Metallogr. Microstruct. Anal. (2012) 1:190–192
DOI 10.1007/s13632-012-0032-x

FEATURE

The Cast Aluminum Cap on the Washington Monument

An ASM Historical Landmark

If certain suggestions had been accepted, the builders of the Washington Monument might have placed a statue of President George Washington on top, or perhaps an open-sided house with his statue seated inside. Instead, a simple cap made of a strong, light, corrosion-resistant, and very rare metal—aluminum—was chosen to complete the monument.

The cap, the largest aluminum casting of its time, was named a Historical Landmark of ASM International during ceremonies at the monument on November 15, 1984. A plaque and a replica of the cap were presented to the Washington National Monument Society and National Park Service, who have the responsibility for the perpetual care of the monument (Figs. 1–2).

In 1969, the ASM Historical Landmarks Designation was established to identify permanently the many sites and events that have played a prominent part in the discovery, development, and growth of metals and metalworking. The designation also increases public awareness of pioneering milestones of metalworking. There are now 130 landmarks so designated throughout the world.

The award citation for the Cast Aluminum Cap reads, "The Cap, installed on 6 December 1884, was the largest aluminum casting of its time. It weighs 100 oz and measures 5.6 inches at the base and is 8.9 inches high. It provided tangible demonstration of the value of this previously 'rare' metal as a useful engineering material" (Fig. 3).

In 1884, aluminum cost $1.10/oz. It was chosen as a metal that would not tarnish and would match the color of the Washington Monument.

Origins of the Monument

The original idea for the memorial to President Washington belonged to Pierre Charles L'Enfant, the designer of the capital city. He proposed an equestrian statue of the president standing at a point where a line from the back door of the White House would cross a line down the mall from the center of the Capitol.

"However, the monument was placed in its present location because L'Enfant's site would have put the monument in the middle of a swamp," explained Allan Ray Putnam, then ASM senior managing director.

President Washington died in 1799, but it was not until 1833 that a group of private citizens formed a society to raise funds and conduct a design competition. Robert Mills, an architect from South Carolina, proposed the winning design, an obelisk, and construction began in 1848. Funding difficulties hampered its progress, however, until Congress in 1876 allocated public funds to finish construction (Fig. 4).

"It was on December 6, 1884, that the final piece, a solid aluminum capstone, was placed on top of the monument, which has become known as one of the most eloquent architectural statements in the world," Putnam said.

This completed what was then the world's tallest building. The engineers knew it would not be easy to visit that peak again, and they wanted an apex that would need little maintenance, one that would withstand the weather and the inevitable bolts of lightning without disintegrating and without discoloring the white marble below.

"The cap itself is rather small—a pyramid only nine inches high, about six inches wide at its base, and weighing every bit of six pounds," said Dr. M. Brian Ives, ASM President 1985. "However, it is the cap's significance that makes it worthy of Historical Landmark status."

In the nineteenth century, aluminum was a very light, bright, untarnishing, and very rare metal, he explained. It was rare in spite of the fact that about 8% of the earth's crust is aluminum—earth's most abundant metal. "It may

Fig. 1 The Cast Aluminum Cap on the Washington Monument, the largest aluminum casting of its time, was named an ASM Historical Landmark on November 15, 1984. Participating in the ceremony were (from *left*) Mr. Arnold Goldstein, assistant superintendent, National Parks Central; Mr. Russell E. Train, first executive vice president, Washington National Monument Society; Dr. M. Brian Ives, 1985 ASM president; Mr. Frank P. Jones, Jr., vice president government relations, ALCOA; Mr. Allan Ray Putman, then ASM senior managing director; and Dr. Charles Gilmore, George Washington University, then ASM Washington Chapter chair

Fig. 2 In recognition of the ASM Historical Landmark Designation of the Cast Aluminum Cap that tops the Washington Monument, George Binczewski (*left*), Kaiser Aluminum Company, in 1986 presented a replica of the Cap to 1986 ASM President John Pridgeon (*center*) and Edward L. Langer (*right*), then ASM Managing Director

be found in a wide variety of minerals and compounds, from bauxite, our most important commercial source, to corundum, which at worst is used as an abrasive and at best as rubies and sapphires," he said.

The problem is that for all its abundance, aluminum is an elusive metal. Its chemical bond to other elements—oxygen, for example—is so strong that it is difficult to isolate. During the 1820s, small quantities of aluminum were first isolated in laboratories, but the resulting metal was of dubious purity and very expensive—about $90 per pound. Aluminum was as rare as silver, but not nearly as coveted.

By 1854, a Frenchman, Henri Saint-Claire Deville, succeeded in producing a fairly large amount of reasonably

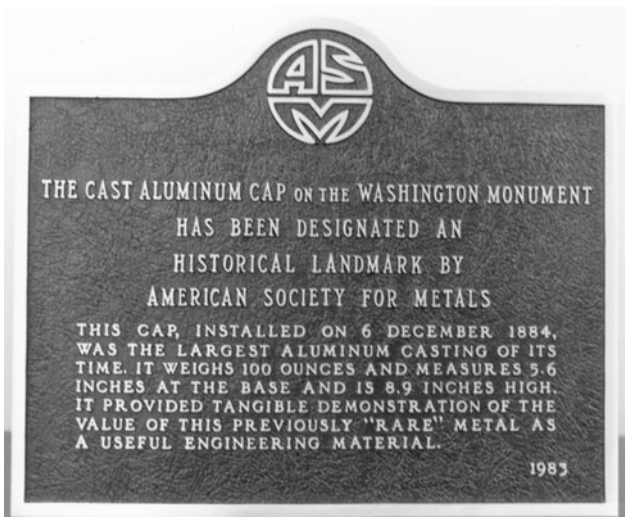

Fig. 3 Historical Landmark Designation plaque for the Cast Aluminum Cap on the Washington Monument

pure aluminum using an elaborate but still imprecise method of reduction. At the Paris Exposition in 1855, bars of aluminum were exhibited as a precious metal. Emperor Napoleon III hoped to use aluminum for lightweight armor, and commissioned Deville to continue his research with the aim of reducing the cost of aluminum. Deville managed to improve his process and within 2 years brought the price of aluminum down from $90 to $27 a pound, but he complained that it still cost more than silver. The cost of aluminum production fell to $20 per pound by the end of the Civil War, and then to $9 per pound by 1872—a more reasonable price, but still too expensive to compete with other industrial metals.

"So when the Washington Monument's capstone was cast, it was quite an achievement," said Ives. An enterprising chemist and metallurgist named William Frishmuth did the work at his shop in Philadelphia. Using the best available method—metallic sodium reduction—he produced the first large aluminum casting in the United States, and the largest in the world at that time. It was a symbol of the beginnings of the aluminum industry.

"He did an excellent job," said Ives. "Aluminum was a perfect choice for the top of the monument—it was a good lightening protector, it was strong, it wouldn't tarnish, it resembled the color of the monument's marble, and it was rare. It was also symbolic, for it would represent the very beginnings of the American aluminum industry."

At the time of its installation, the Cap was the largest piece of aluminum in existence. Made of South Carolina corundum, the apex was an all-American product. Although not quite up to modern standards of purity, the aluminum was about as pure as the production methods of 1884 could make it: 97.75% aluminum, plus two common impurities—1.70% iron, and 0.66% silicon, according to

Fig. 4 The Washington Monument

Joseph W. Richards in *Aluminum: Its History, Occurrence, Properties, Metallurgy and Applications, Including Its Alloys* (Henry Carey Baird & Co., Philadelphia, 1887).

Colonel Frishmuth's Foundry in Philadelphia was designated an ASM Historical Landmark in 1985 as "Site of the first commercial aluminum reduction facility in the United States and the only producer of aluminum from its ore until the late 1880s."

Prior to its installation, the Cap was on display at Tiffany's jewelry store in New York. It was reported that viewers of the display asked to step over it so they could later say they jumped over the top of the Washington Monument.

On December 6, 1884, the day the cap was placed upon the monument, a chemistry student at Oberlin College in Ohio, Charles Martin Hall, turned 21 years of age. Two years later, working in a woodshed laboratory, Hall devised a low-cost method of aluminum reduction, and by 1888 he, with several Pittsburgh industrialists, formed the Pittsburgh Reduction Company. "We know that company today as the Aluminum Company of America—ALCOA," said Ives.

The Pittsburgh Works of the Pittsburgh Reduction Company was named an ASM Historical Landmark in 1979. The citation reads, "Charles Martin Hall invented the first economical process for the extraction of aluminum and in December 1888, the process was first commercialized."

ALCOA, as a part of the Cast Aluminum Cap Historical Landmark designation, contributed to the National Park Service a replica of the aluminum capstone. ALCOA cast this duplicate, which is exact to the weight, dimensions, and engravings upon the original at its research and development laboratories in 1934. This was during the 50th anniversary of the monument's dedication and capping and on the occasion of the first general reconditioning of the shaft and initial inspection of the cap.

In providing tangible demonstration of the value of aluminum as a useful engineering material, the cap also proved to be a harbinger of things to come. "While it doesn't compare in size to the great pyramids of Egypt, it does represent a benchmark worthy of our commemoration," Ives concluded.

Acknowledgments Information in this article has been adapted from "Monument's cast aluminum cap named an Historical Landmark," *ASM News,* December 1984, and "Kaiser donates landmark replica," *ASM News,* July 1986.