Modern aeolian processes in Barguzin Basin (Transbaikalya)

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Barguzin Basin is a dry steppe area, located in Transbaikalya (fig. 1). There is severe con-tinental climate of mean annual temperature from -3°C to -4°C. Mean July temperatures ex-ceed 18°C, whereas temperatures in January fluctuate from -24°C to -26°C. Barguzin Basin lies in the rain shadow of the Barguzin Mountains, therefore it is a very dry area: mean annual precipitation sum amounts here only to 200–250 mm (Baikal, 1993; SZCZYPEK, 1995).

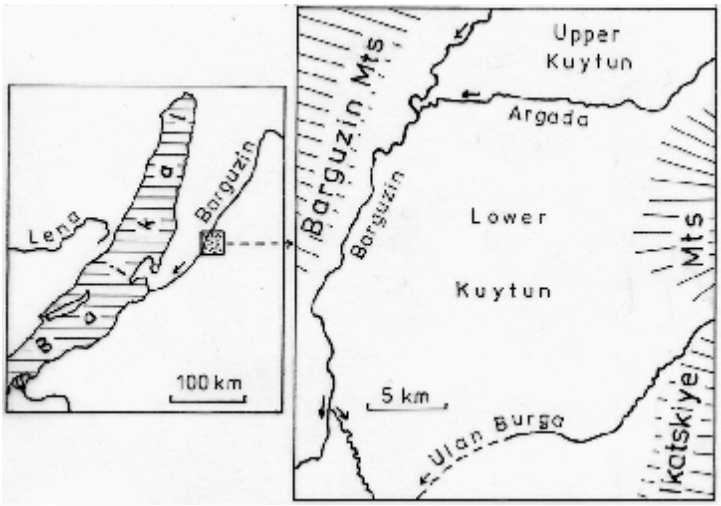

Fig. 1. Location of area investigated

Barguzin Basin is a fault block depression, filled by series of de-posits of large thickness and diffe-rent genesis (Baikal, 1993). In the Pleistocene the accumulation of large mass of sandy-gravely mate-rial, which was undoubtedly con-nected with the Barguzin river valley, took here place. From this material wide sandy ridges were formed. Now they rise 150 m abo-ve the depression bottom. These sandy areas are called kuytuns (LO-GACHEV, GALKIN; GOLDYREV, 1974; VYRKIN, 1998).

In connection with existing here climatic and lithological conditions, in the area of Barguzin Basin dry steppes clearly predominate, including ones from the class *Cleistogenetea squarrosae*, although in some places forest complexes and – in the valley of Barguzin – meadow-swampy vegetation also occur (SZCZYPEK et al., 2002).

The area of kuytuns is characterised by the existence of landform complex of aeolian genesis: dunes and deflation forms. The essential aeolian modelling of the initial deposits of kuytuns took place probably on the turn of the Pleistocene and Holocene. The upper part of aeolian sands of kuytuns to the depth of 3–4 m is young, because it was formed not earlier than 3–4 thousand years ago (VYRKIN, 1998). Present anemological conditions (the majority of winds from south-western and southern directions) cause that presently in the surface of kuytuns, at least in southern part of them, processes of deflation clearly predominate (SZCZYPEK et al., 2002).

In the area investigated formerly accumulated dunes as well as flat and slightly waved blown areas of kuytuns undergo blowing out. The reason of renewed activation of morpho-genetic wind influence is human economic activity connected with so intensive cattle and sheep grazing and land cultivation in summer period.

In this elaboration two typical examples of present forming of aeolian landscape in southern part of Barguzin Basin as well as the mechanical features of blown sand will be presented.

The first example concerns the blown dune form (fig. 2). It was earlier formed at flat surface of kuytun as probably well shaped longitudinal dune. Now it is almost completely

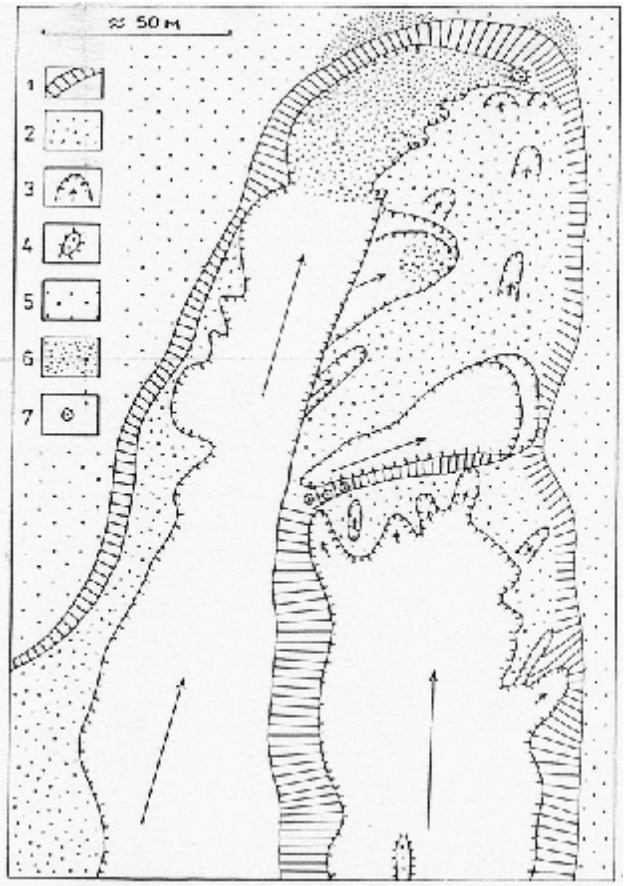

Fig. 2. Geomorphological sketch map of Bolshoy Zarmat range: 1 – steep slopes, 2 – gently slopes, 3 – deflation basins, 4 – deflation remnants, 5 – area of kuytun, 6 – present sandy aeolian covers, 7 – sandy shadows of nebkha type

blown out by southern and southwestern winds. The length of this form amounts to 300 m, the width reaches 100–200 m and the height in the frontal part – 3–3.5 m. It seems that from initial part only the general outline remained with preserved external, relatively steep in the lower part (18–20°) eastern and western slopes. Northern slope is characterised by the slope inclination of 29–30°. In the above-mentioned general outline of the former homogenous ridge, presently three main morphological elements are visible: in western part – thin (20–50 m), but long (up to 300 m) deflation corridor and adjacent to the east two dunes: the southern dune encroaches on the northern one. Both forms are strongly blown out. Within limits of northern dune some relatively small deflation landforms were shaped, whereas from southern form only damaged frontal part with preserved rather steep slope (15°) remained. The remaining part of this dune is occupied by wide deflation basin.

The sand from the mentioned deflation basins and corridor is mostly transported towards north and partly also to both sides. On one hand it leads to formation of present sandy aeolian covers, on the other hand – to carrying out of material beyond the dune area. Due to it the eastern part gradually assumes a shape of barkhan (fig. 2).

In site described, two vegetation communities were shaped adapting to the habitat features: *Oxytropis lanata – Bromopsis pumpelliana* and with *Termopsis lanceolata.* The first one develops in places with predominating deflation. Community with *Termopsis lanceolata* prefers more sheltered places: most of all leeward slope of dune, where sand is less mobile and in relation to it – it can be fixed by this species to a certain degree (SZCZYPEK at al., 2002).

The second example, even more popular in the area of kuytuns in southern part of Barguzin Basin, concerns the present blowing away of slightly waved sandy area, which is also weekly covered with steppe vegetation. In this case the main landforms, visible against a background of flat kuytun surface, are gullies with clear, almost vertical walls (fig. 3). At the following stage aeolian processes remodelled these gullies and now different deflation forms occur within them, originating under the influence of southern and south-western winds. Among these forms one should mention e.g. deflation basins of different sizes and shapes, deflation corridors, deflation scarps and remnants. Concave forms reach the depth of 6–7 m.

Sandy material, carried from bottoms of deflation landforms, undergoes transporting to small distances and is accumulated in a form of small near-scarp sandy covers at the basin edges. These covers are 40–50 cm thick and 50–60 m. long. Within limits of them typical and very characteristic deposits sorting is observed: at deflation scarp they are very coarse-grained and further gradually – as the wind influences – they become finer and finer.

The above described example of deflation relief development at flat surface of kuytun is probably the last stage of gullies development, because in the neighbourhood new gullies as well as gullies slightly remodelled by wind occur. Therefore, it seems that the dynamical development of deflation processes in the area of Barguzin kuytuns takes place after the initial damaging of their surface in result of erosional influence of periodical and episodic waters (SZCZYPEK at al, 2002).

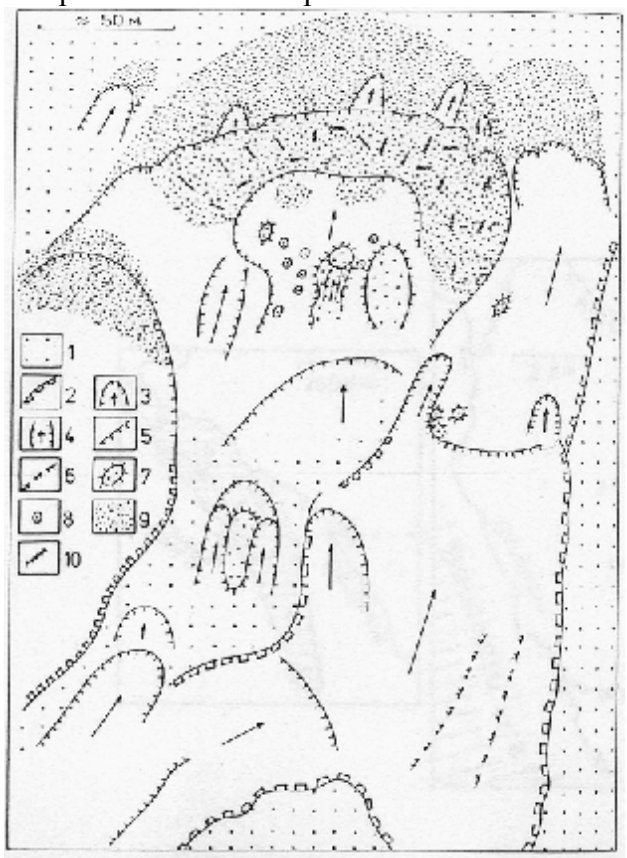

Fig. 3. Geomorphological sketch map of Argada range: 1 – area of kuytun, 2 – erosional scarps, 3 – deflation basins, 4 – deflation ditch, 5 – deflation scarps, 6 – erosional edges, 7 – deflation remnants, 8 – sandy shadows of nebkha type, 9 – recent aeolian covers, 10 – aeolian ripplemarks

In the site described vegetation com-munity *Oxytropis lanata – Bromopsis pum-pelliana* decidedly predominates, because the whole area is intensively blown away (SZCZYPEK at al, 2002).

The important matter is the estima-tion of wind influence degree on the fea-tures of sandy material. The grain size dis-tribution and the degree of quartz grains mechanical abrasion of blown sands and initial sediments – kuytuns deposits was designated (OWCZINNIKOW et al., 2002).

Fig. 4 presents mean results of grain size distribution. Aeolian sands are more co-arse-grained (Mz = 0.390 mm) than kuytun material (Mz = 0.235 mm) and they are also better sorted (σ = 0.80) than kuytun sands (σ = 0.99).

Mean results of quartz grains abra-sion analyses by method of KRYGOWSKI (1964) are presented in fig. 5. It results from it that present aeolian sands in the area discussed are characterised by the lack of abrasion in the wind environment, because they contain minimal content of round gra-ins of γ type, whereas the non-abraded gra-ins of α type predominate here. Thus, these sands are very similar to the initial kuytun deposits.

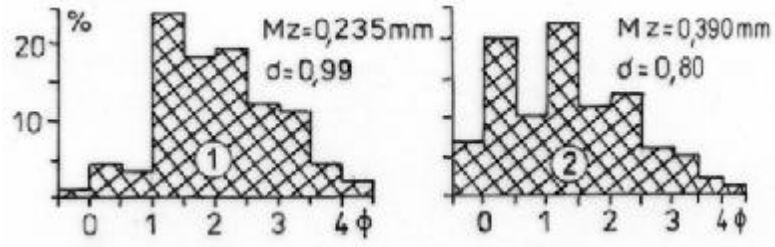

Fig. 4. Grain size distribution of sandy deposits of Barguzin Basin: 1 – kuytun deposits, 2 – presents aeolian sands

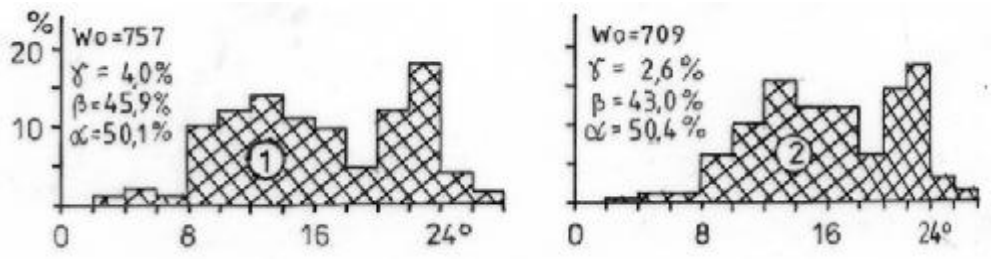

Fig. 5. Quartz grain abrasion of sandy deposits of Barguzin Basin: 1 – kuytun deposits, 2 – present aeolian sands; Wo – abrasion coefficient, γ – rounded grains, β – semirounded grains, α – angular grains

So, the results of analyses indicate that aeolian factor – in a case of analysed sediments – was recorded (omitting the formation of these landforms) only in the grain composition, causing the clear coarseness of blown sands in relation to the source material due to blowing out of dusty particles. Wind did not influence the quartz grains shape owing to decidedly so short way of transport. It rather caused a certain general worsening in this material abrasion degree in relation to the substratum as a result of morphoselection.

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Streszczenie

Współczesne procesy eoliczne w Kotlinie Barguzińskiej (Zabajkale)

Kotlina Barguzińska jest suchym stepowym obszarem, położonym na Zabajkalu (rys. 1). Panuje tu ostry klimat kontynentalny o średniej temperaturze rocznej od -3°C do -4°C, przy czym średnie temperatury lipca przekraczają 18°C, natomiast stycznia wynoszą od -24°C do -26°C. Kotlina Barguzińska leży w cieniu opadowym G. Barguzińskich, dlatego też jest to obszar bardzo suchy: średnia roczna suma opadów wynosi tu zaledwie 200–250 mm. Kotlina Barguzińska jest zapadliskiem tektonicznym, wypełnionym miąższą serią osadów różnej genezy. W plejstocenie miała tu miejsce akumulacja olbrzymich mas materiału piaszczysto-żwirowego genezy głównie fluwialnej. Powstały z tego materiału rozległe garby piaszczyste, nazywane kujtunami. Ich powierzchnia cechuje się obecnością kompleksu form genezy eolicznej. Niewykluczone, że zasadnicze eoliczne modelowanie pierwotnych osadów kujtunów miało miejsce na przełomie plejstocenu i holocenu, natomiast górna część piasków eolicznych kujtunów jest młoda, bo powstała nie wcześniej niż 3–4 tys. lat temu. Współczesne warunki anemologiczne (przewaga wiatrów z kierunku południowo-zachodniego i południowego) powo-

dują, że obecnie na powierzchni kujtunów, przynajmniej w południowej ich części, wyraźnie dominują procesy deflacji. Przyczyna wznowienia procesów eolicznych, to nadmierna hodowla bydła i owiec oraz uprawa roli.

W pracy przedstawiono dwa typowe przykłady współczesnego kształtowania się rzeź-by eolicznej na tym obszarze (rozwiewana wydma – rys. 2 oraz rozwiewana płaska powierz-chnia kujtuna – rys. 3), a także mechaniczne cechy piasków przewianych: uziarnienie (rys. 4) oraz stopień mechanicznej obróbki ziaren kwarcu (rys. 5). Wpływ czynnika eolicznego zazna-czył się tu więc – pomijając utworzenie konkretnych form – tylko w zmianie uziarnienia materiału (wzrost gruboziarnistości i polepszenie stopnia wysortowania), natomiast nie ode-grał żadnej roli w stopniu obróbki materiału (ogólny spadek stopnia obróbki ma związek z pro-cesem morfoselekcji). Wynika to z bardzo krótkiej drogi transportu materiału eolicznego.