ANTONIO DA SANGALLO THE YOUNGER AND THE BUILDING SITE OF THE CITADEL OF ANCONA

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ABSTRACT: I’d like to introduce my recent research concerning the engineering activity of Antonio da Sangallo the Younger and his collaborators in the Marches’ territory and especially the study of the building site activity promoted by the “Camera Apostolica”. On the basis of some sketches of Antonio da Sangallo the Younger, sixteenth century papal engineer, this search gathers documents relative to an iconographical study of machines (barges, hoists, cranes, and mills) in the Adriatic coast, especially in the citadel of Ancona, between 1530 and 1540 through the traditional schools of Florence and Siena during Renaissance.

ANCONA 1532: THE BUILDING SITE ORGANIZATION BY THE “CAMERA APOSTOLICA”

As Giorgio Vasari states, Antonio started to build the citadel of Ancona in 1532 along with his master builders: “si condusse Antonio in Ancona, et ordinò la fortezza in quella città, la quale continuando a fine si condusse” with a building site comprising of “squadratori, gli scalpellini, i muratori et i legnaiuoli (Vasari, [1550] 1986, II, p. 823). This study aims to remedy a shortcoming in the historiography of the artist, in so far as the numerous studies on the works of Antonio da Sangallo the Younger do not detail the issues concerning the organization of the sites along the Adriatic coast. The relationship between the drawings of machines and archival documents relating to the fortifications has provided the opportunity to clarify some aspects yet unknown about the system of collecting funds for the construction and the link between the machines, cranes and mills designed by Sangallo and by the engineers from the Florentine and Sienese schools, as Francesco di Giorgio Martini and Bonaccorso Ghiberti, nephew of the more famous Lorenzo and collaborator of Brunelleschi for the dome of Santa Maria del Fiore (Galluzzi, 1994, p. 28)(Borsi, 1985, pp. 323-332)(Di Pasquale, 1996, pp. 89-106). The city of Ancona, the most important harbor of the papal state in the Adriatic coast, a bridge towards the East is dependent from the proceeds of the sales of the grain, handled by the Apostolic Chamber, to get the money which is needed for the construction of the Citadel. Barges, hoists, cranes and mills designed by Sangallo are just sketched in the many drawings preserved at the Uffizi in Florence, which are not as accurate and detailed as those of his uncle Giuliano in the Taccuino Senese. The lifting devices were supposed to increase the muscle power and that was one of the main goals of Sangallo, a prosecutor with very little interest in theoretical reflections on the problems of mechanics (Popplow, Renn, 2002, pp. 267-268). In particular, the gristmills designed for Ancona (GDSU, 1446 A r.v.), and also employed in the production of gun powder, allowed to work the wheat and thus reap the proceeds which were indispensable to the council to support the building site of the citadel, according to the plans of the papal legate and the Apostolic chamber in Rome. The florentine architect did keep an interest in the machine operation throughout his life, as evidenced by his drawings from the Uffizi, once collected in the VIII volume of the Royal Gallery, which portray many such devices. His first trip in the duchies of Parma, Piacenza and Romagne dates back to 1526, while he got to Ancona in 1532, right after the sack of Rome, for the will of Clemente VII. The province of Ancona stands in north-central Italy and borders to the north with the Emilia Romagna, to the west with the province of Perugia, to the south with that of Macerata, while to the East is bathed by the Adri-
atic Sea. Ancona with its citadel overlooks the Adriatic Sea at the point where the massive Conero stands between the coastal plains to the north and south, and extends its steep cliffs towards the towns of Numana and Ancona itself.

The management of construction sites was decentralized and run by people of trust like the governors or the castle lords, the “castellani”, that remained for longer periods.

It was right after his visit that he produced four sketches for the projects of the fortress of Ancona, of the port and of the arch of Trajan. The design GDSU 1020 A r. shows the first project for the fortress drawn with what will become the main feature of the town of Ancona, namely a five-pointed star shape, with each point different from the others, which took into account the orography of Mount Astagno. This model had considerable success and afterwards he repeated it in Perugia with the Rocca Paolina. Officially, the citadel was raised against the Turks to protect the pope and his administrators.

Figure 1: Antonio da Sangallo the Younger, GDSU 1020 A recto, Ancona, five-pointed star shape (left) and the citadel of Ancona, 1930 (right); (Frommel, 1994, II, p. 372)

Four years after the start of the work, Zefiro, the lord of the castle, accused Sangallo of fraud and corruption for having favored family members and relatives (ASP, CFE, Ancona, b. 171, 9 January 1537). As a prosecutor, Sangallo used to resell iron and materials at twice the price, and similarly he granted rates that were 30% higher than the normal to the boats he operated. Sangallo was the prosecutor in his yards in Rome as well, and he used to follow all the stages of construction, including the recruitment of employees and of the master builders who would direct the works while he was absent. The concept of remote control of the building site was introduced by Wolfgang Lotz in 1975 at the conference of Gaetano Alessi and this kind of system appear in Sangallo’s letters which were sent from Rome to Ancona (Lotz, 1975, p. 10).

The work of the many craftsmen active in the construction sites between 1532 and 1570 was regulated in 1557 with the “riformazioni” decided by the General Council and written by Francesco Maria Beldoni, Chancellor of Community (ASAN, ACAN, ms. 2905, c.1v.). The Statutes of Ancona of 1566 also regulated the sale of the timber which was used in the brick kilns located behind the bulwark of Lazzaretto (ASAN, ACAN, Statuta Magnificentiae Civitatis Anconae, 1566, p. 232).

THE “PIATTA”: A FLAT BOAT WITH A CRANE

The iconography from Sangallo to Brueghel

To avoid the difficult roads on the hills, materials as iron and stones were ferried by a barge called “piatta” from the Conocchia bridge and from Moiano to the port of Ancona and then hauled up to the citadel on wagons. The chalk quarry was in a place called La Trave. A boat with a crane, similar to the ones employed in Ancona, is represented on the building site of Genoa where the architect was later called for the new fortification. A wheel manually operated by a winch moved the blocks of stone. This device would act on a crane and on load positioners, moving the blocks that were placed from the barge to the bottom of the sea, as the illustration would seemingly show. If used in the citadel yard, the blocks were dumped from the “piatta” with the aid of clamps and left on the bench, after which they would be placed on carts, and through the “portelle”, i.e. small doors cut into the walls of the port, they would leave for Mount Astagno. The load positioner was an ancient device used to lift blocks of stone without ties, first described by Heron of Alexandria in the Meccaniche, in 100 AD. As said before, the mechanical projects of Antonio da Sangallo the Younger are to be connected with those of Bonaccorso Ghiberti (Scaglia, 1960-61, pp. 45-67) (Reti, 1974, p. 89). The hypothesis initially supported by Gustina Scaglia, namely, that the drawings of both Leonardo and Sangallo are mere reproductions of projects of Brunelleschi, was plausible but in need of an adequate documentation, which was later provided by Ladislao Reti. The aforementioned scholar (BNF, Ms. Br 228, f. 95 r.) has studied a light winch.
able to reduce the speed between the animal motor and the lifting of the load. The winch on the “piatta” was different from the examples cited by Reti because it was operated by men and, moreover, it was vertical, unlike the one designed by Bonaccorso (BNF, Ms. Br 228, f. 95 r.). In the drawing of the latter, the main wheel was in a horizontal position, with the cables coming up from its core, and with a system employing “denti a rullo”. It was in both cases the combination of a gear wheel and lantern gears, which, in the case of a millstone rotating on a vertical axis, would shift the rotary motion of a vertical waterwheel set on a horizontal axis. Sangallo’s “piatta” system (GDSU 794 A recto) is much simpler than the aforementioned mechanisms of Bonaccorso, which were later employed by Leonardo as well; moreover, it recalls the double wheel of a famous painting of Pieter Bruegel the Elder, a Flemish painter who had had the chance to visit the building sites of the Sangallos in Rome.

In the Babel Tower (1563, Vienna, Kunsthistorisches Museum) machines and men are portrayed with a refined but powerful realism indicating a direct knowledge of construction techniques of the architectural-engineering treatises. Most certainly, Bruegel drew from the reminiscences of the trip to Italy in 1553 using as a model Castel Sant’Angelo. Antonio the Younger became Bramante’s chief collaborator in 1512 and he was involved in the work for Castel S. Angelo “Bramante gli diede la cura del corridore, che andava a’ fossi di Castel Santo Angelo” (G. Vasari, [1550], 1986, II, p. 815) (C.L. Frommel, 1994, I, 23). The fortress was later restored by Giuliano da Sangallo the Younger for Paolo III Farnese (A. Tosi, 2004, p. 43).

![Figure 2: The “piatta” a barge used and designed by Antonio da Sangallo the Younger, GDSU 794 A recto (left) and Peter Brueghel il Vecchio, Torre di Babele, part with the crane, 1563, Vienna, Kunsthistorisches Museum (right); (Frommel C.L., 1994, II, p. 312) (Tosi, A., p. 43)](image)

**SANGALLO’S GRISTMILL**

Functions and mechanisms through the traditional schools of Florence and Siena

Hoists and cranes by Antonio the Younger are based on Brunelleschi’s mechanical inventions of 1418. Basically there are two variants of a traveling crane by Antonio, a crane as variant of Brunelleschi’s invention in Antonio’s drawing (GDSU 1449 A v.), and Antonio’s drawings of hoists operated by a treadwheel or turned by a horse or turned manually.

The interest of Sangallo in mills and grinders was also linked to the fact that they were extremely useful in the defense of the citadel, as these machines were used to “grind up” the gun powder, the new protagonist on the battlefield. The mills could be turned by horses, water or a balancing device using iron balls or large stones as weights. As stated by Gustina Scaglia, even in these drawings Sangallo follows the tradition of Sienese engineers: for instance in GDSU 1471 A verso, 11 of the 14 mills are a copy from Francesco di Giorgio Martini’s Trattato II (Scaglia, 1994, II, p. 238). GDSU 1446 recto and verso is about Ancona. Part of the drawing describes a gristmill driven by animal power, the other by hydraulic power. The device shown in GDSU 1446 verso finds its driving force in a horse connected to a central axis and to a frame with 4 iron ball weights, through a gear wheel: the horse transmits the driving force to a reel connected to the mill. A single turn of the horse would have allowed the mill to rotate 22 times.

The drawing GDSU 1446 verso shows the operation of an overshot waterwheel and it’s linked to the device sketched on the recto. The note of Sangallo illustrates the problems associated with the leveling of the funnel.
The architect measures the gap between the channel of the mill, the garden, the well from which the water flowed and the surface of the sea. The measurements also relate to the channel, the tanks of the “tiratoio” and the sewer. The goal of the engineer is to try to improve the slope by lifting the channel of the mill in order to reach enough power to feed up to two mills. The investigation has not yet revealed the link between the two mechanisms.

In Cesena, not far from Ancona, while surveying the fortresses, Sangallo drew a mill wheel (GDSU, 1442 recto) that later studies have confirmed being inside the fortress (A. Turchini, 1985, pp. 268-271); the same goes for the citadel of Rimini, where there was a mill in a room under the donjon. All we know is that in the citadel of Ancona there’s still a bricked well near the gate next to the curtain, but between the garden where the aforementioned well was in GDSU 1446 verso and the sea level there were only 38 palms, according to Sangallo. The citadel and its well are on Mount Astagno several tens of meters high upon sea level, which means that the mill designed by Sangallo must have been somewhere else, much nearer the sea, maybe under the hill of San Ciriaco where the arsenal, the lazaretto and the port warehouses were located.

The drawings of the mills of Rimini and Cesena should date back to 1526, when Sangallo and his collaborators visited the fortresses of Romagna (Scaglia, 1994, II, p. 146; G. Zavatta, 2008, p. 70). According to Scaglia the drawings for Ancona came later, between 1527 and 1532. Without adequate documentation and evidence, the date of the project for the mill remains vague.

The drawing GDSU 1442 recto illustrates the gears of the mill wheel of Cesena together with those of San Leo and Pitigliano. In Cesena the mill, just like in Ancona, is turned by a horse while in the drawings concerning San Leo and Pitigliano the driving force comes from hanging weights.

![Figure 3: Bonaccorso Ghiberti, light winch (left) and load positioner: “livela da levare pezzi”, from Zibaldone (right). BNF Ms. Br 228, ff. 95 r., 119 r.; (Reti, 1974, pp. 124-125)](image)

The optimization of the mills was crucial because they were real coffers full of money: the proceeds from the sale of grain were necessary for the construction of the citadel. The citizen council through the “depositari” would weigh (“compassavano”) the grain that was ground in the mills, as documented by the yard journal (ASPSF, AAC, III, 2 Soprastanti Lavori Pubblici) of the fortress of Fano, which Sangallo himself worked at from 1532 on.
Albeit very succinctly, the analysis shows the interest of Sangallo the Younger (“procurator” of materials and craftsmen) in “secondary” problems (when compared to his main commitments) and paves the way for further investigations: the comparison between his drawings concerning Ancona and those related to the fortresses of the Marches (Fano, Loreto, Ascoli Piceno) and Romagna (Rimini, Cesena) could lead to further confirmations about the organization of his building sites and the use of the machines, and hence his debt towards the traditional schools of Florence and Siena.
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