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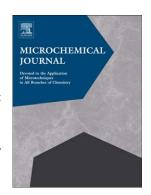
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ACCEPTED MANUSCRIPT

The use of flint-stone fragments as "fire-strikers" during the Neolithic period: Complementary micro-analytical evidences.

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ABSTRACT

The construction of an underground parking garage in the centre of Zurich (Zurich Opéra Parking, Switzerland) unearthed remains of seven Neolithic settlements from the 4th and 3rd millennium BC. The greatest number of prehistoric founds were retrieved from the 3175 BC layer (Horgen culture). Among the findings several thousands of flint-stone fragments were excavated. According to archaeologists' interpretation, based on wear patterns, some of them were certainly used to produce fire. Remarkably, a limited number of the flint-stones revealed additional characteristic metallic traces of potential anthropogenic origin. The contingent relation of these fragments to the fire-production was to be elucidated. An advanced, nondestructive micro-analytical approach was needed to characterise these unusual features. Seven flints were thus analysed by laboratory-based μ-XRF and RAMAN spectroscopy complemented by two-dimensional microscopic chemical imaging based on combined µ-XRD – μ-XRF analysis using micro-focused synchrotron radiation. The complementary results showed that all flint-stones, even the most doubtful, presented abundant traces of Fesulphide which were almost exclusively pyrite. Only sporadic indications towards the presence of trace amounts of marcasite and chalcopyrite were found. Furthermore, during the excavation, Fe-sulphide ore pieces were found in the same layer as the flint-stones. Geologically, these iron nodules appeared to be non-native to the setting in which they have be observed. The Fe-sulphide ore was also undoubtedly recognised as pyrite, indicating its potential use, conjointly with the flints, to kindle fire in a more efficient manner by the Neolithic populations at Lake Zurich more than 5000 years ago.

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