Adobe wall in Popice village, Czech Republic. (photo: Fernando Vegas, Camilla Mileto)
State of the Art. The large region of Pannonia, in Central Europe, possesses an extraordinary richness of different forms of earthen architecture, of a constructive variety seldom found in any other natural region in the world. In this huge plain, situated mostly in the Danube basin, and presently divided into Eastern Austria, Hungary, northeast Slovenia, Southern Slovakia, the Moravia region of the Czech Republic, Western Romania and parts of other countries such as Serbia, Croatia, Ukraine, there are manifold examples of constructive techniques that overcome in number and variety the famous range of earthen architecture techniques once developed by CRAterre-ENSAG. Earth has not only been employed from ancient to recent times to build walls with multiple simple and mixed solutions, but it has also been used to create mortars, pavements, coatings, kitchens, bread ovens, stoves, wall benches, excavated walls (in semi-buried houses), slabs between joists, isolating material (as a filling for roofs), etc. Up to now, this extraordinary variety of uses for earth as a constructive material has not been as widespread as it deserves in local, national or international contexts and, therefore, is still a rather unknown architectural heritage, at least, at a European level. There are interesting and worthy exceptions to the rule, like the studies done in Hungary and the Czech Republic, but these are often published in local languages making it difficult to bring this architecture to the international position it really deserves.

History. The origin of all these earthen constructive techniques goes back very probably even to Roman colonization times. There have been found remains of walls built with formwork, masonry bonding in *opus spicatum* and other details that may have inspired and/or enriched afterwards these earthen vernacular techniques. In any case, linguistic studies done around the terminology of earthen architecture reveal that most of the words used derive from Germanic roots, as in the case of Austria, or from Slavic roots, in the case of the Czech Republic, Slovakia, Slovenia, but also Hungary. At first thought, this circumstance could allow us to date these constructive techniques previous to the arrival of the first Magyar emigration to the Pannonian plain, in the 7th century of our era.

Anyway, its presence as a constructive option in order to build domestic dwellings was not very representative in the middle of a world dominated by the construction of log-houses. These structures with a large consumption of wood were sometimes coated, both on the outside and the inside, with earthen renderings, the same way as the floor was made of tamped earth and the roof was thermally isolated with a layer of earth.

The true Golden Age of earthen architecture in dwellings and auxiliary rural buildings of this extensive region came from the 18th century onwards as certain factors appeared: the wood scarcity due to the increasing deforestation of the plain as a result of agricultural exploitation; the gradual publication of the “fire edicts”, that prohibited the building of new log-houses, requiring the existing ones to be rendered with earth and demanding the building of new kitchens and chimneys with masonry; the diffusion of earthen constructive techniques among master builders through architectural treaties; and the abolition of the serfdom system and the interdiction of cutting trees in the woods of the domains.

In the Bohemia region of the Czech Republic, outside the Pannonian plain, this process also took place in a parallel manner, though in this place of thick woods the former log-houses were substituted by half-timbered houses filled with adobe, cob or wattle and daub, the German Fachwerk that first spread to Bohemia through the cross-influences occurring during the Thirty Years War (1618–1648). Half-timbered architecture combined with earth is also present on the Pannonian plain but, as also happens with the rest of the great variety of

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1 SYROVÁ, Z., Quelques mots sur les mots utilisés dans la région danubienne et dans les langues slaves, unpublished paper

2 SYROVA, Z., SYROVÝ, J., La brique crue moulée dans les pays historiques tschèques (Bohême et Moravie-Silésie), 3ème Échanges Transdisciplinaires sur les constructions en terre crue, Éditions de l’Esperou, Montpellier 2011, p. 93–108

3 Idem

4 Idem
earthen constructive techniques, it lies concealed behind the coatings and usual white-washing of the dwellings. This half-timbered architecture can be divided into two large groups according to the permanence of the auxiliary supporting character of the wooden frame. That is to say, permanent if it retains its supporting function and the earth only becomes the filling to occupy the gaps, and auxiliary if its supporting function disappears when the earthen wall is finished. Generally speaking, these buildings, frequently with angle-braces in order to offer greater stability, have better survived the floods and humidity that may have washed away the earth, sparing the wooden frame and making repair possible.

**Earth with permanent wooden frames.** Among half-timbered buildings with permanent supporting wooden structures, there may be walls with vertical posts and horizontal strips with vertical straw tresses, squared-pattern straw grids or continuous straw screens, generously coated at both sides with earth; walls with vertical posts and vertical strips surrounded with earthen donuts coated afterwards; walls of vertical posts with horizontal strips having thick vegetal plaits knotted to them generously coated with thick layers of earth; or half-timbered walls with fillings of wickerwork, wattle or laths also daubed or earth-coated on both sides. The above-mentioned adobe as filling of half-timbered houses to be found in Bohemia was not common on the Pannonian plain. Finally, in the middle of the 50s there still existed very primitive conical teepee-shaped daubed structures of branches used for animal shelters.

**Earth with auxiliary half-timbered structures.** Among half-timbered buildings with auxiliary supporting structures used while erecting the building, there may be walls with a simple post-and-beam wooden structure subsequently covered by a cob masonry wall; walls with frequent vertical posts rendered on both sides with a thick layer of straw and earth subsequently trimmed; or a variant of the former with horizontal branches intertwined with the vertical posts in order to increase the adherence of the earth.

**Earth as a filling.** Earth-coated wicker, wattle or lathwork, also used to build up distribution walls, combine themselves as a sort of double formwork in order to create structures by filling with earth. It is another example of an aux-

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Terra Europae

The auxiliary wooden supporting structure that will be covered by earthen walls to be filled between two panels of wicker, wattle or lathwork and subsequently daubed on both sides. This technique is particularly interesting, as archaeology has shown that the earthen-filled wall between two wattle screens was already used locally by the Romans in order to build walls and fences.

Cob. Piled earth represents one of the simplest constructive techniques with this material. It also has a great variety of forms frequently to be found in rural areas. There exists the cob masonry wall, either bonded or built with formwork, even with an opus spicatum variant; the cob wall is subsequently trimmed on the external surfaces with a shovel; or the earth and straw wall also subsequently trimmed with the same instrument.

Rammed earth. Rammed earth is also frequent in two versions: walls built with hanging formworks supported with trespassing stakes, as is usual in Portugal, Spain, France, Italy or Maghreb, although with a lower module; or rammed earth walls without trespassing stakes, where the low formwork that may arrive to only one plank is wrapped and supported by posts stuck in the ground at both sides of the wall. There are variants to both versions, like the insertion of little branches between modules to improve the adherence; the total lack of lateral frontiers generating frequent sloped joints; or only in the second type, the setting of the formwork always some centimetres above the former earthen layer to create small projections in the wall that may improve the adherence of the subsequent rendering. In all cases, the formwork is continuous in every corner or T-wall joint in order to avoid weakening the angles with too many joints.

Adobe. Adobe made in several types of formwork with a mixture of earth and straw is very common throughout the area. Walls are normally one foot thick and cross bonded to guarantee a better support. These walls are normally concealed under an earth rendering, as with the other techniques described, but in the case of auxiliary constructions like stalls, storehouses, huts, etc., it may appear naked as happens from time to time with opus spicatum cob walls, with examples of great beauty particularly in Moravia.

Other uses. Earth appears in local construction in many other forms, either very common, as mortars, wall renderings, tamped floors, kitchens, ovens or benches, or very surprising, as covering for the space between joists by surrounding each one with thick earthen rings.

Place. The use of each technique depends first on the availability of materials, not directly earth, but other elements of varying auxiliary characters. Thus, rammed earth requires almost no water at all, and so it appears in places far from water sources, while adobe and cob require water. The availability of straw from agriculture also determines the possibility of making adobes or earth and straw walls and, therefore, vineyard area buildings usually employ other techniques like rammed earth or half-timbered walls combined with wicker, wattle or lathwork. The availability of wood is also definitive,
not only for the use of auxiliary or permanent structures, but also for making formworks and moulds. For this reason, simple cob walls constituted the most common technique among the poorer people.

**Position and function.** Combining several building techniques in one single house after an interesting functional specialization is also very common in the area: sometimes rammed earth is used for the basement of a cob or adobe wall; rammed earth or cob walls are used to the crowning of the wall but the gable end is made of adobes or wattle and daub; adobes are possibly used to finish the crowning of the walls in order to offer a better support for the roof joists; main façades are sometimes double-sided with a fired-brick masonry wall as a protection measure against fire built simultaneously or later; etc.

**Present situation.** Nowadays, while restoring existing domestic architecture, very pragmatic and often unfortunate solutions are found, such as repairing renderings with wire netting to improve adherence that quickly rusts or with cement mortars that stop the wall from breathing. It is necessary to spread adequate maintenance know-how for traditional earthen architecture in order to guarantee durability and compatibility. The open air museum at Szentendre (Hungary) is a reference institution that has been developing an extraordinary work concerning the building and conservation techniques of earthen architecture in the whole Pannonian plain. On the other hand, erecting again new buildings with earth has become something not common but increasingly popular in all the countries of the area. The new sensibility towards ecological and sustainable architecture has allowed a return to partially forgotten techniques or the present reinterpretation of them like building with adobes or compressed blocks, applying traditional or bought pre-dosified earthen renderings, fabricating of tamped earthen pavements, building with earthen coated straw bales, creating pre-fabricated earthen panels, etc. In almost all cases, the architectural forms of this contemporaneous earthen architecture are completely traditional, as if claiming a necessary return to earthen architecture meant to use the traditional rural architecture belonging to the collective imagination.

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6 An example is SZÜCS, M., *Föld- és vályogfalú házak építése és felújítása*, Építségügyi Tájékoztatási Központ Kft., Budapest 2008
8 See the work of engineer Jan Ruzicka at the University of Prague