

**FRIEDRICH WILHELM VON EGLOFFSTEIN, THE IVES-EXPEDITION TO THE GRAND CANYON (1857-58), AND THE FIRST RELIEF SHADED MAPS OF A PORTION OF THE UNITED STATES**

*DEMARDT I.J.*

*University of Texas at Arlington, ARLINGTON, UNITED STATES*

By the mid of the nineteenth century, when the still young United States of America were about to expand rapidly from the banks of the Mississippi to the Pacific coast, increasing numbers of peasants and tradesmen with their families left from Europe for the New World following a mix of economic pressure and wanderlust. Among the immigrant “class of 1849” was also a German baronet destined to leave a prominent mark on the pioneering cartography of the American West by bringing along well nurtured talents in arts and topography. Friedrich Wilhelm von Egloffstein was born on May 18, 1824 in Altdorf in northern Bavaria. Being educated as engineering officer by the Prussian army, he left his home during the German revolution of 1848-49 to arrive as a bachelor in the United States early in 1849. Here he subsequently participated in several exploration expeditions into the West, served in the Civil War, and attempted a business career with a patented printing method (Krygier 1997; Rowan/Szostalo 2005). By 1852, two years after his arrival from Germany, von Egloffstein was working as a surveyor in St. Louis and published a detailed map of the area around Valley Park, Missouri along the Meramex River to promote the use of the Pacific Railroad (Rowan/Szostalo 2005).

The emerging rapid westward expansion of the political and settlement frontier demanded the formation of the U.S. Army Corps of Topographical Engineers in 1838. Given the huge task of undertaking reconnaissance and producing reliable maps of about the western half of the today so-called lower 48 states of the union this specialist task force was constantly understaffed with never more than 36 officers until its merger with the U.S. Corps of Engineers in 1863 (Reinhartz/Saxon 2005). Until the establishment of the U.S. Geological Survey in 1876 the War Department sent out more than one hundred topographical expeditions to gradually unveil the interior between the Mississippi and the Pacific Coast which coined the era as the “Great Reconnaissance” (Krygier 1997). A typical field mapping party then consisted of two officers and twenty soldiers. They were accompanied by local guides (Indians or mountain men) and hunters to supply daily meat rations. As mission specialist the reconnaissance parties always included all-rounded topographers like von Egloffstein or draftsmen to prepare field maps, terrain sketches, and panoramas. Later expeditions would also include naturalists and artists like the Prussian baronet Heinrich Balduin von Möllhausen.

*Figure 1: H.B. von Möllhausen, F.W. von Egloffstein, J.S. Newberry, and J.C. Ives at a camp site during the Ives- Expedition 1857-58 entertaining themselves with making music (Estate of von Möllhausen Family).*

Von Egloffstein’s first association with the exploration of the American West was the last expedition (1853-54) of the mercurial explorer and statesman John C. Frémont in 1853, a private venture to survey a railroad route along the 37th-38th parallels. Since Frémont never published an account, what little is known about this expedition comes from the pens of personal accounts of some participants like the expedition photographer Solomon Carvalho. According to his notes von Egloffstein joined the expedition in St. Louis as a topographer. Setting out in September 1853, the party attempted a winter crossing of the Rocky Mountains and their duties often kept the photographer and the topographer at the rear end of the column. During the winter, which trapped the expedition by heavy snow, von Egloffstein got ill and was forced to leave the party in February at Patowan in Utah. Accompanied by Carvalho, von Egloffstein made his way to Salt Lake City in early March (Carvalho 1858).

It was here that von Egloffstein met Lieutenant Edward G. Beckwith who instantly signed him up for the Germans first association with the U.S. Army Corps of Topographic Engineers. Beckwith had taken over the expedition from Captain John W. Gunnison who, along with most of his party, was killed by hostile Indians, while carrying an official reconnaissance along the 38th parallel in search for “the most practical and economic route for the railroad” between the Mississippi and the Pacific. Hired to replace the killed topographer, coincidentally another German, von Egloffstein produced the maps of the rest of this strictly linear expedition from Salt Lake City westwards including sketches of the scenery at significant points along the route. For practical reasons Beckwith changed dropped the 38th in favor of following the 41st parallel finding suitable passes relatively straight through the Sierra Nevada into northern California – a

route that the construction of the first transcontinental railroad did eventually follow in 1863-69. In his final report, Lieutenant Beckwith described as von Egloffstein's cartographic aim, that the baronet has "endeavored to give such a character to his topography as to present a distinct representation of the country as it appeared to him when taking his notes in the field" (Beckwith/Gunnison 1856).

Skeleton (light) lines showed information about the countryside obtained by second hand sources. Beckwith goes into some detail to explain how the route was surveyed and mapped. Astronomical observations were periodically made to determine accurate positions. Distances were measured by odometers, and barometric observations were made daily. On the extensive plains where no prominent objects existed, the topographer trailed several miles behind the main party to take accurate bearings on them to determine an accurate course of travel. Back bearings were taken using the smoke and camp-fires left behind. The topography adjacent to the trail was noted with great care and outline sketches along with magnetic bearings were made of prominent locations. In addition on an almost daily basis, von Egloffstein made short side trips, climbing mountains and elevated ridges to obtain accurate views of distant terrain.

After Beckwith's expedition had reached California in 1854, von Egloffstein moved to Washington D.C. where he worked as a topographer for the Pacific Railroad Reports. In 1857, after three years effort, Lieutenant G. K. Warren published his Map of the Territory of the United States from the Mississippi to the Pacific Ocean. The map measured 45 x 42 inches and according to Dennis Reinhartz "represents the earliest comprehensive topographic treatment of the entire West based on field surveys" (Reinhartz/Saxon 2005). Von Egloffstein along with Edward Freyhold did the original inking of the hachures depicting the terrain features. Features of the map included existing and projected roads, military forts, towns, and the hunting grounds of western Indians. While primarily compiled from data of the Pacific Railroad surveys of 1853 to 1855, Warren also included data from more than forty western military surveys dating from the time of the Lewis and Clark Expedition in 1804-06. Areas lacking information were left blank and where the data was questionable, features were depicted with faint lines.

*Figure 2: G. K. Warren: Map of the Territory of the United States from the Mississippi to the Pacific Ocean.*

*Washington D.C. 1857.*

Having earned a reputation of being an excellent topographer and experienced expedition man, von Egloffstein in 1857 was requested by Lieutenant Joseph C. Ives of the U.S. Army Corps of Engineers to join his expedition (1857-58) destined to determine the navigability of the Colorado River and explore in a rather unusual areal instead of linear approach the Colorado Plateau. During this third and final advance of von Egloffstein into the barely known landscapes between the Pacific and the Rockies he met Heinrich Balduin von Möllhausen (1825-1905), a likewise adventurous and gifted Prussian baronet. Von Möllhausen, a multi-faceted personality himself, had been lured first into the West by accompanying Prince Paul of Württemberg, who had been exiled from his homeland, on an almost fatal but artistically fruitful expedition into the Rockies (1851), the U.S. Army Corps of Engineers reconnaissance expedition under Lieutenant Amiel Whipple as topographer and draughtsman along the 35th parallel from Arkansas to California (1853-54). By then Balduin von Möllhausen's reputation as experienced traveller and artist was such that Ives specifically requested the service of this civilian "to ascertain the navigability of the Colorado [River] and investigate the area of the Grand Canyon."

The two German baronets, along with paleobotanist John S. Newberry, departed from New York for California via Panama. The lasting fame of the Ives-Expedition largely rests on the fact that its members were the first Anglo-Americans – and Germans! – to reach by following upstream the Colorado River from its mouth into the Gulf of California the floor of the Grand Canyon (Reinhartz/Saxon 2005). William Goetzman characterized this as "a sublime moment in the history of American exploration" (Goetzman 1959). Lieutenant Ives prepared an extremely detailed report of the expedition. The two greatest derivatives of this report were Newberry's Geology Report and von Egloffstein's shaded relief maps – the first of the American West.

The expedition arrived at the mouth of the Colorado River on November 29, 1857. After assembling the steamboat, the "U.S. Explorer", the expedition began its upstream quest on December 21, 1857, and got as far as the Black Canyon in the vicinity of today's Las Vegas. There on March 6, the boat struck a submerged rock so hard that it threw one man overboard and the others onto the deck. The steamboat was severely damaged but stayed afloat allowing von Egloffstein and the others to save their notes and sketches. Lieutenant Ives correctly concluded that this was the "head of navigation" and the party encamped to await re-supply that was traveling by mule train. After waiting a week the expedition started back down river and linked up with the mule caravan on March 18.

*Figure 3: Heinrich Balduin von Möllhausen: Drawing of the Ives' steamboat U.S. Explorer on the Colorado River, possibly depicting Friedrich Wilhelm von Egloffstein sketching on the casing of the paddlewheel (Huseman 1995).*

Unable to proceed any further with the steamboat Ives then divided his expedition: Half the men were sent back down river with the steamboat while the other half proceeded overland to further explore the river and to find a route to Mormon settlements in Utah. "This group included Ives, Möllhausen, Newberry, Egloffstein, Peacock, a Yuma Indian named Yuckeye, two cooks, two servants, eleven Mexican and Californian arrieros [= mule handlers], and an escort of twenty to twenty-four soldiers commanded by Lieutenant Tipton" (Huseman 1995).

*Figure 4: Sketch map of the route of the Ives Expedition 1857-58 (Krygier 1997).*

Von Egloffstein by no means restricted his role during the overland portion of the expedition to that of a technical support specialist. Rather contrary his unbridled enthusiasm got him into trouble on more than one occasion. At camp 73, five miles south of the Grand Canyon, von Egloffstein was among a small party that ventured forth to explore the canyon. After a thirteen-mile trek to the north, the reconnaissance party was "deeper in the bowels of the earth than [they] had ever been before." The walls and towers that surrounded them were so imposing that they defied description. A stone slab that went from one side of the canyon to the other stopped their progress at this point. Water from a small spring above trickled down the side and over the slab. While the other members of the party discussed a course of action, von Egloffstein laid down by the stream and peered over the side. Below the rock was a decrepit ladder "made of rough sticks bound together with thongs of bark." Wanting to be the first one down, von Egloffstein scampered over the edge and attempted to climb down the ladder. The first rung broke under his weight leaving only one side of the ladder still secure. Von Egloffstein continued his descent hand over hand until near the bottom when it too broke and came crashing down, leaving von Egloffstein cut off on the floor of the canyon. The canyon he was in was ten to fifteen yards wide and fringed with cottonwoods and willows on a narrow belt of bottomland. Here the local Yampai Indians grew corn and had a few scattered huts. Cascades prevented von Egloffstein from going further, but he was able to see where the canyon joined the Colorado River. One of the Yampai indicated that he would return to the camp with von Egloffstein but when he saw the broken ladder he refused to proceed further. To get back up the soldiers removed the slings from their muskets and knotted them together to make a crude line which reached the bottom. No one was sure if this "rope" would support von Egloffstein but given the choice of spending the night with the Yampai or attempting the ascent, he chose the latter. Fastening the strap around his shoulders, he was hauled up by the soldiers (Ives 1861).

*Figure 5: Detail of von Egloffstein's map no. 2 of the Grand Canyon showing Camp 73 and the route of von Egloffstein's excursion into a side canyon (Ives 1861: Map No. 2).*

Von Möllhausen described another incident where von Egloffstein's enthusiasm got the better of him. One day the topographer set out to view the canyon accompanied only by a soldier and an Indian. He selected a difficult route to get on top of one of the bluffs to follow the course of the river farther so that he could make corrections to his draft map. The little party was still out when the sun set and the expedition leader began to worry about the fate of the detachment. Fortunately, the men returned to camp late that night – suffering from thirst, hunger, and sore feet (Huseman 1995).

When it had become obvious that the Grand Canyon would not allow the expedition to cross to the north side and continue towards the Mormon settlements in Utah, Lieutenant Ives on May 1 again divided his party. A selected group that included von Egloffstein accompanied him north towards the Moqui (Hopi) Indian villages while the remainder of the party were sent westward towards Fort Defiance on the modern boundary line of Arizona and New Mexico where Ives would rejoin them. The reason for Ives' detour was the fact that at this time the Hopi pueblos were least known and most isolated Indian villages in the American Southwest. On May 11, the Ives party reached the first of the Hopi Pueblos and was invited into the Mishongnovi Pueblo where von Egloffstein made a detailed sketch of the interior. After spending several days with the Hopi, Ives and his group continued eastward to catch up with the rest of the party in Fort Defiance (Huseman 1995).

*Figure 6: Drawing of the interior of a Hopi hut after a sketch by Friedrich Wilhelm von Egloffstein (Ives 1861).*

When the expedition disbanded in June at Albuquerque, New Mexico, Lieutenant Ives returned to Yuma at the lower reaches of the Colorado River by stage coach while von Egloffstein and the other civilian members of the expedition traveled overland to Fort Leavenworth in Kansas along with their collections, notes, and sketches. The better part of the next two years von Egloffstein worked on getting his surveys,

sketches and scenic views ready to be published with Ives' official Report Upon the Colorado River of the West, which was published as congressional document in 1861. In his report Lieutenant Ives had great praise for von Egloffstein and his mapping techniques, mentioning him in his cover letter and devoting an appendix to his methods of map preparation that he developed for the report. Ives describes von Egloffstein's method of preparing maps as partly new:

"Mr. Egloffstein, the topographer to the expedition, conceived the idea [for the style of his maps] while sketching the naked mountains, barren plains, and immense gorges that characterized some portion of the region explored of endeavoring to give to his map the appearance of a small plaster model of the country, with the light falling upon it at a particular angle. Such a model of a bare and rocky region would strongly resemble nature. This method of representing topography is less conventional than [hachures] and truer to nature. It is an approximation to a bird's eye view, and is intelligible to every eye" (Ives 1861, appendix D).

While it is rather likely that von Egloffstein "conceived the idea" already during the conceptualization of his maps to accompany the Beckwith report it remains a fact, that with the maps in the Ives report von Egloffstein nothing less than introduced a shaded relief, based possibly on early 19th century French "shadow hachures", as a method of landform representation in the United States (Goetzmann 1993; Imhof 1982). Eduard Imhof, the doyen of relief shading, describes the method the "shadow hachures", close to von Egloffstein's approach, whereby "the light is supposed to fall at an oblique angle upon the objects represented; illuminating certain portions, and leaving others in shade." This idea was transformed into the planimetric realm of the map where the thickness of hachures was varied assuming a light-source from the north-west, producing "a three-dimensional impression, reminiscent of obliquely lit terrain models" (Imhof 1982).

The technical process of the map production, already hinting towards von Egloffstein's halftone printing patent of 1865, was amazingly elaborate and elusive. It began with a plaster model of the terrain of the area around the Grand Canyon which von Egloffstein created in his New York. The production, which its inventor tried best to keep secret, then involved a daguerreotype photo, possibly already by photographic emulsion directly on a steel plate, and a half-tone lining to create the impression of a shaded relief. A complex play of tones determined by the width of ruled lines on the plate and exposure time to the etching acid determining the width of the printed lines and the darkness of area color created a unique – and now lost method – of three dimensional imagination on a map sheet. To further the relief effect, Egloffstein engraved hachures, stipples, and crosshatches on the plate. Engraved hachures symbolize the eastern and southern side of mountains; stipples represent the level plateaus and valleys; and crosshatchings give an effect of depth in the canyons on the map (Krygier 1997). Ives summarized the secret process and pointed to a benefit of this method: "The maps have been drawn directly upon the plates, which will obviate the ordinary expense for engraving" (Ives 1861).

*Figure 7: Four sections of Friedrich Wilhelm von Egloffstein's map no. 1: Rio Colorado of the West showing the lower regions along that river in relief shading technique (Ives 1861, Map No. 1).*

*Figure 8: John Strong Newberry's geological colors overprinted on von Egloffstein's relief shaded map of the Grand Canyon (Ives 1861, Geological Map No. 2).*

The further life of Friedrich Wilhelm von Egloffstein was not guided by a lucky star. During the Civil War (1861-65) he joined the 103rd Regiment New York State Volunteer Infantry in November 1861 as a Colonel but was already severely wounded during action on April 13, 1862, in North Carolina. Von Egloffstein was never able to return to the regiment and was stuck with a leg injury that never really healed (Scott 1883). Back in New York he was likewise commercially unfortunate with the innovative halftone printing process. Having watched during his stint with the Frémont-Expedition in the winter 1853-54 the photographer Solomon Carvalho "prepare, expose, and develop his daguerreotype plates" must have planted in the topographer the idea to put photography into use in map making. Later, while drawing the master proofs of the maps for the Ives-Expedition, von Egloffstein got the idea of giving a map the appearance of an aerial view of plaster models that were lit from the side. Finally, after being wounded in the Civil war, von Egloffstein continued working with the Philadelphia engraver Samuel Sartain, who already had ruled von Egloffstein's Ives map, on a map of the Amakirima Island group. Von Egloffstein actually built plaster topographical models of two of the islands and photographed them. From this image he created a dia-positive (positive transparency) and combined it with a fine line screen. He exposed the dia-positive onto a prepared plate that produced an image in graded line. This plate was used to print the image, which looked like a photographic copy of the plaster model. The map was likely published shortly after its completion in 1863, which makes it "the first published intaglio halftone illustration in the United States" (Hanson 1993).

In 1865, von Egloffstein received U.S. Patent 51,103, for his halftone method. To promote his patent, von Egloffstein founded the Heliographic Engraving and Printing Company in 1867. Funded by well-known investors including the banker Solomon P. Chase, the company spent over \$ 150,000 in the first year. The investors “hoped that the process would yield huge returns by being used for bank note engraving” but instead dragged on with a number of religious subjects like “The Lord’s Prayer in Fifty Four Languages” with map insets. The actual production process of von Egloffstein’s halftone printing remains somewhat mysterious. According to Stephen Horgan, an expert on the American halftone process in the 1880s, each of the employees worked in a different room and was involved in only a small part of the process. The workers in “one room were not allowed to enter or know what was done in the next room.” In early advertisement flyers the company drew attention to the heliography process’ ability to deter forgeries, pointing out that “Bank Checks are made counterfeit proof by the process” and the accuracy and low cost of printing. However, the halftone printing never found a market niche and in 1871, the Heliographic Engraving and Printing Company closed its doors. According to Horgan, von Egloffstein’s process was too advanced for his time and his “system disappeared along with practically all knowledge of its technique” (Hanson 1993). Friedrich Wilhelm von Egloffstein died 1885 in New York as a poor and forgotten cartographic pioneer of the American West.

#### **REFERENCES**

- Beckwith, E.G. / Gunnison, John W.: Report of Explorations for a Route for the Pacific Railroad, by Capt. J.W. Gunnison, Topographical Engineers, near the 38th and 39th Parallels of North Latitude. Washington D.C.: War Department, 1856.
- Carvalho, Solomon: Incidents of Travel and Adventure in the Far West with Colonel Fremont’s Last Expedition. New York: Derby and Jackson, 1858 (Reprint, Lincoln: University of Nebraska Press, 2004).
- Goetzman, William H.: Army Exploration in the American West 1803-1863. New Haven: Yale University Press, 1959.
- Goetzman, William H.: Exploration and Empire: The Explorer and the Scientist in the Winning of the American West. Austin: Texas State Historical Association, 1993.
- Hanson, David A.: “Baron Friedrich Wilhelm von Egloffstein: Inventor of the First Commercial Halftone Process in America.” *Printing History*, Vol. 15, Issue 1 (1993). 12-24.
- Huseman, Ben: Wild River, Timeless Canyons: Balduin Möllhausen’s Watercolors of the Colorado. Fort Worth: Amon Carter Museum, 1995.
- Imhof, Eduard: Cartographic Relief Pretentation. Berlin: Walter de Gruyter, 1982.
- Ives, Joseph C.: Report Upon the Colorado River of the West explored in 1857 and 1858 by Lieutenant Joseph C. Ives. Washington: U.S. House of Representatives. Excecutive Document 90, 1861.
- Krygier, J.B.: “Envisioning the American West: Maps, the Representational Barrage of 19th Century Expedition Reports, and the Production of Scientific Knowledge.” *Cartography and GIS*, 24:1 (1997): 27-50.
- Reinhartz, Dennis / Saxon, Gerald (Eds.): Mapping and Empire: Soldier Engineers on the Southwestern Frontier. Austin: University of Texas Press, 2005.
- Rowan, Steven / Szostalo, Maksymilan: “The Baron in West Country: Friedrich W. von Egloffstein in St. Louis, 1850-1853.” *Gateway Magazine*, (Summer, 2005): 21-29.
- Scott, Robert N. (Ed.): The War of the Rebellion: A Compilation of the Official Records of the Union and Confederate Armies. Series 1, Volume 9. Washington: Government Printing Office, 1883.