PHYSICAL and CHEMICAL CHARACTERIZATION OF BUILDING MATERIALS

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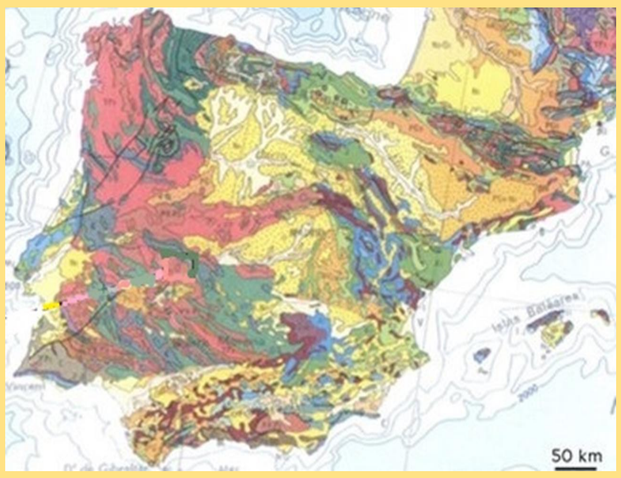
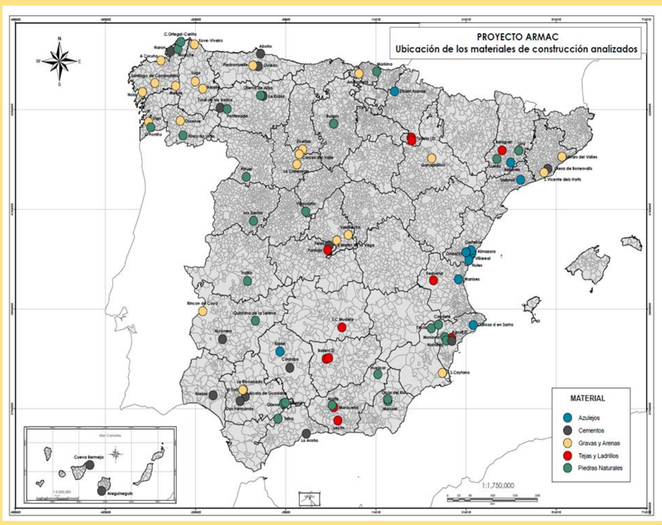
INTRODUCTION.-The products used in the construction of buildings and infrastructures, are made from raw material extracted directly from nature, and after suitable transformation processes are placed on site.
Approximately 2.5 tons of materials per square meter are used in a residential building.
The most abundant percentages are: Gravel and sand 57.8%, ceramics 21.6%, cement 12.5%, lime 1.98% and gypsum 0.46 %.
Some materials used cause a high impact of negative character in the environment but their quantification is low whereas others of low impact but are used of massive form in construction reason why they can cause serious hazards for the human health. The raw material used in the manufacture of construction materials is extracted directly from nature or is originated by a mixture of raw material and recycled material.
In any case, it is necessary to analyze the chemical composition of the construction products whether they are natural, whether they are transformed or mixed.



MATERIAL AND METHODS.-The purpose of this work was to perform a physical-chemical characterization of samples from factories located in three regions of different geological nature: granitic, calcareous and sedimentary.
The materials analyzed came from different factories located in Spain:

● 18 factories of cements ● 15 bricks and tiles ● 16 ceramics ○ 15 sands ● 18 natural stones

They were supplied by manufacturers and it has been made a physic-chemical characterization of the samples received. The chemical composition of the samples of cement, brick, ceramic and roofing tile has been made using ICP-MS (**I**nductively **C**oupled **P**lasma **M**ass **S**pectrometry) and EDXRF (**E**nergy **D**ispersive **X**-**r**ay **F**luorescence). All the samples were also characterized using XRPD (**X**-**r**ay **p**owder **d**iffraction). It is a powerful tool for material characterization in general, and cements materials in particular.



RESULTS
We have measured a total of 54 samples of cement, 32 of ceramic and 15 of bricks and tiles. All samples were subjected to a homogenization process, dried at 100C and sieved before analysis.

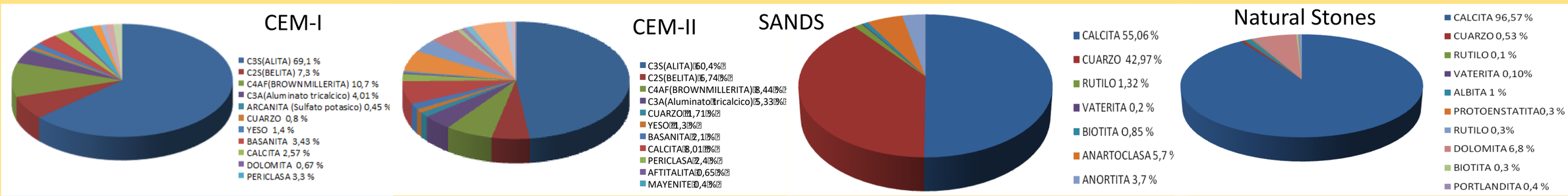
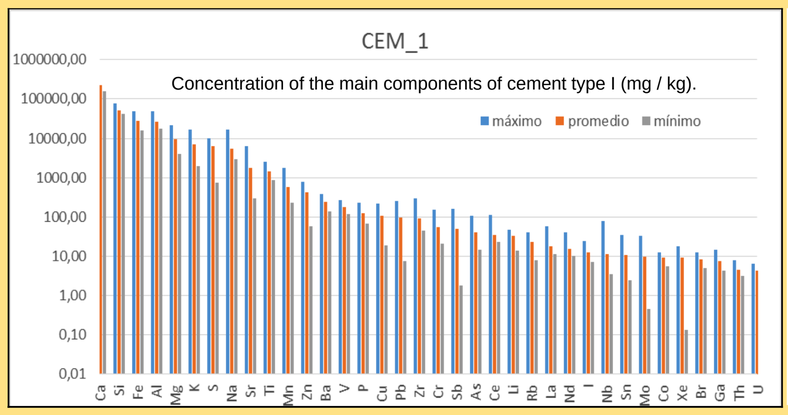
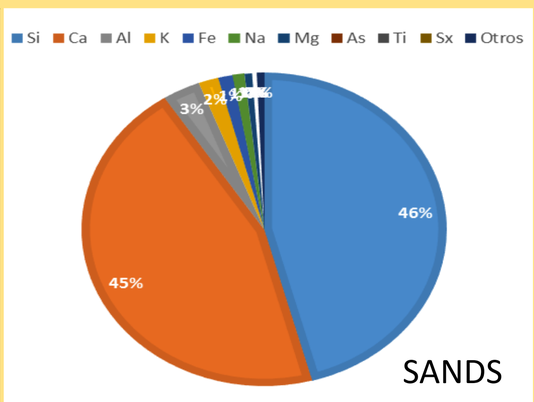
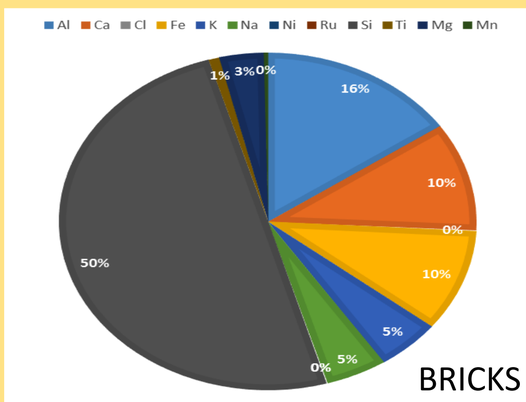


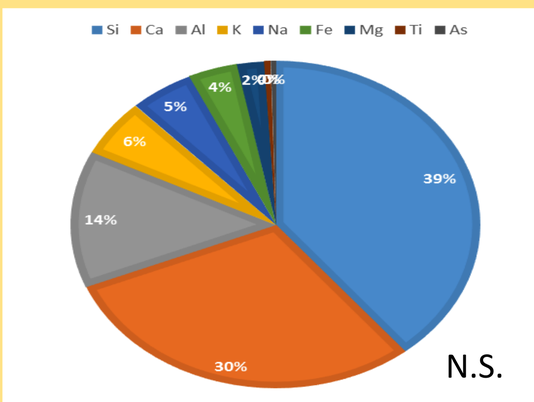
Figure 1.- Different composition of cement (CEM-I and CEM-2), sands and natural stones, respectively

The following figures show the average chemical composition for the different materials analyzed









CONCLUSION
The samples of analyzed cements indicate that they are of Portland type and that they belong to 6 different classes.
The use of the Rietveld method has allowed quantifying the clinkers and cements measured by XRPD giving their accurate phase assemblage. From the average composition of the different classes of cements analyzed, it is concluded that, except for two samples, the rest all correspond to Portland cements of different strength.
In this study, the chemical analysis of several building materials such as, cement, sand, natural stone, ceramic, brick, roofing tile, used in Spain were carried out to assess the chemical components of these samples. The most abundant oxides found were generally SiO_2, Al_2O_3, CaO, MgO, Fe_2O_3, K_2O and SO_3 for all investigated samples.

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