AirSpace Season 2, Episode 5

Big Iron

Emily Martin:

So, what is an asteroid, what do they tell us?

Matthew Shindell:

They're like the solar system's meatballs.

Emily Martin:

Welcome to this episode of AirSpace from the Smithsonian National Air and Space Museum with help from PRX.

I'm Emily Martin.

Matthew Shindell:

And I am Matthew Shindell.

Emily Martin:

And Nick is away this week.

Matthew Shindell:

He is away.

Emily Martin:

Still.

Matthew Shindell:

Mm-hmm (affirmative).

Emily Martin:

Mm-hmm (affirmative) This episode I'm really excited about because this is a mission called the Psyche mission, which is named after the asteroid. It's going to go to, Psyche. So a lot of asteroids, well, I guess a lot of things in space you could argue are named after all kinds of mythologies

Matthew Shindell:

Mm-hmm (affirmative).

Emily Martin:

from different places.

Matthew Shindell:

Like all of the planets are basically named after different gods from Greek and [crosstalk 00:00:51].

Emily Martin:
They're not Greek gods.

Matthew Shindell:
Well, they started as Greek gods.

Emily Martin:
Sure.

Matthew Shindell:
All right, Emily. So who was Psyche?

Emily Martin:
Psyche was notably not a God. She was mortal.

Matthew Shindell:
Mm-hmm (affirmative).

Emily Martin:
Much like Hercules was, which I'm basing off the Disney stories.

Matthew Shindell:
That's Canon. So young hook was more tone.

Emily Martin:
Is that? That's legit.

Matthew Shindell:
I think that's legit.

Emily Martin:
So Psyche, mortal, super pretty.

So pretty. In fact that people started kind of worshiping her as if she was a God, which really made Aphrodite.

Matthew Shindell:
She's like the goddess of love, right.

Emily Martin:
Something like that. Right. Made Aphrodite really mad.

So Aphrodite sent her son Eros, think Cupid. Right. That's kind of his thing.

Matthew Shindell:

Okay.

Emily Martin:

To make her fall in love with somebody really ugly.

Matthew Shindell:

That's mean.

Emily Martin:

And like awful, super mean right. But eventually Psyche and Eros fall in love and get married and she becomes a goddess. She becomes immortal.

Matthew Shindell:

Like Aphrodite's plan really backfired.

Emily Martin:

Super backfire.

Matthew Shindell:

Yeah.

Emily Martin:

So the point is, so what I think is interesting is Eros is an asteroid that was visited by the near mission.

Matthew Shindell:

Right.

Emily Martin:

The near earth asteroid rendezvous mission. So we've been to Eros now we're going to Psyche and they like got married. It's this whole thing.

Matthew Shindell:

So Emily, you know, we send a lot of missions to other planets and to moons, and we're really interested in those. Why are we interested in asteroids? What's special about them?

Emily Martin:

Asteroids are particularly interesting because they are sort of the leftover crummies that never got included in the rocky planets in the inner solar system.

Matthew Shindell:

When some of them are like busted up planets, right? That once were part of the solar system.

Emily Martin:

Right so that's makes psyche and the mission so exciting to me in particular, because one of its primary goals is to explore the interiors of rocky planets.

Matthew Shindell:

Mm-hmm (affirmative).

Emily Martin:

And we care because we can't see those things. And psyche is cool because it's got this really high density. And so we think it's probably made out of iron, like earth's score. And so we think Psyche is a piece of a planet that started to form.

Matthew Shindell:

Mm-hmm (affirmative).

Emily Martin:

And the core of that planet started to form and then it got broken back up. So it never actually became one of the eight or nine planets that we now have.

Matthew Shindell:

Well, we're talking about when we talk about planets forming, right? That's like four and a half billion years ago when the planet started to accrete or come together and all the heavy material like iron moved its way to the center of the mass of the planet. That's where this iron comes from.

Emily Martin:

That's where this iron comes from. It's iron is in all of these rocky bits that started to come together. And as these, they call them planetesimals. It's like little tiny planets.

Matthew Shindell:

Baby planets.

Emily Martin:

Baby planets. As these planetesimals started to come together, they start to spin and they start to have their own gravity. And that's what draws that heavier stuff to the center. And why most of the planets that we think of know of, they're what we call differentiated. The lighter stuff is at the outside in the crust and the heavier stuff is in the middle. So in our earth we have an iron core. And as you move further and further towards the surface, the stuff that the earth is made up of gets lighter and lighter.

Matthew Shindell:

Like the crust of the earth is like foam compared to this really dense, inner core.

Emily Martin:

Yeah. That's one way of thinking about it. Asteroids are really cool because they can tell us about the really early part of our solar system when the earth was forming. And so going to a place like Psyche will inevitably, hopefully tell us one, did it used to be the interior of a planet that never made it? If it did, it'll

start to tell us about the environment in which that planet was being formed, which tells us about what kind of environment the earth was in when it was being formed.

Matthew Shindell:

Nice. And it's much more accessible than the Earth's core, right? We can't actually get down and look at the Earth's core.

Emily Martin:

Hilary Swank pulled it off.

But unless you're Hillary Swank in a movie called The Core in a ship made of fictional stuff called unobtanium, then it's not going to happen.

Matthew Shindell:

I love that name.

Emily Martin:

So no, we can't get to the core. The only way we know anything about the Earth's core is through seismology.

Matthew Shindell:

Right.

Emily Martin:

Which is sort of the study of how vibrations move through the earth.

Matthew Shindell:

Right so everything we know about our own core we've inferred from indirect evidence.

Emily Martin:

Exactly.

Matthew Shindell:

But with Psyche, we're actually going to see firsthand or through a spacecraft. What may have been the core of a planet early in our solar system's history.

Emily Martin:

Planetesimal.

Matthew Shindell:

Planetesimal.

Emily Martin:

Such a cute little word.

The Psyche mission to the asteroid, Psyche, is a mission that was competed. You don't just come up with an idea and say "Hey NASA, I need $600 million".

Matthew Shindell:

Right you propose it when there's an open call for mission proposals.

Emily Martin:

You're competing against many other ambitious proposals. And if you're lucky, your mission is selected to be funded.

Matthew Shindell:

So the Psyche mission was selected in 2017 and a launch in 2022. So there's five years to prepare the spacecraft between the time that it was selected to the time that it has to launch.

Emily Martin:

That's not a lot of time, that's a really fast turnover.

Matthew Shindell:

So then it has to fly to the asteroid belt. And the asteroid belt is just beyond Mars. Right.

Emily Martin:

Right but before Jupiter.

Matthew Shindell:

But before Jupiter, it is sort of the delineating point between the inner and outer solar system.

Emily Martin:

Psyche is about 280 million miles away from the sun.

Matthew Shindell:

That's like three times the distance that we are from the sun.

Emily Martin:

It's really far away. So it won't actually arrive until 2026.

Matthew Shindell:

2026 and then it's going to spend almost two years in orbit around that asteroid.

Emily Martin:

This part was really interesting to me because it takes a lot of energy to slow down. You spend all this time trying to get your spacecraft to go as fast as possible.

Matthew Shindell:

Right.

Emily Martin:

And then in order to get into orbit around something, you actually have to start slowing down. And this is the one of the reasons why the New Horizons mission that went past Pluto was a flyby mission. It never went into orbit because it would have taken like four years to slow down.

Matthew Shindell:

Because you're going like thousands of miles an hour by the time you get to your destination. So is this like really different from the visits we've already done to other asteroids?

Emily Martin:

The mission concept, I think is pretty similar in terms of the kind of data it's collecting. It's really different in the asteroid Psyche is going to be weird.

Psyche is different specifically because we know it's so dense. So we know there's a high fraction of metal. What the craters in the metal look like? What do fractures in metal look like? Can metal fracture? We don't know. I mean, you can do that in a laboratory.

Matthew Shindell:

But we've never seen it out in, in situ.

Emily Martin:

We're going to see a whole new world made out of a material we just haven't seen. Like we've seen icy bodies, my favorite, right. And every time we see a new one that we haven't seen before. They're weird.

I think that's what's going to be really captivating is we're going to see something that's real weird looking.

Matthew Shindell:

Is it going to be as weird as the asteroid from Armageddon?

Speaker 3:

What's it going to be like up there?

Speaker 4:

200 degrees in the sunlight minus 200 in the shade. Canyons of razor-sharp rock. Unpredictable gravitational conditions. Unexpected eruptions, things like that.

Speaker 3:

Okay so the scariest environment imaginable. Thanks, that's all you got to say, the scariest environment imaginable.

Emily Martin:

The asteroid in Armageddon was the size of Texas. Right?

Matthew Shindell:

Right.

Emily Martin:

Psyche is not that big. Psyche is not round, but if Psyche was round-ish on average, it would span sort of like Western to Eastern Massachusetts if you cut the cake off.

Matthew Shindell:

Oh, don't cut. That's the best part of Massachusetts.

Emily Martin:

I know. Oh, sure. The point is, I'm trying to give you something you can visualize. Right? All that to say, this mission doesn't launch until 2022.

Matthew Shindell:

What? I want it now.

Emily Martin:

I know, I'm sorry. It's a long time to wait, but it's too exciting of a mission not to talk about it. How cool will it be to get a glimpse of what the inside of our own earth might look like?

Matthew Shindell:

Well, now I just feel like... well at least there are other asteroid missions out there right now that we can tune in to.

Emily Martin:

I mean, fundamentally we've got OSIRIS-REx which is a sample return mission to the asteroid, Bennu. And what's really cool about Bennu is that it's actually flinging asteroid particles at the spacecraft and we're not sure how or why. So that's pretty cool.

Matthew Shindell:

And it's there to collect pieces of that asteroid and send them back to earth. They should be coming back landing in the Utah desert in 2023.

Emily Martin:

2023 that's soon.

Matthew Shindell:

Yeah.

Emily Martin:

And then there's the Hayabusa2 mission, which is also sample return. Although it's a mission being run by JAXA the Japanese space agency and it's at Ryugu.

Matthew Shindell:

I think that's right. Ryugu.

Emily Martin:

If I got it wrong. You can tell me on Instagram how to say it correctly, but both of these asteroids are interesting. I'll try and post something on Instagram. They've got this sort of like squashed circle look, and they both look really similar, but they're totally different sizes. And they're kind of these [inaudible 00:11:15] gravel piles. And so both of those are cool missions to follow.

Matthew Shindell:

Okay I guess that gives me enough stuff to be excited about before 2026, I can wait.

That's it for this episode of AirSpace.

AirSpace is produced by Katie Moyer, Jocelyn Frank and Lizzie Peabody mixed by Tarek Fouda. Special thanks to Jason Orfanon, Genevieve Sponsler and John Barth. This episode was supported by PRX and the Alfred P. Sloan Foundation, enhancing public understanding of science, technology, and economic performance. More information at sloan.o-r-g.

Getting married doesn't make you immortal. It just makes it feel like your life is lasting forever.

Emily Martin:

I’m gonna tell Jeannette you said that.

Speaker 5:

From PRX.