Under the Ice at the To of the World

by Gary Luton

Sensing the existence of intruders and confused by our lights, a jelly-fish drifts before us casting no shadows. Momentarily diverted, our attention returns to the diver and the wooden vessel which lies beyond. Wiping the transparent medusa-like domed head of his atmospheric diving system, he glides up over the guard rail and gently hovers above a timbered deck awash with a mantle of soft coral. A remotely piloted vehicle (RPV) armed with lights and under-water video camera obediently follows, transmitting images to the surface.

Above those cold grey depths the sun had been shining continuously for three weeks, for it was late April in the high Arctic. There, encamped on the ice of the Northwest Passage we stood above the world's most northerly known shipwreck. Together we formed a 20-man team whose objective—to put a diver on the *Breadalbane*, a 19th century British Barque 100 meters beneath the Arctic Ocean—had just been met.

The Breadalbane Expedition, led by a Canadian physician-diver, Dr. Joseph MacInnes, has already attracted worldwide attention for undertaking perhaps the most ambitious diving operation ever in the polar region. Our purpose was to test technologically sophisticated diving systems, working from an ice platform, in relatively deep water. The program included studies of marine biology, marine geology and sea ice morphology. One part of the exercise involved the adaptation of traditional underwater archaeology to a new and challenging set of conditions.

Canada's Arctic waters have long been a source of interest and enterprise. In 1845, Sir John Franklin left England with two ships in search of a traveller's tale—the fabled Northwest Passage. He considered the elusive channel to be the last great navigational puzzle. Franklin and his 128 shipmates disappeared beyond Lancaster Sound somewhere in the Arctic Archipelago. A message found 14 years later on King William Island in the central Arctic told of his death in 1847.

Our advance party of five first arrived in Resolute Bay, 960 km (600 miles) north of the Arctic Circle. Resolute, a cross-roads in the Arctic, provides the last major civilian staging point to the North Pole and surrounding area.

We came much as Franklin did, hoping to learn more about a still relatively unkown frontier. In a round-about way we also came *because* Franklin did. Our destination, the *Breadalbane*, (pronounced Bred *all* bane) was a 40 m (123') supply ship for the Belcher expedition of 1852-54—one of more than 40 research parties which combed the Arctic in search of Franklin's "lost expedition". The *Breadalbane* was crushed by the ice in Lancaster Sound off Beechey Island on August 23, 1853.

The drama which unfolded off Beechey Island was not uncommon to early Arctic expeditions. What started as a low-pitched groan aboard the *Breadalbane* quickly amplified into the sound of strained timbers cracking under pressure. Instead of the ship hummocking up or down, in keeping with the movements of the surrounding floes, jaws of ice came crunching closed, filling the hold with frigid water. All 21 crew members jumped to safety. Luckily, the *Phoenix*, another ship from the same expedition, lay nearby. As the two crews watched, the *Breadalbane* slipped from sight.

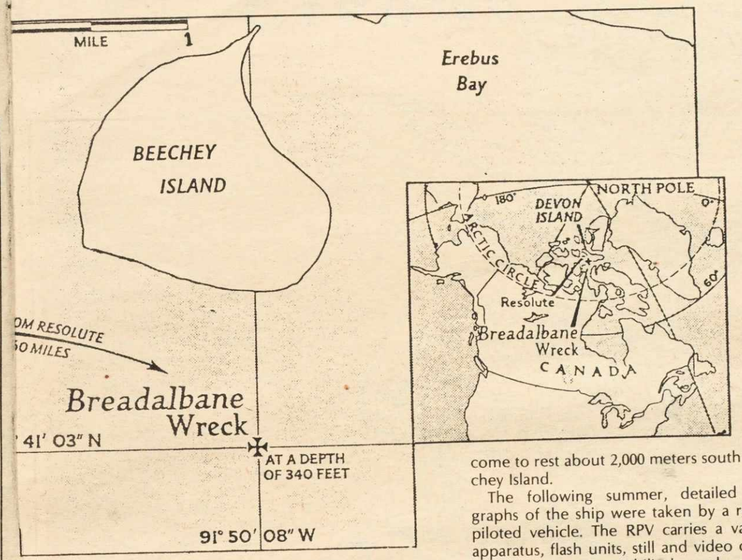
Not surprisingly, ice is a topic much discussed "north of 60." For most of the year it dominates land and seascape, shrinking and growing with the seasons. Between October and May the eastern section of the Northwest Passage is ice-covered. Then, for a fleeting three months from mid-June to mid-August, rising temperatures aided by 24-hour sunshine help break down the ice and large sections of open water develop. By late September the reverse process begins.

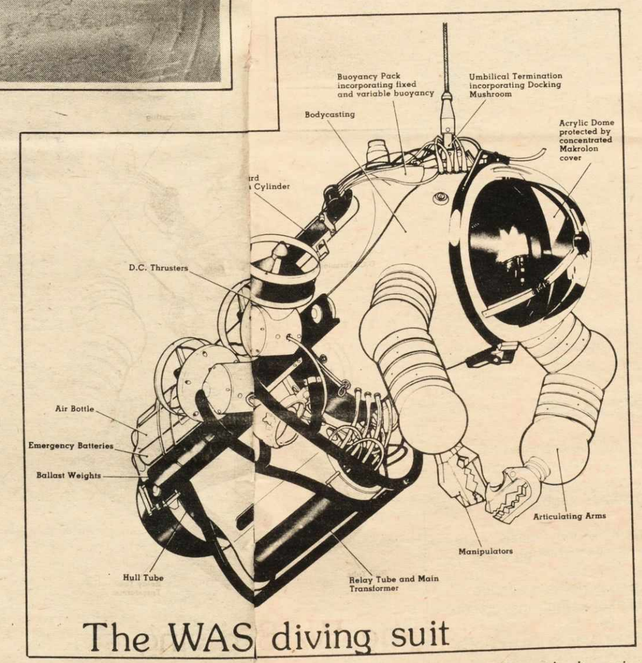
Even though the shipping season is currently restricted to only a few months of the year, water transport is the primary means of moving bulk freight to northern settlements and petroleum exploration operations. "It is inevitable," MacInnes suggests, "that as human activity increases in the north, an object of strategic or industrial significance will come to rest on the sea floor. It may be imperative to recover the object as soon as possible; success will mean search and salvage operations through the ice."

The Beechey Island site was a large pan of thick, smooth pack-ice under a thin layer of snow, and although the area appeared ice-locked, evidence of former tides, currents and storms were documented by the upheaval all around us. It is the collision of drifting pack-ice with shore-bound "fast-ice," buckling to create "pressure ridges," which was responsible for such a phenomenon. With many lives and millions of dollars worth of equipment at stake, anticipating the behaviour of that ice was not taken lightly. Peter Jess, a specialist in ice operation from Dome Petroleum, joined us as camp manager. As a further safeguard, sensitive positioning equipment was installed to monitor any ice movements under our camp.

As we looked out across the ice that first day, Dr. MacInnes contemplated the 100 meter sheer walls of Beechey Island to the north and then surveyed eastward to Cape Riley. He had been to this spot many times before—during different seasons, aboard ice-breakers and bounced about in a Zodiac, only to have nature tell him to go back. "This year," he said in a hushed tone, as much to himself as anyone else, "it feels right."

It took five years to find the *Breadalbane*. The quest began in 1975 when Dr. MacInnis first heard the tale of the ill-fated British Barque. In 1980, with limited time and funds, it was clear that the search could not go on indefinitely. Then, on August 13, MacInnes recounts in his book *The Breadalbane Adventure*, "after years of searching we had found her, a pale ghost beneath the ice." According the the screen of a side-scan sonar, which produced a contour map of the ship, it had come to rest about 2,000 meters south of Beechey Island.





The WAS diving suit

The following summer, detailed photographs of the ship were taken by a remotely piloted vehicle. The RPV carries a variety of apparatus, flash units, still and video cameras. Attached by an umbilical cord, electrical power and commands are carried from the surface. In turn, the vehicle transmits video images back to the surface.

Even the best laid plans in the Arctic mean very little. Large scale scientific-diving and photographic expeditions planned for the spring of 1981 and 1982 were called off at the last minute because treacherous ice conditions would not permit a base camp to be set up over the site of the wreck.

Originally, last year's expedition was planned as a small four-man reconnaissance of the inventor of the Remotely Piloted Vehicle and his crew were now on site and busy rigging their underwater automaton. It was Nicholson, a veteran underwater explorer who commented stoicly "once you leave a wreck, it's lost until you find it again." After several test holes we were confident that we were right over the top of it. From that point on, the wheels began to turn: team divers based in Vancouver were notified, a Back-up WASP suit was *en route* from England.

While much of the actual scientific work was still a week away our job now was to expand the camp and to prepare a diving platform directly above the ship. When finished, our suburb consisted of a cluster of nylon covered "quonset" huts and other assorted shelters for men and material—a tiny outpost in a sea of ice. The dive tent, a colourful circus-like marquee, would allow a hoist to lift the WASP suit in and out of the water comfortably with ample room to manoeuvre if, for some reason, the backup suit should be required. Inside, huge heaters would moderate the temperature and keep the dive hole from freezing. Although most of the equipment had to be airlifted to the site by "Twin Otters," the surrounding pressure ridges prevented larger aircraft such as C-130 Hercules, from delivering the WASP tethered submergibles, their generators and cables. They would have to come across the ice.

Descriptions often heard comparing the polar landscape to that of the moon were reinforced when the WASP suits, often referred to as "the submarine that you wear," were uncrated. With transparent domed heads reflecting the sun and manually operated, fluid-joint arms dangling lifelessly, they looked ready for either outer or inner space. It was now early May and we were ready to send a man below.

Going deep in any sea is a highly specialized undertaking. Only two acquanauts, Phil Nuytten and Doug Osborne would be making the journey. Altogther they made four dives over a three-day period lasting a total of six hours.

The WASP is an atmospheric diving suit (ADS) so named because of its bright yellow wasp-like appearance. The suit, with a working depth up to 600 meters (2,000 feet), features foot operated thrusters for easy manoeuverability. Inside the unit the WASP operator remains at a constant one-atmosphere (sea level) pressure.

With an emphasis on safety the WASP is ideal for Arctic conditions. The suits tether acts as a ready-made safety line. In an emergency a self-contained life support system could sustain a diver for 60 hours. A jettison capability for umbilical cables and thrusters would be of little use in those waters, however, for once the sequence had occurred the diver would be thrust upward against a ceiling of ice—pinned by his own bouyancy with no place to go.

The presence of the remotely piloted vehicle made the expedition come alive for all of us who would be restricted to the surface. With video moniters in several of the tents we were able to study the ship and follow the divers' progress whatever our other duties may have required.

One of the most haunting video images of the series of dives resulted from the unique lighting system. A cluster of 8-250 watt aircraft landing lights were suspended from the ice. The camera of the PRV panning upward allowed us to watch 8 tentacles of light slowly descending to the wreck below. It was somehow fitting that as the diver moved across the deck no air bubbles or silt boiled up around him. The limpid waters remained unchanged by his presence. When in place, the effect was a vivid representation of three dimensional space not normally provided by underwater lighting systems, particularly for an object the size of the *Breadalbane*. The visual result Kristoff created has resulted in a new generation of underwater photography and photographers.

The water which has miraculously produced the visual bounty also acts to preserve its treasures. The -1.5 C sea temperature and the absence of wood boring worms have given the 130 year old *Breadalbane* a different "half-life." Nuytten, who was the first to dive to the ship, was amazed at the condition of the wood. Later, when diver Doug Osborne recovered the ship's wooden wheel we were able to see first-hand its remarkable state of preservation. The wheel's rim, fitted around a circle of brass, was encrusted with coral and sea life. Other objects removed for archaeological study included a pulley block from one of the masts and a piece of copper sheeting from the hull. Together, these items will be used to reveal information about corrosion and how that has been retarded by the Arctic's frigid and relatively unpolluted water.

Several disciplines took part in the adventure and many more will be involved in synthesizing the data collected. The resulting underwater video footage will allow specialists to participate in what MacInnis calls "science at a distance." Biologists who visited the site were less interested in actual samples, although some were taken, than in the relationship of life forms *in situ*. The composite pictures which can now be drawn will provide knowledge of an ecosystem that until recently has seldom been documented, and more seldom still during periods of ice cover.

Increasingly, the application of new diving systems will allow us to reach out and explore the waters of the Arctic.

In the passage of time, the sinking of the *Breadalbane* over 130 years ago marked a final end. In many ways, it represents a beginning.