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Inorganica Chimica Acta

Inorganica Chimica Acta: its publications, references and citations. An update for 1995–1996

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Abstract

Scientometric techniques have been used to characterize the journal *Inorganica Chimica Acta* during the 1995–1996 period. The results are compared to those of a previous study for the 1990–1994 period, with attempts to pinpoint characteristic trends and patterns. An epistemological analysis based on title words is used to locate 'creative foci' of research. © 1997 Elsevier Science S.A.

1. Introduction

In a previous paper [1], a portrait of the journal *Inorganica Chimica Acta* has been given through the mirror of the statistical analysis of publications, references, citations and other bibliographical items. This technique — whether called scientometrics, bibliometrics or by any other name — has nowadays become a standard basis of classifying, mapping and assessing journals [2,3]. In the cited study, scientometrics has been used to portray the journal during the 1990–1994 period. An attempt has been made not only to reveal some of the so far hidden features of the journal but also to give some hints on how to improve its visibility and prestige in the future.

In the present study, an update of the previous study for the 1995–1996 period is given. The tables and figures are partly copying the contents and structure of those in the previous study to allow for direct comparisons, partly supplement it with new aspects, so far not dealt with.

As earlier, the main data source of the analysis was the *Scientometric Indicators Datafiles* of the ISSRU (Budapest, Hungary) [4], derived from the *Science Citation Index* (*SCI*) database of the Institute for Scientific Information (ISI, Philadelphia, PA, USA).

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2. Analysis of publications

A total number of 1015 papers published in Volumes 228 (1995) through 253 (1996) of *Inorganica Chimica Acta* and categorized by the *Science Citation Index* into the document types *Articles* (874 items), *Letters* (0 items), *Notes* (139 items) and *Reviews* (2 items) was taken into account. These documents are usually regarded in our *Datafiles* as relevant (citable) items, while all others (biographical items, editorials, corrections, etc.) are discarded.

2.1. Where do the publications come from?

Countries of origin can be assigned to papers according to the corporate addresses in the by-line of the papers or given as a footnote. It must be noted that the *Science Citation Index* has a policy of omitting certain addresses (e.g. those preceded by the phrase 'on leave from'), but the number of losses from such omissions is statistically negligible. All addresses of all contributing authors are recorded in the database; in our statistics each contributing country is counted exactly once. What counts is, thus, the number of papers to which (any number of) authors from the given country contributed.

Authors from a total of 59 countries contributed to *Inorganica Chimica Acta* during the period under study. Nine countries appeared only once; authors of the most productive one, the USA, were present with 362 publications. In Fig. 1, the number of publications from the countries of the world is given in the form of a *proportional map*, i.e. a map, where

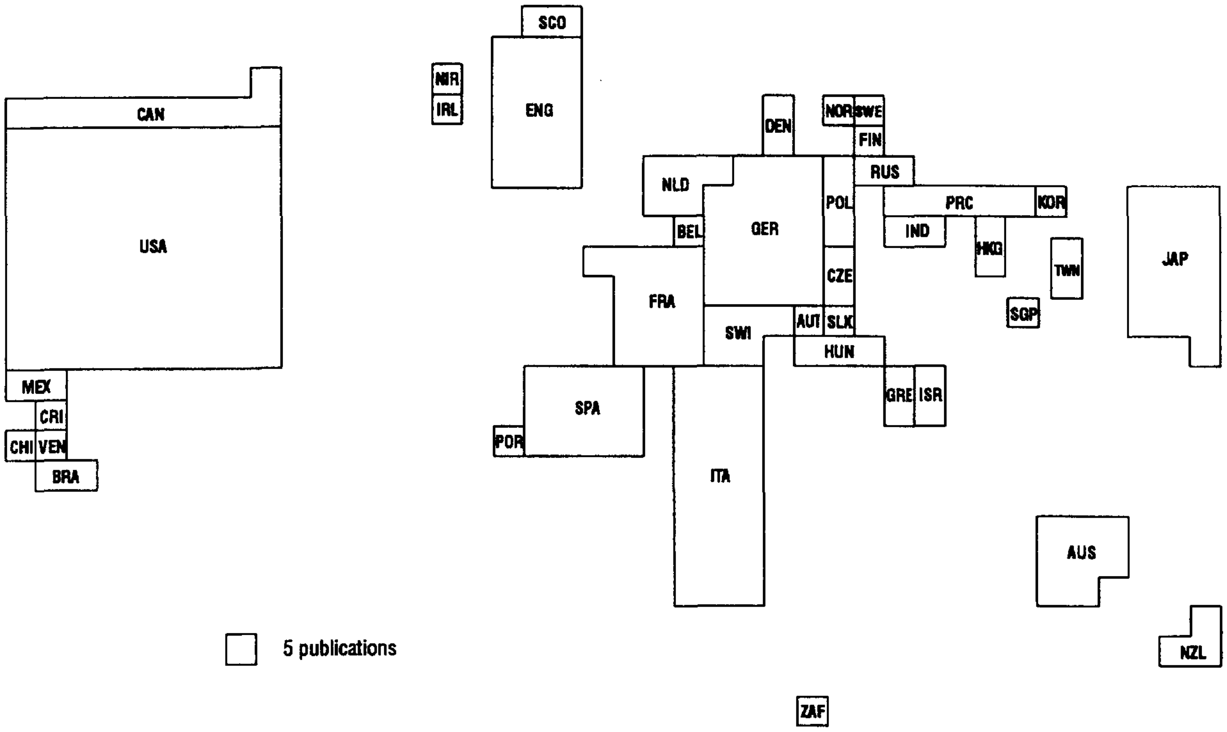

Fig. 1. Proportional map of countries by the number of publications in *Inorganica Chimica Acta* (for an explanation of the country codes see the Appendix).

the relative position of the countries is attempted to represent their 'natural' (geographical) order, whereas their area represents the number of papers published in *Inorganica Chimica Acta.*

To facilitate the assessment of their relative proportions, countries publishing at least 10 papers during the period under study are ranked in Table 1 by their publication activity (absolute numbers and percentage world shares are indicated, as well). Changes relative to the previous period (1990–1994) can be judged by comparing the ranks (first and last columns) or by the percentage changes in the world shares. No dramatic changes in the leading positions can be observed: one can find the same countries — with some slight changes in their order — at the top ten positions in both periods. It should, however, be noted that authors from the USA, France, Canada and Australia have definitely strengthened their presence in the journal — and that seems to be the continuation of a positive tendency (cf. Table 1 of Ref. [1]). There is a greater mobility in the second half of the list, the most 'aggressive' newcomers being Mexico and Denmark, but the emergence of P.R. China and Hong Kong (a kind of 'Torschlusspanik'?) is also worth mentioning. The greatest loser is India, which has just dropped out of the list (sharing now the 23rd–25th position with Brazil and the Czech Republic) from an 11th position.

Table 1
Countries ranked by their publication activity in *Inorganica Chimica Acta* (Vols. 228–253)

Rank	Country	Publications		% Change in world share relative to 1990–1994	Rank in 1990–1994
		Number	% Share		
1	USA	362	28.5	26.8	1
2	Italy	120	9.4	−11.0	2
3	Germany	97	7.6	−17.9	3
4	UK	93	7.3	−6.8	4
5	Japan	81	6.4	−15.0	5
6	France	63	5.0	18.8	7
7	Spain	61	4.8	−14.1	6
8	Canada	50	3.9	61.2	10
9	Australia	41	3.2	2.5	9
10	Netherlands	27	2.1	−34.0	8
11	Switzerland	25	2.0	−4.1	12
12	P.R. China	24	1.9	48.3	15
13	Poland	14	1.1	−8.4	16
14	New Zealand	13	1.0	−0.3	19
15	Hungary	13	1.0	−12.4	17
16	Hong Kong	12	0.9	48.3	25
17	Israel	11	0.9	−15.6	20
18	Mexico	11	0.9	307.9	38
19	Denmark	11	0.9	171.9	32
20	Taiwan	10	0.8	−7.3	22
21	Russia	10	0.8	−43.0	14
22	Greece	10	0.8	−45.7	13

2.2. *International coauthorship patterns*

International cooperation had in 1995–1996 an even more dominating role in publication activity than in the previous years. Although the percentage share of internationally co-authored papers has only grown from 19 to 21%, among the

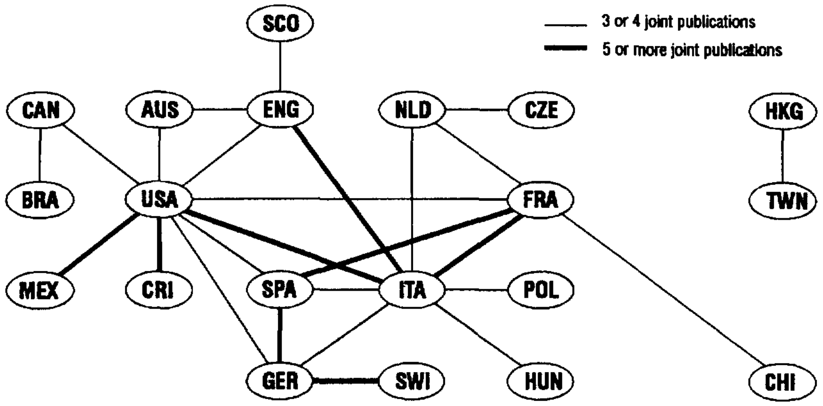

Fig. 2. Coauthorship map (for an explanation of the country codes see the Appendix).

59 countries contributing to *Inorganica Chimica Acta* during the period 1995–1996, there was only one (Venezuela — with a total of 3 papers) without any international coauthorship in the journal. (Just for curiosity, in an early 1997 issue of the journal, a paper coauthored by Venezuelan and Chilean authors has been published.)

Maybe even more interesting than the mere extent of internationality, is the structure of international cooperations. Fig. 2 presents graphically the main coauthorship links between the contributing countries.

The basic structure of the graph is rather similar to that observed in other coauthor studies (see, e.g. Ref. [5]), as well as in the preceding study [1]. The USA and the major European countries form an almost complete core subgraph (the lack of significant collaboration between authors from the UK and France has already been observed in the 1990–1994 period); the 'double bondage' of Australia to the USA and UK can now be well observed. The strongest link now is between Italy and the USA (10 joint publications) — another indication of the successful attempts of the journal to stand in with the US mainstream research.

3. Analysis of references

The distribution of the number of references in the *Inorganica Chimica Acta* papers has slightly changed as compared to the 1990–1994 period. Although the modus is invariably at 20, the median of the distribution has increased from 25 to 27, and the mean from 25 to 30. These changes suggest that while the 'typical' papers have reference lists of more or less the same length, the reference distribution has a longer and/or thicker 'tail', i.e. there is a higher proportion of review type papers with long reference lists. Since reviews do not only have more references but, as a rule, are cited more frequently than ordinary research articles, this change seems to be a positive development as the future citation rate (impact factor) of the journal is concerned.

Altogether, about 30 000 references were made to about 25 000 items during the 1995–1996 period, i.e. the citation rate of an average cited item was 1.20. Nearly 90% of the references were made to journal articles. The average citation rate was the same for journal and non-journal items, but a few non-journal items attracted a significantly higher number of references than any journal article. The list of journal and non-journal items most cited in *Inorganica Chimica Acta* during the 1995–1996 period is given in Table 2. In the case of non-journal items, references to different editions of the same work were totalled. In both categories, most of the items listed could already be found in the 1990–1994 top rankings; Sheldrick's 1990 paper and Cotton's book are real new entries.

The journal references were scattered among more than one thousand journal titles. The seven most cited journals were, however, receiving about one half of the total references (see Table 3).

The age distribution of the references is shown in Fig. 3. The maximum (modus) of the distribution is at 3 years, the median ('reference half-life') at 8 years. This latter value indicates that *Inorganica Chimica Acta* papers largely rely upon more 'mature' literature, but the value is not unusual in this field. A bit more worrying sign, while comparing the 1995–1996 data with the previous five-year period, is the drop in the proportion of 'immediate referencing'. In the 1990–1994 period almost 4% of the references concerned the current year, while this value dropped under 1% by 1995–1996. The same tendency is reflected in the Price-index: the percentage share of references not older than five years. The Price-index of *Inorganica Chimica Acta* decreased from 36 to 32%. Although this phenomenon relates only to a small fraction of the references, and leaves most of the global statistical indicators unchanged, it may suggest a certain slow-down in the editorial-publication process or, even worse, that some authors submit manuscripts of 'secondary freshness' to the journal.

Some of the references are worth attention just because of their extreme age. References to papers more than a century old are collected in Table 4 in the order of their age.

4. Analysis of citations

In our previous study [1], citation analysis was restricted to the fine structure of the *impact factor* [3], i.e. citations in

Table 2
Most cited journal and non-journal items in *Inorganica Chimica Acta* (Vols. 228–253)

Journal items Paper	Times cited in 1995–1996
N. Walker, D. Stuart, An empirical method for correcting diffractometer data for absorption effects, *Acta Crystallogr., Sect. A*, Vol. 39, pp. 158–166 (1983) [Univ. London, Queen Mary Coll., Dept. Chem., London E1 4NS, England]	90
G.M. Sheldrick, Phase annealing in SHELX-90 — direct methods for larger structures, *Acta Crystallogr., Sect. A*, Vol. 46, pp. 467–473 (1990) [Univ. Göttingen, Inst. Anorgan. Chem., D-3400 Göttingen, Germany]	46
A.C.T. North, D.C. Phillips, F.S. Mathew, A semi-empirical method of absorption correction, *Acta Crystallogr., Sect. A*, Vol. 24, p. 351 (1968) [Univ. Oxford, Dept. Zool., Lab. Molec. Biophys., Oxford, England]	37
G.M. Sheldrick, *Crystallographic Communications*, Vol. 3, p. 175 (1985) [Univ. Göttingen, Inst. Anorgan. Chem., D-3400 Göttingen, Germany]	27
M. Nardelli, PARST, a system of Fortran routines for calculating molecular structure parameters from results of crystal structure analyses, *Comput. Chem.*, Vol. 7, pp. 95–98 (1983) [Univ. Parma, CNR, Ctr. Studio Strutturist. Diffrattometr., Ist. Chim. Gen. Inorgan., I-43100 Parma, Italy]	26
R.D. Shannon, Revised effective ionic-radii and systematic studies of interatomic distances in halides and calcogenes, *Acta Crystallogr., Sect. A*, Vol. 32, pp. 751–767 (1976) [Dupont Co. Centr. Res. Dept., Wilmington, DE 19898, USA]	24
W.J. Geary, Use of conductivity measurements in organic solvents for characterization of coordination-compounds, *Coordinat. Chem. Rev.*, Vol. 7, p. 81 (1971) [Sheffield Polytech., Dept. Chem., Sheffield, Yorks, England]	20
D.T. Cromer, J.B. Mann, X-ray scattering factors computed from numerical Hartree-Fock wave functions, *Acta Crystallogr., Sect. A*, Vol. 24, p. 321 (1968) [Univ. Calif., Los Alamos, Sci. Lab., Los Alamos, NM 87544, USA]	19
D.T. Cromer, D. Liberman, Relativistic calculation of anomalous scattering factors for X-rays, *J. Chem. Phys.*, Vol. 53, p. 1891 (1970) [Univ. Calif., Los Alamos, Sci. Lab., Los Alamos, NM 87544, USA]	
R.A. Marcus, N. Sutin, Electron transfers in chemistry and biology, *Biochim. Biophys. Acta*, Vol. 811, pp. 265–322 (1985) [Caltech, A.A. Noyes Lab. Chem. Phys., Pasadena, CA 91125, USA; Brookhaven Natl. Lab., Dept. Chem., Upton, NY 11973, USA]	19
Non-journal items **Author**, title	Times cited in 1995–1996
G.M. Sheldrick, SHELX Program (1976; 1984)	279
Int. Tables of X-Ray Crystallogr., Vol. 4 (1974)	154
Molecular Structure Corp., TEXSAN Crystal Structure Analysis Package (1985)	56
K. Nakamoto, Infrared Raman Spectroscopy (1978; 1986)	51
F.A. Cotton, Multiple Bonds in Metals (1993)	37
A.B.P. Lever, Inorganic Electronic Spectroscopy (1968; 1984)	32

Table 3
The most cited journals in *Inorganica Chimica Acta* (Vols. 228–253)

Journal title	Times cited
Inorganic Chemistry	4982
Journal of the American Chemical Society	3759
Inorganica Chimica Acta	1711
Journal of the Chemical Society, Dalton Transactions	1665
Journal of Organometallic Chemistry	1117
Journal of the Chemical Society, Chemical Communications	999
Organometallics	940

a given year to papers published in the previous two years were considered. In the present study, the citation horizon is broadened: citations in the two-year period 1995–1996 to all years are taken into consideration; special attention is paid to citations to *Inorganica Chimica Acta* papers published during the five-year period 1990–1994.

First some summary statistics. During the years 1995–1996 about 7650 *Inorganica Chimica Acta* papers received 16 400 citations from about 8550 citing papers (including 620 papers from *Inorganica Chimica Acta* itself). The exact numbers are practically impossible to determine because of the numerous misspelled or otherwise ambiguous references in the database.

4.1. The sources of the citations

The country distribution of the authors of the citing items (Fig. 4) superficially resembles the distribution of the authors of *Inorganica Chimica Acta* papers (cf. Fig. 1). A closer look, however, reveals interesting differences.

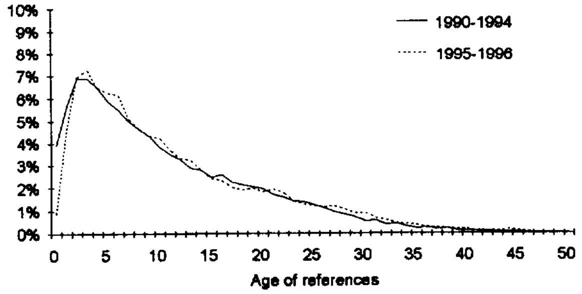

Fig. 3. Distribution of references by age.

Table 4
The oldest references found in *Inorganica Chimica Acta* (Vols. 228–253)

Author	Bibliographic data	Year
W.C. Zeise	Overs. K. Dan. Vidensk 13	1825
W.C. Zeise	Poggendorfs Ann. Phys. 9:632	1827
L. Playfair	Proc. R. Soc. London 5:846	1848
G. Wiedermann	Liebigs Ann. Chem. 68:324	1848
O. Loew	Z. Chem. 4:622	1868
M.E. Royer	C.R. Hebd. Acad. Sci. 70:731	1870
M.T. Sidot	C.R. Hebd. Acad. Sci. 74:179	1872
E.J. Mills	Proc. R. Soc. London 26:504	1877
J.F. Plique	Bull. Soc. Chim. 28:522	1877
M.E. Bouty	J. Phys. 8:241	1879
A. Hantzsch	Chem. Ber. 20:3118	1887
F. Blau	Ber. Dtsch. Chem. Ges. 27:1077	1888
A. Claus	J. Prakt. Chem. 38:208	1888
E. Leidie	C.R. Hebd. Acad. Sci. 111:106	1890
M. Kruger	Z. Phys. Chem. 18:423	1893
O. Unger	Chem. Ber. 30:607	1897

Table 5 lists 30 countries in the decreasing order of an indicator we called the *Publication/Citation Preference Index*. This indicator is the ratio of the country's percentage share in papers published in *Inorganica Chimica Acta* to its percentage share in papers citing the journal. The value of this indicator can be interpreted in two ways: from the side of the numerator or of the denominator. Thus a high value may either mean that authors from the country have a special preference for publishing in *Inorganica Chimica Acta* or that they are negatively biased as citing the journal is concerned; similarly, a low value may equally be interpreted as a negative bias in publication or as a positive bias in citation behavior. To put it a bit aphoristically: those at the top of the list are writers rather than readers, those at the bottom, readers rather than writers.

The papers citing *Inorganica Chimica Acta* came from more than 500 different journals. About 45% of the citing items are, however, from not more than seven titles (Table 6).

The seven journals in Table 6 are identical with the top seven entries of a similar table for the period 1990–1994 (Ref. [1]: Table 7), and differ only in one place from the seven most cited journals in Table 1 of the present paper.

4.2. The targets of citations

Citation rates in 1995–1996 to the previous 30 years of *Inorganica Chimica Acta* basically follow the typical trend of 'citation aging': the citation rate has a maximum at about 3 years and there is an exponential-like decay as going backwards in time. This can be clearly seen on the mean citation rate per paper curve of Fig. 5. At the same time, the citation rate per cited paper curve shows that after a certain age (about 10–15 years), there is no longer any significant difference between the average citation rate of the still cited papers.

Similarly, although one of the nine most cited *Inorganica Chimica Acta* papers is from 1994, and three are from 1992,

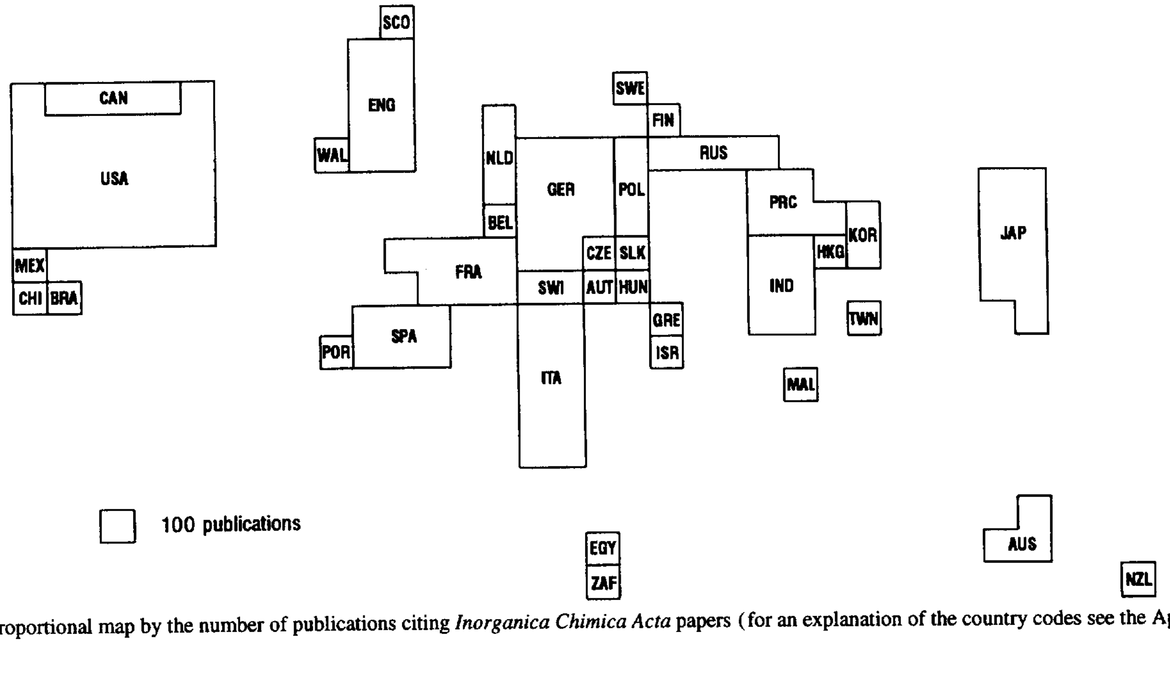

Fig. 4. Proportional map by the number of publications citing *Inorganica Chimica Acta* papers (for an explanation of the country codes see the Appendix).

Table 5
Countries ranked by Publication/Citation Preference Index

Rank	Country	Publication/Citation Preference Index
1	New Zealand	1.92
2	USA	1.44
3	Australia	1.32
4	Canada	1.29
5	Hong Kong	1.28
6	Hungary	1.26
7	Italy	1.22
8	Switzerland	1.12
9	Scotland	1.11
10	Netherlands	1.02
11	England	0.99
12	Spain	0.99
13	Taiwan	0.99
14	Czech Republic	0.98
15	Greece	0.96
16	France	0.96
17	Japan	0.90
18	Germany	0.89
19	South Africa	0.85
20	Chile	0.81
21	Finland	0.71
22	Brazil	0.68
23	Belgium	0.65
24	Poland	0.59
25	P.R. China	0.51
26	Sweden	0.44
27	South Korea	0.35
28	Russia	0.28
29	Egypt	0.19
30	India	0.15

Table 6
Journals most frequently citing *Inorganica Chimica Acta*

Journal	No. of papers citing *Inorganica Chimica Acta*
Inorganic Chemistry	1013
Inorganica Chimica Acta	620
Journal of the Chemical Society, Dalton Transactions	585
Polyhedron	493
Organometallics	416
Journal of Organometallic Chemistry	371
Journal of the American Chemical Society	323

the rest is uniformly distributed in the 80s and even one of them dates back to 1976 (Table 7).

A detailed analysis of the citations received in 1995–1996 by the *Inorganica Chimica Acta* papers published in 1990–1994 showed that from the 2355 papers published 1829 (78% — a remarkably high percentage) were cited and received a total of 5987 citations (2.54 per paper) from 3891 citing items (including 430 *Inorganica Chimica Acta* papers).

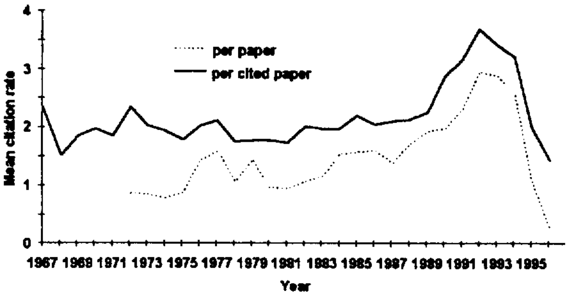

Fig. 5. Dependence of mean citation rate on the age of *Inorganica Chimica Acta* papers.

About 85% of the citations were received by papers with at least one author from the 10 most productive countries. The relative contributions of authors from these countries to the citedness of the journal can be assessed by the relative citation rate (RCR). This indicator gauges the actual number of citations received by each paper to the expected number of citations, i.e. to the average citation rate of the journal. To put it very simply, countries with RCR values higher than 1 contribute to the citedness above par, while those with RCR < 1 contribute under par. The 10 most productive countries are ranked by their relative citation rate in Table 8.

Quite symmetrically, half of the countries are above the average (RCR > 1), half of them are below (RCR < 1). For comparison, the corresponding indicator values taken from the previous study (Ref. [1]: Table 6) are also indicated. Since the cited papers are the same in both cases (those published in *Inorganica Chimica Acta* during the 1990–1994 period), only the citing period differs, the changes in the indicator values reflect the relative 'citation aging' of the publications under study. In this sense, the citation impact of, for example, the Italian or US publications, seems to be less lasting than, say, the Spanish, German or French publications in the journal.

5. Analysis of title words

As a new feature of this study, as compared with the previous one [1], an attempt was made to analyze the topics of research published in *Inorganica Chimica Acta* as reflected in the titles of the papers. No doubt, the titles give only rather scanty information about the subject of the research, reported in a paper, one may, however, hope that — in spite of all the arbitrariness in the individual cases — a statistical analysis may reveal some valid trends and patterns.

In the analysis both the 1990–1994 and the 1995–1996 periods have been covered and an attempt was made to pinpoint the changes. In order to remove some of the arbitrariness in the wording of the titles, title words and phrases were grouped into subject categories, and these categories (title terms) were analyzed.

Table 7
Inorganica Chimica Acta papers receiving the highest number of citations in the 1995–1996 period

Paper	Times cited
J. Reedijk, The relevance of hydrogen bonding in the mechanism of action of platinum antitumor compounds, Vol. 200, pp. 873–881 (1992) [Leiden Univ., Gorlaeus Labs., Dept. Chem., Leiden, Netherlands]	44
J.W. McDonald, G.D. Friesen, L.D. Rosenhein, W.E. Newton, Syntheses and characterization of ammonium and tetraalkylammonium thiomolybdates and thiotungstates, Vol. 72, pp. 205–210 (1983) [C.F. Kattering Res. Lab., Yellow Springs, OH 45387, USA]	35
S. Decurtins, H.W. Schmalle, H.R. Oswald, A. Linden, J. Ensling, P. Gütlich, A. Hauser, A polymeric two-dimensional mixed-metal network. Crystal structure and magnetic properties of $\{[P(Ph)_4][MnCr(Ox)_3]\}_n$, Vol. 216, pp. 65–73 (1994) [Univ. Zürich, Inst. Anorgan. Chem., Zürich, Switzerland; Univ. Zürich, Inst. Organ. Chem., Zürich, Switzerland; Univ. Mainz, Inst. Anorgan. and Analyt. Chem., Mainz, Germany; Univ. Bern, Inst. Anorgan. and Phys. Chem., Bern, Switzerland]	35
P. Gans, A. Sabatini, A. Vacca, An improved computer program for the computation of formation constants from potentiometric data, Vol. 18, pp. 237–239 (1976) [Ist. Chim. Gen., Univ. Florence, Florence, Italy]	29
K.J. Martin, P.J. Squattrito, A. Clearfield, The crystal and molecular structure of zinc phenylphosphonate, Vol. 155, pp. 7–9 (1989) [Texas A&M Univ., Dept. Chem., College Station, TX 77843, USA]	25
R. Colton, J.C. Traeger, The application of electrospray mass spectrometry to ionic inorganic and organometallic systems, Vol. 201, pp. 153–155 (1992) [La Trobe Univ., Dept. Chem., Bundoora, Australia]	24
G.J. Kontoghiorghes, L. Sheppard, Simple synthesis of the potent iron chelators 1-alkyl-3-hydroxy-2-methyl-pyrid-4-ones, Vol. 136, pp. L11–L12 (1987) [Royal Free Hosp., Sch. Med. Dept. Haematol., London, England]	24
J. Halpern, Activation of carbon–hydrogen bonds by metal complexes: mechanistic, kinetic and thermodynamic considerations, Vol. 100, pp. 41–48 (1985) [Univ. Chicago, Dept. Chem., Chicago, IL 60637, USA]	23
Y. Jeannin, F. Sécheresse, S. Bernès, F. Robert, Molecular architecture of copper(I) thiometallate complexes. Example of a cubane with an extra face, $(NPR_4)_3(MS_4Cu_4Cl_5)$ (M = Mo, W), Vol. 198–200, pp. 493–505 (1992) [Univ. Paris 06, Chim. Met. Transit. Lab., Paris, France]	21

Table 8
The most productive countries ranked by their relative citation rate

Rank	Country	Number of publications	RCR (1995–1996)	RCR (1990–1994)
1	Netherlands	118	1.56	1.46
2	Spain	219	1.31	1.01
3	Germany	360	1.27	1.05
4	France	181	1.20	1.03
5	Australia	130	1.13	1.09
6	Italy	420	0.97	1.12
7	UK	313	0.94	0.88
8	USA	997	0.83	0.99
9	Canada	119	0.73	0.90
10	Japan	293	0.72	0.92

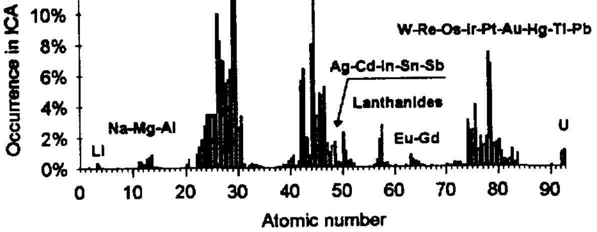

Fig. 6. Frequency of occurrence of chemical elements as title terms.

Table 9
Elements with the most significant changes in the frequency of occurrence in the titles of *Inorganica Chimica Acta* papers

Element	Frequency of occurrence in 1990–1994 (%)	Frequency of occurrence in 1995–1996 (%)	Growth ratio
Pb	0.5	1.2	2.32
Os	1.1	2.0	1.78
Re	2.4	4.0	1.67
Lanthanides	1.1	1.9	1.63
Ti	0.9	1.4	1.55
V	1.8	2.8	1.51
⋮	⋮	⋮	⋮
Ag	1.6	1.0	0.63
Eu	0.8	0.5	0.61
Hg	1.7	1.0	0.57
Sn	2.3	1.1	0.48
Tc	2.0	0.8	0.40

A series of the title terms was formed by the chemical elements explicitly or implicitly mentioned in the titles. In the 3370 papers published in *Inorganica Chimica Acta* during the 1990–1996 period, 69 elements were mentioned in a total of 3678 occurrences (of course, in several papers more than one element was mentioned). The distribution of the occurrences by atomic numbers is given in Fig. 6.

Table 10
Terms with the most significant changes in the frequency of occurrence in the titles of *Inorganica Chimica Acta* papers

Title term	Frequency of occurrence in 1990–1994 (%)	Frequency of occurrence in 1995–1996 (%)	Growth ratio
Macrocycles	2.1	5.5	2.65
Polymers	1.5	3.0	1.99
Stereochemistry	2.0	3.3	1.68
Bipyrid(yne/yl)	2.5	3.7	1.49
Carbonyl	7.8	11.5	1.48
Mechanism	1.6	2.3	1.44
Photochemistry	2.7	3.7	1.40
Cyclopentadienyl	4.5	6.0	1.34
Catalysis	3.1	3.7	1.22
Isomers	1.9	2.3	1.21
Clusters	3.7	4.3	1.19
Schiff bases	1.4	1.6	1.16
⋮	⋮	⋮	⋮
Amino acids	2.4	1.3	0.53
Mössbauer spectroscopy	1.0	0.5	0.48
IR spectroscopy	1.1	0.5	0.43
ESR spectroscopy	0.6	0.2	0.33

The frequency of occurrences is given in Fig. 6 in percentages for both periods, therefore, the changes can be directly observed. Elements with the most significant changes in the frequency of occurrence in the titles of *Inorganica Chimica Acta* papers are, however, spotlighted in Table 9. The elements were ranked in decreasing order of their *growth ratio* (the ratio of percentage frequency of occurrence in 1995–1996 to the same percentage in 1990–1994), and the top and the bottom section of the list is presented. Thus, it can be seen which elements appear to 'come into fashion' and which ones are 'getting outmoded'.

Table 10 is a similar table for title terms other than chemical elements.

More spectacular than the simple one-dimensional rankings are the networks derived from the *co-occurrence* of title terms. The map in Fig. 7 is based on more than 100 co-occurrences of title terms during the 1990–1996 period.

Since an absolute threshold was used to construct the map, the title terms on it are among the most frequently occurring ones also in absolute terms. The map, therefore, represents quite adequately the 'epistemological space' of the journal, at least, as far as it is reflected in the title of the papers. Interestingly, most of the links found in Fig. 7 predominate even if instead of an absolute threshold, some kind of relative 'affinity' between title terms is considered.

Structure - Crystal - X-ray or Coordination Chemistry - Structure - Synthesis are extremely strongly linked terms whatever connectivity measures are used. Using such relative affinity measures, strong links between some less frequent terms like Kinetics - Mechanism or Dinuclear - Mononuclear

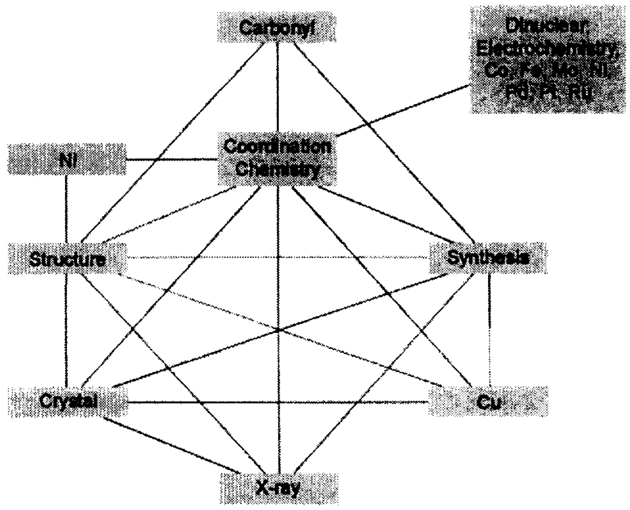

Fig. 7. Co-occurrence map of title terms.

can be found, but these do not add too much to the basic structure presented in Fig. 7.

6. Title term 'bisociation'

In his brilliant giant essay 'The Act of Creation' [6], Arthur Koestler coined the word 'bisociation' to formulate what he deemed to be the essence of human intellectual creativity. Its definition, in his own words, is "the perceiving of a situation or idea in two self-consistent but habitually incompatible frames of reference". In his views, 'creation' is making connection between two well known, but so far unconnected entities. Indeed, the history of science renders an immense storehouse of examples of 'bisociative creativity' in the Koestlerian sense.

If *Inorganica Chimica Acta* title terms are to be viewed in a Koestlerian framework, one should expect a 'focus of creation' where two frequent but so far not co-occurring terms begin to co-occur regularly. By analyzing the terms in the titles of the 1995–1996 period relative to the 1990–1994 period, the following new connections appeared to emerge:

Bipyrid(ine/yl) - Osmium;	Macrocycle - Kinetics;
Bipyrid(ine/yl) - Polymer;	Macrocycle - Lanthanides;
Cyclopentadienyl - Mechanism;	Macrocycle - NMR;
Dinuclear - Stereochemistry;	Macrocycle - Palladium;
Electrochemistry - Osmium;	Nitrosyl - X-ray

If we do not require complete absence of co-occurrence in the first period, only a significant increase in the frequency of co-occurrence from the first period to the second, the following links can also be regarded as 'bisociative':

Polymer - Synthesis;	Coordination Chemistry - Mechanism;
Cluster - Ruthenium;	Macrocycle - Synthesis

Which, if any, of these 'bisociations' represent real creative foci is a question far beyond the scope of such a bibliometric analysis, and requires the knowledgeable discernment of the experts of the field and, after all, the final judgement of time passed.

7. Conclusions

The results of the present study, in general, confirmed and further articulated the portrait of *Inorganica Chimica Acta* drawn in the previous paper [1]. The journal's international character has definitely increased, both as the authors' national diversity and the international cooperative nature of the papers are concerned. A few of the papers published in the journal in the 1990–1994 period have reached a quite early citation eminence, and only a laudably small fraction remained completely uncited. A somewhat warning sign is the decrease of 'immediacy' in the references of the *Inorganica Chimica Acta* papers, what might be connected to an increasing publication delay.

A kind of epistemological analysis using the title words of the papers showed a fairly consistent thematical character of the journal throughout the full 1990–1996 period, crystallizing around title terms like *Coordination Chemistry*, *Structure*, *Synthesis*, *Crystals* and certain groups of chemical elements. Using Koestler's 'bisociation' concept, some potential 'creative foci' were identified in the form of pairs of title terms, around which some new ideas may emerge.

Appendix A

Country codes and full country names (explanation for Figs. 1, 2 and 4)

AUS	Australia	KOR	South Korea
AUT	Austria	MAL	Malaysia
BEL	Belgium	MEX	Mexico
BRA	Brazil	NIR	North Ireland
CAN	Canada	NLD	Netherlands
CHI	Chile	NOR	Norway
CRI	Costa Rica	NZL	New Zealand
CZE	Czech Republic	POL	Poland
DEN	Denmark	POR	Portugal
EGY	Egypt	PRC	P.R. China
ENG	England	RUS	Russia
FIN	Finland	SCO	Scotland
FRA	France	SGP	Singapore
GER	Germany	SLK	Slovakia
GRE	Greece	SPA	Spain
HKG	Hong Kong	SWE	Sweden
HUN	Hungary	SWI	Switzerland
IND	India	TWN	Taiwan
IRL	Ireland	USA	USA
ISR	Israel	VEN	Venezuela
ITA	Italy	WAL	Wales
JAP	Japan	ZAF	South Africa

References

[1] A. Schubert, The portrait of a journal as reflected in its publications, references and citations: Inorganica Chimica Acta, 1990-1994, *Inorg. Chim. Acta, 253* (2) (1996) 111–118.
[2] E. Garfield, Citation analysis as a tool in journal evaluation, *Science, 178* (1972) 471–479.
[3] E. Garfield (ed.), *Science Citation Index, Journal Citation Reports. A Bibliometric Analysis of Science Journals in the ISI Database*, Institute for Scientific Information, Philadelphia, PA, USA, from 1975 annually. From 1995 also available on CD-ROM.
[4] T. Braun, W. Glänzel and A. Schubert, Scientometric indicators datafiles, *Scientometrics, 28* (2) (1993) 137–150.
[5] A. Schubert and T. Braun, International collaboration in the sciences, 1981–1985, *Scientometrics*, 19 (1–2) (1990) 3–10.
[6] A. Koestler, *The Act of Creation*, Dell, New York, 1964.