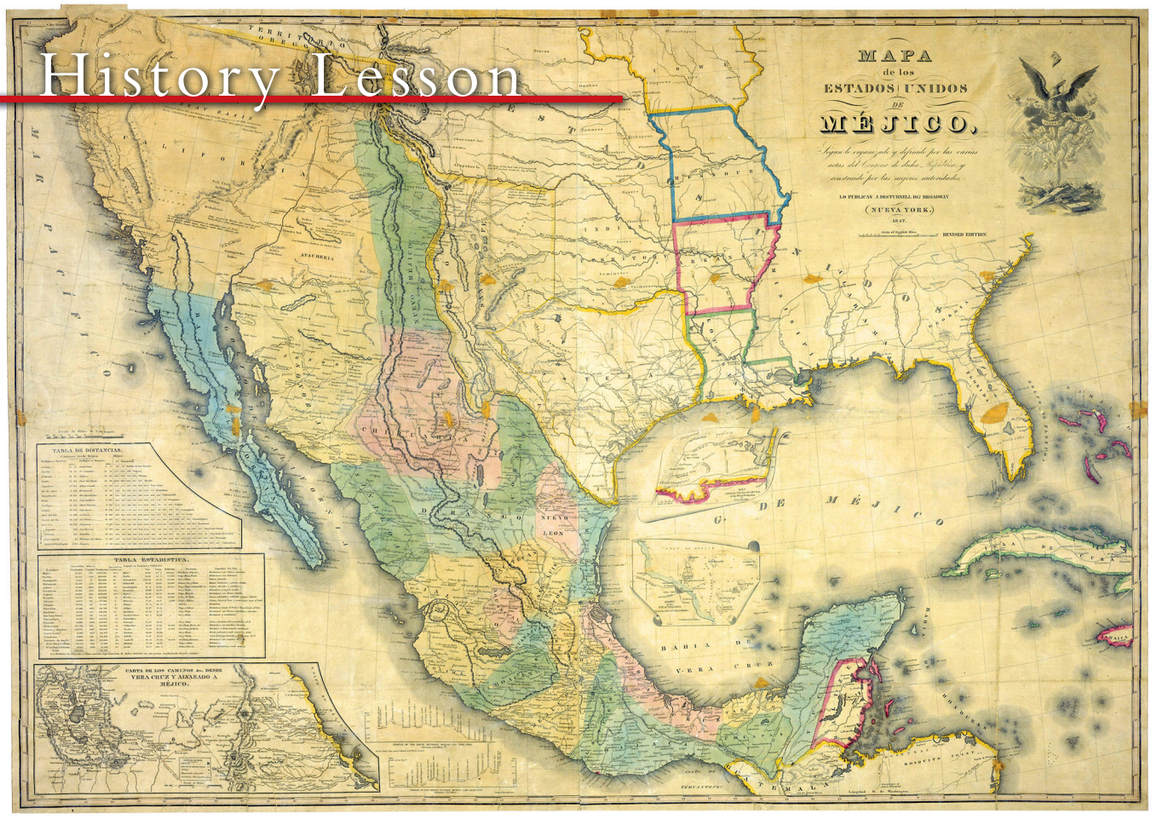


A Fine Line: The U.S.-Mexico Boundary

WHEN THE Mexican-American War ended, in 1848, the United States took possession of what is now the American West, including California, Nevada, and Utah, as well as most of Arizona and portions of New Mexico, Colorado, and Wyoming. But America's grand vision of manifest destiny still required the painstaking work of topographical engineers, who had to accurately chart the 1,954 mi border in an era when much of it was still terra incognita.

The driving force behind the successful determination of the boundary was William H. Emory, a gifted topographical engineer and resourceful leader able to navigate both the treacherous landscape of the Southwest and the equally treacherous politics of the job.

As Earl F. Burkholder, P.S., P.E., F.ASCE, an emeritus faculty member in the surveying engineering department at New Mexico State University, succinctly puts it: "Those guys were good."

Under the terms of the Treaty of Guadalupe Hidalgo, which ended the war when it was signed in 1848, it was expected that marking the boundary would be straightforward. As the geographer Michael Dear notes in a 2005 article, the treaty required that the boundary line extend from the mouth of the Rio Grande up to a point 8 mi above "the town called Paso" (present-day Ciudad Juárez). From there it would proceed due west to the Gila River and then "down the channel of the Colorado River," after which it would follow the division between Alta California and Baja California to the Pacific. The treaty required American and Mexican survey commissions to work together to formally establish the border.

Dear writes that the work largely unfolded in three sections. The first, which was carried out between 1849 and 1851, marked the so-called California azimuth line, a straight line from San Diego to the Colorado River near Yuma, Arizona. The second, from 1851 to 1853, marked the river portion of the boundary. Here the work went southeast from El Paso toward the Gulf of Mexico and then from the Gulf back upstream. The final section, bridging the territory east of the Colorado and west of El Paso, was executed in 1855. This followed the Gadsden Purchase, which was ratified in 1854.

A West Point graduate, Emory had served as the chief topographical engineer for General Stephen W. Kearny's Army of the West during the war, so he knew the land well. After declining President James K. Polk's offer to head the first U.S. boundary commission (he turned it down because he didn't want to resign from the army), he took the post of chief astronomer and commander of the escort of U.S. troops under Commissioner John B. Weller. All told, the first boundary commission comprised 39 people and had an army escort of 105.

The Treaty of Guadalupe Hidalgo defined the U.S.–Mexico border but was based on the inaccurate Disturnell map, published in New York in 1847.

NATIONAL ARCHIVES

Emory and Mexico's team of surveyors arrived in San Diego in the summer of 1849, and the first order of business was to establish the 148 mi California azimuth line. The starting point was 1 marine league (3 nautical mi) south of the port of San Diego, and from there the line would run to the junction of the Gila and Colorado rivers. In his report Emory noted that the best way to determine the line was to "connect the two points by triangulation, and in this way ascertain their relative positions on the face of the earth, and compute the azimuth of the line joining them."

But triangulation was also expensive and time consuming. The next option, as recounted by Paula Rebert in her book *La Gran Línea: Mapping the United States–Mexico Boundary, 1849–1857* (Austin, Texas: University of Texas Press, 2001), was to utilize astronomical observations to determine latitude, longitude, and azimuth. "To measure angles, to measure distances, and you have to do it on a straight line, down through the arroyos, up over the hills, across the rocks," says Burkholder. "It's a rather foreboding landscape, but you must go in a straight line." (Burkholder adds that triangulation was used in such "impossible" circumstances as river crossings and in very rough terrain.)

Even so, Emory himself noted that the terrain heading west from San Diego was "unfavorable to geodetic operations." The terrain presented formidable challenges. Initially it rose quickly in steppes from the Pacific and then, about 30 mi in, was marked by "a succession of parallel ridges, striking the boundary nearly at right angles, and separated by deep and sometimes impassable chasms." The terrain then fell back to near sea level, Emory noting that the rest "stretches across the desert of shifting sand…destitute for the most part of both water and vegetation, rendering it impossible to mark the boundary in the usual manner on the ground."

And the margin for error was thin: "An error in the latitude or longitude of either extremity, of a few seconds, would produce a great departure of the line from the point it was intended to strike," Emory wrote.

As related in *William H. Emory: Soldier-Scientist,* by L. David Norris, James C. Milligan, and Odie B. Faulk (Tucson, Arizona: University of Arizona Press, 1998), Emory directed one of his lieutenants to ignite gunpowder at elevated points along the line so that sightings could be taken to accurately map the boundary. "When the results of this unique method of marking the boundary were later tested by actual surveys by two different parties, one starting from San Diego and the other from the Colorado, the line met within six inches of Emory's calculations," the authors write.

Army engineer William H. Emory, *above,* was the driving force behind the successful survey of the U.S.–Mexico border. John R. Bartlett, as head of the boundary commission, was responsible for a derided compromise with Mexico that would have placed the U.S. border 40 mi north of its present location.

EMORY: LIBRARY OF CONGRESS; BARTLETT: WIKIMEDIA

The California azimuth line was completed by September 1851. "The computational process was very tedious and time consuming by today's standards," Burkholder says. "But they had plenty of time, they had good equipment, and they knew what to do. They kept good records, and they got good results."

Perhaps more remarkable than the technical achievement was Emory's perseverance as a leader. Bickering with his superiors over lack of money, making the most of the limited expertise possessed by the members of his team, and securing supplies would bedevil his work in marking the border. Furthermore, the California gold rush was a huge temptation for the men under Emory's command, especially when they weren't being paid. Emory had to make arrangements to pay his men an additional two dollars a day when not on duty to keep them from deserting.

The second boundary commission, based in El Paso, was headed by the New York historian and bibliographer John R. Bartlett, who was probably more interested in exploring the region's rich cultures and landscapes than in setting the boundary. While he wrote two well-regarded volumes describing his travels, Bartlett was a terrible organizer, says Gabriel Duran, P.E., a consultant realty officer for the U.S. Section of the International Boundary and Water Commission. "He had no experience leading a large group of men into the wilderness. He spent tons of money and accomplished almost nothing when it comes to defining the international boundary as we know it today."

And misfortune seemed to follow him everywhere. After three months of preparation, Bartlett set sail from New York in August 1850 along with 160 tons of freight and a detail

As Dear notes, the boundary survey may have lacked the grandeur of the Lewis and Clark expedition, but it remains "one of the greatest events in U.S. political history and remains deeply present in our contemporary lives."

of 105. As explained by Harold James in a paper entitled "History of the United States–Mexican Boundary Survey, 1848–1955" (in *The Border Region,* edited by D.A. Cordoba, S.A. Wengerd, and J.W. Shomaker [New Mexico Geological Society, 1969]), this detail included "engineers, surveyors, assistant surveyors, topographers, carpenters, blacksmiths, wheelwrights, wagon masters, teamsters, harness makers, shoemakers, tailors, butchers, cooks, laborers, and servants." Bartlett arrived on the Texas coast on August 31.

The 800 mi overland journey to El Paso grew difficult west of San Antonio, where the land became hard and dry and hot. Slowly the members of the party began to quarrel among themselves. A captain killed a drover over cards. A laborer stabbed a butcher. A teamster "shot and killed a Mexican landowner over the rights of woodcutting." Bartlett handled "this by paying the grieving family $100 for their troubles," James writes.

But much greater problems awaited Bartlett when he reached El Paso that November. El Paso, it turned out, was not technically where it was supposed to be. The Treaty of Guadalupe Hidalgo used the Disturnell map, published in New York in 1847. Bartlett and his Mexican counterpart, General Pedro García Conde, realized the map was inaccurate in two respects. As James notes, it showed El Paso at 32°15' N, whereas its true astronomical position was 31°45' N. Furthermore, it showed the Rio Grande to be at 104°39' W, whereas its true position was 106°29' W. In other words, the map showed El Paso 40 mi north of its actual location and the Rio Grande more than 130 mi east of its true location.

Conde argued that, even if inaccurate, the treaty map should be used to set the boundary, and Bartlett was willing to compromise. To "satisfy" Conde, as James puts it, the "initial point" would be fixed on the west bank at 32°22' N, 48 mi north of El Paso, instead of 8 mi north, as called for in the treaty; to satisfy Bartlett, the line running west would adhere to the full 3° of longitude from the true position of the river.

Bartlett felt that he had obtained a good deal. He'd gained, James writes, "137 miles of extended line to the west and had given up only 40 miles to the north." What's more, he thought that the land below 32°22' N wasn't as valuable as the new territories he had picked up. Bartlett and Conde signed the agreement, which became known as the Bartlett–García Conde Compromise, on April 24, 1851.

The problem was the railroad. The American government was determined to build a transcontinental railroad through the southern United States. The compromise reached by Bartlett and Conde placed the border in the small community of Doña Ana, just north of present day Las Cruces, where a mountain range blocked easy rail access to the west.

Meanwhile, after Bartlett had dismissed his chief surveyor and astronomer, Emory was called back into the field. He arrived at El Paso in November 1851 and found the scene chaotic. The men of Bartlett's commission were loitering about, and most were ignorant of the "first principles of surveying." Dear mentions a letter Emory wrote complaining that Bartlett had spent hundreds of thousands of dollars and had done little more than survey 40 mi of river: "My God what will become of our appropriations if Congress knows of the follies of the Commissioner and his antagonists too."

Still, these troubles did not discourage Emory from whipping Bartlett's men into shape and surveying the Rio Grande. "It will surprise many to know that up to the time when I commenced the survey, by far the largest portion of it had never been traversed by civilized man (meaning the Rio Bravo from its mouth to El Paso)."

Boundary marker 1 was established on the west bank of the Rio Grande in El Paso in 1855, marking the successful completion of the boundary survey.

The United States and Mexico share responsibility for maintaining monuments. The foundation of a monument at the California–Arizona border was recently rebuilt after vandals had dug most of it out.

USIBWC, *OPPOSITE;* MEXICO IBWC, *ABOVE*

In many places, particularly around the area that is now Big Bend National Park, the river was "impassable," Emory describing it as "walled in at places by stupendous rocky barriers."

"Their shoes are rags and their feet are bleeding," Duran says of Emory's men. Emory and his men made it all the way from El Paso to Rio Grande City, says Duran, a distance of more than 700 mi and around 100 mi short of the Gulf. Despite the success, problems remained. Many of the 100 men on the detail hadn't been paid in 18 months and had become "almost insubordinate." At Presidio, a third of the way down the river, Emory had to put down a mutinous riot in camp, as he recounts, "at the risk of being shot by an insubordinate fellow, insane from the effects of intoxicating mezcal." Adding to the difficulties, yellow fever hit the survey party and one assistant, Thomas Jones, drowned in the river on July 23, 1853. A monument was later placed in his honor.

Few Americans were happy with the Bartlett–García Conde Compromise. When, as James notes, Congress held up appropriations for continuing the survey until the international boundary could be redrawn at its correct position, 8 mi north of El Paso, Bartlett disbanded the commission and retired in January 1853.

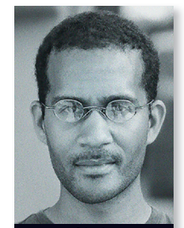
The compromise was soon undone by the Gadsden Purchase. James Gadsden, a South Carolina railroad magnate, was appointed by President Franklin Pierce to resolve the dispute and ensure that the United States had the land it would need for the southern transcontinental railroad. Gadsden arrived in Mexico City in August 1853 and by December of that year had hammered out a deal with the Mexican government: the U.S. would pay Mexico $10 million for 29,670 sq mi. The United States ratified the purchase treaty in April 1854. (The Southern Pacific Railroad was completed in 1881.)

That August Emory was appointed commissioner and chief surveyor for the new Gadsden boundary. He returned to El Paso in the fall and, together with his counterpart, Jose Salazar Ylarregui, who had become Mexico's commissioner following Conde's death in 1851, turned his attention to the final stretch of the boundary, which would run west from El Paso to the confluence of the Gila and Colorado rivers. They completed the survey of the Gadsden line in October 1855. Two years later Emory oversaw publication of a comprehensive, two-volume report and 54 survey maps of the territory.

Although the first boundary marker placed was south of San Diego (it's now designated monument 258), the marker on the international boundary that bears the number 1 was placed on the west bank of the Rio Grande in El Paso. The 12 ft high stone monument was built in 1855 and was accorded landmark status in ASCE's Historic Civil Engineering Landmark Program in 1976.

All told, 52 stone monuments were built under Emory's watch in the mid-19th century. A resurvey of the boundary line begun in 1891 increased the total number of monuments to 258. The newer ones were made of iron, which were easier to maintain. Dear notes that 18 additional monuments were built in subsequent decades, bringing the current total to 276—all in a line-of-sight chain stretching the length of the border.

Today the United States–Mexico border is a flash point of hopes, dreams, anxieties, and fears. Creating it out of 2,000 mi of rugged terrain remains a feat of typical American enterprise. As Dear notes, the boundary survey may have lacked the grandeur of the Lewis and Clark expedition, but it remains "one of the greatest events in U.S. political history and remains deeply present in our contemporary lives." —T.R. WITCHER



Witcher

T.R. Witcher is a contributing editor to Civil Engineering.