

**Mineralogical and petrographic examination of sediments  
from the Tell el-Farkha archaeological site. Nile Delta. Egypt.**

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The presented doctoral dissertation summarizes several years of research conducted by the author on the archaeological site Tell el-Farkha in Egypt. The paper is interdisciplinary in nature and includes geological studies conducted in cooperation with archaeologists. This cooperation is important because during archaeological excavations geologists help effectively understand and interpret the findings, as well as comprehensively describe the materials from each category.

On the Tell el-Farkha site, research is conducted under the supervision of Prof. Krzysztof M. Ciałowicz of the Jagiellonian University in Cracow and Marek Chłodnicki, PhD, of the Archaeological Museum in Poznań. The site is about 1,000 years old, and its origins date back to hundreds of years before the foundation of the country of pharaohs. The most important findings include works of art and a tomb which, according to current knowledge, should not be there, as well as giant structures—previously unknown in other parts of Egypt—and one of the oldest breweries in the world.

Previous geological as well as mineralogical and petrographic examinations of this site had been conducted by Prof. Maciej Pawlikowski, PhD, Eng., and Michał Wasilewski, PhD. This paper contains a comprehensive mineralogical and petrographic analysis of sediments from the site. The research materials were collected during three expeditions in the years 2010, 2011, and 2012.

The first stage focuses on field studies, during which a general geological profile was prepared and samples for laboratory tests were collected. In the next stage, laboratory analyses were conducted: with the use of binocular magnifying glasses, small fractions being the result of the slaking of fragments of the samples from the profile were examined. Then, mineralogical and petrographic examinations of dried bricks were conducted—these included determining the mineral and grainy composition of samples from light and dark bricks. Later,

anthropogenic examinations of coals were conducted; the aim of the analysis was to determine their sorption properties.

Finally, the results were presented, which included sketches, photographs, microphotographs, tables, and diagrams; the research was summarized, and conclusions that could be drawn from it were demonstrated. The paper helped solve interesting problems on the border of mineralogy, geology, and archeology. All of the conducted research is innovative in nature and contributes much new and important information helping explore this site and the activities of people from thousands of years ago.

The results of the research on microrelics indicate a change in the function of the analyzed place with time: at some point, fish were flayed there (as evidenced by the large number of fish bones), and at other times a bonfire was made or stone vessels were finished (or broken) in this place. This is additional information that is hard to acquire when the site is exploited in a classic way. The mineralogical and petrographic examinations of dried bricks had not been performed in Egypt on such a wide scale before. These contributed much new information about the technologies and materials used for the purpose of constructing various objects. The structure of the studied walls was varied as well.

The results of the examinations of dried bricks from graves indicate that these were different in length and width, but approximately the same in thickness. They had been made of dried Nile river mud mixed with other substances, mainly local sand. The results of the examinations of the dried *mastaba* bricks suggested that it had been built in a hurry, and probably rebuilt (double walls from the leeside). The bricks had irregular dimensions and heterogeneous mineral compositions, which may mean that they had been manufactured in different places.

The examination of the coals may be used to recognize the geochemistry of the archaeological environment. Since coals sorb metals, they can be useful for the purpose of locating copper, bronze, and other metals that undergo migration in the geochemical conditions of the site.

The microbiological tests indicated the existence of various kinds of bacteria (aerobic and anaerobic bacteria, or bacteria decomposing fat, starch, and protein) and fungi (including xerophilous fungi) in the samples. Previous studies had been general in nature and had consisted in simply identifying the presence of different bacteria and fungi; as a result, on

their basis one could not establish any risks for people working on the excavations. Therefore, it is important to examine the site in a way that assures that the workers are not exposed to serious health risks.

The comprehensive examinations of the materials from the site presented in the paper aimed at developing knowledge in the field of sciences auxiliary to archeology. They were conducted as part of the scientific cooperation established between the University of Science and Technology and the Institute of Archeology at the Jagiellonian University in Cracow.