

Jiri Chlachula^{1,2*}

¹ Institute of Geoecology and Geoinformation, Adam Mickiewicz University, Poznan, Poland

² Laboratory for Palaeoecology, Tomas Bata University in Zlin, Czech Republic

* **Corresponding author:** altay@seznam.cz

GEO-TOURISM PERSPECTIVES IN EAST KAZAKHSTAN

ABSTRACT. Eastern Kazakhstan and the adjacent Gorno Altai of southern Siberia encompass very mosaic landscapes across all the geographic and geomorphic zones enclosing numerous (pre-)historic monuments, some of them being a part of the UNESCO World natural and cultural heritage. Excepting the high-mountain ranges (Rudno and Southern Altai, Naryn, Tarbagatay and Dzhungarskiy Alatau) surrounding the territory, the interior open arid steppes characterized by a broken relief of the granite-built Central Kazakhstan Hills as well as the barren rocky semi-deserts in the SE parts of the land remain largely unexplored and tourism-uncovered. The extraordinary topographic diversity was generated by complex geological processes associated with the Cainozoic orogenesis and the changing Quaternary climates. Geo-tourism focusing on the most exquisite landscape forms (geo-sites) and geological formations is a new trend in the country with still minor activities that take advantage of the region's supreme geo-heritage potential. The unquestionable touristic-recreational attractiveness of this geographically marginal area of Central Asia (historically a part of the Russian Empire's Tomsk Gubernia) reflects unique natural features – both geomorphic and biotic – including orographic, hydrologic, climatic, mineral and pedogenic, as well as rare endemic plants and wildlife in addition to the colourful national Kazakh and Russian traditions. In spite of these predispositions, an introduction of a vital, sustainable geo-tourism in East Kazakhstan is impeded by the limited accessibility to the region due to an insufficient year-round transport infrastructure and poor local accommodation facilities in addition to the restricting boarder-zone entry regulations.

KEY WORDS: East Kazakhstan, topography diversity, Altai, geo- and cultural heritage, geo-tourism.

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INTRODUCTION

Geo-tourism is a new phenomenon in Kazakhstan despite the major potential linked to the extraordinary relief diversity of this largest country of Central Asia (2 724 900 km²). In some other developing countries and emerging economies, this

environmental sector plays an increasing role as a part of a sustainable development with international geo- and eco-tourism promotions and publicity (e.g., Czerniawska and Chlachula 2018). As a novel form of the global tourism industry, geo-tourism generally means tourism of geologically interesting places – geographical loci

and relief features in terms of acting processes (such as mountain orogeny and glaciations, regional metamorphism, erosion, sedimentation) and resulting forms (alpine peaks, geological formations, rocky outcrops, deposits, minerals, palaeontology occurrences, etc.) (Downing 2011; Downing and Newsome 2010). The territory of East Kazakhstan with the major mountain systems (Southern Altai, Tarbagatay, Alatau), and the continental depressions (the Bukhtarma and Zaisan/Black Irtysh Basins) include the most picturesque and physiographically unique landscapes and geo-sites. The broader regional topographic configuration (Fig. 1) mirrors a long and complex geological history and sequenced (palaeo)-environmental transformations seen by relief features of geomorphic processes related to the Quaternary climate evolution with periodic glaciations in conjunction with the regional tectonics (Deviatkin 1981; Aubekeroev 1993; Galakhov and Mukhametov 1999).

The past climate shifts that sculptured the present relief are evidenced by well-preserved palaeo-landscape forms in the mountain, steppe and semi-desert areas, as well as by deeply stratified sedimentary geology, palaeoecology and geoarchaeology records indicating long-term atmospheric variations in temperature and humidity (Akhmeteyev et al. 2005). Spectacular glaciofluvial terraces in the mountain valleys indicate presence of a system of the ice-dammed lakes that were subjected to periodic cataclysmic drainages during the final stages of deglaciation and considered as the most dramatic geomorphic events in the latest Earth geological history (Rudoy and Baker 1993; Herget 2005). Alpine valleys, upland plateaus, enigmatic rocky canyons, sand dune fields, deep ravines amid of undulating steppe terrains are just some of the most characteristic landscape features (Fig. 2a-f). High-resolution loess-palaeosol sections, enclosing sequenced environmental archaeology data from the Pleistocene human occupation sites, provide evidence of a rather pronounced natural dynamics for the last ca. 130 000 years (Chlachula 2010).

The geo-tourism focus is on visiting and learning these places, adding to ecotourism aimed at biotic diversity (flora & fauna). In essence, it contributes to better awareness of nature-friendly actions, environmental protection, education and landscape preservation. The most interesting loci (geo-sites) are subjected to mapping in terms of environmental management and a geo-heritage evaluation still highly unexplored on the national level (Mazbayev 2016). The major protected areas such as the Katon-Karagay Nature Park, being the major NP in Kazakhstan (643 477 ha), and the Lake Markakol Nature Reserve among others enhance the regional natural value. East Kazakhstan and the adjoining Gorno Altai (southern Siberia) are also known for the World-unique archaeological sites and historical monuments (Chlachula 2018). The combination of pristine nature and the traditional culture makes the country most appealing for local as well as foreign visitors (Saparov and Zhensikbaeva 2016; Zhensikbayeva et al. 2017, 2018). This study presents an insight on the East Kazakhstan landscapes integrating distinctive physiogeographic features with rich cultural monuments, providing in unity a most promising geo-contextual milieu for the modern geo-tourism development by taking into account the regionally specific natural, historical, cultural and modern socio-economic aspects.

The East Kazakhstan Geography, Geology And Environments

The district of East Kazakhstan / Восточно-казахстанская область (283 000 km²; population 1.4 mil.), the administrative centre Ust'-Kamenogorsk (315 000), belongs to the most progressing and historically developed parts of the Republic of Kazakhstan due to the rich natural resources, the mineral-processing industry, the transport network with the country's most vital communication links to the neighboring West Siberian Omsk and Altai Regions of the Russian Federation (Fig. 1). Climate is strongly continental (MAT -4°C) with very pronounced seasonal temperatures. The uneven annual (rainfall and snow) precipitation, ranging from 150



Fig. 1. Geographic location and relief diversity of East Kazakhstan with the most attractive physiographic geo-tourism areas and discussed geo-sites: 1 The West Altai Nature Reserve; 2 The Katon-Karagay State National Park (Fig. 2a-b, 3a,c,f); 3 The Lake Markakol Nature Reserve (Fig. 2c); 4 The arid zone of the Zaisan Basin and the Tarbagatay Range (Fig. 2e-f, 3d); 5 The Shingistau and Kalba Ranges (Fig. 2d, 3b); 6 The East Kazakhstan Highlands (Fig. 3e)

mm in the most arid eastern semi-deserts to 1300 mm on the NW flanks of Rudno (Rudnyy) Altai in the North, together with the great regional relief diversity predisposes a marked vegetation zonality (Chlachula 2007).

The territory is of a broken physiographic configuration of undulating parklands, adjoining the western steppes, and aligned (N-E-S) by the Altai, Tarbagatay and Alatau Mountain ranges (reaching to 4500 m asl.) (Fig. 1). A complex geological history is manifested by past and large-scale geomorphic processes of granitic and gneissic bedrock weathering, erosion and mass sediment transfer in the central Bukhtarma and Zaisan Basins linked to neotectonics and climate change over the past millions of year (Chupakhin 1968; Mikhailova 2002; Yegorina 2002). The broader regional geology is structured by the Proterozoic metamorphic rocks mantled by the Palaeozoic, Devonian, Carboniferous and Palaeogene formations of volcanogenic and sedimentary (sandstone, limestone) origin filling the interior syncline depressions. Karstic cavities are developed in the Palaeozoic limestones (Nekhoroshev 1967). The igneous and metamorphic geological bodies host rich mineral resources – metallic and non-metallic, including the occurrences of semi-precious and precious gemstones (emeralds, garnets, opals, beryl, tourmalines, granates and crystal quartz among other crystalline minerals) and the varieties of decorative stones (such as variegated microcline quartz and jasper) used in the jeweller, artistic and decorative stone-processing industry as well as building construction (Pacekov et al. 1990; Chernenko and Chlachula 2017). The known regional mineral provenience sites are largely bound to the exposed outcrops and shallow sub-surface deposits extracted by a small-scale mining.

The majestic alpine relief (>2000 m altitude) was shaped by periodic Quaternary glaciations accompanied by succeeding fluvial erosion and gravity slope processes particularly active in the mountain valleys. The changing cold/warm Late Pleistocene

(130 000–12 000 yr BP) intervals contributed to formation of desert and parkland-steppe ecosystems during the warm stages, and periglacial arid steppes during the cold stages with glaciations of the East Kazakhstan mountains and loess deposition on the western foothills. The best-preserved landform features date to the Last Glacial stage (24 000–12 000 yr BP). The pronounced palaeoclimate dynamics is eloquently manifested by the preserved Last Glacial topography with most unique geo-sites in the principal valleys – the former ice-dammed lake basins (Butvilovskiy 1985) (Fig. 2a). Stratified, up to 30 m thick aeolian sand and wind-blown silt sedimentary records mantle the present smoothed topography and the palaeo-relief forms (Chlachula 2003; Bábek et al. 2011). East Kazakhstan is a dynamic geomorphic region due to the co-acting continental plate tectonics along the main central Eurasian orogenic belt (Velikovskaya 1946; Svarichevskaya 1965). The climate-driven regional relief restructuring continues until today giving rise to new and most interesting geo-settings. The present territorial aridification evident by active sand dune formation and mass-sediment transfer (Fig. 2f). leads to progressing regional desertification and the steppe ecosystem instability.

Geo-Tourism And Cultural Heritage

The great geo-diversity of the mosaic landscapes of the East Kazakhstan mountains and parkland-steppes is completed by the extraordinary cultural heritage jointly accentuating the touristic values of this still marginally exposed geographic area. The broader region was occupied from the earliest stages of the prehistory manifested by various cultures and traditions leaving behind numerous archaeological monuments as testimony of once flourishing ancient settlements (Chlachula 2018). In East Kazakhstan, the early cultural sites are recurrently associated with picturesque relief forms and places. The past environmental conditions and physiogeographic configurations regulated the sequenced prehistoric occupation as well as historical settlements on this territory



Fig. 2. The East Kazakhstan landscapes and natural geo-sites. **a:** Abraded granite boulders on top of the glacio-fluvial terrace resulting from a cataclysmic release of the Last Ice glacier-dammed ablation-water lake at the foot of the Southern Altai Range (Zhambul, Katon-Karagay District); **b:** Proterozoic monolithic granite rocks sculptured by wind-erosion encountered in the mid-altitude (1500-2200 m asl.) Altai Mountain area (Arshaty, Katon-Karagay District); **c:** Lake Markakol filling a 30 m-deep tectonic depression with picturesque surroundings of the nature reserve (Markakol District); **d:** Lakes Sibinskiye - a popular recreation site in the Kalba Range built by weathered granite formations; **e:** Mesozoic, iron-mineral colored and stratified clayey bedrock at Kiin-Kerish shaped into canyons and badlands amid of the Zaisan Basin semi-desert, indicative of past humid and hot tropical climates, and sealing fragmented Jurassic fauna (dinosaur) skeletal records (Kurchum District); **f:** Active, up to 300 m-high sand dunes (Aygyrkum Sands) along the Kazakh-Chinese border limits resulted from a massive and long-term aeolian sediment accumulation (ca. 40x15 km) with asand-drifting from the interior basin (Zaisan District)

known under the historical name *Sary-Arka* (Saparov et al. 2018). Past climates regulated the occupation dynamics and predetermined formation of specific glacial and non-glacial ecosystems.

The mapped archaeological localities in the East Kazakhstan Region unearthed in diverse geo-settings and geo-contexts indicate a much earlier human inhabitation predating the post-glacial prehistoric cultures. The oldest (Palaeolithic) sites bear witness of the Pleistocene hominine occupancy of this geographic area during the preceding interglacials and interstadials and environmental adjustment to Pleistocene ecosystems. The uncovered Middle Pleistocene sites documented by expedient stone industries (cobble-tools) discarded on the elevated riverine terraces and dry floors of continental basins, and currently wind-exposed within gravel pavements represent the most ancient vestiges of the early human dispersal in this poorly investigated territory (Chlachula 2010). Cave sites and rocky abris with the Middle to Final Palaeolithic findings from West and Southern Altai mountain valleys and the adjoining rocky foothills bear witness to montane adaptations of the last Ice-Age hunting-gathering populations (Fig. 3a). The prehistoric rock-art, rich burial complexes and ritual sites hidden in sheltered mountain valleys and the river-cut canyons inform on the later Holocene-age (Neolithic and Eneolithic) ethnics (Fig. 3b). The most eloquent cultural records are associated with the Bronze Age (late 4th–early 1st Millennium BC) and especially the early historical times (6th Century BC–9th Century AD). The latter are represented by stone-laid royal burial mounds (kurgans) (Fig. 3c), ritual structures, and rock-engraved petroglyphs assigned to the Scythian Period (6th–2nd Centuries BC), being the most famous early cultural relics and a part of the UNESCO World heritage (Polosmak 2001; Samashev 2001, 2011; Gorbunov et al. 2005). The geographical distribution of the mapped archaeological sites displays a broad topographic range of the previously occupied and/or exploited landscapes (Chlachula 2018) (Fig. 3d-e). All these loci have major potential not just for scientific

research, but also for inclusion into the cultural and geo-heritage promoting programs and the related environmental management actions.

The linguistic evidence completing the material culture records points to a rather complex and chronologically long historical development (Konkashpayev 1959; Kenesbayev et al. 1971). This is best-reflected by the names of the major East Kazakhstan rivers and the mountains (hydronyms and oronyms, respectively), with the latter (Altai, Tarbagatay, Alatau) of a definite Mongolian provenance (Saparov et al. 2018). Etymology of the main physiographic entities delivers some insights on the past population shifts in northern Central Asia throughout the millennia since the most ancient Indo-European inhabitants through the Bronze and Iron Ages (3rd and 1st Mill. BC) until the historical period (2nd Mill. AD) represented by nomadic and territorially mobile to semi-sedentary ethnics. This knowledge can be implemented into geo-tourism activities and has an unquestionable national culture-historical significance.

Geo-Tourism Potential Of East Kazakhstan

The multi-faceted geography of East Kazakhstan has all predispositions for eco- and geo-tourism taking into account the pronounced regional climate seasonality, the overall natural beauty and comfort with favourable hydro-geological conditions (mineral waters, balneology loci, radon-gas thermals) and the attractive landscapes underlining, together with the rich cultural heritage, the immense touristic and recreational capacity of the region. The integration of all these aspects provides foundation for the specific tourism sectors and their implementation onto the Kazakhstan landscapes (Mazbaev 2016). Viability and sustainability of the specific tourism activities can be assessed by evaluating each of the particular physical and human geography constituents (i.e., terrain, climate, hydrology, biodiversity, therapeutic resources among other variables) (Inskeep 1994; Wimbledon and

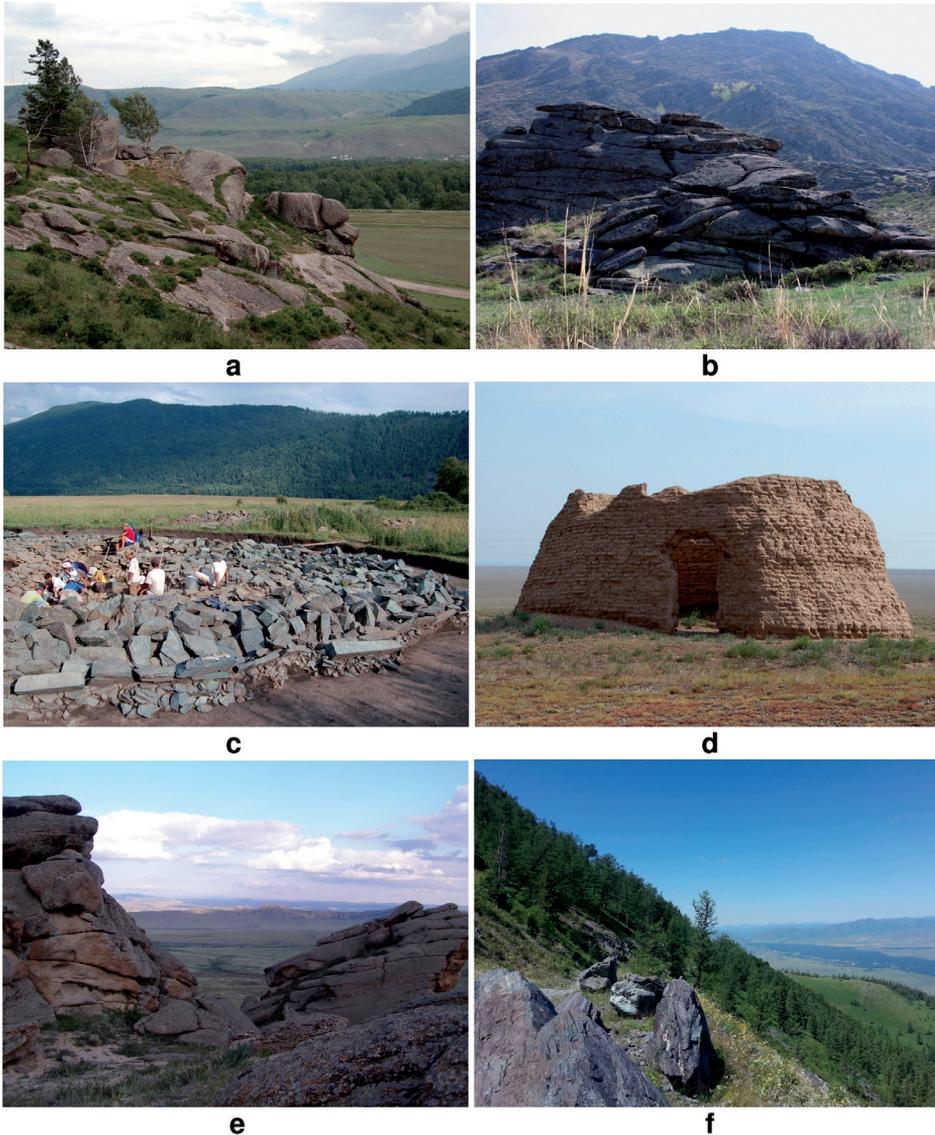


Fig. 3. The East Kazakhstan landscapes and cultural-heritage geo-sites. **a:** A Stone Age site located on an exposed granitic promontory at the margin of the former glacial lake providing evidence of a Final Pleistocene human colonization of the deglaciated Bukhtarma River valley (Zhambul, Katon-Karagay District); **b:** A Neolithic and Bronze Age Ak-Bauyr cultic site with rock-art grottos (Kalba Range); **c:** Excavation (2006) of a rich "royal" burial mound (kurgan) of the Iron Age Pazyryk culture (6th-2nd C. BC) at Berel' (Katon-Karagay District) with mummified bodies preserved in permafrost; **d:** A medieval circular sacral place made of dry-bricks in the middle of the desert (Shilikty, Zaisan District) providing a vivid testimony of ancient tribal settlements; **e:** The scenic rocky steppe landscape with hidden valleys and raised plateaus was a place of refuge as well as sanctuaries since the prehistoric times (the East Kazakhstan Highlands, Shar District); **f:** The "Austrian Road" built in 1915-16 across the Sarym-Sakty Range at ca. 1500-2200 m asl. connecting the Bukhtarma Valley (N) with the Black Irtysh Basin (S)

Smith-Meyer 2012; Yegorina et al. 2016) and the site accessibility, transport possibilities and visitors accommodation conditions. Each of the selected geo-sites of Saryarka may then be considered by its uniqueness among other relief places, its spatial occurrence (concentration) within the particular area, its diversity and complexity in respect to other geo-relief features and the state of physical preservation. The natural and past-present cultural diversity confirms the uniqueness of the geographic area for various tourism activities and free-time recreation (Chikhachev 1974; Yerdavletov 2000; Geta et al. 2015).

The specific geographical aspect of East Kazakhstan is its location in the border zone adjoining the other (Russian, Mongolian and Chinese) nature protection reserves and national parks. The broader area encompasses several major physiographic units of the "Great Altai" including the Gorno Altai-Sayan Mountain Region, the Altai Region, the Mongolian Altai, the Chinese Altai (Kanas NP), and eight Kazakh districts. In East Kazakhstan, five explicit nature-recreational areas can be defined by the regional ortho-climatic characteristics: the Zyryan (Rudno Altai), Katon-Karagay, Lake Markakol, Kurchum and Kalba/Shyngystau (Fig. 1) with pristine taiga, tundra, desert and rocky steppe habitats hosting rich endemic and elsewhere rare biota with unique floral and faunal communities. The particular natural conditions predisposed by the geomorphic settings and the arid-zone atmospheric regime gave rise to the variety of ecosystems reflecting the geographic and climatic zonality of the territory (Chlachula 2007, 2011).

The Kazakh Altai formed by the E-W aligned mountain ranges (Southern Altai, Sarym-Sakty, Narym, Kurchum) is connecting through the Tarbagatay massif (2992 m) and the Saur Range (3816 m) to the Dzhungarskiy Alatau (4464 m) in the South. These orogenic systems are characterized by the erosional northern slopes – uplifted relics of old plateaus (>3000 m asl.) with a decreasing topographic gradient (3900–2300 m asl.). The territory of the Southern Altai (3485 m asl.) is included in the globally

most significant geo-ecological regions hosting unique geo-ecosystems with many varieties of rare and endemic flora and fauna. The Katon-Karagay State National Park is the largest among the protected natural areas and biosphere reserves in the country (est. in 2001). In view to the broken physiography the region also offers good opportunities for adventure tourism (rafting, paragliding, horse-riding and alpinism) (Fig. 2a-c) (Swarbrooke et al. 2003). Overall, the KKSNP has the best preconditions for the geo-tourism industry in the frame of the regional eco-tourism management highly competitive with other mountain regions of the World (Newsome and Bowling 2010; Harns et al. 2017; Ilieş et al. 2017; Saarinen et al. 2017). Together with a more stationary recreation, such as at the Lakes Sibinskiye surrounded by granite hills sculptured by weathering of the Kalba Range (Fig. 2d), these activities contribute to the rural socio-economic sustainability.

A largely forested, lower-elevation relief (800–2200 m asl.) of Rudno Altai encloses the East Kazakhstan territory from the North adjoining the Russian Gorno Altai. Scenic, wind-eroded rocky formations sculptured into granite bedrock centred in the West Altai Nature Reserve (86 122 ha) and the adjoining mountain ranges is the most distinctive landform component of the regional physiography (Fig. 2b). Lake Markakol (1449 m asl.), filling the tectonic depression enclosed by the Sarytau Range (3373 m) and the Azutau Mountains (2300 m) in the middle of the eponymous nature reserve, is renown for the great diversity of plants and animals (mainly birds, fish and insect) (Mitrofanov and Petr 1999; Chlachula 2007) (Fig. 2c). The rather specific and very different geo-relief diversity is encountered in the south-eastern (Kurchum) area of vegetation-free (semi-)desert with badlands (Fig. 2e) and salty evaporates marshes of the Zaisan Depression fed by the Kaldzhyr and Black Irtys Rivers. The dry barren rocky and gravel-pavement steppes transgressing into the rising foothills with closed patchy forests in riverine canyons are gradually replaced by the rising partly forested slopes

of the Tarbagatay and Alatau Mountains. Sodium- and silica-enriched mud deposits of the Mynshunkyr ('a thousand of pits') site have unique therapeutic properties.

In spite of the wide spectrum of the countryside beauty, these touristic zones of eastern Kazakhstan are still being very marginally visited. Until now, only c. 2000–3000 people come to Lake Markakol and the Kaldzhyr River area during the peak season in summer and early fall (Saparov and Zhensikbayeva 2016).

DISCUSSION: FUTURE PERSPECTIVES

The mountain regions encompass some of the major ecosystems on the Earth. They also comprise the most significant mineral, natural and geo-tourism resources (Dunets 2011; Sherba et al. 2000; Melinte-Dobrinescu et al. 2017; Bouzekraoui et al. 2018). The national and internationally-based tourism represents one of the most emerging and profitable sectors of global industry. The regional attractiveness is considered as the principal proviso of geo-tourism. Even formerly geographically marginal and less-accessible places have become increasingly open to visitors and the organized tourism stimulating a further infrastructure and facilities development. This is particularly true for the geo-environmentally-oriented activities (e.g., Mihalič 2000; Goessling and Hall 2005; Mason 2015). Eastern Kazakhstan, with the major alpine mountain systems constituting the extreme NE frontiers of the Republic of Kazakhstan, offers major tourism opportunities, particularly in respect to geo-tourism and eco-tourism that can well compete with other geomorphically most diverse places in the World (Dowling 2009; 2011; Brilha 2016). The natural sites are supplemented by unique anthropogenic landscape construction elements, such as the "Austrian road" built during the I. World War (in 1914-1916) by the imprisoned Austrian soldiers (Fig. 3f), as well as other relief features that constitute a part of the modern regional history and human work imprinted onto the landscape. Nevertheless, because of the limited logistics and the special border-zone entry regulations, this area still represents

one of the most underdeveloped, pristine and most attractive places for sustainable tourism and recreation in Central Asia.

In terms of the modern geo-tourism promotion (Asrat and Zwolinski 2012), field mapping and documentation should not be confined just to the geo-sites listed by UNESCO such as Plateau Ukok (Molodin et al. 2004). Other prominent and regionally specific geo-relief locations should be enclosed with assessment of their attractiveness. Interdisciplinary Quaternary (geological, geomorphologic, hydrological and present climate-change) studies represent a constituent contextual part of the Eastern Kazakhstan geo-diversity documentation in terms of the acting natural processes, their dynamics and chronology, allowing for reconstruction of the regional physiographic history and the present relief formation. The distinct Last Ice Age mountain topography attest to pronounced intensity of these processes and marked climatic fluctuations since the Last Glacial (Chlachula 2001, 2010). A progressing retreat of the mountain glaciers reinforced by global warming observed across the broader Altai area (Surazakov et al. 2007; Chlachula and Sukhova 2011; Narozhniy and Zemtsov 2011) exposes new landforms in the recently deglaciated alpine zone. These actions may generate major geo-environmental risks and geo-hazards subjected to monitoring, including the status of preservation of permafrost-sealed and most unique cultural sites (Hahn 2006; Jakobson-Tepfer 2008). A geo-archaeological survey adds to improved knowledge and better awareness of the regional prehistory as well as protection of the Altai (pre-) historical monuments (Cheremisin 2006). Landscape mapping and GIS visualization constitute a background for the spatial distribution assessment of specific geo-sites as well as biotopes and plant species in the frame of the regional eco-tourism (Hovorkova and Chlachula 2012). Legal regulations should be implemented to prevent destruction of unique geo-sites and geoarchaeology monuments by industrial activities (infrastructure development, mining, building construction, etc.) or human behavior.

The future geo- and eco-tourism resort development in East Kazakhstan is bound to naturally supreme places (such as the salty mud spa at Mynshunkyr, the radon-gas spa at Lake Yazovoye, Rakhmanovskye Klyuchi, Sibinskiye Lakes, Shul'ba Lake, canyon Kiim-Kerish, Aygyrkum dunes, etc.) combined by the traditional economy facilities such as red-deer farms aimed at the pantocrine/blood extract production from velvet antlers used as a traditional medicine or horse-milking farms). A complex regionally-specific physiographic assessment is prerequisite for evaluation of future tourism perspectives (Mazbaev 2016). In spite of the major biotic and geo-sites potential, the introduction of a vital and sustainable tourism in the area is hindered by the insufficient, mostly unpaved road network (with some roads without maintenance during the winter season), inadequate local accommodation facilities, as well as the special boarder-zone entry regulations. Helicopter transport can be used as a faster, yet more costly alternative to the road (car/bus) transportation. Only the airport in Ust'-Kamenogorsk / Oeskemen (Fig. 1) can be used for international flight arrivals. The Irtysh River with local ferries is a good option for a leisure-time yet geographically most cognitive riverine route to Lake Zaisan via the tributary Bukhtarma Lake reservoir. The relatively rising living standard and wages in the main industrial cities of East Kazakhstan, such as Ust'-Kamenogorsk, contribute to expansion of the present tourism industry into the commercial geo-tourism and recreation geography.

CONCLUSION

Geography of the Republic of Kazakhstan, situated in the North of Central Asia, inspires a lot of scientific as well as commercial

attention because of the spectacular landscapes with many World-unique geo-sites found across all the physio-geographic zones. Their extreme diversity mirrors a wide range of geomorphic processes acting on the territory over the past millions of year in linkage with the Cainozoic orogeny and Quaternary climate change. The complex geological history sculptured the present topography of East Kazakhstan by generating the most attractive relief forms and locations enclosing the ancient archaeological sites and historical monuments with the permafrost-sealed royal burial mounds of the Iron-Age Pazyryk Culture being the most famous. Yet, there has been a marginal activity promoting the country's supreme geo-heritage and the geo-tourism potential due to the limited accessibility with a poor infrastructure, and the restricting entry regime of the present Kazakh-Russian-Chinese border zone. Study of climate variations affecting the relief structure and the associated semi-desert, parkland-steppe and the alpine zone biodiversity is most essential for understanding the current geo-environmental transformations over the territory and pre-determining integration of geo-tourism as a part of the national economic development.

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