

Review of doctoral thesis by Greta Brancaleoni, M.Sc.

The reviewed doctoral thesis titled "Reconstruction of depositional and post-depositional processes at Obishirian sites (Central Asia - Kyrgyzstan)" was carried out at the Institute of Geological Sciences of the Polish Academy of Sciences under the supervision of Dr hab. Maciej T. Krajcarz, Professor of ING PAN.

General characteristics of the thesis

The thesis sent to me for evaluation in the form of a bound printout contains: (i) introductory parts (acknowledgements, declaration, list of publications constituting the thesis, abstract, list of abbreviations, tables of contents, figures and tables) – a total of 14 pages, (ii) an extensive chapter which consists of: characteristics of the sites, presentation of the environmental context, discussion of the research methods used, synthetically presented research results, discussion and bibliography – a total of 87 pages, (iii) the main part, consisting of printouts of three co-authored papers by the doctoral student along with supplements to two of them (papers no. 1 and 3; Appendices 1–3), and (iv) statements of co-authors regarding their percentage contribution and its character to the preparation of the above papers (Appendix 4). The main part consists of the following papers:

1. **Brancaleoni, G.**, Shnaider, S., Osipova, E., Danukalova, G., Kurbanov, R., Deput, E., Alisher kyzy, S., Abdykanova, A. & Krajcarz, M. T., 2022. Depositional history of a talus cone in an arid intermontane basin in Central Asia: An interdisciplinary study at the Late Pleistocene–Late Holocene Obishir-I site, Kyrgyzstan. *Geoarchaeology*, 37: 350–373. (with supplements),
2. **Brancaleoni, G.**, Kot, M., Shnaider, S., Mroczek, P., Kurbanov, R., Abdykanova, A., Alisher kyzy, S., Khudjanazarov, M., Pavlenok, K. & Krajcarz, M. T., 2023. A closer look at clasts and groundmass: Micromorphological features in sediments with archaeological significance in Obishir and Katta Sai complexes (Central Asia). *Journal of Archaeological Science: Reports*, 51: 104118,
3. **Brancaleoni, G.**, Shnaider, S., Lempart-Drozd, G., Deput, E., Abdykanova, A., Krajcarz, M. T., submitted. Geoarchaeological approach for tackling the function and preservation state of the Obishir-5 site, the earliest Neolithic site in the Fergana Valley. *Journal of Archaeological and Anthropological Sciences*. (with supplements).

Formal aspects

The main part of the thesis consists of the two published papers and the third one in the form in which it was submitted to the editorial office of the *Journal of Archaeological and Anthropological Sciences* on October 23, 2023. The currently applicable formal regulations allow this "hybrid" form of doctoral thesis. Greta Brancaleoni, M.Sc. is the corresponding author of all the above papers. The doctoral student's contribution to the preparation of these papers is significant, as confirmed by the relevant statements, and her role was visible at all stages, from field research, through laboratory analyzes and interpretation of data, to writing and final editing of texts, as well as necessary contacts with the editorial offices of journals. This statement results from the data presented in Appendix 4, and especially from the detailed description of the authors' contribution contained in the introductory and summarizing chapter of the thesis (pp. 49–50, 54, 57). The participation of Greta Brancaleoni, M.Sc. in the preparation of the papers does not raise any doubts, despite a certain error; the percentage contributions to the preparation of paper no. 2 given by the co-authors add up to 110%, not 100%. Nonetheless, I regard the above discrepancy only as a simple algebraic error.

As for other important formal aspects, it should be noted that the research was carried out under the OPUS grant from the National Science Center received in 2018 by the supervisor.

Advantages of the doctoral thesis

A definite advantage of the reviewed thesis is the multidisciplinary character of the research conducted and the multi-level conclusions drawn from it. Taking into account both the research problems posed and the methods used, the thesis is placed on the border of geology, archeology and soil science. Greta Brancaleoni, M.Sc., skillfully used a wide range of carefully selected research methods. Not only typical geological methods were used, but also those currently applied by soil scientists. In turn, the obtained results made it possible to draw conclusions regarding the history and nature of the activity of prehistoric people in the studied area, and therefore regarding the scope of archeology. The multidisciplinary approach resulted in: (i) developing a coherent model of the paleoenvironmental conditions of the late Pleistocene and Holocene of the studied area, (ii) identifying the impact of multiple post-sedimentary processes on the studied colluvial deposits, and (iii) providing new, convincing evidence of the nature of the settlement of the studied sites in the Neolithic by the Obishirian people.

It is worth emphasizing that the research conducted by Greta Brancaleoni, M.Sc. is a direct continuation of the supervisor's interests and experiences, thus it fits well into the research trend successfully carried out so far at the Institute of Geological Sciences of PAS. Thanks to this, the doctoral

student could benefit from previous methodological experience. However, her research was conducted in a new, poorly explored, but scientifically very attractive area. This required facing certain logistic difficulties and limitations resulting from the relatively scarce regional data. The thesis showed that the doctoral student managed to successfully overcome the above difficulties and limitations.

I consider the recognition of the multidirectional impact of post-depositional processes on the current characteristics of the studied sediments to be a very important achievement. The conclusions from this research go far beyond the Central Asia region and are of universal character. They will become an appropriate reference point for other researchers in the future and will be used to develop detailed paleoenvironmental interpretations, including reconstructions needed as a proper and necessary background for archaeological studies.

The multidisciplinary nature of the research forced the use of many analytical methods. The doctoral student performed some of the analyzes in person. Moreover, she also skillfully used the expert knowledge of her co-authors (e.g., in the field of malacology, OSL dating, grain size analysis). In present times dominated by comprehensive research, such an approach must be considered an advantage of a doctoral student.

The thesis is generally very carefully prepared in terms of editing. Of course, one may encounter minor typographical errors in the text or shortcomings in the illustrations, but they do not affect the overall impression of the thesis.

I must also draw attention to the great scientific activity of the doctoral student, which is visible in the co-authorship of numerous publications in renowned scientific journals. These publications are not included in the doctoral thesis. For this reason, they cannot influence the formal review of the thesis itself. However, in my opinion, the above-mentioned activity of the doctoral student should be noticed and emphasized in the review.

Shortcomings of the doctoral thesis

A more thorough analysis of the thesis reveals certain imperfections and shortcomings in the sphere of interpretation. They result mainly from the omission or lack of a broader discussion of some, sometimes important, aspects and alternative interpretations. Below, I present only the most striking examples.

I regard not discussing the mechanism of washing down fine fractions from higher parts of the slope when interpreting the origin of the studied colluvial deposits as the main shortcoming of the thesis. Taking into account the matrix supported fabric of the vast majority of the examined sediments, small

fractions constituting the matrix must have been delivered during the sedimentation of rock debris, properly interpreted as the effect of rockfalls. The author focuses only on the aeolian supply of fine fractions and subsequent, post-depositional modifications of the resulting sediment. In my opinion, based on the data presented in the thesis, the mechanism of transport of fine fractions after periodic heavy rainfall or during snow melting by, for example, sheet flows or mud flows cannot be ruled out. The prevailing climatic conditions and sparse plant cover would undoubtedly be favorable factors. This alternative scenario should be taken into account and at least discussed in the thesis.

I cannot agree that the grain composition of matrix (grains from sand to silt) in the Obishir-1 site (Fig. 7-1 and Fig. 3 in paper 3) is the result of post-depositional homogenization of sediments. The sand must have been supplied to the sediments, regardless of the subsequent post-depositional processes. The observed difference in sediment grain size between Obishir-1 and Obishir-5, where the matrix is silt-dominated, should be interpreted as the result of depositional processes conditioned by various factors, for example slope exposure, local wind direction, different lithology or susceptibility to weathering of the exposed rocks located in the upper part of the slope. I would expect these issues to be discussed and some interpretations to be proposed and others rejected.

The view about the anthropogenic origin of the crystalline material of the gravel fraction in the sediments at the Obishir-5 site (paper 3, p. 20) would certainly be more justified if the paper clearly stated what rocks make up the entire slope above the studied site and whether they could be the source of this material type or not. What is important here is the occurrence of crystalline rocks *in situ*, but also all sedimentary rocks, including lenses of Pleistocene alluvial gravels, containing grains of crystalline rocks. If a potential source existed above the site, this material could, at least hypothetically, be transported by gravity down the slope, without the involvement of human factor.

Other shortcomings of the thesis include the too scarce presentation of the geological background, both in individual papers and in the introductory and summary part of the thesis. Of course, I am aware that this is, at least to some extent, due to the low level of geological recognition of the research area. However, reservations also apply to the close vicinity of the studied sites. For example, there is no data about spatial orientation of beds in rock cliffs above these sites. Moreover, figures provide contradictory information. Fig. 3-2 (introductory and summary part, p. 18) suggests a dip of the layers in the area of the Obishir-1 site generally towards the N. A similar impression is obtained when analyzing Fig. 2 (paper 2, p. 3). However, the cross-section in Fig. 2 (paper 1, p. 4) clearly indicates the opposite dip of the beds, that is towards S. This is not just a marginal problem of the correctness of the figures or inaccuracies in the presentation of the geological background. The relationship between bed orientation and slope orientation is important in the interpretation of gravity transport and the formation of colluvial sediments, which is an important element of the PhD student's research. The

work also does not reveal anything about the various features of the rocks that are the source of material for colluvial deposits. What I mean here are features such as porosity, possible and probable content of dolomite or non-carbonate components, distribution and density of fractures. It is also not stated whether these rocks are bedded (probably they are) and how uniform the bedding is. Such features determine the susceptibility of rocks to weathering and, to some extent, control the resulting weathering products, so they could influence the mineral and chemical composition (e.g., the discussed content of CaCO_3 , Ca and Mg), as well as the textural features of the studied colluvial deposits.

Some terms used in the thesis also raise doubts. Paradoxically, these doubts partly result from one of the main positives of the thesis, that is its multidisciplinary character. Many of the terms used to describe grain-matrix relationships are taken from soil science. For example, the terms: porphyric, chitonic, eunalic, pellicular. These terms are incomprehensible to most geologists, and probably also to archaeologists, that is to a large group of readers. Therefore, it is a pity that in the thesis, as well as in the papers that are part of it (especially in paper 2), there is no place to define these terms, for example in the form of short "Terminology" chapters. I also came across other terms and expressions that may sound strange, especially to a geologist. As examples, I can cite: "endogenous sedimentation" (paper 1, p. 21; in the context of weathering processes, disintegration of carbonate rocks in the hypergenic zone and illuvial processes) and "(para)autochthon unit filled with carbonate platform formations" (p. 16).

Final conclusion

To sum up, I evaluate the reviewed doctoral thesis by Greta Brancaleoni, M.Sc., unequivocally positively. I am of the opinion that that the papers constituting an integral part of the thesis are based on a wide spectrum of analytical research and solve important scientific problems. This allows us to recognize Greta Brancaleoni, M.Sc., as a mature researcher. The shortcomings noted and listed above are of a subordinate character and certainly do not affect the overall assessment of the thesis. Therefore, I declare that Greta Brancaleoni, M.Sc. meets the conditions specified in the applicable regulations (Act on Higher Education and Science of July 20, 2018, with further amendments) and I request that she be admitted to the next stages of the procedure for awarding the doctoral degree.

Kraków, February 15, 2024


Professor Michał Gradziński