

Chapter 45

Origin and Early Development of the IAMG



Frits Agterberg

Abstract This chapter is primarily concerned with the first 15 years of our existence (I was a member of the IAMG Founding Committee, and on the 1968–1972 and 1996–1980 IAMG Councils). Daniel Merriam and Richard Reyment are the principal fathers of the IAMG, and many other scientists have contributed significantly to its origin and early development. Personal contacts with them are briefly described. These comments are supplementary to those already provided in earlier chapters by Founding Members and others who have made significant contributions to the IAMG originally. Special attention is paid to inputs by prominent mathematical statisticians with an interest in geology. I am grateful to all pioneers who have helped to establish the IAMG and provided a climate encouraging younger scientists, including myself, to pursue careers in their field of interest.

Keywords IAMG history • Richard Reyment • Daniel Merriam
Early mathematical geologists

45.1 Introduction

Perspectives on the origin and early development of the IAMG have already been provided in earlier chapters. Most of the following remarks are complementary to these other reminiscences. They are based on documents in the IAMG Archive, private information and what is publicly available on the IAMG Website including Newsletters from 1970 onward.

Richard Reyment had the original vision of establishing our organization as offspring from two parents: the International Union of Geological Sciences and the International Statistical Institute. As a successful example to follow for geologists, he took the biometrical society which was already in existence for quantitative

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biologists and other life scientists, with its strong component of mathematical statistics. During 1966 and 1967, Reyment sought international support for the formation of our society. Especially mathematical statisticians were very supportive of his idea. He then organized the Founding Committee of the IAMG, although our name was to be chosen later. He invited me to be a member of his committee and chaired our inaugural meeting during the 23rd IGC in Prague where he became the IAMG's first Secretary General.

Daniel Merriam provided us with the essential publication and organizational background support for more than 30 years. In 1969 Dan was the founding Editor-in-Chief of the *Journal of the International Association for Mathematical Geology* (currently: *Mathematical Geosciences*), and in 1975 of *Computers & Geosciences*. Additionally, he was the chief organizer of numerous international meetings in our field, and editor of the proceedings for these meetings, as well as several other multi-author books. Later, in 2001, he took over as Editor-in-Chief of *Natural Resources Research*, our third international scientific journal that had originally been founded by Dick McCammon in 1992 under the name *Non-Renewable Resources*. In 1966, as Head of the Mathematical Geology Section, Kansas Geological Survey, Dan established the Distinguished Visiting Research Scientists program inviting mathematical geologists to work with him and his colleagues for successive one-year periods in Lawrence, Kansas. I was happy to accept Dan's invitation to occupy this position in 1969/70. During this fruitful year, my family and I were housed in the Sunflower apartments on the campus of Kansas University and received great hospitality. Merriam left Lawrence in 1976 to become Chair of the Geology Department, Syracuse University, where he commenced a new school for quantitative geoscientists. John Davis succeeded him at the Kansas Geological Survey.

Although originally educated in classical geology and geophysics at the University of Utrecht, I developed an interest in probability and statistics as a graduate student and published some papers on statistics applied in geology. Because of this, I was in 1962 invited to become "petrological statistician" at the Geological Survey of Canada (GSC) in Ottawa, initially to work within the framework of the Canadian Contribution to the International Upper Mantle Project and later to form their Geomathematics Section. The word "geomathematics" was used in analogy with "geophysics" and "geochemistry", but as a term it was never widely accepted. In 1982, engineers in photogrammetry had the idea of abbreviating the same word to "geomatics", which became widely accepted as a new discipline but is quite different from "mathematical geosciences".

GSC management allowed me to participate in the inaugural IAMG meeting on August 22nd, 1968, during the 23rd International Geological Congress in Prague. As described in earlier chapters, this event was disrupted and aborted because of the Russian-led occupation of Czechoslovakia. A list of participants in the inaugural meeting was included in its Minutes (see Appendix for final version of Minutes copied from the IAMG Archive) but several mathematical geologists including Bill Krumbein and Graeme Bonham-Carter, who had been planning to come to our first meeting, were prevented from coming to Prague to participate in the event.

Fortunately, my hotel was within walking distance of the Congress Centre and I also had been able to see several Founding Members before our meeting. Soon afterwards I was forced to leave Prague by car in a convoy of Dutch nationals led by the Dutch ambassador in the first car. Reyment had asked me to prepare minutes for our inaugural meeting and I handed him my first draft in Amsterdam where he, Geof Watson and I presented review papers at the Geostatistics Session organized during the 1968 meeting of the International Association of Statistics in the Physical Sciences (Section of the International Statistical Institute). This event helped to consolidate our affiliation with ISI. Formal affiliation with the IUGS had already been achieved in Prague.

45.2 Pioneers of Mathematical Geology

At its annual meetings the IAMG continues to honor five most eminent, pioneering scientists in our field: William Christian Krumbein, Andrey Borisovich Vistelius, John Cedric Griffiths, Felix Chayes and Georges Matheron. I was fortunate to know all five of them. Other leading scientists with strong IAMG involvements included John Tukey, Geof Watson, Danie Krige, Tim Whitten, Jean Serra and Walther Schwarzacher. Merriam and Howarth (2004) arranged for the publication of biographical articles on Matheron, Griffiths, Chayes, Reyment, Krumbein and Vistelius in a special edition of *Earth Sciences History*.

Krumbein (1936, 1939) already was developing important statistical techniques for geologists in the 1930s. My initial contact with him took place in the fall of 1961 when I was a postdoctorate fellow at the University of Wisconsin in Madison. My first assignment there was to perform statistical analysis of thousands of measurements on directional features taken by Ph.D. student Garrett Briggs in the Arkoma Basin of east-central Oklahoma (Agterberg and Briggs 1963). My report was reviewed by Krumbein before publication. His helpful comments included the suggestion to expand what initially was a brief footnote into a full section. It said that the circular normal (Von Mises) distribution for vectorial data converges to normal (Gaussian) form when dispersion around the vector mean approaches zero, so that standard (non-directional) statistical techniques including analysis of variance remain approximately applicable. Krumbein said that this remark solved a long-standing problem for him. Later, two of his Ph.D. students working with orientation data made use of this approach publishing their results in the first issue of our first IAMG journal (Jones and James 1969). I did not know at the time that Watson (1960) already had developed better approximations for statistical analysis of directional data. During his career, Krumbein continually sought the advice of mathematical statisticians including Franklin Graybill and John Tukey in order to stay on the right track. In 1963 the GSC invited him to Ottawa as a consultant, and I visited him at Northwestern University in a follow-up visit. Later I saw him regularly at scientific meetings, especially at those organized by Merriam in Lawrence, Kansas.

As a graduate student I gave an economic geology seminar on the skew frequency distribution of ore assays. In preparation I had read Krige's MSc thesis on microfilm in the library of the University of Utrecht. Its published version (Agterberg 1961) drew the attention of Danie Krige who wrote to me about it and became a good friend and esteemed colleague for more than 50 years. In 1963 he came to Ottawa on his way to the 3rd APCOM Symposium held at Stanford University. APCOM stands for "Applications of Computers and Operations Research in the Mineral Industries". With his wife Ansie and a colleague we went to Niagara Falls on a touristic outing. Danie persuaded GSC management that I should attend the 4th APCOM to be hosted by the Colorado School of Mines in 1964. Originally, APCOM meetings provided an important forum for mathematical geologists. I first met Dan Merriam, John Harbaugh, Tim Whitten and many others at early APCOMs.

In 1965 the GSC allowed me two months of travel abroad provided that I paid for my own travel expenses. First I went to the Netherlands where Codien Zwaardemaker invited me to dinner (we got married later that year; from 1993 onward she accompanied me to all IAMG annual meetings except one). From Amsterdam I went on to visit Krige in Johannesburg who took his family and me to the Kruger Park. Next there was the 8th Commonwealth Mining Congress in Australia, and finally the 5th APCOM at the University of Arizona, where I presented statistical analysis results for chemical analyses from the Muskox Layered Intrusion in northern Canada that was considered to be a sample of the upper mantle (Agterberg 1965). After this presentation John Griffiths came forward to congratulate me, also inviting me to present two papers instead of one at the next (1966) APCOM he would be hosting at the Pennsylvania State University. In those days, politicians in public paid more attention to oil and ore than today. The U.S. Secretary then in charge of mineral resources and mining gave the post-Symposium dinner speech. One of my two papers (Agterberg 1966) was entitled "Markov schemes for multivariate well data" and the Secretary singled this one out for a Cold War joke. Griffiths became one of my principal mentors. In 1968 Elsevier invited me to write a geomathematical textbook (Agterberg 1974). Griffiths and Merriam read all chapters and offered numerous helpful comments. Later I was honored to be invited to write the first chapter in the Griffiths commemorative book "Future Trends in Geomathematics" (Craig and Labovitz 1981).

Andrey Vistelius was the first IAMG President and his Laboratory of Mathematical Geology was used for our IAMG name. Tim Whitten, who was with Krumbein at Northwestern University, Evanston, Illinois, had invited him to come to North America in 1975 and for the last two weeks of this visit he was in the Geomathematics Section at the GSC in Ottawa. Before arrival, Vistelius had expressed the desire to sample a Canadian granite intrusion, preferably one with associated tin mineralization. There exists such a granite body in Nova Scotia but logistically we could not mount an expedition to sample it. Instead, with the help of other geologists we sampled the Meach Lake aplite body close to Ottawa. Aplite is fine-grained granite and this turned out to be a practical advantage, because thin sections of rock samples that could be cut in Ottawa were much smaller than the

very large thin sections Vistelius had produced in Leningrad for counting frequencies of transitions between different minerals in granites. In total 104 thin sections were transition-counted and statistically analyzed. The rock body was interpreted to be “ideal granite” in which sequences of mineral grains are Markov chains (Vistelius et al. 1983). Later Xu et al. (2007) provided an alternative multifractal explanation of the Meach Lake aplite textures.

While Vistelius was in Ottawa, a preliminary itinerary was set up for my 6-week visit to the Soviet Union that took place two years later. It commenced with a 10-day stay in Novosibirsk where I participated in the Siberian Seminar on “Application of Mathematical Methods and Computers for Mineral Search and Prospecting” organized by Yuri Voronin. Václav Němec, IAMG Treasurer (East) was participating as well. Neither Vistelius nor Founding Member Dmitry Rodionov attended. Němec was our IAMG ambassador to the Soviet bloc countries (cf. Agterberg 1994). My Siberian Seminar contribution (Agterberg 1977) was the only presentation with slides. Initially, the organizers told that I could only show three slides, because other participants were not allowed to display more than three posters but they relented. A slide projector was brought in from another institute and all my slides were shown. Before I was leaving for Moscow on the next stop, Němec had warned me that during my upcoming visit to Rodionov and his colleagues I would be asked for an opinion on the work of Voronin and his team; he explained that a negative opinion could be detrimental because Moscow controlled funding of the Novosibirsk projects. I was careful in what I said. It was understood in the Soviet Union that the farther east you went, the more philosophical the mathematical approach to geology became. I learned at the Siberian Seminar that rocks are subject to the basic philosophical principle that the “whole is more than the sum of the parts”.

The last two weeks of my visit to the Soviet Union were spent in Leningrad. Every day I arrived at the Laboratory of Mathematical Geology 2 h before Vistelius, who did most of his work at home where we went in the afternoon for discussions and a meal. As explained by Steve Henley, Vistelius was given a hard time under the communist regime because of his aristocratic roots. In order to accept an invitation for a lecture tour he had just received from Japan, he needed numerous approvals. The process, which involved various unpleasant interviews with officials plus extensive form-filling, took more than two weeks. On the day of my departure Vistelius received a phone call from somebody he referred to as a “foxtail” who communicated indirectly to him what could be interpreted as final travel approval. The foxtail did not communicate this in so many words but said that an official in Moscow had remarked that the Laboratory of Mathematical Geology in Leningrad did good work. This implied approval and Vistelius went indeed to Japan shortly afterwards. During our many discussions we were not always in total agreement. Vistelius held very strong opinions and was not at all impressed by geostatistics or geostatisticians. He felt that mathematical geology had to be “pure” and not contaminated with economic motivations. Even much later, after he had invited me to participate in a mathematical geology meeting, he pointed out that in his session

there would be no room for statistics applied to ore deposits, but he suggested other topics on which I could report.

My recognition of the validity of French geostatistics took place in 1964 because of a curious incident. Our library had obtained a copy of the first book by Matheron (1963) but there had been a complaint from the public that this volume contained absolute nonsense and should be removed from the shelf. The head of the Library Committee approached me and asked for an evaluation because: “We don’t want bad books on our shelves”. My report was favorable and the book could stay. Although this is not universally known, Georges Matheron commenced his career at the French Geological Survey (BRGM) in 1954. One of his first publications (Matheron 1955a) concerns the Gara Gjebilet oolitic iron deposit in Algeria. It is a standard geological publication with detailed descriptions of the stratigraphy, structure and genesis of this deposit of Early Devonian age plus a folded geological map in the back. It seems that Matheron started out as a classical geologist but shortly afterwards he published a paper (Matheron 1955b) on applications of statistical methods for ore reserve estimation. This first paper foreshadowed the revolutionary approach to spatial statistics he was to bring about during the last 40 years of the 20th century. Like Vistelius, Matheron had strong opinions on topics that would be suitable for research. His first two Ph.D. students (Michel David and André Journel) ran into significant problems later on, when in some of their projects they deviated from what Matheron felt was appropriate for them. In 1968 Michel David had come to the École Polytechnique in Montreal and we collaborated on several projects. One of these involved correspondence analysis (Agterberg and David 1979). But one day David showed me a letter from Matheron stating that this work should be stopped immediately and that he should return to working full-time on geostatistics.

In 1968 Georges Matheron established the Centre de Morphologie Mathématique in Fontainebleau, as a research institute of the École des Mines de Paris. Jean Serra was his close collaborator. Matheron’s preferred mode of work was to be in his office in Fontainebleau during the day. He would document his findings in limited-edition geostatistical notes. Fully concentrating on his research, he did not like to speak English nor extensive traveling. I visited him three times. Although for about 10 years my position at the GSC was classified as “bilingual”, I never spoke French in Ottawa because all French Canadian colleagues spoke English. However, speaking French was a requirement for personal (and telephone) contact with Matheron. An extra benefit of making the geostatistical pilgrimage to Fontainebleau was that I could consult the numerous geostatistical notes in their library and could bring back to Ottawa any copies of particular interest. Today all these notes are freely available on a website maintained by the École des Mines de Paris. I am sure they continue to contain valuable information that is relatively unknown. During the late 1970s I programmed in FORTRAN some of the methods developed by Matheron and Serra. Twice, I received a *Computers & Geosciences* best-paper award for these efforts. I was pleased to be asked in 1975 to chair a session at the first Geostatistical World Conference held in Frascati, Italy, at which Georges Matheron presented a philosophical paper (Matheron 1976). At the 53rd Session of

the International Statistical Institute in Seoul, August 2001, Georges Matheron was honoured as one of the greatest mathematical statisticians during the second half of the 20th century (cf. Baddeley 2001). After obtaining approval from Mrs. Matheron, the IAMG established its annual Georges Matheron lecture in 2005, delivered for the first time by Jean Serra at IAMG2006 in Liège. Our Matheron Lecture was modeled after the Fisher Memorial Lecture initiated by the International Statistical Institute in 1966.

Felix Chayes was a member of the IAMG Founding Committee and participated in many IAMG events. His numerous contributions have been documented by Howarth (2004). Upon his death in 1993 he left the IAMG a significant legacy in order to fund the biennial Felix Chayes Prize for Excellence in Research in Mathematical Petrology. For many years Chayes was involved in compiling large databases with worldwide data on Cenozoic volcanic rocks. This effort included directing International Geological Correlation Programme (IGCP) Project 163 (1977–1984) IGBA (Igneous data Base) which had supportive software as well. Close IAMG involvement with IGCP had been promoted by Merriam who also helped initiate IGCP Project 148 (1976–1983) “Quantitative Stratigraphy”.

John Cubitt was the original leader of IGCP Project 148 but he left Syracuse University where he was with Merriam in 1977 to become a private consultant in the U.K. and I took over from him. We created a group of lecturers to present one-week short courses on the subject that eventually were held in as many as nine different countries. The strategy was to attract staff from oil companies in “developed” countries willing to pay registration fees that were later used to give the course in “developing” nations. Walther Schwarzacher and I were part of this “traveling circus”. Originally, I had met Schwarzacher in Lawrence, Kansas, where we were both associated with Merriam’s quantitative geology group. He was the IAMG’s second Krumbein Medallist in 1977 (John Griffiths was the first a year earlier). In the IGCP Project 148 short course Schwarzacher lectured on lithostratigraphic correlation. Later he published a book that explained the Milankovitch theory (Schwarzacher 1993) according to which very small periodic variations in solar radiation create major climate changes on Earth. This idea had been anticipated by Croll (1875) as an explanation of the ice ages. Currently, the entire post-Cretaceous international geologic time scale is based on Milankovitch theory.

Walther and I had several things in common. In Europe we had attended similar high schools called “gymnasium” in both Austria and the Netherlands, at which the emphasis was on Latin and Greek. We still could recite some of the Odyssey to each other. Later I tried some of my ancient Greek on Roussos Dimitrakopoulos who smiled benevolently. The supervisor of Schwarzacher’s Ph.D. project had been Bruno Sander at the University of Innsbruck. Later (in 1957) I took a short course at this university in order to learn micro-tectonics in preparation of my fieldwork during four successive summers in northern Italy (Agterberg 1961). The most important results of this doctoral thesis were included in Whitten (1966)’s textbook on structural geology. Later, Hannes Thiergärtner and Heinz Burger invited me to contribute further articles on this subject on two occasions. Original Alpine

deformation patterns for the basement of the Italian Dolomites had to be re-interpreted in terms of rapid movements of the Adria microplate that presently keep on creating earthquakes in the Apennines (cf. Agterberg 2014).

45.3 Inputs from Mathematical Statisticians

Most important among the first mathematical statisticians was Ronald Fisher (1954) who suggested that geology with Lyell (1833) had been evolving as a more quantitative science but, rapidly, opposition against this development grew to the extent that Lyell's elaborate tables and statistical arguments (60 pages long) for his subdivision of the Tertiary were omitted from later editions of his *Principles of Geology*. In 1952 Fisher commenced giving regular talks on continental drift (cf. Fisher Box 1978, p. 440) lamenting that geophysicists and geologists were failing to take seriously Alfred Wegener's ideas on continental drift proposed in 1912. Plate tectonics only became generally accepted as a theory in the mid-1960s.

My Moscow stay in 1977 would have included visiting Andrey Nikolayevich Kolmogorov (1956) who originally formulated the axioms of probability calculus in his famous paper of 1931. Unfortunately, this visit had to be canceled for medical reasons. Like Krumbein in North America, Vistelius regularly consulted with mathematical statisticians and Kolmogorov was a major source of inspiration to him.

In 1983 the traveling circus of IGCP Project 148 was at the Indian Institute of Technology in Kharagpur. The lecturers included Geof Watson, 1968–1972 IAMG Vice President, who within 2 h filled an extra wide blackboard entirely with equations on the relationship between kriging and interpolation splines. It is doubtful that anybody in the audience (including me) could understand what he was talking about. Later I spent significant time understanding his subsequent paper on the subject (Watson 1984). I used smoothing splines extensively for estimating the ages of stage boundaries (with 95% error bars) in the International Geological Time Scale (Gradstein et al. 2004). Watson has done much to make Matheron's work in the fields of geostatistics and mathematical morphology better known in the English-speaking world. He persuaded Matheron (1975) to write his book on random sets and integral geometry. At the time Watson told me that there would be only three people in world able to understand this book from beginning to end.

Originally, Watson (1960) had developed statistical methods for directional features that were similar to methods for ordinary data originally developed by Fisher who was the world's most outstanding mathematical statistician during the first half of the 20th century. Fisher was from before my time. Some of our earliest IAMG members including Griffiths and Schwarzacher knew him personally. When I attended the 1963 congress of the International Statistical Institute in Ottawa, he had already left for Adelaide, Australia where he spent his last years in retirement. Fisher's life is described in detail by his daughter Joan Fisher Box (1978). During the latter part of the 19th century, Karl Pearson had introduced

many basic statistical concepts including the Pearson correlation coefficient and goodness-of-fit tests for contingency tables, basing his approach on normal (Gaussian) distribution models. Fisher derived the mathematical equation for the frequency distribution of the Pearson correlation coefficient and introduced numbers of degrees of freedom for various statistical methods that became widely used, also by the early mathematical geologists. In these methods extensive use was made of independent identically distributed (*iid*) random variables, contrary to geostatistical applications in which the emphasis was on “regionalized” variables that generate observed values that are not stochastically independent but spatially correlated.

In 1966 the GSC allowed me to participate in the Advanced Statistical Seminar at the University of Wisconsin organized by Fisher’s son-in-law Box. During the Icebreaker I was introduced to John Tukey who told me about his interest in geology. At this seminar he presented “The Fast Fourier Transform, for fun and profit” (cf. Cooley and Tukey 1965). Back in Ottawa, I received a box filled with about 2000 IBM cards for running the FFT in 1, 2, or 3 dimensions on our mainframe computer. During the next 25 years, Tukey commented on my projects at the GSC in three of the approximately 800 publications he authored or co-authored (cf. Agterberg 2001; Tukey 1984). Like Matheron, he was recognized at the 2001 ISI Congress in Seoul as one of the greatest mathematical statisticians alive during the second part of the 20th Century. With Watson who had become Chair of the Princeton University Statistics Department, where Tukey was a professor, he attended the 1969 Geostatistics Colloquium organized by Dan Merriam in Lawrence, Kansas, that also had Matheron, Krumbein and Serra as participants.

Watson owned a cottage on Blood Hill near Elizabethville in the Adirondacks, New York State, not too far from Ottawa. In those days, the GSC maintained a pool of cars with the words “Geological Survey of Canada” in big letters on the sides. I could use one if these cars to visit Watson during weekends. Once I drove Geof and some of his family members to Princeton where Tukey spotted us on the campus. He started laughing and pointing his finger at Watson suggesting that Geof had become a “geologist”. Watson stimulated me to improve my mathematical skills. Pointing out some errors in a review of Agterberg (1974) he had, somewhat sarcastically, remarked that one could see I was not trained as a mathematical statistician. However, he would have granted me an MSc degree in this discipline. Subsequently I worked hard on my mathematics. In 1983 I organized a geomathematical workshop at the GSC in Ottawa with Geof Watson, Jean Serra and Benoit Mandelbrot among the presenters. Mandelbrot who had coined the word “fractal” like Matheron had been a student of Paul Lévy at the École Polytechnique in Paris. Other participants in our workshop included the directors of Carleton University’s Centre of Mathematical Statistics who shortly afterwards invited me to become an Adjunct Professor in their Mathematics Department. I felt this was almost as good as a Ph.D. in mathematical statistics. Personally, I have always felt that this discipline offered me more challenges than conventional geology although this remains a scientific discipline in its own right.

45.4 Concluding Remarks

The preceding remarks are to a large extent personal like several reminiscences in earlier chapters. I have tried to add to these other contributions, above all attempting to bring out the generosity our pioneers extended to younger colleagues. By their research and contributions to the IAMG they insured a healthy organization that should continue to exist and expand for many years to come.

Appendix: Minutes of the First Meeting of the International Association for Mathematical Geology, Prague, August 22, 1968

The meeting was attended by 20 representatives from 10 different countries (see attached list of participants).

After a general introduction by the acting chairman, R. A. Reymont, the following two problems were discussed:

1. Statutes and By-laws
2. Journal

The relatively short name of "International Association for Mathematical Geology (I.A.M.G.)" was adopted for the Society.

A. B. Vistelius proposed discussion of possible classes of membership and also which categories of members should be entitled to vote in the General Assembly. It was pointed out that the Association should consider the options of (a) voting by country (each country one vote) or (b) as individual scientists. However, membership should be open to all scientists. The possibility of having a fixed number of voting members was also discussed. It was felt that the latter procedure may be unfair to the larger countries.

Article 7 of the proposed Statutes (each member of I.A.M.G. one vote) was adopted. However, this discussion resulted in the following change in Article 10 of the proposed statutes:

1. There shall be two treasurers (East and West) instead of one, in order to meet the problem of non-convertible currencies.
2. There shall be only one representative on the Council appointed by the geologists of the host country for the next International Geological Congress.
3. The sentence "Not more than two ordinary members shall be from the same country" shall be replaced by "Representation on the Council shall reflect regional distribution of membership as stated in the by-laws."

The following by-law was adopted:

“By-law 7: Not more than two ordinary members, and/or four members of the Council shall be from the same country. This by-law shall be reviewed every four years by the General Assembly.”

The matter of introducing a journal was discussed. First, the following by-law was accepted:

“By-law 8: The editor-in-chief, in consultation with the Council, shall be empowered to appoint up to four associate editors.”

The Assembly adopted a motion initiated by G. S. Watson “that the Society shall have a journal”.

After the acceptance of the statutes and by-laws had been reached and general agreement there shall be a journal, the chairman proposed to the Assembly the electing of the officers of the Council.

The following 13 members of the Council were elected:

- A. B. Vistelius—President
- G. S. Watson—Vice President (also president elect)
- R. A. Reyment—Secretary General
- V. Němec—Treasurer (east)
- T. V. Loudon—Treasurer (west)
- W. C. Krumbein—Past President (instead of Immediate Vice President, see by-law 9)
- D. F. Merriam—Editor-in-Chief
- D. F. Rodionov, S. P. Sen Gupta, F. P. Agterberg, G. Matheron, D. G. Krige, E. H. T. Whitten—Ordinary members.

The following by-law was accepted:

“By-law 9: For the first four years of the Society’s life, instead of an immediate past president, there shall be an additional vice president.”

Since some of the elected members were not present at this meeting, the following motion initiated by J. W. Harbaugh, was adopted:

“If an elected member should not wish to serve on the council, Professor Vistelius shall nominate the next member on the list.” Prof. Vistelius has a list of persons eligible as ordinary members and the number of votes they received at the election.

P. Wilkinson moved that: “The Association encourages, in principle, the formation of national groups in mathematical geology and that the question of affiliation should be discussed at the next General Assembly in Montreal.” This motion was adopted.

Finally, the policy and objectives for the journal were discussed. It was suggested that there should be a broad editorial program. Similar to that of the biometrical journal *Biometrics*. The editor-in-chief should prepare guidelines for the journal. The first issues should also contain educational papers.

The official languages of the organization are French, English, German and Russian. It is appreciated that the editing of papers in Russian may present a

problem to the editor-in-chief, and in practice only two or three languages will be used for publication. All articles shall have an abstract in English.

List of participants, First meeting of International Association for Mathematical Geology, Prague, August 22, 1968.

R. A. Reyment (Sweden)
 D. A. Rodionov (U.S.S.R.)
 A. B. Vistelius (U.S.S.R.)
 F. P. Agterberg (Canada)
 H. Knappe (G.D.R.)
 H. Thiergärtner (G.D.R.)
 G. S. Watson (U.S.A.)
 V. Němec (Czechoslovakia)
 D. J. Burdon (FAO of United Nations)
 C. J. Dixon (U.K.)
 P. Wilkinson (U.K.)
 T. V. Loudon (U.K.)
 R. Ivanov (Bulgaria)
 V. Kutolin (U.S.S.R.)
 F. Benkő (Hungary)
 E. H. T. Whitten (U.S.A.)
 R. B. McCammon (U.S.A.)
 J. W. Harbaugh (U.S.A.)
 R. Hesse (F.R.G.)
 D. F. Merriam (U.S.A.)

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