REVIEW

of the scientific publications of Assist. Prof. Dr. Boyka Kuncheva Zlateva

participant in a competition for obtaining the scientific position "Associate Professor" in professional branch 4.2 Chemical Sciences (Analytical Chemistry – Archaeometry) announced in State Newspaper 100/16.12.2022

CV data of Assist. Prof. Dr. Bojka Zlateva

Assist. Prof. Dr. Bojka Zlateva is born in Sofia in 1973. She accomplished her high education at Faculty of Chemistry, University of Sofia as master of organic and analytical chemistry in the period 1933-1997. Afterwards is became PhD student (1988 – 2001) at Chair of Analytical Chemistry, Faculty of Chemistry and defends her thesis in 2003.

Zlateva works in position of a chemist, followed by senior assistant position at Institute of nuclear research and nuclear energetics – Bulgarian Academy of Sciences between 2002 – 2005 and later is appointed as assistant professor at Chair of Analytical Chemistry, Faculty of chemistry and pharmacy where she is active till present time. In 2019 Dr. Zlateva receives the parallel status of researcher at Faculty of history, Chair of archeology where the present procedure is issued (academic position of Associate professor).

The major teaching and scientific activity of Zlateva is related to teaching instrumental analytical methods (lectures and laboratory), analytical chemistry, archaeometrics, application of instrumental analytical methods in archeology.

Scientometric assessment of the publications presented by the candidate

For the present procedure B. Zlateva participates with totally 17 publications in scientific journals as well as chapters from scientific monographs (14 publications and 3 chapters). Part of these works are included in the presented habilitation thesis. The publications are published in specific journals related to the topics of the procedure (analytical chemistry and archaeometry) being clearly interdisciplinary like *Archaelogica Bulgarica, Mediterranian Archaelogy and Archaeometry, Science and Technology of Archaelogical Research, Bulgarian E-journal of archeology.* It should be mentioned that the interdisciplinary profile of the studies carried out required publication of significant number of research studies in journals with analytical and

ecological agenda (with significantly higher impact factor and significant quartile) like *Journal of Ecosystems and Ecology Science, Compte Rendue of BAS, Journal of Applied Spectroscopy, Journal of Radioanalytical and Nuclear Chemistry.* This variety of selected journals is very positive. Formally, almost all journals have impact factor (often marked as SJR) between 0.2 and 1.4 and quartiles Q1 and Q2.

The number of citations of the publications presented is totally 43 (Scholar Google data), although the candidate has not recorded officially the citations. There is data about all publications of Zlateva. The indicated number of 43 citations for 14 publications is quite acceptable (in average 3 citations per publication). This number corresponds approximately to h factor = 3-4.

The specificity of the research performed by B. Zlateva requires participation of different researchers in the scientific teams. The number of co-authors of the papers presented is between 1 and 6 as she is the only author for all 3 chapters from the monographs. It is important to mention that in the list of authors Zlateva is among the first authors (although this is a relative indicator for the role of every single author's contribution - to me all authors are equally important). It could be stated that B. Zlateva has a significant contribution for the realization of a certain research task.

B. Zlateva has participated in a significant number of local and international scientific forums with reports and poster communications.

The scientometric assessment of the publications has shown that the research presented covers the requirements of the Law for development of the academic personal in Republic of Bulgaria and the local manuals for its application.

The habilitation thesis gives a good idea of the research performed and the role of B. Zlateva for its realization.

Assessment of the scientific contributions of B. Zlateva

The scientific publications presented by B. Zlateva could be summarized as research studies related to archaeometry (analysis of different types of artefacts) based on modern analytical methods. A smaller number of research papers is linked to ecological studies since the environmental conditions determine the general status of the artefacts.

The research related to archeometric tasks could be divided on the basis of the type of the analysed findingds:

1. Metals and metal alloys;
2. Glasses, mosaics, mortar;
3. Organic remains.

In part 1 as indicated above basically copper and copper alloys are studied for belts as well as electrum, gold and silver for production of coins.

From analytical point of view multielemental analysis was used like ICP-AES and ICP-MS, which requires non destructive sampling as the samples are dissolved in a mixure of inorganic acids - HNO_3/HCl (using the analytical techniques mentioned above concentrations of 14 components were determined, namely As, Bi, Co, Cd, Cu, Fe, Mn, Ni, P, Pb, Sb, Se, Sn and Zn,). Additionally p-XRF analysis is used which allows in situ procedure (as required by the laboratories in different museums). A chemical profile of the artefacts is achieved. Statistical data treatment of the analytical data is also performed (correlation, cluster and factor analysis). Regional factors, ethnic and sex requirements are also determined. The technology of production of the belt elements is analysed and local workshops are identified.

A similar approach is realized in investigation of golden and silver artefacts.

In part 2 glass, mortar and mosaics were investigated.

The papers included in this part deal with inhomogeneous from chemical point of view materials. Totally 110 fragments from different glass findings are analysed in the period III century BC - XII century AD).

In part 3 organic matter is analysed and interpreted. Organic extracts from ceramics could contain:

- Substances absorbed on the surface;
- Substances absorbed on the surface subject to structural changes (degradation) during culinary practice or prolonged usage;
- Substances absorbed on the artifact during its stay underground being chemically or enzymatically modified;
- Substances, whose concentration increases due to transfer from the environment (by bacteria, mold etc) and having increased lipid content;
- Substances absorbed on the artifact during archaeological digging;
- Substances absorbed during utilization of the artifact being structurally degradated .

Totally 35 samples are analysed having different origin whose organic content (resins) correspond to the transportation and utilization of wine type “retsina” imported from Atica (Greece). A combination of analytical techniques (FTIR, HPLC, NMR and TLC were used making it possible to identify the original product like amphorae from different origins.

The major contributions of the research work presented by Dr. B. Zlateva could be summarized as follows:

- Since Dr. B. Zlateva possesses a significant experience in application of the methods of multivariate statistics (chemometrics) for interpretation of analytical data, I accept that one of hers substantial contributions in realization of archaeological studies is exactly the data mining (interpretation) of the analytical results from treatment of archaeological artefacts by the use of cluster, discriminant and factor analysis; it allows to clarify the analytical data structure and makes it possible to make conclusions about the origin, technology and composition of the artefacts;
- Another proven contribution of B. Zlateva is her active participation in the application, optimization and adaptation of different instrumental analytical methods for realization of all archaeological studies performed;

- A third type of contribution (along with all co-workers) is the realization of the final archaeometric interpretations of the different artefacts after chemical analysis and chemometric data mining.

Questions and comments

I have following questions and comments to the presented materials:

1. The arrangement of the documents could be much better and informative especially with respect to the scientific contributions of the candidate;
2. What clustering method is applied to the research interpretation and how the statistical significance of the clusters obtained is determined?
3. Does the candidate carry out clustering of the chemical variables and are the results of such a linkage informative from archaeometrical point of view, for instance about the technology used?

Conclusion

The research items presented for reviewing indicate that the candidate assist. prof.dr. Boyka Zlateva has fulfilled all requirements of the law for development of the academic staff in Republic of Bulgaria and the manuals for its application. Therefore, dr. Zlateva could obtain the academic position “associate professor (dozent)” in direction 4.2 Chamical sciences (analytical chemistry – archaeometry) on half position as the requirement is stated. I know personally the candidate since many years and am convinced both by the presented documents and from personal impressions , that B. Zlateva deserves my positive vote.

Sofia, 03/04/2023

Reviewer:

Prof. Dr. Vasil Simeonov, DSc