

DEPARTMENT OF THE INTERIOR

U. S. GEOLOGICAL SURVEY

**Federal District Boundary Markers in Northern Virginia:
Condition and Preservation Issues**

by

Elaine S. McGee

U. S. Geological Survey, Mail Stop 959, Reston VA 22092

Open-File Report 94-592

This report is preliminary and has not been reviewed for conformity with U.S. Geological Survey editorial standards or with the North American Stratigraphic Code.

1994

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Background

The capital of the United States of America was established on 100 square miles of land ceded by Maryland and Virginia to the Federal government in 1790. In 1791 and 1792 the new Federal area was surveyed and marked with gray sandstone boundary markers, typically four feet long and one foot square in size, that were taken from ledges at the Aquia Creek quarry located in Stafford County, Virginia. The boundary markers were placed at one mile intervals around the perimeter of the Federal area, beginning at Jones Point in Alexandria, Virginia at the southern corner of the area.

In 1846, the part of the District located south and west of the Potomac River was ceded back to Virginia. Thus, fourteen of the original markers for the Federal District boundary are located in Northern Virginia. Over the years, responsibility for maintenance of the boundary markers, particularly those in Northern Virginia, has been uncertain (Terman, 1972). However, from 1915 to 1920 various chapters of the Daughters of the American Revolution (DAR) located, restored, and fenced most of the stones. In 1963, the National Park Service, who had responsibility for the Boundary stones along the Maryland - District line, determined that when the Federal land was retroceded to Virginia in 1846, it included the boundary stones so the National Park Service was not responsible for maintaining or protecting the stones that were located in Virginia (Terman, 1972). Through the efforts of the Daughters of the American Revolution, the Federal District Boundary markers were placed on the National Register of Historic Places in 1991.

In 1994, the Northern Virginia Boundary Stones Committee (NVBSC) was formed at the invitation of, and with staff support from the Northern Virginia Planning District Commission. One of the objectives of the Northern Virginia Boundary Stones Committee is to develop a long term plan for the preservation of the fourteen original Federal District survey markers located in Northern Virginia. The committee asked me to speak in general about the Aquia Creek sandstone and about stone preservation issues. As a mineralogist-petrologist with the U.S. Geological Survey, I have been studying stone deterioration due to acid rain and air pollution. I am also working with the National Park Service on their on-going preservation projects at the Lincoln and Jefferson Memorials in Washington D.C. On June 28, 1994 I attended a meeting of the Northern Virginia Boundary Stones Committee in order to provide background information about features and weathering characteristics of the Aquia Creek sandstone and to speak generally about stone preservation issues. On July 21, 1994 I joined several members of the Northern Virginia Boundary Stones Committee in a field trip to examine the condition of the stones. This report summarizes my comments at the committee meeting, summarizes my observations of the condition of the boundary stones, and suggests elements to include in plans for the preservation of the markers.

Aquia Creek sandstone

The Aquia Creek sandstone was quarried from the late 1700s to the early 1800s in Stafford County, Virginia, at a site about 40 miles south of Washington, D.C., where Aquia Creek joins the Potomac. The sandstone was used for many of the early Federal buildings, most notably the White House and the center portion of the U.S. Capitol building. The Aquia Creek sandstone is described in some detail by Withington (1975). McGee and Woodruff (1992) also describe characteristics of the stone and discuss some of the typical weathering features that it exhibits.

Characteristics: The sandstone is light gray to buff in color and it is mostly composed of quartz (SiO_2) with some potassium feldspar (KAlSi_3O_8) and clays. The cement that holds the quartz (sand) grains together is a silica composition cement, thus it is more resistant to the effects of acid precipitation than a sandstone that contains carbonate cement. Stone from the Aquia Creek quarry was not entirely homogeneous. Some of it was strong and of good quality, but some of the Aquia Creek stone taken from the quarry was of such poor quality that its use as a building material was discontinued in the late 1830s. Most of the sand grains in the stone are equally sized (averaging about 0.5 mm in diameter), but in some layers of the stone rounded pebble inclusions may be 1 to 3 cm in diameter. Pockets of clay have also been mentioned in the literature describing this Aquia Creek stone.

Weathering: Some typical weathering features of this sandstone include pock marks (rounded holes) where the pebble inclusions have come out, accentuated layers (slightly harder lineations of red-orange grains), and spalling of portions of the stone. The spalling occurs because the clay in the stone expands when it gets wet and causes layers of the stone near a clay concentration to be gradually pushed outward until the layer breaks off. Hard black surficial crusts are another typical weathering feature that may develop on the stone in areas where there is air pollution. These crusts are amorphous on a microscopic scale and they probably form as a reaction between the stone, dirt, and air pollutants. The crusts may pose a problem for preservation because if they adhere tightly to the stone surface they may be difficult to remove without damaging the stone underneath.

Preservation / Treatment

Before any preservation or treatment effort is made on the boundary stones, it is important to identify and evaluate the problems of stone deterioration that need to be addressed. Such an evaluation will help guide the selection of an appropriate treatment that takes into consideration the stone characteristics, the deterioration problems, and the exposure of the stone to weather and pollution. Three main categories of treatment are likely to be considered: cleaning, chemical consolidation, and repair or replacement of the stone.

Cleaning: Stone surfaces may be washed, preferably by the gentlest means possible, such as water alone, to remove accumulated dirt, grime, and crusts. Care

needs to be taken to choose a method that will preserve the stone surface and its markings.

Chemical consolidation: Loose, granulated surfaces can be bound or protected by surface coatings or by injecting an organic or organic-inorganic complex into the pore spaces of the stone. This type of treatment may pose several dangers to the stone in that the consolidant may not bind well with the stone, or if not carefully selected for the stone, the treatment may accelerate damage to the stone. However, some Europeans working in stone preservation have reported successes on sandstones using alkoxysilanes.

Repair or replacement: Where larger pieces of stone are missing or loosened and may come off, the stone can be repaired with epoxy or with a combination of pinning and epoxy. Replacement stone, if necessary, should be as similar to the original as possible.

It is likely that not all of the stones will require the same treatments, and it is possible that some stones may presently need no treatment. Any information that is known about previous treatments to the stone will be valuable when the condition of the stones is evaluated and may affect the treatment decisions that are made. Another important component of a preservation program should be to consider monitoring the condition of the stones and developing a maintenance plan for them.

The National Park Service (NPS) provides guidelines for preservation of historic structures through their Preservation Assistance Division (located at 800 North Capital St, Washington, D.C.) and through published guidelines (Preservation Assistance Division, 1989; U.S. Department of Interior, 1992). The NPS policy for preservation emphasizes the historic value of the material and architectural features and recommends repair rather than replacement if possible. NPS policy also recommends that any surface cleaning should be done by the gentlest means possible.

Features of the Boundary Markers

Two sizes of stones were used for the original markers: the corner stones were specified to be five feet long and one foot square and the markers, that were placed at one mile intervals, were four feet long and one foot square (Terman and Terman, 1972). The markers and corner stones were placed so that two feet of the stone was buried and the remaining two (or three) feet was above ground. The buried portion of the stone was roughly hewn. The portion of the marker or corner stone above ground had a sawn finish and the top was cut with a bevel edge. A standard inscription (National Capital Planning Commission, 1976) was placed on each of the four sides (Fig. 1) of the marker; the cornerstone inscriptions differed from the mile marker inscriptions (Terman and Terman, 1972). The Virginia boundary markers were placed in 1791. A photographic record was made of the boundary stones in 1908 (Woodward), and between 1915 and 1920 various chapters of the Daughters of the

American Revolution restored and fenced most of the boundary stones (Terman and Terman, 1972). In 1952 Arlington County appropriated money to have the 10 stones on its borders coated with a preservative called "Weatherlox" (Terman and Terman, 1972).

There are fourteen boundary markers in Virginia. Two of these are cornerstones. The South Cornerstone (the first stone in Virginia) is located at Jones Point in Alexandria and the West Cornerstone is located in Falls Church. The remaining markers are numbered consecutively along the sides of the square formed by lines between the cornerstones and they are designated by the compass direction for the side of the square. Thus, markers located between the South and West Cornerstones are designated as "Southwest #" with # being a number from 1-9; markers between the West Cornerstone and the North Cornerstone are designated as "Northwest #". Along the northwest side of the original boundary, only markers numbered 1-3 are located in Virginia.

Current Condition of the Boundary Markers

On our trip to examine the boundary markers, we saw 13 of the 14 markers that are located in Virginia. We photographed, measured, recorded the legible portions of the inscriptions, and visually examined the stones. The fences that surround the markers make it difficult to examine details on the stones very closely. We did not take samples from any parts of the stones.

The boundary markers appear to have been made of some of the best quality and strongest stone from the Aquia Creek quarry. They are solid and mostly intact; some have minor pebble inclusions, but pockets of clay that were such a problem for the Aquia Creek stone at other sites are not present in the boundary markers that we observed. Missing chips, rounded edges, and missing corners and portions of the top or sides are typical deterioration features on the stones. Cracks are present in some of the stones, but they are not particularly severe or common. Many portions of the inscriptions are still legible; where the face of the stone is mostly intact, the letters of the inscription are still quite crisp. Darkening of the surfaces of the stones is fairly common and seems to be especially prominent on broken, uneven surfaces. Organic growth, such as moss, algae, or fungus is present on many stones, as are paint drips that probably resulted from maintenance work on the fences that surround the markers.

The following notes summarize some of the observations made about the characteristic features and current condition of each of the boundary stones. Features that might be relevant to future preservation of the markers were noted in particular.

South Cornerstone: This stone is located in a small concrete enclosure that is part of a seawall constructed at the Jones Point Lighthouse. The marker is visible from the river bank, but it is not accessible at high tide. Most of the original surfaces of the stone are missing, the edges are so rounded and pitted that it is difficult to discern the original shape and size of the stone. The lower portion of the stone has

been undercut compared to the upper portion. Although most portions of the inscription are gone, some letters are still visible and they appear to have some sharp edges. The stone has some algae or other organic growth on the surfaces.

Southwest 1: The overall shape of this stone is still intact. Most of the surfaces are blackened and there is some organic growth on chipped portions of the surface. Pitting and missing chips are concentrated on the edges and there is a small vertical crack that cuts across the top and at least one side of the stone. The inscriptions are somewhat obscured by the surficial coating, but the edges of the inscriptions are still crisp.

Southwest 2: This stone appears very different in size, shape, and surface finish compared to the other boundary markers. It is most likely not an original stone. (Moore and Jackson (1979) note that the Southwest 2 marker is one of the two markers that have been lost from the original 40.) The stone appears to be a sandstone, but close examination of the stone is hindered by the surrounding fence, and surficial blackening makes it difficult to see texture and grains in the stone. There are many slightly elongated grooves on the vertical faces of the stone that resemble pitting but may be a tooling mark finish that was applied to the stone. Closer examination of this stone might be necessary to determine if it is sandstone from the Aquia Creek quarry and to determine if the irregular surfaces on the faces of the stone are weathering features or applied features.

Southwest 3: Most of the edges on this stone are rounded and pitted. Two of the four vertical edges are worn or broken off and the other two edges are only partly remaining. A few areas of the stone surface are blackened, mostly on the rounded top and in the pitted and broken areas. There are drips of paint and possibly primer on the stone. Only in the broken areas is the graininess of the sandstone apparent; on the original vertical faces the inscriptions are distinct and the stone surface appears to retain a smooth finish.

Southwest 4: All that remains of this marker is a rounded stub with no apparent original surfaces. The stone may be a sandstone, but it is difficult to be sure because the pitted surface is almost completely covered with a light colored coating that looks like paint.

Southwest 5: The size and shape of this stone is not like the other markers. The stone appears to be a sandstone. It resembles the Aquia Creek stone in color, in texture, and in some of the slight pitting that is visible. There are no visible inscriptions. The surfaces of the stone appear to be slightly rougher than the finished surfaces on the carved boundary markers. There is some organic growth like moss or algae on parts of the stone surface.

Southwest 6: This stone has several large patches and crack repairs that were poorly done. The edges and top surfaces of the stone are rounded, pitted, and blackened while the vertical faces retain much of the original finish and inscriptions. Some of the faces have rounded indentations like pock marks that are slightly blackened compared to the rest of the face.

Southwest 7: The top and edges of this stone are rounded but most of the vertical faces of the stone are relatively intact. The stone is blackened where it is

rounded and broken; the intact vertical faces remain light in color and portions of the inscription are still quite visible. There is a large spot of white paint near the top of one of the broken, rounded sides of the stone.

Southwest 8: About 6-8 inches of the unfinished base of this marker is exposed. The top and edges of the marker are rounded, pitted, and chipped and the uneven surfaces are blackened. Some portions of the original vertical faces are intact, retain a light color and smooth surface finish and still have readily visible inscriptions. Pock mark indentations are common on both broken and finished surfaces, and pebble inclusions are visible in some broken areas of the stone.

Southwest 9: Only a portion (perhaps half, but it is uneven) of the original 2 feet of this stone is exposed. The original smooth surface finish of the faces and part of the top of the stone is preserved. The inscriptions are very crisp. There are no blackened areas on the surface of this stone but there are some lichens and moss or algae present.

West Cornerstone: A large portion comprising one corner and most of two sides is missing on this marker. Also, although this marker is a cornerstone, its size is like one of the mile marker stones. The vertical and top edges are slightly rounded and have some pitted indentations. The inscriptions are still crisp where the vertical faces are intact. There is little surficial blackening on this stone, although there are organic accumulations on some of the broken surfaces.

Northwest 1: A portion of one side and much of the top part are missing on this marker. The vertical edges are worn and broken but three of the faces of the stone are nearly intact, with crisp inscriptions. The stone is slightly blackened on the broken areas; it has some lichen (and possibly algae or moss) growths and a few drops of paint on some surfaces. There are some carved letters on one face of the stone that are not part of the original inscription. Part of the unfinished base is exposed.

Northwest 2: The top of this marker is rounded, the edges are also rounded with indented pits on the edges and faces. One face of the stone is in good condition, with the inscription clearly visible; the other faces are pitted and somewhat broken. Blackening of the stone surface is concentrated on the broken areas; there are growths of moss or lichens on some surfaces too.

Northwest 3: We did not examine this stone because it is located on private property in a fenced yard. The owners of the property were not at home, so we were not able to ask permission to see the stone.

Although all of the stones appear to be solid, there is a range to their condition that probably reflects the amount and type of care that each marker has received. The most common feature of deterioration is rounding of the top and broken or pitted vertical edges. Curiously many of the faces seem to be at least in partially good condition; where the stone has not been broken, the inscriptions remain quite visible. There is a range in the surface coloration of the stones, particularly on the finished faces compared to any broken or rough surfaces. Some of the range of color may be due to natural variations in the color of the stone, but some of the marker faces (for

example on Southwest 6) appear unusually yellow. It is possible that the "Weatherlox" that was applied to some of the markers in the 1950s has contributed to the variations in the color that we see now.

Pitting or slight pock mark indentations are much more common on the markers than are cracks or surficial discoloration. The pits may come from loss of pebble inclusions that were an original part of the stone. However, pebble inclusions are not a frequent feature on the stones, perhaps because the ones closest to the stone surface have already disappeared as the stones weathered.

There is organic growth such as moss, lichen, and algae on many of the markers, but most of the growths are on broken or rough areas of the stone surface. Plant growth can contribute to stone deterioration, but this sandstone is likely to be resistant to deterioration from organic acids that plants produce as a product of their growth.

Overall, the stones do not appear to be weathering at a very fast rate. The surfaces do not feel grainy and crumble as you would expect if the surface was severely deteriorating. Where the stone surface is rough, the blackened coating does not appear to be contributing to disaggregation of the stone. Cracks are rare, and based on the general appearance of the stones and the cracks, the ones we saw may have been there for a long time. Although small and large pieces of the markers were missing in many places, loose pieces or crumbling stone is not evident on any of the markers. There is some evidence that a lack of maintenance has contributed to problems for the stones, such as paint drips (several stones: SW-3,4, and NW-1), marks from recent vandalism (SW-7), and poorly done repairs (SW-6).

Recommendations

The following recommendations should be considered as the Northern Virginia Boundary Stones Committee begins to evaluate various preservation actions to take for the Federal District Boundary Stones.

- Examine the stones and document their current condition. Evaluate their condition and the rate of changes by referring to earlier documentation that is available about the condition of the stones. Comparison and examination of photographs, such as those taken by committee members, Woodward (1908), and the Daughters of the American Revolution can help you identify large physical changes in the stones. Key elements to look for are: Were cracks or missing pieces that are visible now, present earlier? Can you track changes in any cracks? Can you see variations in the stone faces that occur with time?

- Ensure that the markers are protected when maintenance work is done nearby. Some particular concerns are: protecting the stones from paint and primer when the fences that surround them are maintained, protecting the stones from lawn maintenance, and protecting the stones if road or utility improvements are made nearby.

- Investigate the "Weatherlox" treatment that was reportedly applied to some of the stones. Was the treatment actually done? Which stones (or parts) were treated? What type of treatment is "Weatherlox"? Compare treated stones with untreated stones to get an idea of what effect the treatment has had on the durability of the stones. Also, photographs taken before and after treatment of the stones may help identify the extent and effect of the treatment.

- Investigate possible methods for cleaning or removal of paint, bird droppings, black crusts, and plant growths before deciding to proceed. A thorough cleaning to a fresh stone appearance might be inappropriate because it could minimize the historic appearance of the markers. Also, cleaning methods should be carefully considered so they do not cause harm to the stone.

- Some stones may require special attention: Repairs to Southwest 6 could be improved to be more effective and harmonious with the appearance of the marker. Southwest 4 could be examined more closely to see if it is actually the stub of a marker and to determine whether what appears to be a coating of paint can be safely removed. Southwest 2 and Southwest 5 could be studied to determine if they are the original boundary markers, or even if they are Aquia Creek sandstone.

- It might be useful to consider setting up a plan to regularly monitor the condition of the markers. Periodic checks made with sketches of each individual stone would help an observer monitor cracks, loss of pieces, effects of vandalism, and effects of careless maintenance.

Summary

The boundary markers are in fairly good condition for Aquia Creek stone and considering that most have probably received little maintenance attention over the years. The original stone used for the markers appears to have been a strong stone that has weathered well. The most common element of deterioration on the stones is rounding of the top surfaces and edges, and pitting along the sides of the stones. Pieces are missing from some of the stones, but the losses do not appear to have occurred recently. Each of the stones has a unique appearance that may reflect some of the history of the individual marker.

An important consideration for historic preservation projects is the recognition that changes that have occurred through the course of time may constitute part of the historic significance of the structure. Defining the goals of a preservation project at the beginning of the project is essential, as the intended goals will shape the decisions that are made during the project. Important elements of a stone preservation program include: understanding the characteristics of the stone, identifying deterioration problems, and carefully evaluating treatment options.

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View of the four sides:

Top view:

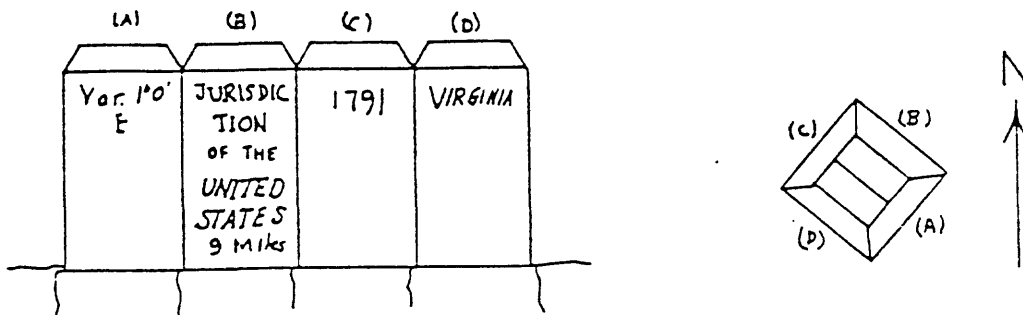


Figure 1. Sketch showing a view of the four sides of a standard marker boundary stone and a top view of the stone to show how it is oriented with respect to the compass directions. This particular example is the Southwest 9 marker. Each of the sides of the stone contained a standard notation: A) The magnetic variation at that location, measured when the mile marker locations were surveyed. B) This side faces the Federal Area and gives the distance of this marker from the cornerstone (in this case the Southwest Cornerstone) for which the side is named. C) The year when the stone was placed. D) This side faces, and gives the name of, the state that borders the Federal Area at this point.