Field reconnaissance in Pamir, Fedchenko Glacier (Tajikistan)

Field report

2006

Arzhan B. Surazakov

PhD student

University of Idaho, Moscow, USA

sura7359@uidaho.edu

Alexey Lushnikov

PhD student

Tomsk State University, Tomsk, Russia

santvp@mail.tsu.ru

Dr. Vladimir B. Aizen
Supervisor
University of Idaho, Moscow, USA
aizen@uidaho.edu

Contents

1. Introduction

In accordance with the Central Asia Deep Ice-coring Program (CADIP http://www.sci.uidaho.edu/cae/cadip/index.html), second reconnaissance trip to the Fedchenko Glacier (Pamir) has been completed in July-August 2006 by the University of Idaho (USA) and Tomsk State University (Russia) joint team.

During the first trip in 2005 (July-August), the University of Idaho and University of Maine team (Vladimir Aizen, Arzhan Surazakov, Daniel Joswiak, Susan Kaspari and Bjorn Grigholm) determined two perspective ice-coring sites at elevation 5206 m and 5365 m at the head of the Fedchenko Glacier snow accumulation area. Two firn cores (9 m and 12 m) were recovered at these sites using "Felix" electromechanical and "PICO" hand drills. One Automatic Weather Station (AWS) "Grant Instruments" (Cambridge Ltd) has been installed on the rock knob (5420 m) 55 m above the 5365 m proposing drilling site for year around meteorological measurements: *every 15 minutes air temperature, humidity, wind speed, wind direction, atmospheric pressure, solar radiance duration, short and long wave radiation.* Two snow pits were dug out in each drilling site to determine snow-firn physical stratigraphy and an annual accumulation. Ten GPS coordinated wooden stakes 3 m high each were installed at the accumulation area to measure ice-flow velocity and annual accumulation rate. The surface topography of the Fedchenko Gl. snow/firn plateau (10x5 km) was measured by GPS and coordinated to the benchmarks on the rock surface (Fig. 6). The results of 2005 Pamir reconnaissance presented in manuscript that will be submitted to the Journal of Glaciology after review [*Aizen, V.B., P.A. Mayewski, E.M. Aizen, S. Kaspari, D.Joswiak, Sneed, S., A. Surazakov, B. Grigholm*. Stable isotope and chemical time series from the Pamir (Fedchenko Glacier firn core)]

Below, we present the 2006 reconnaissance field report. The Pamir 2006 field trip was funded by six CADIP institutions [Institute for Humanity and Nature (Japan), University of Heidelberg and Bavarian Academy of Sciences (Germany), Paul Scherrer Institut, Labor fur Radio- und Umweltchemie (Switzerland), University of Maine and University of Idaho (USA).

2. Objectives of 2006 field reconnaissance

- Download annual meteorological records from the AWS and generate AWS program for the next year of observations,
- Conduct GPS survey over 10 wooden stakes to determine ice-flow velocity and annual accumulation rate,
- Dig snow-firn pit at the proposed drilling site to the depth of annual accumulation (2005/2006), determine snow-firn density, snow-firn physical stratigraphy, and collect snow-firn samples for stable isotope and geochemical analyses,
- Check a possibility of passage through the Abdukagor saddle to the head of the Fedchenko Glacier.

The remoteness of the drilling site on the Fedchenko Glacier from the villages and road, the complexity of hiking through the deep canyons over the glaciers crossed with crevasses, and ascending to high elevated saddles required mobile team to be effective in alpine environment.

Arzhan Surazakov, a graduate student from the University of Idaho and Aleksey Lushnikov, a graduate student from the Tomsk State University (alpine rescue team professional) were two members of this trip. The local consulting and scientific support was provided by Dr. Aleksander Finaev, the Institute of Water Problems, Hydro-Energy and Ecology, of the Tajik Academy of Science. The local logistics and organization of this trip was conducted by "Alp-Navruz" Mountaineering Co., Dushanbe, Tajikistan.

Fig. 1. Tajikistan administration map (source – UN Department of Peacekeeping Operations, Cartographic Section).

3. Route to the Fedchenko Glacier drilling site

Overview of Tajikistan is presented on the Fig. 1.

We arrived to Dushanbe on July 14. Due to delay with OVIR registration in Dushanbe (mandatory registration for foreigners in the Police Department) we flew to Khorugh only on the 18 of July. From Khorugh we drove to Vanch and further up the Vanch river valley to the last village of Poi-Mazor (about 230 km).

Then, we hiked 5 days from the Poi-Mazor to the Fedchenko Glacier drilling site (Fig. 2). with heavy backpacks (40 kg each). When we approached to the Abdukagor Glacier we were forced to split our heavy loaded backpacks and left some food and gas in camp 2 moving other stuff to camp 4, then we returned back to the camp 2 and brought up to the camp 4 the rest of our gears and food. The most difficult part of the route to the Abdukagor Glacier saddle was between elevation of 5000 m and 5300 m, where we spent a lot of time searching a way through the glacier crevasses (Fig. 3). Finally, the way from Abdukagor saddle down to the Fedchenko Glacier and up to the drilling site at 5200 m, the place where we had our base camp in 2005 was more secure. The snow was frozen at night and early morning and we reached our destination point in one day.

We completed the scientific program on the Fedchenko Glacier in three days. The weather was sunny, windless, and without precipitation. However, it took us four days to return from the Fedchenko Glacier to Poi-Mazor because the weather worsened when we started hiking back. We had heavy snowfall during the last two days.

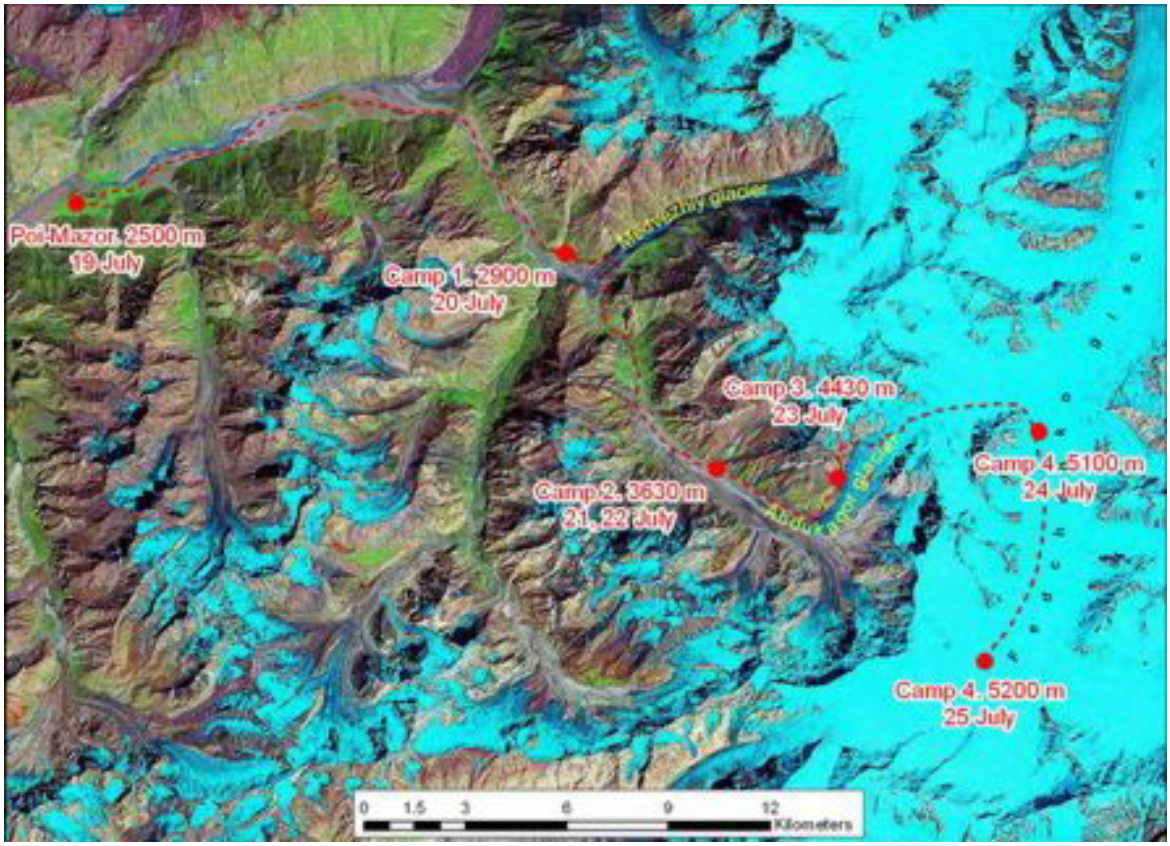

Fig. 2. The route from Poi-Mazor to the Fedchenko Glacier drilling site

Fig. 3. Crossing crevasses on the Abdukagor Glacier

4. Field observations and sampling

A 3 m snow pit has been dug at the same location (5206 m) as the second shallow ice core that was recovered in 2005. Snow samples were collected every 5 cm along with snow density measurements and snow stratigraphy description (Fig. 4).

The AWS was in good overall condition; however, the solar panel was broken and the electric cable was disrooted at the place of attachment to the solar panel. A possible reason for this is strong winter winds that pushed against the solar panel and damaged the main AWS mast at the place of the solar panel attachment (Fig. 5). Because of the failure of the external power source, the AWS data logger worked only through the February of 2006. Unfortunately, we were not able to fix solar battery to be confident that AWS will be supplied with solar power and, therefore, we decided to suspend station for the next year, or whenever we will come here again with new solar battery, the stand, and the mast. The recorded meteorological data will be distributed among the CADIP

Fig. 4. Collecting snow samples in snow pit.

member after initial processing at the University of Idaho web site (http://www.sci.uidaho.edu/cae/index.html).

.

Fig. 5. AWS on the Fedchenko glacier. The right photo shows damage on the AWS mast causes by strong wind that broke down the solar panel and disrooted the electric supply cable.

The coordinates of the glacier speed stakes established during the 2005 field work were measured with Differential GPS (DGPS) Promark 2 system. The shift of the stakes were estimated against a permanent benchmark established in 2005 near the AWS on stable rock base and measurements of the stakes' positions in 2005. However, only three wooden stakes from 10 were recovered in this trip. The other seven stakes were buried under the snow or broken (Fig. 6). The glacier surface velocity determined by three stakes (Fig. 6) with GPS measurements is 16 m/year ±3 m in this relatively flat area, 800 m west from the proposing drilling site.

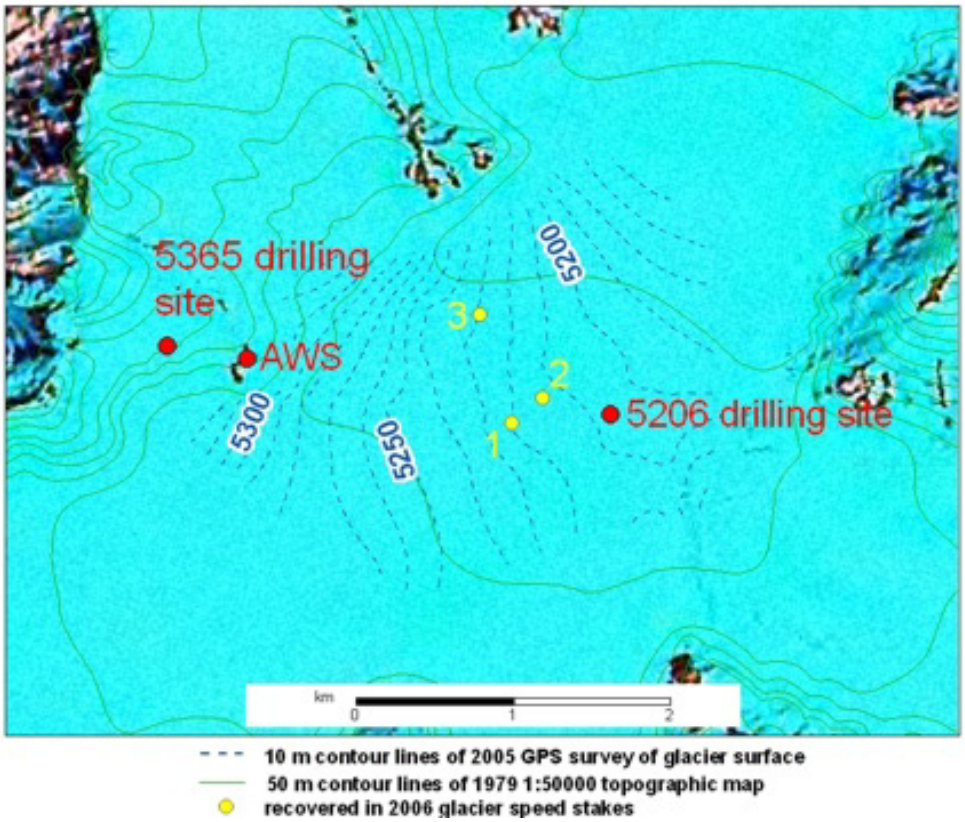

Fig. 6. Accumulation plateau at the head of Fedchenko glacier. The wooden stakes recovered in 2006, the glacier surface contour lines of 2005 GPS survey, and locations of 2005 drilling sites (2000, Landsat).

Table 1. Snow stratigraphy from snow pit dug at elevation of 5206 m a.s.l. to the depth of annual accumulation 2005/2006

Depth, cm	**Description**
0	radiation crust
0-40	soft medium grained snow
40	thin ice layer
40-56	soft medium grained snow
56-58	ice layer
58-62	medium grained snow
62-62.5	thin ice layer
62.5-100	medium grained snow
100-101	ice layer
101-109	medium grained snow
109-110	ice layer
110-114	medium grained snow
114	thin ice layer
114-119	medium grained snow
119-120	ice layer

120-129	medium grained snow
129	thin ice layer
129-156	medium grained snow
156-156.5	ice layer
156.5-160	coarse grained snow
160-162	medium grained snow
162-163	ice layer
163-180	medium grained snow
180-181.5	ice layer
181.5-198	medium grained snow
198	thin ice layer
198-200	medium grained snow
200-202	ice layer
202-203	medium grained snow
203-204	ice layer
204-211	medium grained snow
211-211.5	ice layer
211.5-227	coarse grained snow
227-228	medium grained snow
228-233	coarse grained snow
233-235	ice layer
235-253	medium grained snow
253-254	ice layer
254-258	coarse grained snow
258-259	ice layer
259-263	coarse grained snow
263	thin ice layer
263-265	coarse grained snow
265	thin ice layer
265-269	coarse grained snow
269	thin ice layer
269-275	coarse grained snow
275-276	ice layer
276-280	medium grained snow
280	thin ice layer
280-294	medium grained snow
294-300	ice layer

Table 2. Snow density.

Depth, cm	Density, g/cm^3
0-15	0.30
15-30	0.35
30-45	0.52
45-56	0.55
56-58	0.89
58-75	0.58

75-90	0.55
90-100	0.54
100-101	0.89
101-115	0.46
115-119	0.50
119-120	0.89
120-130	0.50
130-145	0.55
145-162	0.53
162-163	0.89
163-175	0.54
175-190	0.56
190-200	0.52
200-202	0.89
202-203	0.52
203-204	0.89
204-215	0.52
215-227	0.47
227-228	0.89
228-233	0.59
233-235	0.89
235-245	0.59
245-253	0.45
253-254	0.89
254-258	0.45
258-259	0.89
259-275	0.45
275-276	0.89
276-290	0.41
290-300	0.32

NOTE: Snow density and snow stratigraphy were measured from surface to bottom (0 cm to 300 cm), but snow samples were collected from bottom to top and the vials were labeled by distance in cm from bottom to top.

Twenty seven scientific papers about the Fedchenko glaciological investigations in 1930-1970th and monthly meteorological data from several Pamir high elevation stations were copied from the Tajik Academy of Sciences Library during this trip. The papers are published in Russian and meteorological data will be available for CADIP community at the Univercity of Idaho web site (http://www.sci.uidaho.edu/cae/index.html) after translation to English and re-typing to electronic format.

4. Acknowledgements

We sincerely thank Paul Mayewski, Masayoshi Nakawo and Jumpei Kubota, Michael Krachler, Margit Schwikowski, and Ludwig Braun for their financial support on organization of this field trip. We thank Aleksei Lushnikov for his highly professional work during the very strenuous trip.

Aleksander Finaev, who provided invaluable help and data in the organization of the expedition. We are grateful to Mrs.Rano Sabirova the Director of the "Alp-Navruz" Mountaineering Co. for logistics support. We also would like to send our heartfelt thanks to hospitable Tajik people in Vanch valley who gave us shelter on the way from Wanch to Poi-Mazor and kindly advised us in our trip to the Fedchenko Glacier.

Appendix A. Financial report

Funds

1	Michael Krachler	$1,976
2	Masayoshi Nakawo	$1,500
3	Margit Schwikowski	$1,500
4	Paul Mayewski	$1,200
5	Ludwig Braun	$975
6	Vladimir Aizen	$500
	Total:	**$7,651**

Expenses

7	Gasoline (Moscow (US) - Spokane Airport - Moscow (US)	180 mi (Arzhan Surazakov)	$0.445/mi	$80.10
8	Air tickets Spokane - New York - Spokane	Arzhan Surazakov		$507.19
9	Air tickets New York - Moscow - New York	Arzhan Surazakov		$1,204.94
10	Air tickets Novosibirsk – Dushanbe	Arzhan Surazakov		$193.91
11	Excess luggage fee Novosibirsk – Dushanbe	Arzhan Surazakov		$51.00
12	Air tickets Dushanbe – Moscow	Arzhan Surazakov		$394.17
13	Excess luggage Dushanbe – Moscow	Arzhan Surazakov		$79.20
14	Air tickets Novosibirsk - Dushanbe – Novosibirsk	Alexey Lushnikov		$431.99
15	Gasoline (Tomsk - Novosibirsk - Tomsk) 460 km	Alexey Lushnikov		$70.00
16	Per diem in Dushanbe	8 days x $30 x 2 persons + 1 day x $30 x 1 person		$510.00
17	Food in field	12 days x $20 x 2 persons		$480.00
18	Hotel "Avesta" in Dushanbe	3 days x $70		$210.00
19	Hotel "Alp-Mashkov" in Dushanbe	6 days x $30		$180.00
20	Western Union money transfer from US to Tajikistan			$125.00
21	Transfer from airport to hotel (Dushanbe)			$10.00
22	Car rental	$20 x 1 day		$20.00
23	OVIR registration	$30 x 2 persons		$60.00
24	Fee for work at the borderland in Tajikistan (GBO)	$50 x 2 persons		$100.00
25	Mountaineering gear rental			$100.00
26	High-altitude permits	$100 x 2 persons		$200.00
27	Ecology fee (Pamir, GBO)	$1 x 2 persons x 12 days		$24.00
28	Gas	$10 x 8 cans		$80.00
29	Air tickets Dushanbe - Khorog	$70.60 x 2 persons		$141.20
30	Khorog - Poi-Mazor (GBO) - car rental	approx. 230km x 2 (both	$0.4/km	$200.00

		ways)		
31	Poi-Mazor - Dushanbe - car rental	approx. 630km x 2 (both ways)	$0.4/km	$500.00
32	Overweight fee Dushanbe - Khorog			$21.00
33	Local transportation in Pamir (Poi-Mazor - Medveziy glacier)			$70.00
34	Snow samples shipping to US by DHL			$78.20
35	Premium to Guide (Aleksey Lushnikov)	23 days x $30		$690.00
36	Premium to consultant (Dr. Alexsander Finaev)			$500.00
37	Batteries for equipment			$122.78
38	First Aid kit			$38.00
39	2 Motorola radios (rental)			$39.95
40	Taxi in Moscow (Russia)			$60.15
41	Mountaineering rope			$83.08
			Total:	**$7,655.86**