crew can disconnect their eight anchors and the riser and then seal the well, all within ten minutes. The anchors are left behind, marked by buoys that will bob to the surface after the ice has passed. Since no one is sure that the bottom of the ice will not scrape the sea floor, unsealing the wellhead, Dome positions its wellheads in holes dredged deep into the floor.

Panarctic Oils, working off Melville Island, has developed a special diving suit that maintains surface pressure, permitting a diver to work five hours at 915 feet in 27°F. water and then surface in twenty minutes without risking the "bends." The most remarkable Panarctic innovation involves flooding the surface ice which holds the drill rig repeatedly until its thickness is increased three-fold. The wellhead is then lowered through a hole in the ice to the seafloor where it is connected to the shore by a flexible pipeline laid in a tunnel cut by a special plow.

It takes a bit of courage to dive in this water, even with a specially designed wetsuit.

The Northwest Passage and the Pingoes

A pingo is a hill of antidiluvian ice, coated with frozen muck, a thousand feet or more wide at the base, one to two hundred feet high. They grow to maturity over several thousand years and decay only when their summits are ruptured and the sun melts the ice cores. Some pingoes are flat-topped, some cone-shaped, some cratered like volcanoes. A thousand or more are on the Tuktoyaktuk Peninsula on the edge of the Beaufort Sea, others are underwater in the Sea itself. Some of the latter stick up to within forty feet of the ocean surface, waiting to rip out the bottom of deep-draft ships.

In 1969 the supertanker *Manhattan*, escorted by the Canadian icebreaker *John A. Macdonald*, sailed up from the Delaware Capes, past the tip of the continent, then westward across the Arctic to Prudhoe Bay in Alaska. It was searching for a route that could be used to move oil across the top of the continent.

It was an extremely costly voyage, and, as it turned out, a dangerous one.

Less than a year later the Canadian scientific ship *Hudson*, plotting the Beaufort Sea Basin with side-scan sonar, found seven towering pingoes in a row. A few days later it discovered a picket line of them across the *Manhattan*'s route. Any large ship sailing this Northwest Passage was in danger of hitting a submerged, uncharted hill of ice.

No deep-draft ship has sailed the Passage since. The *Manhattan* was later anchored off the coast of Bangladesh and used to store grain.

Pingoes result from pressure on layers of unfrozen material lying between a substratum of permafrost and a frozen surface.

The CSS Hudson *cruised the Beaufort Sea in 1970.*