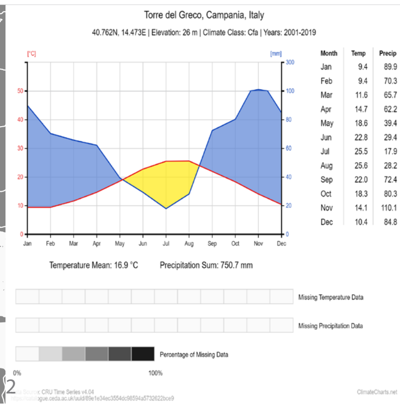
Roman Atrium Villa

House of the tragic poet | Pompeii, Italy | mediterranean | Lat. 40°45'0" N, 14°29'10" E
unknown architect



Abstract

The term Roman „villa" is used for different typologies of ancient Roman house construction. At this point, however, we are concerned only with the town house (domus) that developed in an urban context. The „house of the tragic poet" in Pompeii serves as an example. The devastating eruption of Mount Vesuvius in AD 79 destroyed and buried the city. The volcanic ash preserved many mineral resources. Nevertheless, the buildings have not survived time completely intact, which is why, with regard to some architectural aspects, it is necessary to work with assumptions based on the current state.

urban | vulcanic material | convection

Geography

The ancient city of Pompei is located in the Campania region of southern Italy, on the Gulf of Naples. The „House of the Tragic Poet" is located in the middle of the urban settlement at the foot of Mount Vesuvius. The Mediterranean climate, typical of the region, is characterized by mild, humid winters and dry, hot summers with an average humidity of 50-80%. The summer months range from June to September with an average high of 27 C° and August as the hottest month of the year. In contrast, winter stretches from November to March with temperatures often below the annual average of 16 C°. With 2375 h/a the sum of the sunshine hours is relatively high in the European comparison. However, the special climatic conditions only become clear in combination with the 1007 mm/a of precipitation. [1] This value is higher than that of the northern German city of Hamburg. Since the crops of the region (wine, olives, cereals) have remained the same since time immemorial [2], and since no irregularities can be detected even in examinations of the annual rings in tree trunks [3], it can be assumed that the temperature and the precipitation continue to resemble the climatic conditions of the ancient Roman epochs.

Topography

From the southern to the northern border area of the ancient city, the terrain rises from 24m NN to 48m NN. [4] With an area of just under one hectare, this results in a moderate slope. It can be assumed that due to the open, elevated terrain there is a considerable heat loss of the building material by wind activities.

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Volume

The building volume is enclosed on both the northern and eastern sides by directly attached but independent building structures. This reduces the heat rise and fall at all times of the year. This fact is supported by the box shape of the building and the resulting surface to volume ratio. The streets Vicolo della Fullonica and Via delle Terme flank the western and southern sides of the building. To what extent the upper floor shaded the first floor cannot be said with certainty. However, it can be assumed that cantilevers of the roof in the area of the atrium as well as fixtures in the peristyle protect from sun and rain, while at the same time allowing a continuous air flow. [5]


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Material

As with many buildings of Roman antiquity, the walls of the „House of the Tragic Poet“ were built of yellowish tuff and Roman cement. The numerous buildings and ruins throughout Italy, which are more than 2000 years old, show that the durability of the concrete of that time surpasses that of modern concrete - and this despite „various minor quakes, [...] storms and finally the pollutant loads of modern times.“ [6] The reason for this is the earth material Pozzulan, which was collected in the soil throughout the region by volcanic eruptions 40,000 years ago. This material contains many air pockets through its pores, in which partly crystalline structures were formed over time. This not only makes the ancient cement more resistant to cracking and water exposure [7], it also makes it lighter and an excellent material for heat storage. Pozzulan means that less limestone is needed to produce the cement, which means less CO2 is released. In addition, only a temperature of 1000 C° is needed to burn the clinker. [8] The local availability, durability and thermal conductivity, as well as the energy and emission savings during production, make the Roman cement a very sustainable material. Since no remains of the roof of the „House of the Tragic Poet“ exist, it cannot be said with certainty what material was used. In other places, the houses were mainly roofed with wooden shingles, which is why a similar structure can be assumed here as well. [9]

Envelope

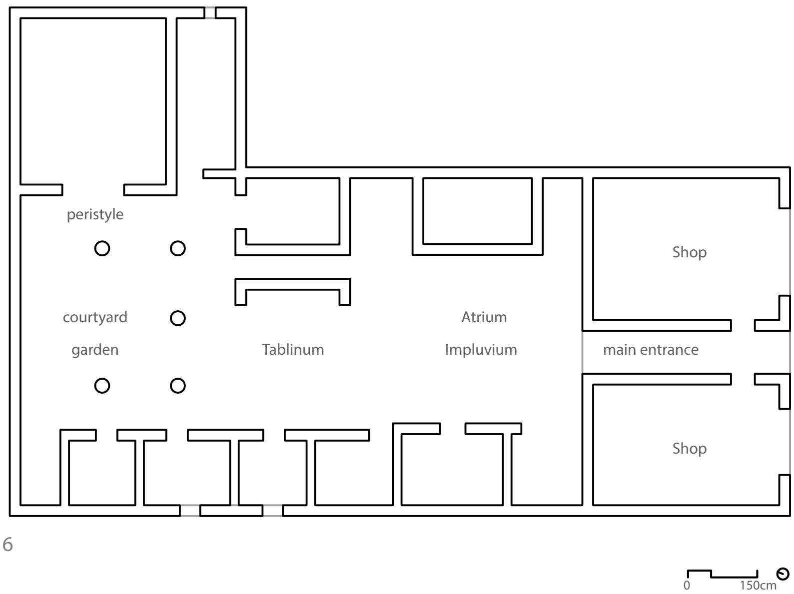
As already mentioned in the Volume section, the house appears boxy in its form. The walls, orthogonal to each other, allow a very economical and organized use of the material. Due to the wall thickness of 50-60cm, the heat storage effect of the cement is multiplied. To maintain this as much as possible, there were hardly any facade openings for windows or the like. This also prevented the rooms from heating up due to direct sunlight, and allowed the envelope to serve as a continuous protective skin. Thus, the courtyards served as the largest natural light source of the interior. Looking at the roof, it is noticeable that monopitch roofs were used for rapid drainage of rainfall. Thus, rainwater also collected in the impluvium from where it was used for cooking or washing. [10]

Technology

Cold, wet winters cause the temperature inside to drop to just above 10 C° on average. [11] As a result, rooms in ancient times were actively heated by a hypocaust system. However, the operation of this heating system was associated with a considerable amount of work and a disproportionately high release of CO_2 stored in the firewood.

Floor plan/ Section Zoning

Due to the preservation of living and furnishing objects, as well as Vitruvius's writings on the typology of the Roman townhouse [12], the following functions can be assigned to the rooms of the building (see Figure 5).



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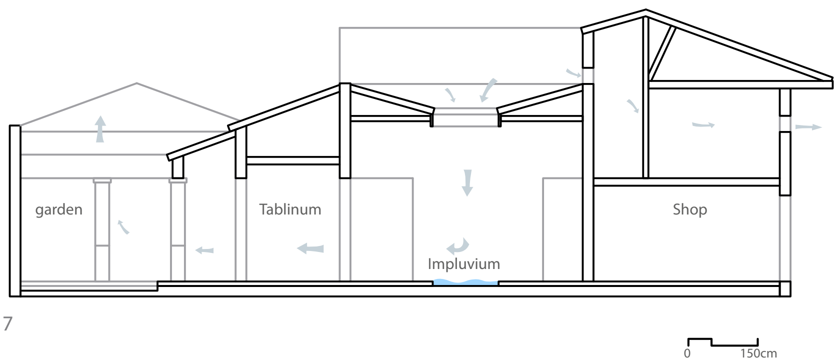
Next to the central entrance in the south of the house, along the main street Via delle Terme, there were small shops. They also served as a buffer zone to protect the living areas inside from the heat radiation of the exposed street as well as the higher noise level. The strategy in the arrangement of the rooms quickly becomes clear: from the entrance, a sequence of rooms aligns from the atrium, tablinum and peristyle to the garden. These day rooms derive the most benefit from convection currents. Functional and private spaces arrange themselves to the side of this zone to benefit from the convection currents.



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The depiction of the construction, room heights, and use of the second floor is an interpreted approximation of the original condition, but cannot be substantiated by sources. It can be assumed that the warm air accumulated in the rooms of the upper floor. Presumably, they thus served as storage space, or else as bedrooms for the household servants.

Ventilation

The wind, blowing mainly from the southwest, entered the building through the openings in the roof of the atrium and peristyle. [13] The outside air met the slightly cooler air of the water surface of the impluvium. The resulting convection currents served to cool the central rooms as well as the surrounding areas. A few small-sized openings in the facade acted as an additional valve through which the heated air could also escape from the bedrooms. [14]

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[1] Rajapaksha, Fiorito,Lazer & Sartogo, 2018
[2] Jongman, W. M. 2007
[3] Buntgen, U. et al. 2011
[4] Yamazaki D. et al. 2017
[5] Rajapaksha, Fiorito, Lazer & Sartogo, 2018
[6] Schwenn, J. 2019
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[9] Rajapaksha, Fiorito, Lazer & Sartogo, 2018
[10] Rajapaksha, Fiorito, Lazer & Sartogo, 2018
[11] Rajapaksha, Fiorito, Lazer & Sartogo, 2018
[12] Vitruv, n.d.
[13] Rajapaksha, Fiorito, Lazer & Sartogo, 2018
[14] Rajapaksha, Fiorito, Lazer & Sartogo, 2018

Picture Credits

Figure 1 : Robinson (n.d.): Map of the World with Countries - Single Color. Retrieved 20th march 2021 at https://freevectormaps.com/world-maps/WRLD-EPS-01-0011

Figure 2 : Laura Zepner, Pierre Karrasch, Felix Wiemann & Lars Bernard (2020) ClimateCharts.net – an interactive climate analysis web platform, International Journal of Digital Earth, DOI: 10.1080/17538947.2020.1829112. Retrieved 20th march 2021 at https://climatecharts.net/

Figure 3 : L. Gai (March, 2021): Climate responsive architecture (App). Roman Atrium Villa. House of the tragic poet

Figure 4,5: Indrika Rajapaksha, Francesco Fiorito, Estelle Lazer & Francesca Sartogo (2018): Exploring thermal comfort in the context of historical conservation. A study of the vernacular architecture of Pompeii, Architectural Science Review, DOI: 10.1080/00038628.2017.1405790

Figure 4,5: L. Gai (March, 2021): Climate responsive architecture (App). Roman Atrium Villa. House of the tragic poet

Figure 6-8: Indrika Rajapaksha, Francesco Fiorito, Estelle Lazer & Francesca Sartogo (2018): Exploring thermal comfort in the context of historical conservation. A study of the vernacular architecture of Pompeii, Architectural Science Review, DOI: 10.1080/00038628.2017.1405790

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