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CRYOGENIC PROCESSES AND FORMATIONS

FLOOD-PLAIN TALIKS IN THE VALLEYS OF MEANDERING RIVERS IN NORTHEASTERN RUSSIA

V.M. Mikhailov

Northeastern Permafrost Research Station, Melnikov Permafrost Institute, SB RAS, 16, Portovaya str., Magadan, 685000, Russia; vmmikhailov@gmail.com

The research on the distribution of frozen and thawed rocks in river valleys has demonstrated that taliks occurring in the floodplains of some meandering streams are the remnants of the past, and the streams themselves are the result of transformation of braided rivers due to differentiated tectonic sinking. Freezing of a talik is caused by the decrease in the valley gradient and channel width, as both factors diminish the convective heat transfer from rivers. The rate of reduction of thawed zones has been demonstrated to be maximal in the territory with thick permafrost and a severe climate; in the region with a mild climate and sporadic permafrost discernible reductions have not been detected. Change in a river channel pattern is accompanied by degradation of flood-plain geosystems, which occurs independently of the talik dynamics. Therefore, landscape indication of remnant taliks is practically impossible to implement, though it is possible to evaluate their distribution based on geological and climatic data.

Floodplain taliks, degradation, braided rivers, meandering, transformation, active tectonics, climatic conditions

INTRODUCTION

Poplar-chosenia forest stands are a traditional indicator of floodplain taliks. The occurrence of both in braided river valleys was first noticed by *G.N. Yegorova* [*1983*]. The cause-and-effect ties among the three components of the natural systems (taliks, deciduous forest stands, and braided river channels) have been investigated in a number of papers and summarized in the monograph by [*Mikhailov, 2013*]. Using various approaches, the author has shown that floodplain taliks (to be later referred to as "taliks") are closest connected not with the traditional indicator but with braided river channels. The second most common river channel process, meandering, has been shown in the monograph to be unfavorable for talik formation for a number of reasons.

It is also stated in the monograph cited that taliks do occur in some valleys with meandering streams and small rivers, and conclusions are made that: 1) earlier these water bodies had braided channels, and thus, taliks are remnant formations from the past; 2) the changes in the types of the river channel processes are due to active tectonics. The main goal of this publication is to substantiate these assumptions. The secondary tasks are to elucidate the immediate causes of freezing of the thawed zones and their dynamics depending on the natural conditions and the possibility of indicating the taliks in the valleys of meandering rivers.

The studies were conducted in the valleys of 11 rivers. Among these, in accordance with the systematization made by *A.I. Kalabin* [*1960*], 4 are located in the first permafrost region with sporadic permafrost, 7 are located in the third permafrost region with continuous permafrost (Fig. 1). According to the above source, the extent and thickness of per-

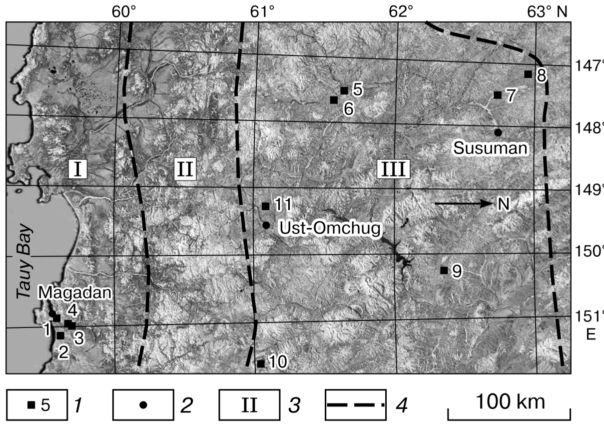

Fig. 1. Location of the studied rivers and streams (*1*) (see the text for numeration interpretation) and meteorological stations (*2*), the data of which were used in the paper;

3 – permafrost regions (I–III); *4* – their boundaries.

mafrost increase as the distance from the coast grows (from the first to the fourth region, as well as within the limits of each of them). Thus, rivers 1–4 are in the mildest geocryological situation, while the conditions for rivers 7 and 8 are close to extremes.

According to *A.I. Kalabin* [*1960*], in the first region permafrost thickness normally does not exceed 20–30 m, its temperature varies from 0 to −1.5 °C (mostly from −0.1 to −0.6 °C), with continuous taliks developing even at the northern boundary of the region at the bottoms of the river valleys and in other depressions of the terrain. In the third permafrost region, continuous taliks occur only under lakes and beds of big rivers, in the valleys and depressions permafrost thickness varies from 100 to 200 m at the temperatures from −3.0 to −5.5 °C.

It has been previously demonstrated [*Mikhailov, 2013*] that in relation to the third permafrost region the data provided need to be adjusted: through taliks are much more common, including the valleys of a number of rivers with catchment areas of only 120–150 km^2. Suprapermafrost taliks in the floodplains of many streams are formed even in the drainage areas of about 20 km^2. At the same time, the data provided in the cited work testify to the fact that in the first region permafrost may develop even in the bottoms of the valleys of relatively big rivers.

The studies were mainly conducted using electric survey methods: vertical electrical sounding (VES) and electrical profiling; the details of their application to the study of floodplain taliks are provided in the monograph [*Ibid.*]. In a number of cases, when the VES results seemed ambiguous, they were complemented by quantitative methods described in the above work. In addition, data provided in the technical reports were used [*Construction…, 2009a,b*].

MEANDERING AND BRAIDED RIVERS AND STREAMS IN NORTHEASTERN RUSSIA: DIFFERENCES AND OCCURRENCES

The main differences between the two river channels under study are provided as a complete list in [*Mollard, 1973*]. In this work, the following characteristics are cited to be the distinctive features of the braided rivers essential for this work:

– A greater longitudinal gradient of the river bed (in fact, even gradients of the river valleys differ considerably [*Romashin, 1968*]);

– A greater share of the bedload in the solid flow;

– A larger size of the alluvium grains forming the floodplain, in accordance with *A.M. Korotky* [*1983*], even at equal gradients;

– Lower resistance of the river banks to ablation, resulting in greater intensity of river channel transformations.

This list should be complemented by greater values of the ratio of the river channel width to its depth (for example, [*Chalov, 2008; Mikhailov, 2015*]).

All the above listed characteristics of braided rivers are to certain extents favorable for the formation of taliks. However, their main advantage is in the structure of the alluvium permeated by the systems of preferential flow pathways and thus having high water permeability [*Mikhailov, 2013*]. The direct cause of talik formation is intense heat and mass exchange of rivers with alluvial massifs.

It is to be emphasized that the preferential flow pathways may be formed only in a relatively thin layer of frequently eroded and redeposited alluvium because the underlying sediments are highly silted; the boundary roughly coincides with the bottoms of deep river pools [*Ibid.*].

For the purpose of this study, highly important is the presence of the cause-and-effect relation between the bedrock lithology and the river channel pattern developed by a river upon completion of the stage of vertical erosion. A special publication is dedicated to this problem [*Mikhailov, 2011*]. In it, bedrocks are subdivided into three types: the stony-blocky type, the rubbly type, and poorly lithified rocks (the first two types are named in accordance with the size of the stone fragments prevailing at the early stages of weathering). It is shown that only the rubbly type is favorable for forming braided river channels. Among common rocks, here belong clayey and sandy-clayey shales, thin-layer sandstones with non-carbonate cement, igneous rocks of felsic and, rarer, medium composition, as well as igneous-sedimentary rocks.

In the mountainous territories of the northeast of Russia, rocks of the rubbly type dominate. Analysis of the materials provided by *S.I. Pinkovsky* [*1965*], dealing with the rivers of the fifth and higher orders (according to the Horton-Strahler system), indicates that braided river channels are in general 13 times longer than the meandering ones [*Mikhailov, 2013*]. However, considering the rivers of the third and fourth orders (rivers with a smaller amount of water are already incapable of forming accumulative floodplains), this advantage becomes less evident.

The characteristics of the meandering rivers in the northeast of Russia are discussed in detail in [*Mikhailov, 2013, 2015*]. It was ascertained that in the upper reaches of the river systems they may drain basins composed of the rocks of the stony-blocky and rubbly types. In the first case, only narrow taliks connected with upwelling or downwelling of ground water occur, which corresponds quite well to the above theoretical assumptions. In the second case, floodplain taliks are also quite common. Such a combination (rocks of the rubbly type + meandering river channels + floodplain taliks) is a double anomaly. As already mentioned in the Introduction, the discrepancy may be resolved by demonstrating that in such cases meandering river channels result from transformation of braided rivers.

The differences between the examined types of river channels as applied to the specific conditions of northeastern Russia and the objectives of this study can be expressed as follows [*Mikhailov, 2015*]. Meandering streams and rivers are distinct by their narrower width. In the low-water period, they are narrower than the braided rivers having the similar water flow at least 2–3 times. The valley gradients of the meandering rivers are also less, but the difference may be small, only 1.5–2 times. The intensity of river channel transformations is much lower, which is manifested in rare occurrence of non-turf-covered surfaces and accumulation of fine-grain and organogenic material in the upper layer, which often results in development of boggy tussocks. As for the composition of the river channel-forming fractions of the alluvium, there are no significant differences, but in the case of meandering rivers and in sediment beds, and especially on beaches sand bars, pebble layers are more often overlaid by sandy and sandy-loam material.

Transverse profiles of the valleys differ significantly, too. Whereas in the case of the braided rivers and streams they follow a "classical" pattern, in which a floodplain is separated from the terraces (slopes) by distinct steps, in meandering rivers only a fragmentary low floodplain is morphologically distinct, occupying sandbars near prominent banks. Then, behind a low step (clearly flooded every spring), only a gradual and visually indistinct rise of the surface is observed up to the foot of the slopes, which are not clearly discernible, either. According to the materials of a report [*Construction..., 2009b*], in the left-side part of the valley of the Intrigan Creek (having the water catchment area of 102 km^2), the transverse gradient of the surface at the distance of up to 320 m from the stream channel varies within the range of $(0.4 \pm 0.1)°$ (Fig. 2). In order to fill the bottom of a valley, water should rise by 3 m with the flood width of 350 m. It is clear that this is impossible even in the highest spring floods (to compare: normally the width of the floodplain of a river or a stream of a similar size is 100–120 m and rarely exceeds 150 m); yet, neither a floodplain nor terraces are discernible in the entire area. Such valleys in the mountainous northeast of Russia are typical of most meandering rivers of the lower (third–fifth) orders.

Certain regularity can be observed in the distribution of the types of river channels [*Mikhailov, 2015*]. More often, braiding is replaced upstream with meandering abruptly, in the next confluence junction (only in one of the confluent streams): in all the cases examined, the second stream retains a multi-channel pattern. Gradual transition is much rarer; in such cases, in the interval between braiding and meandering, a stream forms a relatively straight

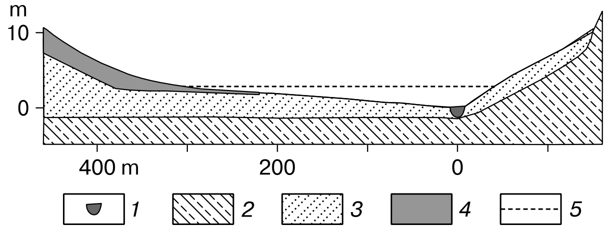

Fig. 2. Cross section of the valley of the Intrigan Creek (according to the report materials of [*Construction..., 2009b*]).

X-axis – distance from the valley bottom, thalweg, m; Y-axis – excess over the low-water level of the stream, m.
1 – stream channel (point sign); *2* – bedrocks; *3* – alluvial sediments; *4* – deluvial sediments; *5* – the level of water required for filling the floor of the valley.

unbranched channel. One of such examples (Lev. Omchug, stream 11 in Fig. 1) is described in Results and Discussion.

WAYS OF TRANSITION FROM BRAIDING TO MEANDERING AND THE ACCOMPANYING PROCESSES IN FLOODPLAINS

It follows from the previous section that transformation of a braided river channel into a meandering river channel is impossible without reduction of the longitudinal gradient of the river valley. It may be caused either by depth erosion intensifying towards the river source or by tectonic sinking of the valley bottom, also more intense in areas close to the water divide. Consider *variant one*. In the absence of ascending tectonic movements (resulting in the increase of the valley gradients), incising may be caused only by a decrease in the bedload size as a result of lowering of the water divide, flattening of slopes, and deceleration of denudation. This process is described, for example, in the work by *R.P. Tokmakov* [*1981*]. It is essential that, according to such a scenario, downward erosion should spread transgressively, as the upper reaches of rivers begin to experience deficit of alluvium earlier than the lower parts of the river (into which loose material arrives, among other sources, from the incising upper reaches).

Schematic cross sections of a river valley in transition from braiding to meandering in accordance with variant one are shown in Fig. 3. As incising continues, the river channel gradually goes down below the bottom of thw layer with preferential flow pathways and loses hydraulic connection with it. A floodplain becomes a terrace above the floodplain, convective heat exchange with the river stops, and the talik freezes (Fig. 3, *b*, *c*). As time goes, incising "...is again replaced with dynamic equilibrium, but the slope will be less steep" [*Tokmakov, 1981, p. 83*], at which not a braided river channel but a meandering one is formed (Fig. 3, *c*). It seems (in accordance with

[*Mollard, 1973*]), that the bedload composition should be shifted to the increase of the content of finer particles.

No evidence of transformation of river channels in accordance with variant one was found. Firstly, in the course of transgressive spread of downward erosion, the river channel patterns should replace each other down the river as follows: meandering (which completed incising)–incising–braiding (not yet affected by downward erosion). In reality, as noted in the preceding section, meandering and braiding river channels are most commonly contiguous with each other; if there is a transition region, a stream or a river forms a relatively straight channel with a wide floodplain, all the characteristics of which are of an interim nature. Secondly, the process of depth erosion is always accompanied by forming "young", clearly visible terraces, which are absent in the valleys studied (Fig. 2, 3).

Finally, no significant decrease in the bedload size is observed, except the above mentioned increase in the content of fine-grained material.

Variant two, in opposition to the first one, not only allows preservation of floodplain taliks, not contradicting the other facts mentioned, but is in good agreement with the current prevalence of descending movements in the northeastern mountains of Russia [*Zolotarskaya et al., 1987*]. It is also in good agreement with the modern ideas that tectonic movements may be strongly differentiated in the smallest scales [*Seminsky et al., 2008*], allowing explanation of the sharp change from braiding to meandering in the confluence junctions.

Consistent substantiation of this variant requires only one additional assumption that tectonic blocks close to water divides sink with greater (or at least equal) intensity, compared to valley bottoms. Otherwise, increased delivery of the loose material from the slopes will prevent flattening of the longitudinal valley profiles. Yet, even such an assumption can be hardly considered a genuine novation. Advanced sinking of more elevated blocks (although in another geomorphological environment) is presumed, for example, by *G.F. Ufimtsev et al.* [*2005*], and *E.N. Bylinsky* [*1962*] to account for advanced sinking of areas close to the water divide in the basin of the Pechora River.

Although in changing of the types of river channels in accordance with the pattern discussed taliks remain, the occurring changes affect their functioning at least in two ways. Reduction of the river channel width leads to reduction of the water surface area, which is the main recipient of energy (mainly of solar radiation) in the river–talik system. Decreasing of the longitudinal gradient of a valley entails proportional reduction of the heat and mass exchange of the floodplain with the river due to deceleration of the groundwater flow. Joint influence of both factors reduces the influx of heat from the river into the talik per unit water surface area (Q_{gr}) 3–5 times and more. Though in typical floodplain taliks Q_{gr} far exceeds the level required for opposing freezing [*Mikhailov, 2013*], such significant reduction can hardly have no consequences. It is likely that it should lead to reduction or even complete freezing of taliks.

Deceleration of the groundwater flow in preferential pathways is another consequence of reduction of the longitudinal gradient of a valley – theoretically it may facilitate its gradual filling with fine-grained material ("silting"), also contributing to talik freezing.

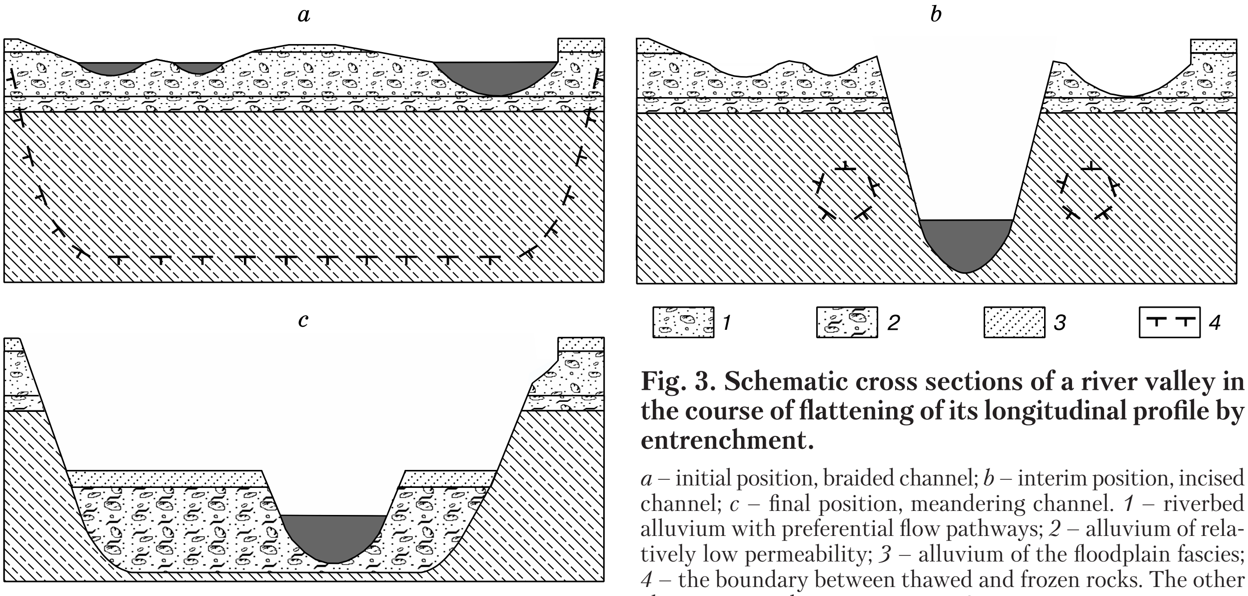

Fig. 3. Schematic cross sections of a river valley in the course of flattening of its longitudinal profile by entrenchment.

a – initial position, braided channel; *b* – interim position, incised channel; *c* – final position, meandering channel. *1* – riverbed alluvium with preferential flow pathways; *2* – alluvium of relatively low permeability; *3* – alluvium of the floodplain fascies; *4* – the boundary between thawed and frozen rocks. The other characters are the same as in Fig. 2.

RESULTS AND DISCUSSION

Brief information on the geocryological conditions for both groups of rivers, “seaside” and “continental”, located in the first and third permafrost regions, accordingly (Fig. 1), is provided in the *Introduction*. Territory-dependent variability of climatic characteristics, most affecting freezing of the taliks, is demonstrated in the table (locations of the meteorological stations are shown in Fig. 1). It can be seen from the data provided that within one region to which the continental group belongs (rivers 5–11), the climatic conditions differ relatively little and are in sharp contrast with the coast of the Sea of Okhotsk, where the other objects of investigation are concentrated. It is reasonable to start analyzing the results with the seaside group.

In the floodplains of the *Balakhapchan* (1)* and *Anmandykan* (2) Creeks, permafrost occurs down to the creek mouths, where the catchment areas are equal to 42 and 34 km^2, accordingly, despite the maximal warming impact of the sea (the distance to the coast is less than 10 km). Both basins (as opposed to the others) are composed of the rocks of the stony-blocky type. Taken together, these facts clearly confirm both concepts described above: 1) both streams developed meandering channels immediately upon completion of the entrenchment caused by mountain-forming movements; 2) therefore, floodplain taliks could not form there. The basins of all the rivers and streams described below are composed primarily (more often exclusively) of rocks of the rubbly type.

Omchik Creek (3). Detailed investigations were conducted in two areas: near the stream mouth and 4.5 km upstream. The drainage areas (F) are equal to 66 and 30 km^2, respectively. The width of the talik in the upper section is nearly 60 m, in the lower section it was not determined.

Khabla Creek (4). Investigations were conducted in three areas: near the steam mouth (F = 65 km^2), near the source (F = 17 km^2) and in an extended (over 2 km) section of the former floodplain, now devoid of the stream due to straightening of the stream channel in the course of highway construction. The talik width in the upper and middle sections is about 50 m, in the lower section it was not determined.

Lev. Itrikan Creek (5). Together with stream Prav. Itrikan Creek, it forms a pair of counterpart streams, i.e., streams equal for the physiographic and geological conditions of their basins but differing dramatically in the aspects considered. This allows evaluation of the location and the sizes of taliks in the valley of Lev. Itrikan Creek before its channel began to be transformed into a meandering one. The talik of the braided Prav. Itrikan Creek is approximately 90 m wide 5 km upstream the mouth. On the right component of this stream, Kontaktovy Creek, where similar investigations were conducted earlier [*Mikhailov, 2013*], continuous floodplain talik begins as close to the stream source as approximately 6 km, where F = 15.6 km^2, the talik width there is 35–45 m.

Table 1. **Climatic characteristics of settlements (according to data by [*Applied Science Reference Book…, 1990*])**

Meteorological station	Air temperature, °C		Snow depth, cm
	annual	mean January	
Susuman	–13.2	–38.2	34
Ust-Omchug	–11.0	–34.1	38
Magadan (Nagayev Bay)	–3.5	–17.0	63

In the floodplain of the Lev. Itrikan Creek, the first three separated taliks 40–50 m wide were found in the interval of 4–5 km from the stream mouth. Upstream, there are no floodplain taliks, while nearer to the stream mouth (where F = 67 km^2), judging by the character of the vegetation (see the details below), their sizes somewhat increase.

Having a common water divide with the Lev. Itrikan Creek, the *Intrigan Creek* (6), flows in the opposite (southward) direction. The catchment area of the stream at the mouth is 220 km^2. It has its own subparallel counterpart – the braided Omchik Creek. Detailed permafrost and hydrogeological studies were earlier conducted in the floodplains of both streams [*Construction..., 2009a,b*]. It was established that, while the second stream, having F = = 151 km^2, forms a continuous floodplain talik 200 m wide, in the second one only when $F > 100$ km^2, separated taliks occur in its floodplain. Their width here is equal to 17–35 m (including the stream channel 4–20 m wide) and their depth is less than 5 m. Upstream, there are only sub-channel taliks left. According to the results of our own investigations, even near the stream mouth the talik here and there is not wider than the stream channel.

The River *Chay-Urya* (7). Due to extensive mining works conducted in the area, the valley of this river has been exposed to essential anthropogenic impact almost all the way downstream. The information about the permafrost and hydrogeological conditions available refers to the period of the impaired thermal regime of the day surface. With the exception of the upstream region, the natural vegetation has been preserved only in a short section of the river with F = 48 km^2. There is no floodplain talik there.

Dolgy Creek (8). According to the results of electrical profiling, there is a floodplain talik 60 m wide and about 250 m long on the section where

* Hereafter the figures in brackets after the names of the rivers and streams correspond to the numbers in Fig. 1.

F = 142 km^2; upstream small local widenings of the sub-channel talik are possible (we were unable to obtain more precise data).

River *Rybnaya* (9). Investigations were conducted near the river mouth, where the catchment area is 86 km^2. There is no floodplain talik there.

Chernoozersky Creek (10). There is no floodplain talik near the stream mouth with the catchment area equal to 30 km^2.

Lev. Omchug Creek (11). This is the only investigated stream among the few (at least, in northeastern Russia) having a relatively straight unbraided channel in a valley with a wide floodplain. In the section where instrumental measurements were applied (F = 96 km^2), the continuous talik occupies the entire right part of the floodplain up to the base of the valley slope (30–40 m), on the left bank it occupies the strip 20–30 m wide; 50 m upstream the stream mouth, a low terrace above the floodplain begins, separated by a flat step. Assuming that originally the talik spread to the entire floodplain (which is typical of braided rivers and streams), we see that it has contracted by about 20 % in its width and that the degradation process has begun. This is also corroborated by the transition-type pattern of the river channel (from the braided to the meandering type), by partial preservation of the terraces and relatively coarse (the same as with braided rivers and streams) mechanical composition of the upper layer of the floodplain sediments.

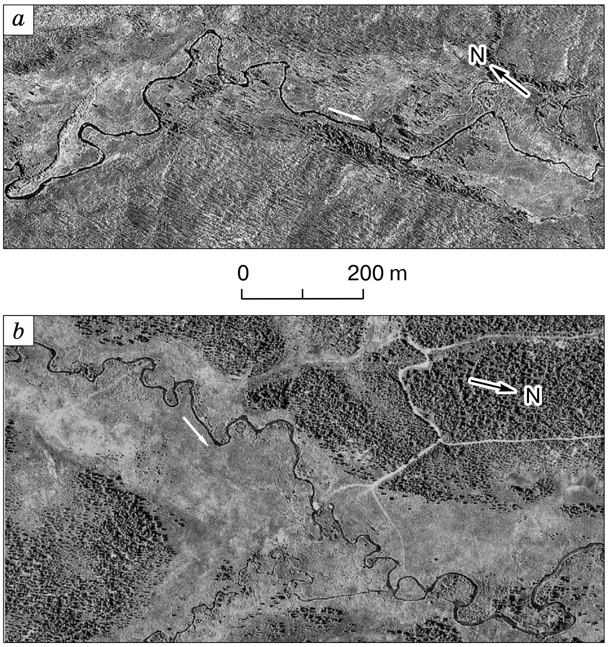

Fig. 4. Air photos (Northeastern Geodetic Survey Company) of the valleys of Omchik (*a*) and Anmandykan Creeks (*b*).

The arrows indicate the direction of movement.

The character of the soils and of the vegetation of the floodplain taliks of meandering rivers and streams varies in a wide range of values. See, for example, Lev. Itrikan (5) and Omchik Creeks (3). On the first one, thawed "islands" are accompanied by small, copses of chosenia and poplars (although consisting of well-developed trees), growing on weakly turfed sand-and-cobble-pebble substrate. On the wide talik of the Omchik Creek, shrubby plant formations occur on tussock bogs with rare groups of suppressed larch trees, outwardly similar to the most scarce vegetation cover occurring on permafrost floodplains (Fig. 4). The absence of any distinct regularity can be seen in the example of the still large talik of the Lev. Omchug Creek, where, despite the light mechanical composition of the substrate and rare occurrence of tussocks, forest stands are sparse, while poplars and chosenia occur only as single plants.

The study results confirm the theoretical assumptions that floodplain taliks in the valleys of meandering rivers are residual formations which are at different stages of degradation. The information about the sizes of thawed zones in the valley of the Intrigan Creek also agrees well with the above concept of transformation of the river channels: due to preservation of convective heat exchange with the river or stream (although gradually decreasing), thawed rocks freeze not from above but from the sides and from the bottom.

The results obtained demonstrate very strong dependence of the freezing rate of the floodplain taliks on climatic conditions. Comparison of the above data on the Lev. Itrikan and Intrigan Creeks with their counterparts shows that under severe conditions of the third permafrost region, rather large (in the past) floodplain taliks have significantly shrunk in their cross section and in their depth and have fully frozen upstream due to transformation of the river channels. It is likely that, within the entire region, where the climate varies little across the territory (see Table 1, Fig. 1), the intensity of talik degradation in the similar tectonic situation is approximately the same.

In the first permafrost region, with its milder seaside climate, there are no signs of contraction of the thawed zones. We cannot exclude that, under modern conditions, they can exist indefinitely long practically within the same boundaries as before the beginning of the unfavorable tectonic processes. The broad taliks of the Omchik and Habla Creeks are an especially characteristic example of it. In the first case, we see an extreme degree of degradation of the floodplain landscape, which seems to correspond to the maximally long period of the existence of the talik already after transformation of the river channel, i.e., under conditions of the significantly reduced heat flux Q_{gr}; in the second case (in the middle section) this value is equal to zero due to isolation of the talik from the stream.

The above characteristic of the studied geosystems, brief as it is, suggests the impossibility of landscape indication of floodplain taliks in the valleys of meandering rivers and streams, with the exception of the rare cases when poplar-chosenia copses grow on the taliks. At the same time, using geological data, we can reliably state the absence of taliks in the situations when the basins of meandering rivers and streams are composed of the rocks not belonging to the rubbly type. In other cases, we can speak about certain probability of preservation of taliks, considering the climatic conditions and the size of the river or stream. Thus, in the first permafrost region, the probability rate approaches 100 % already with the catchment area of 15–20 km^2, with taliks extending downstream as a continuous wide band. In the third permafrost region, it is only when $F > 50$ km^2 that occurrence of small separated thawed "islands" become possible; continuous floodplain taliks were not discovered even when $F > 200$ km^2. Such an approach may be useful for territorial (for example, catchment-based) evaluations of the ground water runoff and of the scope of interaction between surface and underground waters.

Due to a very strong impact of the climatic conditions on the intensity of talik freezing, the role of silting of the preferential flow pathways in this process remains unclear. Judging by prolonged preservation of the talik on the floodplain of the Omchik Creek, silting, per se, is hardly capable of limiting the inflow of heat from the rivers and streams.

CONCLUSIONS

1. It has been established as a result of the studies conducted that floodplain taliks occurring in some valleys of meandering rivers and streams of highlands (orders three–five) are the relics of the previous development period, when these rivers and streams had braided channels.

2. The multi-aspect analysis of the data obtained suggests that transformation of the channels of rivers of streams is caused by local tectonic sinking with advance descents of water divides, the conclusion exceeding the limits of geocryology.

3. Comparison of the results obtained with previously revealed regularities indicates that freezing of taliks is caused by reduction in the convective heat exchange with the rivers and streams due to decrease in both the channel widths and the longitudinal gradients of the valleys, both factors being the inevitable effect of replacement of braiding by meandering). The role of deterioration of the filtration properties of alluvium, if at all, is secondary.

4. It has been revealed that the intensity of talik freezing much depends on the climatic and permafrost conditions, and in the seaside region with sporadic permafrost it is quite low and even close to zero. In the severe climate of the third permafrost region, floodplain taliks of meandering rivers and streams are fragmentary even in the fifth-order valleys.

5. The great variety of the soil and vegetation cover of the taliks considered practically excludes the possibility of their landscape indication. Yet, based on the regularities found, it is possible to make probability estimations in relation to concrete territories.

6. The absence of taliks in the floodplains of meandering rivers and streams, irrespective of climatic or permafrost conditions, may be inferred from the inferior position of the rubbly-type rocks in the river basins.

7. In the territories with prevailing occurrence of the rocks of the rubbly type, one can make conclusions regarding probability of talik preservation considering the climatic conditions and the river/stream size and, consequently, obtain the estimates of their abundance within the boundaries of these territories.

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