

Prompt Gamma Activation Analysis (PGAA)

What is possible with PGAA? – It offers a panoramic analysis of the elemental composition in nearly all kind of samples.

- Qualitative and quantitative analysis of chemical elements (in principle the whole Periodic System, only exception: helium).
- Good detection limits for many elements down to ppb range (e.g. B, Cd, Sm, Gd...).
- Can easily be combined with classical neutron activation analysis (NAA) for a complete analysis of trace elements.

Samples: Size max. $5 \times 5 \times 5 \text{ cm}^3$ (exceptions possible), mass ca. 1 mg – 10 g.

- The result is independent of the chemical and physical properties of the samples (aggregate state, shape, texture and structure, chemical bindings etc.).
- In many cases, no sample preparation necessary.
- Bulk analysis: Effect of possible surface contamination is low.
- Non-destructive, release after a short cooling time possible.

Measurement time $\sim 0.5 - 4 \text{ h}$ in the most cases.

Applications in Archaeometry / cultural heritage (examples):

- Determination of chlorine in ancient iron objects (test of removal procedures to reduce corrosion)
- Trace-element content for provenance analysis, e.g. Roman building material, Mediterranean amphorae.
- Analysis of authenticity, e.g. silver content in gold findings.
- Spatially-resolved element composition of the outer and inner parts of a sample without opening the object, e.g. a reliquary – possible with a special setup, more time-consuming.

Principle: Neutron capture in a nucleus (irradiation in a neutron beam) and emission of characteristic prompt gamma radiation (measured with semiconductor detectors).

