EARTH SCIENCES

Arctic science goes with the floe

Not all science can be done in the womb-like confines of a warm laboratory. Set afloat March 11 on a piece of sea ice 330 miles south of the North Pole, an international research team plans to study the Arctic environment until they hit the continental shelf of Greenland or until May 15, whichever comes first. The Office of Naval Research, which coordinates the program, has launched similar floating laboratories near its now-closed station in Barrow, Alaska, but this is the first attempt to study the Arctic *in vivo*. Because of its inaccessibility, little is known about the present or past Arctic environment. Approximately 16 scientists are pitching camp on the ice station that will drift southeastward with the Arctic currents. They will, among other things, examine the ocean-continental crust junction, monitor seismic activity along the drift path, take sediment core samples to study the Arctic geology and climate history, collect air samples and track polar bears.

Alaskan quake fills seismic gap

On Feb. 28, an earthquake — estimated at 7.7 on the Richter scale — rumbled an uninhabited region of the St. Elias Mountains at the Alaska-Yukon Territory border. No insignificant quake, this: It was the largest in the continental United States since the magnitude 8.5 "Good Friday" quake that devastated Anchorage on March 28, 1964. More important, the quake filled a seismic "gap" — an area identified by researchers as being earthquake susceptible because of accumulated stress and the lack of seismic activity for 30 years or more (SN: 2/3/79, p. 74). The earthquake occurred at the junction of two fault systems, one running to the southeast and another to the west. Quakes in 1964 and 1958 occurred to the west and southeast, respectively, leaving a "gap" of no activity since 1900.

It was the second time in recent months (SN: 12/9/78, p. 404) that a quake occurred in an identified gap, thus adding strength to the concept of monitoring seismic gaps in earthquake forecasting. Forecasting by seismic gaps, unlike prediction, does not specify time, location and magnitude. But detailed monitoring of areas marked by seismic gap data may reveal patterns useful for prediction. Such, researchers hope, will be the case this time. According to Robert Page, who is part of the U.S. Geological Survey team studying the quake, because the Gulf of Alaska area was seismically suspect, activity there had been closely watched along a 500-mile-long network in southern Alaska. Records from the network, which is still picking up aftershocks as large as 5.2 magnitude, will be reviewed to determine the nature of the faulting and to detect any precursor events, he said.

Estuaries said not ecologically vital

Environmentalists who have fought to preserve estuaries as unique ecological niches essential for the survival of certain fish and shellfish will be dismayed at the findings of two researchers at the State University of New York at Stony Brook. Estuaries, small bodies of water, such as bays, that connect oceans and fresh water, are beneficial to many forms of life but not vital for the species that inhabit them, according to Jerry Schubel and David Hirschberg of SUNY's Marine Sciences Research Center. In their report, which appears in *Estuarine Interactions,* (Academic Press, 1978, M. L. Wiley, ed.) the researchers point out that estuaries are short-lived features that vary with changes in climate and sea level. There are few "truly estuarine organisms" and most species, as they have in the past when estuaries disappeared, survive as well in other niches, say Schubel and Hirschberg. Estuaries are most vital, they say, to humans, who use them for resources, recreation and transportation.

PHYSICAL SCIENCES

John H. Douglas reports from the 1979 Particle Accelerator Conference in San Francisco

Proposals for free-electron lasers

Ever since the first operation of a small free-electron laser (FEL) (SN: 4/23/77, p. 260), researchers at several accelerator laboratories have been considering how to modify their machines in order to give the FEL concept a real test. Theoretically, the laser could be tunable over a large range of frequencies and capable of emitting high energies, but the need for a source of high-energy electrons has severely limited the number of laboratories that could even consider such experiments, and the accelerators at these labs already are largely committed to other work.

A vision of what may be in store for the FEL was offered by Claudio Pellegrini of Brookhaven National Laboratory. The theory behind the device is now well understood, he said, and methods have been proposed to overcome the "noise" problems that tend to switch off the lasing action. Pellegrini says that if an accelerator were tailored for the task, producing a one-ampere beam of high-energy electrons, an FEL with an average power output of one kilowatt could now be produced. (Actually, the light would be emitted in one-nanosecond pulses, of 50 kilowatts each, with 50 nanoseconds between pulses.)

In the future, Pellegrini says that FEL's should be able to span the light spectrum from infrared to ultraviolet. An infrared FEL could be used in photochemistry, surface physics and in the study of large biological molecules. A tunable ultraviolet FEL would be particularly important since this is an area in which other types of lasers have difficulty.

Probably the most important potential application of the FEL — as a high-power laser in the visible region for use in laser fusion — was discussed by Pellegrini in an interview with SCIENCE NEWS. One can now conceive of combining an input laser beam from one of the laser fusion projects already underway, he says, with the electrons coming out of a powerful linear accelerator to produce a 100-terawatt (10^{14} watts) beam. Such a development would represent a transition to a whole new realm of laser physics.

KMS Fusion, Inc., in Ann Arbor, Mich., has already been awarded a $100,000 Department of Energy contract for the conceptual design of a free-electron laser for fusion applications.

Japanese accelerators

Although not yet a heavyweight contender in high energy physics, Japan recently began experiments on its newest synchrotron and has made big plans for the future. A progress report was presented by Ken Kikuchi of the Japanese National Laboratory for High Energy Physics, (Japanese abbreviation, KEK).

The largest of some 30 accelerators now operating in Japan is KEK's 12-billion-electron-volt (GeV) proton synchrotron, which began full power experiments last year. Kikuchi reported that the accelerator "works well," with only about seven percent downtime from machine failure. Three beams are available, with lower energy beams used for medical experiments and muon production. Maximum beam intensity is 2×10^{12} protons per pulse.

This machine is still small compared with the 500 GeV beam at Fermilab, but the Japanese are planning to construct a major new accelerator, called TRISTAN, beginning in 1982. The new device will consist of three separate accelerator rings with complex crossover structures. The final ring will accelerate protons to 300 GeV.

Now under construction and scheduled for completion in 1982 is a "photon factory" machine used for the study of synchrotron radiation. Consisting of a linear accelerator and a storage ring, the device produces photons from particles circling in the ring at 2.5 GeV energy.