Mortar is not an organic material. Yet, the chemical process in the hardening is partly similar to those involved in the "C" dating. To make mortar, limestone has to be heated up to at least 900°C. After the carbonate has been released in the process, calcium oxide (calcium carbonate) is mixed with water and aggregate, usually sand. In the hardening process, the initial lime mortar, with atmospheric carbon dioxide, and calcium carbonate is prepared. Thus the mortar absorbs the carbon dioxide from the atmosphere and thereafter behaves as if it were organic. Enhanced luminosity in the mortar can communicate the results, yielding dates too old.

To avoid the effects of contamination different types of separation are needed. At first a mechanical separation with gravity settling, or sieving of the samples is carried out (60-75 microns for further analysis. In the following chemical separation 80% of phosphoric acid is poured over the samples, creating a gas of carbon dioxide.

In the presence of mortar is even more subtle than limestone. Therefore first fraction should be free from contamination. Mortar is an exothermic reaction, producing heat and creating the environment. Lime-lumps give birth to several stages create a sequence of CO₂ age profiles. The contamination is shown towards the end of the profile.

![Diagram of mortar samples analyzed](image1)

**Diagram depicting mortar samples analyzed.** By now the high-tech carbon dating results from more than 60 analyses on 470 individual samples. Some of the samples were analyzed repeatedly, in different laboratories. The sample includes different sorts of mortar, and they cover both Classical and Medieval archaeology.

**Why mortar?**

The physical archaeological excavation is often to establish the chronology of a site. Mortar, lime mortar or pozzolana mortar, is often the only datable material available, in abundance, from all the different building stages. Differently from other datable materials like dendrochronology and 14C of soil and tars, a mortar sample can produce more than one CO₂ fraction within several days. A mortar sample can be divided into a series of three or more samples, giving similar results at each stage. A mortar sample can be analyzed in two to five fractions. Each fraction in a series of three or more samples yield a conclusive date when there is mutual agreement between the dates of the first CO₂ fraction and at least two or more samples from one single building.

**Reliability criteria for the interpretation of the age profiles.**

**Criteria**

1. When analyzed to five CO₂ fractions, and the results from the first CO₂ fraction agree.
2. There is mutual agreement between the dates of the first CO₂ fraction and at least two or more samples from one single building.
3. A second date, with another chemical treatment, gives identical results.
4. A conclusive date independently of age control.

**Mortar dating zones, Torre de Palma, Portugal, the result of 120 samples.**

The project which started in 1997-2000 was our first encounter with Classical archaeology. Out of a total of 60 samples analyzed 18 yielded Criterion I results. Independently of other materials and methods these 18 samples could indicate the date of 12 out of 64 samples analyzed in the mortar.

**Lime fractions in mortar carbonated possibly already before the aggregate is added.** These form a sort of mortar that is called "slaked lime," and the formation of carbon dioxide starts as a result of the hydration process and the morphology of the sample. Only some 15% of all samples could be considered successful, and the interpretation of the CO₂ age profiles was not very complex.

**Lime lumps embedded in mortar.**

Lime lumps embedded in the mortar are highly interesting in this context. There may still be dates of Gabriel in the mortar, which became dated and carbonated possibly already before the aggregate is added. These form a sort of mortar that is called "slaked lime," and the formation of carbon dioxide starts as a result of the hydration process and the morphology of the sample. Only some 15% of all samples could be considered successful, and the interpretation of the CO₂ age profiles was not very complex.

**Recent Advances in Radiocarbon Dating of Ancient Roman Mortar and Concrete.**

**Residual results from 60 samples embedded in mortar.** 175 lime lumps were identified in line mortars, whereas 0 were embedded in pozzolana mortars. Of those 32 samples, that were embedded in lime mortars. Of those 32 samples, that were embedded in lime mortars, 23 yielded promising results. Of those 32 samples, that were embedded in lime mortars, 23 yielded promising results. Of those 32 samples, that were embedded in lime mortars, 23 yielded promising results. Of those 32 samples, that were embedded in lime mortars, 23 yielded promising results. Of those 32 samples, that were embedded in lime mortars, 23 yielded promising results. Of those 32 samples, that were embedded in lime mortars, 23 yielded promising results. Of those 32 samples, that were embedded in lime mortars, 23 yielded promising results. Of those 32 samples, that were embedded in lime mortars, 23 yielded promising results. Of those 32 samples, that were embedded in lime mortars, 23 yielded promising results. Of those 32 samples, that were embedded in lime mortars, 23 yielded promising results. Of those 32 samples, that were embedded in lime mortars, 23 yielded promising results. Of those 32 samples, that were embedded in lime mortars, 23 yielded promising results. Of those 32 samples, that were embedded in lime mortars, 23 yielded promising results. Of those 32 samples, that were embedded in lime mortars, 23 yielded promising results. Of those 32 samples, that were embedded in lime mortars, 23 yielded promising results.