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INTERVIEW WITH VINCIANE DEBAILLE, METEORITE HUNTER

An international team of scientists working at Princess Elisabeth Antarctica recently discovered a meteorite weighing a massive 18kg embedded in the East Antarctic ice sheet, the largest such meteorite found in the region since 1988. We talked to Vinciane Debaille, a geologist from Université Libre de Bruxelles, who led the Belgian team during the expedition.

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The Samba team: Takashi Mikouchi, Akira Yamaguchi, Christophe Berclaz, Yukihisa Akada, Naoya Imae, Vinciane Debaille, Nadia Van Roosbroek, Wendy Debouge, Geneviève Hublet, and Harry Zekollari (front)

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What is the significance of your find?

We didn't expect to find a meteorite like this, not only because of its weight, but because we don't normally find such large meteorites in Antarctica.This is the biggest meteorite found in East Antarctica for 25 years, so it's a very special discovery for us, only made possible by the existence and location of Princess Elisabeth Antarctica.

Small meteorites are the most abundant, and when you go to larger weights they are less abundant. A large meteorite is far rarer. So this one was very unexpected, both because of its weight, and because this is Antarctica, and usually we don't find such meteorites in Antarctica. This is something very exceptional. When you find such a meteorite on earth, it means that when it was in the sky, it was much larger.

Per year, around 1,000 meteorites weighing less than 100g are found, and about 100 less than 1kg. So 1Kg is already special, never mind 18KG.

Why Antarctica?

First, it's easy to find meteorites in Antarctica - because they are black spots on white ice, so you cannot miss them. Second, meteorites are well preserved from terrestrial alterations (they remain intact), because they are kept "in a fridge". And thirdly, glacier movements concentrate meteorites in specific area. This is because meteorites are incorporated into ice when they fall. Then, ice moves towards the sea, but if there is an obstacle (like the Sor Rondane Mountains), then the ice flow is blocked and becomes vertical. Then, the ice is slowly eroded by the wind, and the meteorites are liberated. It means that in those specific zones (blue ice fields), meteorites are concentrated despite coming from a very large area. This phenomenon is very specific to Antarctica.

What else did you find, and where?

We were searching for meteorites scattered across the Nansen Ice Field January 28, at an altitude of 2,900m, 140km south of Princess Elisabeth Antarctica. Along with the 18kg ordinary chondrite, discovered a total of 425 meteorites, with a total weight of 75kg during the 40-day mission. This season's SAMBA mission was a success for us both in terms of the number and weight of the meteorites we found. Two years ago, we found less than 10kg. This year, we found so much that we had to call the travel agency – because we had 75kg of meteorites to take home!

The atmosphere in much thinner at the pole, so with the correction, 2900 was more like 3700m, in terms of effect on the human body. At that altitude you start to feel less oxygen – and it takes some time to get used to it.

How did you find this big one?

When searching for meteorites, we use snowmobile (skidoos), in order to search 15 to 30 km per day, which takes 4 to 6 hours, depending on the weather conditions. Generally, we place ourselves in a V-shape, with the field guide in front of the V. We let 20 to 50 m between each participant, depending of the visibility and the potential dangers on the field, such as crevasse zones. Once someone finds a meteorite, he/she warns the others by radio, and the closest one comes to help by taking GPS position or pictures of the meteorites. Then, everybody retakeshis/her place in the V-shape.

To find something this large was very exciting for us - you can see it from very far away. That's why we look for meteorites in Antarctica, because you can easily find the black spots on the white snow - but when it's huge like that you can see it from 50m away or more.

We didn't expect to find someting so large, so there was a bit of embarrassment when we had to search for a bag big enough to store and isolate the meteorite. We don't want to touch it with human hands, in case introduce contamination. There are people studying the biological markers and organic, and we don't add some more from us humans. So we try not to to touch them.

It's easy when they're small, you have a zip bag and you scoop them up. But when you have this large specimen and you think ok, I have to put it in a bag without touching it, and it was quite a challenge. Luckily our Japanese colleagues were well equipped, with a big bag that was large enough!

Who else was on the team?

Eight scientists: Wendy Debouge, Geneviève Hublet, and myself from Université Libre de Bruxelles (ULB), Nadia Van Roosbroek and Harry Zekollari from Vrije Universiteit Brussel (VUB). From Japan's National Institute of Polar Research (NIPR) we had Naoya Imae and and Akira Yamaguchi, along with Takashi Mikouchi from Tokyo University. We also had two field guides, Yukihisa Akada from Japan and Christophe Berclaz (Switzerland).

What kind of meteorite was it, or where it came from?

Our initial field analysis suggests it was an an ordinary chondrite, the most abundant kind of meteorite. The fusion crust – the meteorite's outer casing - was eroded, allowing us to inspect the rock underneath. The meteorite is currently undergoing a special thawing process in Japan – to ensure water doesn't get inside the rock - but we hope to bring it to to Belgium in the future.

This is good because this meteorite will most likley be dedicated to an exhibition. If it was a rare type, ok it would be very good for science because of then we would have plenty of kilogrammes to study something rare, but then it would not be out of a lab, for us it's very nice to because it's important to show to people what we do, and how a meteorite looks also.

Normally half of what we find ends up in Belgium, half in Japan. Every meteorite is cut in half. The problem now is that we have this big meteorite - and it would be a shame to cut it in half. So we're thinking that this one, and the one of 4 and 6 kg, maybe we're going to keep them intact, and put them in a museum. We can keep a small chip for determination and classification and then keep for the rest entire for exhibition. These are all discussions we need to have.

Right now, the meteorites are in in Japan, where they are being defrosted by a specific procedure – when we retrieve the meteorites, there's always some snow and ice, and we have to be sure that the the water doesn't percolate into the rock when we thaw them. We defrost them in a vacuum, so the ice becomes vapour, instead of liquid, so that no water water enters in the rock.

We don't have the facilities to do this in Belgium, that's why they're in Japan.

What else did you find?

We also found some rare types of meteorite. Meteorites usually have fusion crest; when it passes through the atmosphere it heats up, it becomes a "shooting star", and is going to be very bright. The outside becomes molten, then when it cools it hardens and becomes black or brown, and you can't see what's inside. Its like a Kinder Surprise! For most of what we find, we can't see what's inside, because the fusion crest, this outer cover, is complete. With some, with erosion, you can start to see what's inside. And a few of what we found are very rate. Everything is interesting in science, but when you find something rare, it's even more interesting.

One of the meteorites we found is coming from the asteroid vesta.

How do you know?

Good question! We can measure what's going on space, the spectral signature of the asteroid Vesta is the same as meteorites we find at earth, using measurements of reflected light. What is reflected is depended on the element on the asteroid, so we know the chemical composition of the Asteroid. When we have the meteorite we can see that it has the same chemical signature, so we know there's a good chance it came from the same asteroid.

We quickly recognised a few of them in the field, their name is eucrite, from the Greek, meaning "easily recognisable" – they are very whitish and very different to other meteorites. We found at least two of these, and they're kind of rare. We have one that has a 50% chance of being from mars.

Why is it important to study meteorites?

So, we have two main types of meteorites, the primitive type and te non- primitive type, and they both tell us different stories about the birth and evolution of the solar system. So that's the ultimate goal of studying meteorites – just to understand how the solar system evolved, how it formed, and how the Earth came to be the planet we know now, and why it's unique in the solar system.

What's interesting about the primitive meteorites is that they stayed intact since the birth of the solar system, 4.5 billion years ago. By studying them, we can really touch what was going on at that time. They have remained unchanged, so we have direct clues as to the formation of the solar system. With the non-primitive meteorites, the difference is that they have experienced volcanic activity and geological processes, and so it's an asteroid that started to be a small planet. They have a metallic core, they have a mantle, they have a crust, like Earth, but smaller. Earth is very active geologically, so we lost all this information about the solar system, but by studying the asteroids, and the non-primitive meteorites, we can know happened to Earth. We can know why we started off with primitive meteorite and end up with non-primitive meteorites and these volcanic activities in the early solar system. The evolution of planets how planets are evolving.

How did you get into this work?

I always wanted to be a geologist – I wanted to study volcanoes, and I could do this but studying the chemical signature of rocks, which is what I'm doing now, studying the chemical signature of the meteorites – the amount of each element. It's like a puzzle, where you figure out the geological history of the rock.

I was in France for my Phd, and was trying to find a postdoc, so I contacted someone I wanted to work with who said “I am now working on the moon and mars and doing terrestrial stuff any more”.

And I thought “That’s so cool”, and that’s how I started to work with meteorites from mars and the moon. When I came back to Belgium I started working on chondrites, the most primitive and abundant form of meteorite in the record.

So, I started studying volcanoes, then volcanoes on Mars, and now i’m studying volcanic activity on asteroids. It’s always related to volcanoes, in the end (laughs).

This time in Antarctic, we were four Belgian women, this was a big thing for us. The further up you go, there’s less women in science, less than 15% of academics are women. So it’s something to have more women in the field like this.

When people ask you what you do, is it strange to tell them “I study rocks from the moon?”

Yeah, or “I’m just back from Antarctica”. I think it’s strange when I think about my path, and I think I would never been in Antarctica – normally, with lab work, you’re just there in your lab, and you don’t do anything else. And suddenly, you have this amazing opportnity, to collect meteorites in Antarctica. Normally I’m not in the field – I’m contacting NASA and others for samples – and the meteorites arrive by post.

But then we had this opportunity, thanks to the existence and location of Princess Elisabeth Antarctica, to collect meteorites in the field. Belspo, the Belgian science agency, and partnership between ULB and VUB, from a federal point of view – it’s partnership from both sides of the [Belgian] language divide, and it’s working very well.

But again, for us, it’s thanks to Princess Elisabeth station. If you look at the climatologists, the glacialogists they were already Antarctica. But for us it was very different. We can imagine working there, but without logistics, without the station it would be impossible for us.

That’s why Japanese scientists didn’t go for a long time to the Nansen Ice Field for meteorites – they went there in 1983, but then the Asuka station was gone, so they didn’t go anymore.

By Dave Walsh
