economic development of their countries. If present plans are carried out, each AID mission in Latin America will shortly be instructed to appoint a senior official to handle population matters; all indications of interest on the part of Latin Americans are to be assiduously cultivated and encouraged; grants are to be made available for training Latin-American students, graduate and undergraduate, in all aspects of population matters at institutions in the United States and elsewhere; and U.S. assisance would be provided for government and private institutions in the population field.

In the face of Latin America's appalling population statistics, AID's principal source of encouragement has been that its efforts so far have stirred no hornets and, in fact, have met with interest and even support from rather unexpected places. In one country, for example, the archbishop asked an AID representative for 500,000 copies of a pamphlet advocating family limitation. In others it soon became clear that the government health ministries were virtually unaware of the Church's current interest in population problems, and, as a consequence, public health officials were certain that any family planning effort would create a theological storm. It is possible, of course, that the public-health people know whereof they speak, and the touring AID officials may have been treated to a dose of being told what they obviously want to hear. But when Church officials were delicately queried on where they stood, the answer, it is reported, was that population is indeed a serious problem and the Church should not be considered a monolith on the issue. This attitude, relayed back to the public health ministries, is said to have evoked surprise and a recognition of possibilities that were previously thought to be beyond attainment.

What is perhaps most certain in the population picture is that whatever is going to happen is not going to happen quickly. Strange to say, despite all the berating of the U.S. Government for not turning down the birth rates of the underdeveloped nations, no means now exist for limiting the families of couples who are only mildly motivated toward this goal. A recognition of this technical lack has led to a large-scale expansion of research aimed at producing cheap, simple, and reliable methods, but none yet exists for mass use. The oral contraceptives now in use are still too costly for nations whose per capita incomes are often a few hundred dollars a year, and, even if the cost were reduced, it appears that there are serious difficulties involved in getting uneducated women to follow the dosage schedule.

Thus, however impatient many persons may be to bring about a sudden decline in the birth rates of the underdeveloped nations, the goal is not going to be reached quickly. Education, research, and diplomacy are the only available paths to the goal, and progress along these paths cannot be expected to be swift. But at least a start has been made.

—DANIEL S. GREENBERG

Alaska: A Thorough Postmortem on Earthquake Urged on Behalf of Both Science, Reconstruction

In the weeks since the big Alaskan earthquake, the Coast and Geodetic Survey and the Geological Survey, two old-line, relatively small, low-budget federal science agencies with unglamorous missions, have been receiving unaccustomed attention and deference in Washington.*

Both agencies have been analyzing data and surveying damage in the field since the main quake on 27 March, and they are regarded as the government's expert counsels on earthquakes.

For example, the two federal agencies charged with funneling federal loan funds into reconstruction of private dwellings and commercial buildings—the Federal Housing Administration and the Small Business Administration—have indicated that they will govern the flow of funds according to information gained from the surveys on the effects of the earthquake and prognoses for the future as applied to specific construction sites.

This solicitous attitude toward science advice seems to be fully shared by the Federal Reconstruction and Development Planning Commission for Alaska, established by the President after the quake to assure coordination in federal and state efforts and the most effective use of public funds for relief and reconstruction. The commission is made up of officials of the major departments and agencies involved in Alaskan operations and is chaired by Senator Clinton P. Anderson (D–N.M.).

Anderson is looking for more than immediate, utilitarian returns. He has asked for a coordinated major investigation of scientific and technical aspects of the Alaskan earthquakes, to help penetrate the enigma of earthquakes which makes their cause a subject of continued debate and their prediction impossible.

Such an effort would require detailed analysis of a mass of seismographic data on the Alaskan main shock and aftershocks, and of information on the seismic sea waves which followed the quake, plus an extensive survey of geological and geomorphic changes and of damage to man-made structures. An investigation on the scale Anderson and others contemplate has not been made on earthquakes before and would heavily involve not only government and university scientists but other government elements, such as the Air Force, with its aerial photography capability.

The two survey agencies last week made their early findings available at the annual meeting of the American Geophysical Union in Washington—the Coast and Geodetic Survey in a preliminary report and the Geological Survey in an informal briefing which was to be followed this week by a first report.

The interested reception given the reports at the meeting seems to indicate enthusiasm for a study in depth of the Alaska earthquake swarm. And there appear to be technical grounds for such a study in the fact that the Good Friday earthquake was the best-documented major earthquake in history.

It happens that a new World-Wide Standard Seismographic System, supervised by the Coast and Geodetic Survey, is nearing completion and has some 98 stations operating in more than 50 countries and territories. The instruments in these stations are standardized, and officials involved in operating the network feel that these instruments provide much more accurate measurements of amplitude and time of shocks than were available in the past.

The new seismograph network grew, indirectly at least, out of the so-called Conference of Experts in Geneva in 1958, which was convened to assess the technical capability for the detection of nuclear detonations. The conference called attention to the sketchy state of knowledge about seismic activity in general, and the world-wide network was, in part, a result of a sharpened interest in theoretical seismology here

* The Coast and Geodetic Survey is a bureau of the Department of Commerce and the Geological Survey is lodged in the Department of the Interior.

and abroad. The system itself could not be employed as a monitoring network, but it does provide basic data which would be of use if a test-detection net were required.

The network will have 125 stations in more than 60 countries and territories when it is completed in 1965. The Coast and Geodetic Survey provides instruments, supplies, and services to stations in other countries.

On the basis of the data recorded, the Coast and Geodetic Survey calls the Alaska quake "one of the largest to occur in the United States, at least since the beginning of instrumental recording late in the last century."

Both the Coast and Geodetic Survey (known familiarly as CGS) and the Geological Survey (called by its friends simply "the Survey") report that, so far, no evidence of faulting has been discovered in connection with the Good Friday quake or its aftershocks. The epicenter of the main shock, located on the eastern shore of the northern part of Prince William Sound (see map), and the epicenters of the aftershocks were clustered along a belt of previous earthquake epicenters extending southwest beyond Kodiak Island.

While no faulting was evident, there were definite signs of "bending," along a fairly definite line, which, according to provisional reports, left Kodiak town some 1.8 meters lower than it had been and Seward and Seldovia a meter or so lower, while Cordova was raised some 1½ meters and Valdez, 3 to 4 meters.

The earthquake generated seismic sea waves (tsunami), which caused damage throughout the Gulf of Alaska, along the West Coast of North America, and in the Hawaiian Islands. Hardest hit by the waves were the Alaskan port cities of Seward, Whittier, Valdez, and Kodiak. The big wave at Seward, Kodiak, and Cordova was 9 meters high. At Seward most of the business district was destroyed, and flaming oil from ruptured storage tanks swept into the city. At Kodiak, 40 percent of the downtown area was destroyed, and the Kodiak fishing fleet and waterfront fishing industry were heavily damaged. Some 27 blocks in Crescent City, California, were inundated when the fourth and fifth waves of the tsunami reached a height of 3½ meters.

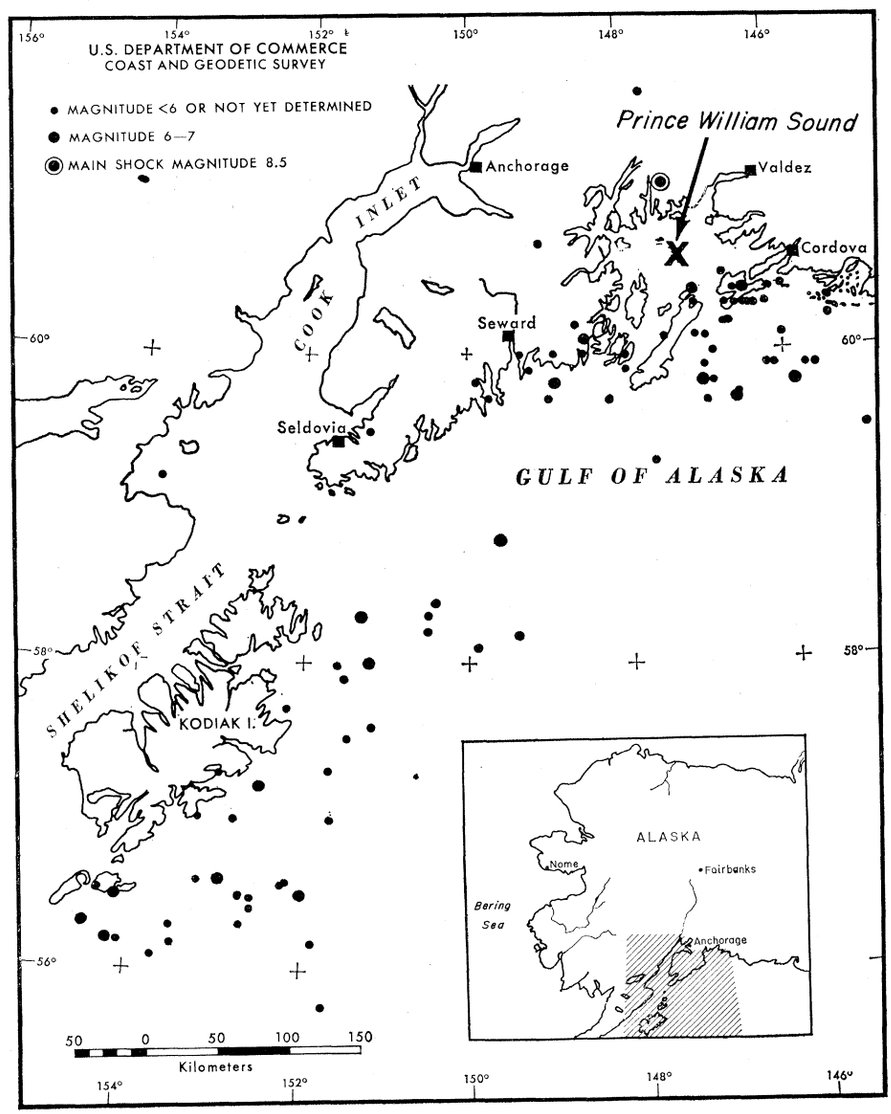
The combined effects of the earthquake and the tsunami on the Alaska fishing industry is still being assessed. It appears that the salmon and halibut fishing industries—salmon is the major catch in Alaska, and halibut the second most important—escaped with relatively minor damage to fleet, gear, major canneries, and freeze plants. The salmon fishing season does not begin until June, and thus there will be time for repairs. Changes in underwater topography, however, may adversely affect some of the important salmon beds. In the Port William Sound area the raising of land in the mouths of streams and in intertidal waters may disturb salmon breeding.

Razor clam beds in a 110-kilometer area of the Copper River delta were shoved upward, and the effect on the animals cannot yet be determined.

The king crab industry sustained extensive damage. Fishing had begun, and this reportedly contributed to the loss of most of the vessels as well as to destruction or severe damage of plants and docks.

The Department of Commerce's Bureau of Commercial Fisheries has been surveying the condition of the fisheries and acting as an intermediary for aid. Rough estimates put the damage to the industry at $15 million, not including damage to wharves used by the fishermen but not belonging to them or to the processing plants. On Kodiak Island, the next high tides may prove some more plants unusable and thus raise damage figures.

Heaviest losses from the earthquake itself were sustained at Anchorage, some 130 kilometers from the epicenter, where extensive damage was dealt by ground movement and "slumping." The Office of Emergency Planning, in a report on the impact of the earthquake on the economy of Alaska, estimated that 75 percent of the city's "total developed worth has suffered some degree of measurable damage."



Epicenter map of Prince William Sound earthquake of 27 March 1964 and aftershocks.

Early estimates put damage to municipal facilities at about $40 million, to the airport at $1 million, and to private property at $165 million. The last figure is not far short of half the pre-quake value of the private property.

In a section on "engineering seismology aspects" in its report, the CGS concentrated on Anchorage, where there was a concentration of buildings and effects of seismic sea waves could be ignored. The pattern of destruction in Anchorage followed that observed in other cities which were fairly far removed from the epicenters of earthquakes elsewhere but sustained severe damage.

Small, low buildings generally came through the quake with minor damage or escaped harm entirely, unless they were affected by the slumps or slides which occurred in several sections of Anchorage.

"Conversely," as the report puts it, "large one and two story structures as well as tall bulidings took the brunt of the vibratory damage." After the quake, 95 percent of Anchorage's high-rise apartments were condemned.

The report also suggests that damage was a function of the duration of shaking. It appears that a longer period of ground motion occurred at Anchorage, for instance, than at the epicenter. Quality of workmanship and the presence or absence of earthquake bracing in buildings were also cited as significantly affecting buildings' resistance to damage.

Events at Anchorage confirmed what has been established in earlier earthquakes about a direct relation of the firmness of substratum to damage. Survey officials at their briefing pointed out that bedrock, when subjected to seismic waves, does not move as much as less solid substances do—that the softer and wetter the ground, the greater the amplitude of earthquake waves. One official noted that the occurrence of the quake before the frost was out of the ground probably helped to limit damage.

Anchorage is built largely on unconsolidated deposits, and landslides, slumps, and fissures abounded. Seward is built on a similar base, and a portion of the town slid into Resurrection Bay.

The violence of the Alaskan quake is perhaps somewhat underestimated by the public because of the fortunate circumstance that loss of life—about 100 dead, or missing and presumed dead—is lower than in other recent, severe earthquakes. The Chilean earthquakes of May and June 1960, for example, claimed 1500 lives. About 1000 persons died as a result of shocks and the resulting collapse of buildings, and another 500 were killed by the seismic sea waves (*maremoto* is the Spanish equivalent of the Japanese tsunami in the international earthquake glossary).

The main shock in Alaska was of considerably greater magnitude than the main shock in Chile—8.4 on the Richter scale compared with 7.5 in Chile. Earthquake casualties, however, are determined not only by the violence of a quake but by the pattern and timing of the shocks, the "depth" of the quake, the concentration of population, the building construction, and the behavior of people in the quake zone.

What the earthquake areas in Chile and Alaska had very much in common was topography and geology. Both areas have long faults, and in both places glaciers gouged out ground rock and left a high and low pattern of escarpments and alluvial deposits.

South-central Alaska, where the quake struck, lies in a particularly lively sector of the "circum-Pacific" earthquake belt. The terrain and the development of commerce and transportation in a frontier state has led many Alaskans to build at the water's edge on shaky underpinnings and made them vulnerable to earthquakes and the sea waves that follow.

Under these circumstances, it seems eminently reasonable for Alaskans to seek the best scientific and engineering advice obtainable on reconstruction.

Relocation of some buildings and, indeed, portions of some cities would appear to be in order. The state's present lack of a building code prescribing for earthquake-resistant structures should be remedied. There was little earthquake insurance written in Alaska before the quake, but the market is sure to improve, and insurance companies are demanding detailed information which will enable them to link coverage and premiums to criteria of vulnerability in specific areas.

The Federal Role

Some Alaska officials and businessmen are impatient with the pace of the federal government in providing assistance for reconstruction. The construction season is short and the winter long and hard, and the Alaskans want action. Heavy pressure is being exerted on the federal agencies and on Congress.

The federal government's role in the Alaska emergency, however, is different from what it might be in, for example, an Ohio River Valley flood or a Plains State drought, where the government provides disaster relief and makes available loans for recovery.

In Alaska, a major portion of the population and economy were affected by the quakes, and the state does not have a strong private-enterprise sector to finance recovery. For the main industry in Alaska is still the federal government.

Personal income in Alaska in 1963 was $700 million, half of it derived from government salaries. Two-fifths of the total $700 million came from the federal government, twice the national average.

The military makes up about 33 percent of the labor force in Alaska, and another 27.3 percent is made up of civilian employees of local, state, and federal governments.

Nearly half of Alaska's 265,000 population live in the south-central area, which was struck by the earthquakes. About 100,000 people live in the area of Anchorage, which is the state's biggest city and main transportation communications center.

Although Alaska has attained statehood, it is clearly still tied economically to the federal government's apron strings.

Alaska's location has made it an important outpost, and the military investment in the state has been regarded generally as a necessary and reasonable one. The Defense Department, after the earthquake, committed itself to an extensive repair and rebuilding program, but some have suggested that the current reevaluation of grand strategy, tactics, weapons, and dispositions going on under Secretary McNamara could result in a slimming down of the Alaska garrison.

Should this happen, there would be even greater pressure on the federal government to foster the economic development of its former territorial ward.

The new federal Alaska commission, headed by Anderson, is itself a version of a "resources development commission" proposed by John F. Kennedy when he was campaigning for the presidency, which materialized only in the aftermath of the earthquake.

Anderson as long ago as 1950 chaired a round of statehood hearings on Alaska and is well acquainted with economic facts of life in the 49th state.

The commission, significantly, has "development planning" in its title, and its work is expected to extend beyond the emergency period.

A broad-based study of earthquake effects, which is now being given earnest attention within the Executive branch, would be a practical indication of the federal government's interest in seeing Alaska build on firm foundations.—JOHN WALSH

Announcements

The election of 35 American and 6 foreign scientists to the National Academy of Sciences was announced this week. The American scientists are:

Thomas F. Anderson, senior member, Institute for Cancer Research, and professor of biophysics, University of Pennsylvania.

James R. Arnold, professor of chemistry, University of California.

Lipman Bers, professor of mathematics, New York University.

Raoul Bott, professor of mathematics, Harvard University.

Robert J. Braidwood, professor of anthropology and professor of Old World prehistory, Oriental Institute, University of Chicago.

Jule G. Charney, professor of meteorology, Massachusetts Institute of Technology.

David Y. Curtin, professor of organic chemistry, University of Illinois.

Philip J. Darlington, Jr., Alexander Agassiz professor of zoology, Harvard University.

Freeman J. Dyson, professor of physics, Institute for Advanced Study.

Harold E. Edgerton, professor of electrical engineering, Massachusetts Institute of Technology.

Louis B. Flexner, professor of anatomy and director, Institute of Neurological Sciences, University of Pennsylvania, and research associate, department of embryology, Carnegie Institution of Washington.

Alfred Gilman, professor of pharmacology, Albert Einstein College of Medicine, Yeshiva University.

Walter Gordy, James B. Duke professor of physics, Duke University.

Philip Handler, James B. Duke professor of biochemistry, Duke University School of Medicine.

George H. Herbig, astronomer and assistant director, Lick Observatory, University of California.

Fritz John, professor of mathematics, New York University.

Walter J. Kauzmann, professor of chemistry, Princeton University.

Eugene P. Kennedy, Hamilton Kuhn professor of biological chemistry, Harvard Medical School.

Otto Krayer, Charles Wilder professor of pharmacology, Harvard Medical School.

Stephen W. Kuffler, professor of neurophysiology, Harvard Medical School.

Tsung-Dao Lee, professor of physics, Columbia University.

Hans Lewy, professor of mathematics, University of California.

Oliver Howe Lowry, professor of pharmacology, Washington University School of Medicine.

Clark B. Millikan, professor of aeronautics and director, Guggenheim Aeronautical Laboratory, California Institute of Technology.

George P. Murdock, Andrew Mellon professor of social anthropology, University of Pittsburgh.

William D. Neff, professor of psychology, Indiana University.

Keith R. Porter, professor of biology, Harvard University.

John R. Raper, professor of botany, Harvard University.

Oscar K. Rice, professor of chemistry, University of North Carolina.

Kenneth D. Roeder, professor of physiology, Tufts University.

Ernest R. Sears, senior geneticist, U.S. Department of Agriculture, and research associate, University of Missouri.

Richard B. Turner, professor of chemistry, Rice University.

Cheves T. Walling, professor of chemistry, Columbia University.

Aaron C. Waters, professor of geology, University of California.

Thomas H. Weller, Richard Pearson Strong professor of tropical public health, Harvard School of Public Health.

The six foreign scientists elected to the Academy are:

Sir Christopher Andrewes, former deputy director of the National Institutes for Medical Research, London, and codiscoverer of the influenza virus in 1933.

J. B. S. Haldane, research professor, Genetics and Biometry Laboratory, Orissa, India.

Sir Hans Krebs, chairman of the department of biochemistry at Oxford University.

Henrik Gunnar Lundegardh, professor emeritus, College of Agriculture of Sweden, and director of the Research Laboratory in Plant Physiology, Penningby, Sweden.

Marcel Gilles Josef Minnaert, professor emeritus, University of Utrecht, and director of the Utrecht Observatory.

Maurice Roy, directeur général de l'Office National d'Etudes et de Recherches Aeronautiques.

A department of **molecular biology** has been established at the University of California, Berkeley. It will offer an M.A. and Ph.D. degree with specialization in ultrastructure, macromolecules, molecular and microbial genetics, cellular regulation and growth, biology of viruses and of bacteria, and bioenergetics. The department will be headed by Robley C. Williams, professor of virology at the university.

Meeting Notes

The **Engineering Foundation research conferences** are scheduled 27 July to 21 August, at Proctor Academy, Andover, New Hampshire. The meetings, patterned after and assisted by the Gordon Research Conferences, will include four 5-day conferences: Technology and the Civilian Economy, 27–31 July; Engineering in Medicine, 3–7 August (both continuations of conferences begun last summer); Technological Challenges for the U.S. in World Markets 1964–1974, 10–14 August; and Engineering Innovation in Building and Construction, 17–21 August. The fee for each conference is $125, which will cover registration, room, and board; some financial assistance will be available. Attendance is limited to 100 at each conference. (H. K. Work, Engineering Foundation, 345 East 47 St., New York 17)

Communications in the area of systems, equipment, techniques, and associated fields will be highlighted during the 10th national **communications** symposium (NATCOM X), 5–7 October in New York. The meeting will be sponsored by the professional technical group on communication technology of the Institute of Electrical and Electronics Engineers. Papers are invited for presentation at the meeting; authors must obtain the necessary DOD clearance for work done under government