha Basins in congruence with the long-term statistical meteorology data show rising MAT that trigger an accelerated permafrost degradation across the Verkhoyansk Region. The fluvial discharge is most dynamic during late spring due to the cumulative effects of snow-melting and solar radiation exposing buried palaeo-surfaces. This knowledge has a fundamental bearing for an increased visibility and frequency of the encountered occurrences of fossil fauna as well as early cultural records released from the permafrost grounds precipitating a more systematic Quaternary geology–palaeoecology research. The Palaeolithic finds are the first ones in the Bytantay River valley area representing a pre-Holocene prehistoric occupation. The new data add to present knowledge on the initial colonization process of the sub-Arctic and Arctic regions of Siberia.

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