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Dyatlov_Master_III.mp3

DATE

October 22, 2021

DURATION

19m 1s

4 SPEAKERS

Jennifer Khakshouri

Alexander Puzrin

Johan Gaume

American guest

START OF TRANSCRIPT

[00:00:05] Jennifer Khakshouri

Once upon a time.... Fairy tales and stories begin like this, from Cinderella to The Brothers Karamazov. And, in a sense, so do true tales in the news. Stories with dramatic twists and sometimes happy ends. In this episode of the ETH Podcast, we will tell you a story without a happy end. One of the many epilogues to the story originates from two scientists in Switzerland. My name is Jennifer Khakshouri. I'm glad you're joining us. It all began a bit more than 60 years ago in the winter of 1959 in a very remote, snowy region of Soviet Russia.

[00:01:05] Alexander Puzrin

A group of students and recent graduates of the Ural Polytechnic Institute went on an expedition to Dead Mountain. They were supposed to be away for 12 days, and they didn't come back.

[00:01:20] Jennifer Khakshouri

This is Alexander Puzrin. He's a professor and a Chair of Geotechnical Engineering at ETH.

[00:01:27] Alexander Puzrin

Originally, they were 10 of them. One of the group members had to return because of a pain in his leg. The nine others continued and did not return on time. Their relatives got worried. Some rescue expeditions were organised, and three-and-a-half weeks after the incident they were found.

[00:01:52] Jennifer Khakshouri

None of them was alive.

[00:01:55] Alexander Puzrin

Their tent was destroyed. There were no bodies near the tent. The closest body was 800 metres away. There were also bodies 1.5 kilometres away in the forest, downhill from the tent. The bodies were found in a very weird state. Some of them were half-naked. They had pretty nasty wounds. This was a mystery which has been haunting Russia for the past 60 years.

[00:02:28] Jennifer Khakshouri

The mysterious circumstances and the tragic death of the young hikers became a big story known as the Dyatlov Pass incident. Alexander was born and raised in Moscow, where his academic journey began. He has studied and taught at universities in several places, including Haifa, London, Oxford, Tokyo and Atlanta. He has been at ETH since 2004. Did Alexander know about the Dyatlov incident back then as a child or young man in Moscow?

[00:02:59] Alexander Puzrin

We didn't know much about it when I grew up in Soviet Russia because the files from the investigation were secret. The criminal investigation lasted three months and was closed because they did not find any criminal intent. The conclusion was that it had been a "compelling force of nature" that had killed them. But for some reason after that, the files were made secret. Of course, after Soviet times, the case became better known. And, at a certain stage, even the files were opened, and there was a page about it in Wikipedia, which I came across one day and was fascinated by it of course.

[00:03:41] Jennifer Khakshouri

This was about 10 years ago. Meanwhile, Alexander Puzrin's name shows up on this exact Wikipedia page about the Dyatlov incident. From being fascinated by a story and all its legends, how did Alexander get involved? It was Johan Gaume who approached Alexander.

[00:04:01] Johan Gaume

I am a professor at EPFL, the Swiss Federal Institute of Technology in Lausanne, and I am the Head of the Snow and Avalanche Simulation Laboratory, which is called SLAB. We are interested in particular in snow and avalanche mechanics.

[00:04:15] Jennifer Khakshouri

Johan has spent much of his time on snow. He used to be a snowboard professional.

[00:04:19] Johan Gaume

I'm a big fan of the mountains. I'm a mountain practitioner. I do a lot of snowboarding, and it's really this passion for the mountains that got me into this field of research.

[00:04:29] Alexander Puzrin

Well, my expertise lies in geotechnical engineering and natural hazards. By natural hazards, I mean, earthquakes, landslides, tsunamis. And, in particular, I am interested in phenomena which are delayed in time when you have a trigger but where the event itself takes place some time later – like a ticking time bomb.

[00:04:54] Jennifer Khakshouri

The mountains, snow and natural hazards link us to the Dyatlov incident. We'll hear more about it in a bit. First, a phone call from the U.S. brought the Dyatlov story to Johan's attention.

[00:05:07] Johan Gaume

It was in 2019 when the Prosecutor General of Russia reopened the case upon the request of the families. And at that time it created quite a big mediatic buzz, and the New York Times wrote an article about it. They wanted to have my opinion about the hypothesis of a slab avalanche to explain the case, which was already the hypothesis of the Prosecutor General.

[00:05:31] Jennifer Khakshouri

The slab avalanche hypothesis was discussed a lot because there weren't any traces of any kind, which is unusual. And, in addition, the slope of the students' tent didn't seem steep enough.

[00:05:42] Johan Gaume

And so when they called me, I had never heard about the Dyatlov case. So I asked them to call me back a few days later. I started to read a lot of the documentation and I really got into it. And when they called me back, not only did I tell them that I really believed that a slab avalanche could be the plausible explanation for the case, but I also told them that I would not stop there. I told them that I wanted to go deeper into the case from a scientific point of view. That's actually when I contacted Alexander Puzrin from ETH to work together with me on this case.

[00:06:13] Jennifer Khakshouri

So a phone call and an email marked the beginning of the collaboration or, in a sense, part two of the Dyatlov story – at least for the geotechnical engineer Alexander and the avalanche expert Johan. How did they actually collaborate?

[00:06:27] Johan Gaume

We were working on different types of models. He was working on the theoretical aspects, and I was working on the numerical aspects to simulate the avalanche's impact on the bodies. And, you know, we are both, I think, perfectionists. So it took us quite a long time to end up with models that were satisfactory for both of us, because we wanted to have not only a physically based model, but also something quite elegant. And so we were going back and forth, you know, questioning our own assumptions until we were both happy with what we had to propose. And that's when we submitted our paper.

[00:07:03] Jennifer Khakshouri

Alexander and Johan wanted to solve the question of what had caused the death of these young students. Since the accident, a bit more than 60 years ago, there have been various attempts to explain it. Tales of Soviet military experiments, conspiracy theories and Yetis, as well as extraterrestrials. But Alexander and Johan didn't want to prove one or another story false or true. They had something else in mind.

[00:07:32] Alexander Puzrin

I will be honest with you. Not because of the mystery, but because all of a sudden we realised that there was an interesting mechanical problem hiding behind this whole story. Because this avalanche was not your usual avalanche, and we were curious whether we could explain it using modern mechanical and mathematical tools.

[00:07:53] Jennifer Khakshouri

According to Alexander, and as Johan mentioned before, the idea wasn't new, but the methods are. But back to when the incident happened and the young people were found far from the tent. According to the scientists, the young people seem to have had a horrible night.

[00:08:12] Alexander Puzrin

Something forced them to leave the tent in the middle of a night with very strong winds and a very low temperature of minus 24 degrees. And to survive without clothes was not possible. So the reason they were so far away is probably that they tried to escape. They went down to the forest where they could hide.

[00:08:31] Jennifer Khakshouri

What forced them to leave? The two scientists assume it was a small avalanche that all of a sudden slid into the tent.

[00:08:39] Alexander Puzrin

But what was special about this avalanche? Actually four things. The first was that the slope which collapsed where this slab avalanche took place was pretty mild. It was about 23 degrees on the surface. The rule of thumb is that an avalanche takes place when your slope is steeper than 30 degrees. This is not entirely true, but nevertheless... Secondly, there were no obvious traces of the snow avalanche when rescuers came. Of course, we have to say they were not looking for the traces of this snow avalanche, right? But there wasn't anything that just popped out to them. One of the biggest mysteries was this delay, because the autopsy established that death took place in the morning or in the early hours of the morning. So you can calculate and realise that they left the tent during the night and froze. But normally, to cause an avalanche, all you need to do is to cut into the slope. And that's what they did in order to put up the tent. So how come it took seven to 13 hours for the avalanche to take place? This delay is a big mystery. And, finally – the injuries – these injuries were absolutely not typical for avalanche victims.

[00:10:09] Jennifer Khakshouri

Can you tell us what are typical injuries for avalanche victims?

[00:10:12] Alexander Puzrin

The typical one is a lack of air – asphyxiation. That's how people die. And here, at least two victims had many broken ribs. One had a broken skull. And then, of course, there were even more mysterious injuries like missing eyes and a missing tongue. This, of course, can in no way relate to the avalanche. This probably happened later with wild animals. But even with those ribs, this was also something that we had to consider. So these four main counterarguments had to be investigated.

[00:10:55] Jennifer Khakshouri

The four points again. One, the slope was not steep enough for an avalanche. Two, there were no traces of an avalanche when the rescue team arrived. Three, the avalanche should have started immediately after they cut into the slope to put up the tent. And, four, the injuries didn't look like they had been caused by a regular avalanche. Alexander and Johan disproved all these points, published their results in a paper and attracted attention.

[00:11:25] Johan Gaume

Of course, people are impressed by the equations and all these things in the paper. But that's not really what the general public is looking for. They are mostly looking at the assumptions that we are making. And one assumption that we make is that the slope angle above the tent is steeper than the average slope angle here. And it is still hard to convince people about this. Even if we have data, even if we have pictures, it's really hard to convince them. And actually I would like to mention that a colleague of ours went to the Dyatlov Pass twice with a drone to finally close this debate about the slope angle and measure it based on drone photogrammetry images. And so we have the data. Now we are currently processing it. This will be part of a big documentary that will be out next year. And I'm really excited about it as well. And also about the impact of a potential avalanche on the bodies. It was hard for people to think that such a small avalanche could lead to these injuries.

[00:12:25] Jennifer Khakshouri

OK, I get it. A slab avalanche, a small one causing great harm, but with no traces of what is commonly understood by an avalanche.

[00:12:34] Johan Gaume

As a mountain practitioner, I know that a big and hard snow block can lead to some serious injuries; but we have to prove it. So that's why we did these numerical simulations. And I think our paper convinced many, many people. But there are still parts of the population who really invested a lot in this case. They will never trust a natural cause for that. They want to believe in a technogenic cause such as, I don't know, a nuclear test. You know, radioactivity was found on some of the people's clothes. But there are very simple explanations for the numerous weird things in the Dyatlov incident. That's why it became the Dyatlov mystery. When you look at an individual piece of evidence, you realise that it's really mysterious when you put all these things together. But when you take them one by one, it's easy to find a simple explanation for all these things.

[00:13:26] Jennifer Khakshouri

Alexander is the one in charge of the delay in hazards, Johan of the simulation. He got inspired by Frozen, a Disney movie.

[00:13:37] Johan Gaume

When you look at the snow in the Disney movie Frozen, you're amazed by how realistic it looks. And that's because they use this particular method. They use a physically based method to make the snow look good in the movie. And this inspired me. I went to Los Angeles to collaborate with a mathematician who actually consulted on the Disney movie Frozen. But I want to mention that the model that we developed is not the Disney model. It's a different one which is based on critical stage soil mechanics, which has been validated based on experiments. So, yes, there is an inspiration. I'm also a big Disney fan, and I like to acknowledge this inspiration. But the model is different from the model used by Disney, which is called Matterhorn - for the anecdote.

[00:14:23] American guest

With a film such as Frozen, the story would have been impossible to tell without compelling and believable looking snow. But how do you animate all that snow? Do you animate each snowflake individually over and over again until you've created convincing-looking snowfall? Because there are so many, artists now harness the strength of the computer to create snow using real world physics. Computer algorithms take away the tedious work and allow artists to focus on the creative work. This is all known as simulation.

[00:14:57] Jennifer Khakshouri

Speaking about films, a Russian series came out last year called Dead Mountain, the Dyatlov Pass incident.

[00:15:05] Alexander Puzrin

[00:15:17] Jennifer Khakshouri

So far, it only exists in Russian, and Alexander watched the series.

[00:15:22] Alexander Puzrin

I was really curious to see, you know, what they took. Of course, it's fiction. But there were a few things that really surprised me. I'm not actually a big fan of Russian-produced series. HBO and Netflix are very difficult to beat. But this one was very special. I have to say this was probably one of the best series produced in Russia. And this is not just my opinion. I think very reputable critics ranked it as number one in 2020. The part which actually describes the Dyatlov expedition has been done very carefully. It's even filmed in black and white. And they even managed to reproduce all the photos. So in some of the episodes you really see people group themselves in the stills that we got, and they very carefully went through all the different hypotheses. And in the last episode, number eight – I mean, believe it or not, I watched the series and it's like reading our paper, because, quite surprisingly, without knowing anything about our paper, right, they reproduced pretty much the same scenario that we find the most feasible with the avalanche hypothesis. The slab avalanche, a crack forming and so on. So this was quite amazing. But what was very interesting for me, OK, was that an avalanche is the trigger. It's very interesting what happened later. This we will never know. But what they show there is actually quite touching, because if indeed some of the people got injured by the avalanche in the tent and not later, then it really becomes a story of friendship and courage, because the remaining people could probably have easily escaped if they had left their friends behind. But they tried to save them until the very last moment.

[00:17:32] Jennifer Khakshouri

There was a lot of noise around Alexander and Johan after they published their paper. The Swiss documentary featuring the two of them is being edited and produced right now and should premiere next year. They both gave several interviews to magazines such as Nature and National Geographic, as well as tabloid newspapers. And they are also superheroes in a graphic novel. So I asked Alexander, where does he go from here with this story?

[00:18:00] Alexander Puzrin

I go back to my boring stuff, which I actually myself probably find more important for humanity. But it will never get that much attention. I'm probably, you know, too rational in order to spend the rest of my life on the Dyatlov mystery. But this doesn't mean if some interesting additional data surfaces one day where I can use my skills to resolve some issues, I won't be happy to go back to it.

[00:18:36] Jennifer Khakshouri

Thank you for joining the ETH Podcast. Alexander Purzin from ETH Zurich and Johan Gaume from EPFL. My name is Jennifer Khakshouri. This podcast is produced by the Audiobande, the joint venture for sound adventures.

END OF TRANSCRIPT



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