

## **Materials analyses of pyrotechnological objects from late bronze age Tiryns, Greece, by means of laser-induced breakdown spectroscopy: results and a critical assessment of the method**

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Laser-Induced breakdown spectroscopy (LIBS) was employed in the investigation of pyrotechnological materials (metal and ceramic items, glass-based objects, plaster-based materials) from several Late Bronze Age workshop and activity area contexts at Tiryns, Greece. The use of portable instrumentation (LMNT-II+ spectrometer), which could be brought into the study place where all objects were housed, was crucial in order to establish the elemental content or verify the composition of almost all materials analysed. In addition, one important object, a bronze ingot exhibited in the Archaeological Museum of Nafplio, was analysed with the same instrumental set-up on location. In almost all cases, the LIBS analyses led to the preliminary identification of the materials investigated. In most cases, LIBS results sufficed to confirm earlier research carried out or was in agreement with similar analyses published in the literature. The analyses demonstrate that the micro-destructive LIBS technique provides useful preliminary elemental characterisation of most of the pyrotechnological materials while for some, additional work needs to be conducted to obtain conclusive results.. Furthermore, the portability and compactness of the instrumentation allow it to be employed in any workspace with a solid desk, light and electricity access. While the technique remains limited by spot analyses it does open up an immense array of possibilities for routine characterization or speedy screening of different types of artefacts in any storage or museum context. These important methodological and scientific findings are considered prerequisite steps leading towards and aiding in responsible sampling strategies for further analysis.