



## Air quality and comfort inside raw earth buildings

### 36 months PhD scholarship

The Université de Pau et des Pays de l'Adour (<http://www.univ-pau.fr/en/home.html>) and the École des Mines d'Alès (<http://www.mines-ales.fr>) seek to recruit a PhD candidate for 36 months to investigate the use of raw earth as a construction material to improve indoor air quality and comfort of occupants inside buildings. The project will also study the durability of raw earth in terms of both hygro-thermal performance and visual appearance. This research is jointly funded by the French Environment and Energy Management Agency (ADEME) and the Université de Pau et des Pays de l'Adour.

The candidate will spend about half of the project at the SIAME laboratory of the Université de Pau et des Pays de l'Adour close to Biarritz on the Atlantic coast of France (<http://goo.gl/maps/OqJoM>). The remaining part of the project will instead take place at the C2MA laboratory of the École des Mines d'Alès located in Pau at a distance of about 100 km from Biarritz (<https://goo.gl/maps/s1m3yMjL4LA2>).

At the end of the project, if successful, the candidate will be awarded a PhD degree from the Université de Pau et des Pays de l'Adour.

### Project description

The sustainability of the building industry depends on the future ability to reduce the environmental impact and energy costs associated to the construction and operation of dwellings. The choice of building materials represents an important factor in the strategy to achieve this objective and the use of raw earth is currently being explored as a particularly promising option. Raw earth is a natural and widely available material with low embodied energy, which can be easily recycled or safely disposed after demolition.

Raw earth can also improve the quality of indoor air with a positive impact on public health. If properly manufactured, this material exhibits advantageous thermal and moisture inertia, which improves the comfort of occupants and reduces the need for costly air conditioning equipment. This is particularly important if we consider that we spend every day more than 22 hours inside closed spaces.

The research team involved in this project has recently developed a method for manufacturing highly dense raw earth bricks whose mechanical properties are adequate for load bearing applications in the same way as conventional fired bricks. No study has however been undertaken so far about the ability of this highly dense porous material to improve indoor air quality by regulating hygro-thermal conditions and capturing atmospheric pollutants inside buildings. The impact of raw earth on the wellbeing of occupants in terms of olfactory, sensory, thermal, visual and acoustic comfort also remains to be ascertained. Although these properties are often difficult to quantify, they are of paramount importance for the development of truly sustainable construction practices.

This project will address the above issues by identifying suitable indicators of indoor comfort. The main points of originality consist in:

1. the study of material behaviour at the scale of both a small earth element and a real masonry unit;
2. the study of the ability of raw earth to maintain an adequate level of performance over time in terms of hygro-thermal behaviour but also retention of pollutants, visual appearance and aesthetics (i.e. psychosensory aspects).

The above objectives will be achieved by testing small masonry units made of earth bricks exposed to variable levels of pollutants/humidity/temperature. The SIAME laboratory will provide the expertise about the use of earthen materials in construction while the C2MA will bring the competences about the study of indoor comfort and air quality.

### **Professional requirements**

Essential - Applicants should hold a first class degree in science of materials or materials engineering or analytical chemistry or civil engineering or equivalent discipline. Applicants must be capable of communicating in good oral and written English.

Preferable - Knowledge of the phenomena involved in the transfer of moisture/pollutants/heat between atmosphere and materials (adsorption, diffusion ...) will be appreciated. Applicants with skills in laboratory testing and/or previous research experience will be favourably considered.

### **Other information**

Candidates must be less than 28 years old at the start of the PhD in September 2017.

The monthly amount of the scholarship is about 1500 € net. Tuition fees are relatively low at about 400€/year but they will have to be covered by the candidate.

There will be the possibility for the candidate to contribute to teaching activities for which s/he will receive additional remuneration.

### **Application procedure**

Applications consisting of:

- a) a full CV including a transcript of the marks obtained for all exams passed at undergraduate level and, if applicable, at postgraduate level
- b) a letter of motivation stating the reasons why the applicant is interested in this position
- c) the names, addresses and emails of two referees, to be contacted if necessary

should be sent in a single email simultaneously addressed to Dr. Céline Perlot-Bascoules ([celine.bascoules@univ-pau.fr](mailto:celine.bascoules@univ-pau.fr)), Prof. Valérie Desauziers ([valerie.desauziers@mines-ales.fr](mailto:valerie.desauziers@mines-ales.fr)) and Prof. Domenico Gallipoli ([domenico.gallipoli@univ-pau.fr](mailto:domenico.gallipoli@univ-pau.fr)) before Wednesday **15 March 2017**.

The start date of the scholarship is September 2017 (some flexibility exists, if necessary).