16th International Zeolite Conference *joint with the*
7th International Mesostructured Materials Symposium

CARMINE COLELLA

A short history of the International Zeolite Conference from London 1967 to Beijing 2007

A. De Frede - Napoli

eni

Carmine Colella

A short history of the International Zeolite Conference

16TH IZC – 7TH IMMS

Sorrento, Italy, July 4-9, 2010

ORGANIZING ASSOCIATIONS

International Zeolite Association (IZA)
International Mesostructured Materials Association (IMMA)
Italian Zeolite Association (AIZ)
Interdivisional Group of Catalysis and Division of Industrial Chemistry of the Italian Chemical Society (GIC-SCI)
EU Network of Excellence IDECAT
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Consorzio Interuniversitario per la Scienza e Tecnologia dei Materiali (INSTM)

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A. De Frede Editore – Napoli
Via Mezzocannone, 69 – Tel. 0815527353– Fax 0815527353
http://www.edizionidefrede.it
e-mail: defrede@fastwebnet.it

Stampa: A. De Frede
Napoli, giugno 2010
ISBN 978-88-89976-30-2

To Giordana,

my better half,

in recognition of her endless

patience and understanding

CONTENTS

Preface

This short history of the International Zeolite Conferences is due to an initiative of our colleague Professor Carmine Colella from the University of Naples. The project of the book emerged during a meeting of the Organizing Committee of the 16th IZC in Sorrento and became a reality after nearly two years spent in collecting and analyzing personal and colleague's archives.

International Zeolite Conferences are the bases on which our community has been built and have contributed most to establish its identity. Since the first Conference held in 1967 in London till the 15th IZC in Beijing in 2007, IZCs have provided at regular time intervals the agora function essential to maintain and reinforce the scientific and personal links of an overwhelming diverse and rich community.

The present book is primarily a priceless database containing all technical and practical details regarding the 15 past IZCs, including the composition of the Organizing Committees, the conference sponsors, the publications, the number, origin and regional distribution of attendees, the scientific content and format of the conference, the social events and related activities…. It lively witnesses the continuous scientific development of the science of zeolites, the spring-up and growth of new domains as well as the economic and strategic evolutions that occurred in the period.

Besides, reports on business meetings, scientific notes, anecdotes and comments from the author drive the reader to the back of the scene showing how geopolitical events or the dedication of some personalities have, in particular circumstances, contributed to and impacted the future of the International Zeolite Association.

On behalf of all the colleagues who will receive this book at the occasion of the 16th IZC in Sorrento, I would like to express my warmest thanks to Professor Carmine Colella for this gift. These pages will undoubtedly remember excellent memories to the older of us and will contribute to give the younger of our colleagues a better insight into the human adventure they are pursuing.

François Fajula
President of IZA
June 2010

Foreword

In one of the first meetings of the Organizing Committee of the Sorrento IZC the idea was launched to prepare a booklet on the history of the previous Conferences, starting from the first held in London more than 40 years before.

Having no idea of the difficulties, I accepted the challenge without hesitation. I am fond of history and have a natural inclination to put together archives of any material, so I had plenty of documents of all the meetings I have attended in the years, in particular twelve IZCs out of fifteen held till then.

I realized very soon that I had embarked in a true enterprise: the material I had saved was abundant, but absolutely fragmentary and with innumerous lacks of information. Moreover, the many attempts I made to collect material from colleagues and friends all over the world were mostly unsuccessful. I discovered that most Conference participants throw away all the redundant material, saving of course the Proceedings and in some cases only the CDs, if any.

I didn't get discouraged and decided to begin the work just collecting as many documents as possible from every source, persons, books, journals and especially Internet. Then, about two months ago I decided that time had arrived to start writing. In these two months I had a lot of problems to solve, many informations to ask for, several colleagues to contact obsessively…At the end, the product of my efforts is under your eyes.

This booklet includes, as an Appendix, the texts of the short lectures to be given at the Barrer Symposium during the forthcoming 16th IZC in Sorrento. I believe that these accounts could not have a better seat: Richard M. Barrer is in fact himself the history of zeolites and therefore the history of the International Zeolite Conferences.

I can not finish this brief foreword without thanking the many friends who helped me with their many personal memories and with unconditioned encouragements. Some of them are mentioned at the end of each chapter. My particular thanks to Alison Davies and Chris Schwob, two of Professor Barrer's daughters, I had the privilege to contact and from whom I obtained plenty of documents and photographs, I will able only in part to present during the Barrer Symposium.

Lastly, my gratitude goes to three of my coworkers, Barbara Liguori, Domenico Caputo and Paolo Aprea, who spent days and days to scan photographs and documents and to convert endless lists of names and titles in hopefully useful statistical data.

Carmine Colella
Chairman IZA-Natural Zeolites Commission
June 2010

Introduction

For about two hundred years, since their discovery in 1756, zeolites have been considered a little more than just mineral curiosities. Their strange properties, mainly the ability to lose water upon heating, doing an impression to boil, and the aptitude to exchange "bases", namely to replace their own extra-framework cations with other cations, were well known phenomena. Basic research, in fact, although slowly (if we measure time with the present meter) had already produced results of a certain significance. For instance, the reversibility of dehydration, the capacity to take up different gases and vapours to fill the space set free of water, the stoichiometric course of cation exchange reactions, all these important stages of knowledge have already been achieved at the beginning of the 20th century. And, in addition, the awareness of the astonishing architectures of zeolite frameworks, their microporosity and the consequent properties, would have been attained only a few years later, in the first decades of the last century.

Nevertheless, nobody could imagine at that time the enormous development of basic and applied research on zeolites in a few years and the myriads of applications of this important class of microporous materials in about every field of industrial, environmental and social relevance. It is, for instance, curious now to read the opinion of E. Artini, a renowned Italian mineralogist, Director of the Civic Museum of Natural History in Milan, who affirmed in a very popular book of mineralogy, at the beginning of the twentieth century: "…*we will present a certain number of representative zeolites to give at least an idea of the great variety of forms and compositions of these minerals, so much considered and so important from a scientific point of view, as meaningless from a practical point of view*…".[1]

Actually, at the end of the 1930s, studies aiming at investigating the adsorption properties of natural zeolites were initiated by Richard. M. Barrer in U.K.[2] Over the next twenty years Barrer proceeded with adsorption and ion exchange experiments on zeolites, resulting in the foundation of zeolite science. He also realized that to make real progress in the application of these materials to processes of industrial significance it was essential to obtain zeolitic material by synthesis. Studies in this research area started at the end of the 1940s and were quickly successful. Dozens of zeolitic products were obtained, either as counterpart of natural zeolites, or completely new.

Similar investigations on chemistry and physical chemistry of zeolites were carried out in those years in other international laboratories. Studies on adsorption had a successful season in USSR in the 1950s, whereas systematic studies

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[1] E. Artini, *I minerali*, 5th Edition, U. Hoepli, Milan, 1938, p. 483 (The first edition of this book was published on 1914).

[2] R. M. Barrer, *Proc. Roy. Soc.*, A167 (1938) 392.

on synthesis resulted, in the same years, in dozens of patents in USA, especially for the propulsive action of Union Carbide scientists.

Time arrived to share the collected experiences with other colleagues. Meetings of essentially local significance, but with an international flavour, were therefore organized during the 1950s and early 1960s. In the USA, apart from specific Symposia inside the Gordon Conferences, e.g., in 1962, an important meeting was held at the College of Mineral Industries, The Pennsylvania State University, from July 5 to 8, 1957. The fifth session of this meeting was devoted to "*Zeolites and phase-equilibrium investigations*"[3].Lectures on zeolites were held by D. W. Breck (Linde Air Products Company, Tonawanda, N. Y.), who claimed the synthesis of twenty new zeolites in the Linde and other laboratories and described the properties of a novel Type-A zeolite; W. Novaki (Bern, Switzerland), who recalled the recently solved structure of faujasite; P. Saha (Penn. State), who described syntheses of analcite and other zeolites from compositions ranging from albite to nepheline; L. B. Sand (University of Utah), who reported on the occurrence of enormous deposits of mordenite-ptilolite in the western United States.

In the same years, similar meetings of local valence were held in USSR., and the relevant Proceedings, translated in English, reached the western world, allowing the first accounts of scientific results to be exchanged. [4]

During his attendance at the Gordon Conference in the USA in 1962, Professor Barrer expressed the opinion that international periodic molecular sieve conferences would be worthwhile. This is the starting point of the International Zeolite Conferences, whose historical development is the subject of this book.

When in 1967 R. M. Barrer organized the first conference of this series, he reported a statement of Wilhelm Eitel, the author of "*The physical chemistry of the silicates*", who, referring to the beauty and variety of natural zeolite crystals, remarked that these minerals had to be considered 'the pride of mineralogists'.[5]

It is believed that nowadays this statement is shareable by any person, mineralogist, scientist or technologist, devoted to the study of zeolites and analogous materials.

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[3] P. Saha and J. V. Smith, *The American Mineralogist*, 43 (1958) 174-175.

[4] Two All-Union Conferences on Zeolites were organized in 1961 and 1964 by the USSR Academy of Science, dealing with their synthesis, properties and applications. An English translation of the second meeting was made available by the International Information Institute.

[5] R. M. Barrer, in "Molecular Sieves", Society of Chemical Industry, London, 1968, p. 3.

Conference on Molecular Sieves

London, U.K.

4th-6th April 1967

Conference site:
Lecture Theatre, School of Pharmacy, University of London,
London, United Kingdom

ORGANIZING COMMITTEE

R. M. BARRER (*Chairman*)

A. A. L. CHALLIS

J. R. HARESNAPE

F. S. SPRING

T. I. WILLIAMS

F. J. GRIFFIN (*Secretary*)

SPONSORSHIP

The Conference was organized under the auspices of the Society of Chemical Industry, 14 Belgrave Square, London, SW1.

PUBLICATIONS

Molecular Sieves
Society of Chemical Industry, London, 1968, 339 pp.

A set of preprints of the Conference Volume in a thin cardboard box was handed over to all the registered participants.

FORMAT

The meeting was organized to give an occasion to specialists from various countries to discuss at international level on the state of art of molecular sieve science and technology. In order to favour discussion, restrictions were introduced in the program as regards the number of papers and the themes considered for presentation.[1] Perhaps there were some invited lectures,[2] but it is believed that most speakers were actually encouraged to submit contributions. According to Barrer's suggestion this would have been the first of a series of meetings, organized in London by the Society of Chemical Industry on the same subject but also extended to similar topics.[1]

The papers officially included in the program were 31,[3] equally distributed in the three days of the meeting (there were no parallel sessions); unexpectedly the published papers in the Proceedings were 33.[4] Wide space was given to discussion, which was fully included in the Conference Volume.

The topics of the Conference were grouped in six sections, headed by the following couples of Session Chairman/President: R. M. Barrer/S. P. Zhdanov; D. W. Breck/W. M. Meier; J. N. Haresnape/W. Schirmer; R. M. Milton/A. A. L. Challis; R. W. H. Sargent/L. B. Sand; J. V. Smith/D. J. C. Yates. It is presumed that the joint presence of a Session Chairman and a President was a means to honour the so many senior scientists attending the Conference. Apparently, being a President was simply a honorary position with perhaps the only function to introduce the Chairman.

PARTICIPANTS

No official figure existing, but the number should be not far from 150.[5] Most participants were from UK and USA., but also representative from Belgium, Canada, Czechoslovakia, France, Germany (FRG and GDR), Italy, The Netherlands, Switzerland and USSR were surely present.

Elevated and qualified was the industrial participation, e.g., Esso Research & Engineering Co., W.R. Grace & Co., Mobil Oil Corp., Norton Company, Shell Development Co., Union Carbide Corp. (all of them from USA), Imperial Chemical Industries Ltd and British Petroleum Ltd (UK), L'Air Liquide (France) and VEB Leuna-Werk (GDR).

HISTORICAL

The beginning of the story is known. Edith Flanigen and Leonard Sand, in the Preface of the Proceedings of the 2nd Conference (see the next chapter), tell: "*During his attendance at the Gordon Conference in the USA in 1962, Professor R. M. Barrer of Imperial College, London, expressed the opinion that periodic molecular sieve conferences would be worthwhile. On the premise that it was appropriate to hold the first conference*

in London to honor Professor Barrer's contributions, a group of British scientists was encouraged to initiate its organization. As a result, the first International Conference on Molecular Sieves was held successfully in London, April 4-6, 1967, under the chairmanship of Professor Barrer and under the sponsorship of the Society of Chemical Industry".[6] It is unknown, on the contrary, why a so long period of time (about five years) was necessary to complete the organization.

Scientific Notes

As one reads the Proceedings of this Conference 43 years later, it is evident that most lectures represent the foundation of the modern zeolite science and technology. Some "review" papers served as reference for tens of years, e.g., "*Zeolite structures*", by W. M. Meier , "*Synthesis and properties of Union Carbide zeolites L, X and Y*" by D. W. Breck and E. M. Flanigen, "*Chemical aspects of zeolite crystallization from alkali aluminosilicate gels*", by S. P. Zhdanov, "*Molecular sieve catalysts: their properties and applications*" by R. L. Mays and P. E. Pickert, "*Electrophilic aromatic substitution reactions catalysed by crystalline aluminosilicate*", by P. Venuto, E. L. Wu and J. Cattanach, "*New ultrastable form of faujasite*", by C. V. McDaniel and P. K. Maher, "*Process for separating mixtures of gases by isothermal adsorption: possibilities and application*" by D. Domine and L. Haÿ.[7]

Among the participants there were many very famous scientists. Several of them had been the pioneers in the respective research branches, e.g., Richard Barrer for about everything, Donald Breck, Robert Milton, Leonard Sand and Sergey Zhdanov for synthesis, Walter Meier and Joseph Smith for structure, Andrei Kiselev and Wolfgang Schirmer for sorption and diffusion, Paul Venuto, Rolland Mays and Paul Pickert for catalysis. The level of the presentation was therefore elevated and the discussion exhaustive. A memorable event was a long discussion/debate between Barrer and Kiselev on theoretical approaches to predicting energies of sorption, the very famous Russian physical chemist had presented at the Conference.[8] Discussion resulted frequently in the requirement of integrations, which were successively included in the Proceedings as extensions or complements.

Social Events

No formal banquet was organized, but a wine reception and buffet was held at the Natural History Museum, Cromwell Road, London SW7. It occurred in a room where a magnificent display of natural zeolites was housed.

Acknowledgments

Alan Dyer, Herman van Bekkum and David Vaughan are gratefully acknowledged for providing some information mostly taken from their memories.

REFERENCES AND NOTES

[1] R. M. Barrer in the General Introduction of the Proceedings [p. 3] informs the readers that, "*in order to keep the discussion within reasonable bounds*"…"*it was decided to omit ion-exchange equilibria, kinetics and thermo-chemistry in zeolites*". The first International Conference on ion-exchange was however organized in London in 1969 under the sponsorship of the Society of Chemical Industry at which only four papers on zeolites were received (A. Dyer, private communication).

[2] In a memorial article on S. P. Zhdanov by A. Corma, F. Fajula, J. Kärger and D. H. Olson [*Micropor. Mesopor. Mat.* **90** (2006) 4], it is explicitly reported that "*along with Richard M. Barrer and Donald W. Breck, Sergey Zhdanov was among the plenary speakers on zeolite synthesis during the very first international zeolite meeting, the London Zeolite Conference of 1967*".

[3] Information reported in a Conference announcement [*Chemistry and Industry*, No. 3 (January 21, 1967), p. 87]. This figure agrees with the number of papers reviewed in a very accurate report of the Conference in October 1967 [see N. Giordano, *La Chimica e l'Industria (Milan)* **49**(10) (1967) 1132-1136 (in Italian)]. On the other hand, R. M. Barrer in the "General Introduction" (see Ref. [1]) says that "*it was decided to limit the number of papers to about 30*".

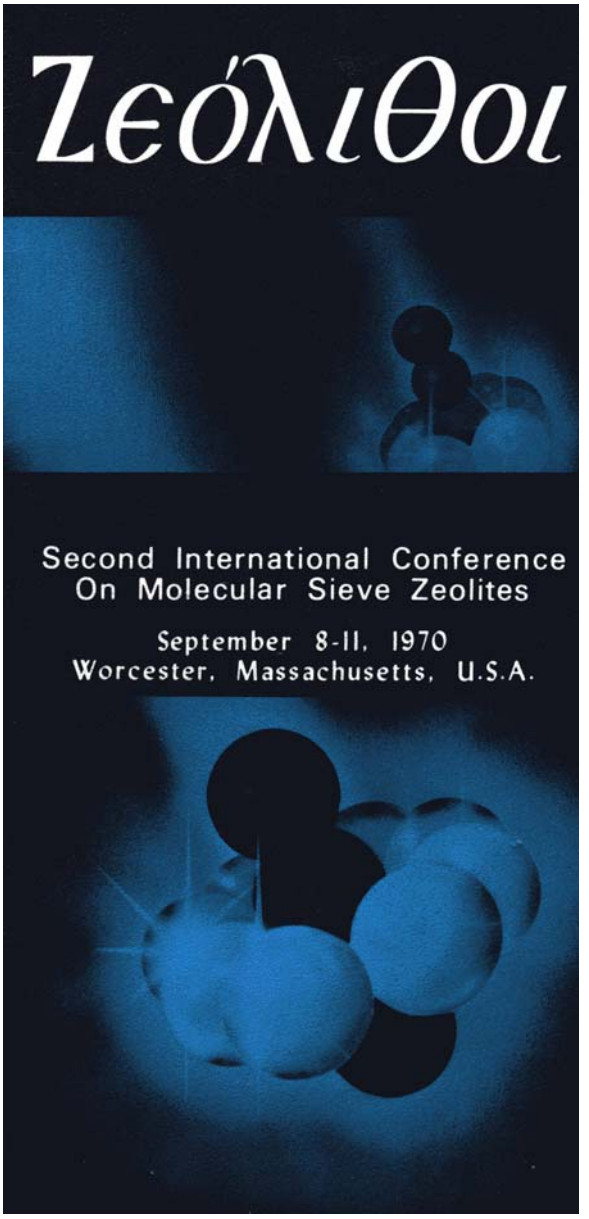
[4] The two additional papers printed in the Proceedings, but possibly missing in the Conference preprints, were those of G. Eppert and R. M. Milton (see Conference Proceedings, pp. 182-185 and 199-203, respectively). Considering that both authors attended the Conference and definitely presented their papers (A. Dyer, private communication), it may be speculated that the absence of their preprints was due to a temporary lack of clearance for political reasons (Eppert) or for industrial reservation (Milton).

[5] This is an average figure of several reported guesses by Conference participants. Note, in addition, that the authors of the papers and the participants to discussion summed to some 80.

[6] E. M. Flanigen and L. B. Sand, in "Molecular Sieves I", *Advances in Chemistry Series* **101** (1971) ix.

[7] Conference Proceedings, p. 10-27; 47-61; 62-70; 112-116; 117-129; 186-195; 204-216, respectively.

[8] Kiselev presented two papers at the Conference: (i) A. V. Kiselev and A. A. Lopatkin, (ii) Yu. A. Elterov and A. V. Kiselev, see Conference Proceedings, p. 252-266 and 267-275, respectively. The paper which originated the discussion was the former one. Account of this was given in an additional contribution appeared in the final Conference Proceedings.



Conference site:
Campus of the Worcester Polytechnic Institute
Worcester, Massachusetts, USA

CONFERENCE COMMITTEE

E. M. FLANIGEN and L. B. SAND (*Co-Chairmen*)

W. L. KRANICH (*Secretary-Treasurer*)

P. K. MAHER (*Industrial Support*)

R. M. BARRER (*Honorary*)

An additional Committee handled all the local activities.

SPONSORSHIP

The Conference was co-sponsored by the American Chemical Society Divisions of Colloid and Surface Chemistry, Physical Chemistry, and Petroleum Chemistry and Worcester Polytechnic Institute (WPI).

Contributors: Petroleum Research Fund – American Chemical Society; BP (North America) Ltd. – British Petroleum Co., Ltd; Esso Research and Engineering Co.; W. R. Grace & Co. – Davison Division; Gulf Research and Development Co.; Mobil Research and Development Co.; Nalco Chemical Company; Norton Company; Shell Development Co.; Sun Oil Company; Texaco, Inc.; Union Carbide Corporation; Union Oil Co. of California; Universal Oil Products Co.

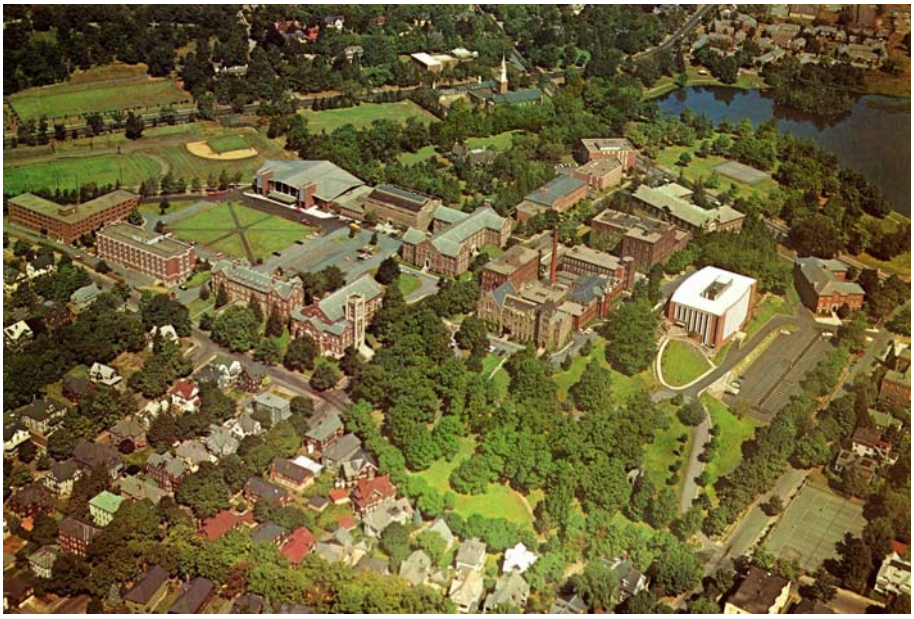
PUBLICATIONS

Molecular Sieve Zeolites – I
Advances in Chemistry Series, No. 101
American Chemical Society, Washington, D. C., 1971, 526 (+ x) pp.

Molecular Sieve Zeolites – II
Advances in Chemistry Series, No. 102
American Chemical Society, Washington, D. C., 1971, 459 (+ x) pp.

PREPRINTS
(not published, but only issued to the Conference participants)

Second International Conference on Molecular Sieve Zeolites
September 8-11, 1970
Worcester Polytechnic Institute
Worcester, Massachusetts
American Chemical Society, Washington, D. C., 1970, 852 pp.



The WPI campus.

Format and Program

The Conference opened on Tuesday, September 8, 1970 with the welcome address to the participants by G. W. Hazzard, President of the Worcester Polytechnic Institute, and lasted three and half days until Friday noon, September 11, with the concluding remarks by W. F. Arey.

The Technical Program was based on the following topics: Synthesis, Sorption, Catalysis, Structure, Mineralogy, Modification and General Properties. Several single or parallel sessions were organized, including Introductory, Invited and Submitted papers, and Concluding Remarks, 1, 10, 65 and 1, respectively. All the contributions were presented orally. Sufficient space was given to discussion, published afterword in the Conference Volumes.

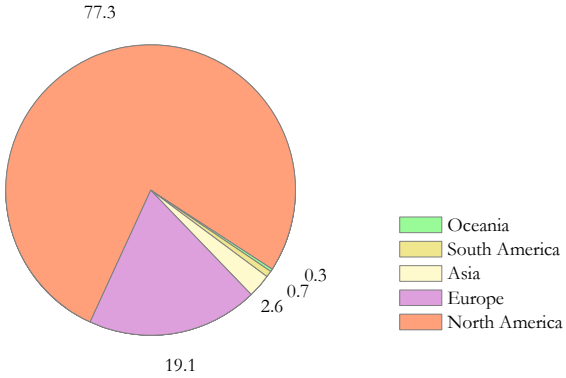
Invited speakers were (in the order of presentation): D. W. Breck (Introductory Lecture), S. P. Zhdanov, R. M. Barrer, A. V. Kiselev, P. B. Venuto, J. A. Rabo, W. M. Meier, J. V. Smith, R. A. Sheppard, H. S. Sherry and J. W. Ward.

Evening panel discussions were scheduled on Tuesday, September 8 (Synthesis and Sorption) and Thursday, September 10 (Catalysis), chaired by E. M. Flanigen, R. M. Barrer and W. K. Hall, respectively. The panels had the purpose to extend critical discussion on the papers presented during the day and to provide an opportunity to discuss problematic points on which there had been disagreement among workers.

PARTICIPANTS

The official List of Participants includes 309 persons from 20 countries.[1] Most of them were from USA (228). Total delegates from America were 241, 59 were from Europe, 8 from Asia, 1 from Oceania. The diagram below shows the relevant percentages.

Participants from industry (175) were prevailing over academic and research people (134, i.e., 43.4%). USA was the country with more industrials (156, i.e., 68.4%).



HISTORICAL

Based on a possible agreement after the successful Conference of London, R. M. Barrer and L. B. Sand initiated in 1968 the continuation of the conference on a triennial basis. The 2nd Conference of the series[2] was planned to be held in 1970 at the Worcester Polytechnic Institute under the sponsorship of the American Chemical Society. The choice of United States was made *to recognize the pioneering commercialization of molecular sieve zeolites by Union Carbide Corporation and the petroleum refining industry*.[3] E. M. Flanigen, designated as the representative of the American Chemical Society, assumed, together with Sand, the chairmanship of the Conference. The Petroleum Research Fund contributed to the expenses of invited distinguished speakers. Financial support was also obtained by several primary Companies from USA and UK. The meeting provided an opportunity for presentation of new scientific information and discussion both formally and informally, in an extremely pleasant and congenial environment. To favour informal discussions and exchange of ideas, most participants were housed in dormitories on campus.

Professor R. M. Barrer and some of his former students in WPI campus: (from left to right) R. Aiello, D. E. W. Vaughan, R. M. B., J. F. Cole, H. Villiger, C. Colella.

The Conference was marked by a dramatic episode. In the preceding weekend three airplanes en route to USA were hijacked in the European skies. Two Swiss delegates to the Conference, Walther M. Meier and Hans J. Sticher, were among the passengers of one of the hijacked aircrafts. The airplane, a Swissair DC8, was forced to land in the Jordanian desert, where the passengers were held hostage for several weeks (see the box at the end of the chapter).

Gazette Photo
Iliana Galabova, one of the Bulgarian delegates to the conference, inspects a model of a zeolite structure.

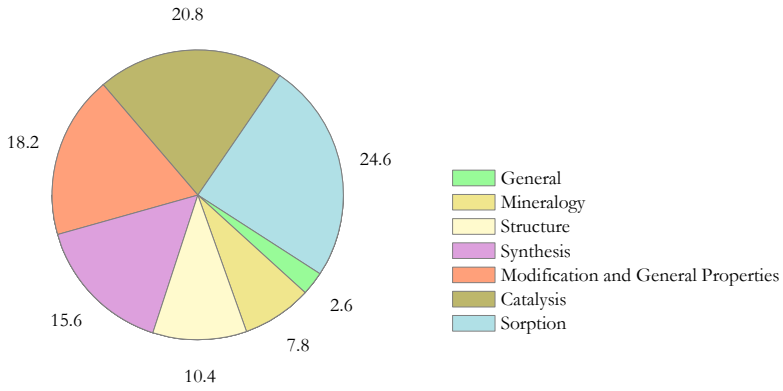
News from the Conference were prominently reported by the local press. An article of the *Worcester Telegram*, on Wednesday, Sept. 9, 1970, titled *300 Scientists Conferring at WPI*, summarized the purposes of the meeting, the nature and uses of zeolites and collected some considerations from the organizers. Emphasis was also given to the presence of zeolite scientists on the hijacked airplane. Similar considerations were reported, in the same day, in another article, titled *Zeolites Break Barriers*, by *The Evening Gazette*. Interviews were made to Leonard B. Sand and some participants and a photo-

graph of a former Barrer's student, Iliana Galabova from Bulgaria, was published (see picture).

SCIENTIFIC NOTES

Similarly to the previous meeting, the Worcester Conference benefited from the presence of several renowned scientists in the field of molecular sieve zeolites. Apart from the Organizers and the Invited Speakers (see above), some other names should be mentioned: D. Barthomeuf, J. Ciric, D. S. Coombs, M. M. Dubinin, A. Iijima, G. T. Kokotailo, M. Koizumi, G. H. Kühl, L. Moscou, D. H. Olson, L. V. C. Rees, H. E. Robson, R. Roy, W. Schirmer, J. Turkevich, J. B. Uytterhoeven. Very important review lectures were presented in each session, i.e., "*Recent advances in zeolite science*", by D. W. Breck , "*Some problems in zeolite crystallization*" by S. P. Zhdanov, "*Zeolite frameworks*", by W. M. Meier and D. H. Olson, "*Zeolites in sedimentary deposits of the United States – A review*" by R. A. Sheppard, "*Cation exchange on zeolites*", by H. S. Sherry, "*Infrared spectroscopic studies of zeolites*", by J. W. Ward, "*Intracrystalline diffusion*" by R. M. Barrer, "*Vapor adsorption on zeolites considered as crystalline specific adsorbents*", by A. V. Kiselev, "*Description of adsorption equilibria of vapors on zeolites over wide ranges of temperature and pressure*" by M. M. Dubinin and V. A. Astakhov, "*Some perspectives on zeolite catalysis* ", by P. B. Venuto.[4]

The main subjects treated in the submitted communications were:[5] isomorphous substitution in zeolite frameworks (synthesis); structure refinements of erionite, offretite, gismondite, laumontite and ultra stable faujasites; present status in zeolite facies (mineralogy); physical and cation exchange properties of some zeolite types (modification and general properties); thermodynamics, kinetics and theory of gas-zeolite interaction (sorption); acidic sites and their action in several catalytic reactions (catalysis).



Business Meeting

A business meeting was held at the end of the Conference, on September 11. The assembly approved the establishment of a permanent International Zeolite Conference Committee, having essentially the tasks to plan future Conferences at three-year intervals and to explore the possibility of permanent affiliation of the participants. The Committee would have continually been renewed by election at each conference of five new members to replace five of the incumbent members.

It was voted to accept the invitation of Professor W. M. Meier to host the 3rd International Conference in Zurich, Switzerland, in September 1973.

The first International Committee included the following members: E. M. Flanigen (*chairman*), R. M. Barrer, H. B. Habgood, A. V. Kiselev, P. K. Maher, W. M. Meier, C. Naccache, J. V. Smith, J. B. Uytterhoeven, P. B. Venuto. Hagbood, Naccache and Smith were elected by the assembly, the other were "suggested" by the organizers.

Social Events

The Conference Banquet was held on Wednesday evening, September 9, at the Pleasant Valley Country Club, Sutton, Mass., preceded by the Social Hour. A speech was delivered during the banquet by Prof. Richard M. Barrer.

A Ladies Program was also organized.

References and Notes

[1] E. M. Flanigen and L. B. Sand in the Preface of the Conference Volumes ["Molecular Sieves I", *Advances in Chemistry Series* **101** (1971) ix] report the figure of 18.

[2] Note that formally the subject of the Worcester Conference, "Molecular Sieve Zeolites", was different from that of the London Conference, which referred to just "Molecular Sieves".

[3] Preface of the Conference Volumes (see Ref. [1]). The custom to alternate the conference sites between Europe and USA has been maintained until the 6th Conference in Reno (1983).

[4] Conference Proceedings, Vol. I, p. 1-18; 20-43; 155-169; 279-310; 350-378; 380-403; respectively.; Vol. II, p. 1-34; 37-54; 69-85; 260-283, respectively.

[5] R. Sersale, *La Chimica e l'Industria (Milan)* **52**(12) (1970) 1267-1268 (in Italian).

[6] C. Colella, *Bollettino AIZ* (Bulletin of the Italian Zeolite Association), **16** (2000) 3-5 (the reported text, translated from Italian, is the starting part of the Editorial).

Worcester 1970: on the thread of memory[6]

Terror in desert

September 9, 1970: a group of guerrillas of the Popular Front for the Liberation of Palestine set off, on a dusty military airstrip of the sweltering Jordanian desert, at Zarqa, 25 miles northeast of Amman, two airplanes, a Swissair DC8 and a TWA Boeing 707. Earlier, the Arab commando had fortunately allowed 178 passengers to get away, while they were waiting terrified that their fate came to end.

This is the last act of an event initiated three days before, on September 6, Sunday, when four groups of armed guerrillas had attempted to seize four airplanes leaving from European airports to New York. In one case the attempt of hijacking had failed: some Israeli security agents had killed an Arab hijacker on an El Al DC8 en route from Amsterdam and reduced to surrender his life-companion, the well known Leila Khaled, later consigned to Scotland Yard after an emergency landing at Heathrow. Another Palestinian commando, who hijacked a Pan Am World Airways Boeing 747 and forced it to land in Cairo, blew up the plane after its 188 passengers and crew left it through emergency chutes.

The last two airplanes had been diverted, as said before, to the Jordanian desert. Here the guerrillas, under the threat to blow up them with the passengers inside, asked for the release of six guerrillas held in Switzerland and in West Germany, besides the mentioned Leila Khaled, imprisoned in London.

After the destruction of the two airplanes in Jordan, the negotiation between the Arab commando and the interested governments, with the mediation of Red Cross, continued for a couple of endless weeks until an agreement was attained, at the end of September, with the release of the hostages, on one side, and the imprisoned guerrillas, on the other side.

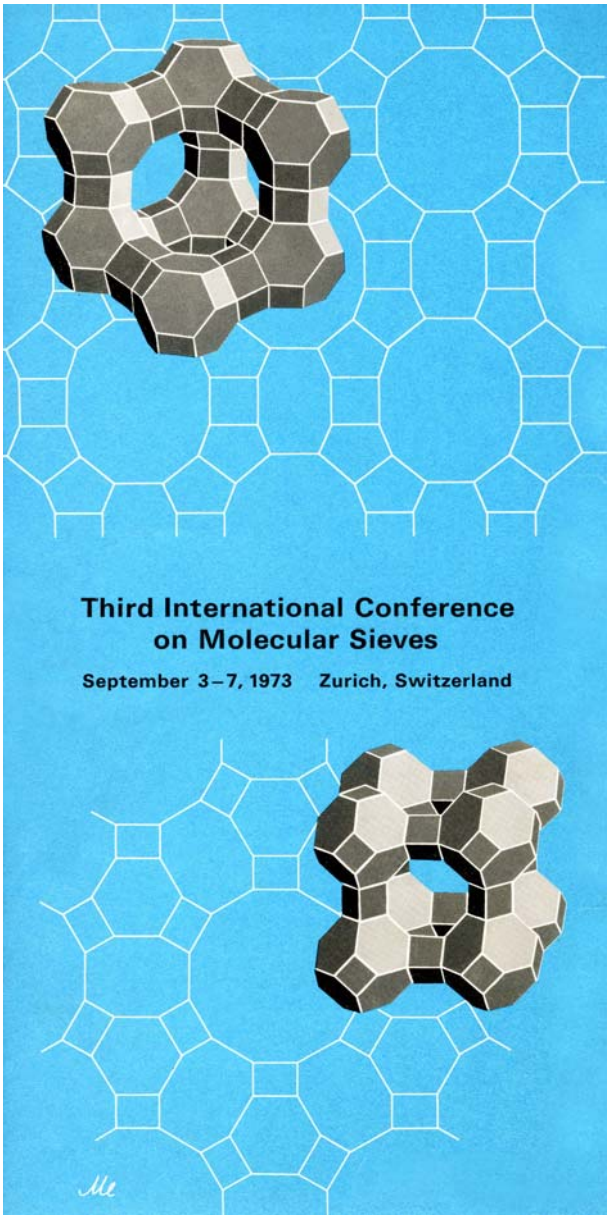
Reflections in Worcester, Mass.

At 9:00 a.m. of Tuesday, September 8, 1970 the approximately 300 participants at the 2nd International Conference on Molecular Sieve Zeolites were assembled in the Alden Auditorium of the Worcester Polytechnic Institute, a renowned School of Engineering – where some years before fundamental studies of rocketry had been carried out –, waiting for the opening of the important scientific event.

Len Sand and Edith Flanigen, chairmen of the Conference, before addressing, as usual, greetings and thanks to the participants, reported on the possibility that two Swiss scientists, Professor Walter M. Meier and Dr. Hans J. Sticher from the Eidgenössische Technische Hochschule in Zurich, and Meier's wife, scheduled to arrive in Worcester Sunday, were on the Swissair airplane, hijacked by the Palestinian guerrillas and diverted to the Jordanian desert. In the forthcoming days the doubt would have become a certainty.

Meier, a famous structurist, who had helped the organization of the Conference, was forced to stay in Jordan, in spite of him, until liberation, occurred in the last days of September. The Assembly of the participants at the Worcester Conference, on Friday, September 11, during the Business Meeting, elected Prof. Meier as the chairman of the 3rd Conference of the series, planned for 1973 in Zurich.

……..



Conference site:
Eidgenössische Technische Hochschule (ETH)
Zurich, Switzerland

CONFERENCE COMMITTEE

W. M. MEIER (*Chairman*)

B. BERTI (after April 1973)

P. K. MAHER

R. PEEST (until April 1973)

H. STICHER

J. B. UYTTERHOEVEN (*Program Chairman*)

An additional Committee handled all the local activities.

SPONSORSHIP

The Conference was co-sponsored by the Swiss Federal Institute (ETH Zurich) and the Swiss Chemical Society.

Contributors: Air Products and Chemical Inc.; Akzo Chemie NV Locatie; Farbenfabriken Bayer AG; British Petroleum Company Ltd; Chevron Research Co.; Joseph Crosfield & Sons Ltd.; Engelhard Minerals & Chemicals Corporation; Esso Research and Engineering Co.; W. R. Grace & Co.; Laporte Industries Ltd.; Mobil Research and Development Corporation; Shell Research Complex; Texaco, Inc.; Union Carbide Corporation; Universal Oil Products Co.[1]

PUBLICATIONS

Molecular Sieves
W. M. Meier and J. B. Uytterhoeven, *Editors*
Advances in Chemistry Series, No. 121
American Chemical Society, Washington, D. C., 1973, 634 (+ xiii) pp.
(including the Conference Papers)

Molecular Sieves
J. B. Uytterhoeven, *Editor*
Proceedings of the Third International Conference on Molecular Sieves
September 3-7, 1973
Zurich, Switzerland
Leuven University Press, Leuven, Belgium, 1973, 484 pp.
(including the Recent Progress Reports and the Discussion of the Conference Papers)

COVER

The cover of the circular was designed by W. M. Meier.

Format and Program

The Conference opened on Monday, September 3, with the welcome address to the participants by H. H. Hauri, President of ETH, and lasted four and half days, until Friday, September 7, when it closed with the Final Assembly.

The Technical Program was based on the following topics: Structure, Crystallization, Ion Exchange and Modification, Sorption, Catalysis. Parallel sessions were organized, including Introductory, Invited and Submitted Papers, and Recent Progress Reports (RPR, i.e., short communications of latest results), 1, 7, 47 and 67, respectively. All the contributions were presented orally. Sufficient space was given to discussion, published after the Conference in the Proceedings.

Invited speakers were (in the order of presentation): R. M. Barrer, (Introductory Lecture), Kh. M. Minachev, E. M. Flanigen, K. F. Fisher, H. W. Kouwenhoven, H. Lee, G. T. Kerr, H. A. Resing.

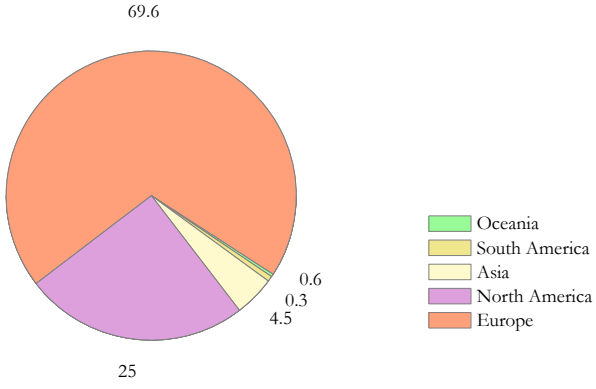
Four Ad-Hoc Meetings were held at the request of interested members of the Conference. The discussed topics were: (i) the mobility and structure of water in zeolites as revealed by NMR spectroscopy, (ii) crystallization, (iii) ion exchange, (iv) influence of ion impurities on the catalytic, electronic and magnetic properties of Y zeolites.

A discussion on Nomenclature, based on a report by R. M. Barrer was held on Tuesday evening, September 4.

Participants

The official List of Participants includes 312 persons from 29 countries.[2] Most of them were from Europe (217). The country with more delegates was USA with 73, followed by Germany (BRD) with 37 and France and UK with 31.

Total participants from industry were 106 (34.0%). USA was the country with more industrials (45, i.e., 61.6%).



HISTORICAL

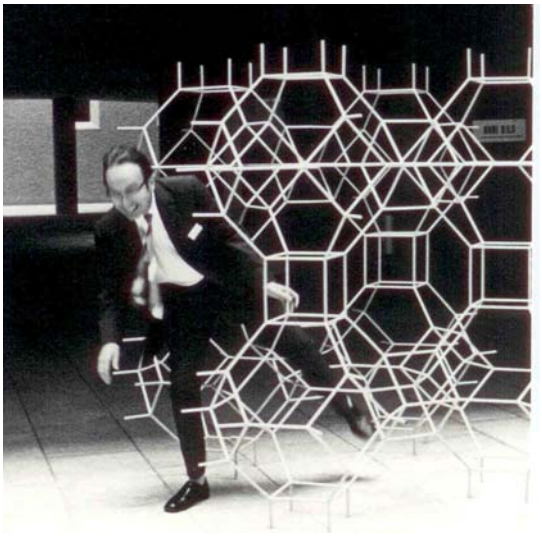
The Zurich Conference benefited from the valuable synergy of the two main organizers: Walter M. Meier and Jan Baptiste Uytterhoeven, who took care also of the editing of the Conference volumes. The organization was careful and capillary even in the minute details. Also the scenography was accurate: a display of models of all the known zeolite structures (including the recently synthesized RHO), an exposition of zeolite minerals, two impressive very large framework models of faujasite and type A zeolites, made of brass tubing (see the photographs), a wonderful carpet, depicting in a schematic way the crystal structure of natrolite, exposed next to the main entrance of the Information center, where the Registration desk was located. Exhibits were also organized of zeolite micrographs supplied by a number of participants.

From left to right: J. V. Smith, S. P. Zhdanov, J. B. Uytterhoeven, D. Barthomeuf, W. M. Meier, E. M. Flanigen, R. M. Barrer, H. Sticher.

From a scientific point of view, the Conference, although entitled "Molecular Sieves" (as the first one in London), was restricted to zeolites, in recognition, as emphasized by the organizers-editors in the Preface of the Conference Volume, of their singularity to be at the same time cation exchangers, physical sorbents and catalysts [3].

The 3rd Conference is noteworthy also for some innovations introduced in the program. Recognizing that *the main value of an international gathering…lies in the possibility of a free exchange of informations and opinions* and that *the information given at a conference must be as recent as possible*, the Conference committee, *to create the opportunity for bringing up recent information*, decided to accept "recent progress reports" *till a deadline of two months prior to the Conference.*[4] Another positive novelty was the introduction of the mid-week excursion, which officially was intended as an occasion to favour informal discussions among the participants in a relaxing atmosphere. Actually, it also served, and still serves nowadays, to provide a rest after two days of full scientific immersion and before one and half day of further mental engagement.

A thorough account of the Conference was given by the local press. A full-page article of *Die Weltwoche*, on Wednesday, August 29, 1973, titled *Die gezüchteten Siebe* (Synthetically grown sieves), announcing the Conference, reported a detailed description of the chemical, structural and microporous nature of zeolites and some impressive examples of their applications. Emphasis was particularly given to molecular sieving and catalysis. An interview to the organizer Walter M. Meier was also included. Meier explained how zeolites can affect our daily life, e.g., enhancing the yield in the conversion of crude oil to gasoline, contributing to decontaminate air, increasing enormously the rate of some important reactions, acting as effective desiccant. Finally, some outlooks for future were given with interesting prospects of utilization, especially in biology and medicine.



Walter Meier entering a α-cage.

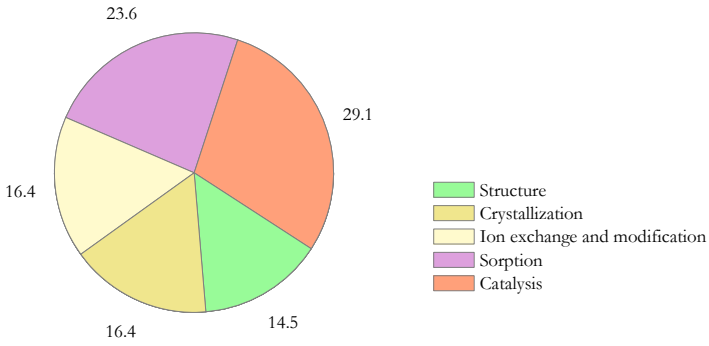
SCIENTIFIC NOTES[3,5]

The technical program of the Conference opened with the Introductory Lecture. The Lecturer, R M. Barrer, treating the subject "*Porous crystals: clathration, trapping and zeolitic sorption*", presented a broad review of a series of compounds which can exhibit molecular sieve properties. The other Invited Lectures dealt with the following subjects: "*Catalytic properties of zeolites – A general review*" (Kh. M. Minachev and Ya I Isakov), "*A review and new perspectives in zeolite crystal-*

lization" (E. M. Flanigen), "*Zeolite structure refinement*" (K. F. Fisher), "*Isomerization of paraffins*" (H. W. Kouwenhoven), "*Applied aspects of zeolite adsorbents*" (H. Lee), "*Hydrogen zeolite Y, ultrastable zeolite Y and aluminium-deficient zeolites*" (G. T. Kerr), "*NMR relaxation and molecular motion in zeolites*" (H. A. Resing).[6]

The Conference Papers, divided in five sections, covered a broad area of investigations, here summarized. The structural papers treated all the usual aspects of the sector, i.e., structural characterization of new zeolites (e.g., the recently synthesized zeolite Rho), the location of exchangeable cations and sorbed molecules, studies of the Si-Al distribution, positional disorder, charge distribution, thermal vibrations, crystal defects and twinning. The section of crystallization comprised zeolite synthesis, kinetics and mechanism of formation, stability relationships, recrystallization processes as well as the genesis of natural zeolites. Ion exchange was treated essentially as a tool to change zeolite properties. Different methods were used to study the modifications and their relation with sorption properties and catalytic activity. The papers of the section sorption dealt with theory, the properties induced by modification and the characterization of sorption complexes by NMR and ESR. At last catalysis, the section with more papers, included presentations on cracking, isomerization and electron transfer reactions. Zeolites tested were Linde Y, mordenite and erionite. Correlations between catalytic activity and physicochemical properties and selectivity in relation to crystal size and molecular shape were other subjects covered.

The percent distribution of the papers in the various sections is reported in the following diagrams.



The continuous increase of the number of synthetic and natural zeolites and the confusion connected with the use of several names for the same species made necessary to introduce agreed rules of nomenclature. This problem was specifically discussed during the Conference. A proposal, entitled "*Suggestions for chemical nomenclature of synthetic and natural zeolites*", was prepared by R. M. Barrer and

circulated in advance among the participants. Several rule were approved. Among the other rules a three-letter code to designate specific framework types was introduced. This proposal, accepted by the International Union of Pure and Applied Chemistry (IUPAC),[7] is the way still used nowadays to distinguish zeolitic phases having different structures.

Business Meeting

The Permanent Committee elected during the Worcester Conference in 1970 held four meetings. The main points in agenda were: (a) selection of time and place of the 4th International Conference on Molecular Sieve, (b1) adoption of an interim constitution and by-laws of the International Molecular Sieve Conference (IMSC), prepared by J. V. Smith and P. B. Venuto, (b2) search for a possible incorporation as an independent body or affiliation to the IUPAC, (c) election of a new Conference Committee.

Following the recommendation of the Permanent Committee, the General Assembly of the Conference decided to hold the next conference at the University of Chicago (USA) in April 1977 under the chairmanship of J. V. Smith.

The "Interim Constitution and By-laws of the International Molecular Sieve Conference" were approved.

A Conference Committee consisting of 12 members was set up in accordance with the new constitution and by-laws in substitution of the previous permanent International Zeolite Conference Committee. Members of this Committee were: J. B. Uytterhoeven (*President*), W. M. Meier (*Vice-President*), J. W. Ward (*Secretary*), D. W. Breck (*Treasurer*), K. Fischer, C. Kemball, M. Koizumi, C. Naccache, D. M. Ruthven, W. Schirmer, P. B. Venuto, S. P. Zhdanov.

Social Events

A Reception offered by the governing bodies of the Canton and City of Zurich took place on Tuesday 4, from 7 p.m. to 8 p.m., at the Muraltengut.

The Conference Banquet was held on Thursday evening, September 9, at the Zunfthaus zur Schmiden, one of Zurich's oldest guildhouses. A speech was delivered during the banquet by Leonard B. Sand, introduced by Walter M. Meier (see the box at the end of the chapter).

A full-day excursion was organized on Wednesday 5 to the Schynige Platte. The location, 1967 m, was reached by a special train. The excursion gave a fine view of the heart of Switzerland, including the Lucerne area and part of the Bernese Oberland. The participants had also the possibility to visit a well-stocked *Alpen Garten* (a research station of the institute of Botany of the University of Berne) with over 500 varieties of plants.

A Ladies Program was also organized.

Schynige Platte – Schreckhörner.

Schynige Platte – Alpen Garten.

ACKNOWLEDGMENTS

Thanks are due to Thomas Armbruster for some suggestions and advices and Markus Meier for providing some photographs and the speech of his father Walter at the Conference Banquet.

REFERENCES AND NOTES

[1] This Contributors list is reported in the Program of the Conference. In a later list, included in the Proceedings, the following three companies were missing: British Petroleum Company, Ltd; Chevron Research Co.; Universal Oil Products Co.

[2] This is the official number of registrants. It is anyway reported that 11 persons were absent.

[3] W. M. Meier and J. B. Uytterhoeven, "Molecular Sieves", *Advances in Chemistry Series* **121** (1973) xi.

[4] J. B. Uytterhoeven, Preface of "Proceedings of the Third International Conference on Molecular Sieves", Leuven University Press, Leuven, Belgium, 1973, p. viii. The RPR, although published in a reduced number of pages and not reviewed in the same thorough way as the conference papers were, had a place in the program as respectable as the normal publications. Unfortunately, this position has changed in the years and, at present, the RPR are definitely considered as contributions of lower rank.

[5] C. Colella, *La Chimica e l'Industria (Milan)* **55**(10) (1973) 847 (in Italian).

[6] Invited Lectures were given exactly the same time than submitted contributions (20 minutes), whereas 15 minutes were allowed for RPR.

[7] R. M. Barrer, "Chemical Nomenclature and Formulation of Compositions of Synthetic and Natural Zeolites", *Pure Appl. Chem.*, **51** (1979) 1091-1100.

[8] Introductory Speech by W.M. Meier at the Banquet of the Third International Conference on Molecular Sieves, Zunfthaus zur Schmiden, Zurich, 6th September, 1973.

After dinner . . . [8]

Ladies and Gentlemen,

When introducing our special guests before dinner I am afraid I must have violated protocol by leaving out our speaker at tonight's banquet, Prof. Leonard B. Sand, but there is really no point in spoiling somebody's dinner, particularly if he is a good friend of yours, by reminding him of his after-dinner speech.

Some of you will know the story of an unfortunate Christian who was thrown into the lions' cage in ancient Rome. Before the animal had a chance to fall on its prey the victim managed to whisper something into the lion's ear. As a result the lion reversed into a corner of the cage, growling but leaving the poor man unharmed. Nero, watching this, could hardly believe what he saw and, being very curious, he let the poor man know he could go free if he disclosed the secret. "Quite simple" replied the Christian, "I just said to the lion 'After dinner – the speech'".

Our banquet speaker, I am glad to note, does not yet show any signs of discomfort. He knows, of course, that he still has some ten minutes to prepare his speech!

Exactly three years ago to this date, as some of you may recall, the Swiss delegation to the 2nd International Conference at Worcester picked the wrong plane at Zurich airport. Instead of reaching our destination, New York and the conference at Worcester, we were forced to land in the Jordanian desert. There we were allowed six days to get accustomed to desert life in a DC-8 loaded with dynamite. After a week the ordeal was fortunately over for most of us, but not for Dr. Sticher. He and some others had to stick it out for another two weeks in the midst of shooting and bombing. When they were finally freed out of the rubble by members of the Jordanian army Hans Sticher had lost all his personal belongings except for his book of Conference Papers. He had actually succeeded in reading this book from end to end while under heavy shell fire (and I had this confirmed). You will therefore understand why he was put in charge of the technical organization at THIS conference.

It would probably be more appropriate if I told you something about Switzerland. Foreign visitors sometimes express surprise that we do not seem to have language problems, bearing in mind that four officially recognised languages are spoken in Switzerland, quite apart from many dialects. Well, – I tell you – this situation offers definite advantages. In Switzerland it is considered polite to say you do not understand, no matter whether you do or not. In other words, one need only understand what one chooses to understand, which solves many problems in a rather diplomatic way. However, what I just said does not apply to the English language, which, after all, is not an official language of Switzerland. Everybody here either speaks English, or tries to speak it, or else would like to speak it, and they will pretend to understand you whether they do or not. I hope this makes it perfectly clear why we have chosen English as the only conference language.

I shall now turn to our speaker, Dr. Leonard Sand, Professor of Chemical Engineering at Worcester Polytechnic Institute in Massachusetts. Len is a good friend of mine of long standing, and I remember we first met at a Zeolite Conference held in the summer of 1959 [*actually, the Conference was held in 1957*] at Penn. State. I vividly remember Dr. Sand provoking a lively dispute on clinoptilolite, a dispute which is still unsettled after 14 years but will, I am sure, eventually prove him right. He also threw in an additional two meaty papers at that meeting for good measure. This was certainly a memorable meeting, and I recall that the registration fee, which was nil, included a theatre party at a near-by playhouse and a plush banquet at the Country Club. This two-day meeting was organized single-handedly by J.V. Smith, and I can only say that we are all looking forward to the next meeting of this kind he is organizing in three and a half years time. But now back to Dr. Sand. I do not have to go into his many accomplishments in hydrothermal phase chemistry and zeolite synthesis. He is no doubt an accepted authority in the field. I understand he also introduced geological processes in chemical engineering, which means that chemical engineers will still be much needed in millions of years when all other present-day activities will be over and done with.

It was largely due to the continued initiative of Dr. Sand that the International Molecular Sieve Conferences were set up. Together with Miss Flanigen he organized the very successful 2nd Conference, and was also largely responsible for the holding of the present one. When the subject of holding the 3rd International Conference at Zurich was first discussed he came to visit us on a friendly inspection tour. Here, we had no reason to be overly confident at that time (3 years ago) for various parts of the ETH were a terrible mess as a result of reconstruction. Naturally we did not want to destroy Dr. Sand's optimism, and for this reason the tour of the building was carefully planned to avoid all spots where doubts could have arisen. When we entered the main building to show him the facilities he asked for the men's room. Luck was with us, because the only decent men's room in the building at that time was just two doors away. Well, he went in and we waited outside discussing the next move at length. We had finally reached a decision when Dr. Sand pulled the chain, came out and said. "Well, your conference facilities are adequate". This is how and when it was decided to hold the 3rd International Conference at the Federal Institute in Zurich.

Ladies and Gentlemen, it gives me great pleasure to introduce to you our banquet speaker, Dr. Leonard B. Sand.

W. M. Meier

FOURTH

INTERNATIONAL CONFERENCE

ON

MOLECULAR SIEVES

APRIL 18 to 22 1977

CHICAGO , USA

Conference site:
Center for Continuing Education, The University of Chicago
Chicago, Illinois, USA

CONFERENCE COMMITTEE

J. V. SMITH (*Conference Organizer*)

D. W. BRECK (*Technical Program Chairman*)

J. R. KATZER (*Publications Committee Chairman*)

J. W. WARD (*Financial Committee Chairman*)

G. T. KERR

D. M. RUTHVEN

Additional staff of the Center for Continuing education.

SPONSORSHIP

The Conference was co-sponsored by the American Chemical Society (Divisions of Colloid and Surface Chemistry, Physical Chemistry and Petroleum Chemistry) and the University of Chicago (Materials Research Laboratory funded by National Science Foundation).

Contributors: Petroleum Research Fund administered by American Chemical Society; Union Carbide Corporation; Universal Oil Company of California; Chevron Research Company (Standard Oil Company of California); UOP Foundation; Mobil Research and Development Corporation; Laporte Industries Ltd. (England); Akzo Chemie (Holland); The Proctor and Gamble Company; Amoco Oil Company; Imperial Chemical Industries Ltd. (England); Exxon Research and Engineering Company; Bayer AG Leverkusen (Germany); Monsanto Company; Engelhard Minerals and Chemicals Corporation; Molycorp, Inc.; W. R. Grace and Co. (Davison Chemical Division); Sun Oil Company; Girdler, Inc.

PUBLICATIONS

Molecular Sieves – II
James R. Katzer, *Editor*
ACS Symposium Series, No. 40
American Chemical Society, Washington, D. C., 1977, 732 (+ x) pp.
(comprising the Conference Papers)

Fourth International Conference on
Molecular Sieves
April 18 to 22, 1977
Chicago, USA

- **Recent Research Reports, 124 pp.**
- **Final Program and Discussions, 175 pp.**

(not published, but only issued to the Conference participants)

Format and Program

The Conference opened on Monday, April 18, with the Welcoming Remarks by J. V. Smith, the Conference organizer, and the Reflections on Zeolites by R. M. Barrer, and lasted four and half days until Friday, September 7, when it closed with the Business Meeting.

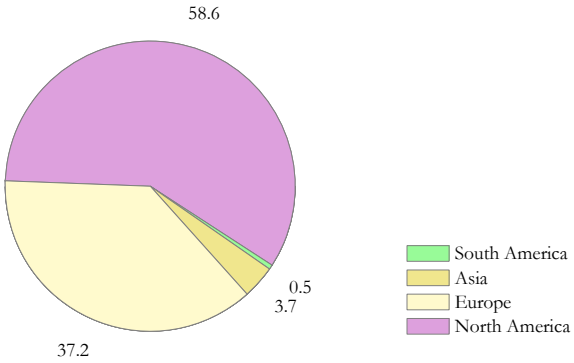
The Technical Program was based on the following topics: Structure, Synthesis and Modification, Adsorption and Diffusion, Catalysis, and Technology. Single sessions were organized in the mornings (except Wednesday), parallel sessions in the afternoons. A total of 100 oral contributions was presented, comprising 58 Conference Papers and 42 Recent Research Reports (RRR), both of them published prior to the Conference.[1] Sufficient space was given to discussion, printed after the Conference together with the Final Program.

Eight Invited Lectures introduced the various sessions. Speakers (in the order of presentation) were: M. M. Dubinin, W. Schirmer, G. V. Gibbs, D. Barthomeuf, J. H. Lunsford, A. Cremers, J. S. Magee, R. A. Anderson.[2]

Participants

The official List of Participants includes 227 persons from 20 countries.[3] The majority of them was from North America (134). The country with more delegates was USA with 128, followed by Germany (BRD + GDR) with 19 and France with 15. The percentages of participants from the various continents are reported in the diagram below.

Industrial participants were 114, exactly half of the total participants. USA was the country with more industrials (92, i.e., 68.7%).



Historical

The Chicago Conference was formally the last Molecular Sieves Conference. The foundation of the International Zeolite Association had, as its natural con-

sequence, the establishment of the International Zeolite Conference, with the term "zeolite", anyway, having a broader and comprehensive meaning.

From the organizational point of view, the Chicago Conference was a "solid" meeting, in which substance was preferred to form. The book collecting the Conference papers was definitely less accurate than the previous editions. The papers were submitted in camera-ready form and printed by photo off-set. The collection of discussions and RRR was intentionally printed in a Spartan way, to avoid any temptation to consider them as real publications. No excursion was organized during the Conference, but several optional cultural events (music, exhibitions) were offered along the week. In contrast with these economic straits, the Organizing Committee offered some travel grants for participants needing financial assistance. According to the final balance of the Conference, 20 grants were assigned, apart from the waiving of a number of registration fees.[4]

As regards the technical side, it has to be emphasized, that, although it had been announced in the first circular of the Conference, no Mineralogy session was included in the program. According to J. R. Katzer, Editor of the Conference Volume, the reason why no natural zeolite papers were submitted had to be connected to the fact that a Natural Zeolite meeting had been held a few months before in Arizona.[5] This is true, at least partly. Actually, the organization of a separate Natural Zeolite meeting (and the establishment of an International Committee on Natural Zeolites) was the tangible sign of a fracture between the words of the natural and synthetic zeolites, which lasts still today.[6]

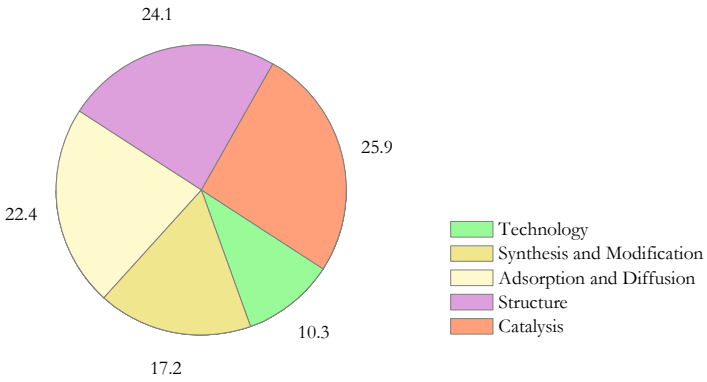
Scientific Notes

The eight Invited Lectures, aiming at presenting the state-of-art in the various sectors of zeolite science and technology, had the following titles: "*New results and investigations of equilibria and kinetics of adsorption of gases on zeolites*" (M. M. Dubinin), "*Thermodynamics of adsorption on zeolites*" (W. Schirmer), "*Molecular orbital calculation for atoms in the tetrahedral frameworks of zeolites*" (G. V. Gibbs), "*Acidic and catalytic properties of zeolites*" (D. Barthomeuf), "*Transition metal complexes in zeolites*" (J. H. Lunsford), "*Ion exchange in zeolites*" (A. Cremers), "*Zeolite cracking catalysts*" (J. S. Magee), "*Molecular sieve adsorbent application*" (R. A. Anderson).

No separate sessions were arranged for the Conference Papers and the RRR, which were presented jointly in the five programmed sections.[7] As concerns the submitted contributions, papers on structure dealt with the locations and electronic properties of cations in the cages and structural information on the location and properties of transition metal complexes in zeolites. Papers regarding synthesis focused on kinetics and thermodynamics of crystallization and on modification of zeolite chemistry through specific reactions, e.g., silanation. The section of adsorption and diffusion treated either theoretical or experimen-

tal aspects. Characterization studies through different techniques were also included. Studies in catalysis concerned efforts to clarify yet unclear chemistry and to quantify previously stated concepts, but in the same time dealt also with novel chemistry, i.e., again transition metal complexes in zeolites. Finally, a panorama on some industrial applications in the various sectors of zeolite science was given in the technological section.

The percent distribution of the Conference Papers in the five above sections is shown in the following diagram.



IZA Business

During the Conference some important events occurred for the future of the zeolite community. Thursday afternoon, April 21,[8] after some discussion, some modifications of the interim bylaws of the IMSC were voted. The name of the organization was changed after an exhaustive debate. First, it was proposed to keep the term "Molecular Sieve". However, in deference to the colleagues working in the field of natural zeolites, the name "International Zeolite Association" (IZA) was accepted.

Also scope and purpose of IZA were reformulated. According to the new Constitution and bylaws "…*the term zeolite is to be understood in its broadest sense. It includes both natural and synthetic zeolites as well as molecular sieves and other materials having related properties and/or structures* (Art. 1, Sect. 2)…*the purpose of IZA is to organize "International Zeolite Conferences" (IZC) on a regular basis*[9]…*and to sponsor and promote other activities, such as special meetings, working groups and publications in the field* (Art. 1, Sect. 3)…*any person active or interested in the study or application of zeolites shall be eligible for membership* (Art. II, Sect. 1)…". Participants to Zurich or Chicago Conferences became automatically members of IZA. A membership fee was not requested at that time.

A council of 14 members was elected. The new officers were: D. W. Breck (*President*), W. Schirmer (*Vice-president*), R. Aiello (*Secretary*), H. Lechert (*Treas-*

urer), D. B. Hawkins, B. Imelik, G. T. Kerr, M. Koizumi, L. V. C. Rees, D. M. Ruthven, J. V. Smith, G. V. Tsitsishvili, J. W. Ward, S. P. Zhdanov.

The Assembly of the participants, acting as IZA members, voted on Friday afternoon, April 22, to select place and organizer for the next IZC. Two proposals were presented: London and Naples. The latter option was selected.[10] Riccardo Sersale, assisted by an international committee of experts in the various disciplines of zeolite science, was entrusted with the organization of the 5th Conference in the first fortnight of June 1980.

Another important event during the Conference was the establishment of the Structure Commission, with the task to look into and to prepare compilations of structural data based on critical evaluation and reviews of available crystallographic results. The projects to be realized were: (1) issue of an atlas of zeolite structure types, (b) issue of a catalog of powder patterns of hydrated zeolites and (c) preparation of a set of figures or stereo drawings showing cation positions in selected zeolites.

Social Events

A Welcoming social hour took place at the Center for continuing education, cocktail lounge, on Sunday evening, April 17. A Reception was held in the same place on Tuesday evening, April 19.

The Conference Banquet was held on Thursday evening, April 21, at the Center for continuing education, preceded by a cocktail. A talk was delivered at the end of the banquet by Vladimir Haensel, Vice-President, Universal Oil Products, des Plaines, entitled: "Science responsibility and crisis in innovation".

No sessions were organized on Wednesday afternoon, April 20. Participants had the possibility to visit optionally the Chicago School of Architecture, where models of buildings of worldwide architectural significance were in display. In the evening, optional viewing of "Treasures of Tutankhamen" exhibit in the Field Museum of Natural History was proposed.

A Ladies Program and a Music Program for the entire week, both optional, were also offered.

References and Notes

[1] The RRR collection was preceded by the following warning by J. V. Smith: "*These Recent Research Reports have been collected by the Organizing Committee and are being distributed only to the attendees of the conference. Each report remains the property of its authors, and it must not be cited in literature reviews. If you wish to make a citation, please write to an appropriate author for permission to quote information; such a citation must be listed as a personal communication and must not be referenced to this collection of Reports. The purposes of this procedure are (a) to preserve the rights of the authors to publication in primary research journals, (b) to re-*

duce the number of citations in the literature, and (c) to avoid any implication that the Reports have been endorsed by the Organizing Committee. Readers should note that none of these Recent Research Reports have been subjected to review, and that the quality of the work is the sole responsibility of the author(s)".

[2] The Invited Lectures were formally labeled as ACS-PRF Short Course. Likely these lectures were sponsored by the Petroleum Research Fund of the American Chemical Society.

[3] The actual number of participants was perhaps a little higher. In fact, the cashed registration fees, as indicated in the final balance of the Conference, were 260. Surprisingly, a figure of about 300 participants is reported in the Preface of the Conference Volume [J. R. Katzer, in Molecular Sieves-II, *ACS Symposium Series* **40** (1977) ix].

[4] Another singularity of the Chicago Conference was the publication of the final balance, which was disseminated some months after the end of the meeting among all the participants.

[5] Zeolite '76, an International Conference on the Occurrence, Properties, and Utilization of Natural Zeolites, was held at the Doubletree Inn in Tucson, Arizona, June 6 to 14, 1976, organized by Frederick A. Mumpton.

[6] J. R. Katzer, in the preface of the Conference Volume (see Ref. [3]) says: "*It is unfortunate that this separation has occurred, and a reuniting of these two areas would benefit the entire field of zeolite science*".

[7] Conference Papers and RRR were given exactly the same time (15 minutes), whereas 40 minutes were allowed for most Invited Lectures.

[8] The reported date is taken from the first issue of the IZA Newsletter, published on August 22, 1977. Actually, according to the final program (published after the Conference), only two business meeting were held, the first on Monday, April 18 and the second on Friday, April 22.

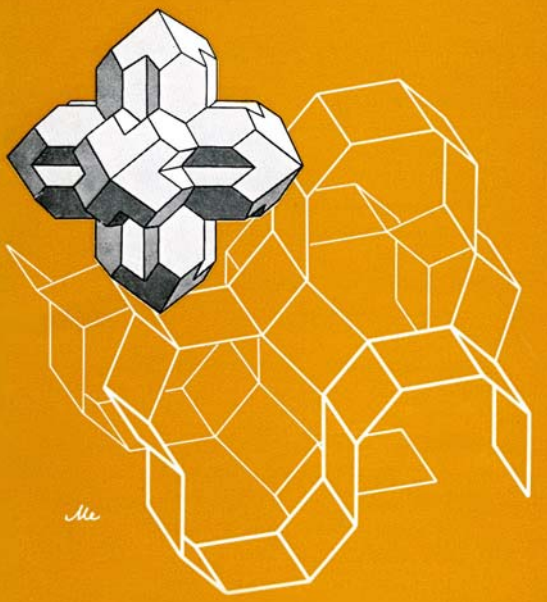
[9] According to the IZA Newsletter (see Ref. [8]), "*these international conferences shall cover the total field of zeolite science and technology in its broadest sense. They shall welcome participation of geologists, mineralogists, chemists, engineers, etc., interested both in natural and synthetic zeolites and related compounds, avoiding all professional and other barriers*".

[10] The proposal to hold the Conference in London was presented by some of the former Barrer's students to celebrate his 70th birthday.

Fifth International Conference on Zeolites

2 - 6 June, 1980

Napoli, Italy



Conference site:
Teatro Mediterraneo, Mostra d'Oltremare
Napoli, Italy

CONFERENCE COMMITTEE

R. SERSALE (*Chairman*)

G. GOTTARDI & W. SCHIRMER (*Technical Program*)

L. V. C. REES (*Publications*)

R. AIELLO (*Budget*)

F. MAZZALI & R. PEEST (*Finance*)

C. COLELLA (*Local Arrangements*)

SPONSORSHIP

The Conference was co-sponsored by the International Union of Pure and Applied Chemistry (IUPAC), Italian Chemical Society (SCI), Italian Mineralogical and Petrological Society (SIMP), Italian National Research Council (CNR), International Zeolite Association (IZA), International Committee on Natural Zeolites (ICNZ), University of Naples, National Society of Sciences, Letters and Arts in Napoli.

Contributors: Italian National Research Council (CNR); Grace GmbH; University of Naples; Union Carbide Corporation; Uniliq SpA; Laporte Industries Ltd.; Mobil Research and Development Corporation; Exxon Research and Engineering Company; Amoco Chem. Corp. – Amoco Oil Company – Standard Oil Co.

PUBLICATIONS

Proceedings of the Fifth International Conference on Zeolites
Lovat V. C. Rees, *Editor*
Heyden & Son Ltd., London, 1980, 902 (+ xxxiii) pp.
(The Proceedings were dedicated to Professor R. M. Barrer, F. R. S., on the occasion of his 70th birthday and in appreciation of his pioneering work in, and significant contributions to, zeolite science).

5th International Conference on Zeolites
Recent Progress Reports and Discussion
R. Sersale, C. Colella, R. Aiello, *Editors*
Giannini, Napoli, 1981, 320 pp.

5th International Conference on Zeolites
Guide to the tuff deposits in the Neapolitan and Roman volcanic areas
Giannini, Napoli, 1980, 28 pp.

COVER

The cover of the circular was designed by W. M. Meier.

5th International Conference on Zeolites
Napoli, June 2-6, 1980

Guide to the tuff deposits in the Neapolitan and Roman volcanic areas

Format and Program

The Opening Ceremony of the Conference was held on Monday, June 2, with the Welcoming Remarks by R. Sersale, the Conference organizer, and the Welcoming Address of various Authorities, and lasted four and half days until Friday, June 6, when it closed with the Closing Remarks.

The Technical Program was based on the following topics: Synthesis, Geology and Mineralogy, Structure, Ion Exchange and Modification, Adsorption and Diffusion, Catalysis, and Technology. The Conference Papers, fully refereed and published in the Proceedings prior to the Conference, were 90. The Recent Progress Reports (RPR), not refereed and published after the Conference, were 48.[1] The different sessions opened with an Invited Lecture, reviewing the-state-of-art of research in the various sectors of zeolite science and technology. Speakers (in the order of presentation) were: J. V. Smith, A. V. Kiselev, C. Naccache, A. Iijima, L. B. Sand, R. M. Barrer, E. M. Flanigen.

Single sessions were held each morning and afternoon of every day, except Wednesday. In considerations of the large number of contributed papers and to avoid separation of the audience, the General Reporter system was adopted.[2] Accordingly, the salient features of the papers of any session were summarized by a specific Reporter – W. M. Meier (Structure), D. M. Ruthven (Adsorption), A. H. Weiss (Catalysis I), R. L. Hay (Geology and Mineralogy), H. T. Lechert (Synthesis and Crystallization), L. Riekert (Diffusion), D. Barthomeuf (Catalysis II), H. S. Sherry (Ion Exchange and Modification), F. Wolf (Technology) – in about one hour. At the end of the presentation enough time was allowed for a general discussion between authors and attendees. Texts of discussion were published after the Conference together with the RPR.

A special conversation on the relationships between natural zeolites and cancer was held by F. A. Mumpton on Tuesday afternoon.[3]

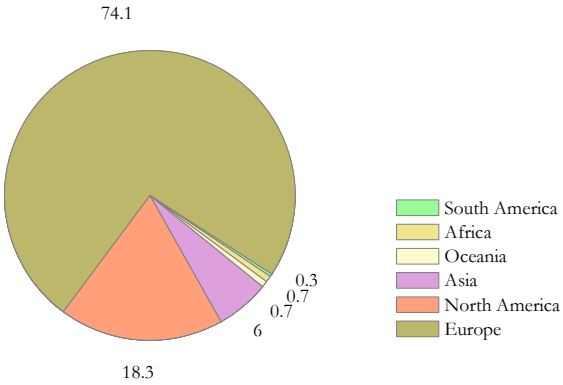
Poster Sessions, arranged on Tuesday, Thursday and Friday (June 3, 5 and 6, respectively) and lasted the whole days, served to accommodate the RPR.

Participants

The official List of Participants includes 303 persons from 30 countries. The majority of them was from USA (53), followed by Italy (45), Germany (44), France (26) and UK (24).

Industrial participants were 140 (46.2%). USA was the country with more industrials (39, i.e., 73.6%), followed by Germany (20, i.e., 45.5%), Italy (15, i.e., 33.3%).

The percentages of participants from the various continents is reported in the diagram below.



Historical

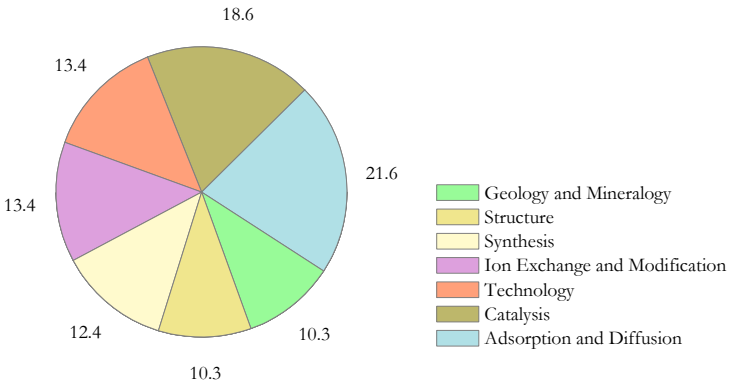
At the end of the 1970s an apparent fracture occurred in the zeolite world. An International Committee on Natural Zeolites was established (see preceding chapter) as a result of the separation of the natural zeolite community from IZA. Natural zeolite scientists and technologists were convinced to have been not adequately represented in the last international zeolite meetings; therefore they abstained from submitting contributions to the Chicago Conference. Recomposing the fracture was considered urgent and necessary by persons from both sides. That is why, in the last months of 1976, J. B. Uytterhoeven and W. M. Meier, IZA President and Vice-President, respectively, contacted R. Sersale, to solicit the presentation of a proposal to have Naples as the site of the 5th IZC. The selection of Italy, and in particular the Neapolitan group, as potential candidate to organize the Conference, was made in order to find a compromise between the requirements of both parts. Italy, in fact, had a good reputation either in the field of natural zeolites (basic science and technology) or in that of synthetic zeolites (crystallization). This was considered a sort of warranty to organize a really equidistant conference.

The details of the proposal were arranged in a meeting during the Chicago Conference. Among the various arrangements, it was agreed that an international committee assisted the local organizer and that an optional field trip to zeolite deposits was included in the Conference program. The Organizing Committee met several times in Naples and once in East Berlin, as a form of deference towards the member W. Schirmer from German Democratic Republic (see the box at the end of the chapter).

(Top) Panoramic view of the Conference Hall. (Bottom) Closing remarks and farewell by R. Sersale, Conference organizer, and F. Gasparini, Dean of the Engineering Faculty, Naples University. Seated: members of the IZA Council, (from left to right) G. T. Kerr (*President*), H. Lechert (*Vice-president*), L. Moscou (*Treasurer*), E. M. Flanigen (*Secretary*).

Scientific Notes[4,5]

The seven Invited Lectures, which adequately covered the advances made in the field of zeolites since the previous conference, had the following titles: "*Review of new crystal structures and mineralogy of zeolites and related materials*", (J. V. Smith), "*Investigation of the adsorption in zeolites at zero filling*" (A. V. Kiselev), "*Recent developments in catalysis by zeolites*" (C. Naccache), "*Geology of natural zeolites and zeolite rocks*" (A. Iijima), "*Zeolite synthesis and crystallization*" (L. B. Sand), "*Zeolite exchangers: Some equilibrium and kinetic aspects*" (R. M. Barrer), "*Molecular sieve zeolite technology: The first twenty-five years*" (E. M. Flanigen).[6]



The submitted papers published in the Proceedings emphasize the interesting applications of zeolites, developed in the past three or four years. Papers dealing with synthesis and crystallization include interesting contributions regarding the synthesis of borosilicates and the preparation of pillared clays, both of them deserving further developments. Papers on zeolite occurrence in several worldwide sites and its characterization are comprised in the geological and mineralogical section. Infrared and n.m.r. spectroscopy were the two most widely used spectroscopic techniques and the application of far infrared spectroscopy to study cation positions in zeolite frameworks was an interesting new development. Ion exchange in zeolite at high temperatures are among the papers dealing with cation exchange. Many contributions regarding modified zeolite Y are included in the section Modification, among which there is a paper of the late D. W. Breck.[7] A number of zeolites have been studied as adsorbents for several gases and vapours; in particular the papers in the Diffusion section seem to resolve the problem of the large differences previously found in the diffusion coefficients of hydrocarbons when measured by sorption uptake and n.m.r. techniques, respectively. Catalysis papers, the most numerous contributions, dealt mostly with zeolite ZSM-5 and Y, tested in a series of reactions (e.g., hydroisomerization and hydrocracking). The use of ZSM-5 and related members of his family in the catalytic conversion of methyl alcohol to petroleum is, un-

doubtedly, the most significant. Several topics were treated by the papers in the Technology section, e.g., use in solar cooling and as potential components of laundry detergents. Some papers on catalytic processes are also included.

The percent distribution of the Conference Papers in the seven sections is shown in the above diagram.

Very interesting advances are found in the RPR, developed subsequently in extended investigations. Among the others, it is to the emphasize the first attempts to have direct images of zeolites at near-atomic resolution, various aspects connected to silicalite crystallization, and various topics regarding adsorption/diffusion and catalysis.

Business Meeting

Participants assembled twice during the Conference, on Monday afternoon, June 2 and on Thursday afternoon, June 5. Six new council members were elected. The new officers were: G. T. Kerr (*President*),[8] H. Lechert (*Vice-president*), E. M. Flanigen (*Secretary*), L. Moscou (*Treasurer*), R. Aiello, D. B. Hawkins, B. Imelik, W. J. Mortier, L. V. C. Rees, L. B. Sand, J. V. Smith, H. Takahashi, G. V. Tsitsishvili, D. E. W. Vaughan.

Two sites were proposed to host the Sixth International Conference on Zeolites in 1983: Leipzig (GDR), under the chairmanship of W. Schirmer, and Lake Tahoe in Nevada, USA, under the co-chairmanship of D. E. W. Vaughan and J. W. Ward. The majority of the Assembly voted for Lake Tahoe.

Social Events

A Reception on the Sunday evening preceding the Conference was held in one of the halls of Castel dell'Ovo, offered by the Municipality of Naples.

Castel dell'Ovo, XII century.

Ischia Island, approaching the harbour.

A full-day Excursion was organized on Wednesday 4 to Ischia Island, offered by the Provincial Tourist Bureau. Participants had the possibility to observe the

potent formations of Green Tuff, apart from spending some hours visiting the attractive touristic sites and enjoying the spectacular landscapes. A lunch was offered in the Restaurant "Oasi di Toscaneto".

The Conference Banquet was held on Friday evening, June 6, at the Hotel Excelsior, on the waterfront, offered by the local Tourist Agency. A talk in honour of R. M. Barrer was delivered during the banquet by Riccardo Sersale, who covered the lifetime achievements of the great scientist. Professor Barrer was then presented with a leather-bound copy of the Proceedings as a memento of the Conference which was dedicated to him on his seventieth birthday.

A Ladies Program was also offered.

Financial Assistance and Facilities

A program of financial assistance was planned, consisting in travel grants and waiving of the registration fee. A temporary post-office was arranged in the Conference site and a special postmark, issued by the Postal Service, was used exclusively in the Conference days.

Field Trip

An optional two-day excursion to the natural zeolite deposits in the vicinity of Naples and Rome was organized at the end of the Conference (June 7-8, 1980). Some 50 persons took part in the field trip.

In the Neapolitan area visits were made to Averno Lake in the *Phlegraean* (i.e., burned) *Fields*, and two quarries of phillipsite-rich Neapolitan Yellow Tuff and chabazite-rich Campanian Ignimbrite (yellow *facies*), respectively. Leaving the Naples area towards Rome, a visit was organized to Casertavecchia, a medieval village some 45 km N of Naples, in which all the houses and the church are made of local zeolitic tuff. Three sites were visited also in the Roman area (SE of Rome): a quarry of phillipsite-rich *Lionato* Tuff, and two quarries of *peperino*, a lithified (phillipsite) grey tuff of phreato-magmatic activity of Albano crater.

A field guide by A. Scherillo and C. Porcelli (Naples area) and E. Franco and M. de' Gennaro (Rome area) was published and delivered to the participants prior to leaving.[9] The same persons served as accompanying guides.

Acknowledgments

Maurizio de' Gennaro is gratefully acknowledged for some information on the Field Trip.

REFERENCES AND NOTES

[1] Actually only 45 RPR (3 to 5 pages), out of the 48 presented contributions, were published in the "RPR and Discussion" volume after the Conference.

[2] This method of conducting the conference was disliked by most of the participants [L. V. C. Rees, *Zeolites* **1** (1981) 55-56]. That is why it was no longer utilized in the next conferences.

[3] The text of the presentation, titled "Zeolites and Mesothelioma" was published in the volume of the RPR (p. 259-285).

[4] R. Sersale, *La Chimica e l'Industria (Milan)* **62**(12) (1980) 960-962 (in Italian).

[5] L. V. C. Rees, see Ref. 2.

[6] The Invited Lectures were also published in the official journal of JUPAC, *Pure and Applied Chemistry* **52**(9) (1980) 2105-2211.

[7] Actually the paper, entitled "Zeolite chemistry IV – Evidence for the elimination and subsequent reinsertion of framework aluminium during the stabilization of NH_4^+-exchanged zeolite Y"(co-authored with G. W. Skeels, see the Proceedings, p. 335-343) was the last paper of Breck, being still alive. The scientist, in fact, died suddenly on July 7, 1980, a few weeks after the conclusion of the Naples Conference.

[8] Under the term of President G. T. Kerr and with particular help of L. V. C. Rees the IZA obtained the status of an Associated Organization of the IUPAC.

[9] An improved version of the field guide, revised and completed by a glossary of volcanic nomenclature by F. A. Mumpton, was published in the volume of the RPR (p. 287-313).

[10] According to the final balance of the Conference, 18 grants were assigned. Waivers of registration fee were also 18.

[11] C. Colella, *Bollettino AIZ* (Bulletin of the Italian Zeolite Association), **25** (2005) 5-11 (the reported text, translated from Italian, is the final part of the Editorial).

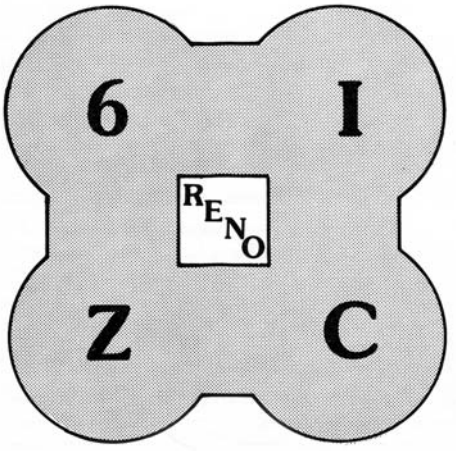
Twenty-five years ago: the Naples Conference[11]

One of the most particular experiences, occurred during the long period devoted to the Conference organization, was the visit to East Berlin. A meeting of the Organizing Committee was, in fact, held at the Science Academy of the German Democratic Republic, hosted by Wolfgang Schirmer, Professor of Physical Chemistry and an authority in the field of adsorption and molecular sieving (recently [*2005*] passed away, aged 85).
We [*Sersale, Aiello and Colella*] arrived in the *enclave* of West Berlin on February 8, 1979 from Frankfurt by a PanAm flight, through one of the air corridors, agreed by the four great Powers. According to the program, prepared by the German friends, the passage through the Berlin Wall took place the day after by underground. The border operations by the GDR police were very exhausting. Our passports "disappeared" for a long lapse of time and reappeared, I suppose, only after an accurate check of our identities and our intentions. We were then invited to buy some local marks, in consideration that the FRG marks had no validity there. The forced rate of exchange was 1:1 with the condition that all the unused money should have been re-exchanged before leaving the East Berlin…at a less favourable rate.
Going out from the underground station, we were picked up by two Schirmer's assistants, who brought us to the Academy by a high-powered car. The friend Wolfgang welcomed us (and the other members of the Organizing Committee, arrived before), did the honours of the house, guiding us to visit the laboratories, then assisted his coworkers, while they reported us on the scientific activity of the group.
At lunch time, some big cars brought us to a private club, perhaps the same place usually used for the meetings of the "nomenclature". I remember a very large hall, with high, heavy curtains covering the windows (or the doors), red brocades on the walls and a large table, round which we took a seat together with Schirmer and one of his coworkers, who had picked up us at the station in the morning. Our guest, being a person of great formal correctness, thanked us for our visit on behalf of Academy and presented us with a folder of lithographic reproductions of famous views and monuments of the German Democratic Republic. Lunch was then served, following a rigid ceremonial, which was formally impeccable. After lunch a discussion on the organizational aspects of the Naples Conference took place, then the meeting ended up with the customary greetings and thanks. Schirmer entrusted us to his coworker.
We had the curiosity to take a stroll to understand where we were, how people lived, if there were any shops and what they offered for sale, but the completely desert road persuaded us, after a few steps, to renounce. The Schirmer's coworker, who was waiting for our decisions with a certain impatience, accompanied us on foot to the underground station. Here the ritual of the morning was repeated, demonstrating that there was no difference in going into or leaving the GDR. We greeted the "strange" Schirmer's coworker (or assistant, or what else?), who was constantly present, but did not say ever a word even during the morning presentation of the scientific group.
So, while the underground, crossing virtually the Wall, took us again to west, we realized that the guy we had considered a Schirmer's coworker, was perhaps somebody else…, but certainly not a Schirmer's coworker.

Sixth International Zeolite Conference

July 10-15, 1983

Reno, Nevada



Conference site:
MGM Grand Hotel
Reno, Nevada, USA

CONFERENCE COMMITTEE

D. E. V. VAUGHAN and J. W. WARD (*Conference Chairmen*)

D. H. OLSON and A. BISIO (*Publications*)

J. R. KATZER (*Publications Committee Chairman*)

J. S. MAGEE (*Finance*)

W. H. FLANK (*Instrument Exposition*)

F. A. MUMPTON (*Natural Zeolite Field Trip*)

J. F. COLE (*Treasurer*)

E. L. MOOREHEAD (*Local arrangements*)

C. BONIFAZ (*Secretary*)

Members of the Program Committee and Symposium Chairman were:
D. M. RUTHVEN (Adsorption-Diffusion), T. R. HUGHES (Catalysis), F. A. MUMPTON (Geology and Mineralogy), J. D. SHERMAN (Ion Exchange), J. M. THOMAS (New Instrumental Techniques), W. M. MEIER (Structure), H. E. ROBSON (Synthesis), G. KUEHL (Zeolite Modification), H. S. SHERRY (Zeolite Technology), E. M. FLANIGEN (Don Breck Memorial Symposium).

CONTRIBUTORS

Air Products and Chemicals Inc.; Akzo Chemie; Chevron Research Co.; Exxon Corp.; Katalistiks Inc.; Laporte Industries Ltd.; Mobil Research and Development Corp.; PQ Corp.; Shell Development Corp.; Standard Oil Co. of Indiana; Suntech Inc.; Texaco; Union Carbide Corp.; Union Oil Co. of California.

PUBLICATIONS

Proceedings of the Sixth International Zeolite Conference
David Olson and Attilio Bisio*, Editors*
Butterworths, Guildford, UK, 1984, 1007 pp.

Sixth International Zeolite Conference
July 10-15, 1983
Reno, Nevada
Program and Abstracts, 114 pp.
(not published, but only issued to the Conference participants)

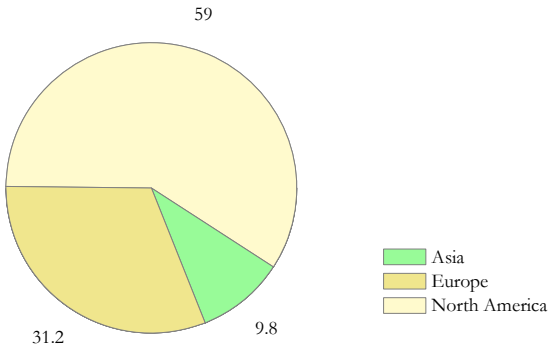
Zeo-Trip '83
An Excursion to Selected Zeolites Deposits in E Oregon, SW Idaho, and NW Nevada, and to the Tahoe-Truckee Reclamation Plant, Truckee, CA
July 7-10, 1983, F. A. Mumpton, Editor
Inter. Comm. on Natural Zeolites, Brockport, New York, 1983, 80 pp.

Format and Program

The Conference opened on Monday, July 11, with a welcoming address of the organizers, followed by a memorial Symposium dedicated to D. W. Breck. After four and half days the Conference closed on Friday, July 15 with the final session of IZA meeting and the banquet.

The Technical Program was based on the following topics: Adsorption and Diffusion, General Acid Catalysis, Metal Catalysis, Pentasil Catalysis, Geology and Mineralogy, Ion Exchange, New Techniques, Structure, Synthesis, Zeolite Technology. A single session was organized Monday morning to accommodate the Invited Lectures of the Breck Symposium. On Monday afternoon and in all the other days (except Wednesday), parallel sessions were held. A total of 87 oral contributions was presented, comprising 12 Invited Lectures, 7 Invited Lectures for the Breck Symposium, and 68 Conference Papers. Space was given to Discussion, whose texts were published in the Proceedings, together with the Conference Papers, a few months after the end of the Conference.[1]

Two Poster sessions were organized on Tuesday and Thursday evening. A total of 67 contributions, accepted without refereeing, were presented. An Ad-hoc Meeting on zeolite geology and mineralogy, comprising 10 presentations followed by discussion, was arranged on Thursday, in parallel with the other two regular sessions. The titles of the poster and ad-hoc meeting contributions are listed in the final part of the Proceedings.[2]



Participants

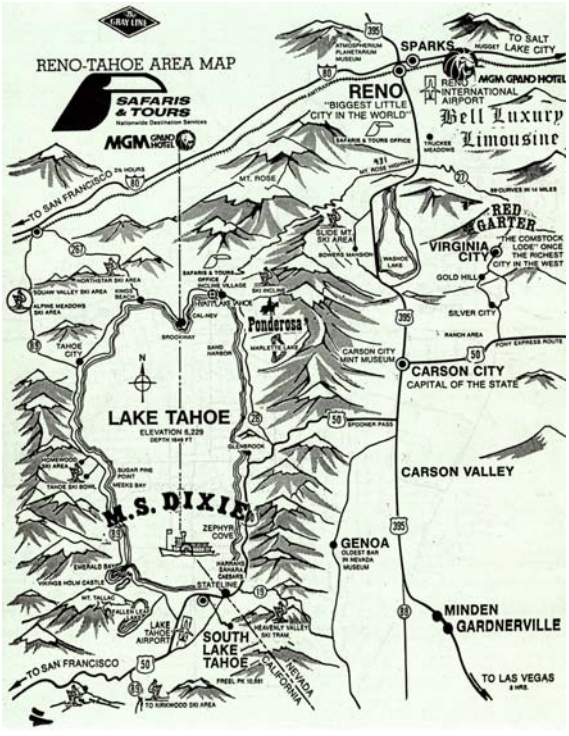
The official List of Participants includes 378 scientists from 27 countries. The majority of them was from North America (323). The country with more delegates was USA with 217, followed by Japan with 26 and Germany (FRG) and

France with 24. There were no attendees from Africa or Oceania (see the percentages from the various continents in the above diagram).

Industrial participants were 230, 60.8% of the total. USA was the country with more industrials (175, i.e., 76.1%).

HISTORICAL

The Reno Conference, in spite of the troubled beginning, was a successful meeting with a considerable number of participants. Actually, at the time of the Naples Conference no American proposal to hold the next IZC had been submitted to the IZA Council. The only formalized submission was from German Democratic Republic (Wolfgang Schirmer) and the proposed site was Leipzig. The political situation of the time, the stormy relationships between East and West, the cold war , all of them were good reasons to avoid any support to this proposal. The Council worried about a scarce participation from the western countries with the result of a not sufficiently "international" conference. An alternative site was found in a rush. During the excursion to Ischia on Wednesday, Vaughan and Ward arranged a second proposal, Lake Tahoe in Nevada, which was selected the day after by the General Assembly of the IZA members. This choice was welcome also for the natural zeolites scientists. In fact, the nearness of Lake Tahoe to several important sedimentary zeolite formations made it an ideal starting point for a field trip. The site of the conference was successively changed for logistic reasons and Reno, not very far from Lake Tahoe (see map), was the definitive site of the 6th IZC.[3]

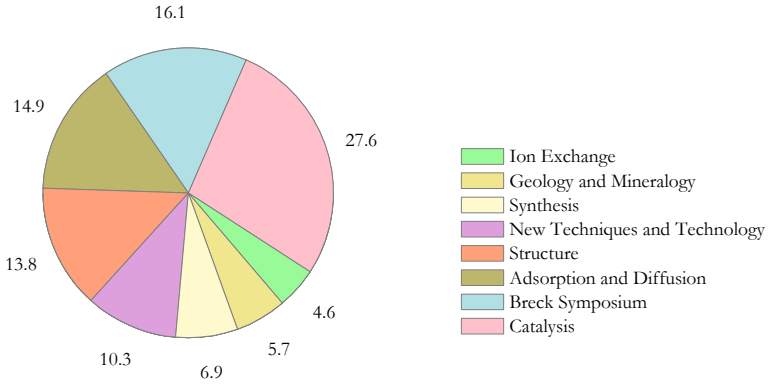


An important event marked the Conference program: with the sponsorship of Union Carbide Corporation, a memorial Symposium was organized to celebrate

D. W. Breck, suddenly passed away three years before, at the end of the Naples Conference. A Breck award was also instituted, to be given every three years by a special Committee appointed by the IZA Council, to single scientists or scientific teams for notable contributions in the field of zeolite science and technology.

Scientific Notes[4,5]

The Invited Lectures were an important part of the Conference program. Because of the inclusion of the Breck Memorial Symposium, the Invited Lectures represented roughly 20% of the total presentations. Their titles give an idea of the wide range of topics treated: "*Mineralogy of natural zeolites*" (R. Rinaldi), "*Structural chemistry of zeolites: interface between structure and activity*" (W. J. Mortier), "*Recent advances in zeolite structures*" (S. Merlino), "*Physical and catalytic properties of noble metals in zeolites*" (P. Gallezot), "*Acid catalysis with medium pore zeolites* (W. Haag), "*^{29}Si and ^{27}Al MAS-NMR of zeolites and silicates*" (E. Lippmaa), "*Use of zeolite NaA in laundry detergents*" (R. A. Llenado), "*Isomorphous replacement in tectosilicates*" (R. M. Barrer), "*Application of Infra Red analysis to sorbed molecules*" (E. Cohen de Lara), "*New directions in heterogeneous catalysis using ZSM-5 type zeolites*" (F. G. Dwyer), "*Study of diffusion in zeolites using NMR*" (K. Kaerger), "*Binary and ternary ion exchange in zeolites*" (L. V. C. Rees). Invited contributions for the Breck Symposium were more or less connected with the life and achievements of the scientist, as it is often pointed out by the titles: "*The word and work of Don Breck*" (E. M. Flanigen), "*Zeolite synthesis: Some chemical aspects*" (R. M. Barrer), "*Adsorption in A, X and Y zeolites: Thirty years of science and technology*" (D. M. Ruthven), "*Speculations on molecular sieves and ionization effects in zeolite Y*" (J. A. Rabo), "*Cation locations and physical chemical properties of zeolite Y*" (J. B. Uytterhoeven), "*New vistas in the structures of molecular sieves and a personal reminiscence of Donald Breck*" (J. V. Smith), "*Zeolite exploration: The early years*" (F. A. Mumpton).



The Conference Papers were scattered much more than usually in the various sectors of zeolite science and technology, as pointed out in the diagram reported above.

A couple of papers must be mentioned for different reasons: the last paper (*post-mortem*) of D. W. Breck (with G. W. Skeels) on the dealumination of zeolites using aqueous ammonium fluosilicate and the paper by S. T. Wilson *et al.* on the synthesis of the novel class of $AlPO_4$ molecular sieves. Almost inevitably the properties of the four zeolite types of greatest industrial importance – synthetic faujasites, pentasils, zeolite A and mordenite – dominated the proceedings, being involved in nearly 80% of the papers. Another observation regarding most papers is the common use of sophisticated instrumentation, more and more accessible to zeolite scientists. In particular, N.M.R. turned out to be a versatile technique, in conditions to give useful responses in many diverse applications.

BUSINESS MEETING[6]

IZA members assembled twice on Monday, essentially to be informed of the agenda of the Thursday General Meeting. Apart from minor changes in Constitution and By-laws, the most important resolutions regarded the election of Council members and the selection of site and organizer of the 7th IZC.

President G. T. Kerr announced that IZA had been incorporated in the State of Delaware, obtaining a tax-exempt state from the U.S. Internal Revenue Service and, in the same time, had become an Associated Organization of the IUPAC. R. Sersale, organizer of the Naples Conference, was acknowledged for a check of twelve thousand dollars to IZA. Attendees were also informed that in 1982 W. J. Mortier, on behalf of the Structure Commission of IZA, had published a *Compilation of extra-framework sites in zeolites*.

S. T. Wilson, C. A. Messina, T. R. Cannan, B. M. Lok and E. M. Flanigen (Union Carbide Corporation, Tarrytown, NY) were announced to be the winners of the first edition of the Breck Award for the discovery of aluminophosphate molecular sieves.

During the General Assembly some new members were elected in the Council in substitution of some expired members. The composition of the new Council was: D. E. W. Vaughan (*President*), W. J. Mortier (*Vice-president*), E. M. Flanigen (*Secretary*), L. Moscou (*Treasurer*), D. Barthomeuf, H. Beyer, J. Dwyer, G. T. Kokotailo, H. F. Leach, D. H. Olson, L. B. Sand,[7] J. D. Sherman, H. S. Sherry, H. Tominaga.

The General Assembly voted also to select place and organizer for the next IZC. Two countries presented proposals: Japan and Yugoslavia. The first op-

tion was selected. Mitsue Koizumi was entrusted with the organization of the 7th Conference in Tokyo sometime in 1986.[8]

Social Events and Exposition

An Informal Reception was offered on Sunday evening, July 10. A Reception commemorating the late Don Breck, sponsored by the Union Carbide Corporation, was held on Monday evening, July 11.

The Conference Banquet, preceded by a cocktail reception, was held on Friday evening, July 15, in the MGM Grand Ballroom. During the banquet the first Breck Award was presented to E. M. Flanigen, as representative of a team working at Union Carbide, for their innovative studies on aluminium phosphate molecular sieves.

A full-day Excursion was held on Wednesday, July 13, providing a forum for informal meeting and discussion. The tour included a drive around the scenic Lake Tahoe shoreline, lunch at the Ponderosa Ranch (of Bonanza fame) and concluded with a western bar-b-que and entertainment at Virginia City (the former gold mining town).

An Exhibit of small zeolite crystals (micromounts) was organized by G. C. Edwards and K. Papke during the Thursday evening poster session.

A Ladies Program was also offered.

Financial Assistance

Financial assistance was offered to a limited number of participants to favour their attendance to the Conference.

Field Trip

An optional three-day excursion to the natural zeolite deposits in the western States of Oregon, Idaho and Nevada was organized, prior to the Conference (July 7-10, 1983), with the cooperation of the International Committee on Natural Zeolites. About 50 persons took part to the trip.

The excursion left from Boise and ended up in Reno. The following stops were programmed to examine some important deposits of sedimentary zeolites: Durkee (chabazite), Castle Creek (clinoptilolite), Sheaville (clinoptilolite), Rome (erionite, mordenite), Lovelock (ferrierite, mordenite). The last stop was in Truckee, California, at the Water Reclamation Plant of Tahoe-Truckee Sanitation Agency, to inspect use of clinoptilolite to remove ammonium-nitrogen from tertiary effluent and synthetic A zeolite to produce oxygen.

A very accurate field guide by R. A. Sheppard and A. J. Gude, 3rd, was published and delivered to the participants prior to leaving. Dick Sheppard leaded the participants during the trip with the assistance of Jim Gude.

ACKNOWLEDGMENTS

David Vaughan and Dick Sheppard are gratefully acknowledged for providing some information.

REFERENCES AND NOTES

[1] There is some uncertainty in the number of the presentations. Figures reported in the final circular of the Conference are different from those of the Proceedings and those mentioned in a report on the meeting [C. J. Adams, *Zeolites* **3** (1983) 369-370]. The numbers reported here are taken from the Proceedings.

[2] See Proceedings, p. 985 and 986-990, respectively.

[3] The only hotel large enough to hold the meeting in Lake Tahoe did not allow to block the number of rooms needed. The Conference would have taken over almost the whole hotel, strongly reducing any offer for regular customers and/or gamblers. The MGM in Reno was a much larger hotel and offered much better facilities and terms/prices. The reason for this can be understood from the following story, happened after the contract had been signed. Asking how they could make such a contract when the Conference would have brought in a bunch of tight fisted scientists, their response was: "You bring in the bodies and we will worry about whether they will gamble". Of course they knew their business!

[4] C. J. Adams, see Ref. [1].

[5] R. Sersale, *La Chimica e l'Industria (Milan)* **65**(11) (1983) 737-740 (in Italian).

[6] G. T. Kerr, "The President Message", in Proc. Sixth IZC, D. Olson and A. Bisio, Eds., Butterworths, Guildford, UK, 1984, p. x.

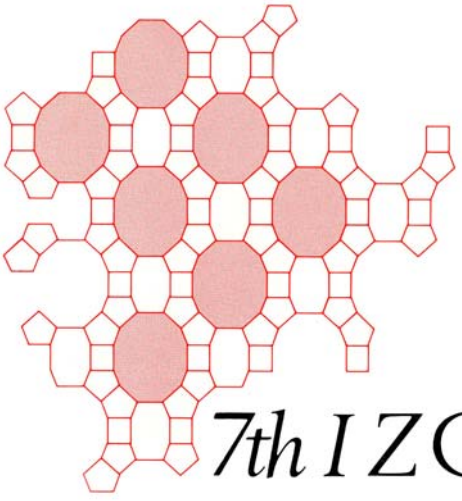
[7] Len Sand passed away in 1985.

[8] The choice of Tokyo was made for the unquestionable fascination of Far East, the perfect organization suggested by the presentation, but also for the belief that the eastern European countries were not ready to organize a so exacting event. That is why the Yugoslav proposal was not admitted to vote by the General Assembly. To compensate this refusal, IZA sponsored an International Symposium on zeolite synthesis, structure and technology, to be held in Yugoslavia. This Symposium was organized by B. Držaj in Portorož-Portorose in 1984. The Proceedings were published in the Elsevier series "Studies in surface science and catalysis" (No. 24).

SEVENTH INTERNATIONAL ZEOLITE CONFERENCE

Tokyo, Japan

August 17-22, 1986



Conference site:
Keio Plaza Hotel
Shinjuku, New Metropolitan Center, Tokyo, Japan

CHAIRMEN OF ORGANIZING COMMITTEE AND SUBCOMMITTEES

T. MUKAIBO (*Honorary Chairman*)

M. KOIZUMI (*Chairman*)

T. TAKAISHI (*Finance*)

Y. MURAKAMI (*Scientific Program*)

K. FUJIMOTO (*Publications*)

E. KIKUCHI (*Social Program*)

A. IIJIMA (*Field Trip*)

T. INUI (*Catalysis Symposium*)

Y. ONO and T. YASHIMA (*Local Arrangements*)

H. TOMINAGA (*Secretary*)

Some additional members defined "working staff".

SPONSORS

International Zeolite Association; International Union of Pure and Applied Chemistry; The Chemical Society of Japan; Japan Association of Zeolite; The Association of Synthetic Mineral Science and Technology; Catalysis Society of Japan; The Ceramic Society of Japan; The Clay Science Society of Japan; The Japan Oil Chemists' Society; The Japan Petroleum Institute; The Mineralogical Society of Japan; The Society of Chemical Engineers, Japan

Contributors: Commemorative Associations for the Japan World Exposition; Kajima Foundation; Shimadzu Science Foundation; Nippon Sheet Glass Foundation for Materials Science; Yoshida Foundation for Science and Technology (+ 70 private firms).

PUBLICATIONS

New Developments in Zeolite Science and Technology

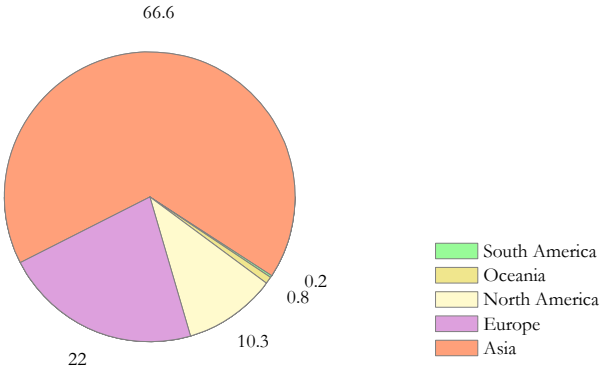
- ***Proceedings of the 7th International Zeolite Conference***
  Y. Murakami, A Iijima and J. W. Ward*, Editors*
  Kodansha/Elsevier, Tokyo/Amsterdam, 1986, xxv + 1091 pp.
- ***Preprints of Poster Papers. The 7th International Zeolite Conference***
  Japan Zeolite Association
  Tokyo, 1986, xvii +370 +iv pp.
- ***Discussion. The 7th International Zeolite Conference***
  Japan Zeolite Association
  Tokyo, 1986, xiii + 201 pp.

Format and Program

The Conference opened on Monday, August 18, with the Opening Ceremony, followed by an Introductory Talk by R. M. Barrer. After five days the Conference closed on Friday afternoon, August 22. The Conference was followed by an optional Catalysis Symposium held in Kyoto, August 24-26.

The Technical Program was based on the following topics: Geology and Mineralogy, Synthesis, Ion Exchange and Modification, Structure, Adsorption and Diffusion, Catalysis, Application. To house the remarkable number of oral presentations (3 Plenary Lectures, 9 Invited Lectures and 121 submitted papers)[1] in the 4 useful days of the Conference, giving also sufficient time for discussion, three parallel sessions operated simultaneously throughout most of the meeting (Monday and Thursday mornings were reserved to the Plenary Lectures and the General Assembly, Wednesday to the traditional mid-week excursion). The Proceedings were made available prior to the Conference, in order to give the participants the possibility to select in time the presentations of their interest, whereas the Discussion book was published three months after the Conference, as a supplement of the Proceedings.

Poster sessions, lasted 60 minutes, were scheduled every day after lunch. A total of 186 contributions, accepted without refereeing, were presented. Two-page abstracts of the poster presentations were published in a special volume before the Conference.



Participants

The official List of Participants includes 590 scientists from 32 countries. The majority of them was from Japan (355, i.e., 60.1%). The other more represented countries were: USA with 54, China and Germany (FRG) with 23, and France with 19. As usually, very limited was the participations from South America and Oceania (see the percentages from the various continents in the above diagram). Participants from industry were 235 (39.8%).

HISTORICAL

The choice of Tokyo as the site of the 7th IZC, the first Conference of the series organized outside Europe and America, was a recognition of the great involvement and the keen interest of Japanese scientists in zeolite science and technology. This decision had, however, a remarkable impact on the public opinion with repercussions on zeolite production and marketing. According to a local technical journal,[2] "*despite its excellent reputation in industrial fields, zeolite was not publicly well known*"; that is why the publicity connected to this event "*began to attract the attention of general users, and, in response to the resultant demand, zeolite manufacturers have been unanimously focusing their efforts on the expansion of application fields. The entry of manufacturers of natural zeolite operating only in local communities into the central market can be highly evaluated because their concern has been to enhance information and technologies exchange with other synthetic zeolite manufacturers*". In summary a real "*zeolite fever*". This resulted in a substantial support to the Conference, as tens of companies contributed to its financial entries.

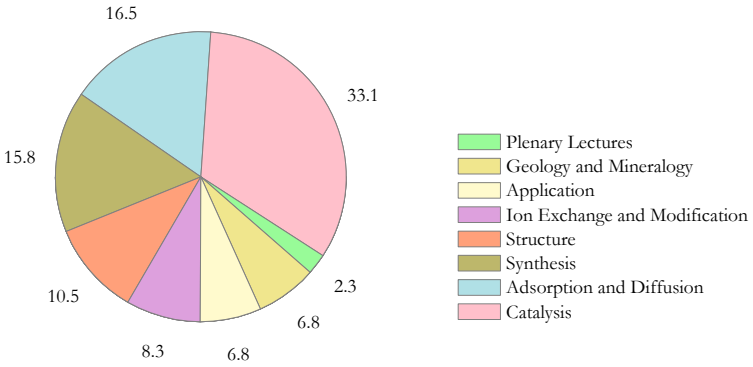
The response of the scientific world was as enthusiastic as the commercial and industrial world. The number of attendees and the number of the papers presented were the highest ever occurred before. But, in both cases, prevalence was clearly and expectedly Japanese.

SCIENTIFIC NOTES[3,4]

Three Plenary Lectures were addressed to all the participants; the first said Introductory, titled "*Porous crystals: A perspective*" was given by R. M. Barrer. The other two, titled "*Zeolites and zeolite-like materials*" and "*Exploration of the void size and structure of zeolites and molecular sieves using chemical reactions*" were presented by W. M. Meier and P. A. Jacobs, respectively. The nine Invited Lectures, opening the various (parallel) sessions of the Conference, were the following: "*Geological occurrence of zeolites and some associated minerals*" (R. L. Hay), "*The crystal chemistry of the natural zeolites*" (G. Gottardi), "*Aluminophosphate molecular sieves and the periodic table*" (E. M. Flanigen), "*Ion exchange in zeolites: Some recent developments in theory and practice*" (R. P. Townsend), "*Zeolite structural investigations by high resolution solid state MAS NMR* (G. T. Kokotailo), "*One dimensional gas adsorbed in the zeolitic pore*" (T. Takaishi), "*Catalytic and acidic properties of boron pentasil zeolites*" (J. C. Vedrine), "*New horizons in catalysis using modified and unmodified pentasil zeolites*" (W. Hölderich), "*Development of zeolite for non-phosphated detergents in Japan*" (I. Yamane).

According to the information provided by the organizers,[5] 260 papers were originally submitted for presentation. They were reduced after a rigorous refereeing procedure to less than 50%, improving consequently the mean quality of

the presentations. A good balance among the various sections was however warranted, as it can be realized from the diagram below.



In general, the standard level of the papers was very high. Although it is difficult to single out particular contributions for comment, in is undeniable that certain themes were prominent overall. One of these themes was the introduction of heteroatoms into the aluminosilicate framework. In some cases such substitution resulted in substantial improvement or in appearance of new and interesting properties, e.g., the microporous analogues of the conventional aluminosilicate zeolites, such as the AlPO's and SAPO's, in other cases, although much was claimed, the substitution was essentially speculative. A second theme was the way in which topological and structural considerations, linked where appropriate with computer modeling studies, could help our understanding of synthesis. A third theme concerned the revolutionary effects that new sophisticated analytical techniques were having on our understanding of zeolite chemistry in general. These themes recurred in many papers throughout the Conference, but were particularly exemplified in the Invited Lectures of Edith Flanigen, Walther Meier and George Kokotailo, respectively.

Business Meeting

IZA members assembled as usually on Thursday to hear the reports of the various officers, to be informed about the most recent events regarding IZA, but especially to be involved in the election of Council members and the selection of site and organizer of the 8th IZC.

The Structure Commission was given the authority to officially approve new structure type designations of zeolite-type materials. In the future, all newly introduced structure type codes will have to be cleared by the Structure Commission prior to appearing in print.

A Catalysis Commission was established to set up procedures that will allow model reactions catalyzed by zeolites or related porous materials to be defined clearly, so that the performance and data treatment aspects of zeolite catalysis can be standardized, and publication guidelines can be formulated.

Attendees were also informed that in 1984 R. von Ballmoos, on behalf of the Structure Commission of IZA, published a *Collection of Simulated XRD Powder Patterns for Zeolites.*

H. Pfeifer, D. Freude and J. Kärger, of the Leipzig Karl-Marx University, and M. Bülow, of the Academy of Sciences of the German Democratic Republic, were announced to be the recipients of the second edition of the Breck Award for their work on proton NMR, and particularly with reference to the identification of acid sites of different strengths in zeolite cracking catalysts using this technique.

After vote the composition of the new Council was as follows: D. E. W. Vaughan (*President*), D. Barthomeuf (*Vice-president*), P. A. Jacobs (*Secretary*), F. G. Dwyer (*Treasurer*), A. Alberti, J. Dwyer, G. T. Kokotailo, E. Ma, D. H. Olson, J. D. Sherman, H. Tominaga, R. P. Townsend, J. Weitkamp, S. T. Wilson.

The General Assembly voted also to select place and organizer for the next IZC. The choice for 1989 proved to be Amsterdam (The Netherlands) under the chairmanship of L. Moscou.[6]

Social Events and Exposition

A Welcome Party was offered on Sunday evening, August 17.

A full-day Excursion was held on Wednesday, August 20, to Hakone, 90 km west of Tokyo, one of Japan's most famous volcanic areas. Visits were arranged to Lake Hakone and Oowakudani Volcano, a crater created during the last eruption of Mount Hakone some 3000 years ago. The area is characterized by showy volcanic phenomena, i.e., sulfureous fumes, hot springs, steam vents and bubbling pools. When eggs are cooked in the naturally hot water, their shells are blackened by the sulphur. Eating one of these eggs is said to prolong one's life by seven years.[7]

The Conference Banquet was held on Thursday evening, August 21 in the Keio Plaza Hotel.

A Ladies Program was also offered.

A permanent Exhibit of remarkably well crystallized natural zeolite specimens was organized by Z. Gabelica. More than 120 selected specimens, representing the whole series of the 46 different species belonging (at that time) to zeolite group, were displayed throughout the Conference. Interestingly, a collection of SEM images of micro synthetic zeolite counterparts, prepared by J. L. Guth, gave the possibility to compare the corresponding morphologies.

Financial Assistance

Financial assistance was offered to some participants to favour their attendance to the Conference.

Field Trip

An optional three-day excursion to the natural zeolite deposits in the Tohoku District (northeast Honshu) was organized after the Conference (August 23-25, 1986) by the Japan Zeolite Association. Participants were some 25.

The following stops were programmed to examine some important deposits of sedimentary zeolites: Ohya, Tochigi (clinoptilolite and mordenite), Castle Itaya, Yamagata (clinoptilolite), Itaoroshi-toge, Miyagi (mordenite).

A field guide was published and delivered to the participants prior to leaving. The trip was leaded by A. Iijima.

Acknowledgments

T. Tatsumi is gratefully acknowledged for providing some information on the field trip.

References and Notes

[1] These figures are taken from the third circular of the Conference. Actually the Conference volume contains one paper more, i.e., 133 in total. The late inclusion in the Program and in the Proceedings of an additional paper might have been a form of deference for some of its Authors, belonging to the team winner of the second edition of the Breck Award (see Proceedings, Paper AD-8-4, p. 633-639).

[2] "JCV Spotlight on Zeolite", *Japan Chemical Week* **27** (1367) (June 12, 1986) 4.

[3] R. P. Townsend, *Zeolites* **7** (1987) 174.

[4] R. Sersale, *La Chimica e l'Industria (Milan)* **69**(3) (1987) 62-63 (in Italian).

[5] M. Koizumi et al. "Preface of the Proceedings", in Proc. 7th IZC, Y. Murakami, A. Iijima, J. W. Ward, Eds., Kodansha/Elsevier, Tokyo/Amsterdam, 1986, p. xiii.

[6] There was at least one competitor, besides Amsterdam. To promote Amsterdam, everyone who was in favour was given a nice small orange rose to wear in the buttonhole. At the meeting it was clear that voting was in fact unnecessary. The hall was entirely orange!

[7] In a Conference Report (see Ref. [3]) the opinion was expressed that on the Wednesday sightseeing trip it would be great to spend far less time on coaches and far more time socializing and relaxing. This opinion, as far as the author knew, was shared by many.

8th International Zeolite Conference

Amsterdam, The Netherlands
July 10-14, 1989

Conference site:
International Congress Centre RAI
Amsterdam, The Netherlands

ORGANIZING COMMITTEE

L. MOSCOU (*Chairman*)
J. H. C. VAN HOOFF (*Co-Chairman*)
M. F. M. POST (*Secretary*)
W. T. KOETSIER (*Treasurer*)
R. A. VAN SANTEN (*Scientific Committee*)
P. A. JACOBS (*Scientific Committee*)
H. VAN BEKKUM (*Pre-Conference School*)
J. C. JANSEN (*Field Trip*)

SPONSORING

Financial support was obtained from:
AKZO Chemicals, Catalysts; Amoco Chemical Research and Development Department; BASF Aktiengesellschaft; Bayer AG; BP International Limited; Catalysis Section of the Royal Netherlands Chemical Society; Conteka B.V.; Chemische Fabrik Uetikon; Crosfield Catalysts; Degussa AG; Dow Chemical (Nederland) B.V.; DSM Research; Engineered Materials Research Center Allied-Signal Inc.; Exxon Chemical Holland B.V.; Grace GmbH; Henkel KGaA; Hoechst AG; ICI Chemicals and Polymers; Institut Français du Pétrol; International Zeolite Association; KLM Royal Dutch Airlines; Mobil Research and Development Corporation; Royal Netherlands Chemical Society; Shell International Petroleum Company Limited; Shell Nederland B.V.; Süd Chemie AG; The PQ Corporation; UOP Inc.

PUBLICATIONS

Zeolites: Facts, Figures, Future

P. A. Jacobs and R. A. van Santen*, Editors*
Studies in Surface Science and Catalysis, No. 49
Elsevier, Amsterdam, 1989

- **Part A, XX + 688 pp.**
- **Part B, XIV + 778 pp. (p. 689-1466)**

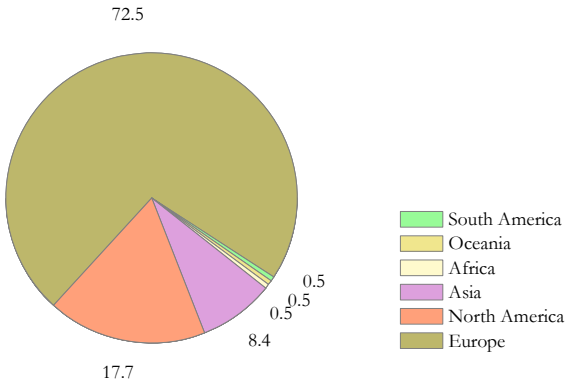
Zeolites for the Nineties
Recent Research Reports
J. C. Jansen, L. Moscou and M. F. M. Post*, Editors*
Amsterdam, 1989, 486 pp.

Format and Program

According to an established ritual , the Conference lasted five days, from Monday, July 10, to the following Friday, July 14. Wednesday afternoon was devoted traditionally to the half-day excursion. The Conference was preceded by an optional Pre-Conference School (July 6-8) and was followed by a Post-Conference Field Trip (July 14-17).

The Technical Program was based on the following topics: Synthesis and Modification, New Materials and Pillared Clays, Natural Zeolites and Utilization, Characterization, Structure and Theory, Adsorption and Diffusion, Metals in Zeolites, Catalysis. The Plenary Lecturers were 5; the Conference Papers accepted for presentation were 133 out of 325 submitted.[1] 80 Conference Papers, considered of a sufficient general nature to attract a broad audience, were presented orally and discussed in two parallel sessions. 10 of these papers were selected as Key-note Lectures and programmed at the beginning of the sessions. The remaining 53 more specialized papers were on display for several days and discussed during a poster session on Tuesday morning, July 11. All these papers were published in the Proceedings, which were made available prior to the Conference. No collection of Discussion transcriptions was published.

To give participants the opportunity to present their latest results, special poster sessions were organized where Recent Research Reports were displayed. These reports, selected by the Organizing Committee on the basis of an extended abstract, were 228. The abstracts were printed in a special book and made available at the Registration desk to the Conference attendants.



Four Specialist Discussion Meetings were programmed during the Conference to discuss the current status of zeolite research and application in some sectors of crucial relevance. The planned SDM were: (i) Cation-exchange applications

of natural zeolites: Progress, problems and prognoses, chaired by D. C. Berghauser and F. A. Mumpton; (ii) Zeolite synthesis, chaired by E. G. Derouane; (iii) Theory and modelling of zeolites, chaired by C. R. A. Catlow; (iv) Diffusion in zeolites, chaired by L. V. C. Rees. A qualified number of panellists developed the various themes in every SDM, before leaving the word to the floor.

PARTICIPANTS

The official List of Participants includes 610 scientists from 36 countries. Both participants from USA and The Netherlands were around 100, followed by Germany (83), France (56), United Kingdom (47), Belgium (28) and Japan (26). Very limited was the participations from South America, Oceania and (for the first time) Africa (see the percentages from the various continents in the above diagram). Participants from industry were 230 (37.7%).

HISTORICAL

The Amsterdam Conference was a very successful meeting, characterized by a large participation, the highest till then. The organization was typically local, analogously to the two previous conferences and differently from the Naples Conference, denoted by an international (European) flavour. The Organizing Committee was composed both of academic and industrial scientists to point out a typical feature of these Conferences: taking in equal consideration both science and technology. Attention was paid to natural zeolites and field trip, in conformity with the experiences made in Naples, Reno and Tokyo.

Cronstedt stationary

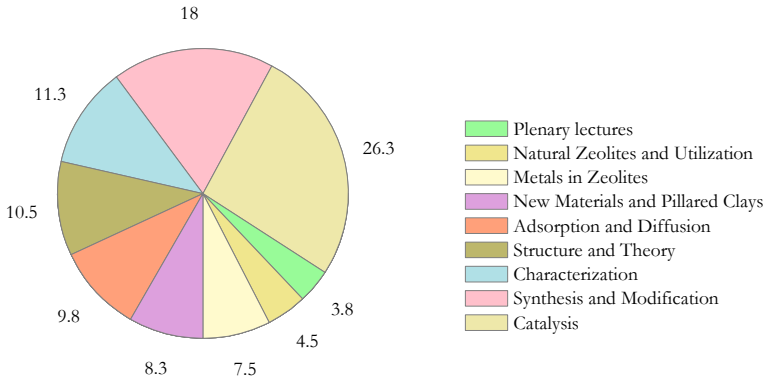
Some novelties gave, however, further relief to this conference. First of all, the organization of a Pre-Conference School on Zeolites for newcomers to the field or those who would like to refresh their knowledge (see below for details). This event would have been repeated in the following conferences. An occasional element of the Conference Program was, on the contrary, the organization of the Specialist Discussion Meetings, which has been mentioned in the preceding section. The idea, launched by F. A. Mumpton for the natural zeolites, was well accepted by the organizers and extended to other subjects. A less important but significant event was lastly the celebration of the zeolite's father A. F. Cronstedt. An attempt to translate his famous article on the discovery of zeolite minerals from old Swedish into English,[2] was presented by Herman van Bekkum in the poster session, arousing curiosity and interest. A stationary celebrating Cronstedt was printed on the occasion (see below).

Scientific Notes

Five Plenary Lectures were presented to summarize the current knowledge and make extrapolations to the future in a variety of timely domains. Here are their titles, together with the lecturers*: "Advances in the structural analysis of zeolites, zeolitic precursors and their analogues*" (J. M. Thomas), "*Towards a comprehensive mathematical theory for the topology and geometry of microporous materials*" (J. V. Smith), "*Application of zeolites in fluid catalytic cracking and related processes*" (A. Corma), "*Zeolites: Catalysis for the synthesis of organic compounds*" (W. F. Hölderich), "*Zeolites and other microporous materials*" (D. E. W Vaughan).

As regards the Conference papers, the selection was very rigorous, so that about 60% of the submitted papers were rejected. According to the editors of the Proceedings, "*on a scientific basis alone hardly 5% of the abstracts could be eliminated, which is indicative of two facts: (i) the zeolite community produces high quality research and (ii) these days, irrespective of their nationality and mother tongue, all scientists have learned how to promote their products*".[3] These problems were obviously connected to the rapid growth of research in zeolite sector. The handling of the great deal of data produced became therefore more and more difficult either in terms of presentation in a conference (notwithstanding the expedient of the parallel sessions) or especially in terms of publication (this problem is now overcome with the digitalization).

The hard selection, although it was too severe with many scientists (who mostly "resubmitted" their contributions as Recent Research Reports),[4] resulted in a marked upgrading of the mean level of the presentations. The following diagram shows the wide spectrum of subjects considered by the Scientific Committee, in order to give a real panorama of the research carried out all around the world.



One of the themes recurring in the Synthesis section was again the introduction of heteroatoms into the aluminosilicate framework and the production of new zeolite-analogues alumino-phoshates. Among the others, the presentation of the recently crystallized VPI-5 had a remarkable impact on the audience. Interesting novelties also in the section of the New Materials (pillared clays, metal sulphides). Numerous the characterization techniques used in studying zeolites, especially as catalysts, with prevalence of NMR. Papers on Structure were dominated by studies of molecular dynamics and modeling. Sorption dealt mostly with diffusion or hydrocarbons and aromatics in zeolitic and aluminophosphate structures. Catalysis, lastly, the richest section presented as usually a large variety of reactions especially in phases belonging to the MFI framework type.

Business Meeting

Thursday was, according to tradition, the day devoted to General Assembly to hear the reports of the various officers and the chairmen of the Structure and Catalysis Commissions. Attendees were in particular informed that in 1987 W. M. Meier and D. H. Olson had published the second revised edition of the *Atlas of Zeolite Structure Types*.

M. E. Davis, C. Saldarriaga, C. Montes, J. Garces and C. Crowder of the Virginia Polytechnic Institute, Blacksburg, VA (USA) were the recipients the third edition of the Breck Award, in recognition of their work on synthesis with particular reference to VPI-5, the first 18-ring molecular sieve.

After vote the composition of the new Council was as follows: P. A. Jacobs (*President*), E. Ma (*Vice-president*), H. G. Karge (*Secretary*), F. G. Dwyer (*Treasurer*), A. Alberti, M. Bülow, F. Fajula, C. A. Fyfe, Z. Gabelica, W. J. Mortier, R. P. Townsend, J. van Hooff, J. Weitkamp, S. T. Wilson.[5]

The General Assembly voted also to select place and organizer for the next IZC. The choice for 1992 was Montreal (Canada) under the chairmanship of D. E. W. Vaughan.

Social Events

A Welcome Reception in the Congress RAI Center was offered on Sunday night, July 9.

A Reception was held on Tuesday night, July 11, in the Rijksmuseum by invitation of the Ministry for Education and Sciences and the City of Amsterdam.

A half-day Excursion was organized on Wednesday, July 12, to the countryside of the province of North Holland with ample opportunity for social contacts with other participants. Buses from Amsterdam directed to north and then to north-east. Stops were planned in Zaandam, where a windmill on the Zaan river was visited, and in Volendam, on the coast, well-known for its old fishing boats and the traditional clothing still worn by some residents. The last part of the excursion consisted in a boat trip to Marken, a picturesque fishing village on a former island that is now connected to the main land.[6]

The Conference Banquet was held on Thursday evening, July 13 in the Sonesta Koepelzaal, a former Lutheran church in use as a theater.

A Ladies Program was also offered.

Financial Assistance

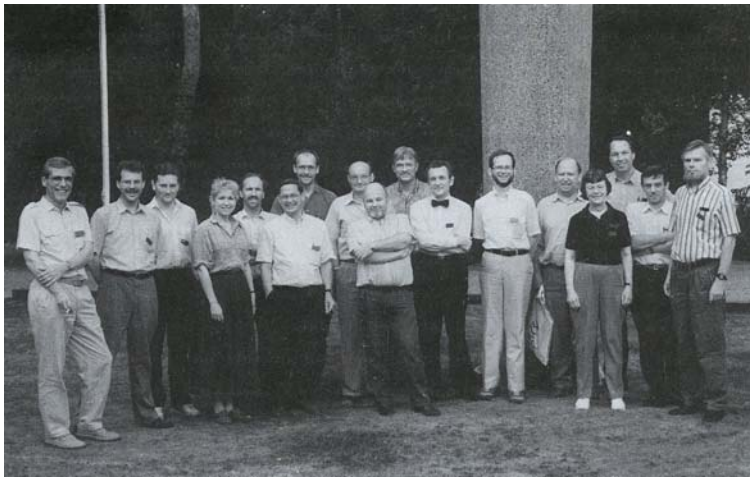
Financial assistance was offered to some participants to favour their attendance to the Conference.

Pre-Conference School on Zeolites

A pre-Conference School was organized in the Dutch National Soccer Centre in Zeist under the chairmanship of H. van Bekkum. Principles, interpretations, recent views and trends in zeolite science and technology were covered. The participants were some 100.

The topics taught ranged from silicate and phosphate structure to synthesis, from characterization techniques to modification, ion exchange and application to detergents, from adsorption and diffusion to catalytic properties and commercial preparation of zeolite catalysts. The teachers were H. van Bekkum, E. G. Derouane, E. M. Flanigen, J. H. C. van Hooff, P. A. Jacobs, J. C. Jansen, H. Van Konigsveld, H. D. Kouwenhoven, I. E. Maxwell, M. F. M. Post, R. A. Van Santen, R. Szostak and R. P. Townsend.[7]

Subsequently the Summer School the lectures were expanded to chapters which together formed an introductory book on zeolites, published by Elsevier.[8]



Lecturers and authors at the Pre-Conference School. From left: G. Engelhardt, M.F.M. Post, R.P. Townsend, R. Szostak, I.E. Maxwell, H. van Koningsveld, D.P. de Bruyn, H.W. Kouwenhoven, P.A. Jacobs, J.C. Jansen, H.G. Karge, S. T. Wilson, J.H.C. van Hooff, E.M. Flanigen, R.A. van Santen, R.A. Schoonheydt, H. van Bekkum.

P. Venuto and H. van Bekkum.

E. Flanigen at the Pre-Conference School.

POST-CONFERENCE FIELD TRIP

An optional three-day excursion (July, 14 to July 17) to visit natural zeolite deposits in western Europe was organized in cooperation with F. A. Mumpton, Chairman of the International Committee of Natural Zeolites. Participants were around 25. A field guide was prepared and delivered to the participants prior to leaving.

Departure from Amsterdam, after the Conference, to Kempenich (Eifel) in Germany. The day after, visit to several quarries in the Rhenish area to examine the chabazite- and phillipsite-rich tuff formations, locally called *trass*. Stop in

Freiburg. The next day transfer to Kaiserstuhl, where in a grove in the so-called Limberg the participants looked for the historical first discovered occurrence of faujasite.

The trip leader on the spot was Wolfhard Wimmenauer of the Freiburg University.

ACKNOWLEDGMENTS

Herman van Bekkum and Koos Jansen are gratefully acknowledged for providing some information.

REFERENCES AND NOTES

[1] These figures are taken from the third circular of the Conference. Actually the Conference volume contains 133 papers in total, including the Plenary Lectures. Perhaps some papers were withdrawn or presented but not published in the Proceedings.

[2] This rough translation was later published [G. Sumelius, in Synthesis of Microporous Materials, Vol. I, Molecular Sieves, M. L. Occelli and H. E. Robson, Eds., van Nostrand Reinhold, New York 1992, p. 1-5].A better translation was, however, published one year later [J. L. Schlenker and G. H. Kühl, in Proc. 9th Int. Zeolite Conference., R. von Balmoos, J. B. Higgins and M. M. J. Treacy, Eds., Butterworth-Heinemann, Boston 1993, p. 3-9].

[3] R. van Santen and P. Jacobs, Preface of the Proceedings, Studies in Surface Science and Catalysis, No. 49, Part A, Elsevier, Amsterdam, 1989, p. xv.

[4] In Italy we say "going out through the door and re-entering through the window".

[5] R. P. Townsend was initially elected at the office of Secretary. In 1990 he resigned and was succeeded by H. G. Karge.

[6] It was a pity that part of buses never reached the right harbour to sail and therefore some participants missed the scheduled boat trip.

[7] The school was very successful in a fine and friendly atmosphere. Only a stain. Herman van Bekkum organized a 80 m race between lecturers. Rodney Townsend fell and broke his collarbone.

[8] *Introduction to Zeolite Science and Practice*, H. van Bekkum, E. M. Flanigen and J. C. Jansen, Eds., Studies in Surface Science and Catalysis, No. 58, Elsevier, Amsterdam, 1991, xvi + 750 pp.

9th International Zeolite Conference

Montreal, Canada
July 5-10, 1992

Conference site:
Queen Elizabeth Hotel
Montreal, Canada

ORGANIZING COMMITTEE

D. E. W. VAUGHAN (*Chairman*)

G. C. COE (*Secretary*)

M. M. J. TREACY (*Treasurer*)

E. M. FLANIGEN and D. H. OLSON (*Program Committee*)

R. VON BALLMOOS (*Proceedings, Publications, Circulars*)

J. W. WARD and D. M. RUTHVEN (*Local Arrangements*)

T. E. WHYTE, JR. (*Public Relations, Advertisements*)

J. M. BENNETT (*Zeolite School*)

H. DONAHOE (*Field Trip*)

Other members of the Program Committee were:
G. C. Coe, R. J. Gorte, J. B. Higgins, S. B. Rice, M. M. J. Treacy, R. von Ballmoos
J. Colwell contributed to the Field Trip organization

SPONSORS

Air Products & Chemicals, Inc.; Allied-Signal Inc.; American Chemical Society Petroleum Research Fund; Amoco Oil Company; BP Research; Butterworth-Heinemann; Chevron Research & Technology Co.; CMP - Cativco International; Dow Chemical Company; Engelhard Corporation; Ethyl Corporation; Exxon Research & Engineering Co.; W. R. Grace & Co.; IFP/Procatalyse; Mobil Research and Development Corp.; PQ Corporation; Shell Development Co.; Union Carbide Chemical & Plastic Co., Inc.; UOP Research.

PUBLICATIONS

Proceedings from the Ninth International Zeolite Conference
R. von Ballmoos, J. B. Higgins and M. M. J. Treacy*, Editors*
Butterworth-Heineman, Stoneham, MA, USA, 1993

- **Vol. I, xxii + 726 pp.**
- **Vol. II, xiv + 724 pp.**

Ninth International Zeolite Conference
Extended Abstracts and Program
J. B. Higgins, R. von Ballmoos, and M. M. J. Treacy*, Editors*
Butterworth-Heinemann, Stoneham, MA, USA, V + 51 + 420 pp.

Format and Program

The Conference opened on Monday morning, July 6, with the welcome addresses of the organizer D. E. W. Vaughan and the IZA President P. A. Jacobs, lasted four and half days (Wednesday afternoon was consecrated to the traditional excursion), and closed on Friday night, July 10 with the Banquet. In conformity with the previous meeting, the Conference was preceded by an optional Pre-Conference School (July 2-4) and was followed by a Post-Conference Field Trip (July 12-14).

The scientific program covered all of the conventional areas of zeolite research: natural zeolites and synthesis, crystallography, sorption, diffusion and catalysis, as well as the newer and growing areas of environmental applications and modelling. Papers presented in the various sessions were in total 150, namely 5 Plenary Lecturers, 1 Key-note Lecture, 95 Full Papers presented orally and 50 Full Papers presented as posters.[1] All these papers, together with the relevant transcribed discussions, were published in the Proceedings, which were made available to the participants some one year after the Conference.

The two poster sessions, held on Monday/Tuesday and on Thursday/Friday, served also to display 261 Recent Progress Reports. These reports, giving the participants the opportunity to present the latest results of their studies, were accepted by the Program Committee with assistance of an International Advisory Board.

A Book of Abstracts, including all oral and poster (either full papers or RPR) two page abstracts, was included in the Registration Package picked up at the Conference.

Time was set aside on Tuesday afternoon for those wanting to take part in special interest topical discussions. Modelling and Environmental Applications were currently planned meetings.

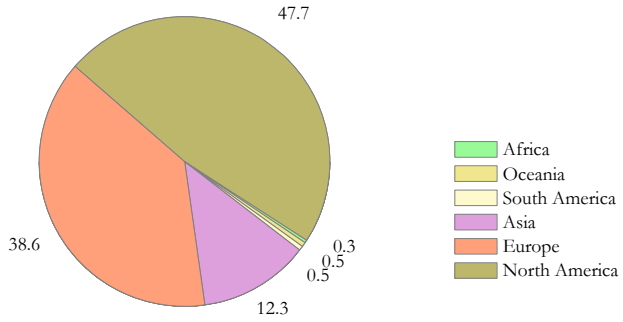
Participants

The official List of Participants includes 575 scientists from 38 countries, including 92 students. The countries with more delegates were USA (228), followed by Germany (44), The Netherlands (40), Canada (39), France (34), Japan (32), United Kingdom (32) and Italy (23). Comparable was the participation of scientists from North America and Europe (see statistics in the diagram below). Participants from industry were 228 (40.0%).

Historical[2]

The Montreal Conference was the largest IZC till then on the basis of the technical contributions, although the number of attendees was a little lower than

either the 7th or the 8th IZCs, reflecting the economic and political difficulties in several parts of the world.



Industrial support was lower than in previous occasions (mediocre, with notable exceptions from the USA and nil from the host country), restricting therefore any ability to offer financial aid to participants.[3] This was mainly caused by tight research budgets in the depressed oil and chemical industries.

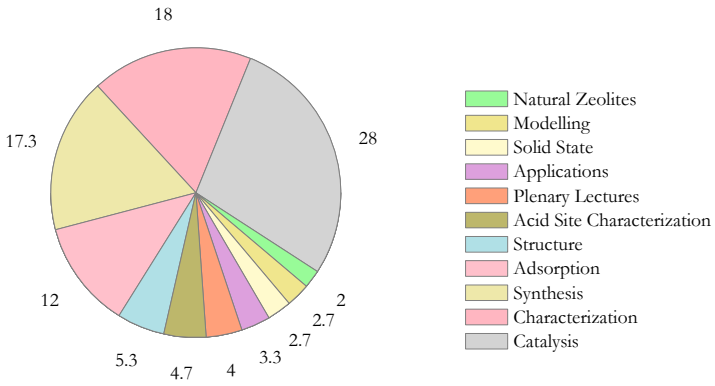
Nevertheless Montreal 1992 was a scientifically successful and socially enjoyable Conference. All aspects of the 9th IZC – School, technical Conference and Field Trip to Nova Scotia – were completed from a management perspective without significant problems and within budgets.[4]

The Montreal Conference was the 25th Anniversary Meeting since the London Conference in 1967 and this was remarked on the final circular. Occasionally it was also the meeting in which important decision were taken for the future of the IZA and IZC. A new Constitution was approved and Conferences were deliberated to be organized on biennial instead of triennial basis.

Scientific Notes

The five Plenary Lectures, given by experts in their respective areas, represented an overview of recent progress as well as an outlook into the future of zeolite research. Titles and lecturers were*: "Host/guest chemistry and catalysis in zeolites*" (J. Weitkamp), "*Ceramic membranes for separations and reactions*" (A. J. Burggraaf), "*Recent advances and perspectives in molecular sieve synthesis*" (H. Kessler), "*Sodalite superlattices: From molecules to clusters to expanded insulators, semiconductors and metals*" (G. A. Ozin), "*Zeolite structural problems from a computational perspective*" (J. M. Newsam). For opposite reasons also the Keynote Lecture deserved a marked interest: J. L. Schlenker and G. H. Kühl gave a look to the past and presented a commented translation of the historical article of A. F. Cronstedt.[5]

As regards the Conference papers, similarly to the preceding conference, the selection was severe: only 145 full papers were accepted out of over 330 entries received in response of the call for papers, so that rejection regarded 56% of the submitted contributions. But also in this case the scientific level turned out excellent and the various souls of zeolite research and technology were adequately represented (see diagram below).



Interesting considerations on the development of research in the area of zeolites and zeolite analogues since the first conference in London were made by the Conference chairman D. E. W. Vaughan and are here reported.[6] "*In reviewing the research "hot spots" of the late 1960's we note surprising similarities with the present – possibly a reflection of the refractory nature of the science problems and that progress is made by repeated cycles of incremental advances. The idea bank expands slowly, but as new methods, materials, instruments and techniques emerge and develop, idea are tested and retested until new constructions are possible. Faujasites and L are still of major interest, as is faujasite resynthesis, modeling and computational chemistry, synthesis mechanisms, phosphate effects and separations. Whereas catalysis was one amongst many equals in 1967, at last in research sense, it is now the dominant interest. Other great changes include the massive expansion of molecular sieve chemical compositions and the new diversity of characterization methods and data handling techniques. …From scientific curiosities, zeolitic materials have grown into a major branch of inorganic chemistry having an economic impact of great proportions. The 1967 domination of the field by a small group of research centers (Mobil, Union Carbide, Imperial College and Russian Institutes) and manufacturers has given way to numerous excellent research centers and producers in most of the industrial and industrializing world. Research, invention and commercialization in molecular sieves is now a global, highly competitive activity. Detergent additives have become the largest tonnage zeolite application and zeolite have penetrated many catalyst and separations processes. Auto NOx catalysts seem to be just around the corner, as do catalysts for a wide range of chemical specialties*".

BUSINESS MEETING

Thursday, July 9, was the day of the General Assembly. Reports of the various officers and the chairmen of the Structure and Catalysis Commissions were made to the membership. The agenda contained in addition some important points to be voted.

(i) A new Constitution and Bylaws was approved. Among the other modifications introduced, the Council members were brought to 15 and the IZC organization was fixed on a biennial basis.[7]

(ii) To give the possibility to organize the next IZC earlier (in 1994 instead of 1995) the Council in 1991 decided to award the organization of the 10th IZC to Germany under the chairmanship of J. Weitkamp. Approval of such resolution was requested (and obtained), with the additional information that the Conference would have been held in Garmisch-Partenkirchen from July 17 to 22. The appointed organizer gave extended information on the progress of works.

(iii) The Synthesis Commission, having been organized after the Chislehurst Meeting of the British Zeolite Association in 1990 by a number of interested scientists under the guidance of H. Robson, was formally established to encourage good research in zeolite synthesis and an orderly reporting of the results, to organize zeolite synthesis literature in such a manner that it is more useful to the scientific community, and to promote zeolite applications research by making basic information more readily available.

(iv) G. Bellussi, M. Clerici, V. Fattore, B. Notari, G. Perego, F. Buonomo, A. Esposito, F. Maspero, C. Neri and U. Romano of Enirecerche S.p.A., Milan, Italy, were the recipients the fourth edition of the Breck Award for advancing our knowledge of the structures and properties of titanium MFI zeolites and for demonstrating both the potential and applications of these novel catalysts for partial oxidation reactions.

(v) An IZA Award was established to be given to individuals for their long-term commitments and contributions to zeolite science. The recipient would have served as ambassador for the IZA to the worldwide zeolite community.

(vi) After vote the composition of the new Council was as follows: H. G. Karge (*President*), J. van Hooff, (*Vice-president*), R. von Ballmoos (*Secretary*), J. M. Bennett (*Treasurer*), T. Bein, M. Bülow, F. Fajula, C. A. Fyfe, Z. Gabelica, V. B. Kazanski, H. Kessler, G. T. Kokotailo, W. J. Mortier, Y. Ono, P. Ratnasamy.

(vii) The General Assembly voted also to select place and organizer for the 11th IZC in 1996. Two bids were presented: Seoul (Korea) by H. Chon and Edinburgh (UK) by L. V. C. Rees. The first option was selected.

Social Events and Exposition

A Welcome Reception was held on Sunday night, July 5 in the Grand Salon of the Queen Elizabeth Hotel, sponsored by the PQ Corporation.
A Poster Reception was held on Monday evening, July 6 in the poster area, sponsored by UOP.

Midweek excursion: participants relaxing at *La sucrerie de la montagne*.

A half-day Excursion was organized on Wednesday, July 8. Participants had initially the opportunity to visit Montreal Biôdome, a facility that allows visitors to walk through replicas of four ecosystems found in the Americas, i.e., the Tropical Forest, the Laurentian Forest, the Saint Lawrence Marine Eco-system and a polar area divided into Arctic and Antarctic. The afternoon and the evening were instead spent in the *Sucrerie de la Montagne*, 120 acres of picturesque maple forest, located between Ottawa and Montreal, where visitors could watch maple syrup being made. Dinner was served in the same sites followed by music and dancing (see photographs).

The Conference Banquet was held on Thursday night, July 10, preceded by a reception, in the Grand Salon of the Queen Elizabeth Hotel. During the banquet the Breck Award was delivered to a delegation of the recipients.

A Guest Program was also offered.

In the occasion of the 25th Anniversary of the International Molecular Sieve/ Zeolite Conferences a poster collecting photographs from previous meetings was on display. Material for that was provided by single participants.

Financial Assistance

Financial assistance, consisting in waiving the registration fee and offering accommodations at McGill University, was allowed to 32 participants, mostly coming from less favourite countries.

Pre-Conference School on Zeolites

Based on the successful experience of the preceding conference, a new edition of the pre-Conference School was organized at Concordia University from July 2 to 4, under the chairmanship of J. M. Bennett. Subjects of the lectures were: history of zeolite science, structure and properties, synthesis, characterization techniques, adsorption and diffusion, catalysis. Participants were 57.[8]

The faculty members included: H. van Bekkum, J. M. Bennett, A. Corma, E. M. Flanigen, C. Fyfe, J. L. Guth, V. B. Kazanski, H. van Koningsveld, L. B. McCusker, D. M. Ruthven, R. A. Schoonheydt.

Post-Conference Field Trip

An optional three-day excursion (July 12 to July 14) to visit the Bay of Fundy in Nova Scotia was organized in conjunction with H. Donahoe (Nova Scotia Department of Minerals and Energy), J. Colwell (Acadia University, Nova Scotia) and E. George (Parrsboro Rock and Minerals). Participants were around 25. A field guide for "*Zeolites in the North Mountain Basalt, Bay of Fundy-Minas Basin Region, Nova Scotia*" was prepared by the field trip organizers and delivered to the participants prior to leaving.

Cape Sharp.

Clarke Head from Wasson Bluff.

The tour departed from and ended up in Halifax. Sites visited were: West Bay at Cape Sharp, East bay at Partridge Island, Wassons Bluff, the Lookoff, Swindells Knob, Mordem Kirk Brook, Ross Creek and Hustons Beach.

The field trip to Nova Scotia was very successful either from a scientific side (excellent mineral collecting) or for the opportunity to visit magnificent places in the background of spectacular landscapes (see photographs).

Left: David Vaughan.
Right: Zelimir Gabelica packing rocks at Bear Brook.

ACKNOWLEDGMENTS

David Vaughan and Francesco Di Renzo are gratefully acknowledged for providing some information and some material regarding the field trip, respectively.

REFERENCES AND NOTES

[1] These figures are consistent with the papers published in the Proceedings and the abstracts published in the volume of the Extended Abstracts and Program. Actually, there was a Plenary Lecture announced in the Final Circular, but possibly not given at the Conference and therefore omitted in the Conference Volume. The missing paper, authored by J. D. Sherman, was titled: "Environmental applications of molecular sieves".

[2] The reported considerations and data have mostly been taken from a letter sent by the organizer D. E. W. Vaughan to the Conference participants on July 7, 1992, a couple of weeks after the end of the Conference.

[3] The participation from eastern Europe was particularly low, only 15 delegates in total (3 from Bulgaria, 3 from Hungary, 2 from Poland, 4 from Romania, 3 from USSR). David Vaughan in his survey letter (see Ref. [2]) stated: "*We regret the absence*

of many familiar faces at the 9th IZC and hope that conditions will improve to facilitate their attendance at future meetings in Germany and in South Korea".

[4] The city location of the Conference turned out to be a problem, as there were lots of alternative hotels downtown and the organizers did not meet their room quota at the Queen Elizabeth hotel to get free services. Therefore they were forced to pay an extra cost of 6000 US dollars. However they did make a nice profit that helped the IZA treasury.

[5] See Ref. [2] of the Amsterdam 1989 chapter.

[6] D. E. W. Vaughan, Preface of the Proceedings, R. von Ballmoos, J. B. Higgins and M. M. J. Treacy, Eds., Butterworth-Heineman, Stoneham, MA (USA), 1993, p. iv.

[7] The decision to change from a 3-year interval between IZCs to a 2-year one was made by the IZA Council without consulting beforehand the membership. The reason for this choice was the following: with the increase in zeolite focused meetings (Gordon Conferences, ACS and single country meetings, etc.) it became apparent that IZA, to prevent the loss of its position as the voice of the zeolite community, needed to go to more frequent meetings and to multiply its educational activities (courses, commissions and others).

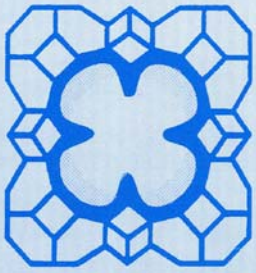
[8] IZA Newsletter No. 4, June, 1994, *Zeolites*, **14** (1994) 386.

10th International Zeolite Conference

Garmisch-Partenkirchen

Germany, July 17 - 22, 1994

Organized in Cooperation
with the Max Planck Society
under the Auspices of IZA



Conference site:
Kongresshaus
Garmisch-Partenkirchen, Germany

ORGANIZING COMMITTEE

J. WEITKAMP (*Chairman*)

H. G. KARGE (*Vice-Chairman and Treasurer*)

H. PFEIFER

W. HÖLDERICH

E. J. LEUPOLD and L. PUPPE (*Chairmen Paper Selection Sub-Committee*)

J. C. JANSEN and M. STÖCKER (*Chairmen Pre-Conference School Sub-Committee*)

J. A. LERCHER (*Chairman Local Arrangements Sub-Committee*)

C. COLELLA (*Chairman Post-Conference Field Trip Sub-Committee*)

Some additional members of the various Sub-Committees.

SPONSORS

Deutsche Forschungsgemeinshafts; Max-Planck-Gesellschaft zur Förderung der Wissenschaften e. V.; Air Products & Chemicals, Inc.; Altamira Instruments, Incorporated; BASF Aktiengesellschaft; Bayer AG; Biosym Technologies GmbH; CEM GmbH; Coulter Electronics GmbH; CU Chemie Uetikon AG; Degussa AG; DuPont Company; Elsevier Science Publishers B. V.; Engelhard Corporation; Exxon Chemical International; Fonds der Chemischen Industrie; Grace GmbH; Haldor Topsøe A/S; Hemmer Repetitorium; Henkel KGaA; Hiden Analytical Limited; Hoechst AG; Hüls AG; Institut Français du Pétrol; Merck & Co., Inc.; Molecular Simulations; Perkin-Elmer GmbH; Quantachrome GmbH; SKW Trostberg Aktiengesellschaft; Statoil Perochemicals and Plastics; Süd-Chemie AG; Texaco Incorporated; The Dow Chemical Company; The PQ Corporation; UOP Research and Development; VAW aluminium AG.

PUBLICATIONS

Zeolites and Related Microporous Materials: State of the Art 1994
J. Weitkamp, H. G. Karge, H. Pfeifer and W. Hölderich*, Editors*
Studies in Surface Science and Catalysis, No. 84
Elsevier, Amsterdam, 1994

- **Part A, xxxvii + 890 pp.**
- **Part B, xxix + 624 pp. (p. 891-1514)**
- **Part C, xxix + 852 pp. (p. 1515-2366)**

Zeolite Science 1994: Recent Progress and Discussions
H. G. Karge and J. Weitkamp, *Editors*
Studies in Surface Science and Catalysis, No. 98
Elsevier, Amsterdam, 1995, xxxv + 486 pp.

Field Trip to Natural Zeolite Deposits of Central Italy
Supplement to "Bollettino AIZ" (Italian Zeolite Association), No. 3
De Frede, Napoli (Italy) 1994, 45 pp.

Format and Program

The Conference opened on Monday morning, July 18, with the welcome addresses of the organizer J. Weitkamp and the IZA President H. G. Karge, and closed, after four and half days, on Friday night, July 22, with the Banquet. Satellite activities completed the program: an optional Summer School was held before the Conference (July 14-16) and an optional Field Trip took place after the Conference (July 24-26).

The scientific program consisted in Plenary Lectures (7), Conference Papers – oral (99) and poster presentations (179) – and Recent Progress Reports (137). Oral papers were presented partly in two and partly in three parallel sessions running over the whole Conference week. Posters were displayed in two sessions scheduled on Tuesday and Thursday afternoon. The Recent Progress reports (RPR), i.e., the latest results from all areas of zeolite science and technology, were shown and discussed in a supplementary posters session held on Monday afternoon.

The topics covered in the technical program included geology and mineralogy, hydrothermal synthesis, structures, post-synthesis modification, characterization by spectroscopic and other techniques, theory and modelling, acidity, diffusion, adsorption, host/guest chemistry, catalysis, and industrial, environmental and entirely new applications.

The PL and CP were published in the Proceedings prior to the Conference, whereas the RPR (two-page abstracts) saw the light, together with Discussion, in an additional volume, issued several months after the end of the Conference.

Participants

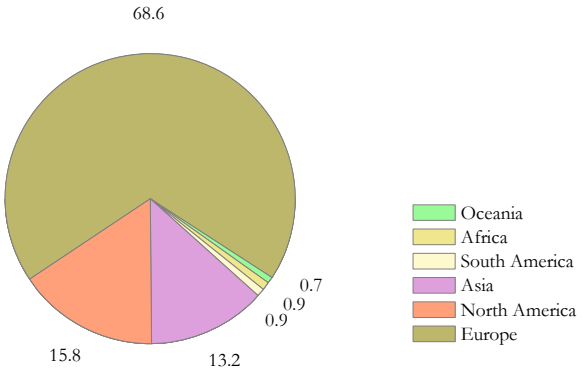
The official List of Participants includes 917 scientists from 47 countries. The countries with more delegated were Germany (231) and USA (129), followed by The Netherlands (63), Japan (59), France (58), United Kingdom (51) and Italy (40). Two third of the scientists came from Europe (see statistics in the diagram below). Participants from industry were 251 (27.4%).

Historical

The Garmisch-Partenkirchen Conference had the highest score as regards the number of participants, the number of abstracts submitted (around 600), the number of papers presented and published. It was also the most wealthy, being supported by a remarkable number of sponsors. The organization was excellent for the great deal of energy spent by the chairman J. Weitkamp and the Vice-Chairman and Treasurer H. G. Karge. Any planned activity was accomplished regularly and with satisfaction of the Conference participants. The publication

of the Proceedings was even anticipated, the three-volume set of books was in fact ready for distribution at the beginning of the Conference, contrary to the previous intention to publish them after the Conference.

One of the most significant decisions of the organizers was to have a very compact and agile Organizing Committee – only four persons – assisted by several Sub-Committees chaired by experts from a number of European countries. This gave to the organization a real "European flavour".[1]

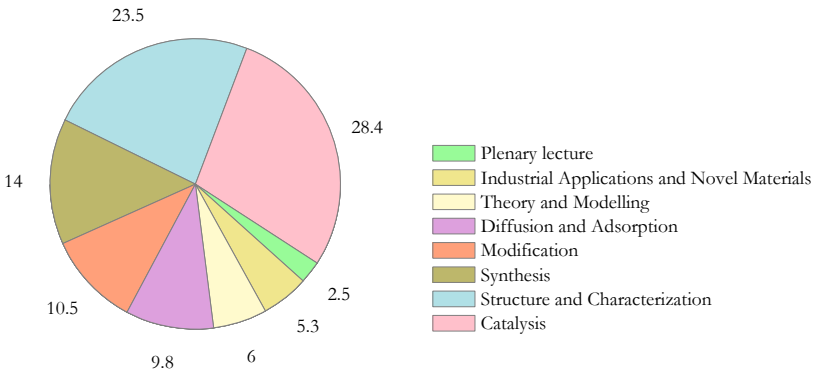


SCIENTIFIC NOTES[2]

Seven renowned scientists accepted the invitation to present Plenary Lectures on the following important subjects of zeolite science and technology: "*Zeolites and their mechanism of synthesis*"[3] (P. A. Jacobs) "*Advances in powder diffraction methods for zeolite structure analysis*" (L. B. McCusker), "*Exciting new advances in diffusion of sorbates in zeolites and microporous materials*" (L. V. C. Rees), "*Catalysis by zeolites – Science and technology*" (W. O. Haag), "*Structure and reactivity of zeolite catalysts: Atomistic modeling using ab initio techniques*" (J. Sauer), "*Industrial applications of zeolite catalysts*" (J. B. Naber), "*Zeolites in environmental catalysis*" (M. Iwamoto).

Less than 50% of the submitted papers were accepted for presentation and publication, approximately the same percentage of rejection of the previous two conferences. The criteria adopted to select the papers were declared by the editors of the Conference Proceedings in the following statement:[4] "*A balance with respect to the various subsections of zeolite research and applications was not intended. Thus, the Proceedings reflect the present activities in the field of microporous materials, at least with respect to the number of researchers being involved. Zeolite catalysis always was and continues to be an area of particular interest, however with an obvious shift from the earlier almost exclusive focus on classical hydrocarbon conversions to one on zeolite catalysis of oxidation reactions, formation of a greater variety of organic compound and, very importantly, environmental catalysis. Synthesis of zeolites and zeolite-like materials is enjoying an ever growing esteem.*

Consequently, contributions related to this area cover another important fraction of the Proceedings' space. Interest in adsorption and diffusion seems to be very much revived and stimulated by the improvement of classical and the introduction of novel techniques for investigation. Other areas of increasing attractiveness are modeling, theory, novel materials and applications, although the number of contributions in these categories is not yet very high".



In the above diagram the distribution of the Conference papers among the various subjects is presented. It is apparent the prevalence of catalysis and synthesis and the absence of natural zeolites, although papers fitting in this section were announced. Among the papers on synthesis there was a series of presentations on the mesoporous molecular sieve materials recently developed by Mobil, essentially MCM41 and other analogous phases. These are the first signs of a trend of zeolite research, which would have been confirmed in future Conferences.

IZA Business

The General Assembly was held on Thursday, July 21. Membership was informed about a series of important resolutions by the Council and was invited to vote for the election of new officers and for the selection of the site of the 12th IZC. Reports of the various officers and the chairmen of the Structure, Catalysis and Synthesis Commissions were presented to the assembly. Further, the following decisions of the Council were announced:

(i) The first IZA Award was presented to an individual, whose name is almost synonymous with zeolites and molecular sieves: E. M. Flanigen.

(ii) The Council, with the aim to honour Professor Barrer's lifetime achievements in the field of molecular sieves, decided unanimously and with applause that Professor Barrer should be made Honorary President of the IZA. This de-

cision required a change in the IZA Constitution and this was approved by the Assembly by an overwhelming majority.

(iii) Two national associations, the Italian and Hungarian Zeolite Associations, asked for formal affiliation with the IZA and received this affiliate state. The Council will grant a representative from each affiliated association an invitation to be present during a Council meeting.

(iv) C. T. Kresge, M. E. Leonowicz, W. J. Roth, J. C. Vartuli and J. S. Beck from Mobil Research and Development Corporation, Princeton and Paulsboro, NJ were the recipients of the fifth edition of the Breck Award for preparing the first ordered mesoporous silicate and aluminosilicate materials containing pores in the range of 16 to 100 Å.

After vote the composition of the new Council was as follows: R. von Ballmoos (*President*), J. Weitkamp, (*Vice-president*), K. Jansen (*Secretary*), J. M. Bennett (*Treasurer*), T. Bein, G. Bellussi, T. Inui, V. B. Kazanski, H. Kessler, G. T. Kokotailo, L. McCusker, Y. Ono, P. Ratnasamy, D. E. W. Vaughan, S. Zones.

As regards the venue of the 12th IZC in 1998 only one candidate was submitted. The organization was therefore assigned to a team campaigning for Baltimore.

Meeting of the IZA Structure Commission at the 10th IZC. Standing (from left): Mike Treacy, John Higgins, Henk van Koningsveld, Rich Kirchner, Roland von Ballmoos, Wilfried Mortier, Christian Baerlocher, Mike Bennett and John Newsam; sitting (from left): Hermann Gies, Walter Meier, Lynne McCusker and Werner Baur.

Social Events

A Welcome Gettogether was held on Sunday evening, July 17 in the Conference site.

A half-day Excursion was organized on Wednesday, July 20. The participants were divided in two groups: the first had the opportunity to visit the spectacular Neuschwanstein castle, built by the Bavarian king Ludwig II at the end of the 19th century; the second visited the nearby Hohenschwangau castle, originally built in the 12th century, destroyed by Napoleon, but restored a few years later. The participants were then brought to the open air Museum Glentleiten with a collection of old farmhouses, shops and workshops, reflecting traditional lifestyle of Bavarian farm villages of more than one century ago. The excursion ended with a dinner party at the restaurant Kreutalm, where the normally measured zeolite scientists were involved in uncontrolled singing and dancing, accompanied by a Bavarian music team wearing traditional clothing.

The Conference Banquet took place on Friday night, July 22, in the hall of the Convention Center (Kongresshaus). During the banquet a speech was given by Cyril T. O'Connor. In addition the Breck and IZA Awards were presented to the relevant recipients. Lastly, a special mention was made and a souvenir gift was given to some ten participants who had attended all ten Conferences held till then.

A Guest Program was also offered.

Financial Assistance

Financial assistance was allowed to some participants to favour their attendance to the Conference.

Pre-Conference School on Zeolites[5]

The third edition of the pre-Conference School on Zeolites, titled "*Advanced Zeolite Science and Applications*" was organized at the Education Center of the Hanns Seidel Foundation in Wildbad Kreuth, Germany, from July 14 to 16, under the co-chairmanship of J. C. Jansen and M. Stöcker. This summer School was intended as a forum for open, intense and advanced discussions of the latest results and trends in zeolite research and applications. The main themes of the school were: zeolite synthesis, materials, active sites: characterization and modelling, chemical-physical characterization, applications. Participants were 105, coming from 28 countries.

C. Colella and J. Weitkamp in a tuff quarry near Riano.

On the bridge to Civita di Bagnoregio, the *dying village*.

The faculty members included: J. Livage, R. H. Thompson, H. Kessler, G. D. Stucky, G. Schulz-Ekloff, G. Bellussi, J. C. Jansen, V. B. Kazanski, R. A. van Santen, H. Gies, J. L. Casci, E. G. Derouane, C. Baerlocher, M. Stöcker, H. van Bekkum, D. R. Rolison, S. T. Sie, F. Fajula, J. A. Martens.

Post-Conference Field Trip

An optional three-day excursion (July 24 to July 26) to visit the sedimentary chabazite- and/or phillipsite-rich deposits of Central Italy was organized in co-operation with the Italian Zeolite Association. Participants were around 25. The technical program was coordinated by M. de' Gennaro. A field guide, authored by A. Langella and M. Adabbo, was prepared and delivered to the participants prior to leaving.

The starting point of the tour was Bolsena, near the homonymous volcanic lake, reached by coach from Garmisch-Partenkirchen at the end of the Conference. Sites visited were: Latera Calderas near Bolsena, Piandirena tuff quarry, Sovana (Etruscan necropolis and medieval village), Pitigliano (citadel and cellar), Bardano pozzolana quarry, Orvieto (town and old underground pozzolana quarry), Civita di Bagnoregio, Falisca tuff quarry, Romana tufo quarry (see photographs). The trip ended up in Rome (railway station or airport).

The field trip, leaded by the organizer C. Colella, together with the authors of the field guide, gave the participants the opportunity to examine tuff rock either in its natural occurrence (quarries), or in its ancient and modern utilization *in situ* (necropolis, cellar) or lastly in its uses as dimension stone in construction (houses in Sovana, Pitigliano, Orvieto, Civita di Bagnoregio) (see the field trip report in the box at the end of the chapter).

Acknowledgments

Lynne McCusker is gratefully acknowledged for providing the photograph of the IZA Structure Commission.

References and Notes

[1] Actually, something similar had already happened at the Naples Conference (1980), but in that occasion the establishment of an international Organizing Committee was a specific request of the IZA Council (see the Sect. "IZA Business" of the Chicago Conference).

[2] Interesting reports on the Conference from two different points of view – those of a senior scientist and of some postdocs and Ph.D. students – are reported in *Microporous Materials*: I. N. Armor [**3** (1994) 353-356] and P. Espeel et al. [**3** (1994) 356-358], respectively.

[3] The original name of the lecture was: "*What degree of understanding is reached in the science of synthesizing zeolite?*"

[4] J. Weitkamp, H. G. Karge, H. Pfeifer and W. Hölderich, Preface of the Proceedings, p. xxxi.

[5] Information taken from the report written by G. Bellussi, one of the lecturers of the School, and published in Italian in *Bollettino AIZ* (Bulletin of the Italian Zeolite Association), **4** (1994) 24-28.

[6] J. Weitkamp, *Bollettino AIZ* (Bulletin of the Italian Zeolite Association), **4** (1994) 33-35.

Field Trip to Natural Zeolite Deposits of Central Italy[6]

It is a well established and good tradition to combine the large International Zeolite Conference with several satellite events, and the most charming and exciting of these events grouped around the 10th International Zeolite Conference (Garmisch-Partenkirchen, Germany, July 17 to 22, 1994) was the Field Trip to natural zeolite deposits in Etruria and Tuscia, in Central Italy. The 1994 Field Trip was organized by a committee headed by Professor Carmine Colella, Dipartimento di Ingegneria dei Materiali e della Produzione, University Federico II, Naples. He was assisted by a team of outstanding Neapolitan scientists, and particular mention deserve Professor M. de' Gennaro who coordinated the technical program, and Dr. Maria Rosaria Adabbo and Dr. Alessio Langella who both prepared the daily tours and visits to the zeolite deposits and quarries, authored the very valuable Field Trip Guide handed out to the participants and assisted the participants in every manner during the tours.

About 25 participants had booked Field Trip. They started from Garmisch-Partenkirchen on Saturday morning, July 23, 1994, by coach. An Italian style lunch was organized in the Osteria dei Poeti in the city of Carpi (Modena) and gave the participants an impression of the excellent cuisine they would encounter during the whole Field Trip. On the same day, around midnight, the headquarters for the tours were reached, viz. the lovely Hotel Loriana sul lago, located in the city of Bolsena, on the shore of the volcanic lake Lago di Bolsena.

The first tour started on Sunday morning, July 24. It went westwards along the Northern rim of Lago di Bolsena and touched such picturesque places like Sorano, Sovana with its impressive cathedral and Etruscan tombs and city of Pitigliano. Major stops were arranged at the Latera Caldera and the Piandirena quarry, excavated in the yellow tuff on the Sorano formation with a daily production of ca. 12,000 blocks for the construction industry. The tuff occurring here is deeply zeolitized with a content of 67% chabazite and 3% phillipsite.

Starting from Bolsena again, the second tour on Monday, July 25, 1994, first went to a pozzolana quarry. Pozzolana denotes a chaotic volcaniclastic material mainly composed of glass fragments, lithic clasts and pumice, and some potassium feldspar. Pozzolana is often considered the volcanic rock which, following post-depositional minerogenetic processes, was transformed into zeolitized facies and almost always lithified. The materials excavated from this quarry is used as an additive in blended cements. The next stop during this tour was in the beautiful city of Orvieto, built on the huge volcanic complex called Orvieto-Bagnoregio. After a visit to Orvieto underground, the tour went on to Palombara tuff quarry where tuff blocks for the construction industry are produced. According to de, Gennaro and Colella, the chabazite and phillipsite content in this tuff are, rispectively, 50% and 14%. A true highlight of this tour was the final stop at Civita di Bagnoregio, often called the dying city: erosion of the sedimentary rocks brought about a series of landslides at the foot of the cliff which caused progressive retreat of the walls.

Two more quarries were visited during the third tour on Tuesday morning, July 26, 1994, viz. Edilcava Falisca and Romana Tuff quarries. The tuff materials in both quarries is again deeply zeolitized with more than 50% chabazite and some 5 to 7% phillipsite. The Field Trip ended in Rome with a superb lunch in a restaurant near Termini Railway Station.

Cordial thanks go to Carmine Colella and his team for having organized this very instructive and exciting Field Trip in one of the most beautiful areas of the world. All participants agreed upon having not only acquired valuable knowledge on naturally occurring zeolites, but they also felt that they had spent three and a half days among most friendly and hospitable people.

Jens Weitkamp
University of Stuttgart

11th International Zeolite Conference

Seoul, Korea

August 12 – 17, 1996

Conference site:
Hotel Lotte
Seoul, Korea

ORGANIZING COMMITTEE

HAKZE CHON (*Chairman*)
HANJU LEE, BAIK-HYON HA and WHA YOUNG LEE (*Co-Chairmen*)
YOUNG SUN UH (*Secretary*)
HANJU LEE (*Chairman Finance Sub-Committee*)
SANG HEUP MOON (*Chairman Program Sub-Committee*)
SON-KI IHM (*Chairman Scientific Sub-Committee*)
SEUNG IHL WOO (*Chairman Pre-Conference Summer School on Zeolites*)
SANG-EON PARK (*Co-Chairman Pre-Conference Summer School on Zeolites*)
YOUNG GUL KIM (*Chairman Post-Conference Symposium on Catalysis*)
Some additional members of the various Sub-Committees.

SPONSORS

Korea Science and Engineering Foundation; Korea Research Foundation; LG-Caltex Oil Corporation; Yukong Limited; SsangYong Oil Refining Co., Ltd.; DaeLim Industrial Co., Ltd.; AeKyung-PQ Advanced Material Co., Ltd.; Samsung Fine Chemicals Co., Ltd.; Korea General Chemical Corporation; Zeobuilder Co., Ltd.; Isu Chemical Co., Ltd.; Cosmo Industrial Co., Ltd.

PUBLICATIONS

Progress in Zeolite and Microporous Materials
Proceedings of the 11th International Zeolite Conference
Hakze Chon, Son-Ki Ihm and Young Sun Uh*, Editors*
Studies in Surface Science and Catalysis, No. 105
Elsevier, Amsterdam, 1997

- **Part A, xxxix + 808 pp.**
- **Part B, xxx + 1166 pp. (p. 809-1674)**
- **Part C, xxx + 711 pp. (p. 1675-2385)**

Discussion on Zeolite and Microporous Materials
Supplementary Materials to the 11th IZC
Hakze Chon and Young Sun Uh*, Editors*
Hanrimwon Publishing Company
Seoul, Korea, 1997, XVII + 449 pp.

A *Book of Abstracts*, containing the full texts of the plenary lectures together with the abstracts of all the other contributions, was handed over to the participants.

Format and Program

The Conference opened on Monday morning, August 12, with the welcome addresses of the organizer and the IZA President, lasted the entire week (Wednesday afternoon was consecrated to the traditional excursion), and closed on Saturday noon, August 17 with the Concluding Remarks. In conformity with the previous meetings, the Conference was preceded by an optional Pre-Conference School (August, 8-10), whereas no field trip was organized.[1]

Common areas of zeolite research and technology were covered, i.e., synthesis, structure, theory, characterization, adsorption and diffusion, catalysis, application. Uncommon topics were mesoporous materials, novel materials, and membranes. According to the program, papers presented in two or three parallel sessions were in total 285, namely 5 Plenary Lecturers, 115 30-minutes oral presentations and 165 selected posters. All these papers were published in the Proceedings some one year after the Conference (actually in the Proceedings the total number of papers is 279, namely, 5; 113 and 161 papers, respectively).

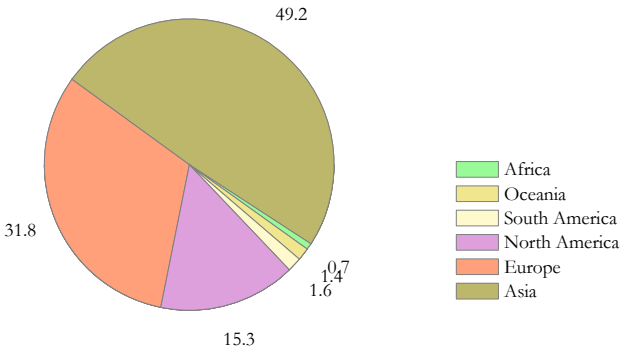
Three poster sessions were organized on Monday, Tuesday and Thursday in which, apart from the above full papers presented as posters, also 139 Recent Research Reports (RRR) were displayed.

A supplementary book, including the transcribed Discussions on the full papers and the abstracts of the RRR was also published after the Conference.

Welcome to participants.

PARTICIPANTS

The official List of Participants includes 481 scientists from 35 countries. The most represented countries[2] were: Korea (116), followed by Japan (105), USA (67), Germany (46), France (22), United Kingdom and The Netherlands (18). Half of the participants were from Asia (see the distribution per continents in the diagram below). Participants from industry were 97 (20.2%).



HISTORICAL

Compared to the successful Conference of Garmisch, the Seoul Conference was not completely satisfactory, essentially for climatic and logistic reasons. As regards the climate, many participants had to complain the very high humidity, unusual and uncomfortable for people coming from European and American countries. This might be the main reason for the low number of participants, the lowest after the Reno Conference in 1983.

In addition people does not love to attend conferences in megacities (10 million of inhabitants in Seoul), too large and too chaotic, in which connections are difficult and any side activity prevented. Other not secondary reasons were the reduction of the IZC frequency from 3 to 2 years and the uneasy political situation. Students demonstrations were very common in that period: "*the less pleasant side of the discipline was again and again demonstrated by bus loads of (very young) special police forces that were stationed outside the conference hotels in order to fight (fortunately non-appearing) demonstrating students*"[3]

On the technical side one thing passed over in silence was the complete disappearance of the natural zeolite subject from any conference activity. No field trip was proposed (in substitution the nth symposium on catalysis was organized!), and apparently no paper on natural zeolites was accepted for presenta-

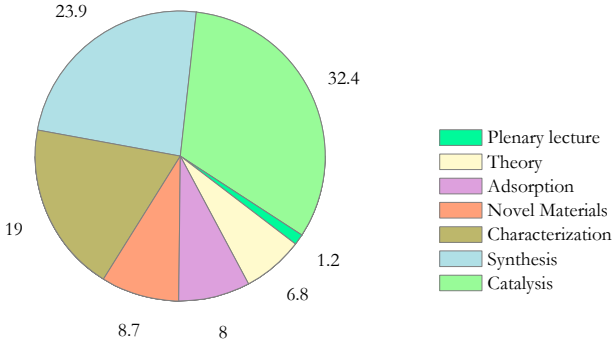
tion and inclusion in the proceedings. This was a remarkable loss from a cultural point of view, resulting in a definitive separation of the natural zeolite world from the IZC.

SCIENTIFIC NOTES[3-5]

Titles and speakers of the five Plenary Lectures, aiming at giving an account of the most recent achievements in zeolite science and technology, were*: "Directed synthesis of organic/inorganic composite structures*" (G. D. Stucky), "*Zeolites as adsorbents and catalysts. The interactive system encaged molecule/zeolite framework*" (D. Barthomeuf), "*High potential of novel zeolite materials as catalysts for solving energy and environmental problems*" (T. Inui), "*Post-syntheses modification of microporous materials by solid state reactions*" (H. G. Karge), "*Structure-reactivity-selectivity relationship in reaction of organics over zeolite catalysts*" (P. A. Venuto).[6]

A special lecture on the history of the International Zeolite Association was delivered by E. M. Flanigen, the first recipient of the IZA Award, who completed her two years as the international zeolite ambassador of the IZA.

As regards the Conference papers, the subjects mainly treated were synthesis, characterization and application in the field of catalysis (see statistics diagram below). Remarkable advances were made in the field of amorphous materials with ordered mesoporosity, e.g. M41S. Great impact was aroused by the synthesis and characterization of the 14 member pore zeolite UTD. Of importance from a commercial point of view in the field of detergents also the report on the synthesis of the zeolite called MAP, structurally analogous to gismondine, having a cation exchange selectivity for Ca^{2+} higher than zeolite A. Many interesting presentations regarded isomorphous substitution, especially Ti and Va silicates.



The IZA Council at work.

Applauses at the end of a presentation.

Regarding characterization, it has been confirmed the trend to combine different chemical physical techniques to achieve a better understanding of material properties, particularly the nature of the active site, i.e., acid features of the materials and state of framework and extra-framework metals. With reference to the most innovative techniques, it was of interest the introduction of the ^{17}O MAS NMR for the study of zeolites, such as Si-FAU and MPI. Numerous the studies on Catalysis, with special mention for the skeletal isomerization of 1-butene to isobutene, alkylation and selective oxidation of olefins and aromatics.
In summary, the mean level of the contributions, although reasonably high, was lower than that of the previous Conference, perhaps for the notable temporal nearness of the two meetings (less than 2 years!).

IZA Business

The General Assembly was held on Thursday, August 15. The IZA officers and the chairmen of the three IZA Commissions reported to the membership upon the relevant activities in the last two years. E. M. Flanigen, the first recipient of the IZA award, reported about her experience as IZA ambassador around the world. In summary, 21 places in 12 countries of three continents (Asia, Australia and Europe) were visited in 18 months. Some announcements were given.

(i) R. von Ballmoos resigned three months before. His work had changed and the present activity did not allow his engagement as IZA President. The Council, during a meeting in Stuttgart on July 8, 1966, elected J. Weitkamp as the new IZA President. The new Vice-President K.-J. Chao was elected via mail after the Conference.

(ii) The journals *Zeolites* and *Microporous Materials* were going to merge. At the end of the year they would have disappeared and replaced by the new journal *Microporous and Mesoporous Materials; Zeolites, Clays Carbon and Related Materials*.

(iii) M. M. J. Treacy (Exxon Research and Engineering Company, Annandale, NJ and NEC Research Institute, Inc., Princeton, NJ) was the recipient of the sixth edition of the Breck Award for his contributions to the characterization and elucidation of intergrowths in FAU/EMT zeolites.

(iv) H. G. Karge, Germany, was the winner of the IZA Award for his contributions to and achievements in the understanding of zeolite acidity, coke formation on zeolite catalysts, the study of sorption, diffusion and counter-diffusion in zeolites by Fourier transform infrared spectroscopy and the modification of zeolites via solid-state ion exchange.

The experience of having the IZC organized every two years had in general a non positive evaluation. After a long discussion inside the Council, the Assembly voted with an overwhelming majority (75%) in favour of a return to the 3-year interval.

After vote the composition of the new Council was as follows: J. Weitkamp (*President*), K.-J. Chao, (*Vice-president*), K. Jansen (*Secretary*), J. M. Bennett (*Treasurer*), T. Bein, G. Bellussi, H. Chon, T. Inui, H. G. Karge, V. B. Kazanski, H. Kessler, L. McCusker, W. Mortier, T. Yashima.[7]

The General Assembly voted also to select place and organizer for the 13th IZC in 2001. The site selected was Montpellier (France) under the chairmanship of F. Fajula.

Social Events

A Welcome Reception was held on Sunday night, August 11, in the Crystal Ballroom of the Hotel Lotte.

A half-day Excursion was organized on Wednesday, August 14. Participants had the opportunity to visit the Korean Folk Village, an outdoor museum which promotes the traditional Korean culture to both domestic and international visitors. The site was reached with some difficulty, because of the heavy and chaotic traffic afflicting day and night the "booming city" of Seoul. The visit included acrobatic and drum dance performances, typical of the local folklore and a (staged) traditional wedding. The excursion ended up with refreshments offered on a boat sailing the Han river.

The Conference Banquet was held on Friday night, August 16 in the Crystal Ballroom of the Hotel Lotte. During the banquet the Breck Award and the IZA Award were delivered to the winners.

An Accompanying Persons' Program was also offered.

Pre-Conference School on Zeolites[8]

The fourth edition of the Pre-Conference Summer School on Zeolites, titled "*Recent Advances and New Horizons in Zeolite Science and Technology*" was organized at the Samsung Fire & Marine Insurance Co. Education Center, Yusung, Taejon, Korea, from August 8 to 10, under the co-chairmanship of Seung Ihl Woo and Sang-Eon Park.

The purpose of the School was to provide those who have already actively worked in zeolite field with an opportunity to be exposed to the latest new developments and the new horizon of zeolite science and technology for the 21st century.

The programmed themes of the School were: synthesis and application of new type molecular sieves; characterization of porous materials; modification and adsorption in zeolites; structural science on zeolites; advanced applications.[9] Participants were 80.

According to the program, the list of the lecturers was as follows: A. Sayari, S. L. Suib, D. Venkartaraman, R. F. Howe, M. Stöcker, S. Kaliaguine, H. S.

Sherry, M. Bülow, A. Micke, J. M. Newsam, K. Seff, T. Bein, C. T. O'Connor, E. Van Steeen, M. E. Dry, S. Feast, J. A. Lercher, M. J. den Exter, J. C. Jansen, J. van de Graaf, E. Kapteijn, H. van Bekkum.

ACKNOWLEDGMENTS

Thanks are due to Kyung Byung Yoon for providing some photographs and statistics of the Conference and to Roberto Millini for some information.

REFERENCES AND NOTES

[1] In a first time (a couple of years before) the organization of a field trip was considered. That is why an observer of the Korean organizers (Dr. K. B. Yoon) took part to the field trip of the Garmisch conference. Later on the project was abandoned, as sedimentary zeolite formations are missing in south Korea and therefore organizing a field trip would have required long-lasting transfers.

[2] The data include 36 accompanying persons. Broken-up data are not available. Accompanying persons were all from foreign countries.

[3] H. van Bekkum and J A. Lercher, Nieuwsbrief (Dutch Zeolite Association) **2** (1996).

[4] H. van Bekkum, *Zeolites* **18** (1997) 239-240.

[5] G. Giodano and F. Testa, *Bollettino AIZ* (Italian Zeolite Association) 8 (1996) 29-30 (in Italian).

[6] The titles are those of the articles in the Proceedings, which are in some cases very different from those of the original lectures, as reported in the program.

[7] The replacement of the resigning R. von Ballmoos, as component of the Council, was delayed to the next Conference in Baltimore (1998).

[8] According to the report of van Bekkum (see Ref. [4]), "*the Summer School operated in a Spartan way: morning music at 5:45 a.m., breakfast at 6:30 a.m., no smoking, and no alcohol. Nevertheless, a fine, sober atmosphere existed among the 80 participants and 15 lecturers*".

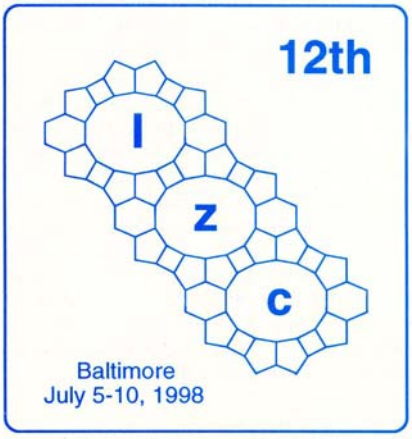
[9] Most lectures were collected in a book, having the same title of the School: "Recent Advances and New Horizons in Zeolite Science and Technology" [*Studies in Surface Science and Catalysis*, No. 102, H. Chon, S. I. Woo and S.-E. Park, Eds., Elsevier, Amsterdam, 1996, 462 pp.].

12 th

International

Zeolite Conference

Baltimore, MD
July 5-10, 1998



Conference site:
Hyatt Regency Hotel
Baltimore, Maryland, USA

ORGANIZING COMMITTEE

D. H. OLSON (*Chairman*)

E. M. FLANIGEN (*Co-Chairman*)

G. C. COE (*Secretary*)

R. J. GORTE and G. H. KUEHL (*Chairmen Program Committee*)

D. E. W. VAUGHAN and J. W. WARD (*Finance*)

M. M. J. TREACY (*Treasurer*)

B. K. MARCUS (*Chairman Publications Committee*)

A. W. PETERS (*Chairman Local Arrangements Committee*)

J. M. BENNETT (*Chairman Pre-Conference Zeolite School*)

Some additional members of the various Sub-Committees.

FINANCIAL SUPPORT

Air Products and Chemicals, Inc.; BOC Gases; Contract Materials Processing; Degussa; Dow Chemical Company; Engelhard Corporation; Exxon Chemical Company; Exxon Research and Engineering Company; Grace Davison; Mobil Technology Company; NEC Research Institute, Inc.; The American Chemical Society – Petroleum Research Fund; United Catalysts; University of Pennsylvania, Department of Chemical Engineering; UOP; Zeolyst International.
Financial contributions were given also by some individuals.

PUBLICATIONS

Proceedings of the 12th International Zeolite Conference
M. M. J. Treacy, B. K. Marcus, M. E. Bisher and J. B. Higgins, *Editors*
Materials Research Society, Warrendale, Pennsylvania, USA, 1998

- **Volume 1, lxxxii + 729 pp.**
- **Volume 2, lxxxii + 744 pp. (p. 733-1476)**
- **Volume 3, lxxxii + 778 pp. (p. 1479-2256)**
- **Volume 4, lxxxii + 771 pp. (p. 2259-3029)**

A *Book of Abstracts*, containing the technical program together with the short abstracts of all the contributions, including the Recent Progress Reports, was handed over to the participants.

FORMAT AND PROGRAM

The Conference opened on Monday morning, July 6, with the welcome addresses of the Conference chair D. H. Olson, lasted five days and closed on Friday evening, July 10 with the Concluding Remarks. The Conference was preceded by an optional Pre-Conference School (July, 2-4), whereas no field trip was organized.[1]

The technical program covered all aspects of zeolites and microporous-mesoporous materials, in particular those related to synthesis, structure, modification-characterization, diffusion-adsorption, catalysis and theory-modelling. Areas of study such as membranes, inclusion complexes and mesoporous materials that were only touched upon at previous conferences had full sessions dedicated to their many contributions. A special Symposium, dedicated to R. M. Barrer (1910-1996) was organized on Thursday morning.

The papers presented were in total 420, namely 5 Plenary Lectures, 112 oral presentations (in two parallel sessions, except for plenary lectures and Barrer Symposium) and 303 poster presentations. Posters were presented in two two-day sessions (Monday/Tuesday and Wednesday/Thursday), in which also 69 Recent Progress Reports (RPR) were displayed.

Plenary Lectures and Full Papers were published in the Proceedings a few months after the Conference (actually in the Proceedings the total number of papers is 398, as a small percentage of the accepted presentations were not submitted for publication in the Proceedings). A particular policy was adopted for publication: the authors had the option to publish a four-page condensed paper (originally presented for selection) or an eight-page full paper, submitted in a second time, after a suitable review.

No publication was made of the Recent Progress Reports (they are only included as short abstracts in the Book of Abstract).

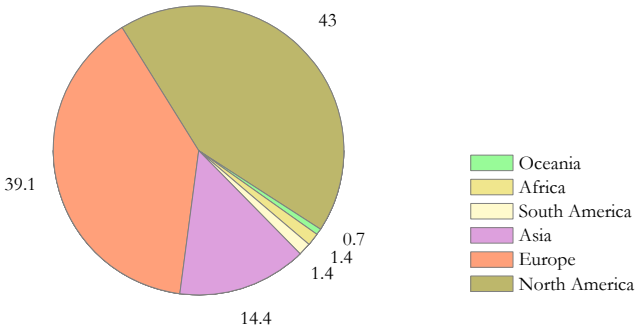
PARTICIPANTS

The official List of Participants includes 723 scientists from 41 countries. The top 10 countries in terms of the number of attendees were: USA (293), Germany (61), Japan (56), France (42), United Kingdom (41), The Netherlands (27), Italy (21), Canada (18), Peoples Republic of China (16), Russia and Korea (13). Participants from industry were 242 (33.5%). Percentages per continent are reported in the diagram below.

HISTORICAL

Although organized only two years after the Seoul Conference, the meeting in Baltimore was a successful one. Participation was once more high, the highest after the Garmisch Conference (which was however favoured by some synergic

circumstances). As a consequence, the number of accepted and presented papers, mostly as posters, was extraordinarily elevated and the Proceedings, encompassing four volumes, were certainly one of the largest collections on zeolite science ever assembled.



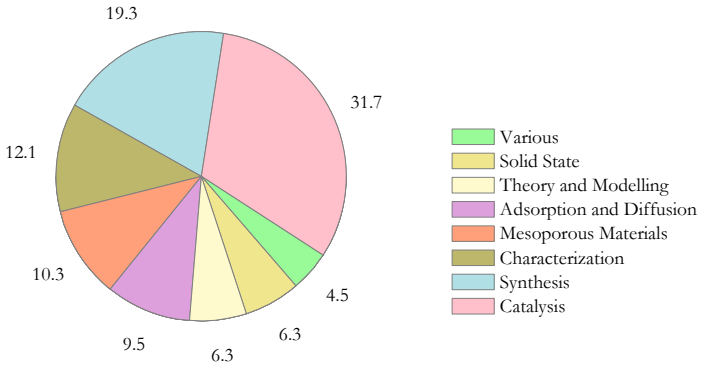
A significant event was the organization of a the Barrer's Symposium. Richard Maling Barrer, who is unquestionably the "father" of zeolite science, died on September 12, 1996, so only a few weeks after the previous Seoul Conference. This was the first occasion after his death to honour his memory and to try to summarize the extensive contributions he gave in many sectors of zeolite science and technology. To do this, three of his former students presented overviews and personal remarks on his major achievements in the field of material synthesis and modification (D. E. W. Vaughan), sorption and ion exchange (L. V. C. Rees) and zeolite characterization (W. M. Meier). W. J. Koros, in addition, illustrated Barrer's contribution to the thermodynamic and diffusion properties of zeolites and membranes.

SCIENTIFIC NOTES[2,3]

Five Plenary Lectures outlined the state-of-the-art of zeolite research in some key fields of science and technology*: "Observation on zeolite applications*" (J. M. Garces), "*Zeolitic coatings for catalysis and separations: Synthesis and potential uses*" (K. Jansen), "*Redox catalysis on molecular sieves: Structure and function of active sites*" (B. Wichterlova), "*Molecular transport in zeolites – miracle, insights and practical issues*" (J. Kärge), "*Using computers to discover novel zeolite frameworks*" (M. M. J. Treacy).

Besides the Plenary Lectures, the technical program gave an impressing overview of the broad field of zeolite science and applications. The contribution to catalysis, which was still the more important topic (see statistics below), focused on acid catalysis and on selective oxidations on transition metal exchanged zeolites or titanium-substituted molecular sieves. Moreover, two recently an-

nounced processes using zeolite catalysts were presented: The Hydro MTO process (UOP), in which methanol was converted in high yield of ethylene and propylene over a SAPO-34-type catalyst, and the use of zeolite Beta in the acid-catalyzed alkylation of benzene with propylene for cumene synthesis (ENI). The contributions on synthesis covered a broad range of topics, such as synthesis of new framework topologies, preparation of known topologies with new framework compositions, studies on crystallization mechanisms and the use of special synthesis techniques, e.g., synthesis of Al-ZSM-5 at 175°C in 5 minutes through microwave heating.



Methods for determining the structures of newly synthesized zeolites and related molecular sieves were advancing very rapidly. In most cases, it was the combined application of several highly sophisticated techniques which allowed to resolve structures within a short time after first synthesis. Post-synthesis modification and characterization of molecular sieve materials using physical-chemical methods was also broadly covered by oral and poster contributions.

IZA Business

IZA membership assembled on Thursday, July 9. Besides the ordinary reports on the activities of the IZA officers and the chairmen of the IZA Commissions in the period elapsed from the last conference, some news were given to the assembly. Among the others it was announced that new Commissions on Synthesis and Catalysis had been elected. The new chairmen were: H. Lechert and M. Stöcker, respectively. It was also announced the publication of the book *Verified Syntheses of Zeolitic Materials* from the Synthesis Commission.

IZA awardee H. G. Karge reported some data connected to his experience of IZA ambassador: 30 places visited in 13 countries of four continents, presenting a total of 43 lectures.

P. A. Jacobs, D. De Vos, P. P. Knops-Gerrits, I. F. J. Vankelecom, D. Tas and R. F. Parton (Katholieke Universiteit Leuven, Belgium) were the recipients of the seventh edition of the Breck Award for having advanced our knowledge on ship-in-the-bottle syntheses of transition metal complexes in molecular sieves and for the use of such materials as enzyme-mimicking catalysts in oxidation and enantioselective hydrogenation reactions.

Hermann van Bekkum, The Netherlands, was the winner of the IZA Award for his contributions to and achievements in the application of zeolite catalysts for the selective preparation of organic intermediates and fine chemicals.

After vote the composition of the new Council was as follows: J. Weitkamp (*President*), C. T. O'Connor, (*Vice-president*), K. Jansen (*Secretary*), R. Szostak (*Treasurer*), G. Bellussi, H. Chon, T. Inui, H. G. Karge, J. Lercher, J. A. Martens, L. McCusker, M Stöcker, M. M. J. Treacy, R. Xu, T. Yashima.

The General Assembly voted also to select place and organizer for the 14th IZC in 2004. The site selected was Cape Town (South Africa) under the chairmanship of C. T. O'Connor, with the cooperation of an Indian group, headed by P. Ratnasamy from the National Chemical Laboratory, Pune.

Social Events

A Welcome Reception was held on Sunday night, July 5, at the Baltimore Aquarium.

A Boat Cruise was held on Tuesday night, July 7. Participants had the opportunity to sail through Chesapeake Bay, while enjoying a buffet dinner, dancing, and music. While sailing a crab feast was organized, consisting in a competition to gain the title of master of the art of cracking crabs.

The Conference Banquet was held on Thursday night, July 9 in the Constellation Ballrooms CDEF of the Hyatt Regency Hotel, preceded by a Reception. During the banquet the Breck Award and the IZA Award were delivered to the winners.

A Guest Program was also offered.

Pre-Conference School on Zeolites[4]

The fifth edition of the Pre-Conference Summer School on Zeolites, titled "*Applied zeolite technology*" was organized at the Bryn Mawr College of Philadelphia, from July 1 to 4, under the co-chairmanship of J. M. Bennett and B. Marcus. According to the program, the list of the lecturers was as follows: M.

Bülow, J. B. Nagy, S. Ernst, E. Borgstedt, B. Toby, R. Bedard, R. Cavanagh, R. Gorte, B. Cormier, R. Hinchey, A. Behan, E. Vansant. Participants were 51.

The school provided an excellent program, centered on the use of zeolites in industry. This gave the participants the opportunity to see how the laboratory experiments can be transformed into large-scale money making processes. Apart from the more ordinary sessions on zeolite synthesis, characterization and ion exchange, other less common sessions regarded zeolite bonding, subtle post-synthesis modifications and standard reference materials. Two poster sessions helped each participant to present their own findings and to discuss them with colleagues and lecturers.

ACKNOWLEDGMENTS

Thanks are due to Roberto Millini and Bonnie Marcus for some information.

REFERENCES AND NOTES

[1] A zeolite trip to New Jersey was planned, but the sites were difficult to access with a group (either in closed mines or road cuts on busy highways). Also another trip to Nova Scotia was considered but that too was scrapped.

[2] L. Carluccio, *Bollettino AIZ* (Italian Zeolite Association) **11** (1998) 41-45 (in Italian).

[3] S. Ernst, Newsbrief, *Microporous and Mesoporous Materials* **27** (1999) 120-121.

[4] A. Healey, *Template* (British Zeolite Association), 1999.

13th International Zeolite Conference

http://www.izc13.enscm.fr

Conference site:
Palais des Congrès Le Corum
Montpellier, France

ORGANIZING COMMITTEE

F. FAJULA (*General Chairman*)

J. VEDRINE (*Scientific Chairman*)

F. DI RENZO (*Secretary*)

P. MASSIANI (*Treasurer*)

M. GUISNET (*Pre-Conference Zeolite School*)

P. ROCHER and A. TUEL (*Field Trip Subcommittee*)

J.-P. GILSON (*Finance*)

A. GALARNEAU (*Publications*)

SUPPORT and SPONSORING

INSTITUTIONS: Ministère de la Recherche; CNRS; Région Languedoc-Roussillon; District de Montpellier; Conseil Général de l'Hérault; Université Montpellier II; Ecole Nationale Supérieure de Chimie de Montpellier; St Nikon Foundation.

PARTNERS: ExxonMobil; TotalFinaElf; UOP; Institut Français du Pétrole.

SPONSORS AND FRIENDS: Air Liquide; DSM Research; Dow Chemicals; EniTecnologie; Grace Davison; Haldor Topsoe; Procatalyse; Rhodia.

PUBLICATIONS

Zeolites and Mesoporous Materials at the Dawn of the 21st Century
A. Galarneau, F. Di Renzo, F. Fajula and J. Vedrine, *Editors*
Studies in Surface Science and Catalysis, No. 135
Elsevier, Amsterdam, 2001

- **Volume, lxxix + 433 pp.** (short abstracts)
- **CD** (papers *in extenso*)

13th International Zeolite Conference
Recent Research Reports
Groupe Français des Zéolithes, 2001, 411 pp.

13th International Zeolite Conference
Field Trip Guide
Massif Central, July 13-16, 2001
Philippe Rocher and Alain Tuel
Groupe Français des Zéolithes, 2001, 20 pp.

Format and Program

The Conference opened on Monday morning, July 9, 2001 with the Opening Ceremony, lasted four full days and half and closed on Friday afternoon, July 13 with the Concluding Remarks. The Conference was preceded by an optional Pre-Conference School (July, 5-7) and followed by an optional Field Trip (July, 13-16).

Based on the response of the Call for Papers, the following topics in zeolite science and technology were covered: 1 Zeolite Synthesis, 2. Mineralogy of Natural Zeolites, 3. Synthesis and Characterization of Mesoporous Molecular Sieves, 4. Crystal Structure Determination, 5. Solid State Chemistry, Modification, Ion Exchange, 6. Spectroscopic Characterization, 7. Modelling and Theoretical Studies, 8. Adsorption and Separation, 9. Diffusion and Membranes, 10. Advanced Materials and applications, 11. Catalysis, 12. Applications of Mesoporous Molecular Sieves, 13. Applications of Natural zeolites, 14. Environmental and Life Sciences.

Participants during a Plenary Lecture.

Five Plenary Lectures were given at the beginning of each day. Accepted papers were divided in 32 thematic sessions. Oral presentations were assembled in 8

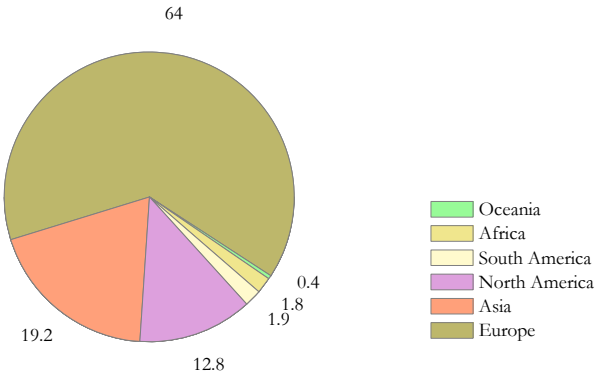
groups, each composed of four parallel sessions, in total 146 papers plus 6 submitted contributions ranked as Key-note Lectures. The remaining 542 Conference papers were presented as posters in four groups of eight sessions each, from Monday to Thursday. Also 188 Recent Research Reports (RRR), dealing with the latest results, were displayed in the Poster sessions.[1]

Plenary and Key-note Lectures were published *in extenso* , together with the short summaries of all the accepted papers, in the Proceedings, which were made available at the beginning of the Conference. The full text of the regular papers were saved in a CD enclosed to the Proceedings.

The two-page abstracts of the Recent Research Reports were collected in a book available to the participants at the Conference site.[2]

PARTICIPANTS

The official List of Participants includes 1027 scientists, including 255 Ph D students, from 55 countries. The top 10 countries in terms of the number of attendees were: France (177), USA (113), Germany (93), Japan (88), United Kingdom (57), Italy (56), Spain (46), The Netherlands (45), Peoples Republic of China (44), Belgium (37). Percentages per continent are reported in the diagram below.



HISTORICAL

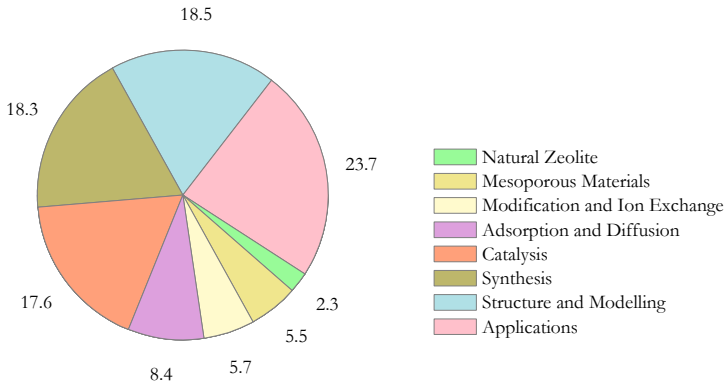
This was a very successful Conference in which all the records were broken. Participants were more than 1000, some 900 the abstracts and over 200 the RRR submitted. In total some 900 papers presented in the five days of the Conference. These favourable results must be ascribed to different joint occurrences. The excellent organization, the scientific reputation and popularity of the organizers, the great efforts to publicize the event, the right dimensions of the town and its location in one of the most attractive French regions, were

among the possible reasons for the success. A favourable action should be assigned however to the open-minded policy adopted by the organizers. Examples, certainly not exhaustive, were the re-introduction of natural zeolites among the themes of the Conference (two themes out of fourteen) and the re-proposition of a Field Trip, after two years of absence.

In summary, it was given a different interpretation of the essence of a conference as the IZC: certainly a place, where research of excellence and useful reviews are presented, but also a forum in which as many persons as possible are allowed to be present, to exchange their mutual experiences.

Scientific Notes[3,4]

Five Plenary Lectures were presented at the Conference. Titles and lecturers were*: "Ordered mesoporous materials – State of art and prospects*" (F. Schüth), "*Clinoptilolite-heulandite: applications and basic research*" (T. Armbruster), "*Evolution of extra-large pore materials*" (M. E. Davis), "*Evolution of refining and petrochemicals. What is the place of zeolites?*" (C. Marcilly), "*Is electron microscope an efficient magnifying glass for micro- and meso-porous materials?*" (O. Terasaki).



Interesting themes were treated also in the Key-note Lectures, i.e., delaminated zeolites as active catalysts for processing large molecules (A. Corma), pentasil zeolites from Antarctica (A. Alberti), ^{1}H NMR imaging to study the diffusion and co-diffusion in zeolites (J. Fraissard), zeolite-based nanocomposites (B. V. Romanovski), combinatorial tools for the discovery of new microporous solids (J. Holmgren) and local structures of transition metal oxides in zeolites and their photocatalytic properties (M. Anpo).

The above diagram reports a rearranged distribution of the various themes of the Conference. The more present subjects were Synthesis, Catalysis, Structure and Applications. The mean level of the presentation was high. Among the others, mention must be given of the structural investigations on a number of new phases and a novel approach in the preparation of bare silver nanowires in zeolites. Of high importance the presentation of the new Internet database of zeolite structures of the IZA Structure Commission. A highlight in the field of characterization was the application of two-dimentional IR spectroscopy for a detailed study of reactants occurring during a catalytic reaction. Very interesting also, from an industrial point of view, some separations performed on specific zeolites. In the field of catalysis a new method for removing organo sulfur compounds from fuels by oxidation with H_2O_2 over Ti-containing zeolites was presented.

IZA Business

IZA membership assembled on Thursday, July 12. Reports were presented by the IZA officers and the Chairmen of the Structure, Catalysis and Synthesis Commissions. A report on his activities as IZA Ambassador in the last three years was also presented by H. van Bekkum.

Two new IZA Commissions were established: the Commissions on Natural Zeolites[5] and on Ordered Mesoporous Materials. President Weitkamp introduced the subject and invited the new Chairmen, C. Colella (also on behalf of the co-chairman A. Alberti) and F. Schüth, respectively, to present shortly their relevant programs.

Stacey Zones (Chevron Research Company, Richmond, CA) was the winner of the eighth edition of the Breck Award for his fundamental studies on organic structure directing agents and their influence on molecular sieve preparations that have led to new insights on synthesis, new materials and new commercial processes.

Lovat V. C. Rees, United Kingdom, was the winner of the IZA Award for his scientific contributions to the fields of ion exchange, Mössbauer spectroscopy and adsorption-diffusion, and for his dedicated promotion of zeolite science, in particular as editor of Zeolites and as organizer of the Chislehurst meetings.

After vote the composition of the new Council was as follows: J. Lercher (*President*), J. A. Martens (*Vice-president*), F. Di Renzo (*Secretary*), R. Szostak (*Treasurer*), J.-P. Gilson, C. O'Connor, Ryong Ryoo, F. Schüth, M Stöcker, T. Tatsumi, O. Terasaki, M. M. J. Treacy, R. Xu, S. Zones.

IZA Executive Council. R. Szostak, C. O'Connor, J. Weitkamp, L. McCusker.

Passage to South-Africa.

The General Assembly voted also to select place and organizer for the 15th IZC in 2007. Two bids were presented: Sorrento (Italy) by G. Bellussi and Beijing (China) by Z. Gao. The site selected was Beijing (China) under the chairmanship of R. Xu.

Social Events and exhibition

A Welcome Reception was held on Sunday evening, July 8, in the reception hall of the Congress Center Le Corum.

The traditional excursion took place on Wednesday afternoon, July 11. Participants visited in Marsillargues, 30 km NE of Montpellier, the Manade Saint Gabriel, a typical farm of this area, where bulls and horses are bred. A bloodless bull-fight was organized in a bull-ring. The visit ended with a lengthy open-air dinner, in which some 900 persons were served.

The Conference Banquet was held on Thursday night, July 12, at "*La maison des vins des Coteaux du Languedoc*". During the banquet the Breck Award and the IZA Award were delivered to the winners.

A Social Program for participants and accompanying persons was also provided.
An Exhibit of some tens spectacular natural zeolite samples was arranged by Z. Gabelica.

Financial Assistance

Grants were assured to 271 individuals consisting of waiving or reducing the registration fee.

Pre-Conference School on Zeolites

The sixth edition of the Pre-Conference Summer School on Zeolites, titled "*Zeolites for cleaner technologies*" was organized at the University of Poitiers (Laboratory of Catalysis in Organic Chemistry), from Thursday, July 5, to Saturday, July 9, under the chairmanship of M. Guisnet and J.-P. Wilson.

The School was a refresher course for academic and industrial researchers already acquainted with zeolite science and technology. The invited lectures focused on refinery processes, aromatics conversion, MTO, oxidation catalysis, and fine chemicals production[6]

The School was attended by 115 delegates from more than 30 countries (including 30 invited participants).

According to the program, the list of the lecturers, mostly from industrial companies, was as follows: A. Corma, T. G. Roberie, R. H. Jensen, E. T. Habib,

J A. R.. Van Veen, F. Schmidt, M. Daage, F. Alario, A. Méthivier, J. S. Beck, P. Barger, P. A. Jacobs, P. Marion, M. C. Laufer, B. Coq.

POST-CONFERENCE FIELD TRIP

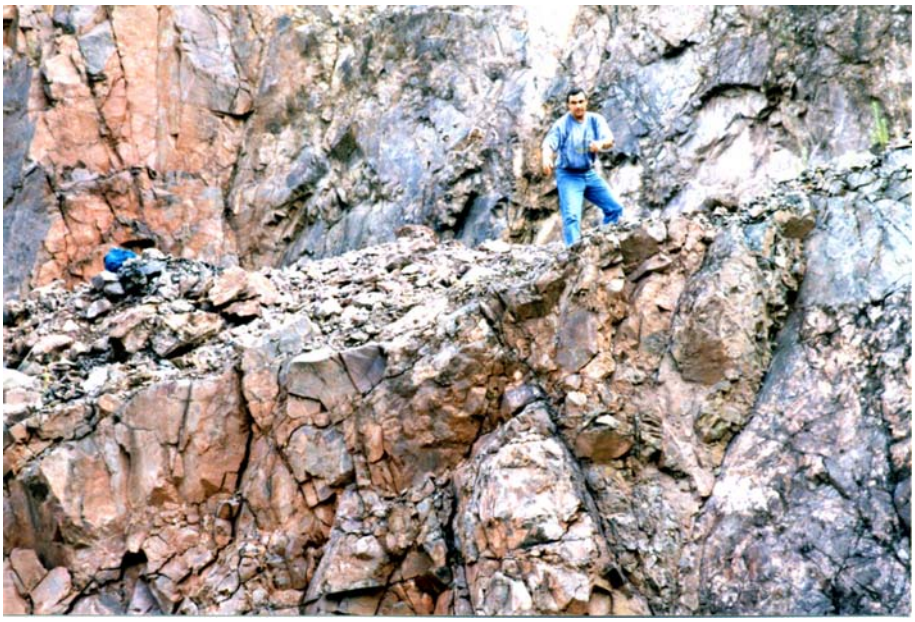
An optional three-day excursion (July 14 to July 16) to visit mineralogically interesting scenic sites in Central France was organized in cooperation with the French Zeolite Group. Stops were programmed to admire and collect specimen of natural zeolites, e.g., locations where gonnardite, mazzite and offretite were discovered. Participants were 32. A field guide, prepared by the trip leaders, Philippe Rocher and Alain Tuel, was handed over to the participants prior to leaving.

The sites visited were: Roc de Gerles quarry (analcime and laumontite) and Puech de Vermus quarry (phillipsite, thomsonite and natrolite) on Saturday; July 14.; Le Martinet (chabazite and phillipsite) and Chaux de Bergonne (gonnardite, thomsonite, phillipsite and chabazite) on Sunday, July 15; Mont Semiol (phillipsite, offretite, chabazite and mazzite) on Monday, July 16. The trip ended in Montpellier.

ACKNOWLEDGMENTS

Francesco Di Renzo is greatly acknowledged for providing plenty of material and photographs connected to this Conference. Thanks are due to Michel Guisnet for providing information on the Pre-Conference School of Poitiers.

Espalion.



Port d'Agrès (P. Rochet).

Port d'Agrès (F. Di Renzo and J. V. Smith).

REFERENCES AND NOTES

[1] Data have been taken from the Proceedings and the book of RRR.

[2] Participants were also given copies of three books from the IZA Structure and Synthesis Commissions, i.e., "Atlas of zeolite framework types", edited by Ch Bärlocher, W. M. Meier and D. H. Olson; "Collection of simulated XRD powder patterns for zeolite", edited by M. M. J. Treacy and J. B. Higgins; "Verified synthesis of zeolitic materials", edited by H. Robson and K. P. Lillerud.

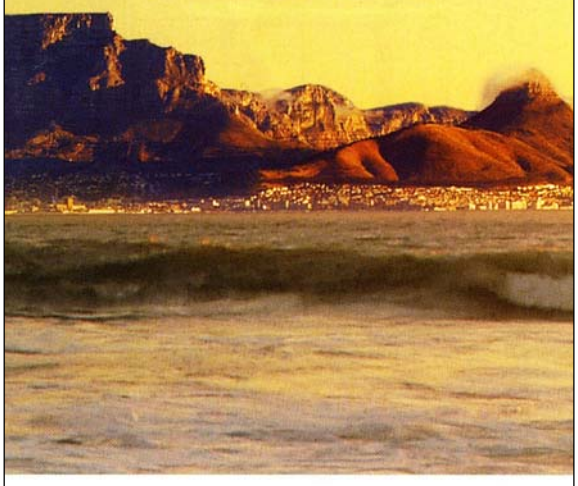
[3] M. Stöcker, *Cattech* **5** (4) (2001) 247-248.

[4] M. Hunger, *Microporous and Mesoporous Materials* **50** (2001) 234-236.

[5] A meeting of the "natural zeolite community" had been held the day before. At the end of a long discussion the establishment of the new commission had unanimously been approved.

[6] Based on the lectures given in Poitiers campus, a book was published, having the same title of the School, i.e., "*Zeolites for cleaner technologies*" (Catalytic Science Series, Volume 3, M. Guisnet and J.-P. Gilson, Eds., Imperial College Press, London, 2002, x + 378 pp.).

14th International Zeolite Conference



Cape Town, South Africa

25-30 APRIL 2004

Conference site:

International Convention Centre

Cape Town, South Africa

EXECUTIVE ORGANIZING COMMITTEE

C. O'CONNOR (*Chair*)
P. CAIRNS
L. CALLANAN
M. CLAEYS
K. MÖLLER
C. MITCHELL
H. TAIT
E. VAN STEIN
M. WINTER (*Secretary*)

TECHNICAL COMMITTEE

E. VAN STEIN (*Chair*)
P. CAIRNS
L. CALLANAN
M. CLAEYS
C. MITCHELL

HOSTING INSTITUTION: Catalysis Society of South Africa (in cooperation with the National Chemical Laboratory of Pune.in India).

SPONSORS: AKZO Nobel (sponsor of CD proceedings); Dishman Africa; EniTechnologie; European Science and Engineering Programme (ExxonMobil Chemical); Institut Français du Pétrole; Sasol; Shell Chemicals; Soyo Chemicals; Süd-Chemie; Taiwan Catalysis Association; UOP; Zeolyst.

PUBLICATIONS

Recent Advances in the Science and Technology of Zeolites and Related Materials, Proceedings of the 14th International Zeolite Conference
E. van Steen, L. H. Callanan and M. Claeys, *Editors*
Studies in Surface Science and Catalysis, No. 154
Elsevier, Amsterdam, 2004

- **Part A, xxxiii + 1159 pp.**
- **Part B, xxv + 958 pp. (p. 1160-2117)**
- **Part C, xxv + 997 pp. (p. 2118-3114)**

14th International Zeolite Conference
E. van Steen, L. H. Callanan and M. Claeys, *Editors*

- **Abstracts**
  Document Transformation Technologies
  Cape Town, South Africa, 2004, 1062 pp.
- **CD** (papers *in extenso*)
- **Recent Research Reports**
  The Catalysis Society of South Africa, Cape Town, 2004, 163 pp.

FORMAT AND PROGRAM

The Conference opened on Monday morning, April 26, with the Opening Ceremony and Welcome, lasted four full days and half and closed on Friday noon, April 30, with the Closing Ceremony. The Conference was preceded by an optional Pre-Conference School (April, 22-24), whereas no field trip was organized.[1]

Based on the subjects treated in the submitted papers the following topical sessions were considered: synthesis, characterisation, adsorption/diffusion, catalysis, mesoporous materials, novel applications.

Five Plenary Lectures were given at the beginning of each day, in addition four Keynotes Lectures were offered (every day except on Friday). Accepted papers were divided in the above six thematic sessions. Papers given orally in three parallel sessions were 117. Poster presentations of the accepted papers were 345 in four sessions from Monday to Thursday. Lastly, 87 Recent Research Reports (RRR), dealing with the latest results, were also displayed in the Poster session of Wednesday.[2]

Plenary and Key-note Lectures were published *in extenso* , together with the 2-page abstracts of all the accepted papers, in the Book of Abstracts, which was made available at the beginning of the Conference. The full text of the regular papers were initially published in a CD (enclosed to the Book of Abstracts), then, after the Conference, also in a set of Conference books.

The two-page abstracts of the Recent Research Reports were collected in a book available to the participants at the Conference site.

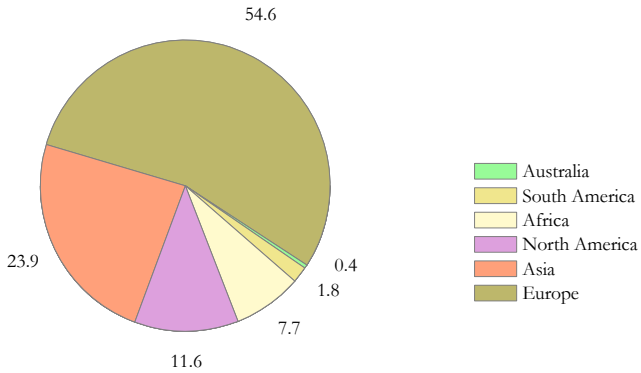
PARTICIPANTS[3]

The official List of Participants includes 456 scientists from 43 countries. The largest delegations were: Germany (56), USA (48), United Kingdom (38), Peoples Republic of China (35), Japan (30), France (28), South Africa (26), The Netherlands (23), Italy (22). Europe covered more than 50% of participants (percentages per continent are reported in the diagram below).

HISTORICAL

The Cape Town Conference was a medium size meeting. Participants were less than half of those present in Montpellier, but this was easily foreseeable. When Africa was selected as the site of the 2004 Conference, the choice was evidently of political character, i.e., giving an opportunity to a country, but also to a continent, to host an event, held till then only by Europe (six times), America (five) and Asia (two). Actually, participation of African scientists to the first seven Conferences had been practically negligible or null, then the trend had been substantially increasing (8 in Garmisch, 10 in Baltimore, 18 in Montpellier). It

was therefore hoped that this occasion could contribute to spread zeolite science and technology in the African continent. African participant in Cape Town were 35, mostly from South Africa (26), but with significant presences from Nigeria (4) and Tunisia (5), never present before (the only previous presences of African scientists were, apart from South Africa, from Angola, Algeria, Egypt and Tunisia).
The Cape Town Conference was, however, from a technical point of view, a successful event, in the wake of the previous meetings, and in addition it was a great experience from a cultural point of view, one of those difficultly occurring in the life again.



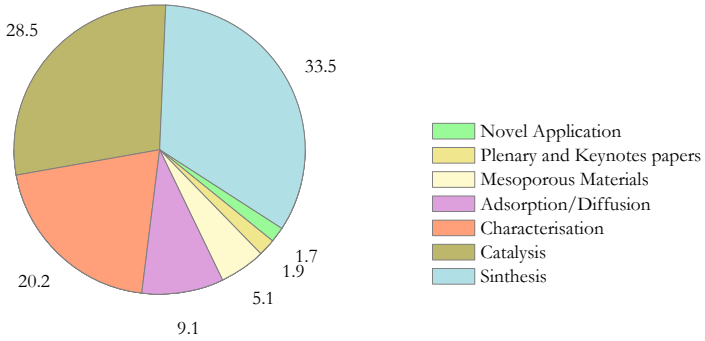
SCIENTIFIC NOTES[4-6]

Five interesting Plenary Lectures were presented at the Conference. Here are the relevant titles and lecturers*: "Towards a rationalization of zeolite and zeolitic materials synthesis*" (A. Corma), "*Zeolite catalysts for the production of chemical commodities: BTX derivatives*" (G. Bellussi), "*Zeolites and mesoporous materials as advanced functional material*" (J. Caro), "*The art of zeolite structure analysis?*" (L. McCusker), "*Mesoporous metal oxides with improved atomic ordering in the pore walls*" (T. J. Pinnavaja).

The state-of-the-art of research in the sector of zeolite and analogous materials was completed by the well selected Key-note Lectures: zeolite effects in sustainable and green synthesis (D. de Vos and P. Jacobs); preparation of low-k mesoporous silica films (K.-J. Chao et al.); molecular modeling in zeolite catalysis (R. van Santen); rational design and synthesis of microporous and related materials (J. Yu and R. Xu).

The diagram below reports the distribution of the various themes of the Conference. It is evident that this conference was characterized by three main themes: Synthesis, Catalysis and Characterization, which actually means that most of the technical part of the Conference focused on catalysis. This trend was already present in the last conferences, but it was particularly manifest in

the Cape Town event, which is even natural considering the character of the hosting institution. No doubt that this situation is determined by the present trend of research on zeolites and related materials. There is an obvious risk anyway, that this Conference may be considered in the near future as a "conference on catalysis", which would mean the end of the IZCs as occasions to put together all the persons recognizing themselves as belonging to zeolite community.



IZA Business

The General Meeting of the International Zeolite Association was held on Thursday, April 29. Reports were presented by the IZA officers and the Chairmen of the five IZA Commissions. A report on his activities as IZA Ambassador in the last three years was also presented by Lovat V. C. Rees.

Avelino Corma (Instituto de Tecnologia Quimica, UPV-CSIC, Valencia, Spain) was the recipient of the ninth edition of the Breck Award for the development of tin-containing zeolites and their application in Baeyer-Villiger oxidation and the innovative use of germanium to synthesize new zeolite structures.

Paul Ratnasamy, India, was the winner of the IZA Award for his seminal contributions to invention and innovation in the field of catalysis by zeolites exemplified by the development of a process for producing alkylbenzenes.

After vote the composition of the new Council was as follows: F. Fajula (*President*), T. Tatsumi (*Vice-president*), M. Anderson (*Secretary*), S. Zones (*Treasurer*), G. Centi, A. Corma, F. Di Renzo, S. Ernst, J.-P. Gilson, S. Qiu, Ryong Ryoo, F. Schüth, O. Terasaki, D. Zhao.

The General Assembly voted also to select place and organizer for the 16th IZC in 2010. Two bids were announced: Sorrento (Italy) and an Indian site. Actually, the latter bid was withdrawn, therefore the site unanimously selected was Sorrento under the chairmanship of G. Centi.

Waiting for the Banquet: (from right to left) J. Weitkamp, C. Colella, H. van Bekkum.

Social Events

A Cocktail Party was held on Sunday evening, April 25 in the Auditorium 1 Foyer at the Cape Town International Convention Center.

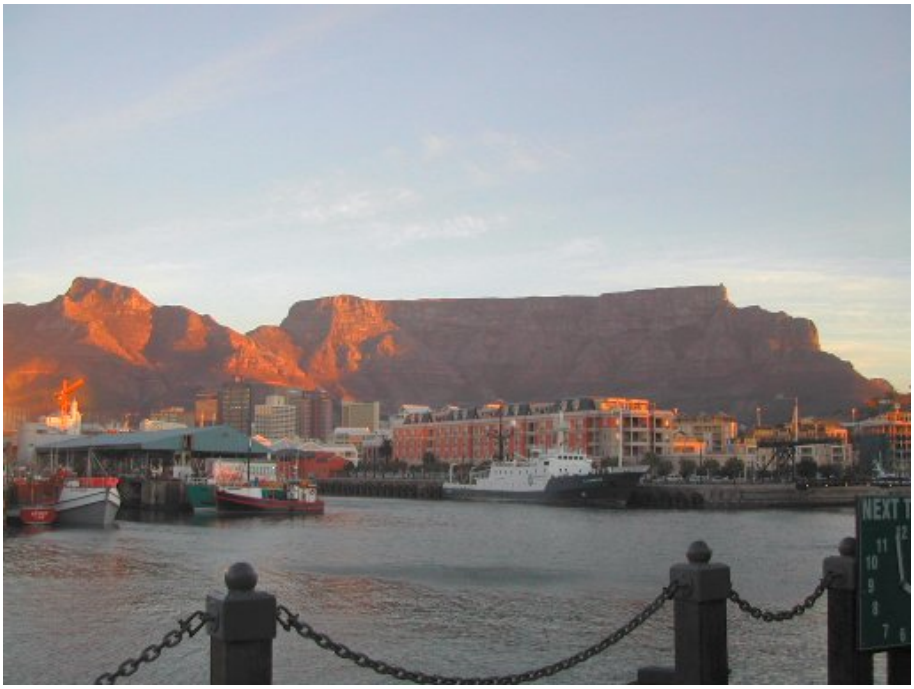
The traditional "excursion" took place on Tuesday evening, April 27. Actually it was a visit to the Nederburg Wine Estate, some half a hour away from Cape Town, followed by a Cape supper, cheered up by a short lyric concert of a group of singers and musicians of the University of Cape Town.

The Gala Banquet, sponsored by Süd-Chemie, was held on Thursday night, April 29, in the Ballroom West of the Cape Town International Convention Center, preceded by pre-dinner drinks and followed by music and dancing. During the banquet the Breck Award and the IZA Award were delivered to the winners.

An Accompanying Persons Program was also provided.

Pre-Conference School on Zeolites[6]

The seventh edition of the Pre-Conference School on Zeolites was held in the Protea Hotel, Stellenbosch, some 50 km E of Cape Town, from Friday April 23 to Sunday April 25, under the chairmanship of J. Weitkamp and G. J. Hutchings. The location was superb as the hotel is situated in the earth of a wine estate with a glorious view of the Table Mountain (see picture).



The School was attended by 45 delegates with a roughly even split between academia and industry. Lecture presenters were J. Casci, M. Hunger, F. Fajula, M. Bülow, M. Stöcker, F. Taulette.

The invited lectures focused on advanced porous materials, preparation and scale-up of zeolite molecular sieves, characterization by *in situ* spectroscopy and NMR, separation and purification, catalysis.[7] Much time was devoted to discussion after each presentation. A panel discussion on key topics emerged during the preceding days was held on the final morning.

On the Saturday night disciples and lecturers took part to a gastronomic feast with very loud and animated African dancing. It also involved that all the participants getting their faces decorated in African style.

ACKNOWLEDGMENTS

Cyril O'Connor is gratefully acknowledged for providing statistical data on the Conference.

REFERENCES AND NOTES

[1] A field trip was in the plans of the organization, although destination was left vague in the first circulars ("to the world-famous zeolite deposits of the Namibian desert" or "to visit Southern Africa's natural zeolite deposits"). Afterword the trip was cancelled, because of the limited interest aroused.

[2] Data on the papers presented refer to the official program of the Conference. Actually, there are notable differences among accepted, presented and published papers, e.g., total accepted papers (published as two-page abstracts) were 479, presented papers (according to the program) were 462, papers published *in extenso* (CD and Proceedings) were 402.

[3] The actual number of participants, taking into consideration renounces and late registrations, amounted to 464, which affects, but only slightly, the continental distribution.

[4] D. Plant, *Template* (British Zeolite Association), 2004.

[5] F. Pepe and D. Caputo, *Bollettino AIZ* (Italian Zeolite Association) **23** (2004) 43-48 (in Italian).

[6] Anonimous [G. J. Hutchings?], Newsbrief, *Applied Catalysis A: General* **272** (1-2) (2004) N2-N3.

[7] The Proceedings of the Pre-Conference School of the 14th IZC, reporting most lectures given in Stellenbosch, were published in a special issue of *Microporous and Mesoporous Materials* [**82** (2005) 217-304], edited by C. T. O'Connor, K. P. Möller, J. Weitkamp and G. J. Hutchings. Five lectures/articles, authored by J. L. Casci; F. Fajula, A. Galarneau and F. Di Renzo; M. Hunger; M. Stöcker; D. E. De Vos and P. A. Jacobs, were included in the issue.

Conference site:
Jiuhua International Convention & Exhibition Center
Beijing, P. R. China

ORGANIZING COMMITTEE

RUREN XU (*Chairman*)
ENZE MIN and MINGYUAN HE (*Co-Chairmen*)
SHILUN QIU (*Secretary-General*), **WENFANG TAN** (*Vice Secretary-General*),
SHILUN QIU and DONYUAN ZHAO (*Scientific Program*)
XIANPING MENG and BAONING ZONG (*Finance*)
FENG-SHOU XIAO (*Treasurer*)
ZI GAO and JIE-SHENG CHEN (*Publications*)
XINHE BAO (*Pre-Conference School*)
NAIJIA GUAN and JUN FU (*Local Arrangements*)
JIHONG YU (*Post Conference Forum*)

SUPPORT: National Natural Science foundation of China; Chinese Zeolite Association; Jilin University; Dalian Institute of Chemical Physics, CAS; Nankai University.

SPONSORING: National Natural Science foundation of China; SINOPEC Catalyst Company; Jilin University; Süd-Chemie Creating Performance Technology; Jianlong Chemicals; Dalian Haixin Chemical Indutrial Co., Ltd.; Institute of Coal Chemistry, CAS, Nanda catalyst Co., Ltd.

PUBLICATIONS

From Zeolites to Porous Materials
The 40th Anniversary of International Zeolite Conference
R. Xu, Z. Gao, J. Chen and W. Yan, *Editors*
Studies in Surface Science and Catalysis, No. 170
Elsevier, Amsterdam, 2007

- **Part A, xxxviii + 1047 pp.**
- **Part B, xxii + 1123 pp. (p. 1049-2171)**
- **CD (**including all the Conference papers**)**

From Zeolites to Porous Materials
The 40th Anniversary of International Zeolite Conference
Y. Liu and W. Yan, *Editors*
Jilin University, 2007

- **Book of Abstracts, CD** (including all the two-page abstracts)
- **Book of Summaries, 345 pp.**
- **Recent Research Reports, 371 pp.**

FORMAT AND PROGRAM

The Conference opened on Monday morning, August 13, with the Opening Ceremony, lasted four full days and half and closed on Friday afternoon, August 17, with the Concluding Remarks. The Conference was preceded by an optional Pre-Conference School (August, 8-11) and followed by a Post-Conference Forum on "*The future perspective of zeolite synthesis*".[1]

The Conference Organizer R. Xu welcomes the IZA President F. Fajula.

Audience during the Plenary Lecture of S. T. Wilson.

The Technical Program was based on twelve research areas. A corresponding number of Sub-Committees was created, which autonomously handled the selection of the relevant submitted papers. The said Sub-Committees and the relative chairs were: (1) Synthesis (S. Wilson), (2) Modifications (T. Tatsumi), (3) Structures (L. McCusker), (4) Characterization (J. Fraissard), (5) Adsorption, separation and diffusion (M. Bülow), (6) Catalysis (J. Weitkamp), (7) Host-guest chemistry and advanced materials (T. Bein), (8) Industrial Applications (W. Mortier), (9) Theory and Modelling (M. Treacy), (10) Mesostructured materials (S. Kaliaguine), (11) MOF materials (G. Férey), (12) Natural zeolites (C. Colella). An additional Symposium was scheduled to celebrate R. M. Barrer.

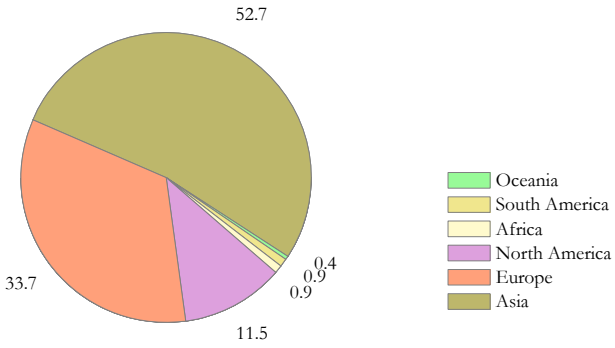
5 Plenary Lectures were scheduled at the beginning of each day, in addition 12 Keynotes Lectures were given at the beginning of each session, coinciding with each of the above research areas. 768 papers were accepted for presentation. 143 selected papers, out of 768, distributed in the above thematic areas, were presented orally in four parallel daily sessions. Poster presentations of the remaining accepted papers, in total 625, were divided in 20 topics and displayed from Monday to Thursday. Lastly, 177 Recent Research Reports (RRR), dealing with the latest results, were also displayed in the Poster sessions spread in the 20 topics mentioned above. Barrer Symposium, comprising 4 invited oral presentations, was held on Thursday afternoon, August 14.

Plenary and Key-note Lectures, Barrer presentations and a selection of accepted papers (all the orally presented contributions plus 124 poster presentations) were published *in extenso* in the Proceedings and on CD, both of them made available at the beginning of the Conference.

The two-page abstracts of all the invited and accepted papers were published on another CD, whereas the two-page abstracts of the RRR were collected in a book also available to the participants at the Conference site.
The short summaries of all the papers (966), whatever they were presented, were collected in a book of summaries, handed over to the participants at the registration desk.

PARTICIPANTS

The official List of Participants includes 814 scientists from 47 countries. The largest delegations were: China (262), USA (80), Korea (73), Japan (55), France and Germany (47), United Kingdom (42). Participants fro China were some one third of the total. Asia covered more than 50% of participants (percentages per continent are reported in the diagram below).



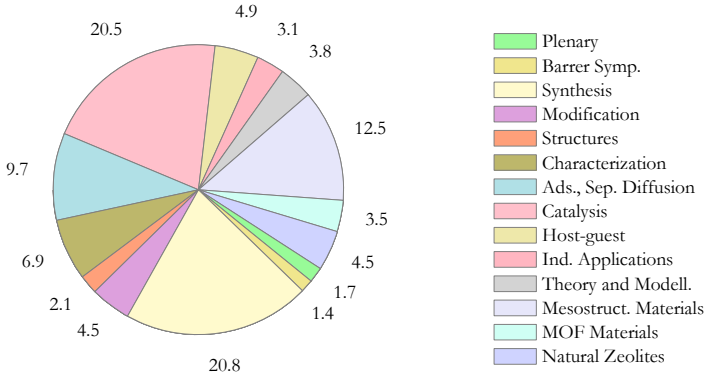
HISTORICAL

The numerous Chinese delegation to Montpellier Conference in 2001 (44 participants) was strongly determined to bring the 2007 Conference in China. They were very convincing in the presentation of the candidature, made good activity of promotion, but above all they were very compact. That is why they were recompensed by the General Assembly. The announcement of the choice of Beijing as the site of the 15th IZC was welcomed with enthusiasm, as a sign of a great victory after a hard competition.

No doubt that the choice of China was a right choice, because the credentials of the Chinese colleagues were of the highest level: great degree of innovation, especially in synthesis and modification, great competence in catalysis and characterization, many research teams in zeolite (*lato sensu*) science and technology were or were growing in several Chinese universities and research centers, such as the Chinese Academy of Sciences (see the box at the end of the chapter). But the choice of China was also a winning choice, because the Beijing Conference was a well organized successful event either from a scientific or from a social point of view. Participants had, in addition, a unique opportunity to approach the ancient Chinese culture: surely they will remember for long the 15th IZC and will benefit from it.

SCIENTIFIC NOTES[2,3]

Five Plenary Lectures were given at the Conference. Here are the relevant titles and lecturers*: "Overview of zeolite synthesis strategies*" (S. T. Wilson), "*Designed open-structure heterogeneous catalysts for the synthesis of fine chemicals and pharmaceuticals*" (J. M. Thomas), "*Tuning functionality and morphology of periodic mesoporous materials*" (T. Bein), "*Recent progress in the development of zeolitic catalysts for the petroleum refining and petrochemical manufacturing industries*" (T. F. Degnan, Jr.), "*Metal-organic frameworks: the young child of the porous solids family*" (G. Férey).



The Invited Lectures of the Barrer Symposium had either a historical valence, e.g., "*Contributions of R. M. Barrer to zeolite synthesis"* (D. E. W. Vaughan) or just took inspiration from the Barrer's research to treat subject of present interest, e.g., "*Zeolite membranes – from Barrer's vision to technical applications: new concepts in zeolite membrane R&D*" (J. Caro), "*Ion exchange equilibria and kinetics in zeolites: influences of framework flexibility and charge density*" (E. N. Cocker), "*Molecular simulations of the adsorption and diffusion of hydrocarbons in molecular sieves*" (B. Smit). As concerns the Key-note Lectures, they were given by the chairs of the twelve Program Sub-Committees, highlighting the major advancements in the specific subjects of zeolite science and technology.

The diagram above, reporting the distribution of the various themes of the Conference,[4] because of the remarkable fragmentation in a plenty of sub-subjects, does not allow an easy evaluation of the "weight" of the conventional macro-areas. It is evident, however, the strong presence of three key "historical" themes, such as catalysis, synthesis and adsorption. In addition, it is interesting the inclusion in the program of topics on innovative materials such as mesostructured and MOF materials.

Given the great deal of contributions, which were presented and discussed during the conference, it is not possible to review any particular presentation or give an account on the specific themes and sub-themes.

IZA Business

The General Meeting of the International Zeolite Association was held on Thursday, August 16. Reports were presented by the IZA officers and the Chairmen of the five IZA Commissions. A report on his activities as IZA Ambassador in the last three years was also presented by Paul Ratnasami.

President Fajula gives O. Terasaki, L. McCusker and Ch. Baerlocher the Breck Award.

Oriental arts and show during the Banquet.

Osamu Terasaki (Stockholm University, Sweden), Lynne McCusker and Christian Baerlocher (ETH Zurich, Switzerland) were the recipients of the tenth edition of the Breck Award for their outstanding contribution to the structural elucidation of inorganic molecular sieves.

Giuseppe Bellussi, Italy, was the winner of the IZA Award for his seminal contribution to the development of zeolite science and use in industrial catalytic processes.

After vote the composition of the new Council was as follows: F. Fajula (*President*), M. He (*Vice-president*), M. Anderson (*Secretary*), S. Wilson (*Treasurer*), J. Cejka, G. Centi, A. Corma, S. Ernst, G. Ferey, I. Ivanova, S. Qiu, B. Su, K.-B. Yoon, D. Zhao.

The General Assembly voted also to select place and organizer for the 17th IZC in 2013. The selected place was Moscow under the chairmanship of I. Ivanova.

SOCIAL EVENTS

A Welcome Reception was held on Sunday evening, August 12, in the Gran Banquet Hall at the Jiuhua International Convention & Exhibition Center Hotel of Beijing.

According to the IZC's custom, Wednesday afternoon and evening, August 15, were devoted to excursion. In consisted in a visit to the scenic Summer Palace, in downtown Beijing. At the end, a dinner, based on Chinese cuisine, was offered in a typical restaurant.

The Conference Banquet was held on Thursday night, August 16, in the Gran Banquet Hall at the Jiuhua International Convention & Exhibition Center Hotel of Beijing. The Banquet was cheered up by a spectacular oriental arts and entertainment show. During the banquet the Breck Award and the IZA Award were delivered.

An Accompanying Persons Program was also provided.

PRE-CONFERENCE SCHOOL ON ZEOLITES

The eight edition of the Pre-Conference School on Zeolites, titled "*Porous materials in processes*" was held in the Conference Hall of Bio-Engineering Building, Dalian Institute of Chemical Physics (DICP), 8–11 August 2007, under the co-chairmanship of Xinhe Bao, Jens Weitkamp, Ruren Xu and Baoning Zong. Dalian is a coastal city located some 840 km E of Beijing.

Participants, coming from 13 countries, were 79. Lectures were given by Michael O'Keeffe, Petra E. de Jongh, Hayim Abrevaya, Jens Weitkamp, Valentin Valtchev, Peng Wu, Ulrich Mueller, Clare P. Grey and Sheng Dai**.**

The invited lectures focused on advanced porous materials, on their characterization and in applications, mostly in catalysis. Sufficient time was given for discussion after each presentation.

Great care was taken of socialization to favour exchange of ideas. An excursion along the Binhai Beach Road was made on Friday, August 10, followed by a Banquet at Dalian Liangyun Hotel (Toast Speaker was the DICP Director Tao Zhang), and a night sightseeing around Dalian downtown area.

ACKNOWLEDGMENTS

Ruren Xu is gratefully acknowledged for providing photographs and statistical data on the Conference.

REFERENCES AND NOTES

[1] Originally a Post-Conference Field Trip was scheduled to enable those interested to visit natural zeolite minerals and/or zeolite manufacturers in China. Three optional trip destinations were considered for the conference participants and accompanying persons to choose. These destinations included Xi'an, Shanghai/ Hangzhou and Yunnan Province. Responsible for the organization were Naijia Guan and Jun Fu. The trip was then cancelled for lack of interest. In place of Field Trip a Post-Conference Forum on "*The future perspective of zeolite synthesis*" was organized at Jilin University in Changchum. The organizers were A. Corma, S. Qiu and J. Yu. About 70 participants took part in the meeting, focused on discussion of the recent achievements in synthesis of zeolites and related materials and their perspectives. The speakers included S. T. Wilson, J. Čeika, K. Strohmaier, M. Anderson, F. Schüth, C. Kirschhock, O. Terasaki, G. Ferey, J. Yu, D. Wragg, M. O'Keefe and B. Slater. The Forum ended up with a round table discussion governed by A. Corma.

[2] J. Čeika, Meeting report, *Microporous and Mesoporous Materials* **107** (2008) I-II.

[3] D. Caputo and F. Pepe, *Bollettino AIZ* (Italian Zeolite Association) **31** (2008) 41-45 (in Italian).

[4] Statistics have been restricted to the papers published in the Proceedings.

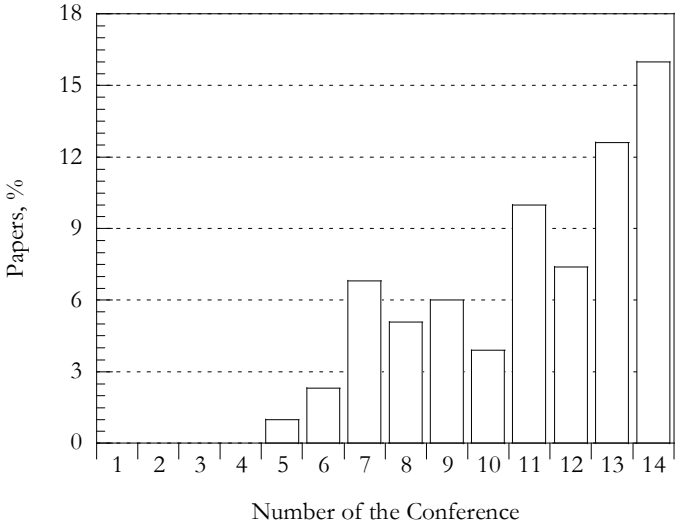
[5] C. Colella, *Bollettino AIZ* (Bulletin of the Italian Zeolite Association), **23** (2004) 5-9 (the reported text, translated from Italian, is the central part of the Editorial).

East wind[5]

[Impact of Chinese research on zeolites in scientific literature]

……..

Primarily I have examined the Conference Proceedings. I have obviously limited my attention to the International Conferences, organized under the auspices of IZA (also because the absence of Chinese colleagues in natural zeolites conferences persists to date). I have considered only research carried out wholly or at least partially in China, neglecting occasional cooperation of single researchers, such as PhD students and post-Docs, in departments and Institutions of the western countries.
The results are summarized in the following figure.



Legend: 1, London, 1967; 2, Worcester, 1970; 3, Zurich, 1973; 4, Chicago, 1977; 5, Naples, 1980; 6, Reno, 1983; 7, Tokyo, 1986; 8, Amsterdam, 1989; 9, Montreal, 1992; 10, Garmisch-Partenkirchen, 1994; 11, Seoul, 1996; 12, Baltimore, 1998; 13, Montpellier, 2001; 14, Cape Town, 2004

No contributions of Chinese colleagues were presented until the 5th Conference in Naples, where one paper coming from the Jilin University (Changchun) on the ion exchange mechanisms was submitted and accepted. The situation changed in a few years, so much so that in Tokyo (7th Conference) the papers become nine in the sectors of synthesis, modification, adsorption/diffusion and catalysis. The conspicuous participation has certainly been favoured by the proximity of the Conference site; a similar occurrence will be observed for the 11th Conference in Seoul. As for the rest, the diagram shows a substantially continuous increment with the only exception of Garmisch (10th Conference), where a decrement respect to the three precedent meetings is observed. At the last Conference of Cape Town the Chinese papers were over 16% of the total.

The universities more frequently appeared are Beijing, Dalian, Changchun (Jilin), Nanjing and Shanghai. Well represented are also the universities of Wuhan, Taiyuan, Tsinghua and the various seats of the Chinese Academy of Sciences. The research theses are mostly focused on synthesis (and connected modification), in which the Chinese colleagues have reached a degree of innovation beyond comparison in the world, which is not limited to the microporous materials in more classic sense, but ranges over classes of compounds, sometimes absolutely new. Remarkable are also the papers in the fields of characterization and catalysis, rare those in the fields of adsorption, diffusion and modeling. Papers on structure are completely missing; it is apparent the care of the scientific bases of research, more than the technological aspects. Modern are the investigation techniques, absolutely of the same level of those of the most advanced western countries.

Not different the situation as regards papers published in *Microporous and Mesoporous Materials*, a seat more convincing and warranted, because it is exempt from possible conditioning connected to the necessity to balance the books. In this case, for the sake of brevity, analysis has been limited to the first complete year of the journal, 1995, and to that of ten years later (2004). In the former case only one Chinese paper ("naturally" in the synthesis sector) is present, out of 106 published papers; in the latter case the values obtained definitely compare with those of the latest Conference (Cape Town), namely the Chinese papers are some 16% of the total. Also the frequency of the themes and of the most represented universities is comparable.

……..

APPENDIX

Lectures given at the Memorial Symposium
held on the occasion
of the Birthday Centennial of

Richard Maling Barrer
(1910-1996)

Key dates and highlights in the life and achievements of R. M. Barrer

Carmine Colella
Department of Materials and Production Engineering
Federico II University, Naples, Italy
carmine.colella@unina.it

Introduction

Richard M. Barrer, the founding father of zeolite chemistry, was born exactly one hundred years ago in Wellington, New Zealand, and died at age 86 in Chislehurst, Kent, U.K.

His biography, due to his former student L.V.C. Rees, has been published in several places with different degrees of details.[1,2] Therefore it will not be recalled in this account, which aspires to remark some important periods of his life and a few of his many achievements, also with the help of an extensive photographic survey.

Barrer's life can be roughly divided in three main periods: the youth (up to 1932), passed in New Zealand, the mean age (1932-1954) lived in U.K., where he completed his studies and began his academic career in different universities, and the maturity (from 1954), spent in London at the Imperial College until retirement (1976) and over.

The youth

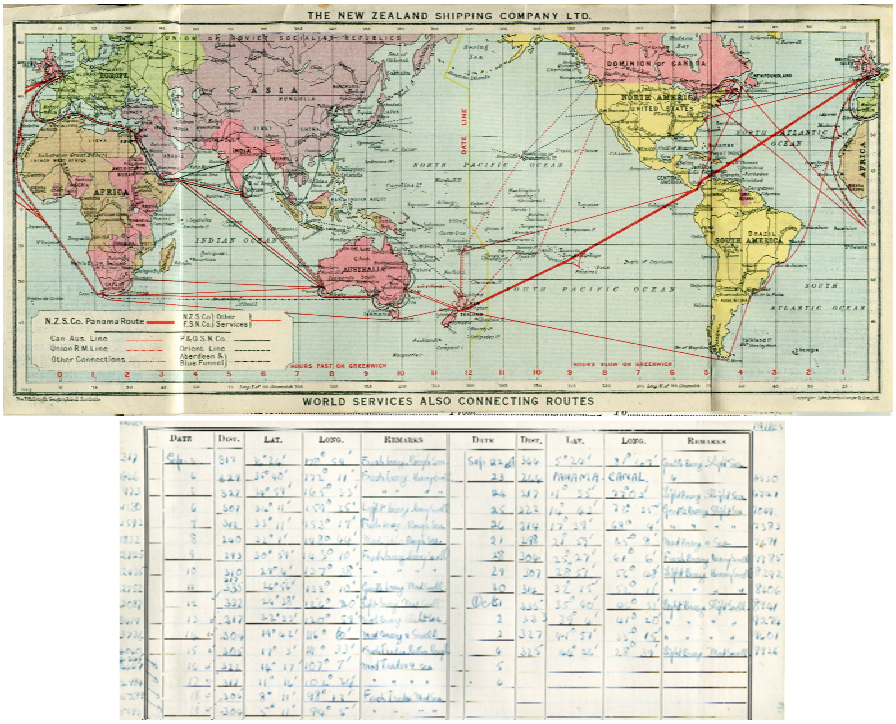
"*Our youngest days were lived happily on our farm 'The Lowlands', which consisted of about 4000 acres of pastoral country. Its hill, valleys and streams and the splendid sweep of the land, climbing slowly towards the greatest of many hills, The Taipos, remain clearly in one's 'inward eye'…The nearest town, Masterton, was about 30 miles distant…During this early period schooling was provided by my Mother, who before her marriage in 1904, had been a teacher. Distances were too great to run a community school…*". These are a few sentences of a short autobiography RMB wrote on the first years he passed in his native country. When in 1919 the family came to live in Masterton, the young boy began to attend the local school. Successively, he went to Wiararapa high School (1923) and lastly to University of New Zealand (Canterbury College) in 1928, where he graduated in 1931 with B.Sc. in Mathematics, Physics and

Chemistry; then he proceed with a M.Sc., specialising in Physical Chemistry in 1932.

"*The years of the Canterbury College, 1928 to 1932, overlapped with the major post-was recession of world-wide extent, but were nevertheless extremely happy ones. Cross-country and track running were among one's relaxations and led to wins in the 3-miles track event in the inter-Collegiate university of New Zealand combined sports, once in Dunedin and once in Wellington; and two wins in the Canterbury provincial cross-country championship*". This is the first indication of his passion for sport that would have accompanied him for all the life.

In 1932 he was successful in obtaining the 1851 Exhibition Scholarship, which allowed him to study for a higher degree in Cambridge University, England.

3rd September 1932: R.MB left New Zealand to go to Clare College, Cambridge on the R.M.S. Rangitata from Aukland to London via the Panama Canal.



Map showing the route that RMB took and also a log that he kept of his journey.

The mean age

In Cambridge RMB joined the famous Sir Eric Rideal's Colloid Science Laboratory. Here, as a result of reading McBain's "*Sorption of Gases by Solids*", he be-

came highly interested in the sorption of gases in zeolites, mainly chabazite, giving rise with his studies to the birth of one of the most significant new fields of research in the 20th century.
He gained his Ph.D. in Cambridge in 1935.

Receiving Ph.D., June 22, 1935.

Competing in athletics, 1935.

Outside the laboratory RMB continued to engage himself in sport, showing great talent at athletics. He won the Oxford-Cambridge cross-country race in 1934 and the British Universities Athletic Union cross-country championship for 1935, becoming a serious contender in the selection for the 10,000 metres race in the 1936 Olympic Games in Berlin. He was not selected, but went there. He was, in fact, very fond of travelling. During the period of his stay at the Clare College (1932-1939), he visited many countries in Europe (Switzerland, Austria, Germany, France, Italy, Belgium, The Netherlands and Norway). In 1938 he came back to New Zealand to visit his parents. There he met and became engaged to Helen Yule (they got married in 1939). During his way back to England, he visited Sidney (Australia), Bombay (India), Aden, Sudan and Khartoum, Port Said and Suez Canal.

Another passion of the young man was sketching. He was quite a good artist and used to sketch when he had time. He tested himself also as writer: during the youth he wrote a number of short stories having as subject science fiction.

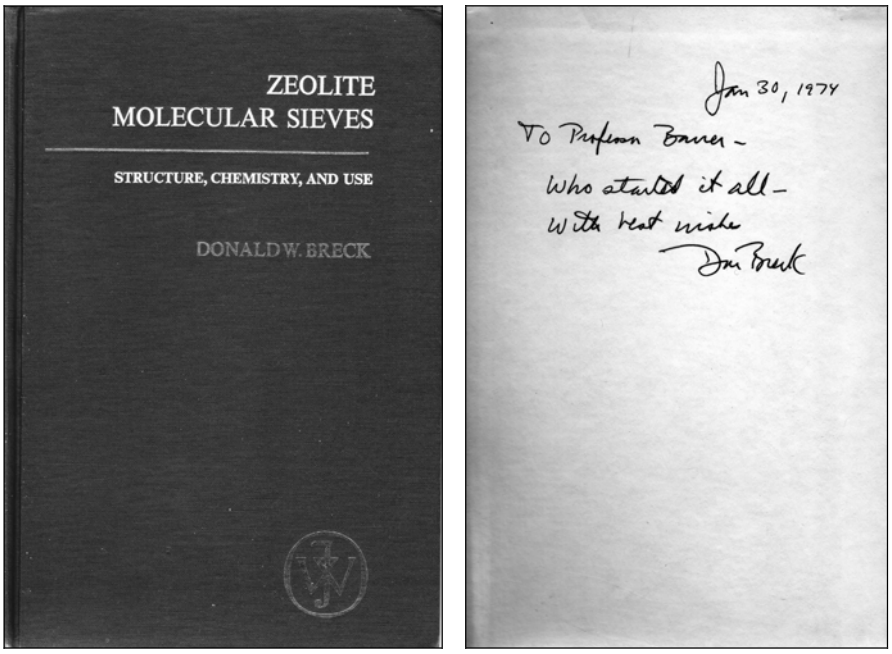
Sketch made by RMB in a typical style of the 1930s (Oct. 1934).

Steps in the career (and in honours) in this period include:

- D.Sc.(New Zealand) in 1937,
- Sc.D.(Cambridge) in 1948,
- Fellow of the Royal Society in 1956 and an Honorary Fellow of the Royal Society of New Zealand in 1965,
- Research Fellow, Clare College, Cambridge (1937-39),
- Head of Chemistry at Bradford Technical College (1939-46),
- Reader in Chemistry, Bedford College, University of London (1946-48),
- Chair of Chemistry and Head of Department, University of Aberdeen (1948-54).

From a scientific point of view, this was a very fruitful period. His initial studies, published in the Proceedings of the Royal Society in 1938, confirmed the molecular sieving properties of zeolites and gave rise to a very productive research line. In the following 15 years, notwithstanding the difficulties of carrying out research during the Second World War, he published some 35 papers on the sorption and catalytic properties of zeolites. He was also able to synthesize a number of synthetic phases, to modify them by ion exchange, demonstrating that they could become extremely strong, environmentally friendly, solid acid catalysts with shape-selective properties. RMB was the first to perceive the usefulness of these materials in many applications. These studies led

to the development of the industrial production of these materials by Union Carbide and the Mobil Corporation, USA in the late 1950s and early 1960s.
The importance of these pioneering studies was witnessed some twenty years later by Donald W. Breck in the dedication to RMB of his book on zeolites.

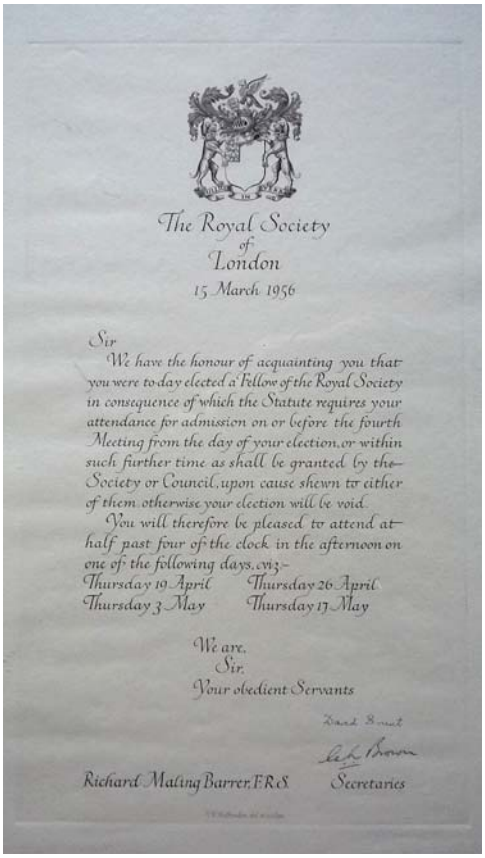


D.W. Breck's dedication to RMB of his book *Zeolite Molecular Sieves* (1974).

The maturity

In 1954 RMB became Professor of Physical Chemistry at Imperial College of-Science and Technology, London. Two years later he was elected Head of the Chemistry Department, an office he would have kept until his retirement. During his headship of the Department he had Sir Derek Barton and the late Sir Geoffrey Wilkinson as Professors of Organic and Inorganic Chemistry, respectively, both Nobel Laureates: surely he chaired one of the most powerful Chemistry departments in the world. He himself was nominated for the Nobel Prize on several occasions, certainly once in 1977[3] and in 1996, in the year of his death when he had very strong support from many distinguished Swedish scientists.
In 1956 RMB was elected Fellow of the Royal Society and thereafter, in the next forty years he collected a series of honours, memberships, honoris causa

degrees and others, e.g., just before retirement, the Honorary Presidency of the International Zeolite Association (1994).
He never stopped doing science and continued working until retirement and over, guiding tens of students and associates, coming from all over the world. He attended regularly Conferences on zeolites and surface chemistry and was invited to give lectures until the eighties and over. He was beloved by his former pupils, who celebrated him in various occasions, e.g., in his birthdays.
During the years he continued to cultivate his passions for sport (tennis, table-tennis), gardening and reading.



The Royal Society
of
London
15 March 1956

Sir
We have the honour of acquainting you that you were to-day elected a Fellow of the Royal Society in consequence of which the Statute requires your attendance for admission on or before the fourth Meeting from the day of your election, or within such further time as shall be granted by the Society or Council, upon cause shewn to either of them, otherwise your election will be void.
You will therefore be pleased to attend at half past four of the clock in the afternoon on one of the following days, viz:–
Thursday 19 April Thursday 26 April
Thursday 3 May Thursday 17 May

We are,
Sir,
Your obedient Servants

Richard Mating Barrer, F.R.S. Secretaries

1956: Fellow of the Royal Society

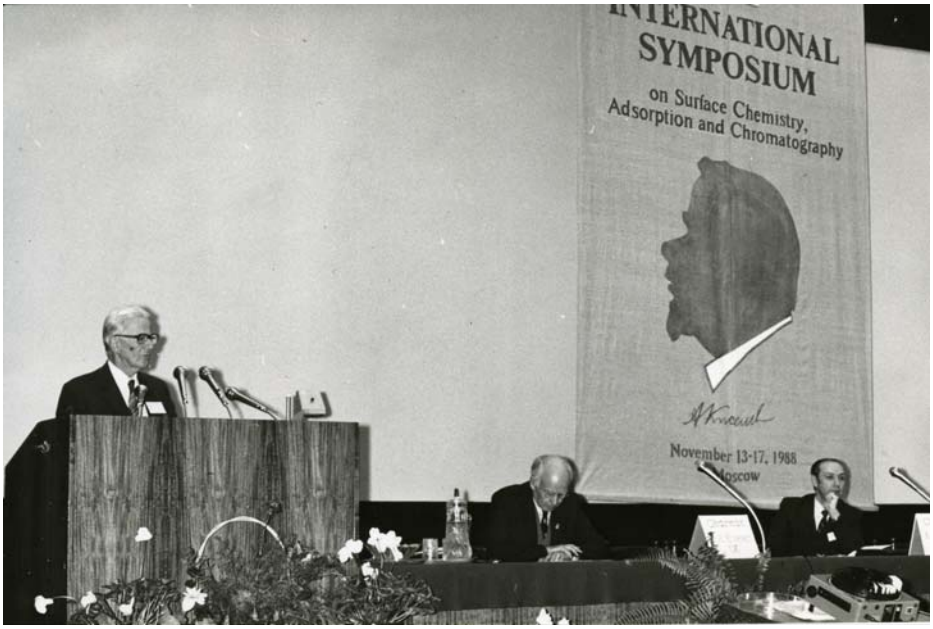
1994: Hon. President of IZA

According to D.E.W. Vaughan,[4] one of his former students, "*Barrer had the key attributes of a successful research manager, an excellent teacher and enthusiasm for the research, a willingness to 'walk around', a tolerance for discussion and debate and a 'fairness' in*

his judgements. He delegated much of the routine administration of the Department and usually managed to visit most of his laboratories every day. The reply to this standard greetings of 'anything new?' could result in anything from a thirty second nicely to a two hour discussion or tutorial. Any indication that results were coming later in the day could trigger a second visit hours later. Material given to him one day was invariably returned the next, analyzed and notated, including whole theses. (The only exception to this behaviour was the 'Wimbledon Fortnight' when tennis took first priority). He cultivated and supervised, with a seemingly imperturbable authority, a multicultural research group that mixed different approaches to almost everything, including science. He was always well aware of industrial trends and problems and consulted for long period with Union Carbide, Grace-Davison and Exxon".

Acknowledgements

I wish to give my hearty thanks to Alison Davies and Chris Schwob, two of Professor Barrer's daughters, and Craig Williams for the abundant material on RMB made available.



RMB gives an Invited Lecture in a Symposium celebrating A.V. Kiselev (1988).

RMB celebrates his 80th birthday with his wife Helen and some of his former pupils.

Playing tennis at 80.

Gardening.

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[3] In 1977 his name was suggested by D. Gabor, Professor of Applied Physics at Imperial College, and he himself Nobel Laureate in Physics in 1971 for his invention and development of the holographic method.

[4] D.E.W. Vaughan, IZA Newsletter No. 7, May 1998.

Contributions of R. M. Barrer to Zeolite synthesis and modification

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It is always difficult to summarize in a few lines the importance of the scientific work of a great scientist such as Professor Richard Maling Barrer, nominated for the Nobel Prize in Chemistry on five occasions, even though limiting the subject only to zeolite synthesis and modification.
In this short commemoration I will rapidly go through the history of his activities in zeolite synthesis and susequentlyI will recall the memory of the great experience I lived during my stay in Professor Barrer's laboratory at the Imperial College more than 40 years ago.
As David Vaughan mentioned in his nice revue[1] of Professor Barrer's work in occasion of the International Zeolite Conference held in Baltimore in 1998 , the interest of Professor Barrer (who was essentially a physical chemist primarily interested in sorption and diffusion) in zeolite synthesis was initially connected with the need of pure and reproducible materials for his sorption researches but, nevertheless, progressively developed into an independent and important research field.
In the early 1940's, in fact, he recognized that an effective program to evaluate zeolite properties and applications would have required a supporting materials synthesis program to provide well characterized, high purity reproducible zeolites and
while working with chabazite for iso/normal paraffin separations in 1942, he realized that effective utilization would have required a synthetic product.
Barrer's initial synthesis activities in that period referred to the use of different mineral raw materials, such as analcime and bentonite, with concentrated basic salts. In this way he synthesized, in reactions of analcime with barium and potassium salts solutions, a new zeolite having the KFI structure. After extracting the excess salt he obtained a zeolite showing similar molecular sieve properties to chabazite.

Subsequently, systematic experiments with alkali and alkali earth hydroxides with these mineral reactants produced several known zeolites such as sodalite, cancrinite and phillipsite showing particular interest in the specific role of cations in structure direction.

Particularly interesting were metakaolin reactions[2-5] in NaOH, KOH and TMAOH systems producing various zeolites, particularly offretite, erionite and "near" chabazite containing ABC sequence of 6-rings.

Through subsequent experiments, extended to low temperatures and with barium hydroxide and numerous mixed bases and based on the concept that nucleation and crystal growth of zeolites from aqueous aluminosilicate magmas in presence of more than one base can yield products which are not simply mixtures of those formed when the single bases are present, Professor Barrer produced many additional zeolite types including KFI, LTL (BaGL), MER, EDI, FAU(X), LTA, GME and ANA.[6-14]

In the late 1940's Barrer started experiments with colloidal silica and "freshly prepared" aluminium hydroxides systematically studying the four component reaction systems M_2O-SiO_2-Al_2O_3-H_2O (M=alkali or alkali earth) at different Si/Al and OH/Al ratios.

Then he gradually expanded the investigation, which lasted many decades and involved a great number of co-workers, to mixed alkali hydroxides and various methylammonium hydroxides instituting more extensive template syntheses programs in which I had the honour of being part.[15]

First of all Professor Barrer showed that varieties of zeolites, often silica-rich, can be made when organic bases such as tetramethylammonium hydroxide replace inorganic bases, particularly evident in the case of sodalite. In fact, the greater the cation fraction of MeN^+ cations, the richer the crystals are in silica, so that this cation specifically promotes isomorphous replacement: M^{I}, $Al^{III} \rightarrow Si^{IV}$.

The products of these studies also included synthetic epistilbite and yugawaralite, synthetically reproduced for the first time, the Na-TMA zeolite omega (whose structure was successively identified as the counterpart of natural mazzite), in addition to two new zeolites now known as ABW (a Li-A) and EAB (TMA-E), together with an unfaulted K-TMA offretite.

Particularly interesting was the study of the co-crystallization and intergrowth between erionite and offretite he carried out in the course of a few years with many co-workers.[16]

Among the other things, with the aid of the little sophisticated techniques of that time, such as essentially X-ray powder diffraction with a Guinier camera, chemical analysis, electron microscopy and diffraction, TGA and DTA, together with sorption experiments, he managed to reach a series of important conclusions on the specific

role of both organic and inorganic cations in the growth of the zeolite framework and on the relative location of the various cations, which later on, turned to be exact when the various structures were solved.

Professor Barrer also showed great interest in isomorphous substitution[17] and his experiments started at the end of the 1950's with an investigation on the substitution of gallium for aluminium in zeolites FAU, LTA and THO (an analogue of thomsonite) and germanium for silicon in FAU, LTA, GIS and THO.

Another research area where he focused his attention throughout his whole carrier was that of post-synthesis modifications, starting from the 1950' when he was the first to make hydrogen form of zeolites via ammonium exchange[18,19] to make materials with significantly enhanced sorption properties. He also utilized fusion exchange techniques as a means to exchange cations, otherwise difficult to exchange, such as Ag^{+} and Ba^{2+} using their low melting temperature salts. This removal technique of the blocking salt molecules by water extraction is now used as a general method to enhance sorption capacity in zeolites containing excess cations.

Professor Barrer was also the first, in the mid 1960's, to investigate dealumination of zeolites in order to significantly change their properties.[20] Acid extraction of clinoptilolite increased the Si/Al ratio markedly enhancing its sorption properties without destroying its structural integrity. Subsequently, at the end of the 1970's, he also proposed aluminium extraction from the lattice by hydroxylation. Silanation after dealumination has also demonstrated to be an effective method to enhance structural stability[21] and to modify pore structure.[22,23] These techniques continue to be used routinely in the preparation of higher silica zeolites.

In conclusion, the contribution of Professor Barrer to zeolite synthesis has been enormous and above all pioneeristic. Many of his developments were made far ahead of their time and took many years to be recognized by researchers working in this field.

Concerning my personal experience at the Imperial College, my stay in Professor Barrer's laboratory was between October 1968 and November 1969 utilizing a scholarship obtained from the Italian Company ENI by my Director of that time at the Naples University, Professor Sersale.

My memory of the first conversation with Professor Barrer, after I walked in his huge office at the Imperial College, was his low tone of voice. When I later asked one of the researchers in the lab why Professor Barrer talked so low, he replied that people who have interesting things to say don't need to talk loud because everybody is all ears to understand what he says.

Professor Barrer asked me about my previous experience in zeolite synthesis and told me about his already mentioned extensive template synthesis program, quite innovative at that time. The specific research plan he chose for me

concerned the systematic investigation of some crystallization fields from systems in which the bases were mixtures of sodium, potassium and tetramethylammonium hydroxides, in pairs or all together.

I was then assigned a lab in the second floor of the old building of the Imperial College and I still remember the particular sensation of being at the centre of the world because in the other rooms there were young researchers coming from all countries.

Working in zeolite synthesis at that time was quite different and tiring from now. For example amorphous aluminium hydroxide had to be freshly prepared from time to time by the action of water on lightly amalgamated aluminium foil.

Even though Professor Barrer was the Head of one of the largest chemistry departments in the world, every day, early in the afternoon, he used to visit all the labs to be informed on the state of the work asking the question which became famous: "Any results?".

During my stay he published three papers with me as co-worker and I was envied by the other researchers of the lab because my name, beginning with the letter A, in the list of the authors, strictly alphabetical, preceded the name of Professor Barrer.

In particular the first paper[15] dealt with the already mentioned zeolite crystallization in the presence of mixed bases, including tetramethylammoniun hydroxide. Among the others it described the synthesis of a Na-TMA-erionite whose structure was successively solved and appeared in the Atlas of Zeolite Framework Types as EAB, where AB stands for Aiello and Barrer. The paper also reported the synthesis of an unfaulted K-TMA-offretite whose molecule sieving in relation to cation type and position was later published in a second paper.[24]

The third paper dealt with the first stages of zeolite crystallization from clear solutions.[25]

After my return to Italy, in 1974, in occasion of my application for a Full Professor position, Professor Barrer wrote for me a very nice recommendation letter which, as I understood later, was much appreciated by the Commission.

In 1994 many of us, who were at the Imperial College at the end of the 1960's, reunited in London for what we called the 25th anniversary of the Barrer Research Group.

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Richard M. Barrer: A commentary on his contributions to the field of ion exchange in zeolites

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Introduction

Richard Barrer's contributions to our understanding of the phenomenon of ion exchange in zeolites are too numerous to do them justice in this short biographical essay; a few highlights (in the author's opinion) will be discussed here. His primary interest throughout his long and fruitful career was in the field of adsorption; work which he had begun in the 1930s at Cambridge University. His research into ion exchange began a little later, as a means to better understand and control sorption properties of zeolites. Barrer's first publications on ion exchange in the late 1940s to early 1950s, e.g., references [1,2], were concerned with the development of modified molecular sieve sorbents, and ion sieves. He noted that a better understanding of ion exchange in zeolites was needed, since previous studies (summarized in his 1950 seminal article) were fragmentary. Lovat V.C. Rees was one of Richard Barrer's long-time co-workers in the field of ion exchange, and their first collaborative publications on ion exchange appeared in the early 1960s, describing the kinetics of self-diffusion (that is, cation A in the zeolite exchanging with cation A in solution) and exchange diffusion (cation A in the zeolite exchanging with cation B in solution).[3,4] A separate joint publication at that time was the first to explore direct measurement of ion exchange thermochemical processes through calorimetry, allowing the enthalpies and entropies of exchange of various mono- and di-valent cations to be determined for zeolite A.[5] This latter work was perhaps one of Barrer's most influential papers in the field of ion exchange as the $2Na^{+} \leftrightarrow Ca^{2+}$ exchange properties described in that paper opened the door for the widespread use of zeolites as builders in laundry detergents. Some one million tons per annum of zeolites are now used as builders in detergents across the world. Zeolite A was introduced as the environmentally friendly replacement for phosphates in detergents in the 1970's.

Direct proton exchange into zeolites invariably led to framework hydrolysis and decomposition, hampering efforts to prepare acidic zeolites. Barrer was the first to report, in 1949,[6] the preparation of hydrogen-zeolites as strong acid catalysts by bathing the parent zeolite in ammonium chloride vapors at 300 °C for extended periods, followed by oxygen treatment at 350 °C. This discovery was central to the development of zeolites as hetereogeneous catalysts via the now ubiquitous ammonium exchange – thermal decomposition process.

Barrer's research papers on ion exchange contain not only impeccably detailed experimental data, but also a large component of theory to back up and corroborate the data; many groundbreaking theoretical developments, which have enabled the ion exchange community to better understand the reactions they study, were first introduced in these publications.

Several key developments pioneered by Barrer will be discussed, including the application of dielectric theory to interpret the measured enthalpies of exchange between ions, the physical significance of the appearance of hysteresis loops in certain ion exchange reactions, the deconvolution of sigmoidal ion exchange isotherms to account for the presence of different types of ion exchange site within the crystal, and the development of a statistical thermodynamic depiction of observed ion exchange reactions.

Dielectric theory

Barrer and Falconer[7] interpreted heats of exchange in terms of dielectric theory, regarding the exchange reaction to involve interchange of ions between two dielectric media which are otherwise inert. This analysis enabled the standard Gibbs Free Energy of an exchange reaction to be determined based upon the permittivity of the systems containing the two exchanging ions in the two exchange media. Barrer said in conclusion about this theory "Future interest will lie, *inter alia*, in the experimental evaluation of exchange energies for comparison with the predictions of this theory. It should enable prediction of the direction of shifts in exchange equilibrium with temperature and should indicate when appreciable shifts will occur." Over the next decade and a half the dielectric theory was refined and elaborated upon in several publications from Barrer's research group, e.g., references [8,9,10].

Limited mutual miscibility of ion exchange end-members

All zeolite structures exhibit some degree of flexibility as evidenced by, for instance, the sorption of molecules whose maximum diameters exceed the nominal pore openings of the zeolite.[11,12] Distortion of the zeolite framework is necessary to allow passage of the sorbate into the channels. This flexibility allows different cation-exchanged forms of a given zeolite to adopt different symmetries and unit cell sizes, depending upon the rigidity of the framework,

the sizes of the cations, the strength of the interaction of the cations with the framework and the degree of hydration. The differing symmetries of the two exchange end-members may give rise to exchange isotherms which exhibit increasing selectivity for the ingoing cation as exchange proceeds. In some instances the forward and reverse exchange branches coincide despite the unusual contour of the isotherm, while in others a hysteresis gap opens up between the forward and reverse exchange branches. [In an ion exchange isotherm where framework symmetry changes and cation clustering are not significant, selectivity for the ingoing cation *decreases*, or is invariant as exchange proceeds, and hysteresis is not observed.] Barrer published numerous ion exchange isotherms which exhibited hysteresis between the forward and reverse exchange branches, and he was instrumental in developing a theoretical picture of these exchange processes. For example, hysteretic isotherms have been reported for $Na^+ \leftrightarrow K^+$ and $K^+ \leftrightarrow Rb^+$ in analcime,[7,13] $Na^+ \leftrightarrow Ag^+$ and $Li^+ \leftrightarrow Ag^+$ in cancrinite, [7] and $Na^+ \leftrightarrow K^+$ and $Na^+ \leftrightarrow Li^+$ in zeolite F.[14] One particularly flexible structure is the gismondine-type zeolite P which is known to convert between three symmetries (cubic, tetragonal, orthorhombic), depending on hydration [15,16] and cation content.[17] For example, zeolite P readily changes symmetry from pseudo-cubic to pseudo-tetragonal on replacing Na^+ by K^+ cations. The symmetry change is accompanied by a contraction of the unit cell, associated with the lower degree of hydration of the K-form. The $Na^+ \leftrightarrow K^+$ isotherm is reversible (i.e., without hysteresis), but has an unusual contour exhibiting increasing selectivity for K^+ as the fraction of K^+ in the solid phase increases. This phenomenon is due to the decline in the energy of interaction between Na^+ and the framework as the latter contracts and sheds water molecules and due to preferential clustering of K^+ in the solid phase. Despite the differing unit cell sizes and symmetries of the pure Na- and K-forms of zeolite P, they are fully miscible, and hysteresis does not arise. X-ray diffraction showed the cubic structure alone to exist until ~ 10% of the Na^+ had been replaced by K^+, after which the tetragonal phase alone was detected, with unit cell parameters changing gradually with K^+-content. In the case of $Na \leftrightarrow Li$ exchange, cubic – tetragonal conversion also occurred, however, the cubic and tetragonal phases *co-existed* up to $Li_z = 0.17$ (i.e., 17% exchange of Li^+ for Na^+ in the zeolite), during which range the selectivity for Li^+ increased. Above $Li_z = 0.17$, only the tetragonal phase was detected by X-ray diffraction, and selectivity decreased with increasing Li^+-content. By contrast, a beryllophophate analogue of zeolite P was later observed to show extremely broad hysteresis loops for $Na^+ \leftrightarrow K^+$.[18] Even at $K_z < 0.01$, the presence of two immiscible solids was evident from the hysteresis loop, and it was only at $K_Z \sim 0.95$ that the forward and reverse exchange branches re-combined. Similar results were observed for $Na^+ \leftrightarrow NH_4^+$ exchange with the P-type beryllophosphate.

Hysteresis in an ion exchange isotherm measured under equilibrium conditions is due to the growth of one cationic form of the zeolite in or on another cationic form. Thus in the exchange of cation A by cation B, as the concentration of B in the crystal grows, the B cations begin to cluster and nuclei of a B-rich phase form and grow into crystallites on or in the A-rich matrix. According to the phase rule, the two co-existing solid phases should be in thermodynamic equilibrium with a solution of one distinct composition only.[19] Therefore the forward and reverse branches of the isotherm should coincide. However, the delay of the rearrangement of the framework from one symmetry to the other by the interfacial and strain free-energies, as described below, allows the original framework to persist until it becomes supersaturated to a certain level with respect to the entering ion. Barrer put forward the following description of the thermodynamics behind the hysteresis effect. The free-energy of formation of the biphasic zeolite containing one mole of cationic charges, Δg, is described by Eq. 4, where ΔG_1 is the free-energy difference which would arise between those amounts of separated A-rich and B-rich phases, i is the number of cationic charges in the nucleus, N_o is Avogadro's number and Δg_σ and Δg_s are the interfacial and strain free-energy terms associated with the formation of the nucleus of the B-rich phase in or on an A-rich matrix.

$$\Delta g = \frac{i\Delta G_1}{N_0} + \Delta g_\sigma + \Delta g_s$$

For a fixed concentration of solution, where the bulk B-rich phase would be more stable than the A-rich phase, $i\Delta G_1/N_0$ would be negative; however, the term $(\Delta g_\sigma + \Delta g_s)$ is positive. As i increases, Δg is at first positive and increases until it reaches a maximum,[20] after which the negative term $i\Delta G_1/N_0$ becomes dominant and Δg decreases. After this maximum, therefore, the nucleus would grow spontaneously. Due to statistical size fluctuations, a certain flux of nuclei past the critical size is inevitable, followed by their spontaneous growth into crystallites. Hysteresis arises if the flux density of nuclei past the critical size is highly sensitive to the composition of the exchanging solution. This leads effectively to a concentration threshold below which the flux density of nuclei is negligible and above which it has a measurable value. For the growth of the B-rich phase in an A-rich matrix this threshold lies above that for thermodynamic equilibrium between solution and the A-rich and B-rich phases in bulk, because of the free-energy term $(\Delta g_\sigma + \Delta g_s)$. Likewise, for the growth of the A-rich phase in a B-rich matrix (reverse exchange reaction), the threshold concentration lies below that for the thermodynamic equilibrium between solution and bulk A-rich and B-rich phases. The exchange isotherm therefore will exhibit a hysteresis loop with the forward and reverse exchange branches lying approximately parallel with the solid phase composition axis.

Ion exchange site heterogeneity

Even before its structure had been solved, Barrer's interpretation of a highly sigmoidal isotherm for $Na^+ \leftrightarrow Cs^+$ exchange in zeolite K-F led to the assumption that the zeolite contained two types of exchange site in the proportions 0.64 (more selective) to 0.36 (less selective). The overall thermodynamic equilibrium constant calculated for the system based upon individual selectivity plots for the two types of sites was very close to that obtained from the direct integration of the combined selectivity plot (Gaines and Thomas approach), supporting their assumptions of site heterogeneity. When the structure was later solved by X-ray diffraction techniques, the structural inferences from ion exchange were proven.[21] Using a similar approach, the ion exchange isotherm of zeolite A with imbibed sodium aluminate was interpreted in terms of two types of exchange site.[22]

Statistical thermodynamic model of the ion exchange process

An approximate statistical thermodynamic description of observed ion exchange phenomena was developed by Barrer, which successfully explained uni-univalent exchange reactions in chabazite, cancrinite and faujasite. The model assigned an energy change when two entering cations (B) occupied adjacent sites, but the energy difference for two outgoing cations (A) in adjacent sites relative to A and B in adjacent sites was negligible. Furthermore, random ordering of cations on available sites was assumed. A later refinement of the model[23] removed the assumption of random ordering and allowed for exchange involving multi-valent cations, which gave rise to some differences in predictions made by the two theorems. Conditions under which continuous solid solubility of A- and B-rich frameworks could be expected were one of the key outputs from this statistical thermodynamic model.

In summary, Richard Barrer's immense contributions to the field of ion exchange in zeolites have had far-reaching consequences, including the replacement of undesirable phosphates in detergents with zeolites, the ability to tune adsorptive properties, and the modification of catalytic zeolites for specific commercial reactions.

Acknowledgements

Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the United States Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.

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Contributions of R. M. Barrer to zeolite sorption

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Introduction

Richard Barrer was a physical chemist with interests in materials synthesis and characterization, ion exchange and catalysis, but his primarily interested was diffusion and flow in solids. Indeed, his materials synthesis programs were a necessity as a source of reproducible materials for his sorption work. His early research with Eric Rideal in the Colloid Science Laboratory at Cambridge University (1932-39) focused on diffusion of gases in membranes - glasses, metals, carbons and organic polymers, particularly rubber. People in this period of the 1930s had the heavy memory of poison gas warfare during the First World War, and with the approaching fear of a new European war, the poison gas bombing of civilian populations was viewed with great trepidation. Research on selective molecular sorption was therefore an important national security issue at the time with the pending need to protect the whole population with gas-masks.[1] McBain's book[2] discussing the zeolite chabazite as a selective gas sorbent was his first introduction to zeolites. At that time the only samples were minerals found in the vesicular basaltic lavas in Northern Ireland, Isle of Skye in Scotland, Iceland and Nova Scotia. These included heulandite, stilbite, chabazite, mordenite, gmelinite and analcime, and were the initial subjects of his zeolite research. These early years were also a time of limited physical resources and many of his early papers were theoretical, with his thinking particularly focused on sorption and diffusion in porous media, as reflected in his first book "Diffusion in and through solids",[3] which included aspects of crystallization and ion exchange phenomena. Barrer's studies of sorption in porous materials can be divided into three separate areas – membranes, zeolites and clays. Within his research group these were distinct entities with little overlap and interaction between them. The last two subjects are reviewed in his book "Zeolites and clay minerals as sorbents and molecular sieves".[4]

Zeolite sorption

The developments in crystallography in the early 1930's by Taylor, Bragg and Wyart revealed the microporous structures of several zeolites and clearly stimulated Barrer's interest in these materials whilst still in Cambridge. His first paper surveyed the sorption properties of CHA, ANA, NAT and HEU for rare gases, nitrogen, hydrogen, ammonia and methane.[5] On becoming Head of the Chemistry Department at Bradford Technical College (now University) in 1939, he extended his zeolite work with particular focus on chabazite, showing that it could be used to separate n- from i-paraffins and aromatic hydrocarbons, and the issuance of the first patent on zeolitic n-paraffin separations from hydrocarbon mixtures.[6] He also had the foresight to include natural and synthetic zeolites in the claims, and observed that in experiments with olefins catalytic polymerization occurred with the formation of oils. Barrer subsequently supplied Shell Oil with samples of CHA to test as catalysts but their researcher (a Mr. Black) observed that they were not effective as they coked-up - a great opportunity in catalysis was lost! (This story was later confirmed by his student John Cole who looked up the research report in the Shell archives.) His first patent on the synthesis of zeolites (KFI, his zeolite P)[7] also prescribed methods for the regeneration of coked zeolites and the need to avoid structural degradation when doing so. He later returned to study the reactions of several halogenated hydrocarbons on CHA, noting different reactivities between the crystal interior and the external surface.[8]

His moves to Bradford, then to London (Bedford College,1946), followed by Head of the Chemistry Department at Aberdeen (1948), were opportunities to expand his membrane and zeolite research. The latter focusing on the higher sorption capacity CHA,[9] MOR and GME,[10] and his new "chabazite-like" zeolite (KFI),[11] defining the sorption energetics and kinetics of several gases in a variety of ion-exchanged forms. At this time he also demonstrated, using a geochemists approach successful with NAT,[12] that the H^+ forms, made via ammonium chloride vapor exchange, gave enhanced sorption capacities and kinetics for mineral CHA and MOR.[13] His reviews[14,15,16,17] also began to open the window on the novel molecular sieve properties of zeolites to a more general science audience.

Most of his research at this time focused on the systematic exploration of the relative energetics of cation-molecule interactions in CHA, MOR, GME and ANA, including the separations of hydrocarbons. A novel "twist" was to modify the cation heterogeneity centers by pre-sorbing strongly polar molecules (H_2O, NH_3), so significantly changing heats and rates of sorption.[18] His move to the Imperial College (1954) again expanded his program and the synthesis effort began to yield zeolite samples useful for sorption experiments, CHA

being the first,[19] and the emphasis moved to synthetic materials. As a consultant to Linde Air Products (later Union Carbide) he obtained synthetic samples of LTA and FAU and these too were rigorously studied with a range of sorbates.[20,21,22,23] Subsequent studies were conducted with several newly available zeolites, including LTL,[24,25] FER,[26] HEU and STI,[27] OFF,[28,29] MER.[30] and RHO.[31]

The availability of computers in the early 1960's facilitated attempt to selectively explain and predict molecule-host energetics using Lennard-Jones 12-6 calculations in well characterized zeolites. These included ammonia in FAU,[32] rare and permanent gases in MOR,[33] and rare gases in SOD[34] and cristobalite and tridymite.[35] The rare gas modeling matched experimental values quite well but the properties of dipolar and quadrupolar gases were far more difficult to predict.

A special area of interest was zeolite inclusion complexes formed during the sorption process, including clathration, metals (e.g. Pt, Pd, P, Hg, Ag, Na), halide and salt complexes, including those with exchanged cations, and reactive gas species. This work has been reviewed elsewhere.[36,37,38] Similarly the sorption properties of de-aluminated zeolites became of important as industry showed interest in high Si/Al ratio zeolites. Originally these were obtained by acid treatment[39] but silanation was a much more selective process, well demonstrated by materials based on MOR[40,41] and FAU.[42]

Membrane sorption

Membrane studies lasted throughout his career (literally from beginning to end), leaving a large body of experimental and theoretical studies, well recognized by his peers with the designation of the "barrer" as the unit of permeability. Parts have been reviewed by himself[43,44,45,46,47] and others,[48] in addition to a special edition of the Journal of Membrane Science issued in his honour.[49] His early experience with chabazite single crystal membranes showed that they cracked and fractured with progressive sorption and de-sorption cycles reflecting the unit cell expansion and contraction as a function of gas loading. His long standing negative view of pure zeolite membranes was off-set by his enthusiasm for polymer, carbon, polymer-zeolite[50] and carbon-zeolite[51] membranes which he strongly supported in consulting discussions.

Clay sorption

The U.K Agricultural Research Council supported major program on the properties of soil minerals in Barrer's laboratory. After the war he had also evaluated for the U.K. Government much of the synthesis research done in Germany during the war on quartz (used for oscillators) and micas (for

insulation), so that he was very familiar with clay minerals. His program covered synthesis and ion-exchange in addition to sorption properties, and had much in common with his parallel zeolite program. Indeed, his first paper on clays described sorption in the zeolite-like clays attapulgite and sepiolite.[52] Most of his sorption studies were on organic intercalated clays and micas, and he was most intrigued when, as a consultant with W.R. Grace and Company in the late 1970's, he was told of our development of Al_{13}-pillared montmorillonite.[53] His last research study was on fluorhectorite sorption.[54] Most of this work was reviewed in some of the last papers that Barrer published.[55,56]

Acknowledgements

The contributions of Richard Barrer to the field of sorption and separations, both experimentally and theoretically, are wide ranging and long lasting. His abilities as a research manager are reflected in the development and reputation of the Imperial College Chemistry Department during his twenty year tenure as Head of the Department. To my knowledge he was nominated for the Nobel Prize in Chemistry on five occasions. I had the privilege to work for him as a student, and with him as a consultee at W.R. Grace and Exxon from 1963 to his death in 1996. As a teacher, mentor and friend he had no equal.

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Printed in Italy
by De Frede
June 2010
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Stampato in Italia
da De Frede
Giugno 2010