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WRITTEN WORD OF PAVLE M. VUJEVIĆ

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Abstract: After completing Serbian Orthodox Gimnasium in 1889, in Novi Sad, Pavle M. Vujević, he has been studied geography in Vienna, where in 1904 he defended doctoral dissertation. He improved his knowledge in climatology and meteorology in Berlin and Postdam. For full professor of University of Belgrade he was selected in 1921. He has written more than 150 scientific articles from climatology, meteorology, hydrology and geography.

Key words: Pavle M. Vujević, geography, climatology, meteorology, potamology, variation climate, bioclimatic elements, climatological statistics.

A student of famous professors from Vienna

Among our famous geographers of the past, Pavle M. Vujević, one of the closest and most loyal associates of Jovan Cvijić, a corresponding and regular member of the Serbian Academy of Sciences and Arts, recognizable in international scientific institutions as a climatologist and meteorologist of world importance, author of extensive scientific studies and university textbooks.

Pavle M. Vujević was born in Ruma on August 22, 1881. After graduating from the Serbian Orthodox Gimnasium in Novi Sad, he went to Vienna where he completed his studies studying geography, geology, physics, climatology, and meteorology and hung out with Milutin Milanković (1879–1958), then a student and doctoral student in technical sciences.

In Vienna, under the mentorship of renowned scholars Albrecht Penck (1858–1945), Eduard Suess (1831–1914), Julius von Hann (1839–1921)

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and Wilhelm Tomaschek, 1841–1901), in 1904 he defended his doctoral dissertation entitled *Tisa*, a potamological study, which was published in Leipzig in 1906, when the author was 23 years old. In the doctoral dissertation of Pavle M. Vujević analyzed the flows of the Tisza River in different seasons from the most upstream part of the river to its confluence with the Danube. By constructing an isohiet map of the basin, according to data from 244 rain gauge stations and flow data, he determined the water balance of the basin (for the period 1891–1900), an equation that is often attributed to his mentor in the professional literature. With four new equations, Vujević determines the flows on the Tisza as a function of precipitation, which practically means that with each annual amount of precipitation, the runoff, ie the flow, can be determined. Vujević explains the frequent coincidence of high waters and the formation of flood waves on the Tisza by the regime and intensity of precipitation, the topography of the terrain and the shape of the upper and middle course basins. The chapter in which the erosive and accumulative processes in the riverbed and the meander's bed are discussed is especially important, the evolution of which is explained on a mathematically based theory (Rakićević, 1998). To determine the flow of the Tisza River, he used four mathematical equations and precipitation data in a basin with 244 rain gauge stations. This book is considered a classic work in the domain of potamology – the science of rivers and is therefore often cited in hydrological studies and textbooks. It was the first permanently significant scientific contribution of Vujević to modern science. He determined the relations between precipitation, runoff and evaporation, which is of special importance for knowing the water balance and the possibility of rational use of water of a large plain river, known for its fairly large basin. He treated the flow of the Tisza through four equations as a function of precipitation, which is important for knowing erosion, accumulation of materials and conditions for the formation of flood waves. After defending his dissertation and publishing a book about the Tisza, Pavle M. Vujević was very interested in hydrology, and over time, in the field of this science, he published several articles (*Hydrography of the Kingdom of Yugoslavia*, *Hydrography of Yugoslavia*, *Hydrography and Climate of Vojvodina*, *Danube, Rivers and Lakes of Yugoslavia*, *Hydrological characteristics of rivers in Serbia*, *Climate and hydrography of Yugoslavia*, *Hydrographic conditions of Yugoslav waters*). In addition to hydrology, he was even more successful in climatology and meteorology and went deep into the domain of mathematical geography and climatological statistics. Scientific articles, extensive monographs and university textbooks from the mentioned disciplines are still cited today.

Scientific training in Berlin and Potsdam

After defending his doctoral dissertation, in 1904 and 1905, Vujević continued his professional development at the Prussian Meteorological Institute in Berlin, as well as at the Meteorological Observatory in Potsdam. There he met and collaborated with the famous German meteorologists Wilhelm von Becold and Gustav Hellmann, under the supervision of Jovan Cvijić, when, starting in 1902, he regularly informed about his work. He returned to Novi Sad from Germany. As one of the Serbs, educated in Vienna, he felt a moral obligation to give his knowledge to his home country - Serbia. At the urging of Cvijić, on the recommendation of Albrecht Penck, in March 1907 he was elected assistant professor of climatology and meteorology, the University of Belgrade was founded in 1905 and was very useful in building the Department of Geography, headed by Cvijić, as well as in preparatory actions for the establishment of the Serbian Geographical Society. To the students of geography of the then Faculty of Philosophy, University of Belgrade, Vujević taught mathematical geography, general climatology, dynamic meteorology. In addition, he held special courses on weather and weather forecasting, the climate of the Balkan Peninsula, climate and man, dynamic meteorology and water circulation in nature. From the election for assistant professor (1907), associate professor (1919) and full professor (1921), until 1941, he was the only university professor of climatology and meteorology in Belgrade and Serbia.

Geographical Society and its Glasnik

In 1910, Pavle M. Vujević participated in the founding of the Serbian Geographical Society, where he was elected its secretary and together with Jovan Cvijić (1865–1927), edited I, III-IV, V, VI, VII-VIII volumes of the Glasnik of the Serbian Geographical Society, which was printed at the suggestion of Jovan Cvijić from 1928 to 1948 as the Glasnik of the Geographical Society. The original name was returned to him in 1948, and as such it remains.

Glasnik Srpskog geografskog društva, po reci profesora Borivoja Z. Milojević, the bed of the late Jovan Cvijić is especially close to his heart: his famous studies give great value to every issue of Glasnik; there is not a single issue of Glasnik, and there is not a single, almost not the smallest work, published in Glasnik, on which Cvijić's clever gaze did not stay, he was seriously ill, he took care of Glasnik, which was being reprinted.

Continuing the work of Cvijić, Pavle M. Vujević approached Glasnik with utmost sincerity and demanded from his associates to check once and again everything they wrote, especially the tables of statistical data, which are the basis for analyzes and conclusions. Loyal to the Serbian Geographical Society and its Glasnik, Pavle M. Vujević published several different works, reviews, notes on the pages of the periodical geographical publication on the Balkan Peninsula, analyzed statistical data and wrote obituaries in memory of his predecessors. From Glasnik, we especially single out an extensive study on the climate of the island of Hvar, which brought him the title of honorary citizen of the town of Hvar, Vujević was the president of the Serbian Geographical Society in three election terms: 1931-1933, 1947-1955 and 1956-1959.

He was especially engaged in organizing the Third Congress of Slavic Geographers and Ethnographers, which was held in 1930 in Belgrade. He edited the publications from the mentioned congress: Kingdom of Yugoslavia, geographical and ethnographic review, page 167, editions in Serbian and French and Description of the path of Slavic geographers and ethnographers, first and second part, a total of 371 pages. In addition, he is known as a long-term editor of the Report of the Meteorological Observatory in Belgrade, that is, the Proceedings of the Geographical Institute Jovan Cvijić of the Serbian Academy of Sciences and Arts and its Special Editions. In 1954, he was proclaimed the lifelong, and to this day the only, honorary president of the Serbian Geographical Society.

Unrepeatable war sufferings

Pavle M. Vujević was a quiet, honest and overworked man and scientist, who enjoyed great respect from his students and associates in the country and abroad. The second decade of the 19th century, when Serbia was affected by great war events, fell hard on him, because it separated him from everyday teaching and research work. He took part in the Balkan wars and the First World War. As a soldier, he crossed the Albanian mountains and arrived in Corfu, severely physically and mentally ill. Although the General Department of the Supreme Command approved his departure for treatment in San Giovanni, he did not board the ship, probably because there were more serious patients. After the end of the Great War, he was sent to London, where he worked on collecting aid within the Red Cross. Upon his return to Belgrade, on June 21, 1919, he determined that the manuscripts he

had been working on for years had disappeared in the bombing and looting. In two letters to Jovan Cvijić, who was still in Paris, he informed that he had visited his house and wrote the following: The library is in good condition, but it seems that something has been reduced. They didn't leave me a single letter. They tore out my atlases. The mass of the houses remained the same as after the bombing. The world will not repair houses; the government is requiring private apartments. My apartment was requisitioned by the Ministry of Food. They barely allowed me to bring out at least my books. I couldn't take anything from things. Among the books I found all my lectures. At least that saved my 15-year work. The temperature tables of the Kingdom of Serbia and the manuscript were taken to me. I worked on that for two full years in the basement of the Observatory, and all that work failed. I have nothing left of the manuscript. Most of the books I procured after the Bulgarian war were taken away. I lost all the dictionaries, all the atlases, all the maps, except for a few 1: 75,000. He was engaged in the renewal of the Geographical Institute and the University, of which he was rector 1919–1920.

Jovan Cvijić and the establishment of meteorological stations in Serbia, Macedonia and Montenegro. During 1919, he helped Jovan Cvijić at the Peace Conference in Paris. He spent some time at the head of the Meteorological Observatory in Belgrade, lectured at the Faculty of Agriculture in Zemun, the Faculty of Agriculture in Novi Sad, and lectured in Cambridge and Aberdeen. He could do all that because he was a modernly educated scientist, who studied not only geography, but also geology, physics, meteorology and climatology, and was in contact with Albrecht Penck, as well as with Jovan Cvijić and Milutin Milanković (1879–1958).

Hanging out with Milutin Milanković

Pavle Vujević was friends with Milutin Milanković, who at that time was intensively dealing with the theoretical foundations of climate. It can be assumed that there was Milanković's influence on Vujević: Vujević tried to look at the climate of the Balkans for a longer period (Opra, 1997). In that sense, the year 1931 is significant, when Vujević in Paris, published the work *Historical documents on climate variations in the territory of the Kingdom of Yugoslavia and surrounding areas*. The work has 55 pages with 300 records on time and climate between 1358 and 1864. He made records based on insights into the books of Orthodox monasteries and churches, but also from books in Turkish and Latin. Vujević organized teaching courses in

which he interpreted the overall knowledge about the circular movement of water in nature, dynamic meteorology, climate and man, weather, weather forecast and the climate of the Balkan Peninsula. From 1947 to 1955 he was the head of the Department of Meteorology at the Faculty of Natural Sciences and Mathematics in Belgrade, and from 1957 to 1961 the head of the Geographical Institute Jovan Cvijić of the Serbian Academy of Sciences and Arts. For several years, he was elected Director of the Meteorological and Climatological Institute of Serbia. He was the representative of Yugoslavia in the European section of the World Meteorological Organization and the president of the National Commission for the International Geophysical Union at the Academic Council of Yugoslavia (1955).

Recognitions and work in international organizations

Over time, Pavle Vujević was elected a corresponding member of the Czechoslovak Geographical Society of Prague in 1926 (Československá Společnost Zemlepisná), the Geographical Society of Berlin in 1928 (Gesellschaft für Ergkunde zu Berlin), an honorary member of the Czechoslovak Geographical Society of Prague in 1931 (Československén), a corresponding member of the Bulgarian Geographical Society from Sofia in 1935 (Bulgarian Geographical Society), the Hungarian Meteorological Society in 1940 (Magyar Meteorológiai Társaság), the Geographical Society of Croatia (1961). He was elected an honorary doctor of the University of Vienna in 1954, the Meteorological Society of Serbia and the Geographical Society of Berlin. In 1960, he received the Lifetime Achievement Award given by the Commission of the Council for Scientific Work of the Socialist Republic of Serbia, for special achievements in the field of science, as well as the Jovan Cvijić Medal. He is the holder of the Albanian Monument, the Order of Saint Sava, the Order of Labor of the First Order, and the Seventh of July Award of the Government of Serbia. Due to the high scientific reach, the Senate of the University of Vienna in 1954, the doctoral dissertation of Pavle M. Vujević, included in the category of golden doctorates. Vujević participated in the work of the International Commission for the Study of Climate Change, for which he used the terms climate variation, climate variation. He collaborated on projects of the World Meteorological Service. For the corresponding member of the Serbian Academy of Sciences and Arts, Vujevic was elected on November 14, 1950, and a regular on January 30, 1958. In 1961, he was a member of the Presidency of the Academy of Sciences. He was declared an honorary citizen of the town of Hvar for his extensive work on the climate

of the island of Hvar (243 pages), for which he used data from 60 years of observations of climatic elements.

Writer of university textbooks

The university textbooks *Mathematical Geography* (XVIII + 815 pages) and *Meteorology* (476 pages) are among the most important editions of the University of Belgrade in the first half of the 20th century. The work *Climatologically Statistics* (310 pages) is unique in our country. For an extensive and very comprehensive university textbook *Fundamentals of Mathematical and Physical Geography*, which in the first part deals with the problems of mathematical geography and geophysics, and in the second atmosphere and oceans, it was stated that it was printed among the first at the University of Belgrade after the First World War. Kingdoms of Serbs, Croats and Slovenes was written on the basis of a good knowledge of world-proven original literature and in its own way it contributed to the high level of teaching and, in its time, to the true aspirations of students and teachers of the University of Belgrade.

The textbook was an irreplaceable reading for students of many professions whose interest was not only in physical geography, in the broadest sense of the word, but also in meteorology, climatology, oceanography, cosmography and the Earth as a planet – a member of the solar system, orientation, determination of geographical coordinates, calculation of time) and its physical properties: mass, density, structure, magnetism, electricity (Rakićević, 1998). The university textbook *Meteorology*, published by Prosveta from Belgrade, appeared in print in 1948 on 476 pages. It was the only one of its kind in Serbia and Yugoslavia at the time, and it is still quoted today. He contributed many times to the general introduction to the peculiarities of the atmosphere and pointed out the applicative importance of climatology and meteorology in a number of vital human activities (agriculture, traffic). Due to its lessons, messages and significance, in 1949 he received the First Prize of the then Government of Yugoslavia. *Climatologically statistics* is possibly one of the most unusual, but very important, university textbooks (Naučna knjiga, 1956). These are instructions for collecting and processing meteorological data and their numerical, graphical and cartographic representation. It abounds in the interpretation of standard methods of mathematical statistics, established probability theories, aspects of control, elements of periodicity of phenomena and processes, computer procedures,

which... often from a very extensive material of meteorological observations can obtain a simple overview of climate change from which certain laws can be derived, to determine the connections and the influence of certain meteorological elements on a specific climatic phenomenon. This textbook is the result of a conscientious and dedicated effort of a teacher's nature, the will to instruct people who want to teach them in climatological work, and it has an exceptional necessity and practical significance. The concept of the textbook is based mainly on the author's many years of experience, and largely presents his original work (Rakićević, 1998). Pavle M. Vujević published scientific and professional articles in domestic and foreign journals in Serbian, German, French and English. Due to the inalienable scientific significance, lessons and messages, many views of Pavle M. Vujević, exhibited in numerous works and extensive books, are still quoted today, especially knowledge about bioclimate.

Climate as the morphology of the atmosphere

Pavle M. Vujevic was a man with many humane and hard-working human qualities, because of which he enjoyed great respect from students and associates, both in Serbia and abroad. He emphasized the importance of science and taught respect, respect, diligence, modesty, and perseverance. He emphasized the fact that almost everything on the planet Earth is based on numerous mutual relations, mergers and permeations, direct, indirect and feedback, evolution. He interpreted climate as the morphology of the atmosphere (Dukić, 1981) in great dependence on the circulation of the atmosphere, changes in the intensity of solar radiation, the distribution of the sea and land, i.e. degree of maritimicity and continentality. It has been noted in the literature that he was, and remains, a pioneer of microclimatology and an immortal researcher of prismatic air layers. In addition, he was the first to start measuring soil temperature at certain depths, which is extremely important for agro climatology. Respecting the climatic conditions, respecting the dialectical-materialist scientific method, he brought them into connection with geomorphology, that is. Relief features. He defined climate as the morphology of the atmosphere, in which the most important are various air masses, quickly changing and easily moving, where the existing relations between the sea and the land are of interest, which maintains the degree of continentality, that is, the degree of maritimeness. With the textbooks Meteorology and Climatologically Statistics, he contributed to the scientific and applied knowledge of the relevant sciences, important for agriculture,

construction, traffic, weather forecast, i.e. the overall life of man and human society. Of special importance is the contribution he gave to the research of microclimatology, ie, research of ground layers of air and thermal regime of the soil at certain depths.

Professor of encyclopedia

Academician and university professor, one of the pillars of our science, Pavle M. Vujević reaches the national, European and world level. His basic scientific preoccupations concerned climatology, meteorology, mathematical geography, astronomy and hydrology. He was a climatologist who, from a pronounced physical-geographical, spatial, aspect, perceived and interpreted the peculiarities of time and climate. Significant journalistic activity of Pavle Vujević is also reflected in his work on Stanojević's National Encyclopedia (Book I-IV, Zagreb, 1928-1929), for which he wrote over 1200 determinants in the field of physical geography and geophysics. In addition, with his professionally popular works, he also greatly contributed to the affirmation of geography as a current, especially its share in the general educational and cultural enlightenment of the people. All the more so because there was something enlightening in his nature. A lot could be learned from him, as a scientist, professor, leader (Rakićević, 1998). In the eighth book of the Encyclopedia of Yugoslavia, published by the Yugoslav Lexicographic Institute in Zagreb, in 1957, on page 549, about Vujević, the text of his doctoral student, later professor of the Faculty of Geography and longtime president of the Serbian Geographical Society, Dušan Đukić (1923-2013), reads: Vujević, Pavle, geographer climatologist (Ruma, August 22, 1881 - Belgrade, November 17, 1966). He finished high school in Novi Sad, and studied at the University of Vienna, where he received his doctorate in 1904.

In March 1907, Vujević became an assistant professor of climatology and meteorology at the Faculty of Philosophy in Belgrade, and since then his intensive teaching and scientific work has begun. He participated in the Balkan Wars and the First World War, in 1919 he became an associate professor, in 1921 a full professor at the University of Belgrade, where he taught physical and mathematical geography, meteorology and climatology. For the climate monograph on the climate of Hvar (Belgrade, 1927-1932), in which he proved that the climate of Hvar is more suitable for treatment and rest than many famous Mediterranean beaches, he received a kind of recognition - he was elected honorary citizen of Hvar in 1931. In 1924-1948,

Vujević was the director of the Meteorological Observatory in Belgrade, the organizer of the network of meteorological stations in Serbia, Macedonia and Montenegro, the head of the meteorology department at the Faculty of Science in Belgrade (1947–1955), the director of the Geographical Institute (1957). He was a corresponding member of many foreign geographical societies, a lifelong honorary president of the Serbian Geographical Society (1954), Vujević received multiple awards for his long-term teaching, scientific-organizational and scientific work (over 150 scientific articles). Many of his works have become classic works in river hydrology and microclimatology. Academician Pavle Vujević died in Belgrade on November 17, 1966.

In 1967, the Serbian Academy of Sciences and Arts printed the Monument (Special Editions, Book CDXII, page 24), dedicated to the late academician Pavle M. Vujević. The speeches of academician Miodrag Tomić, academician Milisav Lutovac, professor of meteorology Marjan Čadež, professor of hydrology Dušan Dukić and president of the Serbian Meteorological Society, Milutin Radošević, were published at the commemorative gathering, which was held on March 25, 1967.

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Conclusion

Pavle M. Vujević belongs to the generation of scientists, university professors and academics who are among the founders of scientific and teaching work in Belgrade, in the first years after the founding of his university. He was educated and trained abroad, but he remained faithful to Serbia and in his own way contributed to the development of hydrology, climatology and meteorology as subjects and operational disciplines in the field. He published short notes, chronicles, statistics, obituaries, reviews of foreign literature, scientific articles, scientific monographs and university textbooks in domestic and foreign journals in Belgrade, Zemun, Zagreb, Novi Sad, Cetinje, Skopje, Sarajevo, Leipzig, Vienna, Paris, Prague, Warsaw, and Sofia. His works have been published in Serbian, German, French, English and Czech. The weather and events in Serbia, on the Balkan Peninsula and in Europe were not in his favor. He often created radio under very unfavorable conditions. In 85 years of his life, among other things, he had the First Balkan War, the Second Balkan War, the First World War, the Second World War, Serbia under the occupation of foreign powers, the formation of the Kingdom of Serbs, Croats and Slovenes and several changes of name, borders and political and social order. For more intensive scientific studies, he lacked data from specific meteorological observations, from a large number of stations in Serbia and on the Balkan Peninsula. It is known that in 1904 there were 83, and in 1914 only 11 meteorological stations in Serbia. Climate studies by Vujević were not an end in itself. He brought the climate into direct and indirect connection with man and human activity. When he defined the basic bioclimatic elements, drying power and cooling power, ie determined the elements of equivalent and equivalent-effective climate and their effect on the human body, he pointed out the importance of climatotherapy. When it comes to the influence of climate on the general life of man, the following sentences are often quoted today: Sunny days have a completely different influence on mood than cloudy and gloomy days. When the sky is clear, a person is not only happier, but also more enterprising and willing to work. In addition, there are significant differences in the nature of the talkative and enthusiastic Spaniards and Italians and the measured and cold-blooded British and Scandinavians. This is felt in literature, music, and folk art. Folk songs are ballads for northerners, and romances for southerners.

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