

Chapter 8.

Partnership in the Natural-Resources Program, 1953–1955

The best natural resources program for America will not result from exclusive dependence on Federal bureaucracy. It will involve a partnership of the States and local communities, private citizens, and the Federal Government, all working together. This combined effort will advance the development of the great river valleys of our Nation and the power that they can generate. Likewise, such a partnership can be effective in the expansion throughout the Nation of upstream storage; the sound use of public lands; the wise conservation of minerals; and the sustained yield of our forests.¹

—Dwight D. Eisenhower

The convening of the 83d Congress on January 3, 1953, and the inauguration of Dwight Eisenhower as the 34th President of the United States 17 days later began an upheaval in the Federal Government. During the almost 20 years since the last Republican President, the Democrats controlled both houses of Congress, except in the 80th of 1947–49, and Cabinet officers, with few exceptions, were Democrats. During those two decades of peace and war, the United States had changed economically, politically, and socially. America's gross domestic product had grown sixfold, the net national income increased sevenfold, and the national debt rose ninefold. The Nation's view of the world changed as well; the so-called rugged individualism of Hoover's day gave way to social consciousness, and internationalism succeeded isolationism. The United States, emerging from World War II as the world's dominant superpower, became the largest contributor to the rehabilitation and development of impoverished nations. At the same time, America's distrust of the globe's other superpower, the Soviet Union, developed into a worldwide cold war against the forces of communism and fueled a fear of Communist activities at home. The Federal Government's operations also shifted markedly in those decades. New agencies arose and existing ones grew to provide more and improved public services, conservation and natural-resource planning received increased emphases, new commissions recommended improvements in economy and efficiency, foreign aid and technological assistance expanded, and a new national foundation now supported science and science education.

Eisenhower's concept of the Presidency differed from that of his two direct predecessors in office and in some ways resembled Hoover's. Both Roosevelt and Truman exerted strong personal leadership and were personally involved in management, but Eisenhower had spent all but 3 years of his 37-year professional life as a career officer in the U.S. Army. Eisenhower claimed he was nonpolitical and abhorred what he termed the partisanship and patronage of the Roosevelt and Truman administrations. The new President admitted only later that he had lived and prospered in the most political organization in the United States—the Army. Charles Pach, Jr., and Elmo Richardson, in evaluating Eisenhower's Presidency,² noted how he organized his administration along the lines of a military staff as he had done as commander of Allied and then North Atlantic Treaty Organization (NATO) forces in Europe and as U.S. Army Chief of Staff. Now Commander in

Chief as well as President, Eisenhower would make the ultimate decisions but leave the details of planning and implementation to his Department Secretaries and their supporting echelons. The effectiveness of Eisenhower's approach would depend largely on the persons he appointed to his Cabinet and to other high-level offices.

Eisenhower's Cabinet selections, influenced by Herbert Brownell, Jr., and Lucius Clay, signaled a change in the Federal Government's operations. All but one of the original Cabinet members, most of them successful lawyers or businessmen, had little or no experience in the inner workings of the Government. The liberal *New Republic* described the new Secretaries as eight millionaires and a plumber but passed over the similar service of Averell Harriman and other wealthy people to former Presidents. The appointment of John Foster Dulles to succeed Dean Acheson as Secretary of State reflected Eisenhower's commitment to internationalism. Dulles, the head of a Wall Street law firm and the grandson and nephew of Secretaries of State, participated in U.S. diplomatic efforts during the peace negotiations after World War I. He helped to prepare the Dumbarton Oaks charter, served as a delegate at the San Francisco Conference, and represented the United States in the United Nations (U.N.) General Assembly from 1946 to 1949. Dulles also advised Secretary Acheson, who entrusted him with working out the peace treaty with Japan, and became one of Eisenhower's principal advisers during 1952. Allen W. Dulles, Foster Dulles' younger brother, was a lawyer who had advised the League of Nations and served with the Office of Strategic Services. At Truman's request in 1946–47, Allen Dulles helped two colleagues draft the Central Intelligence Agency's (CIA's) portion of the National Security Agency's legislation and formulated ways to improve CIA operations. In January 1951, CIA Director and former Lt. General Walter Bedell ("Beetle") Smith, earlier Eisenhower's Chief of Staff and then Ambassador to the Soviet Union, made Allen Dulles the CIA's Deputy Director of Plans. When Smith, confirmed as Under Secretary of State on February 6, 1953, left the CIA 3 days later, Allen Dulles succeeded him as Director.

The other millionaires in the Cabinet also were long-time Republican businessmen. Among them, George Humphrey, the new Secretary of the Treasury, formerly headed the M.A. Hanna Company; as a disciple of Robert Taft, Humphrey believed the country was headed for bankruptcy and chaos because of poor planning and overspending by the Roosevelt and Truman administrations. Eisenhower selected Herbert Brownell as Attorney General. Ezra Taft Benson, Eisenhower's Secretary of Agriculture, acted earlier as an agent for farm cooperatives and supported Taft for President in 1952. Sinclair Weeks, the Secretary of Commerce and the son of a Secretary of War, was a banker and manufacturer, a former Chairman of the Republican National Committee, where he briefly replaced Senator Henry Lodge, Jr., and even more conservative than Humphrey. Charles Erwin ("Engine Charlie") Wilson left the presidency of General Motors Corporation (GMC) to succeed Robert Lovett as Secretary of the Department of Defense (DoD). Wilson achieved immediate notoriety during his confirmation hearings for his reply to a suggestion from a member of the Senate Committee on Armed Services that his extensive holdings of GMC stock might represent a conflict of interest. Wilson, echoing Humphrey's probusiness stance, mused that what was good for the Nation was good for General Motors and vice versa.

The new President considered nominating Earl Warren, then in his third term as Governor of California, as Secretary of the Interior. When Warren demurred, the President promised to appoint him to fill the first vacancy in the U.S. Supreme Court. Eisenhower then turned to Oregon's Senator Guy Cordon, who switched his support from Taft in 1952 and became Eisenhower's principal adviser on public-land, mineral, and water issues. When Cordon asked to stay in the Senate, he recommended his State's Governor J. Douglas McKay for Interior, the fifth-most senior post in the Cabinet. McKay farmed and sold insurance and automobiles in Salem before being elected the city's mayor in 1932, a State senator in 1934, and



Dwight David Eisenhower (1890–1969), the 34th President of the United States (1953–61), was educated at West Point and rose from 2d Lieutenant in 1915 to General of the Army (five stars) in 1944. He also served as Columbia University's president (1948 to 1953), during which tenure, he took a leave of absence to lead the North Atlantic Treaty Organization (NATO) in 1951–52. President Eisenhower achieved armistices in Korea and during the Suez Crisis; eventually opposed Joseph McCarthy's demagoguery; proposed "Atoms for Peace"; strengthened national defense; and authorized direct or indirect U.S. interventions in Cuba, Guatemala, Indochina, and Lebanon. He also signed legislation supporting farmers, housing, and reforms of Social Security and the internal revenue code; approved the interstate highway system, the St. Lawrence Seaway, and U.S. participation in the International Geophysical Year and the international treaty on Antarctica; authorized aerial spying on the Soviet Union; signed civil-rights legislation and supported it; and warned the Nation about the dangers from its military-industrial complex. The Air Force Academy; the Second Hoover Commission; the Department of Health, Education, and Welfare; and the National Aeronautics and Space Administration were established during Eisenhower's two terms of office. (Photograph by the *New York Times*, 1954, from Library of Congress, Prints and Photographs Division, 3c04961.)

Governor in 1948. McKay reluctantly agreed to serve and took his oath of office as the Interior Department's 35th Secretary on January 21, 1953.

McKay, like Eisenhower and Cordon, believed the new administration would best represent business and industry by promoting a smaller bureaucracy, greater rights for States, increased freedom for private interests, and a public-private partnership to develop the Nation's natural resources. McKay also felt that most of the public lands and their resources would be administered more economically and efficiently if they passed from Federal to State control and (or) private ownership. Water's importance for irrigation, the President and the Secretary agreed, often outweighed preserving natural features. Hoping to encourage private enterprise, they opposed creating a Columbia River Authority similar to the Tennessee Valley Authority (TVA) and opposed building the public-funded Hell's Canyon dam on the Snake River in Idaho. McKay, seen by many as a foe of conservation and public-power development, favored building dams elsewhere in the West, including those at Flaming Gorge, Glen Canyon, and eight other sites planned by the U.S. Bureau of Reclamation (USBR) in the 1940s as part of the Colorado River Storage Project.

Among these proposed dam sites was one, approved by Secretary Chapman in 1950, on the Green River at Echo Park in Colorado. That dam's reservoir would flood much of the 238-square-mile area of Dinosaur National Monument that enclosed the upstream portions of the scenic canyons and parks of the Green and Yampa Rivers. Conservationists, now fearing that no federally protected site would be safe if the Echo Park dam were built, rallied much more support for saving that locale from construction than they did for California's Hetch Hetchy Valley some 50 years earlier. On December 22, 1953, the *New York Times* alerted its readers to the dangers posed by the proposed dam and its reservoir. Eisenhower approved, on March 20, 1954, McKay's recommendations for joint Federal-State development of the Upper Colorado River Basin, including the Echo Park and Glen Canyon dams, and promised legislation would be offered in Congress to establish a fund for construction to benefit agriculture, industry, and municipalities. Wallace E. Stegner edited "This is Dinosaur"³ in 1955 as a brief for the defense led by the Sierra Club's David Brower. A year earlier, Stegner's more comprehensive polemic for the whole arid region appeared in "Beyond the Hundredth Meridian—John Wesley Powell and the Second Opening of the West."⁴ In 1956, the Echo Park preservationists won a partial victory.⁵ The Eisenhower administration secured statutory authority for comprehensive development of the Colorado River and Upper Colorado River Basins to regulate flow, control floods, store water for beneficial consumption, apportion it among the States—Arizona, Colorado, New Mexico, Utah, and Wyoming—of 1948's Upper Colorado River Basin Compact, reclaim arid and semiarid lands, and generate hydroelectric power. No dam or reservoir would be built within a national park or monument. Neither would water impounded by any new dam be used for agriculture for at least 10 years, unless the Secretary of Agriculture deemed it necessary for national security.

Interior Secretary McKay shared with Defense Secretary Wilson a tendency toward careless verbosity, but McKay did not exhibit Wilson's indecisiveness. McKay quickly replaced all five of his deputy managers. Ralph A. Tudor, a San Francisco civil engineer, designer of the Bay Bridge, and former Colonel of Army Engineers, succeeded Richard D. Searles as Under Secretary. McKay appointed Fred G. Aandahl, former Governor (1945–51) of and Representative (1951–53) from North Dakota, as Assistant Secretary for Water and Power Development. Lawyer Orme Lewis of Phoenix, Arizona, became Assistant Secretary for Public Land Management. McKay selected Felix E. Wormser, who entered the mineral industry after graduating from Columbia and rose to be an executive in a lead company, as Assistant Secretary for Mineral Resources. Wormser and U.S. Geological Survey (USGS) Director Wrather were old friends, whose association dated from their memberships in the American Institute of Mining and Metallurgical Engineers

and other professional societies. Otis Beasley took Vernon Northrup's place as Administrative Assistant Secretary. McKay also began looking critically at some of the leaders of Interior's agencies.

Eisenhower had his own ideas about how best to structure the Federal Government. On January 24, 1953, he appointed a President's Advisory Committee on Government Organization.⁶ The members of the new Committee included Chairman Nelson A. Rockefeller, the former Assistant Secretary of State for American Republic Affairs and later Eisenhower's Special Assistant; Milton S. Eisenhower, the President's younger brother, who founded the War Relocation Authority, served with the Office of War Information, and now presided at Pennsylvania State University; and Arthur Flemming, Administrator of the Economic Stabilization Agency and Director of the Office of Defense Mobilization (ODM). Before March 31, Eisenhower used the authority of the Reorganization Act of 1949 to submit to Congress 10 reorganization plans, including 1 to establish a new Department of Health, Education, and Welfare (HEW) to take over functions of the Federal Security Agency. Congress' joint resolution approving the new and 10th Department became effective on April 11. Eisenhower named as the HEW's initial Secretary Oveta Culp Hobby, who led the Women's Army Corps during World War II and, later, while president and editor of the *Houston Post*, campaigned for him. Nelson Rockefeller became the HEW's Under Secretary. On July 10, Eisenhower and the 83d Congress established a second Commission on Organization of the Executive Branch of the Government, with a staff and provisions for expenses, "to promote economy, efficiency, and improved service in the transaction of the public business."⁷ Herbert Hoover chaired the new, 11-member Commission, as he had its predecessor during the Truman administration. Hoover's colleagues on his second Commission included Attorney General Brownell and Administrator-Director Flemming; Senators H. Styles Bridges (R-NH) and John L. McClellan (D-AR); Representatives Clarence J. Brown (Sr., R-OH) and Chester E. Holifield (D-CA); James A. Farley, Franklin Roosevelt's Postmaster General and now with the Coca-Cola Company; Solomon C. Hollister, Dean of Cornell's College of Engineering; Joseph P. Kennedy (Sr.); Sidney A. Mitchell, a banker and director of American Electric Power Company; and Robert G. Storey, Dean of Southern Methodist University's School of Law. The 12 Task Groups in Hoover's second Commission included one for Water Resources and Power, led by Admiral Ben Moreell, who also chaired Jones and Laughlin Steel's Board of Directors.

Eisenhower set forth the aims of his new administration in his inaugural address on January 20, 1953, and his State of the Union Message on February 2. The new President devoted his inaugural remarks entirely to foreign policy.⁸ "The world and we," Eisenhower said, "have passed the midway point of a century of continuing challenge,"⁹ the current ones being the dangers of war and aggressive communism. He promised an unceasing effort to seek worldwide peace, an especially urgent goal because

[s]cience seems ready to confer upon us, as its final gift, the power to erase human life from this planet.¹⁰

That peace, the President held, could be achieved by possessing strength sufficient to deter aggression and, ultimately, to make possible a drastic reduction in armaments. As Eisenhower spoke, relations with the Soviet Union remained difficult, those with the People's Republic of China (PRC) continued to grow increasingly strained, and the hot war continued in Korea, where the total of American casualties and those missing in action now exceeded 125,000. More than 7 years after the end of World War II, peace treaties with Germany and Austria remained to be signed. Other conflicts of varying intensity continued in Burma, Cyprus, Indochina, Indonesia, Kenya, Malaya, Oman, Trieste, and Tunisia.

Eisenhower outlined the philosophy of his administration, citing “four ruling purposes.” The executive branch would apply “America’s influence in world affairs with such fortitude and such foresight” that it would “deter aggression and eventually secure peace.” The President and his associates also would build a national administration of integrity and efficiency, encourage “incentives that inspire creative initiatives in our economy,”¹¹ and seek the well-being of all citizens and equal opportunity for all. U.S. business, except in time of crisis, should be left to the workings of natural economic law. He would strive to trim the planned deficit and balance the budget by “reducing expenditures to the safe minimum.” Eisenhower considered debt reduction more important than decreasing taxes, and so first he planned to eliminate the national debt. He pledged to “check the menace of inflation.”¹² Nor would Eisenhower ask Congress to extend the material, product, wage, and price controls due to expire on April 30, “except with respect to defense priorities and scarce and critical items essential for our defense.”¹³ As “only a combination of loyalty and reliability promises genuine security,” he noted, “all principal new appointees to [Federal] departments and agencies have been investigated at their own request by the Federal Bureau of Investigation.”¹⁴ Later background checks by the FBI were authorized by an Executive order on April 27 that established investigations to ensure that “all persons employed by the Federal service be reliable, trustworthy, of good conduct, and of complete and unswerving loyalty to the United States.”¹⁵ Eisenhower also called for extending Social Security; ending segregation in the Federal Government, including the armed forces, and in the District of Columbia; and approving immediate statehood for Hawaii but not for Alaska.

The 83d Congress continued to work on its own agenda. High on the legislators’ list were the goals of reducing taxes, de-emphasizing foreign affairs, and purging all subversive influences from the Government. On the session’s opening day, Representative Daniel A. Reed (R–NY), Chairman of the House Committee on Ways and Means, filed a bill to eliminate on July 1 the 11-percent increase in income taxes adopted to support America’s effort in the Korean war. The Bureau of the Budget’s Director Joseph M. Dodge, formerly president of the Bank of Detroit, offered little hope for drastically reducing the Truman administration’s last budget, cutting taxes, or balancing Eisenhower’s initial budget. The President still chose eliminating the deficit as his initial goal. Two weeks after the State of the Union Message, Reed’s committee, undeterred by Eisenhower’s declared choice, favorably reported the bill while stating that tax reduction remained its initial order of business. On January 7, John Bricker (R–OH), Chairman of the Senate’s Committee on Interstate and Foreign Commerce, proposed a constitutional amendment to limit the scope of international treaties and to impose controls on the power of the President to negotiate treaties. As for alleged subversives, Eisenhower, like Truman, believed that the executive branch, not Congress, held primary responsibility for keeping them out of the Federal Government. Nonetheless, four congressional committees, headed by Senators Joseph McCarthy of Government Operations, William E. Jenner (R–IN) of Rules and Administration, and Alexander Wiley (R–WI) of Foreign Relations and Representative Harold H. Velde (R–IL) of Un-American Activities, launched separate investigations of suspected Communists and their influences within the Government.

The 83d Congress did agree with the Eisenhower administration’s interest in Federal jobs for Republicans. One Representative, intent on placing more Republicans in Federal employment, inserted in the *Congressional Record* at the session’s start a report on political affiliations as an example of those he thought should be supplanted. The Interior Department’s portion of the report listed the names of 282 employees, including 26 from the USGS. The agency’s roll included the Director’s immediate staff, the Division heads, the Branch chiefs, and administrative officers.

Were these persons corrupt, or inefficient, or simply tainted by service under a Democratic administration? Many decades had passed since a form of the spoils system had been applied to professional scientific positions. The Representative and his supporters soon discovered how difficult it would be to displace current employees because the overwhelming percentage of Federal jobs were under Civil Service, including the agency directors, associate directors, and assistant directors placed there by the Reorganization Act of 1946. The solution, worked out by the end of March, directed the Civil Service Commission to review all positions with confidential or policymaking responsibilities for possible reclassification in Schedule C, a new category for high-level posts in which job protection would be inimical to the requirements of the new administration.

The new personnel policy provoked a firestorm about the heads of Commerce Secretary Weeks and Interior Secretary McKay when the national media discovered that long-term career scientists in high-level positions were being replaced in efforts to appease the Republican desire for jobs and propitiate the American business community. On March 31, while Eisenhower arranged to authorize these dismissals, Secretary Weeks announced that he had requested and obtained the resignation of physicist Allen V. Astin, who began work at the National Bureau of Standards (NBS) in 1930 and now was its Director. Weeks' move might have been considered a routine administrative change by an incoming administration had not the NBS antagonized a California manufacturer by declaring as worthless its battery additive AD-X2 that it wanted to sell to the Government. The additive, Weeks announced, had been used by his own company, and outside tests supported the manufacturer's claims. Astin, in response, defended his Bureau's integrity. Newspapers and journals immediately featured the story; on April 17, *Science* declared that the "scientific work in the government has been placed in jeopardy."¹⁶ Weeks retained Astin temporarily while the National Academy of Sciences (NAS), at Weeks' request, evaluated and then validated the NBS' conclusion.¹⁷ On August 21, Weeks reinstated Astin, for what Weeks termed were the best interests of the NBS and the public.

Secretary McKay's recommendation, announced a few days earlier than Weeks' original decision, that John Forbes, a 40-year career public servant, be replaced as Director of the U.S. Bureau of Mines (USBM) then took on new significance. The United Mine Workers protested, and Representative Augustine B. Kelley (D-PA) accused McKay of trifling with the lives of miners. Then McKay fed the flames by announcing the resignation of Marion Clawson, Director of the Bureau of Land Management (BLM) and another career man. Clawson denied that he had resigned and called on McKay to state the reasons for his dismissal in accordance with Civil Service regulations. Newspaper editorials chided McKay for his haste. The rumored severance of Albert Day, a long-serving career officer, as head of the Fish and Wildlife Service brought more outraged protests. Senator William Fulbright brought to the attention of his legislative colleagues a charge by the *Washington Post* that career men with long experience and high professional competence were being replaced by political appointees. USGS Director Wrather, who celebrated his 70th birthday on the day of Eisenhower's inauguration, also might have been vulnerable to the effects of this policy had Wrather served 15 or more years in the Federal Government. The administration did not anticipate the reaction to resignations of Astin and Forbes and the other proposed moves. McKay kept Forbes and Wrather but reassigned Day, at a yearly salary reduced by \$1,400, as an Assistant to new Director John J. Farley of Washington, and replaced the BLM's Clawson with Edward Wozzley of Idaho. Forbes left the USBM in November 1955.

Eisenhower, in his State of the Union Message also claimed conservation as a Republican issue, proposing that "We must more than match the substantial

achievements in the half-century since President Theodore Roosevelt awakened the Nation to the problem.” Although Eisenhower invoked the elder Roosevelt’s name, he did not share Roosevelt’s broad view of conservation and remained primarily concerned with farmlands. The new President called for a “strong Federal program in the field of resources development,” but he suggested that major projects be timed to assist in “leveling off peaks and valleys in our economic life.” The best natural-resources program, he asserted, would “involve a partnership of the States and local communities, private citizens, and the Federal Government, all working together.”¹⁸ Exactly what partnership Eisenhower proposed, he did not make clear, but during the campaign in 1952, he had used the term to describe his intention of rearranging initiatives and participation in resources use. Frank E. Smith (D-MS), who served in House during 1951–62 and on its Committee on Public Works, later recalled in his “The Politics of Conservation” that partnering represented an attempt to reach common ground between the goal of developing river basins and the view that government should not generate and sell electric power. The plan proposed using government funds for the part of multipurpose dams used for flood control, navigation, and other nonreimbursable operations; private companies would pay for and gain title to the part used to generate electric power.¹⁹ Partnership, like fiscal responsibility, one of Smith’s contemporaries observed, again was being redefined to fit specific issues.

Congress seized upon the partnership idea in regard to ownership of the Nation’s tidelands, and their natural resources, which, as the Republicans’ 1952 platform emphasized, belonged to the States. A joint resolution was introduced to give the coastal States the offshore lands within the 3-mile limit, except for the more extensive seaward boundaries of Florida and Texas. After the Republicans quickly pushed the bill through the House and the Senate, managed in the latter by Guy Cordon, Eisenhower signed the measure on May 22 and opened the way for immediate exploitation by private interests. Congress and the President intended the Submerged Lands Act to “confirm and establish titles of the States to lands beneath navigable waters [nontidal and tidal out to 3 geographical miles from the coasts] within State historic boundaries and to the natural resources within such lands and waters, to provide for the use and control of said lands and resources [especially oil and gas], and to confirm the jurisdiction and control of the United States over the natural resources of the seabed of the Continental Shelf seaward of State boundaries.”²⁰ Under the new law, the Federal Government retained the rights to navigation, flood control, and power production. Likewise, it retained “in time of war or when necessary for national defense * * * the right of first refusal to purchase at the prevailing market price, all or any portion of the said natural resources, or to acquire and use any portion of said lands by proceeding in accordance with due process of law and paying just compensation therefore.”²¹ Section 10 of the statute revoked part of Truman’s Executive order of January 16, 1953, setting aside the Continental Shelf’s submerged lands as a Naval Petroleum Reserve, which applied in the new statute to lands beneath navigable waters.

The Outer Continental Shelf (OCS) Lands Act followed less than 3 months later on August 7. The new law provided “for the jurisdiction of the United States over the submerged lands of the outer Continental Shelf” and authorized “the Secretary of the Interior to lease such lands for certain purposes.”²² The new law applied to all submerged shelf lands and their resources seaward of the now State-owned lands on the inner shelf and seaward to a depth of 200 feet. The statute authorized the Secretary to award, via sealed competitive bids, mineral leases, including those for oil and gas, for compact areas of up to 5,760 acres within 5 years and with royalties of 12.5 percent of production. For areas with sulfur deposits as determined by the Secretary, leases required development within 10 years at not less than 5 percent of production. The Federal Government retained the same right of first refusal to purchase OCS minerals in time of war or by the

President's decision. The statute validated the existing leases by the States. The law also authorized the President to withdraw from disposition any of the nonleased OCS submerged lands; reserved to the United States all uranium, thorium, and other fissionable materials on OCS lands; and repealed the remainder of Truman's Executive order of January 16, 1953. On March 15, 1954, the U.S. Supreme Court confirmed the coastal States' jurisdiction over their Continental Shelves out to 3 miles from their shores, and Federal authority beyond that, and increased proprietorship for Florida and Texas to 3 leagues, or 10.3 miles, in the Gulf of Mexico. The decision in *Alabama v. Texas et al.*,²³ holding as constitutional 1953's Submerged Lands Act, gave the States parity in political standing and sovereignty. On April 1, Eisenhower transferred control of the OCS-derived funds from the Navy Secretary to the Interior Secretary.²⁴ Matters pertaining to the resources of the world's Continental Shelves and their overlying waters, including both mineral and living resources, were considered at the Tenth Inter-American Conference of the Organization of American States, held at Caracas, Venezuela, in 1954. Attendees recognized the subject's complexities and the amount of background information required for an adequate understanding of the problems involved. They resolved to call an Inter-American Specialized Conference on the conservation of natural resources, especially those of Continental Shelf and marine waters.

The new executive policies initially lopped \$5 billion off the Federal budget for fiscal year 1953–54 and then another \$5 billion by April 1953 that lowered the total to \$63.2 billion. Those reductions jeopardized the budgets requested for the Interior Department and the USGS. For 1953–54, the Truman administration asked for \$621.5 million for Interior and \$31,070,000 for the USGS. The agency's portion included substantial increases for topographic surveys, geologic surveys, and water-resources investigations and small raises for other activities, including soil and moisture conservation. The largest increase, \$3.6 million for topographic surveys, was more apparent than real, as, by agreement with the DoD, another effort was being made to have funds for military mapping appropriated directly to the USGS. The USGS expected the Eisenhower administration to reduce its budget request.

The House subcommittee began hearing testimony on Interior's budget for fiscal year 1953–54 on February 24, 1953, before the Eisenhower administration completed revising the budget submitted by its predecessor. Iowa's Benton ("Ben") Jensen returned as chairman, joined by fellow Republicans Hamer H. Budge of Idaho and Pennsylvania's Ivor Fenton. Ohio's Michael Kirwan and Arkansas' William Norrell continued to represent the Democrats. Secretary McKay emphasized his strong support

for the conservation of resources, and I do not mean locking them up as some people think, but we must get the most out of our natural resources.²⁵

McKay said that he "was surprised * * * [by] some of the things which this Department takes in. It is really terrific. I do not think," he continued, "there is any department more essential to the welfare of the people." He promised to "do the very best I can to do a good job"²⁶ as Secretary. Jensen renewed his stands for soil conservation on the public lands, timber conservation, and more efficient management of Interior's personnel. He then mentioned that, while the Truman budget was being revised, John Taber (R–NY), the returning Chairman of the House Committee on Appropriations, requested all subcommittees to schedule first the smaller or less important agencies and place nearer the hearings' end those agencies whose budgets might be controversial or require major revision. McKay appeared briefly startled when Jensen noted that he had scheduled the USGS representatives

to be heard the next day. The USGS “is a very important agency,” said Jensen, who added his opinion that the subcommittee “has always had the highest regard for the efficiency and economy which has been practiced in this agency.”²⁷ McKay, recovering quickly, agreed “Yes * * * It [the USGS] is very good.”²⁸

The House subcommittee’s hearings on February 25 for the USGS budget proved no less amiable under Chairman Jensen than they had been under Chairman Kirwan. Director Wrather, whose successful career in the oil industry continued to impress subcommittee members old and new, said at the outset that he recognized “the imperative need for all feasible economy in Government expenditures,” while providing proper support to the most meritorious and urgent Federal functions. “Any request for increased support,” Wrather continued

can be justified only if it can be shown that the national need for greater service by the Survey transcends even the need for economy.²⁹

“There is a growing realization that the functions performed by the Geological Survey should be greatly extended to support the rapidly developing civilian economy, and this is even more necessary in times of national emergency,” an opinion, Wrather noted that “has been most recently expressed by the Paley commission.”³⁰

Most of the subcommittee members’ questions centered on the changes in the military mapping program, which Chief Topographic Engineer Gerald FitzGerald explained as the results of reordering priorities in the DoD. The Army transferred \$4.9 million to the USGS during fiscal year 1951–52, FitzGerald pointed out, but the shift suggested that future funds should be in the agency’s own budget. Last year, he continued, the USGS asked for the necessary amount and got only \$3 million. After conferring with the DoD, the Topographic Division curtailed its program as much as possible “to accomplish the highest priority mapping with this year’s funds”³¹ and was spending more than 50 percent of its current appropriations on work for the military. The USGS asked for an increase to nearly \$3.68 million for its topographic work “to recapture in our budget the amount to cover military mapping.”³² Representative Budge then voiced his concern about possible duplication in work by the USGS, the Bureau of Reclamation, and the Department of Agriculture. Assured by FitzGerald that there was none, Budge passed on to what seemed excessive work by the USGS for the military. When FitzGerald responded that the USGS was not in a position to evaluate the military’s demands, Budge said that Congress should do so. Later, after Budge approved Wrather’s responses to the economic questions and the budget’s reduction of USGS average grade classification from 6.6 to 6.5, the Representative specifically queried the accuracy of USGS groundwater studies, its work for the Federal Power Commission, the effect of silting on the useful life of high dams, soil- and moisture-conservation investigations, the status of special-area studies for the National Security Resources Board (NSRB), and the reasons for the regional changes in the topographic-mapping program for the DoD. The modification, Wrather and FitzGerald explained, started after the DoD, beginning in January 1952, identified critical zones within the larger areas, assigned higher priorities to them, and also added new areas. These changes called for a shift in emphasis in mapping operations to expanded and larger scale coverage of the growing industrial concentrations on the East Coast, at the expense of the allocation in the fiscal 1952–53 justification for work on the Pacific Coast and around the Great Lakes. The types of mapping changed, they said, more than the amount of available funds. The 1952–53 justification called for \$800,000 for engineering and \$2.4 million for topographic and geologic mapping in the Pacific Coast region; the USGS actually expended \$1,380,000 and \$1,525,000, respectively, for those purposes.

Toward the session’s end, Chairman Jensen said, almost wistfully, that “While this committee wants to give the Geological Survey everything it needs that will

help you do the great and important job that you have to do, and which is your responsibility, we always, of course, are hopeful that by new methods and by possibly a little reorganization we can save a few dollars here and there. Do you have any suggestions,” Jensen asked, “as to how you can make your agency more efficient with possibly less personnel and how you can consolidate some of your activities? If there is anything that you can think of that might save some dollars for the taxpayers and will permit you to carry on this great and important work,” Jensen continued, “we would like to know it.”³³

Ordinarily the Senate waited to take action on executive-budget requests until the House passed the appropriations bills, but, in 1953, the Senators began hearings about the Eisenhower administration’s revised version on April 14, several days before the House committee submitted its report. Secretary McKay presented to the Senate appropriations subcommittee the new budget for all Interior agencies except the USBR, which was still being worked on. Senator Cordon now chaired the subcommittee, whose other Republican members included returning Senators Henry Dworshak, William Knowland, and Milton Young. Carl Hayden, now ranking minority member, Dennis Chavez, Harley Kilgore, and Patrick McCarran continued to represent the Democrats and were joined by Warren Magnuson. Overall, the Eisenhower budget slashed Interior’s funds for fiscal year 1953–54 by \$69 million, or 18 percent, from the Truman version. McKay asked for \$307 million for Interior, excluding the USBR and the power agencies, a reduction reflecting the wish to give “certain activities * * * careful examination before undertaking additional programs or expanding existing programs.” Program goals, McKay explained, would be achieved “at lower cost through more efficient utilization of manpower and other management practices.”³⁴ Of that total, the USGS would receive \$27,750,000, a loss of slightly more than 10 percent. The \$3,320,000 reduction, McKay, noted, would be achieved principally by decreases of \$1,950,000 in topographic surveys, leaving the request still \$1.6 million above that for 1952–53; \$750,000 in geologic surveys; and \$460,000 in water-resources investigations but also by smaller reductions in other activities. The revised estimate would still give the USGS nearly \$2.3 million more than its funds for surveys, investigations, and research (SIR) in fiscal 1952–53.

On April 20, Director Wrather repeated to Senator Cordon’s subcommittee his “sincere conviction, that with the need for all possible economy, there is a genuine urgency for the requested strengthening of the Geological Survey.”³⁵ Chairman Cordon agreed, although he remarked that expenditures had to be cut somewhere “until we could use our funds for our own welfare first.”³⁶ When that stricture renewed the old argument about appropriations to the agency doing the work versus appropriations to the agency deriving the benefit of the work, both Cordon and Hayden favored the latter. Wrather interrupted the discussion to assert USGS “responsibility for maintaining a competent technical staff. We have to maintain an organization which is soundly supported by our own appropriation,”³⁷ Wrather emphasized, “but more or less questionably supported by transferred funds, unless the funds are earmarked in the original budget for transfer to the Geological Survey.” The operational problem involved keeping technical personnel adequate to do the job, Wrather cautioned, “and if we cannot do it, I do not want the job.”³⁸ Senator Cordon saw the point; the ideal, he thought, “would be the original appropriation direct to the Geological Survey, but divided as to the beneficiary so that one could clearly see * * * who is to receive the benefits of the work done” and also “be able to separate that portion of the work done that would primarily be the responsibility of your agency.”³⁹ Senator Hayden said that he believed that Congress was concerned with the purpose of the appropriation.

Wrather then pointed out the current situation. When economy was necessary, the USGS did not know, and might not know for another 2 or 3 months, how much it would receive of the estimated \$19.5 million in Federal-transfer funds, yet

it had to maintain a competent organization. "Yes, you have got to have a primary appropriation directly to the Geological Survey," Cordon agreed, "and to a great extent it ought to be a general appropriation, one elastic enough to permit the maintenance of a qualified, highly technical personnel, even though there might be a month or 2 months or 3 months * * * that the personnel would be caring for only the general program, but in advance of the amount of work generally scheduled. So that you could turn it at any time in any direction for these other services."⁴⁰ "That would involve also fluidity of funds with the administrator,"⁴¹ Wrather responded, and "will almost require interchangeability of funds so that we could modify our work as the program progressed."⁴² Again, Cordon agreed.

Cordon and Hayden then queried Wrather about the largest requested increase in the USGS budget, slightly more than \$1,693,000 for the largest program, topographic surveys and mapping. The discussion focused, as before, on completeness and adequacy. FitzGerald emphasized the lack of both for the United States. Although 70 percent of the Nation's land area was now mapped at various scales, only maps for 30 percent of it were deemed adequate for present uses. Of the 6,000 quadrangles now being worked on nationwide, FitzGerald reported, only about one-half were being mapped at the standard scale of 1:24,000. National coverage, he told the Senators, as he had cautioned the Representatives, would not be achieved for decades unless they significantly increased funding each year. The rate, coverage, and accuracy of USGS topographic mapping, FitzGerald also hoped, would increase markedly when the agency got its ellipsoidal reflector-55 (ER-55) projectors "into full production."⁴³

Three days after these exchanges, the House subcommittee submitted its report on Interior's appropriations bill. The subcommittee's members wanted to promote conservation and to ensure the best use of the Nation's natural resources, while making necessary reductions in budget requests, eliminating all present and future expenditures not required for the wise-use resource program, and increasing Federal tax revenues. The subcommittee adopted a somewhat different view of partnership in conservation than the President outlined in his February 2 address. Where Eisenhower called for a strong Federal program involving a partnership of the States, local communities, and private interests with the Federal Government, the House subcommittee held that partnership should come into effect only where private enterprise was unable to completely develop resources without assistance. The Interior Department, the subcommittee asserted, should concern itself only with those functions or activities that private enterprise could not or would not undertake. Where private enterprise needed aid to completely develop natural resources, the members urged it to enter a working partnership with the Federal Government. Private interests should then discharge their obligations to the fullest in serving the public interest and placing additional property on the Nation's tax rolls. These decisions led to a suspension in the development of a national minerals policy.

The House subcommittee allowed for the USGS \$27,750,000, the full amount of the Eisenhower budget, but it specified that the reduction of the Truman budget by \$3,320,000 would be applied to the topographic-mapping effort and not to any of the \$55,000 reduction proposed in the \$100,000 originally requested for the soil- and water-conservation program. The subcommittee's report particularly criticized the military mapping program. The hearing disclosed that the military mapping priorities, which required the large increase in the USGS mapping program for 1953, were altered during the year, and the authorized funds were diverted to other priority work determined by the military. The subcommittee complained that it could not appropriate funds intelligently if priority programs presented in justification of budget estimates were not in fact priority programs. If the military program presentations to the USGS were going to continue as unreliable as this example, the subcommittee declared that it was reluctant to appreciably increase the military

mapping program carried on by the agency. The House accepted its subcommittee's recommendations and passed the Interior appropriations bill on April 28. The Senate subcommittee recommended an appropriation for SIR of \$26,380,000 for the USGS in fiscal year 1953–54, cutting \$1,370,000 from the estimate for topographic surveys in the Eisenhower budget but still providing some \$1,017,000 more than in 1952–53. The conference committee agreed on the Eisenhower budget's amount of \$27,750,000,⁴⁴ an increase of about \$2,387,000, and the President signed the measure on July 31.

Republican zeal to eliminate alleged waste in Federal operations continued unabated after the passage of appropriations for fiscal year 1953–54. To increase coordination, economy, and efficiency within Interior, Secretary McKay discontinued, by the end of fiscal 1952–53, the Department's Program Staff and its Divisions of International Activities, Land Utilization, Minerals and Fuels, and Water and Power. He transferred their responsibilities and staffs to the three programmatic Assistant Secretaries or to the agencies. McKay established, within the Secretary's Office, a Technical Review Staff, an Office of Legislative Counsel, and a public-relations unit. He also reformed the Department's field committees by appointing responsible regional officials from the bureaus as chairmen to replace the former full-time chairmen and their staffs, made his Solicitor responsible for all legal activities, and established committees to investigate the operations of each of Interior's agencies. On August 5, 1953, McKay directed Assistant Secretary Wormser to form a specific group to evaluate the USGS and its programs. Although McKay did not intend his Secretary's Survey Committee on the Geological Survey to be a rubber-stamp body, the USGS employed four of its six members at one time or another during 1908–51.

J. Robert Van Pelt, since 1951 president of the Montana School of Mines, Director of the Montana Bureau of Mines and Geology, and Battelle Institute's director of research education, chaired McKay's new Committee, and Samuel Lasky served as its executive secretary. Committee members included Horace M. Albright, cofounder and former Director of the National Park Service (NPS), and now president of U.S. Potash Company; Donald M. Davidson, a USGS field assistant in 1927, a mining geologist, and now director of the E.J. Longyear Company; William Heroy (Sr.), the USGS, Board of Economic Warfare (BEW), and Petroleum Administration for War (PAW) veteran, Geotechnical's president since 1952, and a current member of the USGS Science Advisory Committee; and John C. Frye, who worked for the USGS during 1938–41 and who now was State Geologist of Kansas but would leave to head the Illinois State Geological Survey later in 1954.

Wrather immediately asked his Division Chiefs to form small groups to prepare and circulate for internal review the summaries of administrative and operational goals, methods, and products that might be useful to Interior's new Committee. The Van Pelt Committee met with Assistant Secretary Wormser on September 1, 1953, and began its work on September 16. During the next 7 weeks, the Committee heard testimony from members of Interior's staff, from members of the USGS and its Divisions, and from persons outside the Federal Government. Committee members regarded "this assignment as a privilege, for each one of us has long held the Geological Survey in high esteem,"⁴⁵ but that appreciation did not prevent them from completing a thorough and critical review. On February 12, 1954, the Committee reported an "unsurpassed record of integrity, ability, and devotion to duty" by the USGS "that should be carefully conserved and encouraged." While crediting USGS management with "many important adjustments to the new conditions" during the agency's sixfold increase in size and corresponding growing complexity of its duties in the past 15 years, the Van Pelt Committee, like the Interior Committee-Princeton group in 1950, emphasized that USGS "structure and practices have not kept pace."⁴⁶



Geologist William Heroy ([Sr.] 1883–1971), like William Wrather a colleague and friend of Everette DeGolyer, left the USGS in 1919 after a decade's service to join the petroleum industry. Consulting for the Board of Economic Warfare led to work with DeGolyer in the Petroleum Administration for War. In 1946, Heroy joined the Geotechnical Corporation (later Teledyne-Geotech) and, with Roland Beers (Sr.), founded Beers and Heroy. During postwar years, Heroy also served on the USGS Science Advisory Committee and participated in the Van Pelt Committee's critical review of USGS organization and performance at the request of Interior Secretary Douglas McKay. In 1965, Heroy retired to an active post at Southern Methodist University. (Photograph from Conselman, 1974.)

The growing need for topographic mapping, geologic research, and mineral discovery is expected to place still greater strains on the Survey in the next ten or fifteen years. The structure and practices of the Survey must be geared, therefore, not only to present conditions, but to more severe future demands.⁴⁷

The Van Pelt Committee followed that general endorsement by pointing out nine “major points of weakness”:⁴⁸ (1) distance from a national minerals policy; (2) inadequate supervision in some Divisions and Branches; (3) insufficient in-service training for staff, especially of the younger and less experienced scientists; (4) reduced coordination between administrative units and their projects; (5) too many uncompleted projects; (6) too much nonspecialist-administrative work required of scientists and engineers; (7) tardy publication of geologic reports; (8) unimproved relations with cooperating agencies and the public; and (9) excessive housekeeping activities by the technical (programmatic) Divisions. Some of these deficiencies, the report continued, reflected undue caution by the USGS; other infirmities mirrored departmental action, lack of space in facilities, congressional-appropriations practices, and work, including “spot jobs,” for other agencies.

To address these problems, the Van Pelt Committee offered 46 specific recommendations for improvements,⁴⁹ to be implemented, if approved, in ways that would not disrupt current operations. The report recommended reorganizing the USGS administratively, so that each regional programmatic or support chief would lead four operational or administrative branches in each of six geographic, but not geologic, areas: (1) a 16-State Eastern Region, from Maine west to Ohio and south to South Carolina, with headquarters in or near Washington; (2) a 9-State Central Region, including Tennessee, Kentucky, Missouri, and north, with headquarters at Rolla; (3) a 7-State Rocky Mountain Region, comprising Kansas, Colorado, and north, with headquarters at Denver; (4) a 9-State Southern Region, from Florida west to New Mexico; (5) a 7-State Pacific Region, including Arizona, Utah, Idaho, and west, with headquarters in Menlo Park; and (6) the Territory of Alaska. Hawaii was not mentioned. The USGS would select, guided by the report’s chapter on implementation, locations for the headquarters of Regions 4 and 6.

In the proposed table of organization, Regional Geologists led branches for plans and coordination, geologic mapping, basic geology, and applied geology. Regional Topographic Engineers directed branches for plans and coordination, field survey, photogrammetry, and cartography. Regional Hydrologists managed branches for plans and coordination, surface water, groundwater, and quality of water. Regional Conservation Chiefs oversaw branches for plans and coordination, oil and gas leasing, mining, and land classification. A new publications division would operate “to consolidate the processing, manufacture, and distribution of publications”;⁵⁰ its Regional Chiefs also would manage the library branches transferred administratively from the Geologic Division but not merged physically. The Regional Administrative Officers oversaw branches for organization and management. In each region, the regional Division heads constituted a Regional Coordinating Committee, already operating in Denver, chaired by a person appointed by and reporting, informally but directly, to the Director and aided by the Regional Administrator as permanent secretary. Regional Division heads would continue to report formally to their Division Chiefs, who also retained control of their nonregionalized topical and (or) administrative branches, which contained the headquarters of the regionalized branches. The Director would retain six Assistants, those for Inspection, External Coordination, Reorganization, Program, Operations Analysis, and Publications. The Geologic Names Committee, appointed by the Director, would report to the Assistant for Publications. The Chief Counsel’s position would be abolished and its work done by Interior’s Solicitor. The Van Pelt Committee,

unlike the Interior Committee-Princeton group in 1950, did not recommend establishing Regional Directors.

The Van Pelt Committee also recommended other changes: (1) establishing a map-reproduction plant for Denver; (2) consolidating land-mapping activities; (3) ensuring better coordination between the USGS and the BLM in administering the mineral-leasing laws; (4) avoiding joint Federal-State purchase of equipment; (5) maintaining (and annually reviewing) programs for at least 6 years; (6) obtaining, through Interior, security for funds through each field season; (7) appointing a coordinator of in-service and bureauwide training; (8) seeking legislation to permit federally supported university training of selected scientists and engineers; (9) appointing an Assistant Director for Publications; (10) extending the concept of the Geologic Staffing Committee to all Divisions; (11) asking the Water Resources Division to establish a General Hydrology Branch; (12) separating the delegation of contracting authority for emergencies from that required for routine procurement; and (13) preparing an orientation manual for USGS employees and desk books of organizational and administrative detail for the USGS and its Divisions.

Assistant Secretary Wormser approved the Van Pelt Committee's report on April 27, 1954, Secretary McKay signed off on the 28th, and the document passed to Director Wrather. Wormser placed in Wrather's hands "full responsibility * * * for carrying out the provisions of the report," while concurring with it "that a considerable period of time will be required for the implementation * * * and that certain phases are dependent upon a successful solution of the space problem." Wormser planned to ask the Department's staff to consider appropriate action on five of the specific recommendations: (1) as urgent Interior policy and action, obtaining "at the earliest practicable date, a building for the Geological Survey in the suburban Washington area"; (2) in so doing, recognizing "present space requirements for scientific and technical work, for trends toward larger equipment, and * * * the growth trend of the Survey"; (3) ensuring that USGS libraries would not be merged with other collections in Interior and "any plans for centralized administration be given most careful consideration before adoption"; (4) asking the Interior Secretary's Office, "to improve programming and to reduce operational inefficiency" by working "out means of securing continuity of funds during the field season"; and (5) seeking legislation "to permit university attendance of carefully selected [USGS] scientists and engineers" to conduct "studies of direct interest and value to the Government."⁵¹

Wrather began modifying his agency's existing organization, management, and regional structure before the Van Pelt Committee issued its report. To maintain "sound bureau-wide organization," his Administrative Circular of June 29, 1953, formalized a policy and established a procedure for "effecting changes in the organization." "All changes in the bureau's organizational structure down to and including section or equivalent level," and all those "in a Division or Branch-level staff organization"⁵² now required Director's approval. Any changes in organization or duty assignments down to Branch level also now needed Secretarial confirmation. Wrather required Division Chiefs to send to him, with an explanatory memorandum, any plan for organizational changes before beginning the process of job classification. To expedite final approval, Wrather asked for outlines for preliminary review, but he specified that each plan must contain a statement of objectives, a table of organization, the location of field offices, brief descriptions of the new positions, and an estimate of their number. He reminded his managers that they must continue to obtain Director's approval "before filling key positions"⁵³ and that his two memorandums, to the Secretary, on December 21, 1950, and to the Division Chiefs, on December 1, 1952, remained the basic guides to field organization.

A subsequent Administrative Circular, dated September 11, 1953, codified "redelegations of authority which have been made by the Director to subordinate officers and employees of the Geological Survey." Acting officials, the Circular

confirmed, needed no special redelegation to act with full authority, and Survey orders would not be so issued, except when “necessary to publish a redelegation in the Federal Register.”⁵⁴ The second part of the Circular described special redelegations of authority in mineral leasing for applications for suspending operations to Regional Supervisors for Oil and Gas and for Mining, and for appeals by persons aggrieved by those supervisors’ actions. The third and last part listed existing general redelegations for personnel management; appointments and status changes of specific positions in the General Schedule (GS) and Crafts, Protective, Custodial (CPC) Schedule; contracts, with the approval levels required for amounts up to \$1,000, \$5,000, and \$25,000; errors in bids; leases in the continental United States and its territories and possessions; approval of and limitations on travel; oaths; and personal-property management.

Wrather, while discussing regionalization as part of the budget request for an additional \$900,000, beyond the previous 2 years’ funding, in capital outlay for building space, reminded the House subcommittee’s members on February 25, 1953, that “We early recognized the fact that we were going to have to establish service centers at various parts of the Country.”⁵⁵ Glendon Mowitt, the USGS Executive Officer and, since February 17, Chief of the agency’s new Administrative Division⁵⁶—including the Budget, Organization and Management, Accounts, and Services and Supply Branches—then described the status of the agency’s regional facilities in the Washington area and those at Rolla, Denver, and Palo Alto in California. After alterations to the building at Denver that required an expected \$2.1 million, and an additional \$297,000 to cover inflation, space was now available to install \$70,000 worth of purchased equipment. In selecting the Pacific Coast and other sites, Mowitt continued, “We have tried, in every case, to stay out of the high-cost rental areas.”⁵⁷ For the Pacific Coast Center, the contract signed by the General Services Administration (GSAd) specified a USGS building of some 40,000 square feet in the Palo Alto area, near Stanford University, to be constructed by a private firm and rented yearly at \$1.31 per square foot. The \$250,000 requested for the Pacific Coast Center would provide laboratory equipment, library and storage shelving, movable partitions, and additional plumbing and other utilities required by the GSAd but one fewer wing than originally planned.

In the Washington metropolitan area, the USGS staff continued to be housed in 397,000 square feet of space in 15 buildings, including the Naval Gun Factory, home to some of the staff that worked on projects for the U.S. Atomic Energy Commission (AEC). “We have found,” Mowitt reported, “that private capital would be more than willing to build a building in which we would consolidate those people.” The USGS, the GSAd, and the Bureau of the Budget (BoB) agreed not to ask Congress for additional appropriations for rent because the USGS planned to “relinquish high-cost downtown space to compensate for it.”⁵⁸ The USGS required some 440,000 square feet for a building for its national and eastern-region headquarters, “on the outskirts of Washington,” that would enable the agency “to maintain contact and liaison with other Government groups” and “plan a more orderly conduct”⁵⁹ of its operations. Part of the \$900,000 would fund continued planning. As part of the future contract, the USGS hoped to arrange a 25-year lease, an interval about equal to the building’s half-life, at \$1.25 million per year, with an option to purchase the building for \$1 when the lease ended. The building, the GSAd estimated, could be constructed for \$27.1 million, not including maintenance but minus the taxes. To avoid disruptions in construction and staff, the USGS asked approval for funds to replace obsolete printing presses; the new equipment would be ordered in fiscal year 1953–54 and installed in 1954–55. The capital-outlay request also included \$231,000 for the new building’s laboratory benches and other fixed installations. The remaining \$360,000 would fund new equipment at Denver, Palo Alto (later Menlo Park), and Washington.

While the Van Pelt Committee evaluated the USGS and Wrather improved decentralization of the agency's operations, but successfully avoided similar administrative changes, the Eisenhower administration's foreign policy gained successes and endured failures in wars hot and cold. The areas of principal concern continued to be Europe, Iran, Korea, and Indochina. Early in May 1953, Eisenhower established Project Solarium, supervised by the National Security Council (NSC) and managed by Robert Cutler, the President's Special Assistant for National Security Affairs and head of the NSC's Planning Board. George Kennan plus an Air Force general and a Navy admiral chaired Solarium's three task groups formed to reassess national-security policy before the administration finalized its 1954–55 budget. On September 23, Spain and the United States signed a 10-year agreement for mutual-defense assistance, by which Franco's government received economic and military aid in return for providing the United States with bases on Spanish soil, even though Spain remained outside NATO. President Eisenhower, Prime Minister Churchill, and French Premier Joseph Laniel met in Bermuda during December 4–7 to discuss international political and military issues, including defending the West, improving relations with the Soviet Union, and organizing Austria and Germany. On December 8, Eisenhower asked the United Nations General Assembly to establish an International Atomic Energy Agency (IAEA), under U.N. aegis, to which all of the nuclear powers would make joint but modest contributions from their stockpiles of uranium and other fissionable materials. The President also encouraged worldwide research using the IAEA-controlled materials, peaceful applications of atomic energy, further reductions in remaining national stockpiles,⁶⁰ and new channels for discussion and new approaches for solving problems related to the nuclear-arms race. When the Council of Foreign Ministers convened in Berlin during January 25–February 18, 1954, they did not agree to reunify Germany or adopt a Soviet-sponsored security treaty that would include all European nations but assign the United States and the PRC only as observers.

Eisenhower, in his second State of the Union Message to Congress on January 7, 1954, recommended “measures to advance the security, prosperity, and well-being of the American people.”⁶¹ The President proposed to use the strategic initiative gained during the past year “to promote three broad causes: First, to protect the freedom of our people; second, to maintain a strong, growing economy; third, to concern ourselves with the human problems of the individual citizen.”⁶² Eisenhower then discussed foreign assistance and trade, his atomic-energy proposal to the U.N., national defense, internal security, the economy, a balanced budget, spending and tax reductions, agriculture, and conservation. He promised to make recommendations for a “uniform and consistent water resources policy,” a “revised public lands policy,” and a “sound program for safeguarding the domestic production of critical and strategic metals and minerals.”⁶³ The President completed his review by covering many other topics, including national highways, statehood for Hawaii, and voting rights for citizens from 18 to 21 years old and all those in the District of Columbia.

On January 12, Secretary Dulles provided more specific information on national- and global-defense policies, worked out by Eisenhower and his economic, scientific, and military advisers to replace Truman's policy of containing communism. NSC 162/2, a policy report approved by Eisenhower on October 30, 1953, emphasized the need for a strong economy, a military capability for massive retaliation, and the liberation of Eastern Europe by peaceful means. The massive-retaliation policy relied on nuclear weapons as a means of deterrence, while avoiding a garrison state and bankruptcy through huge expenditures for defense. Dulles promised that all aggressors, not just the Soviet Union, would face instant and massive retaliation from nuclear weapons delivered by the Strategic Air Command's (SAC's) bombers. To support this doctrine, the Eisenhower administration continued trying to improve the Nation's nuclear deterrent. Edward Teller; Princeton's

John L. von Neumann, another Hungarian-American, who participated in the Manhattan Project and then helped to develop MANIAC and other electronic computers; and other scientists, engineers, and technicians aided this work. In 1953, Teller and von Neumann suggested to the U.S. Air Force's Science Advisory Board that a smaller version of the thermonuclear device could be fashioned as a bomb weighing only 1,500 pounds. The new device, they proposed, also might be used as a warhead for ballistic missiles to be launched from land sites or, as Philip Abelson suggested in 1946, from nuclear-powered submarines.

As planning began for these lighter warheads and seaborne delivery systems, other countries continued testing nuclear weapons or joined the thermonuclear club. On August 12, 1953, the Soviet Union, again aided by information from its spies, secretly tested its own hydrogen bomb of several 100 kilotons, an achievement the CIA failed to predict with any accuracy. Foster Dulles' brinkmanship policy, based on continuing U.S. nuclear superiority but criticized at home and abroad, required extensive persuasion of the Governments of Britain, Italy, and Turkey before they agreed to station on their soil U.S. intermediate-range ballistic missiles. France refused to do so and began to develop her own separate deterrent force. When Eisenhower reorganized the U.S. Atomic Energy Commission in 1953, investment banker Lewis L. Strauss returned as its Chairman, replacing Gordon Dean. Von Neumann joined Willard Libby, also a new appointee, and holdover Thomas E. Murray as Commissioners. Strauss, as a Commissioner during 1946–50, clashed over policy with Lilienthal and Oppenheimer; as Chairman, Strauss continued to favor private control of nuclear power and testing nuclear weapons in the atmosphere. On March 1, 1954, the AEC announced the first of a new series of nuclear-test explosions—a 15-megaton Bravo air device—at its Pacific proving grounds in the Marshall Islands. Radioactive fallout from these aerial tests devastated the crews of several Japanese fishing vessels. That autumn, Soviet nuclear tests above ground also created additional broad areas of fallout. In April 1955, the Soviets agreed to help the People's Republic of China build the atomic bomb whose production Mao ordered in January.

Crises in both hemispheres continued to test the Eisenhower administration's foreign policy. Events in Iran still endangered Anglo-Iranian's operations that supplied 60 percent of the world's oil. Allen Dulles and the National Security Council emphasized for Eisenhower dangers of the unrest in Iran and the growing Soviet influence with Premier Mossadegh,⁶⁴ *Time* Man of the Year, and his government. The CIA's 5-percent share of Marshall Plan funds helped to fuel its global covert operations. The agency, legally authorized to oppose or overthrow unwanted regimes, pursued the administration's goal of not just containing but stopping and, where possible, rolling back Soviet gains. In February 1953, Allen Dulles met with the Chief of British Intelligence to formulate definite plans to oust Mossadegh with the aid of royalist Iranians. Eisenhower, who authorized withholding American aid on June 29, approved the operation on July 11.⁶⁵ Royalist troops overthrew Mossadegh on August 19. The Shah returned to Tehran, and Iran received \$45 million in U.S. aid on September 5. Foster Dulles sent Herbert Hoover, Jr., to Tehran to repeat his Venezuelan success by negotiating a long-term agreement for a new oil consortium to oversee Iranian production and royalties. The agreement with Iran was signed and ratified by October 29, 1954. As Daniel Yergin later reported, the new consortium combined British Petroleum⁶⁶ (BP), 40 percent; Aramco's four U.S. companies, 8 percent each; Gulf, 8 percent; Shell, 14 percent; and a French company, 6 percent. Oil shipments resumed on October 30 when a British tanker left Abadan. Yergin called the new arrangement one of the oil industry's major watersheds.⁶⁷ Although the change left the United States as the most significant participant in Middle Eastern petroleum trade and politics,⁶⁸ he continued, the United States and Europe remained dependent on the region's oil. Iran joined Britain, Iraq,

Pakistan, and Turkey in the Baghdad Pact in 1955 over the Soviet Union's objections that it endangered peace and security in the Middle East.

In Korea, 2 years of advances and retreats on the battlefields produced few lasting geographical changes, as each side tested the other's resolve in close combat and face-to-face negotiation. The stalemate continued in 1953 along a battle line now 20 miles or more north of the 38th parallel, except in the far west. General Maxwell D. Taylor, who led the 101st Airborne Division in General Matthew Ridgway's XVIII Airborne Corps during World War II and later served as Army Deputy Chief of Staff for Operations and Administration, took over the 8th Army on February 11 and continued Ridgway's way of waging the war. Stalin's death on March 5 offered some hope of improved relations with a Soviet Union under new leaders and perhaps a negotiated end to the Korean war. First Deputy Premier Lavrenti Beria did not long survive Stalin. In the ensuing struggle for power, Georgy M. Malenkov emerged as Chairman of the Council of Ministers, or Premier, and First Secretary of the Communist Party's Central Committee but quickly yielded the second post to Nikita S. Khrushchev. Marshal Nikolai Bulganin resumed his roles as Deputy Secretary and Minister of Defense. In June, Malenkov, Khrushchev, and other members of the Presidium, backed by Red Army leaders, arrested Beria. Promptly imprisoned and then executed, Beria was tried and convicted in absentia in December. Walter Ulbricht, opposed by Beria but now supported by Khrushchev, became President of the German Democratic Republic in March 1954.

As Ulbricht took over East Germany, a still-divided Korea had been uneasily at peace for some 7 months. On March 28, 1953, North Korea's Premier Kim Il Sung and General Peng Teh-huai (Peng Dehuai), the PRC's commander in Korea, agreed to arrangements for prisoner exchanges, and the opposing forces completed a preliminary and limited swap in April. On July 10, after the United Nations overrode objections by South Korea's President Rhee to any continued division of Korea and the 8th Army contained another Chinese offensive, the Communists agreed to resume negotiations. President Eisenhower kept his options open in July when Task Force 77, continuing its operations offshore, received nuclear weapons. Representatives from the warring commands agreed to an armistice at Panmunjom on July 27 that General Mark Clark signed for the United Nations. The truce's terms provided for a demilitarized zone, a 2.5-mile-wide separation of the 155-mile-long battle line, between the two Koreas; repatriation of some 90,000 prisoners; and a joint military commission to monitor the armistice. The arrangement gave South Korea some 1,500 square miles of additional land and terrain advantages along the zone. During the war, U.S. forces suffered more than 147,000 casualties, or 30 percent of the 476,000 killed, wounded, captured, and missing incurred by the U.N.'s 15-nation units. The conflict cost the Chinese and North Koreans, and their Soviet advisers, an estimated 1.6 million total casualties in battle, 60 percent of them Chinese, and another 400,000 elsewhere. They, in turn, inflicted total losses of about 300,000 on the South Korean forces, not counting the killed or injured civilians. During the conflict, the United States rebuilt her military power. By the war's end, U.S. forces worldwide totaled 5.8 million, of whom 440,000 were in or near South Korea. In January 1954, the Senate approved a U.S.-South Korea Mutual Defense Treaty. In the following year, the United States increased its economic and military aid to the Republic of Korea, maintaining there at least one infantry division and its supporting units.

The United Nations settled for a draw in Korea, but France lost its coeval war in Indochina. The United States, expecting France to win the struggle and hoping to keep France active in NATO, contributed more than three-fourths of the financial and material cost of fighting the Indochina conflict. During 1950–53, seven French Governments numbered their existence in months, not years. Beginning in October 1953, operations by the Viet Minh rose in frequency and intensity; in one

action, they ambushed and destroyed the veteran but road-bound French battalion sent to Tonkin from Korea after the armistice. To try to repeat on a larger scale the French victory at Na San, 15,000 French and Colonial troops established an air-land base at Dien Bien Phu, near the border with Laos and more than 200 miles from Hanoi. Against the defensive perimeter surrounding the airstrip, General Giáp deployed four full Viet Minh divisions and artillery that vastly outnumbered and outgunned the French troops and their artillery. In trying to resupply their garrison during the siege that began on November 20, some 40 percent of French aircraft, many supplied by the United States and some flown or serviced by U.S. personnel, were lost to or damaged by Communist anti-aircraft batteries. Dien Bien Phu's airstrip fell on March 27, 1954, further reinforcement and resupply by parachute mostly failed, and Viet Minh artillerymen, engineers, and infantry continued to reduce the French bastions.

While French forces struggled to hold Dien Bien Phu, Premier Laniel's government sought to end the war in Indochina. On April 26, 1954, preliminary sessions of a peace conference opened in Geneva to try to terminate the conflict. Admiral Arthur Radford, Chief of the Joint Chiefs of Staff (JCS) since June 1953, and other military and civilian officials urged Eisenhower to intervene militarily at Dien Bien Phu and elsewhere in Tonkin. Radford asked for approval to begin Operation Vautour (Vulture),⁶⁹ by ordering strikes by B-29s and B-50s from the Philippines and Okinawa and by using nuclear weapons. As part of the logistical planning for any increased American deployment in Indochina, Jack Rachlin, of the USGS Military Geology Branch (MGB), prepared for the Army Engineers a study of potential sites for new airfields. Eisenhower, although he feared losing Asia to a domino effect and declared on March 24 that the Communists in Southeast Asia must be defeated, decided not to intervene militarily in what he termed a jungle sinkhole. He would do so only with the support of the JCS, where only Radford favored intervention; Congress, which did not approve; Britain, where Churchill and Eden remained opposed; and the United Nations. On May 7, Viet Minh forces captured the remaining fortifications and nearly all the survivors at Dien Bien Phu; fewer than 100 men escaped the trap.⁷⁰

Formal sessions at Geneva began on May 8, 1954, among the representatives of Britain, Cambodia, France, Laos, the PRC, the Soviet Union, the United States, the two Vietnams, and eight other nations.⁷¹ During the meetings, Secretary of State Foster Dulles, the U.S. delegate, refused to shake the hand of Chinese Foreign Minister Zhou Enlai. Under Secretary Walter B. Smith, who went to Britain to get support for the French, replaced Dulles. On July 21, the delegates agreed to an armistice by which Tonkin and Annam were separated by a demilitarized zone along the 17th parallel to be monitored by an International Control Commission. The arrangement also enabled citizens to choose freely their country of residence; scheduled general elections throughout Vietnam for 1956, aimed at reuniting the country through a plebiscite supervised by Canada, India, and Poland; prohibited foreign bases or alliances; and limited the numbers of foreign military advisers. The accords also recognized Cambodia and Laos as politically independent states. In June 1954, Pierre Mendès-France's new government, replacing Laniel's, agreed to complete independence and free association with France for Bao Dai's southern regime. There, also in June 1954, Ngô Đình Diêm, a prominent member of the Catholic minority in the predominantly Buddhist country, replaced Prince Bao Dai as its premier. The Eisenhower administration then rejected the Geneva accords and recognized Bao Dai's government in August 1954. Eisenhower and Dulles hoped to restore U.S. prestige in Asia and, by replacing France, keep the southern half of Vietnam and other areas in Indochina out of Communist hands. They decided to support Diêm, even after General Joseph Collins, the President's special representative in South Vietnam, advised against it in April 1955.

To contain communism in the region, the United States also joined Australia, Britain, France, New Zealand, Pakistan, the Philippines, and Thailand in signing the Southeast Asia Collective Defense Treaty in Manila on September 8, 1954. The treaty led to the formation in 1955 of the Southeast Asia Treaty Organization (SEATO). A separate and secret protocol extended SEATO's protection to Cambodia, Laos, and South Vietnam, which were prevented by the Geneva accords from full participation, and France declared them economically and financially independent on December 29. The SEATO agreement did not create unified forces and a command like NATO's, but the Governments of these three Indochinese nations agreed to accept French military advisers and American economic and military aid. They also made the Mekong River that crossed their territory a free waterway. The Americans, French, and South Vietnamese proposed to reorganize South Vietnam's army under French direction and assisted by U.S. military personnel. Communist China's responses to SEATO included participating in a conference of 28 other "unaligned" nations from Africa and Asia held in Bandung, Indonesia, during April 18–24, 1955, to discuss their role in gaining peace, self-determination, and influence worldwide.⁷² There, Zhou declared that the PRC would negotiate about Taiwan and other conflicting issues rather than fight the United States, which had ratified a mutual-security pact with the Nationalist Chinese Government on February 9. The U.S. 7th Fleet completed on May 18 a 9-month evacuation to South Vietnam of local military personnel and civilians who did not wish to remain in Communist North Vietnam. Diêm survived a civil and military revolt between late March and early May, trounced Bao Dai in a referendum on October 23, and declared the Republic of Vietnam 3 days later. Hồ's regime began preparing to use its remaining units and infrastructure in the south to subvert and overthrow Diêm's government by a campaign of terrorism and guerilla war to reunite all Vietnam under Hồ's leadership. By then, some of the French forces released from Vietnamese captivity by the Geneva settlement were veterans of a year's counter-insurgency operations in French Algeria.

Closer to home, the CIA, encouraged by its success in Iran, helped to overthrow the land-reforming and socialist Guatemalan Government of Jacobo Árbenz Guzmán, elected in 1950. The CIA again acted to protect U.S. trade and investment interests after the Árbenz government seized most of United Fruit's land, sought Czechoslovakian weapons to outflank a U.S. arms embargo, and claimed that the United States planned an invasion. The CIA's Richard M. Bissell, Jr., a former economics professor at Yale and Economic Cooperation Administration (ECA) Deputy Administrator, who succeeded Allen Dulles as Deputy Director of Plans, led the operation, which Dulles authorized in December 1953. Jack Rachlin, of the USGS Military Geology Branch, completed, at 1:1,000,000, a preliminary estimate of the suitability of sites for airborne operations in Guatemala. Nicaragua's dictator Anastasio Somoza provided training bases for a revolutionary group led by cashiered Colonel Carlos Castillo Armas. When the CIA reported Soviet influence on and involvement in the Árbenz government, the Eisenhower administration authorized a U.S. blockade of Guatemala's coasts. Castillo Armas' nearly comic-opera force invaded Guatemala from Honduras on June 18, 1954. Defeated, they were saved by the intervention of the U.S. Ambassador to Panama and bombing missions by three aging P-47 Thunderbolts flown by CIA-hired U.S. pilots. Árbenz fled, and Castillo Armas' military junta took over the country on June 27. The CIA touted its success but did not assess for Eisenhower how the region's peoples might now view the U.S. positions on democracy and international law.⁷³ On September 1, the United States and Guatemala signed a technical-assistance agreement that brought to that country a full Point Four Program; a military pact followed in 1956.

As the increasingly dictatorial regime stabilized Guatemala in 1956, Fidel A. Castro Ruz, his younger brother Raúl, Ernesto ("Che") Guevara, and nearly 80 Cuban nationalist-socialist dissidents landed on the coast of Oriente Province, then

the island's largest and the Castros' birthplace. On December 2, this small force, about half the size of the one fielded by Castillo Armas, resumed Fidel Castro's earlier attempt to overthrow the increasingly corrupt government of President Fulgencio Batista. The United States supported Batista in part to keep Cuba safe for American involvement in the island's agriculture, tourism, and mining (especially the extraction of chromite and manganese). When the 1956 invasion failed, like the assault on Santiago in 1953, the Castro brothers, Guevara, and the nine other survivors escaped into Oriente's Sierra Maestra, to recruit and continue the military and propaganda war against the Batista government.⁷⁴

At home, the administration's mineral policy began to emerge during the spring of 1954. In 1953, the Illinois State Geological Survey's Morris Leighton extolled the United States' dominance in mineral production. Of the world's output of minerals and related commodities, he asserted, the United States produced 42 percent of the aluminum, 1.75 times as much as Canada; 32 percent of the cement, 4 times Britain's output; 37 percent of the coal, 1.8 times as much as the Soviet Union; 31 percent of the copper, twice Chile's production; 40 percent of the iron ore, 2.5 times the Soviet Union's production; 53 percent of the oil, nearly 5 times Venezuela's output; 42 percent of the phosphate, 3 times French Morocco's production; and 90 percent of the sulfur, 25 times as much as Italy.⁷⁵ "Technology," Leighton continued, "employing minerals of many kinds, has an importance to our present economic welfare that transcends all government efforts."⁷⁶ Leighton urged researchers to explore for new mineral deposits, to find new uses for mineral substitutes, and to develop new and more exacting methods of beneficiation. Leighton, like USGS Directors King, Walcott, and Mendenhall, reminded his readers that basic research advanced science and its applications that aided the States and the Nation. Leighton's figures also showed deficiencies in domestic production and the United States' continuing dependence on minerals from sources abroad. The prices for some of these mineral commodities rose as well. After Truman lifted World War II's price controls in 1947, oil increased from \$1.81 to \$2.76 per barrel. After Eisenhower ended Korean war controls in March 1953, prices for crude oil from the U.S. Gulf of Mexico Coast rose to \$3.11 per barrel in 1954.

After Eisenhower took office in January 1953, some of his advisers urged him to adopt a mineral policy based on the Paley Commission's report of June 1952.⁷⁷ That report, emphasizing the dangers of near-term shortfalls in beryllium, cobalt, columbite, nickel, tantalite, and tungsten, recommended buying less expensive and (or) foreign supplies.⁷⁸ In December 1952, the President-elect had notified Horace Albright, who earlier suggested convening a resources conference, that he might call for another conservation conference like Theodore Roosevelt's in 1908. By the time of Eisenhower's inaugural, most of the domestic mining industry opposed a Paley-like policy; the industry had expanded rapidly to meet defense needs during the Korean war and now faced serious readjustments due to surplus production and new discoveries, especially in lead and zinc. In March 1953, the President released to the press a letter to Albright in which he encouraged competent private organizations, like Resources for the Future, Inc., to study and promote nonpartisan discussions of these and other national issues.

In May 1953, Eisenhower appointed Clarence B. Randall, the author of "A Creed for Free Enterprise," as Chairman of the President's Commission on Foreign Economic Policy; Randall, another ECA veteran, led the opposition by Chicago's Inland Steel and the rest of the industry to Truman's seizure of the mills in 1952. The Randall Commission's other members included Senator Eugene D. Millikin (R-CO), nine additional Members of Congress, and seven persons from business and labor. Eisenhower asked Randall's group to study international trade in relation to sound domestic economy, foreign economic policy, and the trade aspects of national security and foreign policy. The Randall Commission held public hearings,

deliberated, and reported to Eisenhower in January 1954.⁷⁹ Randall's group agreed with the Paley Commission that the United States, although it held reserves of lead and zinc for 10 years, and copper for 20 years, faced increasing dependence on imported raw materials, especially chromite, nickel, platinum, and tin from Indochina, the Philippines, and other countries. The USBM agreed, listing asbestos, chromite, cobalt, columbium-tantalum, industrial diamonds, tin, and tungsten as its seven vital but deficient materials. These commodities must be developed abroad, Randall's group urged, unless geochemical and geophysical methods revealed presently unknown and unsuspected deposits or continued research and technological advances enabled the economic use of low-grade ores or provided substitutes. An intensified development of foreign minerals was not only necessary, the Randall Commission concluded, but also a means of promoting foreign economic development. Avoiding tariffs, supporting the domestic suppliers with DoD subsidies, and increasing stockpiles would mitigate price fluctuations in commodities. Randall's team, agreeing with Defense Secretary Wilson that U.S. allies against communism should be tied by mutual economic interests, called essential the retention in the free world of countries like copper-rich Chile. Millikin, who chaired the Senate's Committee on Finance and the Joint Committee on Internal Revenue Taxation, dissented and called for greater domestic production to offset U.S. dependence on outside sources. Congress did not warm to the Randall Commission's recommendation of increased trade with the Soviet bloc to boost Western Europe's economy, but the legislators did like the Eisenhower administration's repeated call for less aid and more (but not full free) trade. Randall's "A Foreign Economic Policy for the United States" appeared later in 1954, and Congress extended the existing reciprocal-trade agreements the following year for another 3 years.

While the Randall Commission deliberated, the 83d Congress and the President agreed on new measures to promote minerals security and fiscal responsibility. On July 31, 1953, they stopped providing major funds for stockpiling additional amounts of strategic and critical materials. Since the July 1946 amendment of the 1939 statute, a total of nearly \$5 billion had been appropriated for this purpose, including the \$204 million approved for acquisitions in fiscal year 1952–53. Only once during those 7 years, in fiscal 1949–50, were funds reduced, by \$100 million, after being authorized, but they still totaled \$465 million for that year. Now, with the armistice in Korea holding, Congress and the President decided to supply not more than \$30 million in fiscal 1953–54 and to use it to liquidate existing obligations for stockpiling. On August 1, by Reorganization Plan No. 7, a statute established the Foreign Operations Administration⁸⁰ (FOA), under a Director nominated by the President and confirmed by the Senate, to replace the Mutual Security Agency in directing all Federal foreign-aid projects. Six days later, to reduce the United States' dependence on "overseas sources of supply" of strategic and critical minerals, Eisenhower signed the Domestic Minerals Program Extension Act. The President and Congress intended the new law to "encourage the discovery, development, and production of tungsten, manganese, chromite, mica, asbestos, beryl, and columbium-tantalum-bearing ores and concentrates in the United States, its Territories, and possessions." The statute required each Federal department and agency "charged with responsibilities concerning the discovery, development, production, and acquisition of strategic or critical minerals and metals" to "undertake to decrease further and to eliminate where possible the dependency of the United States on overseas sources of supply of each such mineral." The act also extended for at least 2 years "all purchase programs designed to stimulate the domestic production"⁸¹ of these ores and concentrates, but it did not apply to the purchase abroad of sources of columbium-tantalum. On August 14, an Executive order abolished the Defense Materials Procurement Agency (DMPA) and transferred its functions, assets, and staff to the General Services Administration's

Emergency Procurement Service (EPS).⁸² On October 1, Eisenhower also abolished the National Production Authority (NPA) and replaced it with the Business and Defense Services Administration (BDSA), which remained in the Commerce Department until the BDSA's termination in 1970.

“One of the essential problems before our country,” Eisenhower asserted on October 26, 1953, “is the establishment of a national policy relating to the production and utilization of minerals and metals” that he considered “indispensable to the operation of an active economy and a sound defense.”⁸³ To recommend how to avoid recurrences of past chronic shortages in emergencies, secure adequate supplies now and in the future, and alleviate current depressed economic conditions in domestic metal-mining districts, the President on that day established a Cabinet Committee on Minerals Policy, composed of Secretary McKay (Chairman), Secretaries Dulles and Weeks, and ODM Director Flemming. Treasury Secretary Humphrey and the Budget Bureau's Director advised McKay's Committee. Eisenhower, stressing the “depressed conditions within numerous metal mining districts,”⁸⁴ especially lead and zinc, asked McKay to report before March 31, 1954, when the U.S. Tariff Commission's assessment of the Nation's lead and zinc industries and their imports would go to the House Committee on Ways and Means and the Senate Committee on Finance. The Cabinet Secretaries named alternate members from among their Assistant Secretaries. McKay chose Wormser, the mineral industry's chief contact in the Federal Government, who continued to supervise the USGS, the USBM, the Defense Minerals Exploration Administration (DMEA), the Division of Geography, and the Division of Oil and Gas, to which the Petroleum Administration for Defense transferred petroleum and gas mobilization functions. To aid the Oil and Gas Division's work, McKay established, by Secretarial order on April 30, 1954, a Military Petroleum Advisory Board,⁸⁵ as Truman suggested in 1946. Wormser, or his alternates, also represented Interior on the Council on Foreign Economic Policy, the Interdepartmental Materials Advisory Committee, the ODM's Titanium Committee, the Secretary of Commerce's Advisory Committee on Export Policy, and several interdepartmental committees on mineral problems and policy. To Wormser fell the task of organizing and supervising the staff work and meetings of other Secretarial alternates required to prepare position papers for the Cabinet Committee. Among the assignments was a month-long initial and confidential survey by the Legislative Review Task Force, which included members from State, Interior, and Commerce; the survey passed to Wormser on December 31, 1953.

In May 1953, the National Science Foundation (NSF) was operating from the Cosmos Club's former quarters,⁸⁶ after renovations by the GSAd, at 1520 H Street, N.W., in Washington, D.C. The NSF established an Advisory Panel for Earth Sciences, whose 12 members included seismologist Hugo Benioff of the California Institute of Technology (Caltech), USGS geologist James Gilluly, Shell's King Hubbert, USGS hydrologist Luna B. Leopold, Walter H. Munk of the Scripps Institution of Oceanography (SIO), USGS geologist William Pecora, Salt Lake City consulting geologist Philip Shenon (who left the USGS in 1946), and vertebrate paleontologist George Gaylord Simpson of the American Museum of Natural History (AMNH). The NSF also formalized its temporary committee of 1952 by establishing an Advisory Committee on Minerals Research, as recommended by the Paley Commission, to inventory “existing scientific and technical knowledge,” determine “subject areas of greatest need for further research and development,” “devise a coordinated program,” and “estimate the cost and extent”⁸⁷ of required Federal funds.

The NSF chose for the permanent Advisory Committee on Minerals Research 18 geologists, geophysicists, and chemists from the mining and petroleum industries, universities, and government; 6 of the members were current or former

employees of the USGS. James Boyd, who became Kennecott Copper's exploration manager after leaving the USBM in 1951, chaired the new Committee. Its members included NBS Director Allen Astin, who also served on the Inter-Agency Committee on Scientific Research and Development; John G. Bartram, a consultant formerly with Stanolind Oil and Gas; Yale and USGS geologist Alan Bateman; Arthur Bunker of Climax Molybdenum; Gordon L. Davis of the Carnegie Institution of Washington's (CIW's) Geophysical Laboratory (GL); Maurice Ewing, Director of Columbia's Lamont Geological Observatory (LGO); Paul D. Foote of Gulf Research and Development; Harvard's Louis Gratton, who served full time with the USGS during 1903–09; John K. Gustafson, of the M.A. Hanna Company; Wisconsin's Charles Leith, who also served with the USGS and National Research Council; Thomas Nolan, William Rubey, and William Wrather of the USGS; Louis B. Slichter, Director of the Institute of Geophysics of the University of California at Los Angeles (UCLA); John W. Vanderwilt, president of the Colorado School of Mines; Battelle's Clyde Williams; and Paul Zinner, head of the USBM's Minerals Division and later Assistant Director for Programs.

Four topical subcommittees, on which academia, industry, and government were all represented, aided the Advisory Committee's deliberations. The 14-member Subcommittee on Geological Research included USGS geologists Charles A. ("Andy") Anderson and Thomas Lovering, Columbia's Charles Behre, Jr., Arthur Buddington of Princeton and the USGS, Harvard's Hugh McKinstry, and Vincent D. Perry of Anaconda Copper. USGS geologists Robert Garrels and Earl Ingerson, Konrad Krauskopf of Stanford and the USGS, Columbia's John L. Kulp, and Utah's Edwin W. Roedder formed the Subcommittee on Geochemical Research. USGS geologists James Balsley and Henry Faul, Harvard's A. Francis Birch, Sigmund Hammer of Gulf Research and Development, Penn State's Benjamin F. Howell, Jr., and Patrick M. Hurley of the Massachusetts Institute of Technology (MIT) served on the nine-member Subcommittee on Geophysical Research. Howell, Kulp, and Roedder were among the earth scientists who received research grants from the NSF in 1953–54. Charles Hunt, now Executive Director of the American Geological Institute (AGI), and Howard Meyerhoff, still the Executive Director of the Scientific Manpower Commission, formed the Subcommittee on Scientific Manpower.

The Advisory Committee completed an outline "as a guide to division of effort among its subcommittees and a sample catalog of the kinds of problems facing the Nation in the mineral research field," including for completeness those inappropriate for the NSF's direct financial support but important for "its evaluation and policy-making functions."⁸⁸ The Committee recognized "the importance of Federal support of research and training" but industry, the Committee added, should "support the preponderate amount of research in this field, especially applied research and development."⁸⁹

In March 1954, as the Cabinet Committee on Minerals Policy finished its report, Eisenhower signed an Executive order intended to improve economy and efficiency in, and develop a national policy for, "basic research and education in the sciences."⁹⁰ The order authorized the NSF to recommend policies for promoting and supporting basic research and education. Eisenhower asked the NSF to assess present and foreseeable needs for personnel, facilities, and funds; review, with the agencies concerned, the federally sponsored programs; provide increased support through contracts and grants; study, with the agency heads and HEW's Commissioner of Education, the effects of Federal policies and administration of the financial aid on education; and coordinate Federal activities in improving the dissemination, as security considerations allowed, of scientific information. Eisenhower also requested the heads of Federal scientific-research agencies to ensure that their managerial, organizational, and fiscal practices facilitated consultation

with and review by the NSF and that their agencies, whenever possible, shared major equipment and facilities. No such agency, the President cautioned, should procure new major equipment or facilities without determining if existing inventories or facilities might meet their needs. Eisenhower also designed his Executive order to “to strengthen the conduct and support of vital research and development in the several agencies where science is important in achieving their assigned missions.”⁹¹

In the same month, the President’s Cabinet Committee on Minerals Policy discussed its basic proposals with Eisenhower. On March 26, 1954, Eisenhower announced, as the Committee recommended, an expansion of the stockpiles of strategic minerals to serve better the Nation’s security and, as Alfred Eckes, Jr., later observed, specifically to aid the domestic producers of lead and zinc. The Cabinet Committee’s report of November 30, approved by the President on December 1, emphasized that its members had used the lead-zinc situation as a test case. Meeting the newly established stockpile objectives for those two commodities required additional purchases and additional efforts to “maintain domestic production at a reasonable level.”⁹² The announcement of the new stockpile policy firmed up the lead and zinc markets. In June, as purchases began under this new policy, market prices for lead and zinc rose 20 and 24 percent, respectively, above their low points in February, increases the Committee hoped would meaningfully aid that domestic part of the Nation’s mobilization base. The Committee recommended a periodic review of the two minerals and some others.

The Cabinet Committee on Minerals Policy took as its guides three major concerns—having mineral raw materials available “to meet any contingency during the uncertain years ahead,” meeting “the ever-growing mineral requirements of an expanding economy,” and preserving “the added economic strength represented by recent expansion of facilities by the domestic mining industry.” As with oil, the report emphasized prudent use and development of mineral resources at home and “assured access to necessary sources abroad.”⁹³ The Cabinet Committee’s overriding concern in considering “policies relating to mineral production and utilization” remained “the security of the Nation.”⁹⁴ Its members agreed on recommendations they believed would “foster a full and orderly program”⁹⁵ for developing and conserving these resources. As of June 30, 1954, \$4.3 billion worth of 75 materials, of which 55 were metals and minerals, being stockpiled were on hand, out of the minimum objective of \$7 billion. Significant commitments for stockpiling, at least cost whenever possible, were among those funded by the more than \$6 billion already “made to expand supplies of materials to meet defense purposes.”⁹⁶ The Committee recommended preparing studies, on a case-by-case basis, to determine the proper levels of domestic mineral production for each mineral commodity as a basis for mobilization planning. Instead of continuing to emphasize foreign sources, the Committee backed a new, long-term program of stockpiling that gave preference to newly mined metals and minerals of domestic origin. Its members also supported (1) reviewing and modifying the tax structure and the mining statutes to remove deterrents and stimulate discovery and production of minerals and (2) strengthening and expanding the DMEA’s financial assistance to private industry for exploration. The Committee also urged strengthening and widening Interior’s abilities in mapping and research, especially those “that must precede or supplement private exploration,”⁹⁷ activities now supported by the implementation of measures suggested by the McKay-generated reviews of the USGS and the USBM. The Cabinet Committee proposed increasing acquisitions of some 35 to 40 strategic and critical metals and minerals, from domestic sources whenever and wherever possible, to eliminate the risk of future shortfalls. The ODM should review with Interior, Commerce, and other concerned departments and agencies, the report continued, the tasks of building and maintaining the metals-minerals

mobilization base and delegate authority as required “to assure full coverage of mobilization planning.”⁹⁸ Wormser, expecting ODM authorization, arranged for a series of mineral-mobilization studies; an analysis of fluorspar followed the one on lead and zinc completed by the end of fiscal year 1953–54. On November 12, 1954, as recommended by the Cabinet Committee, the ODM delegated to Interior responsibilities for developing preparedness measures for a comprehensive list of minerals and fuels and McKay passed them to Wormser.

The \$27,750,000 in SIR funds authorized on July 31, 1953, for USGS operations during fiscal year 1953–54 represented almost \$2.4 million more than in 1952–53. The Interior Department also received a \$500,000 supplement⁹⁹ on August 7 to carry out its continuing functions under the Defense Production Act. The USGS appropriation included more than \$686,000 for general administration, to which about \$444,000 for similar overhead was added from the funds advanced or reimbursed by other Federal agencies for program expenses, for a total of about \$1,130,500, a \$29,000 increase from 1952–53. The SIR funds also contained some \$98,500 for investigations of soil and moisture conservation. At year’s end, the USGS reported nearly \$48,486,000 in total funds received, about \$430,000 more than in 1952–53. These monies included nearly \$27,034,000 in SIR appropriations; some \$5,622,000 from nonfederal sources, mostly from States, counties, and municipalities; and slightly more than \$15,622,000 from other Federal agencies. The SIR funds now represented nearly 56 percent of the total, up by 4 percent from fiscal 1952–53; 32 percent, or a 4-percent loss, came from other Federal agencies, mostly from the AEC, the Army, and the USBR; and nonfederal sources provided the same 12 percent as in the previous year. Those funds supported salaries and operations by the more than 6,500 full- and part-time employees in the USGS. The staff’s numbers varied in budget estimates and year-end reports according to how their positions were counted—by time worked, as more than 80 percent were employed full time, or by the sources of their salaries and operations, as about 70 percent were funded by SIR monies.

In November 1953, the USGS began operations at Menlo Park in California. The General Services Administration aided the USGS in locating a 4.5-acre site in Menlo Park adjacent to 83 Federal acres under lease to Stanford under the Lanham Act. During the first week of November, the USGS started to occupy the 33,370 square feet of the two-story Building 1 on Middlefield Road as the initial unit of office and laboratory facilities in the USGS Pacific Coast Center. Building 1, constructed under a GSAd build-lease contract, cost \$550,000; the agreement also required holding open adjacent space for any needed additional building. Building 1’s contract provided for an initial 5-year lease to the GSAd, for use by the USGS, that could be extended for sequential 5-year terms and it passed to the GSAd’s control in 1960. The USGS intended its new regional office and grounds as a campus for a bureau field center on the West Coast that would include a library of 25,000 books and serve field operating offices of the Divisions in the Western States. By the end of January 1954, about 120 people, mostly mineral-resources specialists, moved into Building 1. Thomas Osborne transferred from the GSAd to the USGS to lead the latter’s Administrative Division office at Menlo Park. The USGS formally changed the name of its new western headquarters, led by David Gallagher, to the Pacific Coast Center on September 9.

Also in November 1953, Nolan asked Wrather to be relieved from his nearly decade-long service as Assistant Director and to be returned to research. As Wrather pondered Nolan’s request, Nolan sought William Heroy’s advice in January 1954 about staying on as Assistant Director and who would best succeed the now seriously ill Wrather when the Director retired. Beginning in February and continuing throughout the remainder of 1954, Nolan renewed his plea for reassignment in correspondence with Wrather, Wormser, and McKay, a wish also motivated by



James Douglas McKay (1893–1959), the 35th Secretary of the Interior (1953–56), stands at the far right in this group portrait. McKay, an Army veteran of World Wars I and II, also was an automobile businessman before entering politics. He served in Oregon as mayor of Salem (1933–34), State senator (1935–49), and Governor (1949–52). McKay succeeded Oscar Chapman on January 21, 1953, and continued as Interior Secretary until his resignation became effective on April 15, 1956. This photograph, taken in the White House on March 3, 1954, on the occasion of the 75th anniversary of the U.S. Geological Survey (USGS), also includes (from left to right) President Eisenhower, USGS Director William Wrather, and Felix Wormser, McKay's Assistant Secretary for Mineral Resources. (USGS photograph, Public Inquiries Office 50–4a [1c]; published in *Society of American Military Engineers*, 1954.)

Nolan's view on November 5 that his departure would resolve an unstated conflict between the USGS and Interior. Nolan now formally requested from Wrather a reassignment that returned him to work on mineral exploration, especially at Eureka and elsewhere in the Great Basin. Nolan suggested that the NAS be contacted for advice on choosing a successor.

In 1954, as Wrather struggled with his infirmities and Nolan with his responsibilities, the USGS marked its 75th year of public service. Wormser, a friend of Eisenhower who worked with him while he presided at Columbia, urged McKay and Wrather to call on the President at the White House on March 3. "The President," Wrather later recalled, "was in a relaxed and chatty mood. During his early military career he had been given assignments which had brought him in contact with the Survey and its work. * * * He was interested in some bits of Survey history and kept asking questions, ignoring the wig-wagging of his assistants" trying to return him to his schedule. After mentioning annoying activities by one of the bureaus that originated in the USGS, Eisenhower, chuckling as the group rose to leave, told Wrather that he "wish[ed] you had them back again."¹⁰⁰ A group photograph also recorded the visit.

John Rabbitt, after incautiously asking about ongoing plans for activities to be held on the occasion of this USGS anniversary, found himself appointed to lead the agency's planning and preparations for several events and publications. John and Mary Rabbitt arranged for a weekly series of brief news releases about USGS operations to be issued between March and May 1954. Director Wrather's single-page notice of the anniversary, in *Science* for March 5, emphasized the agency's pledge to look "ahead to increasing opportunities to contribute to the advancement of science and to the common welfare of the Nation,"¹⁰¹ thereby also trying to build its own health in the coming years. The Rabbitts coauthored, for *Science* on May 28, a brief history of the agency.¹⁰² Mary Rabbitt, whom James Balsley selected to become Assistant Chief of the Geophysics Branch that year, discussed current work by the USGS in the Colorado Plateau Province in the June issue of *Scientific Monthly*.¹⁰³ Unlike the 25th anniversary in 1904, the USGS held no commemorative dinner. The 75th anniversary's major event took place in the auditorium of the Old Interior (later the GSA) Building in Washington during the evening of April 21, 1954. There, the Washington Society of Engineers and the District of Columbia Council of Engineering and Architectural Societies sponsored a program to commemorate 75 years of scientific investigations by the USGS. McKay, Wormser, Mendenhall, and Wrather formed the quartet of honored guests. Brief remarks by the first three men preceded Wrather's presentation on "75 Years of Scientific Investigations." Wrather reviewed USGS history and current work by the agency's more than 6,500 employees, some two-thirds of whom were classified as engineers and scientists. In closing, he claimed that the USGS consistently chose throughout those 75 years to remain an unbiased fact-finding and investigative professional agency. Wilmot ("Bill") Bradley, Harold Duncan, Carl Paulsen, Gerald FitzGerald, and Robert Moravetz then mentioned some of their units' personnel and aspects of their responsibilities and operations.

For the Geologic Division, Bill Bradley managed more than \$16,466,000 during fiscal year 1953–54, nearly \$494,000 more than in the previous year and a total that exceeded the Topographic Division's monies in 1953–54 by some \$439,000. The AEC's transfer of \$7,192,000, a raise of more than \$24,000, remained well above the Division's SIR appropriation of almost \$6,340,000, an increase of about \$783,000 from the amount provided in 1952–53. Some members of the Geologic Division were uneasy about the increasingly large transfers from the AEC. The Army and its Engineers transferred \$1,067,500, the FOA added about \$451,000, the Navy supplied \$409,000, and the DMEA shifted \$344,000. The USBR, the States

and their political subdivisions, and the Government Printing Office (GPO) furnished a total of some \$437,500; the GPO provided its monies specifically for map reproduction. The GSAd, the U.S. Air Force (USAF), and the Bureau of Indian Affairs (BIA) together gave \$117,500. An additional \$98,000 funded classified work for several Federal agencies. The USBM transferred less than \$2,300.

In the new fiscal year, Olaf Rove relieved Esper Larsen 3d as Assistant Chief Geologist for Operations. The Division restyled as “Publications” its Geologic Information and Reports unit. A series of Survey orders, beginning on January 11, 1954, and signed by Nolan as Acting Director, retroactively confirmed the reorganization, in September 1953, of four of the Geologic Division’s Branches—Fuels, Geochemistry and Petrology, Geophysics, and Mineral Deposits—that represented the initial major modifications since the end of World War II.

The Survey order that reorganized Ralph Miller’s Fuels Branch established “four operating units based upon field centers”¹⁰⁴ to decentralize Branch operations and to promote more effective planning for and review of programs and their publications. Paleontologist Curt Teichert left the New Mexico School of Mines in 1954 to start and lead the Branch’s new Fuels Geology Laboratory. During fiscal year 1953–54, Fuels geologists pursued 45 projects, principally those on oil and gas, in 23 States, and concentrated on areas that most needed exploration and those not fully explored by industry. Howard Rothrock’s team issued its preliminary report on the geology of the Scurry Reef as Oil and Gas Investigations Map OM–143, at 1:48,000, in 1953.¹⁰⁵ By the end of 1952, the reef-limestone fields in Texas’ Scurry County and adjacent Kent County alone had produced more than 139 million barrels of oil, and the nonreef fields yielded another 2.6 million barrels. Production from fields in adjacent Borden and Howard Counties to the west added 39 million barrels by the end of calendar 1953. New fields continued to be discovered in the rocks of the late Paleozoic Horseshoe Atoll during the remainder of the 1950s. Other Branch geologists also mapped areas on the oil-exploration frontier, including those in the Pacific Northwest and the deeper Paleozoic rocks in the midcontinent region, while investigating the hydrodynamic accumulation of oil and gas. For the Navy, Branch geologists examined Eocene oil shales and estimated their reserves in the Naval Oil Shale Reserve No. 2 in eastern Utah, extended that work south and east to similar deposits in Utah and Colorado, and continued studies of Devonian oil shales in New York. Branch geologists mapped coal-bearing stratal sequences in selected areas as part of 18 projects in 12 States. They completed and issued 10 reports on coal fields in Indiana, Kentucky, Montana, North Dakota, and Pennsylvania. A progress report by Paul Averitt’s group summarized the ongoing reestimation of the Nation’s coal resources, work then complete for about half of the States. They also published new detailed estimates of statewide resources in Colorado and Indiana and continued to prepare reports for those in Alabama, Arkansas, Kentucky, and Oklahoma. In the spring of 1954, the USGS and the USBM agreed to shift responsibility, by the beginning of fiscal 1955–56, for all of their long-standing shared work on coal resources to the USGS.

The next Survey order reorganized Earl Ingerson’s Geochemistry and Petrology Branch by establishing three operating groups, each with “a common interest in a major realm of scientific investigation,”¹⁰⁶ and a fourth group to provide technical services. Branch members advanced the application of X-ray fluorescence in determining concentrations of niobium, selenium, thorium, and other elements; developed spectrographic and chemical techniques for thorium and rare-earth elements; and improved the field-test method for germanium. The Branch began operating its trailer-borne laboratory to improve its efforts in geochemical and geobotanical prospecting.¹⁰⁷ To increase the understanding of mineral-formation processes, Branch scientists used a punch-card computer in applying the new Hauptman-Karle method to calculate the atomic structure of crystals of boron-bearing colemanite. They also experimented with synthesizing uranium and

vanadium, developed an apparatus to study acidity and oxidation changes in ores leached by natural waters, and devised methods to estimate the temperature of formation from liquid inclusions in crystals. The radiocarbon laboratory, during its initial full year of operation, contributed to wider efforts to sort out sequences of late Pleistocene glacial events. The Branch also operated two mass spectrometers to determine isotopic ages of minerals and their depositional processes and began applying modern statistical methods to field-geology problems.

Another Survey order, effective August 19, 1954, centralized the Geophysics Branch's administrative functions and confirmed the continuation of its three surveying Sections—Airborne, Ground, and Radiation.¹⁰⁸ As authorized by Bill Bradley's earlier memorandum, James Balsley replaced Henry Joesting as Chief of the Geophysics Branch on November 2, 1953. When Balsley reorganized the Branch in December, Louis C. Pakiser succeeded William Dempsey (Sr.) as Acting Chief of the Ground Surveys Section. Ground-based members of the Pick and Hammer Club's show in May 1953 had again burlesqued the Branch's growing program in airborne geophysics, which now operated two aircraft, in "Aces Wild," using the "Army Air Corps" song of 1939, and later the Air Force's own:

**Off we go into the wild blue yonder,
Seeking out sources of ore.
As you know, we are equipped to ponder
Problems that others abhor.
In a glow over the funds we squander,
All complaints we can ignore.
We steer our kites by magnetite;
Nothing can stop the Survey Air Corps.¹⁰⁹**

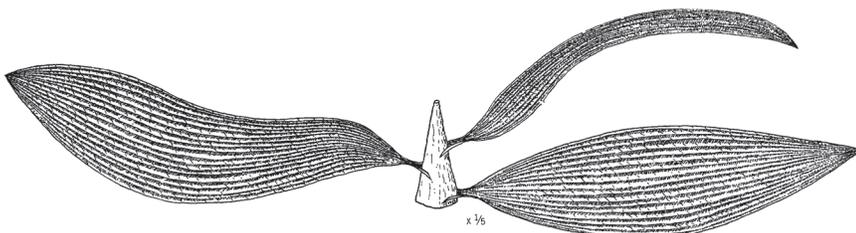
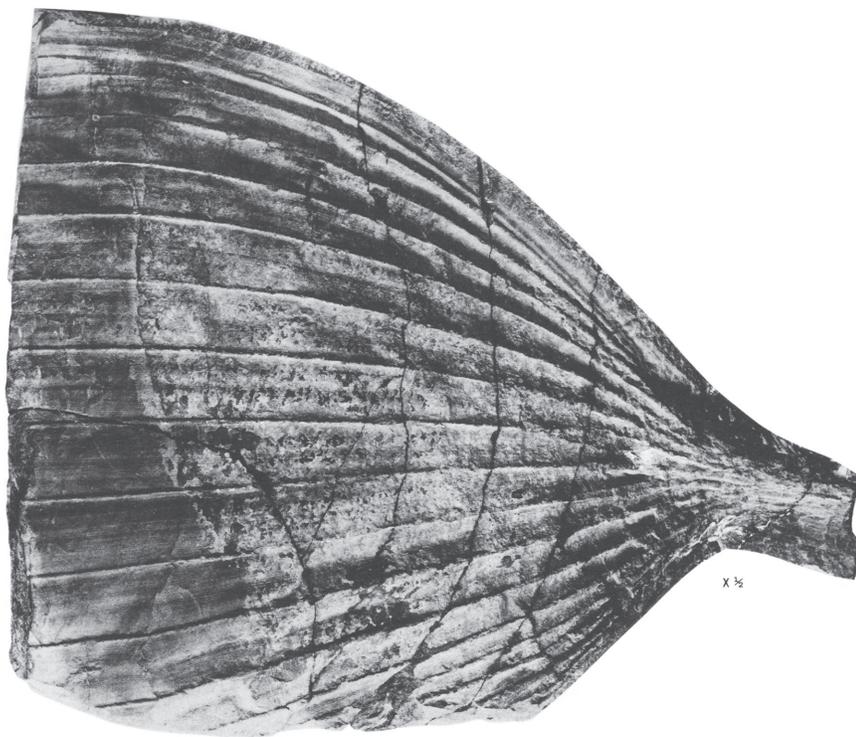
Branch members flew aeromagnetic surveys in six States and Alaska and 30,000 traverse miles of radioactivity surveys for uranium-thorium deposits in eight States during 1953–54. Recording large radioactivity anomalies during the latter surveys led to the discovery of ore-grade material in north-central Arizona and in South Dakota's Black Hills. Electrical, gravity, magnetic, and seismic ground surveys in 10 States, Alaska, and Greenland gathered data on subsurface stratigraphy and structure to apply in studies of engineering and military geology, mineral resources, and water supplies. Gravity and aeromagnetic studies in California's Mojave Desert disclosed information about the geologic structures under the Quaternary alluvial deposits. Investigations on the Colorado Plateau continued to contribute to a better understanding of its regional geology and the occurrence of uranium. The Branch's

This photograph shows the geologic section at the west end of the Rifle Mine on the east side of East Rifle Creek in Garfield County, some 13 miles northeast of Rifle, in western Colorado. The Mesozoic rocks exposed in this section belong to the Chinle Formation (Triassic, **Tc**) and Jurassic strata of the "Navajo(?)" (**Jn**), Entrada (**Je**), and Morrison (**Jm**) Formations. The Rifle Creek area produced "about 750,000 tons of vanadium-uranium ore, mostly from the deposit in the Navajo(?) and Entrada sandstones." Richard Fischer, accompanied by USGS colleagues, returned to this area in 1954 to study and interpret its "structural features, ore habits, and geochemical relations" for the U.S. Atomic Energy Commission's Division of Raw Materials. Fischer suggested that the ore was formed contemporaneously with deposition of the sandstones, "under conditions that selectively mineraliz[e]d a small part of a nearly homogeneous host and permitted the fractionation of the five elements—vanadium, uranium, lead, selenium, and chromium—that are enriched in the ore layers." (Quotations and photograph from Fischer, R.P., 1960, p. 1, 2, and pl. 5.)



shallow-reflection seismograph made possible detailed mapping at depths of 50 to 1,000 feet below the ground surface. Hope continued high that the shallow-reflection methods would be as useful in mineral exploration and studies of groundwater and engineering geology as the deeper reflection technique for structures below 500 feet. The Branch obtained an IBM 701 computer in 1953 to aid in processing seismic data.

Andy Anderson replaced Olaf Rove as Chief of Mineral Deposits Branch after Rove became the new Assistant Chief Geologist for Operations. A Survey order, effective October 22, 1954, reorganized the Branch to provide “four project centers and eight field offices for DMEA activities.”¹¹⁰ Under Anderson’s general direction, Branch members worked on 90 projects in 25 States, 9 in cooperation with State agencies. Branch geologists continued to participate in exploratory drilling in Utah’s Tintic district, in the Mojave Desert, and on the Colorado Plateau, where field studies also continued for the AEC that yielded significant new deposits and extended known reserves. On May 5, 1954, Pick and Hammer players borrowed Ted Koehler and Harold Arlen’s 1931 song “Between the Devil and the Deep Blue Sea” to remind their audience of the continued dangers of working for the AEC:



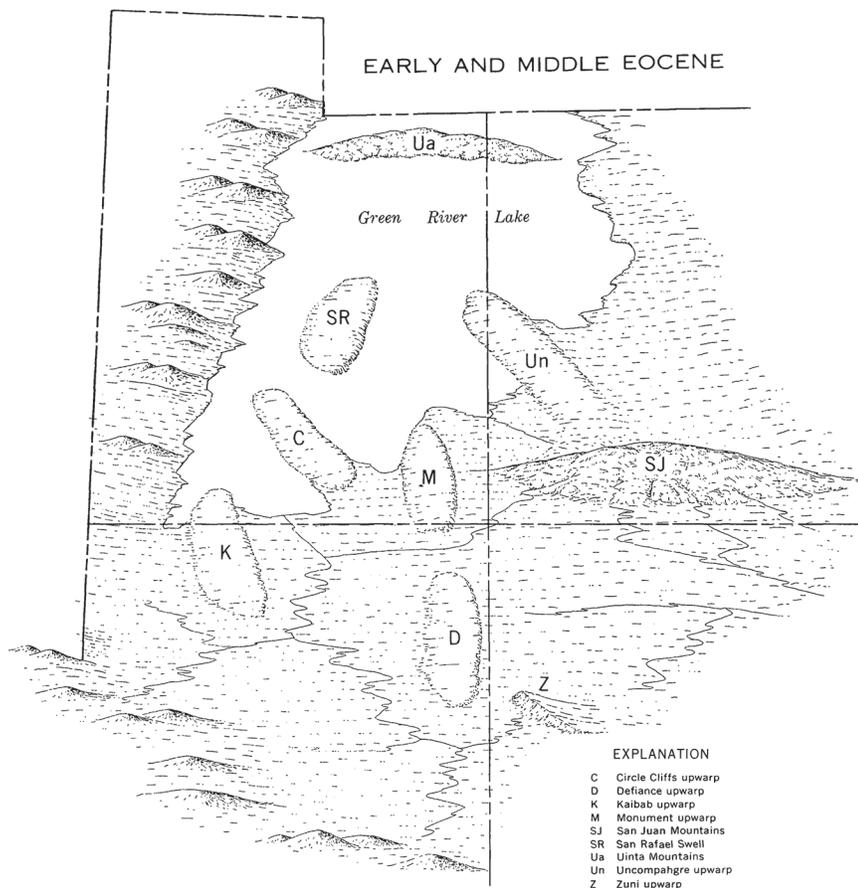
The specimen shown in the photograph (above) of *Sanmiguelia lewisi*, a palmlike plant whose broad leaves had parallel veinlets between the ribs, was collected during 1953–55 by USGS paleontologists G. Edward Lewis and Roland W. Brown from an outcrop of the Dolores Formation (Triassic), near Placerville in southwestern Colorado. The reconstructed plant is shown in the sketch (below). Brown termed these fossils primitive palms or palmlike monocotyledons and “the earliest known angiospermous flowering plant.” Many large land-plant and land-vertebrate fossils were dated and correlated by their stage of evolution or associations with microinvertebrates and megainvertebrates, unless the ages of their enclosing rocks or sediments could be determined by the lead-uranium or other radiometric geochronologic method. Plants and vertebrates often were just as important as invertebrates as indicators of past environments. (Quotation, photograph, and drawing from Brown, R.W., 1956, p. 205, pl. 33, fig. 2, originally shown at $\times 0.5$, and text fig. 29, originally shown at $\times 0.2$.)

**They ought to cross us off their list,
Yet we'd hate to have them slam the door;
A million would be hardly missed—
So we come running back for more.**

**We don't use it,
But we'd hate to lose it,
We're always in between
The devil and the AEC.¹¹¹**

Mineral Deposits Branch personnel also advanced regional studies of mineral resources for two interagency committees—one for rivers in New England and New York and the other for the Arkansas-White-Red Rivers. Branch scientists found, for the DMEA and the EPS, mercury reserves at California's New Idria Mine equal to nearly 32 percent of U.S. production during 1952. Continuing investigations near Idaho's Sugar Pine Creek disclosed a 15-foot-thick section of high-grade phosphate rock. Other specialists working in Minnesota's Cuyama Range subdivided into mappable units a stratigraphic sequence that contained two iron-bearing formations to aid exploration for new deposits. Modifying the field test for titanium, Branch specialists also developed a rapid means of estimating iron content. The Geochemical Prospecting Unit's laboratory similarly produced a quick and accurate field technique for columbium. Branch geologists found a talc deposit in a part of Vermont previously thought to lack that commodity. Mineral Deposits Branch and other Division geologists expected their initial application of modern statistical methods in field analyses to aid mineral exploration.

Personnel in Edwin B. Eckel's Branch of Engineering Geology were involved in 25 field investigations in 10 States during fiscal year 1953–54. They concentrated on mapping large urban or rural areas to provide geologic information to use in the planning and construction stages of engineering projects. Branch members continued to work in Denver, Knoxville, Los Angeles, Oregon's Portland, the San Francisco Bay area, and Seattle. Their efforts also contributed to the long-range program to revise existing small-scale geologic maps of the Nation or to complete the mapping at larger scales. Their colleagues completed three projects in the Missouri River Basin and continued cooperative mapping in Massachusetts and Rhode Island. General and specific studies of landslides and landslide problems continued near Washington's Lake Roosevelt, South Dakota's reservoir (Lake Francis Case) behind Fort Randall Dam, and two of the Navy's radio and ordnance stations elsewhere. Similar work involved investigations of building-foundation conditions in Colorado near Colorado Springs, for the Federal Housing Administration, and a road being relocated near Marshall, for the State's Highway Department. Eckel, Laurence P. Buck, J. Mark Cattermole, Ernest Dobrovolny, Glenn R. Scott, Donald E. Trimble, and Richard Van Horn, all of the Geologic Division, and Harold Thomas of the Water Resources Division's Ground Water Branch combined to produce, as a guide to interpreting geologic maps for engineering purposes, six maps at 1:62,500, with 20-foot contour intervals, of the Hollidaysburg quadrangle, south of Altoona, in Pennsylvania. The authors chose this quadrangle "for interpretation only because the [Geologic Atlas] folio [227, by Charles Butts] was recently published [in 1945], hence easily available by purchase" or "borrowed from or consulted in most public and university libraries." The team's six maps showed topography, general-purpose geology, foundation and excavation conditions, construction materials, water supply, and site selection for engineering works. The site-selection map illustrated the problems connected with three projects—a railroad tunnel, two power dams, and a road. The authors prepared these maps "to show the kinds of information, useful to engineers, that can be derived from ordinary geologic maps."¹¹² They field checked their interpretations; only the scenic-view points and slope angles of artificial cuts were not determined from maps.



This map shows the Colorado Plateau's physiography during the early and middle Eocene, as reconstructed by USGS geologist Charles Hunt. "Downwarping of the Uinta Basin produced the [huge] Green River lake," into which the surrounding upwarped areas contributed sediments to form the varved deposits. The lake's strata and fossil biotas were studied by Wilmot ("Bill") Bradley, Hunt's colleague and also his supervisor while Bradley served as Chief of the Military Geology Unit and later as Chief Geologist. Hunt deciphered the Cenozoic history of the Colorado Plateau and displayed the physiography at 10 intervals in its development—Late Cretaceous, early Paleocene, late Paleocene, early and middle Eocene, late Eocene, Oligocene, early Miocene, middle Miocene, late Miocene to middle Pliocene, and late Pliocene to Recent. (Quotation and map from Hunt, 1956, fig. 56 and caption.)

During fiscal year 1953–54, members of Charles Hunt's General Geology Branch pursued 24 field studies in 16 States and the Territories of Alaska and Hawaii. Mapping and analyzing the geology of phosphate- and uranium-bearing formations in South Carolina yielded information that advanced the Division's continuing search for these minerals and efforts to understand their origin and distribution. The series of Geologic Quadrangle Maps of the United States began including 1:24,000 maps with the appearance in 1953 of the Niota (GQ-18) and Athens (GQ-19) sheets, both in Tennessee and both by John Rodgers and dated 1952. As the remaining smaller scale geologic maps in the series appeared, the number of geologic quadrangle maps at 1:24,000 increased, and that scale later became the new standard.¹¹³ That change reflected the Topographic Division's shift to orthophotographic maps at 1:24,000 to provide national coverage at greater detail. Hugh Miser moved to the Director's scientific staff in 1954; that year the USGS published his geologic map of Oklahoma, at 1:500,000, prepared in cooperation with the Oklahoma Geological Survey.

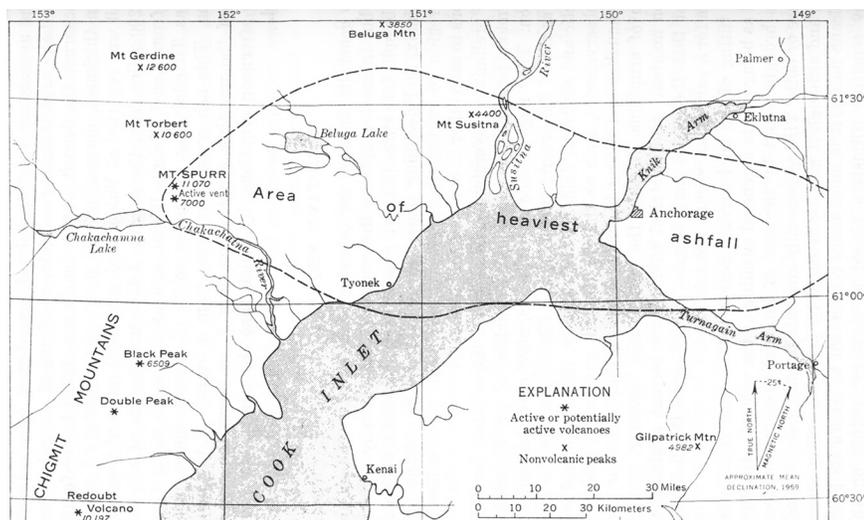
Work by members of the General Geology Branch in Alaska and Hawaii involved, as before, studies of volcanoes and volcanic rocks. During the 1953 field season, studies of an eruption by another of Alaska's historically dormant volcanoes enabled USGS geologists to increase their understanding of these events beyond that already gained at Novarupta-Katmai, Okmok, and Trident. At 5 a.m. on July 9, a relatively small but especially violent eruption began at Crater Peak (a subsidiary vent) on the southern flank of Alaska's Mount Spurr, a stratovolcano in the Tordrillo Mountains, some 75 miles west of Anchorage. Four officers in two jet aircraft on patrol from Elmendorf Air Force Base observed the eruption and the growth of its cloud for about an hour and returned with ash-frosted Plexiglas windows. The cloud rose rapidly to 70,000 feet and passed east on the prevailing winds

This photograph shows the type section of the Chattanooga Shale (Upper Devonian) at Cameron Hill, in Chattanooga, Tennessee. USGS geologist C. Willard Hayes coined the name “Chattanooga black shale” in 1891 for a unit widespread in the interior of the United States and adjacent Canada. In 1944 and in 1947–49, Wilbert Hass and his USGS colleagues investigated the phosphate nodules, the uranium deposits, and the brachiopods, conodonts, and other fossils in the Chattanooga Shale and the overlying Maury Formation (Lower Mississippian) in central Tennessee and adjacent States for the U.S. Atomic Energy Commission’s Division of Raw Materials. As the Chattanooga Shale’s type section exposed only a part of the formation, Hass, Louis Conant, and Vernon Swanson measured a complete standard section some 7 miles east of Smithville in DeKalb County, Tennessee. Hass based his age and correlation of the Chattanooga Shale principally on his descriptions and analyses of the formation’s several distinct conodont faunas. (From Hass, 1956, pl. 5.)



to shower a quarter-inch of ash on Anchorage, Elmendorf, and Fort Richardson, as part of a 25-mile-wide swath that extended as far east as Valdez. The commanding officers of the Alaskan Command and the Alaskan Air Command provided transport for aerial and ground observations of the volcano during July 11–16 by USGS geologists Werner Juhle and Henry W. Coulter, who had been working at Katmai in cooperation with the NPS and the DoD. Ray Wilcox completed on July 27, for the two Alaskan military commands, a preliminary report on the eruption and the ash fall on Anchorage that disrupted air traffic for 2 days. Juhle, Coulter, and Wilcox determined the general sequence of events at Mount Spurr.¹¹⁴ Increased fumarolic activity began late in May. The seismological observatory at College, some 300 miles northeast, recorded on the evening of July 8 and early on July 9 relatively short oscillation intervals that Wilcox termed characteristic of volcanic earthquakes and possible precursor signals. Microseismic swarms started a few minutes before the eruption began at 5 a.m. on the 9th and continued to 9 a.m. and resumed between 3:30 and 5 p.m. Coeval heavy rains caused flooding on the Chakachatna River that formed a temporary debris-dam lake 5 miles long.

Ray Wilcox’s summary report in 1959 offered a preliminary primer for evaluating volcanic hazards. He emphasized that the eruptions of Novarupta-Katmai, Trident, and Spurr occurred in the absence of any historic record of previous events since the 1770s; future eruptions from the remainder of Alaska’s some 40 volcanoes could well come from those still considered dormant. He discussed eruptive symptoms—earthquakes, ground tilt, and local disturbances of electrical and magnetic fields—and eruptive sequences—preliminary, outbreak and climax, and decline. He plotted distribution maps for the ash falls from Java’s Gunung Kelud in 1919, Iceland’s Hekla in 1947, Novarupta-Katmai in 1912, Okmok in 1945, Parícutin in 1943, Chile’s Quizapú in 1932, Spurr in 1953, and Trident in 1952. Wilcox also noted meteorological factors in Alaska, emphasizing the effect of rainfall, as well as wind direction and speed, in determining the distribution of ash falls. He suggested that wind-rose diagrams compiled from upper-wind data at specific Alaska stations could provide preliminary estimates of the distribution of ash from future eruptions of specific volcanoes. Wilcox also reviewed the harmful and short-term effects of eruptions on agriculture, buildings, communication, public health and safety, transportation, utilities, and water supplies and the long-term beneficial influence on crops, soils, and vegetation.¹¹⁵



The dashed line on this map (originally at about 1 inch = 23 miles) encloses the area of the heaviest ash fall during the eruption in 1953 of Mount Spurr in the Alaska Range's Tordrillo Mountains, about 75 miles west of Anchorage. At 5 a.m. on July 9, 1953, after a few minutes of harmonic tremor, "a glacier-filled vent [at an elevation of 7,000 feet] on the south flank of Mount Spurr erupted with tremendous violence, shooting a mushroom cloud * * * to a height of 60,000 or 70,000 feet in * * * some 40 minutes." Volcanic ash began falling on Anchorage and its airfields about noon; one-eighth to one-quarter inch accumulated by the morning of July 10. Ash falls extended eastward to Valdez. In his summary report in 1959, USGS geologist Ray Wilcox also reported seasonal wind directions during 1948–53 at altitudes of 5,000, 10,000, 20,000, 30,000, and 40,000 feet at Adak, Anchorage, Dutch Harbor, and Kodiak, and he prepared wind roses centered on Redoubt Volcano in the Aleutian Range for altitudes above 40,000 feet. (Quotation and map from Wilcox, 1959, p. 420 and fig. 63.)

In Hawaii, Gordon Macdonald, seismologist Jerry P. Eaton (newly joined after completing a doctorate at Berkeley), and other members of the Hawaiian Volcano Observatory's (HVO's) staff combined monitoring facilities with mapping and geochemical and petrological analyses of samples. They used Eaton's pioneering methods for monitoring volcanoes and active fault zones in studying a 5-day eruption of Kilauea during May–June 1954. At the HVO from 1952, as Thomas L. Wright and Taeko Jane Takahashi later recalled, "Eaton introduced the first true seismic network at Kilauea, where field seismometers were hard-wired to recorders." Eaton "developed a generalized crustal model for Hawaii" to "properly locate earthquakes from the new network" that led by the 1960s to "an annual catalog of reliably-determined earthquakes." He "also introduced a network of sensitive water-tube tiltmeters, which quickly replaced the seismographic method of measuring ground tilt."¹¹⁶

Paleontologist and Branch Chief Preston Cloud, Jr., received double attention in the May 1953 Pick and Hammer Show. To the tune of "The Saga of Jenny," from Broadway's 1941 musical "Lady in the Dark," by Kurt Weill, Ira Gershwin, and Moss Hart, the songsters traced Cloud's rise to lead the Paleontology and Stratigraphy Branch:

**Preston made up his mind at thirty-six
That as a Survey branch chief he would get in his licks.
He reorganized the work and left no man in the lurch,
So that Pres is now the only one with time for research.¹¹⁷**

The players expanded that message with the verse that followed George Gryc's ode in "Home Groan Blues," sung to the tune of Irving Berlin's "This Is the Army":

**This is the Survey, Mr. Cloud.
Private consulting's not allowed.
We've made exceptions but folks got sore,
So you can't go to Spain anymore.¹¹⁸**

Cloud convened 40 members of his Paleontology and Stratigraphy Branch (PSB)¹¹⁹ and visiting colleagues in Washington during April 19–21, 1954, to speak in five sessions of a meeting arranged to evaluate objectives, methods, and progress in the PSB's program. In a sixth session, nine invited observers appraised the reports on the status of the paleotectonic-maps project, the geologic-names lexicon, and work by the PSB's four units—Lower Paleozoic, Upper Paleozoic, Mesozoic, and Cenozoic. The visitors' critiques emphasized the value of Branch members'

studies derived in part from the 40,000 fossils, from 31 States, Alaska, and 14 areas abroad, received during fiscal year 1953–54, sent in by USGS geologists and others for examination and report that also provided additional specimens for new basic studies. The visitors hoped for additional monographic studies of the structure, biologic organization, life associations, and time ranges of large or significant fossil groups. The products would be added to those resulting from the three other principal special and collaborative investigations: (1) stratigraphic and paleoecologic studies of rock sequences, community associations, and areas; (2) morphologic and stratigraphic analyses of inadequately known but potentially important groups, such as airborne and planktonic forms, that might be widely distributed in brief time intervals, cross facies boundaries, and be well adapted to quantitative analyses; and (3) studies toward preparing regional field handbooks of selected distinctive suites of fossils in their stratigraphic context. Studies during the year of faunas from some of the subsurface rocks in the Williston Basin of Montana and the Dakotas provided a better understanding of these oil-bearing sequences. Faunal investigations of the Floridian-Bahamian carbonate province also improved ideas about its formation.

On May 5, 1954, the Pick and Hammer players used Shamus O'Connor and John J. Stamford's "Macnamara's Band," more widely known since Bing Crosby's 1946 recording, to comment on the PSB's use of the new electronic computers in the year-old paleotectonic project and the resulting maps:

**Oh, me name is J. Gillhooley, I'm the leader of the band,
Although we're small in number, we are planning to expand.
With paleotectonics we are making history,
We've got the hottest project, boys, outside the A. E. C.**

**We're working on a system that we hold in high regard,
To tabulate our data on a little bitty card,
And if you have a theory that everyone extolls,
We'll put your theory on the card and punch it full of holes.**

**We show the rocks in orange and the thicknesses in blue,
The facies are in orchid and the climate in ecru,
With over here a touch of red and there a dash of green,
By golly, it's the loudest map that man has ever seen!**

**We show everything that's happened, from a bit below the Belt
Right up to and including the hiatus of Van Pelt,
But if you try to decipher it your mind is bound to snap,
We've put the hist'ry of the world upon a single map.¹²⁰**

Initial plans by Cloud and James Gilluly called for paleotectonic maps for the Jurassic, Triassic, Permian, and Pennsylvanian Systems, each prepared with the aid of the new computers. The nine maps, including seven at 1:5,000,000, for the Jurassic System, prepared by Edwin D. McKee, Ralph W. Imlay, and several of their PSB colleagues, appeared in the USGS series of Miscellaneous Geologic Investigations Maps as I-175 in 1956.

Studies during fiscal year 1953–54 by geologists in George Gates' Alaskan Geology Branch concentrated on the Territory's mineral resources (especially those strategic and critical) and coal and oil deposits. Continuing work on Alaska's minerals included reconnaissance geologic mapping in the lower Kuskokwim area; a dip-needle survey of magnetites near Klukwan (southwest of Skagway); and investigations of copper mineralization around Prince William Sound and on the upper Maclaren River east of Denali, scheelite mineralization near Nome and tin deposits elsewhere in the Seward Peninsula, and antimony near Ketchikan and in the Katmai National Monument (the last study was done in cooperation with the NPS). The Branch operated a seasonal radiometric laboratory at College. Branch

personnel continued coal investigations in the Matanuska field, in the Little Susitna district, and, as part of the USBM's drilling operations, at Wishbone Hill. They also completed work in Tertiary deposits in the Yakataga district that disclosed oil seepages in the Samovar Hills and structures favorable for accumulation, continued studies in the Nelchina area of the Talkeetna Mountains, and worked in other parts of interior Alaska and on the Alaska Peninsula. Members of the Alaskan Geology Branch, like their colleagues in General Geology and those elsewhere in the Geologic Division, continued to refine their work in photogeology by adding its results to existing information in beginning preliminary geologic maps using the 1:250,000-scale topographic bases. New investigations began of construction materials and engineering problems, including the route for the proposed Denali Highway, the Alaska Railroad, and power sites on the Kenai Peninsula. In 1953, closeout operations in Naval Petroleum Reserve No. 4 (NPR-4) involved eight USGS projects—six funded by the Navy and two by the USGS—“to bring the geologic surveys to a logical stopping place and to collect sufficient information for the final report.”¹²¹ Between early June and early September, field parties traversed areas at and near the Kiligwa and Nula Rivers, including the Brady anticline; Cretaceous sequences along the Killik and Colville Rivers; Cretaceous strata along Carbon Creek and the Utukok River; the Carter Creek anticline; the upper Paleozoic and Mesozoic rocks of the Corwin-Cape Lisburne area; the Kongakut and Firth Rivers; the Paleozoic and Triassic sequences of the central Brooks Range; and Koyukuk River.

Members of Frank Whitmore's Military Geology Branch finished more than 50 studies of domestic and foreign regions and other special reports and maps during fiscal year 1953–54. As before, these terrain studies and related summaries contained a number of regularly covered topics. Among them were airborne operations, airfield construction, climate, coasts, construction materials, cross-country movement, drainage, engineering geology, geophysics, groundwater, landforms, mineral resources, permafrost, road construction, rock mechanics, rock types, seasonal variations in moisture and snow cover, soils, special physical phenomena (including earthquakes, volcanoes, and landslides), surface water, terrain intelligence, underground installations, and vegetation. Alfred Clebsch, Jr., and his colleagues made maps, at 1:10,000, 1:25,000, and 1:100,000, and evaluated problems in constructing assault-type airstrips at Fort Bragg in North Carolina and Fort Campbell in Kentucky and Tennessee. Other MGB personnel taught or otherwise contributed to the advanced-training program for Army Engineer officers at Fort Belvoir in Virginia. William Davies conducted prediction tests of trafficability at Fort Knox in Kentucky. MGB personnel completed sections on surficial materials and engineering aspects for two chapters in Army Technical Manual (TM) 30–10, “Terrain Analysis.” The Army's declassification of its “Geology and Its Military Applications” (TM 5–545), issued in 1952, publically credited the USGS with its preparation. Members of the MGB's Arctic program, the second long-term effort begun in 1946, continued to investigate, for the Army Engineers, the geologic and related terrain conditions in the region, especially in Alaska. For the Engineers, the Alaska Road Commission, and the Alaska Railroad, specialists in the MGB's Alaska Terrain and Permafrost Section reported on engineering aspects of river ice, roads, and bridges in the Yukon Flats and along the Delta and upper Kuskokwim Rivers. They also worked in the Bristol Bay area, the southwestern Copper River Basin, the central Kenai Peninsula, and the Susitna-Maclaren Rivers district and along the Tote Road from Iliamna to Cook Inlet. In Greenland, they aided a joint project of the Engineers and the Army Transportation Corps.

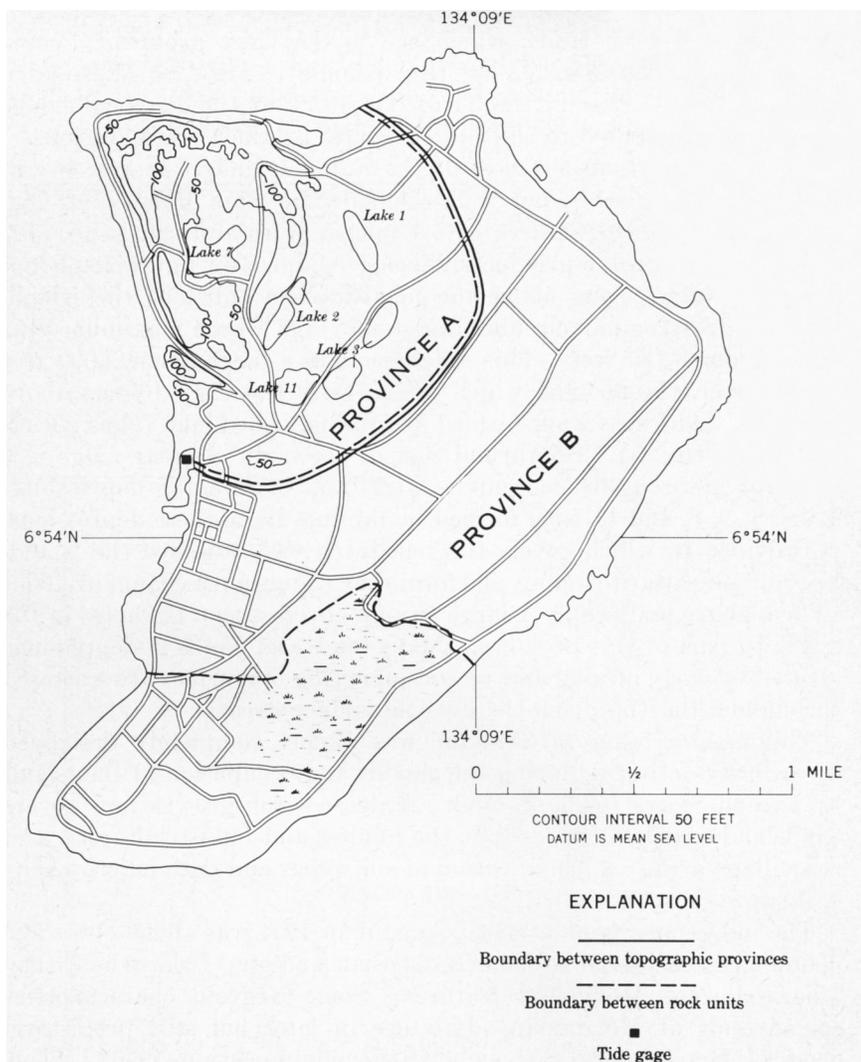
Work by members of the Military Geology Branch also continued in the Far East and in Europe during fiscal year 1953–54. To aid field studies, Theodore Sumida translated into English an extensive list of place names in China, Japan, and Korea. The Trust Territory of the Pacific Islands' three departments moved from Honolulu to Pohnpei (Pohnpei), to Truk (Chuuk) in the Caroline Islands (Federated

States of Micronesia), and to Guam. The High Commissioner's office relocated to Guam in June 1954. Eisenhower's Executive order of July 17, 1953, transferring the northern Marianas (except Rota) from Interior to the Navy became effective in October.¹²² Charles Johnson succeeded Sherman Neuschel as head of the MGB's Pacific Geologic Mapping Program in 1953. On Guam, Joshua Tracey's team completed in November 1953 the detailed mapping of that island's geology and water resources; related studies continued into December 1954. The reports on Guam's terrain and environment, the engineering aspects of the island's geology and soil, and the tactical aspects of its coasts and inland terrain, at 1:25,000 and 1:50,000, appeared in 1959; authors of the reports were Tracey, David I. Blumenstock, David B. Doan, Kenneth Emery, F. Raymond Fosberg, Harold May, Seymour Schlanger, John T. Stark, and Carl Stensland. Porter E. Ward and Joseph W. Brookhart's supplement on Guam's water resources followed in 1962. Schlanger, who joined the Pacific program to conduct petrologic studies of limestones and ocean sedimentation on Guam, passed to investigations of Ulithi Atoll, northeast of Yap in the western Carolines. He also studied Enewetak as part of the program's operations in the Northern Marshalls, and his report appeared in 1956. Schlanger, with Allen Nicol, also completed a preliminary manual of engineering geology. The Pacific geologists also finished a report on antimony deposits in Okinawa and geologic summaries of three additional atolls in the Carolines. Groundwater geologist Ted Arnow assessed the effects of phosphate mining on Angaur in the southern Palau Islands.

In Europe, Frederick Betz, Jr., a USBM veteran who joined the USGS in 1943 and later served as one of Frank Whitmore's Assistant Branch Chiefs, now led the MGB's team. Betz's group aided for a second year the Army Engineer Intelligence Center by helping to prepare terrain studies and working up a model map for Army personnel tasked with making additional terrain-evaluation maps. His European Team also finished, at 1:100,000, a special report on trafficability in the Frankfurt area. In Britain, Arnold Orvedal, who assessed the general military requirements for cross-country maps, joined Esther Aberdeen and Morris Austin in comparing MGB and other test studies of trafficability, especially for tracked vehicles, and airfield sites in the Norwich area.

With assistance from the FOA and the State Department, members of William Johnston's Branch of Foreign Geology participated in cooperative projects during fiscal year 1953–54 in 16 countries in Latin America, the Middle East, and Asia. John Dorr continued to lead the iron-resource investigations in Brazil's Minas Gerais. Max G. White and Gene E. Talbot advanced the uranium reconnaissance in Brazil begun in fiscal 1952–53. Monta E. Wing continued the Branch's investigation, renewed through the Point Four Program in 1952, of Chile's mineral resources. The Branch's work in Latin America also involved studies of mineral resources in Colombia, Cuba, Ecuador, and Mexico. Branch members also conducted, with aid from national and local officials, an engineering study of landslides and their mitigation in La Paz, Bolivia.

In the Middle East, members of the Foreign Geology Branch continued fieldwork in Jordan and Iran but concluded their efforts in Egypt and Saudi Arabia. Louis Gardner spent several months investigating stratigraphic sequences in Jordan. Russell Gibson continued Dwight Lemmon's study of Iran's mineral resources. The USGS completed its analysis of Egypt's metallic-mineral deposits to help its Government's long-range plans for their development. George Rozanski prepared a manuscript hydrologic map of Egypt at 1:2,000,000. In Saudi Arabia, the passing of King Ibn Saud significantly affected American and USGS work in the Kingdom. To treat the ailing King, Truman sent, in April 1950 and again in August 1952, his personal White House physician and other specialists. Eisenhower continued to promote good relations that would ensure the continued flow of Saudi oil. At the White House on March 2, 1953, the President and Prince Faisal discussed matters



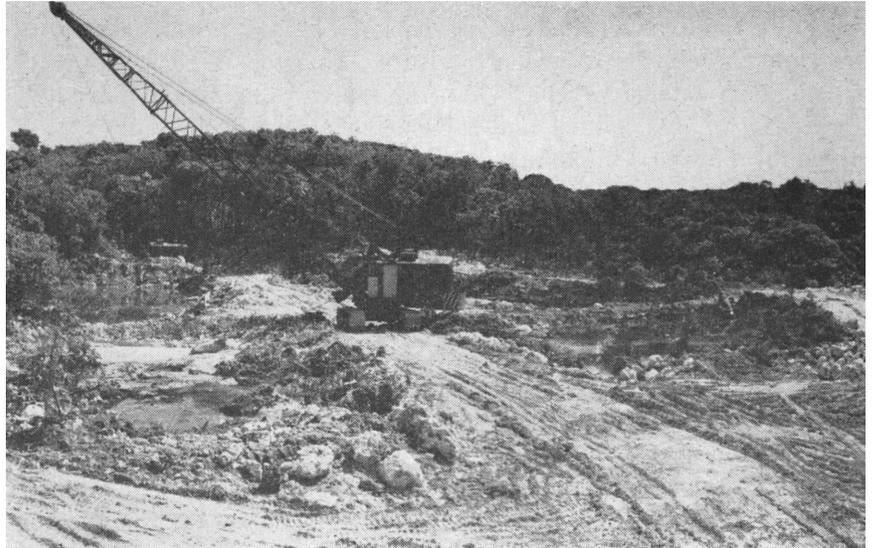
This map and the two photographs (facing page) show Angaur Island, the southernmost of the Palau Islands and part of the Trust Territory of the Pacific Islands, whose administration was granted by the United Nations to the United States after World War II. Phosphate, principally from the guano of Pliocene–Pleistocene sea birds, was mined on Angaur during 1900–44. Mining resumed in 1946 and created large lakes that filled with brackish or saline water. The map (originally at 1 inch = 0.6 mile) depicts topographic provinces A and B and the lakes on Angaur Island. In 1951, 3 years after USGS military geologists mapped Angaur’s geology and soils, USGS hydrologist Ted Arnow studied samples from test holes and observation wells to determine if the lakes’ water would spread and adversely affect the island’s agricultural lands and water supplies. As Angaur’s two topographic provinces functioned as independent units, mining in province A’s coralline limestones did not affect province B’s groundwater. The top photograph on the facing page shows a locality near lake 1 as strip mining began on July 14, 1952. The bottom photograph shows the same area after backfilling was completed on October 4, 1952. Backfilling the lakes significantly reduced water salinity in province A within 1 year, “as a layer of fresh water was built up at the water table” and continued to enlarge through May 1955. (Quotation, map, and photographs from Arnow, 1961, p. A–2 and figs. 2, 14, and 15.)

of mutual interest to their countries. When Ibn Saud died on November 9, Crown Prince Saud became King and made Faisal the new Crown Prince, Prime Minister, and Foreign Minister. Saudi oil seemed ever vital but, on December 24, Everette DeGolyer, with his company’s secret study of Saudi reserves now complete, a decade after his initial assessment, decided that

[t]he Middle East is rapidly getting into a condition which has been almost chronic in the United States since the earliest days of the industry, that is, the problem becomes market rather than production.¹²³

Glen Brown, Richard Bogue, and Gus Goudarzi continued geologic mapping and mineral studies in the Arabian Shield for a while after Ibn Saud’s death, but King Saud terminated the USGS Mission in July 1954. Brown returned to the United States and joined Roy Jackson and other colleagues in compiling a 1:4,500,000 geologic map of Saudi Arabia. Brown’s group also began preparing geographic and geologic maps of Saudi Arabia at 1:500,000 with place names in both English and Arabic.

In Asia, Interior Department geologist Frederick N. Ward resumed U.S. investigations of India’s manganese and other mineral resources, principally as a consultant to that country’s geological survey. John Straczek continued his aid, begun in fiscal year 1950–51 for the Technical Cooperation Administration, to institutional



development within the Geological Survey of India. Earl Irving, Ronald Sorem, and Arthur Kinkel, Jr., advanced their investigations of mineral resources in the Philippines. Biostratigraphers Harold E. Vokes and J. Marvin Weller, professors, respectively, at Johns Hopkins and Chicago, continued their cooperative evaluation for the Branch, begun in late 1952, of the Philippines' coals. Related studies began on Taiwan. Branch personnel also trained in the field and laboratory 34 young scientists and technicians from Afghanistan, Brazil, Burma, Chile, Colombia, Cuba, India, Mexico, Norway, Paraguay, Peru, and the Philippines.

Gerald FitzGerald's Topographic Division drew on nearly \$16,028,000 in total funds during fiscal year 1953–54, a sum about \$295,000 less than that received in 1952–53. The new total included about \$11,573,000 in SIR monies, representing a \$483,000 increase; almost \$1,657,000 in reimbursements and direct payments from States, counties, and municipalities, or a loss of about \$90,000 but, as before, matched by an equal SIR amount in 50:50 sharing; and some \$1,166,500 from the USBR, a decline of more than \$702,000. Both the Air Force and the Navy reduced their transfers by a total of almost \$50,000, but the Army provided about \$259,500. The AEC transferred nearly \$199,000, the FOA and the GPO furnished a total of about \$84,500, and other Federal agencies and miscellaneous sales added another \$211,000. The Division maintained its operations in Arlington, Rolla, Denver, and Sacramento. The Western Mapping Center worked on plans to move from Sacramento to Menlo Park as soon as facilities became available. The funding shortfall reduced the number of personnel-years at those four locations by 5 percent, but the Division increased by 25 percent the number of square miles mapped or revised in the continental United States.

The Topographic Division continued to concentrate its efforts on completing the topographic atlas of the United States and its Territories and possessions. Division members finished 64,500 square miles at 1:24,000 and completed an additional 37,000 square miles at 1:62,500. The Division claimed that good-quality topographic maps now covered some 33 percent of the 48 States but that 2.5 to 5 years were required to survey and publish a quadrangle map. Cooperative domestic programs involved 30 of the States, including Arizona for the first time since 1927; Alaska, at 1:63,360; Hawaii, at 1:24,000; Puerto Rico, at 1:30,000; and the Virgin Islands, at 1:24,000. After President Eisenhower authorized the private-sector Samoan Airlines in April 1954, the USGS arranged with a New Zealand company to provide airphoto coverage for mapping American Samoa's 7 islands and its 73-square-mile area. The USGS cooperatively mapped at 1:24,000 more than 12,000 square miles in Kentucky, 1,700 more than in 1952–53; more than 9,000 square miles in California, with another 6,100 at 1:62,500; and nearly 4,800 square miles in Florida. The Division published a new base map for California at 1:500,000 and new base maps for Connecticut, Indiana, Massachusetts, New Hampshire, Rhode Island, Vermont, and Wyoming at 1:1,000,000. The Kentucky Project, with its field surveys now 90-percent complete, published 90 maps to raise the total issued to 328 of the Bluegrass State's 707 7.5-minute quadrangles. Division topographers, aided by Army Engineer ground surveys and Air Force and Navy photographic crews, also mapped some 19,500 square miles in Alaska. The Division also began revising its 1:250,000 and 1:2,500,000 maps of Alaska.

All this mapping added 3 percent to the Topographic Division's coverage of the continental United States during the year, but the Division's further progress toward its domestic goals continued to be delayed by the need to keep existing large-scale maps up to date and to satisfy the immediate needs of the Department of Defense. At the DoD's request, the Division expanded its 6-year program of mapping strategic areas that began in fiscal year 1950–51. The Air Force asked the Division to map, aided by USAF photos, 70 bases, which required depicting a total area of about 40,000 square miles. The Division let contracts for 112,500 square miles of aerial coverage, received 115,000 square miles of aerial photography for its maps, and reduced its unit cost by 21 percent of the sum required in fiscal 1952–53. The Special Maps Branch continued to prepare some components for the USAF's worldwide aeronautical charts and compiled or scribed maps for the Geologic Division, the AEC, the FOA, and the Office of Naval Petroleum and Oil Shale Reserves (ONPR). Some Division maps were compiled for the U.S. Coast and Geodetic Survey, the U.S. Forest Service, and the TVA. The Division continued to publish and distribute the civilian edition of the Army Map Service's coverage of the United States on 468 sheets at 1:250,000. Division photogrammetrists and topographers, supported by the FOA, began or continued mapping and training local specialists in Burma and other countries, as well as advising U.N. personnel.

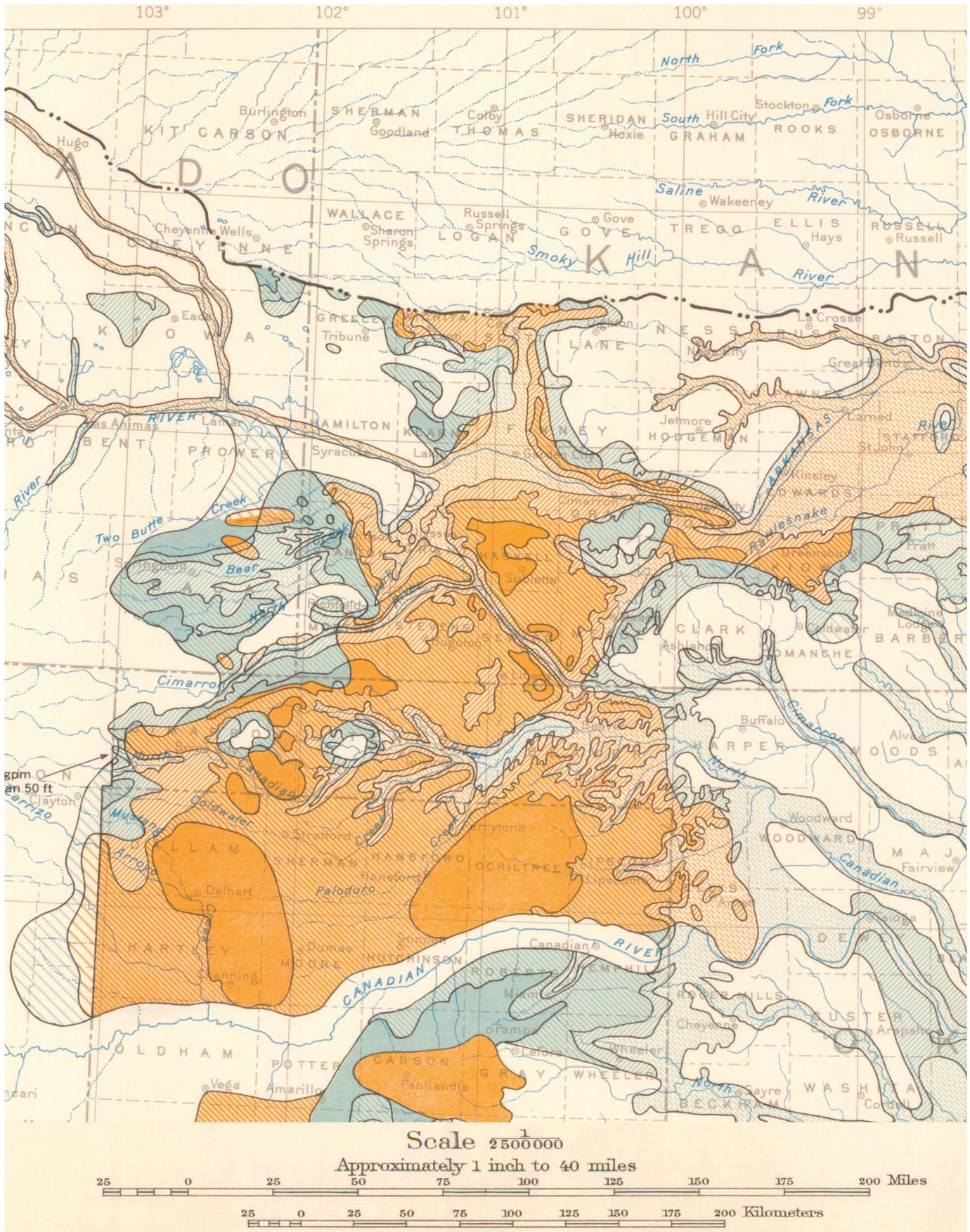
The Topographic Division's decade of photogrammetric research and development culminated during fiscal year 1953–54 in a viable system of twin low-oblique photography based principally on the ER–55 projector and the Twinplex plotter. The Division planned to have the new photogrammetric system replace the vertical method throughout the Division late in 1954. The new photogrammetry depended on the development of six major elements: (1) twin low-oblique photography; (2) ER–55 projectors and Twinplex plotters; (3) improved diapositive printers for principal reduction ratios of 153:30, 153:55, and 153:153; (4) high-precision cameras with nearly distortion-free lenses; (5) multicollimator camera calibrators; and (6) precision pantographs, to compile map detail at or near publication scale. The Division also began experiments in applying scribing to the field-survey and stereo-compilation stages of mapmaking to try to simplify further the whole process of compiling and finishing maps. Members of the Special Maps Branch also tested in Louisiana and elsewhere the stereotemplet method, which used fewer

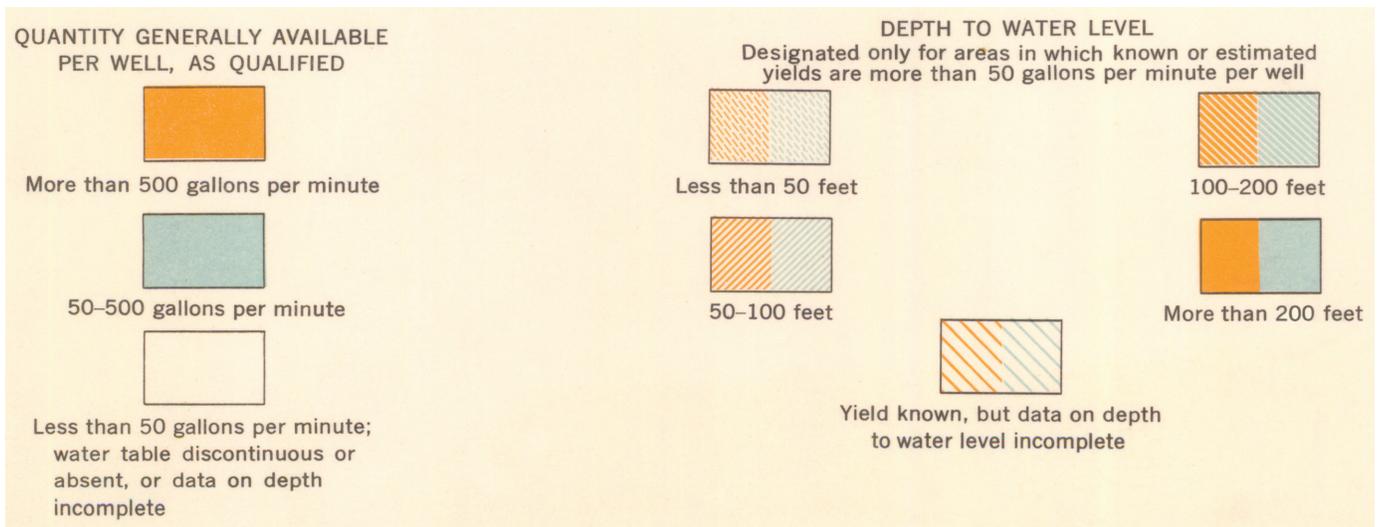
points to establish horizontal control, in areas where flight patterns, difficult terrain, and meager horizontal control precluded the use of other techniques. During the year, the Division began courses on photogrammetric applications for geologists, as recommended by a joint committee of the Topographic and Geologic Divisions.

Carl Paulsen's Water Resources Division received \$13,566,000 for fiscal year 1953–54, an increase of about \$391,000 over the sum authorized in 1952–53. The SIR appropriation for 1953–54 rose by \$617,000 to nearly \$6,732,000. All 48 States, led by California, and joined by Guam, Hawaii, counties, and municipalities, added nearly \$3,823,500, a \$220,000 increase, in reimbursements and direct payments, exceeding the Division's SIR-funds limit of \$3.7 million available only for the cooperative program. Interior's Office of Territories supplied more than \$14,000 for the Division's detailed work in American Samoa after the reconnaissance survey of its surface water and groundwater early in 1953 led to recommendations for a continuing program to obtain water data and to find ways to improve the quantity and quality of its water supplies. Other Federal agencies transferred about \$2,914,000, of which the Army and its Engineers shifted \$1,070,000, a \$38,000 gain; the USBR contributed a little more than \$807,000, a \$352,000 loss, reflecting fewer investigations in the Missouri River Basin; the AEC gave \$260,568, a \$77,000 increase; and the FOA shifted about \$229,000, or nearly \$161,000 more than the Mutual Security Agency transferred in 1952–53. Highlighting the Nation's ever-increasing need for water-resources investigations, the Business and Defense Services Administration queried the USGS for water-resources data on the Nation's critical centers of industrial production, and *Fortune Magazine* published in its March 1954 issue an article that asked "How Are We Fixed For Water?" By then, the Division operated 102 principal field offices nationwide to support the operations of its three programmatic Branches. Division investigations of stream sediment, based on 50,000 samples collected at some 130 sites nationwide and analyzed at 15 laboratories, continued to assess its effect on dam reservoirs to aid the future design and operation of water-control structures. Sediment studies were concentrated on the basins of the Colorado, Missouri, and Rio Grande Rivers but also included cooperative work with Kentucky, Ohio, Pennsylvania, and Virginia. Division specialists continued to apply the results of reservoir-evaporation studies at Lake Mead and began similar work on botanical evaporation-transpiration along the Little Blue River near Fairbury in Nebraska. For the National Security Resources Board, the Division published studies of flood protection, pollution control, and water supply in six large industrial centers and continued work on eight others.

For the FOA during fiscal year 1953–54, Division hydrologists began or continued investigations in and the training of specialists from Afghanistan, Egypt, India, Iran, Jamaica, Libya, Pakistan, and Saudi Arabia. In the fall of 1953, Karl J. Ketter resumed the Division's studies of Iran's groundwater and surface-water resources. George B. Maxey continued his investigations, begun for the Technical Cooperation Administration in late 1952, of water resources in Libya; he was aided by Harold A. Whitcomb, who carried on when Maxey left Libya at the end of fiscal 1953–54. George C. Taylor, Jr., continued to lead similar work in India, begun in 1951, and was assisted by Arthur A. Garrett. George La Rocque, Jr., and F.D. Bertleson investigated Pakistan's water resources between June and December 1953. Thomas Eakin, following his tour in Iran in 1952, examined water resources in Thailand from April through June 1954. The United Nations supported the Division's streamgaging operations and other preliminary investigations of Jamaica's water resources.

During fiscal year 1953–54, Joseph Wells' Surface Water Branch recorded data at 6,400 gaging stations in the 48 States, Alaska, Guam, and Hawaii, in cooperation with 187 agencies of the States, and their political subdivisions, and 15 Federal agencies, including, as before, the Federal Power Commission (FPC),





This map (originally at 1:2,500,000) shows the general availability of groundwater (yield in gallons per minute) and depth (in feet) to water level in the northwestern part of the Arkansas, Red, and White River Basins of Arkansas, Colorado, Kansas, Louisiana, Missouri, New Mexico, Oklahoma, and Texas. The heavy dashed line marks the northern boundary of the basins. USGS hydrologists Stanley Lohman and Verle M. Burtis, assisted by members in the Ground Water Branch's district offices and in cooperation with members of State agencies in those States, prepared this map as USGS Hydrologic Investigations Atlas HA-3; it supplemented their map HA-2, which showed (at the same scale) the areas of principal hydrologic investigations in the same basins. The new Hydrologic Investigations Atlas (HA) series began with the multisheet HA-1, a report on the hydrology of the San Bernardino and eastern San Gabriel Mountains in California; see Troxell and others, 1954. (From Lohman, S.W., and Burtis, 1953 [but not issued until 1954].)

11 interstate compacts, and the American-Canadian International Joint Commission. The Branch tested a new electronic low-velocity flowmeter that was available commercially, powered by battery, and designed to increase measurement accuracy. Its personnel also designed, for production elsewhere, a high-speed electronic computer to aid processing of surface-water records. In 1954, completion of the Branch's 2-year compilation of streamflow records collected before 1950 neared 50 percent. Branch members finished a flood-frequency report for the Iowa State Highway Department and continued or completed similar studies in 11 other States. The Branch also sent to similar departments in other States hydraulic data on 86 sites proposed for new bridges, published the results of a laboratory study of flow through bridge openings, and continued work on flow through culverts and over dams.

Nelson Sayre's Ground Water Branch's cooperative investigations operated in 43 States and advanced 30 projects related to the national interest and (or) other Federal agencies during fiscal year 1953-54. The State-Territorial collaborations included studies of areas large and small in Alaska, Arizona, and California's Central Valley; the basins of the Arkansas, Red, and White Rivers; and river basins in New York and New England. Other investigations encompassed artificial recharge in Arkansas; economical dewatering of mining districts in Alabama, Arkansas, Michigan, Nevada, Pennsylvania, Tennessee, and Wisconsin; and recovery of water used by phreatic plants in the arid West. Branch specialists also completed a nationwide reconnaissance to outline saline-water areas for future desalinization by the techniques being developed in academia and government that drew comment from the writers for the Pick and Hammer Club. In the Club's show for May 1953, the third verse of "Home Groan Blues," sung as before to Irving Berlin's "This Is the Army," cautioned Sayre, like Gryc and Cloud, to remember that:

**This is the Survey, Mr. Sayre,
We know that water's everywhere.
We've got the ocean outside your door,
So we don't need your branch anymore!¹²⁴**

The Branch also used electronic computers to solve complex quantitative problems, especially those involving boundary conditions. Branch members also completed an electrical "slide rule" to determine theoretical drawdowns caused by pumping, developed a new meter for more accurately fixing moisture content in soils to determine how water moves through unsaturated materials above water tables,

tested methods to discover how radioactive wastes enter streams, and continued developing better techniques for collecting water samples specifically for analyzing their radioactivity.

Kenneth Love's Quality of Water Branch placed greater emphasis on studies of mineral pollutants, including analyses of trace metals, and began expanding its field centers, operating by 1957 those at Denver, Fort Collins, and Menlo Park. In fiscal year 1953–54, the Branch's 15 laboratories analyzed more than 85,000 samples. The national program emphasized chemical-quality investigations in the basins of the Colorado, Columbia, and Pecos Rivers, in States in New England, in New York, and in Alaska, looking carefully at how trends in mineral content affected irrigation projects. In cooperation with agencies in 17 States, Branch members collected daily surface-water samples at nearly 230 sites and intermittently collected samples at some 200 others. Robert A. Krieger, James L. Hatchett, and Joe L. Poole continued a study of the Nation's saline waters, and a more detailed one of those in Texas, to determine their sources. Other Branch specialists began collecting and analyzing, at a single laboratory, data on radioactive substances in water nationwide.

In fiscal year 1953–54, Harold Duncan's Conservation Division remained the USGS programmatic unit with the highest proportion, 98 percent, of direct appropriations to the total funds available to support its work. Of the total of almost \$1,640,000, an increase of nearly \$200,000 from 1952–53, SIR funds supplied some \$410,000 for land classification, a gain of about \$50,000, and nearly \$1,195,000 for supervising mining and oil and gas leases, a \$174,000 increase. For supervising leases, the Navy added \$33,000; for both operations, other Federal agencies transferred a total of only \$700, representing a \$5,200 loss, and no funds arrived from the States and their political divisions.

Benjamin Jones, John Northrop, and Howard Smith, three of the Conservation Division's Chiefs, retired in 1954. J. David Cerkel, Jr., succeeded Northrop as Chief of the Mineral Classification Branch. Cerkel's mineral classifiers, working from field offices in California, Colorado, Montana, New Mexico, Oklahoma, Utah, and Wyoming, processed more than 27,700 cases, prepared original or revised definitions of 52 producing oil and gas fields, determined the leasehold relations to the productive limits of 9 such fields and reported the discovery and geologic significance of 150 others, handled 16 appeals from the BLM, and completed nearly 130 reports on the mineral potential of specific lands. Arthur Johnson replaced Jones as Chief of the Water and Power Branch. Johnson's staff, operating from field offices in Denver, Oregon's Portland, Sacramento, and Tacoma, mapped and appraised waterpower resources and storage possibilities of 280 channel miles of streams and 11 dam sites in Alaska, California, Colorado, Idaho, Montana, New Mexico, Oregon, and Washington. Classifications by Branch members added more than 225,000 acres to power-site reserves, increasing them to nearly 7.2 million acres in 23 States and Alaska. They also supervised 960 power projects for the Federal Power Commission and handled some 5,800 hydraulic cases for the FPC and the Interior Department. Members of the Mining Branch, where Joe D. Turner succeeded Smith, supervised operations in 1953–54 on about 1,460 lease, permit, or license properties in Federal lands in 32 States and Alaska. The 17.9 million tons of coal, lead, phosphate, potash, sodium, uranium, vanadium, zinc, and other mineral resources produced from these lands, valued at \$119.4 million, provided the Treasury with nearly \$4.5 million in royalties.

The staff of Harold Barton's Oil and Gas Leasing Branch, deploying from its 20 district offices in California, Colorado, Louisiana, Montana, New Mexico, Oklahoma, Utah, and Wyoming, oversaw the discovery, development, and production of some 87,500 properties on nearly 66 million acres in 23 States and Alaska. In October 1953, Duncan and Wrather joined Wormser in McKay's party to inspect several wells off Louisiana and also to examine the district by air. Production from

wells on the public lands rose significantly from that of 1952–53 to 108 million barrels of petroleum, 238 billion cubic feet of natural gas, and 201 million gallons of gasoline and butane. Royalties from these resources and those from acquired and Indian lands, and Naval Petroleum Reserve No. 2 (NPR–2), increased from the previous year by some \$18.1 million to nearly \$68.5 million in 1953–54. The Branch approved 80 new unit plans and terminated 48 others, leaving 301 plans in operation on 5.2 million acres. A Survey order dated November 6, 1953, but effective on May 1, transferred supervision of oil and gas operations in Oregon and Washington from the Northwestern Region’s chief in Casper to the California Region’s manager in Los Angeles.¹²⁵ The order also renamed, effective on July 1, the California Region as the West Coast Region to reflect more accurately its two new States and its older components, California and the Alaska Territory.

The budget for fiscal year 1954–55 that President Eisenhower transmitted to Congress on January 21, 1954, extended his administration’s reductions of the previous year. Current estimates for 1953–54 all were lowered below the Truman administration’s numbers by \$12.5 billion in appropriations requests, \$11 billion in new obligated authorities, and \$7 billion in expected expenditures. For 1954–55, the President proposed additional reductions of \$4.4 billion in obligations and \$5.5 billion in estimated expenditures. Tax reductions would total nearly \$5 billion and leave a budget deficit of \$2.9 billion, compared to \$9.4 billion in 1952–53 and the original estimate of \$9.9 billion and the revised estimate of \$3.3 billion in 1953–54. Eisenhower’s budget specialists now projected obligated authorities for \$56.3 billion and expenditures of \$65.6 billion in fiscal 1954–55. As part of proposed tax reforms, the President asked for an end to the double taxation of business income, approval of firms’ deduction of research and development expenses, and extension from March 1 to April 1 of the deadline for filing individual returns. Eisenhower’s “New Look” in national-security policy required developing improved nuclear weapons and their guided delivery systems to secure adequate defense. Reaching those goals would be at the expense of conventional forces. The new approach would slash \$5 billion, or 14 percent, from Defense Department expenditures but would increase U.S. air power. The greater effectiveness of the Republic of Korea’s armed forces, Eisenhower asserted, would enable two Army divisions to be withdrawn from Korea. When the authorized funds were redistributed among the three armed services, the Air Force received an 8-percent increase, and the Army’s share fell by the same percentage. By comparison, the AEC’s expenditures would “rise in the fiscal year 1955 to the highest point in our history.”¹²⁶ Progress in the stockpiling of “about 50 of the 73 strategic and critical materials objectives,” Eisenhower expected, would be “virtually completed”¹²⁷ by expending \$585 million in 1954–55 to produce \$5.5 billion worth of on-hand emergency supplies. The 1954–55 budget also included \$66 million for the Soil Conservation Service’s continuing improvements of agricultural land and water resources. The President asked for an additional \$858 million for conserving and developing the Nation’s mineral and other natural resources by the Interior Department and other Federal organizations. Eisenhower renewed the request he made in his State of the Union Message for legislation to establish a Federal corporation for cooperative work with Canada on the St. Lawrence Seaway and asked for \$555 million for highway construction, of which some \$150 million would support projects in the interstate system. In May, Congress approved nearly \$2 billion for highways during the next 2 years and a St. Lawrence Seaway Development Corporation; in June, Eisenhower gave the latter’s direction to Defense Secretary Wilson.

Ben Jensen’s House subcommittee began hearings on Interior’s budget request for fiscal year 1954–55 on January 31, 1954. Secretary McKay reported the results of his continuing changes in management and operations. Calling his Secretarial staff too small for its work, McKay continued to seek a solution that

would reduce the burden on the Assistant Secretaries. He transferred the functions of the former Divisions of International Activities, Minerals and Fuels, Land Utilization, and Water and Power to one technical-review staff. Each field committee would now be chaired by a bureau representative. The Secretary's Office now reviewed all contracts larger than \$10,000 and required all bureaus to report weekly on purchases and contracts between \$500 and \$10,000. McKay, reflecting on the mixed results of his efforts to oust some of his agency chiefs in 1953, recalled encountering "our greatest difficulty" in reforming his bureaus, where "most of the incumbents in policy determining positions were under civil service." McKay asserted his firm belief in civil service but added that "there is a point beyond which civil service should not be used. * * * [W]e must have flexibility of appointment," he cautioned, "if we are to have flexibility of policy with each succeeding change of administration." McKay found some persons in top positions "who did not measure up to the standards we demanded" and others, although able in a technical sense, "were so imbued with a philosophy conflicting with that of the new administration that they were incapable of doing a good job under our new policies."¹²⁸ He excepted the rank and file, lauding their devotion to duty and objecting to unwarranted criticism of them, hoping that public confidence and employee prestige could be reestablished. McKay then highlighted the reductions he achieved in Interior's personnel. His directive of February 9, 1953, required all but a few new appointments to be reviewed by his office. By November, Interior shed 3,980 employees and their salaries of \$18 million. McKay, warning the House subcommittee about the dangers of an unbalanced Federal budget, also touted the 20-percent reduction of Interior's allotment by \$109 million during his first year in office and noted that the fiscal 1954-55 estimate of a little more than \$422 million would save another \$12.5 million. He expected Interior's revenues in 1954-55 to reach \$259 million, or \$13 million more than in 1953-54. Budget Bureau employees cut Interior's request for the year from \$538 million to \$434 million. They shaved the USGS portion from \$29,020,000 to \$27,335,000, ostensibly a reduction of \$415,000 from its appropriation for 1953-54 but actually a loss of \$1,890,000 because the Bureau of Reclamation asked for a transfer of base of \$1,475,000 of its proposed funds to the USGS for its continuing work in the Missouri River Basin.

When Jensen's subcommittee examined the USGS budget on February 2, Assistant Secretary Wormser accompanied Director Wrather. The USGS representatives shaped their presentations by using the experience gained in dealing with the new administration during the past year. The agency gave "Close attention," Wrather claimed, "to achieve practical economy without too greatly hampering essential work."¹²⁹ The USGS looked at each element, he continued, to determine if the work should be done by the Federal Government, done now, and done at the requested rate. As an example, the formal justification for geology included a discussion of the philosophy behind the program that allowed Chief Geologist Bill Bradley to discuss the dollar value of his Division's work, as he had done at several earlier hearings. He said, "in general, the money the Government puts into this program is paid back in terms of new wealth several times over. I never tried to cast up the figures until the other day." Bradley continued, "I find that a rough estimate of how much, exclusive of transferred funds, the Government has put into the geologic work of the Geological Survey since it was founded 75 years ago is somewhere between \$75 and \$80 million. Then if one casts up on the other side of the ledger," Bradley compared "the total estimated value, at today's prices, of a few of the deposits whose discovery can be attributed to this geologic work, you come up with an amount 27 times the amount put into the surveys. That only includes five discoveries actually that were attributed directly, quite directly, to the work of the Geological Survey in this program."¹³⁰ Germanium, hafnium, zirconium, and other rare metals now in demand, Bradley added, were being given priority in geologic mapping and investigations. In view of the difficulties faced by

the mineral-procurement agencies during World War II, Ivor Fenton asked “Are we proceeding fast enough in this program?”¹³¹ No, replied Wrather, the proposed expenditure for geology during fiscal year 1954–55 was just a little more than \$5 million. “[I]f this geologic mapping and appraisal program is stepped up to an amount of approximately \$24 million a year for about 25 years,” Wrather estimated, “we would have adequate basic information.”¹³²

The House subcommittee then passed to the funds requested by the USGS for work on water resources, in the Missouri River Basin, and on conservation and for a new home. Adequate supplies of water remained a critical issue, Paulsen emphasized, due to the “tremendously increased use in industry, by municipalities and for agriculture,” and because of the recurring drought “in several parts of the country for several years.”¹³³ The Interior Department continued to support efforts to convert saline to potable water. Individuals and organizations in U.S. academia, industry, and government, and their counterparts in Europe, pursued commercially significant techniques of desalinization by distillation based on electrical, low-temperature, osmotic-cell, phase-separation, solar, solvent-extraction, and vapor-compression methods. Regarding the Missouri Basin work previously funded by the USBR, Fenton raised the old issue about placing appropriations with the requesting agency or with the operating bureau. “You cannot maintain,” Fenton stated, “a high-grade technical organization at a normal level to take care of needs unless you have a firm financial base,”¹³⁴ as good personnel cannot be let go and then rehired when needed. Fenton, noting the 50-percent increase to \$100,000 requested for supervising offshore oil and gas leases on the Continental Shelf, asked if boats or aircraft were needed for the work off Louisiana, the initial producing area in the Gulf of Mexico. Harold Duncan offered his hope that the USGS “will not have to have a navy.”¹³⁵ Duncan’s Conservation Division would need more employees to handle this work, but the numbers remained to be determined pending the advent of firm regulations and the Federal agreement with Louisiana and Texas. Wrather pointed out the inadequacies of the Old Interior Building, calling its auditorium a regular bat roost, but he could report only minimal progress toward a move to the consolidated headquarters in the Washington area favored by Wormser and Jensen. As Jensen suggested in the previous year, a bill to acquire land and authority to plan the new building had been prepared, then cleared Interior after discussions with the GSAd, and subsequently went to the BoB.

Just before the House subcommittee closed its hearings, Wormser announced that Wrather would receive the John Fritz Medal on February 4, 1954, the latest of his distinctions that included honorary doctorates awarded during 1945–52 by Southern Methodist University, the Colorado School of Mines, the University of Kentucky, and the Montana School of Mines. Four national engineering societies—the American Institute of Electrical Engineers, the American Institute of Mining and Metallurgical Engineers, the American Society of Civil Engineers, and the American Society of Mechanical Engineers—established the Fritz gold-medal award in 1902, named for John Fritz (1822–1913), a pioneer in the Nation’s iron and steel industry, and also honoring “notable scientific or industrial achievement.”¹³⁶ Lord Kelvin received the Fritz Medal in 1905; among the subsequent 47 awardees were Vannevar Bush in 1951, Everette DeGolyer in 1942, Herbert Hoover in 1929, and Frank Jewett in 1939. “We all know,” Jensen added, “that he [Wrather] is entitled to that fine recognition,”¹³⁷ but that opinion did not affect the subcommittee’s decision to reduce still further to \$25,362,685 the USGS appropriation for fiscal year 1954–55.

When the Senate subcommittee’s hearings began on April 12, Secretary McKay complained to Chairman Cordon about both the Budget Bureau’s and the House subcommittee’s reductions of the Interior Department’s estimates for fiscal year 1954–55. The BoB cut out projects and imposed ceilings, slashing more than 13 percent from Interior’s total and reducing the estimate for the USGS from

\$29,020,000 to \$27,335,000; the House chopped off another \$1,972,315. Interior's own reductions in expenditures, McKay emphasized, demonstrated that he was "for economy in Government," but he was also "strong for efficient and effective Government." The House bill made it impossible, without major changes in the Department, to meet its responsibilities "efficiently and with dispatch."¹³⁸ Interior's surveys of its agencies, aimed at improving economy and efficiency, and including the now-completed one for USGS, cost \$90,000 but were expected to pay for themselves in future savings.

Wrather appeared before Cordon's subcommittee on April 16 to specify how the House's cut would curtail the agency's programs, reducing their funding well below the level of fiscal year 1953–54. Wrather requested a restoration of \$497,315. Of these replaced monies, \$372,315 would fund water-resources investigations to achieve the least dislocation of work on the water problem that Senators Cordon and Hayden agreed "was getting worse and worse."¹³⁹ Restoring \$65,000 to topography and \$60,000 to geology, Wrather agreed with Cordon, would "not break or make"¹⁴⁰ either program, but so much work remained backlogged that the USGS needed and wanted every penny it could get. FitzGerald described the Air Force's recent request to map some 850 quadrangles; most of them were not included in the current program, but they contained airports that must be reactivated in emergencies. To Hayden's query about progress in national topographic mapping, FitzGerald reported that it was now 31 percent completed and forecast a yearly progress rate of 2 percent.¹⁴¹ At that rate, Cordon estimated, and FitzGerald agreed, completion would take almost 35 years. Wrather suggested that future cost cutting, better technology, and faster operations would allow mappers to cover more territory and reduce the time required to prepare maps. Bradley added that photogeology and other new techniques doubled, from 20,000 to 40,000 square miles each year, in the past 2 years the rate of mapping the Nation geologically. The House allowed the full amount requested by the USBR but there would be no transfer of funds for the Missouri River Basin program. The House also rejected placing that sum in the USGS appropriations, although Cordon still favored it. Cordon agreed with Fenton and Wrather that year-to-year stability of trained staff was vital for the USGS and maintaining it posed a problem if the amount of transfer funds fluctuated significantly.

During the subcommittee's hearing, Wrather reminded the Senators that the USGS continued to occupy 16 different buildings in the Washington metropolitan area, some with fire hazards and others not suitable for the agency's needs. He urged subcommittee members to concur with the House decision on procuring adequate centralized housing to improve communication and management. He asked to keep \$75,000 of the unexpended balance from 1953–54 to continue planning for the new headquarters building. The phantom building also continued to draw attention in the Pick and Hammer Club's annual shows. In May 1954, the players sang, to "You're Just in Love," from Irving Berlin's "Call Me Madam" of 1938:

**I hear music when Tom Nolan's there,
I see money, though our cupboard's bare,
Dream of buildings rising in the air.
I wonder why, I wonder why.¹⁴²**

The Senate and the conference committee restored all but \$125,000 of the cuts, and Eisenhower signed the Interior bill on July 1, 1954. The new statute gave the USGS \$25,735,000 in SIR funds for salaries and operations in fiscal year 1954–55. That total represented \$2,015,000 less than the sum provided in 1953–54, the first significant decline in direct appropriations, but not including those supplemental, since fiscal 1942–43, and the initial one of more than \$1 million in the agency's history. Up to \$75,000 of the SIR amount for 1954–55 was "continued

available until expended for preparation of plans and specifications for a building or buildings to meet the special needs of the Geological Survey in the metropolitan area of Washington, D.C.”¹⁴³ The USGS appropriation supplied about \$750,000 for general administration, to which \$524,000 for similar overhead was added from the funds advanced or reimbursed by other Federal agencies for program expenses, for a total of \$1,274,000, or \$143,500 more than during 1953–54. The USGS also received directly nearly \$101,000 for investigations of soil and moisture conservation. At year’s end, the USGS reported almost \$46,859,000 in total funds received during its 75th year, nearly \$1,627,000, or 3 percent, less than during 1953–54, but the proportions derived from the three principal sources remained the same. About 56 percent of USGS funds came from direct appropriations, other Federal agencies transferred 32 percent, and direct payments and reimbursements from nonfederal sources supplied 12 percent, of which States, counties, and municipalities supplied 99.6 percent. The total funds supported salaries and operations by the agency’s now more than 7,000 full- and part-time employees, a total well past the 6,472 persons reported as of December 16, 1953.

On January 6, 1955, Secretary McKay established within the Interior Department the Office of Minerals Mobilization (OMM) and made it responsible for solid fuels and metals and minerals, except for domestic-mineral exploration.¹⁴⁴ The OMM received functions that McKay had delegated elsewhere in Interior in 1954. Solid fuels passed to the USBM on July 1 and metals and minerals shifted to the Office of Defense Mobilization on November 12, except for responsibilities he delegated to the General Services Administration on December 22. McKay appointed Spencer S. Shannon as OMM Director on May 4, 1955; operating funds became available on July 1. Assistant Secretary Wormser’s office and the OMM coordinated USBM and USGS studies of mineral-mobilization problems. During May–June 1955, Wormser traveled through Europe and the Middle East to gain information on those regions’ oil industries.

Significant changes occurred in the membership of the USGS Science Advisory Committee. When Morris Leighton retired from the Illinois State Geological Survey and the Advisory Committee, John Frye replaced Leighton in both posts. Major General Herbert Loper joined the USGS advisers in 1955 after retiring from the Army. Since 1949, Loper served as Deputy Chief of the JCS Joint Intelligence Group, Deputy for Atomic Energy to the Acting Chief of Staff G–4, Army Member (later Chairman) of the AEC’s Military Liaison Commission, Deputy Commander of the Joint Task Force, Chief of the Armed Forces Special Weapons Project, and Assistant to the Secretary of Defense. Eliot Blackwelder, who had led Stanford’s Geology Department until 1945, retired from the USGS advisers in 1955. Vertebrate paleontologist George Gaylord Simpson, of the American Museum of Natural History, replaced Blackwelder on the Committee. Horace Albright, who still led the U.S. Potash Company, also served as one of the USGS advisers. Continuing on the Committee were William Heroy, Donald McLaughlin, and Abel Wolman, professor of sanitary engineering at Johns Hopkins, who also advised the AEC, the Army Surgeon General, the NSF, the NSRB, the State Department, the TVA, the United Nations, the U.S. Public Health Office, and the World Health Organization.

On December 16, 1954, two Survey orders by Wrath established, respectively, USGS Committees for Program Planning and for Program Analysis. The Director’s Staff Assistants for Program Planning and for Program Analysis chaired the new Committees, and they each served ex officio as a member of each other’s Committee. The Committees included a representative from each Division, who served, in alphabetical order of their last names and when necessary, as Acting Chairmen. Wrath asked the program planners to “review jointly bureau and division objectives and short-range and long-range plans in their formative stages”

for conformance with agency and division responsibilities, to assure interdivisional coordination, and to consider how programs “related to budget ceilings and allowances.”¹⁴⁵ He directed the program analyzers “to develop a bureau-wide system of project reporting, cataloging, and approval and to assist in compiling and maintaining program schedules.”¹⁴⁶ Both advisory Committees reported to the Director through the USGS Executive Committee. Commenting on the flurry of USGS committees recently established, geologists in the Pick and Hammer Club’s show in the April 1955 show wondered why:

**Committees are the thing today—the bosses think they’re great!
They send us questionnair[e]s to find out how we operate,
They look for ways to streamline and to cut our work in half:
Then start another office which poor Andy has to staff—
And every processed manuscript needs one more autograph!**¹⁴⁷

The Geologic Division drew on nearly \$14,342,000 in fiscal year 1954–55; that sum represented a loss of nearly \$2,125,000 and the only major one incurred that year by the USGS four operating divisions. Of the new total, the SIR appropriation supplied \$5,346,000, representing a decline of \$993,000. The remainder of the overall loss reflected principally the \$1,374,000 reduction by the AEC, but it also included cuts of \$93,000 by the USBR, and \$104,000 by the Army and the Navy together. Increases in funds transferred by the USAF, the DMEA, the FOA, the States and their smaller political entities, and the USBM only totaled about \$103,000. On January 6, 1955, Wrather’s Survey order, effective November 10, 1954, reorganized the staff in the Office of the Chief Geologist, Bill Bradley.¹⁴⁸ The order retained the two Assistant Chief Geologists (ACGs), one for Operations, where Dwight Lemmon replaced Olaf Rove, and the other for Program, still directed by Harold Bannerman. Establishing an ACG for Trace Elements, and appointing Lincoln Page to the post, emphasized the shift from discovery and appraisal of uranium-thorium resources to a program of longer range geologic studies. The order also established three new staff positions—Publications, Research Operations, and Scientific Personnel—and filled them, respectively, with John Rabbitt, Wilbur Irving, and Robert Bryson. Williams Postel remained Chief of the Office of Geologic Reports.

During fiscal year 1954–55, the Geologic Division’s program, as before, emphasized developing new and improved methods of exploring for mineral resources, accelerating geologic mapping, and conducting cooperative investigations with Federal and State agencies, each supported by basic-research components. On July 17, 1954, another self-promoting article about the USGS, Harold H. Martin’s “Uncle Sam’s Treasure Hunters,” appeared in the *Saturday Evening Post* to publicize the agency’s continuing efforts to aid the search for strategic and critical minerals.¹⁴⁹ Martin noted the importance of USGS techniques for discovering deposits of columbium (needed for strength in steel alloys for jet engines) and germanium (used in transistors and now priced at \$350 per pound but recently found in Pennsylvania coals and factories’ smokestack soot). Martin also emphasized USGS geochemical field tests that detected amounts of these commodities as small as 1 part in 10 million and other techniques that used air photos taken in spring to identify concentrations of Patterson poisonvetch (*Astragalus pattersoni*) and other plants as guides to selenium and uranium deposits.

During fiscal year 1954–55, members of the Mineral Deposits Branch and those in other Branches in the Geologic Division, in cooperation with USBM engineers, continued to provide technical data and evaluation for the Emergency Procurement Service’s programs as well as those of the Defense Minerals Exploration Administration. On November 1, 1954, Wrather’s Survey order reorganized, as of October 22, the Mineral Deposits Branch. The order provided for “four project centers and eight field offices for DMEA activities”¹⁵⁰ and made staff assistants in



This photograph shows dead specimens of Patterson poisonvetch (*Astragalus pattersoni*), a leguminous weed with a deep taproot, that USGS geologist Helen Cannon demonstrated in the early 1950s was “useful in fall and winter in deciding where to [diamond] drill” on the Colorado Plateau to confirm uranium deposits indicated by the results of two methods of botanical prospecting combined with those from geological and other investigations on the surface. Cannon showed that the ash from tree-branch tips that contained “[g]enerally more than 1 part per million of uranium” and maps of indicator plants, whose distribution depended on the association of calcium, selenium (*Astragalus*), and sulfur with uranium, were “useful in semiarid country in prospecting for ore-bearing beds at depths as much as 70 feet.” She described and illustrated with drawings and photographs of living specimens of species of “[f]ifty indicator plants commonly associated with carnotite deposits and plants tolerant of mineralized ground.” (Photograph and quotations from Cannon, H.L., 1957, fig. 74 and caption and p. 399. See also the live *A. pattersoni* shown in Cannon’s figs. 76 and 77.)

Washington responsible for all resource activities related to metals, nonmetals, uranium, and the DMEA. For the FOA, Branch and Division scientists studied mineral resources in Latin America, Asia, and Africa. They continued the broad program of investigating fissionable-mineral resources, mapping terrain, and conducting other strategic studies for the Army Engineers and served as advisers and consultants to the NSF, the ODM, and the DoD. During the year, Branch members conducted these and related field studies of mineral deposits in 84 projects in 23 States. Branch geologists completed a regional investigation of mineral resources for the New England-New York Interagency Committee. A mining company discovered an ore body in Wisconsin's lead-zinc district on a geologic structure revealed by USGS mapping. Diamond drilling near New Market, Tennessee, extended the limits of a major zinc deposit. Geologic maps of Arizona's Globe-Miami project showed a well-defined mineral belt and stimulated active prospecting in its parts concealed by younger rocks. Exploratory drilling continued at Tintic in Utah, in the Mojave Desert, and on the Colorado Plateau. Arnold L. Brokaw, the Colorado Plateau Project's District Geologist since 1952, became the District Supervisor at Grand Junction in 1954 and then Project Chief. Geologic mapping continued toward providing large-scale coverage of the Plateau, supported by more specific studies that found new uranium deposits of significant size and extended the known reserves of other deposits. Work increasingly shifted to the program of longer range geologic studies to determine the geologic setting of the carnotite and similar uranium deposits and the factors controlling their distribution and localization.¹⁵¹ Detailed investigations of the distribution of chemical elements in sandstone-type uranium deposits revealed a statistical relationship between the sizes of uranium deposits and the concentrations of their elements.

Investigations by members of the Fuels Branch in fiscal year 1954–55 involved surface mapping in 15 States and subsurface mapping in 11 States. Branch geologists studied coal resources in 12 States, including those in the Tennessee River Valley, the Missouri River Basin, and other areas that required steam coal to provide the additional electric power beyond the capacities of hydroelectric sources. In investigating coal in older mining areas, they discovered a thrust fault on the north side of Pennsylvania's Southern anthracite field that repeated the coal-bearing rock sequence and suggested the possibility of additional deposits. Summary studies of coal resources were underway in Arkansas and Kentucky and concluded in Alabama, Colorado, and Oklahoma. James F. Pepper, the Branch's Eastern Region Supervising Geologist; Wallace de Witt, Jr.; and David F. Demarest published a regional analysis, begun by the USGS in 1943 in cooperation with State geological surveys, of the paleogeography and sedimentation of two Lower Mississippian formations—the Bedford Shale and the overlying Berea Sandstone—formed in one sedimentary cycle in a 47,000-square-mile area of the Appalachian basin in contiguous parts of Kentucky, Ohio, Pennsylvania, Virginia, and West Virginia. The trio's study showed areal variations in the oil- and gas-bearing Berea's thickness and lithology as a guide to potential sites for additional drilling. Fuels geologists also continued field investigations of and a core-drilling program in the oil-shale deposits of the Naval Oil Shale Reserve No. 2 in eastern Utah and completed their study of the Tertiary geology and oil-shale resources of northwestern Colorado's Piceance Creek Basin.

The Engineering Geology Branch's 25 continuing projects operated in 11 States in fiscal year 1954–55. For the Kansas Highway Commission, Branch geologists studied part of the proposed Kansas Turnpike and added investigations of structural-foundation conditions for the National Park Service to those ongoing for the Navy Ordnance Laboratory.

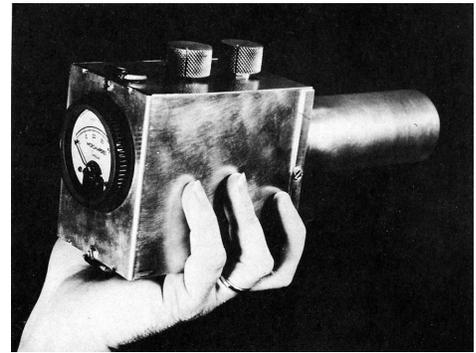
William Benson replaced Charles Hunt as Chief of the General Geology Branch during fiscal year 1954–55. During the 1954 field season, Branch scientists completed work on Unalaska. The geologists and geophysicists at the USGS

facility on Adak, having finished studies for the DoD, ended their operations. At Denver, Ray Wilcox continued his work in what geologist John Fournelle later called “‘applied volcanology,’ tephrochronology.” Using “his background in optical mineralogy,” Wilcox “developed the spindle stage and then the dark field masking technique to compare the minerals and glasses from different ash layers.”¹⁵² HVO scientists decided that Kilauea would erupt during the winter of 1954–55. Although a flank eruption in February destroyed more agricultural land than any Hawaiian event since 1868, the prediction and subsequent evacuation prevented loss of life and minimized property damage. Jerry Eaton and Gordon Macdonald’s analysis of the events served “as a model for all eruption studies”¹⁵³ at the HVO. Other Branch scientists finished stratigraphic studies of Florida’s phosphates; completed geologic investigations in Nevada’s Carson Desert, Utah’s La Sal Mountains, and the Appalachian’s Great Smoky Mountains; and worked up the results of similar efforts in Glacier National Park in Montana.

A revised Survey order of May 19, 1955, effective May 1 and signed by Nolan as Acting Director, again modified James Balsley’s Geophysics Branch; this order abolished its Radiation Section and transferred the Section’s staff and remaining projects to the Ground Surveys Section.¹⁵⁴ Branch members continued to develop, test, and improve their instruments and techniques, including jeep-mounted and hand-portable scintillation loggers, a liquid scintillation core scanner, and shallow-seismic-reflection equipment used to locate buried river channels in Ohio. They also used radiowave-frequency-propagation, induced-polarization, and electromagnetic methods. Regional gravity and aeromagnetic surveys continued to provide information on groundwater in the Salt Lake and Utah Valleys, uranium on the Colorado Plateau, and iron in the Lake Superior area. Investigations of radon in well water in Utah’s Salt Lake Valley indicated that buried faults influenced concentrations and that radon-content contours defined fault traces. Studies of Colorado Plateau cores indicated that uranium-ore emplacement in two or more geologic settings was related to pore-water content and permeability, promising more utility from electrical-resistivity surveys. During the year, Branch specialists flew some 70,000 miles of airborne magnetic and radioactivity surveys; their reconnaissances for radioactive raw materials in 9 States included initial examinations of radioactivity patterns associated with oil and gas fields and varied terrains and their vegetation. For the EPS, they began detailed precision geophysical surveys of chromite in Cuba’s Camaguey Province to increase reserves of refractory grade.

The Geochemistry and Petrology Branch developed X-ray fluorescence equipment that its members expected would produce quantitative analyses of very small grains of ore minerals. The equipment would enable comparisons of individual particles in thin and polished sections and analyses of elementary constituents in the powdered minerals in the spindles used for X-ray diffraction. Branch personnel built a mobile spectrographic laboratory for rapid geochemical analyses in the field. Studies of uranium in coal, oil, and other carbonaceous materials generated data about its migration and concentration, while work on radioisotopes of copper, lead, uranium, and zinc provided information about their age and genesis. Mass-spectrographic studies of hydrogen isotopes in surface water and groundwater increased the understanding of atmospheric and oceanic circulation. Radiocarbon determinations helped to establish a more accurate chronology for the Pleistocene’s Wisconsinan Stage and to measure the addition of carbon dioxide to the atmosphere. Neutron bombardment of zircons and copper samples, at Oak Ridge, and coals, at Brookhaven, showed aspects of how they were formed and changed with age. During 1955, Edwin Roedder joined the Branch to lead its Solid State Group.

Alaska enacted, on March 15, 1955, an oil- and gas-conservation statute similar to laws passed during 1931–55 in California, Mississippi, Pennsylvania, and Wyoming. The Bureau of Land Management leased more than 500,000 acres of potential oil lands in Alaska during fiscal year 1954–55, while drilling continued



USGS geologist Henry Faul and three of his USGS colleagues (managed by Lincoln Page and advised by several specialists in two of the U.S. Atomic Energy Commission’s laboratories) designed, developed, and began field-testing this prototype “integrating (total intensity) scintillation counter.” They intended this smaller and lighter version to replace their earlier portable scintillation counter (12 inches tall and weighing 7 pounds) that was used extensively in 1953’s field season in place of the larger and heavier Geiger-Müller meters. The new instrument and its batteries fit in a case measuring 4 by 4.5 by 3 inches “with a probe 2 inches in diameter projecting 5½ inches from the front”; the whole device weighed less than 3.5 pounds. The new counter used “the same high voltage supply” but simplified the counting circuit to measure “the total intensity of light emitted by the [sodium-iodide] crystal” to read more accurately the total dosage rate in gammas rather than the number of disintegrations. (Photograph and quotations from Wilson, E.E., and others, 1954, fig. 7 and caption and p. 5 and 9.)

around Cook Inlet and in the coastal area east of Cordova. The Interior Department asked Congress and the Navy to modify Public Land Order 82 to open to exploration 25 million Federal acres outside Naval Petroleum Reserve No. 4. The Navy approved, provided that the work did not affect the status of lands in NPR-4. By fiscal year's end, the USGS had mapped photogeologically more than 100,000 square miles of Alaska, including NPR-4, and more than 10 percent of the Territory's 1:250,000 quadrangles. Airborne-magnetometer surveys began in southern Alaska to gain additional information about oil possibilities in the rocks of its sedimentary basins. Alaskan Geology Branch geologists demonstrated that the Lower Cretaceous rocks of the Nelchina area, northeast of Anchorage, extended eastward under the adjacent Copper River Tertiary basin. Their colleagues completed mapping in the Nenana coal field and the greater Anchorage area, used power augers to obtain samples from four localities in the Little Susitna and Homer districts, and briefly worked along the Beluga River west of Anchorage. Mineral studies included those in the Lituya Bay-Lynn Canal Traverse Belt, the southern Prince of Wales Island, the Seward Peninsula's tin and tungsten deposits, and the northeastern Nutzotin Mountains. Branch members also examined routes for the proposed Denali and Brown-Nenana Highways, during the Alaska Road Commission's 50th year, and waterpower sites for the Conservation Division. George Plafker looked at sites flanking Taku Inlet, near Juneau, in 1954. Frederick A. Johnson and Kenneth S. Soward checked locales in the Kenai Peninsula's Bradley River Basin in 1955 and examined two lakes on Baranof Island in 1956.

Members of the Military Geology Branch continued to work in North and Central America, Europe, Asia, and the Pacific during calendar year 1954-55, producing more than 70 reports and maps. Louis C. Peltier, a specialist on the Pleistocene, completed assessing requirements for worldwide information about military geography. In Alaska, MGB personnel made reconnaissance studies of terrain, geology, and (or) permafrost in areas in or around the Copper River Basin, Cook Inlet, the southwest Talkeetna Mountains, and the Brooks Range's North Slope. John R. Williams finished a special report on the Beaver area along the Yukon and mapped trafficability, at 1:130,000, in the Big Delta Military Reservation. The USGS Trace Elements Planning and Coordination Office (TEPCO) sponsored an MGB study of possibly commercial deposits of diatomaceous earth in the northern Kenai lowlands. Werner Juhle and Henry Coulter completed special reports for the NPS on their studies of the terrain and volcanic activity in Katmai National Monument. For the BLM, MGB members evaluated permafrost and groundwater conditions at reservations for town sites in the Glennallen area of the Glenn Highway. At Barrow, Arthur Lachenbruch continued his studies, begun in 1952, of the thermal properties of permafrost. At Fort Hood in Texas in 1954, MGB personnel assessed, at 1:50,000, the Army post's climate, landforms, state of ground, and vegetation. A related study, at 1:250,000, of the possibilities of cross-country movement in Louisiana appeared in 1955. MGB members also taught a 2-week course in military geology to 20 Army Engineers at Fort Belvoir. Allen Nicol, Richard W. Lemke, Alfred Clebsch, Joseph H. Hartshorn, and other specialists prepared Engineer Intelligence Studies of areas at Thule (at 1:100,000), Nunatarssuak, and southern Inglefield Land in Greenland. Jack Rachlin and his colleagues finished terrain studies at 1:100,000 of British Honduras (Belize), Costa Rica, El Salvador, Honduras, and Nicaragua; they were similar to those for Guatemala. In 1955, Frederick Betz's team in Europe, working at headquarters in Heidelberg and Salzburg, began issuing a set of cross-country-movement maps of West Germany, at 1:100,000, that displayed information about drainage, landforms, soils, trafficability, and vegetation; they were completed in 1958 with input from the Soil Conservation Service. The team also prepared a terrain study of Austria on 14 maps, at 1:50,000, 1:250,000, and 1:500,000, and the Army Signal Corps sponsored a morphometric analysis of

Cyprus. Cornelia Cameron completed a lithologic map, on 2 sheets at 1:2,000,000, of Europe in 1955.

Among the Military Geology Branch's work in the Far East and the Pacific during 1954–55, Jack Rachlin and his colleagues completed for the Army's G–2 Section a 20-page handbook on Indochina and special reports on possible airfield sites within 150 miles of Saigon and the French naval base at Cam Ranh Bay, at 1:2,250,000, about sources of timber for construction in the Red River delta and surrounding area, and on construction materials near Nha Trang, the French administrative center, just north of Cam Ranh. MGB members also assessed construction materials and water resources in Burma, China (except Hainan and Manchuria), and Indonesia. They revised a 30-page brief on "Manchuria," including Manchuria, Korea, northern China, the Shantung (Shandong) highlands, and the southeastern coast of Siberia. For Army headquarters in Tokyo, MGB personnel evaluated the water resources of campsites for the 7th Infantry Division; studied installation development at Fukae, east of Nagasaki, and on Mi-shima, off Hagi in southwestern Honshu; and assessed the relation of volcanism to water resources and base facilities on Iwo Jima. During July–September 1954, the Pacific Geologic Mapping Program's Gilbert Corwin led Lawrence Bonham, Maurice J. ("Ric") Terman, and George Viele in mapping the general and engineering geology, at 1:25,000, of Pagan, the island just north of Saipan in the Marianas. The Program's report on Saipan's engineering aspects and an analysis of the island's beaches and terrain, also at 1:25,000, appeared in 1955. The summary of Saipan's water resources, by Preston Cloud, Robert George Schmidt, and Harold Burke, followed in 1959. The five-volume report on the engineering aspects, geology, soils, trafficability, and water resources of Okinawa, at scales from 1:25,000 to 1:250,000, by Corwin, Cornelia Cameron, Delos Flint, Allen Nicol, Raymond Saplis, Carl Stensland, and soils-scientist A. Joseph Vessel, appeared between 1957 and 1959. Program members issued their description of the tactical and engineering aspects of Tinian's terrain in 1960. During November 1954–July 1955, John Stark, David Blumenstock, Max Carson, Richard L. Hay, Harold G. May, James E. Passeur, and Elmer D. Patterson mapped and studied the terrain, geology, climate, and hydrology of Truk Atoll in the central Carolines. The team published a summary report, with maps at 1:25,000, about Truk in 1958 and a water-resources supplement, by Santos Valenciano and Kiyoshi Takasaki, in 1959. Members of the Pacific program also briefly examined Ponape.¹⁵⁵

During fiscal year 1954–55, members of the Branch of Foreign Geology began or continued investigations and training in Latin America, Africa, the Middle East, and Asia for the AEC, the FOA, and the EPS. Jacob E. Gair, Robert F. Johnson, and Samuel L. Moore joined John Dorr 2d's mineral-appraisal group in Brazil's Minas Gerais, while Helmut Wedow and William W. Vaughn helped Max White and Gene E. Tolbert's reconnaissance of that country's uranium resources. Bolivia's Government used the results of Branch members' studies of geologic-engineering features in La Paz to mitigate construction hazards and plan for the capital's future development. George Ericksen, as USGS Mission Chief, began advising Chilean Government officials about founding a national geological survey and initiating a countrywide program to investigate and develop the nation's copper and other mineral resources. Parker Trask briefly aided these mineral investigations and Raymond L. Parker arrived to succeed Monta Wing. William R. Hemphill provided photogeologic and other support for Benjamin Webber's investigation of mineral resources in British Guiana. Gus Goudarzi, having completed his work in Saudi Arabia, began a long-term investigation of Libya's mineral resources as USGS Mission Chief and as adviser to the government of King Idris. Britain's and the United States' treaties with Libya in 1953–54 gave them 20-year rights to maintain military forces and installations in that country in return for economic and other monetary subsidies; the United States promptly began to expand Wheelus Air Force Base. In

India, Branch members introduced the newest USGS techniques in geochemical prospecting to their local colleagues. Harley Barnes and Frank Spencer extended the studies by Harold Vokes and Marvin Weller of coals in the Philippines.

USGS personnel returned to Antarctica in the austral summer of 1954–55 when geologist William Davies accompanied the Navy's first deployment to the continent since Operation Windmill in 1947–48. After the Navy completed Windmill, the CIA notified the State Department that U.S. passive claims now covered most of coastal and inland Antarctica. The State Department tried but failed in June 1948 to arrange for an international settlement of all claims on the continent. In April 1949, Truman approved Highjump II, the Navy's third Antarctic Developments Project. Highjump II, to be led by Rear Admiral Richard Byrd, would extend U.S. claims, expand aerial mapping of the continent, test new equipment, and advance scientific knowledge. Lloyd Berkner, as a radio engineer-operator on Byrd's initial expedition to the Antarctic in 1928–30, completed in May 1949 a report for the National Academy of Sciences that recommended a coordinated program of U.S. scientific research in Antarctica. Berkner's report drew support from the new interagency Technical Advisory Committee on Antarctica. Three months later, Truman, seconded by Defense Secretary Louis Johnson, decided to save funds, and at the same time remind Senator Harry Byrd that he opposed Truman's reelection in 1948, by canceling Highjump II.

In April 1950, Berkner attended a party held at physicist James A. Van Allen's home in Silver Spring, Maryland, to honor Oxford geophysicist Sydney Chapman.¹⁵⁶ Van Allen, a Navy veteran, now supervised Johns Hopkins' High Altitude Research Group. During the festivities for Chapman, Berkner proposed to organize and hold a third International Polar Year, whose program would be patterned on but expanded far beyond the studies conducted during its 1882–83 and 1932–33 predecessors. In June, the Soviet Union claimed priority from Fabian von Bellingshausen's voyage in 1819–21, which overlapped and encountered that of American Nathaniel Palmer in 1920–21.¹⁵⁷ The Soviets wanted to participate in any international meeting convened to settle Antarctic claims and would not recognize the legality of any agreement that they did not help to formulate. When the International Council of Scientific Unions (ICSU) met in Amsterdam in October 1952, Chapman suggested changing the new polar year's name to the International Geophysical Year (IGY). In July 1953, the ICSU established the Comité Spécial de l'Année Géophysique Internationale (CSAGI), whose directing Bureau included Berkner, Chapman, Belgium's Marcel Nicolet, France's Jean Coulomb, and Soviet economic and structural geologist Vladimir V. Belousov. Chapman, who left Oxford in 1953 for research in Alaska and at the University of Colorado's High Altitude Observatory, was appointed the Bureau's president. Berkner, who led the Associated Universities consortium that included the Brookhaven National Laboratory, served as vice president and Nicolet became the secretary general. Within 2 years, the IGY gained international approval and participation. Plans for the IGY called for participating scientists, from many more nations than during the two earlier Polar Years, to work in both polar areas but especially in Antarctica, along the equator, in three pole-to-pole areas flanking selected meridian strips, and in space. Astrophysical, geodetic, geophysical, glacial, gravimetric, meteorological, oceanographic, seismological, and other observations would be made at and above (via balloons and sounding rockets) many ground sites during the 18-month interval in 1957–58 of maximum sunspot activity in that 11-year solar cycle. Vice Admiral Archibald Day, the Royal Navy's former Hydrographer, was brought in as the IGY's Coordinator in 1956 to oversee the programs and the world data centers.

The U.S. National Committee for the IGY, established by the National Academy of Sciences and the National Research Council (NAS–NRC) in March 1953, replaced the earlier informal group founded in 1950. UCLA physicist-geophysicist Joseph Kaplan, an NSF consultant who also served on the ICSU's Committee on

Space Research, chaired the U.S. IGY Committee. NBS physicist Alan H. Shapley served as the Committee's vice chairman and the NBS's Hugh Odishaw was its executive secretary and later director. The U.S. IGY Committee included among its members Allen Astin; Lloyd Berkner, also a rear admiral in the U.S. Naval Reserve (USNR); Lyman Briggs; Laurence Gould; Paul Siple; Athelstan F. Spilhaus, at the Woods Hole Oceanographic Institution; and Merle Tuve of the Department of Terrestrial Magnetism (DTM) at the Carnegie Institution of Washington. Berkner supervised the Committee's rockets and satellites program, and Gould chaired its Antarctic group; these were 2 of the Committee's 18 working groups and technical panels. To support U.S. activities for the IGY during fiscal year 1954–55, the NSF supplied \$2 million. The Army Engineers founded in 1953 an Arctic Construction and Frost Effects Laboratory by combining their Snow, Ice, and Permafrost Research Establishment with their Frost Effects Lab. Before April 1954, the State Department created an ad hoc interdepartmental committee to coordinate U.S. policy for and claims in Antarctica and expected Admiral Byrd to fill any gaps during the 1954–55 expedition.

In July 1954, NSC 5424 persuaded Eisenhower that the IGY, especially its work in Antarctica, would be significant for peaceful as well as military uses by the United States, even though the NSC estimated the continent's strategic and resource value as low. Scientific programs there would add to the administration's ongoing efforts to reduce international tensions while also helping to enforce existing U.S. rights and monitor Soviet activity. The President approved the paper's recommendations to increase exploration and mapping, establish permanent stations, and begin scientific investigations. He asked Congress for supporting funds, and the Navy continued its logistical aid. When the CSAGI met again in Rome during September–October 1954, its members considered a list of nearly 30 proposed stations in Antarctica, including those at Little America, on Marie Byrd Land, and at the South Pole suggested by the United States. During January–February 1955, 276 men, including William Davies; seismologist Daniel Linehan, director of Weston Observatory of Boston College; and Highjump veteran Walter Sullivan, of the *New York Times*, sailed to the Ross and Weddell Seas in Navy icebreaker *Atka*,



This view, taken in 1957, shows USGS cartographer Dean Edson using a Twinplex stereoscopic plotter at the Topographic Division's Western Region headquarters in Sacramento, California. Members of the Topographic Division widely used Twinplex stereoplotters, with ER-55 projectors, in compiling maps from aerial photographs in the late 1950s and early 1960s. Bausch and Lomb produced its Balplex as the commercial version of the Twinplex. The Division abandoned further development of the Twinplex after the advent of successful super-wide-angle photography, which eliminated the problems associated with using convergent or transverse low-oblique photos in aerotriangulation. The Orthophotoscope subsequently replaced the Twinplex. (Photograph from the USGS Denver Library Photographic Collection as Patterson, E.F., pef00223, <https://www.sciencebase.gov/catalog/item/51dda09de4b0f72b4471ddab>; published in Yochelson and Nelson, C.M., 1979, p. 34.)



Topographic engineer and photogrammetrist Russell Kerr Bean (1900–76) originally worked for the USGS in 1923–26. He spent subsequent years in industry and with the Army Engineers and later worked for the Tennessee Valley Authority in its cooperative mapping with the USGS before rejoining the USGS in 1941. He led the Arlington (Virginia) office of the Topographic Branch (later Division) during 1944–47, the Photogrammetry Section (later Branch, 1947–59), the Research and Design Laboratory (1958–59), and the Research and Design Branch (1959–60), before becoming Assistant Chief Topographic Engineer and Chief of the Office of Research and Technical Standards (1960–63). Bean retired in 1963. Bean and his colleagues improved the Kelsh plotter and developed the ER–55 projectors used in the double-projection Twinplex plotters that replaced the Multiplex units. In 1950, Bean and his team began developing the Orthophotoscope. The new instrument subsequently revolutionized map compilation and production and facilitated the completion in 1991 of topographic coverage (at 1:24,000) of the conterminous United States. (Photograph from the USGS Denver Library Photographic Collection, Portraits, in the “Last Name A–B” folder as Public Inquiries Office 63–05; see also Radlinski, 1985, and Evans, R.T., and Frye, 2009, fig. 26.)

the Coast Guard’s former *Southwind*. From February 1, *Atka* formed part of Task Force (TF) 43, the Naval Support Force Antarctica (NSFA), led by Rear Admiral George Dufek, retired but now also reactivated like Byrd. TF 43 drew aid from the Navy’s month-old Air Development Squadron 6. The NSFA assumed responsibility for supporting all U.S. efforts in Antarctica on February 1, 1955. Davies examined the geology of several locales, and Linehan assessed ice thicknesses as part of the cruise’s evaluation of ice conditions and selection of potential sites, including one at Kainan Bay for the next Little America, for U.S. participation in the IGY.¹⁵⁸

The Topographic Division, to its SIR appropriation of nearly \$11,500,000 for fiscal year 1954–55, added \$3,180,000 from other Federal agencies, nearly all of which came from the \$1,045,000 transferred by the Army and its Engineers and the \$979,000 shifted by the Air Force. The USBR transferred \$902,000, representing a loss of \$264,500, and the AEC shifted \$159,000, or \$39,500 less than the previous year. States, counties, and municipalities supplied about \$1,233,000. The Topographic Division survived the cuts by Congress and the transfer agencies far better than the Geologic Division; the former’s total of \$16,019,000 for 1954–55 represented a loss of only some \$8,400 compared to 1953–54. Continued technological improvements enabled the Division to reduce its permanent staff by 6 percent while increasing its square-mile coverage by 15 percent. The mapping program in fiscal 1954–55 continued to be directed largely toward national-defense requirements, but plans were made to begin mapping in areas related to implementing portions of the new Watershed Protection and Flood Prevention Act¹⁵⁹ of August 4, 1954, and to accommodate the anticipated priority requirements of civil defense. During the year, overall coverage of the continental United States increased to 73 percent. Good-quality maps now showed 37 percent of the same surface, representing a 4-percent increase. By fiscal year’s end, 142 maps, including 5 for the Hawaiian Islands, of the 1:250,000 U.S. civilian series were made available to the public. Total new mapping, including surveys in the Territories, reached almost 133,000 square miles, of which 36 percent was at 1:24,000; revisions involved more than 9,000 square miles. The 5-year cooperative mapping project in Kentucky was almost finished by year’s end, and State officials began a program of maintenance for maps that depicted more than 40,000 square miles. The DoD requested dual coverage, at 1:25,000 and 1:50,000, of an area of 16,600 square miles in Texas. The DoD also asked for an early completion of Alaska’s 1:63,360 maps; as a result, 31,000 square miles were mapped in Alaska during 1954–55. The DoD also wanted a new 1:250,000 series of the Territory. The Topographic Division published new revised-base and shaded-relief editions of Alaska Map E at 1:2,500,000.

During 1954–55, the Topographic Division also let contracts for nearly 183,700 square miles of precision aerial photography, of which some 133,400 was of the more efficient twin low-oblique type, to support its mapping program. One of the largest contracts called for photographing the 121,800 square miles of Alaska’s Brooks Range to support a pioneer venture in 1:250,000 mapping from transverse low-oblique photographs. In addition, the Division obtained from the Air Force about 118,000 square miles of photographic coverage. The Twinplex plotter, patented on December 14, 1954, entered production during the year. Design work by Russell Bean and his team on the Orthophotoscope neared completion; the new instrument converted conventional-perspective photographs to the equivalent of orthographic photographs. By simple or differential rectification, the Orthophotoscope eliminated the image distortions on air photos caused by camera tilt and terrain relief. Two new KC–1 (formerly T–12) aerial cameras were delivered to the Division. Some commercial-contract work used federally owned T–12 cameras, equipped with nearly distortion free lenses, and the Division began a new system of checking contractors’ cameras to determine their acceptability before they were used in Division projects.

The Water Resources Division's funds for fiscal year 1954–55 rose by \$345,000 to a total of \$13,901,000. The Division received more than \$6,658,000 in SIR funds, a loss of \$73,000 from the previous year, of which \$3.8 million was limited to the cooperative work with the States and their smaller political entities. Other Federal sources provided about \$12,857,000. The largest transfers included \$1,049,000, a \$21,000 reduction from the previous year's contribution, from the Army and its Engineers, and \$723,000, an \$85,000 loss from the USBR. The Division received nearly \$4,077,000 in reimbursements and direct payments from States, counties, and municipalities; as before, California, Texas, and New York provided the largest amounts of these cooperative funds. In September 1954, Carl Paulsen transferred the Columbus (Ohio) Equipment Development Laboratory (CEDL) from the Office of the Chief of the Surface Water Branch to the Office of the Chief Hydraulic Engineer; in December 1955, he assigned the CEDL to the Technical Coordination Branch. Arthur Frazier became the local representative in Columbus of the Technical Coordination Branch's Research Section, and Keith S. Essex shifted from Denver in June 1956 to lead the CEDL.

On May 13, 1954, Eisenhower signed legislation that established the Saint Lawrence Seaway Development Corporation,¹⁶⁰ modeled on the TVA and earlier supported by Truman, to construct the seaway in cooperation with a similar organization in Canada. In June 1955, the 25-member U.S. Commission on Intergovernmental Relations, formed by Eisenhower in September 1953, and chaired by Clarence E. Manion, Dean of Notre Dame's Law School and manager of the Manion Forum, reported its findings to the President. The Manion Commission recommended providing greater initiative and responsibilities to the States for water-development projects, including those involving more than one basin.

The Surface Water Branch obtained records of streamflow data at more than 6,800 sites in the 48 States and in Alaska, Guam, and Hawaii. Those records included 4,400 collected in cooperation with 187 agencies of States and their political subdivisions and 1,700 for other Federal agencies. Studies included water use by industry, frequency of floods, and flow in open and constricted channels. Field tests began on battery-powered, electronic, low-velocity flowmeters in locations where the standard units were insufficiently accurate. Compilation of all streamflow records in the United States between 1888 and 1950 increased to 57 percent of completion. Branch members continued to measure available water to help fulfill the U.S.-Canadian treaty on their boundary waters and the 17 existing interstate contracts for apportioning and dividing interstate waters; they also planned to contribute to the 2 other interstate contracts being negotiated. The U.S. Supreme Court appointed Paulsen as the Master for the Delaware River; as such, he administered the Justices' decree for diverting water from the Delaware to supply New York City and the release of water to improve the river's low flow.

The Branch's preparation of special reports on floods continued in 17 States, and Branch hydrographers began a nationwide study of flood frequency as part of the Division's responsibility, shared with the Weather Service, for collecting basic data to carry out provisions of the Watershed Protection and Flood Prevention Act. That statute, cosponsored by the two Republican chairmen of the congressional Committees on Agriculture and Forestry in the 83d Congress—Kansas' Representative Clifford Hope and Vermont's Senator George D. Aiken—authorized “the Secretary of Agriculture to cooperate with States and local agencies in the planning and carrying out of works of improvement for soil conservation and for other purposes.”¹⁶¹ The new law provided for coordinated programs in small-watershed districts, those not larger than 250,000 acres, in cooperation with the Soil Conservation Service. The statute enabled watershed reservoirs to be built only for flood control and irrigation. Subsequent Congresses appropriated \$29.5 million to carry out these measures and passed comprehensive amendments and new legislation to allow the

addition of municipal and industrial water supply, fish and wildlife development, and recreation facilities as appropriate components of the projects.

The Branch continued its comprehensive sediment-monitoring programs in the Colorado, Missouri, and Rio Grande Basins and similar projects in conjunction with the Soil Conservation Service in small watersheds in Kentucky, Nebraska, North Carolina, Oklahoma, Texas, and West Virginia. The Branch released a report by Bruce Colby and Charles H. Hembree on the Niobrara River's total sediment discharge near Cody, Nebraska; the results were based on improved and simplified methods for computing those numbers. In a similar report, these authors analyzed sediment sources and erosion processes typical of areas like the upland gullies in Nebraska's Dry Creek Basin. Research projects underway included those on aggradation and degradation in alluvial channels, sediment transport, the radioactivity of natural water supplies, the backwater effects of channel constrictions, the distribution of flow in multiple-opening river crossings and through culverts, new techniques for measuring water loss from reservoir and land surfaces, and more rapid computation of streamflow records.

Members of the Ground Water Branch were involved during fiscal year 1954–55 in more than 500 projects, in 40 States, Guam, and Hawaii, that involved determining the occurrence, quantity, quality, and recharge potential of underground water resources; the occurrence and quality of inland saline waters; the nature and extent of saltwater encroachment in coastal areas; the hydrological details of mining areas and oil fields; and the amount of water lost to phreatophytic vegetation of no direct benefit to humans. One of the most significant of these groundwater studies involved the Minidoka pumping project in Idaho, the initial Federal reclamation development in the United States based on groundwater. USBR and USGS studies were designed to provide data for local decisions on tapping for irrigation the water in the basalt beneath the Snake River Plain. During the year, the Branch issued a series of areal geologic maps, bringing the total to 89 quadrangles mapped at 1:62,500 in cooperation with the Bureau of Indian Affairs; the maps depicted most of the 20,000 square miles of the Navajo and Hopi Indian Reservations in Arizona, New Mexico, and Utah. These maps were intended primarily for use in developing well-water supplies and were also for use in locating mineral and fuel resources. Ongoing research and development projects involved factors in the artificial recharge of groundwater and the design and development of geophysical-exploration units and electrical-analog analyzers for water wells. Herbert E. Skibitzke and Geraldine M. Robinson developed a method that used resistor-capacitor model analogs for solutions of nonsteady flow to solve a flow problem in groundwater systems.

During fiscal year 1954–55, members of the Quality of Water Branch determined the chemical quality of some 64,000 water samples, most from about 450 regular stations; 9,000 of these samples came from wells and springs. The Branch issued a two-volume compilation, by chemist Edwin W. Lohr and Kenneth Love, of the industrial utility of America's public water supplies during 1952; these books contained the results of chemical analyses of water from 1,315 of the Nation's larger cities that superseded a similar report published in 1932. The new report formed the initial publication of a new series intended to provide comprehensive information about the chemical quality of surface water used for irrigation in the United States. Branch members hoped that long-term records would aid in determining water quality prior to irrigation development, the extent of water-quality impairment due to drainage return, the requirements for maintaining proper salt balance, and methods for a more equitable distribution of water supplies. Continuing to assert that increasing amounts of radioactive waste affected the real and potential contamination of water, they compiled data on background levels of radiation and continued their research on techniques aimed at producing a limited program of systematic radiometric sampling and interpretation. Branch members

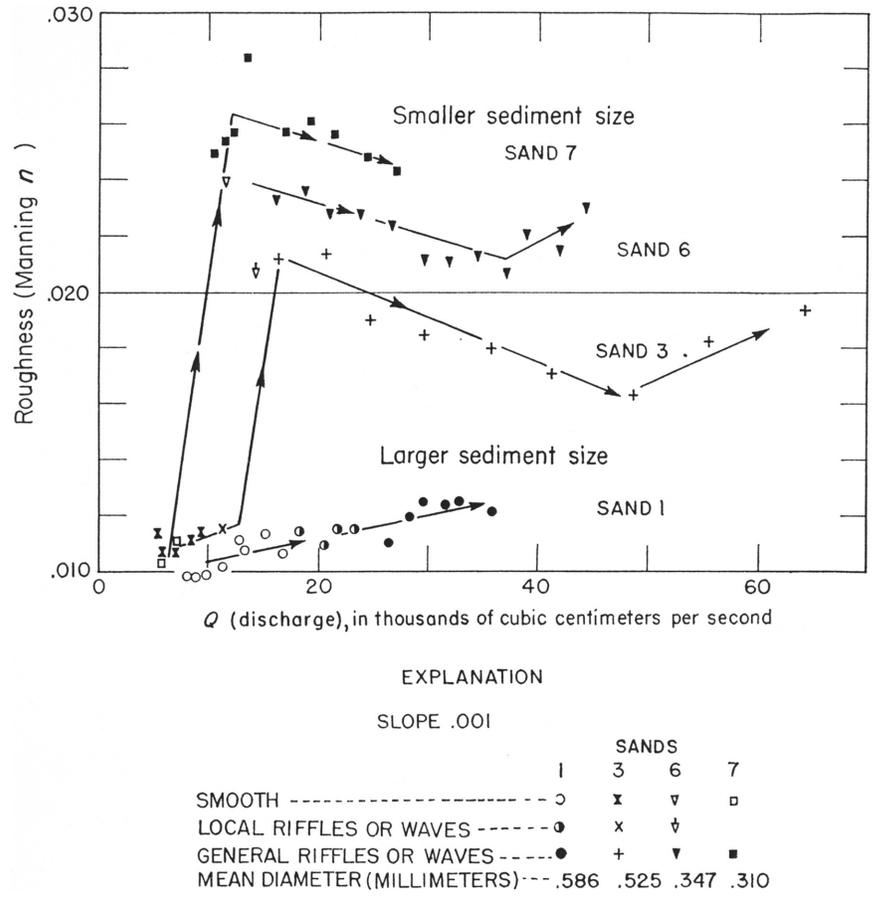


This view of the Saskatchewan Glacier, looking west, was taken from Parker Ridge on July 11, 1952. To increase the understanding of water in its solid form, USGS geologists resumed the work of the agency's François Matthes (1874–1948) on glacial characteristics, mechanisms, and deposits. In 1952, Mark Meier began a 3-year study of surface- and depth-flow velocities and modes at 51 stations on the Saskatchewan Glacier, the principal outlet of the Columbia Icefield, in Banff National Park in Canada's Alberta Province. A seismic survey of the valley glacier's bedrock channel by Clarence R. Allen (Caltech) in 1952 aided Meier's investigation. (From Meier, 1960, pl. 6; also available in the USGS Denver Library Photographic Collection as Meier, M.F., mmf00010, <https://www.sciencebase.gov/catalog/item/51dd8abbe4b0f72b4471c2e0>. See also Colbeck, 1996.)

continued to contribute to the Division's inventory of the occurrence and quality of all of America's saline-water resources, but they concentrated on detailed evaluations of those in North Dakota and Texas. The Division advanced an investigation, begun at the request of the National Security Resources Board and renewed in 1953 by the Business and Defense Services Administration, of the Nation's critical areas of industrial production by issuing reports on Indianapolis, Mobile, Oregon's Portland, San Francisco, Steubenville in Ohio, and Wheeling in West Virginia. Comparative studies also began or continued of the amount of water estimated to be required and the amount actually used by the acetate-fiber, aluminum, carbon-black, copper, paper-pulp, petroleum, and rayon industries.

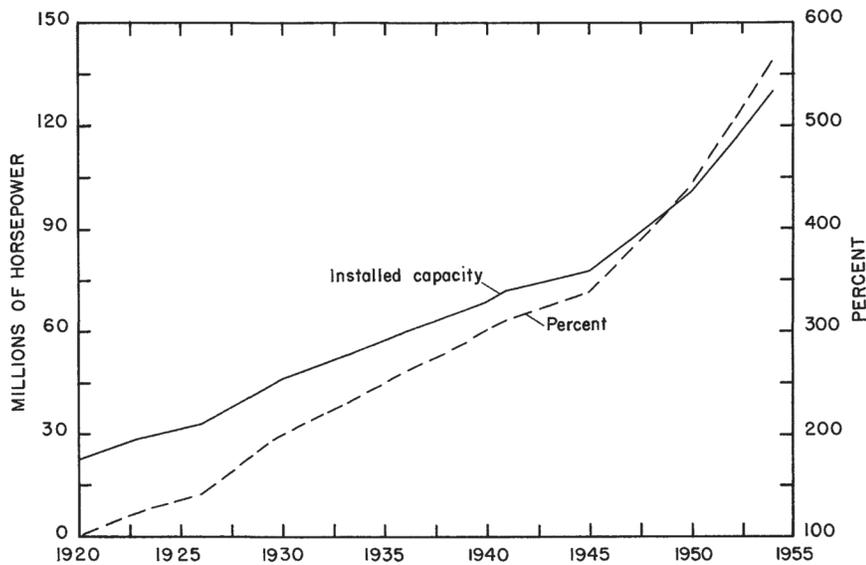
Members of the Water Resources Division continued investigations in U.S. possessions and in areas outside American jurisdiction, the latter with the FOA's continuing support. The Division's ongoing detailed assessment of American Samoa's water resources became more significant as American Samoa gained regular services by sea and by air. Longer term projects abroad involved seven groundwater and two surface-water studies. In 1954, Mark F. Meier, aided by Charles R. Allen's 1952 seismic investigation of the Saskatchewan Glacier's bedrock channel in Alberta, completed a 3-year study of flow modes in the glacier, the principal outlet of the Columbia Icefield. Allen earlier investigated the Taku Glacier near Juneau in Alaska. In May 1955, Robert J. Dingman began a long-term study of Chile's groundwater resources. Work in Africa and Asia included a groundwater reconnaissance in the Anglo-Egyptian Sudan (the Republic of the Sudan from 1956) and the continued gathering of water-resources and flood-control data in India, where USGS hydrologist Luna Leopold and Thomas Maddock, Jr., the Chief of the Bureau of Reclamation's Irrigation Division and chief irrigation analyst for the second Hoover Commission, spent the spring of 1955 with George C. Taylor, Jr.'s USGS investigation. Roger Baker joined the Division's FOA-supported and continuing investigation of Pakistan's water resources. During October 27–November 20, 1954, Philip LaMoreaux and six colleagues from Thailand's Geological Survey and its Royal Irrigation and Public Health Departments completed a reconnaissance of geological and mineral resources of the Khorat Plateau in the

This graph shows the relations of flume-bed roughness, measured by Manning's n (roughness factor), and water discharge (Q) for four sands of different diameters. Hydrologists Luna Leopold (USGS) and Thomas Maddock, Jr. (Bureau of Reclamation, later USGS), derived the relations by analyzing published data from studies at the U.S. Waterways Experiment Station. In the hydraulic geometry of river and stream channels (principally in the Western United States), they demonstrated, "for the same slope and discharge, the effect of decreasing particle size is a tendency to increase the roughness even when the condition of the bed is observed to remain the same." They also noted that "with no change in particle size, a change in bed configuration may violently change bed roughness and its effect may be of the same or greater order than the effect of differences in particle size." Depth, suspended load, velocity, and width determined the shape of natural stream channels, and these hydraulic factors varied "with discharge as simple power functions." As average river channel-systems developed, they produced "an approximate equilibrium between the channel and the water and sediment it must transport * * * even in headward ungraded tributaries and in a given cross section for all discharges up to the bankful stage." (Graph and quotations from Leopold and Maddock, 1953, fig. 30 and title page and p. 1 and 41.)



northeastern part of the country. Division personnel also trained colleagues on field projects in Egypt and other countries; hydrologists from Canada, Colombia, Cuba, Egypt, and Thailand improved their expertise while with the USGS in the United States.

The Conservation Division received \$1,746,000 during fiscal year 1954-55, a sum that represented a gain of \$106,000 from 1953-54. The new total included SIR funds of \$411,000 for classifying mineral and waterpower lands and more than \$1,291,000 for supervising mining and oil and gas leases. Two new laws enacted during the fiscal year influenced the Division's work. On August 13, 1954, a statute amended the mineral-leasing and mining laws "to provide for multiple mineral development of the same tracts of the public lands."¹⁶² A second statute, signed on June 16, 1955, authorized "agricultural entries under the nonmineral land laws of certain mineral lands * * * to increase the limitation with respect to desert entries"¹⁶³ from 160 to 320 acres. During the year, members of the Mineral Classification Branch handled over 24,000 cases, nearly 4,000 fewer than in 1953-54, and made required reports on field examinations of geologic structures, coal fields, oil and gas fields, and dam sites in California, Colorado, Kansas, Louisiana, Montana, New Mexico, Washington, and Wyoming. Specialists in the Water and Power Branch evaluated the power resources and storage possibilities of 13 dam sites along 242 channel miles of rivers on Federal lands in Alaska, California, Colorado, Montana, New Mexico, Oregon, and Washington. A general survey of the world's developed and potential waterpower accompanied the completed reports of specific earlier surveys. New additions of some 7,250 acres and elimination of about 67,000 acres left the power-site reserves in Alaska and the conterminous States at about 7.1 million acres, a subtraction of almost 60,000 acres from the



This diagram shows the global growth of waterpower facilities during 1920–54. The installed capacity of U.S. waterpower plants rose from 7.5 million horsepower in 1920 to 34.7 million horsepower in December 1954, while the world's capacity increased at a greater percentage from 23 million to 129.7 million horsepower. The United States' share of the world's total installed capacity fell during the same interval from 32.6 to 26.8 percent. After World War I, the USGS studied the world's waterpower installations and their capacities. The subsequent report on the world's waterpower formed Part II of the "World Atlas of Commercial Geology," a reference used at the First World Power Conference in London in 1924 (see Rabbitt, M.C., 1986, p. 217, 249–250). In the 1950s, specialists in the USGS Conservation Division resumed these investigations. (From Young, 1955, fig. 1, based on data in table 1.)

previous year's total. The Mining Branch supervised leases on about 1,810 properties in Alaska and 32 States that produced more than 18.8 million tons of asbestos, bentonite, coal, feldspar, lead, manganese, mica, phosphate, potash, quartz crystals, quartzite, sand and gravel, sodium, and zinc. That output returned to the Treasury more than \$5.4 million in royalties, a year's gain of more than \$956,000. The Oil and Gas Leasing Branch oversaw nearly 95,900 oil and gas properties on the public lands in Alaska and 23 States, some 3,700 acquired land leases, and 10,900 leaseholds on Indian lands. Initial sales of offshore oil and gas leases began on October 13, 1954. Royalties from the oil, natural gas, gasoline, and butane produced from all leases totaled about \$60.5 million, about \$7.9 million less than in 1953–54.

Eisenhower continued to pursue peace while enhancing America's defenses against the growing challenges from the Soviet Union and the People's Republic of China. In July 1954, as the delegates in Geneva reached an agreement about Indochina, the two Chinas continued their low-level conflict. In August, Zhou Enlai announced his country's continuing intent to liberate Taiwan; Eisenhower replied that the U.S. 7th Fleet would repel any attempted invasion. In September, Communist Chinese forces shelled the Nationalist-held islands of Quemoy (Jinmen) and Matsu, just off the mainland and of symbolic value only. In return, Nationalist artillery struck a nearby island held by the Communists. Although Chiang's government signed a mutual-defense treaty with the United States on December 2, the agreement with the Republic of China did not include American protection of the small, Nationalist-held islands along the Communist coast. On January 22, 1955, Congress authorized the President to use force to protect Taiwan and the Pescadores (Penghu Islands) from attack. After the U.S. 7th Fleet helped the Nationalists to evacuate, during February 6–13, 1955, the less defensible Tachen (Taizhou) Islands, Secretary Dulles announced on March 3 that U.S. protection would be extended. The Chinese Communists discontinued their attacks on the other offshore islands held by the Nationalists to lessen the risk of a general war. On January 1, the United States began providing economic assistance to Cambodia, Laos, and South Vietnam. Zhou's offer to negotiate with the United States and Taiwan arrived in April.

On August 30, 1954, Congress and the President revised the Atomic Energy Act of 1946 to help foster the peaceful uses of atomic energy by authorizing the AEC, or its licensees, to distribute abroad, at domestic costs, to any nation or individual special nuclear, source, and byproduct material, unless it "would be inimical

to the common defense and security.”¹⁶⁴ All such export licenses would be suspended in times of war or national emergency. The modified law required the AEC and the President to approve all nuclear cooperation with other nations or regional defense organizations. The statute also allowed private power companies to develop peaceful atomic-energy projects, to own reactors and nuclear materials, and to take out patents to be shared for 5 years with other companies. The TVA could not then accommodate both the growing demand for power for the AEC at Oak Ridge and the rapid growth of normal consumer demands in the Tennessee River Valley, without enlarging its generating and transmission facilities. The administration preferred that the TVA not be allowed to do so. Instead, Lewis Strauss’s AEC awarded a Federal contract on October 5 to Middle South Utilities, Inc., and the Southern Company (the Edgar Dixon-Eugene Yates group) to build a generating plant at West Memphis, Tennessee, and feed power into the TVA system and supply the Memphis metropolitan area. The AEC’s action gave the Democrats a major issue for the midterm elections.

The Eisenhower administration’s “New Look” in national-security policy did not end interservice rivalry over funds and turf, especially for guided missiles. As historians Walter Boyne and Michael Neufeld described, each of the three services claimed dominion over most of those new weapons.¹⁶⁵ The Army and Navy portrayed them as longer range artillery, and the Air Force promoted them as pilotless bombers. The Truman administration gave the USAF operational control of surface-to-surface strategic missiles, while the Army received responsibility for tactical and anti-aircraft missiles. Counsel for the USAF’s effort came from its Science Advisory Board, established by General Arnold during World War II and still chaired by Theodore von Kármán, who also led Caltech’s Jet Propulsion Laboratory. On June 30, 1953, General Nathan F. Twining succeeded General Vandenberg as the USAF’s Chief of Staff. In response to the Soviet Union’s successful test of its hydrogen bomb in August, the Executive Secretary of the National Security Council recommended in NSC 162/2 to the President and the Joint Chiefs of Staff that the Strategic Air Command’s nuclear arsenal would be the Nation’s first and best deterrent defense. Convair and Martin developed, respectively, the Atlas and Titan liquid-fueled intercontinental ballistic missiles (ICBMs), whereas Douglas developed Thor, an intermediate-range ballistic missile (IRBM). The USAF sponsored these strategic missiles to counter those being developed in Soviet Union and also to supplement SAC’s bomber force.

USAF Colonel Bernard A. Schriever (Kármán’s coworker) realized that the 1,500-pound thermonuclear device proposed by Teller and von Neumann in 1953 might become a warhead on a lighter weight, and thus longer range, ICBM. Von Neumann succeeded Kármán as chairman of the Science Advisory Board in January 1955; he also led the Strategic Missiles Evaluation Group, also known as the “Teapot Committee,” that included Hans Bethe, George Kistiakowsky, Edward Teller, and Jerome B. Wiesner, the Radiation Laboratory and Los Alamos veteran who now directed MIT’s Research Laboratory for Electronics. The Teapot Committee advised Air Force Secretary Harold E. Talbott, in whose office Trevor Gardner, another of Kármán’s colleagues, served as Assistant Secretary for Research and Development. Talbott, Gardner, and Twining supported Brigadier General (later Major General) Schriever as Assistant Chief of the Air Research and Development Command and head of the Western Development Center, the Ballistic Missile Division from 1957. Schriever proved to be, like Generals Leslie Groves and Curtis LeMay (who earned his fourth star in 1951), a talented manager of a systems program that grew to have more funds and personnel than the Manhattan or B-29 projects.

In February 1955, the NSC and Eisenhower received a requested report from the Technological Capabilities Panel (TCP) of the ODM, formed in April 1954 and chaired by James Killian, Jr. Noting the Soviet Union’s own improving,

but still medium-range, piston- and jet-engined bombers, ICBMs, and IRBMs, the TCP members warned in their report that their use in a surprise attack might, as Eisenhower believed, inflict a thermonuclear Pearl Harbor. TCP members recommended giving the highest priority to producing and deploying the U.S. ICBMs and future versions underground, developing land- and sea-based and solid-fuel IRBMs, dispersing SAC's forces, developing a high-altitude reconnaissance aircraft, completing the Distant Early Warning (DEW) radar line across Canada to gain better intelligence, planning to fight limited wars as alternatives to a nuclear Armageddon, developing antiballistic missiles, putting reconnaissance satellites into orbit, and strengthening support for basic-science programs and their application.

To provide early warning of intruding aircraft, the United States built and linked, during 1949–55, computer systems, radar sites, aircraft, and surface-to-air missiles in a Semi-Automatic Ground Environment (SAGE) Defense System. Three radar lines were finished during the same interval—the DEW Line, which extended 3,000 miles along the 69th parallel from Alaska's Barter Island to Thule in Greenland; the Pinetree Line, which was 1,000 miles south of the DEW Line; and, between them, the Mid-Canada Line. Detecting incoming aircraft and alerting SAGE, the Air Defense Command, and SAC would give LeMay the minimum 15-minute warning required to get his standby bombers aloft. Planning, with USGS input on site selection, started toward constructing stations in Alaska and at Thule to detect Soviet ballistic missiles inbound over the north-polar region.

During the early 1950s, the U.S. Army began deploying its own missiles to intercept hostile aircraft, strike targets on battlefields, and deliver warheads to short- and medium-range strategic sites. Bell, Western Electric, and Douglas combined efforts to produce the Nike-Ajax, a two-stage solid- and liquid-fueled missile with three proximity-fused warheads and a range of 30 miles, which entered service in 1952. Work continued on the Nike-Hercules, a nuclear-capable, all-solid-fueled successor, planned to intercept groups of aircraft at altitudes of up to 70,000 (later 100,000) feet and ranges of some 50 (later 90) miles. The Army transferred Wernher von Braun's team from Fort Bliss, Texas, to its Redstone Arsenal at Huntsville, Alabama, and shifted its launch facility for surface-to-surface missiles from White Sands, New Mexico, to Cape Canaveral in Florida. At Huntsville, von Braun, supervised by Army Ordnance Colonel John B. Medaris, led the Guided Missile Development Division's effort to design a nuclear-armed successor to the V-2 and reduce its range to 250 (later 175) miles to increase its payload. Chrysler's Redstone, also powered by a liquid-fueled engine and carrying a separable 4-megaton thermonuclear warhead crafted for smoother reentry, was finally launched successfully in August 1953. Regular production began in 1955, as the Soviets tested their own megaton thermonuclear device. Medaris, now a Major General, took over the renamed Army Ballistic Missile Agency, von Braun became a naturalized U.S. citizen, and he and his team continued work on the Jupiter, a successor missile with a range up to 1,850 miles, to give the Army its own IRBM. NSC 5520, like the Killian report, contained recommendations for developing and placing U.S. satellites in space.

The U.S. Navy also developed a series of cruise and ballistic missiles as it acquired an atomic-powered submarine and planned for similarly powered surface warships, installed its own underwater detection system, placed surface-to-air missiles on a cruiser and a destroyer, planned for aircraft carriers larger than the *Forrestal* class, armed carrier aircraft with air-to-air and air-to-surface missiles, and built wholly new classes of combat and support vessels. On September 30, 1954, the Navy commissioned the initial nuclear-powered submarine, the USS *Nautilus*. In response to a 1950 report of a committee (chaired by Rear Admiral Francis S. Low) that identified the Soviet Union's submarines as the greatest threat to U.S. security, the Navy began deploying its Sound Surveillance System, a network of hydrophone arrays connected to cables in the Atlantic, Caribbean, and Pacific.

The Navy also began building amphibious-assault ships, each designed to embark one marine battalion and its equipment. Beginning in 1954, some Navy submarines sailed on patrol armed with the Regulus I, a liquid-fueled, turbojet-powered, nuclear-armed, and subsonic cruise missile that could be launched, but only when the boat surfaced, on targets initially up to 500 miles distant. The Navy established late in 1955 a Special Projects Office to develop a longer range and solid-fueled IRBM that could be fired from submerged submarines. Lockheed developed the Polaris IRBM to replace the Regulus and perhaps also the Navy's liquid-fueled and surface-launched Viking. On May 24, 1954, the latest version of the Viking research rocket lofted 825 pounds of camera and meteorological equipment to an altitude of nearly 160 miles. The Naval Research Laboratory and Martin hoped to use the Atlas guidance system to enable Viking to reach higher speeds and heights and also longer ranges. Eleven days later, Navy Secretary Charles S. Thomas set 1965 as the limit for developing Polaris.

Senator McCarthy began a national tour in February 1954 to expose what he termed two decades of treason by members of the Federal Government. George Kennan, speaking at Notre Dame, responded by decrying the anti-Communist hysteria. Superpatriotism, Kennan claimed, led toward totalitarianism. Eisenhower worked mostly behind the scenes to oppose McCarthy, especially after the Senator suggested that the President sheltered real or potential subversives. Eisenhower, his own authority now directly challenged, ordered Defense Secretary Wilson to withhold from McCarthy's Permanent Subcommittee on Investigations (of the Committee on Government Operations) information about and testimony by executive branch staff and advisers. For Eisenhower and Attorney General Brownell, the Constitution's separation of powers validated the assertions of executive privilege invoked initially by George Washington in 1796. McCarthy's hunt for Red witches and warlocks, real and imagined, culminated in the Army-McCarthy hearings held by McCarthy's subcommittee and televised, at Eisenhower's request, beginning late in April 1954. McCarthy failed to substantiate his charges of subversives in the Army and elsewhere in the Federal Government. On June 9, before a television audience later estimated at 20 million persons, McCarthy broke a verbal agreement between his staff and Joseph N. Welch, the Army's special counsel, not to slander further a former employee of Welch's law firm. Welch, calling McCarthy cruel and reckless, asked the Senator if he had any sense of decency. Representatives of the press rushed from the chamber to report Welch's puncturing of McCarthy's image and tactics.¹⁶⁶

Ten days later, Julius and Ethel Rosenberg, convicted and sentenced to death in 1951 as nuclear-weapon spies for the Soviet Union, were executed after Eisenhower refused to commute the sentences to imprisonment.¹⁶⁷ Some thought the Rosenbergs innocent, but one of their three codefendants, convicted and sentenced to 14 to 30 years' imprisonment, and their Soviet spymaster later confirmed the guilt of Julius Rosenberg and Klaus Fuchs. Meanwhile, the Eisenhower administration and Congress continued to test citizens' loyalties. On June 1, the AEC's investigating panel, against the advice of many leading scientists, withdrew the security clearance of Robert Oppenheimer, now Director of Princeton's Institute for Advanced Study, and ended his work as an AEC consultant. Eisenhower himself initiated the investigation when he learned that information received from Teller and others indicated that Oppenheimer was not disloyal although he still might be a security risk. In hearings held that spring, Oppenheimer stood accused of lacking enthusiasm, as did others, unlike Teller and his coworkers, for the hydrogen bomb. The anti-Communist hysteria continued in the United States after McCarthy's fall. On August 24, the Communist Control Act¹⁶⁸ outlawed the Communist Party and further restricted the civil rights of Communists in the United States. The Civil Service Commission reported on October 11 that more than 2,600 persons accused

as security risks had been dismissed from Federal jobs and another 4,300 individuals had resigned before their cases were completely evaluated. The Senate examined McCarthy's actions during 1954 and then voted overwhelmingly to censure him for unbecoming conduct contrary to Senate traditions.

Meanwhile, the United States held its regular midterm elections. As before, events and problems abroad and at home influenced the outcome of the November 1954 balloting for the 84th U.S. Congress. The economic recession and higher unemployment that began in 1953 embarrassed the Eisenhower administration and alienated many voters. These factors were augmented by civil rights, or the lack of them, gaps between government and private wages, and alleged corruption in the Eisenhower administration. The Democrats regained control of both houses, gaining a 29-seat majority in the House but only a single-seat edge in the Senate.¹⁶⁹ In July 1953, Eisenhower offered the post of U.S. Solicitor General to Earl Warren, who accepted but did not serve. After Chief Justice Fred Vinson died on September 8, Eisenhower nominated Warren as Vinson's replacement, and the Senate confirmed Warren on March 1, 1954. Less than 3 months later, the Warren Court, in *Brown v. Board of Education*,¹⁷⁰ of Topeka, Kansas, unanimously reversed the 1896 doctrine of separate-but-equal facilities in public education as an abridgment of equal protection under the law. Eisenhower did not endorse the decision, but he agreed to obey in carrying out his constitutional responsibilities. In 1955, after the Court ordered nondiscriminatory admission, to be achieved with all deliberate speed, Southern States pledged and acted to maintain their segregation of the races. The National Association for the Advancement of Colored People (NAACP) responded in part by organizing its own boycotts, including opposition to segregated bus service in Montgomery, Alabama, led successfully by the Rev. Martin Luther King, Jr., and others, and supported by the Justices, but opposed, often hatefully and sometimes violently, by some lesser officials and ordinary citizens.

To respond to salary inequities among Federal employees, the 83d Congress and President Eisenhower agreed on September 1, 1954, to amend further the Classification Act of 1949,¹⁷¹ to ensure that no positions would be placed in or removed from General Schedule (GS) 16 or 17 unless approved by the Civil Service Commission (CSC) or placed in GS-18 unless agreed by the CSC and the President. The new law limited the GS-16 positions to 400, the GS-17s to 115, and the GS-18s to 35. The statute changed the Federal Employees Pay Act of 1945, as amended, to provide compensation for overtime work, call-back overtime, time-in-travel status, and night and holiday work. The law also established work schedules, the basic workweek, criteria for incentive and other awards and promotions, uniform allowances, and a 30-day limit on unused annual leave for which employees would be paid at severance. Additional legislation enacted on August 14, 1957, added five additional supergrade positions—two GS-18s, one GS-17, and two GS-16s—to the Federal rolls. The USGS later gained authority for advancing some of its most productive scientists to the Scientific and Professional 3104 (later ST-3104) positions that were GS-16 equivalents. Nonetheless, the USGS and the rest of the Federal Government lost to industry and academia increasing numbers of its employees in the early 1950s as the pay gap increased, especially after 1953, between the Federal and private sectors. On June 28, 1955, the Federal Employees Salary Increase Act¹⁷² adjusted upward the yearly compensation in the steps of the GS pay scale and those for the corresponding Custodial Services (CS) scale. Under the new schedule, GS-1s started at \$2,690 per year and GS-18s earned a single salary of \$14,800. Another statute, enacted 2 days later, provided funds for the pay raises and \$200 million for mutual-security programs during fiscal year 1954-55. The Critical Skills Reserve Act of 1955 also helped the USGS and the rest of the Federal Government to retain trained personnel.

The nature of the Dixon-Yates (Southern Company) negotiations also received renewed attention during and after the 1954 congressional campaign.

In the new 84th Congress, hearings by the Joint Committee on Atomic Energy disclosed in February 1955 that Adolph H. Wenzell, a consultant to the Bureau of the Budget, participated in these negotiations while he was vice president of the First Burton Corporation, Dixon-Yates' financial agent. A report by the staff of the Subcommittee on Antitrust and Monopoly, of the Senate's Committee on the Judiciary, summarized the embarrassing Dixon-Yates affair. After the City of Memphis voted to build its own steam-generating plant, President Eisenhower canceled the Federal contract with the two private-power companies on July 11.

Six months earlier, on January 6, 1955, Eisenhower's report on the State of the Union reflected the new domestic political reality: the Democrats controlled the 84th Congress. "We shall have much to do together," the President promised the legislators, hoping that "we shall do it in harmony and good will." If not, perhaps the majorities would not be large enough to override vetoes. Eisenhower reminded Congress that he still held the Federal Government to have three main purposes. "First," the President asserted, we must "maintain justice and freedom among ourselves" and "champion them for others so that we may work effectively for enduring peace." "Second," he continued, we need "to help keep our economy vigorous and expanding, thus sustaining our international strength and assuring better jobs, better living, [and] better opportunities for every citizen." "Third," the President concluded, we have "to concern ourselves with the human problems of our people so that every American may have the opportunity to lead a healthy, productive and rewarding life."¹⁷³ Other messages that expanded domestic- and foreign-policy initiatives followed quickly. On January 6, Eisenhower sent to the Senate the mutual-defense treaty between the United States and the Republic of China. His special message of the 11th¹⁷⁴ proposed significant changes in Federal personnel management that not only included pay-scale adjustments but also voluntary group health insurance, adequate and comprehensive training, improved personnel practices overseas, and an increase in travel per diem. The national-security message of January 13¹⁷⁵ sought an extension of the draft for 2 years of active duty in the Army, plus several years in some Reserve capacity, but it also offered as an alternative 6 months of active-duty-for-training, followed by 7.5 years in the Ready Reserve. On the 17th, Eisenhower requested authority for \$58.6 billion for fiscal year 1955–56, less than the estimated expenditures of \$62.4 billion and receipts of more than \$60 million, a \$1 billion increase, to aid the administration's continued efforts to balance the budget. Of that total, \$40.5 billion, or 65 percent, would support national defense. About \$952 million would go to natural resources, \$180 million less than in fiscal 1954–55, including \$673 million for developing land and water resources. During the year, the President expected U.S. stockpiles of strategic materials to reach 78 percent of completion.¹⁷⁶

On January 31, Secretary McKay appeared before the House subcommittee on Interior's appropriations, again chaired by Representative Michael Kirwan, to defend the Department's budget request for fiscal year 1955–56. William Norrell continued to serve on the subcommittee, as did Republicans Ben Jensen, who reverted to his earlier role as the subcommittee's ranking minority member, and Ivor Fenton. McKay reported receiving bids of \$144 million for drilling rights on the Federal submerged lands and he expected subsequent oil and gas production from new offshore wells eventually to generate \$6 billion in royalties, bonuses, and rents. Interior, he estimated, would be able to transfer to the Treasury \$57 million in royalties from the \$570 million in oil and gas production from the public lands during 1955–56. As the ODM delegated to the Department of the Interior (DoI) the responsibility "for detailed mobilization planning for the production of minerals and metals,"¹⁷⁷ McKay asked for \$300,000 for his new OMM and its core staff to evaluate and coordinate resource data received from the USBM and the USGS. McKay and the BoB asked for nearly \$424.5 million, a gain of \$17.1

million, for the new fiscal year, a sum more than balanced by expected revenues of \$428 million, for the DoI's nearly 43,300 employees. "There is no department in America," McKay emphasized, "more important than the one * * * responsible for the natural resources."¹⁷⁸ Interior's budget contained for the USGS \$26,285,000, or \$1,050,000 less than the sum sought for 1954–55, to support a staff expected to be required to shed 27 of its 5,432 full-time or full-time-equivalent employees, while Interior's total increased by 42. Among the unexpected departees was USGS geologist Robert Garrels, who left for Harvard in 1955.

Kirwan responded by outlining a return to a former policy for conducting the subcommittee's hearings that reflected significant changes in approach and length. He expected complete cooperation from Interior's staff, earlier and more organized submission of estimates and justifications, direct answers to questions, and a limited number of witnesses to facilitate briefer testimony that would require less comment. The Chairman, "never strong for supplementals," promised "to make every effort" to see that the Secretary received "every dime for which you make a request."¹⁷⁹ Kirwan, whose fiscal philosophy was well known by now, supported larger expenditures for the Nation's principal needs. "Again I tell you," he replied, "as I have told the Congress before, there is not anywhere near the money spent on America that there should be. We see today that there are great efforts being made to spend \$100 billion on the roads and highways. Well, it is needed, but needed far more than \$100 billion for roads is \$50 billion for water."¹⁸⁰ Jensen said that he agreed 100 percent.

Kirwan's subcommittee began hearing Assistant Secretary Wormser and the USGS delegation on February 1. Assistant Director Nolan substituted for the ailing Wrather. After reading Wrather's statement into the record, Nolan repeated the Director's view "that the demand for our products seems to be continually increasing."¹⁸¹ USGS managers faced an increased workload generated by many Federal sources. The President's Cabinet Committee on Minerals Policy recommended an enlarged program of topographic and geologic mapping. Water-resources and energy-resources groups and the Watershed Protection and Flood Prevention Act required additional water-resources information and basic mapping. The President's proposed interstate highway program and other public works needed topographic mapping, engineering geology, and streamflow data. The AEC continued to request information about domestic uranium deposits. Other work resulted from the growing interest in the mineral and energy resources of the public lands, especially those on the Outer Continental Shelf. Nolan expected USGS investigations to produce a better theoretical understanding of groundwater that would facilitate predictions of its movement, contribute to improving and increasing recharge, and determine how best to use any surplus. The new highways, Kirwan noted, would change runoff patterns; as less water would flow into the ground, some kind of action was needed. Kirwan suggested that the USGS "should ask for \$50 million,"¹⁸² to study U.S. lands and resources before the next civilian or military crisis occurred.

Before the House subcommittee reviewed the monetary requests by each USGS Division, Nolan concentrated on the agency's regional activity, increasing their operational development as recommended by the Van Pelt Committee in 1954. The Denver Center neared full operation and early work continued at Menlo Park, where, in 1955, the USGS gained title to 7 of the 83 Federal acres adjacent to the 4.5-acre site of Buildings 1 and 2. Efforts toward expansion started in Rolla, and planning progressed for the new building needed for the national center. Nolan requested another \$350,000 for detailed planning for the latter project, but he cautioned that the site and building costs were not represented in that amount. Only a day earlier, the General Services Administration's Public Buildings Service informed the USGS that the new national center was one of four buildings on the list for the Washington metropolitan area sent to the Bureau of the Budget. The GSAd would handle, through the recently enacted lease-purchase legislation, the costs of

the new national center. Nolan thought the four centers would increase operational efficiency, enabling the USGS to serve better the Nation. During the April 1955 show, the Pick and Hammer players asked, in their “Constructional,” sung to that year’s “Where will the Dimple Be?,” about the new national center: would it be nearby and “[w]ill they build it fore we die?” They decided that “it’ll be an awful blow / If it’s run by the G.S.A[d].”²¹⁸³

Amidst continued requests by members of the subcommittee for increased economy in USGS operations, Kirwan emphasized that the “saving of dollars is not the saving. The saving that you are going to provide, in the way of discovery of minerals, [is] because the real wealth is mineral wealth, whatever it is, when it is discovered.”²¹⁸⁴ Kirwan, following a philosophy he applied Governmentwide, also hoped that the USGS would match dollar-for-dollar the sums offered by the States for cooperative work in topography and water resources. Jensen renewed his interest in the agency’s topographic-mapping program by asking about progress of national coverage and the cost and possible duplication of aerial mapping by Federal agencies. Jensen claimed he was “not critical,” and, like the subcommittee’s other members, continued to hold the USGS “in high regard.” Jensen, as before, emphasized pursuing the consolidation of “most, if not all, of the mapping offices under one agency.”²¹⁸⁵

The Senate subcommittee on Interior’s budget, meeting with the public-works subcommittee, heard McKay on February 28, 1955. Carl Hayden, again the Chairman, joined three returning Democrats—Dennis Chavez, Harley Kilgore, and Warren Magnuson—and new colleagues Earle C. Clements (KY) and Spessard L. Holland (FL), both of whom had been Governors of their States. Henry Dworshak, William Knowland, and Milton Young continued as Republican members of the subcommittee. McKay, in supporting his bureaus, emphasized that of the additional \$399,000 requested for the USGS (the difference between the 1955–56 budget and the adjusted appropriation for 1954–55), one-half represented “a modest increase in water resources investigations.”²¹⁸⁶

Wormser and Nolan appeared before the Senate subcommittee on March 4; Wrathier remained indisposed. Chairman Hayden, in questioning three relative transfers totaling \$184,780 in Federal funds to and from the USGS during fiscal year 1954–55, wanted to know which agency actually got the appropriations. The USGS, Nolan responded, received \$167,970 of the total provided. Hayden renewed his preference for transfers over permanent changes. He then asked about the \$46.6 million projected to be appropriated for or transferred by other agencies to the USGS in 1955–56, a loss of nearly \$1.1 million from 1954–55. Nolan ascribed nearly all of the decrease to monetary reductions expected from the AEC’s support for USGS geologic and mineral-resource surveys and mapping, principally due to the huge growth in private exploration for uranium on the Colorado Plateau. By 1955, some 800 mines were producing high-grade ore from 12 principal deposits, and new rushes were underway in areas beyond the Plateau. Yes, Hayden agreed, “some people fear we will have uranium running out of our ears here before long.”²¹⁸⁷ The \$6.2 million the USGS planned to receive from the AEC during 1955–56, Nolan hoped, would be used to continue long-term research on the localization of uranium ores, prepare for future increases in demand, and improve geochemical and other methods of prospecting. The completion of the Kentucky project accounted for all but \$40,000 of the projected loss of \$235,000 in State funds for cooperative topographic mapping. The USGS asked for an additional \$200,000 to meet the increased sum offered by the States for cooperative investigations of water resources. Duncan estimated that oil wells on public and Indian lands would produce petroleum worth close to \$400 million, including \$50 million in royalties. Without an expenditure of \$2 million to \$3 million, Duncan estimated, USGS monitors could no longer visit each oil and gas field, but Hayden approved the effectiveness of the overall methods by which the USGS closely verified records on

well production and pipeline runs. Duncan added that the \$1.3 million, the same sum as the previous year, the USGS required for supervising the mining and oil and gas leases alone ought to return more than \$40 million to the Treasury. Nolan, after meeting on March 2 with Donald E. Doyle, Chief of the Public Buildings Service's Projects and Sites Branch, reported less concern about facilities dispersal and confirmed that the proposed national center building for the USGS was "very high on the list of the ones that they are considering"¹⁸⁸ sending to the BoB. The GSAd and the DoI would have to agree on the building's exact location, but Nolan hoped it would be about 10–15 miles from Washington to avoid the congested area, keep the needed close contacts with other Federal agencies in the Capital, and avoid losing employees unwilling to commute to a more distant site. Hayden agreed that it "has to be a suitable location and nearby."¹⁸⁹

The House-Senate conference committee agreed to provide the USGS with \$26,635,000 in SIR appropriations for fiscal year 1955–56. Eisenhower signed Interior's appropriations bill for the year on June 16, 1955.¹⁹⁰ With the \$1.65 million in supplemental SIR funds added on May 19, 1956,¹⁹¹ the USGS reported total funds available to support its staff and operations during 1955–56 of about \$49,269,000, some \$2,410,000, or 5 percent, more than in 1954–55. Of the total funds available for 1955–56, nearly \$27,859,000, or 57 percent, represented SIR monies; some \$6,425,000, or 13 percent, came via reimbursement or direct payments from nonfederal sources, and \$14,985,000, or 30 percent, came by transfers from other Federal agencies. For a second year, the U.S. Comptroller General continued to be concerned about the effectiveness of the agency's overall accounting methods, and the General Accounting Office's Civil Accounting and Auditing Division began an audit and review of USGS financial administration during fiscal 1954–55.

The second Hoover Commission issued its seven-volume final report just before the beginning of fiscal year 1955–56. The Commission's task forces suggested that properly disposing of surplus Federal property would return some \$10 billion to the Treasury. The Commissioners noted that the problems it faced were "by no means purely financial." In making its recommendations for improving the Federal Government, the Commissioners sought to reach six principal objectives: (1) preserving "the full security of the Nation in a disturbed world," (2) maintaining "the functioning of all necessary agencies which make for the common welfare," (3) stimulating "the fundamental research upon which national security and progress are based," (4) improving efficiency and eliminating "waste in the executive agencies," (5) eliminating or reducing "Government competition with private enterprise," and (6), "perhaps the most important of all, strengthening the economic, social, and governmental structure which has brought us, now for 166 years, constant blessings and progress."¹⁹² In supporting increased funding for military and civilian research and development to achieve the third objective, the Commissioners noted that support for the latter,

so important to our national life,¹⁹³

grew from \$68 million in 1946 to the \$350 million requested for fiscal 1955–56.