British team looks for life in Antarctica

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Today, a British team of scientists and engineers will realise a 16 year ambition to drill down through over three kilometres of Antarctic ice into an ancient buried lake.

The team hopes to find signs of life in the water and clues to the Earth's past climate in the mud at the lake floor.

Using a high-pressure hot-water drill specially designed for the mission, the 12-man team will begin boring a hole through solid ice into Lake Ellsworth on the West Antarctic Ice Sheet today (Wednesday, 12 December).

It will be a race against time to keep the access borehole open long enough to lower and raise two state-of-the-art instruments that will collect water samples from the lake surface to the lake bed, and a core of mud from the lake floor. The team can only keep the borehole open for

24 hours before it refreezes to an unusable size, ultimately sealing the lake off again.

Newcastle University physical geography lecturer Dr Neil Ross, is part of hte project and took part in two expeditions to map the lake. He said: "It is fantastic to hear that the exploration of Subglacial Lake Ellsworth has reached such an important milestone after so many years of detailed preparation, planning and sheer perseverance by so many people.

"This monumental British project is internationally pioneering, both scientifically and technically, and could revolutionise our understanding of the hidden world beneath the Antarctic Ice Sheet. Having spent four months of my life above Lake Ellsworth remotely imaging and mapping the lake and its surrounding sub-ice landscape, I am incredibly excited to hear what its direct exploration will reveal."

Precision engineering and technology are at the heart of this scientific experiment. The hot-water drill, designed by British Antarctic Survey (BAS) engineers will take around five days of continuous drilling through the ice to reach the lake. A titanium probe, designed by a team at the National Oceanography Centre (NOC) will collect water samples and data. A sediment corer developed by BAS with Austrian partners will capture lake-bed mud samples.

The science team thinks that unique forms of microbial life could have evolved in Lake Ellsworth's extremely cold, pitch black and pristine environment and these may have been isolated for up to a million years. If so the lake will provide clues about the potential origin of and constraints for life on Earth, and shape scientific thinking about the evolution of life on other planets. If no life is found this would be an equally valuable result that indicates the limits of life on Earth.

Sediment samples (mud) from the lake are expected to yield important

insight in to the ancient history of the West Antarctic Ice Sheet and reveal vital secrets about the Earth's past climate. This will have implications also for our understanding of future sea level rise.

It has taken the 'Deep Field Team' four weeks to set up living and working facilities at the camp; to prepare and test the drill rig; and ensure final sterility measures are in place before drilling commences.

The drilling mission is made up of four-stages:

1) Pump a high pressure jet of hot water slowly into the ice to create a borehole that is around 40cm wide
2) Create a chamber in the ice (the size of a caravan) 300 metres below the surface, fill with hot water, place a water pump inside to balance the pressure and prevent lake water rushing back up the borehole when the lake is penetrated. This should take around two days of constant drilling
3) Continue to drill the borehole for approximately three days more, going deep through the ice and into the lake
4) Lower and raise the instruments to retrieve water and sediments samples for analysis in UK laboratories – the team has just 24 hours to complete this stage before the hole re-freezes to an unusable size

To protect Lake Ellsworth's pristine environment and to ensure that uncontaminated samples are brought back to the UK for analysis, space-industry-standard clean technology has been used to sterilise every piece of equipment. This included a four-stage chemical wash followed by full exposure to hydrogen peroxide vapour (HPV) during the final assembly process. All equipment was transported from the UK in sterile packaging and will be treated with HPV again on site. The water used for drilling will undergo a four-stage filtration process, down to 0.1 microns, before being passed under UV light and heated to 90 degrees C.

Lake Ellsworth Principal Investigator Martin Siegert from the University

of Bristol said: "This British mission is part of an international effort to discover and explore subglacial lake environments. We are about to explore the unknown and I am very excited that our mission will advance our scientific understanding of Antarctica's hidden world. Right now we are working round the clock in a cold, demanding and extreme location – it's testing our own personal endurance, but it is entirely worth it."

Lake Ellsworth Programme Manager and Expedition Leader Chris Hill from British Antarctic Survey said,

"A major milestone last year was getting the bulk of the equipment and supplies to the site - the logistical effort alone to get 100 tonnes of equipment to Lake Ellsworth has been phenomenal. Now everything we've planned and prepared for is about to happen and it's tremendously exciting – if not a little nerve-racking!"

Lead Hot-Water Drilling Engineer Andy Tait from British Antarctic Survey said: ""This is a huge, but delicate operation. Although hot-water drilling technology has been used extensively by scientists in the past, this is the first time we've ever attempted to go through three kilometres of solid ice - this will be the deepest borehole ever made this way. We've fired up the boilers to heat the water to 90°C. The water pressure coming out of the hose will be around 2,000 PSI – 15 to 20 times more powerful than the kind you wash your car with. It is the most effective way to obtain rapid, clean access to Lake Ellsworth."

Provided by Newcastle University