Some Tendencies in the Literature of Organometallic Chemistry

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A survey of the number of references published annually for individual elements or groups of elements suggests that the organometallic chemistry literature is approaching a phase of slower increase.

In the last decade, organometallic chemistry has had a phenomenal growth. Particularly the organometallic chemistry of transition metals, which was virtually nonexistent before 1951 (the year of the discovery of ferrocene) and which became a field of explosive development. The avalanche of research papers also promoted a flood of the book market with works on organometallic chemistry, often superimposed in their scope; this was generated by the real need to systematize the enormous amount of information which became available, but probably commercial reasons were also involved to a great extent.

We are concerned here only with the tendencies of the primary literature—i.e., research papers published in various journals. An investigation of these tendencies is greatly facilitated by the publication, since 1965, of the "Annual Surveys of Organometallic Chemistry" (by D. Seyferth and R. B. King) which in 1968 became "Organometallic Chemistry Reviews. Section B. Annual Surveys" (Elsevier Publishing Co.). This publication reviews the literature published during each year concerning the organometallic compounds of individual elements or groups of analogous elements. It covers fairly completely the world literature on organometallic chemistry, and therefore the annual number of references (ANR) quoted for each element (or group of elements) reflects fairly well the research effort in each particular area.

Table I contains the annual number of references cited for each element (or group of elements) from 1964 to 1970 (only partial data are available for 1970). A rapid increase in the amount of organometallic literature occurred during this period. Some correction should probably be made owing to some improvement in the coverage of the primary literature, from the first volume (covering the literature published in 1964) to the more recent ones. This correction is difficult to estimate, but probably it does not introduce a significant error into our conclusions.

The growth of the organometallic chemistry literature is visualized in Figures 1 to 3, which plot the variations of ANR during the period covered by the Annual Surveys. Figure 1 shows the tendencies of the literature on organoalkali compounds and Group II and III element derivatives. For Group IV elements (Figure 2), a different scale had to be used because the organosilicon and organotin literature surpasses the organometallic literature of any other element. Figure 3 plots the data concerning transition metal compounds.

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A summary analysis of these diagrams allows us to draw some interesting conclusions.

1. Except for silicon and tin, the ANR of no other element passed the 300 mark during the whole period. Considering the maximum value of ANR achieved by various elements (or groups of elements) the following picture emerges:

—maximum ANR > 1000: Si (1968)
—maximum ANR between 300 and 500: Sn (1967–1969)
—maximum ANR between 200 and 300: Li, Mg, Hg, B, Ge, As, Cr-Mo-W, ferrocene-ruthenocene-osmocene, Fe-Ru-Os, Ni-Pd-Pt
—maximum ANR between 100 and 200: Al, Sb, Mn-Tc-Re, Co-Rh-Ir
—maximum ANR between 50 and 100: Zn, Pb, Ti-Zr-Hf
—maximum ANR under 50: Be, Ca, Cd, Ga-In-Tl, Bi, lanthanides and actinides, V-Nb-Ta, Cu-Ag-Au.

2. The growth rate of the literature varies greatly for individual elements or groups of elements. The years 1965, 1967, and 1969 for nontransition metals, and the years 1964, 1966, and 1968 for transition metals were arbitrarily selected as landmarks and the growth factors (i.e., 1967 vs. 1965 and 1969 vs. 1967) were calculated. The results are given in Tables II and III. For many elements, the annual number of references more than doubled over a period of only two years. For others it required four years for a similar increase.

3. Figures 1 to 3 show that the years 1968–1969 marked a peak for certain elements, after which the growth rate (reflected by the slope of the curve) decreased. This is true especially for boron, aluminum, zinc, and beryllium. For several groups of transition elements, the year 1966 marked a plateau, followed by a dramatic increase in 1968 and then by a decrease again (except for the group Ni-Pd-Pt). However, the literature about certain metals continued to grow rapidly even after 1968; this is true for lithium, magnesium, and the group Ni-Pd-Pt.

It is premature to make any predictions, before having full data for 1970, but it seems that a leveling-off of ANR for several elements or groups of elements is taking place during the present period. This is very encouraging for the organometallic chemist facing the prospect of an im-

Table I. Annual Number of References Covered in Annual Surveys

	Volume						
	1	2	3	4	5	6	7,8
	Year Covered						
Element	1964	1965	1966	1967	1968	1969	1970
Li	89	113	139	155	156	239	259
Na, K	11	29	14	21	20	46	68
Be	4	10	13	13	21	11	16
Mg	53	66	82	112	154	237	238
Ca	...	1	2	...	6	4	7
Zn	12	37	34	50	56	54	58
Cd	5	10	19	17	22	23	17
Hg	53	85	95	116	212	240	244
B	147	191	235	239	259	283	277
Al	49	76	72	112	108	143	129
Ga, In	8	13	8	32	19	21	24
Tl	9	14	13	25	26	27	39
Si	184	265	615	865	1169	823	...
Ge	48	72	148	147	196	208	...
Sn	153	182	207	324	420	537	...
Pb	28	36	71	69	73	82	...
As	not surveyed			76	192	249	242
Sb	16 (Sb, Bi)	22 (Sb, Bi)	18 (Sb, Bi)	23	31	103	76
Bi				2	2	25	23
Lanthanides and actinides	4	7	8	11	3	18	...
Ti–Zr–Hf	19	21	41	56	56	74	...
V–Nb–Ta	15	10	12	22	27	44	...
Cr–Mo–W	77	97	130	137	296	291	...
Mn–Tc–Re	74	71	68	94	211	187	...
Ferrocene-osmocene-ruthenocene	64	70	74	87	207	231	...
Fe–Ru–Os	80	121	103	139	230	222	...
Co–Rh–Ir	60	95	93	162	198	145	...
Ni–Pd–Pt	71	105	103	126	219	287	...
Cu–Ag–Au	10	6	17	16	34	41	...
Papers of general interest	...	...	...	57	222	247	...
Structure determinations	...	...	...	...	155	179	...
Totals	1343	1825	2434	3305	5000	5320	...

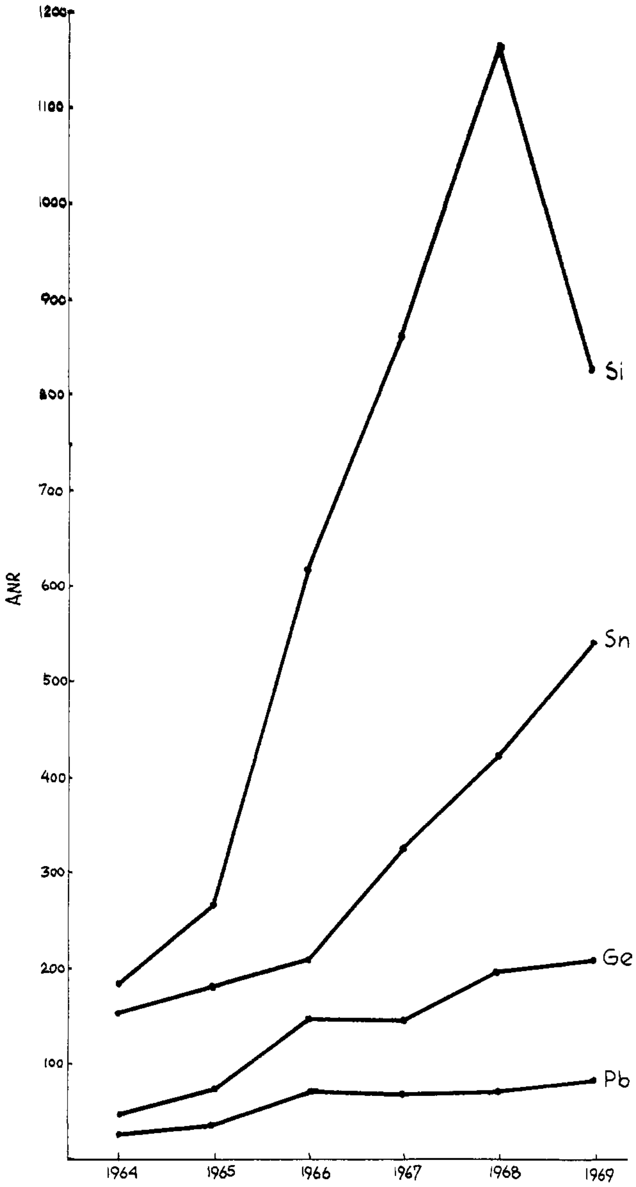

Figure 1. Organometallic literature of Group IV elements

Table II. Growth Factors for the Literature on Main Group Elements

Element	1967 *vs.* 1965	1969 *vs.* 1967	1969 *vs.* 1965
Li	1.3	1.5	2.1
Na, K	0.7	2.2	1.5
Be	1.3	0.8	1.1
Mg	1.8	2.1	3.6
Zn	1.3	1.1	1.4
Cd	1.7	1.3	2.3
Hg	1.3	2.0	2.8
B	1.4	1.1	1.4
Al	1.4	1.2	1.9
Ga, In	2.4	0.6	1.5
Tl	1.0	1.9	1.9
Si[a]	3.2	1.3	4.4
Ge	2.0	1.4	2.8
Sn	1.2	1.6	2.9
Pb	1.9	1.2	2.2
As	[b]	3.2	[b]
Sb	[b]	4.4	[b]
Bi	[b]	12.5	[b]

[a] The 1968 data were used.
[b] Not surveyed individually in 1965.

Table III. Growth Factors for the Literature on Transition Metal Organometallic Chemistry

Elements	1966 *vs.* 1964	1968 *vs.* 1966	1968 *vs.* 1964
Lanthanides and actinides	2.0	0.3	0.7[a]
Ti–Zr–Hf	2.1	1.3	2.9
V–Nb–Ta	0.8	2.2	1.9
Cr–Mo–W	1.7	2.2	3.8
Mn–Tc–Re	0.9	3.1	2.8
Ferrocene-ruthenocene-osmocene	1.1	2.8	3.2
Fe–Ru–Os	1.3	2.2	2.8
Co–Rh–Ir	1.5	2.1	3.3
Ni–Pd–Pt	1.4	2.1	3.0
Cu–Ag–Au	1.7	2.0	3.4

[a] The 1969 *vs.* 1964 factor is however, 2.5.

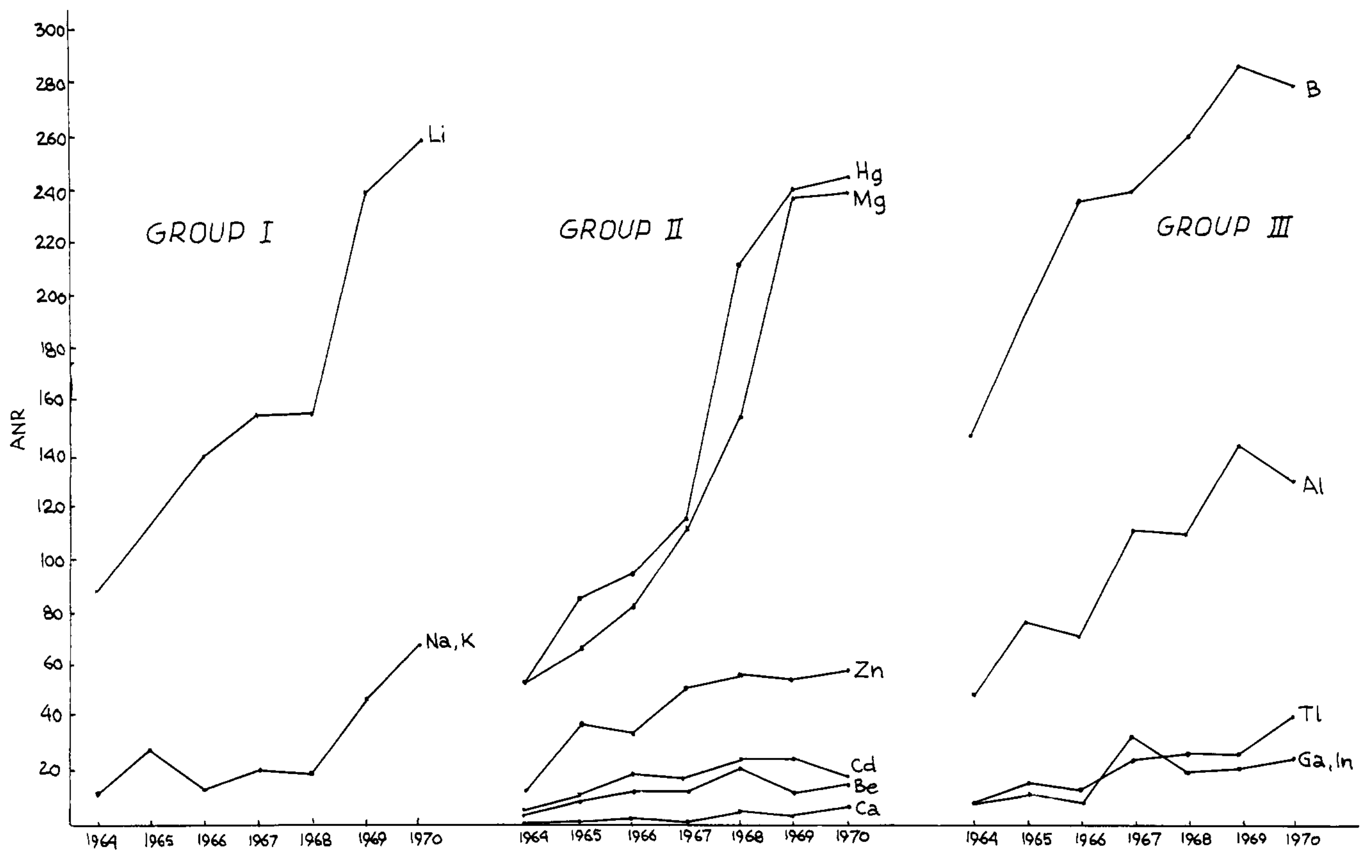

Figure 2. Organometallic literature of Groups I–III elements

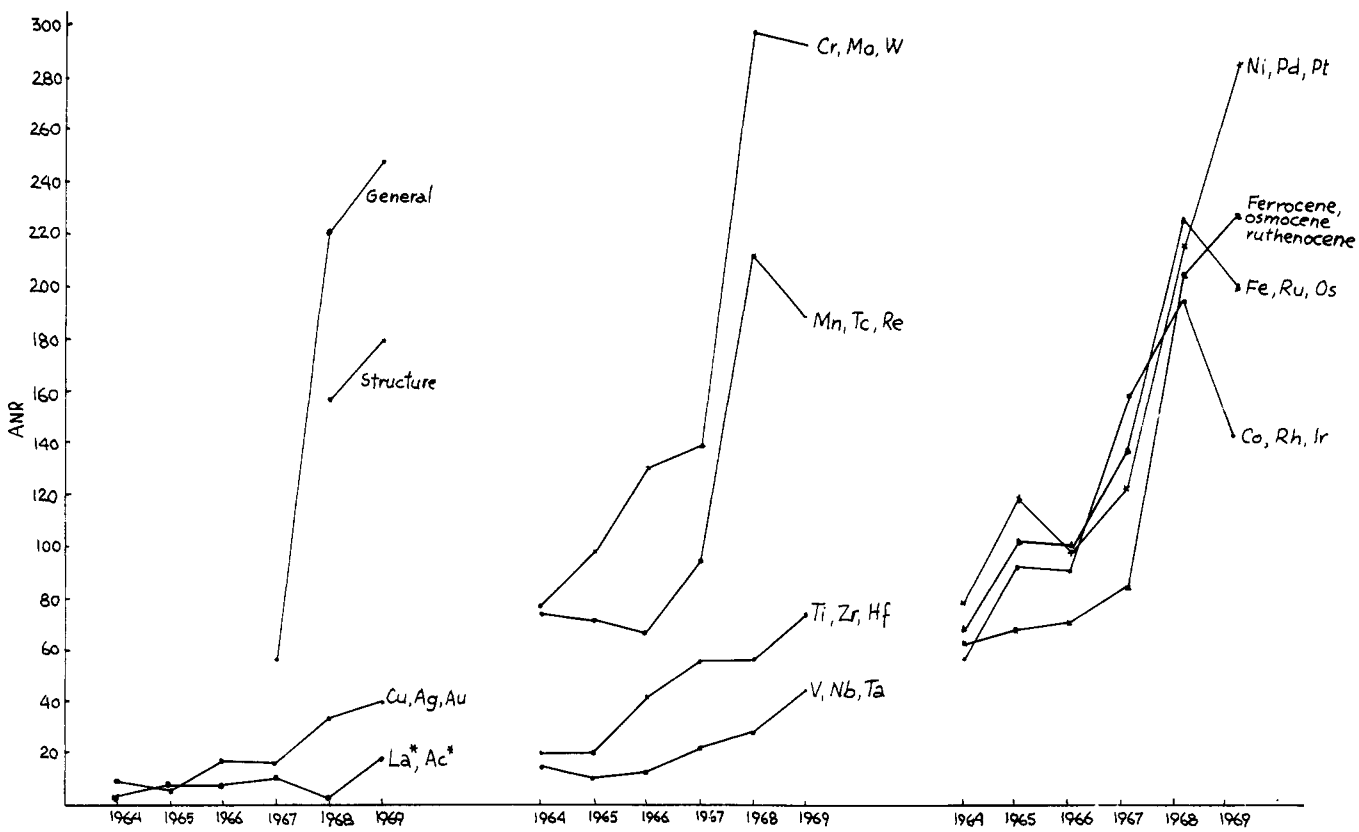

Figure 3. Organometallic literature of transition metals

mense volume of literature, with which he cannot cope. Some sort of "saturation" is to be expected soon and probably for some metals, the period 1968–1969 already marked this new tendency. In future years, we can probably expect only modest growth of the ANR for most metals or groups of metals.

4. Tables II and III show that the most spectacular growth rate was observed in the transition metal chemistry; in 1968, at least twice as many papers as in 1966 were published for most of the groups of the transition metals; unusual increases over a two-year period were observed also for thallium, arsenic, antimony, and bismuth. If a four-year period is considered, high growth rates of ANR are observed also for Mg, Hg, Si, Ge, Sn, and most of the transition metal groups.

We feel that such estimation of the growth tendencies in the literature can be useful in detecting the areas of most concentrated interest.

Acronym Compilation by Computer (ACRODABA - ACROnym DAta BAse)*

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The complex and time-consuming task of preparing an acronym directory with fully documented entries for the library, information, and computer science fields was appropriately aided by methodology of these fields. The input record is constantly available for searching despite dispersal of the component 3 × 5 card records. The use of the data base as a teaching tool is interesting and meaningful for the students involved. The KWOC printout provides an index to significant words in the full text.

Acronym compilation by computer gives continual integrity of records, permits dispersal of control cards for the gathering of additional data, and the resulting alphabetical and KWOC printouts optimize editorial surveillance of related terms.

Most directories of acronyms and initialisms give only the full text of the acronym. Often this information is not enough for the average reader. It was felt by the authors of the proposed "Directory of Acronyms and Initialisms in Library and Information Science" that additional information was required. To be able to look up and add to the main file and simultaneously separate the file into nine different categories to search for added information, it was decided to keypunch acronyms and full text in alphabetical order of acronym and to KWOC full text to terms on both IBM equipment (located at Pratt Institute) and UNIVAC equipment (located at S.U.N.Y. Albany).

Acronyms and initialisms in the literature, in speeches, and even in correspondence, present a serious problem to the neophyte, and, indeed, even to experienced individuals in the field.

As editor of the Science Associates International publication, "Scientific Information Notes" (now called "Information: News/Profiles/Sources"), the senior author received many news releases with acronyms sometimes explained in parenthesis, but surprisingly often unexplained with the assumption that all readers knew the terms for which the acronym stood.

A publisher who was interested in publishing a directory of acronyms for the library, information sciences, and computer fields approached the authors to consider compiling such a directory. The study of a large number of available acronym directories and dictionaries revealed that none gave adequate interpretive information, documentation, or references back to the original literature. For example, when you discover that CARES means "Central Advisory and Referral Service," what do you really know about that project if it happens to be unfamiliar to you?

What is needed is a directory that will tell the reader *where* the project is located (in this instance, New York Metropolitan Reference and Research Library Agency, which is also known as METRO) and hopefully what the project is about—rationale, procedure, output or results, methodology, and similar information. A complete and accurate bibliographic citation to a document would at least provide an answer to the source of this information, thus eliminating the need for knowing what reference tool might contain that information, and having to consult the tool that would provide the final answer to the reader's questions.

First, it was decided to include all acronyms in the strictly correct sense of the word. An acronym has been defined by Weik as "a *word* formed from the initial letter, letters, or syllables taken from a succession or group of words, and capable of being articulated .... An acronym may also be constructed from the initial letters plus the terminal letters of words ... [but] *must* be capable of being pronounced."[1] In addition, it was decided to include initialisms to broaden the scope of the book. These are usually included in most directories that purport to cover acronyms, although some compilers do not distinguish between initialisms and acronyms. An example of

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