Colonial America and Medieval Technology

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Introduction

What have colonial America and medieval Europe in common? More than is popularly believed. Early America was a cultural and technological extension of the Middle Ages. Most of the farming and metalworking methods used in colonial America were from the scientific revolution that had taken place in the twelfth century. Medieval Europeans had been forced to new inventions, because the farming and metallurgical techniques practiced in the Roman Empire were unsuited for Europe north of the Alps. By the year 1000, there were new methods to grow crops, process food, and make metal. The last refinements came about during the period 1100-1200, at the same time that the population began to grow rapidly, traditional energy sources (wood) were depleted, and there was a demand for a better standard of living. At that time, North America was a part of medieval Europe. Viking settlements along the Atlantic coast of North America, made by colonists from Greenland, brought medieval technology to the Americas.

Moving ahead six centuries, there were later, and more successful, colonies. Once again, colonial society in North America was an extension of medieval European culture and technology. As immigrants adapted familiar forms and industries to the realities of life in a new land, they faced problems that had been addressed in the Middle Ages: land reclamation, transportation, and food supply. Their solutions involved the two crucial industries of food processing and metalworking or, more simply, the mill and the forge. As had been true in medieval Europe, Early Americans had to find sources of energy to power their machines, and this dictated how they lived. How successful they were depended on an idea: freedom. Individual self-reliance and the freedom to choose their own course of life was important for the ability to adapt to new conditions and to develop beyond earlier machines. Colonial adaptation of this technology flourished in those parts of the new world where individual freedom and self-determination were encouraged.

Medieval America

European settlement of North America began in the Middle Ages and continued sporadically for centuries. Leaving aside legendary figures such as St. Brendan the Navigator, the Irish saint whose story claims that he visited the Western Hemisphere, there is no doubt about the settlement by the Vikings. They settled in Greenland *circa* 970 and from there made a colony at what is now southeast Canada/northeast United States, *circa* 1000 A.D. A Viking named Leif “the Lucky” set up camp at a place now called L’Anse aux Meadows, in what is now Newfoundland. The settlement was within a territory the Vikings named Vinland. Six hundred years later, later colonists/adventurers set up their own settlements in what they called Massachusetts and Virginia. Whether at

Vinland or Virginia, all aspects of life--home organization, family roles, farming, manufacturing, and culture--were continuations from medieval society.

Emigration to North America was one aspect of the movement of peoples around the Atlantic Ocean that had led the Vikings to Greenland and Canada or the English to New England and Virginia. Whether in the eleventh or seventeenth centuries and regardless of motive--desire for religious freedom, escape from persecution or a search for economic opportunity--the basic problems of food and shelter remained for everyone. When moving westwards, eleventh-century Vikings or seventeenth-century farmers brought with them the only technology that they knew, the processes and techniques of their homelands.

The farmstead at L'Anse aux Meadows reveals a typically medieval configuration with homes, barns, livestock pens, and, significantly, ironworking at a smithy. This settlement was active into the twelfth century, when a bishop for Greenland and Vinland was lost at sea as he attempted to sail to his parishioners. The Viking settlement at Greenland continued into the fifteenth century, and recent scholarship suggests that knowledge of its routes was one of the reasons why Europeans turned their attention once again to North America in the sixteenth and seventeenth centuries.

At both the Vinland and Greenland settlements there were contacts between the Europeans and the native inhabitants: trade, conflict, and cultural borrowing. A coin illustrates this contact, the so-called Maine penny. In 1957, among a collection of Native American artifacts was a penny minted during the reign of the Norwegian King Olaf II ("The Peaceful") Haraldsson (reigned 1061-1093). Current scholarly opinion believes that this coin passed because of trade, possibly with the Vinland colony.

Once again, let us go forward six centuries. In order to supply the necessities for life, two industries dominated early American society: milling and forging. Both these manufactures had undergone tremendous changes during the Middle Ages, especially by the twelfth century, often known as the industrial revolution of early Europe. Their developments demonstrate that change can be rapid and frequently relies on many factors, as seen in the following example. There is no evidence of freestanding mills at L'Anse aux Meadows. The colonists apparently used a hand mill or "quern." A century later the post windmill (see below) appeared in Germany and became a common sight throughout Europe. Six centuries later, the mill building is a standard feature of the colonial landscape.

Like the post windmill, widespread use of large mills came a century after the Viking settlement, when renewable energy sources such as wind and a steady water flow from millponds began to drive milling machinery. Gears made that transformation possible as they more efficiently converted the speed of the wheel into mechanical energy and directed more power to the grinding axles. This was a great improvement on the gearless mechanisms of an earlier age. European knowledge of gear ratios expanded during the eleventh and twelfth centuries with the rediscovery of Greek mathematical texts that flowed into medieval Europe via the Jewish schools in Muslim Iberia (modern

Spain). Jewish merchants brought those texts north to the great commercial fairs, such as the famous one at Champagne. These fairs had come into existence during the economic prosperity begun in the tenth century when the Vikings turned their attention from raids to trade using water routes rather than the slower and more expensive land routes. The Vikings brought their idea of commercial gatherings to North America. A famous passage in the Vinland Sagas describes how the Vikings and the Native Americans traded. The Vikings took the goods they had to trade to the seashore, where they left them overnight. In the morning, they returned and found Native American goods in return. Perhaps the Maine penny was among a later collection of trade goods.

From Medieval Europe to Colonial America: Mill

The mill in colonial America grew out of three developments in medieval Europe: technological change or improvements in design, demographic expansion or increased population, and cultural concerns leading to individual freedom. The improvement in design can be called more accurately competing designs. The windmill provides the best demonstration of this competition. Unlike the water-powered mill, the windmill is completely medieval. There appear at the same time two competing designs. One was the German or post mill, which first appears in the twelfth century, while the other was the Dutch or stationary mill. The German model had the entire mill built on a central post, hence its name of “post mill”. As the direction of the wind shifted, the miller simply turned the mill to best advantage. The Dutch mill is more familiar. The mill building is stationary (hence the name) while the top with the sails moves on a pivot; so the sails turn with the prevailing wind, but not the entire building. By the beginning of the sixteenth century, just before European settlement in North America, the weight of the milling equipment became so heavy that the stationary mill largely replaced the post design.

Technological change occurred at the same time as demographic change. There was a tremendous increase in population in Europe during the period from 1100 to 1300. For example: in 1100, Florence had about 6,000 inhabitants; by 1300, there were almost 100,000. These people needed food, and the main staple of the medieval diet was bread. More bread needed greater quantities of flour. So, mills became larger and more efficient. Their efficiency extended to new sources of power. The power source of classical antiquity was human. Slave labor powered the mighty Roman Empire. Even though the Romans understood the principle of the waterwheel, and made some waterpower grain mills, especially in Gaul (modern France), the most common source of power was the much cheaper slave labor. The conversion of the Roman Empire to Christianity, a religion that taught the dignity and value of each person, gave the European Middle Ages its religious basis. That led to numerous prohibitions against trafficking in humans during the early Middle Ages. Individual kingdoms outlawed slavery. In 1102, for example, the Council of London made slavery illegal in England. Slavery was virtually extinct throughout Europe by the twelfth century.

Searches for a new motor source looked to two principal energies: wind and water. These natural resources were inexpensive to harness, inexhaustible, and powerful.

Water wheeled mills are powered by swift moving water. The water turned paddles that moved the grinding stones within the mill building. In regions with little rapid water, such as Flanders, wind was the alternate. The picturesque Dutch windmills used the energy available, as was also done on the American plains. The windmills used sails attached to axles that moved the millstones. Medieval engineers had to overcome various problems, of which one was their variable rate. Winds could be too still to turn the mill sails or so wild that they pulled the sails from the building. Gently flowing streams could dry up in hot summers and become raging floods in the spring thaw. Therefore, medieval engineers built more efficient sails, placed brakes on the axles, constructed reservoirs for holding water, more commonly known as millponds, or made artificial channels alongside rivers to protect the expensive machinery from devastating floods.

When emigrants left their European homes for North America, they brought with them the technology that they had used. North America had water and wind in abundance. Of the two, water was preferred because it generated more power, was more reliable, and more easily controlled. Settlers preferred to build mills by streams rather than the more powerful rivers. Millponds provided a steady supply of water for the mill, and they were convenient sources of protein when stocked with fish. Names such as Francis Mill in Virginia reveal both the owner of the establishment as well as the type of service provided. In colonial America, there was more freedom to own a mill. European literature has many stories of corrupt millers, while American literature has fewer because more Americans owned the mills; the increased competition ensured that dishonest millers lost customers.

From Medieval Europe to Colonial America: Forge

As the mill was one important part of technology in colonial America, another was the forge. This was the earliest industry practiced by Europeans in the Western Hemisphere. The Vikings settlers at L'Anse aux Meadows worked iron on a small scale produced from bloomeries, a simple industry for separating metallic iron from iron ore. The Viking forges were more limited than the large smithies found, for example, on the plantations of tidewater Virginia. Smiths worked metals into everything from ploughshares to knives. There was even a recycling program associated with the forge in colonial America. In order to assure English manufacturers a monopoly, the colonists could not use the technology for making pewter. They had to gather disused items for melting in order to cast new pieces.

The most important metal in medieval Europe or colonial America was iron and its refinement, steel. In Norway, during the ninth century, a cheap way to produce good quality iron developed. An improved type of smelter made a greater quantity of iron, with fewer impurities. That development coincided with the economic revival of Europe beginning in the tenth century. By the twelfth century, the rapid growth of towns increased the need for iron throughout Europe.

There were several social contexts for working iron. In the Tidewater of colonial America were large plantations. The model for them was the large manor of England and

France. There was practiced a type of farming known as “champion,” and this was an early form of agribusiness in which a number of farm families worked together in fields. The manufacturing of worked metals changed as settlers moved into the Piedmont and the mountains. Those settlers came largely from the Highland regions: North Ireland, Scotland, and southern Germany. They were familiar with small independent farms, which practiced a type of agriculture called “woodland.” They made forges that stood alone and did not depend on a blacksmith shop owned by the great lord of the region. Their location is visible today in names such as Old Forge or Valley Forge where the Continental Army wintered, in part, because of the need to repair equipment.

The colonists’ choice and use of technology reveal much about their homeland. For example, windmills were not popular in colonial America because a better power source--water--was convenient. In New Amsterdam (now New York), however, windmills were preferred, because the Dutch settlers were familiar with them. There were also differences in the use of this technology. The great estates of the tidewater with their mix of farming, milling, and metalworking were impractical in the Allegheny Mountains and its foothills. So in mountainous regions, such as western Pennsylvania, mill towns developed. These were imitations of the mill towns found in the settlers’ homes: the Scottish Highlands and the north of Ireland. To take an example, the records of the diocese of Aberdeen show that mill towns--such as the “mill toun (sic)” of Arbuthnot--were not only common, but they were so profitable that law suits over their ownership could drag on for generations. This was less frequent in colonial America because individuals could move more easily. If one mill became too much of a legal expense it was closed, and the parties opened new establishments elsewhere.

There is a side note to the subject of metals, and that is prospecting. One of the reasons why Europeans were eager to make colonies in the Americas was the hope of finding precious metals. Impoverished European princes dreamed of the discovery of an Eldorado, a source of limitless wealth. Discovery of precious, or even useful, metals could have significant consequences. The California gold rush is one example, while throughout western America are abandoned towns that appeared with the discovery of metallic ores. There were also boomtowns in medieval Europe. In 1136, silver was discovered near the German town of Freiburg. The news spread, and by 1170, there was a town of about 30,000 people, huge by medieval standards, for the miners.

Mills and Forges: Problems and Solutions

Whether in the highlands of Europe or North America there was a common problem: the transportation of bulky goods over rough terrain. The solution was the same in both: river transport. The location of Pittsburgh at the confluence of three rivers is testimony to water as the economic lifeblood of colonial society much as the river Shannon is the artery for society in rolling lands of western Ireland.

The use of mills and forges reveals the structure of colonial society. These crucial industries needed to be near to sources of raw materials. To make even greater profits, they were located near to their customers. One of the most profitable customers was

the military, so many mills or forges are near forts. The importance of forts/military bases for technology began with the Romans, whose fortifications marked the bounds of their empire. To take one example: alongside Hadrian's Wall, in northern England, were the garrisons for the Roman troops. In addition to the living quarters were bake houses, smithies, infirmaries, and miscellaneous offices. The flour for the ovens, and the different lengths and qualities of metals for the smithy, came from a mile or so south of the garrisons, from the towns that serviced the military bases. Northwest of the modern town of Hexham, England, are the remains of the village Vindolanda that supplied the fort at Housesteads two miles farther north.

The Middle Ages imitated the Roman use of fortifications in defensive structures such as Newcastle upon Tyne, built by the Normans and now completely submerged under the settlement that existed originally to serve it. In the eleventh century, Domesday Book, the tax survey of England and Wales, shows the importance of a fort. A note mentions that there had not been a town at Rhuddlan, in Wales, until the building there of a castle. This was a direct parallel with the situation in colonial America, where the building of fortifications was part of the settlement of a region. In central Pennsylvania, the crossroads known as Old Fort is testimony to the need to protect the village of Spring Mills, a few miles to the east. The great colonial port of Baltimore had the protection of Fort McHenry, which it supplied with flour and iron.

The analogy with the Romans is closer than the chronology suggests. Under Roman law, members of the senate could practice only one occupation: farming. This was continued through the Middle Ages. Kings rewarded their barons with land, not business, and the landowners were the important individuals of society. As late as the nineteenth century, the British Prime Minister Benjamin Disraeli had to go into debt to buy land so that he could accept elevation to the House of Lords. Colonial elites prided themselves on their classical parallels as well as their classical education. That included immediate familiarity with authors such as Julius Caesar and Tacitus, whose father-in-law Agricola was Legionary commander in Britain. Not only did these men have estates, but also their military activities were, to some degree, directed by Rome's need for fertile land. In Rome as in colonial America was the belief that to be a farmer was to be virtuous. The city of Cincinnati in Ohio honors the Roman general Cincinnatus, who left his plow to lead the Romans to victory and then refused further honors to return to his farm; George Washington was the American Cincinnatus.

One of the many curiosities of history is the way discarded technologies can acquire a new "lease on life." Take, for example, the windmill. Two developments made them obsolete. The first occurred by the eighteenth century, when the more potent water-powered mills largely replaced the wind-powered mills in America. The second development took place in the nineteenth century, when steam power replaced both water and wind power. There have been, however, two revivals of the windmill, both using medieval designs. The first revival occurred in the nineteenth century, when settlers on the American prairie needed to find a way to pump water. Daniel Halladay discovered the answer in 1854 with his watermill that used the design of the Dutch windmill. The main design change was the substitution of wooden sails for cloth, due to

the height of the apparatus and the constant movement of the air. The second revival is one currently at the center of debate on the generation of electricity. The movement of the wind turns a dynamo that produces electricity. The question at the heart of the debate is if the amount of power produced justifies the expense of the windmill.

Continuations

Historical labels are not always just conveniences for scholars. The fourteenth-century poet Petrarch invented the term “Middle Ages,” inspired by the eighth-century historian Bede’s phrase “Middle Earth” to identify the location of humanity (later borrowed by J.R.R. Tolkien). While they are useful, they can also hide continuation. Preceding the Industrial Revolution of the nineteenth century was a period of technological change that began in the twelfth century and encompassed colonial American society. The settlers of New Amsterdam built windmills like the medieval structures of their home, while the colonists at Jamestown built watermills like the ones that had stood in England for centuries. Scotch-Irish immigrants to the Alleghenies built mill towns and forges along the fast-flowing rivers that they had learned to tame in the Highland zone of Ireland/Britain even as German colonists at Ephrata organized themselves into communal settlements that supported large-scale mills and smithies. When a young British officer named George Washington was fighting in the French and Indian wars, chronologically he was as close to the medieval battle of Bosworth Field as he would be to Desert Storm. When that same young officer returned home and, much later, built a new threshing barn, his model was the medieval tithe barn of southern England.