

**OPINION**  
**by Assoc. Prof. Dr. Tatiana Vasilevna Orehova**  
**CAWRI-BAS**

**member of the scientific panel**

**(order of the Rector of SU "St. Kliment Ohridski" No. ПД 38-41/26.1.2023)**

About: dissertation work of **Alexander Dimitrov Vassilev** on the topic "Hydrographic characteristics of the lakes in the Rila Mountain" for the acquisition of the educational and scientific degree Doctor" in professional field 4.4 "Earth Sciences" (Hydrology and water resources)

**General characteristics of the dissertation**

The present opinion is based on the dissertation of 163 pages (main text), containing 54 tables, 63 figures and one Appendix, as well as the Abstract of 30 pages.

The structure of the dissertation corresponds to the generally accepted requirements. The dissertation contains: title page, content, introduction, three chapters, summary of the obtained results, bibliography and Appendix.

The Introduction includes: topicality and analysis of the degree of knowledge of the issue under study, definition of object and subject of the research, goal and tasks, territorial scope and limitations of the research. Finally, a structure of the dissertation is presented.

*The first chapter* is devoted to the methodological basis of research. The methods used for measuring and calculating the morphometric characteristics of the lakes are described, as well as methods for processing and analyzing the empirical data.

*The second chapter* presents the general regularities in the distribution of the lakes according to different geographical and morphometric indicators, as well as the obtained statistically significant relationships between the individual indicators.

*The third chapter* presents a description of the morphometric characteristics of the lake groups and the individual lakes in mountain sections with an indication of the statistically significant relationships between certain parameters. The Urdini lake group has been analyzed in detail (subsection 3.1). Subsection 3.2 describes the lakes in the Iskar, Maritsa, Mesta and Struma river basins.

The *conclusion* is presented in the form of a summary, which in a synthesized form presents and justifies the obtained results.

The *bibliography* consists of 132 titles - 45 in Cyrillic and 87 titles in English.

The dissertation concludes with an *Appendix* of 7 pages, including basic geographical and morphometric indicators for each lake with an indication of lake group and lake system.

The thematic orientation of the dissertation work is in accordance with the professional direction 4.4. Earth Sciences (Land Hydrology and Water Resources).

**Topicality of the issue under study**

Topicality of the issue under study in the dissertation is indisputable in the context of global climate change. Lake water bodies without anthropogenic impacts on them are of particular interest for tracking climate changes on a regional scale. The current state of the lakes (and their morphometric characteristics) in the 20s of the XXI century will represent an invaluable testimony for future generations.

**Main contributions**

The dissertation contains specific contributions that relate to new data, expand and deepen knowledge. In general, they are well defined and clearly show the achievements of the dissertation work.

An important applied value (including for the Rila National Park) is the systematic description of 173 lakes – 20 more than in previous studies, as well as a number of geographic and morphometric indicators presented in the Appendix.

The description of the lakes from separate river basins (of Iskar, Maritsa, Mesta and Struma) is also important.

An additional valuable contribution is the proposed names of 16 nameless lake reservoirs, as well as proven statistically significant relationships between different morphometric parameters of the lakes.

Scientific and methodological contributions (not mentioned by the author as contributions) are indisputable - a complex of methods was used including:

- Using a satellite image (Google Earth Pro) to determine the area of the lakes, their length, width and the lake coastlines;
- Field observations with the watches (Suunto ambit 3 and Polar V800 Javier Gomez Noya) equipped with technology allowing precise description of the route, drawing of polygons, measurement of latitude, longitude and altitude;
- Determining the depth of the Urdini and Dzhendemski Lakes using the three-dimensional Sonar Deeper;
- Use of GPS Garmin 62sc for more precise measurement of coordinates, altitude and circumference of Dzhendemski Lakes;
- Use of a specially adapted D11 RC Boat Fish Finder during part of the lake bottom measurement procedures;
- Drone photography of Dzhendemski Lakes in 2021.

#### **Assessment of compliance with minimum national requirements**

The applicant has fulfilled the minimum national requirements for acquiring the educational and science degree “Doctor”. He presented his dissertation with the results of his research. He published three scientific papers (all in non-refereed editions with scientific review or edited collective volumes), one of them is co-authored.

#### **Abstract of the dissertation**

The abstract is compiled according to the requirements, correctly reflects all the main parts of the dissertation and well presents the results of the research. It ends with a statement of contributions, a list of publications on the dissertation work, the name of a successfully completed and reported university research project, and a declaration of originality.

#### **Critical notes and recommendations**

Unfortunately, there are many technical errors in the dissertation. The author uses sometimes decimal points, sometimes decimal commas.

On page 50, the area of the lake named Smallest Karaomerichko is indicated, equal to 0.05 ha (0.478 m<sup>2</sup>) - here the area in hectares is correct, and in brackets it should be (478 m<sup>2</sup>). On the same page, Table 2 states: "Area (km<sup>2</sup>)", while the actual area is given in hectares (ha). The same mistakes are also in the Abstract on page 9. In other places, including in Table 3, the areas are given in the correct dimension – ha.

On page 59, Table 7 states: "Area (km<sup>2</sup>)" when it should be: "Length (m)". In the Abstract in the same table under the name Table 4 it is correctly indicated: "Length (m)".

On page 106, the author writes: "The lakes have an area of the water mirror between 2.0 m<sup>2</sup> (Dodovo Lake) and 26.4 m<sup>2</sup> (Golyamata Panitsa Lake)" - here there are annoying mistakes: the areas are 2000 and 26400 m<sup>2</sup>, respectively. The same errors were also found in the Abstract

on page 21: "The measured area of the lakes on the Google Earth satellite image from 2018 is between 2.0 m<sup>2</sup> (Dodovo Lake) and 26.4 m<sup>2</sup> (Golyamata Panitsa Lake)".

On page 106, Table 37 states: F (km<sup>2</sup>), while the actual areas are given in hectares (ha). On page 122 in Table 42 it is stated: "Area (m<sup>2</sup>)", while in reality the area of the lakes is given in hectares. The same error is found in Table 49 on page 134.

On p. 107 lists the calculated morphometric parameters, which are given in "table. 1", but there is an error here - it means Tabl. 37, but in none of these tables there is no data on the parameters *Кудълж* and *Osgood index*. The last index is not specified anywhere in the dissertation for any of the Rila lakes, therefore the author's conclusion that the Rila lakes refer "to the polymictic lakes" is not justified.

On page 115, the author writes about the area of Central Rila: "236.61 m<sup>2</sup> (9.0% of the total area of Rila Mountain)" - here the correct one is 236.61 km<sup>2</sup>.

On page 127, Fig. 53 the horizontal axis (abscissa) is the area of lakes up to 300 ha – a clear error, because their maximum area is up to 26 ha. The same error occurred in Fig. 11 in the Abstract (p. 20).

On page 135, Fig. 57 b) distribution of the lakes in Eastern Rila by average width is given, the latter being indicated in % instead of m.

On page 143 it is written: "The maximum depth of lake reservoirs is between 0.5 m (Fourth Gorno Prekorechko Lake) of the Gorno Prekorechko Lakes group and 16.4 m (Zhaltiya Göl Lake) (Lakes in Bulgaria, 1964)". In the Appendix there are the following values for the average depth Dcp. of these lakes: 0.91 and 1.15 m respectively. There is no comment in the text regarding this contradiction.

On page 143 it is written: "The length of the coastline varies from 61 m for Second Malomalovishko Lake to 257 m for Triangle Lake". These values, however, refer to the length of the lakes. The length of the coastline is 210 and 747 m, respectively, which can be seen in the Appendix.

On page 146 it is written: "The area of the lakes (377,184 m) is within the limits between 589 m - Malko Redzhepsko Lake and 102,564 m - Ribno Yakoruda Lake" - it is correct m<sup>2</sup>. On the same page we read: "The deepest lake in the Mesta river basin is 16.5 m - Dead Yakoruda Lake, and the shallowest, 1.0 m - Second Small Banensko Lake (Lakes in Bulgaria, 1964)". In the Appendix there are the following values for Dcp.: 1.42 and 1.92 m, respectively, which contradicts the quoted values. No comment from the author. The List of Abbreviations states: Dcp. – average depth.

On page 148 we read: "Maximum depth of lacustrine bodies is between 1.0 m (Smradlivo Lake 3) from Smradlivi Lakes group and ...". The Appendix has the following value for average depth Dcp.: 3.00. The Appendix on pp. 163-169 does not specify a dimension for the average depth (m).

The dissertation contains a series of technical errors regarding the area of the lakes given in km<sup>2</sup>. For example, on page 108, the area of Lake Visoko Urdino is wrongly indicated as 0.958 km<sup>2</sup> (the correct one is 958 m<sup>2</sup>). There are similar errors on page 109 for Dodovo and Suhoto lakes, on pages 110-113 for Triangle, Malkata Panitsa, Ribno Urdino, Botanichesko and Golyamata Panitsa Lakes.

It should be noted, however, that all areas given in hectares (ha) are specified accurately and without errors both in the dissertation (including the Appendix) and in the Abstract.

Based on his dissertation work Al. Vassilev could prepare a valuable monograph, for which he would have to precisely edit the text.

Even before working on this monograph, I strongly recommend Al. Vassilev to prepare a scientific paper with the obtained main results for the Rila Lakes together with the Appendix as an integral part of the paper.

### **Personal impressions**

I do not know Alexander Vassilev personally. From the presented materials, it can be seen that he has an affinity for using newer tools and methods, and possesses the persistence necessary to achieve the set goals.

Despite the indicated technical errors and the remarks made, I highly appreciate the presented dissertation work, which contributes new valuable knowledge about the Rila Lakes. The research is up-to-date and original in nature.

### **CONCLUSION**

The dissertation work presented by Alexander Dimitrov Vasilev on the topic "Hydrographic characteristics of the lakes in the Rila Mountain" is an original, complete and in-depth scientific work containing a number of significant results and contributions.

With conviction, I declare *my positive assessment* of the dissertation work and *recommend to the respected Scientific Jury to vote for the awarding of the educational and scientific degree "doctor" to doctoral student Alexander Dimitrov Vassilev in professional field 4.4. Earth Sciences (Hydrology and Water Resources).*

Sofia, 19/04/2023

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