



Facing the Great Disaster

How the Men and Women of the U.S. Geological Survey
Responded to the 1906 "San Francisco Earthquake"

General Information Product 31

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By Elizabeth M. Colvard and James Rogers

When the powerful April 18, 1906, earthquake struck northern California, staff of the U.S. Geological Survey stationed in Sacramento and Berkeley swung into action, bringing help to the residents of devastated San Francisco, documenting the effects of the quake, and investigating the causes of that major geologic event.



Downtown San Francisco (the corner of Taylor and Market Streets) at about 3:00 a.m. on April 19, 1906. Fires rage out of control in the ruins from the previous day's magnitude 7.8 earthquake. (Photograph by USGS topographer C.L. Nelson.)

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FRONT COVER

San Francisco, California, the day after the catastrophic earthquake of April 18, 1906. This photograph by U.S. Geological Survey topographer C.L. Nelson shows the view from Nob Hill down Jones Street at 10:00 a.m. on April 19. Dense smoke billows from the burning center of the stricken city.

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A ferry boat carries refugees fleeing the burning city of San Francisco after the catastrophic earthquake of April 18, 1906. (This photograph, from the George R. Davis family collection, was probably taken by USGS topographer C.L. Nelson on April 19.)



San Francisco the day after the 1906 earthquake. This photograph, taken by U.S. Geological Survey topographer C.L. Nelson, shows the view to the northeast from City Hall at 1:00 p.m. on April 19. Smoke from the spreading fires billows over the rubble of buildings destroyed by the quake.

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By Elizabeth M. Colvard¹ and James Rogers²

Introduction

It was the most devastating earthquake in California’s history. At 5:12 a.m. on April 18, 1906, the ground under the San Francisco Bay Area shook violently for more than 40 seconds. The magnitude 7.8 earthquake created a rupture along nearly 300 miles of the San Andreas Fault and was felt from southern Oregon to Los Angeles. Because the earthquake’s epicenter was just offshore from San Francisco, the impact on that city was catastrophic. Fragments of broken houses and buildings tumbled into the streets. The pipeline carrying water into the city was severed; fires triggered by broken gas mains raged out of control for 3 days. An area of almost 5 square miles in the heart of the city was destroyed by shaking and fire, and earthquake damage was widespread elsewhere. At least 3,000 people were killed, and 225,000 were left homeless. Drinking water, food, and supplies quickly became scarce.

In 1906, the only permanent U.S. Geological Survey (USGS) office in California was the Pacific Division topographic mapping office in Sacramento, 70 miles up the Sacramento River from San Francisco Bay. The office had been established just 3 years earlier and was the only USGS office ever created for the sole function of topographic mapping. At the time of the earthquake, many USGS topographers were in Sacramento preparing for a summer of field work.

Although moderate shaking was felt in Sacramento, then a town of about 30,000 people, detailed information about the earthquake was slow to reach the residents there. USGS topographic engineer George R. Davis, not knowing the full extent of the damage, was fearful that his 62-year-old father Edward Davis in San Francisco was caught up in the devastation. George therefore left Sacramento on the first train bound for the San Francisco Bay area. “He was very worried. The phones were down and he wasn’t sure whether or not the hotel his father was living in was damaged,” said George Davis’s daughter Anna (Davis) Rogers, then an octo-

genarian, in a 2005 interview. Recalling the stories she heard of these events while growing up, Anna added, “Fortunately [the hotel] hadn’t fallen down.”

George Davis, a tall man with a quiet demeanor and a dry wit, was accompanied to San Francisco by fellow USGS topographer Clarence L. Nelson. Both were 29 years old and in excellent physical condition after a year spent mapping the Mount Whitney quadrangle, which includes some of the most rugged terrain in the conterminous United States.

On their arrival in San Francisco, the pair was fortunate to find the elder Davis unharmed at the hotel where he had been living. Nelson—handsome, athletic, and artistic—had brought his camera in order to get photographs while things were still “hot” and began taking what were to become a memorable set of images. The three men wandered through San Francisco all night and through the following morning, moving from one dramatic scene to the next. Nelson captured the horse-mounted “dynamite squad,” soldiers marching on Van Ness Avenue, and a rare scene of two horse-drawn fire engines with one engine drawing water from a cistern on Union Street. One ironic photograph shows refugees making their way through rubble-filled streets in the direction of a wrecked City Hall. Flames from the burning heart of the city shone brightly against the darkness, and Nelson captured the surreal glow in several of his photographs, including one of Union Square with the Breuners building burning in the background.

USGS Topographers Swing Into Action

While Nelson and the two Davises were witnessing events in San Francisco, USGS personnel back in Sacramento were beginning to assist the larger community in organizing relief efforts. Because of its proximity to the Bay Area, Sacramento—the State Capital—figured prominently in early relief efforts. At a mass meeting on the Sacramento Courthouse steps the morning of April 19th, citizens cheered when Sacramento’s ad hoc General Relief Committee declared that they would not wait to be asked to help and that a riverboat

¹U.S. Geological Survey, Menlo Park, California.

²Sacramento, California; grandson of USGS topographer George Davis and USGS stenographer Adelena Fontaine.

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had already been secured to transport supplies to San Francisco at the earliest opportunity.

As authorized in a telegram from USGS Director Charles D. Walcott, Robert B. Marshall, the geographer in charge of the USGS Pacific Division topographic mapping office, announced to the General Relief Committee that the USGS stood ready to send a complete outfit of camp property, horses, wagons, and men sufficient to take care of 500 people and that he could be ready to leave that day. The offer was gratefully accepted, and Marshall was assigned to take charge of

purchasing additional supplies using the more than \$50,000 in donations collected that day from the citizens of Sacramento.

USGS stenographer Adelena Marie Fontaine described the events of April 19th in a letter to USGS historian Richard T. Evans dated September 18, 1946: "Men in the Sacramento office...hurried to the warehouses and packed blankets, tents, cooking stoves and utensils, folding tables, chairs, axes, picks, shovels and much other equipment. [They] loaded the big camp wagons, buckboards, and hitched teams to water tank wagons and brought them all to the wharf in Sacramento."

In addition to these supplies, Marshall bought large quantities of canned goods, milk, baby food, soup, and other prepared food. At his request, a factory ran all night producing crackers and cookies. According to Fontaine's letter, Marshall and the other USGS topographers soon had an old stern-wheeler, the *San Joaquin*, "loaded to the water's edge with relief supplies."

At some point during the night of the 19th, the *San Joaquin* began its trip down the Sacramento River toward San Francisco. Aboard were Marshall, topographers A. Benson Searle, Sidney Stoner, and Albert H. Sylvester, and field assistant Jake W. Muller. George Davis and Clarence Nelson

Staff of the U.S. Geological Survey Pacific Division topographic mapping office in Sacramento shown at work about 1904-1905. Left to right: Geographer in charge Robert B. Marshall (back to camera), topographer A.I. Oliver, topographer Albert H. Sylvester, topographer Sidney N. Stoner, topographer George R. Davis, and topographer A.B. Searle. Marshall, Sylvester, Stoner, Davis, and Searle were all part of the USGS group that took the first boatload of relief supplies down the Sacramento River to San Francisco following the 1906 earthquake. (Photograph from the George R. Davis family collection.)





Devastation in San Francisco in the wake of the magnitude 7.8 earthquake that struck at 5:12 a.m. on April 18, 1906. Top, view down Geary Street, showing the ruined downtown of the city. Bottom, fires in the downtown area raging out of control by late evening on April 18. (Photographs by USGS topographer C.L. Nelson.)



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Fighting the disaster in San Francisco, April 19, 1906. Top, troops from the Presidio of Monterey march down Van Ness Avenue after arriving in the city. Bottom, one fire engine draws water from a cistern, while another retreats from the spreading fires to make a stand at a new position. (Photographs by USGS topographer C.L. Nelson.)



were also on board; they had returned to Sacramento by train after relocating the elder Davis in a hotel in Oakland. When the pair learned that the *San Joaquin* was about to depart with their USGS colleagues, they decided to embark as well—their second trip to the beleaguered city in 48 hours. The boat was accompanied by a barge under the direction of Almerin Sprague, the father of Sidney Stoner’s fiancée, Marjorie Sprague. The barge carried wagons, horses, and water barrels (Sacramento Bee, 1906).

At 8:00 a.m. on the morning of April 20th, the *San Joaquin* with its load of relief supplies and USGS topographers

landed at the Presidio of San Francisco. Fontaine’s 1946 letter states that it was greeted with cheers. The military officer who met the boat immediately asked about baby food and milk and was overjoyed by Marshall’s reply of “a carload.” Volunteer stevedores, soldiers, and citizens assisted the USGS men in unloading the shipment. The topographers offered to remain in San Francisco to set up camps and teach people how to cook in the street, but the army was firmly in control and declined their services.

By this time on the morning of April 20th, uncontrolled fires and continuous dynamiting (done in an attempt to create firebreaks) had filled the air of San Francisco with heat, smoke, and dust, making it unpleasant to breathe. George Davis and Clarence Nelson attempted to renew their exploration of the ravaged city before the *San Joaquin*’s return trip but were unable to bear the conditions for long. At one point, they were forced to quench their thirst by drinking the liquid from cans of tomatoes they found in an abandoned grocery store.

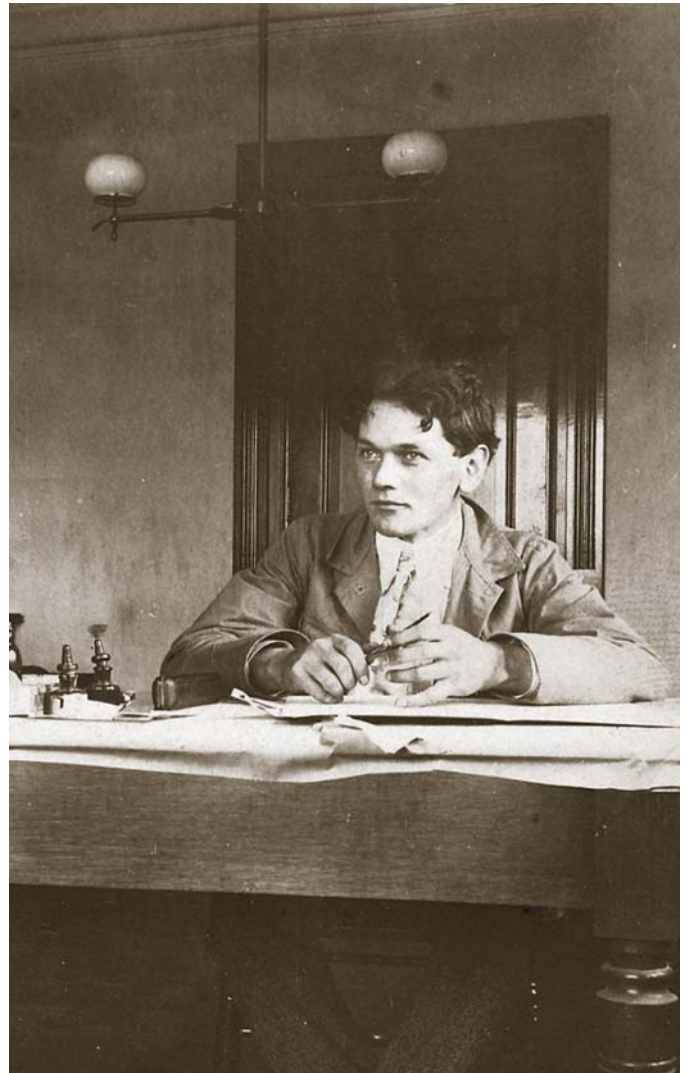


San Francisco scenes on April 19, 1906, taken by USGS topographer C.L. Nelson. Left, broken pavement and bent streetcar tracks on Mission Street near Seventh. The man on the left is USGS topographer George Davis; the other man is probably his father, Edward J. Davis. Below, residents fleeing the spreading fires, dragging trunks along Van Ness Avenue.



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U.S. Geological Survey employees from the Pacific Division topographic mapping office in Sacramento who responded to the 1906 earthquake disaster. Upper left, Robert B. Marshall, geographer in charge. Upper right, topographer George R. Davis. Lower left, Adelena M. Fontaine, stenographer (and later Mrs. George Davis). Lower right, topographer (and accomplished photographer) Clarence L. Nelson. (Photographs from the George R. Davis family collection.)



Staffers Worked Overtime Aiding Refugees

Back in Sacramento, the women of the USGS family were hard at work. Stenographer Adelena Fontaine, Marjorie Sprague, and the wives of Robert Marshall and Albert H. Sylvester volunteered to assist the Sacramento Women's Council in processing thousands of refugees who soon arrived from San Francisco. "I worked on [the] general Relief Committee several nights, meeting trains crowded to the doors with refugees," wrote Fontaine. "We fed them, clothed them, took them to friends if they had any, and those who were destitute we assigned to the homes in the city whose doors had kindly been opened to welcome the unfortunates" (Fontaine, 1906).

Fontaine recounted the story of one refugee, a young man of about 20, whose brother was mistaken for a looter and shot to death. "[He was] endeavoring to extricate his brother and their belongings from the hotel where they had lived, [and] saw his brother shot down before his eyes by a soldier. The soldier had made a mistake, and the boy was not stealing. This young refugee was a telegraph operator and volunteered his services [until] the building was abandoned; [he then] fled before the flames," wrote Fontaine, "He was in a dreadful state from exhaustion, hunger and exposure" (Fontaine, 1906).

Mapping the Fault

The topographers in Sacramento were not the only USGS employees working in the vicinity of San Francisco. By great coincidence, the eminent USGS geologist Grove Karl (G.K.) Gilbert had been in Berkeley (7 miles across the bay from San Francisco) since 1905 studying sedimentation and the effect of hydraulic gold-mining debris in the Sacramento River. A vigorous 63 years old in 1906, Gilbert was considered one of the top field and experimental geologists of his day. He was one of the first five principal geologists hired by the USGS when it was created in 1879 and served as its first Chief Geologist. His scientific reports are considered some of the best geologic papers ever written.

Gilbert wrote of his experiences on the morning of April 18th, "It is the natural and legitimate ambition of a properly constituted geologist to see a glacier, witness an eruption and feel an earthquake...When, therefore, I was awakened in Berkeley on the eighteenth of April last by a tumult of motions and noises, it was with unalloyed pleasure that I became aware that a vigorous earthquake was in progress... In my immediate vicinity the destructive effects were trivial, and I did not learn until two hours later that a great disaster had been wrought on the opposite side of the bay and that San Francisco was in flames" (Gilbert, 1907). As soon as regular ferry traffic to San Francisco was restored, Gilbert traveled across the bay to observe the fires and the results of the earthquake firsthand:

"The flames work with wonderful speed. While I lingered, whole squares were consumed. An hour is probably enough to raze a square of wooden houses" (quoted in Pyne, 1980).

Gilbert's assistant in Berkeley was 32-year-old François E. Matthes, a native of the Netherlands and a highly accomplished USGS topographer and geomorphologist. The USGS had sent Matthes to California in 1905 for the express purpose of mapping Yosemite Valley. Matthes had recently garnered praise for his topographic map of the upper half of the Grand Canyon, which is one of the finest plane-table maps ever produced by the USGS. While Matthes was between field seasons in Yosemite, Gilbert employed him to research scientific articles that were written in Dutch and French.

Matthes too was jolted awake on April 18th by the earthquake: "Woke up 5 a.m. by violent earthquake, lasting 28 seconds. Found on getting up San Francisco enveloped in flames. Severe quake 8:15 while eat[ing] breakfast ...Made tour of inspection of Berkeley; found brick chimneys demolished by the wholesale; many brick houses badly damaged. All day long dynamite blasts are heard from the city... Fire rages all night" (Matthes, 1906).

There was no lack of scientific interest in the earthquake; geologists and other scientists quickly flocked to the area. Local geologists gravitated around Andrew C. Lawson, chairman of the geology department at the University of California at Berkeley, and John C. Branner, professor of geology at Stanford University, both of whom also worked part-time for the USGS.

Three days after the earthquake, the governor of California appointed a California State Earthquake Investigation Commission, chaired by Lawson, to oversee and consolidate all of the scientific investigations. Gilbert was one of eight men assigned to the commission. Only Gilbert and one other had any experience with earthquake research. The commission ultimately brought together more than 21 scientists, architects, and engineers to study the earthquake and its effects. This included several members of Japan's Imperial Earthquake Investigating Committee, at that time a leading authority on earthquake research. The commission primarily focused on studying surface changes caused by the earthquake, earthquake intensity, earthquake arrival times, and the geophysics of the earthquake. Gilbert wrote several reports about the earthquake, and both he and Matthes took many photographs of the earthquake's effects.

The Earthquake Commission quickly appropriated the services of François Matthes by sending him into the field to examine the effects of the earthquake north of San Francisco. He later mapped the trace of the San Andreas Fault through the northern part of the State. His maps were included in an atlas published by the commission, and his field observations were incorporated into the commission's final report (Lawson and others, 1908).

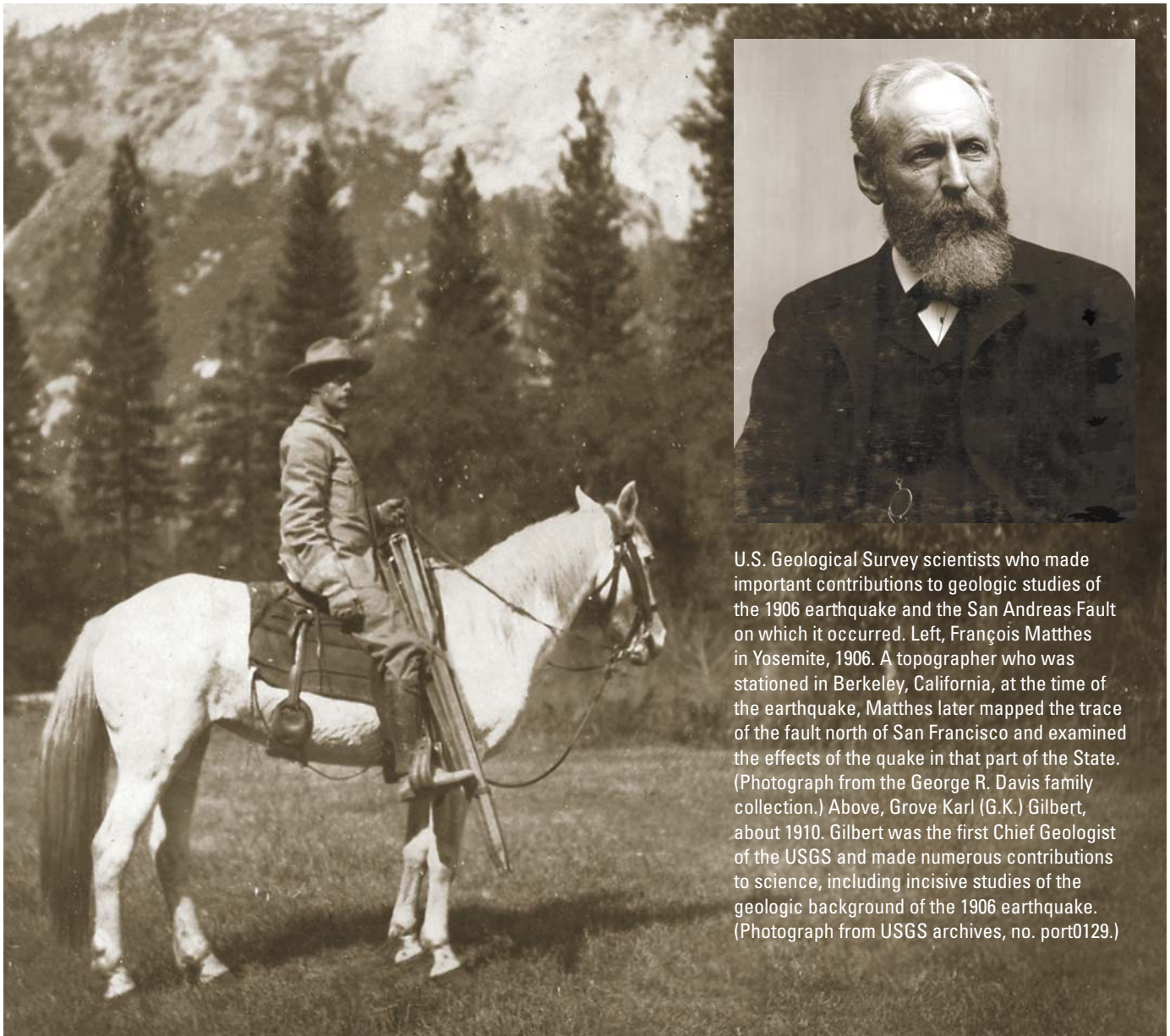
The USGS and the Army Corps of Engineers collaborated on a separate Federal investigation of the earthquake's effects on buildings and construction materials. Richard L. Humphrey from the structural materials division was the pri-

mary USGS representative on this team. He was dispatched to San Francisco the day after the earthquake. Gilbert contributed an overview of the earthquake to the team's report.

Aftermath

It is difficult to know what long-term impact the events of 1906 may have had on the USGS employees involved with it. Robert Marshall was made Chief Geographer of the entire USGS just 2 years later. Topographer George Davis eventually took over Marshall's position as geographer in charge of the Pacific Division topographic mapping office. Davis and stenographer Adelen Fontaine were married in 1916; their only child, Anna Davis Rogers, provided much of the mate-

rial for this article and their grandson, James Rogers, is one of the authors. Topographer Sidney Stoner and Marjorie Sprague were also married. Topographer Clarence Nelson continued his adventures with the USGS on mapping jobs in Argentina, Puerto Rico, Alaska, and other parts of the United States. Topographer Albert Sylvester transferred to the Forest Service in 1908 and became the highly influential Superintendent of Wenatchee National Forest in the Cascades; he is credited with officially naming more than 1,000 places and features in Washington State. Topographer François Matthes became a leader in the study of the geology and geomorphology of Yosemite National Park. Geologist G.K. Gilbert continued his interest in earthquake studies by serving as a member of the Scientific Committee of the Seismological Society of America, which was formed in the fall of 1906. They were all ordinary people who responded to a natural disaster in extraordinary ways.



U.S. Geological Survey scientists who made important contributions to geologic studies of the 1906 earthquake and the San Andreas Fault on which it occurred. Left, François Matthes in Yosemite, 1906. A topographer who was stationed in Berkeley, California, at the time of the earthquake, Matthes later mapped the trace of the fault north of San Francisco and examined the effects of the quake in that part of the State. (Photograph from the George R. Davis family collection.) Above, Grove Karl (G.K.) Gilbert, about 1910. Gilbert was the first Chief Geologist of the USGS and made numerous contributions to science, including incisive studies of the geologic background of the 1906 earthquake. (Photograph from USGS archives, no. port0129.)

Acknowledgments and Sources of Information

The personal records and photograph collections of the Rogers (Davis) family in Sacramento provided much of the material for this account. Before she passed away in March 2006, the memories of Anna (Davis) Rogers added details and a human dimension to the story of her parents' and others' actions. We are also grateful for assistance from librarians at the U.S. Geological Survey and the University of California in locating and making available relevant documents. In addition, the following publications and written documents were consulted and are cited in the text:

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U.S. Geological Survey topographer George R. Davis (standing) at work in the field about 1908. Davis worked in the Pacific Division topographic mapping office in Sacramento, California, from 1903 until 1922 and was geographer in charge of that office from 1917 to 1922. After the earthquake on April 18, 1906, Davis was one of the USGS people who rushed to respond and help the stricken city of San Francisco. (Photograph from the George R. Davis family collection.)





San Francisco residents living in the streets and facing an uncertain future after the April 18, 1906, earthquake. This view, taken by U.S. Geological Survey topographer C.L. Nelson at about 6:00 a.m. on April 19, is looking northeast from the U.S. Treasury Mint on Fifth Street between Mission and Jessie.



The U.S. Army "dynamite squad" in San Francisco after the catastrophic earthquake of April 18, 1906. The Army blew up entire blocks of buildings in an attempt to create firebreaks and thus contain the raging fires that were spreading through the city. This photograph, taken by U.S. Geological Survey topographer C.L. Nelson at 10:00 a.m. on April 19, shows Captain Le Vert Coleman and members of the dynamite squad on Van Ness Avenue.



Clarence L. Nelson (center) with fellow U.S. Geological Survey topographers in the field about 1905. The plane table he is using was an essential instrument for mapping at that time, and in rough country sometimes had to be set up in strange places, as here up in a tree. Nelson, who was also an accomplished photographer, traveled to San Francisco with his colleague George Davis immediately after the 1906 earthquake and took many excellent photographs of the stricken city, some of which are included in this pamphlet.



San Francisco, California, ravaged by earthquake and fire in 1906. This photograph, taken by USGS topographer C.L. Nelson at 5:00 a.m. on April 19, the day after the earthquake, shows the last block to burn on Market Street in the city's center

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