

## Roman In-Floor Heating Ahead of Its Time

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By Thomas Beck, AIA, NCARB

Happy Earth Day! In years past Thomas Beck and Together We Build have written articles for the EP Trail specific to Earth Day, first observed April 22, 1970. The Library of Congress' website estimates that "20 million people nationwide attended inaugural events." The youngest members of the Baby Boom Generation, born 1964, were six years old when this event took place.

This year we are looking at some ancient wisdom surrounding the heating of one's home. The website UNRV.com (United Nations of Roma Victrix) has a wealth of information about the Romans. Love them or hate them, they had some very clever innovations in building materials and techniques. We found the article on Roman Hypocaust from this site extremely informative. Doing an internet search will show you references to underfloor heat by modern plumbing companies, museums, and lots of images of what it looked like.

The term hypocaust derives from Greek words meaning under and burnt. The idea was to construct "pilae" stacks of tiles, which in turn supported a poured slab of concrete. The furnace was lit, and the heat radiated through the building, through the floor and also through hollow flues running through the walls of the building.

Hypocaust underfloor heating is the earliest known use of this system. At the time of underfloor heating use in ancient Rome, the technology was expensive and labor intensive. It was important to keep the furnaces stoked with appropriately sized wood and branches, and ash had to continually be removed from the furnace. Adequate venting was imperative. The use of ceramic tile tightly laid on floors and walls helped seal the interior of the structure, keeping smoke and carbon gases from infiltrating the home or public space.

The ancient city of Pompeii had multiple "thermae", public baths. The Stabian Thermal Baths are the oldest, built during the Samnite period, approximately 400 to 424BC. According to the website Pompeionline.net, the thermal baths in Pompeii used a "system of heating the rooms – which was fairly ingenious – worked by running heated water through the cavities in the wall." The Romans used these techniques in the floors and walls, using hollow clay tile. The exhaust from the furnace circulated below the floor and through the walls and ceiling to chimneys on the roof. It was an effective way to provide even heating for the entire bath house "sauna" structure.

Another of the resources which appeared in our search for underfloor heating is a story at Getty.edu, "Keeping Warm the Roman Way." In this article underfloor heating is discussed, but there are other flexible ways of life more common, such as portable braziers, hot drinks and most importantly designing homes sensibly and letting the use of their rooms change with the seasons. "They vacated the northern-facing rooms that they enjoyed in the summer and inhabited the western-facing rooms that captured more warmth and light during the winter." Architecture was designed with this in mind, to take advantage of the afternoon light "and not less so because the setting sun casts its rays upon them, and but its heat warms the aspect towards the evening hours," wrote Roman Architect Vitruvius in the 1<sup>st</sup> century BC. He wrote that there were three elements needed in well designed buildings: Firmness, Commodity and Delight.

I built a home for myself with in-floor hot water heat with 16 different zones, all with individual thermostats. This type of system is labor intensive to install, therefore expensive, unless you install all of the in-floor tubing yourself, which I did. It is a very comfortable heating system and efficient. When this system is combined with a slab on grade or a structural slab, it becomes even more efficient. The one negative characteristic is its response time to warm the room up, much slower than forced air or baseboard heat. So, when you return from a vacation and you have turned the house down to, say, 55 degrees it takes several hours to warm up. A system designed with more mass such as concrete slabs

does have the additional benefit of staying cool in the summer when the hot water heat is off. It is typically the most expensive heating system to install, but I say by far the most comfortable.

Designing our buildings in relationship to nature's elements is a far more sensible way to build our homes than ignoring nature's seasons. Harnessing passive solar, taking advantage of our more than 300 days of sunshine, and letting our living spaces be more flexible in relation to the planet's schedule is something we all should be able to get on board with..

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