



# Age determination and authentication of ceramics: advancements in the thermoluminescence dating laboratory in Torino (Italy)

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## ABSTRACT

Classified as an absolute dating method, thermoluminescence (TL) is a well-established radiation-based technique for the age determination and authentication of ceramic materials. Specifically, this method allows the determination of the time elapsed since kiln firing (or later fire events) by evaluating the luminescent emission of ceramics under heating at high temperatures. This paper provides a comprehensive presentation of the TL laboratory developed over the last decade at the Physics Department of the University of Torino. The laboratory was set up in collaboration with TecArt S.r.l. and is also currently operating within the cultural heritage network of the National Institute of Nuclear Physics (INFN-CHNet). More than 10 years of experience in the field has resulted in improvements in procedures, with the development of customised  $\alpha$ - and  $\beta$ -irradiation systems and the optimisation of sampling approaches and chemical pre-treatment. Thanks to TecArt S.r.l., the laboratory has been employed for dating and authenticating hundreds of archaeological sites and artworks, some of which are discussed in this work and compared, when possible, with radiocarbon dating.

**Section:** RESEARCH PAPER

**Keywords:** Thermoluminescence; dating; customised instrumentation; authentication

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## 1. INTRODUCTION

The dating process of archaeological records can be of the utmost importance for an in-depth understanding of ancient civilisations and their development. Given the need for accurate temporal collocation, absolute dating techniques have, over time, completely complemented the archaeological relative approach [1]-[3].

Luminescence is a suitable parameter for characterising cultural heritage objects, being directly proportional to some of the intrinsic characteristics of the material. Therefore, out-of-context objects can also be investigated [4], [5]. The team at the University of Torino extensively applies various luminescence-

based techniques, such as ionoluminescence [6]-[9] and X-ray luminescence [10], to this field, always pursuing the development of customised instrumentation tailored to archaeological and artistic samples. In 2007, a thermoluminescence (TL) dating laboratory was opened in the Physics Department, in collaboration with the National Institute of Nuclear Physics (INFN) and TecArt Srl, a small enterprise dedicated to the scientific analysis of cultural heritage founded as a spin-off of the University of Torino. In its first decade of activity, the TL dating laboratory has provided excellent support to archaeological surveys in the nearby Piedmont area [11], [12]. The laboratory, the only one in Piedmont and one of the few providing TL dating and authentication in Italy, has been progressively expanded with new instruments and methods, which are presented in this work.