



Interplay of adverse natural factors as possible cause of decline and abandonment of the Sasso Simone city-fortress during the Renaissance (AD 1566–1673)

Взаимодействие на неблагоприятните природни фактори като възможна причина за упадък и изоставянето на града-крепост Сасо Симоне по време на Възраждането (1566–1673)

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The Renaissance period remains a key period of the Modern Age. The population located in the Northern Hemisphere was subject to severe famines and successive epidemics and demographic crisis. The factors are to be found in a more acute phase of Little Ice Age (1250–1850), and a high amount of sulfate aerosols, injected into the stratosphere by powerful explosive eruptions, that tend to cool global surface temperatures. The slow building of the city-fortress on the Sasso Simone massif, its decline and the subsequent complete abandonment, is further evidence of the impact of adverse weather disruption on human activities in the seventeenth century.

The Sasso Simone (1204 m) is a calcareous massif of mid-Miocene age located in the Marche Region (Montefeltro area, Central Italy). In the year 1554, the Medici Lords of Florence, drew up the project to build on Sasso Simone a city-fortress in order to better defend the borders of the Duchy. The fortress was built notwithstanding great delays and adversities and it never became a sufficiently inhabited town (Coppi, 1975). As reported by Allegretti (1992), the development of worsening climatic conditions induced by the Little Ice Age onset, made life in the city-fortress practically impossible at such high altitudes. The city-fortress underwent a decline and was later abandoned. In 1673 the fortress was definitively dismantled. However, on the basis of previous literature data, these climate perturbations as reported from historical sources could be caused also by interplay of natural factors (Venturati, 2014): the Little Ice Age onset (Fig. 1), large explosive volcanic eruptions and/or periods with reduced solar irradiance as the Maunder Minimum (Shindell et al., 2001). In fact, during the slow building of the city-fortress, the Earth recorded several powerful volcanic activities and a subsequent related drop of temperatures that struck the Northern Hemisphere, as inferred

from dendrochronological studies (Briffa et al., 1998). Sulfate aerosols, from volcanic sulfur injected into the stratosphere by explosive eruptions, tend to cool global surface temperature. The aerosols scatter incoming solar radiation and absorb outgoing infrared radiation, thereby warming the lower stratosphere and cooling the Earth's surface (Robock, 2000). The observed Renaissance period (1566–1673) was marked by different volcanic eruptions recognized by a volcanic explosivity index (VEI) equal to 4, 5 and 6. Eruptions of the volcano San Salvador in the year 1575, Galeras 1590, Ruiz 1595, Hekla 1597, Vesuvius 1631, Llaïma 1640, Guagua Pitchncha 1660, Quilotos 1660 and San Salvador 1671, recorded VEI 4. Eruptions of the volcano Kelut in the year 1586, Raung 1593, Katla 1625, Furnas 1630, Komaga-take 1640, Awu 1641, Usu 1663, Shikotsu 1667, Tarumai 1667 and Gamkonora 1673, recognized VEI 5. Moreover, eruptions of the volcano Billy Mitchell in the year 1580, Huaynaputina 1600, Parker 1641, Long Island 1660 revealed VEI 6.

Additional historical sources reported that the significant deterioration of the climatic conditions of Renaissance period, engraved radically the rate of population and the economic activity in other localities of the Montefeltro area as Casteldelci (Renzi, 1993) and Monte Copiolo (Sacco, 2006). Moreover, Italy, Europe and the Northern Hemisphere of America and Asia were affected by severe famines, caused by several consecutive years of adverse meteorological situation which damaged directly the crops and also favoured the insurgence of maladies such rug-gine or wheat rust (Alfani et al., 2015; Morici, 2015). Similarly, freezing of rivers and lagoons recorded the impressive drop in temperatures (Corradi, 1867, 1870; Camuffo, 1987; Morici, 2015). The Po River froze in the year 1572–1573, 1595, 1635, 1665, and 1660. The Venice Lagoon froze in the years 1569,

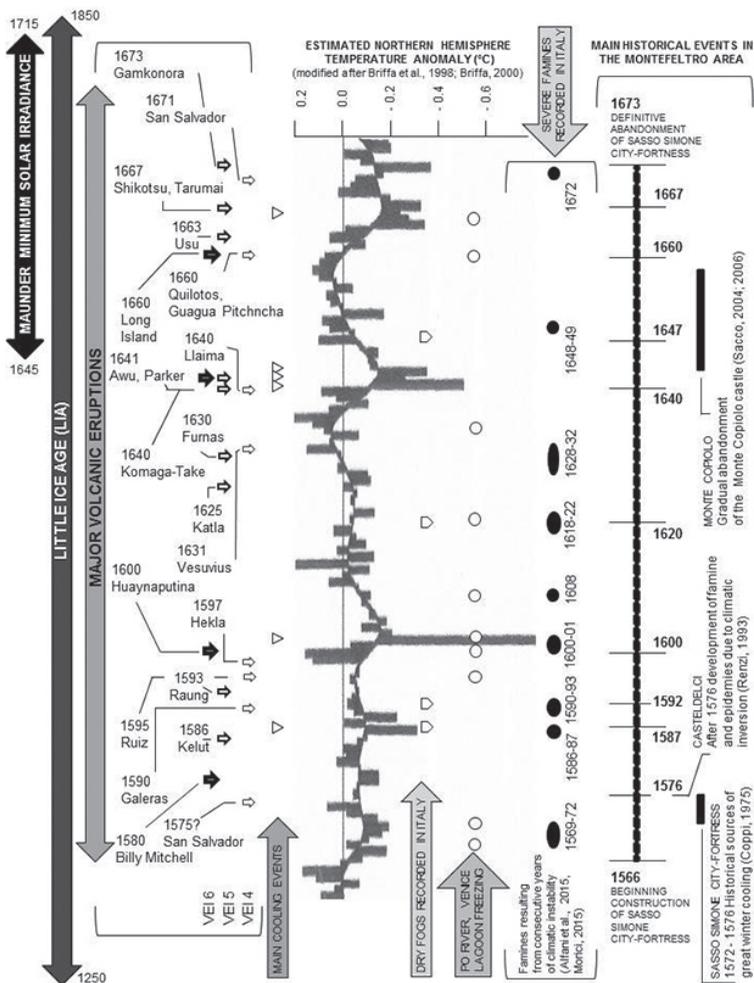


Fig. 1. Main historical events in the Montefeltro area during the Renaissance period, plotted against major environmental and worsening climatic conditions

1595, 1600, 1603, 1608, and 1621. In Europe, Rhine River and Scheldt also froze in 1595 (Camuffo, 1987). The Arno river froze in the last days of the year 1604 and the beginning of 1605 (Corradi, 1870; Morici, 2015). Particular interest is also given to the appearance of dry fogs caused by a concentration of volcanic gases and aerosols in the lower stratosphere that created damage on people, animals, crops and vegetation (Camuffo, Enzi, 1995).

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