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Nature that is thawing before our eyes: the diary of the second International Aktru Summer School in the Altai Mountains

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In the summer of 2013, the Tomsk National Research State University became a meeting place for young and eminent scholars at a summer school devoted to the problems of climate change. For a second time, the international research and educational school 'Natural environment of Arctic and Alpine areas: relief, soils, permafrost, glaciers and biota as indicators of climatic changes' was held in the Aktru valley, at the university research station, a member of the international SCANNET/INTERACT.

More than 40 participants – students and scholars from Russia, Poland, the Netherlands, Mongolia, the USA and Australia – took part in the school. The experts were leading specialists in the fields of archaeology, social anthropology, hydrology, glaciology, botany, zoology and other related spheres; Nobel prize winner, Professor Terry Callaghan among them.

The plenary meeting with reports by leading Russian and foreign researchers took place in Tomsk, a small university town in the south of Western Siberia on July 4–5. On July 6 the bus with school participants left for the 'Aktru' Alpine station. The expedition schedule was very rich, and the weather made a surprise for us. Although the school was held in July we saw a lot of snow in the environs of the Aktru ravine and along the Severo-Tchuisky ridge. In July 2011 during the first International Summer School, the scene was completely different. Now, the climate change issues were stated in the environment before our very eyes.

The experts from Tomsk who visited the Aktru valley, and who knew the area for several decades, said that they had not seen so much snow in the mountains in the mid summer for a long time. The conditions in the region in July 2013 were those of nature in late spring, not summer. The glacier tongue along which in July 2011 the participants of the summer school had climbed to the Goluboye Lake located at a height of 2800 m above sea level now turned out to be forbidding: it was covered with snow hiding ice traps. The lake in July 2013 was practically covered with ice; whereas 2 years earlier there had been neither ice nor snow near the lake at that time. Many couloirs of the mountain peaks surrounding the Aktru valley remained impassable because of snowdrifts. But, a great amount of snow does not indicate positive dynamics: glaciers continue retreating. The Maliy Aktru glacier, a regular visiting point for the TSU station and a mountaineering camp located nearby, darkened and became smaller in size as compared to the year 2011 (figure 1).

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Figure 1. The Maliy Actru Glacier, the Goluboye Lake, and the plateau Uchitel.

Figure 2. The petroglyphs of the Kyzyl-Chin.

TSU scholars have been doing regular research in the Aktru valley glaciers since 1952. For more than 50-year observation period summer air temperature has increased on average by 0.2 °C per decade. And the process of warming has been accelerating since 1985 everywhere in the Altai Mountains. The researches show that the rate of retreat has increased in recent years. The published data [1] indicate that during the period from 1999 to 2008 annual retreat rate of the Maliy Aktru increased from 5.4 to 16.1 m per year. There are no precise data concerning the glacier's retreat for the last 2–3 years, but it can be seen that its square and volume of ice have decreased considerably.

Moreover, the glacier proper has changed. It used to have a salient shape, which made it possible for water and stones to roll to the mountain slope; now its central part has sunk and the streams flowing down the glacier are washing out the depression. Water brings great changes into the valley landscape. There are now numerous landslides and water inrushes as a result. In 2012 in the neighbouring valley Maashey, the discharge of a large lake of glacier origin took place, caused by moraine failure. And not far from a mountaineering camp near Aktru, a large waterfall emerged.

The expedition schedule was very rich. The first day at the station was devoted to presentations of the researches conducted by young researchers, participating in the school. The researches belong to different spheres – from studying soils in various world regions to radiation features in the Aktru region. The participants were given a serious test, a little mountaineering – they climbed to the plateau Uchitel (3000 m over sea level), where one could find a small glacier not long ago – in 2008 its area was 0.04 km^2. In July 2013 the plateau was covered with snow, but there was not a glacier.

All these changes in the Aktru valley need monitoring. A weather station of Tomsk State University used to work here, and now it is planned to install new equipment that will be able to record information about environmental conditions and to transmit it on line. This region is a unique place popular among both researchers and tourists, which means that it is necessary not only to observe nature and improve the infrastructure but also continue attempts to give the territory a special conservation status. The issue was discussed during the first and second summer schools at Aktru.

After some days at Aktru station the programme of the excursion continued in different natural conditions. Summer school participants went to the steppe near the border with

Mongolia, a dry valley of a small river, the Kyzyl-Chin. In its surroundings students from Tomsk State University – geologists, geographers and archaeologists – have their field practice every year. Scientists and ecotourists are interested in the exceptionally colourful landscape: rocks here are red, yellow and brown. These colours are caused by exposure of the trace elements in the rocks. The territory is also famous for its archaeological and ethnographical findings. You can come across rocks with petroglyphs, revealing the life of ancient people who used to live in the Gornyi Altai (figure 2). There are many burial mounds in the neighbouring steppe giving evidence of the warlike character of the people living in this region in the VI–XIXth century presumably. The remains of one of the burial mounds were near the Summer school camp, and a workshop on finding and copying of the Bronze Age petroglyphs was exciting.

The experience of organizing an international summer school has shown that Gornyi Altai is a territory offering a great amount of possibilities for a researcher and a traveller. It is of great interest for the world community. Tomsk State University was the first to investigate the region at the beginning of the previous century, and remains aware of its responsibility for comprehensive studying and conserving these unique natural regions.

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Reference

[1] Narozhniy, Yu. and Zemtsov, V., 2011, Current state of the Altai Glaciers (Russia) and trends over the period of instrumental observations 1952–2008. *AMBIO*, **40**(6), 575–588.