

second to the Smithsonian and deposited collections of his finds there. In his 1871 report he had written,

Let me say that an attempt is being made to gather a very large collection, fully representing the silver ores of the Pacific coast, by large and characteristic specimens, collected in duplicate, and deposited in the national museums of the Smithsonian and West Point. (Wheeler, 1872, p.17)

When in 1880 his survey had been discontinued and he was finishing up the office work, Wheeler wrote that

The collection of rocks, minerals, ores, &c., comprising over 4,000 specimens from various localities in the West, as mentioned in the summarized list in the Annual Report of 1879 as having been forwarded to the Smithsonian Institution, was, at the request of the officer in charge, donated to the museum at West Point, for use and exhibition there. (Wheeler, 1881, p.2495)

Thus in Wheeler's view West Point remained one of the best institutions in the country.

The committee considered, compromised, and kept the status quo arrangement intact. They concluded,

It will appear that each of the three surveying parties has been doing very excellent work for the benefit of the people and appropriate for the particular end it has in view There is abundance of work for the best talents of both the War and Interior Departments in these scientific examinations of the Western Territories for many years to come A generous rivalry will be maintained among the good men therein, and a stimulus will be given to each to do the best work possible ("Surveys West of the Mississippi," 1874, p.16)

But the committee's recommendation also contained a warning for the Army's Engineers. The time was coming to place all the surveys under the Interior Department because of "the limited number of officers of the Engineer Corps, being only about one hundred in all, their general training for military pursuits rather than pursuits in natural sciences" ("Surveys West of the

Mississippi," 1874, p.16) pointed toward the fact that with the need for military construction and harbor work there might not be enough Engineers available for survey work that could be carried on by trained civilian scientists.

RESPONSE TO THE 1874 HEARINGS.

Wheeler emerged from the 1874 Congressional hearings still in charge of his Geographical Surveys West of the One Hundredth Meridian. But he instituted changes in response to some of the criticism directed at his methods during the investigation. He particularly set about reducing the size of his parties and the practice of taking along large Army escorts. He also worked to increase the accuracy of his surveying methods. While neither change is ever directly attributed to the criticism, the timing strongly suggests this reason as Wheeler's motivation.

The earlier parties had been huge processions winding through the Western deserts and mountains. In the 1871 field season the survey was divided into two parties. One had a 50-mule pack train, while the smaller party had only a 40-mule train. This was further amplified by an instrument wagon, 2 instrument carts, 2 odometer vehicles, and riding animals for officers, civilian assistants, and employees. (Wheeler, 1872, p.6) In the 1873 field season, the field party of Lieutenant W.L. Marshall had a total of 42 men. The smaller seventeen man party under Lieutenant R.L. Hoxie had two packers desert with 32 mules, indicating the size of the trains supporting the survey parties. Six of Hoxie's party constituted a military escort, which contributed a large

part of the logistical burden. (Wheeler, 1875, pp.481-483)
 Wheeler's parties sacrificed mobility and flexibility with the large size of the parties during the early years.

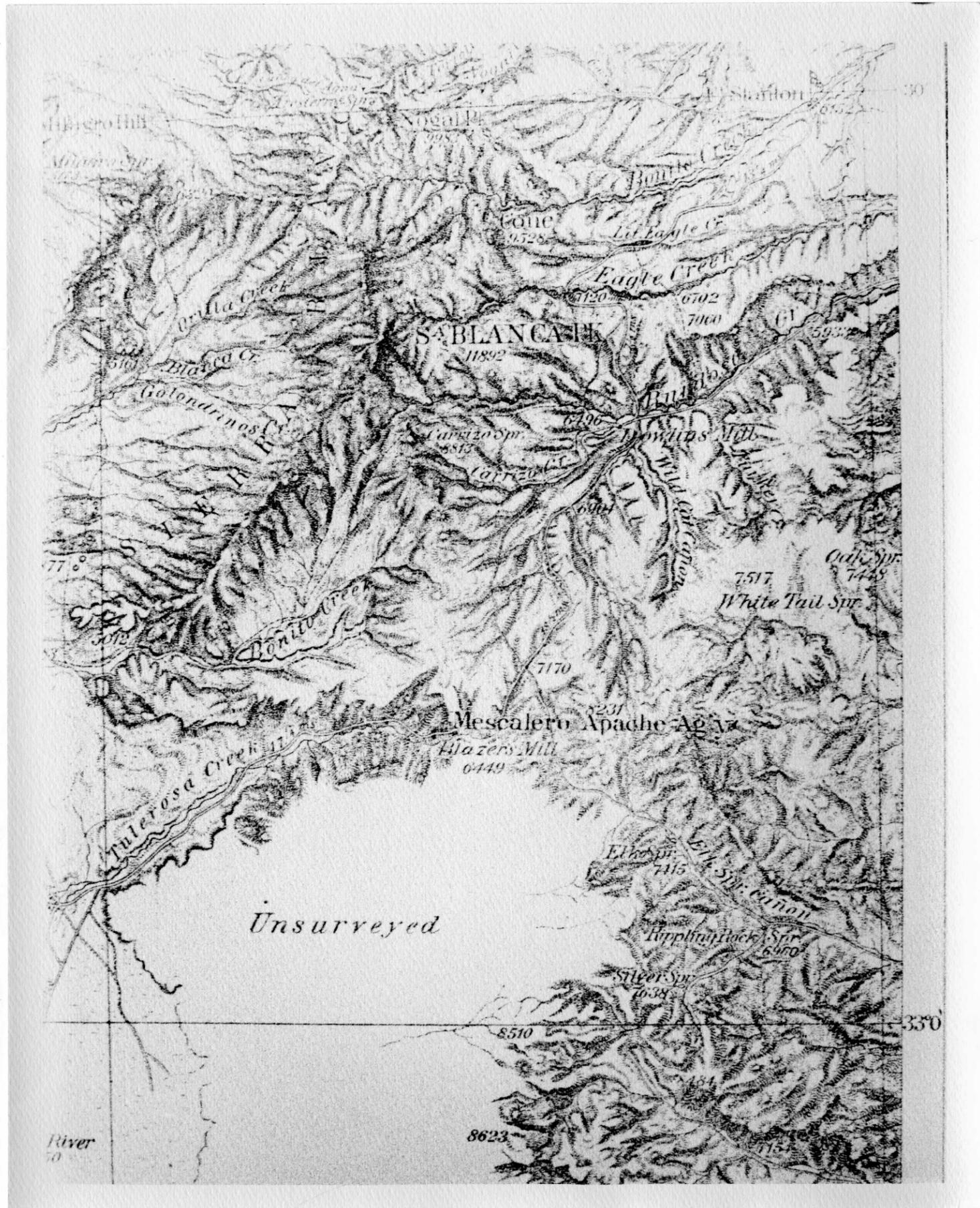
Starting with the 1874 field season which began shortly after the Congressional hearings, Wheeler began to divide his survey into many small sections. The 1874 expedition was comprised on nine parties, six under Army lieutenants, two under acting assistant surgeons, and one under a civilian. (Wheeler, 1876, p.935) The 1875 expedition had at least nine sections, with sub-parties occasionally sent out. With this breakdown Wheeler had for the season 77 officers, assistants, and employees, and 145 riding, pack, and team animals. (Wheeler, 1876, pp.923,941.956) This represented a substantial reduction in the size of the parties that did the actual surveying.

During the 1875 field season New York Times correspondent William Rideing travelled with the Colorado section of Wheeler's survey under Lieutenant Morrison. In that party there was a total of ten men and eight pack mules for baggage. However they were usually still further subdivided into three working parties: the meteorologist and assistant meandering the road or trail and followed by the main party, four packers and a cook; Lieutenant Morrison and the assistant topographer occupying the prominent points for triangulation; and the chief topographer in the high mountain regions. (NY Times, 31 October 1875, p.10) A Times story explained the reason for the small parties.

All experience demonstrates, in fact, the advantage of dividing a surveying expedition into a number of small parties, as Lieut. Wheeler has done with his, and dispensing

Map 2.

This is one of Wheeler's later hachure maps. The enlargement is from a section of map sheet 84. The field work was performed in the field seasons of 1873, 1876, 1877, and 1878. The officers involved were Lieutenants Tillman, Russell, Morrison, Griffin, and Birnie. The civilian topographers were G. Thompson, R.J. Ainsworth, E.J. Sommer, F.O. Maxson, W.G. Walbridge, Louis Nell, and E.D. Gillette. The work on this sheet should be compared with the two sheets shown on Map 1.



with an escort in all cases where military protection is not absolutely necessary. It is proverbial that soldiers are inclined to provoke hostilities with the Indians, who regard their appearance with distrust. (NY Times, 31 October 1875, p.10)

In an earlier report Rideing averred that to maintain the effectiveness of his small party, Lieutenant Morrison had dispensed with the military escort which the forts along their route habitually offered. (NY Times, 9 August 1875, p.2)

Wheeler did have soldiers besides the lieutenants leading parties for that field season of 1875, but apparently did not use them en masse for protection. He had two privates first class from the Engineer Battalion for use as barometer recorders, presumably replacing civilian assistants, and an eight member detail from Company G, 12th Infantry, which he split among the seven parties working in California. (Wheeler, 1876, p.924) Rideing noted that the ten men in Lieutenant Morrison's party in New Mexico in 1875 had only three carbines and six revolvers. (NY Times, 31 October 1875, p.10) So by reducing the use of military escort and protection and by greatly increasing the number of parties sent into the field, Wheeler decreased the size of each party to increase efficiency.

In reports after 1874 or 1875 Wheeler dated an increase in the scientific accuracy of his work from that time. (See Map 2 for one of Wheeler's maps completed after 1874.) Again, the change comes suspiciously soon after the criticism levelled against him in the Congressional hearings. In his report for the fiscal year ending in June 1874, which would have been written during the summer of 1874 after the spring investigation into

consolidation, Wheeler wrote that "The degree of accuracy of the survey was considerably in advance of that in former years." (Wheeler, 1875, p.486) In the 1875 report, ~~writing~~ on the 1874 field season, he again commented on the newly increased accuracy.

The area embraced during the past season has not been so large as in former years. Another step has been made in the direction of a more perfect and refined geodetic survey; and the system once established, the results as to areas mapped in a manner that will require no future change, except in details incident to the development of the country. .. (Wheeler, 1876, p.934)

Writing in 1878 when his survey was again under consolidation pressure, he noted that triangulation methods were first introduced to the survey in 1872, more generally in 1873, and that "In 1874 the work was developed into a completely connected geodetic survey." (Wheeler, 1879, p.1522) Without explicitly acknowledging the criticism he had received, starting in 1874 Wheeler endeavored to increase the accuracy of his survey and stressed this in his publications.

The reports issued to cover the 1874 and 1875 field seasons contained a new feature. Each had, in addition to the annual progress map which showed the geographic extent of the work, a map showing the triangulation of the Colorado section. These maps showing the triangles connecting the main observation points helped to justify Wheeler's claims of increased accuracy and graphically showed the mathematical basis of the work.

RECOGNITION.

Following the lack of appreciation from the American scientific circles in 1874, Wheeler's work received praise from

other quarters in the next few years. In early 1875 the Army and Navy Journal published a translation of a letter from the Prussian chief of staff von Moltke. Wheeler had apparently sent copies of his maps overseas. (In his 1878 report he claimed that the 800 copies of his work allocated to his office for distribution "to prominent libraries and institutions of learning, and learned societies at home and abroad, and to practical workers in the several scientific branches treated" were not adequate for the demand. (Wheeler, 1879, p.1515)) In response von Moltke praised the United States War Department for its mapping efforts. "This is a work of great value. Science will acknowledge its great obligation to the War Department of the United States of North America for undertaking this immense task," read the translation of the Prussian's letter. (Army and Navy Journal, 30 January 1875, p.393)

In December 1875 upon the issue of a volume of Wheeler expedition photographs, the somewhat partial Army and Navy Journal warmly praised the value of the photos as "a real treat to lovers of art. The only word that fitly describes the Cañons of the Colorado is sublimity, and the War Department has conferred a favor on the country by showing us what they actually are." (Army and Navy Journal, 4 December 1875, p.268)

Two years later the Army and Navy Journal reprinted a story from the Mining Record. That periodical reported that it was "glad to hear" that Wheeler's men would prepare a map of the Comstock Lode mining district. They felt that the Corps of Engineers "could not be better employed than in these surveys at

a time of profound peace in our fortunate country." (Army and Navy Journal, 7 July 1877, p.769)

Meanwhile Wheeler was having no trouble finding volunteers to fill out the parties for his expedition. In the report for the fiscal year ending in June 1874 shortly after Congress finished its hearings, Wheeler noted that he had increasing numbers of applications from the young graduates of the scientific schools and from Gentlemen of note. (Wheeler, 1875, p.487) The next summer his Times correspondent commented on the same fact, noting that Wheeler received hundreds of applications each year from young men eager to accompany the expedition, some of whom offered to pay all their own expenses. (NY Times, 19 July 1875, p.1) Yet these young volunteers were not always interested in the scientific and serious work of surveying. In 1876 Rideing described the past season's work for Harper's New Monthly Magazine.

Among the members of the expedition was a young man from one of the Middle States, a fresh graduate of Georgetown College, who was destined for the profession of law . . . His great ambition was to write thrilling letters, depicting the perils of our life, to his friends at home . . . His mania was for abundant discomforts and "hair's-breadth 'scapes". (Rideing, May 1876, p.804)

Wheeler had caught a measure of the public fancy, and his survey was not ostracized. No public uproar demanded the end of Army involvement in Western exploration.

TREATMENT OF INDIANS.

Although Wheeler may have decreased the size of his parties in acknowledgement of the lessened danger from hostile Indians, he did not improve his estimation of the Indian. He seems to have

shared the general Army estimation of the Indian. For instance in his 1869 annual report the same General Ord who first sent Wheeler exploring had written:

Hostile bands of Indians which have, since the country was known, infested Arizona and portions of Nevada. . . . These Arabs of Arizona [the Apache] have heretofore neither given nor asked quarter; their hands have always been bloody, their favorite pursuit killing and plundering, their favorite ornaments the finger and toe nails, the teeth, hair, and small bones of their victims. The few settlers and scattered miners of Arizona were the sheep upon which these wolves habitually preyed . . . therefore I encouraged the troops to capture and root out the Apache by every means, and to hunt them as they would wild animals. (Ord, 1870, p.121)

In 1871 three members of Wheeler's party left the field expedition early. The three included Frederick W. Loring, whom Wheeler had invited along to report for the Eastern press of the exploration. A Harvard graduate, Loring had authored several popular books and was returning to the lecture circuit. The Army and Navy Journal quoted the Prescott (Arizona Territory) Miner in describing Loring.

A writer of rare ability, he has, upon general principles, a pretty clear and ready perception of matters generally. He says that the people of New England have no idea of the actual condition of affairs here, or of the untamable character and insatiable rapacity of the Apache Indian. (Army and Navy Journal, 2 December 1871, p.254)

Unfortunately for Loring and the other survey personnel, the stage in which they were riding was attacked in the Wickenburgh Stage Massacre. The Wheeler survey men were killed, and Indians or outlaws were variously regarded as the perpetrators of the crime. Wheeler, writing months later in his 1872 report, had no reservations concerning the identity of the criminals in

the late Wickenburgh stage massacre, another of the atrocities

committed, so far as circumstantial evidence can determine, at the hands of Indians fed and fostered by our Government upon reservations. (Wheeler, 1872, p.11)

Later in the report Wheeler again discussed the massacre, stating that an investigation had determined that the Indians responsible might even have been receiving government supplies. He also showed some racist sentiment about the Indians, who were "beyond the notion of anything like order." (Wheeler, 1872, p.19) Wheeler added that the moral reliability of the Indians made them of dubious value as guides. "By dint of great perseverance a semi-friendly Indian may be impressed into the service of guiding a party into hostile country, but there is no certainty that he will be true to his trust." (Wheeler, 1872, p.20)

Wheeler's lack of regard for the Indian becomes clear in considering an article from the Army and Navy Journal for October 1872. The article reproduces correspondence from the Boston Advertiser. The correspondent had accompanied Wheeler on a quick trip to Cheyenne to set up an astronomical station. Then he wrote that "I have had the pleasure of opening several Indian mounds and recent Indian graves." (Army and Navy Journal, 26 October 1872, p.171) Ethnology in the name of science seems to have exceeded the boundaries of decency, with Wheeler caring little for the rights of Indians.

The situation did not improve much after the 1874 hearings where Powell had boasted of his own relationship with the Indians and accused Wheeler of stirring up the savages. The Army parties still looked down on the Indian, as evident from the Times report filed from Fort Wingate, New Mexico, on 24 July 1875. The Navajos

were characterized as peaceable, good looking, "an honest tribe as Indians go," but they were also "mendacious, lazy, and filthy in the extreme." (NY Times, 9 August 1875, p.2) The rights of Indians were respected as little in 1874 as in 1872. In the report for the fiscal year ending in 1874, an appendix written by acting assistant surgeon H.C. Yarrow commented on the value of Indian crania obtained at great risk from the Ute burial grounds at Salt Lake during the 1873 field season. (Wheeler, 1875, p.584) While this work took place before the Congressional hearings, Wheeler made no effort to cover up his plundering of recent Indian graves, even after the criticism from Powell.

The subject of the treatment of Indians never became a major issue. Wheeler and his survey reflected the values of the Army and the frontier society in their dealings with the Indians. They lost an opportunity to show an enlightened, humane judgment in treatment of the Indian, but retrospective social judgments must be treated with suspicion and not used to condemn.

USE OF NAMES.

The frontier was closing during the decade Wheeler worked in the West. Powell testified before Congress in April 1874 that "there is now left within the territory of the United States no great unexplored region, and exploring expeditions are no longer needed for general purposes. ("Surveys West of the Mississippi," 1874, p.10) Wheeler had already countered this argument in his 1872 report, admitting the lack of unexplored territory but claiming that many new discoveries would be made.

"Although the day of the path-finder has sensibly ended in this country, still it is to be expected that among the results of an exploration there should be something new." (Wheeler, 1872, p.55)

A story filed for the New York Times from Lake Tahoe in 1876 characterized the diminishment of unexplored territory. Part of Lieutenant Macomb's party had clambered to the top of a mountain peak to set up their instruments for triangulation, and at the top they found inscribed on the rocks names from Calcutta, Hong Kong, Cheyenne, Newcastle-on-Tyne, and Laramie City. This prompted Rideing to lament, "Where, I wonder, can the explorer of to-day find new ground?" (NY Times, 1 October 1876, p.4)

If the ground was not virgin territory, at least Wheeler's hope did come true and his parties discovered much that proved new to science. The same article that carried the lament over the names scratched in the rock on the mountaintop also noted that in the region around Carson City, Wheeler's ornithologist H.W. Henshaw had discovered several new species of fish. The scientific as well as the geographic discoveries gave Wheeler the opportunity to name the new features and creatures. The names given afforded Wheeler the opportunity to repay debts and establish credits with others in influential positions.

During the 1871 field season, Humphreys Peak was discovered or at least named. Located at 35°21' N and 111°41' W and extending 12,633 feet above sea level, the mountain selected by Wheeler to bear the name of the Chief of Engineers proved to be the highest point within what became the state of Arizona. To insure that General Humphreys knew about the new mountain, in his 1872 report

Wheeler concluded a section on the general geography of the West with a romantic paragraph describing the view from Humphreys Peak.

The view from Humphrey's Peak, on the San Francisco Mountains, is along a magnificent and extended horizon to the northeast, east, and southeast, limited by the plateau formation with its mesa bluffs of various colors, on the west by the ranges along the Colorado, and on the south and southwest by the Black Hills and Mazatzal, while in this direction, also, the grand peaks of the White Mountain Range tower in the horizon. At our feet lay the upturned mouths of numerous craters, upon the sides of which, in many cases, heavy timber is growing, undisturbed by those volcanic bursts which, in their efforts to reach an equilibrium, carried high in air that lofty pile upon which we were standing, which served a long time as a vent for those interior fires, and then became forever silent, leaving what we now saw--the bed of an immense extinct crater. (Wheeler, 1872, p.16)

Given his own background in the Topographical Engineers and the flattering reference in the new mountain, General Humphreys approved the design of the young lieutenant and the Engineers continued their support of Western exploration. Humphreys also wound up with two other mountains named after him, one in Yosemite and the other in the Sierra Nevada near Bishop, California.

While Wheeler was naming one mountain for his superior officer, he or someone else was naming mountains for the leader of the Geographical Surveys West of the One Hundredth Meridian. Two separate mountains emerged with the identical name Wheeler Peak. The first is in eastern Nevada, at 38°59' N and 114°19' W, and attains an elevation of 13,061 feet. The other Wheeler Peak lies in northeastern New Mexico at 36°34' N and 105°25' W. At 13,161 feet in height it is the highest point in the state. The Nevada peak was definitely named in honor of George Montague

Wheeler. (Gannett, 1905, p.322) In defense of Wheeler, he may not have been greedy in naming two Wheeler Peaks. Another Wheeler was also involved in the survey, apparently not related to the lieutenant. The 1874 report listed assistant W.D. Wheeler, who ably assisted with general duties in both the field and the office. (Wheeler, 1875, p.488) The following year W.D. Wheeler was listed spending the entire year as "clerical" personnel. (Wheeler, 1876, p.927) This second Wheeler appears to have come from the Lake Survey, another Engineer enterprise under General Comstock and involving the survey of the Great Lakes. Without the discovery of the particular Wheeler for whom each peak is named and the date and author of the name, Wheeler should be presumed innocent of naming mountains for himself twice. But the possibility remains that his vanity actually did name two peaks for himself or allowed subordinates to do so.

Besides the mountain peak, General Humphreys was also honored with the description of a new species of fossil camel bearing his name. Wheeler's vertebrate paleontologist E.D. Cope, in an appendix to the 1875 annual report, described the new camel from the Santa Fe marls, Plianchenia humphresiana gen. et sp. nov. Cope stated the reason for the trivial name.

This species is dedicated to Brigadier-General A.A. Humphreys, Chief of Engineers, U.S. Army, in recognition of the enlightened interest in all departments of scientific investigation exhibited in his long and able administration. (Wheeler, 1876, p.990)

Cope then went on to note that another paleontologist (not named, but Marsh) had traced the evolution of the horse, and he was now himself able to trace the evolution of the camel, which like the

horse^{was} proving to be of American descent.

In the 1878 annual report two of Wheeler's naturalists named a new species of toad for Cope, Bufo copei Yarrow and Henshaw. (Wheeler, 1879, p.1629) Significantly, in the 1878 investigation and report prepared by the National Academy of Sciences, Cope cast the only dissenting vote against the resolution calling for the consolidation of the surveys under civilian leadership.

The 1874 field season Cope spent with Wheeler's party under H.C. Yarrow (one of the toad's describers). In exasperation Cope wrote his father of the experience. "All this comes from the system of orders and regulations which it is customary to issue for the government of parties of engineers, but which are useless for explorers, for unknown objects in new fields." (The survey party was^{not} proceeding in the direction where Cope expected to find the best fossils, so he went to General Gregg, the commander of the regional headquarters at Santa Fe, and had the general change Wheeler's orders. Then in August and September 1874 Cope made his most important scientific discoveries, which should have included Plianchenia humphresiana. (Lanham, 1973, pp.126-127) By 1878 Cope could have forgotten his difficulties with the Engineers, especially with the new toad. He also got along very poorly with the rest of the Eastern scientific establishment, and very likely feared that if Hayden or Powell got the combined survey then he would have no further government support--which actually happened when his arch-rival Marsh got the vertebrate paleontology job with the Geological Survey.

Similarly in one of his atlases Wheeler chose carefully the mountain shown in a legend explaining map symbols. The mountain depicted was named Belknap, coincidentally the same name as the Secretary of War whose name appeared on the title page.

At least Wheeler's names represented an improvement on one reported by Rideing.

It disgusts one to be told on inquiring at the ranch that this noble old rock is called Lover's Leap--a name of such feeble sentiment and extensive application that we wonder when Americans will learn to be sensible in their geographic nomenclature. (NY Times, 5 November 1876, p.4)

In his own geographic nomenclature Wheeler sought to use the names to further the goals of the survey.

EXCHANGE OF LETTERS WITH EMORY.

During the early summer of 1874 the Army and Navy Journal published an exchange of letters which reveals something of the character of Wheeler. The first letter printed was addressed to Wheeler from Colonel and Brevet Major General W.H. Emory, and referred to an article in the 11 May 1874 New York Tribune. That article cited Lieutenant Wheeler as its source of facts, and gave a resume of the the exploration of the West. Emory wrote for

The purpose of calling more pointedly to your notice the singular fact that your resume ignores absolutely and entirely my contributions and labors in that same field, where I passed several years in the most arduous and exposed labors and contributed many hundred fixed astronomical points to the geography of the interior.

Emory, who led surveys for the Corps of Topographical Engineers before the Civil War, expressed his regret to Wheeler that "your study of the records of your own distinguished Corps, or those of

the Topographical Engineers, now the same" had not brought out the results of Emory's work. In the remainder of the letter Emory recounted his own work, and claimed partial credit for the map of the West as then known. (Emory, 1874, p.727)

Wheeler's reply to Emory attempted to placate the older Engineer. The Tribune article was derived from Wheeler's remarks in a casual conversation, which he was unaware would form the basis for an article. Furthermore Wheeler appreciated the contribution of Emory, but

So far, I have not been placed where I could be considered the historian or principle compiler of all geographical work under either the War Department or the Engineer Bureau, and were it to happen, you can rest assured that no one more than myself would gladly take all necessary time and means to discriminate as you suggest. This would in natural justice place a few names in a more prominent position, your own being one of the number. (Army and Navy Journal, 11 July 1874, p.758)

Wheeler can be pictured talking to the Tribune reporter. Young and confident, the lieutenant told the reporter of his work in the American West. Aware of his tradition, he mentioned some of his predecessors from the Army who had also mapped in survey reconnaissance work. Of course Wheeler would have concentrated on his own effort, the value of his survey's contribution and the hardship he and his men had to endure from nature, the elements, and from the ever-present hostile Indian. Perhaps not aware that the article would purport to give a chronicle for the Army work in the Western exploration, Wheeler certainly must have realized that the reporter could be counted on to present another piece of public information. With Loring taken along to write for the magazines and Rideing following a party for two seasons, Wheeler's

appreciated the effects that public relations could have for his survey. Then when Emory wrote taking offense with the article, Wheeler had to become apologetic. He had not known how the reporter would interpret his remarks. Further he was just an explorer, busy with his own work, and had never been tasked to prepare a summary history of all Army exploration in the West. But the ambitious lieutenant would gladly undertake the mission of official historian if ordered to do so. If he did, Wheeler was sure Emory would deserve a prominent place in history, which Wheeler would be happy to document. From this exchange of letters the young Wheeler emerges confident, ambitious, and deferential to superiors.

BETWEEN THE CONGRESSIONAL HEARINGS.

Following the decision of 1874 to retain the competing surveys, the issue smoldered in the background. Annually the subject came up in Congress when the appropriations had to be voted, and both the newspapers and periodicals frequently carried reports from the field.

During the 1875 and 1876 field season Wheeler's expedition was accompanied by a correspondent from the New York Times. The newspaper reports identified him only as "Our Own Correspondent," although the writer must have been William H. Rideing. In 1875 he accompanied the field party of Lieutenant Morrison, who made no mention of either Rideing or a correspondent in his report with its list of personnel. (Wheeler, 1877, p.300) The next year Rideing accompanied the California party under Lieutenant Macomb, and was listed in the annual report as a "general assistant" for

the party. (Wheeler, 1878, p.1278) Rideing also wrote a series of articles for Harper's New Monthly Magazine which generally repeat the content of the Times dispatches and follow the same small parties, pinpointing Rideing as the Times's "own correspondent."

In January 1876 Captain Charles W. Raymond of the Corps of Engineers wrote an article entitled "The National Surveys" for Galaxy magazine. Raymond graduated first in the Military Academy class of 1865, one year earlier than Wheeler graduated. Between 1871 and 1881, Raymond was first Assistant Professor and then Instructor at West Point. In March 1874 he took charge of the United States Expedition to Tasmania to observe the transit of Venus, returning to West Point in August 1875. (Register of Graduates, 1970, p.259)

Responding to an article by J.D. Whitney in the North American Review, Raymond entered the debate over the surveys squarely behind the Engineers. He pointed out that Army efforts were divisible into several categories and must be judged on that basis. The incidental record of a route of march over which a column must pass provided valuable information, but must not be judged by the same critical standards applied to a survey like Wheeler's sent to the field deliberately to explore. Raymond defended the education offered at the Academy.

The instruction at the Academy is more rigorous than at any other institution in the country, and a failure satisfactorily to pass any one of the eight examinations required before graduation (each examination involving several branches) is followed by the dismissal of the student. (Raymond, 1876, p.32)

Further the Corps of Engineers received only the best cadet scholars. An academic board annually reviewed the records and determined the number qualified for commissions in the Corps of Engineers, which generally ran between one and four each year, although none might be selected in a given year.

Then Captain Raymond discussed the training received at West Point which suited the graduates for survey work in the West. In mathematics, the cadet studied algebra, geometry, plain and spherical trigonometry, descriptive geometry, surveying, shades, shadows and perspectives, construction of maps, analytical geometry, and differential and integral calculus. The cadet received considerable instruction in topographical drawing, and studied mineralogy and geology. For the three subject areas identified as most important for the leader of a survey, Captain Raymond listed surveying "sufficient to give the student a good idea of the instruments used and their manipulation," field astronomy with "very frequent work with the sextant, and actual work in a perfectly appointed field observatory," and reconnaissance with "considerable practical instruction in rapid map-making, both mounted and on foot." (Raymond, 1876, p.33)

Raymond saw four reasons that direction of the surveys should be entrusted to the Engineers. First, because of his training and experience the Chief of Engineers could best select personnel and get the best man available. Next the Army could offer better economy and integrity than a civilian survey. Thirdly Army officers would insure honest and trustworthy work. In connection with these two points, Raymond proudly claimed that in over seventy years "no

[Engineer] officer has ever been guilty of dishonesty." (Raymond, 1876, p.38) Finally an Engineer led survey would have no fatal defect, an absolute dependence on one man, but could instead rely upon the entire trained and able officer corps of the Engineers. (Raymond, 1876, p.44)

That same month, January 1876, The Nation commented on the article by Raymond. Many of the points raised by the officer were conceded to be true, but some of the civilian's doubt of the fitness of the military for scientific work emerged.

The corps of engineers constitutes a sort of aristocracy--something entirely abhorrent to the scientific spirit of our times. It is true that its aristocracy is exclusively one of intellect, combined with the highest moral qualities, and therefore possessed of more claims on our consideration than any other aristocracy--one, indeed, of which our nation may well be proud. . . . If in placing the surveys under the Engineer Office, it were well understood to be a purely administrative measure, designed to secure the unity of plan and action so much needed, and to secure the selection of men by those best acquainted with what was to be done, there would, we apprehend, be little objection to it in any disinterested quarter. (The Nation, 6 January 1876, p.9)

But the implication remained clear if not explicit. Support for Engineer control of the surveys should not be forthcoming if the Army intended to attempt more than administrative supervision of civilian scientists.

In 1874 the Army and Navy Journal had noted that

Our readers know that the Government surveys have been yearly delayed by the lateness of the appropriation, and we see one effect of this delay in the fact that the expedition [Wheeler's] was always too late to observe the nesting habits of the birds with thoroughness. (Army and Navy Journal, 21 November 1874, p.233)

Two years later it was late June before an amendment was proposed to perpetuate Wheeler's survey. Parties were unable to begin

leaving for the field until mid-August, severely shortening the time available. However during the course of House debate to restore Wheeler's funds to the appropriations bill, several representatives praised his work. Congressman Banning, chairman of the Committee on Military Affairs, introduced the measure. "This amendment is intended to perpetuate the survey of Lieutenant Wheeler, which has been conducted for several years, and which is one of the best, if not the best, that we have." From Mr. Hamilton of New Jersey came the comment, "This survey of Major[sic] Wheeler is entirely different from the others; it is a geographical survey of the country, and useful as a guide to Army operations and for other purposes." Finally representative Warren stated that "The maps of the Wheeler expedition are the most valuable maps of this country that have ever been prepared." (Congressional Record, 23 June 1876, p.4097)

During 1877 debate over the appropriations for the Hayden and Powell surveys, the overall question of the usefulness of the surveys arose. Wheeler's work was also mentioned, with the same question concerning the value of Western survey work.

Representative Piper of California attacked the surveys.

I will venture to say that there is no gentleman on this floor who can point to one single item of advantage to the people or to the nation that has accrued from these explorations. It is true that they take a great many stereoscopic views which are circulated about this House; in fact I have quite a box of them myself. They are very nice things for young gentlemen to amuse young ladies with.

A defense of the general surveys came from Congressman Lane.

It is from this character of surveys that we are able to ascertain the nature of the soil, the surface, the character of the earth, its altitude, its fitness for cultivation, and

its general geological character. . . . When we know, as we can by this system, the nature and character of the earth, we can intelligently determine that which should be surveyed [in more detail, ultimately for distribution to settlers].

A major criticism of the surveys was their concentration upon scientific investigation rather than practical land surveys for the sale and subdivision of government land. As Representative Elkins testified,

The people I represent are about as interested in the Rocky Mountains as anybody, but what they want is surveys of the public lands, and do not want ornamental and scientific surveys. . . . None but scientific men can understand them; the people on the frontier care nothing about geodetic points, isothermal lines, and the Silurian system; they want homes, farms, and mines, and therefore desire the public domain surveyed.

To counter the argument of immediate results and economy,

Representative Clymer pointed out that

These reports go into the hands of the young and intelligent of this land; they are disseminated through our institutions of learning, and by these means we are educating the men who are to take our places in the future, and who out of this vast territory, this terra incognita of to-day, are to carve thriving and populous commonwealths in the future. (Congressional Record, 21 February 1877, p.1793)

All three surveys received their appropriations for the fiscal year beginning in 1877, but already the future course of events was looming more and more clearly. The general questions of the value of the surveys, added to the specific reservations concerning the adequacy of the Engineers to lead surveys in a modern scientific manner, pointed to difficult times ahead for the Wheeler Survey.

THE 1878-1879 CONSOLIDATION.

Once again in 1878 Congress raised the question of consolidation