Glomar Challenger: Enter IPOD

For more than seven years, the research vessel Glomar Challenger has plied the seas for the Deep Sea Drilling Project, extracting core samples from the ocean floor in the course of a multi-legged journey that has carried it the equivalent of more than 10 times around the earth. Following its most recent journey, Leg 44, it put in at Norfolk, Va., on Sept. 30 for its first major refurbishment in all that time, from which it will reemerge late this month into an expanded version of the project: the International Phase of Ocean Drilling, or IPOD.

During Leg 44, as if to signal the coming transition, the ship's drilling crew set a record for the deepest penetration ever made into the sea bottom—1,412 meters, which yielded late Jurassic sediments as much as 140 million years old. A major accomplishment of the leg was the recovery of samples from a previously suspected submerged reef, presently about 225 miles east of St. Augustine, Fla., on the rim of the Blake Plateau in nearly 9,000 feet of water. The limestone-rich reef was apparently above sea level several times during its lifetime, before finally sinking beneath the waves for good about 125 million years ago. Confirmation of the reef's presence, according to the University of Delaware's Robert E. Sheridan, is important for future projects seeking minerals and fuels on the continental shelf.

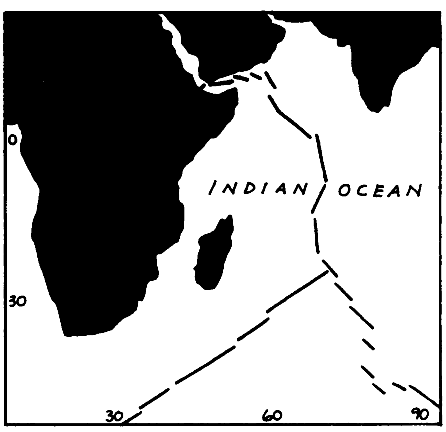
IPOD (SN: 1/4/74, p. 9) is scheduled to begin Nov. 27, when the Challenger sails northeastward from San Juan to spend most of two months drilling just west of the crest of the Mid-Atlantic Ridge, about 10 degrees south of the region explored by Project FAMOUS, the French-American Mid-Ocean Undersea Study (SN: 8/24/74, p. 118). The drilling program has long had extensive participation by foreign scientists, so the transition to IPOD will be a subtle one. The primary difference will be that foreign organizations are becoming members of the Joint Oceanographic Institutions for Deep-Earth Sampling (JOIDES), which provides scientific advice to the project. The Soviet Union and the Federal Republic of Germany signed on in 1974 (Germany is renegotiating its participation but is expected to continue); Great Britain and Japan have since joined, and France is in the process.

The participating foreign institutions each have "pet sites" at which they would like to drill, but each is also providing surface ships to survey agreed-upon sites in advance, as well as ready access to various national research capabilities. ☐

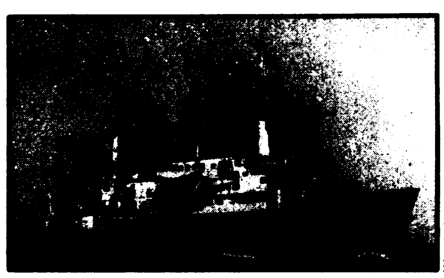
Woods Hole embarks on supercruise

One of the world's major centers for the study of the sea, the Woods Hole Oceanographic Institution in Massachusetts, employs some 800 people and a miniature navy of research craft ranging from the sophisticated minisub Alvin, to the 245-foot surface vessel Knorr. Woods Hole ships have been plying the waves since 1931, but last week, its 210-foot Atlantis II sailed from Cape Cod on what is expected to be the longest voyage—21 months—in the history of the institution.

Numerous and diverse studies are planned for the expedition, which will follow a course down the western Atlantic to Recife, Brazil, eastward to Capetown, South Africa, into the Indian Ocean, down to Australia and the Banda Sea between Indonesia and New Guinea, back up across the Indian Ocean to the Persian Gulf and then home, either across the Mediterranean and the northern Atlantic or back down around the southern route. The ship will stop at several ports to restock its supplies and shift personnel in a scientific complement that will vary from 15 to 25, but the initial logistics were still imposing. About 19,000 pounds of hollow glass spheres were sent along as floats, for example, and even the mere paper charts for the ship's recording seismometers totaled half a ton.



Triple plate junction in Indian Ocean.



Woods Hole

Atlantis II: Home at sea for 21 months.

A major task en route to Brazil is the collection of magnetic data from the seafloor rocks, reflecting changes in the earth's magnetic field as well as movements in the crustal material of the planet. Study of crustal motions will be a major goal of the cruise, particularly an extensive investigation of the triple junction where the African, Antarctic and Indian crustal plates meet at about 25 degrees south latitude by 70 degrees east longitude in the Indian Ocean. Results will be compared with a similar study made last year by another Woods Hole ship, the Chain, at the South Atlantic junction of the African and Antarctic plates with the South American plate.

Chemists on the journey will be studying the sediments in southern waters, including the area of the submerged Walvis Ridge off the west coast of southern Africa. Geophysical studies of the Ridge's composition and history will also be made for comparison with rocks from the Mid-Atlantic Ridge at the same latitude. Measurements of the deep circulation of the Indian Ocean, once thought to be nearly motionless at great depths, are on the itinerary. ☐

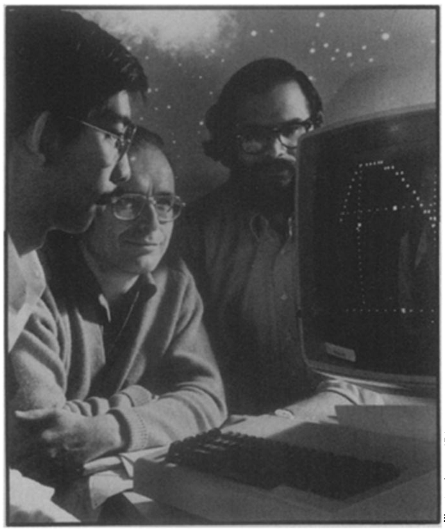
Supernova explosion: A computer model

Ever since the first calibrated spectrum of a Type I (no hydrogen) supernova was obtained at the Hale Observatories in 1972, astronomers have sought to explain the observations in terms of a model of the explosion process. Now a research team at IBM's Thomas J. Watson Research Center has devised a computer program based on a simple physical model that correctly predicts light emission for the first month of a supernova's brief, spectacular emergence.

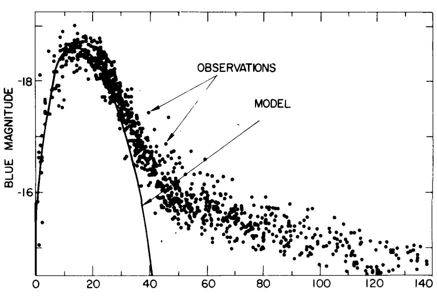
Initial analysis of the spectral data indicated that the light was coming from a shock wave passing through an expanding envelope of gas. The assumption was that a supergiant star had been surrounded by this low-density cloud of helium for some time, gradually fusing the drifting nuclei together to make heavier elements, which were then caught in the star's dense, compact core. When nuclear forces could no longer support the accumulated weight, gravitational collapse occurred.

How energy released by the the collapsing core is coupled to the expanding gas envelope remains uncertain (ill-understood weak interactions release a variety of particles), so the IBM team, led by Gordon Lasher, developed their model without reference to any specific nuclear reactions. Together with postdoctoral fellows Alan Karp and Kwing Lam Chan, Lasher programmed a computer to predict just what would happen when a hypothesized shock wave passed through the helium envelope.

What they found was a very short—one hour—burst of X-rays, followed by steadily increasing amount of visible light given off, which reaches its peak in about


Illustrations: IBM

Chan, Lasher and Karp at computer.



Light prediction and observation.

20 days. Lasher explains that until the envelope expands for several days, most of the light created cannot escape because of electron scattering. The model then predicts a steady decrease of emerging light to practically nothing by 40 days.

The predicted intensity curve follows observed data almost exactly, with two exceptions: The initial burst of X-rays has never been detected, and after about 30 days, the light fades much more slowly than the simple model would lead one to expect. Lasher says this lingering "tail" is probably caused by additional energy coming from the collapsed core—now a pulsar—and that a colleague at the Watson Center, Charlotte Gordon, is attempting a mathematical model of that phenomenon. Detection of the X-ray burst will require new observations by astronomical satellites.

Previous models of supernova behavior have tended to yield only qualitative information about a wide range of phenomena, Lasher says. By concentrating on one aspect, his group has succeeded in generating quantitative estimates. Understanding supernova explosions is particularly important in the study of stellar evolution, since most heavy elements are thought to originate in stars (as opposed to being formed by the primordial "big bang") and to be liberated for use elsewhere by just such events. □

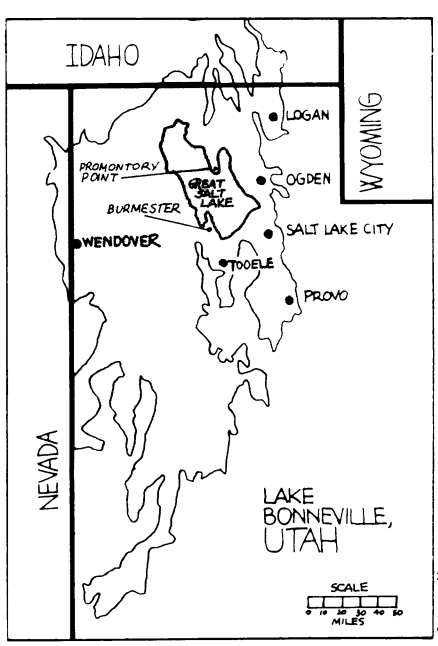
Lake Bonneville's cycles: Climate clues

The Great Salt Lake is the largest lake in the United States west of the Mississippi River, but it is just a salty drop in the bucket compared with its ancient predecessor, Lake Bonneville. At its maximum, 14,000 years ago, Lake Bonneville was 13 times larger than the present Great Salt Lake, sprawling over 19,750 square miles of northwestern Utah and parts of Nevada and Idaho. It was then 1,000 feet higher than it is now. Its waters covered the present sites of most of the large cities of Utah. It rose until its waters spilled over the basin rim at Red Rock Pass in present-day southern Idaho, creating a Niagara-sized river flowing into the Columbia and westward to the Pacific.

Actually there has been not just one Lake Bonneville but many. Time and time again this great intermontane lake has expanded and then shrunk again. Studies reported and reviewed at the Geological Society of America annual meeting in Salt Lake City show that the lake has gone through far more rise-and-fall cycles than previously thought. They also show that those fluctuations provide an excellent, and for some intervals, unsurpassed, record of the vast climate changes in North America in the last one million years.

Times of the lake's greatest extent coincide with periods of extensive glaciation in North America, when colder weather caused precipitation to exceed evaporation. The lake shrinks to its minimum levels during warm interglacial periods when the higher temperatures cause evaporation to exceed rainfall.

It was once thought that the ancient lake had gone through perhaps four or five cycles of expansion and retreat. The evidence collected in the last five years clearly reveals no fewer than 28 such cycles in the last 800,000 years. This lengthens the duration of the climatic record of Lake Bonneville by six times.



Science News

Bonneville dwarfed the present Salt Lake.

One key piece of evidence is a core obtained in 1970 by drilling from the surface to a depth of 307 meters on the south shore of Great Salt Lake near Burmester, Utah. University of Utah researchers (A.J. Eardley, et al) have analyzed the upper 110 meters of this paleomagnetically dated core to produce a detailed record of lake cycles (GEOLOGICAL SOCIETY OF AMERICA BULLETIN 84:211). Roger B. Morrison of the U.S. Geological Survey at Denver calls the Burmester core "one of the best climatic cores in the world from land."

The second line of evidence is above the surface, exposed stratigraphy at a gravel pit near South Promontory Point, Utah. Morrison considers this exposure, which he has studied extensively, an outstanding record, one that "surpasses any other" on the surface. "It has established many details of lake history that were previously totally unknown."

In general, deep cores provide a good record of when lake water was present or absent at any level and time; surface stratigraphy provides the clearest evidence of maximum levels of the lake.

Morrison has prepared a chart of lake cycles, not yet published, that shows more than 20 major lake cycles in the last 850,000 years, 10 of them farther back than 500,000 years ago. Included is the clearest picture yet of a group of three strong interglacial periods, with weak glacial periods, 600,000 to 700,000 years ago. "I know of no better record of this time in North America," says Morrison.

In more recent times, Morrison's record clearly shows the strong, well-defined glacial periods of approximately 125,000; 200,000; 300,000; 400,000 and 440,000 years ago, plus the more recent glacial advances of the last 100,000 years.

South of Salt Lake City in Little Cottonwood Canyon geologists have found intriguing direct proof that the lake's high levels coincided with times of maximum glaciation. There they have found glacier-deposited rocks interbedded with former lake deposits in such a way that the rocks had to have been rolled in wet lake mud. The glaciers virtually licked the edge of the expanded lake. "I know of no other place in the world that shows that relationship better," says Morrison.

All in all, the sediments along and beneath the shores of the Great Salt Lake are revealing a record of a prehistoric Lake Bonneville that has gone through many more oscillations than previously expected ("This surprised many people," says Morrison) and is simultaneously proving to be a valuable indicator, nearly akin to deep-sea-core records, of how climate has changed in North America in the last million years. □