MOONS OF THE SOLAR SYSTEM
Europa

Narrator:
Ever since man first looked into the heavens, the most intriguing question has always been, "Are we alone?".
An icy world, circling Jupiter, could answer that age old question.

Professor Michele Dougherty:
Moons in our Solar system are very important so that we can understand how they formed and what their interiors are made of, then we'll better understand how our planets formed, and so we'll better understand where we came from.

Dr Lewis Dartnell:
We now think that beneath the frozen shell of Europa there lies an ocean with more liquid water in it than al the seas and lakes and rivers and oceans for the whole of the Earth put together. And on Earth, where there's water there's life.

Narrator:
Europa first attracted attention back in the 1970s, when the Voyager spacecraft flew past Jupiter and took the first close up images of its moons.

Dr David Rothery:
The Voyager fly bys showed that Europa had a young surface and we already knew it was icy and we already knew that the ice couldn't be more than about a 100 kilometres thick. The question was, is it ice all the way the to the rock or is the ice sitting on top of some water? And because it looks like though the surface has moved around a little bit, a lot of people including Arthur C Clarke, the famous science fiction author, were suggesting there is water down there below the ice.

Mission Audio:
The spacecraft is stable. Galileo is on its way to another world.

Professor Michele Dougherty:
People have been interested in Europa for many years, but really their interest in it was focussed following the Galileo spacecraft, which orbited around the Jupiter system, twenty years ago now.

Lewis Dartnell:
As we've been exploring Europa we see great signs of activity on the surface, great big ridges and cracks from the tectonic pulling and stretching of this world, and also regions where the ocean from beneath has risen up and melted through the ice.

Dr David Rothery:
What the high resolution view from Galileo showed us is this kind of terrain, which is called ball of string terrain, with multiple generations of double ridged grooves criss-crossing the surface, but also showed places where the ball of string terrain has been broken apart in what we now call chaos.

I can show you this here as a global view with this area magnified here at higher resolution. There's ball of string terrain all over it except in this chaos region here, where the ball of string terrain has been broken apart, and at even higher resolution you can see rafts of terrain, with ball of string texture, separated from one another by just a jumbled mess. And many of these rafts can be fitted back together like pieces of a jigsaw, round here or round here, and what's

happened is the ice has become thinner from below, there's been some melting of the base of the ice sheet, and eventually the edges of the ice have drifted into the temporarily exposed ocean which has now refrozen and they are just locked in place.

When you look at the chaos terrain it's very much like you see at the edge of the ice pack round Antarctica or in the Arctic Ocean where rafts of ice have drifted apart and then perhaps refrozen again. So once you've got an ocean, sitting on rock, below ice, there's all kinds of ways that that can be inhabited by various types of life.

Dr Lewis Dartnell:
I think the issue of whether there is life beyond our planet is one of the most current and portent questions in modern science today. My research is all about the most hardy, tolerant life forms in our planet the so-called extremophiles, and one of the most exciting places on Earth for finding extreme living life is Lake Vostok. Now Lake Vostok is in Antarctica and is buried beneath miles and miles of solid ice, and the kind of biology we might find in Lake Vostok would be potentially very similar to what might be able to survive in the sealed ocean of Europa.

Professor Michele Dougherty:
When people talk about life at Europa they think about us. I don't think that's what we'll find. We'll find bacteria of some kind.

Dr Lewis Dartnell:
Life on Europa is going to have to have developed without powering itself by sunlight. You have to live by fuelling yourself and powering yourself from inorganic energy like ecosystems we find round hydrothermal vents.

Narrator:
But it may be some time before we find out just what lies beneath Europa's ice.

Professor Michele Dougherty:
What we really want to do is try and get an understanding about where the life is, how it might have formed and what we'll do is we'll actually go into orbit around Europa because people are talking about trying to get below the surface. And for us to be able to do that, what we need to have an understanding of, is where the ice layer is at its narrowest.

Dr David Rothery:
The next mission to Europa is probably going to always be twenty years into the future the way things are going. There was meant to be a joint NASA European Space Agency mission to Europa. That's on hold at the moment. Some people say it’s on ice waiting for budgets to be unfrozen so I don't know when it's going to happen. I'm not holding my breath.

Professor Michele Dougherty:
This orbiting mission at Europa, that's just a precursor really for us to be able to go back in the future to be able to tunnel through the ice and make measurements in the water itself . . . because for us to be certain that there's life, we really need to be able to go and almost taste it.

Dr David Rothery:
If life began on Europa and began on the Earth, that's twice in one Solar system, then it's very likely that life began on many places elsewhere in the galaxy.

Professor Michele Dougherty:
Discovering bacteria or life on another body in our Solar system would probably be the most important discovery that scientists have ever made. . . Because it will mean that the Earth isn't the only place where the conditions were just right for life to form. I can't believe that in our entire Universe we are the only place where the conditions were perfect. There has to be somewhere else.