

747 Miles 73 Chains **Joseph C. Brown's Epic Traverse**

By
L. Stephen (Steve) Schmidt
PE (CO), PE Emeritus (KS)

Introduction

This paper draws heavily on the results of a study performed under a Scholarly Research Grant provided by the Santa Fe Trail Association by L. Stephen (Steve) Schmidt and Richard E. (Rich) Hayden in 2011. The objective of the study was to plot the “Sibley Expedition’s Survey” on base maps contained in the National Park Service’s (NPS) *Santa Fe National Historic Trail, Comprehensive Management and Use Plan, Map Supplement* (May 1990). I will refer to those as the NPS Base Maps.

Additional information about the Sibley Expedition has become available since that study was completed, and is incorporated into this paper.

In addition to the Santa Fe Trail Association and its Scholarly Research Committee, I wish to acknowledge Mr. Richard Hayden for his efforts in plotting Brown’s survey on modern maps, Mr. Craig Crease for providing key documents and for his encouragement and assistance, Ms. Brooke Safford with the National Park Service for providing extra copies of the *Map Supplement*, Ms. Susan Calafate Boyle (formerly with the National Park Service) for invaluable assistance in locating and obtaining digital copies of original maps of the survey, and the late Mr. Harry Myers for providing electronic copies of important documents related to the survey. It is with great disappointment that Harry was not able to participate further in this study.

Overview of the Expedition

In late 1824, Missouri Senator Thomas Hart Benton was agitating for a government road from Missouri to the Mexican Boundary. A bill authorizing a road to the Mexican Boundary underwent a metamorphosis into one authorizing a road to be surveyed and marked from Missouri to the Mexican settlements (Santa Fe). March 3, 1825 such a bill was signed into law by President John Quincy Adams.¹ Of the three Commissioners appointed to oversee the task, George C. Sibley emerged as the leader and the driving force behind the survey which became known as the Sibley Expedition.

The Sibley Expedition began its survey near Ft. Osage, Missouri July 17, 1825.² After entering what is now Kansas, the men and animals were tormented by green flies to the point they had to travel at night and could not perform their survey in the manner they had

hoped. They were not able to make a reconnaissance of the country to mark out the best route. This continued until they reached approximately what we now call Diamond Spring.³

They then surveyed westward to the Mexican Boundary, which was the Arkansas River on the north and the 100th meridian on the east, where they arrived Sept 11, 1825.⁴ They had no authorization to continue the survey into Mexico, and they remained in camp several days contemplating what to do. They decided that two of the three Commissioners, with most of the men and equipment, should return to Ft. Osage, and the other Commissioner (Sibley), Surveyor Brown, and a few of the men and their equipment should travel to Santa Fe to spend the winter and await instructions.⁵

Sept 22, 1825 Sibley, Brown, and party started for Santa Fe (via what we now call the Cimarron Route), making only cursory notes and determining the latitude of notable points, with expectation of making a detailed survey on their return trip.⁶

On October 18, upon reaching the Point of Rocks, Sibley decided that the horses would not hold-out to Santa Fe, so he decided to go to Taos (San Fernando) instead. He followed the Taos Trail to the vicinity of present-day Rayado (ray-ah-doe), NM. At that point, the supplies and equipment were carried over the mountains on pack mules (hired from Taos) via the pack mule trail, and the weakened horses hauled the two empty wagons to Taos by another route farther to the south to prove the existence of a wagon road over the mountains.⁷

The party arrived in Taos Oct 30, 1825.⁸ In late November, Sibley, Brown, and a few others then traveled to Santa Fe where they spent the winter while most of the remainder of the party wintered in Taos.⁹ Sibley returned to Taos March 8, 1826,¹⁰ and apparently spent the spring and most of the summer trying to get permission to complete the survey in Mexico.

After finally receiving authorization from the Mexican Government to complete the survey in Mexico,¹¹ Sibley, Brown, and party left Taos Aug 24, 1826, arrived at the Mexican Boundary September 16th,¹² Walnut Creek (Great Bend of the Arkansas) Sept 23, and Ft. Osage Oct 12, 1826.¹³ On their way east they performed the survey of the portion of the route west of the 100th meridian. They also corrected some of the previous year's survey east of the 100th meridian to show preferred routes, but did not have time to correct the survey of the first 160 miles east of Ft. Osage.¹² The corrections east of the 100th meridian in 1826 are evidenced by the maps not in all cases agreeing with Sibley's diary going west in 1825.¹⁴

Then on May 18, 1827 Sibley embarked on the re-survey of the first 160 miles west of Ft. Osage, making corrections to note the preferred or recommended routes of travel for the Santa Fe Road.¹⁵ June 10 they reached Diamond Spring, and turned around, returning to Ft. Osage July 8, 1827.¹⁶

On September 20, 1827 Sibley bundled up the survey notes in his possession and sent them to Brown for Brown to assemble into a Field Book and into maps drawn to a large scale; Sibley asked that this all be completed by Oct 20.¹⁷ Apparently this was accomplished, and

Sibley's report to the Secretary of the Dept. of War was ready by October 25 and signed October 27, 1827.¹⁸

Previously, on October 13, Brown had written to Sibley enclosing a table of survey data.¹⁹ That table clearly shows the extent of the 1827 re-survey. The fact that the dates of the survey from the 100th meridian to Taos run "backward" in the table (as described in Brown's letter) shows that the survey of that portion of the route did in fact occur on the return trip in 1826. The table contains no indication of corrections made in 1826 to the eastern portion of the survey.

Some Comments and Observations

The Field Book: The Field Book of the Expedition, with a map of the route on one page (Figure 1), and a corresponding narrative description of the route and compilation of mileages on the facing page (Figure 2), was not a surveyor's field notebook at all.²⁰

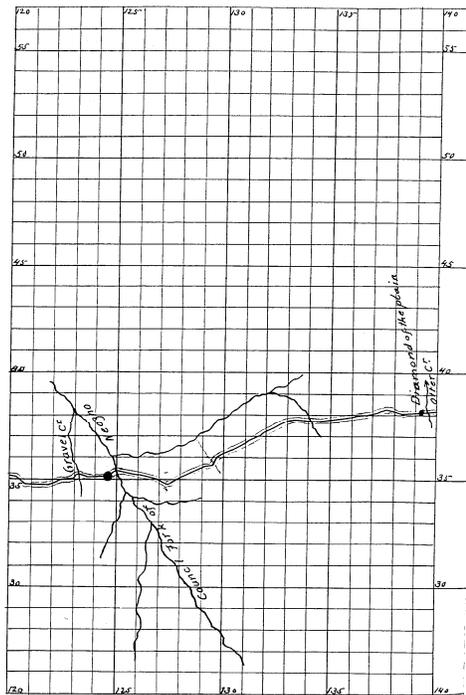


Figure 1

140	58	607	18	Branch Creek 30 links wide runs south westerly, this is a pretty little stream affording some excellent land & has some groves, at 19 th chains there is a fine spring & good camping grounds.
141	57			
142	32	605	41	Counsil Grove, where the Commission met the Brag. Chiefs in Council on the 10 th August 1825. This is the largest body of woods land I passed through after leaving Big Horn. It has about a quarter of a mile wide, above it below are some groves more extensive. The timber & land are of superior quality & the general face of the country interesting. Springs of excellent water are frequent & no doubt good water wells will be found on this fork of the Rio Grande & its branches in small branches that water this beautiful track of country.
143	51	608	72	Counsil fork of the Rio Grande, here 50 links wide & runs S.W. Southward good ground.
144	38			
145	01	594	72	Small creek 15 links wide, runs Southward. No timber.
146	27			
147	28	589	45	Diamond of the plains a remark

Figure 2

A surveyor's field book would contain the distances measured along straight lines, the angle or deflection when direction of the survey was changed, astronomical observations to determine latitude, and probably other technical information. In the introduction to the Field Book, Surveyor Brown, in fact, says as much: "It is deemed unnecessary to annex a complete copy of the courses and distances."²¹ Instead, the Field Book is intended to be a guide to travelers: "It is thought a map of the road in this form, with the brief remarks and directions, would be useful to such as may travel it."²¹

The Field Book was not prepared in-the-field as the survey progressed. Instead, the Field Book was assembled in October 1827, after Surveyor Brown obtained a supply of paper of acceptable quality¹⁹ and received the survey notes from Sibley. Brown assembled the Field Book from the actual surveyor's field notes from the surveys completed in 1825, 1826, and 1827. Those notes are probably the six bundles of papers Sibley sent Brown on September 20, 1827¹⁷ as Sibley would have needed the original field notes to perform the correction survey in 1827. The distances reported in the final Field Book are slightly different than in the Oct 13, 1827 table, indicating the Field Book was completed between Oct 13 and Oct 20, 1827.

What was surveyed: It is also clear that the maps of the survey in the Field Book do not represent an exact survey of the Santa Fe Trail as it was actually traveled at the time. Instead, a survey was made which generally followed the route of travel from Missouri to the Mexican settlements --- the route established by traders from 1821 through 1824, a period of a mere four years. What the maps depict is a combination of actual locations of points on the trail in some places, and in other places deviations from the established route that Sibley thought would provide easier or shorter travel. In addition, in general, the maps in the Field Book are composed of relatively long straight line segments and do not depict every twist and turn in the trail, particularly so in the western portions of the survey.

Field Book Maps: The maps in the Field Book are plotted at a scale of 1 inch = 4 miles. The maps are rather unique. --- South is "up" and West is to the right. In other words, the maps are presented upside down and backwards from normal map conventions. In that way, reading left to right, the mileage increases on the page as one goes west (to the right) from the beginning near Ft. Osage; likewise, reading from bottom to top, the mileage increases on the page as one goes south (upward) from the beginning near Ft. Osage. As Brown stated, "The progressive marginal numbers from the bottom to the top of the map, show the southing and those from left to right show the westing from the commencement." ²²

Upon arrival in Taos in 1825, Surveyor Brown also prepared a map depicting the entire survey on one map at a scale of 1 inch = 20 miles. That map will be discussed in more detail later in this report.

Joseph C. Brown, Surveyor

The surveyor chosen to be in charge of the surveying for the Sibley Expedition was Joseph C. Brown, one of the more noted and capable surveyors of the time. Among other things, Brown had determined the base line for the Fifth Principal Meridian (1815), the Osage Indian Line from Ft. Osage to the Arkansas River (1816), boundaries of the Incorporated Limits of St. Louis (1820), and the Kansas-Missouri Line south of the Kansas River as well as the Arkansas-Missouri Line (1823).²³ For the 1815 survey, Brown ran the base line (East-West) and Prospect K. Robbins ran the Meridian (North-South). Those two lines became the basis for other land surveys and was the Louisiana Purchase Initial Survey Point.

Apparently, Joseph Brown also possessed a sense of humor. While surveying in the swamp in 1815, he noted the character of the land: "This would be good land were it not subject to

inundation.” And, “Terrain seems to consist of briars and swamp, alternating with swamp and briars.”²⁴

Brown was in charge of the surveying for the 1825-1826 surveys for the Sibley Expedition from near Ft. Osage to Taos and return. However, neither he nor Archibald Gamble (Brown’s assistant on the 1816 survey of the Osage Line, and Secretary of the Sibley Expedition) is in the list of personnel involved in the 1827 re-survey west from Ft. Osage in 1827.²⁵ We can only assume that Sibley (and perhaps some of the men in the re-survey party who were on the first expedition) thought he knew enough about surveying by that time that he did not need Brown in the field. He only needed Brown at that point to assemble all of the survey notes into a Field Book and maps.

How They Did It

The general procedure was to use a surveyor’s chain (Figure 3) to measure distances along straight lines (called chaining²⁶) and a magnetic compass (Figure 4) to determine the

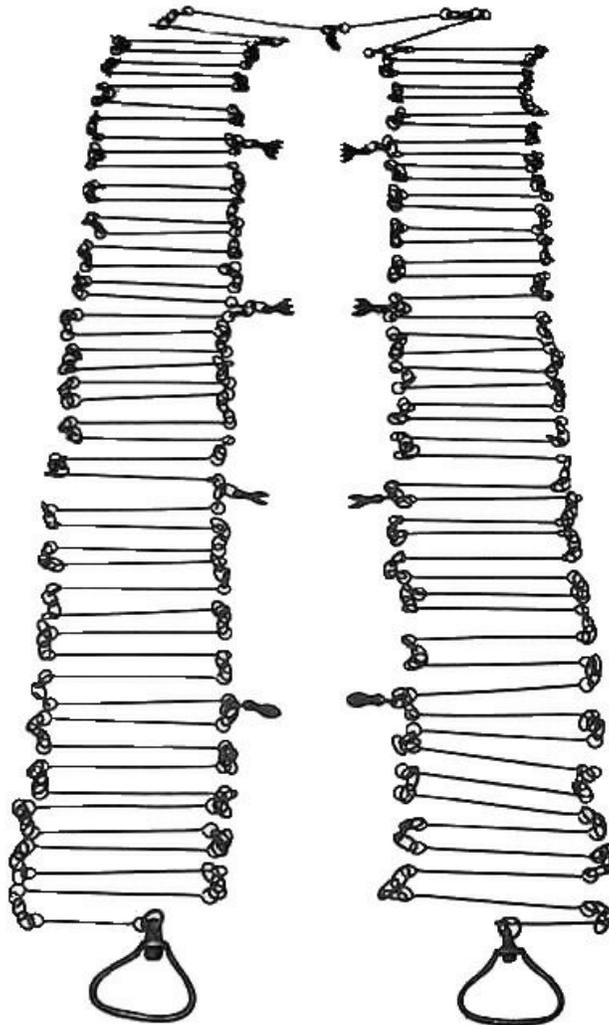


Figure 3 – Gunter’s Chain



Figure 4 – Early Surveyors Compass

direction (called a bearing²⁷) in which they were going. These measurements were supplemented by astronomical observations using a sextant to determine latitude.²⁸

Brown did not have the equipment necessary to accurately determine Longitude. He did periodically make what he believed were fairly accurate determinations of Latitude. He also believed his distance measurements were good and bearing measurements were reasonably accurate. After surveying along several straight line segments, he would use the measured distances and bearings to compute how far West and South he had traveled. He would then use observations of Latitude to check his computed Southing, and make any necessary corrections. In this way, he believed his Southings were good (because of observations of latitude) and his Westings nearly so.

The information in the Field Book would imply that all distances were chained, and distances are, in fact, reported in the Field Book in Miles and Chains.²² Distances were no doubt determined by chaining in 1825 from near Ft. Osage to the Mexican Boundary, and in

1827 from near Ft. Osage to Diamond Spring. From the Mexican Boundary to Taos in 1825, as previously mentioned, a detailed survey was not made. Instead, “the distances were not measured, but were estimated by time and the travel of wagons and horses frequently corrected by the Latitude. It [the map] will be found nearly correct it is believed as to Westing quite so as to Southing.”²⁹ In other words, he believed his Latitudes were “good,” but the Longitudes were “OK” due to the distances being estimated.

For the 1826 survey from Taos to the Mexican Boundary, the methods used are not described. Due to the rapidity with which the 1826 survey was performed, it is difficult to imagine that the entire distance was chained, even though the distances between locations are reported in Miles, Chains, and Links.¹⁹ Perhaps the number of revolutions of a wagon wheel was used to determine distances; we just do not know for sure.

The following table summarizes the four surveys.

<u>Segment Surveyed</u>	<u>Year</u>	<u>Miles/day</u>	<u>Distances</u>
Near Ft. Osage to Mexican Boundary	1825	6.8	Chained
Mexican Boundary to Taos	1825	9.2	Estimated
Taos to Mexican Boundary	1826	15.0	???
Near Ft. Osage to Diamond Spring	1827	6.7	Chained

Where Did They Start?

Given the importance of the survey, and the care with which it was performed and documented, it is rather surprising that the point of commencement is not precisely defined. Brown notes that the latitude of Ft. Osage is 39°11’50”.²⁹ Brown states that the point of commencement for the survey is 1-3/4 miles south of old Ft. Osage, and that the latitude of the point of commencement is 39°10’19”.²² When calculated from Brown’s data, the point of commencement is 00°01’31” of latitude south of Ft. Osage.

Archibald Gamble says, “The road commences a mile or two south of Fort Osage, upon a line run some years ago as the boundary of the Indian lands.” Gamble is presumably referring to the Osage Line of the 1808 Treaty and surveyed in 1816. Therefore, we are left to speculate, to some degree, on the location of the point of commencement of the survey.³⁰

Let us assume the old gate at the western point of the stockade is the location of Ft. Osage for purposes of the 1825 survey; the 1816 survey does confirm that the Osage Line passed north-south through the middle of the gate. Going from that point due south 1-3/4 miles parallel to the western boundary of Missouri³¹ would put the point of commencement at 39°09’44.47” N Latitude and 94°11’33.08 W Longitude on Google Earth. The point of commencement would be just south of present-day Sibley, MO, not far east of Buckner-Tarsney Road, just north of the power line easement. That point is 22.3 miles east of the western boundary of Missouri which corresponds to the Field Book map. The point (by

Google Earth) is 00°01'31.21" Latitude south of the old gate of Ft. Osage, which compares with 00°01'31" from Brown's determinations of Latitudes.

Although the stated point of commencement at 39°09'44.47" N Latitude and 94°11'33.08 W Longitude on Google Earth may not be perfectly correct, it is probably not far off. This point seems reasonable with respect to the topography and the known location of the Osage Trace / Santa Fe Trail in that area.³²

How Accurate Were They?

The accuracy of the survey is rather astonishing, especially considering (1) the equipment and methods used, and (2) the inherent errors in determining bearings, chaining distances, and determining latitudes and (3) there was no way to verify and correct the survey along the way except by observation of Latitude.

According to the Field Book, Taos is 616.1 miles west and 191.5 miles south of the beginning point of the survey, for a calculated straight line distance of 645.2 miles. Using Google Earth, the straight line distance from the point of commencement to the square at Taos is 650.2 miles. That is a difference of 5 miles in 650.2 miles, an error of 0.77 percent.³³

Small Scale Map

As mentioned earlier in this report, Brown prepared a map depicting the entire survey on one map at a scale of 1 inch = 20 miles. The map is available on-line from the Library of Congress.³⁴

In all probability, the map was drawn by Surveyor Brown shortly after arrival in Taos in late 1825. The map, therefore, depicts the first map of the survey prior to any corrections being made to the survey in 1826 and 1827.³⁵

The map is presented in the conventional format, North being "up" and East being to the right. The map is very interesting for a number of reasons.

- The hand-written text contains valuable details about how Brown established the Latitude and Longitude used on the map.
- The hand-written text explains how distances were determined between the Mexican Boundary and Taos in 1825.
- The map shows the location of rivers, settlements, trading posts, and camps far removed from the route of the survey. Locations of some of those features were likely determined from Brown's earlier surveys, but some locations were estimated.
- A table of latitudes of certain points along the survey is presented.
- The detail of the route between the Point of Rocks (in New Mexico) and Taos depicts both the pack trail and the wagon road.

- The location of San Fernando (Taos) is different than shown on the Field Book map.

	<u>Field Book</u>	<u>1"=20mi Map</u>	<u>Difference</u>
Southing	191.5 mi	193 mi	1.5 mi
Westing	616.1 mi	599 mi	17.1 mi

- The Westings on the 1"=20 mi map between the Lower Spring and Taos are different than shown on the Field Book map. The following table compares the Westings (in miles) scaled from the Field Book and scaled from the 1"=20 mi map.

<u>Location</u>	<u>Field Book</u>	<u>1"=20mi Map</u>	<u>Difference</u>
Lower Spring	389	389	0
Cr. Near Upper Spr.	449	448	1
Louse Cr.	478	473	5
N. Bend Turkey Cr.	448	473	5
Point of Rocks	538	525	13
Rock Cross. Canadian	557	544	13
Pt. near Ocate Cross.	575	558	17
Taos	616	599	17

The differences are most likely due to the fact that for the 1" = 20 mi map west of the Mexican Boundary "the distances were not measured, but were estimated by time and the travel of wagons and horses frequently corrected by the Latitude. It [the map] will be found nearly correct it is believed as to Westing quite so as to Southing." ²⁹ If that is the case, then the error due to estimating distances is 17 miles in a distance of approximately 360 miles, which is on the order of 4.7% --- not bad, in my opinion.

Plotting the Survey on Modern Maps

Preliminary Work: In 2005 Richard Hayden electronically scanned the maps from the Field Book, and electronically connected them together to form a strip-map of the survey from Cottonwood Crossing to the Little Arkansas Crossing. We (Hayden and Schmidt) chose those two points on the theory that (a) the location of major features along the Santa Fe Trail might be determined by Sibley/Brown with greater care than other points, (b) the location of those major points probably did not change significantly during the life of the Trail, and (c) we were familiar with that portion of the Trail. We expected some systematic error in the Sibley/Brown survey, and expected to have to adjust the scale of the survey to plot it correctly on modern maps.

Hayden then electronically scanned modern maps and electronically connected them together to form a strip-map of the same area. When he made both strip-maps the same scale and when he electronically over-laid the maps onto each other, the end points (Cottonwood Crossing and Little Arkansas Crossing) corresponded exactly without any scale adjustments. The only adjustment was to rotate the Field Book Map slightly (north was slightly different on the two maps), but the distance between the two crossings matched exactly. Also, as suspected, the location of intermediate features (such as Running Turkey Creek and Dry

Turkey Creek) did not correspond exactly and the survey route deviated slightly from the route of the Trail as recorded in 1857 and 1865 public land surveys.

We then repeated this procedure for Cottonwood Crossing to the Neosho Crossing at Council Grove and from the Little Arkansas Crossing to Walnut Creek Crossing using enlarged/reduced photo copies and a light table. Again we observed excellent agreement of the end-points of the survey map and modern maps, with some deviations of the routes in between. From these initial trials, we concluded the entire route could similarly be mapped, and we made application for a Scholarly Research Grant from the Santa Fe Trail Association to repeat the procedures for the entire survey. Of course, as it turned out, this remarkable agreement between the survey and modern maps was the exception rather than the rule, and was somewhat unique to the portions of the survey selected for our trials!

Initial Methodology: Based on the initial success of our trials, Hayden then electronically assembled a strip map of the Field Book Maps from the Field Book for the entire survey from near Ft. Osage to Taos. He did the same with modern maps utilizing the maps in the *NPS Map Supplement* as our modern base map. When he overlaid the two maps, our problems began.

East of Council Grove, it was clear that the survey route deviated significantly in places from the route of the Santa Fe Trail (SFT) shown on the NPS Base Maps, and it was difficult to confidently assign points that should be common to both maps.

West of Walnut Creek Crossing, we could more confidently assign points that should be common to both maps, but the scale of the survey had to be frequently adjusted to match the base map; and, the adjustments were not uniform. And the rotation or differences in north between the maps was not uniform. Also, when matching major landmarks that should be common to both maps, we observed significant deviations between the routes --- deviations that were topographically nonsensical and clearly not attributable to Sibley's "adjustments" to achieve a preferred route.

It became clear that our initial methodology of simply using key points to adjust the scale of the survey and to rotate the survey to match the base map would not produce a satisfactory result.

Adopted Methodology: We abandoned the idea of creating an electronic strip-map of the Sibley Expedition, and then trying to force a match of certain key points many miles apart on the maps (Taos to Rock Crossing of the Canadian as an example). Instead, we decided to individually orient each Field Book Map to the NPS Base Map as best we could. We oriented the maps using the location shown on the Field Book Maps of stream crossings and landmarks, along with topographic maps and Google Earth terrain photos, supplemented by the text mileages of the Field Book. We chose not to adjust the scale of the individual Field Book Maps. Instead, we made both the Field Book Map and the Base Map the same scale, and oriented the Field Book Map for a "best fit" to the Base Map. We chose this approach so that the maps would "speak for themselves"; we chose not to "rubber sheet" the Sibley maps to fit our interpretation of what the survey should have shown.

We attempted to make the Field Book route remain continuous as we transitioned from map to map, but that was not always possible. We also attempted to match major landmarks that should be common to both the Field Book Map and the NPS Base Map, but that, too, was not always possible.

The location of streams and other features that are shown on the Field Book Map, but which are not actually intersected by the survey route, are only estimations and were not determined by survey. In other words, the location of a stream crossed by the survey was determined with some accuracy, but the location of that stream (or other features) shown either side of the surveyed route is an estimation only, and may differ markedly from its actual location.

As the reader can quickly appreciate, trying to achieve agreement among four sets of maps (NPS Base Map, Field Book Map, topographic map, Google Earth images) plus the text of the Field Book, and also have continuity between maps is a much more involved task than originally envisioned. In my opinion, we were able to confirm that the survey of the Santa Fe Trail is a combination of actual routes of travel at the time and deviations from that route which Sibley/Brown thought would be better, easier, or faster for the wagons to follow.

An example of the resulting maps is shown on Figure 5 where the NPS base map is red, the superimposed Field Book map is black, and the Sibley/Brown route of the Santa Fe Trail is superimposed in blue. The map is roughly centered on Burlingame, KS. In some reaches the route of the SFT coincides with the NPS maps and in some reaches it does not. In this area we had good continuity between adjacent Field Book maps and the Sibley/Brown route of the SFT. Such was not always the case, although discontinuities were usually not drastic. North on the Field Book maps was generally very close to north on the NPS base maps.

Words of Caution Because the Field Book maps were plotted on a grid representing square miles, there is a tendency to assume the survey is much more accurate than it actually is. With our understanding of the GLO surveys ---- where the location of the Santa Fe Road is determined to the nearest foot and the location can be accurately reproduced on the ground today --- there is a tendency to view the Sibley Survey in the same way. Not so. The GLO surveys have reference points (section corners) on a mile grid. The Sibley Survey has no such reference points (except, perhaps, at the western boundary of Missouri) that can be accurately reproduced on the ground today, and a relatively few points that can be approximately located with any degree of certainty. No latitudes and longitudes were correctly determined. In addition to the inherent errors in the determination of bearings and distances, there are plotting errors in creating the maps. The pencil line alone is a tenth of mile wide, and the plotting accuracy is probably plus or minus one or two tenths of a mile.

In our opinion, the Field Book Maps of the Sibley Expedition are what they are portrayed to be in the Field Book introduction --- a guide to travelers and not necessarily a precise map. The location of the Santa Fe Road shown on the Field Book Maps should be considered approximations only, accurate to perhaps several tenths of a mile. Nevertheless, the survey is an amazing surveying achievement and an important document in the history of the Santa Fe Trail. The Expedition contributed greatly to the understanding of the geography of the west and was relied upon for subsequent surveys of the west.³⁶

Conclusion We believe the maps of the Sibley Expedition which are plotted on modern maps and are available on the the SFTA web site³⁷ present a reasonable orientation of the Field Book Maps onto the NPS Base Maps. Our intent is to make available to other researchers the information needed to further study and perhaps refine the location of the route of the Sibley Expedition. To that end we will make available upon request the raster files of the Sibley Maps and NPS Base Maps with corresponding geo-referencing data files in ArcGIS format, Universal Transverse Mercator (UTM) Zone 14 North. This zone of the UTM system covers most of the Santa Fe Trail route and was selected because this coordinate system allows for extrapolation beyond the edges of the zone while still maintaining the desired placement accuracy.

All comments on our work are welcome and can be sent to the authors in care of the Santa Fe Trail Association, 1349 K-156 Hwy, Larned, KS 67550 info@santafetrail.org .

Subsequent Discoveries

After the report on the plotting of the Sibley Expedition's survey on modern maps was completed, I was able (with funding assistance from the SFTA) to obtain digital copies of other maps produced by Joseph Brown. Obtaining those copies was an epic undertaking which will not be described here; suffice to say it would not have been possible without the assistance of Ms. Susan Boyle, then with the National Park Service. Additionally, Mr. Craig Crease was able to furnish copies of some of the original notes from the 1827 resurvey (which also shed light on the methods of the original survey), as well as the western portion of the map prepared for Mather. All documents can be found on the SFTA web site³⁷; below, I will attempt to give the reader a 'feel' for the different maps and other information.

Reeves Booklet This booklet of maps³⁸ of the survey was prepared by Brown in 1825 upon arrival in Taos. I have been able to study the maps in some detail for the portion of the survey westward from Point of Rocks, NM and correlate the maps with present-day features. On those maps, "up" is South and West is to the right, upside down and backward from conventional presentation. On the maps, notable points/camping locations/events are labeled, mileages are shown between the notable points (solid circles) and/or camping locations (open circles), and the mileages from near Ft Osage and from Taos are shown.

On Figure 6, the map depicts the Point of Rocks (Figure 7) and a unique 'gap' in the terrain (Figure 8) west of Point of Rocks. The map of Figure 6 continues on Figure 9. Near present-day Rayado, NM, Sibley sent most of his baggage to Taos using pack mules traveling the Taos Trail. Sibley continued the survey expedition south with two nearly empty wagons to prove a wagon route to Taos was feasible, camping at Laguna Yeso (Figure 10), Ocate (oh-kah-tay) Gap, Ocate Mesa, and Osah Pass, and on the Rio Fernando de Taos before reaching Taos.

1825, 1"=20mi Map³⁴ As discussed previously herein, this map was prepared by Brown upon arrival in Taos in 1825. The portion of this map shown on Figure 11 covers the area of the Reeves maps discussed above. The 1"=20 mi map is drawn in the convention manner, with "up" being north and west to the left. Distances south and west of the beginning point

of the survey are shown, as well as Latitude and Longitude. Camping locations are shown by open circles, although they did not camp at Point of Rocks; the camp was actually west of Point of Rocks, immediately east of the 'gap' in the terrain. The salt pond is not shown; however, an attempt was made to show the location of major streams and other features some distance from the survey line. As previously mentioned, locations not actually on the survey line are estimates only; some of the stream locations on the 1"=20mi map are incorrect, but were corrected on subsequent maps of the expedition.

Both the Reeves Maps and the 1"=20mi map are quite historically significant because they show the Taos Trail, a trail that had been used for centuries eastward from Taos to Point of Rocks, from which location one could continue northeast to the Arkansas River, east to the buffalo range, or southeast to the canyon country of the present-day Texas panhandle. Brown actually mapped the Taos Trail from Point of Rocks to present-day Rayado, and showed its approximate route through the mountains from Rayado to the mouth of Tienditas (tee-en-dee-tas) Creek on the Rio Fernando de Taos. To my knowledge, no other reliable maps of the Taos Trail exist. The other significant historical aspect of these maps is that the Sibley expedition blazed a portion of the Mountain Route of the Santa Fe Trail from Rayado to Ocate Crossing, a route that did not come into use until years later. And, Sibley proved that wagons could reach Taos, whereas previously pack animals were used to carry goods.

Mather Map Also prepared by Brown in 1825 upon arrival in Taos, only the portion of the Mather Map west of the 100th meridian has been located. Not all of the map is in good condition. cursory comparison of the Mather Map with the 1"=20mi map does not indicate the Mather Map differs substantially or contains addition insights.

1827 Report, 1"=12mi Map⁴⁰ This map is presented in two sections: (1) from the beginning near Ft. Osage to the South Bend of the Arkansas River 300 miles west of Ft. Osage and (2) from the South Bend of the Arkansas River to Taos including Taos to Santa Fe. Unfortunately, portions of the first 70 miles of the survey have been lost due to deterioration of the map.

On the second section of the map, Brown wrote:

"This map is on a scale of 12 miles to an inch & these checks being 10/12 of an inch are all 10 miles square. The marginal numbers will show the miles of Southing & of Westing of any particular point. The Latitudes of places were determined by very careful observations with a good Sextant. The Longitudes are deduced from the Meridian of the Mouth of the Ohio River as determined by Mr. Ellicot to be in Longitude 88°50'42" West from Greenwich – at Ft. Osage the Magnetic Variation is 11¼° E & perhaps a few minutes more, at Santa Fe or rather at Taos it was found to be about 12° East.

October 27, 1827

Joseph C. Brown"

Also on the second section of the map the following is written:

*“Bureau Corps Topographical Engineers
Washington February 20th, 1844
This is to certify that this paper is an
original plot of the Survey from Fort Osage
to Santa Fe.*

*John J. Abert⁴¹
Col. Corps T. Engrs”*

There are two faint and partially illegible handwritten notes on the maps signed by “WHE”, presumably William Hemsley Emory.⁴²

Figure 12 presents a portion of the 1827 1”=12mi map corresponding to the same area previously discussed for the 1825 Reeves and 1825 1”=20mi maps. Note that the route east in 1826 deviated from the route west in 1825 between approximately Apache Hill and Point of Rocks. The portion of the 1826 route between Apache Hill and the Rock Crossing of the Canadian is historically significant because this appears to have later become a major route of travel, but has not heretofore been identified as a branch of the Santa Fe Trail. More study is needed on the historic use of that route. Figures 13 and 14 show views along that route.

1827 Report, 1”=4mi Map⁴³ This map is presented in four sections. Two different versions of the 1”=4mi maps are shown on Figure 15, and cover the detailed area in Northeastern New Mexico previously discussed for the other maps. The upper view is from the 1”=4mi map drawn by Joseph Brown in 1827, while the lower view is from the Field Book maps previously discussed. Brown also drew the Field Book maps at a scale of 1”=4mi. On Figure 15, I have re-oriented the Field Book map to make North “up” and East to the “right.”

1827 Resurvey Notes We are fortunate to have copies of the field notes for the 1827 resurvey.⁴⁴ As previously discussed, neither Brown nor Gamble was in the field for the 1827 resurvey. Instead Sibley performed the survey. From the resurvey notes, it appears Sibley had the original field notes with him during the resurvey, then afterward shipped all the notes to Brown who prepared the maps and the so-called Field Book.” Although we do not have any of Browns original field notes, some interesting information can be gleaned from Sibley’s resurvey notes:

- In his resurvey summary notes, Sibley copied portions of Brown’s 1825 notes verbatim. Thus, we see that Brown recorded bearings in whole degrees. Sibley’s resurvey notes are predominately recorded in whole degrees, with an occasional entry of ½ a degree and one ¼ degree. From this observation, and the fact that magnetic declination was carefully observed, I believe they probably used a vernier compass.
- Sibley recorded the resurvey distances in chains (and links); however, it is clear from his notes and comparison of his field notes with his resurvey summary notes, that his chain was a 2-pole (33 feet) chain. Therefore, 80 chains in Sibley’s resurvey notes represent a distance of ½ mile.

- The 1827 resurvey extends from the western Missouri border to Diamond Spring and back. Going west, Sibley marked out the preferred route by setting posts surrounded by a mound of soil; seventy-eight such mounds were constructed. Then, he surveyed the mounds going east, tying the “corrected” segments to the original survey to create a combination “existing” and “preferred” route of travel.
- It does not appear that reference monuments were set during the 1825 and 1826 surveys. Therefore, the 1827 resurvey was tied to prominent features of the landscape, such as fords at streams.
- The upper part of Figure 16 shows a portion of the 1827 resurvey field notes from the ford of Murder Creek to the ford of Pati Creek (later changed to Waggon [sic] Creek). The lower part of the Figure 16 shows a portion of the resurvey summary notes for that same reach on the resurvey. In attempting to read the notes, remember that a double ‘s’ appears as “fs”; for example, “crossing” appears as “crofsing.” Also of interest in the lower part of Figure 16, are the recopied portions of Brown’s 1825 notes. The resurvey summary notes, therefore, provide a complete set of field notes from the Missouri border to Diamond Spring. These notes cover some of the area shown on Figure 5.
- In comparing the field notes and the summary notes, it becomes clear that (1) Sibley’s 2-pole chain measurements were converted to miles, 4-pole chains, and links and (2) the field resurvey was run eastward but the summary notes run westward.

Closing

Joseph C. Brown demonstrated great skill, integrity, and patience in performing the field survey work of the Sibley Expedition in 1825 and 1826, and in creating the Field Book and various maps in 1827 based on his and George Sibley’s surveying work. Brown gave attention to every detail including the selection of the paper for his maps and Field Book. Brown wrote to Sibley on October 13, 1927:

“You directed me to get materials of the best quality to make the returns⁴⁵ on. This is a sample of the best I can get. The Field book & maps will all be of this paper. I had some large paper purchased last winter to make maps the best I could then get, but not half enough & the quality a little inferior to this. I therefore lay it by & take this altogether. It will be a ??????? weight, 17 sheets of this paper to our map or that part of the road beyond Fort Osage & about 25 sheets to the map in book form which I have determined to make 20 miles on the single page as more simple & plain than any other I can think of.”

The Field Book and maps prepared by Brown were assembled and submitted along with Sibley’s report of the expedition on October 27, 1827. Arguably the most important, extensive, carefully performed, and detailed survey of the West was then immediately filed away and forgotten! The results of the Sibley Expedition were not publically available at the time. By 1827 the Road to Santa Fe was clearly established on the ground and Brown’s survey and “Guide to Travelers” was not needed by the traders and others using the Santa Fe

Trail. The attention of the US government had turned to other things. Nevertheless, George Sibley deserves our respect because he persevered and completed the expedition where a lesser man would have given up in disgust. Joseph C. Brown deserves our respect because of his perseverance, skill, and attention to detail in performing his epic open traverse of 747 miles, 73 chains over a period of two and one-half years.

High resolution digital versions of most of the referenced maps and notes can be found at: <http://www.santafetrail.org/about-us/scholarly-research/sibley-survey/index.html>.

Notes and References

1. Kate L. Gregg, *The Road to Santa Fe – The Journal and Diaries of George Champlin Sibley*, Albuquerque: University of New Mexico Press, Second Paperback Edition 1952 with Preface 1995, pp 6-7.
2. K. Gregg, p 54.
3. K. Gregg, pp 197-198, 203.
4. K. Gregg, p 78.
5. K. Gregg, p 199.
6. K. Gregg, pp 84-85, 118, 202.
7. K. Gregg, pp 104-106.
8. Sibley's Journal says Oct 30 (K. Gregg, p 111), but the Official Report says Oct 31(K. Gregg, p 200).
9. K. Gregg, pp 116, 131.
10. K. Gregg, p 155.
11. K. Gregg, p 201.
12. K. Gregg, p 203.
13. K. Gregg, p 44.
14. A good example of this is in the vicinity of present-day Larned, Kansas. Going west in 1825, Sibley's diary clearly describes camping at and crossing the Pawnee Fork a mile above its mouth (K. Gregg, p 73), approximately where present-day Hwy 56 crosses the Pawnee River just southwest of downtown Larned. The location of that camp is confirmed by the map Brown prepared in Taos in November 1825, which Sibley then sent to Benjamin Reeves November 13, 1825 (K. Gregg, p 115; The State Historical Society of Missouri, Abiel Leonard Papers, Collection No. 1013, map, folder 34). On the return trip east in 1826, the route was apparently "corrected" because the map in the Field Book clearly coincides with crossing the Pawnee Fork at present-day Larned State Hospital.
15. K. Gregg, pp 176, 203.
16. K. Gregg, pp 184, 193. The re-survey actually began at the western boundary of Missouri and ended a little over 3 miles west of Diamond Spring.

17. K. Gregg, pp 193-194.
18. K. Gregg, pp 195, 210.
19. Letter from Joseph C. Brown to George Sibley dated October 13, 1827, and accompanying table titled "Summary of Notes on the Santa Fe Road," copies of which were provided by Mr. Craig Crease. Original documents are at the Missouri Historical Society in St. Louis.
20. It is interesting to note that the maps are the odd-numbered pages appearing on the left-hand side of the book and the even-numbered pages are the mileages and written descriptions appearing on the right-hand side of the book. This is confirmed by the introductory text of the Field Book, Field Book Page 6.
21. Introductory Text of Field Book, Field Book Page 5.
22. Introductory Text of Field Book, Field Book Page 6.
23. K. Gregg, pp 16-17.
24. Hardy Peacock, *Everything Has to Start Somewhere...*, Arkansas Oil Marketers Association, Summer 2003.
25. K. Gregg, p 175.
26. Surveyor Brown used a four pole Gunter's Chain²² which was 66 feet long, there being 80 chains per mile. The chain had 100 links with a tag or tally every 10 links. For accurate chaining, the chain had to be pulled taut and level, with no twisting of the chain. The distance between points had to be accurately marked, and distances had to be measured along straight line segments with the bearing of the straight line segment recorded. If a change in direction was required, a "turning point" had to be established and the bearing of the next line segment determined. While sounding simple enough, accurate chaining, particularly over long distances and across country, is not easy to accomplish. Interestingly, Sibley used a two-pole chain for the resurvey in 1827. In Sibley's 1827 field survey notes, the distances are recorded as "chains," but they are actually two-pole chains.
27. Bearings are horizontal angles stated in Degrees, Minutes, and Seconds from a north-south line; for example, a bearing of S38°45'10"W would be along a line running at an angle of 38 degrees 45 minutes 10 seconds west of due south. There are 360 degrees in a full circle, 60 minutes in a degree, and 60 seconds in a minute. Bearings were determined using a surveyor's compass. The compass would be set-up at a "turning point" in the survey, and sighted along the next straight-line segment to be chained. The compass would be read to determine the bearing of the line. The compass bearing would have to be corrected for magnetic declination (also called variation), the difference between magnetic north and true north. Magnetic north varies depending on your location on the earth. The compass shown in Figure 4 is a plain compass; however, I believe Brown may well have used a vernier compass. The resurvey notes, which reference and repeat some of the 1825-26 notes, indicate the bearing were usually recorded in whole degrees, with an occasional reading to ½

- or ¼ degree. Great care was required to obtain consistently accurate determinations of bearings.
28. William H. Goetzmann, *Army Exploration in the American West*, New Haven: Yale University Press, 1959, Appendix C, p 451. [Special thanks to Mr. Andre Dumont, *Dumont Maps and Books of the West*, Santa Fe, NM for identifying this reference.]; Also see text of 1"=20mi map prepared by Brown in 1825 after arrival in Taos.
 29. Text of 1"=20mi map prepared by Brown in 1825 after arrival in Taos.
 30. The quote by Archibald Gamble is from K. Gregg, p 228. The 1808 Treaty established the western boundary of the Osage lands as "...beginning at Fort Clark, on the Missouri, five miles [along the Missouri] above Fire Prairie, and running thence a due south course to the river Arkansas..." (*Indian Affairs: Law and Treaties, Vol. II, Treaties*, Compiled and edited by Charles J. Kappler, Washington, Government Printing Office, 1904, "Treaty With the Osage, 1808. --- Nov. 10, 1808/7 Stat., 107./Ratified Apr. 28, 1810"). "Joseph C. Brown, Deputy surveyor, under instruction from William C. Rector, Surveyor General of Missouri and Illinois, surveyed the Osage Indian line of 1808 from Fort Clark to the Arkansas River. He had Archibald Gamble assigned to assist him as an assistant surveyor. Brown and Gamble with John A. Taylor, Rueben M. Hatton, Wm. Hatton, Jahoyda Martin, David Briggs, Andres Hunter, Solomon Wells, Owen Wingfield and Andrew Harrison, as chainmen, markers, pack-horsemen and hunters, at one dollar per day each, commenced the survey at Fort Clark, on the 15th day of August, and reached the Arkansas River October 16, 1816." (John L. Thomas, "Some Historic Lines in Missouri", *Missouri Historical Review*, Vol. 3, No.3, April 1909, pp 216-217). Through the efforts of Dr. Richard (Dick) Elgin, a copy of the 1816 survey of the Osage Line was located. Unfortunately, that survey does not call out the Osage Trace or a local road at what is believed to be the commencement of the survey of the Santa Fe Trail. (Vol. 289, Copy of Field Notes of Deputy Surveyor Joseph C. Brown from his surveys of the Osage Boundary (1816) in the records of the Land Survey Program, Missouri Dept. of Agriculture, Rolla, MO.) "The suggestion that it [Osage Line of 1808] be run and some adjustment made in the difficulties between the Osage, Cherokees and Quapaws was made by [William] Clark, [Ninian] Edwards and August Chouteau in 1816." Further, it was stated that the "... Osage boundary line strikes the [Arkansaw] river at Frog Bayou..." However there is no reference to the line actually being surveyed. (*Before the Indian Claims Commission, The Osage Nation of Indians, Petitioner, v. The United States of America, Defendant*, Docket Nos. 106-106 (Consolidated), Decided Sept 20, 1968, 19 Ind. Cl. Comm 477.) [As an aside, this latter reference is a fascinating history of the Osage Nation, describing location of villages, hunting grounds, population, treaties, cessations, extent of the buffalo, and so forth from time immemorial.] From these references, the 'point of commencement' stated in the text of this report appears to fit the available data.

31. North-south on the Field Book maps is indicated as being parallel to the western boundary of Missouri.
32. Topographic map of Sibley, MO area with the location of the Osage Trace plotted thereon, provided by Mr. James Harlan, Dept. of Geography, University of Missouri at Columbia, August 4, 2011. The Osage Trace and portions of the Santa Fe Trail are shown on the GLO Survey Plat, T50N, R30W, 5th PM dated December 19, 1839. This is a corrected plat, with references of changes made as early as 1818 to the original plat.
33. This comparison is not exactly correct (although nearly so) because of the curvature of the earth and the way the Field Book maps are drawn; nevertheless, it is indicative of the remarkable overall accuracy of the survey.
34. Map is available at: [http://memory.loc.gov/cgi-bin/map_item.pl?data=/home/www/data/gmd/gmd405/g4052/g4052s/ct000190.sid&itemLink=r?ammem/gmd:@field%28NUMBER+@band%28g4052s+ct000190%29%29&title=\[Santa+Fe+route\].&style=gmd&legend](http://memory.loc.gov/cgi-bin/map_item.pl?data=/home/www/data/gmd/gmd405/g4052/g4052s/ct000190.sid&itemLink=r?ammem/gmd:@field%28NUMBER+@band%28g4052s+ct000190%29%29&title=[Santa+Fe+route].&style=gmd&legend) accessed 2015-07-18
35. "...surveyor Brown prepared at least seven maps of the Santa Fe Road, only five of which have been located. The five known maps vary in content and presentation from each other and include the three that accompanied the official report of 1827, a sectional map sent to Commissioner Benjamin Reeves in November 1825 from Taos, and a map drawn by Brown for Sibley after the arrival of the surveying team in Taos, New Mexico, on October 30, 1825. The latter map was Brown's first map of the Santa Fe Road [and] was recently [1975] uncovered in the cartographic collections of the Library of Congress where it had remained unidentified as to purpose or author since its purchase in 1937 from Goodspeed's in Boston.....This map shows the route followed by the commissioners on their outbound journey from Fort Osage which ended with Sibley's arrival in Taos on October 30, 1825...The three manuscript maps submitted with the official report of 1827 show the final route of the Santa Fe Road following Sibley and Brown's resurvey and marking. Preserved in the Cartographic Archive Division of the National Archives, these maps are drawn, respectively, to scales of four miles to an inch, twelve miles to an inch, and four miles to an inch in 32 sections." (John R. Hebert, *Mapping the Road to Santa Fe, 1825-1827*, Terrae Incognitae, The Journal for the History of Discoveries, Vol. 7, No.1, 1975, pp 47-48) Commissioners Benjamin Reeves and Thomas Mather were sent a map of the survey in November 1825. (K. Gregg, p 115) Governor Narbona was sent a map of the survey in January 1826. (K. Gregg, p. 137) The Narbona a map has not been located. Brown discusses the various maps to be included with the Commissioner's report. (See Note 19.)
36. Of particular note is information on the location and character of major streams such as the Rio Colorado, Red River of Natchitoches, Canadian, Arkansas, and Rio Grande del Norte. (K. Gregg, pp 209-210) "The maps and field notes prepared by Joseph Brown became valuable reference sources for future western exploration; the

- Corps of Topographical Engineers' 1844 map of Texas is but one example of its use. As late as 1855, Lt. G. K. Warren of the Army's Corps of Topographical Engineers remarked that Brown's 'maps, though not displaying great skill in topographical representation, were constructed from a survey more elaborate than any subsequent one over the same route. They are, therefore, of much value at the present time.' ” (John R. Hebert, *Mapping the Road to Santa Fe, 1825-1827*, *Terrae Incognitae*, The Journal for the History of Discoveries, Vol. 7, No.1, 1975, pp 50)
37. See <http://www.santafetrail.org/about-us/scholarly-research/sibley-survey/> accessed 2015-07-18.
 38. The State Historical Society of Missouri, The Abiel Leonard Papers, C1013, map, folder 34.
 39. Copy provided by Mr. Craig Crease who obtained his copy from the Newberry Library, Chicago, Ill.
 40. Cartographic Section of the National Archives, RG 77: RDS 25-3.
 41. See http://www.topogs.org/b_abertjj.html accessed 2015-07-18.
 42. See http://www.topogs.org/b_emory.html accessed 2015-07-18.
 43. Cartographic Section of the National Archives, RG 77: RDS 25-1 and RDS 25-2.
 44. Copy provided by Mr. Craig Crease who obtained his copy from the Missouri Historical Society, St. Louis, MO.
 45. Return: A report, list, etc, especially a formal or official report; a set of tabulated statistics (Funk and Wagnall's Standard Desk Dictionary, 1974)