SOME SHORT HISTORICAL NOTES ON DEVELOPMENT OF MATHEMATICAL LOGIC IN SOFIA

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We present some information about the pre-history and the history of development of mathematical logic in Sofia. The history of the so-called Sector of Mathematical Logic (existing from 1972 to 1989) is considered in some detail.

Keywords: mathematical logic, history, Department of Mathematical Logic, Sofia University, Faculty of Mathematics, Bulgarian Academy of Sciences, Institute of Mathematics

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Currently, mathematical logic in Bulgaria has some presence not only at Sofia, but also at several university centres. However, I shall restrict myself only to its history in Sofia, since both the history and the present state of the field in those other places are far from being as abundant as in Sofia. In addition, I shall speak mainly about the earlier part of the history, since it is probably the less known to the audience. The year 1989 will be regarded as the end of that period of time. Besides, I shall actually speak mostly about the history of the Department of Mathematical Logic, meaning the former Sector of Mathematical Logic and the two currently existing units that succeeded it in 1989. In fact, almost all people who work or have worked in mathematical logic at the Sofia either are present or former members of this department, or have graduated from it. There are only a few exceptions. Bojan Petkanchin (1907–1987), a greatly respected professor in geometry at the Sofia University, is one of them, and his pioneering role in the history of mathematical logic in Sofia will be considered further. Another exception is Nadejda Georgieva (1931–1995) – her education at the Sofia University was completed before the

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time of mathematical logic had come there. she was a professor at the Institute of Mining Engineering and taught General Mathematics. but she did research mainly in mathematical logic after a specialization abroad. (Information about some other people not mentioned here can be found in Section 3 of [15].)

As well known, the foundations of mathematics have been and still are an important background and an object of study for mathematical logic. The interest in them has a long tradition in Sofia. For example. several competently written articles on the foundations of arithmetic were published in the Journal of the Physico-Mathematical Society in Sofia almost a century ago, in particular, a series of articles by an author publishing under the alias "Uni". (Corresponding references can be found in the survey [16]). Mention may be made here also of a lecture of the German mathematician Otto Blumenthal (1876–1944). which was held in Sofia in 1935. The title of this lecture is "The life and the scientific work of David Hilbert", and the contents of the lecture is known from its Bulgarian translation [1]. A short description of Hilbert's work on the foundations of arithmetic and logic can be found on pp. 49-50 there, namely, the idea of Hilbert's program is briefly explained (without using the term "mathematical logic" and, unfortunately, keeping off the then already known problems encountered by that program).

One may be curious about the earliest occasions when mathematical logic was explicitly mentioned in Sofia in public. The first such occasion, known to me, is a lecture held in 1945 by the Bulgarian mathematician Yaroslav Tagamlitzki (1917–1983). An information about it can be found in [2], where one sees a list of 11 titles of talks given in the Sofia University during the summer semester of the academic year 1944/1945. Tagamlitzki's lecture is the second one in the list and has the title "On some problems of mathematical logic". To my regret. there is no other information about the contents of this lecture. I should like to note that Tagamlitzki has been an assistant professor in 1945 and one of the eminent professors in the Sofia University later. It is known that he has attended a series of Blumenthal's lectures still being a high school student, so probably he has attended also the above-mentioned one.

The next ten years after 1945 have not been favourable for doing mathematical logic in Bulgaria. As in the former Soviet Union at that time, some scientific areas became practically forbidden then in our country too. Although mathematical logic did not completely fall in such a position, it was definitely not favoured by the political authorities, since only the so-called dialectical logic was officially accepted by them. Nevertheless, several mathematical courses at Sofia University have been taught in a modern logically clear way that raised the interest towards logical problems and prepared a ground for further acquaintance with their contemporary treatment. I would like to mention as examples of such courses the ones in Analysis, taught by Professor Y. Tagamlitzki, and in Foundations of Mathematics. taught by Professor B. Petkanchin. The second one of them was especially helpful in this respect thanks to its subject matter and the irreproachable way of its presentation. (The corresponding monumental textbook [3] has some of the features of a monograph).

At a certain moment of time prior to 1960 the authorities in the Soviet Union changed their attitude to mathematical logic. (This happened when they learned about the importance of electronic computing machinery and about a relation of mathematical logic to it). When those authorities finally admitted that mathematical logic should be considered as a legitimate and promising part of mathematics, so did the Bulgarian ones.[1] An attempt to take advantage of the changed situation was made in July 1959 in a plan signed by the Director of the Institute of Mathematics[2] at the Bulgarian Academy of Sciences. The plan contained a clause about having next year a Bulgarian Ph.D. student in mathematical logic in the German Democratic Republic or Poland. (However, as far as I know, this clause was not put into effect.) Several months later, in November 1959, a decree of the Central Committee of the Bulgarian Communist Party and of the Ministerial Council planned a number of activities aiming at the scientific progress of Bulgaria. The decree assigned many tasks to the Academy of Sciences. one of them being the creation of seven sections at the Institute of Mathematics, including a Section of Mathematical Logic (cf. [4, p. 2]). Such a section was eventually created, and Professor B. Petkanchin became its head. (Already in 1960 some documents listed this section in the structure of the Institute of Mathematics, but with an empty set of regular members). The section existed until the end of 1970, remaining a small one during all this time.

The first course of mathematical logic in the Sofia University was given by Professor B. Petkanchin during the academic year 1959/1960. It contained material from propositional and predicate calculus that is usually present in such courses, including also Gödel's Completeness Theorem. Starting from 1962 (soon after my return back to Bulgaria from a one-academic-year stay at the Department of Mathematical Logic of the Moscow State University) I also began giving some lecture courses in the field of mathematical logic. especially a course in Recursive Function Theory.

No particular department at the Sofia University was officially engaged in teaching mathematical logic at that time. Me and the somewhat younger colleagues Petio Petkov and Dimiter Vakarelov had positions in the Faculty of Mathematics at various departments. whose main teaching duties had been in other scientific areas. The research in mathematical logic was something additional to our main obligations too, with the following two exceptions: for P. Petkov in a several-years period (ending in 1970), when he was a Ph.D. student at the Department of Mathematical Logic of the Moscow State University, and for me during the already mentioned stay there and during a second one in the academic year 1968/1969. At the end of 1970 and the beginning of 1971 the so-called United Centre of

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[1] On the other hand, the official tradition to deny or undervalue the philosophical significance of mathematical logic continued during a much longer period of time, as seen for example from [5]. Even now some after-effects of this can be still observed.

[2] The names "Institute of Mathematics" and "Faculty of Mathematics" (to be encountered further) are used in these notes as the invariant parts of two names that changed in the course of time. For example, an addition "and Mechanics" was present in them during a certain period of time, and this addition was replaced by "and Informatics" later.

Mathematics and Mechanics was formed. It encompassed the Faculty of Mathematics of the Sofia University and the Institute of Mathematics of the Bulgarian Academy of Sciences. The structure of the United Centre included a unit called Sector of Topology and Mathematical Logic. Professor Doitchin Doitchinov (1926–1996), one of the Bulgarian topologists, was appointed chief of the sector. (To be more precise, I ought to mention that all chiefs of such units figured during a long period of time as temporary ones in the administrative hierarchy of the United Centre, but their duties were not substantially influenced by this.) The staff of the Sector of Topology and Mathematical Logic consisted of specialists in both scientific areas from the Faculty of Mathematics and from the Institute of Mathematics. Before the formation of the United Centre, these people had belonged to different departments of the faculty and sections of the institute.

The logicians, who became members of the sector at the beginning, are the following ones (in alphabetic order of surnames): Radoslav Pavlov, Petio Petkov, Dimiter Skordev, Vladimir Sotirov and Dimiter Vakarelov. All of them except Pavlov had graduated from the Faculty of Mathematics of the Sofia University, and Pavlov had graduated from the Moscow State University not long ago. Petkov, Skordev and Vakarelov themselves belonged to the staff of the faculty at the time of the formation of the sector, and they had been members of the departments of Applied Mathematics, of Analysis and of Geometry, respectively. On the other hand, Sotirov and Pavlov were members of the Section of Mathematical Logic at the Institute of Mathematics at that time (Sotirov entered the staff of the section in January 1970 and Pavlov entered it in August 1970). In 1971 one more logician came into the sector – the late Georgi Gargov (1947–1996), who had then just graduated from the Moscow State University. However, in October 1972 Gargov went to Moscow again and became a Ph.D. student there. (He returned to his work in Sofia only several years later).

In 1971 among the logicians in the sector only Petkov and Skordev had Ph.D. degrees, and Skordev was also an associate professor. (Petkov received his Ph.D. degree from the Moscow University in 1970 after defending a dissertation in constructive mathematical logic; Skordev's Ph.D. degree was received three years earlier, but it was from the Sofia University – for some results in functional analysis.) It is appropriate to mention that in the course of the next eight years the other three of the five people listed above also received Ph.D. degrees – Vakarelov received his one from the Warsaw University, and Pavlov and Sotirov – from the Moscow University.

The heterogeneity of the Sector of Topology and Mathematical Logic was fairly obvious – actually both its components, the topological and the logical one, had quite good activities in their fields, but without any substantial interaction between them. The main areas in mathematical logic developed by members of the logical part were recursive function theory, constructive mathematical logic, many-valued logic, algorithmic problems in algebra, set theory.

A remarkable event in the life of the logical part of the sector took place in the autumn of 1972, namely a one-month visit of the eminent Russian logician Andrei

Andreevich Markov (1903–1979), head of the Department of Mathematical Logic in the Moscow State University. On the 6th of October Markov delivered a lecture under the title "Introduction into constructive mathematical logic", and nine other lectures on constructive mathematical logic followed it during the next three weeks.

Having in mind the heterogeneity of the sector, its chief took reasonable steps toward a correction of this situation. In a report dated March 7, 1972, Professor Doitchinov suggested to the authorities of the United Centre to split the sector in two – a Sector of Topology and a Sector of Mathematical Logic. He indicated that there were sufficiently many specialists in the sector (7 in topology and 6 in mathematical logic) for the normal functioning of the two prospective sectors. The splitting became reality not later than a few days after the departure of Markov from Sofia. The decision was taken by the Bulgarian Academy of Sciences on the 8th of November, 1972, and on the 20th of November an order of the Rector of the Sofia University and of the Head of the Academy appointed Dimiter Skordev as chief of the Sector of Mathematical Logic.

No essential changes occurred in the activity of the logic group after that administrative change. In fact, few things of administrative nature depended on the newly appointed chief, who never became member of the Communist Party. Fortunately, all members of the group had the abilities and the enthusiasm needed for fruitful work in the field of mathematical logic – both in research and in teaching, and the work did not get embarrassed by careeristic conflicts inside the group. In addition, there were certain opportunities for rising our research qualification by specializations in leading universities and other scientific institutions abroad, as well as by contacts with distinguished foreign logicians who visited our group. I shall list some of the first realizations of these opportunities.

Dimiter Vakarelov had a 7-month specialization in the Warsaw University during the academic year 1972/1973. Radoslav Pavlov and Vladimir Sotirov entered external Ph.D. study at the Moscow University in 1973. Dimiter Skordev had a 3-month specialization in the USA during the period November 1974 – February 1975. (He stayed at the Stanford University for about two months, and the rest of the time was spent mainly at UCLA.) Professor Helena Rasiowa (1917–1994) from the Warsaw University visited the sector for about a month in the academic year 1974/1975 and she delivered nine lectures on algorithmic logic in the period from February 17 to March 11, 1975. I would like to mention that professor Rasiowa was a guest of the sector many times later and gave a lot of other talks to its members and to a broader audience. A great number of other specialists in mathematical logic and in related fields from abroad visited the sector and gave talks in the next years of its existence too, many of them several times. Here is a possibly incomplete list of them (37 persons, listed in alphabetic order of surnames): S. N. Artemov (Moscow), F. G. Asenjo (Pittsburg), N. da Costa (Sao Paolo), B. Dahn (Berlin), A. G. Dragalin (Debrecen), K. Dyrda (Kelce, Poland), A. P. Ershov (Novosibirsk), Ju. L. Ershov (Novosibirsk), J. Gehne (Berlin), K. Härtig (Berlin), V. E. Itkin (Novosibirsk), I. Janicka-Żuk (Kelce, Poland), A. Jankowski (Warsaw), M. J. Kanovich (Kalinin), A. Kučera (Prague), L. L. Maksimova (Novosibirsk), I. A. Malcev (Novosibirsk),

A. Mazurkiewicz (Warsaw), N. N. Nepeyvoda (Izhevsk), V. A. Nepomnyashchy (Novosibirsk), E. Orlowska (Warsaw), G. Priest (Australia), C. Rauszer (Warsaw), V. Rybakov (Krasnoyarsk), L. Rudak (Warsaw), A. Salwicki (Warsaw), A. L. Semyonov (Moscow), A. Shen (Moscow), N. Shilov (Novosibirsk), D. I. Sviridenko (Novosibirsk), A. Trybulec (Bialystok), I. Urbas (Australia), P. Urzyczyn (Warsaw), V. A. Uspensky (Moscow), J. van Benthem (Amsterdam), M. Weese (Berlin), G. Wolf (Berlin). This list does not include some names of people who gave talks at conferences organized by the sector (these conferences will be considered later in this report).

The subject matter of the research done in the sector gradually became wider. In particular, more attention was directed towards the interconnections with theoretical computer science. This process was also accelerated to some extent by the reinforcement of the sector with several new people in the course of time. In January 1976 Georgi Gargov came back to Sofia from his Ph.D. study and entered the staff of the sector (two months later he got his Ph.D. degree in Moscow). A completely new person came in the Sector of Mathematical Logic in July 1976 – then Anatoly Buda moved from the Sector of Software Programming after finding out that our research field was better related to the directions of computer science studied by him in Novosibirsk (Buda had received his education from the Novosibirsk State University, there he had defended a Ph.D. dissertation under the supervision of A. P. Ershov in 1975). Three other persons came later – Slavian Radev in 1980, Lyubomir Ivanov in 1981 and Solomon Passy in 1985. All three of them had been graduate students at the Sector of Mathematical Logic before, and entered its staff immediately after receiving their Ph.D. degrees (at the Warsaw University in the case of Radev and at the Sofia University in the case of Ivanov and Passy).

The interest of the sector's members in the connections between mathematical logic and theoretical computer science can be seen from the survey [9], a joint work of all the staff of the sector as it was about 1984 together with two Ph.D. students. The bibliography of the survey contains 58 references (without claims on exhaustiveness) to relevant works of foreign authors and 37 references to publications in the mentioned scientific area with results obtained by members of the sector and by other participants in the seminars of the sector.

All people who entered the staff of the sector had high professional qualities, and they did first class research that was acknowledged abroad. In particular, the results from Ivanov's dissertation were published in England in 1986 in his monograph [11]. (These results present a rather interesting algebraic generalization of Recursion Theory, different from the one given in my book [6].) All these people contributed very much to the high level of the scientific and educational activities of the sector. Unfortunately, no other new members of the sector came during its existence, although five other excellent Ph.D. dissertations of our former graduate students were defended in the same period of time, and efforts were made to appoint their authors – Jordan Zashev, Ivan Soskov, Angel Ditchev, Tinko Tinchev and Valentin Goranko. (These dissertations were defended in 1983, 1984, 1984, 1986 and 1988, respectively.) It is difficult to give an explanation of this injustice, except

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by repeating once more that quite many things did not depend on the will of the sector's chief. A partial correction of the situation was achieved in 1987–1988, when, thanks to the exceptional activity of professor Dimiter Vakarelov, a Laboratory of Applied Logic was created at the Sofia University, and all of the five persons mentioned above became its members. To come to an end of the story about the staff of the sector, I shall list those people who were there in 1989, the last year of existence of the sector. They are (in alphabetic order of surnames): Anatoly Buda, Lyubomir Ivanov, Solomon Passy, Petio Petkov, Dimiter Skordev, Vladimir Sotirov and Dimiter Vakarelov. (Buda, Ivanov, Petkov and Vakarelov were already associate professors at that time, and Skordev was Dr. habil. in mathematics and a full professor.) Three people are missing – Radoslav Pavlov, who left the sector about 1978, and Georgi Gargov and Slavian Radev, who left it about ten years later. (All three of them also were associate professors in 1989.)

The Sector of Mathematical Logic has had a very intensive teaching activity. It has been directed mostly to graduate students. They have been taught the main topics in mathematical logic and recursion theory, as well as many topics of current research by the members of the sector. (A lot of things from mathematical logic taught to these students in the period from 1975 to 1980 are presented in Professor P. Petkov's book [10].) A series of 33 master theses, most of them excellent, were defended during the existence of the sector. The authors of 12 of them have been later (for some time) or still are members of the sector or of some of the two units that descended from it in 1989. If we are to encompass also the period after 1989 too, then we should add 32 more master theses of the same quality with 4 of their authors being members now of some of the two above-mentioned units.

Several conferences were organized by the Sector of Mathematical Logic in the period of its existence. (Three other conferences were organized later by the successors of the sector, namely one in 1990, another one in 1996 and, finally, the present one.) Here follows brief information on the first several conferences.

The very first of them was a Summer School on Algebra and Logic, organized together with the Sector of Algebra of the United Centre of Mathematics. The school took place in September 1979 in Blagoevgrad. The invited lecturers from abroad for the logical part of the school were H. Rasiowa and A. Skowron from Warsaw.

In September 1980, a Conference on Mathematical Logic, dedicated to the memory of A. A. Markov, took place in Sofia. N. M. Nagorny from Moscow presented a talk (prepared jointly with N. A. Shanin) on the works of Markov in mathematical logic and the theory of algorithms. Most of the talks given on the conference were published in [8]. (Unfortunately, no written copy of Nagorny-Shanin's talk was presented for publication in that volume.)

A Summer School on Mathematical Logic and Its Applications took place in September 1983 in Primorsko. Here is the complete list (extracted from [7]) of the participants from abroad (22 persons, including not only the invited lecturers, but also the other participants): B. R. Boričić (Beograd), W. Dańko (Bialystok),

O. Demuth (Prague), Ju. L. Ershov (Novosibirsk), A. Gajda (Bialystok), G. Georgescu (Bucharest), S. S. Goncharov (Novosibirsk), J. Harrera (Paris), A. Jankowski (Warsaw), K. P. Jantke (Berlin), J. Krempa (Warsaw), A. Ju. Muravitsky (Kishinev), N. M. Nagorny (Moscow), S. Puczylowski (Warsaw), H. Rasiowa (Warsaw), C. Rauszer (Warsaw), A. Salwicki (Warsaw), A. Skowron (Warsaw), D. I. Sviridenko (Novosibirsk), A. Szalas (Warsaw), H. Thiele (Berlin), P. Vopěnka (Prague)[3].

A Summer School and Conference on Mathematical Logic honourably dedicated to the 80th anniversary of Kurt Gödel took place in Druzhba near Varna from September 24 to October 4, 1986. The list of invited lecturers includes 20 persons, namely: C. C. Christian, J. W. Dawson, Jr., P. P. Petkov, J. van Benthem, D. S. Bridges, O. Demuth, A. G. Dragalin, Yu. L. Ershov, S. S. Goncharov, H. R. Jervell, Y. N. Moschovakis, N. M. Nagorny, V. A. Nepomnyashchy, N. A. Shanin, A. Skowron, H. Rasiowa, G. Sambin, K. Segerberg, B. A. Trakhtenbrot, V. A. Uspensky (there was also an invited seminar talk by D. Siefkes). The corresponding proceedings [12] include 14 of the invited papers and 13 of the contributed ones. The event was estimated by many of the participants as very successful, and a person to be certainly thanked for the success was Professor Petio Petkov whose activity at organizing the event was highly productive.

The last event of this kind during the existence of the sector was a Summer School and Conference on Mathematical Logic honourably dedicated to the 90th anniversary of Arend Heyting. It took place in September 1988, again near Varna. Petio Petkov was the chairman of the Organizing Committee, and the event was very successful too. A proceedings volume [14] was published again. It contains two invited papers on intuitionism and Heyting, 12 invited lectures and 14 selected contributed papers. The invited papers and lectures included in the volume are by the following people: A. S. Troelstra, D. van Dalen, D. de Jongh (joint with F. Veltman), S. Hayashi, B. Kushner, G. Mints, D. Normann, H. Ono, V. Shehtman (joint with D. Skvortsov), I. N. Soskov, G. Takeuti, W. Veldman, A. Visser, S. S. Wainer.

Along with the conferences, the sector also had an activity of another nature, namely a series of nine popular lectures in 1987, followed by a discussion. The lectures and the discussion attracted a very large audience and surely helped some more students to make their choice in favour of the mathematical logic. The realization of this activity resulted in the book [13].

In July 1989, after long previous discussions in other places, the Faculty Council of the Faculty of Mathematics took the decision a Department of Mathematical Logic and Its Applications to be formed at the faculty. It was to include the people from the Sector of Mathematical Logic who administratively belonged to the faculty, i.e. Petkov, Skordev and Vakarelov, as well as Buda, who moved from the Institute of Mathematics into the Faculty of Mathematics at that time, the five members of the Laboratory of Applied Logic, namely Ditchev, Goranko, Soskov, Tinchev, Zashev and, in addition, Roussanka Loukanova, who came into the new department

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[3]It seems, however, that P. Vopěnka in fact did not attend the event.

from the former Sector of Mathematical Linguistics. Skordev was chosen to be the chief again. The other people from the Sector of Mathematical Logic, i.e. Lyubomir Ivanov, Solomon Passy and Vladimir Sotirov, formed a Section of Mathematical Logic at the Institute of Mathematics with Lyubomir Ivanov as its chief.

The staff of both units underwent some changes in the next years. For example, Marion Mircheva was a member of the Section of Logic during a certain period of time, Solomon Passy left the section at a certain moment and devoted himself completely to politics, Dimiter Dobrev and Dimitar Guelev came into the section later. (Guelev did this after defending his Ph.D. dissertation at the Sofia University.) Several new persons came into the department at the faculty: Stela Nikolova in 1991, Alexandra Soskova in 1994, Vessela Baleva in 1998, Anton Zinoviev in 1999. Three of them had to replace Valentin Goranko, Jordan Zashev and Roussanka Loukanova, who had left the department at different times within this period. (Zashev moved to the Section of Logic, whereas Goranko and Loukanova got academic positions abroad.) Meanwhile Soskova, Nikolova and recently Baleva defended their Ph.D. dissertations at the Sofia University, and Loukanova defended one at the Moscow State University when she still was a member of the department. Soskov, Ditchev and Tinchev (as well as Zashev and Sotirov in the Section of Logic) became associate professors. Vakarelov and Soskov received also the Dr. habil. degree in this period, and Vakarelov became a full professor. In connection with the age restrictions imposed by the law the chief position in the department was eventually taken by Ivan Soskov. Unlike before 1989, now the department has many teaching activities in the first stage years of education (the Bachelor Program). The teaching traditions from the past have been continued by the department's activities in the M.Sc. Program.

At the end, I would like to say a few concluding words. To my opinion, history must be known and respected. Unfortunately, the department's archives turned out to be not in a sufficiently good state. Of course, this is mainly my fault. I am sorry for all imperfections and possible incorrectnesses that resulted from this in the present notes. I recommend to my younger colleagues to take care about preserving and saving all essential information about what happens in the department in order that this information could be used by those, who will come later.

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