THE REVOLUTIONARY CARTOGRAPHY OF HAL SHELTON

Shaded relief, natural colour, and ski area mapping

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In 1952 Richard Edes Harrison (1901–1994), one of the twentieth century’s most renowned cartographers, described the work of artist and mapmaker Hal Shelton as ‘magnificent in execution and conception.’

Forty-five years later, in 1997, Hal Shelton (1916–2004) was honoured by the Geography and Map Division at the Library of Congress as one of ‘the four greatest living American mapmakers’ along with Harrison, Arthur Robinson (1915–2004) and Mario Tharp (1920–2006). \(^1\)

I had admired Shelton’s maps for years and had added several to my collection, so I was excited to attend this special event. After the programme, a small dinner was held for the honorees at which I was seated next to Hal and his wife. Among the crowd of cartographers, we happened to live only twenty miles apart in Colorado and struck up a friendship.

As I had researched Hal’s cartographic work, including having made several visits to his home in the town of Golden, just on the edge of the Rocky Mountains, it became clear why the Library of Congress was so keen to honour him. Shelton had done groundbreaking work in three different genres of cartography: shaded relief, natural colour, and ski area maps. This paper describes his career and the different types of maps he produced.

After earning a degree in scientific illustration from Pomona College in California, and unable to find a job as an artist during the Great Depression, in 1938 Shelton obtained a position as a surveyor with the United States Geological Survey (USGS). Although he spent most of his time creating maps in the field and at the drafting table, his artistic talents were soon discovered, and he was assigned to several special art projects for the USGS including a painting (Fig. 1) which still hangs in the regional office in California.

Shaded relief maps

Mapmakers who create shaded relief maps use special printing techniques and occasionally add colour to emphasize mountain slopes to create ‘the effect of the third dimension for the map and rendering its larger features more understandable.’ \(^2\) The technique is most successful for mapping mountainous areas where the terrain has considerable altitude differences. The idea for using shading to indicate slopes had been around since the 1800s; however, putting it into practice proved difficult. Baron Friedrich Wilhelm von Egloffstein (1824–1885), a brilliant German-trained cartographer working for the United States Army

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\(^1\) In 1997, the Library of Congress honored the four greatest living American cartographers: Richard Edes Harrison, Arthur Robinson, Hal Shelton, and Mario Tharp.

\(^2\) Egloffstein’s technique involved using shading to create a sense of depth and dimension on maps.
Corps of Topographical Engineers was a forerunner of the technique. He accompanied 1st Lieutenant Joseph Christmas Ives on his 1857-58 expedition to explore the Colorado River and Grand Canyon area and produced a striking shaded relief map of the Grand Canyon. It was published in 1861 (Fig. 2). To demonstrate differences in altitude Eglolfstein developed a technique to show topographic features from an oblique angle by illuminating one side and leaving the other dark. This was accomplished using a time-consuming process of etching extremely fine parallel lines (impossible to see with the naked eye) on the printing plate which created different intensities of grey rather than the traditional black ink on white paper. This approach had never been done, at least not by mapmakers in the United States. But it was prohibitively expensive and Eglolfstein used the technique only once for a map of expeditions and surveys of New Mexico and Utah. Early in the twentieth century, the US Secretary of the Interior requested a more artistic technique be employed for a special map series of the western national parks. John Remakshere (1852-1894), inspector of maps and accomplished watercolourist, adapted existing topographic maps of the area by replacing the contour lines with gradations of colour to indicate relief. In 1913 the USGS began publishing Remakshere's maps which included Crater Lake (1913), Yosemite (1914), Glacier (1915), and Yellowstone (1916) along with one or two a year thereafter. The practice was discontinued in 1928 when it too was deemed too expensive (Fig. 3). In Europe, Eduard Imhof (1895-1904), Professor of Cartography at the Swiss Federal Institute of Technology, began developing these techniques in the 1930s; but in the United States, shaded relief maps were no longer produced. And this is where Hal Shelton comes into the story. How did Shelton get the idea for shaded relief maps? He described the momentous event to me: In the early 1940s, after preparing a draft quadrangle map in a remote part of Nevada, he went into town to ask the locals for the names of the various geographic features in their area. As was standard for USGS, the map he had created
used contour lines to illustrate the topography. When
he asked residents to tell him the name of a mountain
he had pointed to on the map, they did not recognize
the narrowing lines as a mountain because they did
not understand contour lines. However, when Hal
pulled out a pencil and started shading in the
mountain’s features, the group immediately declared,
“Oh, that’s Deer Mountain”. The experience
prompted him to urge USGS senior management in
Washington to create a new kind of map that could
be easily understood by the average user. His request
benefitted from recent events. During World War II,
the War Department had made some shaded relief
maps for a few key military objectives. These proved
very popular with the troops, so it was agreed to try
and produce similar maps for civilian use. Hal was
assigned to start the project in 1946.

It is no surprise that for one of his earliest efforts he
drew the dramatic landscape of the Prince William
Sound in Alaska. Its spectacular topography is noted
for its mountains which tower to elevations of over
1,524 m (5,000 ft) and plunge to sea level in less
than 3 km (2 miles) and glaciers that scour valleys
in their slow descent to the sea (Fig. 4). ‘Valdez and
Vicinity’ was published in 1948. It is based on a
traditional 1930s 1:62,500 scale topographical map
with standard contours at 15 m (50 ft) intervals.
Figures 5a and 5b are details taken from Shelton’s
1948 map and from the 1930 map. Most observers
find that Shelton’s map better illustrates the dramatic
topography even though some technical information
is lost. For the untrained eye the technique produces
a map that is much easier to understand.

Shelton was immensely proud of this map and kept
it as a trophy for decades. Near the end of his life he
signed the map and gave it to his close friend and
colleague at the USGS, Lynn Yehle (1929–2019), a
specialist in glaciology who worked in the Denver
office.

Although the expense of printing shaded relief
maps was only marginally more than printing
traditional USGS maps, the cost of creating them was
high. The techniques Shelton used at the time
required months of work to produce a single map. Of
the thousands of USGS quadrangle maps published
using contour lines, only a very few were prepared
using this elaborate method. For example, of the
hundreds of individual USGS produced topographical
map sheets of Colorado, only four employed shaded
relief. In addition to one map of the entire state
(1957), the other quadrangles were of the Rocky
Mountain National Park (1963), Pikes Peak and
Vicinity (1946), and Denver Mountain Area (1948).
The costly technique was reserved for those
mountainous landscapes which made the best use of
shaded relief.

As noted earlier, Shelton was not the first to use
shaded relief, but he deserves credit for refining the
technique and restarting the USGS shaded relief
mapping programme. It would continue beyond his
leadership, producing about ten such maps per year.
As a result of greatly improved production processes,
they were still being made by the USGS into the
twenty-first century.
Natural colour maps

A few years after establishing the shaded relief operation Shelton started experimenting with classical landscape painting techniques in an attempt to represent the land in its natural colour. He tried various media and found that zinc plates were the most successful. After the painting of the terrain was complete, the publisher added features such as roads and toponyms in black or coloured ink (Fig. 6b). With special maps in mind Shelton proposed this new painting approach to the USGS management in Washington, but it was rejected. He resigned in 1949.

After a chance meeting with Denver-based pioneer pilot and aviation map and chart publisher Captain Elrey B. Jeppesen (nickname Jepp), Hal joined Jeppesen & Co. Jeppesen knew that aviators needed to better understand the apparently flat terrain and invited Shelton to the firm’s commercial art studio. Shelton recounted his visit, “There were two or three artists trying to make a map. Jepp said he wanted passengers to enjoy their flight and part of that was to be able to recognise the terrain they were flying over; the artists were attempting to do that.” After the two men left the building, Jepp asked Shelton what he thought about the illustrators’ work. He replied, “They are very good commercial artists, but they are not equipped to do this particular thing.” Jepp then asked Shelton if he would produce a few sample drawings.

Fig. 6a and 6b: The top image is a detail of a natural colour relief map of Colorado (1948) painted by Hal Shelton. The lower image is a detail of the same geographical area showing the additions of toponyms made by the publisher The H. M. Gough Company to Shelton’s painted landscape. Original proof in author’s collection.

Fig. 7 Hal Shelton, natural colour relief map of North America, c. 1948. 79 x 60 cm (31 x 24 in). Signed by Shelton. Author’s collection.
— strip charts — of the route between Denver and the West Coast that realistically depicted the hills, rivers, forests, mountains, highways and cities as they would look from the air. Shelton agreed and captured Jepp’s brief perfectly.\(^7\)

Unlike Imhof, who used colour to emphasise elevation differences, Shelton felt that whatever existed on the ground mattered as much as its altitude and [therefore he] adjusted the colour of the terrain to reflect the nature of the surface.\(^7\) He used various shades of green for vegetation and brown for drier landscapes (Fig. 7). To make natural colour maps, Shelton etched faint guidelines of the topography on zinc plates which he overpainted with acrylic paint using an airbrush and very fine paint brushes (Nos 00 and 000).\(^7\) Using this technique was extraordinarily time-consuming. Writing about the Jeppesen Company, Art\& magazine (April 1960) noted, ‘A skilled artist, faced with the job of getting mountains, rivers and highways shaded exactly right, does well if he completes one square inch per hour. Original artwork on the map of California took 1,500 man-hours\(^76\) (Fig. 8).

Recognising in Hal Shelton an artist with an exceptional sense of terrain, cartographic skills and strong artistic talent, Captain Jepp showed his work to the president of United Airlines who thought Shelton’s maps were far better than those publisher Rand McNally were supplying, and he gave Jeppesen an order. The technique took off. Airlines clamoured to buy Shelton’s painted landscapes. From there they could print their own route maps. According to aviation map historian Ralph Ehrenberg, Shelton and Jeppesen dominated the American airline market for nearly three decades with about twenty airlines under contract.\(^7\) Rand McNally and arch competitor, The H. M. Geisha Company, were soon engaging the Jeppesen Company to have Hal produce natural colour topographic paintings for maps to be used in their atlases and for general non-aviation purposes.

Tom Patterson and Nathaniel Kelso point out that ‘although before the advent of satellites, the Jeppesen series proved so detailed and realistic that the National Aeronautics and Space Administration (NASA) used them to index photographs of the earth taken on early space missions’.\(^7\)

Ski area maps

Although skiing gained some popularity during the 1930s (particularly in the eastern United States with Ivy League college kids), in the West, its roots were deep. In the late 1800s, in the high mining towns of Colorado and California, skiing was essential mountain transportation. The sport became modestly popular at dozens of minor ski hills during the 1930s. My father described using a make-shift rope tow hoked up to an automobile during this decade to ski the Berthoud Pass in Colorado.

World War II profoundly changed the sport when the military decided to create a unique force for combat in winter in harsh terrain – the 10th Mountain Division, based at Camp Hale in the central Colorado Rockies at 2,834 m (9,000 ft). The Army’s only mountain division saw brief but brilliant action in Italy in the spring of 1945. After the War, the Division was deactivated, releasing thousands of ambitious young men who, with their training and love for the mountains, created new ski areas across the country and launched the industry. Early resorts like Aspen, Colorado and Mammoth Mountain in California, joined Sun Valley, Idaho, America’s first destination ski area which had been created in 1936. From the late 1940s to the early 1960s, dozens of ski areas were established across the country.

An early example painted by Shelton in about 1963 is the Alta Ski area in Utah. (Fig. 9). Founded in 1938, Alta was one of the earliest ski areas in western United States. Only 45 minutes from Salt Lake City and located on the eastern flank of the Wasatch Mountains, Alta collects massive volumes of snow at the eastward flowing moisture hit the uplifting mountains. If we look closely at Shelton’s image, we can see that he painted every tree and used shadows to give the sense of slope. Ski runs on multiple aspects of the mountain were artistically situated so the skier could understand their connection in one glance. The stunning display was depicted under a blue sky with wispy white clouds.

In 1960 one of the Jeppesen natural colour images of Colorado painted by Shelton was adapted for use by Continental Airlines to show its routes to the major ski destinations. But Colorado Ski Country

*Fig. 9 Hal Shelton, ‘Alta [Ski Area] Utah’, c. 1963. 60 x 58 cm (23 3/4 x 23 in). Author’s collection.*
USA, the industry's trade association, needed something more appealing that would feature each of its members. Shelton, who always engaged in freelance work apart from Jeppesen, was commissioned to paint a large panoramic map highlighting each of its member ski areas. But how to highlight such a vast area spread over hundreds of miles and numerous mountain ranges? Studying dozens of USGS topographic maps, Shelton converted this information into a bird's-eye view image that was instantly applauded by the industry (Fig. 10). Colorado Ski Country USA used Shelton's painting for large posters which were distributed throughout the country. It was printed repeatedly in various magazines and displayed in bars as large, framed posters by the Coors Beer Company. Ralph Ehrenberg hung a print of it in his office while he was serving as Chief of the Geography and Map Division of the Library of Congress.

Shelton's mountainscape are reminiscent of the famous and beautiful panoramas of the Alps created by Austrian cartographer and artist Heinrich C. Berann (1935–1999). Shelton knew of Berann's work but chose a different color palette and style. Panoramic views of large areas were necessary to promote the ski industry and to attract tourists to take ski vacations. They appeared in trade magazines and airline advertisements as well. What Berann did for the European ski industry, Shelton did for the North American.

Although maps showing hiking trails had been published since the late 1800s, only a few ski-route maps had made their way into print by the early 1900s in Europe. In the United States, maps of ski runs were first painted on large wooden signs located around the ski area as guides. As resorts became larger and more complex, the idea of small, cheap and disposable trail maps was developed. But how best to depict a complex multifaceted mountain topography, with various slopes, ridges, bowls, valleys, and ski runs all observed from one viewpoint? Shelton, with his feel for mountain terrain, demonstrated his expertise in painting this topography; and as a resident of Colorado, a cradle of the industry, he received some early commissions to try his hand at painting close-up images of mountains with gaps where the ski runs
Fig. 11 Hal Shelton, detail from the poster for the Vail Ski Area, Colorado. Published by Colorado Ski Country USA, c. 1965. 73 x 51 in (3 x 20 in). Author’s collection.

could be superimposed. This was a task in which he excelled, and by the early 1960s, Shelton became the first ski area artist in the country.

His paintings were used not only for trail maps but also for promotional posters and keepsakes such as a 1965 poster of the Vail Ski area in Colorado (Fig. 11).

Vail opened in late 1962. It had been founded by Pete Seibert, veteran of the 10th Mountain Division, who started work in the Red Gillies Aspen Ski area in 1946. His partner was Earl Eaton, an amateur prospector whose adventures through the mountains led him to discover Vail’s ideal location. They brought in one hundred initial investors. Each received a very generous deal: $10,000 not only bought an equity interest but the right to buy a lot at the base of the ski hills for $350 plus four lifetime ski passes. At the time the lot was exercised in 1986, it sold for $675,000! Shelton also got a lifetime ski pass in addition to cash for his artwork.

As the young industry exploded in popularity owners and operators of other ski areas who admired Shelton’s work ordered his paintings. The owner of the ski area would commission a painting, to which, on completion, they would add symbols for chairlifts and trail names. As owners of the rights to the artwork, they would make changes to the map to reflect developments in their area.

Shelton’s maps were produced for ski areas around the country including Jackson Hole, Aspen, Mammoth Mountain, Winter Park, Sun Valley, and Purgatory. Having produced scores of paintings in the 1960s and 1970s, he eventually passed the torch on to other artists: the first was Bill Brown, who was followed by James Niehues, and most recently by Kevin Masten, all of them had worked in Colorado. According to Niehues, “Hal was such a good artist... One thing that really stayed with me from Hal: he said paint the trees and shadows as if you were down skiing [amongst them] paint the colors [as if you were] on the ground, not as if you were in the plane.”

Conclusion

Shelton will be remembered for his impressive contribution to mapmaking. He made maps for the USGS in the late 1950s and 1960s where he led the department in the creation of shaded relief maps. From the 1950s through the 1970s, he worked with the Jeppesen Company (later owned by Times Mirror Company), where he painted natural colour maps. These were used for flight crews, airline flight guides, skiers and individual wall maps for the general public, and even NASA investigations. They were licensed to numerous airlines, The H.M. Goulda Company and R and McNally & Co. During the 1960s and 1970s he freelanced as an artist making ski area maps for dozens of resorts. In addition, throughout his career and especially during his retirement, he was engaged as a fine art painter. Many of his landscapes won awards including Study of Erosion—Narruah Creek which won Best of Show in a regional art exhibition.

During his tenure as Chief of the Geography and Map Division of the Library of Congress, Ralph Ehrenberg became a serious fan of Shelton and his work. He understood his considerable contribution to cartography and ensured that Hal was recognized at the 1997 conference – Four Greatest Living American Mapmakers. The Division’s association with Shelton began in 1985 when it was donated 32 of Shelton’s original acrylic-painted zinc plates by the Times Mirror Company (which had acquired the Jepperson Company in 1961) and its subsidiary The H.M. Goulda Co. Other related items have been added, including Shelton’s Campylanes, a painted triptych of Millard Canyon, Utah.

Hal Shelton brought artistic talent, a keen sense of terrain, sophisticated cartographic understanding, and an inventive spirit to the business of mapmaking that has enriched the field. He had enormous feeling for the land and stated that a successful map allowed a person to “smell the mountain and hear the wind.” His ability in painting the earth’s topography with the detail and realism of a satellite image requires our continued admiration.

Notes

1 Thank you to Professor Susan Shelton for bringing to my attention this correspondence from Richard Ehrin Harrison to renowned cartographer Brown Russ following a 1972 conference on surveying and mapping. (Richard Ehrin Harrison Collection, General Correspondence, Box 14, 2 August 1982, letter from Harrison to Brown, Map and Geography Division, Library of Congress).

2 Map Division of the Library of Congress centennial celebration held 28 and 29 November 1997 in the Library’s Jefferson Building in Washington, DC.


4 The other maps is titled ‘Map of Exploration and Surveying in New Mexico and Utah made under the direction of the Secretary of War by Capt. JHN Macomb Topi, Engrs. assisted by C.H. Dinnick, C. Engrs.’ Ehrin Harrison produced this map in 1981 and it was finally published in 1990. The Cool War delayed the publication for fifteen years. This data had a benefit to the striking chorographic of the plates would not have been possible in 1843. For Ehrin Harrison see J. Ehrin Harrison, ‘Robert Wilcox von Sigeloff, The two-expedition to the Grand Canyon (1987-93), and the first shaded relief maps of portions of the United States. [https://lacsic.org/documents/COPRODJFCOM/jc010005.pdf](https://lacsic.org/documents/COPRODJFCOM/jc010005.pdf).

5 Evans and Frey, p. 79.

6 A quadrangle map covers a rectangular area in a specific scale to a specified number of degrees of longitude and latitude. A contour USGS Survey map quadrangle covers 7.5 degrees of longitude and 7.5 degrees of latitude.


10 Huth, p. 15.


14 Patterson and Kelso, p. 4.

15 Drake, p. 12.


18 Patterson and Kelso, p. 4.

Wes Brown has been a collector of old maps for forty years with special interest in the exploration and settlement of the West and Colorado from the sixteenth century to the twentieth. A Denver resident, he co-founded the Rocky Mountain Map Society in 1991, has served as the Co-Chairman of the National Map and Geography Society of the Library of Congress and is currently the International Chairman of IMCOS, responsible for organizing the annual international symposiums. He is a frequent speaker at map and history conferences and has published many papers on maps. Wes fell in love with maps at age sixteen when using US Geological Survey maps for climbing mountains.