

Paper Number: 3077

Present Permafrost Degradation in NE Siberia: Environmental Implications

Jiri Chlachula^{1,2} and Jolanta Czerniawska¹

¹Institute of Geoecology and Geoinformation, Adam Mickiewicz University, Poznan, Poland; paleo@amu.edu.pl

²Laboratory for Palaeoecology, Tomas Bata University in Zlin, Czech Republic; Altay@seznam.cz

Permafrost degradation is causing major environmental and engineering problems in the (sub-) Arctic areas. Prominent changes in the natural and occupation environment of Yakutia (the Sakha Republic, NE Siberia) have been increasingly observed during the last two decades due to permafrost thaw and associated geomorphic actions, such as surface collapsing, slope slumping, thermokarst lake (alas) expansion and increased ground salinization, among others. All these processes pose major risks to the local communities as well as the regional infrastructure. Of particular concern are the stability of largely unpaved gravel roads and maintenance of the transportation route system, as well as overall industrial development. Monitoring of the actual cryogenic hazards and modeling of their potential impact to local communities in the formerly permafrost-stable central and northern areas are of key relevance. Effects of mass collapses of deconsolidated grounds are observed in an increased measure especially in the lowland locations along riverine channels. The main rivers (Lena, Viluy, Aldan) experience enhanced seasonal water level fluctuations due to intensified early summer (May-June) warming, causing landscape openings at the expense of tundra-forest, bringing a higher regional thermal capacity. The increased solar radiation triggers thermokarst lake expansion and top ground water saturation leading to vegetation cover changes and formation of marshlands. A regular monitoring of these processes is essential for sustainability of local Yakut and geographically largely dispersed communities, infrastructure maintenance, as well as the overall central economic planning. Present absolute atmospheric and regional hydrology measurements confirm empiric field observations on raising MAT in the Verkhoyansk Region, causing accelerated permafrost degradation on both the river floodplains and the mountain plateaus. This fact has a fundamental bearing for a better visibility of unburied occurrences of fossil fauna records released from the ancient permafrost grounds, precipitating and facilitating more active paleontology and geoarchaeology exploration with employment of the integrated Quaternary geology – palaeoecology research approaches. Diagnostic stone and bone tools as well as anthropogenically modified and used parts of skeletal remains of Late Pleistocene fossil fauna associated with exposed de-freezing alluvial and colluvial formations provide evidence of rather early (>40,000-yr) human adaptations to the (mid- and late) Last Glacial Arctic and sub-Arctic environments [1-2]. Our recent investigations in the Yana River basin (66-68°N) produced new multi-proxy data on the palaeogeography development and geo-contexts of Palaeolithic cultural finds associated with the initial prehistoric occupation of this geographically marginal territory. Mapped alluvial formations interbedded by moss/fossil wood horizons illustrate past environmental shifts within meandering stream settings with marked fluvial dynamics of laterally shifting palaeo-channels. Sequenced series of silty-clay strata interspersed by fossil organic/peat/ layers from active permafrost settings point to detailed high-resolution (palaeo) climate variations in NE Siberia during the Late Pleistocene – Holocene time span as well as the marked rate of present erosional processes.



References:

- [1] Pitulko et al. (2016). *Science* 351(6270), 260-263.
- [2] Chlachula J. et al. (2014). *Eurasia in Cenozoic* 3, 166-175.

Figure 1. Permafrost collapsing ground, SE Yakutia

