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For the competition for occupation the academic position of "Associate Professor" in the professional field 4.4. Earth Sciences (Mineralogy and Crystallography) for the needs of the "Mineralogy and Mineral Raw Materials" department at the Institute of Mineralogy and Mineral Resources of the Bulgarian Academy of Sciences announced in the "State Gazette", №36/29.04.2025.

Candidate: Chief Assistant Professor Dr. Elena Slavcheva Tacheva, Institute of Mineralogy and Crystallography "Acad. Ivan Kostov" - BULGARIAN ACADEMY OF SCIENCES)

Reviewer: Assoc. Prof. Dr. Irena Kirilova Mihailova, University of Chemical Technology and Metallurgy - Sofia

This review was prepared on the basis of an order of the Head of the Institute of Mineralogy and Crystallography "Acad. Ivan Kostov" No. 381ПД09/ 01.07.2025 and a decision of a meeting of the Scientific Jury held on 15.07.2025. The review is in accordance with the requirements of the Law for the Development of the Academic Staff in the Republic of Bulgaria (LDASRB), the Regulations for its Application, and the Regulations on the Terms and the Conditions for Acquiring Scientific Degrees and for Holding Academic Positions at the Institute of Mineralogy and Crystallography "Acad. Ivan Kostov" - BAS.

One applicant, Chief Assistant Professor Dr. Elena Slavcheva Tacheva, participates in the competition. She acquired her Master degree in 2002 at the Sofia University "St. Kliment Ohridski", Faculty of Geology and Geography. Since 2006, she has been working at the Institute of Mineralogy and Crystallography, IMC-BAS successively as a doctoral student, geologist, Assistant Professor and Chief Assistant Professor. The scientific interests of Dr. Tacheva relate to: Mineral raw materials, Hydrology, Geochemistry; Processes of magmatic evolution (mixing of magmas); Accessory minerals as petrogenetic indicators; SEM (scanning electron microscopy), LA-ICP-MS (mass spectrometry with inductively coupled plasma and laser ablation); Archaeomineralogy.

1. General description of the submitted materials

In the announced competition for Associate Professor, the applicant has submitted the following materials: 34 scientific publications, a list of the citations, information on participation in 7 research projects and in 31 scientific forums. According to Appendix 2 of the Regulations on the terms and conditions for acquiring scientific degrees and for holding academic positions at the Institute of Mineralogy and Crystallography "Acad. Ivan Kostov" - BAS, the minimum required points in the groups of indicators for the academic position "associate professor" are the following: for group of indicators A - 50 points; for group of indicators B - 100 points; for group of indicators Г - 220 points; for group of indicators Д - 60 points. The applicant in the competition Assist. Prof. Dr. Tacheva presented Diploma No. 000332/30.10.2013, with which she certified that she successfully defended a dissertation for the educational and scientific degree "Doctor" entitled "Mineralogical-geochemical characterization of accessory minerals from the Petrohan Pluton" and fulfilled the requirements for group of indicators A - 50 points. For group of indicators B - indicator 4, 11

publications were presented: 1 [No. 8] with quartile Q1 (25 points), 1 [2] with quartile Q2 (20 points), 4 [No. 6, 9, 10, 11] in *Review of the Bulgarian Geological Society* indexed and referenced in the Web of Science Core Collection from 2018 (48 points), 1 article in *Geologica Balcanica* [7] (included in the National Reference List of Contemporary Bulgarian Scientific Publications with Scientific Review) (6 points). To determine the corresponding points for the publications, I have checked the indexing of the journals indicated, because I have found that there were inconsistencies in the documents submitted by Dr. Tacheva. This group also includes 4 publications [No. 1, 3, 4, 5] in conference proceedings with editor *GEOSCIENCES* (ISSN 1313-2377), proceedings not included in the national reference list of contemporary Bulgarian scientific publications with scientific review. [1] is in *GEOSCIENCES* 2006 Collection of extended abstracts from a National Conference with international participation. Publications [3, 4 and 5] are in *GEOSCIENCES* 2015, 2016 and 2017 and are described as peer-reviewed short communications.

According to the Notes in Appendix 1 of the IMC Regulations:

Points are awarded for "other" scientific publications (for indicators B4 and D7) in peer-reviewed publications.

4. (supplemented - SG, issue 15 of 2019) The Ministry of Education and Science, through National Centre for Information and Documentation (NCID), creates and maintains a National Reference List of Contemporary Bulgarian Scientific Peer-reviewed Publications. On the basis of this list, works and citations in peer-reviewed publications that are not referenced and indexed are counted, with the works and citations being brought to works and citations in peer-reviewed and indexed publications through corresponding numerical values of correspondence. At the discretion of the scientific jury or the faculty, respectively the scientific council, foreign peer-reviewed scientific publications that are not referenced and indexed in world-renowned databases of scientific information are equated to Bulgarian peer-reviewed scientific publications."

As long as works No. 1, 3, 4 and 5 are in an ISSN edition and are peer-reviewed, I accept that they can be included in this review. From the text quoted above, it is not clear whether for the so-called "other" scientific works in Bulgarian peer-reviewed scientific publications, it is a mandatory condition to be included in the National Reference List of Contemporary Bulgarian Scientific Publications with Peer Review.

For a group of indicators Γ - indicator 7, the applicant has submitted 23 publications: 4 [No. 21, 31, 33, 34] in quartile Q2 (80 points); 1 [No. 30] in quartile Q3 (15 points); 9 [No. 20, 22, 23, 24, 25, 26, 27, 28, 29] in quartile Q4 (102 points); 7 [No. 12, 13, 14, 15, 16, 19, 32] in peer-reviewed scientific publications (42 points). Publications [13, 14] are in edited conference proceedings with ISSN, which are not included in the National Reference List of Contemporary Bulgarian Peer-Reviewed Scientific Publications. The case is similar to the one discussed above.

For the group of indicators Δ , the candidate has presented data on citations corresponding to 215 points.

In addition, Assistant Professor Dr. Elena Tacheva has presented a list of research projects in which she has participated. These projects have been implemented in the period from 2005 to date, and 3 of them - in the last 5 years. The majority of the projects are funded by the National Science Foundation, 3 of them have international participation. The connection between the topics of the projects and those of the publications with which the candidate participates in this competition is obvious.

The list of participation in scientific forums includes 31 participations (17 posters and 14 oral presentations). Chief Assistant Professor Dr. Elena Tacheva has participated 16 times in the Annual National Conference of the Bulgarian Geological Society with international participation "Geosciences", as well as in international scientific forums in the USA, Canada, Albania, Macedonia, Austria, Serbia, etc.

From the review of the submitted materials for participation in the competition for the academic position of "Associate Professor", it was found that all required documents were submitted and the quantitative indicators of the requirements of the IMC-BAS, as well as those of the Regulations governing the application of the Law on the Academic Staff Development in Republic of Bulgaria, were met.

2. General characteristics of the applicant's scientific activities

The scientific activities of Elena Tacheva, reflected in the publications submitted for participation in the competition, participation in research projects and in scientific forums, refer to the following scientific topics:

- I. Mineralogical, geochemical and geochronological characteristics of the Petrohan Pluton (Western Balkan, Bulgaria);
- II. Electron microscopic studies of natural and artificial mineral phases;
- III. Geochemistry of pyrite from the Sarnak deposit, Eastern Rhodopes;
- IV. Geochemical behaviour of tungsten in the oxidation zone, soils and waters of the Grancharitsa River in the area of the Grancharitsa deposit, Western Rhodopes.

The first thematic group includes publications No. 1, 2, 3, 4, 7. This topic is obviously a development of the research corresponding to the dissertation work of Elena Tacheva – “Mineralogical and geochemical characteristics of accessory minerals from Petrohan Pluton”. The object of research are various accessory minerals: titanite, ilmenite, magnetite, apatite and zircon. The results of the research are interpreted as indicators of the parameters of the geological environment in which the processes of formation and alteration of igneous rocks took place. The experimental data are considered in relation to the hypothesis of mixing of magmas during the formation of the Petrohan pluton. Specific characteristics in the morphology, chemical composition, and alteration processes of the studied accessory minerals have been established, which support this hypothesis and provide information about the conditions. The interpretation of the data on the distribution of REE in accessory titanites is related to the magmatic evolution of the rocks in the Petrohan pluton [1]. A comparison of the behaviour of magnetite and ilmenite under changes in magmatic and post-magmatic

conditions has been made [2]. While magnetite is characterized by inertness, ilmenite is much more sensitive to changes. Accessory apatite also responds sensitively to changes in the crystallization environment associated with the mixing of magmas [3, 4]. In this thematic group, the most complete and in-depth scientific study is publication [7] presenting data on the age and geological history of the Petrohan pluton. A combination of methods was applied: high-precision conventional U-Pb (CA)-ID-TIMS dating of zircon and titanite and CA-LA-ICP-MS dating and tracing of zircon.

The second thematic group - Electron microscopic studies of natural and artificial mineral phases - includes the largest number of publications [10, 11, 12, 15, 16, 18, 19, 20, 21, 29, 33, 34]. The objects of study are:

– *mineral associations from the Krumovgrad gold field;*

– *minerals from Bulgarian deposits:* subalkaline igneous rocks in the region of Northwestern Rila, turquoise from the Chala deposit, Eastern Rhodopes, a mineral from the deviline group, clinoptilolite tuffs;

– *laboratory-synthesized materials:* geopolymers based on natural zeolites, willemite, Br-gordaite, zirconium-modified Engelhard titanosilicate;

I would like to mention publication [34] describing the synthesis and characterization of catalysts based on zirconium-modified Engelhard titanosilicate 4 (Na-K-ETS-4/xZr) in terms of their photocatalytic efficiency. Experimental results show that the synthesized material is a promising candidate for applications in ecological water purification due to its high photodegradation efficiency and stability.

The migration of 32 elements from natural zeolitized tuffs from the Beli Plast and Golobradovo deposits (Bulgaria) was determined in ultrapure, tap, mineral and mining waters to assess their desorption and adsorption properties [33]. The possibilities and risks for the purification of mining and drinking waters were assessed.

Scanning electron microscopy and electron probe microanalysis are key methods for the phase analysis of natural and technical minerals. In the mentioned publications, Dr. Tacheva has demonstrated the ability not only to work with scientific equipment and obtain results with good quality, but also to know the relevant diverse objects and for adequate interpretation in view of the specificity and goals of the scientific research. The participation in various author groups testifies her good teamwork skills.

Three publications [25, 27, 30] are part of the research project "Geochemistry of pyrite from the Sarnak deposit, Eastern Rhodopes" with the participation of Dr. Tacheva. Using optical microscopy, SEM-BSE, SEM-EDS, LA-ICP-MS and HRTEM, data were obtained on the chemical composition, spatial distribution of As and Au, the internal structure and the mechanism of formation of pyrite and marcasite from the low-sulfide gold deposit Sarnak.

Publications [22, 23, 24, 26, 28, 31, 32] are part of the research project "Geochemical behavior of tungsten in the oxidation zone, soils and waters of the Grancharitsa River in the area of the Grancharitsa deposit, Western Rhodopes" in which Dr. Tacheva participated. The

content, distribution and forms of W presence in the oxidation zone, soils, sediments and waters from streams, drainage waters and their sediments in the area of the deposit [23, 24, 28, 31] “Grincharitsa”, Bulgaria were studied. Data on the geochemical behavior of W were obtained and the dangers of environmental problems were discussed.

The seasonal variations of drainage waters and ochre products from their discharge from the closed abandoned old gallery in the scheelite deposit “Grincharitsa” (Bulgaria) were studied using field and laboratory methods in the period 2019–2023 [31]. It has been proven that drainage waters and ochre sediments do not have an inherently negative impact on the environment. The risk of environmental problems was assessed and a prescription was made for their prevention.

In the documents submitted for participation in the competition, publications [5, 6, 8, 9, 13, 14, 15 and 17] refer to archaeomineralogical research. The objects studied are prehistoric artifacts and plasters and murals from archaeological sites. The rock materials from which the prehistoric artifacts were made have been identified and hypotheses have been proposed for local rocks that served as material. The plasters and murals of archaeological sites have been characterized. The materials used for the pigments in the murals from the different archaeological sites have been identified and the sites have been compared according to this indicator.

As a summary of the above, the documents presented by Dr. Tacheva in the competition characterize her mainly as a researcher whose competence in the field of geology and geochemistry and skills in conducting analyses: optical microscopy, scanning electron microscopy, electron microprobe, inductively coupled plasma mass spectrometry and laser ablation, etc., as well as for adequate interpretation of the results, allow her to participate in solving topical research problems.

3. Reflection of the applicant's scientific publications in the Bulgarian and foreign literature

The total number of publications submitted for participation in the competition is 34, of which 16 are referenced and indexed in world-renowned databases Scopus or Web of Science (Q1 – 1; Q2 – 5; Q3 – 1; Q4 – 9). The remaining works of Dr. Elena Tacheva are in scientific magazines with scientific review. It makes a positive impression that the latest publications (after 2018) are in more prestigious international journals, with a higher impact factor and SJR. Participation in foreign and Bulgarian scientific forums with international participation also contributes to the popularization of scientific research.

25 citations of the works of the Dr. Elena Tacheva are citations in scientific publications, monographs, collective volumes and patents, referenced and indexed in acknowledged scientific information databases (Web of Science and Scopus); 8 are citations in monographs and collective volumes with scientific review and 23 citations are in non-refereed journals with scientific review. The total number of points for group D is 215, which significantly exceeds the minimum requirement of 60 points. Therefore, Dr. Tacheva's publications have been reflected in Bulgarian and foreign literature.

4. Main scientific and/or applied scientific contributions

The main contributions of the publications of the candidate, Dr. Tacheva are scientific and applied scientific. In summary, they can be formulated as follows:

Establishment of mineralogical, geochemical and geochronological characteristics of the Petrohan Pluton (Western Balkan, Bulgaria). Study of accessory minerals as indicators of changes in the crystallization environment related to the mixing of magmas. This contribution can be assigned to proving with new means significant new aspects of already existing scientific fields, problems, theories, hypotheses.

Complex characterization of the phase composition, microstructure and chemical features of rock, laboratory-synthesized materials, artifacts and materials from archaeological sites using scanning electron microscopy and electron probe microanalysis in order to solve current scientific research problems. This contribution can be attributed to the groups obtaining and proving new facts and obtaining confirmatory facts.

All publications presented by Dr. Tacheva are collective. For the above contributions, I base myself on the information contained in the competition documents.

5. Critical comments of the reviewer on the submitted works

I have critical comments to Dr. Tacheva, which relate to the preparation of the documents for participation in the competition. In the documents, I have found a number of technical errors and inconsistencies, which made my work on preparing the review difficult.

I would also like to use the opportunity to make recommendations for her future research work to continue the trend of the last few years of publication activity, to publish in prestigious scientific journals, to engage in the management of research projects and to form her own scientific topic.

6. Conclusion

Based on all submitted documents for participation in the competition, announced in the "State Gazette" № 36/29.04.2025, for the academic position of Associate Professor in professional field 4.4. Earth Sciences (Mineralogy and Crystallography) for the needs of "Mineralogy and Mineral Raw Materials" department at IMC-BAS, I believe that the candidate Chief Assistant Professor Dr. Elena Slavcheva Tacheva meets the requirements of the Law on the Development of the Academic Staff in the Republic of Bulgaria (LDASRB), the Regulations for its Application and the Regulations on the Terms and Procedure for Acquiring Scientific Degrees and for Holding Academic Positions at the Institute of Mineralogy and Crystallography "Acad. Ivan Kostov" - BAS. I propose to the members of the esteemed Scientific Jury to vote positively for awarding Chief Assistant Professor Dr. Elena Slavcheva Tacheva the academic position of Associate Professor. I recommend to the Scientific Council of IMC-BAS to support the election of Chief Assistant Professor Dr. Elena Slavcheva Tacheva for the academic position of Associate Professor in professional field 4.4. Earth Sciences (Mineralogy and Crystallography) for the needs of the "Mineralogy and Mineral Raw Materials" department at IMC-BAS.

12.09.2025

Reviewer:

**Заличено съгласно
чл. 2 от ЗЗЛД**

Assoc. Prof. Irena Mihailova